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U.K. LOCAL ELECTRICAL AND MECHANICAL ENGINEERING INSTRUCTIONS

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EQUIPMENT, RADAR, A.A., No. 3, MK. V

GENERAL DESCRIPTION

NOTE. *This information is provisional and is supplied for guidance pending the issue of more complete instructions. All errors of a technical nature should be notified, through the usual channels, to the War Office (M.E.10).*

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MAIN FIGURES

GENERAL SURVEY OF THE EQUIPMENT (Figs. 1001, 1002, 1003)

Range unit

1. The heart of the system is the crystal-controlled 81.95 kc/s oscillator in the range unit. From this is derived the triggering pulse for the P.P.I. and the transmitter. Strobe, or gate, voltages for the range indicating system and receiver are also generated in the range unit.

Transmitter

2. The transmitter system produces short pulses of carrier at a recurrence frequency of 1,707 c/s. The transmitting valve is a magnetron, with permanent magnet field, operating on approximately 3,000 Mc/s.

Antenna system

3. The antenna system consists of a single parabola, employing common T and R. The dipole assembly is housed in a polystrene bowl. This housing and the coaxial transmission line from transmitter and receiver are kept under pressure when the set is operating in order to ensure that the interior of the line is as dry as possible. The dipole is spun at 1,800 r.p.m. and a slightly asymmetrical construction skews the beam by 1.5°. The complete pedestal can be lowered into the trailer cabin for travelling purposes. The antenna mount contains the motors which move the parabola in asimuth and elevation, also the spinner motor and reference generator. Inside the pedestal are the azimuth selsyns and 43 sliprings, supplying voltages to the antenna mechanism. Associated with the antenna is the transmit-receive box which prevents the strong transmitter pulses from going into the receiving system. (General details of the antenna system are shown in Fig. 1011.)

Receiver

4. The receiving system consists of a crystal mixer, klystron local oscillator and the pre-amplifier, all mounted upon the modulator rack close to the magnetron. The main portion of the receiver is in the left-hand tier of the control rack at the rear of the trailer. The inputs to the receiving system are :—

(*a*) 30 Mc/s I.F. signal from crystal mixer.

(*b*) Narrow strobe (or gate) from range unit.

The outputs from the receiver are :—

(*a*) Video frequency signal for automatic tracking unit.

(*b*) Video frequency signal for range indicator unit.

(*c*) Video frequency signal for P.P.I. unit.

Putting-on facilities

5. The SCR-584 provides its own early warning service. The main purpose of the P.P.I. system is to present a panoramic picture with a maximum radius of 70,000 yd. of the site. A 7 in. cathode ray tube is used. Two ranges are available to the operator, namely, 70,000 yd. and 35,000 yd. Range markers are provided on the sweep at 10,000 yd. intervals. The start of the time base sweep is controlled from the range unit ; also a strobe spot is superimposed upon the time base—the spot moving in accordance with the setting of the range handwheel. In this way the range operator may check that his range indicating system is set on the selected target.

Fine and coarse range indication

6. For range indication two 3 in. cathode ray tubes are provided. Both have circular time bases, the one representing a range of 32,000 yd. and the other representing 2,000 yd. The latter is known as the fine range C.R.T. In addition to the two C.R.Ts. the range indicator unit houses the mechanical gearing, rate motors, differentials and two handwheels. The 32,000 yd. range C.R.T. has a single radial hair line superimposed over the tube scale and screen and the fine tube has two hair lines set at about 30° to each other and superimposed in the same manner. As the range or TRACKING handwheel is turned the two sets of hairlines are rotated. The fine hair lines are set on the leading edges of the target pips. The other handwheel is known as the SLEWING control, and facilitates rapid movement of the hair lines. The length of the sweep on the fine range tube can be varied from 0 to 2,000 yd. by adjustment of the NARROW GATE WIDTH control on the range unit panel. A minimum sweep of 400 yd. is generally used for tracking. As the range handwheel is turned when following the leading edge of a target on the fine range tube, whatever length of time base is used at the moment will travel round with the target pip. This is due to control of the narrow-gate pulse by a potentiometer geared to the range handwheel. The slant range obtained from this system is transmitted through the data panel (located on the under side of the trailer floor) by selsyns in the case of mechanical predictors, and by a Bell potentiometer in the case of electrical predictors. For predictors requiring altitude data an altitude convertor data unit is provided. This latter unit operates with the U.S. M4 or M7 directors.

Antenna positioning control

7. The azimuth and elevation controls are situated in the position control unit BC-1085-( ) of the control rack at the rear of the trailer. The azimuth and elevation of the antenna are indicated on two dials above the azimuth and elevation handwheels. The scale, at present, on these dials is in mils (6,400 mils = 360°). The dials are double-indicating and register the directions in which both antenna and predictor are pointing. The dials are actuated by selsyns driven by other selsyns located in the pedestal and the tracking head of the predictor.

Automatic, manual or remote handling

8. The mode of operation of the SCR-584 is determined by the setting of the CONTROL SWITCH on control panel PN-24-( ). This switch has four positions :—

(*a*) P.P.I. SCAN

(*b*) MANUAL

(*c*) AUTOMATIC

(*d*) REMOTE

Another switch marked DIRECTOR SIGNAL, when thrown to ON, notifies the predictor crew that the SCR-584 is tracking a target. When the CONTROL SWITCH is turned to AUTOMATIC the antenna tracks the target automatically in azimuth and elevation, but not in range, which has to be tracked manually by setting the TRACKING handwheel for the correct rate of turning of the hair lines so that they accompany the moving target pip at the same rate. The azimuth and elevation tracking unit BC-1090-( ) is the centre of control and works in conjunction with the automatic tracking unit BC-1086-( ). The automatic tracking unit receives the strobed video signal from the receiver, selected by placing the fine hair line of the 2,000 yd. range tube on the leading edge of the target to be tracked. If the parabola is slightly off-target, the echo signal amplitude will vary as the dipole rotates. The tracking unit demodulates this varying signal and converts it into a 30 c/s inverted error signal, the magnitude of which is a measure of the amount by which the parabola is off-target. Next, the azimuth and elevation tracking unit receives the varying error signals and makes them directional as well as magnitude sensitive. Thus the amount of antenna movement, as well as its vertical or horizontal directional movement, is controlled by the error signal. This unit also supplies excitation current for the servo generators, which in turn control the drive motors that move the antenna mount in azimuth and elevation.

Power source and auxiliary equipment

9. The SCR-584 can be operated from local power lines (115 V, 3-phase, 60 c/s) or from the motor-generator used for supplying power to the predictors and guns. A suitable power unit is the U.S. M12 (35 kVA, 125 V, 3-phase, 60 c/s). The power input receptacle is on the data panel PN-22-( ). On this panel are found also three telephone line terminals and four sockets for cable connections to whatever type of predictor is used. Switch box SW-214-( ), located on the trailer wall by the small front-end door, contains switches which control the spinner motor, elevation and azimuth servo generators or amplidynes, and the raise and lower switches for the antenna mount elevator. Power intake ventilation is provided and there is also a petrol heater within the trailer.

List of major components

10. Radar set SCR-584 consists of trailer K-78, in which are contained the major components given in Table 1.

Description of component	*U.S. Signal Corps designation*	
Antenna position control unit	Control unit	BC-1085-( )
Antenna position indicator unit	Indicator	BC-1076-( )
Altitude converter	Control unit	BC-1094-( )
Altitude data unit	Data unit	BC-1075-( )
Altitude converter power supply	Rectifier	RA-70-( )
Antenna	Antenna	AN-101-( )
Automatic tracking unit	Tracking unit	BC-1086-( )
Azimuth/elevation tracking unit	Tracking unit	BC-1090-( )
Azimuth motor generator	Amplidyne or servo generator	—
Control panel	Control panel	PN-24-( )
Crystal mixer	Crystal mixer	BC-1130-( )
Data panel	Data panel	PN-22-( )
Driver unit	Driver unit	BC-1080-( )
Elevation motor generator	Amplidyne or servo generator	—
Field power supply	Rectifier	RA-71-( )
High voltage rectifier	Rectifier	RA-68-( )
Junction box	Junction box	JB-71-( )
Local oscillator	Oscillator	BC-1096-( )
Modulator	Modulator	BC-984-( )
Pedestal antenna mount	Pedestal	MP-61-( )
P.P.I.	Indicator	BC-1092-( )
P.P.I. power supply	Rectifier	RA-69-( )
P.P.I. unit	Plan position unit	BC-1058-( )
Pre-amplifier	Amplifier	BC-1078-( )
Range indicator unit	Indicator	BC-1088-( )
Range power supply	Rectifier	RA-72-( )
Range unit	Range unit	BC-1062-( )
Receiver	Radio receiver	BC-1056-( )
Receiver power supply	Rectifier	RA-66-( )
Remote video amplifier	Amplifier	BC-1074-( )
Switch box	Switch box	SW-214-( )
Test equipment	Test equipment	RC-234-( )
Trailer	Trailer	K-78-( )
T/R box	Ant. switch box	BC-1132-( )

Table 1. Major components of SCR-584.

TECHNICAL DESCRIPTION

SIGNALS REQUIRED TO CONTROL THE SYSTEM

11. The basis of all electrical synchronization in the set is the crystal oscillator in the range system. The frequency of the crystal oscillator is 81.95 kc/s. This frequency is stepped down by means of a series of multivibrators, and controls a trigger generator which, in conjunction with a " coincidence " valve circuit in the range unit, produces a trigger pulse at a frequency of 1,707 c/s.

12. This trigger from the range unit is fed to the P.P.I system for synchronization of the sweep circuits, as well as to the transmitter system, in which it controls the driver. The driver, in turn, modulates or " keys " the transmitter at 1,707 c/s and determines the width of each transmitted pulse.

13. The received video signal is fed to both the P.P.I and the range systems.

14. The range system accepts the video signal and presents it on the 32,000 yd. range C.R.T. The video signal is also fed to the 2,000 yd. C.R.T., but it is only visible on this tube when a variable-position narrow strobe (or gate) is positioned to include the echo signal.

15. The gate produced and used in the range unit is also applied to the receiver servo channel and the P.P.I system, so that the receiver output is applied to the servo system only during the gated portion of the range. The gate also appears upon the P.P.I tube to enable the operator to see the portion of the range included within the gate. The gated signal is fed to the servo system, so that only the target which is selected by the gate will be tracked automatically.

RANGE SYSTEM

RANGE UNIT

16. A block diagram of this unit is shown in Fig. 1008 and circuit diagrams are shown in Figs. 1009 and 1010. A simplified block diagram is also shown in Fig. 1.

Base oscillator

17. The base oscillator is crystal-controlled, and the crystal maintains the oscillator frequency within $\pm$ 4 c/s of 81.95 kc/s for temperature variations up to 100° Centigrade. Two crystals are provided and either can be placed in operation by means of CRYSTAL SELECTOR SWITCH S-601. One crystal is a stand-by.

18. A 6SK7 (V-601) is used in the electron-coupled oscillator circuit. The tank circuit of the oscillator is comprised of the primary of the sweep transformer T-601 and condensers C-621, C-622 and C-625. By means of inductance L-601 and its distributed capacitance the cathode circuit is fixed tuned to a frequency higher than the crystal frequency. This permits feed-back in the proper phase to maintain steady oscillation of the crystal at its resonant frequency. The amplitude of the output voltage may be varied by R-698. This control is labelled DIAMETER on the panel of the range unit on the 2000 YARD SWEEP side.

Sweep transformer

19. Sweep voltages for the 2,000 yd. range C.R.T. are produced by transformer T-601. The purpose of the transformer is to produce two voltages, 90° out of phase, for the sweep of the 2,000 yd. trace.

20. The primary of the transformer is loosely coupled to the secondary. Both primary and secondary are tuned to resonance. C-621 tunes the primary. Detuning the primary will merely reduce the amplitude of secondary current. C-627 tunes the secondary, and adjustment will affect both phase and amplitude of secondary current. However, the main function of C-627 is to provide phasing control. R-620 and R-621 are shunted across the secondary and the latter serves as the main control of secondary voltage amplitude.

21. R-621 is mounted on the panel of the range unit and is labelled BALANCE. The trimmer C-627 is also on the panel of the range unit and is labelled PHASE. Condenser C-621 is labelled OSCILLATOR TUNING. Proper adjustment of these controls is indicated by a perfect, circular trace of maximum diameter on the 2,000 yd. C.R.T.

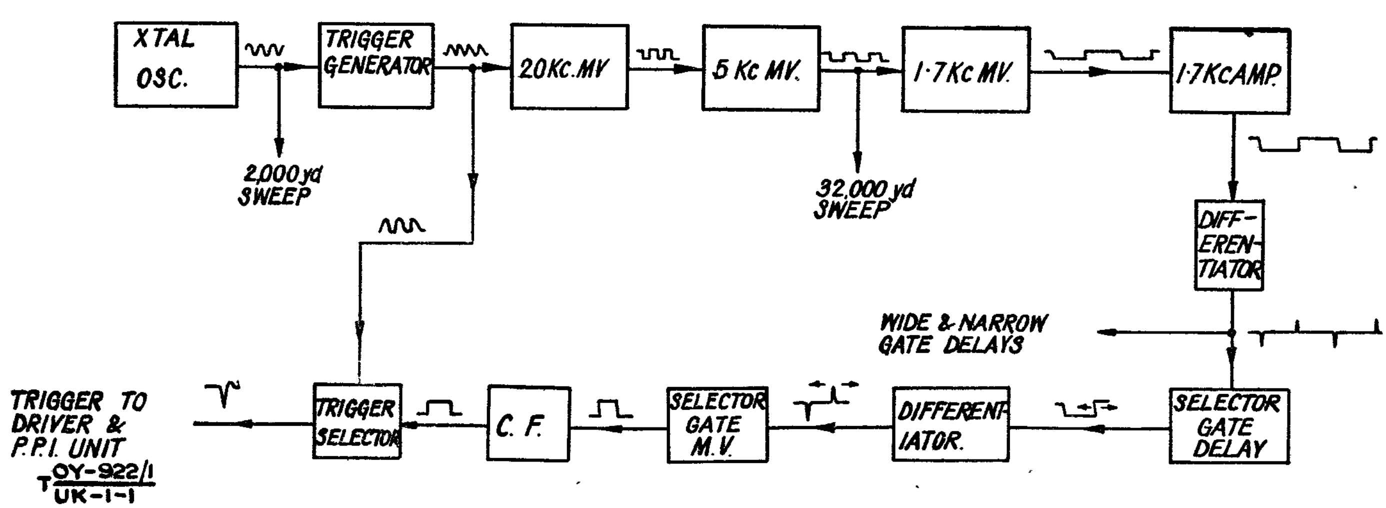


Fig. 1. Simplification of Fig. 1008, showing method of obtaining the trigger pulse for the whole system

22. The output voltage of T-601 is taken from two low-impedance coils, tightly coupled respectively to primary and secondary of T-601. The voltage induced in these coils is determined by the amplitude and phase of the currents in the windings of the transformer. With proper adjustment of the transformer the coils will furnish two voltages of equal magnitude and 90° out of phase. These voltages are fed to the sweep circuits of the fine range 2,000 yd. C.R.T. in the range indicator unit (see range indicator unit).

Trigger generator

23. The output voltage from the plate of the 81.95 kc/s oscillator is also applied through C-658 to the grid of one triode section of V-613 (pins 4, 5 and 6). This is a 6SN7 double-triode, shewn in Fig. 1010. This triode section serves as the trigger generator.

24. The output of the trigger generator is a unidirectional, positive, pulsating voltage which is taken from the cathode and applied through C-657 to the grid of the trigger selector or "coincidence" valve, V-614, as well as being applied through C-604 to the 20 kc/s multivibrator circuit of V-602.

Frequency division

25. As mentioned above, the output of the trigger generator is applied to one plate (pin 2) of V-602, the 6SL7GT valve in the 20 kc/s multivibrator circuit. Both halves of V-602 are used in this circuit, which is adjusted to have a natural frequency of approximately 20.49 kc/s. The trigger pulse is 81.95 kc/s and serves to synchronize the operation of the multivibrator so that its frequency is exactly one quarter of the trigger frequency. Adjustment of the frequency of the multivibrator over a limited range is accomplished by means of C-606, which is a 10—100 pF trimmer on the range unit panel marked 20 KC-MV.

26. The output of V-602 is fed through C-608 to the 5 kc/s multivibrator circuit of V-603, which is also a 6SL7GT. The output frequency of this multivibrator is 5.12 kc/s ; that is, one quarter of the 20 kc/s multivibrator frequency. Frequency adjustment is by means of R-624 which is mounted on the range unit panel and is labelled 5 KC-MV.

27. The 5 kc/s multivibrator drives both the 1.7 kc/s multivibrator (V-604) and the 5 kc/s amplifier (V-605). The action of the 1.7 kc/s multivibrator is identical to that of the 5 kc/s circuit of V-603, except for its frequency. It is synchronized from V-603, and the time constant is controlled by R-616, labelled 1.7 KC-MV, which is mounted on the range unit panel. The multivibrator is adjusted to a frequency of 1,707 c/s, that is, to one third that of its input.

28. The output of the 5 kc/s multivibrator is also applied to the grid of V-605, a 6L6-G. The plate load of this valve is the tuned primary of sweep transformer T-602.

29. The primary of T-602 together with C-618, C-619, C-628 and C-629 forms a resonant circuit tuned to 5.12 kc/s. Hence two 5.12 kc/s sinusoidal voltages, 90° out of phase, are obtained from T-602 for application to the sweep circuits of the 32,000 yd. range C.R.T. A 0.5 MΩ potentiometer R-699 in the screen circuit of V-605 serves as an adjustment for the diameter of the circular sweep. This control is labelled DIAMETER on the 32,000 yd. sweep side of the range unit panel. A trimmer is not provided for tuning the primary of T-602.

30. Phase control is obtained by trimmer C-620 in secondary of T-620. This is labelled PHASE. Variable resistor R-625 provides amplitude control and is labelled BALANCE. These controls are adjusted in a similar manner to those on the fast or 2,000 yd. range sweep.

Selector gate multivibrators

31. The output of the 1.7 kc/s multivibrator is also applied to the grid of V-606 by way of C-630. V-606 is a 6AC7, working as a limiter. It squares the multivibrator output and provides the trigger for the three delay multivibrators V-607, V-609 and V-611. (See Fig. 1010 and paras. 32 and 52.)

Trigger selector gate delay

32. V-611 (a 6SN7 type double-triode) delays the start of the selector gate until the desired instant. The square wave output of V-606 is applied to grid No. 1 of V-611 through the differentiating network of C-651 and R-671. This results in a series of positive and negative peaked pulses applied to the grid of the first half of the valve. (See Fig. 1.)

33. The multivibrator circuit of V-611 is the cathode coupled " one kick " type. If no grid signal is applied, the input section of the double-triode will remain cut off and the output section heavily conducting.

34. Both grids are biased positive with respect to ground. Bias for the input section is obtained from the voltage divider made up of R-672, R-673 and R-674. The output grid obtains its bias from the 250 V H.T. line through its series grid resistor R-678.

35. The positive bias voltage between input grid and ground is adjustable by means of R-673, which is mounted on the panel of the range unit and is labelled TRIGGER DELAY. Its maximum value is not sufficient to cause the input section to conduct.

36. When the peaked pulses are applied to V-611 the negative peaks will have no effect but the positive ones will drive the grid sufficiently positive to operate this first half of the valve. When the input half of the valve conducts, its plate voltage will fall and this drop is coupled to the grid of the output half by means of C-653. This, of course, reduces the plate current of the second half of the valve, which reduces the cathode voltage. The action is cumulative and results in the output grid being driven to cut-off almost instantaneously.

37. The cathode is now held at a potential determined by the current in the input half of V-611. This current will be determined by the setting of R-673.

38. Immediately succeeding the positive pulse C-653 will commence to discharge and the output grid will commence to become less negative. As soon as the cut-off point is reached the output section will again conduct and the circuit will return to its stable position.

39. The cut-off potential on the output grid is determined by the cathode potential which in turn is determined by the input grid bias.

40. When the input section is cut off, its plate voltage rises to 250 V and when it conducts this voltage drops. Thus, a negative pulse of voltage is produced at the plate of the

input section of V-611 and the duration of this pulse is controlled by adjustment of the input grid bias. If this bias is increased, the cathode voltage will be higher and so the discharge period of C-653 will be longer before the cut-off point of the output section of the valve is reached.

Trigger selector gate

41. The output of V-611 is applied from plate 2 to grid 1 of V-612 through another differentiating circuit C-654 and R-679. V-612 and its associated circuit is another " one kick " multivibrator and produces the selector gate. It operates in the same manner as V-611, and its exact moment of operation is controlled by the trailing edge of the negative pulse from V-611.

42. The circuit of V-612 is designed so that the width of the output pulse (taken from plate 2) is between 5 and 9 μsec. It must not exceed 12 μsec. if double pulsing of the transmitter is to be avoided.

43. The selector gate is applied through C-656 to grid 1 of V-613. This section of the valve acts as a cathode follower. The output of the cathode follower is coupled to the screen grid of the trigger selector or " coincidence " valve V-614 by way of C-659.

44. As was mentioned above in paras. 23 and 24, the other section of V-613 is the trigger generator. Its output is passed through the chain of multivibrators and finally appears as the 5 to 9 μsec. gate pulse at the screen grid of V-614. The output of the trigger generator is also applied directly to the grid of V-614.

Trigger selector valve

45. The purpose of the trigger selector valve V-614 is to pass a trigger pulse only during the incidence of the selector gate.

46. V-614 is a 6AG7 pentode, having both grid and screen grid biased negatively with respect to ground. The necessary bias voltages being obtained from a voltage divider in the high voltage rectifier circuit. (See Fig. 1017.)

47. Trigger pips from the cathode (pin 6) of V-613 are applied to the grid of V-614 at a frequency of 81.95 kc/s—that is at 12 μsec. intervals. Trigger selector gate pulses from the cathode (pin 3) of V-613 are applied to the screen grid at a frequency of 1,707 per second—that is, at 586 μsec. intervals. Thus V-614 opens up for some 5 to 9 μsec. every 586 μsec. and passes a trigger pip, or portions thereof.

48. The position of the trigger selector gate must be so adjusted as to include one of the trigger pulses. This can be done by adjustment of the width of the pulse output from V-611. The width of this pulse can be varied from approximately 3 to 30 μsec., so that it is possible to select any one of three trigger pips.

49. The output of the trigger selector is negative and is matched to a 75 Ω coaxial cable by the step-down pulse transformer T-603. This is necessary because of the 32 ft. line to the modulator.

50. Both the modulator and plan position unit are triggered from the output of the pulse transformer T-603. In both units the trigger is made to set off a multivibrator.

51. Thus, only one trigger pulse is permitted to pass from the range unit out of every 48 generated. The pulse selected as above is the starting trigger for the entire system. All other adjustments are made with reference to this pulse.

Narrow- and wide-gate multivibrators

52. V-607 is the narrow-gate delay multivibrator. The output of this valve determines the starting time of the narrow-gate signal. This variable must be introduced in order that the narrow-gate multivibrator may be made to start at the proper time relative to the trigger pulse which has been described above. A similar arrangement is necessary with the wide-gate signal.

53. In the case of the wide-gate, it must start at the same time as the beginning of the main pulse. The narrow-gate position is a variable, controlled by the range handwheel, whose minimum is at the main pulse.

Narrow-gate delay multivibrator

54. The operation of V-607 is identical with that of V-611, which has been described. However, the grid bias arrangements are more elaborate, and the output is taken from the second half of the valve, giving a positive variable pulse. (See wave forms, Fig. 1011.)

55. The voltage on the grid of the input section of V-607 is controlled by potentiometer R-901 which is part of the voltage divider network R-638 to R-634 inclusive. R-901 is mounted in the range indicator unit and is geared to the range indicator on the 32,000 yd. C.R.T.

56. When a target is being followed the arm of the potentiometer is moved in proportion to the range of the target. The variable resistor R-636, which is at the rear of the range unit chassis and is marked NARROW GATE, adjusts the voltage which appears across R-901. That is, the voltage change per degree of rotation of R-901 can be controlled within limits.

57. R-634 is the adjustment for bias ; it is mounted on the range unit panel and labelled NARROW GATE DELAY. This adjustment is necessary to obtain the correct value of bias when the potentiometer is in the position corresponding to minimum range. As explained in para. 40, variation of grid bias produces variation in the time at which the output section commences to conduct. Linear relationship between bias voltage and pulse width is possible as only a small part of the coupling condenser charge curve is used.

Narrow-gate multivibrator

58. V-608 is another " one kick " multivibrator. The variable width output pulse goes from V-607 to V-608 via the usual differentiating network. The input grid (pin 1) is biased positively from a voltage divider network made up of R-644 and R-645. The other grid is biased negatively from the range power supply, so that the second half of the valve is normally cut off.

59. As a result of C-637 and R-646 the input to the grid of V-608 is a series of positive and negative peaks. The positive peaks will have little effect because of the diode limiting action between grid and cathode. At the incidence of the negative peaks grid 1 is driven negative and the plate voltage of the input section rises. This change is coupled to the grid (pin 4) of the second half of V-608. The first half is cut off, and the cut-off period is determined by the time constant of the input grid circuit. This can be varied by adjustment of the variable resistor R-646, the NARROW-GATE WIDTH control on the range unit panel.

60. The narrow-gate width can be varied from zero to approximately 150 μsec. The width normally used is about 2.5 μsec, which corresponds to approximately 400 yd. Wider gate widths are used only in adjusting the 2,000 yd. range C.R.T.

61. There are three outputs from the narrow-gate multivibrator :

(a) Negative gate signal from second plate (pin 5) of V-608 goes to the receiver.

(b) Positive gate, taken from a portion of the load of input section plate (pin 2), goes to the plan position unit.

(c) Positive gate goes to the control grid of the 2,000 yd. range C.R.T. in the range indicator unit.

Wide-gate delay multivibrator

62. The operation of V-609 is similar to that of V-607. The only adjustment is by means of R-656, WIDE-GATE DELAY. The wide-gate delay control adjusts the starting point of the 32,000 yd. sweep.

Wide-gate multivibrator

63. Action of V-610 is similar to that of V-608. The only output of V-610 is a positive signal taken from first plate (pin 2) for the 32,000 yd. C.R.T. grid. The width of the wide-gate signal is adjustable by means of R-663, WIDE-GATE WIDTH, on the panel of the range unit. Maximum width is 210 μsec., corresponding to a range of 34,000 yd.

Centering controls

64. Although not connected with range circuits, the beam centering controls are located on the range unit. Four potentiometers, R-628 and R-629 for the 2,000 yd. C.R.T., and R-622 and R-623 for the 32,000 yd. C.R.T., are connected in parallel. A voltage of -100 V is connected at one end and a voltage of $+120$ V at the other (see Fig. 1009).

65. The voltage available at the arm of each potentiometer is variable from -100 to $+120$ V. One potentiometer is connected to one of each pair of deflection plates of its C.R.T. The potentiometers are mounted on the range unit panel, and are labelled CENTERING.

RANGE INDICATOR SYSTEM

BLOCK SCHEMATIC DIAGRAM

66. A block diagram of this system is shown in Fig. 1014.

RANGE INDICATOR UNIT

67. Circuit diagram is shown in Fig. 1015.

68. The purpose of this unit is to provide visual and electrical data on target range. It consists of two range C.R.Ts., two range motors, the aided range, the tracking gear train, the narrow-gate delay potentiometer and the slant range potentiometer.

69. The two electrostatic deflection C.R.Ts. provide coarse and fine indications of range. Both employ a circular sweep, and the available length of trace is approximately equal to the outer circumference of the 3 in. tubes, or about 9 in. On the coarse range tube (V-902) this represents 32,000 yd. and on the fine range tube (V-901) it represents 2,000 yd.

Sweep control

70. Sweep voltages, which are supplied from the range unit, are applied to tuned step-up transformers T-902, T-903, T-904 and T-905. These transformers are necessary because the sweep voltages in the range unit are stepped down to obtain a low impedance source and prevent loss in connecting cables.

71. The sweep transformers are identical. Taking T-904 as an example : C-917 is a D.C. blocking condenser which prevents the centering voltage from being applied to both plates of V-902. R-923 is a leakage resistor to ground for D.C. C-915 and R-924 comprise a filter to prevent the A.C. sweep voltage from feeding back to the centering circuits in the range unit.

Centering controls

72. R-622, R-623, R-628 and R-629 are mounted on the range unit panel as described in para. 64. One of the potentiometers furnishes a variable voltage to one plate of the X plates, and the other potentiometer provides a variable voltage to one plate of the Y plates.

Focus and intensity controls

73. High voltage for the range C.R.Ts. is provided from the range unit power supply. High negative potentials exist on the cathode and grid of both C.R.Ts. and can be removed by disconnection of the H.T. cable connected to J-804 on the range power unit.

74. High voltage ($-2{,}000$ V) is fed into the range indicator panel at J-910. This voltage is applied to a voltage divider network which provides focus and intensity control for both C.R.Ts.

75. R-910 is the intensity control for V-901, and R-911 is the similar control for V-902. R-910 and R-911 are in parallel and at the negative end of the dividing network. R-909 is a series dropping resistor.

76. R-907 is the focus potentiometer for V-901 and R-908 is the focus control for V-902.

77. Resistors R-906, R-905 and R-904 form the remainder of the network to ground.

C.R.T. filament transformer

78. T-901 provides the filament voltage for both V-901 and V-902. The insulation of this transformer, between primary and secondary, must be high in order to insulate the high voltage on the cathodes, which are tied to the filaments of both tubes, and prevent it breaking down to the core or primary of the transformer.

Range tracking

79. The range tracking gear train drives a hair line pointer on each of the two C.R.Ts. The hair lines are driven according to the rate set by the operator. The correct rate is that which maintains the hair line pointer of the fine range tube matched with the leading edge of the signal. The leading edge is always in a counter-clockwise direction.

from the centre of the signal, regardless of whether the target range is increasing or decreasing. Fig. 2 illustrates this point.

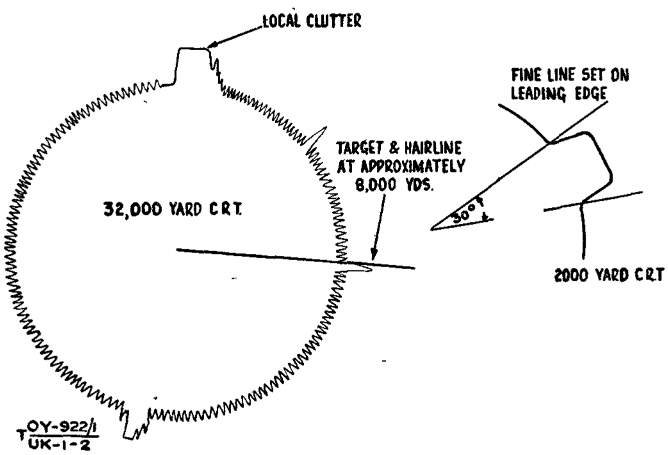


Fig. 2. Setting of hair lines on the range C.R.Ts.

80. Fig. 1016 shows a diagram of the range gearing which should be studied in conjunction with the following paragraphs.

81. The SLEWING handwheel is geared directly to the pointer on the fine C.R.T. with a 1 : 1 ratio, and to the pointer on the coarse tube with a 16 : 1 ratio.

82. The two range selsyn transmitters are also geared to the SLEWING handwheel. The fine selsyn is geared in a 1 : 1 ratio, and one revolution represents 2,000 yd. The coarse selsyn is geared in a ratio of 25 : 1, one revolution representing 50,000 yd.

83. The selsyn output is fed to the data panel PN-22-( ) for coupling into the predictors or tracking units.

Range potentiometer

84. The range potentiometer R-903, referred to as the Bell potentiometer, is also geared to the SLEWING handwheel, and approximately 16 turns of the handwheel are required to drive the potentiometer arm through one complete revolution, representing 32,000 yd. Actually the potentiometer furnishes range data only to 28,000 yd.

Narrow-gate range potentiometer

85. R-901 has been mentioned already in the description of the range unit. The delay potentiometer is geared to the SLEWING handwheel, 16 turns of which cause a 270° rotation of the potentiometer arm ; 270° rotation corresponding to 32,000 yd. range.

86. The potentiometer has mechanical limit stops at 300° rotation, and a cam on the potentiometer shaft operates an electrical limit switch, cutting off the power to the range motors before the mechanical stops are engaged. Damage could be caused by rotation of the SLEWING handwheel after the stops have been reached. This is prevented by the insertion of a slipping clutch in the slewing drive.

Differentials and range motors

87. The gear train includes two differentials. Differential No. 5 is driven by two variable speed motors, known as the RANGE motors. If both motors turn at the same speed the output of the differential will be zero. If the speeds of the motors are different the output of the differential will be clockwise or anti-clockwise, depending upon which motor is the faster, and the output speed will be one half the difference between the input gear speeds.

88. The other differential, labelled DIFFERENTIAL NO. 6 in Fig. 1016, is driven from the first differential and from the TRACKING handwheel. The output is coupled to the shaft of the SLEWING handwheel by means of a second clutch which permits use of the slewing handwheel without interfering with the rates which have been set into the aided tracking system.

89. The TRACKING handwheel is also geared through a third clutch to a variac VR-901, which controls the speed of the range motors. When the tracking handwheel is stationary the range pointers rotate at a constant speed, depending upon the setting of the variac. There is one position of the variac which causes both range motors to rotate at the same speed. When the tracking handwheel is rotated the range pointers will be accelerated, or decelerated, due to change in variac setting and will be displaced through an angle proportional to the rotation of the handwheel. Thus rotation of the TRACKING handwheel will displace the pointers and change their rate of rotation.

Range motor speed control

90. Three rectifier valves V-801, V-802 and V-803, located in the range power unit, provide the necessary power for the range motors. The speed controls are mounted on the range indicator unit panel. See Fig. 1017 for the rectifier circuit.

91. The input voltage to transformer T-801 in the range power unit is 115 V, 60 c/s. It is applied through the potentiometer limit switch S-901 and the RANGE MOTORS switch S-902, both of which are mounted on the range indicator panel.

92. The type 83 full-wave rectifier V-801 supplies power for the range motor fields. The field current is adjustable by means of rheostat R-902, which is on the chassis of the range indicator. The setting of R-902 determines the maximum tracking speed for a particular position of the TRACKING RATIO switch S-903.

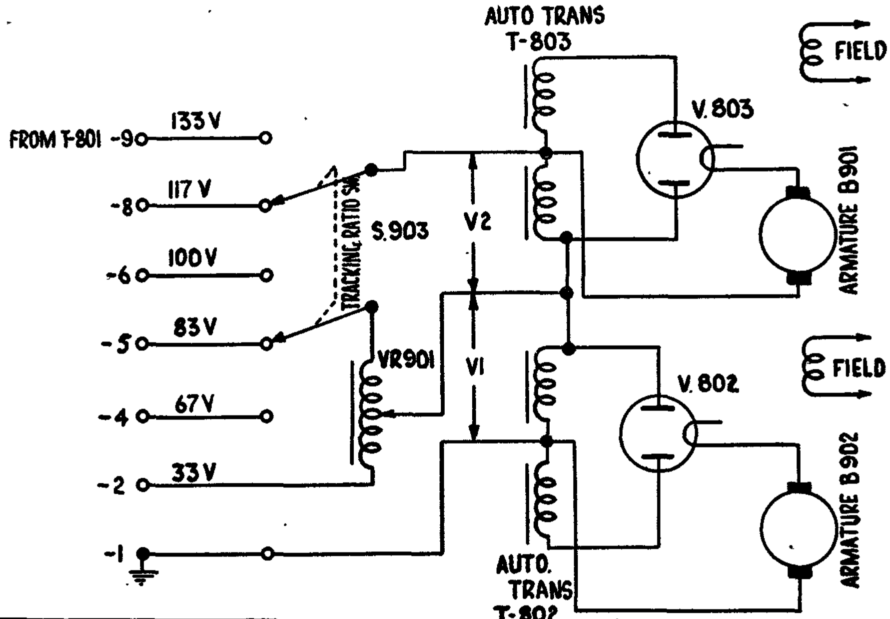
93. Armature current for the two range motors is supplied by the type 83 rectifiers V-802 and V-803, each valve supplying one motor.

Tracking ratio switch

94. The tracking ratio switch has three positions and each position determines a maximum amount of current which can be applied to the range motor armatures. The importance of this switch is that the change in tracking rate per turn of the tracking handwheel will be determined by its position.

95. Six voltages are applied to the tracking ratio switch, the variac and transformer T-803. These voltages are derived from transformer T-801.

96. Variation of the voltages selected by the tracking ratio switch is accomplished by the variac VR-901, thus controlling the input to the armature rectifier circuits. Fig. 3 will help to show how this variation is obtained.



SW. S903 POSITION	V1 MAX.	V2 MAX
1	100	100
2	83	84
3	67	67

In position 2 of S903 as shewn, V1 can be varied from 33 volts to 83 volts, & V2 from 84 volts (117-33) to 34 volts (117-83)

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Fig. 3. Simplified circuit of tracking motors

RANGE POWER UNIT RECTIFIER

97. Power for range unit BC-1062-( ) and indicator unit BC-1088-( ) is provided by rectifier RA-72-( ), which has three separate supply circuits.

98. The function of the range motor power supply has already been described. This part of the power supply system, though mounted on the rectifier RA-72 chassis, is wired separately and is switched on and off by the RANGE MOTORS switch on the range indicator panel. The pilot lamp, labelled RANGE MOTORS indicates when power is applied to the motors.

Range unit power supplies

99. Referring again to Fig. 1017, V-804 (5U4G) supplies low voltage for the range unit. Its output is filtered in the conventional style, and is also regulated by an electronic voltage regulator circuit.

100. The 6B4G valves V-805, V-806 and V-807, the 6SJ7 valve V-808 and the VR 105-30 valve V-809 comprise the regulator circuit. The parallel combination of V-805, V-806 and V-807 is connected to act as a variable resistance in series with the line, the resistance depending upon the grid bias applied to the valves. The grid bias voltage is controlled automatically by the control valve V-808. By changing the grid voltage on V-808 it is made to take more or less current. This in turn causes a greater or less voltage drop across R-808 and so varies the bias on the regulator valves. The cathode of V-808 is held at a constant reference level by the voltage regulator valve V-809.

101. The grid voltage of V-808 is obtained from R-807 in the bleeder comprising R-805, R-806 and R-807. Variations in the output voltage will be reflected on the grid of V-808 and this will control the bias on the 6B4G's. Adjustment of R-807, the VOLTAGE ADJUST control, on the chassis of the power unit, enables the voltage output to be altered over a limited range. It is adjusted for +250 V. A tap is taken off before the regulator and is fed to the range unit as a +400 V unregulated source for one side of the centering voltage divider in the range unit.

Indicator unit power supply

102. Half-wave rectifier V-810, a type 2X2/879 valve, provides the high negative voltage for the range C.R.Ts. A voltage divider network made up of resistors R-809 to R-815 inclusive provides negative low-voltage tappings at − 100 V, − 10 V and − 5 V, for use in the range unit (see Fig. 1010).

103. Filament voltage is supplied by transformer T-806 for all valves in the power unit, save the three range motor rectifiers. Power is applied to this portion of the unit by switch S-801, on the panel of the power unit. This switch also applies power to the filament transformer T-901 in the range indicator unit (see Fig. 1015). As mentioned in para. 98, transformer T-801 is energized by switching on S-902 on the range indicator unit.

TRANSMITTER SYSTEM

BLOCK SCHEMATIC

104. A block diagram of driver, modulator and transmitter is shown in Fig. 1018.

DRIVER UNIT

105. As has been shown under range unit, the output of the trigger selector is a negative pulse of − 70 V peak. This output is matched to the 32 ft. coaxial line by a step-down pulse transformer (see para. 49). The result of this is that the driver unit receives a −15 V synchronizing pulse of approximately 1.7 μsec. duration at a p.r.f. of 1,707 c/s.

106. Referring to Fig. 1019, the negative trigger is fed to the first grid of a 6SN7GT double-triode multivibrator which produces a negative, square-topped pulse of 2 μsec. duration every 583 μsec.

107. The pulse is capacitively coupled to the grid of a 6L6 (V-102) connected as a triode and acting as an inverter.

108. The inverted pulse is now fed to the first pulse driver (V-103). This is a type 829A valve with the two tetrode sections connected in parallel. The output is now a negative voltage pulse, and it is fed to an inverting transformer, T-104, for application to the grids of two more 829A's connected in parallel. V-104 and V-105 are known as the second pulse driver. The input voltage to this stage is of the order of 200 V.

109. The output of the 829A's is negative, and this is again inverted by a second pulse transformer, T-105, providing a 3,500 V positive pulse of about 0.8 μsec. duration. The series C and R circuit across the primary of T-105 is to maintain the rectangular shape of the pulse.

110. Coupled to the plate circuit of the second pulse driver is a delay network which feeds the negative pulse back to the grid of the first driver with a delay of 0.7 μsec. Thus V-103 is cut off 0.7 μsec. after it has started to conduct. As a result the output of this valve is of 0.7 μsec. duration.

Power supplies for driver unit

111. The power supplies for the driver unit are self-contained save for the 4,000 V plate and screen grid supply for the final driver stage. This supply is located in the modulator.

Plate supplies

112. V-107 and V-108 are 5U4G full-wave rectifiers connected in cascade to give positive voltage outputs up to 750 V. Plate voltage for the two rectifiers is supplied by transformer T-102. The output of V-107 supplies plate voltage for the pulse inverter V-102, and + 220 V for the multivibrator V-101. The output of V-108 is cascaded with V-107 and supplies the high positive voltages for plate and screen of the first driver V-103.

Bias supplies

113. One rectifier in the driver unit provides negative bias for the driver stages and the multivibrator. This is another 5U4G, V-106. It also energizes an interlock relay K-101 in order to complete the holding circuit for contactor K-202 (see Fig. 1021). This contactor must be closed before plate voltage can be applied to the driver stages, and so acts as a no-bias cut-out.

High voltage interlock

114. Power is applied to transformer T-102 when the voltage output of rectifier RA-68-( ) exceeds 10 kV. Contactor K-203 in the modulator is interlocked with the high voltage rectifier and must be closed to energize T-102. Closing of K-203 is indicated by the red pilot light on the modulator. This interlock prevents the driver unit from pulsing the modulator valves with low plate voltage applied with subsequent damage to the valves.

Monitoring of trigger

115. J-103, located on the driver unit panel, provides a monitoring point for checking the trigger pulse from the range unit.

MODULATOR UNIT

116. This circuit, in conjunction with high voltage rectifier RA-68-( ), when pulsed by the driver unit applies a high negative pulse to the cathode of the magnetron transmitter.

117. The modulator contains three modulator, or " keyer " valves (type 6C21), V-203, V-204 and V-205. These valves are biased to cut-off and their plate supply is provided from rectifier RA-68-( ). (See Fig. 1020.)

118. With the three valves cut off, C-208 (0.125 μF) charges to + 22 kV through the series resistors R-215 to R-218. The three damping diodes, V-206, V-207 and V-210 effectively short-circuit the inductance L-201 during the charging period. The negative side of C-208 is connected to the cathode of the magnetron.

119. When the driver pulse is applied to the grids of the three modulator valves they will provide a short-circuit and C-208 will discharge through the magnetron. There is no appreciable discharge through L-201.

120. After each pulse C-208 is partially discharged. Its negative side would immediately return to ground potential but for the distributed negative charges on the magnetron and associated wiring. If this charge were allowed to leak away, the magnetron would pass through undesirable modes of oscillation. With choke L-201 in circuit the energy would oscillate between inductance and distributed capacity. However, with the damping diodes in circuit, as soon as the charge on the negative side of C-208 swings positive, the diodes appear as a low resistance through which the energy stored in the magnetic field of L-201 is discharged. In this way the decay time of the pulse is kept to a minimum. Fig. 4 illustrates this point.

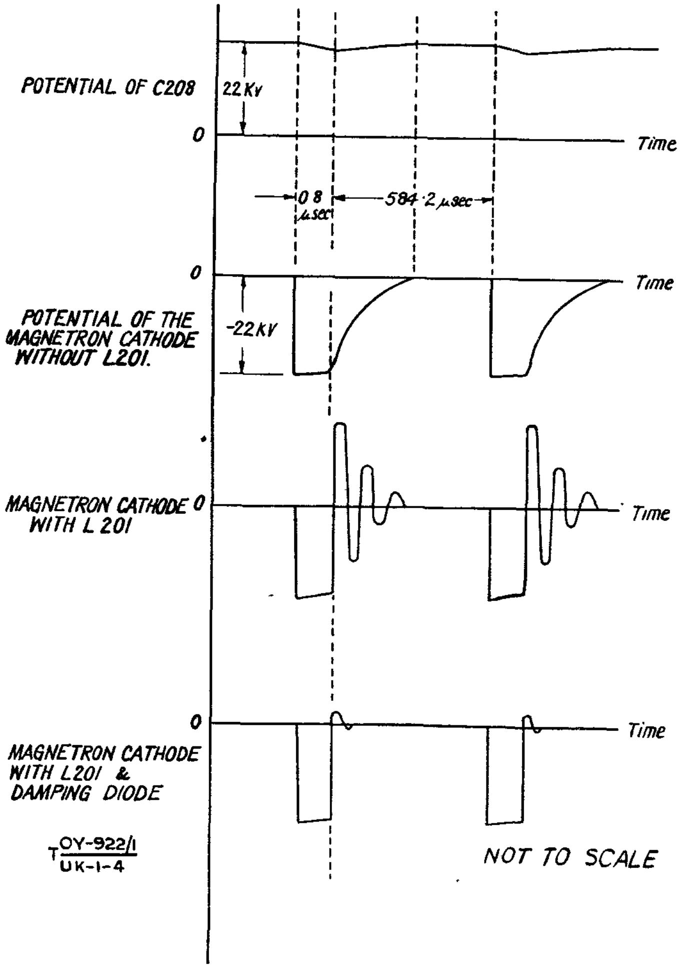


Fig. 4. Action of inductances and damping diodes

121. C-208 discharges less than 5% during the period of the pulse; thus the voltage applied to the magnetron is reasonably constant during oscillation. This is important as the frequency of the magnetron varies with applied voltage.

122. The peak current during the pulse is approximately 40 A. The average charging current is 25 mA. Milliameter M-203 is located on the modulator panel and is labelled OSCILLATOR PLATE. It is protected against pulse variations and surges by C-209 and the paper film cut-out SG-202.

123. In the same circuit is found relay K-206, the coil of which carries the average magnetron current. When this exceeds 18 mA the relay operates and breaks the filament circuit of the magnetron. It is found that the heat dissipated within the magnetron is sufficient to maintain the cathode at a temperature high enough for satisfactory emission.

High voltage interlock

124. Grounding switch S-206 is operated when the modulator doors are opened. The switch grounds the input from the high voltage rectifier.

Monitoring jacks

125. J-201 is provided for checking the wave form of the voltage applied to the grids of the modulator valves. The voltage at this point has been reduced by a 100 : 1 ratio for convenient monitoring. J-202 provides a check point on the wave form of the voltage applied to the cathode of the magnetron. The voltage at this jack has been reduced in a 400 : 1 ratio. (See Fig. 1020.)

Pulse shape

126. The pulse supplied to the magnetron remains at its peak value for approx. 0.7 μsec. Time of rise is approximately 0.2 μsec and the time of decay 0.4 μsec.

Modulator unit power supplies

127. Reference Fig. 1021, there are two D.C. power supplies in the modulator unit. V-208 and V-209 provide the − 1,500 V bias for the modulator valves V-203, V-204 and V-205. The grid current taken by the modulator (keyer) valves is indicated on meter M-202 when S-204 is thrown to the KEYER GRID CURRENT position. The grid current should be from 15 to 20 mA.

128. Jack J-204 is connected to the bleeder of the bias supply to provide approximately − 750 V as a "keep-alive" voltage for the antenna switching box.

129. S-210-B closes when the modulator cabinet doors are opened and so grounds the secondary of transformer T-214.

130. The other D.C. power supply is composed of V-201 and V-202 and transformers T-201 and T-202. This supplies the positive 4,000 V for the plates of the final driver stage. The output is filtered by C-201, and driver plate current can be indicated on M-202 when S-204 is in the DRIVER PLATE position. Driver plate current should be between 20 and 25 mA.

Modulator filament supplies

131. Referring again to Fig. 1020, T-208 supplies 6.3 V for the filament of the magnetron. The input voltage to this transformer is adjusted by R-219 (500 Ω) until M-204 reads 100 V. Filament volts for the keyer valves are provided by T-209, its input voltage being controlled by the auto-transformer T-210.

132. T-212 provides 5 V for the filaments of the damping diodes.

133. Power is supplied to the filament transformers, the driver bias supply and the blower motors when the LINE-SWITCH S-201 is closed. The white pilot lamp on the modulator panel, labelled POWER, lights when filament voltage is switched on.

Modulator blower motors

134. The three-phase blower BL-201 circulates air through the modulator and driver. Blower motor BL-203, also operating from the three-phase supply, provides cooling for the magnetron. BL-202 cools the filament seals of the keyer valves. This last blower motor is single phase.

Modulator time delays and interlocks

135. Time delay relay K-201 is energized when line switch S-307 in the high voltage rectifier, RA-68-( ) and line switch S-201 in the modulator are closed. K-201 takes approximately 30 sec. to close, the actual closing being indicated

by the lighting of the green pilot light on the modulator, labelled READY. This delay allows the filaments to reach their correct operating temperature before application of plate voltage.

136. Relay K-202 (Fig. 1021) controls the application of power to the final driver plate supply transformer T-202 and to the keyer bias supply transformer T-214. This relay has a number of interlocks as follows :—

(*a*) S-205 and S-207 door interlocks on modulator.

(*b*) S-208, closed, a thermal contact which opens when the temperature within the modulator cabinet becomes excessive.

(*c*) Contacts 3 and 4, on terminal board No. 13, which are connected when the magnetron compartment cover is closed.

(*d*) K-205, overload relay in driver plate supply circuit.

(*e*) K-204, overload relay in keyer bias supply circuit.

(*f*) K-101, closed, in driver unit (see para. 113).

When all these interlocks are in the correct position, and after K-201 has closed, K-202 will close when the START button, S-202, on the modulator panel is pressed. When K-202 closes the amber pilot located on the modulator panel, and labelled BIAS will light, indicating that power is supplied to the keyer bias supply.

137. Relay K-203 is energized when the plate contactor K-302 in rectifier RA-68-( ) is closed and when voltage regulator VR-301, also in the rectifier, is in a position corresponding to 10 kV. When K-203 is closed, power is applied to the driver plates and to the keyer plates (see para. 114). Closing of K-203 also lights the red pilot, DRIVER PLATE.

Voltmeter M-201

138. Voltmeter M-201 shown in Fig. 1021 indicates DRIVER GRID, DRIVER SCREEN, DRIVER PLATE and KEYER GRID voltages, according to the four positions of S-203. Variable resistors R-223 to R-226 are in series with one side of the voltmeter for each of the four switch positions. These resistors are adjusted so that in all four positions M-201 will read " 5 " under the following conditions :—

(*a*) Driver bias	− 200 V
(*b*) Driver plate	+ 750 V
(*c*) Final driver plate	+ 4,000 V
(*d*) Keyer bias	− 1,500 V

Modulator output

139. The modulator normally operates at a peak power of 300 to 400 kW.

HIGH VOLTAGE RECTIFIER

140. The high voltage rectifier provides 27 kV at 100 mA for the modulator. It is operated from the three-phase power supply. Circuit diagram is shown in Fig. 1022.

141. By closing the LINE SWITCH, S-307, voltage is applied to the rectifier blower motor BL-301, filament transformers T-301-B, T-301-C and T-301-D, FILAMENT voltmeter M-303 and the LINE voltmeter M-304. S-307 incorporates a thermal overload breaker, which will trip at approximately 25 A.

142. M-304, in conjunction with metering buttons S-305 and S-306, will indicate the voltage between any two of the three phases. Line voltage should be adjusted to 155 V by means of the manually operated voltage regulator located behind the modulator unit (see Fig. 1002). Turning the regulator handwheel clockwise increases the line voltage.

Rectifier voltage regulator

143. The induction regulator VR-301 has star primary and secondary windings, and the secondary windings can be varied in relation to the primary so that the output of the unit is variable from 10 to 225 V. The position of the secondaries is controlled by a reversible split-phase induction motor VR-301-B. Raising or lowering of the voltage is accomplished by means of the RAISE or LOWER push buttons on the rectifier panel. Three Thyrite resistors TY-301 are connected between regulator input and ground and act as surge protectors.

144. An interlock S-311, operated by a cam on the regulator shaft, limits the travel of the regulator by opening the motor circuit when the regulator reaches its maximum voltage position. S-312 acts similarly to stop the motor when the regulator reaches its minimum voltage position. Interlock S-314 is also operated by regulator position and lights the amber pilot on the rectifier panel when the regulator voltage is minimum. Interlock S-313 operates relay K-203 in the modulator when the regulator is in such a position that the rectifier output voltage is greater than 10 kV.

145. The output of VR-301 is applied to the three-phase transformer T-301, which has a step-up ratio of 20 : 1. Filament transformers T-301B, T-301C and T-301D are built into the same casing as T-301.

High voltage rectifier valves

146. Six 8020 rectifier valves are connected in a three-phase bridge network. The D.C. output of the rectifier is filtered by the resistance-capacity circuit of R-301 and C-391.

Rectifier safety devices

147. Relay K-301 closes contacts 1 and 2 when the power is switched off and connects R-304 and R-303 across the output, thus discharging C-301.

148. A safety switch S-310 shorts C-301 when the cabinet doors are opened.

149. R-311 and R-312 are in the negative side of the rectifier output between the rectifier valves and C-301. These prevent the initial charging current of the condenser exceeding the peak current limit of the valves. Relay K-307 short-circuits these resistors on the application of the high voltage to the rectifier—the delay being only that required for the mechanical closing of the contacts.

150. K-305 is an overload relay which can be adjusted by means of resistor K-305-A, to trip at a predetermined value of D.C. output current. K-305-C limits voltage surges across the relay, as its resistance varies with voltage.

Rectifier on-off control

151. Before power can be applied to the high voltage transformer, K-302, must be closed. This contactor serves as the main on-off control. It is closed by START button,

S-301, the circuit being interlocked through K-308, door interlocks, and K-202 (in the modulator)—all closed. Once K-202 becomes energized it is kept closed by a holding current which is broken by pressing the STOP button, S-302. The voltage is normally reduced to below 10 kV before the STOP button is pressed.

152. A red pilot light indicates that K-302 is closed and a green pilot that it is open. The TIME TOTALISER M-305 is paralleled with the red pilot and registers the total hours that plate voltage has been applied to the rectifier.

Current overloads

153. Relay K-308 is energized directly from one phase of the 115 V supply as soon as the main switch S-307 is closed. R-313 is in series with the pick-up coil K-308A. This coil is shorted by a contact of K-305, the current overload relay in the high voltage circuit, and by contacts of K-303, K-304 and K-306, which are current overload relays in each phase of the supply. As long as normal currents flow in the system, all these contacts will remain open and K-308 will remain energized. However, an overload on any of these relays will cause the coil of K-308 to be short-circuited. In turn K-308 will open K-302 and remove power from the rectifier input. R-313 prevents shorting of the line when the coil of K-308 is shorted out by any of the above contacts.

PRE-PLUMBED SECTION

154. The magnetron will deliver maximum power to a load have a certain definite impedance. The actual impedance presented by the R.F. line and the dipole assembly is different from this optimum value, which is determined by the characteristics of the magnetron. It is therefore necessary to insert a matching transformer between the magnetron and the R.F. line in order to secure maximum transference of power. It is also necessary to make the connection of this transformer a sound mechanical job. Both these requirements are fulfilled in the pre-plumbed joint section, which couples directly to the magnetron output.

155. A third purpose is served by the pre-plumbed section. When a common T.R. system is used it must be remembered that the impedance presented to the R.F. line by the magnetron when it is not delivering power (cold impedance) is different from the impedance desired in the line when the magnetron is firing (hot impedance). Thus, during the period when the magnetron is not delivering power, it does not constitute a matched load for electromagnetic energy propagated along the line toward the transmitter. This means that there will be a point near the magnetron coupling at which the impedance, looking toward the magnetron, will appear to be very high.

156. If a branch is made in the R.F. line at such a point, and the branch and its load presents a low impedance, the returning electromagnetic energy will follow the branch line with a negligible loss of energy along the line to the magnetron.

157. The junction to the T.R. box and receiving system is located at just such a point in the line. The pre-plumbed junction is so called because the uniformity in manufacture of magnetrons makes possible the accurate determination of the high impedance point. Thus there is no need for re-setting the tee-junction each time a new magnetron is inserted.

158. A cross-section diagram of the pre-plumbed assembly is shown in Fig. 1005.

RECEIVING SYSTEM

BLOCK SCHEMATIC DIAGRAM

159. A block diagram of the receiving system is given in Fig. 1023.

160. The units of the receiving system are as follows :—

(*a*) Antenna, AN-101-( )
(*b*) Antenna switch box, BC-1132-( )
(*c*) Crystal mixer, BC-1130-( )
(*d*) Local oscillator, BC-1096-( )
(*e*) Pre-amplifier, BC-1078-( )
(b)–(e): Located on the transmitter, see Fig. 1012
(*f*) Radio receiver, BC-1056-( )
(*g*) Receiver power unit, RA-66-( )
(*h*) Remote video amplifier, BC-1074-( )

Antenna and R.F. lines

161. An outline of the antenna system is shown in Fig. 1004. The radiating antenna (Fig. 1007) is set at the focal point of the parabolic reflector, and a slight asymmetry of the dipole skews the beam through an angle of approximately 1.5° from the mechanical centre of the antenna shaft. The R.F. line serves both receiving and transmitting systems. The centre conductor is supported by quarter-wave stubs along the line and at the corners. The line reaches the antenna through the centre of pedestal MP-61-( ) and emerges at the right side of the pedestal, from which point it continues through the central axis of the paraboloid to the antenna assembly.

Rotating joints

162. As only the paraboloid moves in azimuth and elevation, two slow-speed rotating joints are necessary—one known as the azimuth rotating joint, the other known as the elevation rotating joint (see Fig. 1006). These joints are identical and interchangeable. As antenna AN-101-( ) is rotated at 1,800 r.p.m. a further high-speed joint is necessary to connect the line to the antenna. This joint is shown also in Fig. 1006. Both types of rotating joint employ the principle of overlapping tubes.

ANTENNA SWITCH BOX

163. This unit is generally referred to as the T.R. box (see Fig. 1005). Its function is to permit the passage to the receiver of all the energy of any echo reaching it, while preventing the high power pulse of the transmitter from entering and damaging the sensitive elements of the receiving system. Fig. 5 gives a diagrammatic picture of the unit.

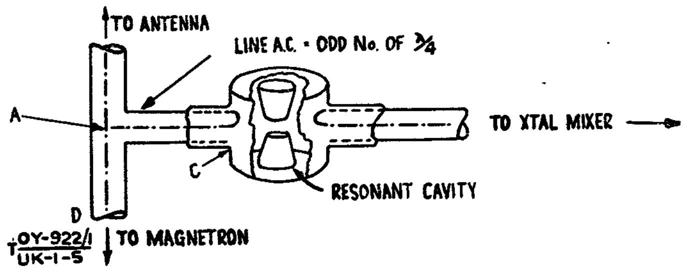


Fig. 5. Diagrammatic view of antenna switch box

Action of spark gap

164. When the transmitter radiates, the pulse enters the short section of line AC and is loop-coupled to the cavity formed by the shell of the switching box and the two circular plates which are part of the type WE-721-( ) spark gap. This cavity is resonant at the frequency of operation. The magnetic flux in the cavity sets up high potentials between the spark gap cones and a spark forms. A small " keep-alive " electrode is maintained at a negative potential with respect to the cone electrode (see modulator power supplies, para. 128). This potential is high enough to cause ionization of the gas within the gap and so assist the breakdown across the electrodes. The length of line AC (Fig. 5) is an odd number of quarter wavelengths. When the gap breaks down it acts as a short-circuit at point C. This will appear as an open circuit at point A, hence the input impedance of the line toward C will appear very high and only a small amount of power will pass along it. This power is sufficient to maintain the spark across the electrodes of the switching box during the time of transmission. When the transmitter is quiescent, the cavity is resonant and the crystal mixer is coupled through the cavity into the loop on the line at point C, and the received signal will be fed into the receiver channel. The line AD to the transmitter is terminated at the magnetron and presents a relatively high impedance. Consequently the larger proportion of echo signal will enter the line AC to the cavity.

Tuning of antenna switch box

165. At two points on the cavity there are plugs, the adjustment of which will alter the volume and resonant frequency of the cavity. When receiving, the cavity has a very high Q. Thus, whenever the operating frequency is changed, the cavity should be retuned.

CRYSTAL MIXER

166. Here the received echo signals are combined with the output of a local oscillator to produce an intermediate frequency signal of 30 Mc/s. The crystal has two inputs, one at 3,000 Mc/s and the other at 3,030 Mc/s.

167. A cross-section view of the crystal mixer can be seen in Fig. 6. The entire unit is connected directly to the cavity of the antenna switching box.

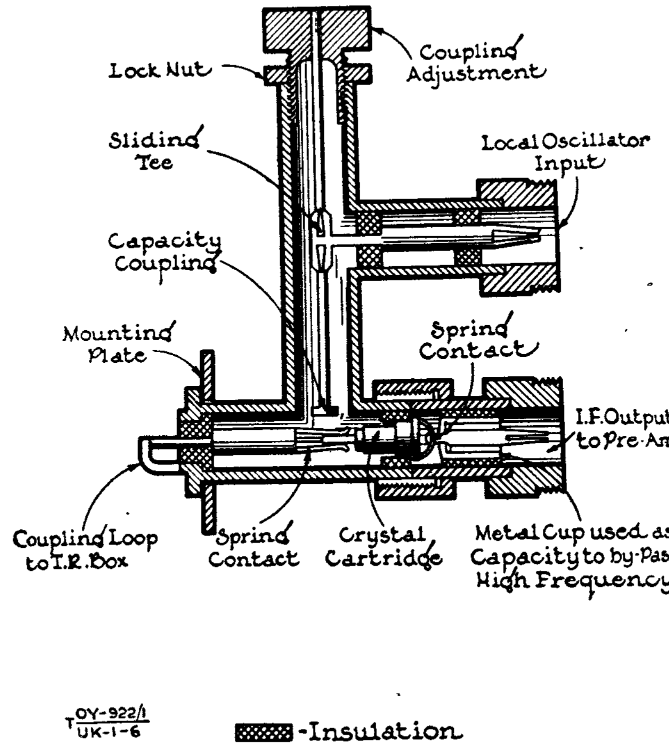


Fig. 6. Crystal mixer

168. The crystal is connected to the pick-up loop at the T.R. box by a quarter-wave resonant line which acts as a step-up transformer between the low impedance loop and the crystal holder. The crystal capsule is of silicon.

169. The output of the local oscillator is capacitively coupled to the inner conductor at the base of the crystal cartridge. The degree of coupling can be adjusted by the knob on top of the mixer. A locking nut is provided to prevent unwanted changes in coupling.

Coupling the crystal mixer

170. Since the received signal is always weak, the mixer has to be carefully matched to the input signal. However, in the case of the local oscillator, there is a deliberate mismatch between mixer and local oscillator. This is done to prevent overloading of the crystal with subsequent shortening of its useful life. Another disadvantage of matching the oscillator line to the mixer would be the diversion of part of the echo signal into the oscillator. The crystal current, which can be read on the meter marked CRYSTAL CURRENT on the receiver, should never exceed 0.5 mA.

Care of crystals

171. The crystal material, silicon, has been chosen as a compromise between the more sensitive but less stable galena, and carborundum, which can stand considerable contact pressure, but is relatively insensitive. The crystal capsules should be guarded from electric and magnetic fields likely to harm them. Static discharges to the crystal should also be avoided.

D.C. crystal resistance

172. The " back resistance " of a crystal is a rough indication of its efficiency. A crystal check circuit is not provided in the SCR-584. However, crystals can be checked with a 1½ V cell and a test ohmmeter.

LOCAL OSCILLATOR

173. The local oscillator is a reflex klystron, type WL-417-( ). It generates a frequency in the 3,000 Mc/s band which is fed to the crystal mixer to beat with the received echo signals. A circuit diagram is shown in Fig. 1024.

174. Fig. 7 shows a cross-section diagram of the klystron used. Tuning is accomplished by varying the dimensions of the resonant cavity of the klystron. It is tunable between 8.8 and 10.7 cm.

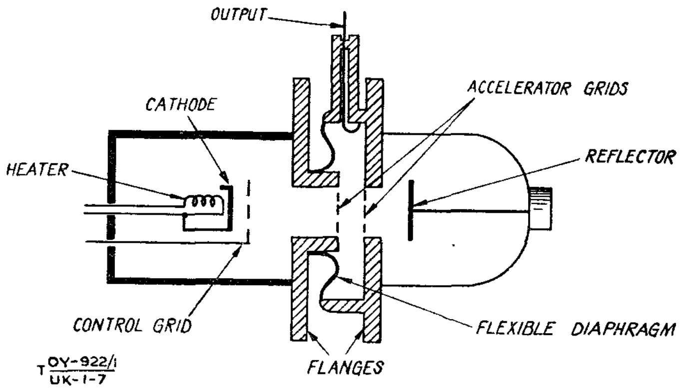


Fig. 7. Type WL-417-( ) klystron

Operation of the klystron

175. Due to the construction of the valve and the potentials on the various electrodes the cathode emits a stream of, electrons in the form of a beam. Cathode potential is − 575 V with respect to ground. This is necessary in order that the metal structure of the cavity may be at ground potential.

176. The control grid, through which the stream of electrons passes, is 10 to 15 V more positive than the cathode and serves to accelerate and focus the beam.

177. The resonant cavity is a metal structure of approximately the form shown in Fig. 7. Provision is made for varying the size of the cavity and consequently the output frequency of the valve. This is accomplished externally by varying the distance between the flanges. The section between flanges is flexible, and so varying the distance between these two flanges will alter the inter-grid spacing within the valve.

178. The beam of electrons passes through the accelerator grids of the cavity and moves toward the reflector. The electric field set up in the cavity modulates, or bunches, the beam.

179. The reflector is a metal plate at right-angles to the beam. Its potential is variable between − 575 and − 785 V.

180. The WL-417-( ) klystron uses a single cavity, which serves both as buncher and catcher. Provided that the bunched electrons turned back by the reflector plate return through the cavity grids in the right phase, they will give up their energy to the cavity and thus maintain a state of continuous oscillation.

181. Phase relationship between primary and reflected electrons at the cavity grids is critical. This relationship is determined by the ratio of accelerating and reflecting potentials. Therefore, it is possible for the klystron to oscillate at several different combinations of these voltages. The maximum output for any given mode of oscillation is obtained by adjustment of the reflector voltage, through potentiometer R-1822.

182. The power output of this valve is between 25 and 60 mW.

Local oscillator power supply

183. There are two D.C. supplies, one referred to as grounded and the other as ungrounded. V-1801 is the rectifier for the grounded supply and provides approximately 550 V at 50 mA, with the positive side earthed. V-1802 is the ungrounded rectifier, supplying 500 V at 5 mA, with its positive side connected to the negative side of V-1802.

184. There are two bleeders on the grounded supply. One of these bleeders contains R-1817 which supplies voltage for the klystron grid. This potentiometer has a range from 0 to 20 V. The actual range obtainable will vary with different valves as it is dependent upon the current drawn by the klystron grid. This control is marked GRID VOLTS on the oscillator chassis. The other bleeder series contains R-1806, COMP. VOLTS, for adjusting the compensating voltage (see para. 186).

185. The ungrounded supply operates V-1804, V-1805, V-1806 and V-1807. These are type VR-105-30 valves (voltage regulators). Potentiometer R-1822 is used to control the reflector voltage. The exact range covered by this potentiometer depends upon the setting of R-1806. However, a range of between 0 and 100 V negative with respect to cathode can always be obtained.

Power supply compensating circuit

186. In a reflex klystron the frequency of oscillation is a function of both accelerator and reflector voltages. When the accelerator voltage varies in the positive direction, or the reflector voltage goes more negative, the frequency of the valve will increase. Conversely, it will decrease for changes of opposite polarity in accelerator and reflector. The frequency is three or four times as sensitive to changes in reflector voltage as it is to accelerator variations. The effect of such line voltage variations can be cancelled by taking a portion of the accelerator voltage and applying it to the reflector. R-1806 has been located by experiment to give the necessary range of compensation. The function of the voltage regulator valves is to furnish a steady source of D.C. potential which can be added to the voltage at the compensator tap. The design of the circuit enables the transference of the correct variation to the reflector while maintaining the proper D.C. value on the reflector. Potentiometer R-1806 is first set to give the proper voltage variation on the reflector, and then R-1822 is set to give the correct average D.C. value to produce oscillations in the valve.

187. Jacks J-1805 and J-1806 allow the accelerator grid current to be measured from the front of the panel. Oscillation in the klystron is indicated by a sudden rise in accelerator grid current measured between J-1805 and J-1806. The normal accelerator current is 20 mA.

Local oscillator power switches

188. Power is applied to the local oscillator first by closing S-1801 labelled FILAMENT, and then closing S-1802, which is labelled PLATE. Both switches are located on the front panel of the local oscillator.

PRE-AMPLIFIER

189. The first two stages of intermediate frequency amplification are contained upon the chassis of the local oscillator unit. The pre-amplifier is placed as close as possible to the crystal mixer in order to keep the cable between mixer and first I.F. stages as short as possible. Gain of pre-amplifier is approximately 38 db.

First I.F. stage

190. See Fig. 1024. The 30 Mc/s input from the mixer is fed, through 6 in. of 50Ω coaxial cable, to the primary of T-1852. The primary of this transformer is factory tuned, with the capacity of cable and mixer, to resonate at the I.F. frequency. Changing the length of the input cable will therefore detune the circuit with deleterious results.

191. The R.F. filter circuit, composed of R-1852, C-1852 and C-1864, isolates the input to the pre-amplifier from the leads to the crystal current milliameter in the receiver.

192. The secondary of T-1852 is tuned by means of a silver-plated copper slug.

Second I.F. Stage

193. The grid circuit of the second stage (V-1852) is tuned by the variable inductance L-1853. This inductance also is slug-tuned.

194. Automatic gain control bias from the receiver is applied to the grid of V-1852 through the R.F. filter R-1852 and C-1851.

195. The plate circuit of V-1852 is designed to couple into a 75Ω line at J-1853. The plate circuit inductance L-1856 is tuned to 30 Mc/s with the plate to ground capacitance of V-1852.

Supply voltages

196. T-1851 supplies filament volts for the two 6AC7 valves. Plate and screen voltage is supplied from the receiver through J-1851.

RADIO RECEIVER

197. The radio receiver BC-1056-( ) contains the receiver proper, a narrow-gate amplifier and a voltage regulator.

Receiver I.F. stages

198. The input from the pre-amplifier is fed into the third I.F. stage (V-701) via J-705 (see Fig. 1026). The grid bias on V-701 is derived from the A.G.C. valve V-713. Thus A.G.C. is applied to the second and third I.F. stages. The fourth I.F. stage (V-702) and the fifth (V-703) are of similar design but do not have A.G.C. applied.

199. After the fifth stage the I.F. channel is split into a range channel and a servo channel.

200. The sixth I.F. stage is really two valves—one known as the servo sixth I.F., the other as the range sixth I.F. V-704, the servo channel, is narrow-gated and serves as the initial amplifier of the automatic tracking channel. V-711, the range channel, is ungated and serves as the initial stage of the range channel.

201. The plate circuit of V-711 is a single tuned resonant circuit feeding a low impedance line to the video amplifier via J-706.

202. The screen and plate voltage of V-704 are applied by V-712 only during the narrow-gate period. This allows only the signals occurring during the narrow-gate period to be passed into the automatic tracking system.

Receiver gain control (manual)

203. The gain control circuit appears at first sight to be unduly complicated; but the output of the automatic tracking channel must be constant, whereas the output of the range channel must be variable so that weak signals may be followed on the range C.R.Ts. V-711 has insufficient gain to provide this variation by itself. Therefore control of the earlier stages is necessary; but increasing the gain of these previous stages would, if it were not compensated, increase the gain of the tracking channel. To accomplish this a SENSITIVITY control (R-749) is provided, which increases the gain of the common I.F. stages and at the same time decreases the gain of V-704 by an equal amount.

204. R-749 is located in the cathode of V-704 and varies the gain of this stage by changing the grid bias. Reducing the gain of V-704 causes the A.G.C. voltage to change in such a way as to increase the gain of the second stage in the pre-amplifier and the first stage in the receiver. This increase in gain will compensate for the loss of gain in V-704, thus maintaining a constant output regardless of the position of the SENSITIVITY control R-749. However the output through the range channel V-711 will be increased as its output is dependent upon the A.G.C. voltage.

Narrow-gate amplifier and limiter

205. The negative narrow gate input from the range unit enters the receiver via J-703. The negative pulse is amplified by V-710, which is a triode-connected 6L6 beam tetrode.

206. V-714 is connected as a diode between the grid circuit of V-712 and the regulated 120 V supply. This limits the gating voltage applied to the cathode follower (V-712) to 120 V. The output of the cathode follower during the gating period is actually about + 114 V.

207. This output is fed through an R.C. circuit to the plate, and screen grid of V-704.

Receiver seventh I.F. stage (servo channel)

208. The output of V-704 is coupled, through a single tuned resonant circuit, to the grid of V-705, which acts as the second I.F. stage in the servo channel. Its output is coupled via another single tuned circuit to the cathode of one half of a 6SN7 double-triode, V-706.

Receiver second detector (servo channel)

209. This half of V-706 acts as a diode detector, using grid and cathode as the diode and having the plate grounded in order to prevent possible coupling of the 30 Mc/s I.F. signal to the other half of the valve.

Receiver video amplifiers (servo channel)

210. The second half of V-706 acts as the first stage of video amplification. Inductance L-707 and condenser C-723 comprise a 30 Mc/s filter, and grid resistor R-752 also serves as the diode load.

211. V-707, a 6AG7 valve, is the second stage of video amplification. The output of V-707 is connected to the automatic tracking unit by way of J-702. The output is also connected, through R-753 and C-737, to one cathode (pin 3) of V-713, the automatic gain control valve.

Automatic gain control circuit

212. It is important to note that the A.G.C. valve is operated from the automatic tracking channel only, although (as has been explained in paras. 203 and 204) its effect is felt on both channels. The purpose of the A.G.C. is to maintain constant gain through the tracking channel.

213. A circuit diagram of the A.G.C. section is shown in Fig. 1027. One half of V-713 is used as an automatic gain detector, and the other half is employed as a cathode follower.

214. Although it is essential to have A.G.C. when the set is tracking automatically, it is desirable to have manual control when not in the automatic position. The change over from automatic to manual control is accomplished by relay K-701 and switch S-701, labelled A.G.C.-OFF on the receiver panel (see Fig. 1013). With the relay not energized the automatic gain is in operation. In order to energize the relay it is necessary to close S-701 and turn the control switch on control panel PN-24-( ) to a position other than AUTOMATIC.

215. When the control is set to manual operation the following conditions hold. The detector portion of V-713 employs pins Nos. 1, 2 and 3, the grid and plate being tied together to form the plate of a diode detector. The cathode of the detector is held at a potential of 30 V positive with respect to ground by means of the potential divider R-741 and R-748. As was stated in para. 211 the input from the receiver video amplifier is applied to the cathode pin of this half of V-713.

216. For manual control, relay K-701 is energized, and this connects the grid (pin 4) of the cathode follower half of V-713 to the arm of the gain control R-738. R-743, marked A.G.C. ADJUST, is set to have the cathode voltage at ground potential when R-738 is set as maximum. Now if R-738 is lowered, the voltage applied to the grid of the cathode follower will be less, and so the cathode potential will fall, thus becoming negative with respect to ground.

217. The A.G.C. voltage is taken from the cathode (pin 6) and is fed to the second and third I.F. stages. These valves operate at maximum gain when their grid bias is a minimum. Any voltage output from the A.G.C. valve will be negative and so will operate to reduce the gain of these stages. Any detected signals from V-713 will have no effect on the manual operation because only a small fraction of the signal appears across R-743.

218. For automatic gain control, relay K-701 is open circuited. This results in the grid of the cathode follower section being connected to a point between R-740 and R-739. In this position no A.G.C. voltage is developed until detection occurs.

219. The negative video frequency signals from V-707 are applied to the cathode of the detector section of V-713 across R-742 and R-748. When the signal voltage at the cathode exceeds − 30 V the diode section will conduct and a voltage will be developed across the detector load R-739, R-740 and R-743.

220. Repetition frequency (1,707 c/s) and error signal frequency (30 c/s) will be present in this output. These are filtered by C-735, C-736 and C-739 together with R-739 and R-740. Occasional strong signals from nearby radar equipments are prevented from paralyzing the A.G.C. circuit by the presence of R-739 which prevents sudden charging of C-735 and C-736.

221. C-735 and C-736 effectively by-pass the error signal frequency of 30 c/s and the resultant voltage applied to the grid of the cathode follower section is D.C. and follows the average amplitude of the video signals.

Stabilized 120 V supply

222. The receiver contains a voltage regulator circuit comprised of V-708 and V-709. It uses the negative 105 V regulated supply from the receiver power unit as a reference and provides a stabilized + 120 V from the unregulated 300 V supply of the same power unit. (See Figs. 1028 and 1030.)

223. V-708 is used as a variable resistance in series with the load. Variations in the voltage on its grid will alter the internal resistance of the valve. V-709 controls the grid of V-708 and ensures correct regulations. R-726, R-727 and R-728 are connected between the 120 V to be regulated and the steady − 105 V supply from the receiver power unit. The grid of V-709 is connected to the arm of potentiometer R-727, labelled VOLT REG ADJ, and is set so that the normal regulated output is + 120 V.

224. A positive increase in load voltage causes an increase of current in V-709 and consequently a drop in the grid potential of V-708. This effectively increases the resistance of V-708 and so brings down the voltage at the + 120 V point. A decrease in load voltage will operate in the opposite way.

225. C-727 allows sudden changes to be applied directly to the grid of the control valve V-709. This provides better regulation on rapid variations.

REMOTE VIDEO AMPLIFIER (Range Channel)

226. This circuit is located in the field supply unit RA-71-( ), (see Fig. 1003). A circuit diagram of the remote video amplifier is shown in Fig. 1029.

227. The amplifier receives the ungated I.F. signals from the sixth I.F. stage of the range channel (V-711 in the receiver) and applies negative signals to the range C.R.Ts. and the P.P.I. unit.

228. The overall voltage gain of the range channel, that is, from the input to the pre-amplifier to the output of the

remote video amplifier, is about 141 db. with a bandwidth of 1.6 Mc/s. The overall delay in the range channel is the same as that of the servo channel, namely 0.6 μsec.

229. The remote video amplifier circuit is similar to that of the servo channel in the receiver, beginning with V-705 ; but the range channel, beginning with V-711, has an extra stage of video amplification in V-1104.

230. The I.F. signal from the receiver enters the remote video amplifier at J-1101. The range seventh I.F. is V-1101 and the first half of V-1102 is used as the range second detector. The plate output of the amplifier half of this valve is applied to the grid of the second video stage V-1103 through C-1108.

231. V-1103 serves three purposes in addition to its function as amplifier. It limits the maximum signal which can be applied to the C.R.Ts., increases the slope of the leading edge of the signal pulse, and tends to keep noise level constant. Since negative signals are applied to the grid of V-1103, any exceptionally strong signals will cut the valve off, thereby limiting the signals passing through the valve. The cathode circuit has a very short time constant and causes negative feed back on lower frequencies, thus increasing the slope of the signal pulse. Finally, the high resistance R-1107 produces sufficient bias, when positive noise peaks draw grid current from the valve, to limit undesirable effects and maintain noise level sensibly constant, regardless of variations in signal strength.

232. The output valve is V-1104. Its output pulses are negative and go to the range C.R.Ts. via J-1102, and to the plan position unit via J-1104.

RECEIVER POWER UNIT

233. A circuit diagram is shown in Fig. 1030. Rectifier RA-66-( ) supplies power to the receiver, remote video and the pre-amplifier.

234. It consists of two full-wave rectifier power supplies. The first supply is the unregulated positive 300 V. The second is the regulated negative 105 V.

235. T-1103 supplies filament volts for the two 5U4G's connected as half-wave rectifiers. This transformer also supplies filament volts to the remote video unit and pilot light I-1001. A choke capacity filter network is employed and R-1003 acts as a bleeder across the 300 V supply.

236. The second supply has a 5U4G rectifier (V-1003), a choke-capacity filter and bleeder, followed by a voltage regulator valve (V-1004) across the output, which is held at 105 V. Actually, the positive side is grounded so the output is — 105 V. This voltage is used as a reference for regulating the 120 V plate supply in the receiver (see para. 222).

Interlocks

237. The line supply to the transformers is interlocked through two pins on the voltage regulator valve socket and through interlocks in the connection cables.

P.P.I. SYSTEM

BLOCK SCHEMATIC DIAGRAM

238. The function of the plan position indicator system of the SCR-584 is to provide facilities for locating and plotting targets at all ranges up to 70,000 yd. Its primary use is for searching either manually or automatically. The system provides data on the approximate range, azimuth and course of a target.

239. The P.P.I. system consists of four basic components. These are :—

Plan position unit, BC-1058

Indicator (containing P.P.I. C.R.T.), BC-1092.

P.P.I. selsyn, B 2005—located in base of pedestal, MP 61.

P.P.I power unit, rectifier RA-69.

A block diagram of the system is shown in Fig. 1031.

PLAN POSITION UNIT

240. This unit receives the synchronising trigger from the range unit and produces the sweep voltages for the deflection coils of the P.P.I. tube. The unit also generates the range marker pips and receives the narrow-gate pulse and video signals, applying them to the P.P.I. tube for target indications. A circuit diagram is shown in Fig. 1032.

Multivibrator circuit

241. The negative trigger from the range unit is fed to one grid of V1614 via J-1606 and C-1634. V-1614 is a double triode and acts as a two stage trigger amplifier. The output taken from the second plate (pin 5) is negative. This negative pulse is sufficient to drive the grid (pin 1) of V-1603 to cut-off. The sudden rise in the voltage of plate 2 is transmitted by C-1611 to grid 4 with the result that the second half of the valve is driven to saturation. The drop in potential at plate 5 is referred to grid 1 through C-1612 with the result that the grid of the first section of V-1603 is driven still more negative. This action is, of course, practically instantaneous ; therefore on the application of the trigger to grid 1 the potential on plate 5 drops sharply. The trigger pulse duration is approximately 1.7 μsec. but the time constant of the grid circuit of the first section is considerably longer. Thus a time longer than 1.7 μsec. is required for C-1612 to charge sufficiently for grid 1 to rise above cut-off. When this occurs, the first section conducts and grid 4 is driven to cut-off and remains so until the arrival of the next trigger.

242. The output of the multivibrator is taken from plate 5, and is a negative rectangular wave whose leading edge coincides with the onset of the trigger pulse. The width of the negative portion is determined by the discharge time of the C.R. circuit of the first section of V-1603. This time constant can be altered by the RANGE SELECTOR SWITCH, S-1601, provided on the panel of the plan position unit and giving the choice of two time constants corresponding to ranges of 35,000 yd. and 70,000 yd.

243. The output of the multivibrator provides the timing for four other stages ; namely, the C.R.T. intensifying circuit, the saw-tooth generator, the electronic switching valves and the 16.4 kc/s range marker oscillator.

Beam intensifying circuit

244. The output of V-1603 is applied to the grid (pin 1) of one section of the double triode V-1602. The cathode of this half of the valve is held at a positive potential from the variable tap on R-1614, which is part of the voltage divider made up of R-1616, R-1613, R-1617 and R-1614. The cathode is also connected to the cathode of the P.P.I. C.R.T.

245. Thus the cathode of the P.P.I. tube is held at a potential above ground equal to the drop across the lower part of the voltage divider. This voltage drop depends upon the setting of the tap and the current being drawn by the first section of V-1602.

246. When the negative pulse output of V-1603 is applied to grid 1 of V-1602, the valve is cut off and the potential of its cathode drops to a low value. This drop is applied to the P.P.I. tube cathode and intensifies the beam for the duration of the pulse. R-1614 is a screwdriver control on the P.P. unit panel and is labelled INTENSITY.

Saw-tooth generator

247. The other half of V-1602 is employed as a saw-tooth voltage generator. The grid (pin 4) is positive and the valve, normally conducting heavily, effectively short circuits C-1603. When the triode is cut off by the arrival of the negative pulse from V-1603 the short-circuit becomes open circuit and C-1603 charges through one of two possible paths, depending upon the position of switch S-1601.

248. In either case, the time constant of the circuit is long compared with the applied negative pulse, so that only a relatively small portion of the charge curve is used. At the cessation of the applied pulse the valve conducts again and rapidly discharges C-1603.

249. The charging voltages are adjustable by means of R-1604 and R-1605. This permits variation of the sweep voltage amplitude between desirable limits. R-1605 and R-1604 are mounted on the chassis of the P.P. unit and are labelled 70,000 YD. SWEEP and 35,000 YD. SWEEP respectively.

P.P.I. selsyn driver

250. The output of V-1602 is applied to the grid of V-1601. This valve is a 6L6 used as a sweep amplifier with low frequency feed-back in the cathode circuit. Actually, the output of V-1601 is considerably different from the sweep voltage wave form applied to its grid ; but the output of the selsyn appears on the grids of the next stage of phase inverter valves as a sweep wave. This purposeful distortion in V-1601 is to compensate for the fact that the selsyn is not an ideal transformer, and also for the fact that the leads to the selsyns have considerable capacity to ground.

251. The negative going saw-tooth output of V-1601 is applied to the rotor of the P.P.I. selsyn (mounted in the pedestal) through pin H of connector J-1601. The rotor induces a corresponding sweep voltage in each of the three stator windings of the selsyn. The rotor is geared to the parabola, so that the position of the antenna governs the amount of coupling between rotor and stator windings. Thus, when the rotor is turned, the flux linking the stator windings varies not only with the saw-tooth current but also with the position of the rotor.

252. That is, in each stator winding the saw-tooth wave will suffer a sinusoidal variation in amplitude as the rotor turns through 360°. Because of the geometric spacing of the stator windings, the saw-tooth waves in the arms of the selsyn stator will reach their maximum amplitude 120° apart.

Scott connection

253. Reference to Figs. 1033 and 1034 will show that the windings of the selsyn stator are connected to the three arms of a resistance " Y " network, R-1640, R-1641, R-1642 and R-1643. Fig. 8 will help in considering this circuit. These resistors are connected in a manner similar to the Scott transformer, which is used for converting a three-phase to a two-phase system. The purpose of this resistor network is to provide two voltages of equal maximum amplitude, one of which varies in amplitude as the sine, and the other as the cosine, of the rotor displacement angle.

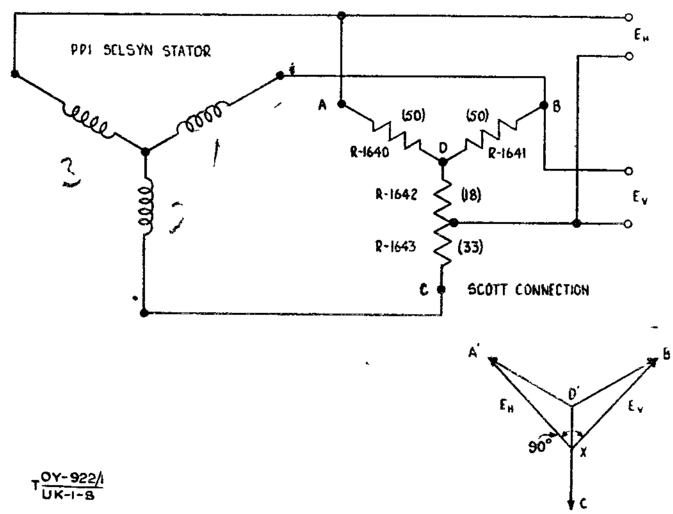


Fig. 8. Scott connection

254. The three induced stator voltages can be represented as a rotating vector. Since the network is comprised of pure resistance, the voltages across the legs will be proportional to the resistance of the legs. Now if E_{AD}, which is the maximum amplitude of the corresponding sweep voltage, is assumed to be 50 ; then E_{BD} and E_{CD} will also be 50. It can then be shown that the tapping point X on arm DC to make E_{XA} at right-angles to E_{XB} is where DX is equal to 18. This is actually so as R-1640 and R-1641 are each 50 Ω and R-1642 is 18 Ω.

255. Now if the voltages $E_{XA} = E_H$ and $E_{XB} = E_V$ are applied to the horizontal and vertical deflection coils respectively, of a magnetic deflection C.R.T., the resulting sweep will describe a circle in step with the rotation of the parabola. The rotation thus produced is superimposed upon the much faster linear saw-tooth voltage and the result is a linear, radial, rotating trace on the P.P.I. tube.

Phase inverters

256. The voltage across R-1640 and R-1642 is applied to the grids of V-1606, a double triode 6SN7-GT ; and the voltage across R-1641 and R-1642 is applied to the grids of a similar valve V-1607. These valves act as phase inverters for the horizontal and vertical deflection sweeps.

257. The cathodes in each valve are tied together and have common cathode resistors which couple the first section of each valve to its second half. The outputs from V-1606 are taken from tappings on the loads of the two plates. One on R-1638 is adjustable for the purpose of balancing the outputs from the two sections of the valve. This potentiometer R-1638 is mounted on the chassis and marked CIRCLE ADJ. R-1644 performs the same function for V-1607 and is also a screwdriver adjustment on the chassis, marked CIRCLE ADJ. These controls are used to ensure that, when the antenna rotates, the sweep describes a circle whose centre is coincident with the centre of the P.P.I. tube. When adjusting these controls it should be remembered that the sweep amplitude also is affected and the sweep should be checked on both ranges after any such adjustment.

Push-pull output

258. One output of V-1606 is coupled through C-1626 to the grid of V-1616, a 6L6 beam tetrode. The other output goes via C-1628 to the grid of V-1615, a similar type valve. These two valves comprise the push-pull sweep amplifier for the horizontal deflection coils of the P.P.I. tube. An identical arrangement is employed for the vertical sweep, using V-1617 and V-1618.

" Clamping " circuit

259. In order to ensure that the P.P.I sweep shall always start from the centre of the tube face, it is necessary to " clamp " or switch the grids of the final sweep amplifiers to some fixed potential between sweeps.

260. There are four valves employed thus ; namely V-1610, V-1611, V-1612 and V-1613. Two valves V-1610 and V-1611 are used with the horizontal sweep, and the other two V-1612 and V-1613, with the vertical sweep. They operate as electronic switches to connect a constant voltage to the grids of the sweep amplifiers between sweep pulses and to disconnect this voltage during sweep pulses. These valves are generally referred to as " clamping " triodes.

261. The action of all four is identical. A simplified diagram of V-1610 is shown in Fig. 9. During the sweep,

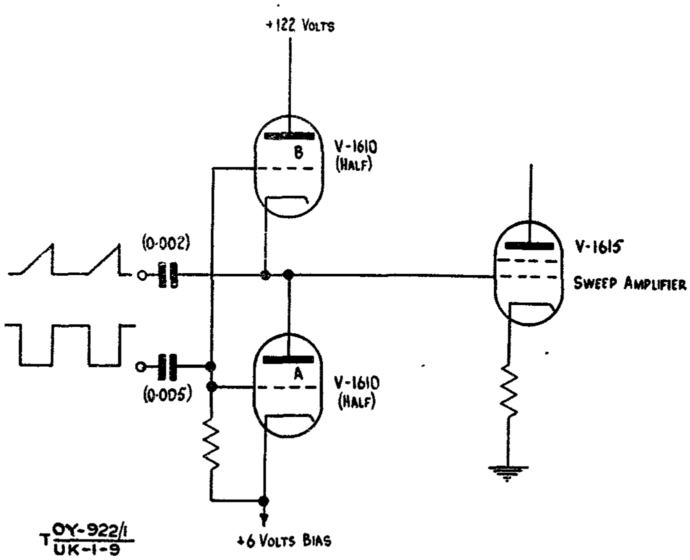


Fig. 9. Simplified circuit of clamping valves

the grids of V-1610 are held negative beyond cut-off by the multivibrator pulse, and so V-1610 has no effect on the operation of V-1615. At the end of each sweep the grids of V-1610 are driven positive by the multivibrator and both valve sections conduct.

262. When the grid of section A reaches the bias potential set by R-1679 (see Fig. 1034) it will commence to draw current, and never greatly exceeds this potential. Thus, from the trailing edge of one negative square wave until the leading edge of the next, both grids of V-1610 will be at the same potential.

263. When this is so it does not matter whether the potential at the point common to the cathode of section B and anode of section A is negative or positive with respect to that bias voltage, because in either case one of the triodes will conduct. The result is that the control grid of V-1615 will be brought to very nearly the bias potential set by R-1679, during the time between sweeps. Thus the P.P.I. sweep will always start from the same point.

264. Due to variations in valves, the potentiometer R-1679 and R-1682 have been provided for bias adjustment on both the horizontal and vertical clamping triodes. These potentiometers are screwdriver controls mounted on the chassis and marked CENTER ADJ.

265. The deflection coils of the P.P.I. are energised by the push-pull amplifiers V-1615 and V-1616 for the horizontal, and V-1617 and V-1618 for the vertical sweep. The resistors coupling the plates of each pair of valves act as dampers to prevent possible oscillation.

Video, range marker and narrow-gate circuits

266. The video signals from the remote video amplifier are coupled to the plan position unit via jack K-1605 (see Fig. 1035), and applied to grid 1 of V-1608. This half of the valve acts as an inverter amplifier to convert the negative input signals to positive signals. The second half of V-1608 is used as a D.C. restorer.

267. The output of V-1608 is applied via C-1622 to grid 1 of another double triode, V-1609. The D.C. restorer, by preventing any negative component developing, helps the P.P.I. operator in the detection of weak signals.

268. V-1604 functions as a 14.6 kc/s oscillator and produces the 10,000 yd. range marker pips for the P.P.I. The oscillator circuit consists of inductance L-1602 and capacitance C-1615. The grid is maintained at a slightly positive potential and so the valve conducts and effectively shorts the resonant circuit of L-1602 and C-1615. When the leading edge of the negative square wave from multivibrator V-1603 arrives at grid 4, it drives the valve to cut-off and the valve cathode circuit oscillates. The grid of the oscillating portion is tied to the 120 V supply through R-1625. This is to ensure a quick response when the multivibrator negative pulse ceases. The second half of V-1604 is the first range marker amplifier.

269. The second range marker amplifier is the first section of V-1605. Both the first and second amplifiers are overdriven in order to square up the marker signals. The second section of V-1605 has an inductive plate load and produces narrow positive pips, which are applied to grid 4 of the mixer valve V-1609.

270. The narrow gate signal from the range unit is applied through J-1607 and appears across the potentiometer R-1658. This is the NARROW GATE AMPLITUDE adjustment and is located on the plan position unit chassis between V-1604 and V-1605.

271. V-1609 is a double-triode cathode follower. Signals arriving at either grid will appear proportionally across the cathode load R-1654. The valve, however, has a limiting action because exceptionally strong video signals applied to grid 1 may tend to drive the potential of the grid up to, or above, that of the cathode. When this happens the grid cathode space in the first half of the valve will conduct and thus limit the amplitude of video signals applied to grid 1.

272. The video signals, the range markers and the narrow gate signals are all mixed in the common cathode of V-1609 and the mixed signal is fed to the control grid of the P.P.I. C.R.T. via pin B of J-1604.

Power supplies for P.P. unit

273. The only power supply in the plan position unit is that from the filament transformer T-1601. This transformer supplies all the filaments of the valves in the unit, and also the filament of the P.P.I. C.R.T. All other supplies come from rectifier RA-79 ( ).

Focus control

274. R-1674 is mounted on the chassis and marked FOCUS. It is a screwdriver control and adjusts the amount of current flowing through the focus coil of the P.P.I. tube.

PLAN POSITION INDICATOR

275. This unit is comprised of a type 7BP7 C.R.T. and its deflection yokes. A circuit diagram is shown in Fig. 1036.

276. Beam focussing and deflection is electromagnetic; focussing being accomplished by the control of a direct current passing through a cylindrical coil L-1701 concentric about the neck of the C.R.T. Deflection of the beam is accomplished by the establishment of two magnetic fields, having their axes mutually at right-angles and also at right-angles to the tube axis, by means of coils mounted about the neck of the P.P.I. tube and rotated by the P.P.I. selsyn in the antenna pedestal.

277. The second anode of the tube receives + 4,000 V, and an interlock located on the indicator chassis removes power from the rectifiers in the plan position power unit, when the oscilloscope panel is removed from its rack.

278. The three indicator lights I-1701, I-1702 and I-1703 are connected in parallel with the P.P.I. tube filament and provide illumination for the scale around the face of the tube.

POWER UNIT

279. Fig. 1037 gives a circuit diagram of this unit, which supplies power for the P.P. unit and indicator. The rectifier contains a high voltage (+ 4,000 V) D.C. supply and two 3,000 V supplies—one of them regulated. Fig. 1038 shows power distribution for the P.P. unit.

High voltage supply

280. This is comprised of transformer T-1505, a half-wave type 2 X 2 rectifier valve, a special filament transformer T-1506 and a resistance capacity filter network. A constant load is provided by the bleeder consisting of R-1518 to R-1528 inclusive. R-1529, R-1530 and R-1531 are included to limit the charging current on the first filter condenser. The output of this power supply is 4,000 V, and is fed to the P.P. indicator through jack J-1502.

281. Due to the high voltage involved, an A.C. safety interlock is provided. This is operative under any of the following conditions, and removes power from all three rectifiers :—

(*a*) Removal of C.R.T. from its socket.

(*b*) Removal of indicator unit from rack.

(*c*) Disconnection of P.P.I. selsyn cable.

(*d*) Disconnection of the low voltage power cable to the P.P. unit.

(*e*) Disconnection of the low voltage power cable to the P.P indicator.

Unregulated 300 V supply

282. This consists of transformer T-1502, full-wave rectifier V-1501 and a two-section choke input filter with a bleeder resistance R-1501.

Regulated 300 V supply

283. The regulated supply is made up of transformer T-1504, full-wave rectifier V-1502, and a single section of condenser input filter. The voltage regulator consists of two 6B4G valves in parallel, a 6SJ7 control valve and a VR 105-30 voltage regulator valve. The operation of such a system has already been described when dealing with the receiver power supplies.

SERVO SYSTEM

GENERAL DESCRIPTION

284. The purpose of the servo system is to position the antenna and its paraboloid in azimuth and elevation. There are four methods of accomplishing this :—

(*a*) P.P.I. scan

(*b*) Manual operation

(*c*) Automatic tracking operation

(*d*) Remote operation

The components of these systems are control panel PN-24-( ), automatic tracking unit BC-1086-( ), aximuth and elevation tracking unit BC-1090-( ), position control unit BC-1085-( ), position indicator BC-1076-( ), the spinner motor and reference generator, the servo generator (or amplidynes), the drive motors and field supply rectifier RA-71( ).

P.P.I. scan

285. This method of antenna positioning is used for searching. When the control switch on panel PN-24-( ) is set to the P.P.I. SCAN position, the parabola will rotate in azimuth at a speed of 5 r.p.m. During rotation the

parabola is elevated through 20° in $6\frac{1}{2}$ revolutions and is then lowered to its original position in approximately one quarter of a revolution. This cycle is automatically repeated as long as the control switch is in the P.P.I. SCAN position.

Manual operation

286. When the control switch is set to MANUAL, the paraboloid can be positioned by the operator by means of two handwheels on the front of the position control unit.

Automatic tracking

287. When the control switch is set to AUTOMATIC the paraboloid will follow automatically, in azimuth and elevation, any target which has been placed within the receiver narrow-gate. The paraboloid has, of course, to be pointed first at the target manually.

Remote operation

288. When in the REMOTE position the paraboloid will follow the predictor in azimuth and elevation, while providing slant range data. This is of use when the target can be followed visually.

DETAILED DESCRIPTION

289. There are two basic methods of positioning the antenna, one through the automatic tracking circuits and the other by means of the manual control system. When the control switch is thrown to AUTOMATIC, the movement of the antenna derives ultimately from a comparison between a 30 c/s " error signal," produced by the modulation of video signals due to the conically scanned beam, and two 30 c/s reference voltages supplied by the reference generator. When the control switch is thrown to MANUAL or REMOTE, the positioning of the antenna is accomplished either by the local control handwheels on the position control unit or by a corresponding set of controls on the predictor. However, in both of these cases the actual drive for the antenna originates in the azimuth and elevation tracking unit from a comparison between two synthetic 60 c/s signals analogous to the " error signal " in automatic tracking, and a 60 c/s voltage analogous to the reference voltages in automatic tracking. In the case of P.P.I. SCAN the mode of operation is similar to that in MANUAL and REMOTE, the only difference being that manual displacement of the control handwheels is replaced by a continuous motor drive.

Automatic tracking

290. As has already been mentioned, the antenna and its reflector dipole are rotated at 1,800 r.p.m., and due to the construction of the dipole assembly the beam radiated is displaced by approximately $1\frac{1}{2}°$ from the axis of the paraboloid. Rotation of the beam will produce a cone, which, with a rotation of 1,800 r.p.m., will be traced out 30 times per second. If a target appears upon the centre line of the parabola the echo signal received from it will be constant regardless of the position of the beam around the cone ; but if the target is displaced from the centre line of the parabola, the echo signal will vary throughout each cycle of rotation from maximum to minimum and back to maximum. This variation is at a frequency of 30 c/s ; there are 1,707 pulses radiated per second, so that the receiver video pulses will be of the form shown in Fig. 10.

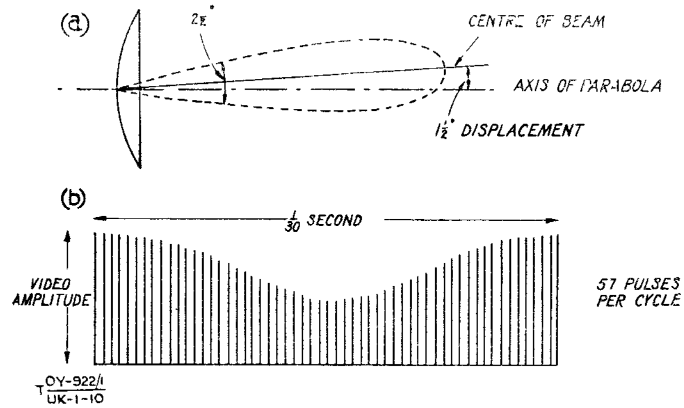


Fig. 10. (*a*) **Antenna beam pattern (spinner motor stopped)**
(*b*) **Modulation of video signal when target is displaced from axis of parabola (spinner motor running)**

291. The video signals, thus modulated, are fed into the automatic tracking unit (see Fig. 11) where they are demodulated and smoothed into a 30 c/s sinusoidal error voltage. This is converted into a push-pull error signal and applied to the azimuth and elevation tracking unit. This unit also receives the two 30 c/s reference voltages, in quadrature, from the reference generator, and compares them with the two parts of the push-pull error signal in both phase and amplitude. The output of the azimuth and elevation unit consists of two push-pull D.C. voltages. At any instant the amount and "sense" of the azimuth pointing error are reflected respectively in the magnitude and polarity of one of these D.C. voltages, while the other reflects the corresponding elements of the elevation pointing error.

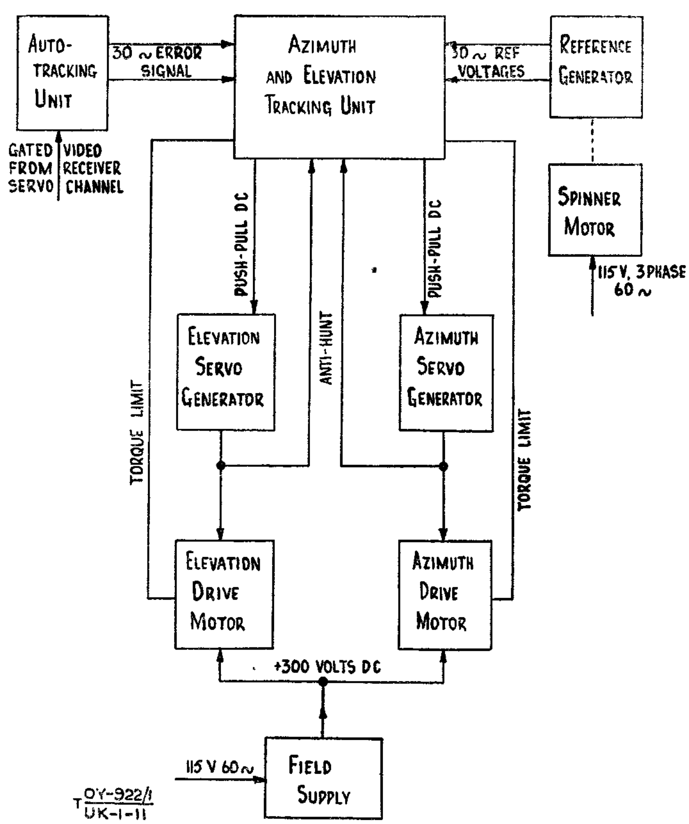


Fig. 11. Servo system in automatic tracking

292. The azimuth and elevation D.C. voltages go to the azimuth and elevation servo generators respectively. The outputs of the servo generators go to the corresponding drive motors in the pedestal, which position the antenna to reduce the 30 c/s modulation of the received video signals to zero amplitude. Arrangements are also made for anti-hunt precautions and limitation of the torque applied by the drive motors to the azimuth and elevation drive shafts in the pedestal.

Manual control

293. Fig. 12 shows the corresponding block diagram for manual control. The rotors of the azimuth and elevation control selsyns are excited from a common 60 c/s 115 V supply derived from the predictor or from the mains supply in the SCR-584. The stators of the selsyns are mechanically linked with the azimuth and elevation handwheels on the position control unit and are directly connected to the stators of corresponding control transformers in the pedestal.

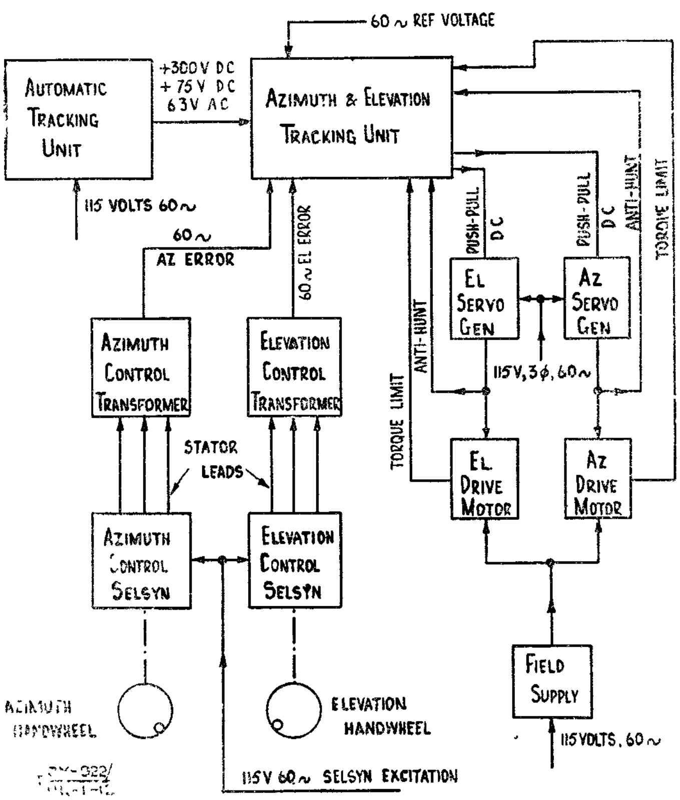


Fig. 12. Servo system in manual control

294. For any given current distribution in the stators of the control selsyns, there is one position of the antenna in azimuth and elevation for which the corresponding currents in the stators of the control transformers will induce no current in the rotors of these transformers. Assuming that the antenna is in such a position, then if either the azimuth or elevation control selsyn is displaced by movement of the corresponding handwheel, the resulting change in current distribution in the control transformer stator concerned will induce a current in its rotor. This current is a 60 c/s sine wave, whose amplitude is dependent upon the amount of rotation of the handwheel and whose phase, with respect to the original excitation voltage, is either zero or 180° depending upon the direction of rotation of the handwheel.

295. The output of the control transformer rotor is then fed into the azimuth and elevation tracking unit where it is combined with the original 60 c/s exciting voltage to produce a push-pull D.C. voltage whose polarity and magnitude reflect respectively the direction and amount of handwheel displacement. From there on, the operation of the system is similar to that for automatic tracking.

Remote control and P.P.I. scan

296. For remote control, the 60 c/s supply comes from the predictor and the antenna is positioned in azimuth and elevation from the predictor using, by remote control, the same channels in the SCR-584 as are employed for local manual control. In the case of P.P.I. scanning, the antenna is rotated by a scan motor, located in the position control unit, which is geared to the azimuth and elevation control selsyn stators.

CONTROL PANEL PN-24-( )

297. A diagram of connections is given in Fig. 1039. This panel is located in the centre of the sloping shelf of the control rack (Fig. 1003). Besides the main control switch, S-1751, the panel has three other switches. S-1752, marked COAST, is used for removing the error signal from the automatic tracking circuits when two targets appear within the receiver gate, and it is desired to follow only one of them. S-1753 is a safety switch, and when in the STOP position prevents any movement of the antenna by the antenna positioning system. This is of use when personnel are working on the trailer roof. Finally, Switch S-1754, when thrown to ON lights an indicating lamp on the predictor to signify that the set is on target and following smoothly.

SPINNER MOTOR AND REFERENCE GENERATOR

298. The spinner motor rotates the antenna dipole at a constant speed of 1,800 r.p.m. The motor is mounted coaxially around the R.F. line, passing through the centre of the paraboloid. It is a 4-pole induction motor operating from the 115 V, 3-phase, 60 c/s supply, and is operated by the SPINNER MOTOR switch in Switch box, SW-214-( ).

299. The reference generator is mounted in the same housing and on the same shaft as the spinner motor, and is a 2-phase, 30 c/s generator with an output of approximately 50 V. This generator supplies the reference voltages for comparison with the error signal. One phase is the azimuth reference phase, while the other phase is the elevation reference phase.

AUTOMATIC TRACKING UNIT

300. A block diagram of the whole tracking system is shown in Fig. 1040 and a circuit diagram of the automatic tracking unit is shown in Fig. 1041. The function of the automatic tracking unit is to convert the output of the receiver servo channel to a 30 c/s error signal which is independent of changes in the action of the receiver

A.G.C. and of fluctuations which the receiver A.G.C. cannot follow. The unit consists of a third and fourth detector, a balanced amplifier and a power supply.

Diode detector

301. The input to the automatic tracking unit comes from the video amplifier of the receiver servo channel. The signal consists of a series of negative pulses of approximately 0.8 μsec. duration ; the average maximum amplitude is 50V. This signal is applied to the cathode of the 6H6 double-diode detector V-502 which is known as the error signal, or third, detector. The demodulated 30 c/s error voltage appears across the load potentiometer R-504.

302. Referring to Fig. 1041 it can be seen that each negative pulse of the video signal permits conduction through the diode and charges C-502. Between pulses C-502 discharges through R-504 ; but the charge time constant of C-502 through the diode is very much shorter than the discharge time constant through R-504. This results in the voltage across C-502 tending to follow the modulation envelope of the video pulses as it does not have time to discharge very much between pulses. There is an average negative D.C. voltage about which the voltage across C-502 will vary, and this average value is used as grid bias for the following stage. There is some phase shift in the detector, but this remains constant and can be compensated by correct setting of the 30 c/s reference generator The magnitude of the average negative voltage across R-504 is proportional to the average amplitude of the video input pulses. The potentiometer R-504 is mounted on the panel of the automatic tracking unit, and labelled A.V.C. Its arm is connected to the grid of V-503, a 6SK7GT valve.

Percentage modulation detector

303. V-503 is a variable-mu pentode with operating voltages so chosen that the inverse variation of its amplification with change in grid bias is linear within certain limits.

304. Since any variations in average amplitude of signal input to V-502 produce proportional changes in D.C. output, an automatic grid bias is provided for V-503, which will vary its amplification in such a way that it is independent of the signal input to V-502. If the receiver A.G.C. was 100% efficient, V-503 would be unnecessary, but the receiver gain control will not function on weak signals. It is important to remember that what is required of the final output is a 30 c/s signal whose amplitude is proportional to the VARIATION in amplitude of the received signal. Thus, the output of V-503 must be proportional to the percentage modulation of the video pulses by the error signal, and be completely independent of the average amplitude of the video signal.

305. To obtain proper automatic gain control for this stage, R-504 must be adjusted to give operation over the correct range of amplifier characteristic. This is done by adjusting R-504 until the plate current of V-503 registers 5 mA on the PLATE CURRENT meter M-501 (Fig. 1013).

Push-pull amplifier

306. The output of V-503 is coupled to the grids of the double-triode V-504 through transformer T-501. Potentiometers R-505 and R-506 are operated from the same GAIN control on the front of the panel, and provide adjustment of the error signal amplitude.

307. The cathodes of V-504 are grounded through R-514, which permits adjustment of the cathode bias to the correct value for the valve. This control is mounted on the panel of the unit and is labelled VOLTAGE CONTROL. R-516 is also positioned on the panel and is labelled BALANCE. It is used to balance the push-pull output by compensating for slight differences in the two halves of the circuit.

Automatic tracking unit power supply

308. The power supply for the unit is mounted on the chassis and comprises transformer T-502, full-wave rectifier V-501, a two section choke input filter and a voltage regulator valve V-505. A voltage divider, R-522 and R-523, supplies + 75 V bias which is fed to the azimuth and elevation tracking unit with the error signal. The voltage regulator supplies a constant source of regulated voltage at + 1 to 5 volts to the screen grid of V-503.

Coast relay

309. K-501 is the coast relay and is actuated by the COAST push-button on the control panel (see para. 297). When this relay is energized the cathode of V-503 is switched from ground to + 105 V, thus cutting off the error signal output from the valve. The paraboloid will continue its motion for a few seconds and this time is usually sufficient for the effect of the interfering target to disappear.

Safety relay

310. This is K-502, which is de-energized by the SAFETY switch on the control panel (see para. 297), and by several other interlocks in the system. When this switch is opened it removes the positive voltage from the azimuth and elevation tracking unit and so stops all movement of the paraboloid. The following switches and interlocks control this relay :—

(*a*) SAFETY switch S-1753.

(*b*) ELEVATOR STOP button S-1901 (switch box SW-214-( )).

(*c*) SAFETY switch S-2001 (in pedestal MP-61-( )).

(*d*) Elevator interlock S-2007.

(*e*) Azimuth interlock S-2002 (azimuth drive assembly).

(*f*) Elevation interlock S-2053 (elevation drive assembly).

AZIMUTH AND ELEVATION TRACKING UNIT

311. The function of this unit is to provide control currents for the fields of the azimuth and elevation servo generators, which in turn control the speed and direction of the drive motors and hence the rotation of the paraboloid. There are two main inputs to the unit : one for automatic tracking and one for manual tracking. In the case of automatic operation the 30 c/s reference voltage is connected to the unit and, when manual tracking is used, a 60 c/s error signal from the position indicator is connected. The operation in either case is almost identical so that one explanation will cover both methods of tracking. The unit has two channels, one azimuth and the other elevation. Both function in a similar manner. Circuit diagrams are shown in Figs. 1042 to 1046 inclusive.

Error signal relays

312. When relays K-401 and K-402 are energized, the unit is connected for automatic operation. These relays are activated by turning the control switch on panel PN-24 to AUTOMATIC.

313. Relay K-401, when closed, connects the 30 c/s error signal to the grids of the azimuth channel commutator valves V-401 and V-402, and to the grids of the corresponding elevation channel valves V-451 and V-452. It also connects the azimuth follow-up motor B-1303 in the position control unit to the azimuth control transformer B-2004 in the pedestal. When K-401 is de-energized, it connects the rotor of the control transformer to the primary of the 60 c/s manual tracking signal transformer T-401 and applies the output of T-401 and T-402 to the grids of the commutator valves.

314. When relay K-402 is energized, it applies the quadrature 30 c/s reference voltages to the azimuth and elevation squaring valves V-408 and V-458, and connects the elevation follow up motor B-1353 to the elevation control transformer B-2054. When K-402 is de-energised it connects the rotor of the elevation control transformer to the primary of the 60 c/s manual tracking signal transformer T-402, and applies the output of the 60 c/s reference signal transformer T-1202 to the grids of the squaring valves.

Squaring and commutator valves

315. The function of the squaring and commutator valves is to provide a D.C. potential which is proportional to the product of the 30 c/s error signal and the cosine of the angle of phase shift between the error signal and reference signal when the unit is operating in the automatic condition. They also provide a D.C. potential which is proportional to the magnitude of the 60 c/s manual tracking error signal for the other three operating conditions.

316. While the automatic tracking circuits are functioning the same 30 c/s error signal is applied to the grids of both elevation and azimuth commutators, but the 30 c/s reference signals for elevation and azimuth squaring valves are 90° out of phase. Fig. 13 shows the wave forms of the commutator and squaring valves for the azimuth tracking channel.

317. The original voltages from the reference generator are of equal amplitude but, as has already been mentioned, have a phase difference of 90°. One of these phases is applied to the primary of a transformer T-1901, and the other to the primary of transformer T-1902, in the switch box. The secondaries of both transformers are centre-tapped, so that the respective outputs are two push-pull reference voltages in quadrature, one for azimuth and the other for elevation.

Consideration of the azimuth circuit

318. The push-pull azimuth voltage is applied across the grids of V-408 (see Fig. 1043). Both sections of the valve are operated with zero bias. During the first half of the reference voltage cycle the negative component of the reference voltage waveform is sufficient to drive one half of the valve to cut-off, while the positive component will drive the other half of the valve to the point where a small amount of grid current will be drawn.

319. A positive D.C. supply of 300 V is applied to the plates of V-408, V-401 and V-402. The value of plate resistors plus normal load of the valves results in a potential of 100 V at the plates of the three valves. However, when the grid of one section of V-408 is driven positive, the additional current drawn through that section is sufficient to reduce the plate voltages of the " leg " in question to 90 V positive. V-401 and V-402, the commutator valves, are operated in such a condition that when the plate voltage falls to 90 V the valves are cut off. Thus it will be seen that as the push-pull reference voltage is applied to V-408, first one section and then the other section will be taking more than its normal current, with the result that alternately the corresponding sections of V-401 and V-402 will be cut off. At the same instant the other sections will react to signals applied to their grids.

320. Thus, the function of the reference voltage is to maintain one leg of the circuit in an operative condition to function with the error voltage signal for 180°, and to cut this leg off and switch over to the other leg for the remaining 180° of the 360° phase rotation of the reference voltage.

321. If no error signal is applied to the grids of V-401 and V-402, the voltage developed across the cathode resistors R-405 and R-406 will be that due to the bias level supplied from the automatic tracking unit ; approximately 76 V. The application of an error signal to the grids of the commutator valves will cause the circuit to produce a difference in the cathode potentials of V-401 and V-402. This voltage difference between the two cathodes can be amplified and applied to the excitation field of a servo generator to control the position of the antenna. Furthermore, the polarity of the voltage difference between the two cathodes will depend upon the phase relationship between reference and error signal voltages, and the magnitude of the error voltage will be translated by the circuit into a corresponding voltage magnitude between the two cathodes.

Wave forms found in commutator circuit

322. The above description can be illustrated by Fig. 13. Let it be assumed that an error signal in phase with the azimuth reference voltage is applied to the circuit. Such a condition will exist when the antenna is on in elevation but has a pointing error in pure azimuth. (The condition for zero pointing error is that the error signal is 90° out of phase with the reference signal.) From Fig. 13 it can be seen that over one complete cycle of rcference and error voltage, the average potential developed across the cathode load of V-402 is more positive than that developed across the cathode resistor of V-401. The second diagram of Fig. 13 shows the conditions holding when the error signal is 90° out of phase with the reference voltage. Here the average cathode potentials produce a mean voltage change of zero and the 76 V bias appearing across R-405 and R-406 will not be affected. Again, if the error signal is assumed to be 180° out of phase with the reference voltage a difference in potential between cathodes will be established, but will be of opposite polarity to that discussed when the phase difference was zero degrees.

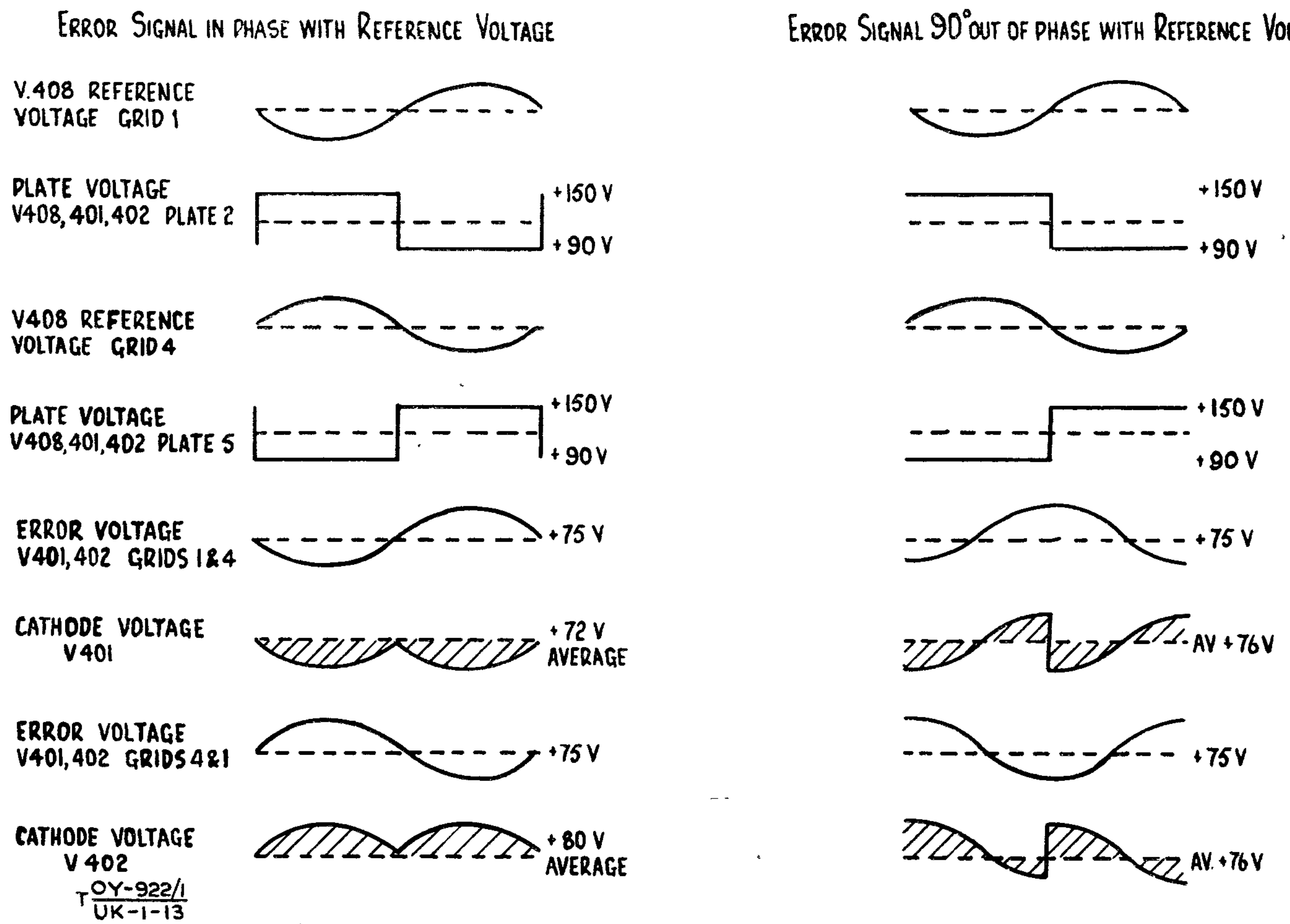


Fig. 13. Wave forms on squaring and commutator valves

Consideration of the elevation circuit

323. The voltages discussed above are developed by comparison of phase differences between a pure azimuth error signal and the azimuth phase of the reference generator. A similar circuit (Fig. 1045) develops similar voltages when errors exist in elevation. The functioning of this circuit is identical, but for the fact that the elevation reference voltage is 90° out of phase with the azimuth reference voltage described in para. 318.

Pointing error in both azimuth and elevation

324. In cases where there is an error both in azimuth and elevation it can be shown that the average potentials of the azimuth commutator valves will be proportional to the azimuth component of the angular pointing error, while the elevation commutator valves will have average cathode potentials proportional to the elevation component.

325. For instance, suppose the paraboloid is off target to the extent that the target is at a 30° angle above the horizontal centre line, and at a 60° angle to the vertical centre line, of the paraboloid. In this condition the resulting error signal will be 60° out of phase with the azimuth reference voltage, and 30° out of phase with the elevation reference voltage. The unbalance of cathode potentials in the azimuth and elevation circuits of the tracking unit will be such as to cause the paraboloid to be driven in increasing azimuth and elevation. But the rate at which it is driven will be greater in azimuth than it is in elevation. The ratio of unbalance, in average cathode potentials, of the azimuth commutators to the elevation commutators will be as the ratio of Cos 30° : Cos 60°.

Commutator valves in non-automatic operation

326. This condition corresponds to P.P.I. SCAN, MANUAL or REMOTE operation. In this case the unbalance of the cathode potentials will be determined by the magnitude of the 60 c/s manual tracking signal.

Output of commutator valves

327. The output of the commutator valves is filtered to produce steady D.C. potentials corresponding to the average difference in the potential of the commutator valve cathodes. The smoothed output is next applied to the grids of two beam power amplifiers—that is, two amplifiers for the azimuth channel and two amplifiers for the elevation channel. The actions of these two circuits are essentially the same, so only the azimuth commutator amplifier will be considered.

D.C. amplifiers

328. With reference to Fig. 1044, the two azimuth commutator amplifiers are V-403 and V-404; both are 6L6 beam tetrodes. These valves control the current in the differential field of the servo generator. The potentials at the grids of V-403 and V-404 are established at 76 V by the commutator cathode bias voltage. When these potentials are balanced the plate currents pass through the differential field windings of the servo generator; and when these currents are balanced the output voltage of the servo generator will be zero.

329. To compensate for mis-match in the valves, circuit constants and effective turns in the field windings, the screen grid potential of the amplifiers is made variable by means of potentiometer R-412. This control is mounted on the panel of the unit and is labelled BALANCE. When R-412 is varied it alters the voltage on grid 4 of the anti-hunt amplifier valve V-405. This causes one half of V-405 to take more or less current than the other, and so produces an unbalance in the screen voltages for V-403 and V-404.

330. As has already been discussed, when the paraboloid is on target the error signal is zero and there is no unbalance between the commutator valve cathode potentials. In this condition the D.C. amplifier plate currents are balanced, with the result that there is no voltage output from the servo generator. As soon as an error signal appears the grid potentials of the D.C. amplifiers will be unbalanced, the magnitude and polarity of the unbalance depending upon the magnitude and phase of error signal. This will result in the plate currents of V-403 and V-404 being different, and the difference of these currents now will produce a field in the servo generator having a polarity corresponding to the polarization applied to the grids of V-403 and V-404.

Field current meters

331. Milliammeters M-401 and M-402 are located on the panel of the azimuth and elevation tracking unit and are labelled FIELD CURRENT. These meters indicate the plate currents of V-403 and V-404 respectively. Switch S-401, mounted immediately below the meters, allows the same meters to be used to indicate corresponding plate currents for V-453 and V-454 in the elevation D.C. amplifier circuit. When no error signal is present, the field current should be approximately 25 mA.

332. Potentiometer R-408 is part of the common cathode resistor of V-403 and V-404. This potentiometer is located on the chassis and is labelled CURRENT CONTROL. With S-401 in the AZIMUTH position, R-408 is adjusted until the azimuth field currents are approximately 25 mA. R-458 is the similar control for the elevation valves V-453 and V-454 (see Fig. 1046). When these two controls have been set they should require no further readjustment until the D.C. amplifiers age or are replaced by a new set of valves.

Torque limiting circuit

333. On the azimuth side the twin-triode V-407 operates as a torque limiter to protect servo-generator and drive motor by limiting the current which can be drawn by the motor. When excessive current flows to the drive motor, V-407 applies negative feed back to the grids of the D.C. amplifiers. V-457 fulfils a similar function on the elevation side.

334. A divider network across the 300 V supply provides a positive potential of 30 V which is applied to the centre connection of the two series fields of the drive motor. The cathode of V-407 is biased positive with respect to this point through potentiometer R-433. This control is located on the chassis and is labelled TORQUE CONTROL. One plate of V-407 is connected to the control grid of V-403 and the other plate is connected to the control grid of V-404. The two grids of V-407 are connected to the ends of the drive motor series field. Both halves of the current limiter are normally at cut-off when the motor is not accelerated. When the voltage drop across the field winding is greater than the cathode bias of V-407, one half of the valve will conduct to reduce the input of the corresponding D.C. amplifier valve. Thus, when the armature current of the drive motor reaches a pre-determined value, the grid voltage of the D.C. amplifier will be limited by the plate current of V-407.

335. The TORQUE CONTROL, R-433, also controls the elevation torque limiter valve V-457. The control is normally set to give a voltage of 3.5 V between jacks J-413 and J-414 (i.e., between the 30 V bias point and the cathode of V-407).

Anti-hunt circuit

336. Due to the inertia of the tracking system the drive motors will have a tendency to lead or lag on the error signal. Under some conditions this would result in hunting and would interfere with smooth following. In order to prevent the possibility of hunting, a negative feedback voltage is introduced, having a low cut-off frequency. This feedback is called the anti-hunt (A.H.) voltage.

337. Referring again to Fig. 1044, two resistors R-434 and R-422 are connected across the azimuth servo generator output, and the voltage between the centre tap of R-434 and R-422 and the centre tap on the drive motor field winding is approximately equal to the back e.m.f. of the motor. If hunting occurs, an alternating voltage develops at the hunting frequency with a magnitude proportional to the amplitude of hunting. This voltage is applied to the anti-hunt filter, which has a low frequency cut-off at approximately 1 c/s. A potentiometer R-424 across the output of the filter is used as a gain control. It is mounted on the panel of the unit and is labelled A.H. GAIN. A similar control is used in the elevation circuit (R-474 in Fig. 1046).

338. The output of the filter is applied to grid 1 of V-405, a 6SN7-GT double-triode. The plate of this section of the valve is connected to the screen grid of V-404. The valve has a common cathode resistor R-419, so variations in the first half of the valve are coupled to the second half. Thus the anti-hunt voltage is inverted and applied to the screen grids of the D.C. amplifier valves. The A.H. control is adjusted until the correct feedback to prevent hunting is obtained.

Anti-hunt limiter

339. V-406 is known as the anti-hunt limiter. This is a double-diode which is connected across the anti-hunt filter through the ganged potentiometers R-414 and R-415. This is called the ANTI-HUNT LIMIT CONTROL and is so adjusted that the diode will conduct when the anti-hunt voltage exceeds $\pm$ 8 V. This control is necessary in order to prevent ordinary tracking from developing an anti-hunt

voltage which would be larger than the error signal effect. The elevation anti-hunt limiter is V-458, controlled from R-414 and R-415.

POSITION CONTROL UNIT

Block schematic

340. A block schematic of the gearing involved in this unit is shown in Fig. 1047 (reference to Fig. 12 will also help). The purpose of the unit is to cause the correct positioning of the paraboloid in azimuth and elevation when manual or P.P.I. scan operation is in use. Also it prevents slewing of the paraboloid when the control switch is turned from AUTOMATIC to some other position.

Azimuth and elevation selsyn transmitters

341. The unit contains a 1 : 1 speed azimuth selsyn transmitter B-1301 and a 64 : 18 speed elevation selsyn transmitter B-1351, an A.C. motor and cam for P.P.I. scan; handwheels for turning the azimuth and elevation selsyns; and the follow-up motors.

342. The stators of the selsyns are connected to the primaries of the control transformer selsyns located in the pedestal, when the control switch is in MANUAL, P.P.I. SCAN or AUTOMATIC positions. In the case of remote control the stators are connected to selsyn transmitters in the predictor. The rotors are all energized from the predictor. When no predictor is being used the rotors can be energized by connecting a jumper connection between receptacle "A" (J-1926) and the polarized 115 V A.C. outlet (J-1931) of the data panel PN-22.

Azimuth and elevation follow-up motors

343. The azimuth and elevation "follow-up" motors are geared to their respective selsyns through a 10 : 1 ratio. These motors are two-phase 20 V induction motors and their function is to keep the azimuth and elevation selsyns in line with the position of the paraboloid, so that slewing will not occur when switching from AUTOMATIC to some other mode of operation. One phase of each motor is supplied from the rotor of the corresponding control transformer selsyn in the pedestal, while the other phase receives its supply from the 60 c/s source in the predictor.

Control unit gearing

344. The rotors of the selsyns are geared to the handwheels and scan motor through differentials. The elevation differential is not geared directly to the scan motor, but through a cam. The gear ratio between scan motor and azimuth selsyn is 400 : 1 and the ratio between scan motor and elevation cam is 2,618 : 1. The cam is so cut that it will cause the elevation selsyn to rotate through 71° in 2,564 revolutions of the scan motor, then it will be returned to its original position in a further 54 revolutions of the scan motor. Due to the 64 : 18 ratio of the elevation control transformer selsyn, the 71° rotation of the position control unit selsyn corresponds to an elevation of 20° of the paraboloid. The 2,564 revolutions of the scan motor correspond to 6.4 complete revolutions in azimuth of the paraboloid, and the 54 revolutions, during which the paraboloid returns to its original position, correspond to 45° rotation in azimuth.

345. Flywheels are geared to the azimuth and elevation hand wheels to assist in smooth operation when manually positioning the paraboloid. One revolution of the elevation handwheel is equivalent to $6\frac{2}{3}$° elevation of the paraboloid; one revolution of the azimuth handhweel corresponds to 10° rotation of the paraboloid in azimuth.

POSITION INDICATOR UNIT

Block schematic

346. A diagram of connections is shown in Fig. 1048. The purpose of this unit is to indicate to the operator the direction in which the SCR-584 paraboloid is pointing at any instant. It will also tell him in which direction the predictor tracking head is pointing if the equipment is being employed with a predictor.

347. The unit contains four selsyn repeaters; these are :—

Local azimuth selsyn repeater B-1201

Remote azimuth selsyn repeater B-1202

Local elevation selsyn repeater B-1203

Remote elevation selsyn repeater B-1204

The rotors of both local and remote selsyn repeaters are connected in parallel, and are energized either from the predictor or by a similar voltage derived from the SCR-584.

Azimuth local and remote indication

348. The azimuth local selsyn repeater is geared in 1 : 1 ratio with the inner pointer of the azimuth dial. Its stator is connected to the 1 : 1 speed azimuth selsyn transmitter in the antenna pedestal, so the inner pointer indicates the position of the paraboloid in azimuth. The azimuth remote selsyn repeater is geared in 1 : 1 ratio with the outer pointer of the azimuth dial. The stator of this selsyn is connected to a 1 : 1 speed selsyn transmitter in the predictor and so indicates, on the outer dial, the position of the predictor.

Elevation local and remote indication

349. The elevation local selsyn is geared in 1 : 1 ratio with the inner pointer of the elevation dial and indicates the elevation of the paraboloid. Its stator is connected to the 1 : 1 speed selsyn transmitter in the pedestal. The remote elevation indication involves a 64 : 18 speed selsyn repeater geared to the outer pointer of the elevation dial. The latter selsyn may require orienting with the predictor each time the voltage is removed from the stator, owing to the 64 : 18 ratio. In any case all these selsyns will require orienting whenever the location of the equipment is changed.

Position indicator unit relays

350. Relays K-1201 and K-1202 are energized when the control switch is set to REMOTE. When energized, K-1201 connects the azimuth remote selsyn repeater and the azimuth control transformer in the pedestal with a coarse azimuth transmitter at the predictor. When de-energized it connects the azimuth remote selsyn repeater to the coarse transmitter at the predictor, and connects the azimuth selsyn transmitter in the position control unit. Relay K-1202 carries out similar functions for the elevation side.

351. The ELEVATION REMOTE selsyn repeater remains connected to the elevation selsyn at the predictor in either position of the relay K-1202, in order to prevent the possibility of having to orient the elevation remote selsyn each time the control switch is set to REMOTE.

Power supplies

352. Transformer T-1202 supplies 6.3 V A.C. for the three lamps behind each indicator dial. Transformer T-1201 supplies 230 V A.C. to the squarer valves of the azimuth and elevation unit. The 60 c/s mains supply comes from either the predictor or data panel (see para. 352).

SERVO GENERATORS AND DRIVE MOTORS

Servo generator and amplidyne

353. At present there are two methods of coupling between azimuth and elevation tracking unit and the drive motors. The SCR-584-(A), manufactured by Westinghouse, employs the servo generator, whereas the SCR-584-(B), which is manufactured by General Electric, uses the amplidyne. The result is the same but the method of obtaining it differs in the two equipments. The function of these is to develop the D.C. differential, provided by the azimuth and elevation tracking unit, into a comparatively large D.C. voltage for useful operation of the drive motors. One servo-generator, or amplidyne, is required for azimuth and one for elevation operation.

354. The servo generators and amplidynes accept the same inputs and deliver the same outputs, and therefore are completely interchangeable. As mentioned above, however, their internal working is different and the following is a brief comparison. Fig. 14 shows a sketch of the circuits of both types of equipment.

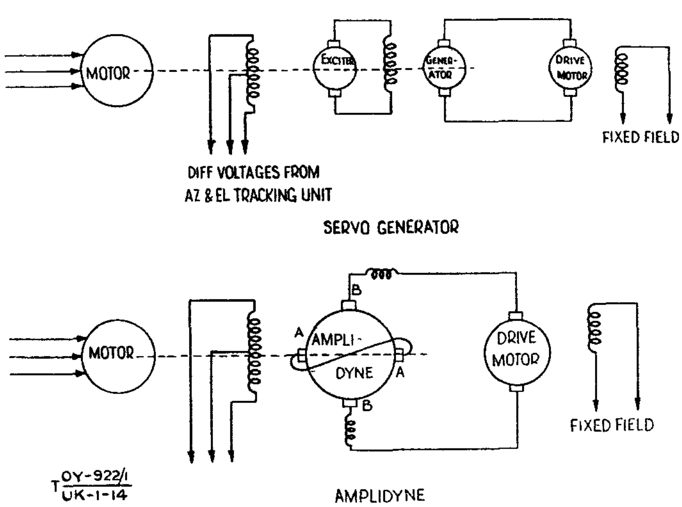


Fig. 14. Servo generator and amplidyne

Servo generator

355. This consists essentially of a continuously driven motor and an exciter generator set, all mounted on the same shaft. The motor is a 1 H.P., 3-phase induction motor operating from the 115 V, 60 c/s mains. The full load speed is 3,400 r.p.m. The exciter has a differential field which is excited by the D.C. potential outputs of the commutator amplifier valves in the azimuth and elevation tracking unit (see para. 328). If these D.C. voltages are equal, no current will flow in the field windings of the exciter ; but if there is a difference of potential (of either polarity) between them, then the resultant current in the exciter field will induce a proportional current of corresponding polarity in the exciter armature. This current flows in the generator field winding and the output voltage from the commutator of the generator is applied to the armature of the antenna drive motor. The field of the antenna drive motor is supplied at constant voltage from the field supply unit ; the motor, therefore, turns until the output of the servo generator is reduced to zero and the antenna is correctly positioned in azimuth (or elevation).

Amplidyne

356. In the servo generator we have seen that the exciter generator action functions as a motor driven D.C. amplifier. The amplidyne, however, obtains the same result in a very different manner. It is a motor generator set comprised of a driving motor and a D.C. generator which has two field windings but only one armature. The generator has two sets of brushes, placed at right-angles to each other. The centre-tapped field winding of the amplidyne receives the D.C. voltages from the azimuth and elevation tracking unit. As in the case of the servo generator, when these voltages are unequal a current will flow in the field winding. The position of the brushes with respect to the field is such that the pair marked "A" in Fig. 14 are at a high voltage point, and the pair " B " are at a zero (or nearly so) voltage point. The two "A" brushes are short-circuited, and the resulting large armature current produces a correspondingly large voltage across the brushes at " B." This voltage is applied to the armature of the antenna drive motor. It can be seen that the polarity and magnitude of voltage across the commutator brushes at " B " is dependent upon the polarity and magnitude of the voltage difference originally applied to the differential field winding of the amplidyne. The second field winding, in series with the load, is a compensating winding to neutralize any tendency of the load current to set up an armature flux in opposition to the control flux.

357. The overall gain of both servo generator and amplidyne is such that an effective exciter field current of 0.013 A will produce an approximate output of 250 V at 2 A for the drive motor armature. These are maximum figures.

Azimuth and elevation antenna drive motors

358. These are 250 V, $\frac{1}{2}$ H.P. motors and are a part of the antenna mount. Their fields are supplied from the field supply rectifier unit, RA-71.

FIELD SUPPLY RECTIFIER

359. A circuit diagram is shown in Fig. 1049. Rectifier RA-71-( ) supplies 300 V D.C. to the field of the antenna drive motors. No filter is provided as the inductance of of the motor fields gives sufficient smoothing. Power is applied to the transformer primaries from a power connector on data panel PN-22-( ). The maximum output is 300 V at 225 mA ; one secondary winding of each power transformer is unused. The rectifier unit is mounted on the control rack and is part of the remote video amplifier chassis.

ANTENNA MOUNT MP-61-( )

Wiring diagram

360. Various components of the antenna mount have been described as, and when, they were related to other units of the equipment. What follows is a brief description of the principal features of the mount. Figs. 1050 and 1051 give details of the wiring, and Fig. 1052 shows a general view of the main parts of the antenna mount. Figs. 1062 and 1063 show the position of the various data selsyns, etc.

Electrical and mechanical considerations.

361. Electrically the antenna mount consists of an azimuth drive, an elevation drive, an azimuth data transmission system and an elevation data transmission system. The spinner motor and reference generator have been described previously.

362. Mechanically the mount can be considered in two sections :—

(*a*) The azimuth base and azimuth drive shaft housing.

(*b*) The elevation section, comprising the yoke, elevation gear housing and paraboloid support.

Azimuth drive

363. The drive to the azimuth shaft comes from a 3,600 r.p.m., ½ H.P. D.C. motor (see para, 368) through a 471 : 1 reduction gear chain. The azimuth drive shaft is mounted in the pedestal from the top and has a bearing at top and bottom. The top bearing takes the thrust, while the bottom bearing centres the shaft. The shaft has a flanged top to which the yoke is attached. The yoke is the azimuth rotating member upon which the elevation mechanism is mounted.

364. The azimuth drive shaft also carries 43 sliprings and 5 dummy rings. The slipring brushes are mounted on the pedestal. Thus the ring rotates but the brush is rigidly mounted and is connected to the pedestal base.

Azimuth data transmission

365. This system consists of three selsyn transmitters, one selsyn transformer and the azimuth potentiometer. One selsyn, 1 : 1 ratio, and another selsyn, 16 : 1 ration, supply the coarse and fine azimuth data respectively for the predictor. The remaining selsyn (also 1 : 1 ratio) is the P.P.I. selsyn, and provides the rotating sweep on the P.P.I. tube. The selsyn transformer is used in the positioning of the paraboloid when on MANUAL, P.P.I. SCAN or REMOTE operation. The layout of the system is shown in Fig. 1050.

366. The azimuth potentiometer furnishes azimuth data for electrical predictors.

Elevation drive

367. The drive is housed in the elevation drive gear casing, sometimes referred to as the " banjo." The elevation system is driven by a 3,600 r.p.m. ½ H.P. D.C. motor through a sun and planet gear chain with the same reduction ratio as that of the azimuth drive system.

Elevation data transmission

368. This comprises two selsyn transmitters, a selsyn transformer and the elevation potentiometer. Mechanical and wiring details are shown in Fig. 1051.

Elevation limit and stowing switches

369. S.2056 and S2055 are micro-switches actuated by a cam on the selsyn drive shaft These switches limit the travel in elevation (see para. 385). The limits through which the paraboloid may be rotated electrically are from $-9°$ to $+89°$. The maximum permissible mechanical travel is $102\frac{1}{2}°$. Thus the switches provide a safety factor of $2\frac{1}{4}°$ at either end of the travel.

370. The stowing switches are also located inside the yoke, at the right-hand side. These are two micro-switches, one of which is normally open and the other closed. They are operated by a plunger which is actuated by the elevation stowing lock on the elevation gear casing.

DATA SYSTEM

Schematic diagrams

371. The circuits of the data system, as it is at present, are shown in Figs. 1053 to 1058 inclusive. The function of such a system is to compute and transmit present position data to gun directors M4, M7, M9, M10 and similar types. The system comprises seven selsyn transmitters, three voltage transmitting potentiometers, the data panel, PN-22; the altitude converter control unit, BC-1094; the data unit, BC-1075 ; and the converter power supply, RA-70. Detailed information on these units will be published shortly as another E.M.E.R.

TRAILER WIRING

Power distribution

372. The main supply is controlled, initially, at the MAIN LINE SWITCH—or at the plug marked POWER on the data panel in early models. Diagrams of the power distribution are shown in Fig. 1055 (data panel PN-22) and Fig. 1059 (trailer wiring).

373. The 115-V, three-phase mains is supplied to the data panel from which it is routed through the MAIN LINE SWITCH and LINE VOLTAGE ADJUSTER and thence back to the data panel. From the data panel distribution is made to the high voltage rectifier, the modulator, the switch box, and one 115 V outlet. The switch box serves as a secondary distribution point for the remainder of the units in the equipment.

Switch box SW-214

374. Fig. 1061 shows the connections within the switch box. It contains fuses and circuit breakers for all units in the trailer except the high voltage rectifier and the modulator cabinet—both of which have local protective devices. It also contains the following components :—

Push button S-1901, and contactor K-1901—for operating the pedestal elevator motor.

Error signal push-pull transformers, T-1901 and T-1902.

Selenium rectifiers, CR-1901 and CR-1902.

Cabin light switch, S-1905.

Line outlet, J-1901.

375. The Selenium rectifiers are connected across the elevation servo generator field by the action of the limit switches. This effectively shorts the field for current flowing in one direction and so prevents any output from the servo generator driving the elevation motor in the same direction. Of course, current in the opposite direction can flow and so permits the motor to be reversed.

376. The SPINNER MOTOR, AZIMUTH and ELEVATION switches are of the current overload circuit breaker type.

Junction box JB-71

377. See Fig. 1060. The box serves as a tie point between various units of the SCR-584.

Pedestal elevator

378. The control circuits for the elevator contain a large number of interlocks. Fig. 1064 shows a diagram of connections and interlocks related to the operation of the elevator system. The elevator motor is a reversible three-phase induction motor which is operated from S-1901 in the switch box. The motor raises or lowers the platform bearing the pedestal through a gear and chain drive. The upper and lower unit switches, S-2007 and S-1977, are operated by the moving platform to stop the motor when the platform is fully up or down.

379. The UP and DOWN coils of relay K-1901 are energized through the RAISE and LOWER buttons of S-1901 and through a number of interlocks. K-1901 also incorporates two thermal overload elements in series with two of the phases to the elevator motor. These protect the motor in case of overload. When either of these operate, the relays cannot be closed until the manual reset on the contact is operated.

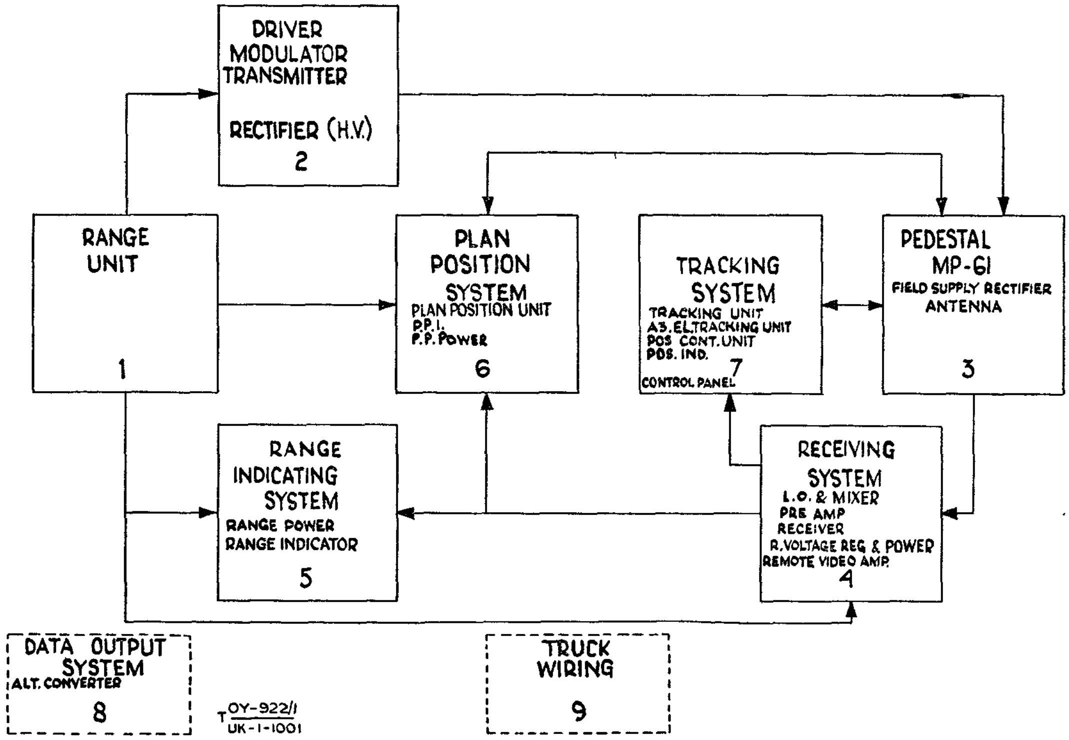
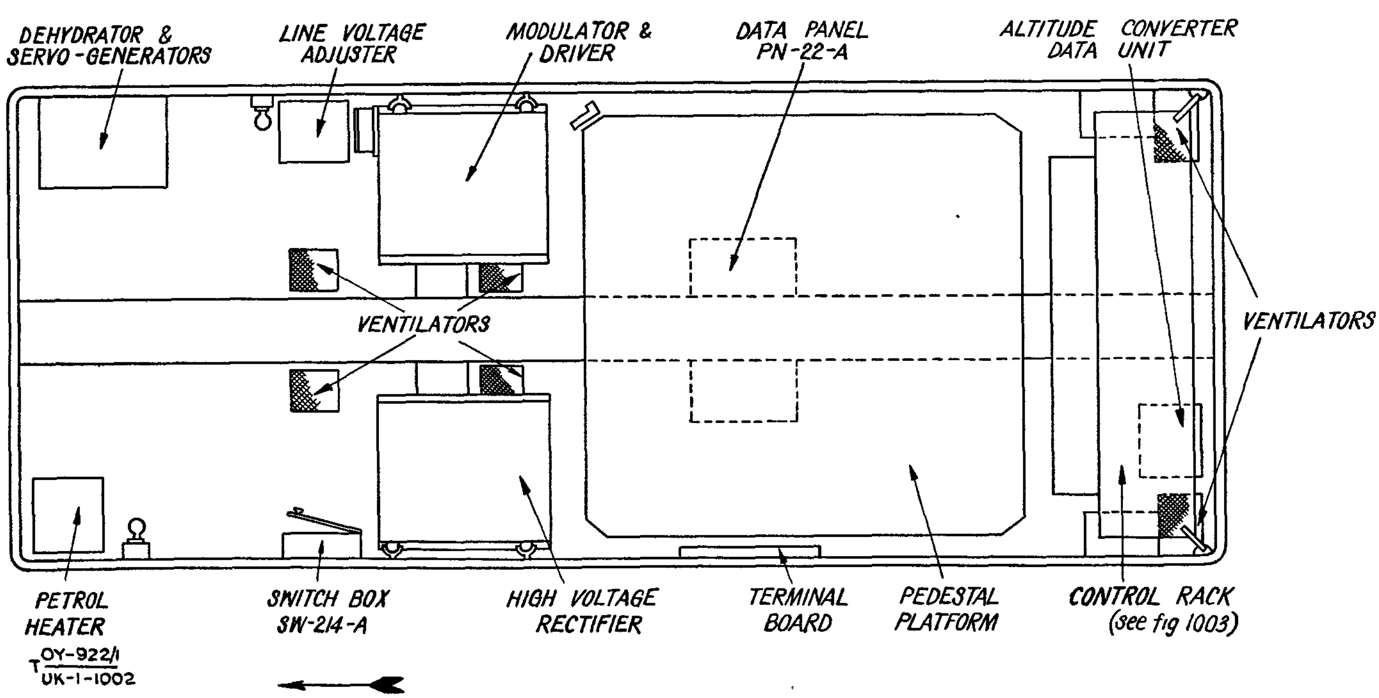


Fig. 1001—Block schematic



(approx scale : 2 feet = 1 inch.)

Fig. 1002—Trailer K-78-A, plan view

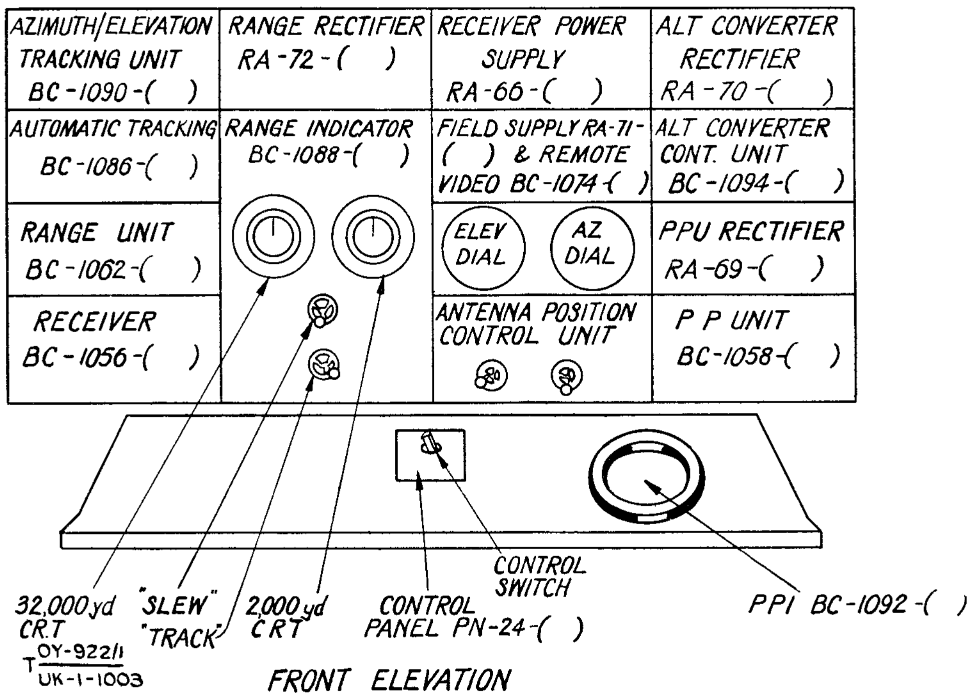


Fig. 1003—Layout of control rack

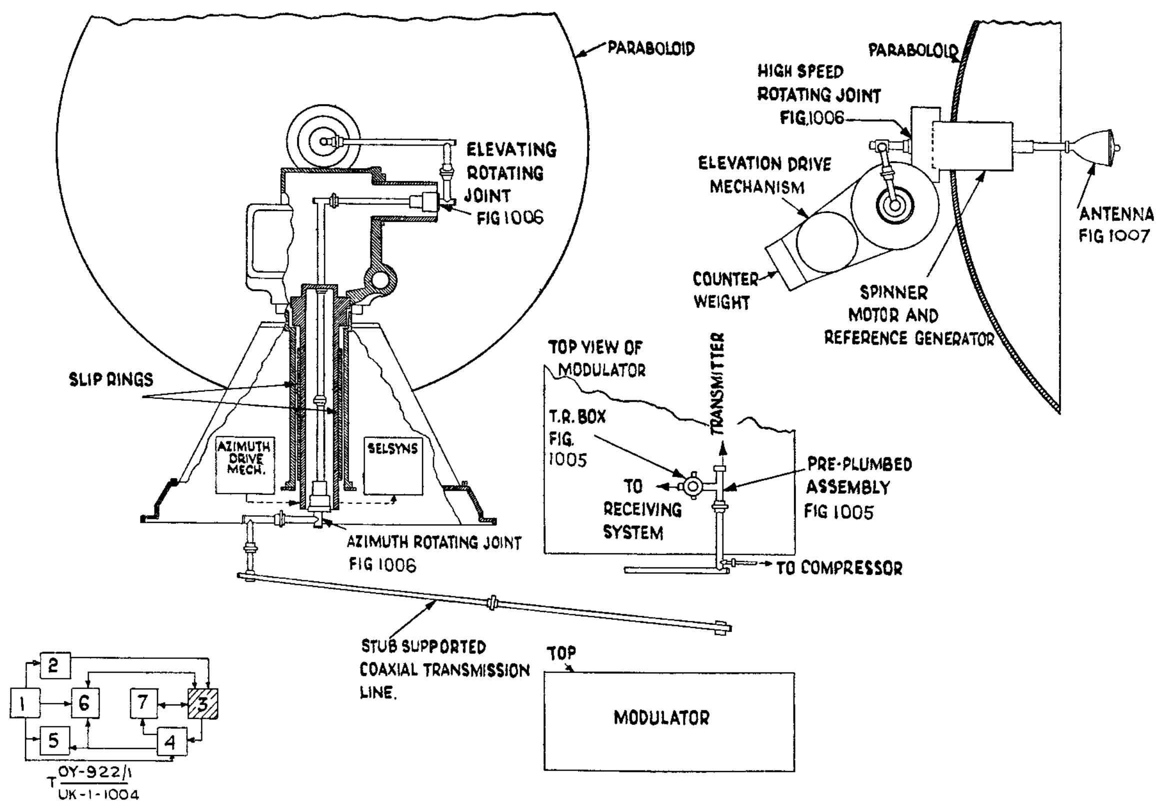


Fig. 1004—Pedestal functional diagrams

NOTE.—Power supply for exciting fields for azimuth and elevation drive motors is shown in Fig. 1049

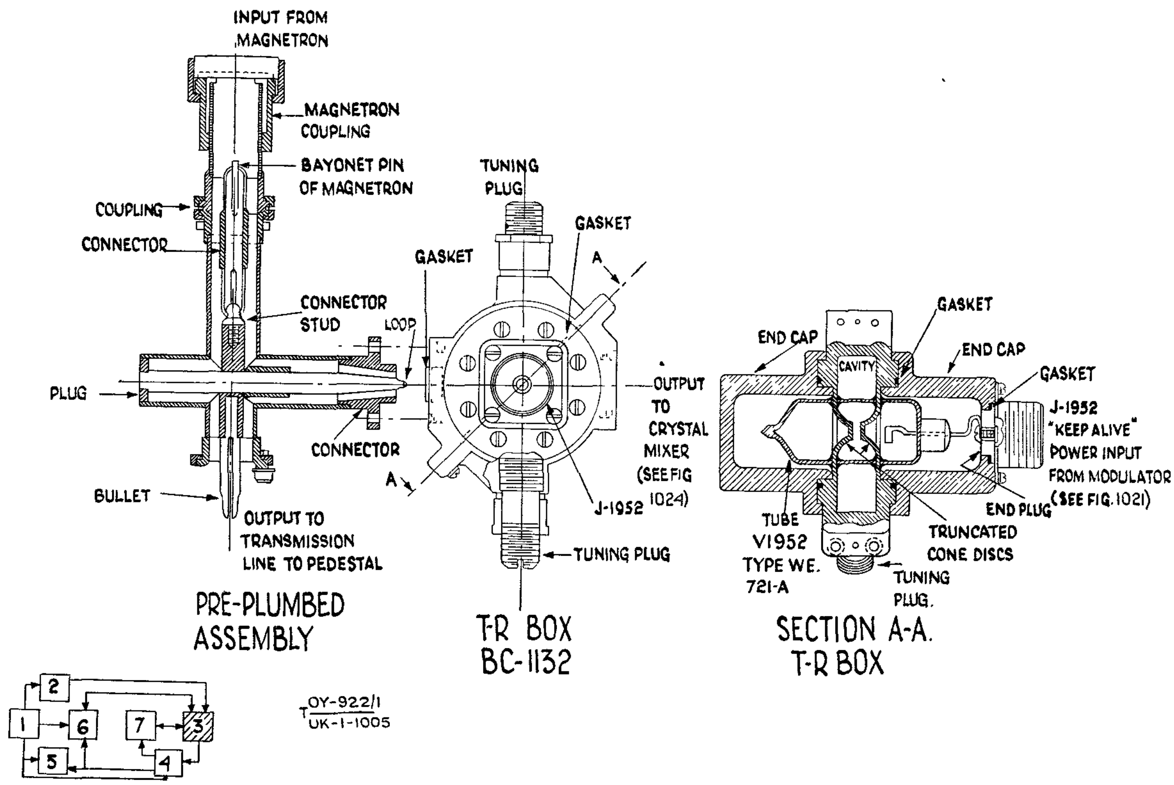


Fig. 1005—Pre-plumbed assembly

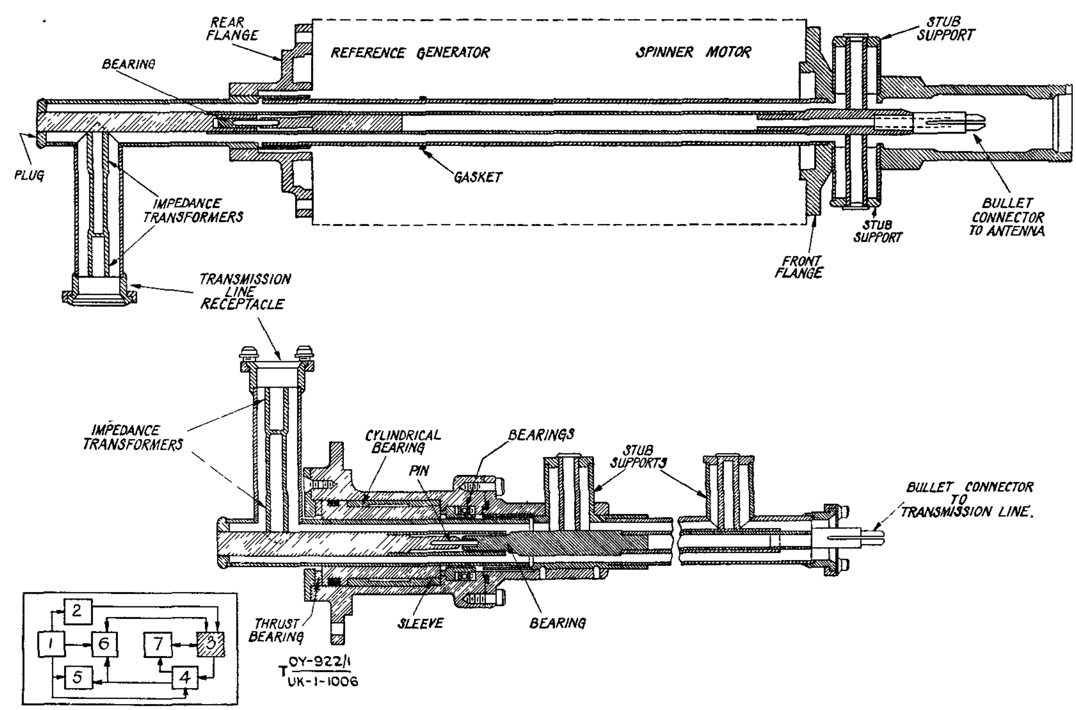


Fig. 1006—High-speed and azimuth or elevation rotating joints

Capacitors

Circuit reference	*Value and working voltage*
C-602	0.0005 μF ± 10%, 500 V D.C. wkg.
C-603	0.01μF + 20%, − 10%, 600 V D.C. wkg.
C-604	20 pF ± 10%, 500 V D.C. wkg.
C-605	0.0005μF ± 10%, 500 V D.C. wkg.
C-606	10-110 pF, 500 V D.C. wkg.
C-607	100 pF ± 10%, 500 V D.C. wkg.
C-608	5 pF ± 10%, 500 V D.C. wkg.
C-609	0.002 μF ± 10%, 500 V D.C. wkg.
C-611	0.0015 μF ± 10%, 500 V D.C. wkg.
C-612	5 pF ± 10%, 500 V D.C. wkg.
C-613	0.006 μF ± 10%, 300 V D.C. wkg.
C-614	0.01 μF + 20%, − 10%, 600 V D.C. wkg.
C-615	1.0 μF ± 10%, 500 V D.C. wkg.
C-616, C-623	0.01μF + 20%, − 10%, 600 V D.C. wkg.
C-624	100pF ± 10%, 500 V D.C. wkg.
C-630	0.01 μF ± 20%, − 10%, 600 V D.C. wkg.
C-631, C-632	1.0 μF ± 10%, 500 V D.C. wkg.
C-633	20 pF ± 10%, 500 V D.C. wkg.
C-634	0.1 μF, 500 V D.C. wkg.
C-635	0.0005 μF ± 10%, 500 V D.C. wkg.
C-636	0.1 μF, 500 V D.C. wkg.
C-637	0.00001 μF ± 10%, 500 V D.C. wkg.
C-638, C-639	0.00005 μF ± 10%, 500 V D.C. wkg.
C-640, C-641	0.01 μF + 20%, − 10%, 600 V D.C. wkg.
C-642	20 pF ± 10%, 500 V D.C. wkg.
C-643	0.1 μF, 500 V D.C. wkg.
C-644	0.00015 μF ± 10%, 500 V D.C. wkg.
C-645	0.1 μF, 500 V D.C. wkg.
C-646	50 pF ± 10%, 500 V D.C. wkg.
C-647	0.0005 μF ± 10%, 500 V D.C. wkg.
C-648	0.00015 μF ± 10%, 500 V D.C. wkg.
C-649	0.006 μF ± 10%, 300 V D.C. wkg.
C-650	0.01 μF + 20%, − 10%, 600 V D.C. wkg.
C-651	0.00001 μF ± 10%, 500 V D.C. wkg.
C-652	0.1 μF, 500 V D.C. wkg.
C-653	100 pF ± 10%, 500 V D.C. wkg.
C-654	50 pF ± 10%, 500 V D.C. wkg.
C-655	0.00007 μF ± 10%, 500 V D.C. wkg.
C-656 to C-659	0.01 μF + 20%, − 10%, 600 V D.C. wkg.
C-660	0.1 μF − 3%, + 10%, 600 V D.C. wkg.
C-661	0.0005 μF ± 10%, 500 V D.C. wkg.
C-662	1 μF, 500 V D.C. wkg.
C-663	100 pF ± 10%, 500 V D.C. wkg.

Resistors

Circuit reference	*Value and rating*
R-601	2.2 MΩ ± 10%, ½ W
R-602	470Ω ± 10%, ½ W
R-603	100 kΩ ± 10%, ½ W
R-604	47 kΩ ± 10%, ½ W
R-605, R-606	22 kΩ ± 10%, 1 W
R-607	120 kΩ ± 10%, ½ W
R-608	47 kΩ ± 10%, ½ W
R-609, R-610	22 kΩ ± 10%, 1 W
R-611	27 kΩ ± 10%, ½ W
R-612	47 kΩ ± 10%, ½ W
R-613, R-614	22 kΩ ± 10%, 1 W
R-615	15 kΩ ± 10%, ½ W
R-616	25 kΩ ± 10%, 2 W, potentiometer
R-617	470 kΩ ± 10%, ½ W
R-618	1 kΩ ± 10%, 1 W
R-619	100 kΩ ± 10%, 1 W
R-621	500 kΩ ± 10%, 2 W, potentiometer
R-622, R-623	1.0 MΩ, ± 10%, 2 W, potentiometer
R-624	100 kΩ ± 10%, 2 W, potentiometer
R-625	500 kΩ ± 10%, 2 W, potentiometer
R-626	120 kΩ ± 10%, ½ W
R-627	330 kΩ ± 10%, 1 W
R-628, R-629	1.0 MΩ ± 10%, 2 W, potentiometer
R-630	100 kΩ ± 10%, ½ W
R-631	5,100 Ω ± 5%, 2 W
R-632	47 kΩ ± 10%, 1 W
R-633	150Ω ± 10%, ½ W
R-634	5 kΩ ± 10%, 3 W, potentiometer
R-635	3,900 Ω ± 10%, 1 W
R-636	5 kΩ ± 10%, 3 W, potentiometer
R-637	5,100 Ω ± 5%, 1 W
R-638	100 kΩ ± 5%, 1 W
R-639	27 kΩ ± 10%, ½ W
R-640	2,700 Ω ± 10%, 2 W
R-641	5,600 Ω ± 10%, 1 W
R-642	5,600 Ω ± 10%, 2 W
R-643	3.3 MΩ ± 5%, ½ W
R-644	2,700 Ω ± 10%, ½ W
R-645	100 kΩ ± 10%, 2 W
R-646	500 kΩ ± 10%, 2 W, potentiometer
R-647 to R-651	1,500 Ω ± 10%, 2 W
R-652	3,900 Ω ± 10%, 2 W

Table 1001—Details of components of range unit BC-1062 (Figs. 1009 and 1010)

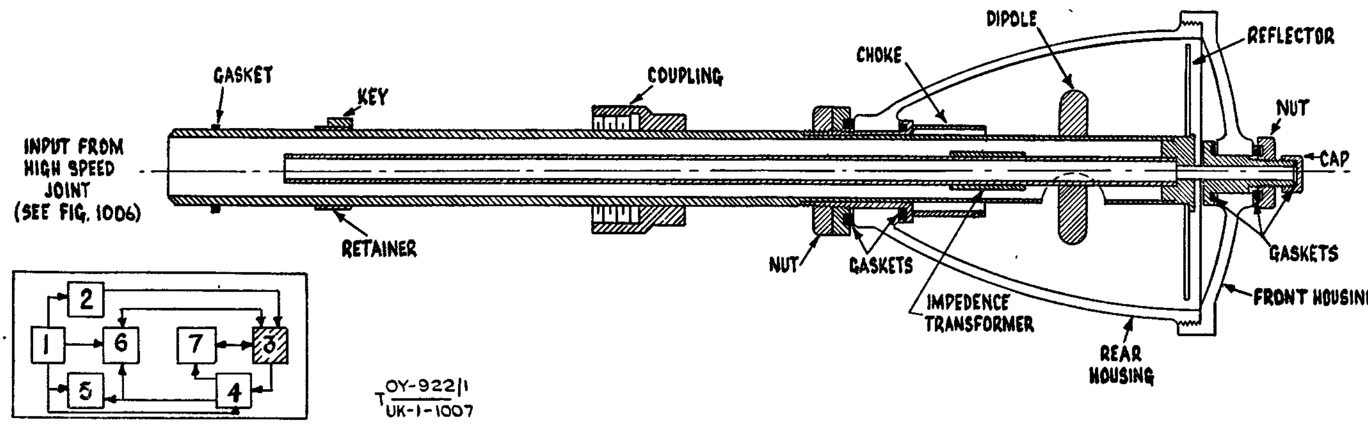


Fig. 1007—Antenna assembly

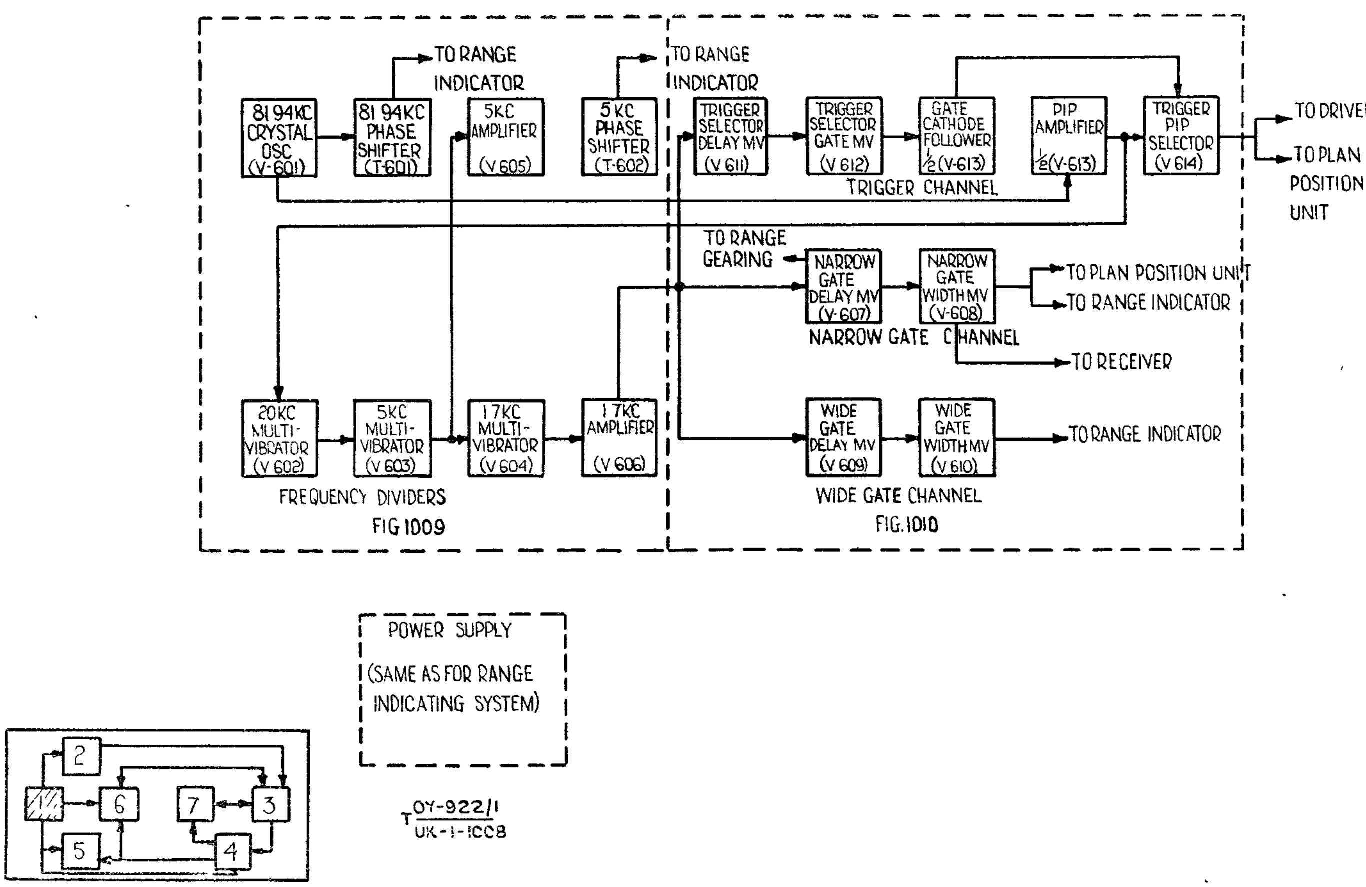


Fig. 1008—Range system, block schematic

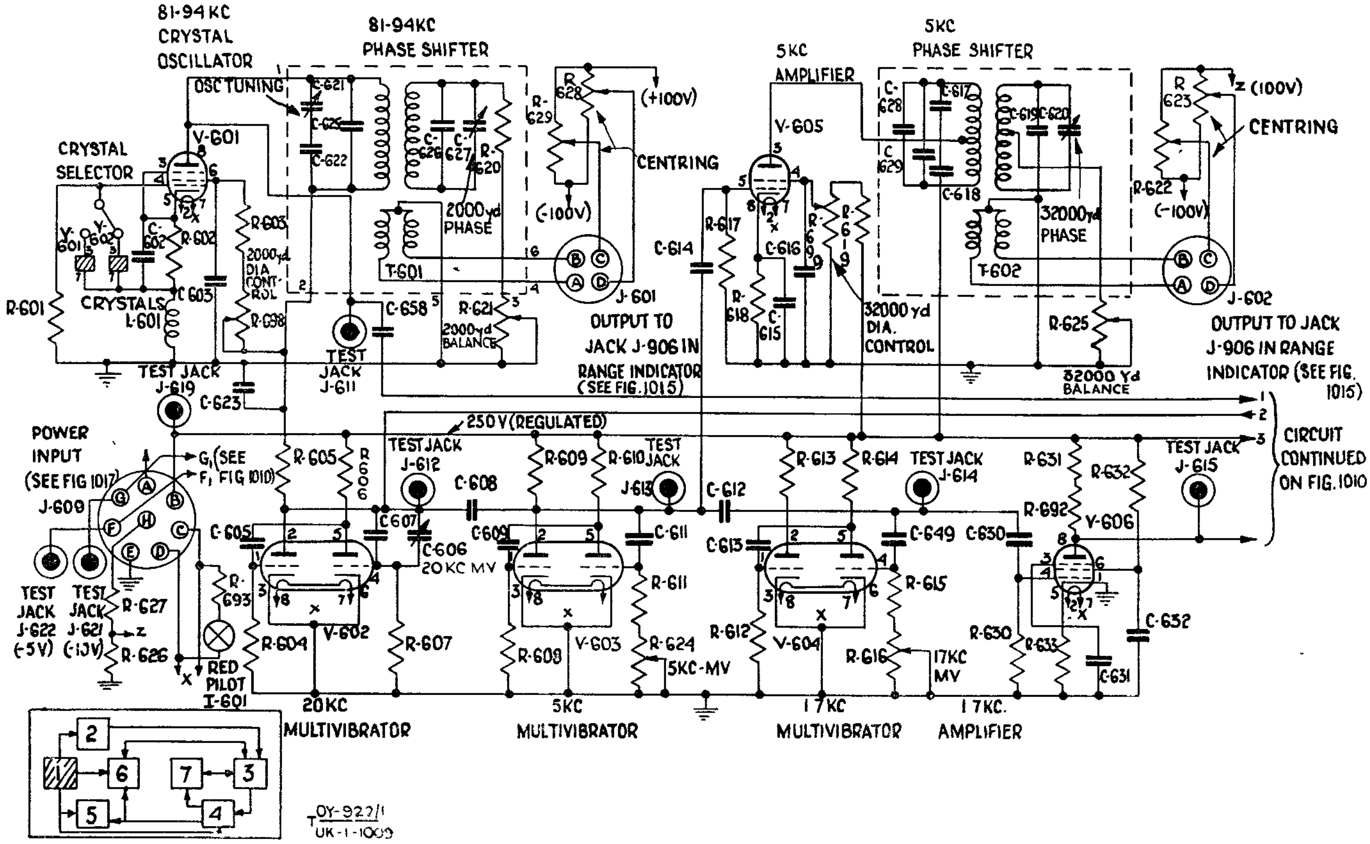


Fig. 1009—Range time base circuits (Table 1001)

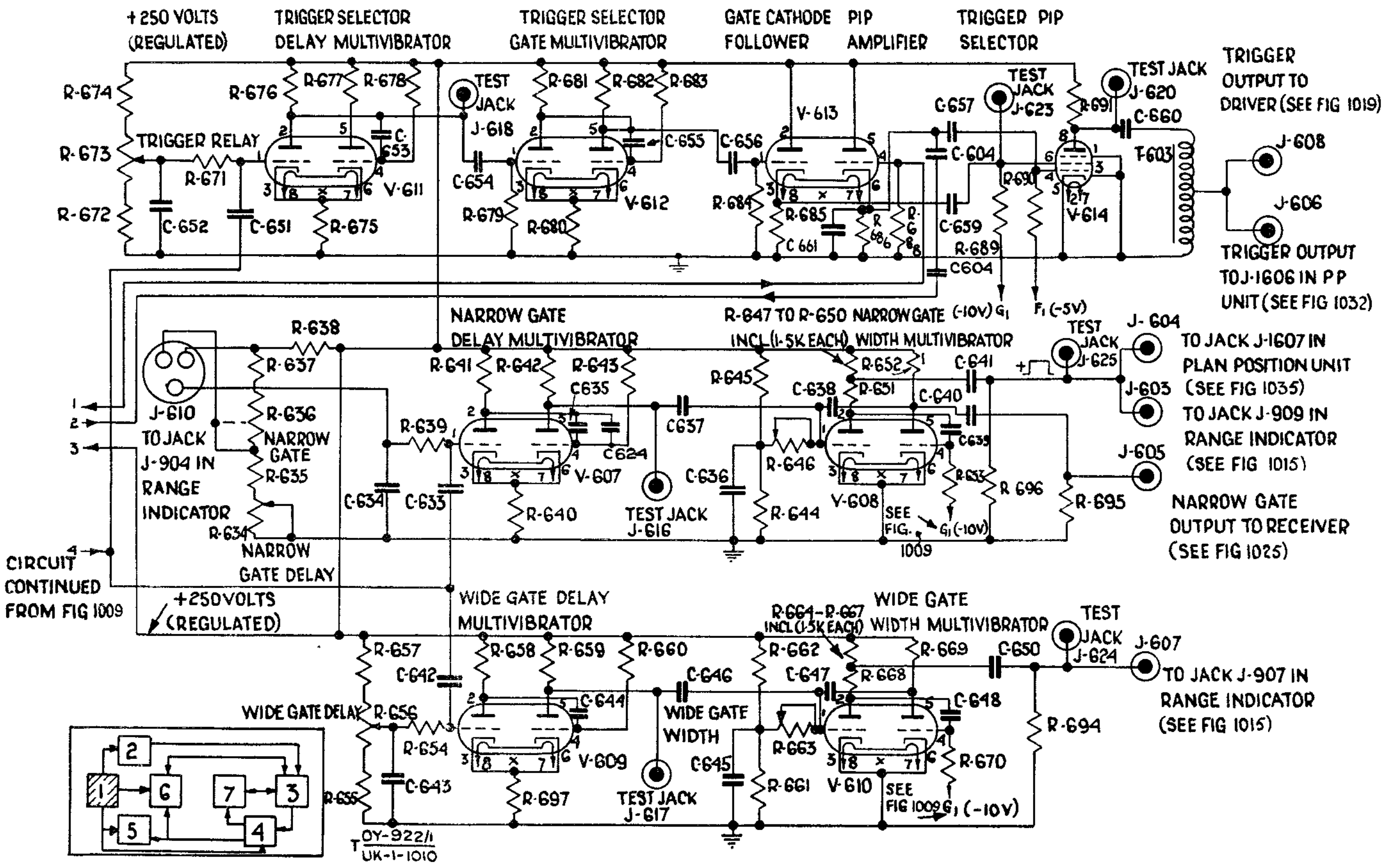


Fig. 1010—Range unit pulse selector and gate circuits (Table 1001)

RESISTORS—*contd.*

Circuit reference	*Value and rating*
R-653	4.7 MΩ ± 10%, ½ W
R-654	24 kΩ ± 5%, ½ W
R-655	27 kΩ ± 10%, ½ W
R-656	75 kΩ ± 10%, 2 W, potentiometer
R-657	1.0 MΩ ± 10%, ½ W
R-658	5,600 Ω ± 10%, 1 W
R-659	5,600 Ω ± 10%, 2 W
R-660	3.3 MΩ ± 5%, ½ W
R-661	1,500 Ω ± 10%, ½ W
R-662	100 kΩ ± 10%, 2 W
R-663	500 kΩ ± 10%, 2 W, potentiometer
R-664 to R-668	1,500 Ω ± 10%, 2 W
R-669	3,900 Ω ± 10%, 2 W
R-670	4.7 MΩ ± 10%, ½ W
R-671	24 kΩ ± 5%, ½ W
R-672	47 kΩ ± 10%, ½ W
R-673	75 kΩ ± 10%, 2 W, potentiometer
R-674	1.0 MΩ ± 10%, ½ W
R-675	2,700 Ω ± 10%, 2 W
R-676	5,600 Ω ± 10%, 1 W
R-677	5,600 Ω ± 10%, 2 W
R-678	3.3 MΩ ± 5%, ½ W
R-679	27 kΩ ± 10%, ½ W
R-680	1,500 Ω ± 10%, 1 W
R-681	7,500 Ω ± 5%, 1 W
R-682	7,500 Ω ± 5%, 2 W
R-683	3.3 MΩ ± 5%, ½ W
R-684	100 kΩ ± 10%, ½ W
R-685	10 kΩ ± 10%, 1 W
R-686	8,200 Ω ± 10%, 2 W
R-687	220 kΩ ± 10%, 1 W
R-688	1.0 MΩ ± 10%, ½ W
R-689	33 kΩ ± 10%, ½ W
R-690	180 kΩ ± 10%, ½ W
R-691, R-692	5,100Ω ± 5%, 2 W
R-693	10Ω ± 10%, 1 W
R-694 to R-696	1.0 MΩ ± 10%, ½ W
R-697	2,700 Ω ± 10%, 2 W
R-698	300 kΩ ± 10%, 2 W, potentiometer
R-699	500 kΩ ± 10%, 2 W, potentiometer

RECEPTACLES

Circuit reference	*Description*
J-601,	80 kc/s exciting and centering voltage output
J-602	5 kc/s exciting and centering voltage output
J-603, J-604	Positive narrow-gate output
J-605	Negative narrow-gate output
J-606	Trigger output
J-607	Wide-gate output
J-608	Trigger output
J-609	Power input
J-610	Variable, bias input (for V-607)
J-611	Moulded bakelite, single contact socket with retainer ring, XTAL monitor
J-612	Moulded bakelite, single contact socket with retainer ring, 20 kc/s monitor.
J-613	Moulded bakelite, single contact socket with retainer ring, 5 kc/s monitor
J-614	Moulded bakelite single contact socket with retainer ring, 1.7 kc/s monitor
J-615 to J-625	Moulded bakelite, single contact socket with retainer ring

MISCELLANEOUS

Circuit reference	*Description*
I-601	Pilot light, red cap
I-601A	Lamp, 6–8 V, 0.25 A with bayonet base
L-601	Inductor, 8.0 mH ± 5%
S-601	Switch, 1 pole, 2 positions, 1 section, 30° throw
T-601	Transformer (includes capacitors C-621, C-622, C-625, C-626, C-627 and resistor R-620)
T-602	Transformer (includes capacitors C-617, C-618, C-619, C-620, C-628 and C-629)
T-603	Transformer, 75/15 V A.C. Trigger output impedance step-down
V-601	Valve, 6SK7GT
V-602 to V-604	Valve, 6SL7GT
V-605	Valve, 6L6G
V-606	Valve, 6AC7
V-607 to V-613	Valve, 6SN7GT
V-614	Valve, 6AG7
X-601 to X-614	Valve socket, octal
X-615, X-616	Socket, octal
Y-601, Y-602	Crystal, 81.950 kc/s, measured at 30° C. temp.

Table 1001 (*contd.*)**—Details of components of range unit BC-1062 (Figs. 1000 and 1010)**

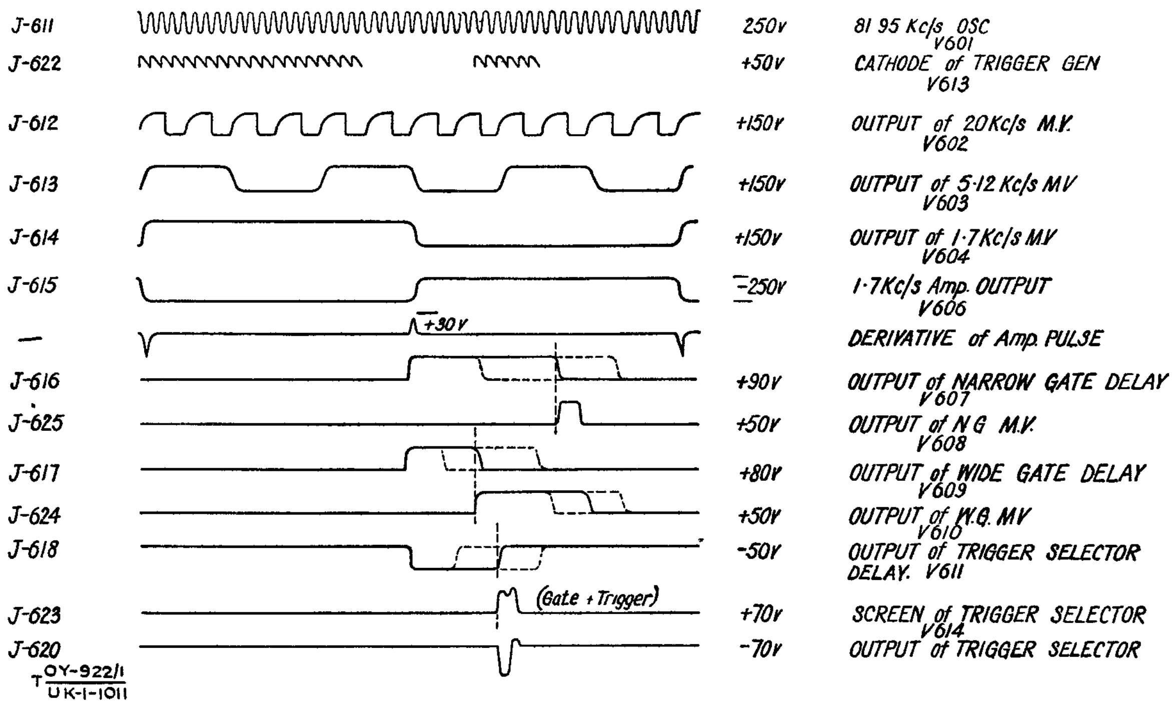


Fig. 1011—Approximate wave forms in range unit

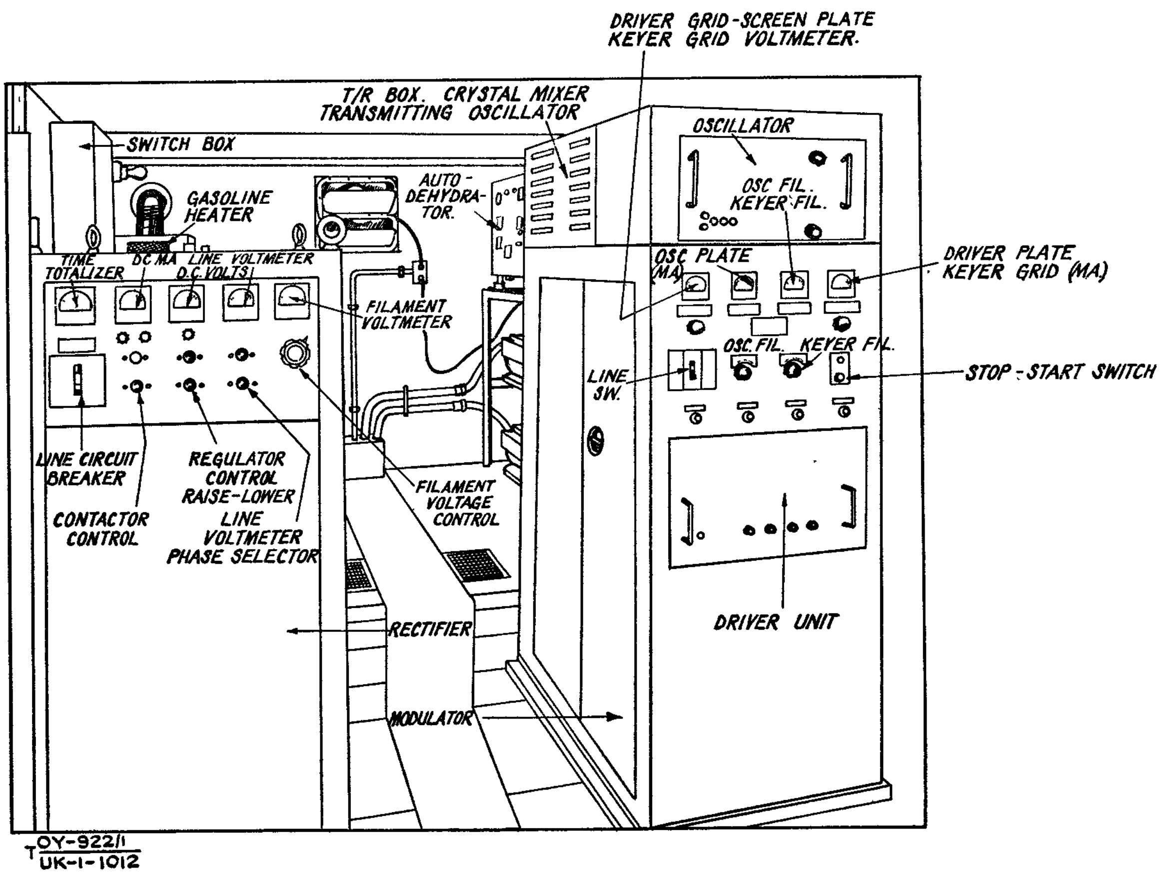


Fig. 1012—Components in front section of trailer

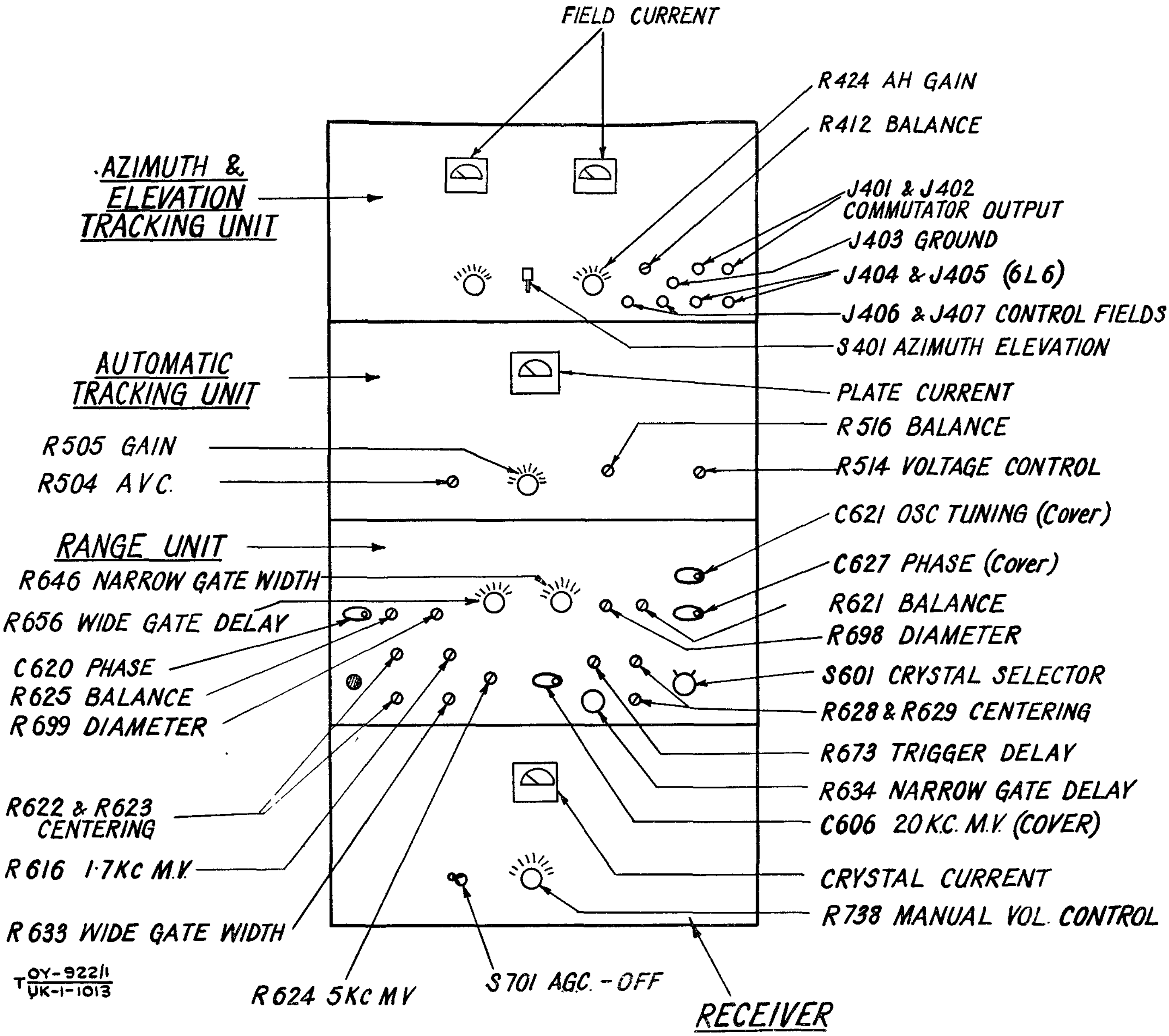


Fig. 1013—Left-hand tier of control rack (important controls)

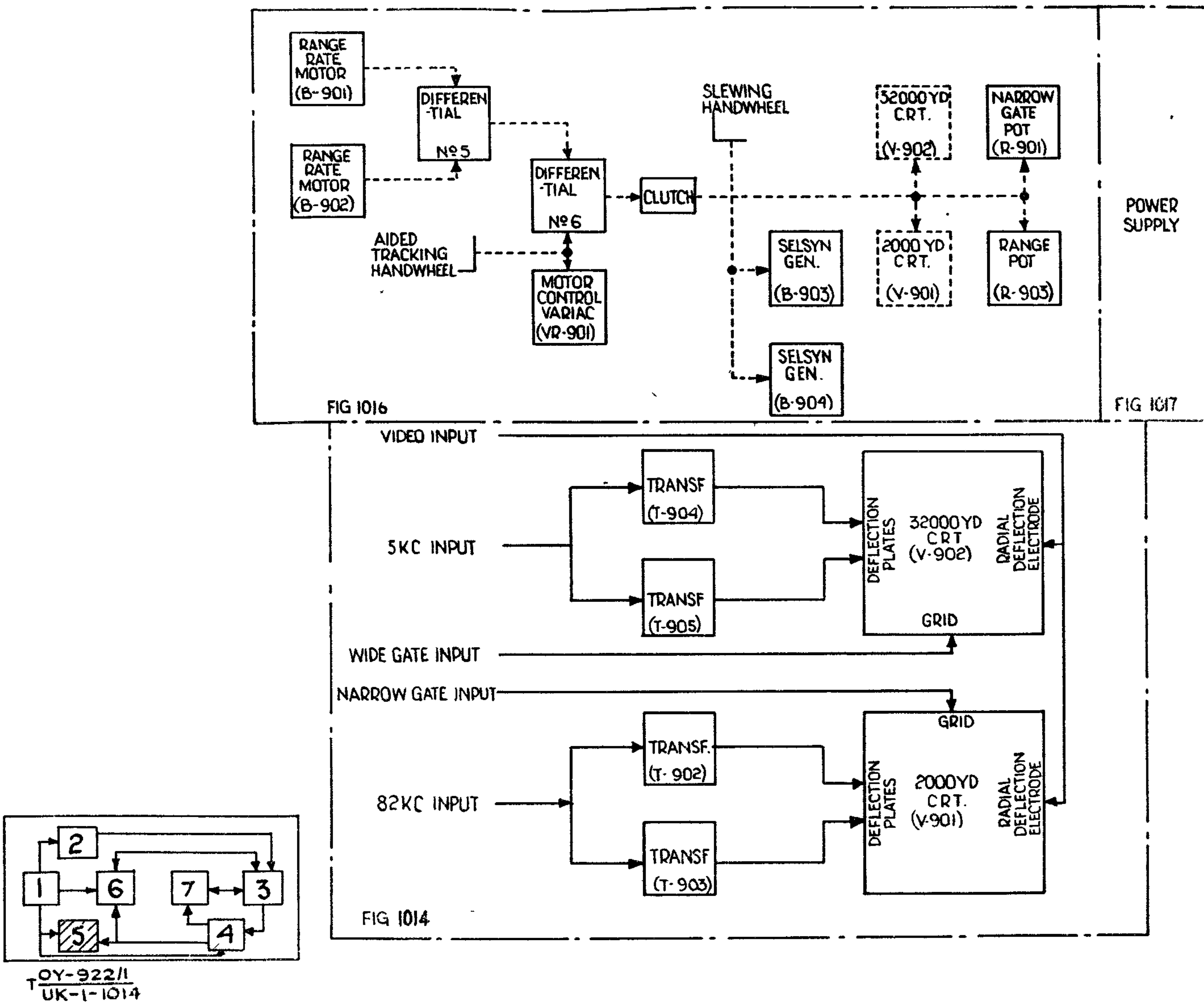


Fig. 1014—Range indicating system block schematic

Circuit reference	*Name of part*	*Description*
B-901, B-902	Motor	
B-903, B-904	Selsyn generator	
C-901 to C-903	Capacitor	0.1 μF, 500 V D.C. working
C-904	Capacitor	0.01 μF $\pm$ 10% 2,500 V D.C. working
C-905	Capacitor	0.001 μF $\pm$ 10% 2,500 V D.C. working
J-901 to J-911	Receptacle	
R-901	Resistor-potentiometer	
R-902	Resistor-potentiometer	250Ω $\pm$ 10%, 25 W
R-903	Resistor-potentiometer	
R-904 to R-906	Resistor	150 kΩ $\pm$ 5%, 2 W
R-907, R-908	Resistor-potentiometer	300 kΩ $\pm$ 10%, 2 W
R-909	Resistor	100 kΩ $\pm$ 5%, 2 W
R-910, R-911	Resistor-potentiometer	100 kΩ $\pm$ 10%, 2 W
R-912, R-913	Resistor	270 kΩ $\pm$ 10%, $\frac{1}{2}$ W
R-914, R-915	Resistor	470 kΩ $\pm$ 10%, $\frac{1}{2}$ W
R-916	Resistor	100 kΩ $\pm$ 10%, 1 W
S-901	Switch	1 normally closed contact
S-902	Switch	Toggle, single-pole, single-throw, 3 A at 250 V
S-903	Switch	2-circuit, 3-position
T-901	Transformer	115 V to 6.5 V
T-902	Transformer	Includes capacitors C-906, C-907, C-908 and resistors R-917, R-918
T-903	Transformer	Includes capacitors C-909, C-910, C-911 and resistors R-919, R-920
T-904	Transformer	Includes capacitors C-912, C-913, C-914 and resistors R-921, R-922
T-905	Transformer	Includes capacitors C-915, C-916, C-917 and resistors R-923, R-924
V-901, V-902	Cathode ray vacuum tube	Type 3DP1
VR-901	Variac	
X-901, X-902	Tube socket	Med. shell diheptal, 12-pin
X-901A,	Base clamp	
X-902A	Base clamp	

Table 1002—Details of components of range indicator BC-1088 (Fig. 1015)

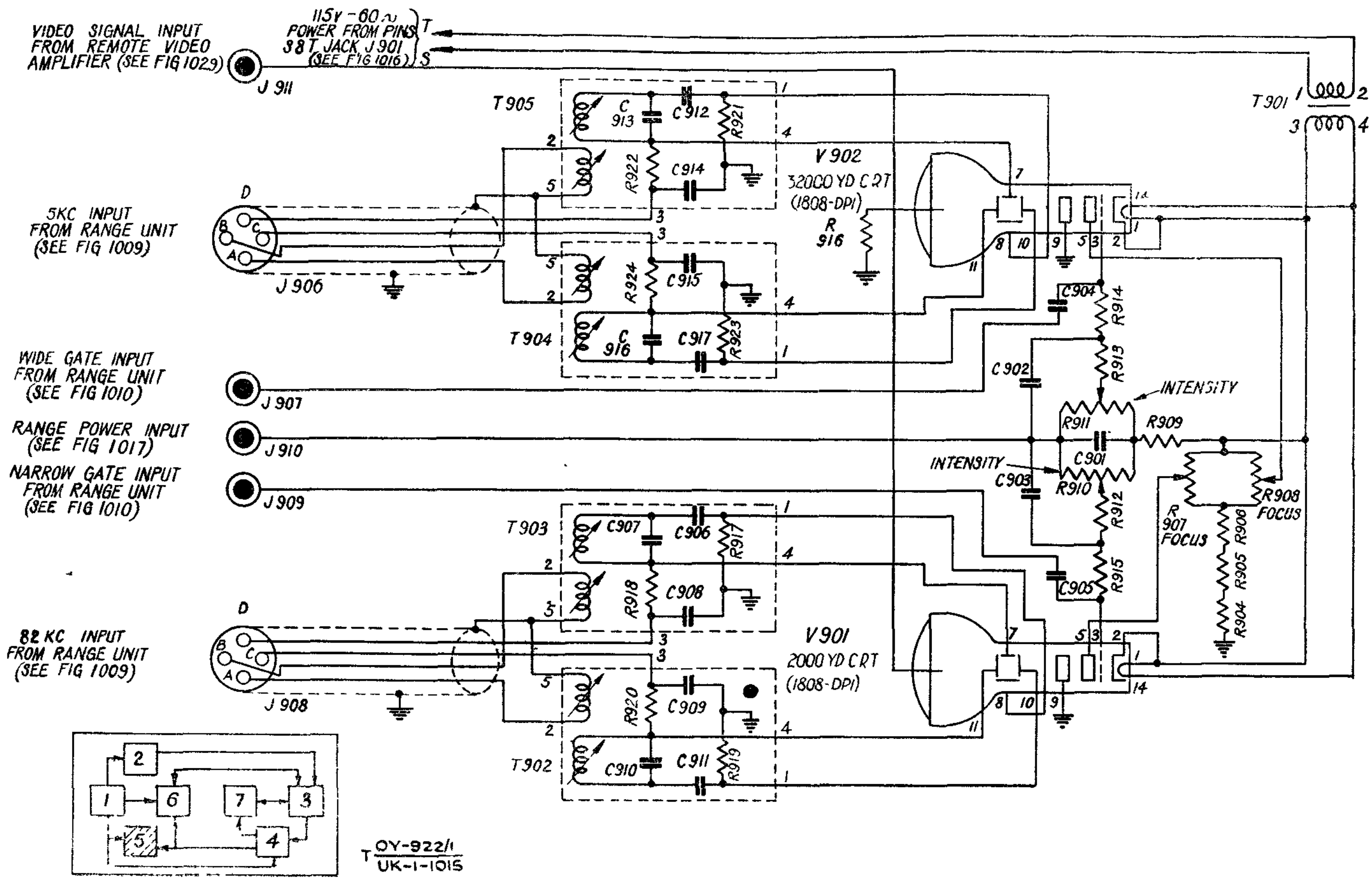


Fig. 1015—Range indicator (Table 1002)

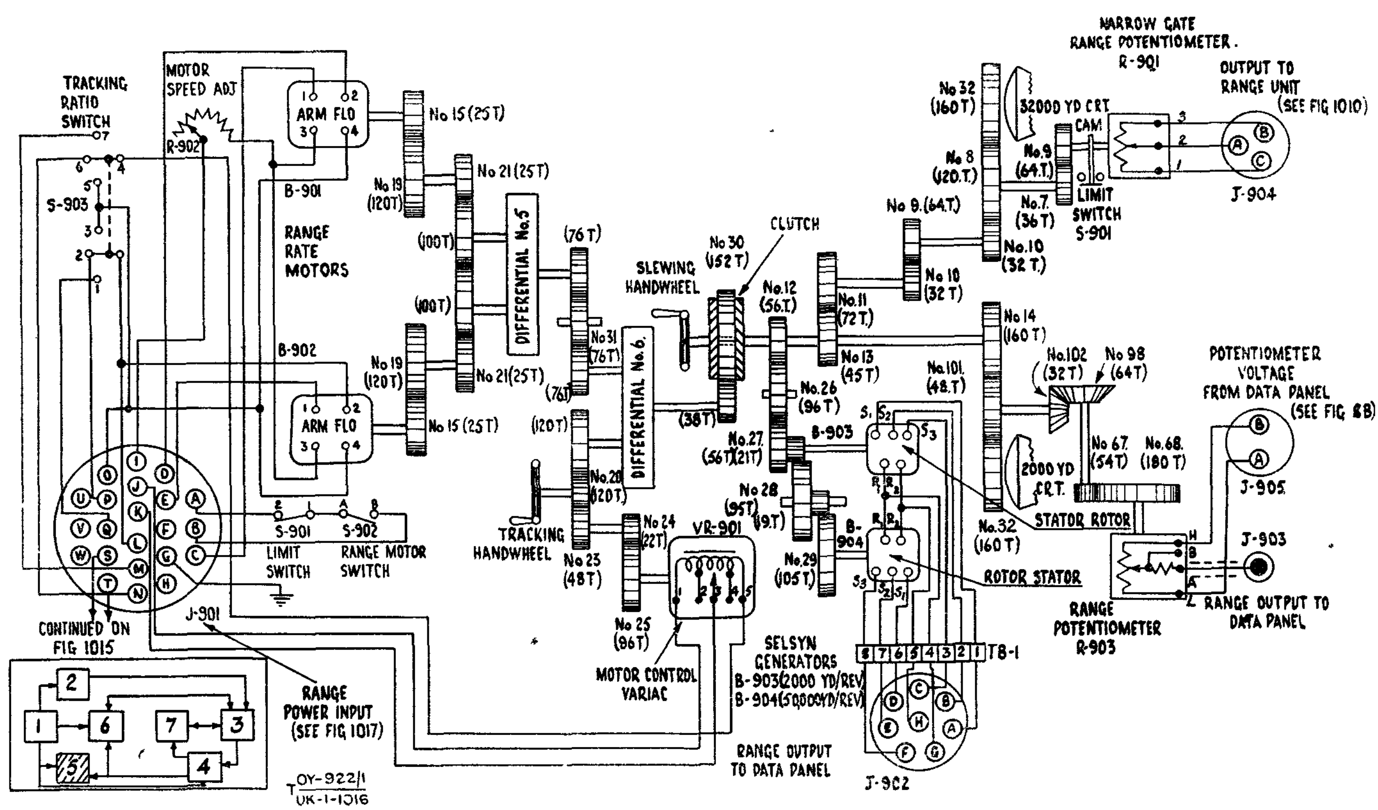


Fig. 1016—Range indicating system, range gearing

Circuit reference	Name of part	Description
C-801 to C-803	Capacitor	4 μF, 600 D.C. wkg.
C-805	Capacitor	2 μF, 2,000 V D.C. wkg.
C-806, C-807	Capacitor	1.0 μF, 500 V D.C. wkg.
C-808	Capacitor	0.1 μF, 3 kV D.C. wkg.
C-809	Capacitor	0.1 μF, 600 V D.C. wkg.
C-810	Capacitor	0.002 μF + 20% − 10%, 600 V D.C. wkg.
F-801, F-802	Fuse	3 A, 0.07 Ω, 250 V
F-801A to F804A	Fuse post	
F-803, F-804	Fuse	5 A, 0.016Ω, 250 V
I-801, I-802	Indicator light	Red cap
I-801A, I-802A	Lamp	6–8 V, 0.25 A
J-801	Receptacle	125 V, 15 A, male flush mtg.
J-802	Receptacle	Power output (to aided range motors in BC-1088)
J-803	Receptacle	Power output (to range unit BC-1062)
J-804	Receptacle	2,000 V D.C. power output
L-801, L-802	Reactor	5 H at 225 mA D.C. 80 Ω D.C.R.
R-801	Resistor	10Ω ± 10%, 1 W
R-803	Resistor	3,900 Ω ± 10%, 1 W
R-804	Resistor	10 kΩ ± 10%, 2 W
R-805	Resistor	56 kΩ ± 10%, 1 W
R-806	Resistor	39 kΩ ± 10%, 1 W
R-807	Potentiometer	10 kΩ ± 10%, ½ W
R-808	Resistor	470 kΩ ± 10%, ½ W
R-809 to R-812	Resistor	390 kΩ ± 5%, 2 W
R-813	Resistor	68 kΩ ± 5%, 1 W
R-814	Resistor	10 kΩ ± 5%, 1 W
R-815	Resistor	8,200 Ω ± 5 %, 1 W
R-816, R-817	Resistor	47 kΩ ± 10%, 1 W
R-818	Resistor	39 kΩ ± 10%, 2 W
R-819	Resistor	10Ω ± 10%, 1 W
R-820 to R-822	Resistor	22 kΩ ± 10%, 2 W
R-823	Resistor	39 kΩ ± 5%, 2 W
S-801	Switch	10 A at 250 V
T-801	Transformer	115 V to 5 V/5V/5 V
T-802, T-803	Transformer	250 V to 125 V
T-804	Transformer	115 V to 900 V C.T.
T-805	Transformer	
T-806	Transformer	115 V to 6.3 V/6.3 V/5 V/2.5 V
V-801 to V-803	Valve	Type 83
V-804	Valve	5U4G
V-805 to V-807	Valve	6B4G
V-808	Valve	6SJ7GT
V-809	Valve	VR-105-30
V-810	Valve	
X-801 to X-803	Valve socket	4-contact
X-804 to X-809	Valve socket	Octal
X-810	Valve socket	4-pin, high voltage

Table 1003—Details of components of rectifier RA-72 (Fig. 1017)

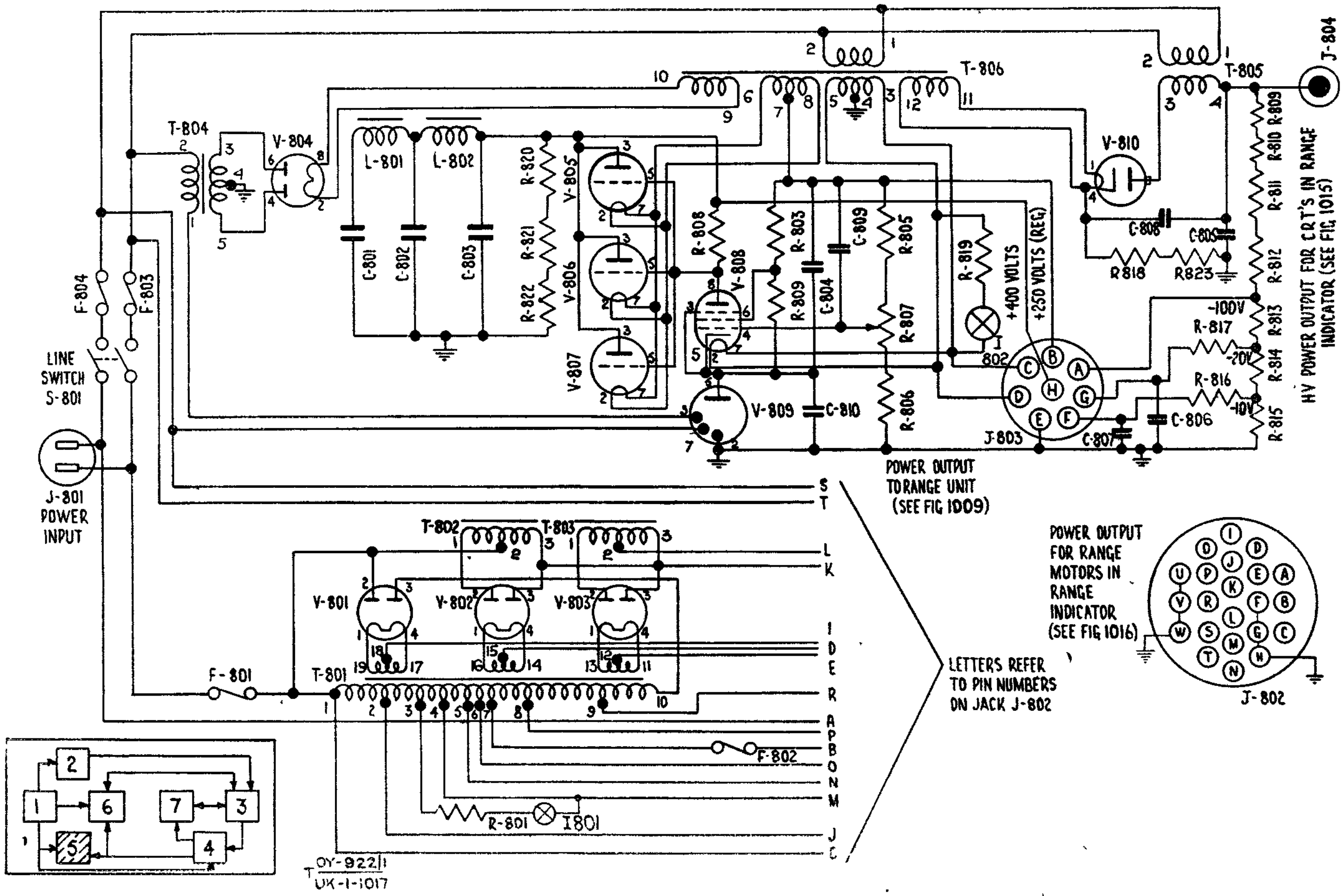


Fig. 1017—Range indicating system, power supplies (Table 1003)

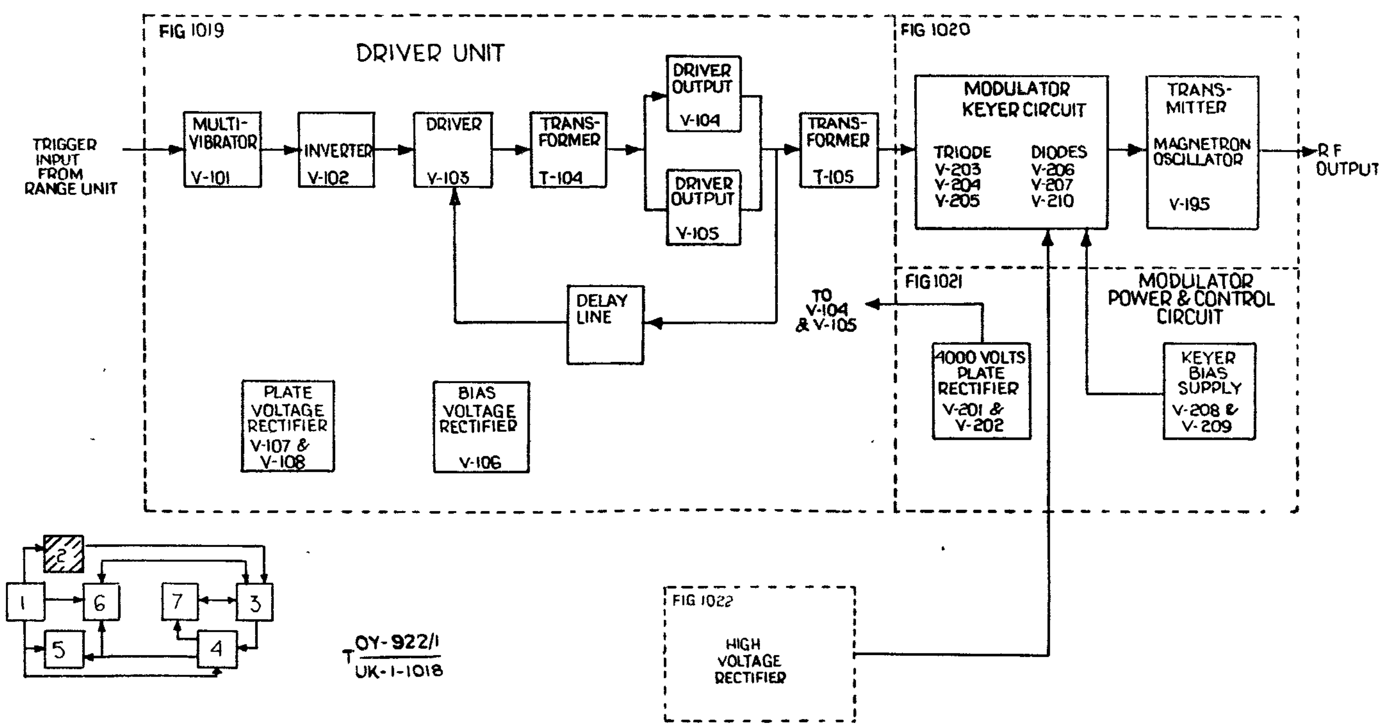


Fig. 1018—Transmitting system block schematic

Capacitors

Circuit reference	Value and working voltage
C-101	20 μF $\pm$ 10%, 500 V D.C. wkg.
C-102	10 μF $\pm$ 10%, 500 V D.C. wkg.
C-103, C-104	0.003 μF $\pm$ 10%, 500 V D.C. wkg.
C-105	0.003 μF $\pm$ 10%, 1.25 kV D.C. wkg.
C-106	40 pF $\pm$ 10%, 500 V D.C. wkg.
C-107	0.25 μF $\pm$ 10%, 1 kV D.C. wkg.
C-108	4 μF $\pm$ 10%, 600 V D.C. wkg.
C-110	0.5 μF $\pm$ 10%, 500 V D.C. wkg.
C-111, C-112	1.0 μF $\pm$ 10%, 500 V D.C. wkg.
C-113 to C-116	4 μF $\pm$ 10%, 600 V D.C. wkg.
C-117	4 μF $\pm$ 10%, 1 kV D.C. wkg.
C-118 to C-121	100 pF $\pm$ 5%, 1.25 kV D.C. wkg.
C-122, C-123	200 pF $\pm$ 10%, 2.5 kV D.C. wkg.

Resistors

Circuit reference	Value and rating
R-101	300 Ω $\pm$ 10%, 3 W, potentiometer
R-102	180 kΩ $\pm$ 10%, 2 W
R-103	15 kΩ $\pm$ 5%, 1 W
R-104	150 kΩ $\pm$ 10%, 1 W
R-105	10 kΩ $\pm$ 10%, 2 W
R-106	4,700 Ω $\pm$ 5%, 1 W
R-107	47 kΩ $\pm$ 10%, 1 W
R-108	8 kΩ $\pm$ 5%, 35 W
R-109	47 kΩ $\pm$ 10%, 1 W
R-110	27 kΩ $\pm$ 10%, 1 W
R-111, R-112	47 Ω $\pm$ 10%, 1 W
R-113, R-114	50 Ω $\pm$ 5%, 5 W
R-115 to R-117	47 Ω $\pm$ 10%, 1 W
R-118, R-119	10 Ω $\pm$ 5%, 5 W
R-120, R-121	47 Ω $\pm$ 10%, 1 W
R-122, R-123	22 Ω $\pm$ 10%, 1 W
R-124, R-125	10 Ω $\pm$ 5%, 5 W
R-126	5 kΩ $\pm$ 5%, 50 W
R-127	4 kΩ $\pm$ 5%, 50 W
R-128	10 kΩ $\pm$ 10%, $\frac{1}{2}$ W
R-129	100 kΩ $\pm$ 10%, 1 W
R-130	8 kΩ $\pm$ 5%, 35 W
R-131, R-132	8,200 Ω $\pm$ 10%, 2 W
R-133	100 kΩ $\pm$ 10%, 2 W
R-134	390 kΩ $\pm$ 10%, 1 W
R-135	27 kΩ $\pm$ 10%, 2 W
R-136	3,900 Ω $\pm$ 10%, 1 W
R-137	2,200 Ω $\pm$ 10%, 1 W
R-138	500 Ω $\pm$ 5%, 10 W
R-139	8,200 Ω $\pm$ 10%, 2 W

Miscellaneous

Circuit reference	Description
F-101 to F-104	Fuse, 3 A, 0.07 Ω, 250 V
F-101A to F-104A	Fuse post
J-101	Receptacle, for trigger input
J-102	Receptacle, for power input
J-103	Receptacle, for trigger monitoring
K-101	Relay, 40 mW coil, 108 Ω, pick-up 20 mA, drop-out 10 mA
L-101	Inductor, 1 mH $\pm$ 2½%, 10 Ω $\pm$ 10%, 1.5 $\pm$ 0.5 pF, 125 mA
L-102	Inductor, 2.1 mH $\pm$ 2½%, 35 Ω $\pm$ 10%, 1.2 $\pm$ 0.5 pF, 125 mA
L-103, L-104	Inductor, 12 H, 75 mA, 20 H, at zero D.C.
L-105	Inductor, 1.8 mH $\pm$ 5%, artificial line
T-101	Transformer, 115 V pri., 5 V, 3 A/175-0-175 V sec.
T-102	Transformer, 115 V pri., 400-0-400 V/225-0-225 V sec.
T-103	Transformer, 115 V pri., 5 V, 3 A/5 V, 8 A/6.3 V, 8.5 A sec.
T-104	Transformer, 420 to 280 V
T-105	Transformer, 3,600 to 3,600 V
V-101	Valve, 6SN7GT
V-102	Valve, 6L6G
V-103 to V-105	Valve, 829A/3E29
V-106 to V-108	Valve, 5U4G
X-101, X-102	Valve socket, 8-pin, octal
X-103 to X-105	Valve socket, 7-pin
X-106 to X-108	Valve socket, 8-pin, octal
X-109	Socket, 5-pin (relay)

Table 1004—Details of components of driver unit BC-1080 (Fig. 1019)

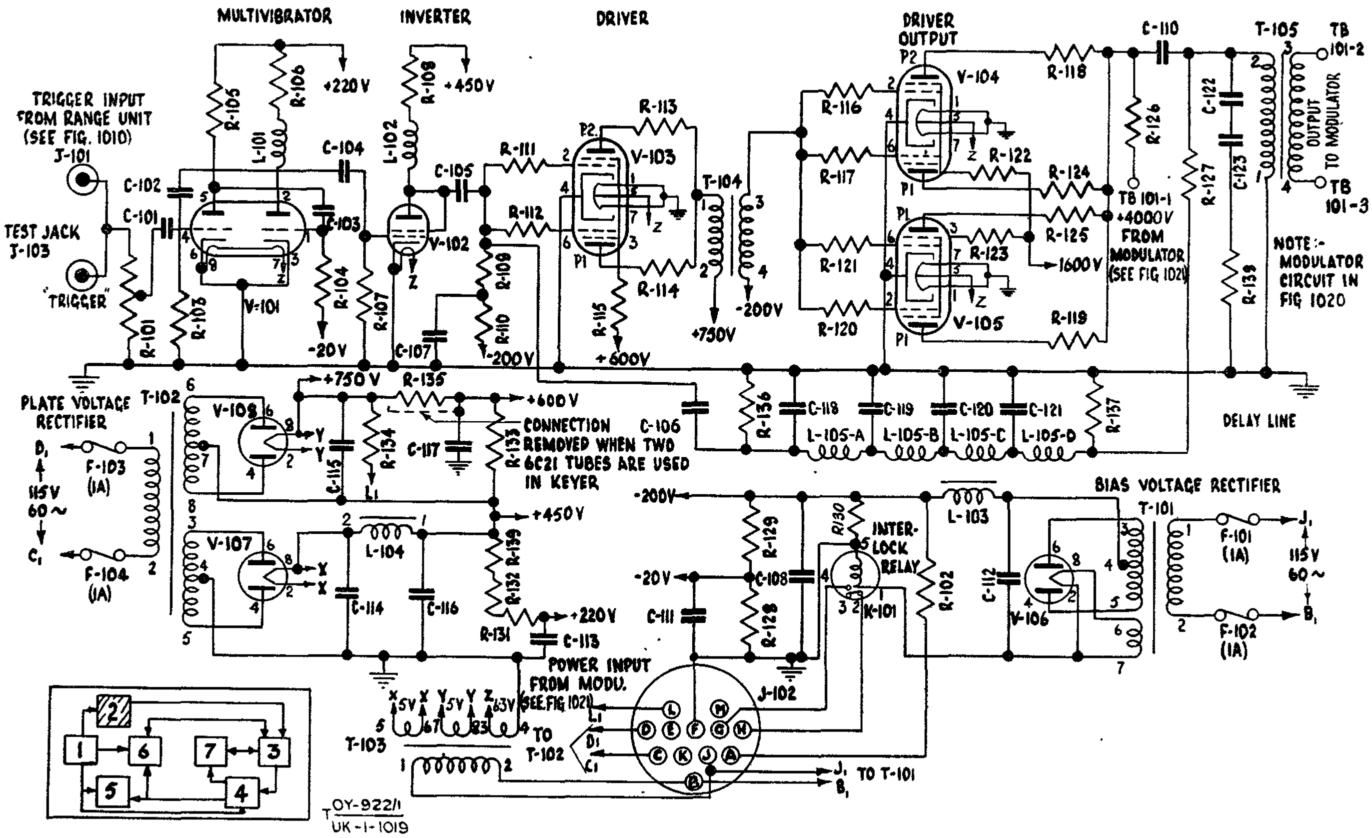


Fig. 1019—Driver unit for modulator (Table 1004)

Circuit reference	*Name of part*	*Description*
BL-201	Blower	3-phase, 115 V, 60 c/s, 1,725 r.p.m., 1/6 h.p.
BL-202	Blower	
BL-203	Blower	3-phase, 115 V, 60 c/s, 3,450 r.p.m., 1/8 h.p.
C-201	Capacitor	2 μF, 5,000 V D.C. working
C-202	Capacitor	0.01 μF + 20% − 10% 600 V D.C. working
C-203	Capacitor	2 μF, 2,000 V D.C. working
C-204	Capacitor	10 pF, 4,000 V
C-205	Capacitor	50 pF $\pm$ 10%, 500 V D.C. working
C-206	Capacitor	0.001 μF $\pm$ 10% 500 V D.C. working
C-208	Capacitor	0.125 μF, 27,000 V
C-209	Capacitor	0.25 μF $\pm$ 10%, 1,000 V D.C. working
C-210	Capacitor	2 μF, 2,000 V D.C. working
C-211	Capacitor	600 pF min. $\pm$ 30%, 1,600 pF max. + 20%, − 10%
F-201	Fuse	Renewable, 25 A, 250 V
F-201A	Fuse holder	3-fuse holder
F-202, F-203	Fuse	Renewable, 25 A, 250 V
I-201	Indicator light	White, power-on
I-201A to I-204A	Bulb	0.25 A, 6–8 V, Mazda, No. 44
I-202	Indicator light	Green, ready
I-203	Indicator light	Amber, bias-on
I-204	Indicator light	Red, driver plate
J-201, J-202	Receptacle	Monitoring
J-204	Receptacle	TR box keep alive
K-201	Relay	15 sec. to 5 min., 115 V 60 c/s, coil, 2 nor. open, 1 nor. closed
K-202	Contactor	110 V, 60 c/s, coil, 4 nor. open
K-203	Contactor	115 V, 50–60 c/s, coil, open type
K-204, K-205	Relay	3 A, nor. current, 1 nor. closed contact, automatic reset
K-206	Relay	40 mW, coil, 108 ohms, pick-up, 20 mA, drop-out 10 mA
L-201	Choke coil	5 mH $\pm$ 5%, 100 mA D.C. 25 kV
L-202	Reactor	12H, 100 mA D.C., 160Ω D.C.R.
L-203	Choke coil	2.5 mH $\pm$ 5%, 5,000 V
M-201	Milliammeter	Scale 0–1 mA D.C. calibrate for use on 1/8 in. steel panel
M-202	Milliammeter	Scale 0–50 mA D.C. calibrate for use on 1/8 in. steel panel
M-203	Milliammeter	Scale 0–150 mA D.C. calibrate for use on 1/8 in. steel panel
M-204	Voltmeter	Scale 0–150 V A.C. calibrate for use on 1/8 in. steel panel
P-102, P-204	Plug	
R-201 to R-205	Resistor	390 kΩ $\pm$ 10%, 1 W
R-207, R-208	Resistor	47 Ω $\pm$ 10% 1 W
R-209 to R-211	Resistor	10Ω $\pm$ 10%, 8 W
R-212 to R-214	Resistor	50Ω $\pm$ 5%, 5 W
R-215 to R-218	Resistor	2,500 Ω $\pm$ 5%
R-219	Rheostat	500Ω $\pm$ 10%, 150 W
R-220	Rheostat	390 kΩ $\pm$ 10%, 1 W
R-221, R-222	Rheostat	10 kΩ $\pm$ 5%
R-223 to R-226	Rheostat	200 Ω $\pm$ 5%, 8 W, adjustable
R-228 to R-231	Resistor	3.3 MΩ $\pm$ 10% 1 W
R-232 to R-238	Resistor	390 kΩ $\pm$ 10%, 1 W
S-201	Switch	25 A, 230 V A.C., 3-pole.
S-202	Switch	Start-stop, 3 wire, push button
S-203	Switch	2-pole, 4-position
S-204	Switch	2-pole, 2-position
S-205	Interlock	10 A, 250 V, door
S-206	Switch	Grounding
S-207	Interlock	10 A, 250 V, door
S-208	Switch	150° F to 160° F, 12° F differential, contacts one normally open, one normally closed, 10 A at 110 V
S-209	Switch	Single-pole, double-throw, 3 A at 125 V, 1 A at 250 V
S-210	Switch	Grounding
SG-201	Gap	Film meter protector
T-201	Transformer	115 V to 5 V at 13 A
T-202	Transformer	115 V to 6,200 V/5,800 V/5,400 V
T-204 to T-207	Transformer	Indicator light
T-208	Transformer	100–200 V to 12.6 V at 3 A
T-209	Transformer	115 V to 8.5 V/8.0 V/7.5 V
T-210	Transformer	115 V to 0–135 V at 5 A
T-212	Transformer	115 V to 5.3/5.5/5.7 V at 21.8 A
T-213	Transformer	115 V to 2.5 V at 10 A
T-214	Transformer	115 V to 2,700/2,530/2,360/2,190/2,020/1,850 V
V-201, V-202	Valve	GL8020
V-203 to V-205	Valve	6C21
V-206, V-207	Valve	GL8020
V-208, V-209	Valve	GL1616
V-210	Valve	GL8020
X-201, X-202	Valve socket	4-pin, med. base
X-203 to X-205	Valve socket	4-pin, 50 W
X-206 to X-210	Valve socket	4-pin, med. base
X-211	Socket	5-pin, relay

Table 1005—Details of components of modulator BC-984 (Figs. 1020 and 1021)

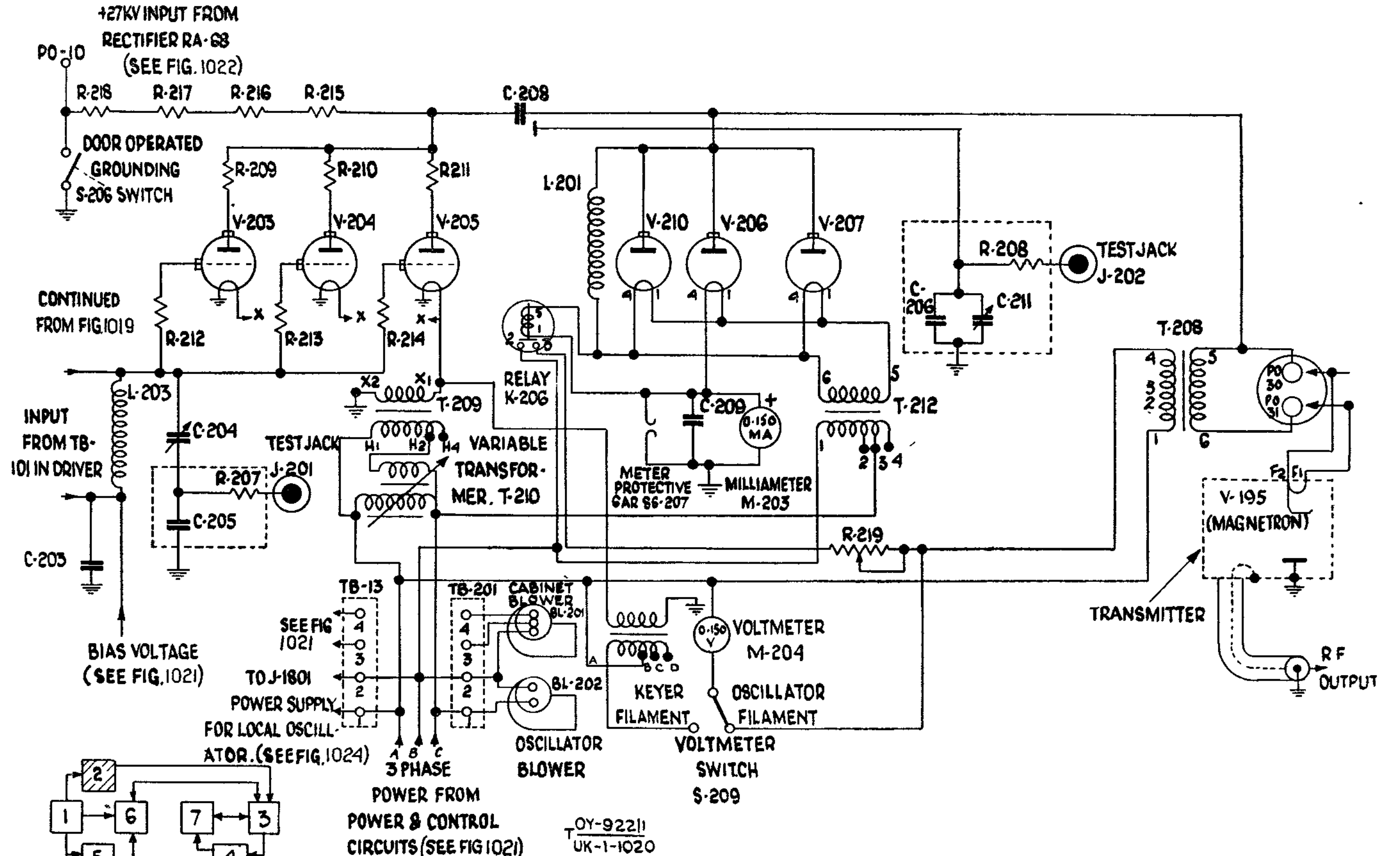


Fig. 1020—Modulator keyer circuit (Table 1005)

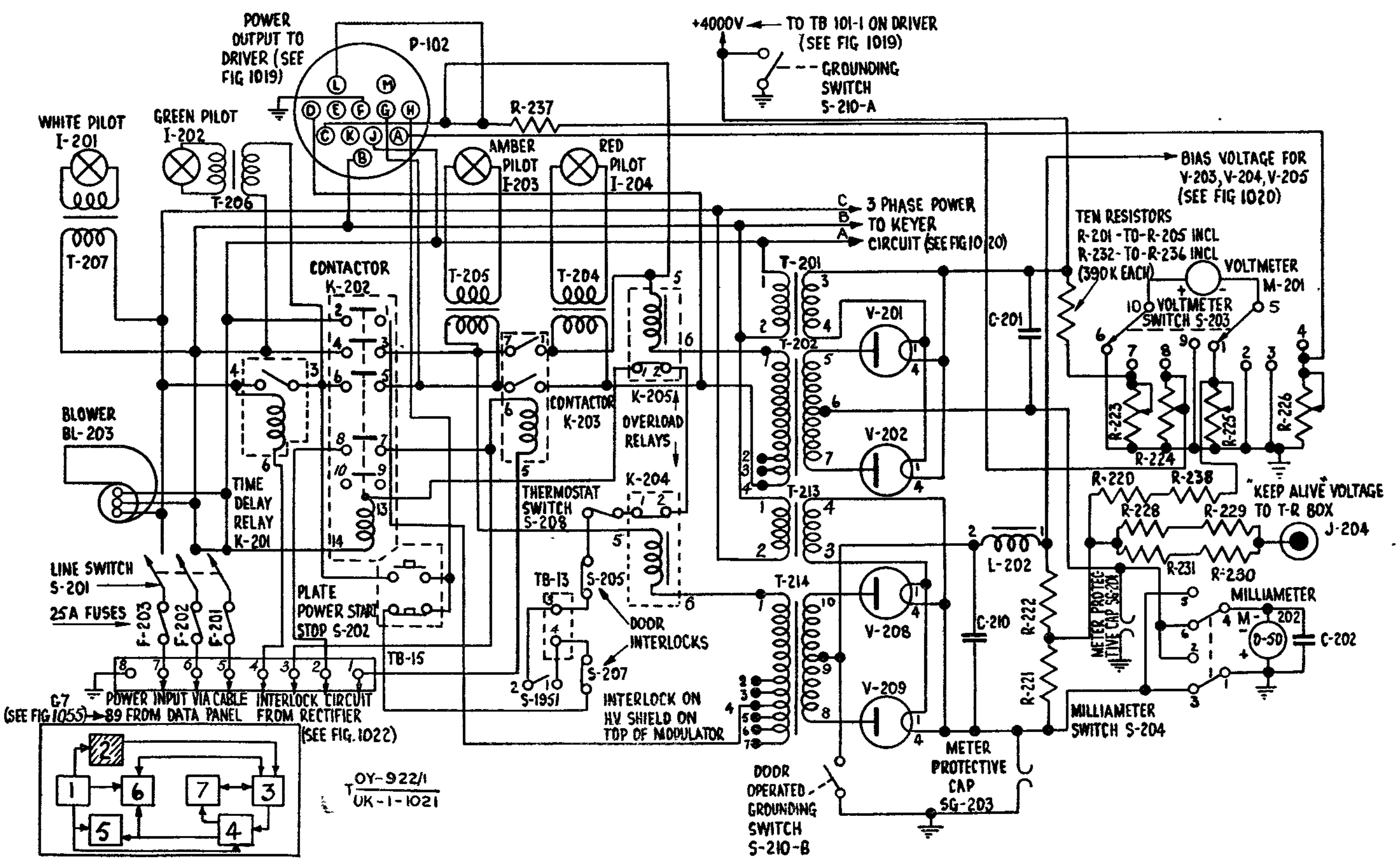


Fig. 1021—Modulator power and control circuits (Table 1005)

Circuit reference	*Name of part*	*Description*
B-301	Motor	Drive for VR-301
BL-301	Motor and blower assy	3-phase, 115 V, 60 c/s, 1,725 r.p.m., 1/6 h.p.
C-301	Capacitor	32,500 V D.C., 0.25 μF + 20%, − 10%
C-302	Capacitor	Supplies for VR-301, 10 μF, 330 V A.C. wkg.
F-301 to F-306	Fuse	Cartridge and link renewable 10 A, 250 V
F-301A, F-304A	Fuse block	3-place
I-301	Lamp socket	With red cap, indicates K-302 closed
I-302	Lamp socket	With green cap, indicates K-302 open
I-303	Lamp socket	With amber cap, indicates VR-301 in maximum lower position
I-301A to I-303A	Lamp	6–8 V
K-301	Switch	Solenoid operated
K-302	Contactor	1 normally open contact, 3-phase, 25 A, 115 V, 60 c/s
K-302A	Switch-interlock	S.P.D.T., 10 A, 115 V
K-303	Relay	D.C. to 60 c/s adjustable 10–40 A, coil rated 25 A cont.
K-304	Relay	D.C. to 60 c/s adjustable 10–40 A, coil rated 25 A cont.
K-305	Relay	Adjustable, D.C., overcurrent
K-305A	Resistor	750 Ω, 25 W
K-305B	Relay	2,200 Ω, 16,000 turns
K-305C	Resistor	Supplied as part of K-305
K-306	Relay	D.C. to 60 c/s adjustable 10–40 A, coil rated 25 A cont.
K-307	Switch	Solenoid-operated, 115 V coil
K-308	Relay	115 V, 60 c/s, coil
M-301	Milliammeter	Milliammeter, 2 mA full-scale deflection
M-302	Milliammeter	Scale 0-150 mA D.C.
M-303, M-305	Voltmeter	Scale, 0-150 V A.C.
	Meter	60 c/s, 120 V, registers in hours
R-301	Resistor	Non-inductive, 100 Ω, 80 W
R-303, R-304	Resistor	100Ω, 13 W
R-305	Rheostat	Tapered, 40 Ω, 225 W
R-306 to R-310	Resistor	Assembly kilovoltmeter leakage
R-311, R-312	Resistor	15 kΩ $\pm$ 10%
R-313	Resistor	50 Ω, 20 to 25 W
S-301	Switch	Red push button, spring return
S-302	Switch	Green push button, spring return
S-303 to S-306	Switch	Black push button, spring return
S-307	Switch	Three-pole, 25 A, 115 V
S-308, S-309	Interlock	Normally open contacts
S-310	Switch	Manually operated
S-311 to S-313	Switch	Supplied for VR-301, micro-switch, normally closed
S-314	Switch	Supplied for VR-301, micro-switch, normally open
SG-301	Protective gap	Protective film cut-outs for M-301 and M-302
T-301	Transformer	220 V, 3-phase, 60 c/s, rectifier unit
T-302 to T-304	Transformer	115 V to 4 V, 60 c/s
TY-301	Thyrite	Three-pole thyrite resistor with grounded neutral
V-301 to V-306	Valve	Type GL 8020
VR-301	Regulator	115 V, 3-phase, 106 V, buck and boost
W-301	Cable assembly	H.V. output
X-301 to X-306	Socket	

Table 1006—Details of components of rectifier RA-68 (Fig. 1022)

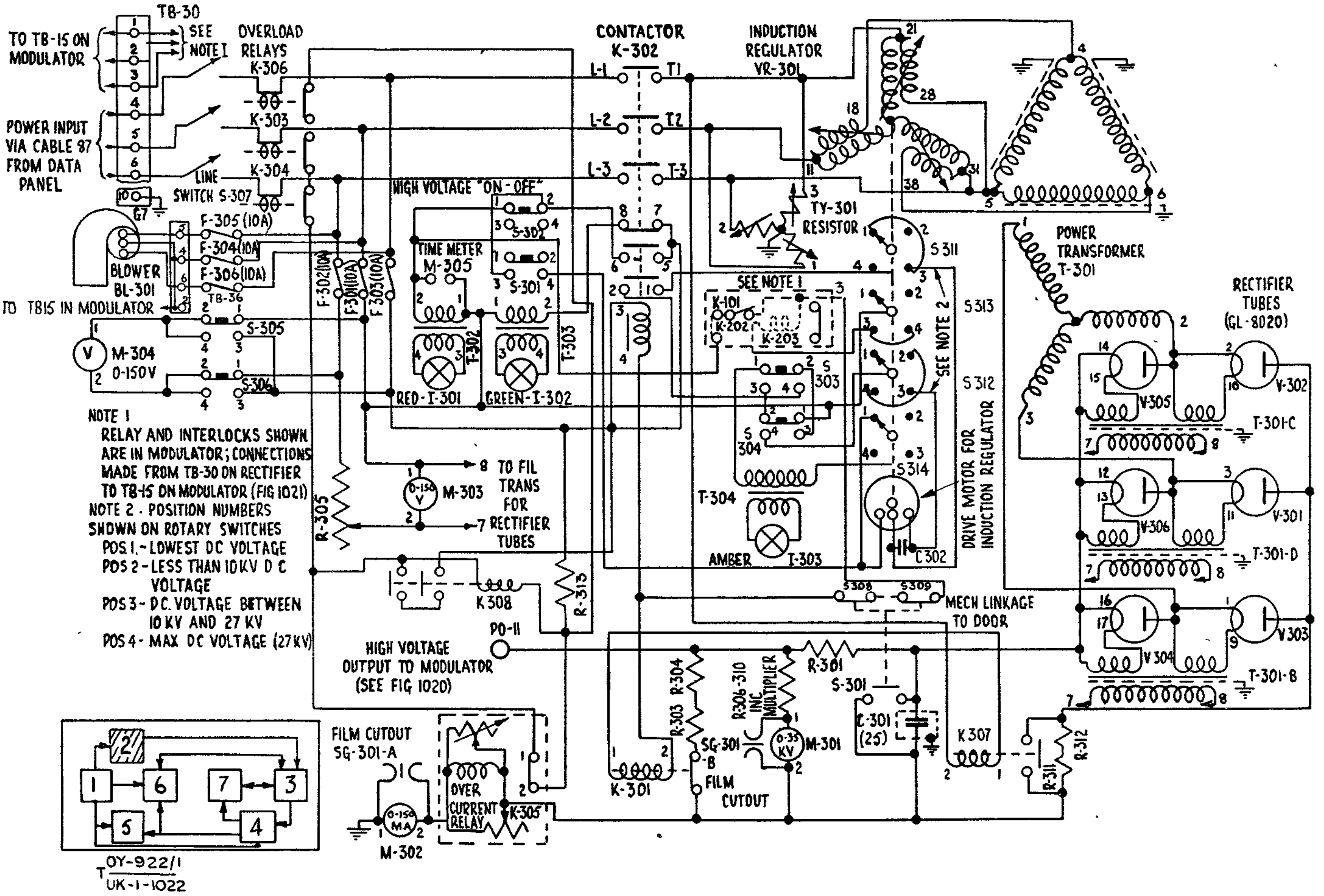


Fig. 1022—Modulator high voltage power supply (Table 1006)

Circuit reference	*Name of part*	*Description*
C-1801 to C-1804	Capacitor	4 μF, 600 V D.C. wkg.
C-1805	Capacitor	2 μF $\pm$ 10%, 1,000 V D.C. wkg.
F-1801, F-1802	Fuse	3 A, 250 V
F-1801A, F-1802A	Fuse post	
I-1801	Pilot light	Red cap
I-1801A	Lamp	6–8 V
J-1801	Receptable	15 A, 115 V, male, flush mtg.
J-1804	Receptable	Female, 4-hole, panel mounting, for RMS-16 cable
J-1805, J-1806	Receptable	Phone tip jack
L-1801, L-1802	Inductor	12 H at 75 mA, 20 H at zero mA, 350 Ω D.C.R.
P-1802	Plug	(Klystron) for RMA-16 cable
R-1801	Resistor	10 Ω $\pm$ 10%, 1 W
R-1802 to R-1805	Resistor	3,900 Ω $\pm$ 10%, 2 W
R-1806	Resistor-potentiometer	25 kΩ $\pm$ 10%, 4 W
R-1807	Resistor	27 kΩ $\pm$ 10%, 2 W
R-1808 to R-1816	Resistor	10 kΩ $\pm$ 10%, 2 W
R-1817	Potentiometer	15 kΩ $\pm$ 10%, 4 W
R-1818, R-1819	Resistor	5,100 Ω $\pm$ 5%, 2 W
R-1820, R-1821	Resistor	27 kΩ $\pm$ 10%, 2 W
R-1822	Potentiometer	1 MΩ $\pm$ 10%, 2 W
R-1823 to R-1825	Resistor	1 MΩ $\pm$ 10%, $\frac{1}{2}$ W
R-1826	Resistor	820 Ω $\pm$ 10%, 1 W
S-1801, S-1802	Switch	D.P.S.T., 10 A, 250 V
T-1801	Transformer	115 V to 5 V/5V/500-300 V
T-1802	Transformer	115 V to 6.3 V at 1.5 A
V-1801, V-1802	Vacuum tube	
V-1803	Valve	Klystron, WL-417A
V-1804 to V-1807	Valve	VR-105-30
X-1801 to X-1808	Valve socket	Octal

Table 1007—Details of components of oscillator BC-1024 (Fig. 1024)

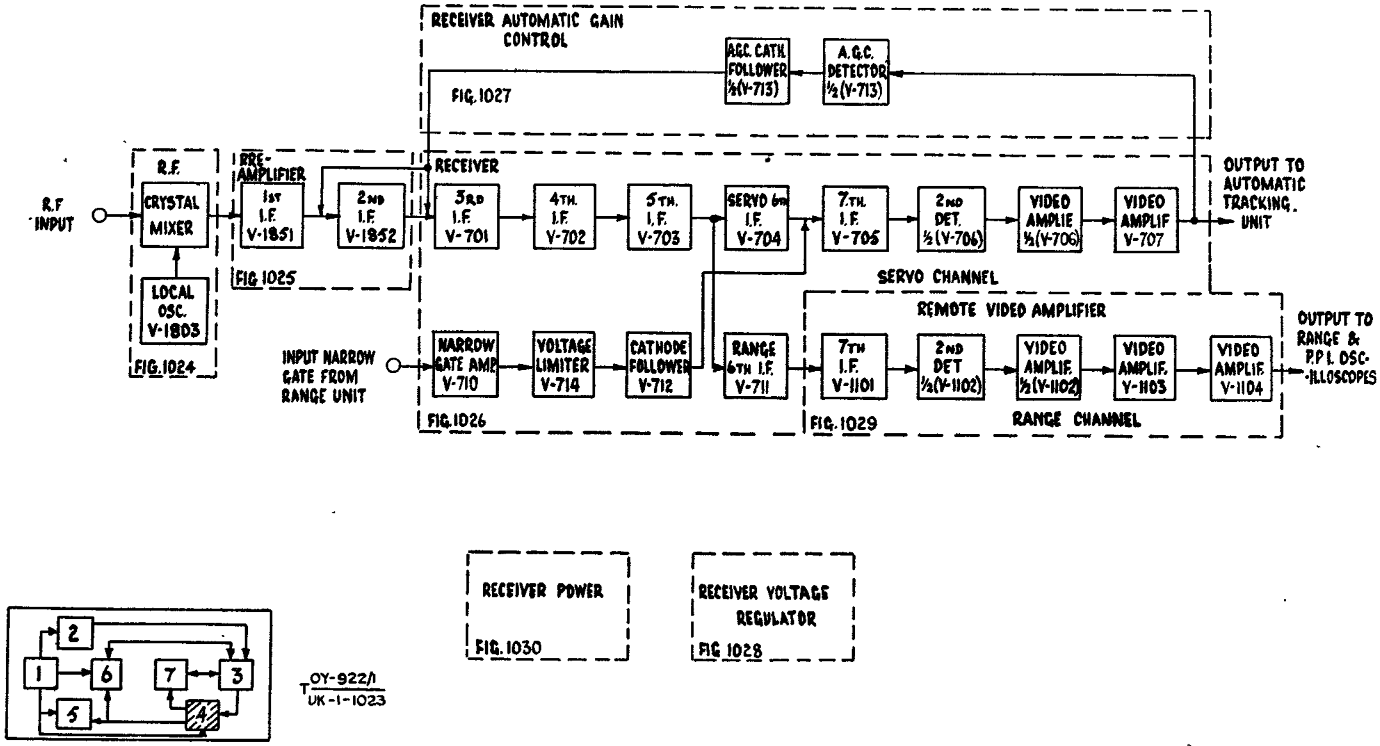


Fig. 1023—Receiving system, block diagram

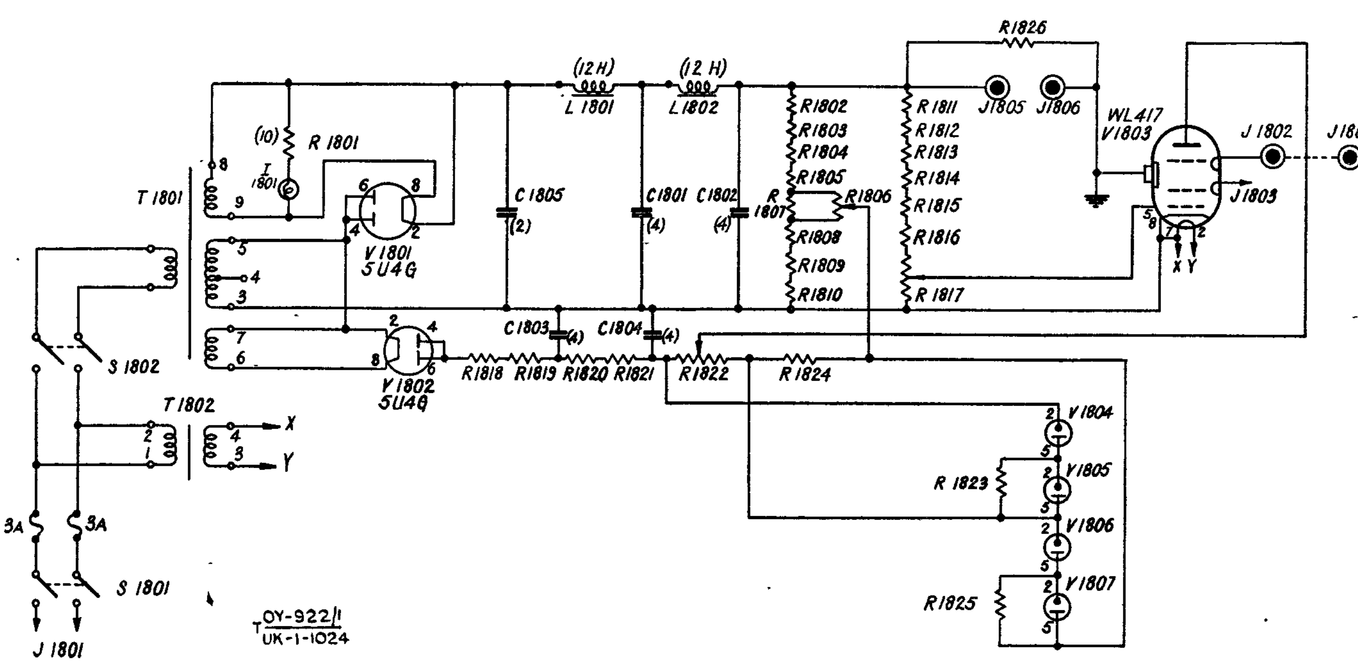


Fig. 1024—Receiving system, local oscillator (Table 1007)

Circuit reference	*Name of part*	*Description*
C-1851 to C-1856	Capacitor	0.001 μF $\pm$ 10%, 500 V D.C. wkg.
C-1857	Capacitor	0.0001 μF $\pm$ 10%, 500 V D.C. wkg.
C-1858, C-1859, C-1861 to C-1864	Capacitor	0.001 μF $\pm$ 10%, 500 V D.C. wkg.
J-1851	Receptacle	Power input from J-707
J-1853	Receptacle	I.F. output to J-705
L-1853	Inductor	I.F. grid resonating
L-1856	Inductor	I.F. impedance matching
P-1851	Plug	Type N
R-1851, R-1852	Resistor	47Ω $\pm$ 10%, $\frac{1}{2}$ W
R-1853	Resistor	120 Ω $\pm$ 10%, $\frac{1}{2}$ W
R-1854	Resistor	1 kΩ $\pm$ 10%, $\frac{1}{2}$ W
R-1855	Resistor	100 Ω $\pm$ 10%, $\frac{1}{2}$ W
R-1856	Resistor	120 Ω $\pm$ 10%, $\frac{1}{2}$ W
R-1857	Resistor	1,500 Ω $\pm$ 10%, $\frac{1}{2}$ W
R-1858, R-1859	Resistor	10 Ω $\pm$ 10%, $\frac{1}{2}$ W
R-1860	Resistor	47 Ω $\pm$ 10%, $\frac{1}{2}$ W
R-1861	Resistor	100 Ω $\pm$ 10%, $\frac{1}{2}$ W
R-1862	Resistor	270 Ω $\pm$ 10% , $\frac{1}{2}$ W
T-1851	Transformer	115 V to 6.3 V at 1.5 A
T-1852	Transformer	
V-1851, V-1852	Valve	6AC7/1852
X-1851, X-1852	Valve socket	Octal

Table 1008—Details of components of pre-amplifier BC-1078 (Fig. 1025)

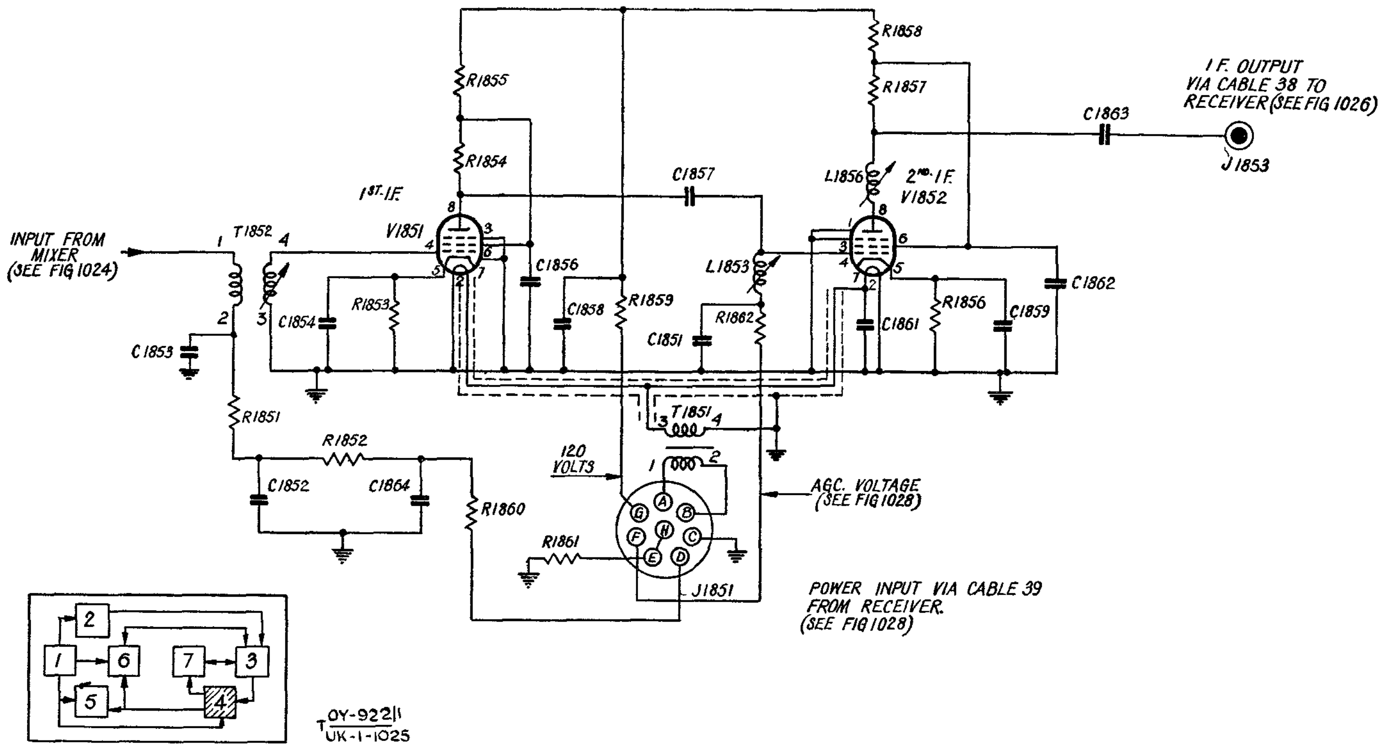


Fig. 1025—Receiving system, pre-amplifier (Table 1008)

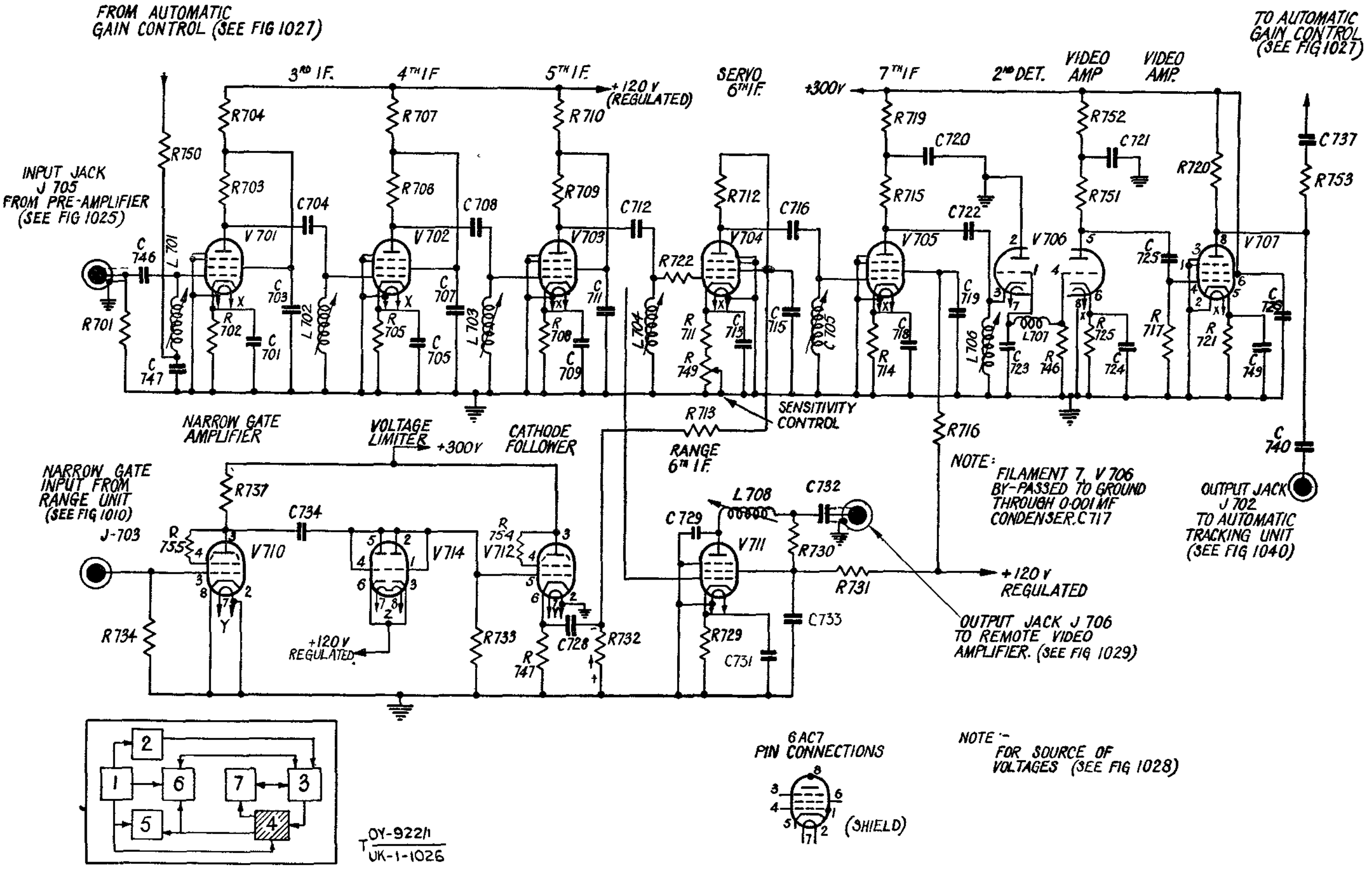


Fig. 1026—Receiving system, receiver (Table 1009 on page 1024)

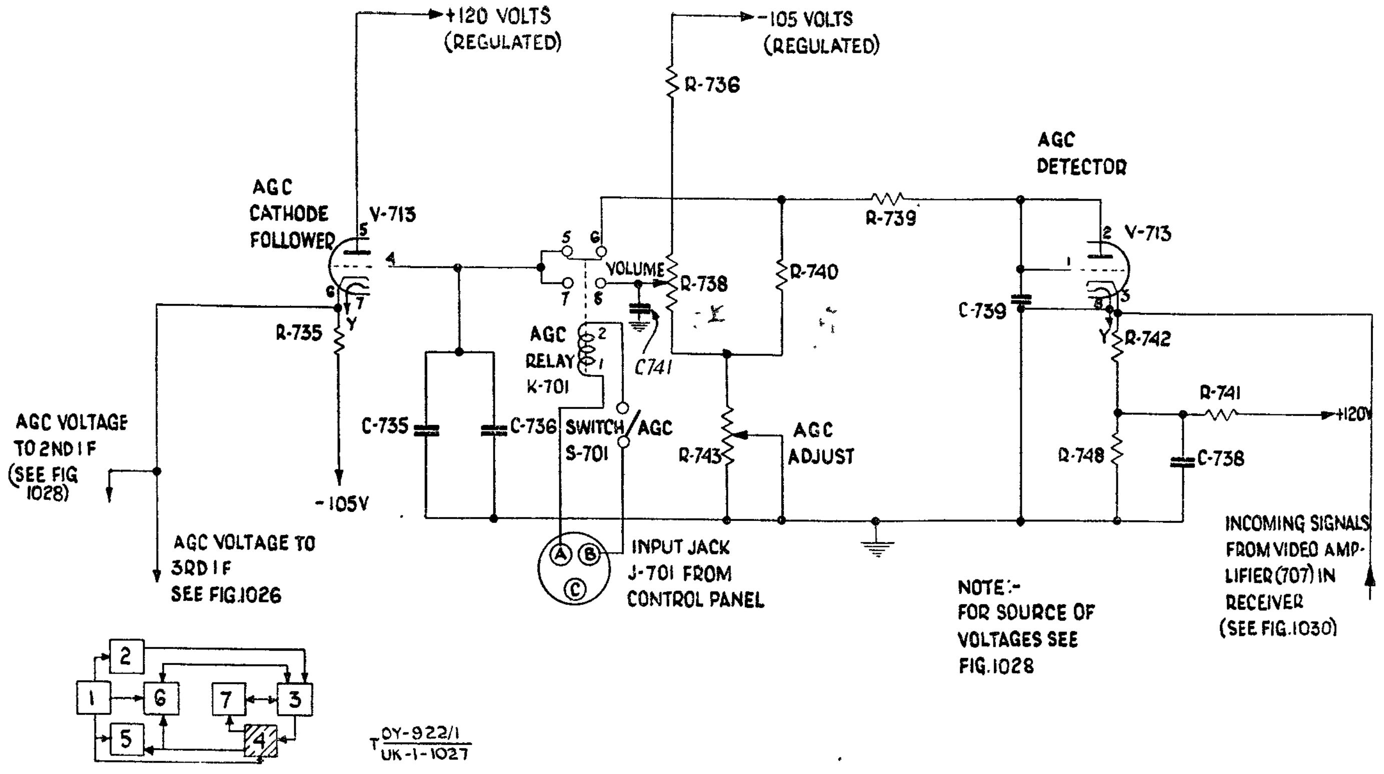


Fig. 1027—Automatic gain control on receiver (Table 1009)

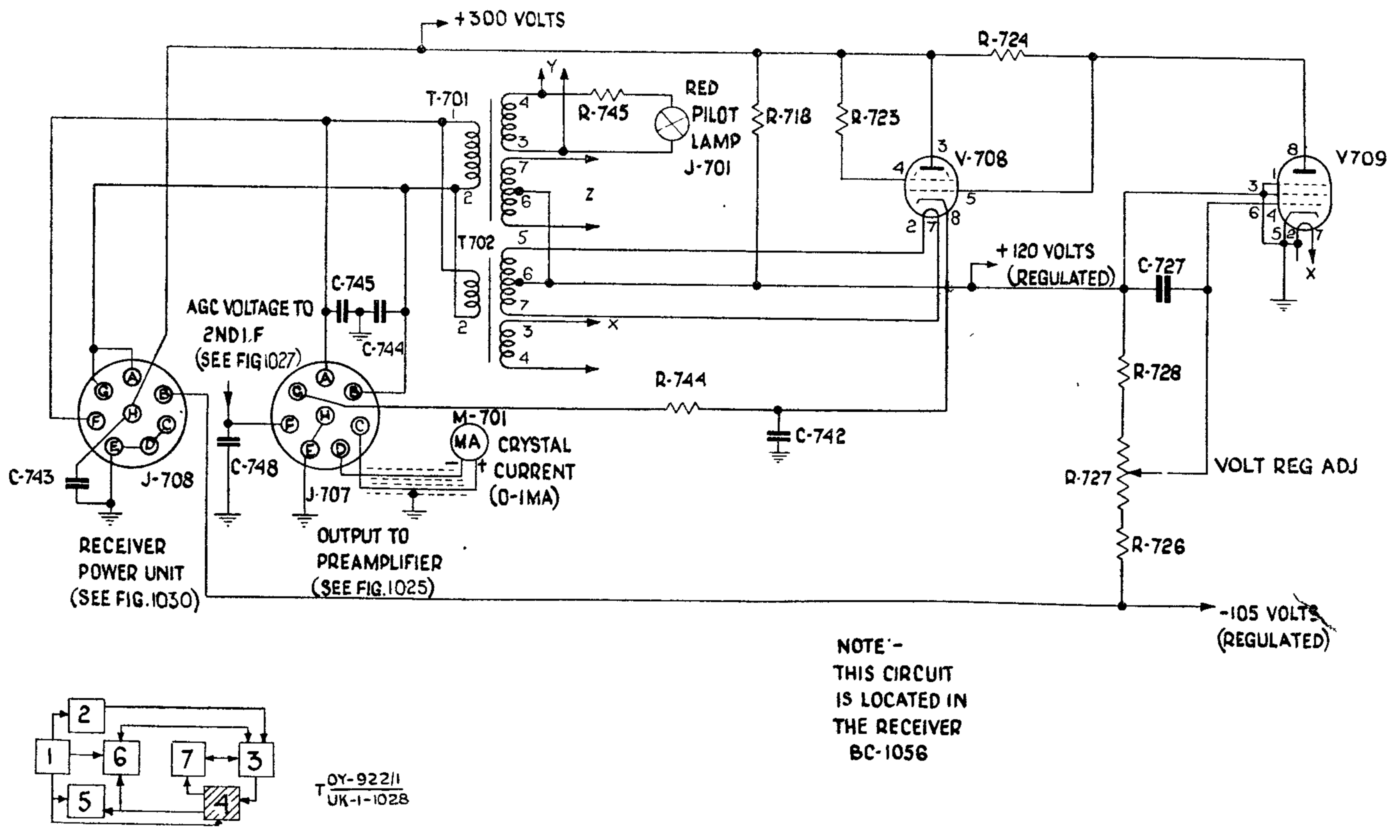


Fig. 1028—Receiver voltage regulator (Table 1009)

CAPACITORS

Circuit reference	Description
C-701, C-703	0.001 μF ± 10%, 500 V
C-704	0.0001 μF ± 10%, 500 V
C-705, C-707	0.001 μF ± 10%, 500 V
C-708	0.0001 μF ± 10%, 500 V
C-709, C-711	0.001 μF ± 10%, 500 V
C-712	0.0001 μF ± 10%, 500 V
C-713	0.001 μF ± 10%, 500 V
C-715	0.00025 μF ± 10%, 500 V
C-716	0.0001 μF ± 10%, 500 V
C-717 to C-720	0.001 μF ± 10%, 500 V
C-721	0.5 μF, 500 V
C-722	0.0001 μF ± 10%, 500 V
C-723	0.00001 μF ± 10%, 500 V D.C.
C-724	0.1 μF, 500 V D.C.
C-725	0.003 μF + 20% − 10%, 600 V D.C.
C-726, C-727	0.1 μF, 500 V D.C.
C-728	0.5 μF, 500 V
C-729	0.000005 μF ± 10%, 500 V
C-731 to C-733	0.001 μF ± 10 %, 500 V
C-734	0.01 μF + 20%, − 10%, 600 V
C-735, C-736	1.0 μF ± 10%, 500 V D.C.
C-737	0.001 μF ± 10%, 500 V
C-738	0.1 μF, 500 V D.C.
C-739	0.001 μF ± 10%, 500 V
C-740	0.1 μF, 500 V D.C.
C-741, C-742	0.001 μF, ± 10%, 500 V
C-743	1.0 μF ± 10%, 500 V D.C.
C-744, C-745	0.001 μF ± 10%, 500 V
C-746	0.0001 μF ± 10%, 500 V
C-747, C-748	0.001 μF ± 10%, 500 V
C-749	0.1 μF, 500 V D.C.

RESISTORS

Circuit reference	Description
R-701	75 Ω ± 5%, 1/2 W
R-702	120 Ω ± 10%, 1/2 W
R-703	820 Ω ± 5%, 1/2 W
R-704	270 Ω ± 10%, 1/2 W
R-705	120 Ω ± 10%, 1/2 W
R-706	820 Ω ± 5%, 1/2 W
R-707	270 Ω ± 10%, 1/2 W
R-708	100 Ω ± 10%, 1/2 W
R-709	820 Ω ± 5%, 1/2 W
R-710	270 Ω ± 10%, 1/2 W
R-711	56 Ω ± 10%, 1/2 W
R-712	1,500 Ω ± 10%, 1/2 W
R-713	270 Ω ± 10%, 1/2 W
R-714	100 Ω ± 10%, 1/2 W
R-715	1,500 Ω ± 10%, 1/2 W
R-716	270 Ω ± 10%, 1/2 W
R-717	100 kΩ ± 10%, 1/2 W
R-718	10 kΩ ± 5%, 10 W
R-719	270 Ω ± 10%, 1/2 W
R-720	1,500 Ω ± 10%, 2 W
R-721	3,300 Ω ± 10%, 2 W
R-722	270 Ω ± 10%, 1/2 W
R-723	470 Ω ± 10%, 1/2 W
R-724	470 kΩ ± 10%, 1/2 W
R-725	1 kΩ ± 10%, 1/2 W
R-726	82 kΩ ± 10%, 1/2 W
R-727	50 kΩ ± 10%, 2 W, potentiometer
R-728	10 kΩ ± 10%, 1/2 W
R-729	100 Ω ± 10%, 1/2 W
R-730	1 kΩ ± 10%, 1/2 W
R-731	270 Ω ± 10%, 1/2 W
R-732	2,200 Ω ± 10%, 1 W
R-733	47 kΩ ± 10%, 1/2 W
R-734	100 kΩ ± 10%, 1/2 W
R-735	18 kΩ ± 10%, 2 W
R-736	82 kΩ ± 10%, 1/2 W
R-737	10 kΩ ± 5 %, 12 W
R-738	10 kΩ ± 10%, 2 W, potentiometer
R-739	4.7 MΩ ± 10%, 1/2 W

RESISTORS—*contd.*

Circuit reference	Description
R-740	1.5 MΩ ± 10%, 1/2 W
R-741, R-742	100 kΩ ± 10%, 1/2 W
R-743	3 kΩ ± 10%, 2 W, potentiometer
R-744	100 Ω ± 10%, 1/2 W
R-745	10 Ω ± 10%, 1 W
R-746	4,700 Ω ± 10%, 1/2 W
R-747	3,500 Ω ± 5%, 10 W
R-748	33 kΩ ± 10%, 1/2 W
R-749	1 kΩ ± 10%, 3 W, potentiometer
R-750	270 Ω ± 10%, 1/2 W
R-751	6,200 Ω ± 5%, 1 W
R-752	6,800 Ω ± 10%, 1 W
R-753	4,700 Ω ± 10%, 1/2 W
R-754, R-755	56 Ω ± 10%, 1/2 W

MISCELLANEOUS

Circuit reference	Description
I-701	Pilot light
I-701A	Lamp, 6–8 V, 0.25 A
J-701	Receptacle, A.G.C. relay control input from control panel J-1751
J-702	Receptacle, video output to automatic tracking unit J-509
J-703	Receptacle, narrow-gate input from range unit J-605
J-705	Receptacle, I.F. input from pre-amplifier J-1853
J-706	Receptacle, I.F. output to remote video amplifier J-1101
J-707	Receptacle, power output to pre-amplifier J-1851
J-708	Receptacle, power input from rectifier J-1002
K-701	Relay A.G.C./manual 115 V, 60 c/s, coil
L-701 to L-706	Inductance-variable
L-707	Inductor, 300 μH ± 5% D.C., 8 Ω ± 20%
L-708	Inductor-variable
M-701	Milliammeter, scale, 0–1 mA D.C.
S-701	Switch, D.P.S.T., 10 A, 250 V
T-701, T-702	Transformer, 115 V to 6.3 V/6.3 V
V-701 to V-705	Valve, 6AC7
V-706	Valve, 6SN7GT
V-707	Valve, 6AG7
V-708	Valve, 6L6G
V-709	Valve, 6SJ7GT
V-710	Valve, 6L6G
V-711	Valve, 6AC7
V-712	Valve, 6L6G
V-713, V-714	Valve, 6SN7GT
X-701 to X-714	Valve socket, octal

Table 1009—Details of components of receiver BC-1056 (Figs. 1026, 1027 and 1028)

CAPACITORS

Circuit reference	Description
C-1101 to C-1104	0.001 μF ± 10%, 500 V D.C. wkg.
C-1105	0.0001 μF ± 10%, 500 V D.C. wkg.
C-1107	10 pF ± 2.5%, 500 V D.C. wkg.
C-1108	0.01 μF + 20% − 10%, 600 V D.C. wkg.
C-1109	0.002 μF + 20% − 10%, 600 V D.C. wkg.
C-1110	0.1 μF ± 10%, 500 V D.C. wkg.
C-1111	0.5 μF, 500 V D.C. wkg.
C-1112	0.25 μF ± 10%, 600 V D.C. wkg.
C-1113	0.05 μF 600 V D.C. wkg.
C-1114	10 μF 600 V D.C. wkg.
C-1115	0.5 μF 600 V D.C. wkg.
C-1116	0.05 μF ± 10%, 1 kV D.C. wkg.
C-1117	0.001 μF ± 10%, 500 V D.C. wkg.
C-1118	0.1 μF ± 10%, 500 V D.C. wkg.
C-1119	1.0 μF ± 10%, 500 V D.C. wkg.
C-1120	0.25 μF ± 10%, 1 kV D.C. wkg.

RESISTORS

Circuit reference	Description
R-1101	75Ω ± 5 %, ½ W
R-1102	150 Ω ± 10%, ½ W
R-1103	22 kΩ ± 10%, 2 W
R-1104	820 Ω ± 10%, ½ W
R-1105	270 Ω ± 10%, ½ W
R-1106	3.3 kΩ ± 10%, ½ W
R-1107	470 kΩ ± 10%, ½ W
R-1108	100 Ω ± 10%, ½ W
R-1109	27 kΩ ± 10%, 2 W
R-1110	120 kΩ ± 10%, 2 W
R-1111	12 kΩ ± 10%, 2 W
R-1112	2.7 kΩ ± 5%, ½ W
R-1113	10 kΩ ± 10%, ½ W
R-1114	7.5 kΩ ± 5%, ½ W
R-1115	33 kΩ + 5%, 1 W
R-1116 to R-1118	510 Ω ± 5%, 2 W
R-1119	33 kΩ ± 10%, 2 W
R-1120	20 kΩ ± 5%, 1 W
R-1121	1.2 kΩ ± 10%, 1 W
R-1122	10 kΩ ± 10%, 2 W
R-1123	68 kΩ ± 5%, ½ W
R-1124	2.4 kΩ ± 5%, ½ W
R-1125	5.6 kΩ ± 10%, ½ W
R-1126	47 Ω ± 10%, ½ W

Table 1010—Details of components of remote video amplifier BC-1074 (Fig. 1029)

MISCELLANEOUS

Circuit reference	Description
J-1101	Receptacle, I.F. input from J-706
J-1102	Receptacle, video output to J-911
J-1103	Receptacle, power input from J-1101
J-1104	Receptacle, video output to J-1605
L-1101, L-1102	Choke, variable
L-1103	Choke, approx. 0.3 mH
V-1101	Valve, 6 AC7
V-1102	Valve, 6SN7GT
V-1103	Valve, 6AC7
V-1104	Valve, 6L6G
X-1101 to X-1104	Valve socket, octal

Circuit reference	Name of part	Description
C-1001, C-1002	Filter capacitor	4 μF ± 10%, 600 V D.C. wkg.
C-1003, C1004	Filter capacitor	10 μF ± 10%, 600 V D.C. wkg.
F-1001, F-1002	Line fuse	5 A, 0.016 Ω, 250 V
F-1001A, F-1002A	Fuse post	
I-1001	Pilot lamp	
I-1001A	Lamp	6-8 V, 0.25 A
J-1001, J-1002	Output power receptacle	
J-1003	Input power receptacle	15 A, 125 V, male, flush mtg.
L-1001	Filter choke	5 H at 0.3 A, 20 H at zero A, 110 Ω D.C.R.
L-1002	Filter choke	12 H at 0.3 A, 110 Ω D.C.R.
L-1003, L-1004	Filter choke	12 H at 75 mA, 24 H at zero A, 350 Ω D.C.R.
R-1001	Resistor, bleeder	100 kΩ ± 10%, 2 W
R-1002	Resistor, limiting	5,500 Ω ± 5%, 12 W
R-1003	Resistor, bleeder	12 kΩ ± 5%, 16 W
R-1004	Resistor, dropping	10 Ω, 1 W
S-1001	Line switch	D.P.S.T., 10 A, 250 V
T-1001	Transformer, plate	115 V to 860 V C.T. at 25 A
T-1002	Transformer, plate and filter	115 V to 700 V C.T./5 V
T-1003	Transformer, filament	115 V to 5 V/6.3 V C.T.
V-1001 to V-1003	Valve	5U4G
V-1004	Valve	VR-105-30
X-1001 to X-1004	Valve socket	Octal

Table 1011—Details of components of rectifier RA-66 (Fig. 1030)

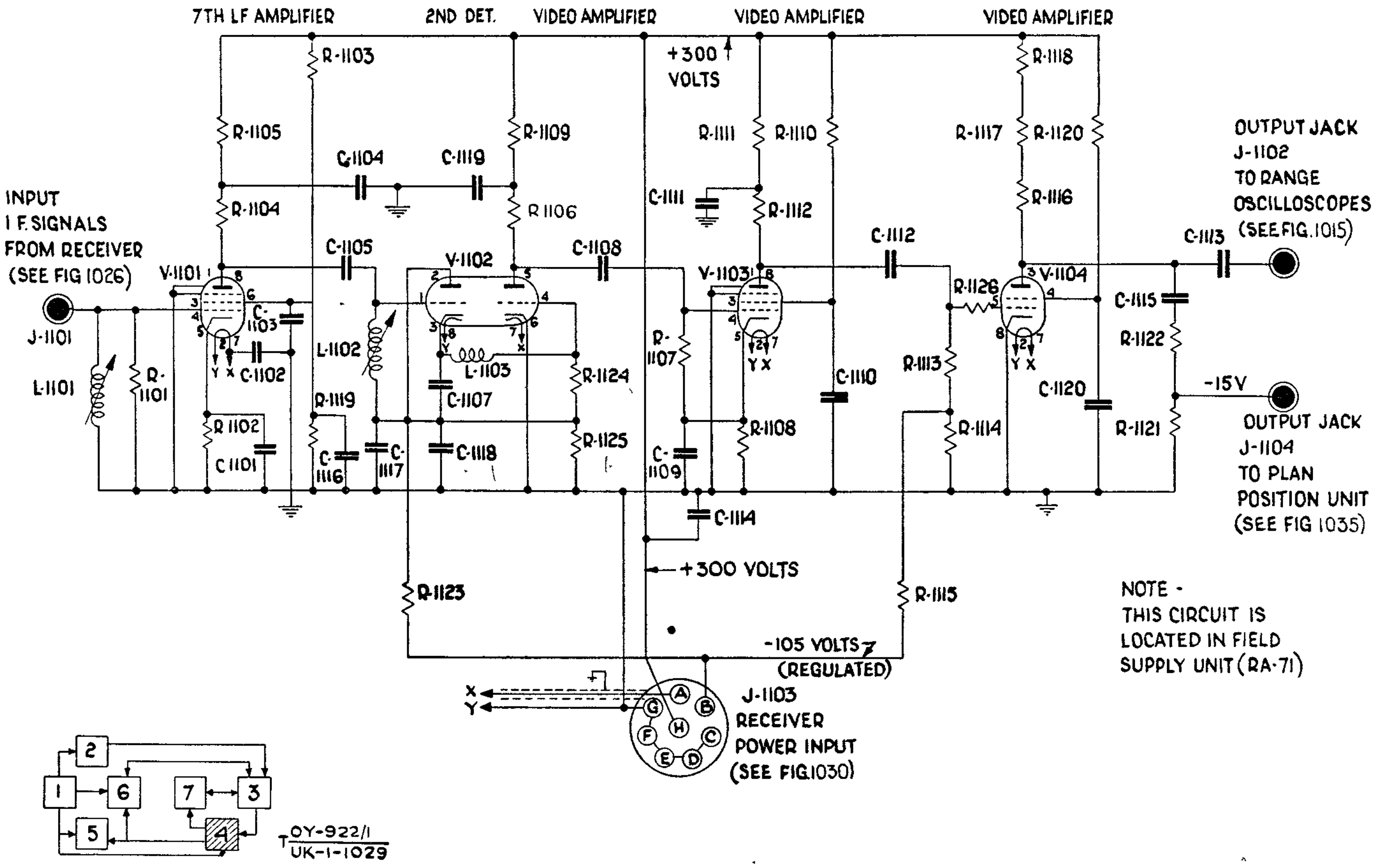


Fig. 1029—Remote video amplifier, range channel (Table 1010)

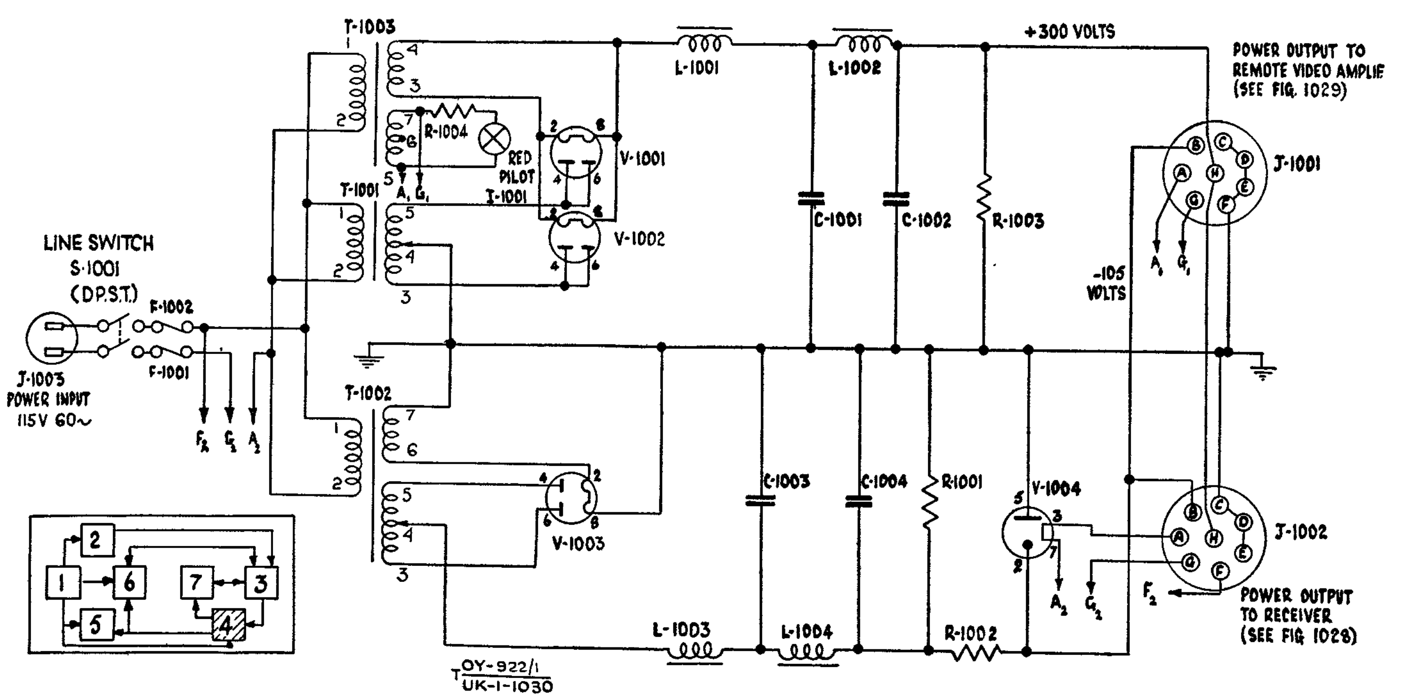


Fig. 1030—Receiving system power supply (Table 1011)

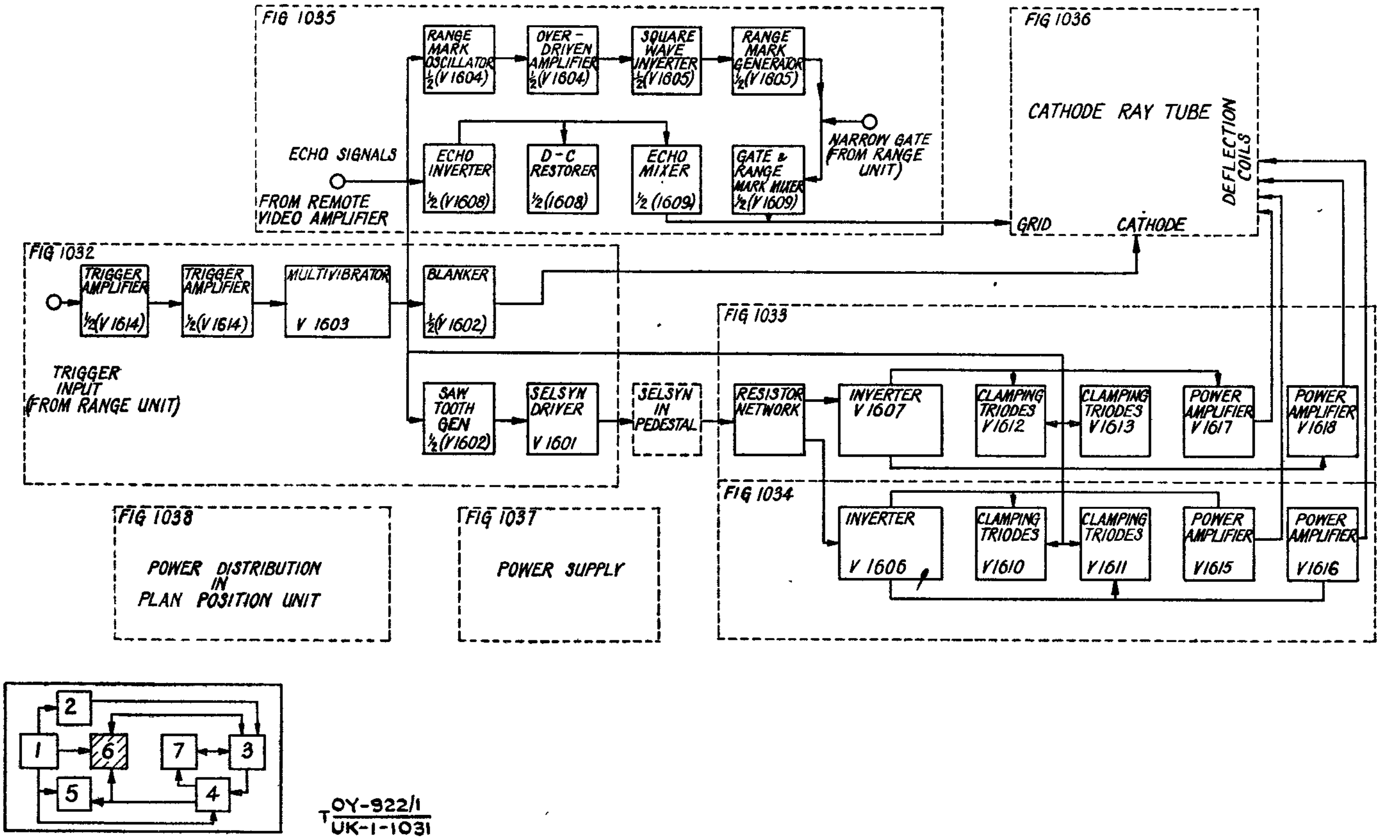


Fig. 1031—Plan position system, block diagram

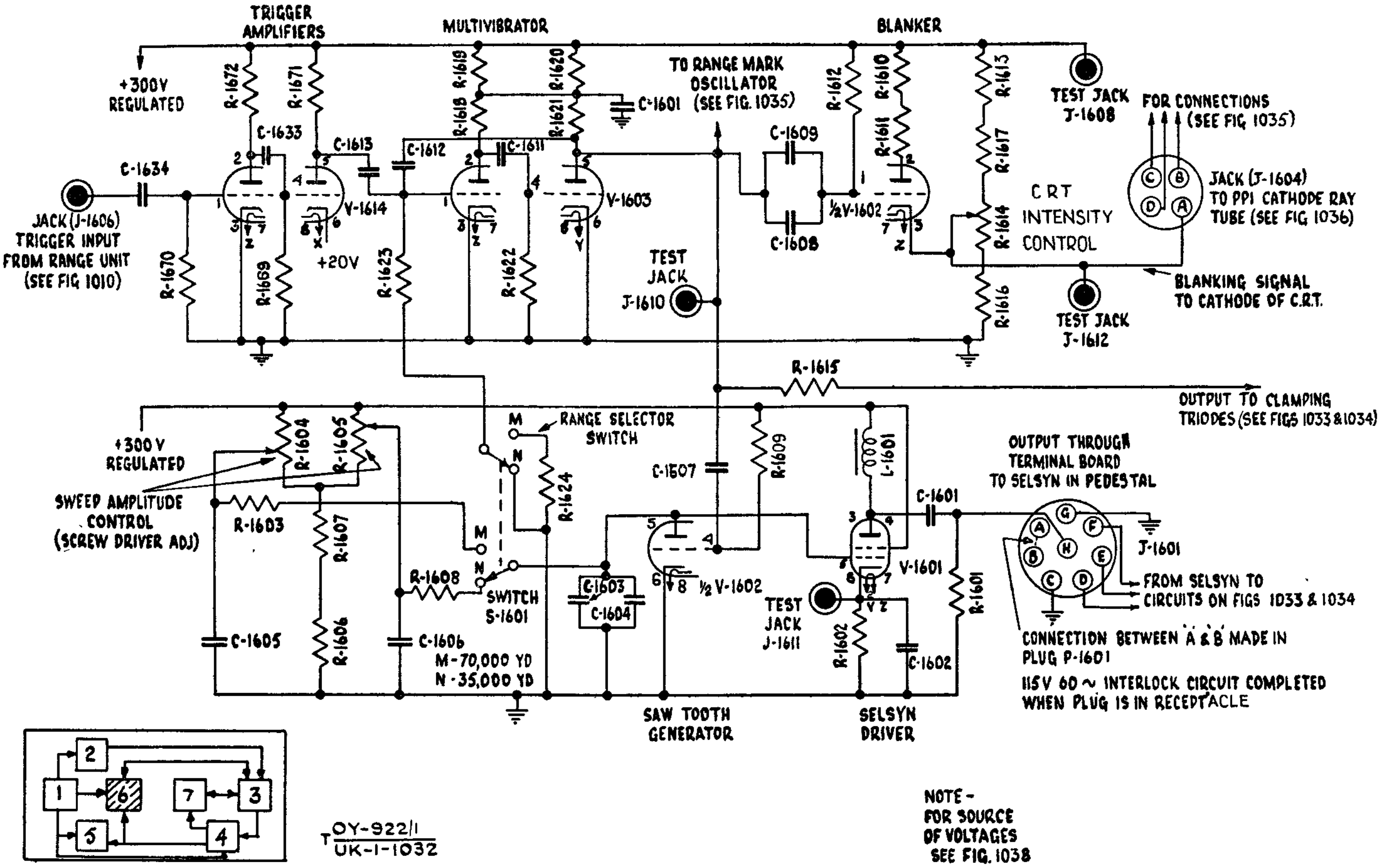


Fig. 1032—Plan position system, trigger amplifier and saw-tooth generator (Table 1012 on page 1029)

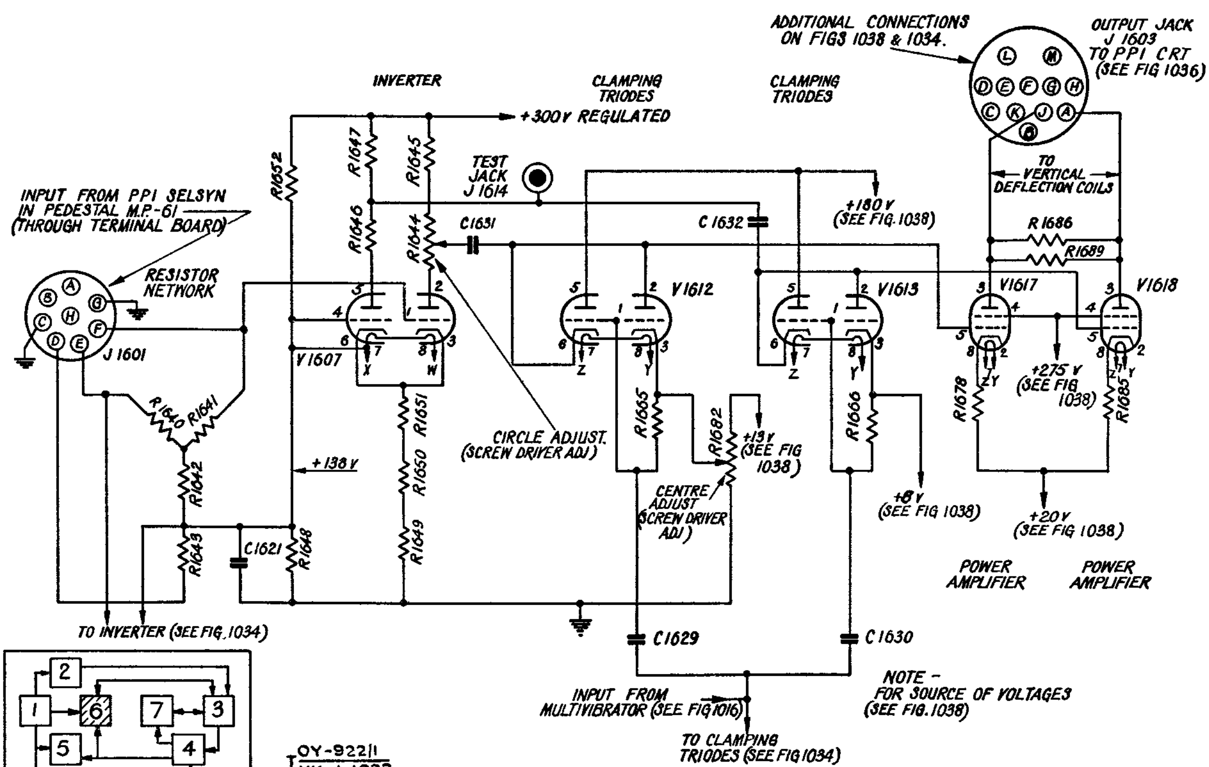


Fig. 1033—Plan position system, time base rotation circuits (1) (Table 1012 on page 1029)

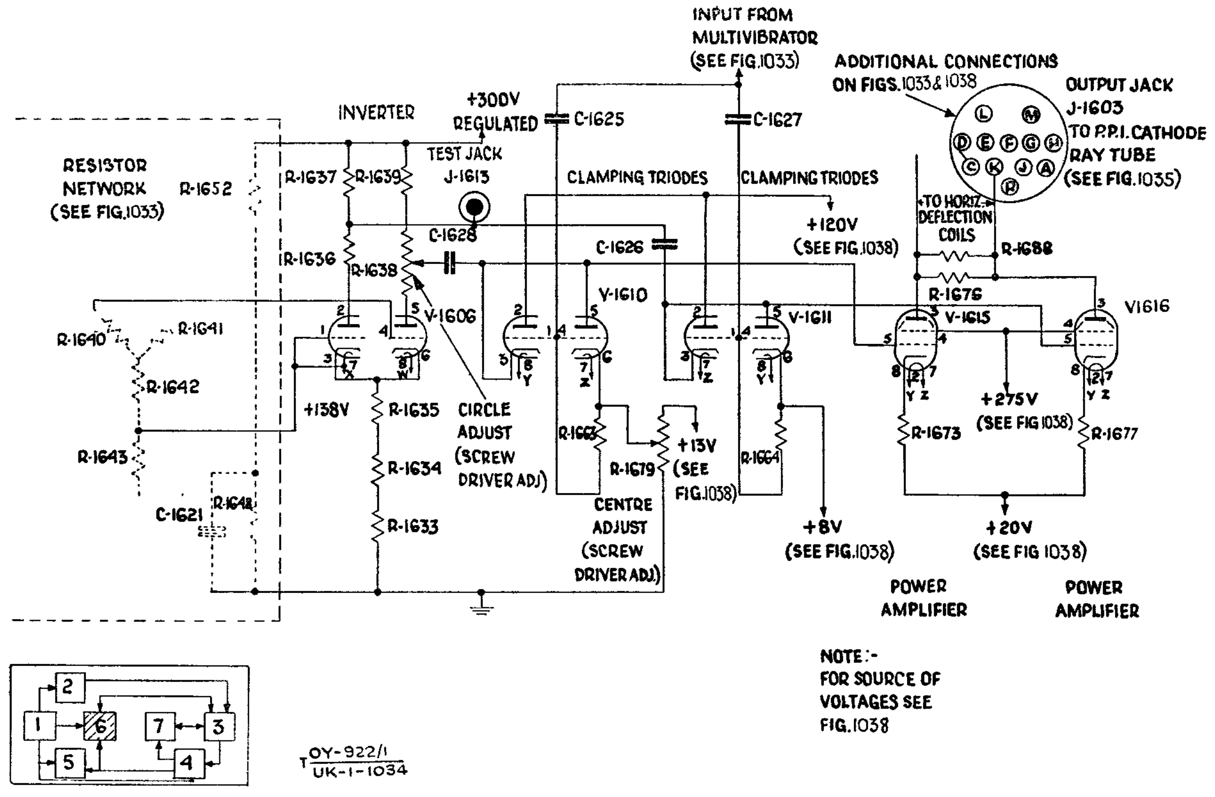


Fig. 1034—Plan position system, time base rotation circuits (2) (Table 1012)

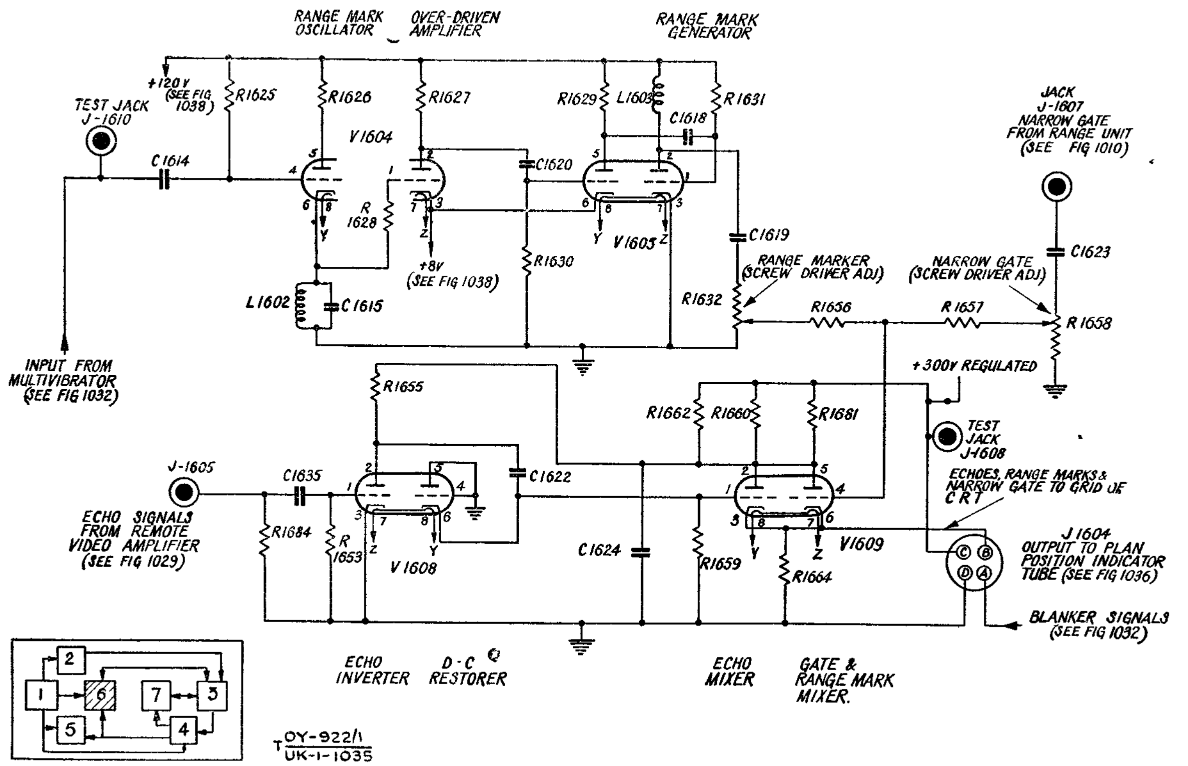


Fig. 1035—Plan position system, signal and gate circuits (Table 1012)

CAPACITORS

Circuit reference	Description
C-1601	1.0 μF, 500 V D.C.
C-1602	0.01 μF + 20% − 10%, 600 V D.C.
C-1603	0.005 μF + 20% − 10%, 600 V D.C.
C-1605, C-1606	0.1 μF, 500 V
C-1607	0.001 μF ± 10%, 500 V D.C.
C-1608	0.005 μF + 20% − 10%, 600 V D.C. working
C-1610	2 μF, 600 V
C-1611	0.01 μF ± 10%, 600 V
C-1612	0.0005 μF ± 5%, 500 V
C-1613	50 pF ± 10%, 500 V D.C.
C-1614	0.01 μF + 20% − 10%, 600 V D.C.
C-1615	0.001 μF ± 1%, 500 V
C-1617	2 μF, 600 V
C-1618	0.01 μF ± 10%, 600 V D.C.
C-1619	0.001 μF ± 10%, 500 V D.C.
C-1620, C-1621	0.01 μF + 20% − 10%, 600 V D.C.
C-1622, C-1623	0.001 μF ± 10%, 500 V D.C.
C-1624	2 μF, 600 V
C-1625	0.005 μF + 20% − 10%, 600 V D.C.
C-1626	0.002 μF + 20% − 10%, 600 V D.C.
C-1627	0.005 μF + 20% − 10%, 600 V D.C.
C-1628	0.002 μF + 20% − 10%, 600 V D.C.
C-1629, C-1630	0.005 μF + 20% − 10%, 600 V D.C.
C-1631, C-1632	0.002 μF + 20% − 10%, 600 V D.C.
C-1633, C-1634	0.001 μF ± 10%, 500 V D.C.
C-1635	0.01 μF + 20% − 10%, 600 V D.C.
C-1636	0.1 μF, 500 V

RESISTORS

Circuit reference	Description
R-1601	3,900 Ω ± 10%, 1 W
R-1602	1 kΩ ± 5%, 10 W
R-1603	180 kΩ ± 10%, 1 W
R-1604, R-1605	100 kΩ ± 10%, 2 W, potentiometer
R-1606, R-1607	27 kΩ ± 10%, 2 W
R-1608	100 kΩ ± 10%, 1 W
R-1609	4.7 MΩ ± 10%, 1/2 W
R-1610, R-1611	10 kΩ ± 10%, 2 W
R-1612	4.7 MΩ ± 10%, 1/2 W
R-1613	11 kΩ ± 5%, 2 W
R-1614	5 kΩ ± 10%, 3 W, potentiometer
R-1615	27 kΩ ± 10%, 1/2 W
R-1616	2,200 Ω ± 10%, 2 W
R-1617	11 kΩ ± 5%, 2 W
R-1618	10 kΩ ± 10%, 2 W
R-1619, R-1620	22 kΩ ± 10%, 2 W
R-1621	10 kΩ ± 10%, 2 W
R-1622	4.7 MΩ ± 10%, 1/2 W
R-1623, R-1624	300 kΩ ± 5%, 1/2 W
R-1625	4.7 MΩ ± 10%, 1/2 W
R-1626, R-1627	10 kΩ ± 10%, 1 W
R-1628	27 kΩ ± 10%, 1/2 W
R-1629	10 kΩ ± 10%, 1 W
R-1630	100 kΩ ± 10%, 1/2 W
R-1631	1.0 MΩ ± 10%, 1/2 W
R-1632	25 kΩ ± 10%, 2 W, potentiometer
R-1633 to R-1635	8,200 Ω ± 10%, 2 W
R-1636	1 kΩ ± 10%, 1/2 W
R-1637	9,100 Ω ± 5%, 1 W
R-1638	2,500 Ω ± 10%, 2 W, potentiometer
R-1639	7,500 Ω ± 5%, 1 W
R-1640, R-1641	50 Ω ± 2%, 2 W
R-1642	18 Ω ± 2%, 2 W
R-1643	33 Ω ± 2%, 2 W

RESISTORS—*contd.*

Circuit reference	
R-1644	2,500 Ω ± 10%, 2 W, potentiometer
R-1645	7,500 Ω ± 5%, 1 W
R-1646	1 kΩ ± 10%, 1/2 W
R-1647	9,100 Ω ± 5%, 1 W
R-1648	100 kΩ ± 10%, 1 W
R-1649 to R-1651	8,200 Ω ± 10%, 2 W
R-1652	75 kΩ ± 10%, 1 W
R-1653	180 kΩ ± 10%, 1/2 W
R-1654	1 kΩ ± 10%, 1 W
R-1655	1,500 Ω ± 10%, 1 W
R-1656, R-1657	27 kΩ ± 10%, 1/2 W
R-1658	100 kΩ ± 10%, 2 W, potentiometer
R-1659	1.0 MΩ ± 10%, 1/2 W
R-1660 to R-1662	33 kΩ ± 10%, 2 W
R-1663 to R-1666	470 kΩ ± 10%, 1/2 W
R-1667	100 Ω ± 10%, 2 W
R-1668	10 kΩ ± 5%, 10 W
R-1669 to R-1671	220 kΩ ± 10%, 1/2 W
R-1672	100 kΩ ± 10%, 2 W
R-1673	200 Ω ± 5 %, 2 W
R-1674	350 Ω, 25 W, potentiometer
R-1675	47 Ω ± 10%, 2 W
R-1676	47 kΩ ± 10%, 1 W
R-1677, R-1678	200 Ω ± 5%, 2 W
R-1679	200 Ω ± 10%, 3 W, potentiometer
R-1680	100 Ω ± 10%, 2 W
R-1681	12 Ω ± 10%, 2 W
R-1682	200 Ω ± 10%, 3 W, potentiometer
R-1683	12 Ω ± 10%, 2 W
R-1684	1.0 MΩ ± 10%, 1/2 W
R-1685	200 Ω ± 5%, 2 W
R-1686	47 kΩ ± 10%, 1 W
R-1687	820 Ω ± 10%, 1 W
R-1688, R-1689	47 kΩ ± 10%, 1 W
R-1690	47 Ω ± 10%, 2 W

RECEPTACLES

Circuit reference	Description
J-1601	To selsyn B-2005
J-1602	Power input (to J-1503)
J-1603	Sweep output (to J-1702)
J-1604	Signal output (to J-1701)
J-1605	Video signal input (to J-1104)
J-1606	Trigger input (to J-606)
J-1607	Narrow-gate input (to J-604)
J-1608	Regulated voltage test-pin
J-1609	Unregulated voltage test-pin
J-1610	Range multivibrator gate test-pin
J-1611	Saw-tooth amplifier cathode test-pin
J-1612	C.R.T. cathode blanking amplifier
J-1613, J-1614	Sweep phase inverter
J-1615	Ground test-pin
J-1616	C.R.T. grid mixer test-pin

MISCELLANEOUS

Circuit reference	Description
L-1601	Choke, 12 H, 75 mA, 20 H at zero A, 350 Ω D.C.R.
L-1602	Choke coil, 91.8 mH ± 1%, 330 Ω ± 10%
L-1603	Choke coil, 4.25 mH ± 5%, 39.3 Ω ± 10%
S-1601	Switch, 1-section, 2-pole, 2-position
T-1601	Transformer, 115 V to 6.3 V/6.3 V
V-1601	Valve, 6L6G
V-1602 to V-1614	Valve, 6SN7-GT
V-1615 to V-1618	Valve, 6L6G
X-1601 to X-1618	Valve socket, octal

Table 1012—Details of components of plan position unit BC-1058 (Figs. 1032 to 1035)

Circuit reference	*Name of part*	*Description*
I-1701 to I-1703	Dial light	
I-1701A to I-1703A	Lamp	6-8 V
J-1701	Receptacle	Sweep circuit (to J-1604)
J-1702	Receptacle	Sweep circuit (to J-1603)
J-1703	Receptacle	H.V. (to J-1502)
L-1701	Inductor	3,450 turns $\pm$ 10%, No. 27 enam. wire D.C. R. at 20° C., 120 $\Omega \pm$ 10%
L-1702	Inductor	Prim. and sec. winding, 1,080 turns No. 30, enam. wire
R-1701 to R-1703	Resistor	10 $\Omega \pm$ 10%, 1 W
S-1701	Switch	Single circuit, normally open, momentary contact, 3 A at 250 V
V-1701	Cathode ray tube	GL-7SP7
X-1701	Socket	Octal
K-1751	Relay	115 V, 60 c/s, coil
J-1751	Receptacle	(To J-701)
J-1752	Receptacle	(To J-501)
J-1753	Receptacle	(To J-1205)
S-1751	Switch	2-pole, 4-position, 1-section
S-1752	Switch	Push button, normally open, 110 V
S-1753, S-1754	Switch	D.P.S.T. 10 A, 250 V

Table 1013—Details of components of plan position indicator BC-1092 (Fig. 1036)

Circuit reference	*Name of part*	*Description*
C-1501 to C-1504	Capacitor	4 μF $\pm$ 10%, 600 V D.C. wkg.
C-1505, C-1506	Capacitor	0.1 μF, 7.5 kV D.C. wkg.
C-1507	Capacitor	0.1 μF, 500 V D.C. wkg.
C-1509	Capacitor	0.002 μF + 20% − 10%, 600 V D.C. wkg.
F-1501, F-1502	Fuse	5 A, 250 V
F-1501A, F-1502A	Fuse post	
I-1501	Indicator	Red cap
I-1501A	Lamp	6-8 V, 0.25 A
J-1501	Receptacle-power	15 A, 125 V, male, flush mtg.
J-1502	Receptable	H.V. (to V-1703)
J-1503	Receptacle	Power input (to J-1602)
L-1501, L-1502	Inductor	10 H at 0.225 A D.C., 100 Ω D.C.R.
L-1503	Inductor	10 H at 0.125 A D.C., 110 Ω D.C.R.
R-1501, R-1502	Resistor	100 k$\Omega \pm$ 10%, 2 W
R-1503	Resistor	1.8 M$\Omega \pm$ 10%, $\frac{1}{2}$ W
R-1504	Resistor	470 k$\Omega \pm$ 10%, $\frac{1}{2}$ W
R-1505	Resistor	150 k$\Omega \pm$ 10%, $\frac{1}{2}$ W
R-1506	Resistor-potentiometer	25 k$\Omega \pm$ 10%, 2 W
R-1507	Resistor	68 k$\Omega \pm$ 10%, $\frac{1}{2}$ W
R-1508	Resistor	15 k$\Omega \pm$ 10%, $\frac{1}{2}$ W
R-1509	Resistor	10 k$\Omega \pm$ 10%, 2 W
R-1510	Resistor	15 k$\Omega \pm$ 10%, 2 W
R-1511	Resistor	10 $\Omega \pm$ 10%, 1 W
R-1512 to R-1517	Resistor	120 k$\Omega \pm$ 10%, 2 W
R-1518 to R-1528	Resistor	470 k$\Omega \pm$ 10%, 2 W
R-1529 to R-1531	Resistor	33 k$\Omega \pm$ 10%, 2 W
S-1501	Switch	D.P.S.T., 10 A, 250 V
T-1501	Transformer	115 V to 5 V/5 V
T-1502	Transformer	115 V to 900 V C.T. at 170 mA
T-1503	Transformer	115 V to 6.3 V/6.3 V C.T.
T-1504	Transformer	115 V to 900 V C.T. at 90 mA
T-1505	Transformer	115 V to 4.5 kV at 4 mA
T-1506	Transformer	115 V to 2.5 V at 2A
V-1501, V-1502	Valve	5U4G
V-1503	Valve	2X2
V-1504, V-1505	Valve	6B4G
V-1506	Valve	6SJ7GT
V-1507	Valve	VR-105-30
X-1501, X-1502	Valve socket	Octal
X-1503	Valve socket	4-pin
X-1504 to X-1507	Valve socket	Octal

Table 1014—Details of components of rectifier RA-69 (Fig. 1037)

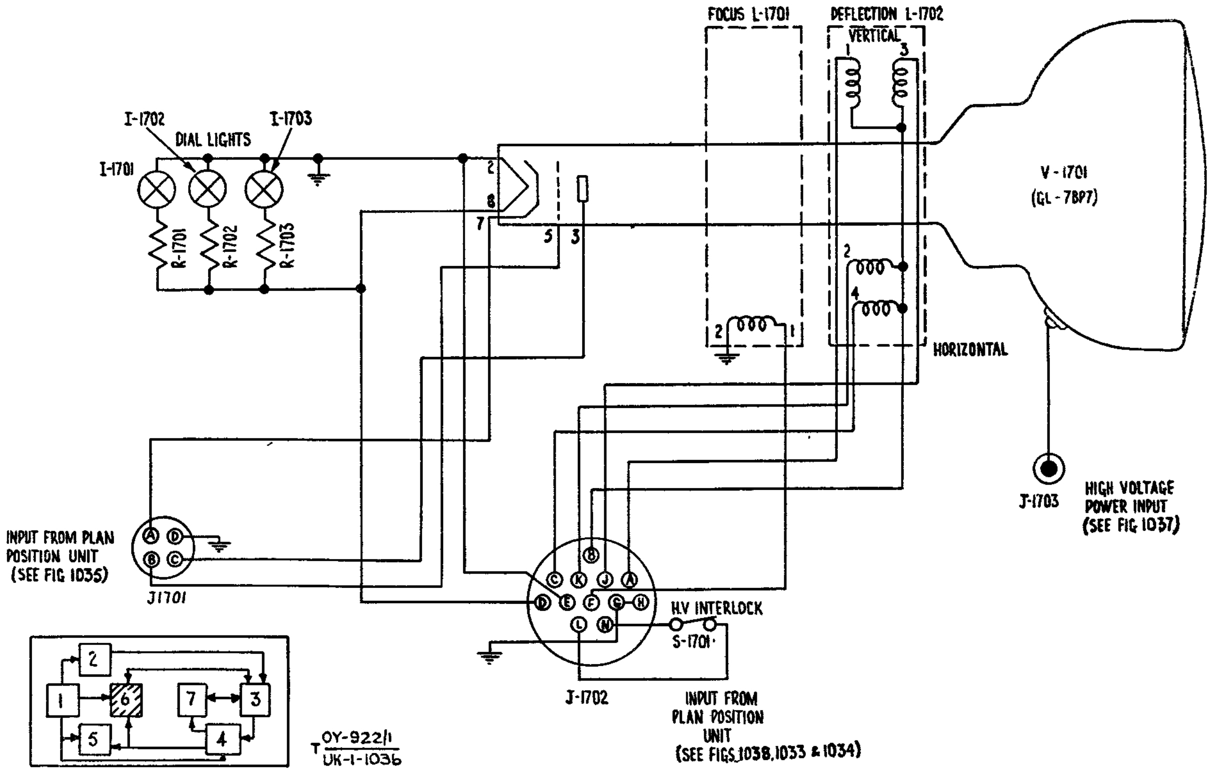


Fig. 1036—Plan position system, display unit (Table 1013)

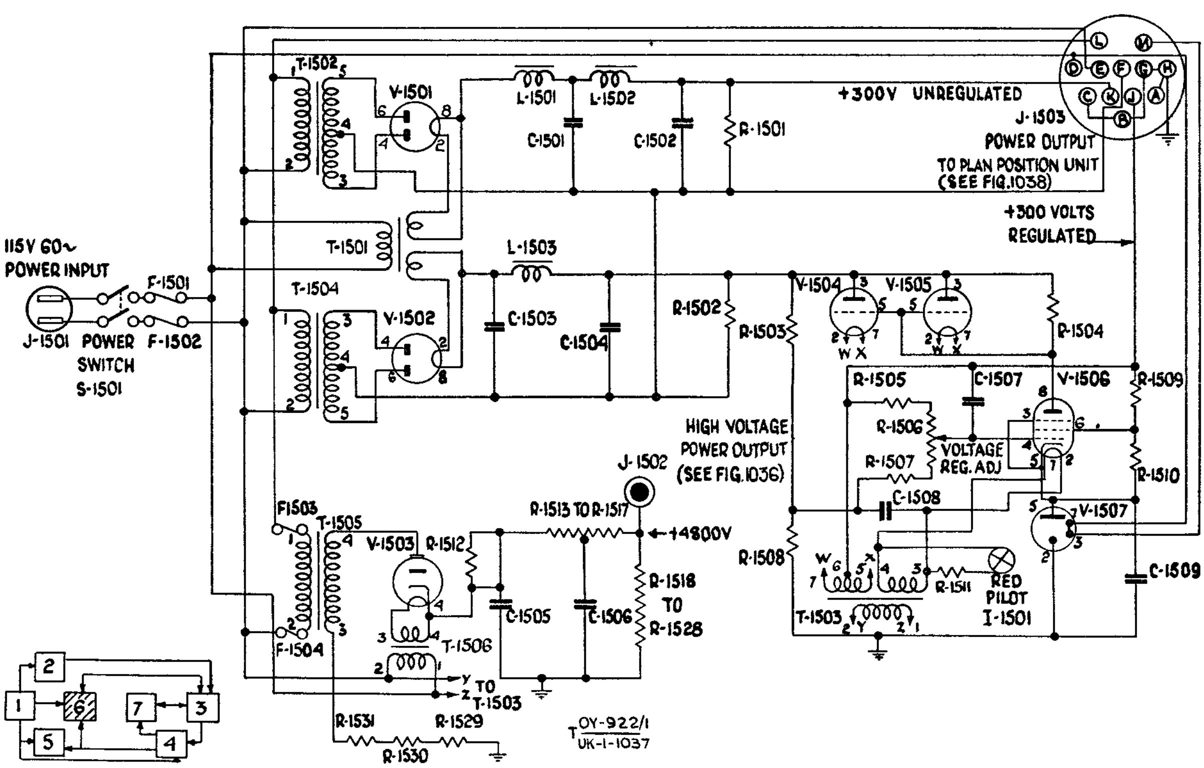


Fig. 1037—Plan position system, power supply (Table 1014)

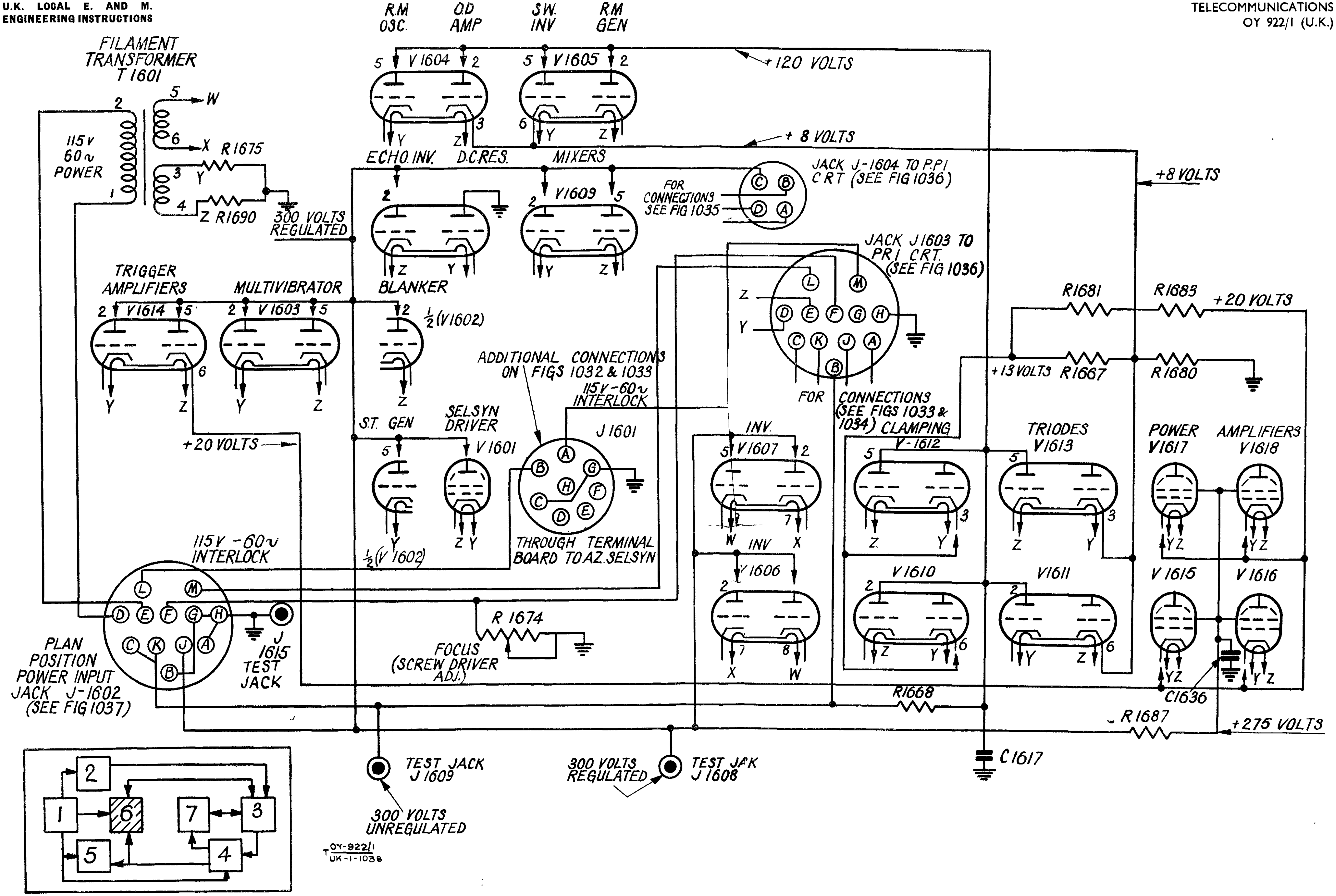


Fig. 1038—Power distribution in plan position unit

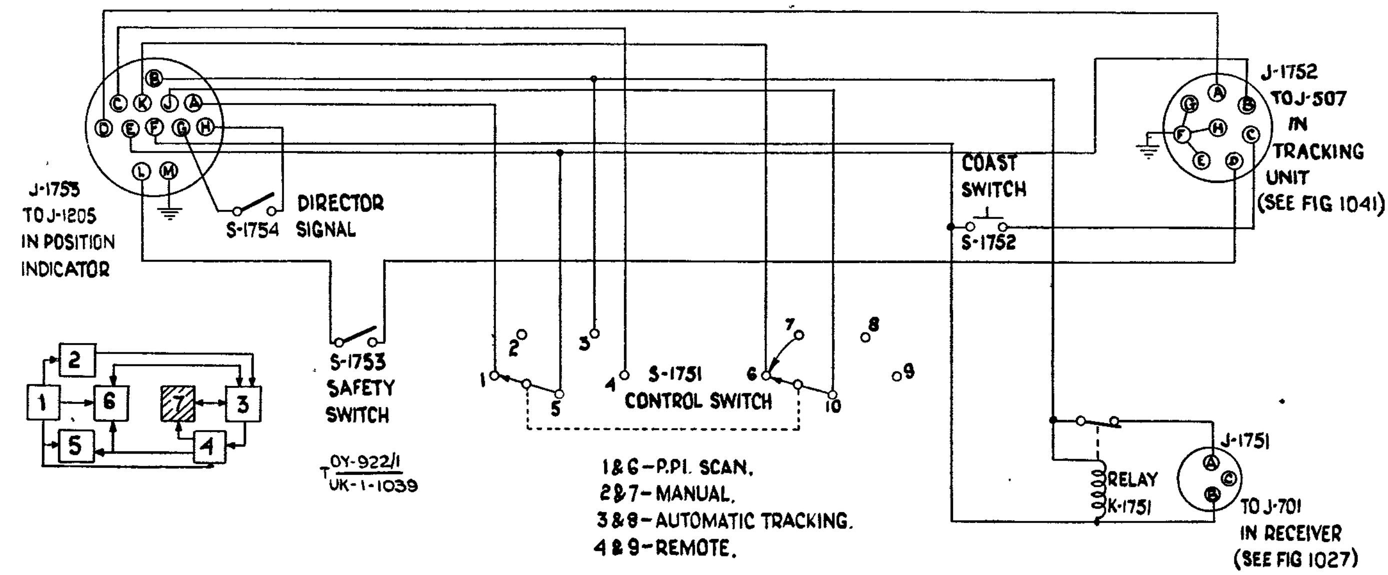


Fig. 1039—Control panel

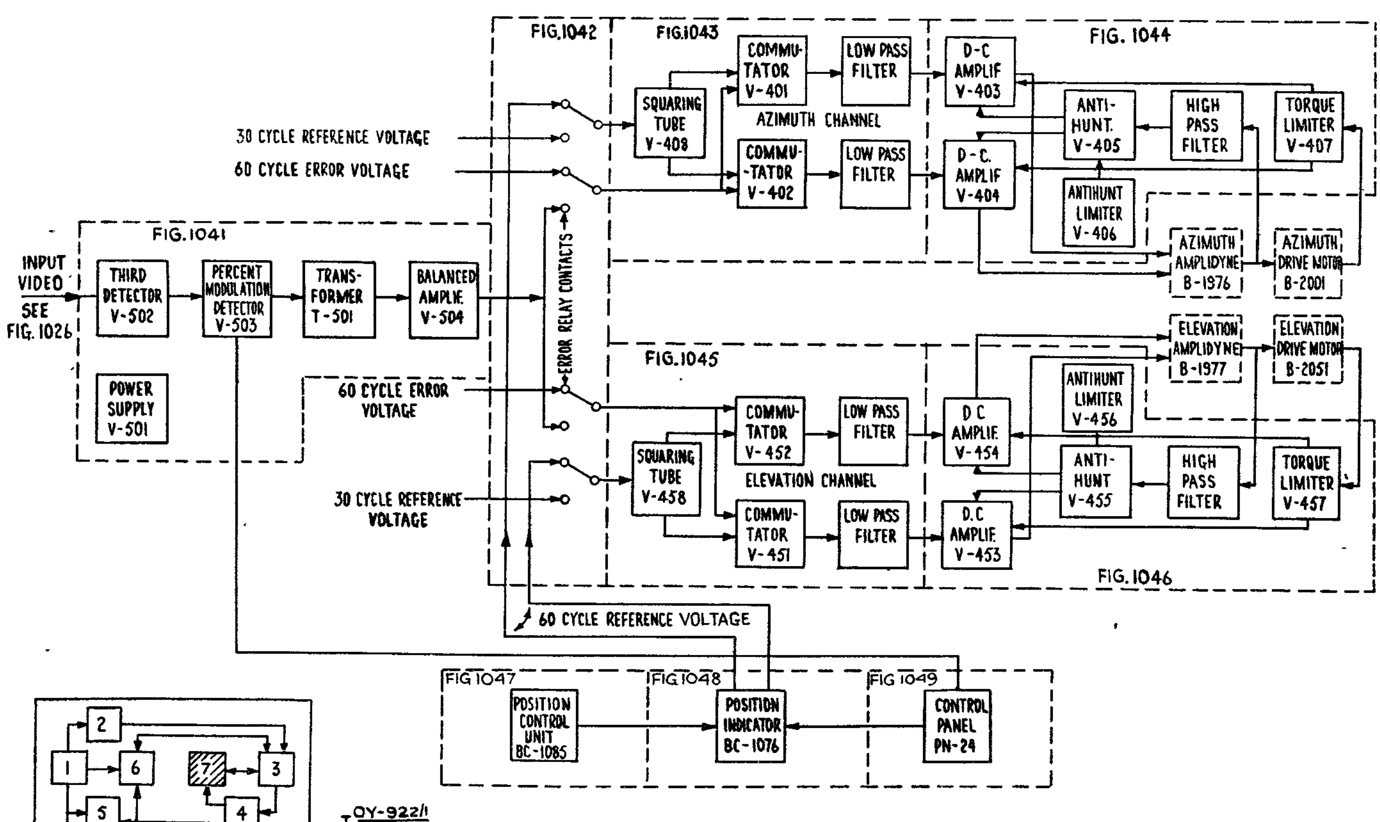


Fig. 1040—Tracking system block diagram

Circuit reference	*Name of part*	*Description*
C-501	Capacitor	4 μF, 600 V D.C. wkg.
C-502	Capacitor	Fixed mica, 0.01 μF $\pm$ 5%, 300 V D.C. wkg.
C-503, C-504	Capacitor	1 μF − 2.5% + 10%, 600 V D.C. wkg.
C-505 to C-508	Capacitor	10 μF, 600 V D.C. wkg.
C-509	Capacitor	1 μF, 600 V D.C. wkg.
C-510	Capacitor	1 μF − 2.5.% + 10%, 600 V D.C. wkg.
F-501, F-502	Fuse	5 A, 250 V, type 3AG
F-501A, F-502A	Fuse post	
I-501	Indicator light	Red cap
I-501A	Lamp	6–8 V
J-501 to J-506	Receptacle	Moulded bakelite, single-contact socket with retainer ring (tip jack)
J-507	Receptacle	(To J-172)
J-508	Receptacle	(To J-410)
J-509	Receptacle	(To J-702)
K-501	Relay (coast)	Coil, 115 V, 60 c/s, D.P.D.T., 6 A, contact
K-502	Relay (safety)	Coil, 115 V, 60 c/s, D.P.D.T., 6 A, contact
L-501, L-502	Inductor	5 H, 0.2 A D.C., 90 Ω D.C.R.
M-501	Meter	Scale 0–15 mA D.C., calibrate for use on $\frac{1}{8}$-in. steel panel to operate in ambient of − 40° F to + 122° F and 100% humidity
R-501	Resistor	5,100 $\Omega \pm$ 5%, $\frac{1}{2}$ W
R-502	Resistor	5,600 $\Omega \pm$ 5%, $\frac{1}{2}$ W
R-503	Resistor	15 k$\Omega \pm$ 5%, 1 W
R-504	Potentiometer	1.0 M$\Omega \pm$ 10%, 2 W
R-505	Potentiometer	2 sections, each 250 k$\Omega \pm$ 10%, 2 W
R-506	Potentiometer	Part of R-505
R-507	Resistor	10 $\Omega \pm$ 10%, 1 W
R-509, R-510	Resistor	51 k$\Omega \pm$ 5%, $\frac{1}{2}$ W
R-511	Resistor	10 k$\Omega \pm$ 5%, 2 W
R-512, R-513	Resistor	39 k$\Omega \pm$ 5%, 2 W
R-514	Resistor-potentiometer	500 $\Omega \pm$ 10%, 2 W
R-515	Resistor	11 k$\Omega \pm$ 5%, $\frac{1}{2}$ W
R-516	Resistor-potentiometer	3 k$\Omega \pm$ 10%, 2 W
R-517	Resistor	11 k$\Omega \pm$ 5%, $\frac{1}{2}$ W
R-518	Resistor	20 k$\Omega \pm$ 5%, 2 W
R-519, R-520	Resistor	51 k$\Omega \pm$ 5%, 1 W
R-522	Resistor	75 k$\Omega \pm$ 5%, 1 W
R-523	Resistor	24 k$\Omega \pm$ 5%, 1 W
S-501	Switch	Double-pole, single-throw, 10 A at 250 V
T-501	Transformer	30 c/s, ratio 1.0 to 1.0 C.T. with 0.25 kV ins.
T-502	Transformer	60 c/s, 115 V to 880 V C.T., 6.3 V C.T., 5 V
V-501	Valve	5U4G
V-502	Valve	6H6
V-503	Valve	6SK7GT
V-504	Valve	6SN7GT
V-505	Valve	VR-105-30
X-501	Valve socket	8-pin, octal
X-502 to X-505	Valve socket	

Table 1015—Details of components of tracking unit BC-1086 (Fig. 1041)

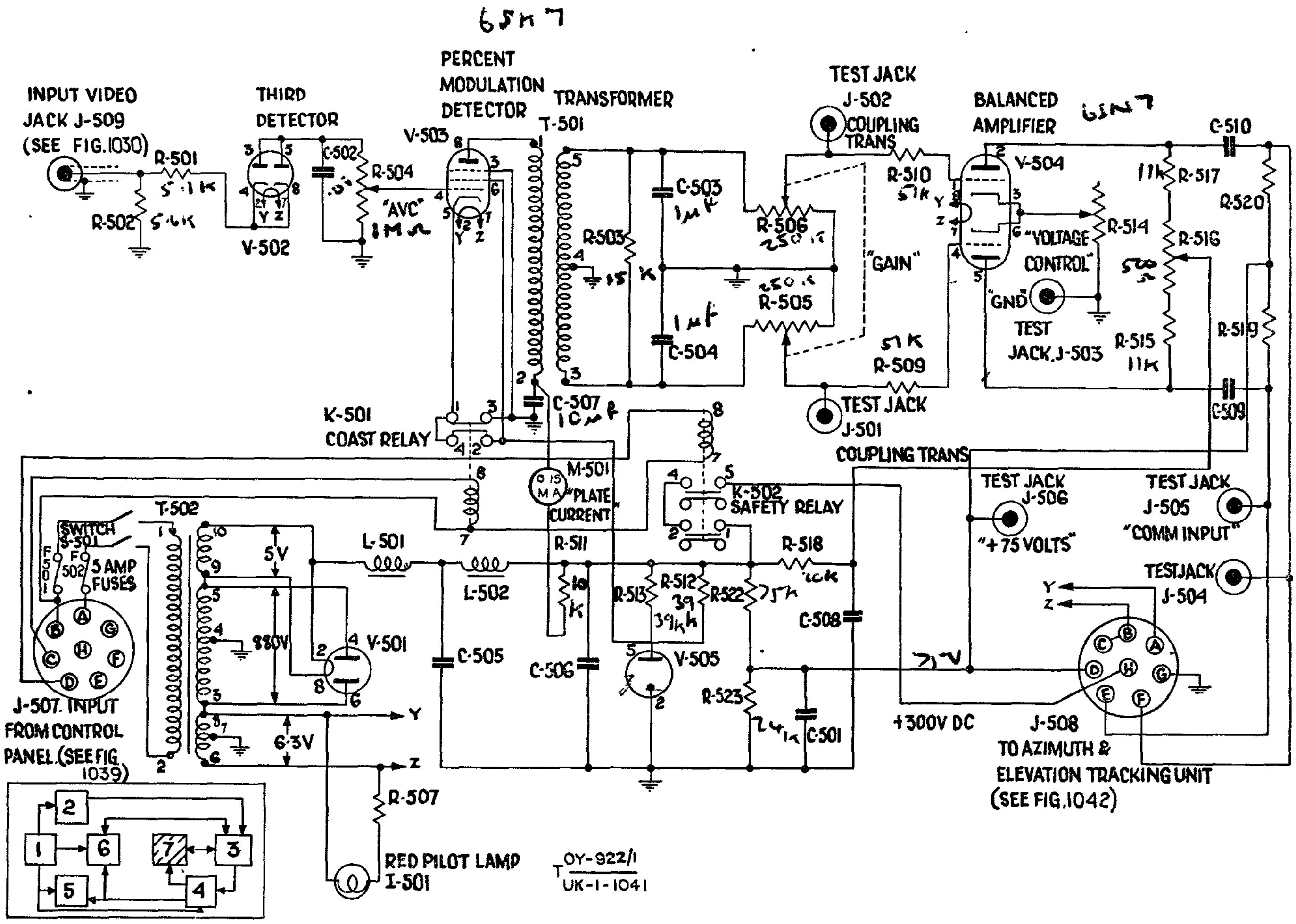


Fig. 1041—Tracking unit (Table 1015)

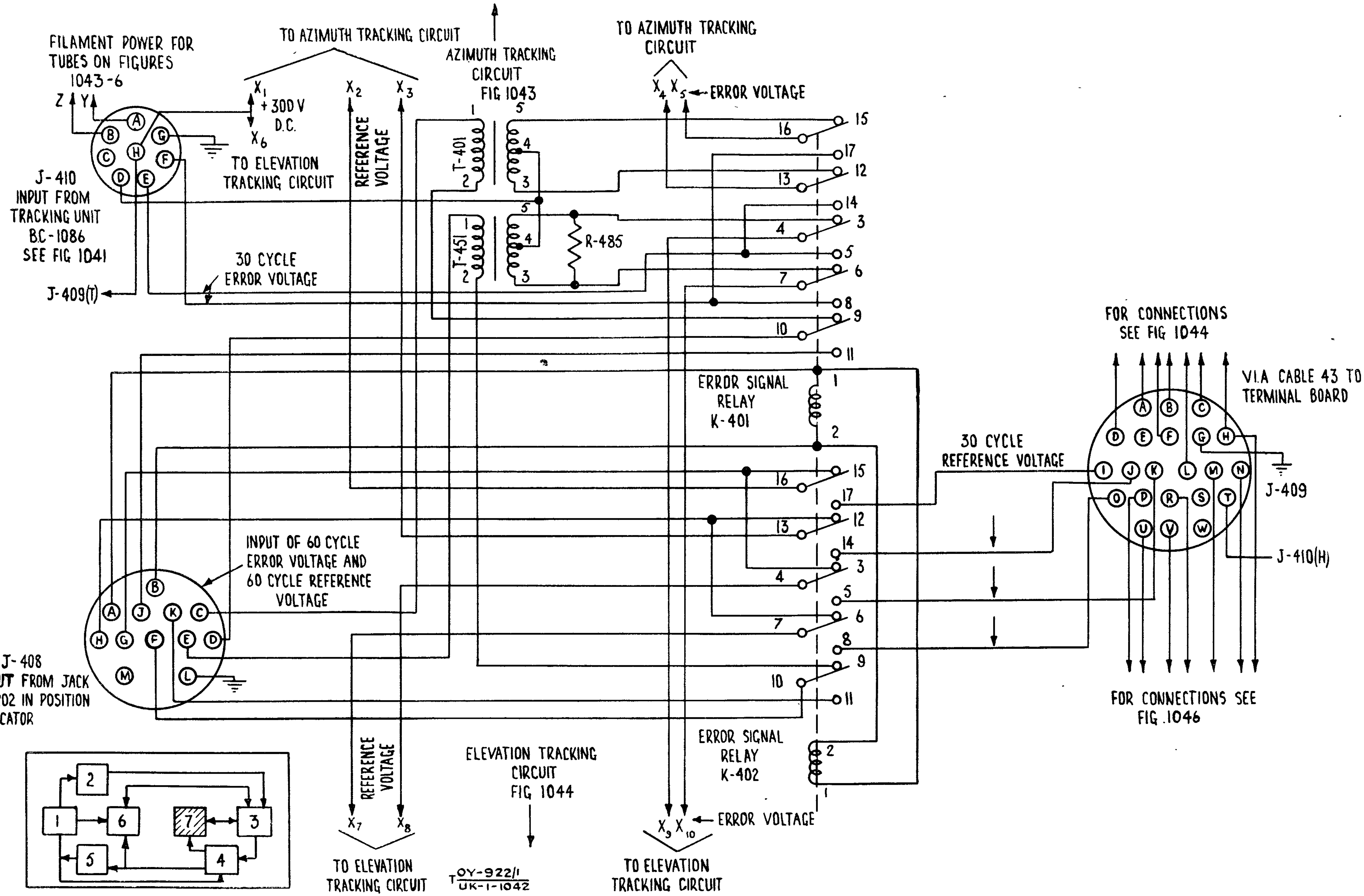


Fig. 1042—Azimuth and elevation tracking unit

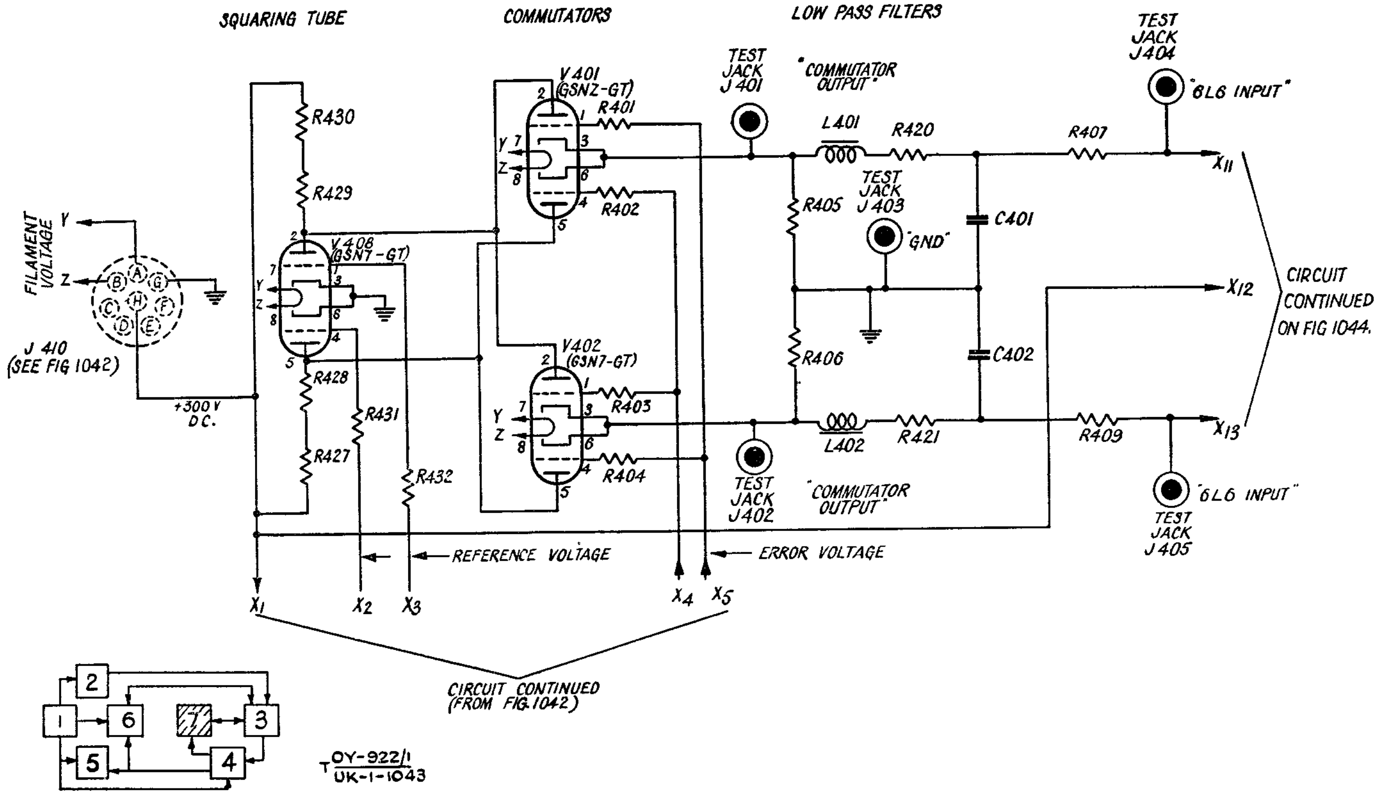


Fig. 1043—Azimuth circuit in tracking unit (1) (Table 1016 on page 1038)

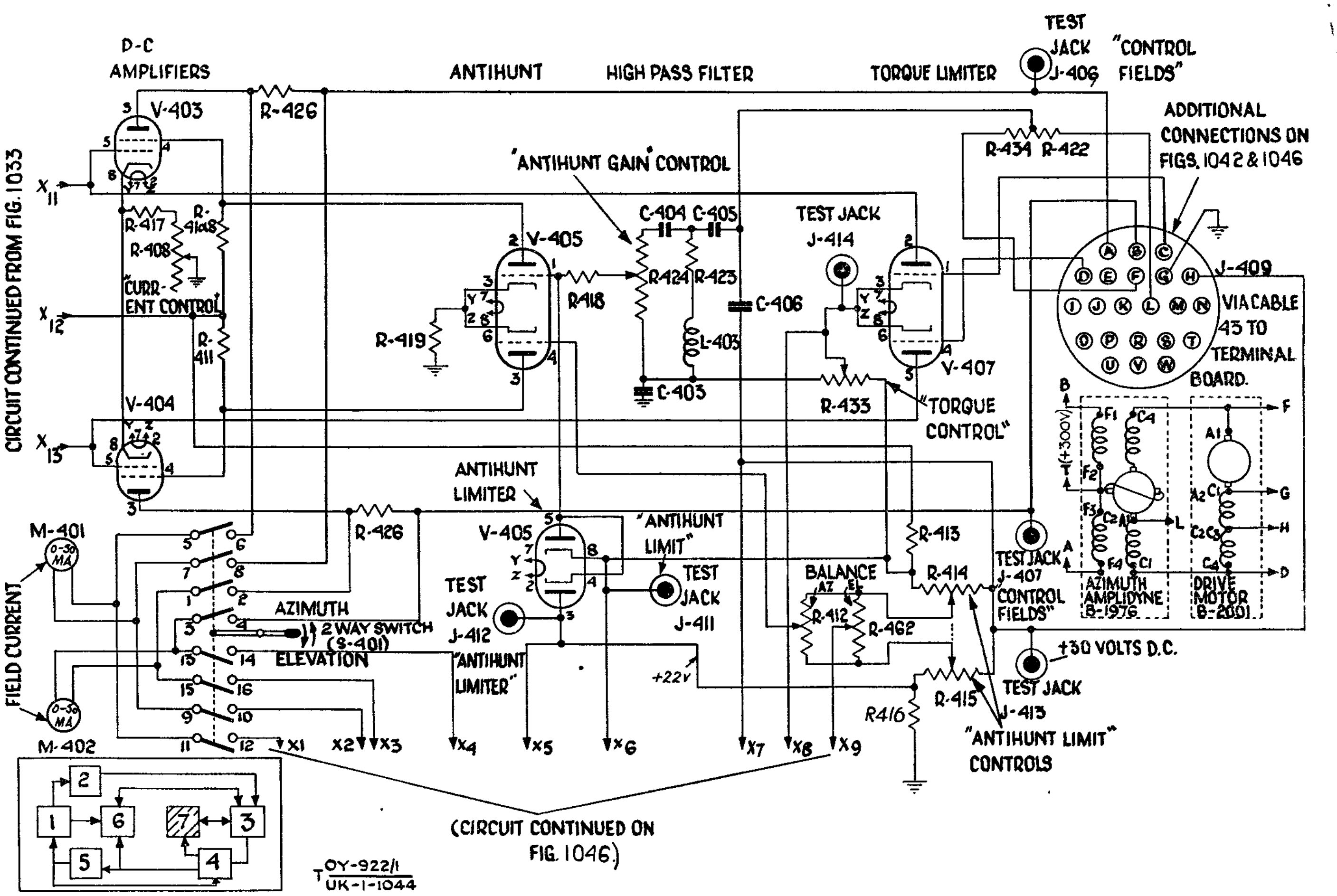


Fig. 1044—Azimuth circuit in tracking unit (2) (Table 1016 on page 1038)

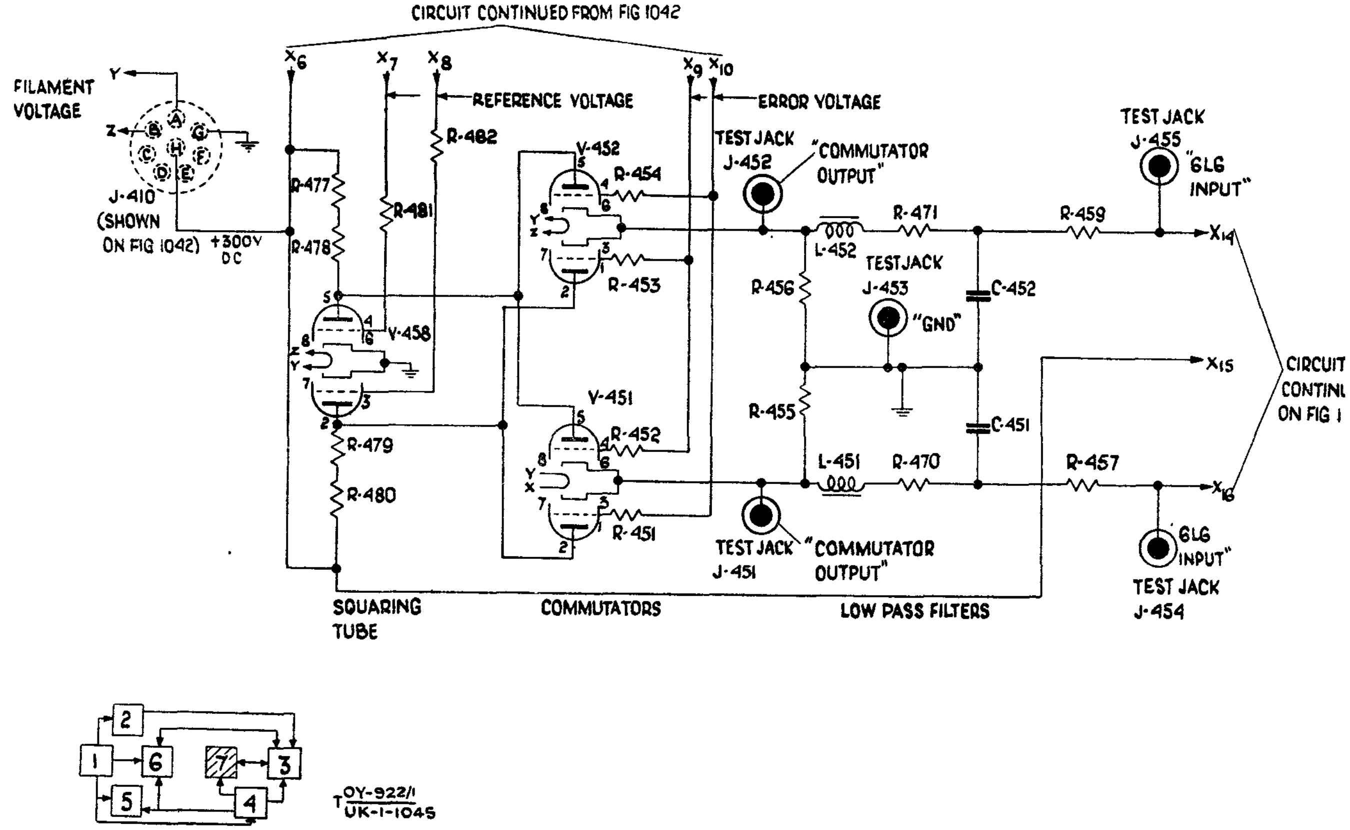


Fig. 1045—Elevation circuit in tracking unit (1) (Table 1016)

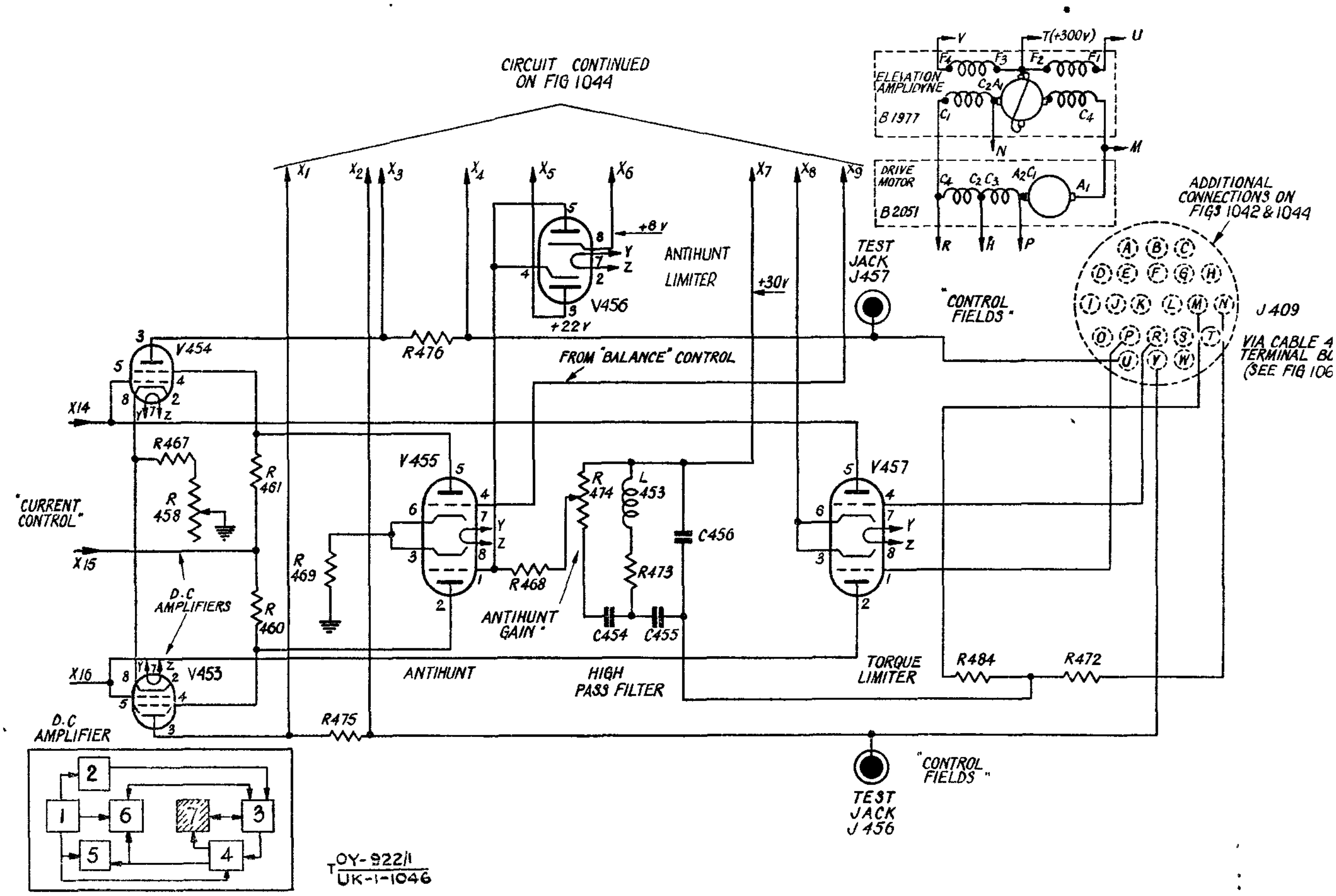


Fig. 1046—Elevation circuit in tracking unit (2) (Table 1016)

CAPACITORS

Circuit reference	Description
C-401, C-402	0.1 μF, 500 V D.C. working
C-403	4 μF, 600 V D.C. working
C-404	1 μF, 600 V D.C. working
C-405	4 μF, 600 V D.C. working
C-406	0.5 μF, 500 V D.C. working
C-451, C-452	0.1 μF, 500 V D.C. working
C-454	1 μF, 600 V D.C. working
C-455	4 μF, 600 V D.C. working
C-456	0.5 μF, 500 V D.C. working

RESISTORS

Circuit reference	Description
R-401 to R-404	1.0 MΩ ± 10%, ½ W
R-405 R-406	20 kΩ ± 5%, 1 W
R-407	100 kΩ ± 5%, 1 W
R-408	500 Ω, ± 10%, 25 W, potentiometer
R-409	100 kΩ ± 5%, 1 W
R-410, R-411	8,200 Ω ± 5%, 2 W
R-412	3 kΩ ± 10%, 2 W, potentiometer
R-413	25 kΩ ± 5%, 18 W
R-414	2 sections, each 2 kΩ ± 10%, 2 W, potentiometer
R-415	Part of R-414, potentiometer
R-416	2 kΩ ± 10%, 1 W
R-417	1,200 Ω ± 5%, 20 W
R-418	510 kΩ ± 5%, ½ W
R-419	3 kΩ ± 5%, 1 W
R-420, R-421	100 kΩ ± 5%, ½ W
R-422	10 kΩ ± 5%, 2 W
R-423	75 kΩ ± 5%, 1 W
R-424	500 kΩ ± 10%, 2 W, potentiometer
R-425, R-426	100 Ω ± 2%, 1 W
R-427 to R-430	10 kΩ ± 1%, 1 W
R-431, R-432	1.0 MΩ ± 10 %, 1 W
R-433	50 kΩ ± 10%, 2 W, potentiometer
R-434	5,100 Ω ± 5%, 2 W
R-451 to R-454	1.0 MΩ ± 10%, ½ W
R-455, R-456	20 kΩ ± 5%, 1 W
R-457	100 kΩ ± 5%, 1 W
R-458	500 Ω ± 10%, 25 W, potentiometer
R-459	100 kΩ ± 5%, 1 W
R-460, R-461	8,200 Ω ± 5%, 2 W
R-462	3 kΩ ± 10%, 2 W, potentiometer
R-467	1,200 Ω ± 5%, 20 W
R-468	510 kΩ ± 5%, ½ W
R-469	3 kΩ ± 5%, 1 W
R-470, R-471	100 kΩ ± 5%, ½ W

RESISTORS—*contd.*

Circuit reference	Description
R-472	10 kΩ ± 5%, 2 W
R-473	75 kΩ ± 5%, 1 W
R-474	500 kΩ ± 10%, 2 W, potentiometer
R-475, R-476	100 Ω ± 2%, 1 W
R-477 to R-480	10 kΩ ± 1%, 1 W
R-481, R-482	1.0 MΩ ± 10%, 1 W
R-484	5,100 Ω ± 5%, 2 W
R-485	100 kΩ ± 10%, 1 W

MISCELLANEOUS

Circuit reference	Description
J-401 to J-407	Receptacle, moulded bakelite single-contact socket with retainer ring (tip jack)
J-408 to J-410	Receptacle
J-411 to J-414 and J-451 to J-457	Receptacle, moulded bakelite single-contact socket with retainer ring (tip jack)
K-401, K-402	Relay, 5 sets of contacts
L-401, L-402	Inductor, 2,000 H, at zero D.C.
L-403	Inductor, 19,000 H at zero D.C.
L-451, L-452	Inductor, 2,000 H at zero D.C.
L-453	Inductor, 19,000 H at zero D.C.
M-401, M-402	Meter, 0–5 V D.C. movement, 1,000 Ω per V with scale calibrated 0–50 mA D.C. calibrated for use on ⅛ in. steel panel (used with 100 Ω external shunt) to operate in ambient of — 40° F to 122° F and relative humidity of 100%.
S-401	Switch, 2-way lever key
T-401, T-451	Transformer, 60 c/s, ratio 1 V to 20/10 V
V-401, V-402	Valve, 6SN7GT
V-403, V-404	Valve, 6L6G
V-405	Valve, 6SN7GT
V-406	Valve, 6L6G
V-407	Valve, 6SL7GT
V-408, V-451, V-452	Valve, 6SN7GT
V-453, V-454	Valve, 6L6G
V-455	Valve, 6SN7GT
V-456	Valve, 6H6
V-457	Valve, 6SL7GT
V-458	Valve, 6SN7GT
X-401 to X-408 and X-451 to X-458	Valve Socket, octal

Table 1016—Details of components of azimuth and elevation tracking circuits of unit BC-1090 (Figs. 1043 to 1046)

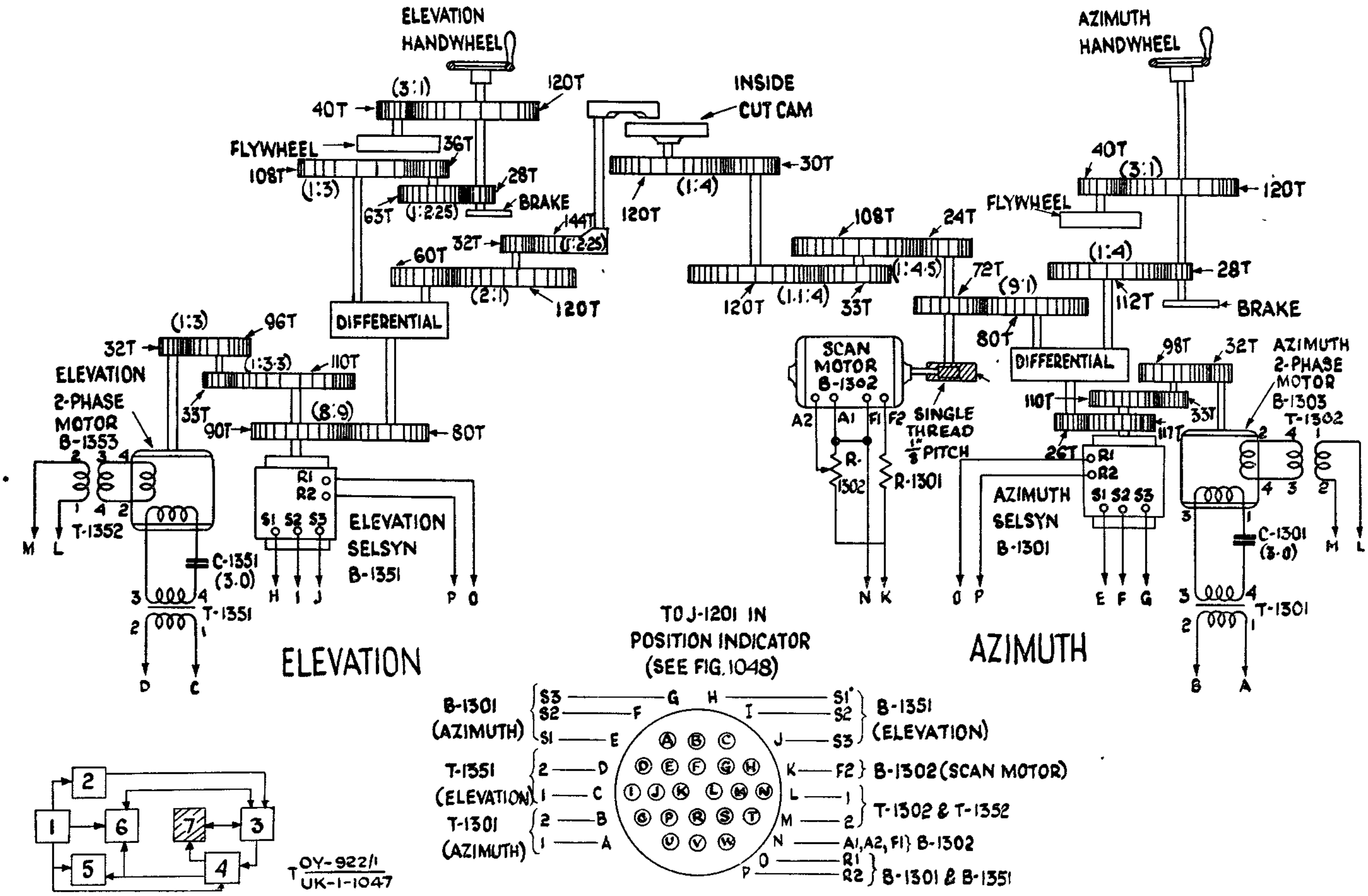


Fig. 1047—Position control unit (Table 1017)

Circuit reference	*Name of part*	*Description*
B-1301	Motor-selsyn control	Manual positioning
B-1302	Motor-slewing	P.P.I. scan.
B-1303	Motor-follow-up	2-phase, anti-slew
B-1351	Motor-selsyn control	Manual positioning
B-1353	Motor-follow-up	2-phase, anti-slew
C-1301, C-1351	Capacitor	3 μF, 600 V
J-1301	Receptacle	
R-1301	Resistor	330 $\Omega \pm 10\%$, 60 W
R-1302	Potentiometer	350 $\Omega \pm 10\%$, 50 W
T-1301, T-1351	Transformer	10 V/2.4 V
T-1302, T-1352	Transformer	115 V/21 V
E-1301, E-1351	Solenoid brake	

Table 1017—Details of components of control unit BC-1085 (Fig. 1047)

Circuit reference	Name of part	Description
B-1201	Selsyn repeater	Local position indicating
B-1202	Selsyn repeater	Remote position indicating
B-1251	Selsyn repeater	Local position indicating
B-1252	Selsyn repeater	Remote position indicating
I-1201 to I-1206	Lamp socket	
I-1201A to I-1206A	Lamp	6–8 V 0.25 A
J-1201	Receptacle	(To J-1301)
J-1202	Receptacle	(To J-408)
J-1203	Receptacle	(To terminal board)
J-1204	Receptacle	(To data panel)
J-1205	Receptacle	(To J-1753)
J-1206	Receptacle	(To data panel)
K-1201, K-1202	Relay	Coil, 115 V, 60 c/s
R-1201	Resistor	1.5 Ω ± 10%, 10 W
T-1201	Transformer	60 c/s, 115 V to 6.3 V, 5 A
T-1202	Transformer	60 c/s, 115 V to 230 V C.T.

Table 1018—Details of components of position indicator BC-1076 (Fig. 1048)

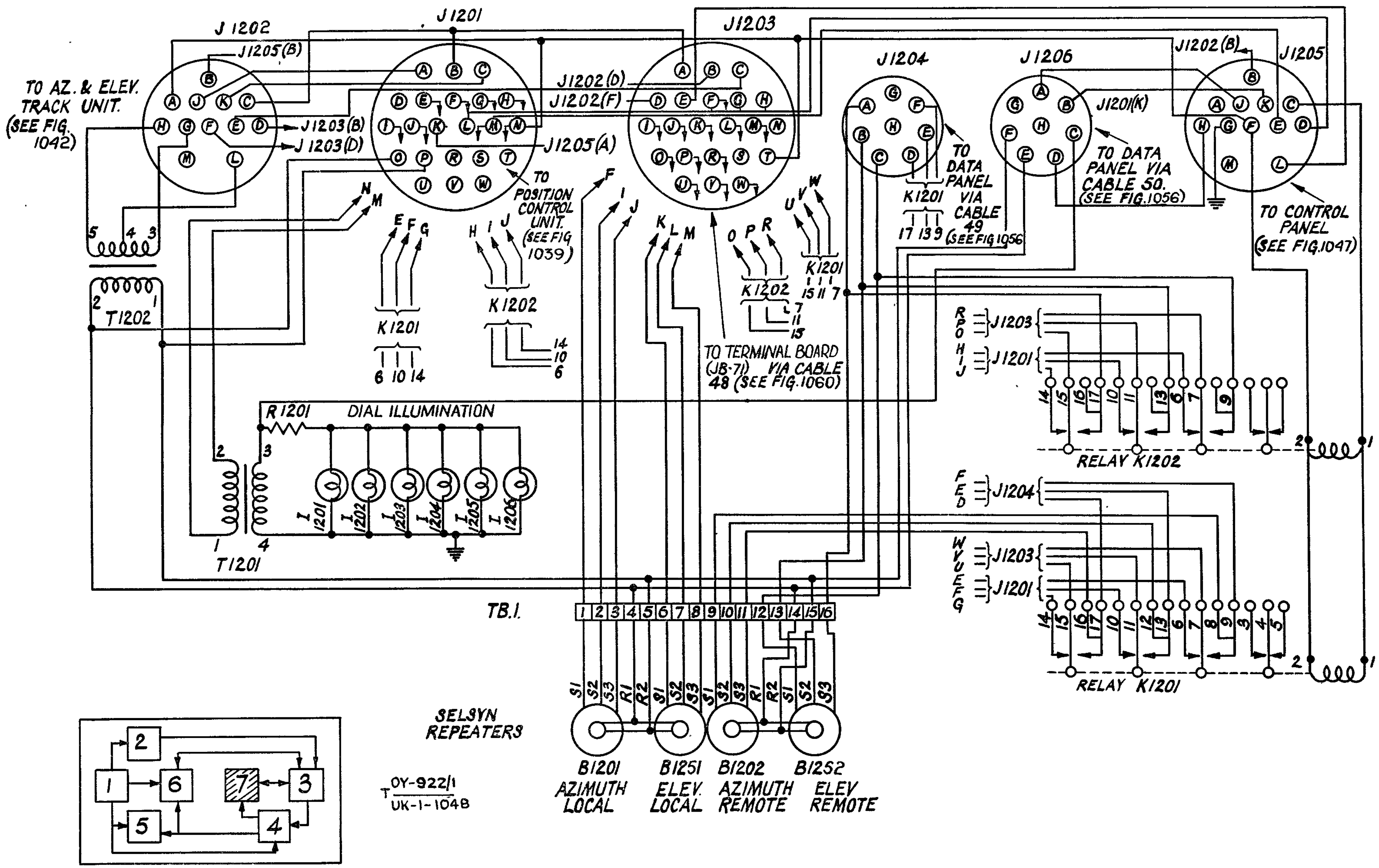


Fig. 1048—Position indicator (Table 1018)

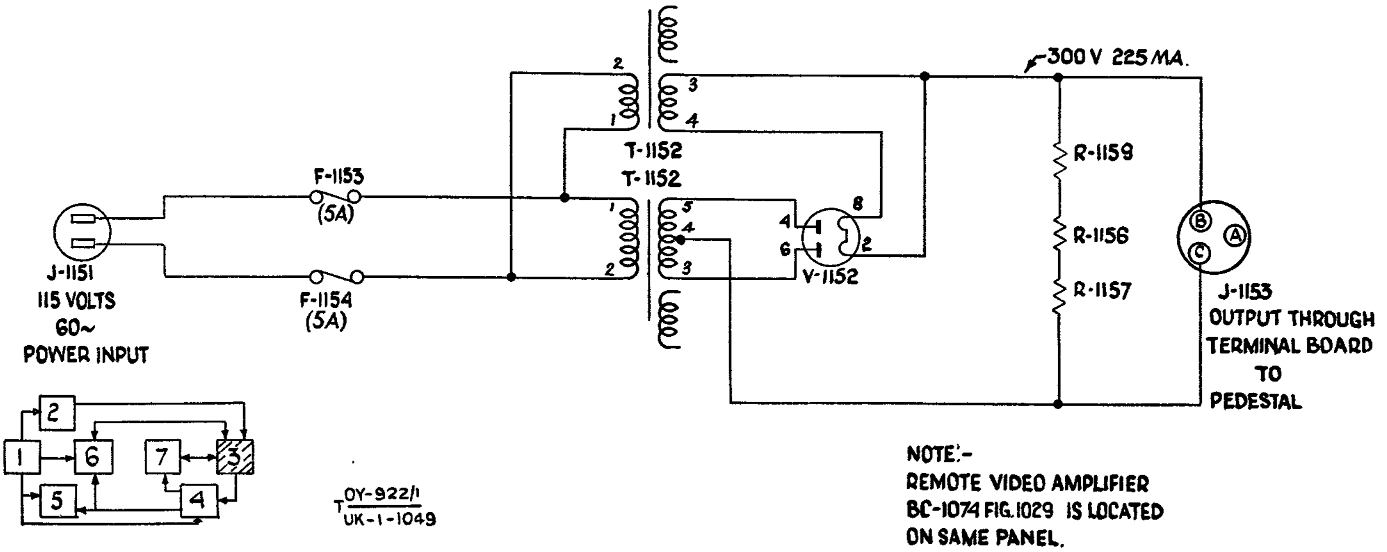


Fig. 1049—Power supply for azimuth and elevation motor fields (Table 1019)

Circuit reference	*Name of part*	*Description*
F-1153, F-1154	Fuse	5 A, 250 V
F-1153A, F-1054A	Fuse post	
J-1151	Receptacle	110 V, male, flush mtg.
J-1153	Receptacle	Output receptacle to T-317 in junction box JB-71
R-1157 to R-1159	Resistor	10 kΩ ± 10%, 2 W
T-1152	Transformer	115 V to 5V
T-1153	Transformer	115 V to 800 V C.T./6.3 V
V-1152	Valve	5U4G
X-1152	Valve socket	Octal

Table 1019—Details of components of rectifier RA-71 (Fig. 1049)

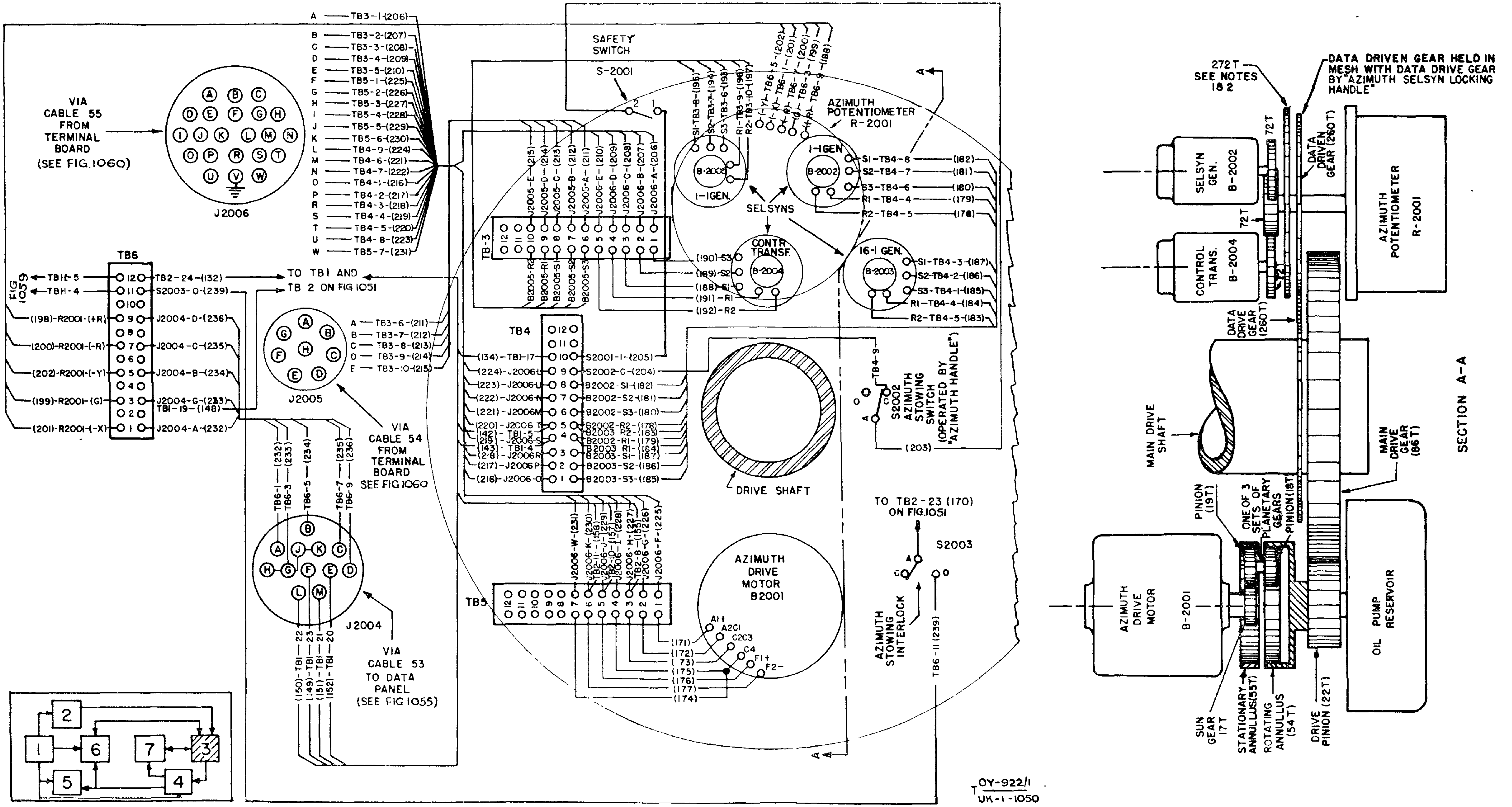


Fig. 1050—Azimuth mechanism (wiring in pedestal)

NOTES.—(1) This 272-tooth gear meshes with a 17-tooth pinion driving the 16-1 selsyn generator

(2) A 17-tooth pinion on the shelf with the azimuth selsyn adjusting handwheel meshes with the 272-tooth gear only when synchronizing selsyns with director

Circuit reference	*Name of part*	*Description*
B-2001	Motor	Model BC-46AB772
B-2002	Selsyn generator	Model 2J5HA1
B-2003	Selsyn generator	Model 2J5HA1
B-2004	Transformer	Model 2J5FB1
B-2005	Selsyn generator	Model 2J5HA1
B-2006	Motor	Type KO63128, 3/4 h.p. 1750/150 r.p.m., 115 V, 3-phase, 60 c/s
B-2051	Motor	Model BC-46AB772
B-2052	Selsyn generator	Model 2J5HA1
B-2053	Selsyn generator	Model 2J5HA1
B-2054	Transformer	Model 2J5FB1
B-2056	Generator	Model AQB33YD2
J-2003	Socket	Potentiometer data
J-2004	Socket	Potentiometer data
J-2005	Receptacle	P.P.I. sweep selsyn generator
J-2006	Receptacle	Azimuth power and data
J-2007	Receptacle	Elevation power and data
J-2008	Receptacle	Elevation selsyn data
S-2001	Switch	D.P.S.T., 10 A at 250 V
T-2051	Transformer	G.E. Cat. No. 68G541

Table 1020—Details of components of pedestal MP-61 (Fig. 1051)

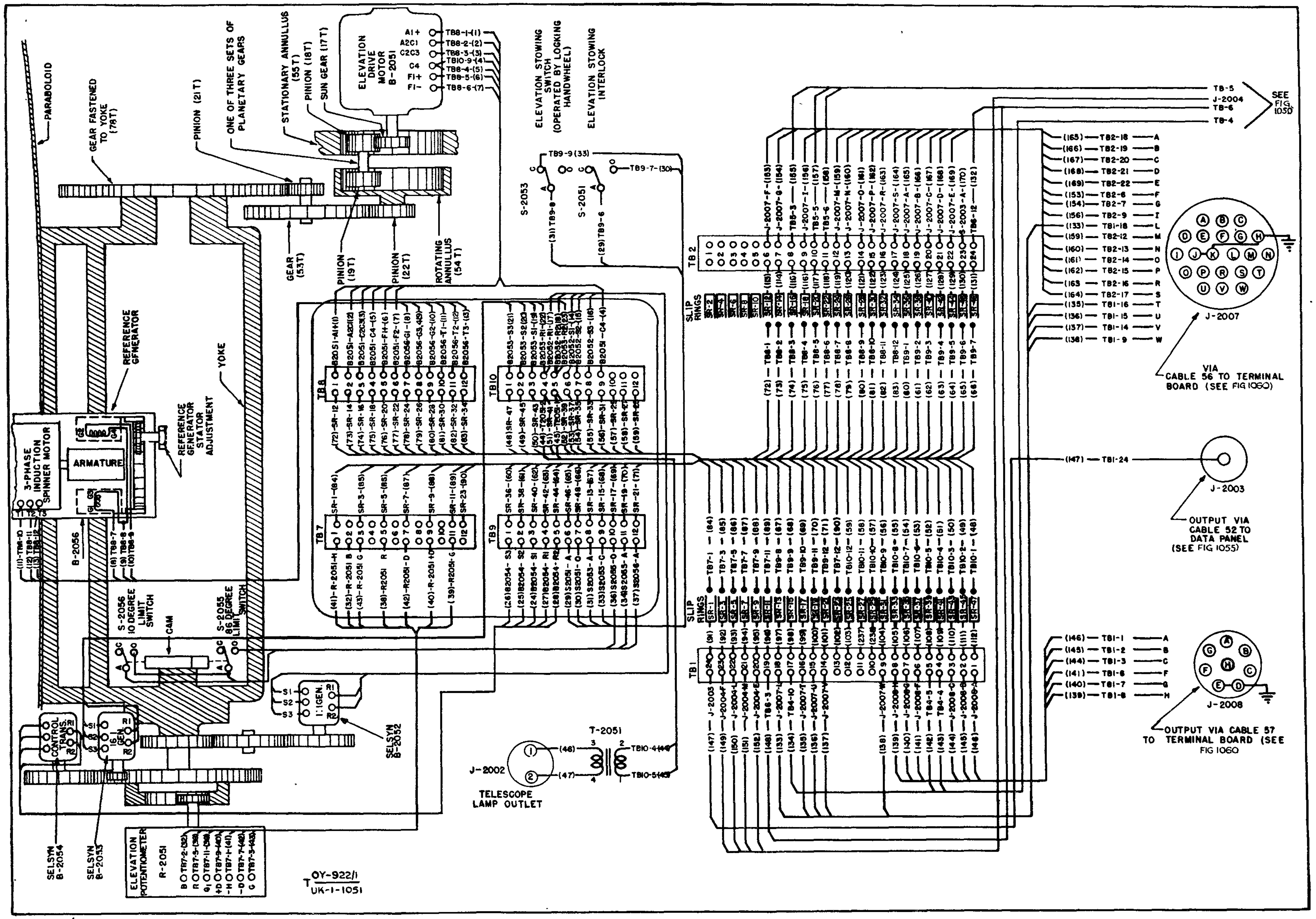


Fig. 1051—Elevation mechanism, wiring in pedestal (Table 1020)

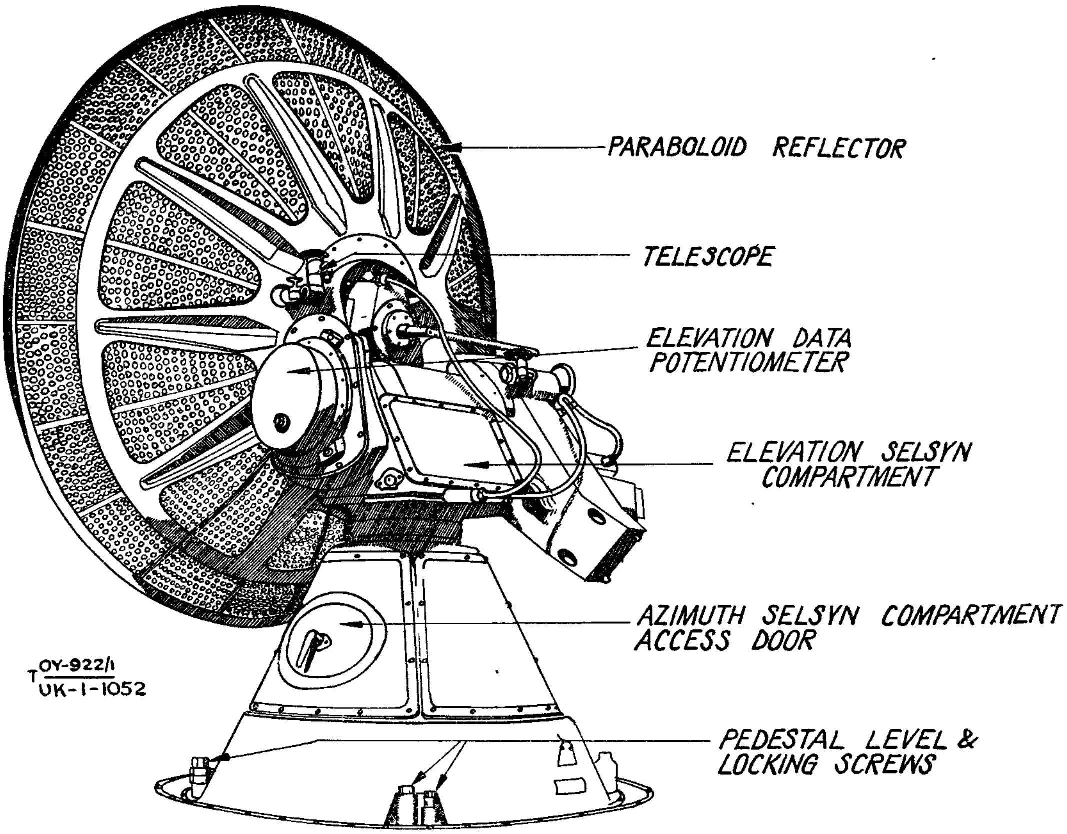


Fig. 1052—Pedestal, rear view of paraboloid

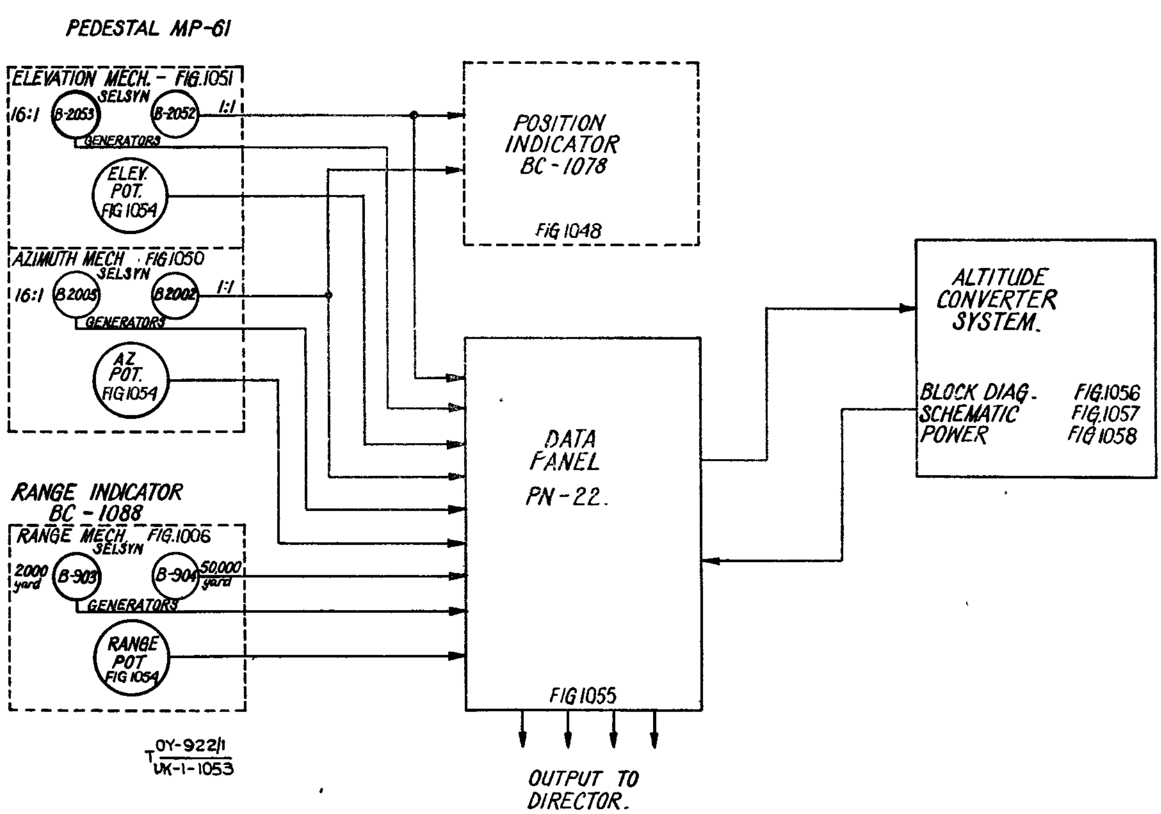


Fig. 1053—Data output system, block diagram

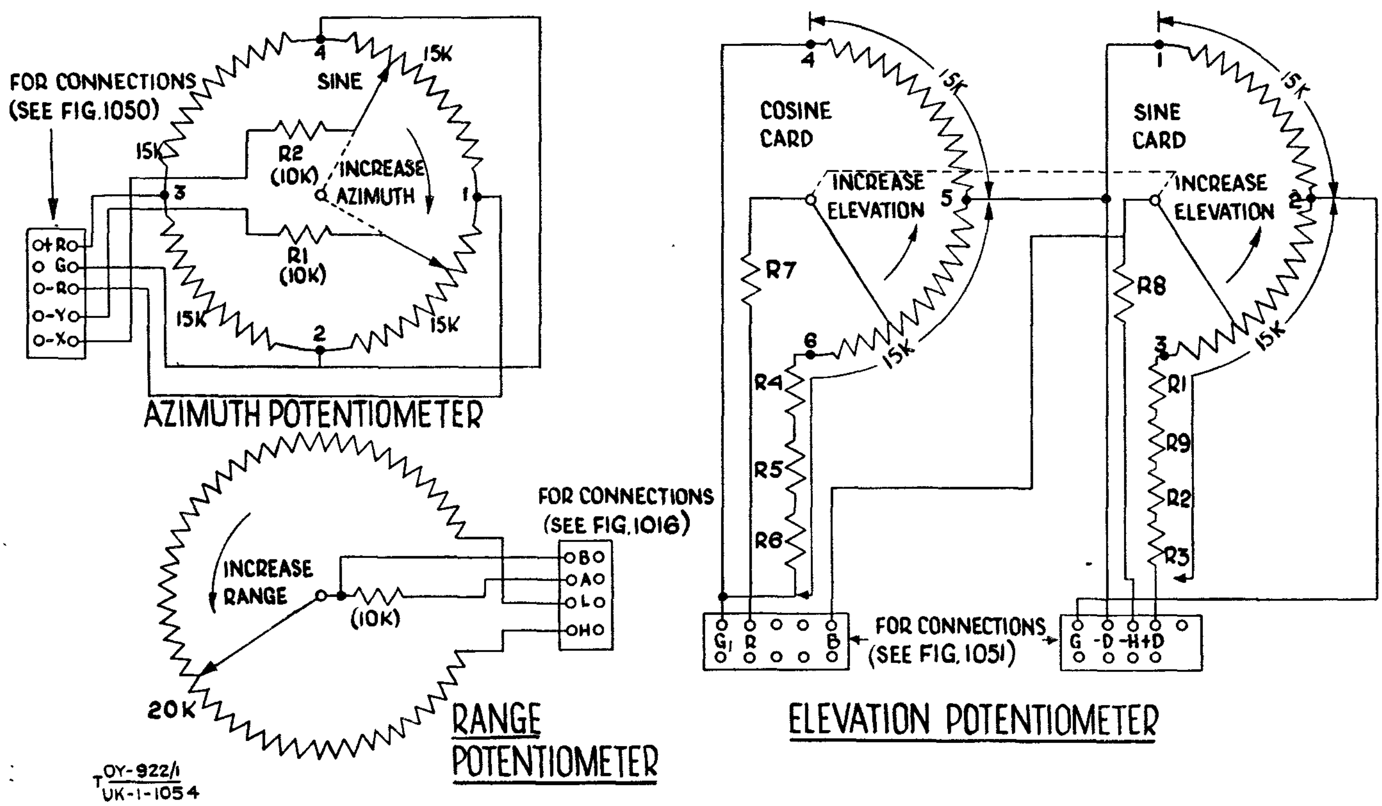


Fig. 1054—Data output system, data potentiometers

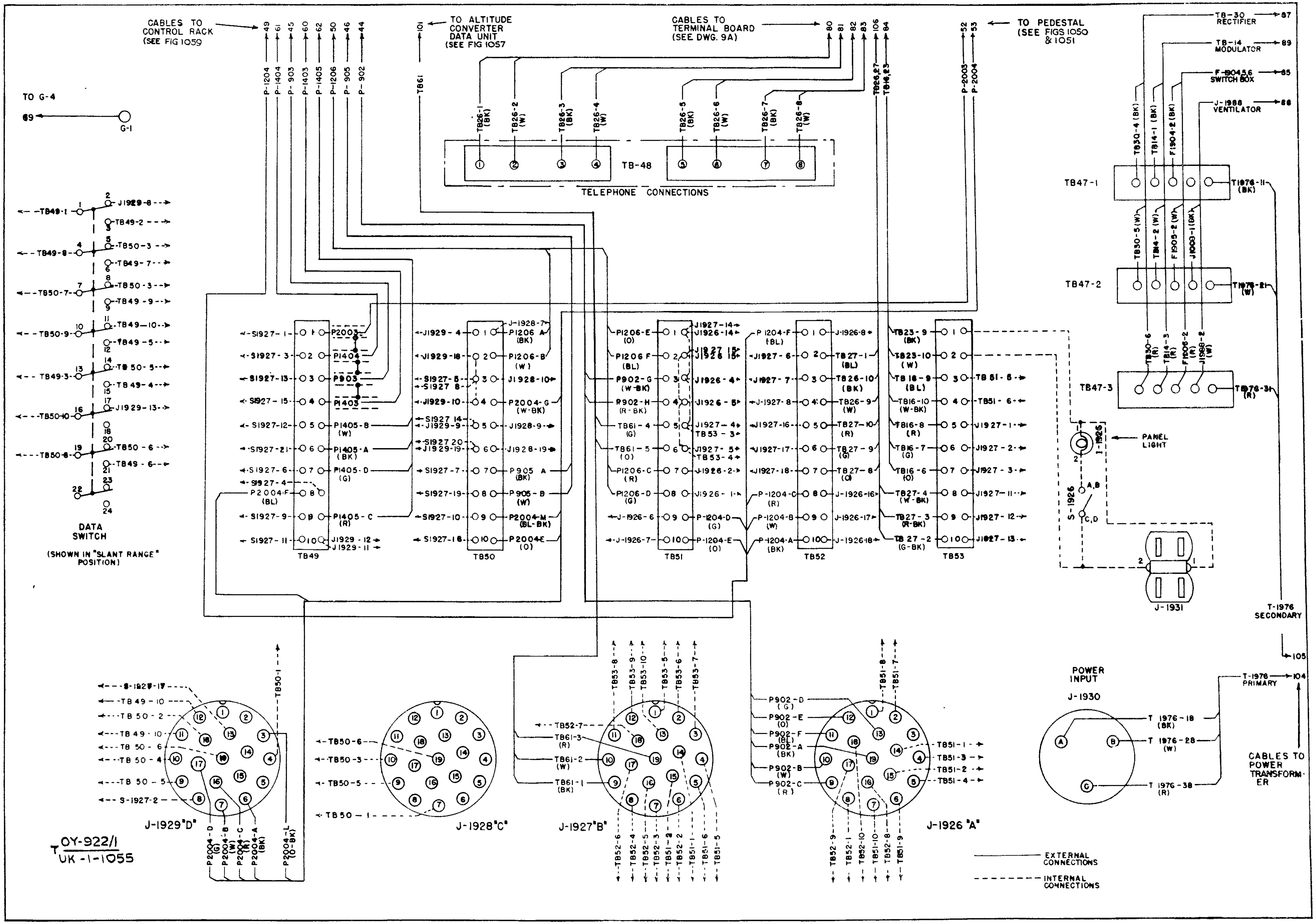


Fig. 1055—Data panel

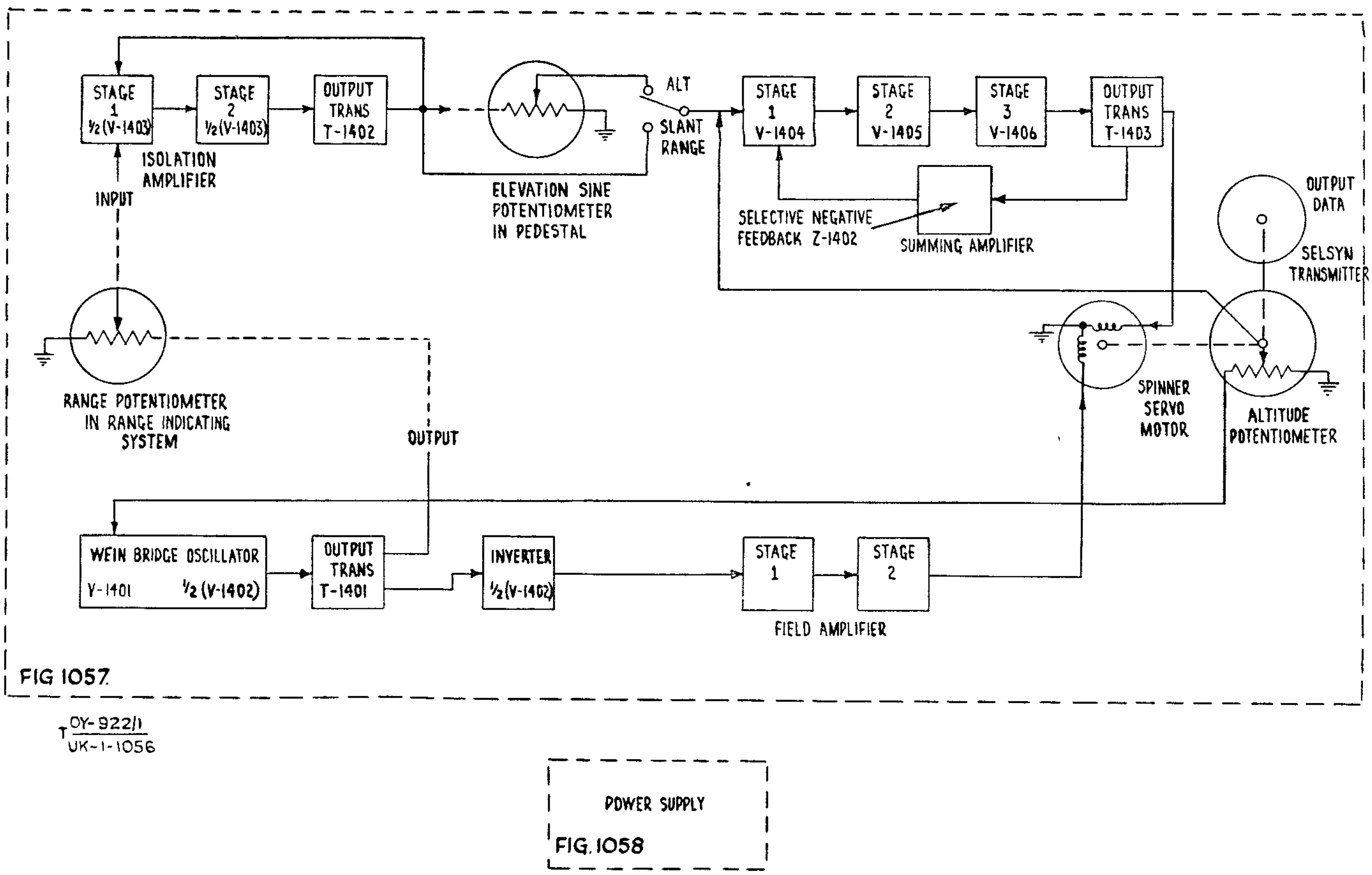


Fig. 1056—Data output system

CAPACITORS

Circuit reference	*Description*
C-1401, C-1402	8,000 pF ± 1%, 500 V
C-1403, C-1404	0.25 μF − 10% + 20%, 600 V
C-1405	510 pF ± 5%, 500 V
C-1406	0.015 μF − 10% + 20%, 1,000 V
C-1407	1.0 μF − 10% + 20%, 600 V
C-1408	8,000 pF − 10% + 20%, 1,000 V
C-1409	1.0 μF − 10% + 20%, 600 V
C-1410	0.25 μF − 10% + 20%, 600 V
C-1411	8,000 pF − 10% + 20%, 1,000 V
C-1412	Variable, 99 pF
C-1413	0.5 μF − 10% + 20 %, 600 V
C-1414, C-1415	1.0 μF − 10% + 20%, 600 V
C-1416	0.015 μF − 10% + 20%, 1,000 V
C-1417	0.5 μF − 10% +20%, 600 V
C-1418	0.25 μF − 10% + 20%, 1,000 V
C-1419	0.1 μF − 10% + 20%, 600 V
C-1420	0.25 μF − 10% + 20%, 1,000 V
C-1421	0.2 μF − 10% + 20%, 600 V
C-1422	75 pF ± 5%, 500 V
C-1423	1,500 pF ± 20%, 500 V

RESISTORS

Circuit reference	*Description*
R-1401	75 kΩ ± 1%
R-1402	80 kΩ ± 1%
R-1403	7,500 Ω, potentiometer
R-1404, R-1405	2,500 Ω, potentiometer
R-1406, R-1407	7C, 7/W, 115 V, white, lamp
R-1408	51 kΩ ± 5%, 1 W
R-1409 to R-1411	0.3 MΩ ± 5%, 1 W
R-1412	0.1 MΩ ± 10%, ½ W
R-1413	0.56 MΩ ± 10%, ½ W
R-1414	1 kΩ ± 10%, ½W
R-1415	0.130 MΩ ± 5%, ½ W
R-1416	19 kΩ ± 5%, ½ W
R-1417	0.2 MΩ ± 5%, ½ W
R-1418	19 kΩ ± 5%, ½ W
R-1419	1 kΩ ± 10%, ½ W
R-1420	7,500 Ω, potentiometer
R-1421	33 kΩ ± 5%, ½ W
R-1422	27 kΩ ± 5%, ½ W

RESISTORS—*contd.*

Circuit reference	*Description*
R-1423	0.2 MΩ ± 5%, ½ W
R-1424	19 kΩ ± 5%, ½ W
R-1425	75 kΩ ± 1%
R-1426, R-1427	80 kΩ ± 1%
R-1428	0.24 MΩ ± 5%, ½ W
R-1429	1 kΩ ± 10%, ½ W
R-1430 to R-1434	80 kΩ ± 1%
R-1435	0.1 MΩ ± 10%, ½ W
R-1436	1.0 MΩ ± 10%, ½ W
R-1437	1 kΩ ± 10%, ½ W
R-1438	10 kΩ ± 1%
R-1439 to R-1444	80 kΩ ± 1%
R-1445	2.2 MΩ ± 10%, ½ W
R-1446	750 Ω ± 5%, ½ W
R-1447	100 Ω ± 5%, ½ W
R-1448	1.0 MΩ ± 5%, ½ W
R-1449	0.24 MΩ ± 5%, ½ W
R-1450	1.0 MΩ ± 10%, ½ W
R-1451	910 Ω ± 5%, ½ W
R-1452	15 kΩ ± 10%
R-1453	1.0 MΩ ± 5%, ½ W
R-1454	0.24 MΩ ± 5%, ½ W
R-1455	0.56 MΩ ± 10%, ½ W
R-1456	300 Ω ± 10%
R-1457	6 kΩ ± 5%, ½ W
R-1458	100 Ω ± 5%, ½ W
R-1459	10 kΩ ± 1%

MISCELLANEOUS

Circuit reference	*Description*
J-1401 to J-1407	Receptacle
J-1408 to J-1412	Receptacle tip jack
S-1401, S-1402	Switch, D.P.D.T.
T-1401 to T-1403	Transformer
V-1401	Valve, 6SJ7GT
V-1402, V-1403	Valve, 6SN7GT
V-1404, V-1405	Valve, 6AC7
V-1406	Valve, 6L6G
X-1401 to X-1406	Socket, octal
X-1407, X-1408	Lamp socket
Z-1401, Z-1402	Network

Table 1021—Details of components of altitude converter control unit BC-1094 (Fig. 1057)

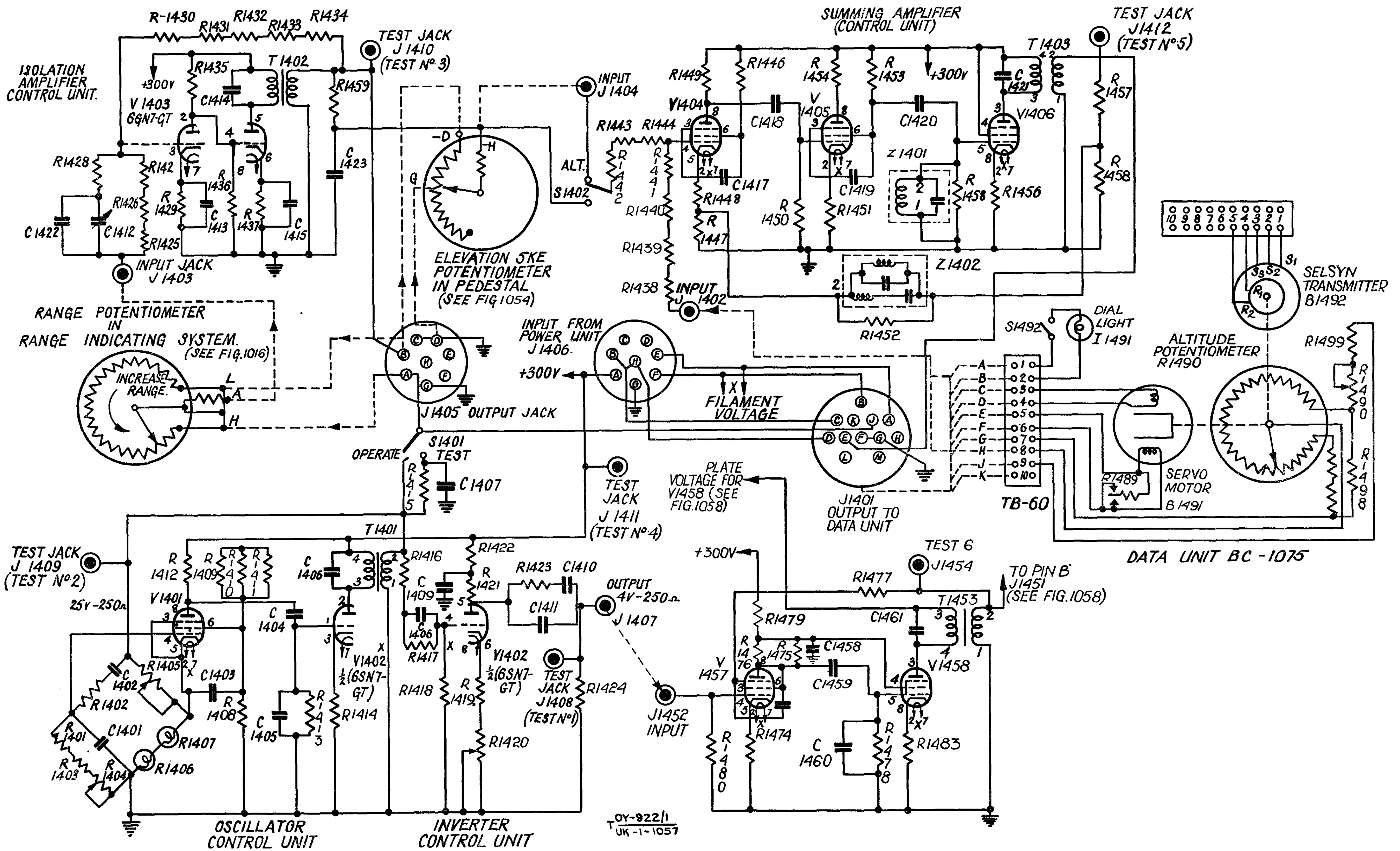


Fig. 1057—Altitude converter system, control unit, data unit, field amplifier (Tables 1021 and 1022)

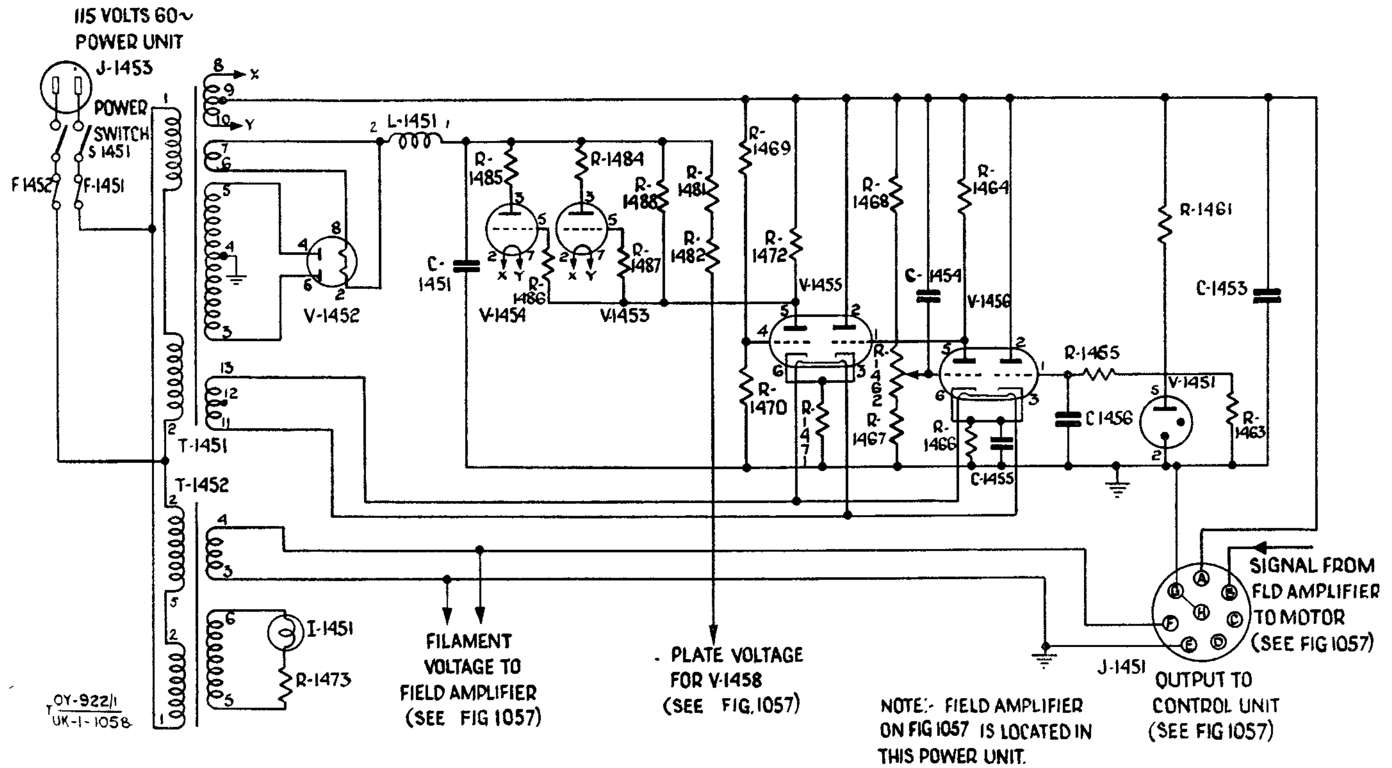


Fig. 1058—Altitude converter power supplies (Table 1022)

CAPACITORS

Circuit reference	*Description*
C-1451 to C-1453	8 μF − 10% + 20%, 1,000 V
C-1454	1.0 μF − 10% + 20%, 600 V
C-1455, C-1456	0.5 μF − 10% + 20%, 600 V
C-1457	0.1 μF − 10% + 20%, 1,000 V
C-1458	0.5 μF − 10% + 20%, 1,000 V
C-1459	0.25 μF − 10% + 20%, 1,000 V
C-1460	0.003 μF ± 20%, 800 V
C-1461	0.2 μF − 10% + 20%, 1,000 V

RESISTORS

Circuit reference	*Description*
R-1461	51 kΩ ± 5%, 2 W
R-1462	10 kΩ, potentiometer
R-1463	2 MΩ ± 5%, ½ W
R-1464	0.24 MΩ ± 5%, 1 W
R-1465	0.24 MΩ ± 5%, ½ W
R-1466	51 kΩ ± 5%, 2 W
R-1467	55 kΩ ± 1%
R-1468	0.1 MΩ ± 1%
R-1469	68 kΩ ± 10%, 1 W
R-1470, R-1471	0.1 MΩ ± 10%, 1 W
R-1472	0.24 MΩ ± 5%, 1 W
R-1473	10 Ω ± 10%, 1 W
R-1474	910 Ω ± 5%, ½ W
R-1475	1 MΩ ± 10%, 1 W
R-1476	0.24 MΩ ± 5%, ½ W
R-1477	3 kΩ ± 5%, ½ W
R-1478	0.47 MΩ ± 10%, ½ W
R-1479	10 kΩ ± 10%, 1 W
Five resistors used in pot.	10 kΩ ± 10%
R-903, R-2001 and R-2051	Protective resistors

RESISTORS—*contd.*

reference Circuit	*Descrtpiion*
R-1480	1 MΩ ± 10%, ½ W
R-1481, R-1482	750 Ω ± 10%
R-1483	300 Ω ± 10%
R-1484, R-1485	50 Ω ± 10%, 1 W
R-1486, R-1487	470 Ω ± 10%, ½ W
R-1488	1 MΩ ± 10%, ½ W
R-1489	5 Ω ± 5%
R-1490	3 kΩ, 25 W, potentiometer
R-1498	65 kΩ ± 1%
R-1499	9,300 Ω ± 1%
	10 kΩ ± 0.1%

MISCELLANEOUS

Circuit reference	*Description*
F-1451, F-1452	Fuse, 5 A, type 3AG
1-1451, 1-1491	Indicator lamp, 6-8 V
	Lamp base
J-1451 to J-1453	Receptacle
J-1454	Receptacle tip jack
L-1451	Retard coil
S-1451	Switch, rates 5 A at 250 V, 12 A at 125 V, double-pole, single-throw
S-1492	Switch, S.P.S.T.
T-1451 to T-1453	Transformer
V-1451	Valve, VR-105-30
V-1452	Valve, 5U4G
V-1453, V-1454	Valve, 6B4G
V-1455, V-1456	Valve, 6SL7GT
V-1457	Valve, 6SL7GT
V-1458	Valve, 6L6G
X-1451 to X-1458	Valve socket, octal
X-1491	Lamp socket

Table 1022—Details of components of rectifier RA-70 (Figs. 1057 and 1058)

T OY-922/1
UK-1-1059

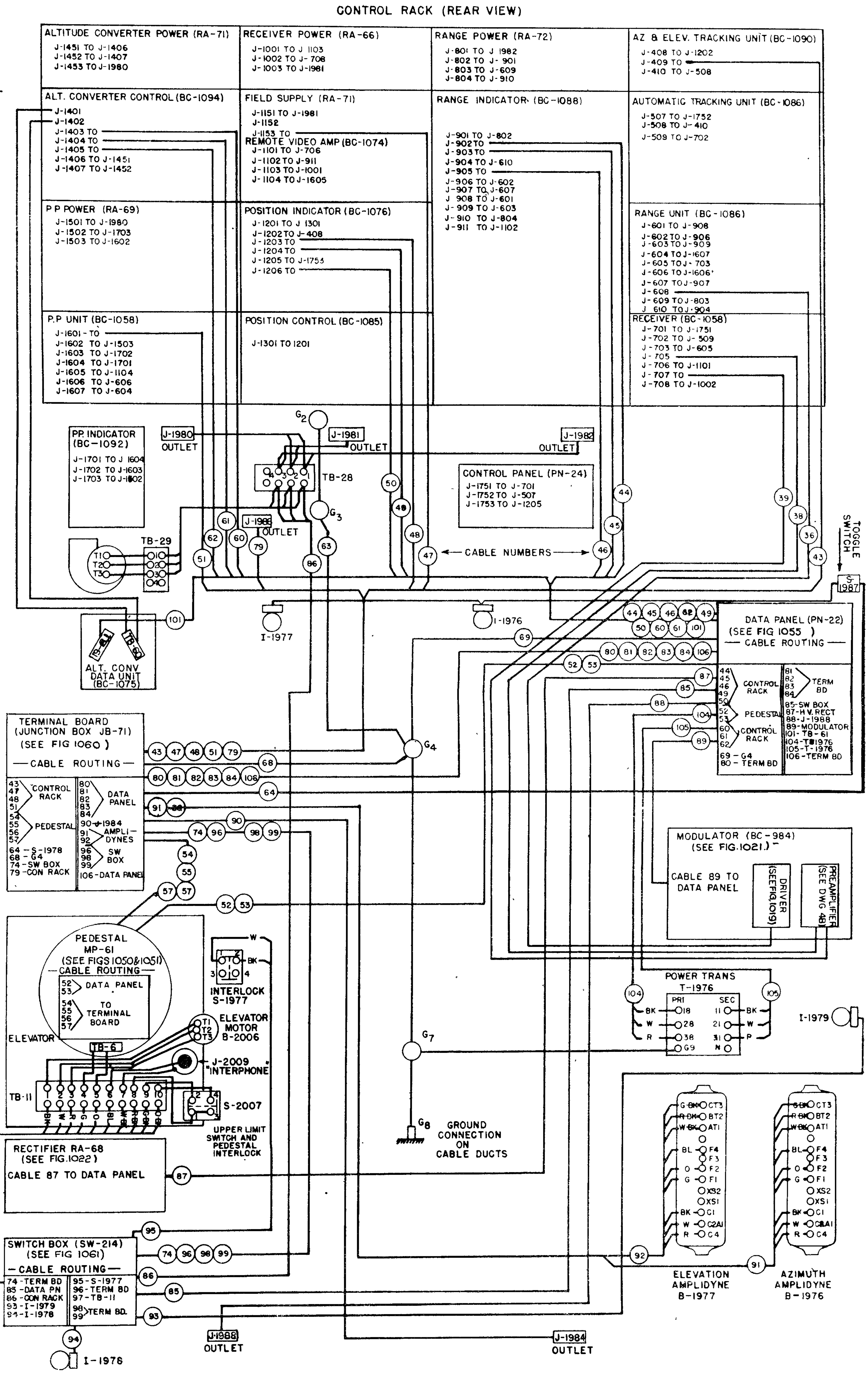


Fig. 1059—Trailer wiring, control rack

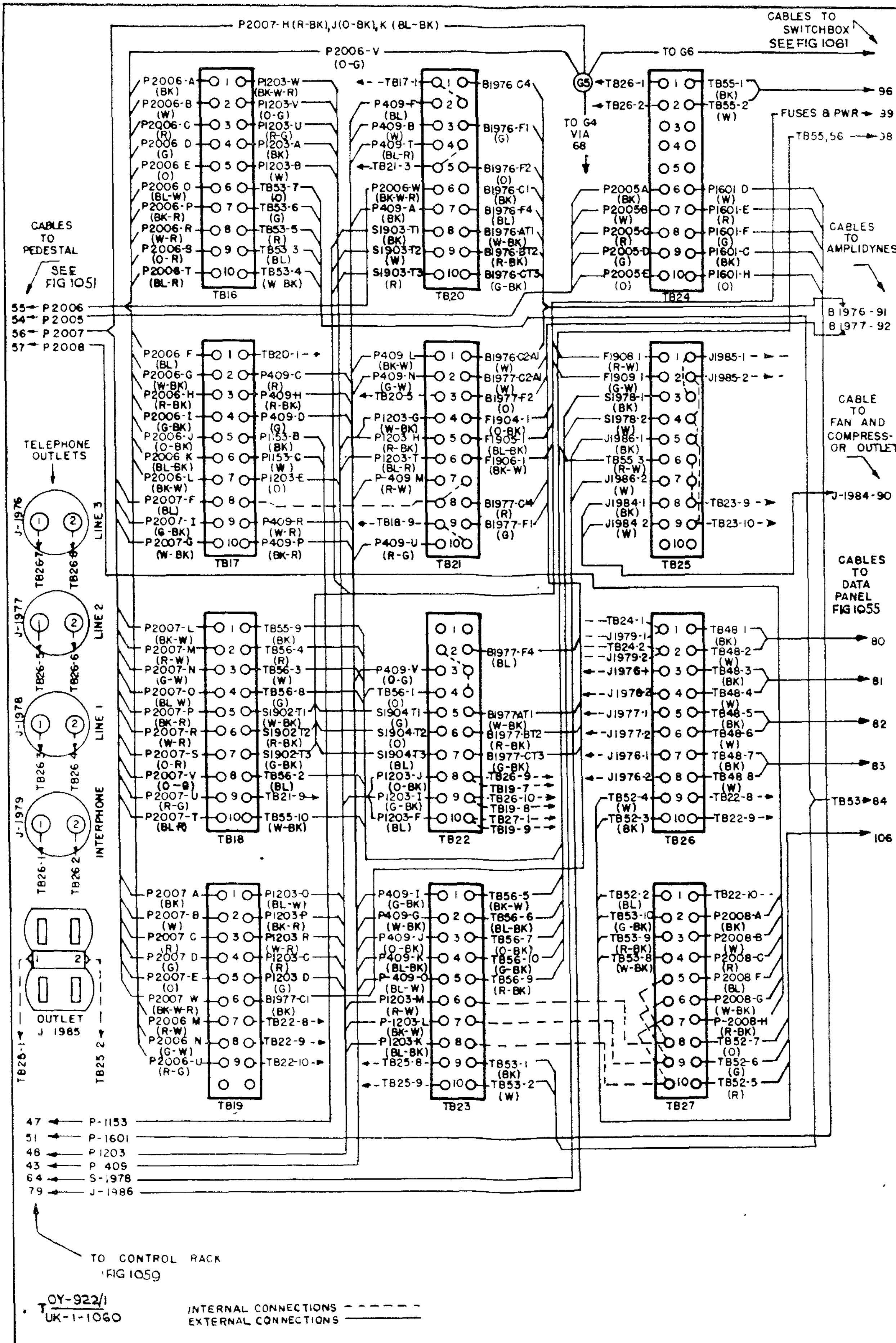


Fig. 1060—Trailer wiring, terminal board

Circuit reference	*Name of part*	*Description*
B-1978	Blower	
CR-1901, C-1902	Contact rectifier	Single-phase, half-wave
F-1901 to F-1909	Fuse	25 A, 250 V, renewable, cartridge type
F-1901A, F-1904A, F-1907A	Fuse holder	Triple holder
I-1926	Lamp holder	Candelabra
I-1926A	Lamp	6 W, 115 V, candelabra base
J-1901	Receptacle	110 V duplex
J-1926 to J-1929	Receptacle	19-pole
J-1930	Receptacle	
J-1931	Receptacle	110 V duplex
J-1976 to J-1979	Receptacle-jack plug	
J-1980 to J-1982, J-1985, J-1986	Receptacle	110 V, duplex
K-1901	Contactor-reversing starter	1–1/2 h.p., 3-pole, 110 V, 60 c/s
S-1901	Switch-push-button	3-button station
S-1902 to S-1904	Switch-starting	110 V, 3-phase, 1–1/2 h.p., size 0
S-1905	Switch	110 V, 20 A, D.P., indicating
S-1926	Switch	D.P.S.T., 10 A, 240 V
S-1927	Switch	2-section, 8-pole, 2-position
S-1951	Switch-interlock	
S-1976	Switch-main line	100 A, 3-pole, 250 V A.C.
T-1901, T-1902	Transformer	50 V to 200 V C.T., 30 c/s
T-1976	Transformer, adjustable	12 kVA, 3-phase, 50/60 c/s, 105 to 125 V

Table 1023—Components of trailer wiring of switch box SW-214, (Fig. 1061)

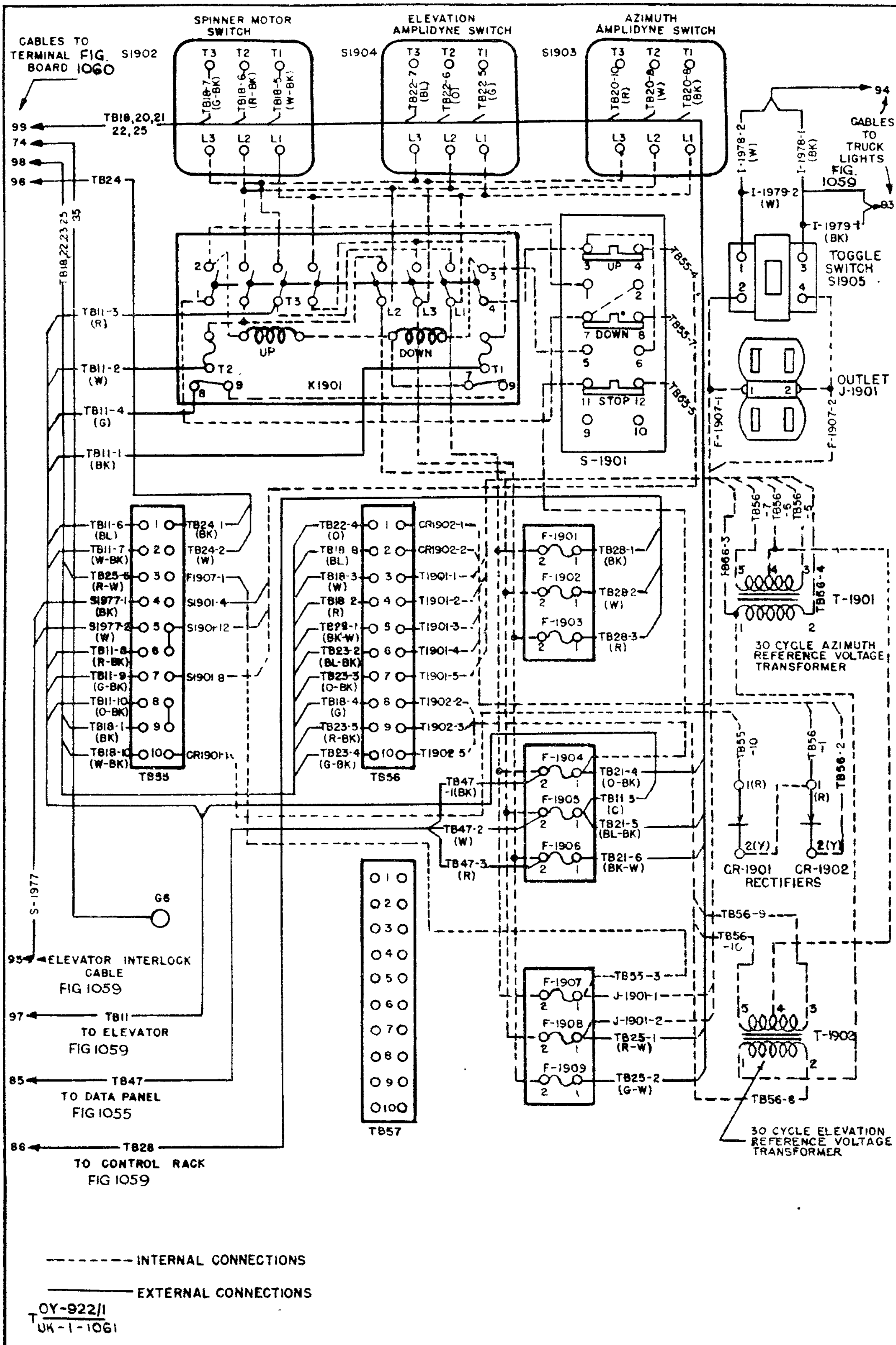


Fig. 1061—Trailer wiring, switch box

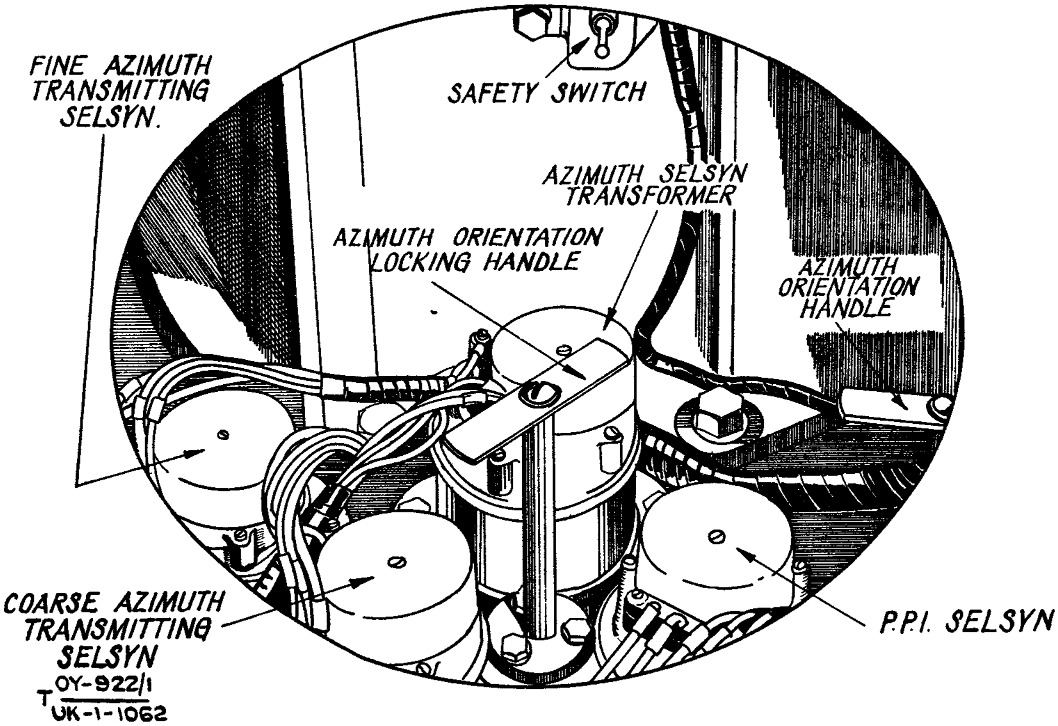


Fig. 1062—Azimuth selsyn compartment in base of pedestal

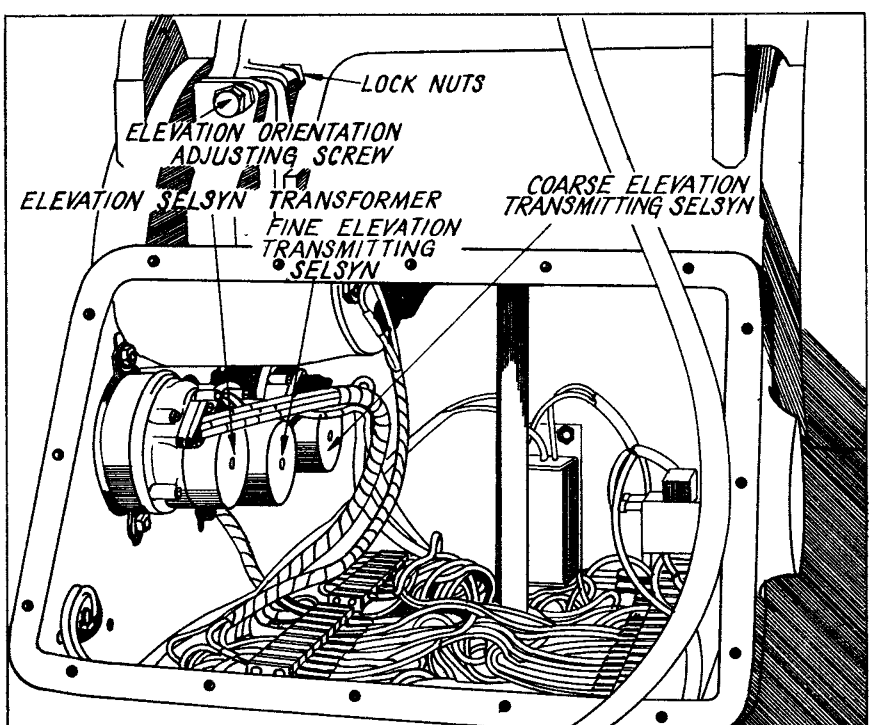


Fig. 1063—Elevation selsyn compartment in yoke of pedestal

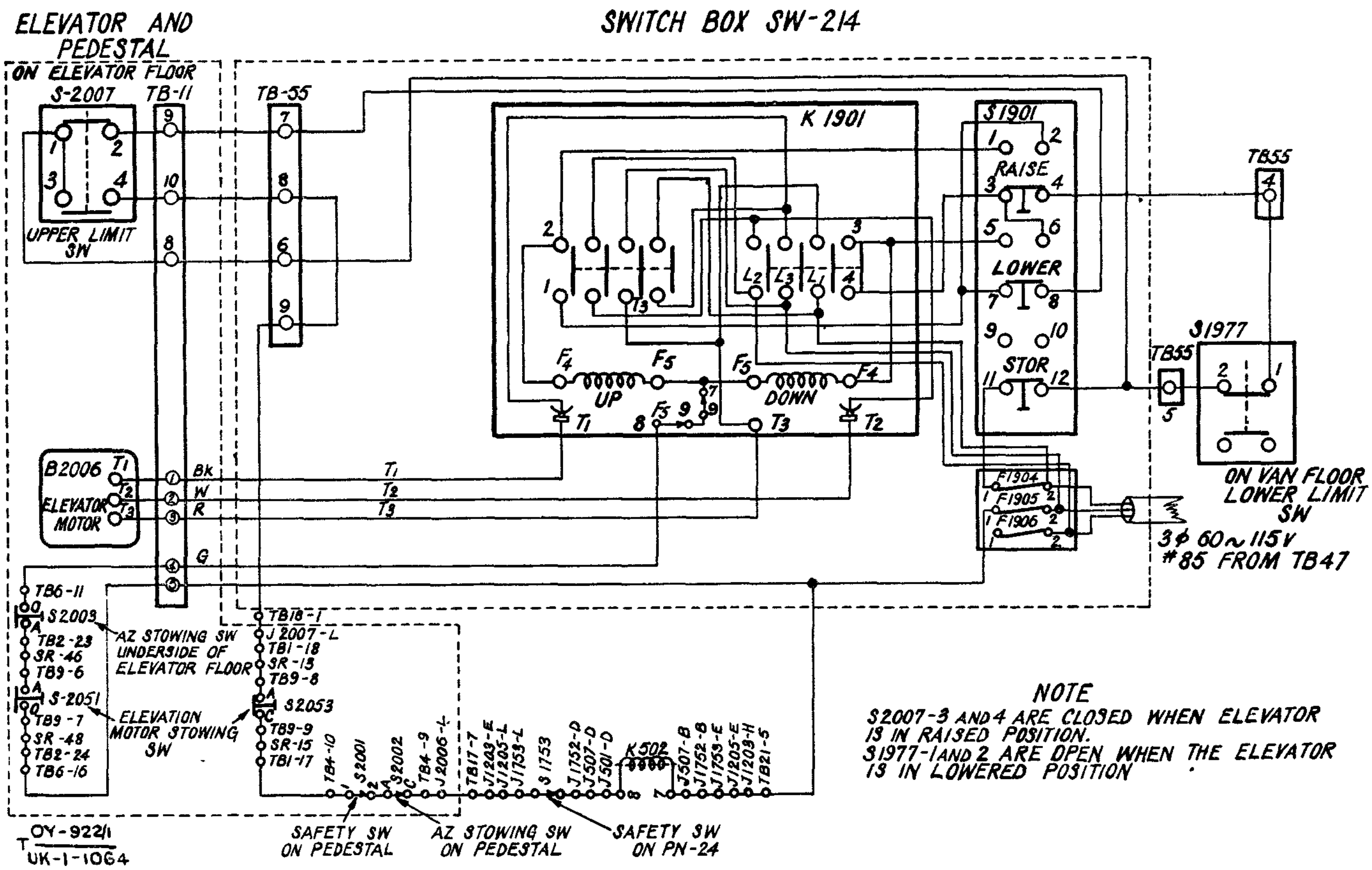


Fig. 1064—Elevation control circuits, reversing selsyns and interlocks

END

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ELECTRICAL AND MECHANICAL ENGINEERING REGULATIONS

CONFIDENTIAL

TELECOMMUNICATIONS OY 103

EQUIPMENT RADAR A.A. NO. 3, MK. V

(SCR-584 A and B)

ADJUSTMENT AND REPAIR IN FIRST ECHELON

This information is provisional and is supplied for the guidance of RA and REME pending the issue of more complete instructions. All errors of a technical nature should be reported in accordance with EMER Tels AY 009.

Issue 1 October 1944 **DISTRIBUTION-CODE NO-5 PLUS**

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(SCR-584 A AND B)

ADJUSTMENT AND REPAIR IN FIRST ECHELON

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WARNING: Before working on the high voltage power supplies, or chassis fed by these supplies, the Mechanic must always ensure that the circuit is not at a high potential by earthing it with a screw-driver having an insulated handle. This is particularly important on the high voltage rectifier and modulator racks.

INSTALLATION AND OPERATING INSTRUCTIONS

Purpose

1. This section has been compiled with a view to providing information to enable maintenance personnel to test the equipment operationally after repairs or adjustments have been effected.

2. The instructions contained in the sections devoted to assembling and dismantling the equipment have been arranged according to the order in which they will be carried out.

SITING

Requirements

3. (a) The sector under observation must not be screened by solid obstacles such as trucks, buildings, trees or hills.

(b) A site about 26 feet long by 16 feet wide, level within 10 degrees, is required for the actual set. Owing to the use of a paraboloidal reflector giving sharp focussing of the beam, the ground need not be particularly level outside these limits.

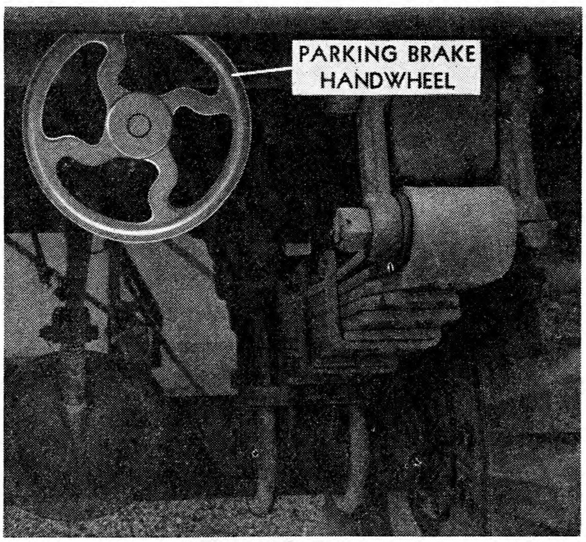
(c) Because of cable length, the maximum separation between the SCR-584 and the power unit is 300 ft.

(d) For the same reason, the maximum separation between the SCR-584 and the predictor is 225 ft.

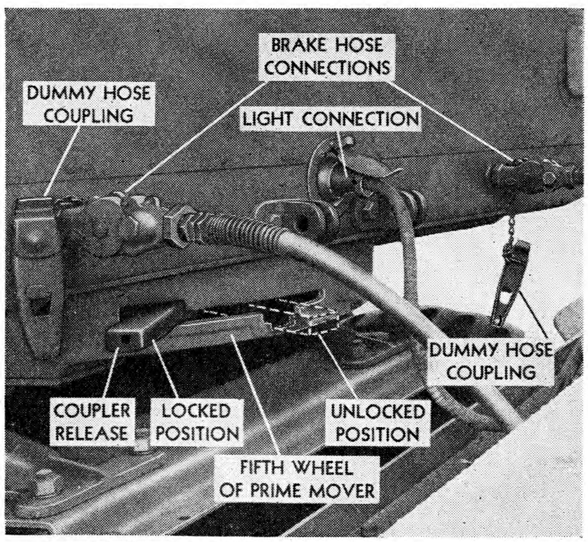
SETTING UP THE TRAILER

Uncoupling the trailer

4. (a) Direct the driver of the towing vehicle to the selected site.



T $\frac{\text{OY-103}}{\text{1-1}}$ **Fig. 1—View of part of rear of trailer, showing parking brake handwheel**



T $\frac{\text{OY-103}}{\text{1-2}}$ **Fig. 2—View of part of front of trailer showing coupler release and towing vehicle connections in position.**

EQUIPMENT RADAR A.A. No. 3, MK. V

(SCR-584 A AND B)

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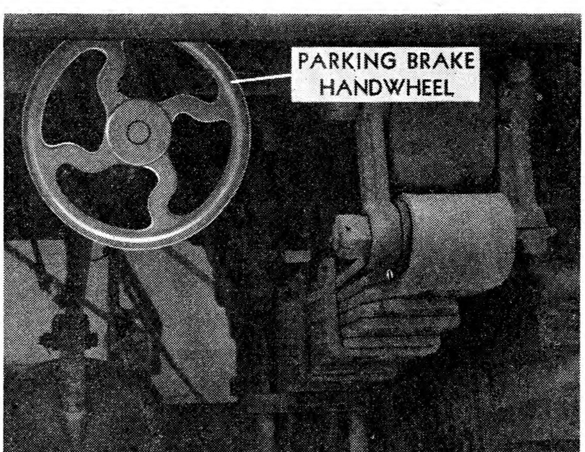


T $\frac{\text{OY-103}}{\text{1-1}}$ **Fig. 1—View of part of rear of trailer, showing parking brake handwheel**

(b) A site about 26 feet long by 16 feet wide, level within 10 degrees, is required for the actual set. Owing to the use of a paraboloidal reflector giving sharp focussing of the beam, the ground need not be particularly level outside these limits.

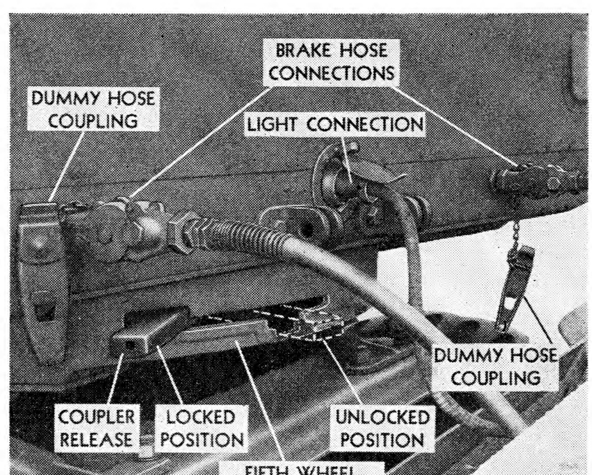
(c) Because of cable length, the maximum separation between the SCR-584 and the power unit is 300 ft.

(d) For the same reason, the maximum separation between the SCR-584 and the predictor is 225 ft.

SETTING UP THE TRAILER

Uncoupling the trailer

4. (a) Direct the driver of the towing vehicle to the selected site.



T $\frac{\text{OY-103}}{\text{1-2}}$ **Fig. 2—View of part of front of trailer showing coupler release and towing vehicle connections in position.**

(b) Apply the parking brake fully by rotating the handwheel located near the right rear spring in a clockwise direction (Fig. 1). Pull the crank handle for the support wheels, located below the centre of the right-hand side of cabin, free of its clips. Crank the support wheels fully downward to a vertical position, placing planks beneath them if the ground is soft. Replace the handle in its clips.

(c) Close the cut-off cocks on the air hoses of the towing vehicle.

(d) Disconnect both air hoses from the trailer by raising each hose until its coupling is free, thus automatically setting the trailer airbrakes.

(e) Fit the dummy hose couplings to the trailer hose connections and place the two hose couplings in the dummy sockets on the towing vehicle (Fig. 2).

(f) Disconnect the light-connection from the trailer.

(g) Release the coupling between the trailer and the towing vehicle by moving the coupler-release lever to the fully-forward position (Fig. 2).

(h) Drive the towing vehicle ahead slowly until the dolley is separated from the trailer.

Rough levelling of the trailer

5. (a) Remove the gravity latch pin, which holds the entire right-hand front jack assembly in the travelling position, and lower the jack downwards.

(b) Using the gravity latch pins as shown in Fig. 3, fit the removable side brace and the inner folding brace, which are stowed in the storage compartment.

(c) Repeat (a) and (b) above for the left front jack, referring to Fig. 4.

(d) Repeat for the rear jacks, referring to Figs. 5 and 6.

(e) Lay planks on the ground beneath the four jacks if the ground is soft.

(f) Using the hand cranks provided in the storage compartment, lower the jacks until all of them just touch the ground.

(g) With two men working together, lower the two front jacks until the support wheels are 2 or 3 inches clear of the ground.

(h) Using the hand cranks, lower the rear jacks until the weight is removed from the rear wheels.

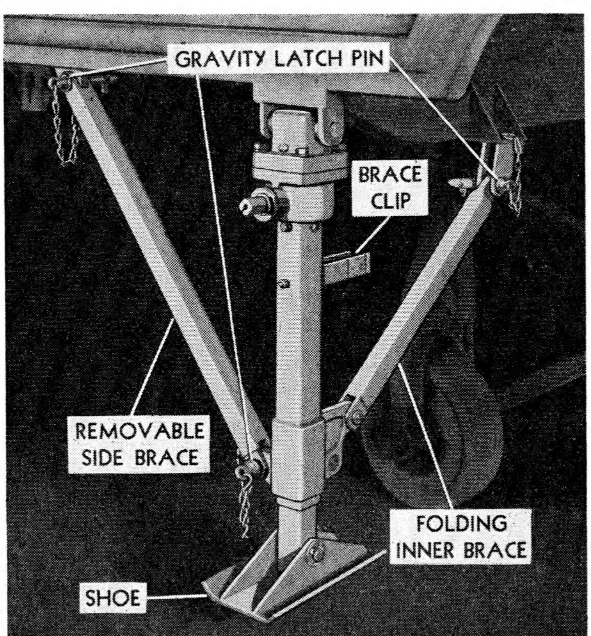
(i) Enter the trailer by the single door on the left side near the front. Hook the ladder, found just inside this door, into the catches in the sill.

(j) From the inside, unlock and open the large double door, which is locked with a cylinder-type lock. It may also be thumb-latched on the inside.

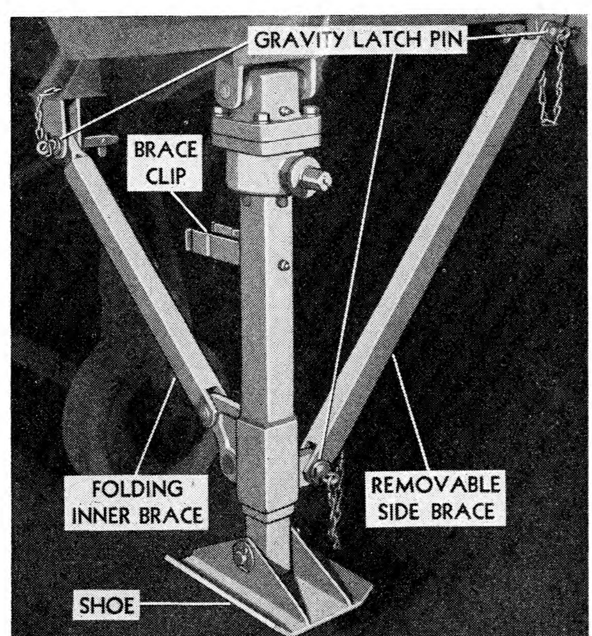
(k) With one man on the trailer watching the spirit levels, mounted on the yoke on the pedestal, and instructing the men handling the jacks, roughly level the trailer longitudinally and laterally until the bubbles are approximately in the centre of the glass tubes.

Earthing the equipment

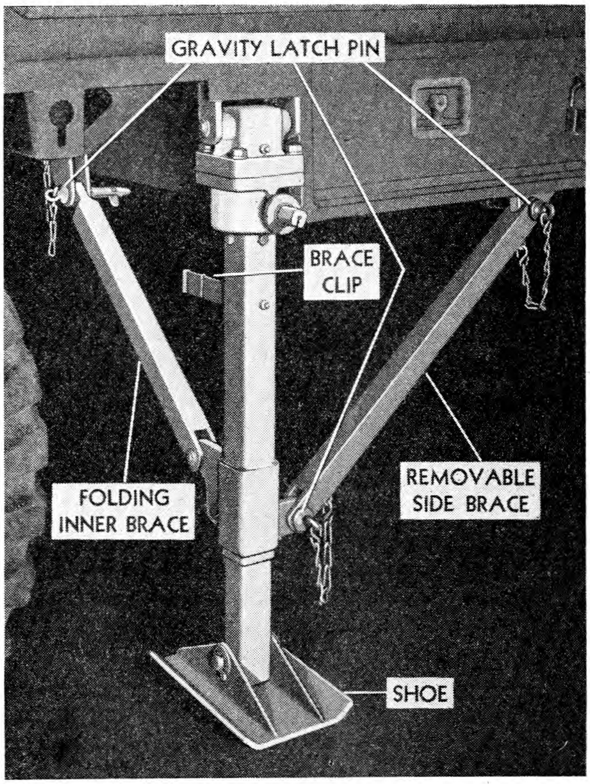
6. The earthing pin should be installed before the power is switched on. Remove the pin and its attached cable from the storage compartment. Clean any dirt or corrosion from the free end of the cable and fasten it securely



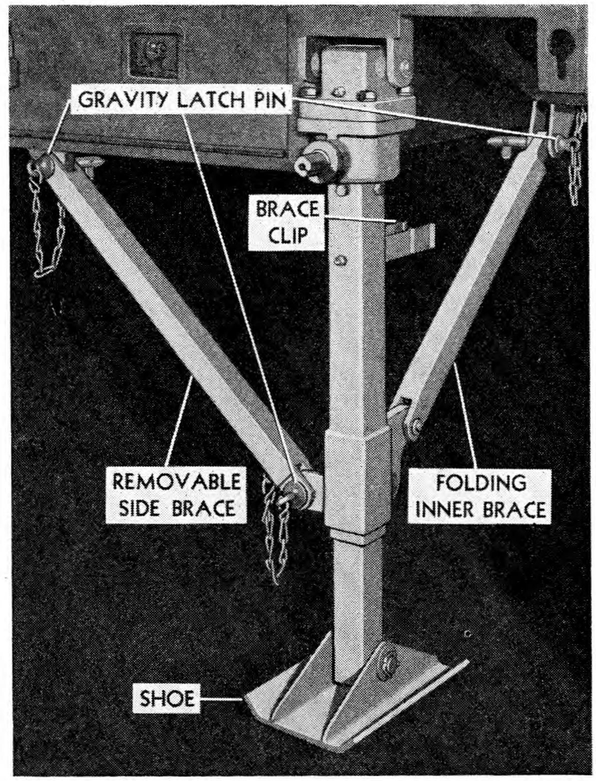
T $\frac{\text{OY-103}}{\text{1-3}}$ **Fig. 3—Right front levelling jack**



T $\frac{\text{OY-103}}{\text{1-4}}$ **Fig. 4—Left front levelling jack**



T $\frac{\text{OY-103}}{\text{1-5}}$ **Fig. 5—Right rear levelling jack**



T $\frac{\text{OY-103}}{\text{1-6}}$ **Fig. 6—Left rear levelling jack**

under the GROUND wing-nut on the data panel underneath the trailer. Make certain that the end of the cable is securely fastened to the clamp and that the clamp itself is tight on the pin. Drive the stake deep into the ground at some convenient spot. If the soil is dry, keep it moistened around the stake.

Initial precautionary equipment settings

7. (a) The voltage regulator control must be turned fully anticlockwise.

(b) The main line switch must be in the OFF position.

NOTE: The main line switch is contained only in later models of the SCR-584.

(c) On the control rack the following switches must be in the down position.

(i) The P.P.I. power supply on-off switch.

(ii) The altitude converter power supply on-off switch.

(iii) The receiver power supply on-off switch.

(iv) The range power supply on-off switch.

(v) The automatic tracking unit on-off switch.

(vi) The receiver A.G.C. switch must be set to OFF.

(d) On the control panel.

(i) The DIRECTOR SIGNAL switch must be set to OFF.

(ii) The CONTROL SWITCH must be set to MANUAL.

(iii) The SAFETY switch must be set to STOP.

(e) On the high voltage rectifier rack.

(i) The LINE CIRCUIT BREAKER must be in the OFF position.

(ii) The FILAMENT CONTROL must be fully anticlockwise.

(f) On the modulator rack.

(i) The POWER switch must be in the OFF position.

(ii) The OSCILLATOR FILAMENT control must be fully anticlockwise.

(iii) The KEYER FILAMENT control must be fully anticlockwise.

(g) On the local oscillator unit.

(i) The FILAMENT switch must be in down position.

(ii) The PLATE switch must be in the down position.

(h) In the switch box.

(i) The AZIMUTH MOTOR switch must be in the OFF position.

(ii) The ELEVATION MOTOR switch must be in the OFF position.

(iii) The SPINNER MOTOR switch must be in the OFF position.

(i) On the dehydrator.
  (i) The ON-OFF switch must be in the OFF position.

(j) All the plugs connecting to the amphenol sockets in units in the modulator and control racks must be screwed fully home.

Application of power

8. (a) Plug in the power cable to the data panel.

(b) Switch on the main line switch if fitted.

(c) Throw the LINE CIRCUIT BREAKER on the high voltage rectifier rack to the ON position. The green pilot light should glow and the blower motor in the rack should start.

(d) After noting the reading of the LINE VOLTMETER on the high voltage rectifier rack, turn the voltage adjuster control clockwise until the LINE VOLTMETER reads 115 V.

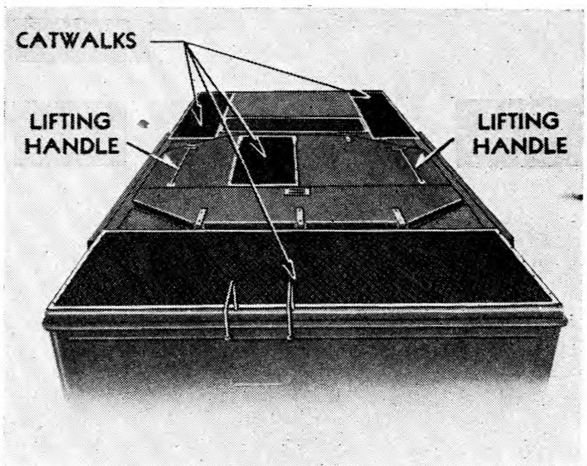
Phasing the power supply

9. (a) Throw the LINE CIRCUIT BREAKER to the OFF position, open the door of the high voltage rectifier rack and observe the fan of the cooling blower as it comes to rest. If the power supply is correctly phased, the fan will be seen rotating in a clockwise direction. If the direction of rotation is not clockwise, the phase is incorrect.

(b) To correct the phase, throw the main switch at the power supply generator to the OFF position, and interchange any two of the three leads connected to terminals 11, 21 and 31 on the voltage adjuster.

(c) Switch on the power at the generator and close the door of the rectifier rack.

(d) Set the LINE CIRCUIT BREAKER to the ON position. This will start the blower motor in the rectifier. Stop the motor again by setting the LINE CIRCUIT BREAKER back to the OFF position and observe the direction of rotation of the fan as it slows down.



T $\frac{\text{OY-103}}{\text{1-7}}$ **Fig. 7—Roof of trailer showing catwalks**

Opening the roof hatch

10. (a) Release the four roof hatch latches inside the trailer. Sweep any accumulation of rain water from the moveable section of the hatch with a broom. Open the rear section of the hatch first, by raising it and folding it back. Two men are required for opening the front section, one on each side. Use the two large handles to pull the door up and towards the front of the trailer until it rests upon the roof, (Fig. 7).

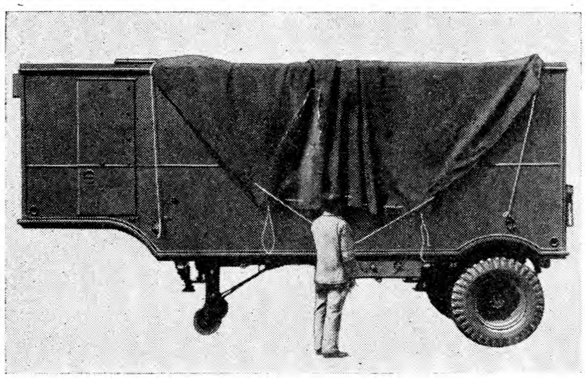
NOTE: Whenever possible, during any operations on the roof of the trailer, personnel should stay on the grilled catwalks.

Installing the storm curtain over the roof hatch

11. The large tarpaulin, supplied as part of the trailer equipment, is designed to act as a storm curtain to cover the roof hatch while the antenna pedestal is being raised into the operating position during bad weather, and to protect components in the control rack when it is necessary to have the back door open.

12. Install the curtain as follows:

(a) Refer to Fig. 8. Place the folded curtain over the hatch opening, so that equal amounts hang over the two sides of the trailer. The curtain is marked with the words Side and End to ensure correct installation.

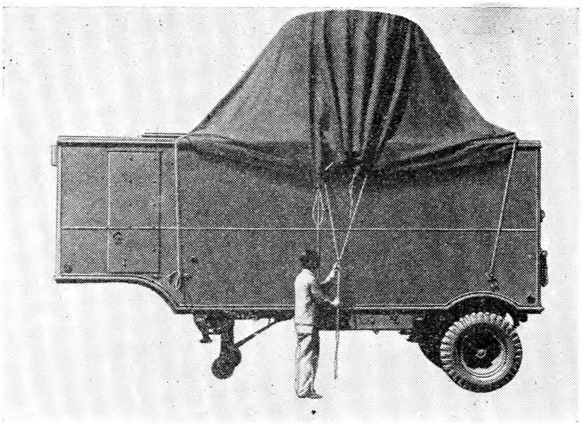


T $\frac{\text{OY-103}}{\text{1-8}}$ **Fig. 8—Storm curtain in position to raise pedestal**

(b) Pull the rear end of the curtain towards the rear of the trailer, so that it will drape over the back edge of the open rear hatch door.

(c) Pull the front end of the curtain forward until it is even with the front edge of the roof rub-rail.

(d) Fold all the surplus curtain into two large pleats at the centre of the hatch.



T $\frac{\text{OY-103}}{\text{1-9}}$ **Fig. 9—Storm curtain in position with pedestal raised**

(e) Tie the rear ropes to the rear hoisting brackets, making sure that the curtain is securely anchored over the rear hatch door.

(f) Bring the front ropes around the front edges of the roof rub-rails and tie them to the front hoisting brackets. Leave these ropes slightly loose to allow for movement of the curtain.

(g) In a high wind, two men should hold the centre ropes, one at each side, to prevent the curtain from blowing out of position.

(h) The pedestal may now be raised. The surplus curtain pleated at the centre will unfold as the pedestal rises, keeping it entirely covered to its maximum limit of travel, as shown in Fig. 9.

Raising the elevator

13. (a) Remove the canvas covers from the four elevating screws.

(b) Remove all four clamping screw nut assemblies.

(c) Make certain that the rubber weather stripping around the top edge of the elevator platform is clean, and remove all loose objects which may have been stored on the platform. Make certain that the clamp hooks for the roof doors are pulled back against the wall so that they do not catch on the edges of the elevator platform. **NOTE: Never use the elevator to carry personnel, tools or equipment to the roof of the trailer.**

(d) Switch on the LINE CIRCUIT BREAKER, open the door of the switch box which is located inside the trailer near the single door, and press the button marked RAISE on the 3-button switch labelled ELEVATOR SWITCH.

(e) One person must watch the elevator closely as it rises to ensure that the elevation drive motor is switched off by the upper travel limit switch. If the limit switch fails to trip, the STOP button in the switch box must be immediately pressed to prevent damage to the elevating mechanisms.

(f) When the elevator platform has reached the upper limit of travel it must still be raised about ¼ inch in order to seal the roof hatch. This is done manually with the aid of the four clamping screw nut assemblies which were removed when the elevator was in the lowered position.

(g) Place the four clamping nuts on the studs projecting through the platform at the four corners. Tighten the nuts in succession, by hand, taking approximately one turn on each at a time, until the platform is as high as it will go.

(h) Remove the two drain hoses from the clamps under the elevator platform and place them on the nipples projecting down from the platform. The lower ends of the hoses are placed in the drain holes in the side walls.

(i) Replace the canvas covers on the elevating screws to prevent accumulation of dirt on the screw threads.

(j) Remove the storm curtain from the pedestal if it was used.

Unlocking the pedestal

14. (a) Turn the azimuth locking handle on the pedestal anticlockwise as far as possible. This releases the azimuth stowing lock.

(b) Turn the elevation locking handwheel counterclockwise until a distinct click is heard as the lock holding pin drops into place. The locking handwheel controls the elevation stowing lock.

(c) Check to see if the safety switch in the azimuth selsyn compartment is in the RUN position.

Levelling the pedestal

15. (a) Set the toggle switch on the automatic tracking unit to the up position. The red pilot light adjacent to the toggle switch will glow. Wait 15 seconds for the valve cathodes to reach normal operating temperature.

(b) Set the CONTROL SWITCH on the control panel to AUTOMATIC.

(c) Set the SAFETY switch to the RUN position. Wait 5 seconds and then set the CONTROL SWITCH to MANUAL.

(d) Set the key switch on the azimuth and elevation tracking unit to AZIMUTH, and each FIELD CURRENT meter should indicate about 25 mA.

(e) Set the AZIMUTH MOTOR switch in the switch box to the ON position.

(f) Continue the levelling begun in para. 5 with one man on the trailer who directs the levelling from a position on the roof where he can observe the levels on the pedestal.

(g) Note the reading of the longitudinal level on the yoke of the pedestal.

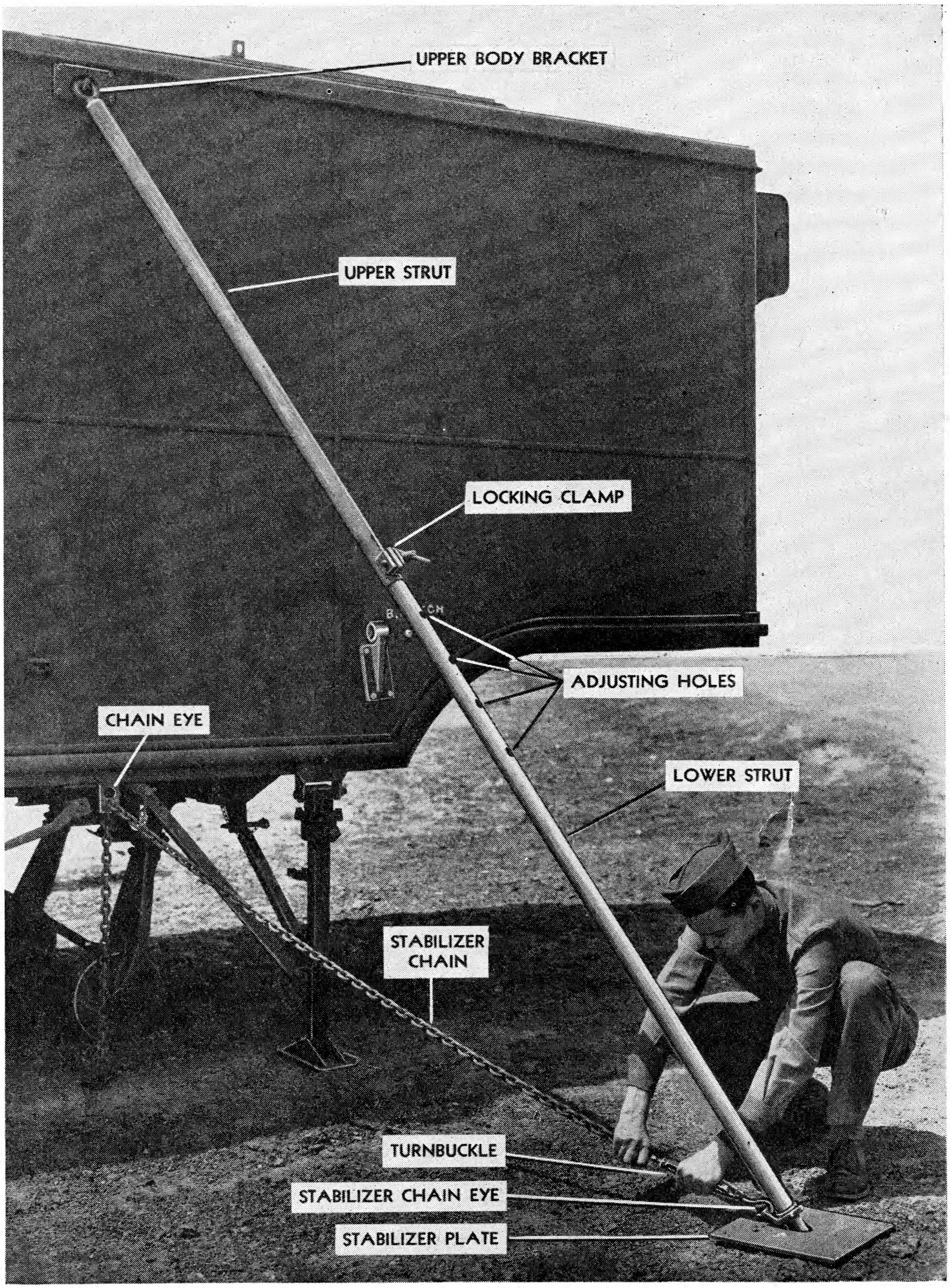


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Fig. 10—Stabiliser assembly in position, turnbuckle being tightened

(h) Rotate the paraboloid through 180 degrees in azimuth and note the travel of the bubble in this level.

(i) Adjust both the jacks at one end of the trailer by an equal amount, to halve the travel of the bubble.

NOTE: Do not use the levelling screws at the base of the pedestal.

(j) Repeat (f) to (i) using the cross level and the pair of jacks at the low side of the trailer.

(k) Continue to rotate the paraboloid through 180 degrees and adjust each pair of jacks concerned to halve the travel of the bubbles, observing the longitudinal and cross levels alternately, until the bubble travel in both cases is reduced to a minimum.

(l) Slowly rotate the paraboloid through 360 degrees and check the total movement of the bubbles in the levels.

(m) Continue the above procedure until the total movement of each of the bubbles in (l) is less than one division (2 mins.)

Stabilising the trailer

16. (a) Remove the four stabiliser struts, four turnbuckles, four anchor chains, and four stabiliser plates from the storage compartment of the trailer. Place one of each of these items near each jack for convenience. Do not permit dirt or sand to get on the threads of the turnbuckles.

(b) Refer to Fig. 10. Slacken the locking clamp handle, and slide the lower strut out until the locking pin, which is under the locking clamp handle, falls into the fifth adjusting hole in the lower strut. Tighten the locking clamp handle. (The other holes in the lower struts are provided for lengthening or shortening the struts when the ground around the trailer is not level).

(c) Hook the eye of the upper strut over the prong of the upper body bracket, ensuring that the eye of the bottom end of the lower strut is pointing toward the trailer. Place the turnbuckle hook in the lower strut eye, and pull the other end of the chain through the hole in the lower body bracket, until most of the slack is taken up.

(d) Put the stabiliser plate in place on the ground, letting the prong on the end of the lower strut project through the hole in the plate.

(e) Dig the point of the lower strut into the ground (through the stabiliser plate) and take up any slack in the chain by tightening it at the chain-eye bracket. The chain will be held in place if it is pulled tight and a link is put edgewise into the chain-link slot. Stamp on the chain, close to the stabiliser strut, thereby driving the sharp point of the stabiliser strut deep into the ground. Take up the resulting slack in the chain at the chain-link slot.

(f) Repeat the foregoing procedure for the other three stabiliser assemblies.

(g) Adjust each stabiliser by means of the turnbuckle until a reasonable tension on the chain is obtained. This adjustment can be determined only by experiment, but care should be exercised that the level of the trailer body is not changed.

NOTE: Do not adjust the stabilisers so that they support the weight of the trailer. They are used merely to prevent side-sway.

(h) Rotate the pedestal in azimuth and check that the levelling is still within the tolerance laid down in para. 15 (n).

OPERATION OF THE PETROL HEATER

Preliminary

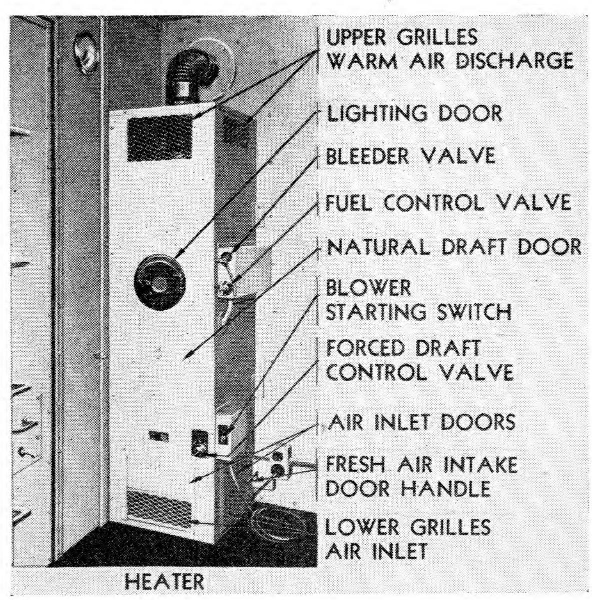
17. (a) Refer to Fig. 11. Turn the fuel control valve to the OFF position.

(b) Turn the forced draught control valve to the OFF position.

(c) Ensure that the fuel tank located on the front of the trailer, near the roof, contains sufficient petrol for operation.

NOTE: The removable ladder stowed inside the single door may be attached to the cleats on the front of the trailer in order to inspect and fill the tank.

(d) Turn the shut-off valve on the fuel tank to the on (vertical) position.



T OY-103 1-11 **Fig. 11—Petrol heater showing operating controls**

(e) At the heater, bleed the air from the fuel line by turning the bleeder valve handle anticlockwise, catching the escaping petrol in a can held at the opening of the drain pipe attached to the bleeder valve. Tighten the bleeder valve as soon as petrol starts to flow steadily without air bubbles.

NOTE: Bleeding the line is usually necessary only when the heater is lighted for the first time or after the fuel tank has run dry.

(f) Ensure that the natural draught door is closed (in the down position).

(g) To use re-circulated air, open the two air inlet doors on the lower grilles and close the fresh air intake door on the front of the trailer.

(h) To use fresh air, close the two doors on the lower grilles and open the fresh air intake door on the front of the trailer.

To operate the heater on forced draught

18. (a) Plug in the heater cable to one of the 115V A.C. sockets.

(b) Set the blower switch to the ON position.

(c) Open the lighting door and drop a small piece of lighted paper into the burner pilot, or dip into petrol the wick on the long wire which is supplied with the heater, and apply it to the burner pilot. The flame must reach the bottom of the burner pot.

(d) Ensure that the paper or wick is burning and turn the fuel control valve to the HIGH position.

(e) When the fuel starts to burn, turn the fuel control valve and also the forced draught control valve to the LOW position.

(f) Close the lighting door and allow the heater to warm up for 10 minutes.

(g) To increase the heat, turn the fuel control valve to MEDIUM or HIGH and set the forced draught control to the corresponding position.

To operate the heater on natural draught.

19. (a) Set the blower switch to the OFF position.

(b) Set the forced draught control valve to the OFF position.

(c) Raise the sliding natural draught door and open the lighting door.

(d) Drop a small piece of lighted paper into the burner pilot, or dip into petrol the wick on the long wire which is supplied with the heater, and apply it to the burner pilot. The flame must reach the bottom of the burner pot.

(e) Ensure that the paper or wick is burning and turn the fuel control valve to the HIGH position. When the fuel is burning, turn the control valve to the LOW position.

(f) Close the lighting door and allow the unit to warm up for 10 minutes.

(g) To increase the heat turn the fuel control valve to the MEDIUM or HIGH position. If black smoke comes out of the chimney, turn the fuel control valve in the opposite direction until the smoke disappears.

General notes

20. (a) When the heater is operating properly the fire will burn without soot or smoke, and the flame observed through the mica window of the lighting door will be a clean yellow colour.

(b) If black smoke issues from the chimney, fuel and air are not being properly supplied, and the fuel control valve should be adjusted to decrease the supply of fuel, or the forced draught supply should be increased until the smoke disappears.

(c) Any change in the amount of heat required necessitates adjustments of both fuel supply and the forced draught control.

(d) Never light the heater if the burner is hot.

(e) Always operate the burner just below the smoke point.

(f) Do not allow paper ash to accumulate in the burner pot.

(g) Do not open the fuel control valve before the lighted paper wick has been placed in the burner.

(h) Ensure that the paper or wick is still lighted when the fuel is turned on.

(i) Ensure that the fuel control valve is closed whenever the burner is lighted, or fuel will be washed through the overflow drain line.

To extinguish the heater

21. (a) Turn the fuel control valve to the OFF position.

(b) When the fire is out, close the sliding natural draught door.

(c) Turn the shut-off valve at the petrol tank to the off (horizontal) position.

Precautions to be taken in handling petrol near operating radar sets.

22. (a) Shut down the transmitter before attempting to fill the petrol heater fuel tank.

(b) Do not attempt to handle open petrol cans in any way that involves bringing metal objects in contact with them without first shutting down the transmitter.

(c) Do not use plastic containers for filling purposes as static electricity may cause igniting sparks.

PREPARING THE EQUIPMENT

Lowering the paraboloid

23. (a) Set the key switch on the azimuth and elevation tracking unit to ELEVATION, and each FIELD CURRENT meter should indicate about 25 milliamperes.

(b) Set the ELEVATION MOTOR switch in the switch box to the ON position.

(c) Slowly move the elevation (left) handwheel on the antenna position control unit until the ELEVATION indicator (left) dial on the antenna position indicator unit indicates zero degrees. Absolute accuracy is not required in attaining this setting. The paraboloid is now in position for convenient installation of the antenna.

(d) Set the ELEVATION MOTOR switch to the OFF position and the SAFETY switch on the control panel to the STOP position.

(e) Set the toggle switch on the automatic tracking unit to the down position. The red pilot light will cease to glow.

Installing the antenna

24. (a) Remove one of the two antenna units from its stowed position by unscrewing the locking nut from the threaded portion of the storage rack sleeve and sliding the unit out of the sleeve. Use extreme care in handling and installing the antenna to avoid bending the tubing or breaking the plastic cover.

(b) Inspect the gasket and make certain that is it not twisted and is in good condition.

(c) Remove the dust cap from the end of the transmission line in the centre of the paraboloid and insert the shaft of the antenna into the sleeve. It will be necessary to rotate the antenna gently until the key falls into the slot in the sleeve. The antenna will seat properly in the antenna sleeve only in one position. If the locking nut is tightened with the antenna in the wrong way round, the tracking circuits will not function correctly.

(d) The antenna locking nut should be tightened **by hand** as much as possible. Do **not** use a wrench.

(e) To prepare for the bleeding of the R.F. line, unscrew and remove the bleeder cap from the end of the antenna.

(f) Screw the dust cap, which was taken from the transmission line, on the stowing sleeve in the trailer from which the antenna was removed.

Installing the R.F. line

25. (a) Remove the R.F. transmission line sections from the stowing rack by unscrewing the wing nuts and removing the retaining cleats.

(b) Check the gasket at the end of each section of line, to make sure that it is in place and in good condition. The gaskets are essential for solid, airtight joints between coupled sections.

(c) Place the shorter section into position so that the straight end joins the fixed line leading from the modulator unit, and let it rest in the adjustable support indicated in Fig. 12. See that the short section of the right-angle is pointing in the direction of the pedestal base. The general location of the shorter section of line, when put in place, is shown in Fig. 13.

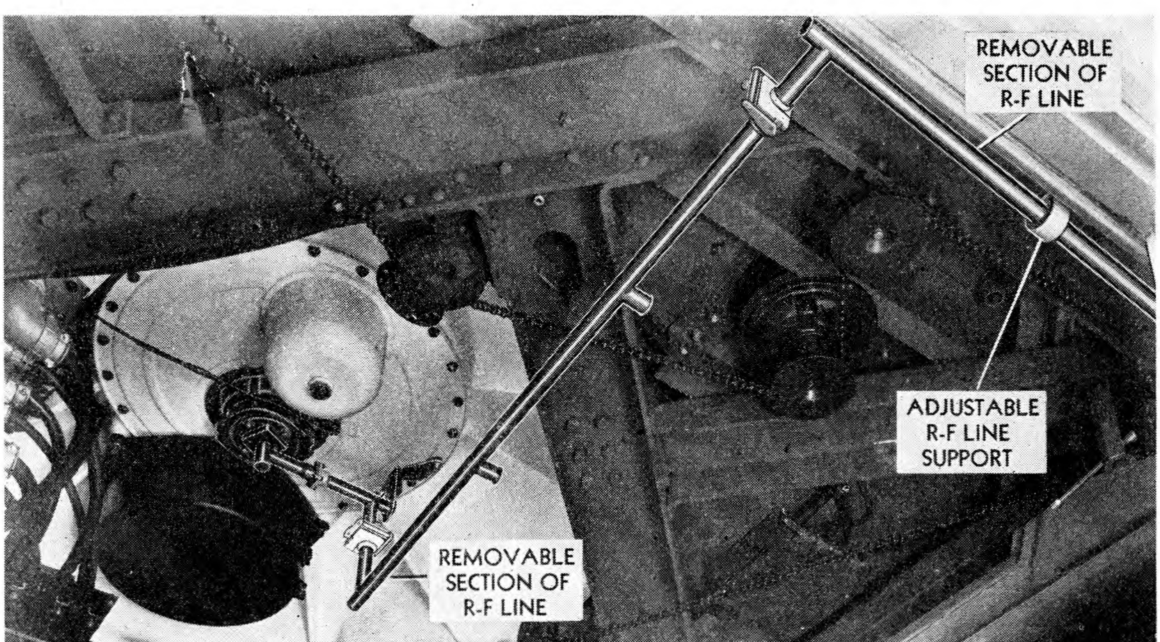


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Fig. 12—View of underside of pedestal showing R.F. line installed

(d) Install the longer section of line, with its straight end fitted into the right-angle end of the shorter section. The other end of the longer section is fitted into the fixed line section extending from the bottom of the antenna pedestal.

(e) Make certain that all three junctions in the line are tight, and then fasten the connectors. Care must be taken to avoid twisting or bending the line, and forcing the joints together until they are properly seated. The complete installation is shown in Fig. 12.

(f) Check all the electrical cables leading into the receptacles on the underside of the antenna pedestal. Ensure that the clamping rings are securely fastened.

Applying pressure to the R.F. line

26. (a) Set the line switch on the front panel of the dehydrator to the ON position. Since the bleeder cap on the antenna has been removed, the dry air from the dehydrator will flow through the line.

(b) At the end of about 15 minutes (in dry weather) replace the bleeder cap on the antenna and tighten it securely. Under extremely cold or humid weather conditions, it may be necessary to extend this bleeding period to 30 minutes.

(c) Check the pressure in the transmission line on the dehydrator pressure gauge.

(d) If the pressure gauge does not register close to 5 pounds per square inch, turn the LINE PRESSURE knob slowly until the desired pressure is obtained. Do not allow the pressure in the transmission line to exceed 5 pounds per square inch.

STARTING PROCEDURE

27. (a) Read the LINE VOLTMETER on the high voltage rectifier rack. This reads the voltage of phase AB and should indicate 115V. Press the PHASE BC button on the rectifier panel and read the LINE VOLTMETER. The voltage should be within 2V of the phase AB voltage. Press the PHASE AC button and read the indication on the LINE VOLTMETER. This reading should be within 2V of the phase AB voltage.

(b) If the amber pilot light on the high voltage rectifier panel is not glowing, press and hold down the LOWER button of the REGULATOR CONTROL until the amber light glows, to indicate that the high voltage regulator is set for minimum voltage output.

(c) Rotate the FILAMENT CONTROL on the high voltage rectifier until the FILAMENT VOLTMETER indicates 105V.

(d) Set the power switch on the modulator to the ON position. The white POWER pilot light should glow, indicating that the filaments are on. The modulator blower will have started and can be heard.

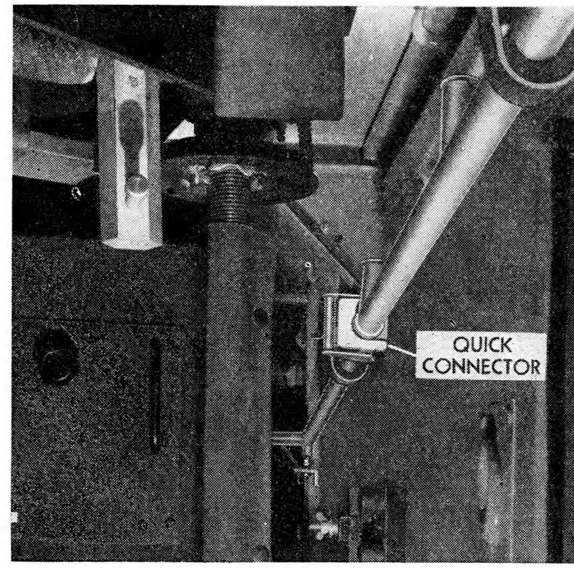

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Fig. 13—Installation of shorter section of R.F. line

(f) Set the toggle switch below the filament voltmeter (second meter from the right on the modulator) to the KEYER FILAMENT position.

(g) Turn the KEYER FILAMENT control clockwise until the filament voltmeter indicates 100V.

(h) Set the toggle switch below the filament voltmeter on the modulator to the OSCILLATOR FILAMENT position.

(i) Turn the OSCILLATOR FILAMENT control clockwise until the filament voltmeter indicates 100V.

(j) Set the power switches of the following units, all located on the control rack, to the up position:
- (i) The P.P.I. power supply unit. (The red pilot light will glow).
- (ii) The receiver power supply. (The red pilot lights on the receiver power supply and the receiver panels will glow).
- (iii) The range power supply. (The red pilot light on the range power supply and the pilot light on the range unit will glow).
- (iv) The automatic tracking unit. (The red pilot light will glow).

(k) Set the FILAMENT switch on the local oscillator panel to the up position. Wait 15 seconds and set the PLATE switch to the up position. The CRYSTAL CURRENT meter on the receiver panel should indicate between 0.15 and 0.5 mA.

(l) Thirty seconds should have elapsed since step (e) and the green READY pilot light on the modulator panel should be glowing. Press the START push button on the modulator panel. The amber BIAS light should glow, indicating the application of keyer bias voltage.

(m) Wait 5 seconds and press the CLOSE button of the CONTACTOR CONTROL on the high voltage rectifier panel. The green pilot light on that panel should go out and the red pilot light should glow, indicating that the high voltage can be increased.

(n) Press and hold down the RAISE button of the REGULATOR CONTROL on the high voltage rectifier panel. The amber pilot light will go out. Continue depressing the RAISE button and note that as the high voltage rises to approximately 10 KV, the red DRIVER PLATE pilot light on the modulator glows. Raise the high voltage to 20 KV and check the indication on the OSCILLATOR PLATE meter on the modulator panel. This should be 22 mA. Check the D.C. MILLIAMMETER on the high voltage rectifier panel which should indicate 30 to 35 mA.

NOTE: Extreme care should be exercised while the high voltage is being raised to keep the OSCILLATOR PLATE current from exceeding its limit of 27 mA. Special care is necessary because the OSCILLATOR PLATE current rises very rapidly as the high voltage increases from about 16 to 22 KV.

(o) Set the ELEVATION MOTOR, AZIMUTH MOTOR, and SPINNER MOTOR switches in the switch box to the ON position. (The elevation and azimuth motor-generators will be heard).

(p) When necessary, readjust the voltage adjuster so that the LINE VOLTMETER on the high voltage rectifier indicates 115V, or within 2V of that value, for all three phases.

NOTE: If the line voltage must be increased after the high voltage has been applied to the transmitting oscillator, the high voltage must first be lowered to between 12 and 14 KV.

(q) Restore the high voltage and recheck the indication on the OSCILLATOR PLATE meter on the modulator panel. The current should be 22 mA.

(r) Recheck the keyer and high voltage rectifier filament voltages and make any necessary adjustments.

(s) Warn any personnel who may be on the roof that the paraboloid is to be rotated. Turn the CONTROL SWITCH on the control panel to the AUTOMATIC position.

(t) Set the SAFETY switch on the control panel to the RUN position.

(u) Wait 5 seconds for the follow-up motors to operate, and then turn the CONTROL SWITCH to the MANUAL position.

(v) Check the readings of the meters on the modulator panel. On the VOLTAGE meter, the DRIVER GRID, DRIVER SCREEN, DRIVER PLATE, and KEYER GRID readings should all fall between the two red marks. On the CURRENT meter the DRIVER PLATE reading should be between 12 and 22 mA and the KEYER GRID reading between 11 and 17 mA.

TUNING THE LOCAL OSCILLATOR

28. (a) Adjust with a screwdriver the FOCUS and INTENSITY controls for the best definition of the traces on the 2,000 yard and 32,000 yard oscilloscopes.

(b) Set the paraboloid to zero degrees elevation by turning the elevation handwheel on the antenna position control unit.

(c) Switch the AGC switch on the receiver to the OFF position and set the receiver VOLUME control to obtain a noise level between ½ and ⅓ of the height of the main pulse on the 32,000 yard oscilloscope.

(d) Turn the azimuth handwheel on the antenna position control unit until a fixed target echo appears on the 32,000 yard oscilloscope. Adjust the SLEWING handwheel on the range indicator unit to bring the echo on to the 2,000 yard oscilloscope.

(e) Carefully adjust the knob in the upper right-hand corner of the local oscillator panel until the chosen echo is at its maximum height. Do not attempt to vary the position of the knob over its full range. The setting of the receiver VOLUME control must be such as to keep the amplitude of the selected echo below the saturation level of the receiver.

NOTE: The crystal current, as indicated on the meter located on the receiver panel, should be continuously observed during the tuning operation. The indication on the meter should not exceed 0.5 mA.

OPERATION

P.P.I. search

29. (a) Set the ELEVATION indicator to 20 degrees (350 mils) by turning the elevation handwheel on the antenna position control panel.

(b) Ensure that the SAFETY switch on the control panel is at RUN.

(c) Turn the CONTROL SWITCH on the control panel to P.P.I. SCAN.

(d) Set the RANGE SELECTOR switch on the P.P.I. unit to 70,000.

Setting the elevation scanning sector for P.P.I. search

30. (a) When the pointer on the ELEVATION index indicates that the reflector has been depressed to the lowest point, stop the scanning movement by turning the CONTROL SWITCH from P.P.I. SCAN to MANUAL.

(b) Turn the elvation handwheel on the antenna position control panel to the desired minimum elevation.

(c) Set the CONTROL SWITCH from MANUAL to P.P.I. SCAN.

(d) If it is desired to scan in azimuth only, the clutch is thrown so that the elevation scanning mechanism is disconnected. This clutch is not fitted on early equipments.

Manual tracking

31. (a) When a target has come within 32,000 yards of the equipment, set the RANGE SELECTOR control knob on the P.P.I. unit to 35,000 and the CONTROL SWITCH to MANUAL.

(b) Turn the elevation and azimuth handwheels to produce the brightest spot on the P.P.I. oscilloscope.

(c) By turning the SLEWING handwheel place the narrow strobe on the P.P.I. oscilloscope on the target. Observe that the target echo appears on the 2,000 yard oscilloscope.

(d) Set the RANGE MOTORS switch on the range indicator panel to ON.

(e) Adjust the range controls to position the V formed by the fine cursor and the short thick hairline about the echo on the 2,000 yard oscilloscope.

(f) Rotate the TRACKING handwheel to keep the fine range cursor aligned on the leading edge of the echo.

(g) Adjust the azimuth handwheel to keep the spot on the P.P.I. at its brightest and the elevation handwheel to keep the break on the 2,000 yard C.R.T. at maximum height.

Automatic tracking

32. Automatic operation is the method normally used for tracking targets. P.P.I. scanning and manual operation are utilized for locating and selecting targets before adjusting the equipment for automatic following.

33. With the equipment operating as detailed in paras. 31 (f), (g), set the CONTROL SWITCH to AUTOMATIC. Continue to keep the fine range cursor on the leading edge of the echo by movement of the tracking handwheel.

NOTE: It is usually necessary to adjust the NARROW GATE DELAY control from time to time in order to be able to keep the narrow strobe centered about the target.

Two signals in the narrow strobe

34. When there is the possibility that two targets may appear simultaneously in the narrow strobe, press the COAST button for about 4 seconds. When the COAST button is released, the selected echo should still be in the strobe on the 2,000 yard oscilloscope, and tracking should continue as before.

Remote control operation

35. During remote control operation, the positioning of the paraboloid in azimuth and elevation is controlled from the predictor. The determination of range only is carried on by the radar set. This type of operation is accomplished by setting the CONTROL SWITCH to the REMOTE position. All other settings correspond to those used for AUTOMATIC tracking.

SWITCHING OFF THE EQUIPMENT

NOTE: If the station is being closed preparatory to changing sites, the items marked with a double asterisk ** will not be done during the switching off procedure. They will be done after the detail given in para. 38 has been completed.

Normal stopping procedure

36. (a) Set the CONTROL SWITCH to the MANUAL position.

(b) Set the paraboloid to zero degrees elevation by rotating the elevation handwheel.

**(c) Set the SAFETY switch on the control panel to STOP.

(d) Set the RANGE MOTORS switch to OFF.

(e) Press and hold down the LOWER button on the REGULATOR CONTROL on the high voltage rectifier. When the voltage drops below 10 KV the red DRIVER PLATE pilot light on the modulator will go out. When the voltage is at a minimum the amber light on the high voltage rectifier will go on.

(f) Press the TRIP button on the CONTACTOR CONTROL on the high voltage rectifier. The D.C. VOLTMETER indication will fall to zero, the red pilot light will go out, and the green pilot light will go on.

(g) Set the PLATE switch of the local oscillator to the down position. The CRYSTAL CURRENT meter on the receiver will read zero.

(h) Set the FILAMENT switch on the local oscillator to the down position.

(i) Press the STOP button on the modulator. The amber pilot light will go out, and the VOLTAGE meter will indicate zero with the switch in the KEYER GRID position.

(j) Set the line circuit breaker on the modulator to the OFF position. The white POWER light and the green READY light will go out.

(k) Set the LINE CIRCUIT BREAKER on the high voltage rectifier to the OFF position. The LINE VOLTMETER will now read zero, and the green light on the high voltage rectifier will go out.

(l) Set all the power switches on the control rack to the down position. The switches are on the following units.

(i) The P.P.I. power supply. (The red light will go out).

(ii) The receiver power supply. (The red light on this unit and the red light on the receiver unit will go out).

(iii) The range power supply. (The red light on this unit and the red light on the range unit will go out).

**(iv) The automatic tracking unit. (The red light will go out).

**(m) Set the SPINNER MOTOR, AZIMUTH MOTOR and ELEVATION MOTOR switches in the switch box to the OFF position.

(n) Set the dehydrator power switch to the OFF position. (The red light will go out).

**(o) Set the main line switch to the OFF position (late model). Turn off the power at the generator (early model).

Emergency stopping procedure

37. (a) Set the LINE CIRCUIT BREAKER on the high voltage rectifier and the power switch on the modulator to the OFF position.

(b) Set the main power switch to the OFF position (late model) or remove the cable from the POWER receptacle in the data panel (early model).

PREPARATION FOR TRAVEL

Lowering the antenna pedestal

38. (a) Turn the SPINNER MOTOR switch in the switch box to the OFF position.

(b) Remove the section of the R.F. line near the bottom of the antenna pedestal and at the end of the fixed section of line from the modulator rack.

(c) Remove the connector which joins the two removable sections, and carefully separate the sections by drawing them apart. Place them in their stowing positions and fasten the stowing rack cleats securely in place by tightening the wing-nuts.

(d) Check to see that the SAFETY switch on the control panel is in the RUN position.

(e) Turn the azimuth handwheel on the antenna position control unit to rotate the paraboloid until the roller of the pedestal interlock switch is seated in the positioning depression of the interlock cam.

(f) Remove the antenna from the transmission line in the centre of the paraboloid by slackening the locking nut and carefully withdrawing the antenna shaft from the line.

(g) Screw the dust cap on to the open end of the transmission line.

(h) With a broom sweep any accumulated water from the hatch doors onto the pedestal base and down the drain holes.

(i) Stow the antenna in its place in the storage rack and make certain that it is secure by tightening the antenna locking nut.

NOTE: The antenna must be removed from the paraboloid before the antenna pedestal is lowered. If it is not removed, it will be damaged when the roof hatch doors are closed.

(j) Elevate the paraboloid to 89 degrees by operation of the elevation handwheel.

(k) Turn the SAFETY switch to STOP, set the power switch on the automatic tracking unit to the down position.

(l) Set the ELEVATION MOTOR and AZIMUTH MOTOR switches in the switch box to the OFF position.

(m) Pull the holding pin and turn the elevation locking handwheel on the elevation yoke clockwise as far as it will go. On being released, the holding pin should seat firmly. Turn the azimuth locking handle on the antenna pedestal in a clockwise direction until it is tight.

(n) Remove the four clamping screw nut assemblies at the four corners of the elevator inside the trailer.

(o) Remove the covers from the four elevating screws. Remove the two drain hoses from their connections on the wall and on the elevator. Stow each piece of hose in its clamps.

(p) Stow the operator's chairs under the control rack, fastening them securely with the straps.

(q) Clear the space under the elevator. **Ensure that all objects have been removed from the top of the elevator.**

(r) Install the storm curtain as detailed in para. 12 if required.

(s) Press the LOWER button of the ELEVATOR SWITCH in the switch box. The elevator will descend slowly to its stowing position, requiring about five minutes, and will stop automatically at its lower limit of travel.

NOTE: One person must watch the elevator closely as it descends, to ensure that the elevator drive motor is shut off by the lower travel limit switch. If the limit switch fails to trip the STOP button in the switch box must be immediately pressed to prevent damage to the mechanism.

(u) Place the clamping screw nut assemblies on the four studs projecting through the elevator platform, and tighten them securely.

(v) Remove the storm curtain if it was used.

(w) Close the hatch doors.

(x) Lock the hatch doors from inside the trailer.

(y) Replace the elevating screw covers.

(z) Set the main line switch to OFF (late model) or have the power turned off at the generator (early model), and turn the voltage adjuster handwheel fully anticlockwise.

Final packing

39. (a) Remove the power cable, data cables, and earthing pin connections from the data panel underneath the trailer, remove the earthing pin and place it in the storage compartment.

(b) Make certain that the six floor ventilators, the two side wall ventilators, and the front wall ventilator are securely closed.

(c) If the petrol heater has been used, close the shut-off valve near the base of the fuel storage tank by turning the pet-cock handle to the off (horizontal) position.

(d) Close the fuel valve and the air intake valve on the heater.

(e) After loosening the turnbuckles on the stabilisers, remove the stabilisers and chains. Slide the struts together, and place them, with chains and stabiliser plates, in the storage compartment.

(f) Make certain that the parking brake handwheel at the rear of the trailer is tight.

(g) Raise the rear jacks with the crank handle until the tires bear the full weight of the rear end of the trailer. Fold the jacks under the trailer and lock them in place with latch pins. Place the removable jack braces in the storage compartment. If the ground is soft and planks were used under the rear jack plates, take the planks and place them beneath the two support wheels at the front of the trailer. Make certain the support wheels are **completely down in the vertical position.**

(h) Raise the front jacks until the full weight of the front end of the trailer rests on the support wheels. Remove and stow the removable braces. Fold the jacks under the trailer and lock them in place with the gravity latch pins. Replace the crank handle in its clip at the side of the trailer.

(i) Stow the removable ladder on its brackets on the inside of the single door at the front of the trailer. Close and lock all trailer doors.

(j) Wipe the dirt from the two halves of the fifth wheel, the lower one on the dolley and the other on the trailer.

(k) Back the dolley carefully under the front of the trailer, with the fifth wheel in the unlocked position. This operation will lift the support wheels from the ground.

(l) Lock the fifth wheel by pushing the locking bar as far back as possible.

(m) Remove the planks from under the support wheels, and stow all four planks in the storage compartment. Lock the storage compartment.

(n) Drive the towing vehicle ahead just enough to make certain that the coupling is secure.

NOTE: Do not attempt to tow the trailer as the parking brakes are still on.

(o) Install the trailer light connection, and fasten the air brake hoses on the towing vehicle to the couplings on the front of the trailer.

(p) Open the air brake hose valves on the towing vehicle.

(q) Release the trailer parking brake by turning the brake handwheel anticlockwise as far as possible.

(r) Raise the support wheels by means of the crank, and then replace the crank firmly in its retaining clips.

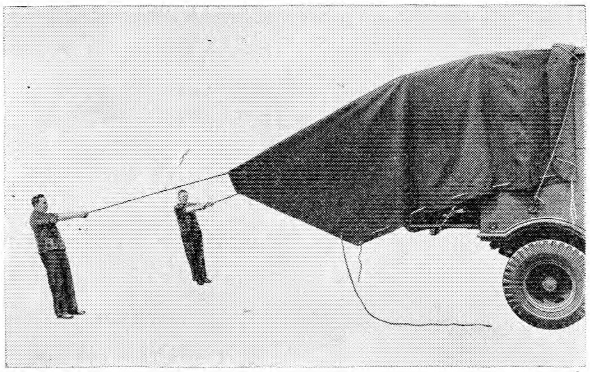
(s) Check the running lights of the trailer, and throw the blackout light switch on the right side of the trailer to appropriate position.

TESTS AND ADJUSTMENTS

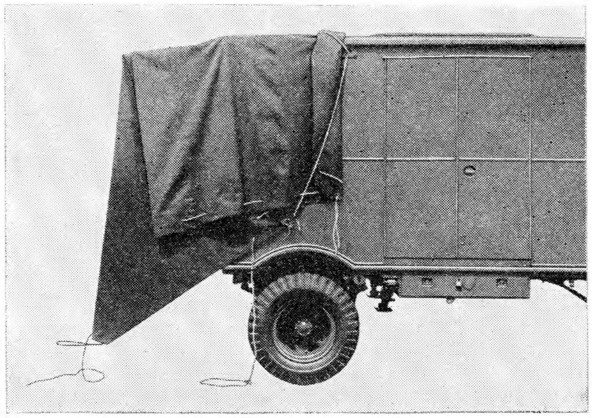
40. The following sequence of adjustments will be used when setting up the complete equipment. Each section is complete and may be carried out at any time provided it is known that all preceding adjustments, upon which the adjustment to be made is dependent, are correct and the equipment is functioning satisfactorily up to that point.

41. It is essential that the Mechanic carrying out the adjustments is assisted by a second Mechanic, or an Operator under the direction of the Mechanic, as due to the physical arrangement of the equipment, many of the adjustments cannot be effected by one man alone.

42. In wet weather the inside of the control rack may be protected from rain coming through the open rear doors,



T $\frac{\text{OY-103}}{\text{1-14}}$ **Fig. 14—Storm curtain in position to open rear doors**



T $\frac{\text{OY-103}}{\text{1-15}}$ **Fig. 15—Storm curtain in position with rear doors open**

and at night a blackout may be effected, by arranging the storm curtain over the doors to form a tent (See Fig. 14 & 15). The curtain may be secured by tying the attached ropes to the stabiliser body brackets and the rear hoisting brackets. The curtain should be dropped over the rear of the trailer before opening the doors.

43. Before commencing Tests and Adjustments ensure that all power switches are in the OFF position.

SWEEP AND TRIGGERING SYSTEM

Range power supply

44. (a) Switch on the range power supply and allow the range unit to warm up for about ten minutes before commencing the adjustments.

(b) Partially withdraw the range unit and connect the multi-meter (1000V D.C. range) between J619 and chassis.

(c) Adjust the VOLT REG. ADJ. control, situated at the rear of the range power supply chassis, to produce a reading of 250V on the multimeter. Lock the control and remove the meter.

Adjustment of 2,000 yard range sweep

45. (a) Switch the CONTROL SWITCH to MANUAL Rotate the NARROW GATE WIDTH control fully anticlockwise. Adjust the INTENSITY and FOCUS controls of the 2,000 yards range oscilloscope to produce a complete well defined sweep.

(b) Adjust the OSCILLATOR TUNING control on the range unit to produce maximum sweep diameter on the 2,000 yard oscilloscope.

(c) Adjust the 2000 YD SWEEP PHASE and BALANCE controls to produce an exactly circular sweep on the 2000 yard C.R.T. Adjust CENTERING to set the sweep exactly in the centre of the C.R.T. screen. Circularity may be judged by comparison with the engraved circles on the disc in front of the C.R.T. Lock the BALANCE control.

(d) If difficulty is found in obtaining a true circle:

(i) Temporarily short circuit terminals 1 and 4 of transformer T902, located at the rear of the range indicator unit.

(ii) Adjust the OSCILLATOR TUNING control for maximum length of the straight line so formed.

(iii) Adjust the CENTERING controls so that this line is bisected by the centre of the tube.

(iv) Rotate the SLEWING handwheel until the range cursor is exactly at right-angles to the line on the oscilloscope.

(v) Remove the short circuit from transformer T902 and adjust the BALANCE control fully clockwise.

(vi) Adjust the PHASE control until the longer axis of the elipse formed on the C.R.T. lies along the range cursor.

(vii) Adjust the BALANCE control until a true circle appears on the oscilloscope. Lock the BALANCE control.

(e) Adjust the 2,000 YD. SWEEP DIAMETER control to produce a 2 inch circle on the C.R.T. (Full clockwise rotation of this control should increase the sweep diameter to 2½ inches). Lock the control.

(f) Switch the CRYSTAL SELECTOR control from position 1 to position 2 and back again. Note that in each position there is no change in the shape or size of the sweep on the 2,000 yard range oscilloscope.

Adjustment of the 32,000 yard range sweep

46. (a) Set the WIDE GATE WIDTH control fully anticlockwise. Adjust the INTENSITY and FOCUS controls of the 32,000 yard C.R.T. to produce a complete well defined sweep

(b) Remove V602 and V604, the 20KC and 1.7KC multivibrators.

(c) Tune the 5KC MV control for the largest single ellipse which can be produced. The trace will be steady over quite a large rotation of this control. Set the control to the centre of this rotation.

(d) Rotate the 32,000 YD. BALANCE control until a straight line is produced on the 32,000 yard C.R.T.

(e) Adjust the CENTERING controls until the pivot of the range cursor bisects this straight line.

(f) Rotate the SLEWING handwheel until the range cursor is at right-angles to the line on the C.R.T.

(g) Rotate the BALANCE control to its other limit. An ellipse will appear on the screen.

(h) Adjust the 32,000 YD. PHASE control until the range cursor lies along the longer axis of the ellipse.

(i) Adjust the 32,000 YD. BALANCE control until the trace assumes the shape of a perfect circle.

(j) Replace V602 and V604.

(k) Disconnect the input from the remote video amplifier at J911 at the rear of the range indicator unit. Connect the test jack J612 of the range unit (located on top of the chassis) to J911 of the range indicator unit with the test cable W2118.

(l) Adjust the 20KC MV control, using a non-metallic screwdriver since the control is live, to produce a stationary pattern of four complete rings on the 2,000 yard C.R.T. as shown in Fig. 16. The pattern will be stationary over a fairly large range of rotation of the control. Note the limits of rotation and set the control to the centre of these limits.

(m) Disconnect the end of cable W2118 which is attached to J612 and connect it to J611. Adjust the 5KC MV control to produce a stationary pattern of 16 sine waves on the 32,000 yard oscilloscope as shown in Fig. 17.

(n) Connect the cable W2118 between J911 and J615.

(o) Adjust the 1.7KC MV control to produce a stationary pattern on the 32,000 yard C.R.T. as shown in Fig. 18. The ratio B:A should be approximately 2:1.

(p) Remove the cable from J911.

(q) Steady the trace on the C.R.T. by slight adjustment of the 1.7KC MV control if necessary.

(r) Lock all controls, remove cable W2118 and reconnect the remote video amplifier output to J911.

NOTE: The loading effect of the test cable W2118, especially on the 20KC multivibrator circuit, sometimes prevents proper alignment. The position is often improved by the addition of a 10KΩ resistor in series with the cable at the range unit end.

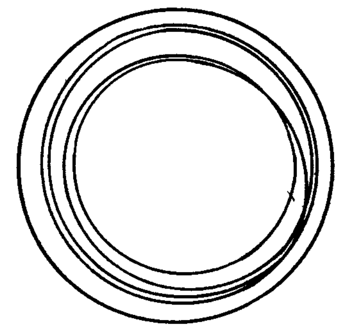


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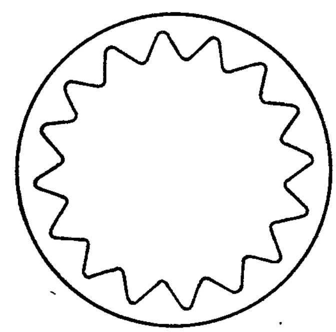
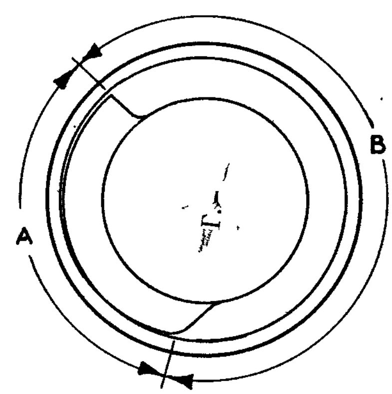
Fig. 16—Output of 20 K.C Multivibrator taken at J612 as seen on 2000 yard Oscilloscope



T OY-103/1-17

Fig. 17—Output of Crystal Oscillator taken at J611 as on 32000 yard Oscilloscope



T OY-103/1-18

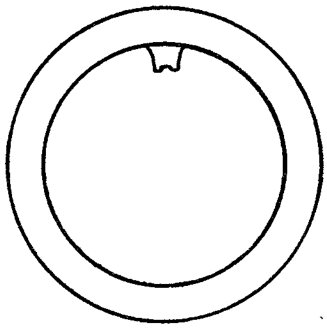
Fig. 18—Output of 1-7K C Multivibrator taken at J615 as seen on 32000 yard oscilloscope

Adjustment of the narrow and wide strobe controls

47. (a) Adjust the NARROW GATE WIDTH control to produce an arc of about 500 yards on the 2,000 yard oscilloscope.

(b) Adjust the WIDE GATE WIDTH control until the trace on the 32,000 yard C.R.T. is just on the point of completing a circle. Lock the control.

(c) Reduce the settings of both INTENSITY controls to give normal brilliance and focus the C.R.T.'s to produce clearly defined traces.



T OY-103 1-19

Fig. 19—Trigger Delay Adjusted to show Second Trigger Pip Centered in Strobe on 32000 yard Oscilloscope

Adjustment of trigger pulse selector gate delay

48. (a) Connect the test cable W2118 from the jack J911 of the range indicator unit to J623 of the range unit.

(b) Set the TRIGGER DELAY control fully anti-clockwise.

(c) Slowly rotate the TRIGGER DELAY control until a small negative pulse is super-imposed on the positive deflection produced by the trigger gate pulse as shown in Fig. 19.

(d) Continue rotation of the TRIGGER DELAY control until a second negative pulse appears on the gate pulse exactly at its centre. Lock the control.

(e) Remove the test cable between J911 and J623 and reconnect the output cable from the remote video amplifier to J911 of the range indicator. Replace the range unit in the rack.

TRANSMITTING SYSTEM

49. The adjustment of the air gap of the transmitting oscillator magnet should be such that a smooth variation of the oscillator PLATE CURRENT meter indication is obtained for a variation of high voltage over the range 18KV to 22KV. The setting should, in the case of most magnetrons, produce a plate current of 27mA when the high voltage is set to 22KV. This adjustment must be checked when ever a new oscillator is installed.

> **NOTE: The limiting values of voltage and current of the oscillator are 22KV and 27 mA. These values must not be exceeded at any time.**

Adjustment of the magnet gap

50. (a) Remove your wrist watch. Switch on the high voltage rectifier and modulator racks, the receiver power supply and the local oscillator FILAMENT and PLATE switches.

(d) Press the RAISE button and increase the high voltage to about 18KV. A reading of about 20 mA should be obtained on the OSCILLATOR PLATE meter. The transmitter pulse should appear on the 32,000 yards range oscilloscope.

(c) Ascertain that only one main pulse appears on the 32,000 yard C.R.T. If necessary adjust the TRIGGER control at the rear of the driver unit until double-pulsing ceases. The transmitter is usually operated with this control fully clockwise. Before opening the door of the modulator rack in order to adjust the trigger control, lower the high voltage and shut down the high voltage rectifier and modulator racks.

(d) Observe the OSCILLATOR PLATE meter and check that the reading is constant. If the reading is unsteady, check the D.C. VOLTMETER for fluctuations. If the variation in the meter reading is not produced by line fluctuations, adjust the gap in the magnet until the reading of the OSCILLATOR PLATE current meter is steady and indicates about 20 mA plate current for 18KV. (Anticlockwise rotation of the magnet-gap spacing control will increase the oscillator current).

(e) Raise the high voltage from 18KV to 22KV and check that a smooth variation of oscillator current occurs. Any fluctuation in the current reading indicates that the gap is out of adjustment.

(f) Repeat (d) and (e) until a smooth variation of plate current up to 27 mA with 22 KV is obtained.

51. Owing to the slight variations in characteristics of the magnetrons produced by different manufacturers, it may not always be possible to adjust for the condition of 27 mA plate current with 22KV rectifier voltage. When Westinghouse valves are used it will usually be necessary to decrease the magnet gap to minimum and to use a lower plate voltage.

RECEIVING SYSTEM

Adjustment of the local oscillator power supply

52. (a) Switch off the modulator and high voltage rectifier racks and the PLATE and FILAMENT switches of the local oscillator unit.

(b) Disconnect the input and output connections of the crystal mixer, the three connectors at the rear of the local oscillator unit, and withdraw the chassis from the rack.

(c) Connect the power input connection to the 115V A.C. supply with the A.C. test cable W2101.

(d) Set the Klystron frequency control to the middle of its range by adjusting the knob to set the tuning lever to the centre of its travel. Set the REFLECTOR VOLTS control to 10 and the FILAMENT switch to the up position. Wait 30 seconds and put the PLATE switch to the up position.

(e) Connect the multimeter (50 mA range) between the two jacks BEAM CURRENT on the front panel. The left-hand jack is positive.

(f) Adjust the GRID VOLTS control located on top of the chassis to obtain a reading of about 15 mA on the meter. Disconnect the meter.

(g) Switch the multimeter to the 50V range and connect it between pin 5 of V1805 and terminal 3 of T1801.

(h) Adjust the COMP. VOLTS control located on top of the chassis to produce minimum voltage (zero if possible) as indicated on the meter. Disconnect the meter.

(i) Set the meter to the 50 mA range and reconnect it to the BEAM CURRENT jacks.

(j) Adjust the tuning and the REFLECTOR VOLTS controls on the front panel until a sharp rise in the beam current reading occurs when the valve commences to oscillate. If the valve oscillates at two different settings of the control, the setting producing the highest beam current should be chosen.

(k) Adjust the REFLECTOR VOLTS control to obtain a maximum current, adjust the GRID VOLTS control to make this current 18 to 22 mA. Lock the GRID VOLTS control and disconnect the meter.

(l) Re-connect the multimeter between pin 5 of V1805 and terminal 3 of T1801 and check that the voltage is still zero. If necessary, adjust the COMP. VOLTS control. Tighten the locking nut when the control is correctly adjusted.

(m) Check that the Klystron is still oscillating. (See sub-paragraph j).

(n) Set the PLATE and FILAMENT switches in the down position, disconnect the test cable W2101 and replace the chassis in the rack. Reconnect the input and output connections to the crystal mixer and the three connectors at the rear of the unit.

Tuning R.F. stages using echo box

53. Considerable drift in the frequency of the local oscillator occurs during the first 15 minutes after switching on. No attempt should be made to adjust the frequency until the unit has reached normal operating temperature.

54. (a) Switch on the transmitting system, the local oscillator power supply, the automatic tracking unit and the motor generators.

(b) Manually position the paraboloid so that it faces the echo box dipole which should have its reflector away from the paraboloid, and rotate the SCR-584 dipole until viewing it through the unpainted section of the plastic cap reveals it in the same plane as the echo box dipole.

(c) Set the meter switch on the echo box to the X1 position.

(d) Tune the echo box until maximum deflection is obtained on the echo box indicator meter.

(e) Bracket the equipment in azimuth and elevation and accurately retune the echo box for maximum indication on the meter.

(f) Turn the receiver AGC switch to OFF and adjust the VOLUME control to maximum clockwise position. Keep the CONTROL switch to MANUAL.

(g) Tune the REFLECTOR VOLTS control for maximum reading of the CRYSTAL CURRENT meter on the receiver. Reduce this reading to about 0.4 mA by means of the knurled screw at the top of the crystal mixer.

(h) Carefully tune the cavity of the Klystron local oscillator for maximum length of ringing time on the 32,000 yard C.R.T.

(i) Remove your wrist watch. Tune the TR box for maximum ringing time as indicated on the 32,000 yard scope by unlocking and screwing in or out the two plungers at the sides of the box. The tuning plungers will need to be screwed right out for 2J34 magnetrons, in the mid position for 2J33 and 2J32 and screwed in for 2J31 magnetrons.

(j) When resonance is reached, as indicated by a very sharp increase in ringing time, lock one plunger and rotate the other through resonance to determine the optimum tuning point. Tune for maximum ringing time.

(k) Repeat paras. (h), (i) and (j) until the maximum ringing time is obtained and lock the TR box plungers and the crystal mixer control.

NOTE: When locking the plungers care must be taken to ensure that the tuning of the box is not disturbed. It is essential that the plungers are locked tightly. A spanner should be used. It should be necessary in most cases to tune only one plunger of the TR box, provided the point of resonance appears within its travel. The setting of the other need not be disturbed.

(l) Detune the echo box.

NOTE: If it is found impossible to tune the local oscillator by means of the cavity tuning control owing to the difference between its frequency and that of the magnetron being too great, the Klystron should be replaced as detailed in paras. 129 and 130 and the new oscillator tuned as detailed in the preceding paragraph. The untuned Klystron should be returned to second line workshops for adjustment.

Tuning R.F. stages without using echo box

55. (a) Switch on the transmitting system, the local oscillator power supply, the automatic tracking unit and the motor generators.

(b) Turn the receiver A.G.C. switch to OFF and adjust the VOLUME control to the maximum clockwise position. Keep the CONTROL switch to MANUAL.

(c) Tune the REFLECTOR VOLTS control for maximum reading on the CRYSTAL CURRENT meter on the receiver. Reduce this reading to about 0.4 mA by the knurled screw on the top of the crystal mixer.

(d) Tune the cavity of the Klystron for maximum breadth of the main transmitter pulse and maximum number of local echoes on the 32,000 yard oscilloscope.

(e) Remove your watch. Tune the TR box for maximum width of main Tx pulse and maximum number of ground echoes on the 32,000 yard scope by unlocking and screwing in or out the two plungers at the sides of the box. The tuning plungers will be screwed out for 2J34 magnetrons, in the mid position for 2J33 and 2J32 and screwed in for 2J31 magnetrons.

(f) When resonance is reached, as indicated by a very sharp increase in the number of local echoes, lock one plunger and rotate the other through resonance to determine the optimum tuning point.

NOTE: It should be necessary in most cases to tune only one plunger of the TR box provided the point of resonance appears within its travel. The setting of the others need not be disturbed.

(g) Pick an isolated fixed target and lay the equipment accurately on it in azimuth, elevation and range. Switch the CONTROL SWITCH to AUTOMATIC.

(h) Repeat adjustments of the cavity of the TR box and the Klystron tuning until the reading of the PLATE CURRENT meter on the automatic tracking unit is a minimum. (Note that sudden dips in the reading of the meter will be due to other transmitter pulses from nearby equipments.)

(i) Readjust the REFLECTOR VOLTS control for maximum crystal current and keep it below 0.5 mA by the crystal mixer tuning control.

(j) Repeat para. (h) and lock the TR box and crystal mixer tuning plungers.

NOTE: When locking the plungers of the TR box care must be taken that the tuning of the box is not disturbed. It is essential that they are locked tightly and a spanner should be used. Also see the notes at the end of para. 54.

Adjustment of the receiver

56. (a) Partially withdraw the receiver unit from the rack. Remove V1852 from the pre-amplifier and V701 from the receiver.

(b) Connect the multimeter (250V D.C. range) between pin 6 of V701 socket and the chassis. Adjust VOLT. REG. ADJ. (located on top of the chassis) to give a reading of 120V on the meter. Remove the meter and lock the controls.

(c) Connect the multimeter between pin 4 of V701 socket and chassis. Ensure that the CONTROL SWITCH is set to MANUAL and the A.G.C. switch to OFF. Adjust the VOLUME control for maximum gain (fully clockwise).

(d) Adjust the A.G.C. ADJ. control on top of the receiver chassis for zero voltage at pin 4 of V701 socket. Lock the control.

(e) Remove the multimeter and replace V701 and V1852.

(f) Switch on the spinner motor and, using MANUAL control, adjust the paraboloid to a fixed target. Set the A.G.C. switch to the A.G.C. position. Adjust the range controls to bring the echo on to the 2,000 yard oscilloscope.

(g) Adjust the SENSITIVITY control located on top of the chassis until the signal on the range oscilloscopes just saturates. Lock the control.

(h) Replace the receiver unit in the rack.

(i) Set the A.G.C. switch to OFF. Rotate the VOLUME control fully anticlockwise and check that full scale deflection is produced on the PLATE CURRENT meter on the automatic tracking unit. The meter reading should be reduced with clockwise rotation of the VOLUME control. Set the VOLUME control fully clockwise.

(j) Set the receiver A.G.C. switch to the A.G.C. position. The PLATE CURRENT meter on the automatic tracking unit should indicate between 5 mA and 8 mA. The signal on the range oscilloscopes should be just saturated.

(k) By operation of the range handwheel, move the narrow strobe at least 500 yards off the signal. The noise on the 32,000 yard C.R.T. should increase to greater than ⅛th of an inch.

(l) Switch on the P.P.I. power supply, adjust the P.P.I. INTENSITY control so that the receiver noise produces a plainly visible sweep of normal operating brilliance.

(m) Set the receiver A.G.C. switch to OFF. Check that clockwise rotation of the VOLUME control increases the brightness of the P.P.I. sweep.

RANGE SYSTEM

Determination of zero range error

57. In order to determine the zero range error it is necessary to know the exact range of an isolated fixed target. The transmitter and receiver must be tuned to give optimum operation conditions and must have been in operation for at least fifteen minutes.

58. (a) Lay accurately on the fixed target.

(b) Set the receiver A.G.C. switch to the A.G.C. position and set the range cursors exactly to the known range of the target. Adjust the NARROW GATE DELAY control so that the signal on the 2,000 yard oscilloscope appears in the strobe.

(c) Slacken the four clamping screws at the back of the 2,000 yard oscilloscope mounting and rotate the C.R.T. to bring the onset of the echo signal to the cursor. Tighten the clamping screws.

(d) Adjust the range cursor to the onset of the transmitter pulse and note the range reading. Record this reading in the History Book AB 20A as the zero range error.

NOTE: This range reading is to be used whenever it becomes necessary to replace the 2,000 yard C.R.T.

Orientation of the range C.R.T.'s

59. (a) Set the range cursors to zero.

(b) Adjust the NARROW GATE DELAY control and the WIDE GATE DELAY control so that the transmitter pulse is visible on both oscilloscopes.

(c) Release the four clamping screws at the back of each oscilloscope mounting and rotate each C.R.T. to bring the onset of the transmitter pulse to the range reading noted in (d) para. 58. Tighten the clamping screws.

Narrow strobe tracking adjustment

60. (a) Adjust the NARROW GATE DELAY control so that the visible portion of the 2,000 yard sweep is positioned centrally about the fine range cursor at zero yards range. Ensure that the transmitter pulse is in the strobe.

(b) Run the range out to 32,000 yards. Adjust the NARROW GATE control to position the strobe centrally about the fine range cursor.

(c) Repeat (a) and (b) until the narrow strobe is correctly adjusted with respect to the cursor at zero yards and 32,000 yards.

(d) Slowly run the range from zero to 32,000 yards and check that the narrow strobe tracks with the fine cursor rotations. Slight readjustments to the NARROW GATE DELAY and NARROW GATE controls may be necessary in order to obtain optimum tracking.

NOTE: It is essential that accurate tracking occurs between 3,000 yards and 15,000 yards range.

PPI SYSTEM

Adjustment of the P.P.I. power supply

61. (a) Rotate the INTENSITY control on the front panel of the P.P.I. unit fully anticlockwise.

(b) Connect the multimeter (1,000V D.C. range) between the test jack J1608 on the P.P.I. unit (located on the top at the rear of the chassis) and chassis.

(c) Adjust the control VOLT. REG. ADJ. at the rear of the P.P.I. power supply to give a reading of 270V on the meter.

(d) Lock the control and remove the meter.

Adjustment of the P.P.I. unit

62. (a) Set the RANGE SELECTOR switch on the front panel of the P.P.I. unit to the 35,000 YD position. Adjust the INTENSITY control so that the brilliance is low. Adjust the FOCUS control (located on top of the chassis at the rear) to produce a clearly defined sweep on the C.R.T.

(b) Adjust the CENTER ADJ. controls (located on the top of the chassis) to position the start of the sweep exactly under the spot in the centre of the screen over the C.R.T.

(c) Adjust the RANGE MARKER control (located on top of the chassis) so that calibration pulses appear as bright dots on the sweep. The intensity of the pulses should increase with clockwise rotation of the control.

(d) Adjust the range, by means of the handwheels on the range indicator unit, to about 15,000 yards. Adjust the NARROW GATE control (located on top of the P.P.I. chassis) so that the strobe pulse is plainly visible on the sweep.

(e) Adjust the 35,000 YD SWEEP control (located on top of the P.P.I. chassis) to produce a sweep having a duration of 37,000 to 40,000 yards.

(f) Set the RANGE SELECTOR switch to the 70,000 YD position. Adjust the 70,000 YD SWEEP control to produce a sweep of about 75,000 yards length.

(g) Set the CONTROL SWITCH on the control panel to the P.P.I. SCAN position. The sweep on the P.P.I. oscilloscope should rotate in a clockwise direction.

(h) Adjust the two CIRCLE ADJUST and the CENTERING controls (located on top of the P.P.I. chassis) so that the calibration rings produced by the range markers are circular. (It sometimes makes this operation easier to increase the setting of the RANGE MARKER control.) The maximum allowable departure from a true circle is ±10% of the radius.

(i) Finally adjust the FOCUS and INTENSITY controls while the sweep is rotating, to produce a line 1/32 inches wide or less. Lock all controls with the exception of the INTENSITY control which should be set so that the sweep is just barely visible. Decrease the setting of the RANGE MARKER control so that the range markers are just clearly visible.

(j) Check the range intervals of the calibration rings by setting the range cursors to each multiple of 10,000 yards. Note that the narrow strobe on the P.P.I. brightens the trace about the calibration rings within 10% of the range at each setting.

Orientation of the P.P.I. sweep

63. (a) Set the CONTROL SWITCH to MANUAL, set the paraboloid to zero degrees azimuth as noted on the antenna position indicator. Set the SAFETY switch to STOP.

(b) Remove the cover plate over the azimuth selsyn compartment in the pedestal. Using the 9/16 inch socket wrench and the ten inch ratchet handle extension slacken the two hex. head bolts holding the two clamping plates which secure the P.P.I. selsyn B2005.

(c) Turn the body of the selsyn by hand to rotate the P.P.I. sweep to zero degrees as indicated by the scale around the P.P.I. oscilloscope.

(d) Tighten the hex. head bolts and replace the cover over the selsyn compartment.

SERVO SYSTEM

64. (a) Switch off the receiver power supply and the azimuth and elevation motor generators.

(b) Press the COAST button on the control panel. The PLATE CURRENT meter on the automatic tracking unit should read zero. Release the COAST button and the meter should read approximately full scale.

(c) Partially withdraw the automatic tracking unit from the rack. Connect the multimeter (10V D.C. range) between the underside of pin 3 or 6 of V504 socket and the GROUND jack on the front panel. Adjust the VOLTAGE CONTROL on the front panel to produce a reading of 2.9V on the multimeter. Remove the meter and lock the control.

(d) Check that the voltage between text jack +30 and earth is between 26V and 32V.

(e) Partially withdraw the azimuth and elevation tracking unit from the rack. Set the SAFETY switch to RUN. Connect the multimeter (10V D.C. range) between the right-hand A.H. jack (positive) and the jack marked +30 located on the top of the chassis. Adjust the A.H. LIMITING CONTROL to produce a reading of 8V on the multimeter. Remove the meter.

(f) Connect the meter between the other A.H. jack (negative) and the +30V jack. Adjust the A.H. LIMITING CONTROL to produce a reading of 8V on the multimeter.

(g) Repeat (e) and (f) until one A.H. jack is as much above +30V as the other is below.

(h) Connect the multimeter (10V D.C. range) between the test jacks TORQUE (positive) and +30, located on top of the chassis. Adjust the TORQUE control to produce a voltage of 3.5V as indicated on the multimeter. Remove the meter and lock the control.

(i) Raise the key switch on the azimuth and elevation tracking unit to the AZIMUTH position. Adjust the azimuth handwheel on the antenna position control unit to balance the FIELD CURRENT meters on the azimuth and elevation tracking unit. Adjust the right-hand CURRENT CONTROL located on top of the azimuth and elevation tracking unit to produce a balance current of 25 mA ±2 mA. Lock the control.

(j) Press the key switch on the azimuth and elevation tracking unit to the ELEVATION position. Adjust the elevation handwheel to balance the FIELD CURRENT meters. Adjust the left-hand CURRENT CONTROL located on top of the azimuth and elevation tracking unit to produce a balance current of 25 mA ± mA. Lock the control.

(k) Turn the A.H. GAIN controls in the azimuth and elevation tracking unit to 4. Turn the SAFETY switch on the control panel to the STOP position. Turn the AZIMUTH MOTOR and ELEVATION MOTOR switches in the switch box to the ON position. Turn the SAFETY switch on the control panel to the RUN position. The paraboloid may move slightly but it should stabilize. It may elevate or depress to the stops. Rotate the elevation handwheel until control is obtained and elevate to about 45 degrees (800 mils.).

(l) Clockwise rotation of the elevation handwheel should cause the following:

(i) The paraboloid should elevate.

(ii) The local ELEVATION indicator on the antenna position indicator should move in a clockwise direction.

(iii) The right-hand FIELD CURRENT meter on the azimuth and elevation tracking unit should read low while the antenna is moving. (Key switch in the ELEVATION position.)

(m) Clockwise rotation of the azimuth handwheel on the antenna position control unit should cause the following:

(i) The paraboloid should rotate clockwise in azimuth.

(ii) The local AZIMUTH indicator on the antenna position indicator unit should rotate clockwise.

(iii) The right-hand FIELD CURRENT meter on the azimuth and elevation tracking unit should read high. (Key switch in the AZIMUTH position.)

(n) Set the CONTROL SWITCH on the control panel to the AUTOMATIC position. Rotate the azimuth and elevation A.H. GAIN controls and the automatic tracking unit GAIN control to zero. Adjust the azimuth and elevation BALANCE control until the drifting motion of the paraboloid stops. Rotate the azimuth A.H. GAIN control to 4. Recheck (e), (f), (g) and (h) and finally repeat (n).

(o) Set the CONTROL SWITCH on the control panel to the MANUAL position. Set the field current meter switch to ELEVATION. Move the elevation handwheel slightly. The paraboloid will oscillate in elevation. Turn the elevation A.H. GAIN control slowly clockwise until the oscillation of the FIELD CURRENT meters just ceases. (The setting should be repeated several times in order to obtain an optimum setting of the control.) Rotate the control one dial division clockwise (one-half unit) and record the setting in the AB 20A.

(p) Set the azimuth A.H. GAIN control to about 2. Set the field current meter switch to AZIMUTH. Move the azimuth handwheel slightly and the paraboloid will oscillate in azimuth. Turn the azimuth A.H. GAIN control slowly until the oscillation of the FIELD CURRENT meters just ceases. (The setting should be repeated several times.) Rotate the control one dial division clockwise (one-half unit) and record the setting.

(q) Set the elevation to 45 degrees (800 mils). Set the CONTROL SWITCH on the control panel to the P.P.I. SCAN position. The paraboloid should rotate clockwise in azimuth and should elevate through 20 degrees (356 mils) in approximately 5½ revolutions. The paraboloid should then return to its initial angle in one-half azimuth rotation and should then re-commence the cycle. The local indicators on the antenna position indicator should follow the movement of the paraboloid. If necessary adjust the MOTOR SPEED control on the top rear of the antenna position control unit to adjust the paraboloid rotation to the correct speed of about 5 r.p.m.

NOTE: In cold weather it may be necessary to adjust the MOTOR SPEED control to increase the torque of the P.P.I. scan motor until normal operating temperature is reached, after which time the control should be set to produce the correct scanning speed.

(r) Set the CONTROL SWITCH to MANUAL. Position the paraboloid to about 45 degrees (800 mils) elevation. Turn the CONTROL SWITCH to the AUTOMATIC position. If the azimuth and elevation amplifiers have been correctly balanced, there will be no appreciable paraboloid drift. Turn the azimuth handwheel 5 revolutions clockwise, wait 5 seconds, and then set the CONTROL SWITCH to the MANUAL position. The pedestal should not move more than 5½ degrees (100 mils) in azimuth. If it does, the follow-up motors are not functioning correctly. Repeat using the elevation handwheel and also repeat turning the controls in an anticlockwise direction.

AUTOMATIC TRACKING SYSTEM

65. Switch on the receiver power supply. Manually lay on an isolated fixed target (no other echo should be within 1,000 yards of the one chosen for this alignment). The target selected should not cause an excess of modulation, due to polarization, on the received echo signal. This is indicated by filling of the signal on the 2,000 yard oscilloscope.

66. Decrease the width of the narrow strobe to about 200 yards. Adjust the range controls so that the target is centered within the narrow strobe. Ensure that the receiver switch is set to the A.G.C. position, check that the GAIN control on the automatic tracking unit is set to approximately 5. The modulation appearing on the signal seen on the range oscilloscopes should not be more than one-third of the signal amplitude.

Adjustment of the balanced amplifier

67. (a) Connect the multimeter (10V A.C. range) from one of the COMMUTATOR INPUT test jacks on the front panel of the automatic tracking unit to the +75V jack. Adjust the position of the paraboloid carefully by means of the handwheels on the antenna position control unit so that the 30-cycle error signal, as indicated on the multimeter, is reduced to zero. Set the A.V.C. control on the automatic tracking unit so that the PLATE CURRENT meter reads 6 mA.

(b) Turn the elevation handwheel to raise the paraboloid by 3 degrees (50 mils). Note the reading on the multimeter.

(c) Connect the multimeter between the other COMMUTATOR INPUT jack and the +75V jack. Note the reading.

(d) Adjust the BALANCE control on the front panel of the automatic tracking unit to obtain equal outputs from either COMMUTATOR INPUT test jack.

To check the reference generator

68. (a) With the multimeter (250V A.C. range) measure the reference voltage between the following terminals of the junction box: TB23-2 (common) to TB23-1, TB23-3, TB23-4 and TB23-5. The voltage should be 115V A.C. ±10V and a steady meter reading should be obtained.

(b) Connect the multimeter (10V A.C. range) from one of the COMMUTATOR INPUT test jacks on the front panel of the automatic tracking unit to the +75V jack. Adjust the position of the paraboloid carefully by means of the handwheels on the antenna position control unit so that the 30-cycle error signal, as indicated on the multimeter, is reduced to zero.

(c) Turn the elevation handwheel to elevate the paraboloid by 3 degrees (50 mils).

(d) Set the AZIMUTH MOTOR and the ELEVATION MOTOR switches to OFF. Allow the motor generators to come to a complete stop.

(e) Set the CONTROL SWITCH to AUTOMATIC and set the field current meter switch to the ELEVATION position. Adjust the GAIN control on the automatic tracking unit to produce an unbalance of approximately 10 mA on each FIELD CURRENT meter. The right-hand meter should read ~~low~~ HIGH. An unbalance in the reverse direction usually indicates a reversal of the connections to transformer T1902.

(f) Set the field current meter switch to the AZIMUTH position. The unbalance in the FIELD CURRENT meters should be almost zero. If any appreciable unbalance of the meters exists when the meter switch is in the AZIMUTH position, the reference generator is not correctly aligned and the procedure detailed in para. 69 should be carried out.

(g) Switch on the motor generators and switch the CONTROL SWITCH to MANUAL. Accurately position the paraboloid as detailed in (b). Rotate the azimuth handwheel to move the paraboloid 3 degrees (50 mils) in a clockwise direction.

(h) Switch off the motor generators and allow them to stop.

(i) Set the CONTROL SWITCH to AUTOMATIC and set the field current meter switch to the AZIMUTH position. The right-hand meter should read ~~high~~ LOW. An unbalance in the reverse direction usually indicates a reversal in the connections to transformer T1901.

Alignment of the reference generator.

69. (a) Adjust the paraboloid as detailed in (b) para. 68. Switch the motor generators off. Allow them to come to rest. Set the CONTROL SWITCH to AUTOMATIC and the field current meter switch to AZIMUTH.

(b) Unlock the shaft at the rear of the reference generator housing at the back of the paraboloid by holding the shaft with a 5/16 inch spanner and slackening the locking nut with a 5/8 inch spanner.

(c) Turn the shaft to obtain a balance on the FIELD CURRENT meters with the switch to AZIMUTH.

(d) Lock the shaft. Check that the setting of the shaft has not changed while the locking nut is tightened, by rechecking the balance on the FIELD CURRENT meters.

Adjustment of the automatic tracking gain control

70. Set the control switch to the MANUAL position. Switch on the motor generators and lay on a target. Adjust the antenna 3 degrees (50 mils) off target, first in azimuth and then in elevation; check that in both cases when the CONTROL SWITCH is turned to the AUTOMATIC position the antenna rapidly positions itself on the target without more than three overshoots. If the antenna overshoots more than three times, adjust the GAIN control on the automatic tracking unit in an anticlockwise direction until the antenna positions itself on target correctly. The final setting of the GAIN control is usually about 5. Record the setting of the GAIN control in the AB 20A.

Interaction between channels

71. (a) Lay the equipment accurately in azimuth, on a fixed isolated target. Note the reading of the azimuth antenna position indicator dial.

(b) Switch the FIELD CURRENT meters switch to the AZIMUTH position.

(c) Go off target 3 degrees (50 mils) in elevation. The FIELD CURRENT meters will unbalance a certain amount.

(d) Adjust the AZIMUTH handwheel until the meters again balance and again note the reading of the azimuth antenna position indicator dial.

(e) If the difference between the two readings is more than 0.75 degrees (12½ mils), re-check the alignment of the reference generator.

(f) Repeat the above procedure for the elevation channel.

ALTITUDE CONVERSION SYSTEM

72. (a) Set the altitude converter power supply switch to the ON position. Set the ALTITUDE/SLANT RANGE switch on the data panel to ALTITUDE.

(b) Partially withdraw the altitude converter control unit. Connect the multimeter (1,000V D.C. range) between the jack TEST 4, located on top of the chassis, and chassis. (TEST 4 is positive.)

(c) Adjust the VOLTAGE CONTROL, located on the top of the altitude converter power supply, for an output voltage of 300V as indicated on the multimeter. Lock the control and remove the meter.

(d) Connect the multimeter (50V A.C. range) between the jack TEST 2, located on top of the control unit, and chassis. Adjust the control OSC. OUTPUT (located on top of the chassis) to produce a reading of 25V on the meter. As the control is varied the meter pointer will oscillate for several cycles. Allow the circuit to stabilise before taking a final reading. Lock the control and remove the meter.

(e) Connect the multimeter (50V A.C. range) between the jack TEST 6, on the top of the power supply unit, and chassis. Adjust the FIXED FIELD V. control (on top of the control unit) for a reading of 15V on the meter. Lock the control and remove the meter.

(f) Set the range cursors of the range indicator unit to approximately 28,000 yards. Elevate the paraboloid to approximately 20 degrees.

(g) Measure the voltage between the jack TEST 3 and chassis (test 3 is located on the top of the control unit) with the multimeter (50V A.C. range). If the previous adjustments have been correctly made, a reading of 40V ±3V should be obtained.

(h) Set the ALTITUDE/SLANT RANGE switch on the data panel to SLANT RANGE.

(i) Set the range cursors on the range indicator unit to 5,000 yards.

(j) Measure the voltage between jack TEST 5, located on the altitude converter control unit, and ground using the multimeter on the 10V A.C. range. Adjust the PHASE BAL. control for minimum deflection.

(k) Set the range cursors to 9,000 yards. Set the ALTITUDE-SL. RANGE switch on the control unit to the SL. RANGE position. The dial on the altitude data unit should indicate approximately 9,000 yards.

(l) Depress the paraboloid to below zero elevation. Press the FREQ. TEST switch, set the ALTITUDE-SL. RANGE switch to the ALTITUDE position. If the dial on the altitude data unit moves, adjust the FREQ. TEST control until the dial is stationary. Lock the control.

NOTE: It is essential that this adjustment be made with the data unit dial reading between 7,000 and 9,500 yards. For this reason the FREQ. TEST switch must be pressed throughout the test in order to prevent the motor driving the data unit dial to 300 yards.

(m) Set the range cursors to exactly 5,000 yards. Set the ALTITUDE-SL. RANGE switch to the SL. RANGE position. Unlock and adjust the HEIGHT CALIBRATE control on the altitude data unit to produce a reading of exactly 5,000 yards on the data unit dial.

(n) Check the operation of the altitude conversion system in accordance with table 1:

(o) Set ALTITUDE/SLANT RANGE switch on the data panel to the SLANT RANGE position.

TABLE 1 — ALTITUDE CONVERTER TEST SETTINGS

Range Dial Setting	Elev. Dial Setting (See footnotes)	Pos. of Alt.-Slant Range Switch	Data Unit Dial Should Indicate
Below 300 yards.		SL. RANGE	Below 300 yards.
Any setting from 300 to 10,000 yards.		SL. RANGE	Range dial setting ±30 yards.
Any setting from 3,000 to 28,000 yards.	346.03* ang. mils (19.46 degrees)	ALTITUDE	One-third range dial settings ±30 yards.
Any setting from 300 to 20,000 yards.	533.3** ang. mils (29.99 degrees)	ALTITUDE	Half range dial settings ±30 yards.

* To obtain an elevation setting of 19.46 degrees, set the range cursors to exactly 18,000 yards and elevate the paraboloid to obtain a reading of 6,000 yards on the data unit dial.

** To obtain an elevation setting of 29.99 degrees, set the range cursor to exactly 10,000 yards range and increase elevation to produce a reading of exactly 5,000 yards on the data unit.

OVERALL R. F. PERFORMANCE CHECK

73. In order to couple the maximum amount of R.F. energy to the echo box, the echo box pick-up dipole must be parallel with the antenna of the SCR-584. Orient the echo box antenna so that the reflector is away from the radar antenna.

74. (a) Switch on the equipment as detailed in para. 27.

(b) Manually position the paraboloid to point directly at the echo box antenna.

(c) Switch off the spinner motor.

(d) Rotate the radar antenna by hand until, when it is viewed through the unpainted section of the plastic cap, it is seen to be horizontal.

(e) Operate the equipment for 10 minutes.

(f) With the SPINNER MOTOR switch still to OFF, and the echo box indicator meter switch in the X1 position, tune the echo box until the maximum deflection is obtained on the echo box indicator meter.

(g) Bracket the equipment in azimuth and elevation using manual operation and retune the echo box for maximum indication on the meter. Ensure that it is the main lobe and not a side lobe which is exciting the box. The echo box is now tuned to the frequency of the transmitter. The echo box should not be touched again until para. 75 (b).

(h) Note the scale and knob tuning positions of the echo box. The first two significant figures (0-25) are found by the position of the indicator under the lucite scale on the tuning knob barrel. The fractional divisions are read off on the circumference of the tuning knob. Determine the frequency by using the dial division-calibration factor chart. The correct frequency may be found by adding the constant, 2700, to the calibration factor as follows: Correct frequency = 2700 + calibration factor. Record this frequency in the AB 20A.

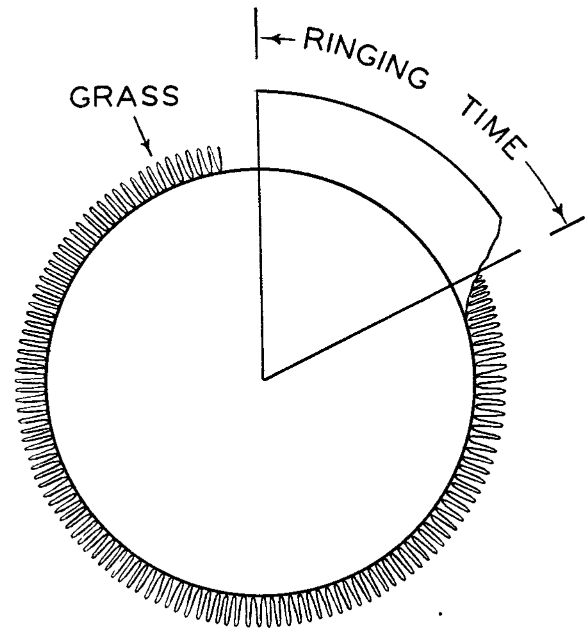
(i) Record the reading of the indicator meter on the echo box. If it does not agree with the value previously observed, the power output of the set has changed.

Measurement of overall R.F. performance

75. (a) With the receiver VOLUME control at the maximum setting and the receiver A.G.C. switch to OFF, observe the ringing time of the echo box on the range oscilloscopes.

(b) Tune the echo box and check that when it gives maximum deflection on its meter it also gives maximum ringing time, if not retune the local oscillator and TR box until these two maxima coincide, but ensure the echo box is finally reset to the reading noted in para. 74 (h).

(c) Measure the range to the point where the echo box signal joins the noise level, as denoted in Fig. 20.



T OY-103/1-20 **Fig. 20—Ringing time shown on 32,000 yd. oscilloscope**

NOTE: In measuring the echo box ringing time ensure that it is the echo box ringing time and not a block of signals which is being checked. This can be determined by tuning the local oscillator and noting whether the ringing time goes back and forth. Signals will change in amplitude when this is done, but not in range. The echo box signal will change in range.

(d) Make four estimates of ringing time and average them.

(e) Read the temperature in the trailer. Correct the reading noted in (c), according to the temperature correction table given below.

TABLE 2—ECHO BOX TEMPERATURE CORRECTIONS

Temperature	Change in Ringing Time (Yards)	Temperature	Change in Ringing Time (Yards)
−20°F.	400	+60°F.	0
0°F.	290	+80°F.	−70
+30°F.	180	+100°F.	−150
+40°F.	70	+120°F.	−210

(f) Record this ringing time in the AB 20A and check it against the value obtained previously, or, if this is the first occasion on which the echo box has been used, against the figure given in the literature supplied with the echo box.

Measurement of transmitter frequency spectrum

76. (a) Tune the echo box slowly through the band of approximately 5 Mc/s either side of the transmitter frequency noting the dial readings and the corresponding indicator meter readings.

(b) Convert the dial readings to frequencies as detailed in para. 74 (h) and plot the frequency output curve of the transmitter. The two troughs on either side of the main pulse should be 2 Mc/s apart and sharply defined as shown in Fig. 21.

(c) Detune the echo box completely.

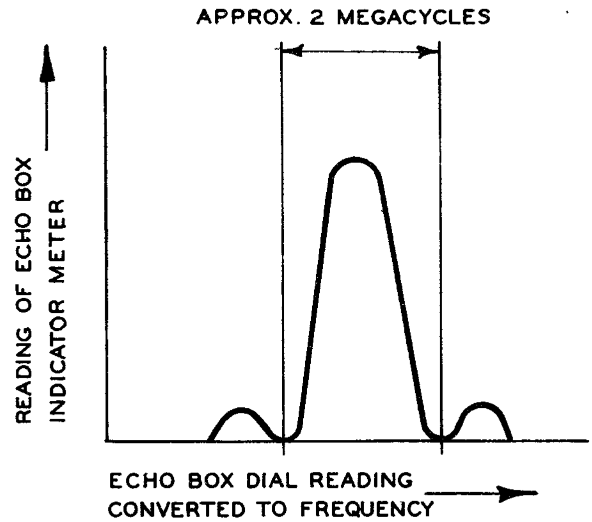
Measurement of local oscillator frequency

77. (a) Disconnect the input cable from the bottom of the echo box.

(b) Ensure that the cable is connected between the local oscillator valve and the output jack on the front of the local oscillator panel.

(c) Connect this output jack to the jack on the base of the echo box by a long cable. (This is to provide attenuation to prevent the frequency of the Klystron from being pulled. Use two cables joined together if necessary.)

(d) Switch the FILAMENT switch on the local oscillator panel to the up position, wait 30 seconds and switch the PLATE switch to up.



T OY-103/1-21 **Fig. 21—Good transmitter frequency spectrum**

(e) Allow the unit 15 minutes to warm up.

(f) With the meter switch to the X1 position, tune the echo box carefully for maximum deflection on the meter.

(g) Calculate the frequency of the Klystron as described in para. 74 (h).

(h) Detune the echo box, switch off the local oscillator, remove the cable between the echo box and the local oscillator and replace the echo box cable. Remove the local oscillator monitoring cable from the Klystron.

ORIENTATION OF THE DATA TRANSMISSION SYSTEM WITH THE PREDICTOR

78. The following adjustments must be made only after the predictor has been correctly set up and when the optical and electrical axes of the radar equipment are known to be in alignment. The procedure will be carried out in co-operation with the predictor operators whenever the equipment is set up on a new site.

79. All dials on the correction panel of the computer must be set to normal (zero correction) and the test switch on the computer adjustment panel must be set to TRACKER TEST.

Lining up the radar and the tracker

80. (a) Switch on the main line switch if fitted.

(b) Switch on the automatic tracking unit. Wait fifteen seconds. Set the CONTROL SWITCH to AUTOMATIC and the AZIMUTH MOTOR and ELEVATION MOTOR switches to ON. Set the SAFETY switch on the control panel to RUN and the CONTROL SWITCH to MANUAL.

(c) Position the paraboloid accurately to line up the radar telescope and the azimuth telescope of the tracker.

(d) Switch off the motor generators. Wait until the motors stop and set the SAFETY switch on the control panel to STOP.

(e) Check that the telescopes are still accurately lined up on each other. If the paraboloid has moved, switch on the motor generators. Set the SAFETY switch to RUN and repeat (c) and (d) until the paraboloid is correctly positioned.

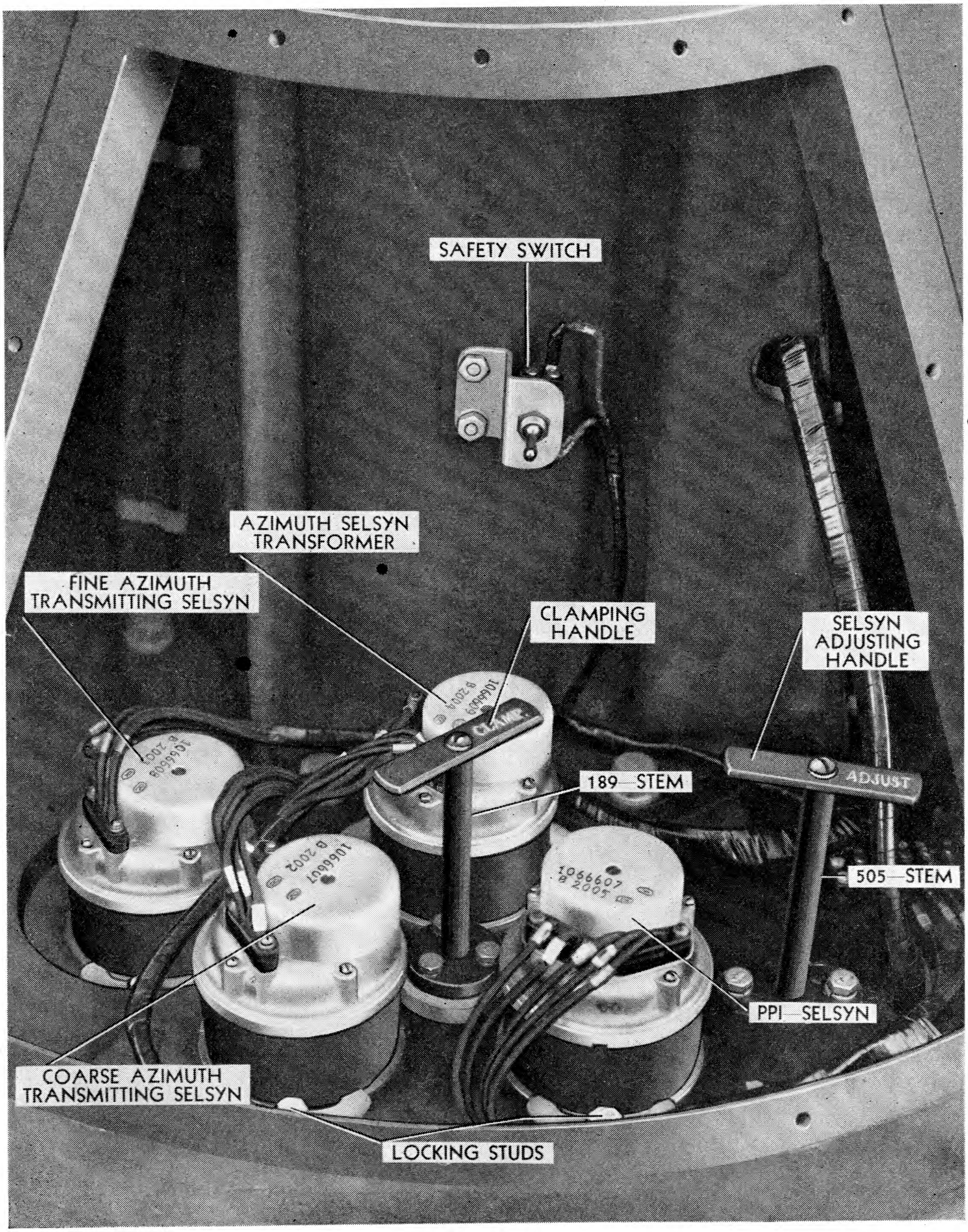


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Fig. 22—Azimuth selsyn compartment

Orientation in azimuth

81. (a) Remove the azimuth selsyn cover plate on the pedestal. Slacken the azimuth orientation clamping handle (Fig. 22) by turning it anticlockwise. Push down the selsyn adjusting handle and rotate it until the readings of the azimuth dials of the computer differ by exactly 180 degrees from the azimuth mechanical dials of the tracker. Tighten the clamping handle in place. Check that the computer azimuth indication has not changed.

(b) Check that the azimuth selsyn receivers on the antenna position indicator and the azimuth selsyn receivers on the tracker indicate exactly the azimuth reading of the computer. If the readings are correct replace the cover plate. If the readings are incorrect proceed as follows:

(i) If both the indications agree but are incorrect, align the azimuth selsyn transmitters B2002 and B2003, individually as detailed in para. 111.

(ii) If the azimuth readings of the computer, the tracker selsyn receivers and the antenna position indicators are all different, align the selsyn transmitters on the pedestal and the selsyn receivers in the antenna position indicator. The adjustment of the selsyns in the antenna position indicator is given in para. 112.

(iii) If one of the readings is different from the computer, that selsyn receiver producing the incorrect reading must be re-oriented.

Orientation in elevation

82. (a) Slacken the locking nut on the elevation selsyn drive shaft and the lock nuts on the elevation orientation adjusting screws (see Fig. 23).

(b) Adjust the elevation orientation adjusting screws until the angle of depression indicated on the computer elevation dials is equal to the elevation angle indicated on the mechanical dial on the tracker. The screws should be adjusted a little at a time; a quarter of a turn clockwise on one followed by a quarter of a turn anticlockwise on the other until the desired adjustment is made. Tighten the adjusting screw locking nuts and the selsyn drive shaft locking nut.

(c) Check that the elevation selsyn receivers in the antenna position indicator and the elevation selsyn receivers on the tracker read exactly the angle of depression indicated on the computer. If any of the readings are incorrect proceed as follows:

(i) If both the readings agree but are incorrect, individually adjust the elevation selsyn transmitters (B2052 or B2053) in the pedestal as detailed in para. 111.

(ii) If all the readings disagree, adjust the elevation selsyn transmitters in the pedestal and the elevation selsyn receivers on the antenna position indicator. The adjustment of the antenna position indicator selsyns is given in para. 112.

(iii) If one of the readings is different from the computer, individually adjust the selsyn receiver producing the incorrect reading.

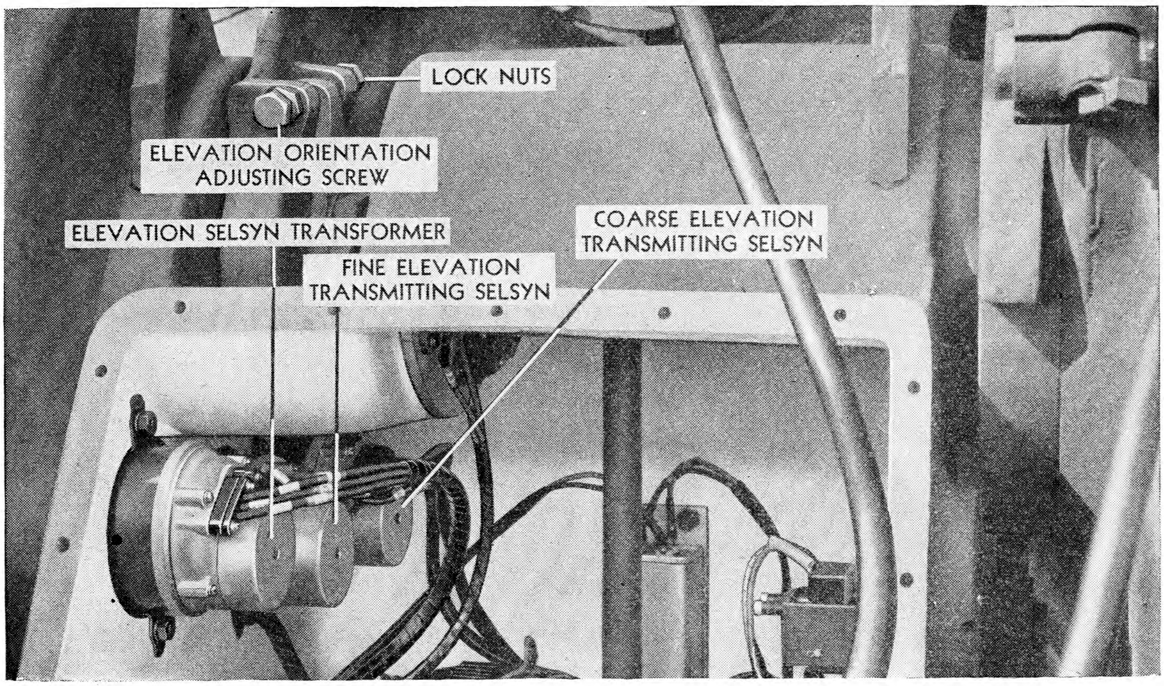

Fig. 23—Elevation selsyns and adjusting screws

Orientation in remote control

83. (a) Switch on the azimuth and elevation motor generators. Set the SAFETY switch on the control panel to RUN. Rotate the paraboloid in azimuth through approximately 180 degrees and adjust in elevation to coincide with the elevation of the tracker telescope. Set the CONTROL SWITCH to REMOTE.

(b) Check that the inner and outer pointers of the coarse and fine azimuth indicators of the tracker are matched. If they are not matched adjust the azimuth selsyn transformer (B2004) in the azimuth selsyn compartment, until the pointers coincide, as detailed in para. 112.

(c) Check that the pointers on the fine and coarse elevation indicators are matched. If they are not matched adjust the elevation selsyn transformer (B2054) in the elevation yoke, as detailed in para. 112.

(d) Operate the tracker azimuth and elevation handwheels. Check that the paraboloid follows the movement of the tracker telescopes and that the pointers on the tracker indicators remain coincident.

(e) Set the CONTROL SWITCH to AUTOMATIC and allow the follow-up motors to operate.

Orientation in range

84. (a) Ascertain that the SLANT RANGE/ALTITUDE switch on the data panel is set to the SLANT RANGE position.

(b) By means of the range handwheels adjust the range cursors exactly to 6,000 yards. Check that the range indicated on the range meter of the computer is exactly 6,000 yards.

(c) If the range meter reading is incorrect orient the range data potentiometer as follows:

(i) Partially withdraw the range indicator unit from the control rack.

(ii) Adjust the SLEWING and TRACKING handwheels on the range indicator to produce a reading of exactly 6,000 yards on the computer range meter.

(iii) Unscrew the four securing screws and remove the circular pinion cover-plate (located on the front right-hand corner on the top of the assembly). Slacken the three clamping screws on the pinion gear sufficiently to ensure that the clamping plate is loose and move the range controls to bring the cursors to 6,000 yards range. Note that the reading of the range meter on the computer does not change when this is being done. Tighten the three clamping screws on the pinion gear.

(iv) Rotate the handwheels to increase the range setting of the cursors and then bring the cursors back to 6,000 yards. Check that the range meter on the computer indicates exactly 6,000 yards. Repeat for a decrease in range.

(v) If the reading on the computor is not exactly 6,000 yards repeat (ii), (iii) and (iv) until that condition is obtained. Replace the pinion cover plate.

INSTRUCTIONS FOR CLEANING AND ADJUSTMENT OF CERTAIN COMPONENTS

TRAILER

To clean the fuel filter of the petrol heater

85. (a) Turn the shut-off valve on the fuel tank, located on the outside of the front of the trailer, to the off (horizontal) position.

(b) Remove the fuel control valve guard by removing the four rd. hd. machine screws which hold it to the right-hand side of the heater, (see Fig. 24).

(c) Unscrew the knurled knob at the bottom of the filter bowl and remove the bowl.

(d) Remove the filter bowl gasket and filter screen.

(e) Wash the screen and the bowl in clean petrol.

(f) Replace the filter bowl gasket and filter screen.

(g) Replace the fuel control valve guard.

(h) Turn the fuel tank shut-off valve to the on (horizontal) position.

To remove ice or water from the petrol heater fuel system

86. (a) Turn the shut-off valve on the fuel tank to the off (horizontal) position.

(b) Disconnect the fuel pipe from the union at the base of the tank.

(c) Remove the fuel tank from the outside front wall of the trailer.

(d) Drain, thaw and carefully clean the fuel tank, taking care to keep it well away from naked lights.

(e) Remove as much of the fuel pipe as appears necessary and thaw and clean it, taking care that no dirt is allowed to remain, continuing to observe fire precautions.

(f) Replace the fuel lines and the tank. Reconnect the union at the base of the tank.

(g) Refuel the tank and turn the shut-off valve to the on (vertical) position.

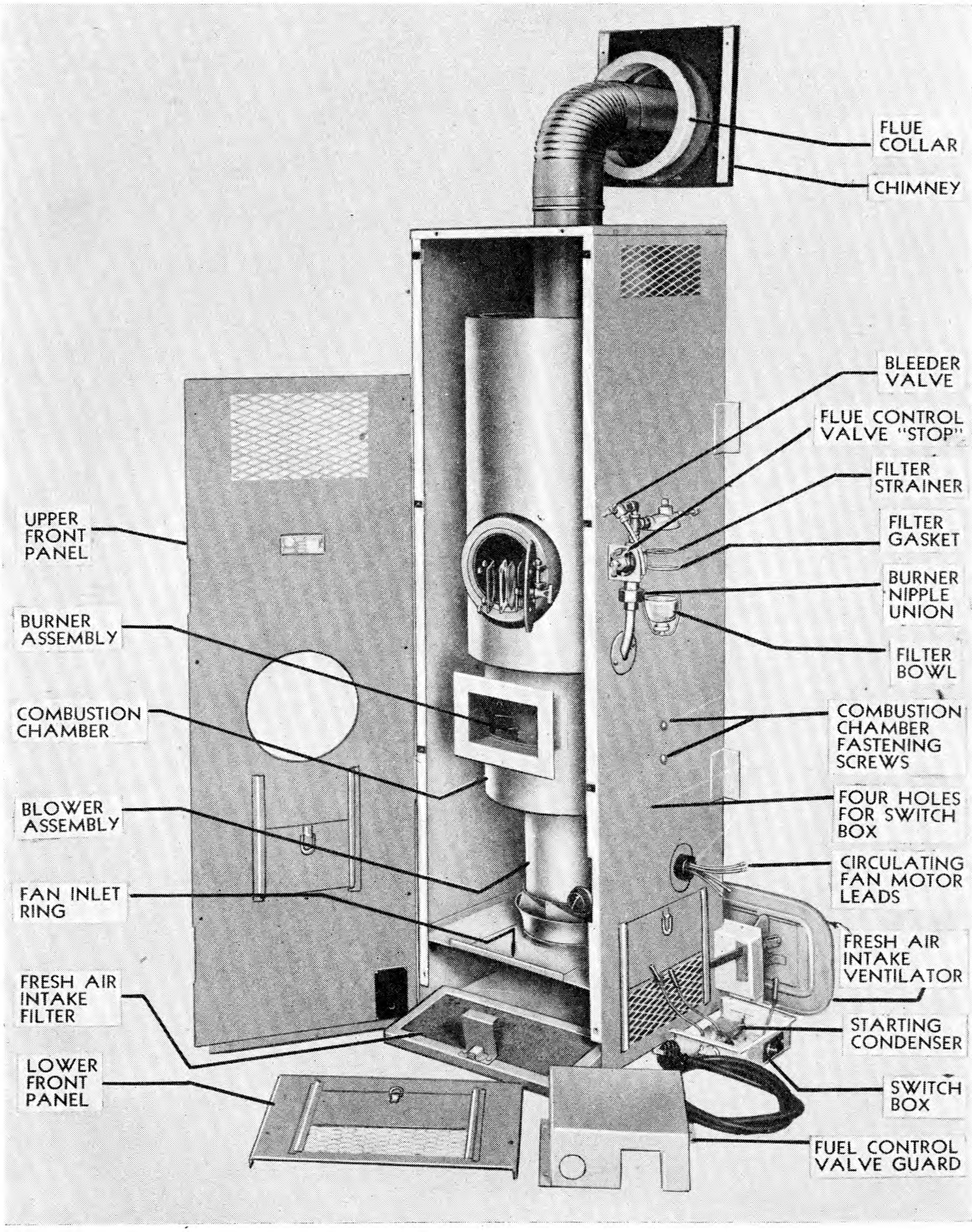

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Fig. 24—Petrol heater with parts identified.

To clean an obstructed fuel control valve in the petrol heater

87. (a) Unscrew the acorn nut holding the fuel control handle in place and remove the handle.

(b) Turn the valve stem in and out as far as possible and the needle, with its larger permitted length of travel due to the removal of the handle, will probably clear the obstruction.

(c) Replace the handle and the acorn nut.

To clean the fresh air intake filter on the petrol heater

88. (a) Remove the lower front panel from the heater assembly by removing the four screws visible on the front of the heater.

(b) Reach into the lower part of the heater, grasp the clip fastened to the filter and pull it straight out. (The filter is held in place by a light spring catch.) Mark the filter to enable it to be replaced correctly.

(c) Clean the filter in petrol using a brush to remove the dirt from the steel wool.

(d) Allow the filter to drain and dry thoroughly.

(e) Lubricate the filter element by dipping it in a bath of oil.

NOTE: In temperatures above 20 degrees F. use 30 H.D. engine oil. In temperatures below 20 degrees F. use 10 H.D. engine oil.

(f) Allow the filter to drain away from a dust laden atmosphere.

(g) Replace the filter by pushing it in towards the rear of the heater until the catch snaps in place.

(h) Replace the lower front panel.

To adjust the fuel control valve to remedy smoking of the petrol heater

89. (a) Before attempting to change the setting of the fuel control valve to remedy this condition, check that:

(i) The lighting door is closed tight.
(ii) The attaching flue parts are free of soot.
(iii) The burner air parts are clear.
(iv) The sliding natural draught door is closed.
(v) The blower motor is operating.

(b) Loosen the jam nut holding the high position stop of the fuel control valve in place and turn the stop clockwise about 1/8 of an inch. Tighten the jam nut.

(c) Wait about 15 minutes and if the smoking has not abated, repeat para. (b).

(d) If moving the stop a total of 1/4 of an inch does not correct the trouble replace the fuel control valve.

To clean the trailer intake ventilator filter

90. (a) Remove the two screws holding the hinged louvre to the outside box assembly.

(b) Swing the louvre to one side and the filter is accessible for removal.

(c) Clean the filter as detailed in para. 88 (c) to (f).

To clean the control rack air filter

91. (a) Remove the air filter access plate located on the inside of the right-hand blower motor housing at the bottom.

(b) Release the retaining clips and lift the filter from its mounting.

(c) Mark the filter to enable it to be replaced correctly.

(d) Tap the filter against the wall or on the ground to remove as much dirt as possible.

(e) Clean the filter as detailed in para. 88 (c) to (f).

(f) Replace the filter and the filter access plate.

MODULATOR RACK

To clean the vitreous resistors and insulators

92. (a) Clean all dirty or corroded metallic connections of the vitreous resistors with a brush or cloth dipped in carbon tetrachloride, or, if the corrosion is very bad, with No. 000 glass paper.

(b) Wipe the connections thoroughly with a clean dry cloth.

(c) Wipe the body of the resistors and the insulators with a clean dry cloth, or with a brush or cloth dipped in carbon tetrachloride if the dirt deposit is unusually hard to remove. Polish the resistors and insulators with a dry cloth.

To clean the air filters in the modulator rack

93. (a) Remove the filters from their retaining clips and clean them as detailed in para. 88 (c) to (f).

To check film cut-outs SG 201, 202, and 203.

94. (a) Pull the contact spring gentle away from the contact post and remove the insulating paper.

(b) Inspect the contact spring and post for dirt, and burned or pitted places.

(c) Clean off the dirt with a rag or brush dipped in carbon tetrachloride and dry thoroughly with a cloth.

(d) Smooth the surfaces of the spring and post with a crocus cloth stick or a glasspaper stick, taking care not to remove more metal than is necessary and to preserve the shape of the contacts.

(e) Polish the surfaces with a cloth.

(f) Replace the paper, changing it if it is perforated, and ensure that the spring clamps the paper firmly against the post. Bend the spring slightly at one or two points along the length to obtain a bow if necessary.

To age a magnetron valve

95. All new magnetrons should be aged before they are placed in operation, in order to avoid damage to the valve and seal. Spare magnetrons should be similarly treated once every two weeks. Any magnetron having a tendency to internal flashing should be immediately subjected to the ageing process. Internal flashing is audible and produces an erratic indication on the OSCILLATOR PLATE current meter.

96. The ageing process is as follows:

(a) Adjust the high voltage, by means of the RAISE button on the high voltage rectifier rack, to increase the magnetron current in steps as indicated in table 3.

(b) At each value of current, operate the valve for 5 seconds, then remove the high voltage for 5 seconds and repeat for the number of cycles indicated in the table.

(c) Operate the valve continusouly for 1 minute at the end of each series of cycles before increasing the magnetron current to the value.

TABLE 3 — MAGNETRON AGEING CYCLES

MAGNETRON CURRENT	AGEING CYCLES
12 mA	4 cycles
17 mA	4 cycles
22 mA	6 cycles
27 mA	6 cycles

(d) On completion of this procedure, the valve may be operated continuously.

To proof a 6C21 valve.

97. All new 6C21 valves should be proofed before operation and spares should be proofed every two weeks as follows:

(a) Disconnect the magnetron filament leads. Tie the leads so that the plugs are not touching each other and are well separated from the cover.

(b) Switch on the high voltage and modulator racks and raise the high voltage to 27KV.

(c) If the overload relay trips reduce the high voltage to about 10KV, press the CLOSE button and increase the H.T. to a value which does not cause the overload relay to trip.

(d) Operate with this voltage for a few minutes and again increase the H.V. Always keep the high voltage to a value which does not cause the relay to trip.

(e) Repeat (d) until the valves will operate for five minutes at 27KV without an overload.

(f) Lower the voltage, press the TRIP button and replace the magnetron filament leads.

HIGH VOLTAGE RECTIFIER RACK

To check film cut-out SG 301

98. (a) Carry out this procedure as detailed in para. 94.

To clean the air filter

99. (a) Remove the filter from its retaining clips and clean it as detailed in para. 88 (c) to (f).

R.F. SYSTEM

To clean the fixed joints in the R.F. transmission line

100. (a) Separate the two parts of the joints by removing the four retaining machine screws and lockwashers and the rubber gasket.

(b) Remove any corrosion (usually in the form of a white or green deposit) with No. 000 glass-paper.

(c) Polish the metal with crocus cloth.

(d) Remove all trace of the abrasive from the joint before replacing it.

(e) Replace the joint by reversing the removal procedure outlined in (a) above, ensuring that the gasket is not perished or broken.

To clean the low speed joints in the transmission line

101. (a) Refer to Fig. 25. Remove the four screws A securing the split flange B to the casing C.

(b) Remove the split flange.

(c) Separate the coupling by removing either the transmission line clamp or the screws E.

(d) Pull the pins out for examination.

(e) Remove the bearing sealol Barco Assembly No. 50940C-BM. This consists of a rubber ring and three metal washers. The order of removal of these parts should be noted for correct replacement.

(f) Clean all parts thoroughly, including all removed bearings, using very fine glass paper where necessary.

(g) Check very carefully that all grit has been removed.

(h) Coat the sleeve bearing F with a thin film of light machine oil.

(i) Replace the bearing sealol, taking care that the slot engages the key in the lockwasher.

(j) Reassemble in the reverse order.

RANGE INDICATOR UNIT

To adjust the range motors limit switch

102. (a) Remove the machine screws which hold the range indicator unit in the control rack.

(b) Pull the unit forward as far as it will go.

(c) The range motors limit switch is located behind the range indicator panel in the bottom left-hand corner.

(d) Using a tubular spanner to fit a 3/8-inch hex. head bolt, loosen the two bolts which hold the switch to the panel.

(e) Move the switch lengthwise, say 1/8-inch, and retighten the bolts.

(f) Switch on the range unit power supply and, by setting in a rate with the tracking handwheel, note the reading of the range indicator oscilloscopes when the range limit switch comes into effect at each end of the range scale.

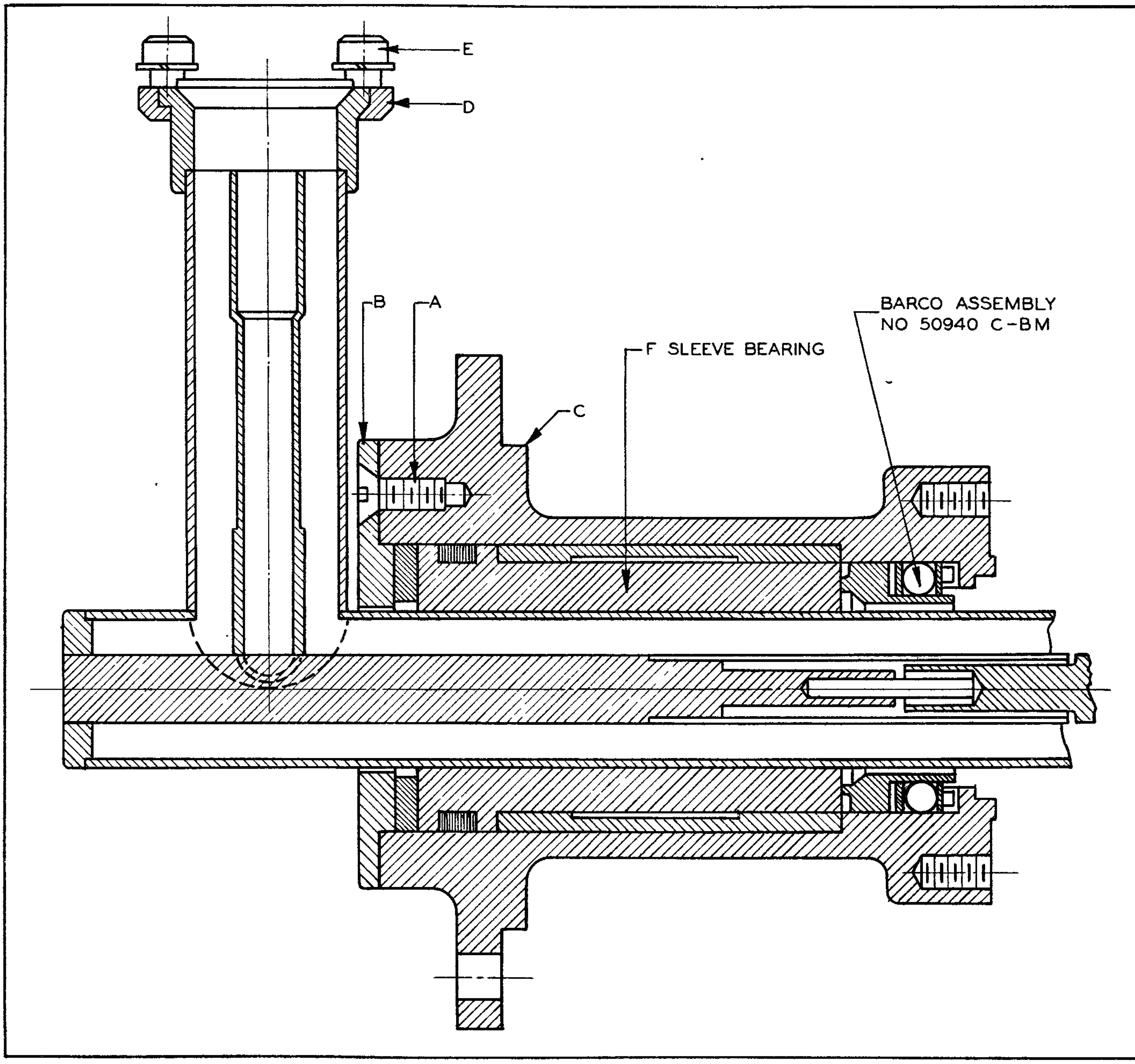

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Fig. 25—Low speed rotating joint assembly

(g) Repeat paras. (c), (d) and (e) until the range limit switch comes into effect at about −230 yards (an actual reading of 1770 yards on the 2,000 yard C.R.T.) after the pointer has been rotated anticlockwise, and ±350 yards when the pointer has been rotating in a clockwise direction.

(h) Replace the unit in the rack and reinsert the screws.

To adjust the position of zero range on range indicator oscilloscopes

103. (a) Some range units will be found to generate sweep voltages which are 180 degrees out of phase with those of other units. This is due to a reversal in the direction of winding of sweep transformers T601 and T602 which occurred in early production units. The reversal will become evident when changing range units by the appearance of the transmitter pulse in a position 180 degrees from normal. This effect may also be encountered after the installation of a new sweep transformer.

(b) In such cases the oscilloscope should be rotated through 180 degrees to locate the zero position correctly as detailed in para. 59.

P.P.I. OSCILLOSCOPE

To adjust the focus coil of the P.P.I. oscilloscope

104. (a) Remove the four machine screws, partly withdraw the P.P.I. unit from the rack and remove V1603.

(b) Connect the test multimeter on the 10V D.C. range between pin 3 of V1615 and pin 3 of V1616, the horizontal push-pull sweep amplifiers.

(c) Adjust the right-hand of the two controls marked CENTRE ADJ. on the top of the P.P.I. unit until the meter reads zero.

(d) Repeat for the vertical push-pull sweep amplifiers, V1617 and V1618, using the left-hand CENTRE ADJ. control.

(e) If the spot is not within ¼ inch of the dot on the centre of the screen, loosen the two side and the bottom adjusting screws which hold the focus coil.

(f) Move the coil sideways, pivoting it about the bottom adjusting screw, until the spot is horizontally at the centre of the screen.

(g) Partly tighten the side adjusting screws.

(h) Repeat (f) moving the bottom of the coil towards and away from the screen until the spot is as close as possible to the centre of the tube.

(i) Tighten the adjusting screws.

(j) Replace V1603 in the chassis and replace the chassis in the rack.

(k) Replace the four machine screws.

To adjust the deflection coil of the P.P.I. oscilloscope

105. The deflection coil will not normally require adjustment unless the shape of a replacement C.R.T. is such that the coil must be moved towards the socket of the end of the tube in order to replace the front screen. Mal-adjustment of the coils is indicated by the outer portion of the sweep having low brilliance and poor focus.

(a) Adjust the focus coil as detailed in para. 104.

(b) Slacken the two side adjusting screws of the deflection coil and slightly loosen the bottom adjusting screw.

(c) Find by trial and error the position of the coil which gives satisfactory uniformity of intensity and focus over the whole screen.

(d) Tighten the adjusting screws.

AZIMUTH AND ELEVATION TRACKING UNIT

To clean the contacts of S401

106. (a) Set the switch to the up position.

(b) Draw a strip of clean wrapping paper, moistened with carbon tetrachloride if necessary, between each pair of contacts which should be closed, meanwhile holding them together with the fingers.

(c) Polish by repeating the process with a dry paper strip.

(d) Repeat (b) and (c) above, for the other set of contacts with the switch in the down position.

ANTENNA POSITION CONTROL UNIT

To adjust the clutches on the antenna position control handwheels

107. (a) Remove the machine screws which hold the antenna position control unit in the rack.

(b) Pull out the unit as far as it will go.

(c) Using a short tubular spanner tighten the nuts which are accessible underneath the unit just behind the front panel until the handwheels turn freely, but do not slip when released.

(d) Replace the unit in the rack and reinsert the screws.

To adjust the speed control for the P.P.I. scan motor

108. The recommended normal pedestal rotation speed is 5 r.p.m. At low ambient temperatures this speed will be slower than normal due to the stiffness of the grease on the motor driven scan mechanism in the antenna position control unit. At extremely low temperatures the pedestal may rotate too slowly or may not start at all. It is then necessary to adjust the MOTOR SPEED control to increase the torque of the scan motor. This may be done by withdrawing the antenna position control unit, part way out of the rack. The MOTOR SPEED control will be found on the left rear top of the chassis. The chassis may be left partly withdrawn from the rack for a few minutes while the scan mechanism warms up, after which reset the control and return the chassis to the rack.

PEDESTAL

To release a jammed paraboloid

109. (a) Slacken the bolts securing the elevation drive motor to the elevation drive case until the motor may be pulled out sufficiently to disengage the oldham coupling.
(b) Push the paraboloid upward by hand to release the gear train.
(c) Slide the motor back into position ensuring that the coupling is correctly engaged to tighten and elevation drive motor bolts.

To adjust the elevation limit switches

110. (a) Remove the cover over the elevation compartment of the upper pedestal. Refer to Fig. 26.
(b) Loosen the two screws which hold the mounting plate to the elevation yoke.
(c) Turn the mounting plate cam with a 7/16 inch wrench applied to its square end until the limit switches cut out the elevation drive motor at −3 degrees and +85 degrees.
(d) Tighten the holding screws.
(e) If it should be necessary to make a radial adjustment to one of the limit switches, loosen the mounting screws at either end of the switch.
(f) With a screwdriver turn the switch adjusting pin until the desired radial position is obtained.
(g) Tighten the switch mounting screws.
(h) Replace the cover over the elevation compartment.

SELSYN DATA SYSTEM

To adjust a transmitting selsyn in the pedestal

111. (a) Using the 9/16 inch socket wrench and the ten inch ratchet handle extension, slacken the two hex. head bolts holding the two clamping plates which secure the selsyn.
(b) Turn the body of the selsyn by hand until the antenna position indicator dials show the desired reading.
(c) Tighten the hex. head bolts.

To adjust a receiving selsyn in the antenna position indicator unit

112. (a) Remove the retaining screws from around the antenna position indicator unit and with draw the unit as far as possible from the rack.
(b) Slacken the thumbscrew which holds the selsyn, and rotate the body of the selsyn until the antenna position indicator dial shows the correct reading.
(c) Tighten the thumbscrew.
(d) Slide the unit back into the rack and replace the retaining screws.

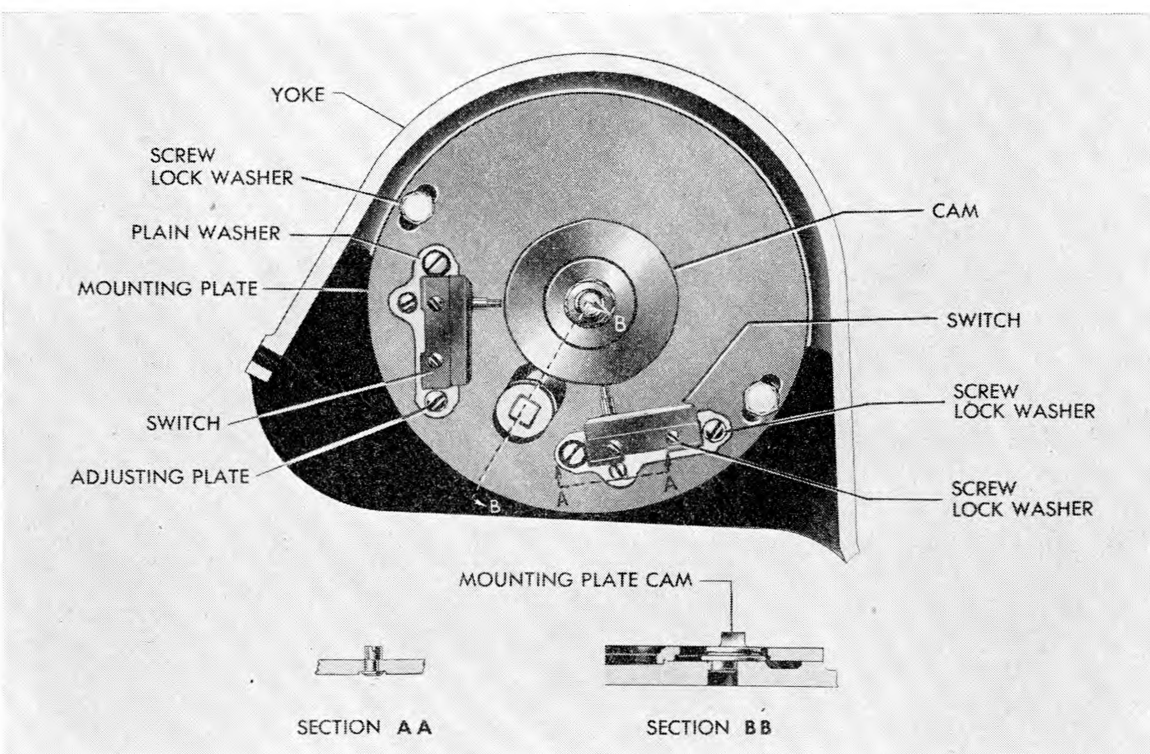

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Fig. 26—Adjustment of elevation limit switches

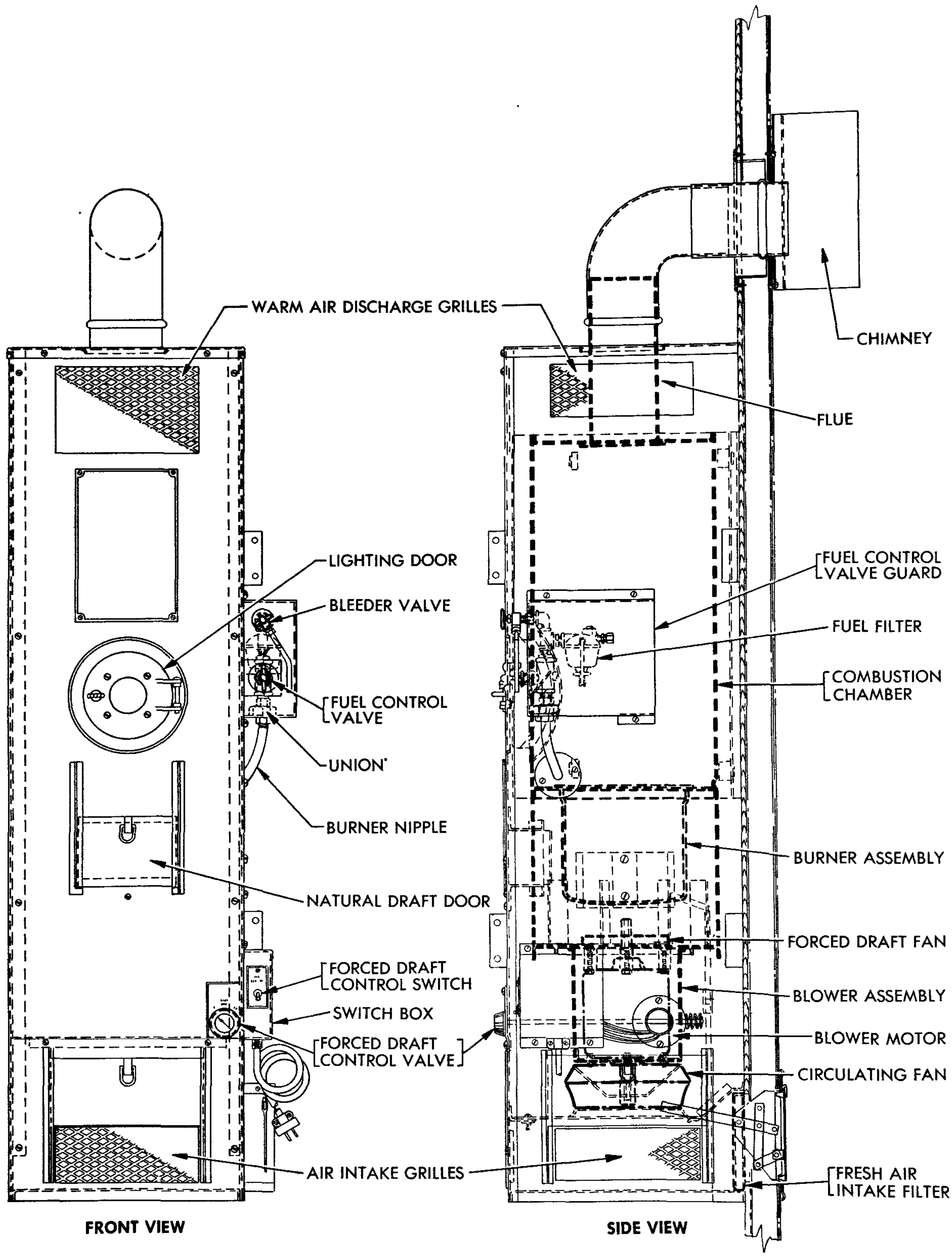

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Fig. 27—Phantom view of heater showing parts assembled

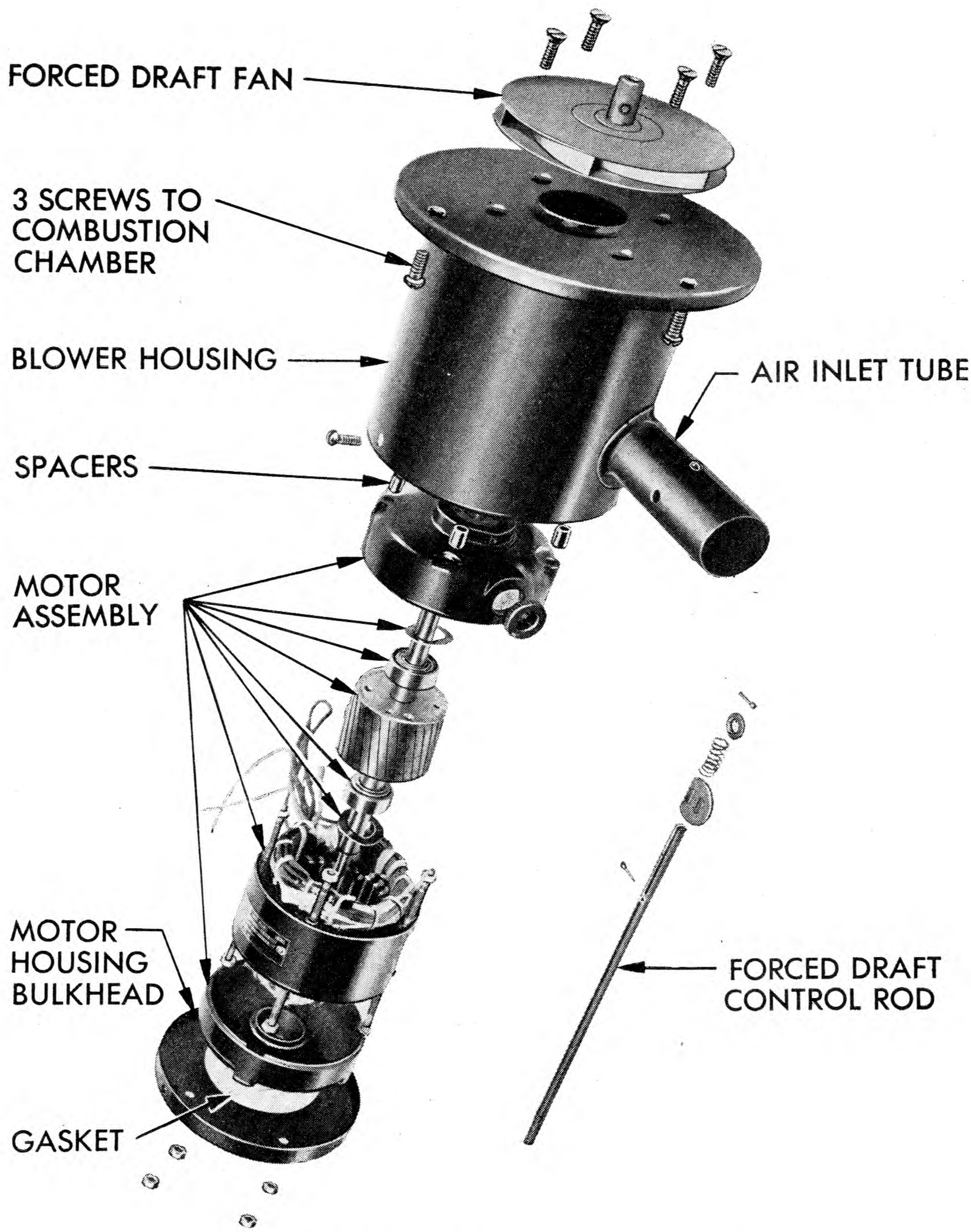

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Fig. 28—Exploded view of combustion unit of heater

To replace

121. (a) Polish the surface of the magnetron valve pin, using an extremely fine abrasive cloth.

(b) Check the fingers of the bullet which grab the valve pin. If necessary bend the fingers so that they touch each other at the tip of the bullet.

(c) Increase the gap between the magnet poles sufficiently to allow the magnetron anode connection to pass through by rotating the pole spacing adjusting screw clockwise.

(d) Install the magnetron by reversing the procedure detailed in para. 120. The new magnetron is not supplied with a rubber gasket. Replace the old gasket before replacing the coupling unit on the anode terminal. **Observe the precaution in para. 120(f).** When sliding the anode connection into the bullet ensure that the bullet does not move to one side. If the bullet and anode connections are not concentric damage will probably result to the fragile glass seal of the magnetron.

(e) Adjust the magnet gap as detailed in paras. 49 to 51.

(f) It is very important that the tungsten pin of the magnetron valve is kept clean at all times.

TR BOX

To remove the TR box

122. (a) Remove the cover over the magnetron compartment.

(b) Remove the screen over the modulator filament connections (A sets only).

(c) Remove the connection to the keep-alive electrode at the bottom of the TR box.

(d) Remove the connections to the crystal mixer.

(e) Remove the two round head screws securing the TR box and the crystal mixer to the support bracket.

(f) Remove the two screws securing the TR box to the tee junction.

(g) Slacken the screws securing the support bracket to the top of the modulator rack and slide the bracket away from the TR box.

(h) Remove the box by pushing it towards the support bracket to clear the input coupling loop. Care must be taken to avoid damage to the input coupling loop.

To replace

123. (a) Replace the box in the reverse order of its removal.

To replace the TR tube

124. (a) Remove the TR box as detailed in para. 122.

(b) Remove the top and bottom caps by unscrewing the eight round head machine screws securing each cap to the body.

(c) Remove the four round head screws holding together the two halves of the box.

(d) Remove the TR tube and clean and polish carefully the inside of the TR box.

(e) Replace the TR tube and reassemble the box ensuring that the pins of the tube are securely clamped by the two end caps. If new gaskets are fitted they may have to be reduced in size.

(f) Replace the TR box. Tune the plungers as detailed in paras. 54 or 55.

CRYSTAL MIXER

To change the crystal

125. The expected useful life of the crystals supplied is about 100 hours. The crystal should be checked by replacement in the event of decreased signal to noise ratio observed on the range oscilloscopes or poor ringing time when the echo box is in use.

(a) Remove the I.F. output lead from the crystal mixer and unscrew the knurled coupling nut next to the I.F. output lead coupling nut. Remove the output fitting. Pull out the crystal from its seating.

(b) *When handling a crystal it should always be short-circuited with the fingers of the hand holding it. When replacing the new crystal keep it short-circuited with the fingers. Touch the mixer assembly with the fingers to remove any static charge before removing the short-circuit and inserting the crystal.*

(c) Insert the crystal in position in the mixer. The springs which form the contacts to the crystal should make a snug positive contact. If the crystal does not slide easily in place with a light pressure do not force it in. Examine the crystal and the mixer to determine the cause of the poor fit.

(d) Replace the output fitting and tighten the knurled coupling nut. Replace the I.F. output lead.

(e) Tune the R.F. stages as detailed in paras. 53 and 54 or 55.

To remove the crystal mixer

126. (a) Remove the TR box as detailed in para. 122.

(b) Unscrew the two screws securing the clamping plate to the box and remove the mixer.

(c) If necessary unscrew the clamping nut to remove the coupling loop and the crystal contact.

To replace

127. (a) Secure the coupling loop to the mixer with the clamping nut ensuring that the loop is in the same plane as the local oscillator coupler.

(b) Reassemble the mixer to the TR box and screw the clamping plate with the two round head screws.

(c) Replace the TR box.

(d) Tune the TR box and adjust the coupling loop as detailed in paras. 54 or 55.

LOCAL OSCILLATOR

To remove the local oscillator

128. (a) Remove the two cables to the crystal mixer.

(b) Remove the three connectors at the rear of the local oscillator chassis.

(c) Undo the screws in the front panel of the unit and withdraw it from the front of the rack.
(d) Remove the reflector connection from the top cap of the Klystron and the output connections.
(e) Remove the four screws which hold the Klystron to the tuner.
(f) Reach under the chassis and grasp the socket, hold the Klystron firmly by the lower part of the valve with the other hand. Remove the Klystron from its socket.

To replace

129. (a) Place the four holding screws through the holes in the flanges of the Klystron. Place the Klystron in position in the local oscillator unit. Hold it firmly by the lower part of the valve and put on the socket. Fasten the Klystron to the tuner with the four screws.
(b) Replace the top cap connection and output cables.
(c) Replace the unit in the rack and replace the connections to the crystal mixer and the three connections at the rear of the chassis. Tune the Klystron as detailed in para. 54 or 55.

RANGE INDICATOR UNIT

To remove a range indicator C.R.T.

130. (a) Switch off the range indicator power supply.
(b) Remove the glass cover in front of the C.R.T. by slackening the six bolts which clamp the retaining ring in place.
(c) Unclip the wire which is connected to the terminal on the front of the tube.
(d) Open the rear doors of the trailer, and remove the panel behind the indicator unit.
(e) Remove the three screws which hold the large circular plate at the rear of the shield. Pull the circular plate, tube socket, and tube a short distance out of the tube shield. Remove the tube socket.
(f) Pull the circular plate, socket and wires away from the rear of the tube shield.
(g) Remove the tube from the shield.

To replace

131. (a) Replace the tube in the shield. Hold the tube by the glass neck, and place the socket firmly on the base of the tube.
(b) Push the assembly back into the tube shield and insert the studs which hold the circular plate in position. Do not screw them tightly. Tighten them only enough so that the tube seats lightly but firmly in the shield.
(c) Clip the lead to the terminal on the front of the tube.
(d) Slacken the four screws which fasten the inner metal ring to the circular plate and which, when loosened, allow the tube socket to be shifted with respect to the circular plate.
(e) Rotate the range gearing to the zero range error as given in the AB 20A.
(f) Switch on the range indicator power supply.
(g) If the 32,000 yard C.R.T. has been replaced, rotate it until the transmitter pulse is centered beneath the range pointer. If the 2,000 yard C.R.T. has been replaced, rotate it until the **leading edge** of the pulse is aligned with the range cursor.

NOTE: Do not attempt to rotate the tube, or place hands within the unit, unless the power to the unit is completely off. It will be necessary to turn the power off and on while making adjustments in order to do it safely.

(h) After the new tube has been oriented, tighten the four screws which fasten the inner metal ring to the circular plate and tighten the three screws which bolt the circular plate to the tube shield. These three screws should be tightened until the front of the tube is pressed tightly against the rubber ring in the face of the tube shield.
(i) Replace the cover and retaining ring on the front of the C.R.T. and replace the door at the back of the rack.

P.P.I. OSCILLOSCOPE

To remove the P.P.I. oscilloscope

132. (a) Switch off the P.P.I. power supply unit.
(b) Remove the cover plate from the bottom of the P.P.I. shield and remove the tube socket.
(c) Remove the three screws which fasten the P.P.I. indicator assembly to the front panel. (These are the three large screws of the nine on the scale ring).
(d) Remove the front ring and scale assembly from the panel.
(e) Remove the P.P.I. tube, being careful to remove the connection to the second anode terminal.

To replace

133. (a) Replace the above items in the reverse order of their removal. It is unnecessary to remove the focus or deflection coils in order to install a new tube. However, it may be necessary to slide the deflection coil further towards the base of the socket as detailed in para. 105 if the new tube is so shaped that it is impossible to replace the front ring and scale assembly.
(b) Adjust the P.P.I. sweep as detailed in paras. 62, 104 and 105.

ANTENNA POSITION CONTROL UNIT

To remove the P.P.I. scan motor

134. (a) Remove the rear cover over the bay of the control rack containing the antenna position control unit.

(b) Remove the plugs from the rear of the antenna position control unit.
(c) Remove the screws around the front panel which retain the antenna position control unit in the rack.
(d) Remove the unit from the rack.
(e) Remove the cover box over the worm gear at the end of the P.P.I. motor drive shaft.
(f) Remove the cable clamp from the azimuth control selsyn.
(g) Remove the P.P.I. motor by unscrewing the four screws on the back plate.

NOTE: Take care that the shims under the motor are not lost.

(h) Remove the leads from the motor terminal board and tag them to facilitate replacement.
(i) Remove the jaw clutch from the motor shaft.

To replace

135. (a) Assemble the jaw clutch on the shaft of the motor.
(b) Place the motor on its mounting bracket, ensuring that the shims are replaced, and that the jaw clutch on the motor shaft engages the drive tongue of the worm. Reinsert the mounting screws.
(c) Reconnect the motor leads and the cable clamp.
(d) Switch the CONTROL SWITCH to P.P.I. SCAN and run the motor.
(e) If there is a rattling noise from the point where the jaw clutch engages the drive tongue, slightly loosen the mounting screws of the motor, and shift the motor and its shims until the noise ceases.
(f) Tighten the motor mounting bolts.
(g) Replace the unit in the rack, reconnect the cables and replace the cover over the rear of the rack.

To remove a follow-up motor

136. (a) Remove the cover at the back of the control rack over the antenna position control unit.
(b) Remove the screws in the front panel which retain the unit in the rack, remove the plugs and slide the unit from the rack.
(c) Remove the motor leads and the corresponding selsyn leads, tagging them to facilitate replacement.
(d) Remove the selsyn by unscrewing the three retaining bolts.
(e) Remove the follow-up motor by unscrewing the four short screws securing its back plate to the main bed.

NOTE: Care must be taken not to damage the electric brake.

(f) Remove the gear from the motor shaft.

To replace

137. (a) Mount the gear on the shaft of the motor.
(b) Mount the motor on the rear bearing plate in the same manner as before and tighten the holding screws.

NOTE: It is important that considerable backlash exist between the gear on the motor shaft and the gear with which it meshes.

(c) Spin the gear train from the motor up to the selsyn stator with the finger to ensure that it runs very freely and coasts to a stop slowly.
(d) If not readjust the position of the motor, and the meshing of its gear until the friction is reduced to a satisfactory level.
(e) Replace the selsyn.
(f) Replace the motor leads and the selsyn leads.
(g) Slide the unit into the rack, reconnect the leads at the rear of the chassis, reinsert the retaining screws around the front panel and replace the cover over the rear of the rack.

SELSYN DATA SYSTEM

To remove an elevation selsyn

138. (a) Remove plugs P2007 and P2008 from their receptacles on the underside of the azimuth base.
(b) Open the door to the azimuth selsyn compartment and set the safety switch to the SAFE position.
(c) Remove the cover over the elevation selsyn compartment.
(d) Disconnect and tag for replacement the wires feeding the selsyn at terminal board TB9 or TB10.
(e) Using a ½ inch socket wrench, extension and ratchet handle remove the two cap screws and clamps which hold the selsyn in place.
(f) Remove the selsyn by pulling it out of the hole in the gear housing.

To replace

139. (a) Replace the items above in the reverse order of their removal.
(b) Orient the selsyn as detailed in paras. 80, 82 and 111.

To remove an azimuth selsyn

140. (a) Remove the door over the azimuth selsyn compartment and set the safety switch to the SAFE position. Removal P2005 and P2006.
(b) Remove the housing panel over the azimuth compartment by removing 14 cap screws.
(c) Disconnect and tag for replacement the wires to the selsyn at terminal board TB3 or TB4.
(d) Remove the two screws and clamps retaining the selsyn, using the 9/16 inch socket wrench and the 10 inch extension and ratchet handle.
(e) Remove the selsyn by pulling it vertically upward to bring its gears out of mesh.

To replace

141. (a) Replace the items above in the reverse order of their removal.
(b) Orient the selsyn as detailed in paras. 80, 81 and 111.

VOLTAGE AND RESISTANCE TABLES

GENERAL

142. (a) All voltages + DC unless otherwise stated.

(b) All DC voltages taken with a 20,000 ohms per volt meter.

(c) All voltages measured to earth in volts and with all cables connected unless otherwise stated.

(d) All resistances measured to earth in ohms and with all cables disconnected unless otherwise stated.

(e) *Means use caution when taking this reading—high voltage.

(f) Similar readings on the same component which are printed in italics on the same horizontal line indicates that the readings are taken between those points and not from each to earth.

(g) NC means no connection.

DRIVER UNIT, BC-1080

Conditions of Voltage Measurement. Modulator and high voltage rectifier operated so that the high voltage is applied and the DRIVER PLATE pilot is lighted.

TABLE 4—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V101	–15	195	0	0	90	0	6.3 A.C.	0
V102	NC	0	80	80	0	NC	6.3 A.C.	0
V103	6.3 A.C.	–190	740*	0	0	–195	6.3 A.C.	....
V104	6.3 A.C.	–200	750*	0	0	–200	6.3 A.C.	.....
V105	6.3 A.C.	–200	750*	0	0	–200	6.3 A.C.	.....
V106	NC	2.5 *5 A.C.*	NC	180 A.C.	NC	180 A.C.	NC	2.5 *5 AC*
V107	NC	470* *5 A.C.*	NC	390 A.C.	.NC	390 A.C.	NC	470* *5 AC*
V108	NC	750* *5 A.C.*	NC	275*A.C.	NC	275*A.C.	NC	750* *5 AC*

TABLE 5—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V101	.16M	Inf.	0	15K	Inf.	0	0	0
V102	NC	0	Inf.	Inf.	47K	NC	0	0
V103	0	81K	Inf.	0	0	81K	0	.....
V104	0	7.4K	Inf.	0	0	7.4K	0	.....
V105	0	7.4K	Inf.	0	0	7.4K	0	.....
V106	NC	100	NC	7.4K	NC	7.4K	NC	100
V107	NC	Inf.	NC	180	NC	180	NC	Inf.
V108	NC	Inf.	NC	Inf.	NC	Inf.	NC	Inf.

TABLE 6—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5
K101	2.5	0	NC	0	0
T104	750*	750*	–200	–200	....

TABLE 7—RESISTANCE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5
K101	100	Inf.	NC	Inf.	0
T104	*2.8*	*2.8*	*1.2*	*1.2*	....

LOCAL OSCILLATOR, BC-1096

Conditions of Voltage Measurement. Test cable W2101 used to bring 115V A.C. power from any convenient outlet.

TABLE 8—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1801	NC	37 *5 A.C.*	NC	–490*	NC	–490*	NC	37 *5 A.C.*
V1802	NC	–480* *5 A.C.*	NC	–460*	NC	–960*	NC	–480* *5 A.C.*
V1803	NC Top cap Max. 700* Min. 500*	0	NC	NC	0	NC	0	0
V1804	NC	–640*	NC	NC	–535*	NC	NC	NC
V1805	NC	–535*	NC	NC	–430*	NC	NC	NC
V1806	NC	–430*	NC	NC	–336	NC	NC	NC
V1807	NC	–335	NC	NC	–230	NC	NC	NC

TABLE 9—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1801	NC	1.45K	NC	35K	NC	35K	NC	1.45K
V1802	NC	35K	NC	2M	NC	2M	NC	36K
V1803	NC	36K	NC	NC	36K	NC	36K	36K
V1804	NC	2M	NC	NC	2M	NC	NC	NC
V1805	NC	2M	NC	NC	1M	NC	NC	NC
V1806	NC	1M	NC	NC	1.1M	NC	NC	NC
V1807	NC	1.1M	NC	NC	26K	NC	NC	NC

TABLE 10—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

	Component	Ter. 1	Ter. 2	
	R1806	....	–280	
	R1817	....	–520*	
	C1801	12	–530	
	C1802	4.5	–530	
	C1803	–900*	–530	
	C1804	–585*	–530	

PRE-AMPLIFIER, BC-1078

TABLE 11—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1851	0	0	0	0	1.5	119	6.3 A.C.	111
V1852	0	6.3 A.C.	0	0	1	119	0	112

TABLE 12—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1851	0	0	0	0	130	Inf.	0	Inf.
V1852	0	0	0	Inf.	132	Inf.	0	Inf.

TABLE 13—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1851	Inf.	Inf.	0	Inf.	100	Inf.	Inf.	100
J1853	Inf.	....	....	....	....	....	....	....

RECEIVER, BC-1056

Conditions of Measurement. Transmitter off, VOLUME control set at 0, A.G.C. off and R727 set to give 120V at V708 pin 8. No narrow strobe applied at J703.

TABLE 14—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V701	0	0	0	–10	0	115	6.3 A.C.	120
V702	0	0	0	0	1.3	115	6.3 A.C.	110
V703	0	0	0	0	1.1	115	6.3 A.C.	110
V704	0	0	0	0	0.025	0	6.3 A.C.	0
V705	0	0	0	0	1.4	115	6.3 A.C.	280
V706	0	0	0	0.5	240	7.8	6.3 A.C.	0
V707	0	0	0	0	14	300	6.3 A.C.	300
V708	NC	0	300	300	100	NC	120	120
V709	0	0	0	0	0	120	6.3 A.C.	100
V710	NC	0	60	60	0	NC	6.3 A.C.	0
V711	0	0	0	0	2	114	6.3 A.C.	105
V712	NC	0	310	310	0	NC	6.3 A.C.	32
V713	0	0	23	13.5	120	–10	6.3 A.C.	0
V714	0	0	117	0	0	117	*6.3 A.C.*	*6.3 A.C.*

TABLE 15—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V701	0	0	0	95K	120	95K	0	95K
V702	0	0	0	0	120	95K	0	95K
V703	0	0	0	0	100	95K	0	95K
V704	0	0	0	270	52 Min. 1.1K Max.	28K	0	4.5K
V705	0	0	0	0	100	95K	0	100K
V706	5K	0	0	5K	100K	1.1K	0	0
V707	0	0	0	100K	3K	100K	0	100K
V708	NC	100K	105K	110K	580K	NC	100K	100K
V709	0	0	0	115K	0	90K	0	560K
V710	NC	0	115K	115K	195K	NC	0	0
V711	0	0	0	0	100	90K	0	95K
V712	NC	0	110K	110K	450K	NC	0	350
V713	6 M	6 M	13K	1.5 M	100K	350K	0	0
V714	450K	450K	95K	450K	450K	95K	95K	95K

TABLE 16—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J701	Inf.	Inf.	NC	.....	.....	.....	.....	.....
J702	Inf.	.....	.....	.....	.....	.....	.....	.....
J703	95K	.....	.....	.....	.....	.....	.....	.....
J705	75	.....	.....	.....	.....	.....	.....	.....
J706	Inf.	.....	.....	.....	.....	.....	.....	.....
J707	Inf.	Inf.	Inf.	Inf.	0	95K	95K	0
J708	Inf.	80K	0	0	0	Inf.	Inf.	100K

RECEIVER POWER SUPPLY, RA-66

Conditions of Measurement. Switch in OFF position for resistance readings.

TABLE 17—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1001	NC	340 *5 A.C.*	NC	400 A.C.*	NC	400 A.C.*	NC	355 *5 A.C.*
V1002	NC	350 *5 A.C.*	NC	440 A.C.*	NC	440 A.C.*	NC	350 *5 A.C.*
V1003	NC	5 A.C.	NC	*735 A.C.**	NC	*735 A.C.**	NC	0
V1004	NC	–108	115 A.C.†	NC	0	NC	115 A.C.†	NC

† Between this point and F1002.

TABLE 18—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1001	NC	10K	NC	0	NC	0	NC	10K
V1002	NC	10K	NC	0	NC	0	NC	10K
V1003	NC	0	NC	100K	NC	100K	NC	0
V1004	NC	100K	Inf.	NC	0	NC	Inf.	NC

TABLE 19—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1001	Inf. *Inf.*	100K	0	0	0	0 *Inf.*	Inf.	10K
J1002	Inf. *1*	100K	0	0	0	Inf. *1*	Inf.	10K

TABLE 20—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

	Component	Ter. 1	
	C1001	345	
	C1002	315	
	C1003	–304	
	C1004	–294	

TABLE 21—RESISTANCE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5
T1001	*1.5*	*1.5*	*115*	....	*115*
T1002	*1.5*	*1.5*	*300*	....	*300*
L1001	*90*	*90*	....	....	....
L1002	*112*	*112*	....	....	....
L1003	*350*	*350*	....	....	....
L1004	*350*	*350*	....	....	....

REMOTE VIDEO AMPLIFIER, BC-1074

TABLE 22—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1101	0	0	0	0	2.1	164	6.3 A.C.	315
V1102	–8.9	–8.9	–8.5	–8.5	230	0	6.3 A.C.	0
V1103	0	0	0	0.1	1.1	67	6.3 A.C.	190
V1104	0	0	248	273	–19	–19	6.3 A.C.	0

TABLE 23—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1101	0	0	0	0	150	36K	Inf.	62K
V1102	6K	6K	8.5K	8.5K	87.5K	0	Inf.	0
V1103	0	0	0	550K	115	200K	Inf.	80K
V1104	0	0	62K	82K	19K	8K	Inf.	0

TABLE 24—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1101	0	.....	.....	.....	.....	.....	.....	.....
J1102	Inf.	.....	.....	.....	.....	.....	.....	.....
J1103	Inf.	29K	0	0	0	0	0	60K
J1104	1.3K	.....	.....	.....	.....	.....	.....	.....

RANGE UNIT, BC-1062

Conditions of Measurement. All potentiometers adjusted for normal operation.

TABLE 25—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V601	NC	*6.3 A.C.*	1	0	1	100	*6.3 A.C.*	250
V602	–20	170	0	–22	200	0	*6.3 A.C.*	*6.3 A.C.*
V603	–30	170	0	–28	180	0	*6.3 A.C.*	*6.3 A.C.*
V604	–28	165	0	–22	160	0	*6.3 A.C.*	*6.3 A.C.*
V605	NC	*6.3 A.C.*	235	75	–47	N.C	*6.3 A.C.*	9.5
V606	0	*6.3 A.C.*	1.9	–35	1.9	75	*6.3 A.C.*	185
V607	†	225	35	34.9	185	35	*6.3 A.C.*	*6.3 A.C.*
V608	3	110	0	0.4	240	0	*6.3 A.C.*	*6.3 A.C.*
V609	10	240	35	35	165	35	*6.3 A.C.*	*6.3 A.C.*
V610	–8.2	170	0	–4	220	0	*6.3 A.C.*	*6.3 A.C.*
V611	20	240	42	41	140	42	*6.3 A.C.*	*6.3 A.C.*
V612	0	240	20	20.5	150	20	*6.3 A.C.*	*6.3 A.C.*
V613	0	240	11.5	0.4	240	37.5	*6.3 A.C.*	*6.3 A.C.*
V614	0	*6.3 A.C.*	0	–25	0	–14	*6.3 A.C.*	233
Y601	0	NC	0	NC	NC	NC	0	NC
Y602	0	NC	0	NC	NC	NC	0	NC

† Depends on setting of SLEWING handwheels.

TABLE 26—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V601	NC	Inf.	500	2.2M	500	.35M	Inf.	32K
V602	47K	52K	0	120K	52K	0	Inf.	Inf.
V603	47K	52K	0	80K	52K	0	Inf.	Inf.
V604	47K	52K	0	32K	52K	0	Inf.	Inf.
V605	NC	Inf.	31K	.1M	.47M	NC	Inf.	1K
V606	0	Inf.	150	.1M	150	75K	Inf.	40K
V607	Inf.	36K	2.8K	3.3M	36K	2.8K	Inf.	Inf.
V608	.5M	39K	0	Inf.	38K	0	Inf.	Inf.
V609	80K	39K	2.8K	3.4M	38K	2.8K	Inf.	Inf.
V610	.4M	39K	0	Inf.	35K	0	Inf.	Inf.
V611	.1M	38K	2.7K	3.4M	38K	2.7K	Inf.	Inf.
V612	27K	39K	1.5K	3.4M	38K	1.5K	Inf.	Inf.
V613	100K	30K	10K	1M	30K	8.2K	Inf.	Inf.
V614	0	Inf.	0	Inf.	0	Inf.	Inf.	37K
Y601	0	NC	Inf.	NC	NC	NC	50	NC
Y602	0	NC	Inf.	NC	NC	NC	50	NC

TABLE 27—VOLTAGE READINGS AT JACKS

Jack	Pin A	Jack	Pin A	Jack	Pin A	Jack	Pin A
J611	250	J615	185	J619	250	J623	−14.5
J612	175	J616	185	J620	250	J624	0
J613	170	J617	165	J621	−14.5	J625	0
J614	170	J618	240	J622	−28		

TABLE 28—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J601	0	0	NC	NC	.....	.....	.....	.....
J602	0	0	NC	NC	.....	.....	.....	.....
J603	1M	.....	.....	.....	.....	.....	.....	.....
J604	1M	.....	.....	.....	.....	.....	.....	.....
J605	1M	.....	.....	.....	.....	.....	.....	.....
J606	0	.....	.....	.....	.....	.....	.....	.....
J607	1M	.....	.....	.....	.....	.....	.....	.....
J608	0	.....	.....	.....	.....	.....	.....	.....
J609	.38M	31K	Inf.	Inf.	0	Inf.	Inf.	.46M
J610	Inf.	7.5K	14K	.....	.....	.....	.....	.....
J611	32K	.....	.....	.....	.....	.....	.....	.....
J612	52K	.....	.....	.....	.....	.....	.....	.....
J613	52K	.....	.....	.....	.....	.....	.....	.....
J614	52K	.....	.....	.....	.....	.....	.....	.....
J615	40K	.....	.....	.....	.....	.....	.....	.....
J616	36K	.....	.....	.....	.....	.....	.....	.....
J617	38K	.....	.....	.....	.....	.....	.....	.....
J618	38K	.....	.....	.....	.....	.....	.....	.....
J619	31K	.....	.....	.....	.....	.....	.....	.....
J620	37K	.....	.....	.....	.....	.....	.....	.....
J621	Inf.	.....	.....	.....	.....	.....	.....	.....
J622	Inf.	.....	.....	.....	.....	.....	.....	.....
J623	Inf.	.....	.....	.....	.....	.....	.....	.....
J624	1M	.....	.....	.....	.....	.....	.....	.....
J625	1M	.....	.....	.....	.....	.....	.....	.....

TABLE 84—TELS. MECHANIC'S ROUTINE MAINTENANCE SCHEDULE

	MAINTENANCE TASK	PARA. NO. In Routine Maintenance	DAY OF MONTH																											
	WEEKLY		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	Check efficiency of dehydrator	189	x							x							x							x						
2	Clean exhaust ventilators	190	x							x							x							x						
3	Clean control rack air filter	191	x							x							x							x						
4	Clean fuel filter of petrol heater	192	x							x							x							x						
5	Check line voltage regulator	193		x							x							x							x					
6	Check control rack blower motor	194		x							x							x							x					
7	Check trailer intake ventilator	195		x (a)							x							x							x					
8	Check magnetron output pin	196			x							x							x							x				
9	Check modulator blower motors	197			x(b)							x(b)							x(b)							x(b)				
10	Check components in modulator rack	198				x							x							x							x			
11	Clean modulator air filters	199				x							x							x							x			
12	Check condensers C301 and C302	200				x							x							x							x			
13	Clean high voltage rectifier air filter	201				x							x							x							x			
14	Check high voltage rectifier blower motor	202				x							x							x							x			
15	Check antennae (2)	203					x							x							x							x		
16	Check range motor brushes	204					x							x							x							x		
17	Check P.P.I. scan motor brushes	205						x							x							x							x	
18	Check azimuth compartment of pedestal	206						x							x							x							x	
19	Check brushes of azimuth drive motor	207							x							x							x							x
20	Check brushes of elevation drive motor	208							x							x							x							x
21	Check elevation compartment of pedestal	209							x							x							x							x
	FORTNIGHTLY																													
22	Age all spare magnetrons	210	x														x													
23	Proof all spare 6C21 valves	211		x														x												
	MONTHLY																													
24	Check elevator	212			x (c)																									
25	Check underside of pedestal base	213				x(d)																								
26	Check junction box JB 71	214				x																								
27	Clean petrol heater fresh air intake ventilator filter	215				x																								
28	Check petrol heater	216					x																							
29	Check driver unit	217					x																							
30	Check components in modulator rack	218						x (e)																						

RANGE POWER SUPPLY, RA-72

Conditions of Measurement: Voltage readings on V801, V802, V803, and T801 made with RANGE MOTORS switch on and TRACKING handwheel set so that the range pointers do not move. RATIO switch at 1.

TABLE 29—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V801	*5 A.C.*	*182*	*182*	*5 A.C.*	.....	.....	.....	.....
V802	*5 A.C.*	*92*	*92*	*5 A.C.*	.....	.....	.....	.....
V803	*5 A.C.*	*98*	*98*	*5 A.C.*	.....	.....	.....	.....
V804	NC	*5 A.C.*	NC	380 A.C.	NC	380 A.C.	NC	*5 A.C.*
V805	NC	270 *6.3 A.C.*	450*	NC	210	NC	270 *6.3 A.C.*	NC
V806	NC	270 *6.3 A.C.*	450*	NC	210	NC	270 *6.3 A.C.*	NC
V807	NC	270 *6.3 A.C.*	450*	NC	210	NC	270 *6.3 A.C.*	NC
V808	NC	*6.3 A.C.*	105	100	105	210	*6 3 A.C.*	215
V809	NC	0	0	NC	105	NC	0	NC
V810	*2.5 A.C.*	NC	NC	*2.5 A.C.*	.....	.....	.....	.....

TABLE 30—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V801	Inf.	Inf.	Inf.	Inf.	.....	.....	.....	.....
V802	Inf.	Inf.	Inf.	Inf.	.....	.....	.....	.....
V803	Inf.	Inf.	Inf.	Inf.	.....	.....	.....	.....
V804	NC	70K	NC	75 *130*	NC	60 *130*	NC	70K
V805	NC	105K	70K	NC	5.6M	NC	105K	NC
V806	NC	105K	70K	NC	5.6M	NC	105K	NC
V807	NC	105K	70K	NC	5.6M	NC	105K	NC
V808	NC	0	110K	50K Max. 40K Min.	120K	120K	0	5.6M
V809	NC	0	Inf.	NC	130K	NC	Inf.	NC
V810	80K	NC	NC	80K	.....	.....	.....	.....

TABLE 31—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J802	Inf.	Inf.	Inf.	Inf.	Inf.	0	0	0
J803	80K	110K	0	0	0	50K	70K	70K
J804	170K	.....	.....	.....	.....	.....	.....	.....

Jack	Pin I	Pin J	Pin K	Pin L	Pin M	Pin N	Pin O	Pin P
J802	Inf.	Inf.	Inf.	Inf.	Inf.	Inf.	Inf.	Inf.

Jack	Pin R	Pin S	Pin T	Pin U	Pin V	Pin W		
J802	Inf.	Inf.	Inf.	0	0	0		

Jack	Pin A	Pin D	Pin E	Pin I	Pin J	Pin L	Pin N	Pin O	Pin P	Pin R
†J802	3	Inf.	Inf.	Inf.	1	1.5	2	2.5	3	3.2

†Taken to J802 Pin C.

TABLE 84—TELS. MECHANIC'S ROUTINE MAINTENANCE SCHEDULE—Continued

	MAINTENANCE TASK	PARA. NO. In Routine Maintenance	DAY OF MONTH																											
	MONTHLY—Continued		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
31	Check components in high voltage rectifier rack	219																							x (f)					
32	Check stationary joints of RF transmission line inside trailer	220								x																				
33	Check stationary joints of RF transmission line outside trailer	221									x																			
34	Check elevation low speed rotating joint	222										x																		
35	Check azimuth low speed rotating joint	223											x																	
36	Check TR box	224												x																
37	Check local oscillator and power supply	225													x															
38	Check receiver	226													x															
39	Check receiver power supply	227														x														
40	Check range unit	228														x														
41	Check range indicator unit	229																			x									
42	Check oil level in range potentiometer	230																	x											
43	Check range power supply	231																		x										
44	Check P.P.I. unit	232																		x										
45	Check P.P.I. power supply	233																	x											
46	Check automatic tracking unit	234																				x								
47	Check azimuth and elevation tracking unit	235																					x							
48	Check motor generators	236																				x								
49	Check antenna position control unit	237																				x								
50	Check control panel	238																					x							
51	Check field power supply and remote video amplifier	239																						x						
52	Check the antenna position indicator unit	240																						x						
53	Check data panel	241																							x					
54	Check altitude converter control unit	242																								x				
55	Check oil level altitude potentiometer	243																								x				
56	Check switch box	244																									x			
57	Check oil level in azimuth potentiometer	245																										x		
58	Check elevation limit switches	246																											x	
59	Check oil level in elevation potentiometer	247																											x(g)	
60	Lubricate trailer chassis	Table 83																												x
	QUARTERLY																													
61	Check dehydrator	248							x(h)																					
62	Check components in modulator rack	249																										x(h)		

TABLE 32—VOLTAGE READINGS ON MISCELLANEOUS COMPONENTS

Component	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10
† T801	33 A.C.	60 A.C.	67 A.C.	83 A.C.	100 A.C.	115 A.C.	117 A.C.	133 A.C.	200 A.C.

† Taken to Terminal 1.

Ter. 11 to 12 – 2.5 A.C. Ter. 14 to 16 – 5 A.C.	Ter. 11 to 13 – 5 A.C. Ter. 17 to 18 – 2.5 A.C.	Ter. 14 to 15 – 2.5 A.C. Ter. 17 to 19 – 5 A.C.

PPI UNIT, BC-1058 35000 YARDS RANGE

Conditions of Measurement: Voltages taken with J-P1601 extended with test cable W2109, J-1602 with W2112, J-P1603 with W2111, J-P1604 with W2105, J-P1606 with W2121. Range unit turned on and furnishing trigger for PPI Unit. All potentiometers adjusted for normal operation.

TABLE 33—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1601	NC	3.2 A.C. *6.4 A.C.*	275	300	68	NC	3.2 A.C. *6.4 A.C.*	72
V1602	29	220	52	–25	60	0	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1603	–13	137	0	–50	145	0	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1604	0.25	97	8.5	–37	93	0.8	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1605	–22	115	0	–5.4	90	8.5	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1606	176	265	180	175	270	180	176 *6.4 A.C.*	176 *6.4 A.C.*
V1607	176	265	180	175	270	180	176 *6.4 A.C.*	176 *6.4 A.C.*
V1608	–0.4	115	0	0	0	0.7	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1609	0.7	170	5.7	0	170	5.7	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1610	–17	115	18	–17	18	10	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1611	–17.5	115	8.6	–17.5	8.6	8.5	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1612	–19.8	13	5	–19.8	115	13	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1613	–17.5	8.6	8.5	–17.5	115	8.6	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1614	–0.4	44	0	0	270	20	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1615	NC	3.2 A.C. *6.4 A.C.*	250	285	17.5	NC	3.2 A.C. *6.4 A.C.*	33
V1616	NC	3.2 A.C. *6.4 A.C.*	250	285	8.2	NC	3.2 A.C. *6.4 A.C.*	30.2
V1617	NC	3.2 A.C. *6.4 A.C.*	250	285	13	NC	3.2 A.C. *6.4 A.C.*	31
V1618	NC	3.2 A.C. *6.4 A.C.*	250	285	8.6	NC	3.2 A.C. *6.4 A.C.*	29.5

TABLE 84—TELS. MECHANIC'S ROUTINE MAINTENANCE SCHEDULE—Continued

	MAINTENANCE TASK	PARA. NO. In Routine Maintenance	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	MONTHLY—Continued																													
63	Check oil level in high voltage transformer	250																				x(h) (i)								
64	Check components in high voltage rectifier rack	251																			x(h) (j)									
65	Check contacts of switch S401	252																					x(h)							
66	Check pedestal slip rings	253						x(h)																						
67	Lubrication of motor generators	Table 81 Item 16														x(h)														
68	Lubrication of control rack blower	Table 81 Item 10																					x(h)							

(a) Lubricate ventilator motor as detailed in Table 81, item 14.

(b) Lubricate BL.202 as detailed in Table 81, item 7.

(c) Lubricate elevator as detailed in Table 82.

(d) Check oil level of azimuth oil reservoir and add oil if necessary as detailed in Table 1, item 1.

(e) Lubricate as detailed in Table 81, items 8 and 9.

(f) Lubricate as detailed in Table 81, items 4 and 5.

(g) Check oil level in elevation oil reservoir and add oil if necessary as detailed in Table 81, item 2.

(h) These will be performed only every third month.

(i) Lubricate BL.201 and BL.203 as detailed in Table 81, item 6.

(j) Lubricate BL.301 as detailed in Table 81, item 3.

TABLE 34—RESISTANCE READINGS ON VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1601	NC	23	20K	20K	132K	NC	23	1K
V1602	4.8M	40K	5K	4.8M	132K	0	23	23
V1603	300K	42K	0	4.7M	42K	0	23	23
V1604	28K	Inf.	65	Inf	Inf.	350	23	23
V1605	Inf.	Inf.	0	100K	Inf.	65	23	23
V1606	50K	33K	25K	50K	30K	25K	50K	50K
V1607	50K	30K	25K	50K	30K	25K	50K	50K
V1608	180K	34K	0	0	0	1M	23	23
V1609	1M	32K	1K	39K Max. 19K Min.	32K	1K	23	23
V1610	0.47M	Inf.	Inf.	0.47M	Inf.	48	23	23
V1611	0.47M	Inf.	Inf.	0.47M	Inf.	65	23	23
V1612	0.47M	Inf.	38	0.47M	Inf.	Inf.	23	23
V1613	0.47M	Inf.	65	0.47M	Inf.	Inf.	23	23
V1614	220K	120K	0	220K	240K	90	23	23
V1615	NC	23	Inf.	23K	Inf.	NC	23	300
V1616	NC	23	Inf.	23K	Inf.	NC	23	300
V1617	NC	23	Inf.	23K	Inf.	NC	23	300
V1618	NC	23	Inf.	23K	Inf.	NC	23	300

TABLE 35—VOLTAGE READINGS AT JACKS

Jack	Pin A	Jack	Pin A	Jack	Pin A
J1608	300	J1611	72	J1614	270
J1609	285	J1612	52	J1615	0
J1610	140	J1613	270	J1616	5.7

TABLE 36—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1601	Inf.	Inf.	0	50K	50K	50K	0	3.9K
J1602	0	0	0	Inf.	Inf.	175	0	0
				3	*3*			
J1603	Inf.	NC	Inf.	23	23	0.75	0	0
J1604	5K	1K	20K	0	.....	.....	.....	.....
J1605	1M	.....	.....	.....	.....	.....	.....	.....
J1606	Inf.	.....	.....	.....	.....	.....	.....	.....
J1607	Inf.	.....	.....	.....	.....	.....	.....	.....
J1608	20K	.....	.....	.....	.....	.....	.....	.....
J1609	Inf.	.....	.....	.....	.....	.....	.....	.....
J1610	42K	.....	.....	.....	.....	.....	.....	.....
J1611	1K	.....	.....	.....	.....	.....	.....	.....
J1612	5K	.....	.....	.....	.....	.....	.....	.....
J1613	30K	.....	.....	.....	.....	.....	.....	.....
J1614	30K	.....	.....	.....	.....	.....	.....	.....
J1615	0	.....	.....	.....	.....	.....	.....	.....
J1616	1K	.....	.....	.....	.....	.....	.....	.....

Jack	Pin J	Pin K	Pin L	Pin M				
J1602	20K	Inf.	Inf.	Inf.				
J1603	Inf.	Inf.	Inf.	Inf.				

TABLE 85—OPERATORS' ROUTINE MAINTENANCE SCHEDULE

	OPERATORS' TASKS	PARA. NO. In Routine Maintenance	DAY OF MONTH																											
	DAILY		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	Clean cabin	254	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2	Check fire extinguishers	255	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	Check director signal switch	256	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4	Check telephones	257	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
5	Check A.C. outlets	258	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	WEEKLY																													
6	Check ventilators	259	x							x							x							x						
7	Check operators' seats	260	x							x							x							x						
8	Check essential spares, tools and test cables	261	x							x							x							x						
9	Check drain hoses	262		x							x							x							x					
10	Check storage racks	263		x							x							x							x					
11	Check earthing pin	264		x							x							x							x					
12	Check roof hand grilles and ladders	265		x							x							x							x					
13	Check tyres	266		x							x							x							x					
14	Check jacks	267			x							x							x							x				
15	Check external ventilator grilles	268			x							x							x							x				
16	Check data panel	269			x							x							x							x				
17	Check petrol heater	270				x							x							x							x			
18	Check pedestal hatch seal	271				x							x							x							x			
19	Check stabilisers and turnbuckles	272					x							x							x							x		
20	Check levelling	273					x							x							x							x		
	MONTHLY																													
21	Check hoisting rings	274					x																							
22	Check coupler release etc.	275					x																							
23	Check paintwork	276						x																						
24	Check storage compartment	277							x																					
25	Check running gear etc.	278													x															
26	Check elevation gear housing	279																				x								
27	Check exterior of pedestal	280																					x							
28	Lubricate trailer door hinges, locks	Table 81 Item 15																											x	

END

70,000 YARDS RANGE

TABLE 37—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1601	NC	3.2 A.C. *6.4 A.C.*	275	300	66	NC	3.2 A.C. *6.4 A.C.*	80
V1602	21	280	45	–28	65	0	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1603	–19	155	0	–16	110	0	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1604	–0.1	102	8.7	–47	116	0.6	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1605	–29	128	0	–10.3	92	8.7	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1606	176	265	180	175	270	180	176 *6.4 A.C.*	176 *6.4 A.C.*
V1607	176	265	180	175	270	180	176 *6.4 A.C.*	176 *6.4 A.C.*
V1608	–0.4	115	0	0	0	0.7	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1609	0.7	170	5.7	0	170	5.7	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1610	–12	118	19	–12	19	10	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1611	–12.5	118	6	–12.5	6	8.7	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1612	–16	15	5	–16	118	15	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1613	–13	5.4	8.7	–13	118	5.4	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1614	–0.4	44	0	0	270	21	3.2 A.C. *6.4 A.C.*	3.2 A.C. *6.4 A.C.*
V1615	NC	3.2 A.C. *6.4 A.C.*	250	285	19	NC	3.2 A.C. *6.4 A.C.*	35
V1616	NC	3.2 A.C. *6.4 A.C.*	250	285	6	NC	3.2 A.C. *6.4 A.C.*	30.7
V1617	NC	3.2 A.C. *6.4 A.C.*	250	285	14.5	NC	3.2 A.C. *6.4 A.C.*	33
V1618	NC	3.2 A.C. *6.4 A.C.*	250	285	5.4	NC	3.2 A.C. *6.4 A.C.*	29

TABLE 38—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1601	NC	23	20K	20K	240K	NC	23	1K
V1602	4.8M	40K	5K	4.8M	240K	0	23	23
V1603	650K	42K	0	4.7M	42K	0	23	23
V1604	28K	Inf.	65	Inf.	Inf.	350	23	23
V1605	Inf.	Inf.	0	100K	Inf.	65	23	23
V1606	50K	33K	25K	50K	30K	25K	50K	50K
V1607	50K	30K	25K	50K	30K	25K	50K	50K
V1608	180K	34K	0	0	0	1M	23	23
V1609	1M	32K	1K	39K Max. 19K Min.	32K	1K	23	23
V1610	0.47M	Inf.	Inf.	0.47M	Inf.	48	23	23
V1611	0.47M	Inf.	Inf.	0.47M	Inf.	65	23	23
V1612	0.47M	Inf.	38	0.47M	Inf.	Inf.	23	23

TABLE 37—RESISTANCE READINGS AT VALVE BASES—Continued

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1613	0.47M	Inf.	65	0.47M	Inf.	Inf.	23	23
V1614	220K	120K	0	220K	240K	90	23	23
V1615	NC	23	Inf.	23K	Inf.	NC	23	300
V1616	NC	23	Inf.	23K	Inf.	NC	23	300
V1617	NC	23	Inf.	23K	Inf.	NC	23	300
V1618	NC	23	Inf.	23K	Inf.	NC	23	300

TABLE 39—VOLTAGE READINGS AT JACKS

Jack	Pin A	Jack	Pin A	Jack	Pin A
J1608	300	J1611	80	J1614	270
J1609	285	J1612	45	J1615	0
J1610	105	J1613	270	J1616	5.7

TABLE 40—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1601	Inf.	Inf.	0	50K	50K	50K	0	3.9K
J1602	0	0	0	Inf.	Inf.	175	0	0
				3	*3*			
J1603	Inf.	NC	Inf.	23	23	175	0	0
J1604	5K	1K	20K	0	.....	.....	.....	.....
J1605	1M	.....	.....	.....	.....	.....	.....	.....
J1606	Inf.	.....	.....	.....	.....	.....	.....	.....
J1607	Inf.	.....	.....	.....	.....	.....	.....	.....
J1608	20K	.....	.....	.....	.....	.....	.....	.....
J1609	Inf.	.....	.....	.....	.....	.....	.....	.....
J1610	42K	.....	.....	.....	.....	.....	.....	.....
J1611	1K	.....	.....	.....	.....	.....	.....	.....
J1612	5K	.....	.....	.....	.....	.....	.....	.....
J1613	30K	.....	.....	.....	.....	.....	.....	.....
J1614	30K	.....	.....	.....	.....	.....	.....	.....
J1615	0	.....	.....	.....	.....	.....	.....	.....
J1616	1K	.....	.....	.....	.....	.....	.....	.....

Jack	Pin J	Pin K	Pin L	Pin M				
J1602	20K	Inf.	Inf.	Inf.				
J1603	Inf.	Inf.	Inf.	Inf.				

PPI OSCILLOSCOPE, BC-1092

TABLE 41—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1701	Inf.	Inf.	Inf.	0	.....	.....	.....	.....
J1702	Inf.	Inf.	Inf.	Inf. *1*	Inf. *1*	120	0	0
J1703	Inf.	.....	.....	.....	.....	.....	.....	.....
Jack	Pin J	Pin K	Pin L	Pin M				
J1702	Inf.	Inf.	Inf. *0*	Inf. *0*				
Jack	Pin A	Pin C	Pin J	Pin K				
†J1702	85	85	85	85				

†Measured from Pin B.

PPI POWER SUPPLY UNIT, RA-69

Conditions of Measurement: Voltages taken with J-P1501 extended with test cable W2101, J-P1503 with W2111. Cap of V1503 removed and kept free of other connections, Regulated output 270V. Do not touch T1505.

TABLE 42—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1501	NC	321 *5 A.C.*	NC	450* A.C.	NC	450* A.C.	NC	321 *5 A.C.*
V1502	NC	455* *5 A.C.*	NC	450* A.C.	NC	450* A.C.	NC	460 *5 A.C.*
V1503	*2.5 A.C.*	NC	NC	*2.5 A.C.*	.....	.....	.....	.....
V1504	NC	290 *6.3 A.C.*	445*	NC	275	NC	270 *6.3 A.C.*	NC
V1505	NC	290 *6.3 A.C.*	445*	NC	275	NC	270 *6.3 A.C.*	NC
V1506	NC	109 *6.3 A.C.*	106	100	106	225	106 *6.3 A.C.*	290
V1507	NC	0	0	NC	105	NC	0	NC

TABLE 43—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1501	NC	2M	NC	2M	NC	2M	NC	2M
V1502	NC	2M	NC	2M	NC	2M	NC	2M
V1503	5M	NC	NC	5M	.....	.....	.....	.....
V1504	NC	260K	2M	NC	2.5M	NC	260K	NC
V1505	NC	260K	2M	NC	2.5M	NC	260K	NC
V1506	NC	280K	280K	110K Max. 85K Min.	280K	270K	285K	2.5M
V1507	NC	0	0	NC	283K	NC	Inf.	NC

TABLE 44—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1502	5M	.....	.....	.....	.....	.....	.....	.....
J1503	0	0	0	Inf.	Inf.	2M	0	0

Jack	Pin J	Pin K	Pin L	Pin M				
J1503	0.25M	2M	Inf.	Inf.				

TABLE 45—VOLTAGES AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Component	Ter. 1	Component	Ter. 1	Component	Ter. 1
C1501	297	C1502	288	C1503	257	C1504	244

AUTOMATIC TRACKING UNIT, BC-1086

Conditions of Measurement: Voltages taken with J-P509 extended with test cable W2121, J-P507 with W2110, J-P508 with W2109, voltages and resistances taken with S501 at on, GAIN controls at 0, VOLUME control on receiver at 0. Resistance readings taken with S501 at off.

TABLE 46—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V501	NC	415* *5 A.C.*	NC	450* A.C.	NC	450* A.C.	NC	415* *5 A.C.*
V502	NC	0 *6.3 A.C.*	0	0	0	NC	0 *6.3 A.C.*	0
V503	NC	0 *6.3 A.C.*	0	0	0† 108‡	108	0 *6.3 A.C.*	243† 400‡
V504	0	143	3	0	143	3	0 *6.3 A.C.*	0 *6.3 A.C.*
V505	NC	0	NC	NC	108	NC	NC	NC

†Normal. ‡Coast button pressed.

TABLE 47—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V501	NC	100K	NC	73	NC	73	NC	100K
V502	NC	0	1M Max. 0 Min.	11K	1M Max. 0 Min.	NC	0	110K
V503	NC	0	0	1M Max. 0 Min.	0	120K	0	110K
V504	51K	130K	500 Max. 0 Min.	51K	130K	500 Max. 0 Min.	0	0
V505	NC	0	NC	NC	120K	NC	NC	NC

TABLE 48—VOLTAGE READINGS AT JACKS

Jack	Pin A	Jack	Pin A	Jack	Pin A
J501	0	J503	0	J505	75
J502	0	J504	75	J506	75

TABLE 49—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J501	0	.....	.....	.....	.....	.....	.....	.....
J502	0	.....	.....	.....	.....	.....	.....	.....
J503	0	.....	.....	.....	.....	.....	.....	.....
J504	75K	.....	.....	.....	.....	.....	.....	.....
J505	75K	.....	.....	.....	.....	.....	.....	.....
J506	24K	.....	.....	.....	.....	.....	.....	.....
J507	Inf.	Inf. *0*	Inf. *0*	Inf. *0*	NC	NC	NC	NC
J508	0	0	0	24K	75K	75K	0	Inf.
J509	5.6K	.....	.....	.....	.....	.....	.....	.....

TABLE 50—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

T502		
Ter. 1 to Ter. 2 115 A.C. Ter. 4 to Ter. 5 450*A.C. Ter. 7 to Ter. 8 3.15 A.C.	Ter. 3 to Ter. 4 450*A.C. Ter. 6 to Ter. 7 3.15 A.C.	Ter. 3 to Ter. 5 900*A.C. Ter. 6 to Ter. 8 6.3 A.C.

Component	Pin 1	Component	Pin 1	Component	Pin 1	Component	Pin 1
C501	75	C505	400*	C506	390	C508	202

AZIMUTH AND ELEVATION TRACKING UNIT, BC-1090

Conditions of Measurement: Unit removed from the rack, and J408, 409, and 410 extended with test cables W2111, W2114, W2109, respectively. Automatic tracking unit and receiver on, and GAIN controls of both units set to 0. Servos off. A.H GAIN controls at 0, CONTROL SWITCH at MANUAL, A.C. voltage input to T401 and T451 set to zero by adjustment of AZIMUTH and ELEVATION controls of antenna position control unit.

TABLE 51—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V401	75	105	75	57	120	75	*6 A.C.*	*6 A.C.*
V402	75	105	75	57	120	75	*6 A.C.*	*6 A.C.*
V403	NC	*6 A.C.*	220	210	71	73	*6 A.C.*	82
V404	NC	*6 A.C.*	220	215	70	NC	*6 A.C.*	82
V405	19	210	35	28.2	220	35	*6 A.C.*	*6 A.C.*
V406	NC	*6 A.C.*	19	19	19	NC	*6 A.C.*	36
V407	28	71	34	28	70	34	*6 A.C.*	*6 A.C.*
V408	–42	105	0	–42	120	0	*6 A.C.*	*6 A.C.*
V451	67	120	70	60	120	70	*6 A.C.*	*6 A.C.*
V452	61	120	70	50	120	70	*6 A.C.*	*6 A.C.*
V453	NC	*6 A.C.*	220	210	68	68	*6 A.C.*	80
V454	NC	*6 A.C.*	220	225	65	NC	*6 A.C.*	80
V455	19	210	32	26	225	32	*6 A.C.*	*6 A.C.*
V456	NC	*6 A.C.*	18	19	18.5	NC	*6 A.C.*	36
V457	28	67	34	27	65	34	*6 A.C.*	*6 A.C.*
V458	–42	120	0	–42	125	0	*6 A.C*	*6 A.C.*

TABLE 52—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V401	Inf.	50K	20K	Inf.	50K	20K	Inf.	Inf.
V402	Inf.	50K	20K	Inf.	50K	20K	Inf.	Inf.
V403	NC	Inf.	Inf.	39K	.22M	.13M	Inf.	1.7K
V404	NC	Inf.	Inf.	39K	.22M	NC	Inf.	1.7K
V405	.57M	39K	3K	4K	39K	3K	Inf.	Inf.
V406	NC	Inf.	2K	.57M	.57M	NC	Inf.	6K
V407	Inf.	.22M	16K	Inf.	.22M	16K	Inf.	Inf.
V408	Inf.	50K	0	Inf.	50K	0	Inf.	Inf.
V451	Inf.	50K	20K	Inf.	50K	20K	Inf.	Inf.
V452	Inf.	50K	20K	Inf.	50K	20K	Inf.	Inf.
V453	NC	Inf.	Inf.	39K	.22M	.13M	Inf.	1.7K
V454	NC	Inf.	Inf.	39K	.22M	NC	Inf.	1.7K
V455	.57M	39K	3K	33K	39K	3K	Inf.	Inf.
V456	NC	Inf.	2K	.57M	.57M	NC	Inf.	6K
V457	Inf.	.22M	16K	Inf.	.22M	16K	Inf.	Inf.
V458	Inf.	50K	0	Inf.	50K	0	Inf.	Inf.

TABLE 53—VOLTAGE READINGS AT JACKS

Jack	Pin A	Jack	Pin A	Jack	Pin A
J401	75	J407	220	J452	70
J402	75	J411	35	J453	60
J403	0	J412	17	J454	68
J404	70	J413	30	J455	65
J405	70	J414	34	J456	220
J406	220	J451	70	J457	220

TABLE 54—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H	Pin I
J401	20K	......	......	......	......	......	......	......	......
J402	20K	......	......	......	......	......	......	......	......
J403	0	......	......	......	......	......	......	......	......
J404	.22M	......	......	......	......	......	......	......	......
J405	.22M	......	......	......	......	......	......	......	......
J406	Inf.	......	......	......	......	......	......	......	......
J407	Inf.	......	......	......	......	......	......	......	......
J408	*39*	*39*	*48*	*48*	*45*	*45*	Inf.	Inf.	......
J409	Inf.	Inf.	Inf.	Inf.	NC	*16.1K*	0	3.7K	Inf.
J410	*0*	*0*	Inf.	Inf.	Inf.	Inf.	0	32K	......
J411	6K	......	......	......	......	......	......	......	......
J412	2K	......	......	......	......	......	......	......	......
J413	3.8K	......	......	......	......	......	......	......	......
J414	16K	......	......	......	......	......	......	......	......
J451	20K	......	......	......	......	......	......	......	......
J452	20K	......	......	......	......	......	......	......	......
J453	0	......	......	......	......	......	......	......	......
J454	.22M	......	......	......	......	......	......	......	......
J455	.22M	......	......	......	......	......	......	......	......
J456	Inf.	......	......	......	......	......	......	......	......
J457	Inf.	......	......	......	......	......	......	......	......

TABLE 54—RESISTANCE READINGS AT JACKS—Continued

Jack	Pin J	Pin K	Pin L	Pin M	Pin N	Pin O	Pin P	Pin R	
J408	Inf.	Inf.	0	NC	......	......	......	......	......
J409	Inf.	Inf.	*16.1K*	...... *16.1K*	...... *16.1K*	Inf.	Inf.	Inf.	

Jack	Pin S	Pin T	Pin U	Pin V	Pin W				
J409	NC	31K	Inf.	Inf.	NC				

TABLE 55/VOLTAGE READINGS ON MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5
T401	0	0	67	67	67
T451	0	0	67	67	67

ANTENNA POSITION CONTROL UNIT

Conditions of Measurement: CONTROL SWITCH to MANUAL.

TABLE 56—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H	Pin I
J1301	*Inf.*	*Inf.*	...... *Inf.*	...... *Inf.*	...... *31*	...... *31*	...... *31*	*31*	*31* ......

Jack	Pin J	Pin K	Pin L	Pin M	Pin N	Pin O	Pin P	Pin R
J1301	*31*	*190 Max.* *67 Min.*	NC	NC	*190 Max.* *67 Min.*	*4.5*	*4.5*	NC

Jack	Pin S	Pin T	Pin U	Pin V	Pin W			
J1301	NC	NC	NC	NC	NC			

TABLE 57—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4
T1301	*0*	*0*	.... *0*	.... *0*
T1302	*115 A.C.*	*115 A.C.*	*20 A.C.*	*20 A.C.*
T1351	*0*	*0*	.... *0*	.... *0*
T1352	*115 A.C.*	*115 A.C.*	*20*	*20*

Component	Ter.	S1†	S2†	S3†	R1	R2
B1301	......	*97 A.C.* *78 A.C.*	...... *18.2 A.C.* *78 A.C.*	*97 A.C.* *18.2 A.C.*	*115 A.C.*	*115 A.C.*
B1351	......	*27.2 A.C.* *99 A.C.*	...... *73 A.C.* *99 A.C.*	*27.2 A.C.* *73 A.C.*	*115 A.C.*	*115 A.C.*

†Voltages vary according to positions of hand wheels.

CONTROL PANEL, PN-24

TABLE 58—RESISTANCE READINGS AT JACKS

J1751 B to J1752 C	Inf. †	J1752 F to earth	0
J1751 B to J1752 C	0 ‡	J1752 G to earth	0
J1752 A to J1753 D	0	J1752 H to earth	0
J1752 B to J1753 E	0	J1753 A to J1753 E	0 (a)
J1752 C to J1753 F	Inf. †	J1753 B to J1753 F	520
J1752 C to J1753 F	0 ‡	J1753 B to J1753 E	0 (b)
J1752 D to J1753 L	0 ††	J1753 C to J1753 E	(c)
J1752 D to J1753 L	Inf. ‡‡	J1753 G to J1753 H	Inf.
J1752 E to earth	0	J1753 M to earth	0

† COAST button up.
‡ COAST button down.
†† SAFETY switch to RUN.
‡‡ SAFETY switch to STOP.

(a) CONTROL SWITCH to PPI SCAN.
(b) CONTROL SWITCH to AUTOMATIC.
(c) CONTROL SWITCH to REMOTE.

TABLE 59—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter 9	Ter. 10
S1751	66 A.C.	NC	66 A.C.	66 A.C.	66 A.C.	0	0	NC	NC	0

TABLE 60—RESISTANCE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10
S1751	Inf.	NC	Inf.	Inf.	Inf.	*0*	*0*	NC	NC	Inf.

FIELD POWER SUPPLY, RA-71

TABLE 61—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1152	NC	370 *5 A.C.*	NC	420 A.C.* *840 A.C.**	NC	420 A.C.* *840 A.C.**	NC	370 *5 A.C.*

TABLE 62—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1152	NC	30K	NC	38 *75*	NC	38 *75*	NC	30K

TABLE 63—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C
J1153	0	30K	0

TABLE 64—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6
T1152	*115 A.C.*	*115 A.C.*	*5 A.C.*	*5 A.C.*	NC	NC
T1153	*115 A.C.*	*115 A.C.*	*420 A.C.**	*420 A.C.**	......	......
				*420 A.C.**	*420 A.C.**	
			*840 A.C.**		*840 A.C.**	

ANTENNA POSITION INDICATOR

TABLE 65—RESISTANCE READINGS AT JACKS

J1201—A	to J1202 – J	0	J1201-L		NC
B	to J1202 – C	0	J1201-M		NC
	to J1203 – A	0	J1201-N	to J1203 – T	0
C	to J1202 – K	0	J1201-O	to J1206 – E	0
D	to J1202 – E	0	J1201-P	to J1206 – F	0
E	to J1203 – W	0	J1201-R		NC
F	to J1203 – V	0	J1201-S		NC
G	to J1203 – U	0	J1201-T		NC
H	to J1203 – R	0	J1201-U		NC
I	to J1203 – P	0	J1201-V		NC
J	to J1203 – O	0	J1201-W		NC
K	to J1205 – A	0			
J1202—B	to J1205 – B	0	J1202-G	to J1202 – H	800
D	to J1203 – B	0		to J1202 – L	400
E	to J1203 – C	0	J1202-H	to J1202 – L	400
F	to J1203 – D	0		J1202 – M	NC
J1203—E	to J1205 – L	0	J1203-I	to J1203 – J	30
F	to J1203 – I	30	J1203-K	to J1203 – L	30
	to J1203 – J	30		to J1203 – M	30
G	to J1205 – D	0	J1203-L	to J1203 – M	30
H	to J1203 – T	15			
J1204—A	to J1204 – B	30	J1204-D	to J1204 – E	30
	to J1204 – C	30		to J1204 – F	30
B	to J1204 – C	30	J1204-E	to J1204 – F	30
J1205—C	to J1205 – F	38	J1205-J	to J1206 – A	0
G	to earth	0	J1205-K	to J1206 – B	0
H	to J1206 – D	0			
J1206—C	to earth	0			

ALTITUDE CONVERTER, BC-1094

Conditions of Measurement: ALT-SL RANGE switch to SL RANGE.

TABLE 66—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1401	0	0 *6.3 A.C.*	2	0	2	75	0 *6.3 A.C.*	60
V1402	0	300	9.3	0	210	5	0 *6.3 A.C.*	0 *6.3 A.C.*
V1403	0	79	2.5	0	300	9.3	0 *6.3 A.C.*	0 *6.3 A.C.*
V1404	0	0 *6.3 A.C.*	1.15	0	1.15	35	0 *6.3 A.C.*	50
V1405	0	0 *6.3 A.C.*	1.2	–1	1.2	35	0 *6.3 A.C.*	100
V1406	0	0 *6.3 A.C.*	310	310	0	NC	0 *6.3 A.C.*	25

TABLE 67—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1401	0	Inf.	Inf.	80K	–	51K	Inf.	.25M
V1402	.56M	.151M	1K	17.5K	.21M	8.5K Max. 1K Min.	Inf.	Inf.
V1403	.4M	.25M	1K	1M	.151M	1K	Inf.	Inf.
V1404	0	Inf.	810	.215M	810	1.15M	Inf.	.39M
V1405	0	Inf.	910	1M	910	1.15M	Inf.	0.39M
V1406	0	Inf.	.151M	.151M	270	NC	Inf.	300

TABLE 68—VOLTAGE READINGS AT JACKS

Jack	Pin A	Jack	Pin A	Jack	Pin A	Jack	Pin A	Jack	Pin A
J1408	3.5 A.C.	J1409	25 A.C.	J1410	0	J1411	310	J1412	1A.C.

TABLE 69—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1401	Inf.	Inf.	Inf.	Inf.	2	0	0	NC
J1402	4.7M	†	.....	.....	.....	.....	.....	.....
	2.45M	‡	.....	.....	.....	.....	.....	.....
J1403	.635M	.....	.....	.....	.....	.....	.....	.....
J1404	Inf.	†	.....	.....	.....	.....	.....	.....
	2.44M	‡						
J1405	171	174	0	0	NC	NC	NC	NC
J1406	.151M	Inf.	NC	NC	Inf.	Inf.	0	Inf.
J1407	19K	.....	.....	.....	.....	.....	.....	.....
J1408	19K	.....	.....	.....	.....	.....	.....	.....
J1409	171	.....	.....	.....	.....	.....	.....	.....
J1410	174	.....	.....	.....	.....	.....	.....	.....
J1411	.151M	.....	.....	.....	.....	.....	.....	.....
J1412	2	.....	.....	.....	.....	.....	.....	.....

Jack	Pin J	Pin K	Pin L	Pin M				
J1401	171	NC	NC	NC				

†Taken with Altitude—Slant Range switch in Slant Range position.
‡Taken with Altitude—Slant Range switch in Altitude position.

TABLE 70—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4
T1401	0	1.7	310	295
T1402	0	0	310	295
T1403	0	0	310	310

TABLE 71—RESISTANCE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 4	Ter. 4
T1401	0	171	.151M	.151M
T1402	174	0	.151M	.151M
T1403	0	2	.151M	.151M

ALTITUDE CONVERTER POWER SUPPLY, RA-70

Conditions of Measurement: Resistance readings taken with all potentiometers clock-wise.

TABLE 72—VOLTAGE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1451	110	0	NC	110	110	110	NC	NC
V1452	NC	440* *5 A.C.*	NC	520*A.C. 0 D.C.	NC	520*A.C. 0 D.C.	NC	440* *5 A.C.*
V1453	NC	310 *6.3 A.C.*	435*	NC	290	NC	310 *6.3 A.C.*	NC
V1454	NC	310 *6.3 A.C.*	435*	NC	290	NC	310 *6.3 A.C.*	NC
V1455	180	310	190	170	295	190	190 *6.3 A.C.*	190 *6.3 A.C.*
V1456	110	310	110	110	180	110	190 *6.3 A.C.*	190 *6.3 A.C.*
V1457	0	0 *6.3 A.C.*	0.7	0	0.7	23	0 *6.3 A.C.*	68
V1458	0	0 *6.3 A.C.*	340	260	0	NC	0 *6.3 A.C.*	19

TABLE 73—RESISTANCE READINGS AT VALVE BASES

Valve	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1451	.36M	0	NC	.12M	.12M	.12M	NC	NC
V1452	NC	1.4M	NC	60	NC	60	NC	1.4M
V1453	NC	80K	1.4M	NC	.35M	NC	80K	NC
V1454	NC	80K	1.4M	NC	.35M	NC	80K	NC
V1455	.32M	80K	.1M	65K	.35M	.1M	.1M	.1M
V1456	.36M	80K	51K	60K	.32M	51K	.1M	.1M
V1457	0	0	700	1M	700	1.1M	0	.33M
V1458	0	0	1.32M	90K	.47M	NC	0	300

TABLE 74—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1451	80K	2.1	NC	NC	0	0.04	0	0
J1452	1M	.....	.....	.....	.....	.....	.....	.....
J1454	2.1	.....	.....	.....	.....	.....	.....	.....

TABLE 75—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8
T1451	*115 A.C.*	*115 A.C.*	*520 A.C.*	*520 A.C.* *520 A.C.*	*520 A.C.*	440 *5 A.C.*	440 *5 A.C.*	310 *6.3 A.C.*
T1452	*115 A.C.*		*6.3 A.C.*	*6.3 A.C.*		*115 A.C.*		

Component	Ter. 9	Ter. 10	Ter. 11	Ter. 12	Ter. 13
T1451	310	310 *6.3 A.C.*	190 *6.3 A.C.*	190	190 *6.3 A.C.*

TABLE 76—RESISTANCE READINGS AT MISCELLANEOUS COMPONENTS

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8
T1451	Inf.	Inf.	60	0	60	1.4M	1.4M	80K
T1452	Inf.	Inf.	0	0.04	Inf.	Inf.	.....	.....
T1453	0	2.1M	1.4M	1.4M	.....	.....	.....	.....

Component	Ter. 9	Ter. 10	Ter. 11	Ter. 12	Ter. 13
T1451	80K	80K	.1M	.1M	.1M

JUNCTION BOX JB-71

Conditions of Measurement: All voltages measured with complete truck operating.

‡ These voltages vary as the pedestal is rotated in azimuth by means of the "Azimuth" handwheel on the positioning control unit. Values shown give maximum and minimum variation.

† These voltages are measured with pedestal rotating when "CONTROL SWITCH" on control panel is in "PPI SCAN" position.

§ These voltages vary as the pedestal is moved in elevation by means of the "ELEVATION" handwheel.

TABLE 77—VOLTAGE READINGS AT TERMINAL BOARDS

Terminal Board	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10
TB16	*105 A.C.‡*	*105 A.C.‡*	*105 A.C.‡*	*115 A.C.*	*115 A.C.*	*88 A.C.‡*	*88 A.C.‡*	*88 A.C.‡*		
	0	*0*	*0*			*0.5 A.C.*	*0.5 A.C.*	*0.5 A.C.*	*115 A.C.*	*115 A.C.*
TB17	*210†*	*210†*								
		1†	*1†*		*300*	*300*				
			1†	*1†*						
TB18		*45 A.C.*	*45 A.C.*		*115 A.C.*	*115 A.C.*	*115 A.C.*			
			45 A.C.	*45 A.C.*						
TB19	*85.5 A.C.§*	*85.5 A.C.§*	*85.5 A.C.§*	*115 A.C.*	*115 A.C.*		*105 A.C.‡*	*105 A.C.‡*	*105 A.C.‡*	*NC*
	0	*0*	*0*				*0*	*0*	*0*	
TB20								*115 A.C.*	*115 A.C.*	*115 A.C.*
TB21				*115 A.C.*	*115 A.C.*	*115 A.C.*				
TB22	NC				*115 A.C.*	*115 A.C.*	*115 A.C.*	*105 A.C.‡*	*105 A.C.‡*	*105 A.C.‡*
								0	*0*	*0*
TB23	*100 A.C.*	*100 A.C.*		*200 A.C.*	*200 A.C.*	*105 A.C.§*	*105 A.C.§*	*105 A.C.§*	*115 A.C.*	*115 A.C.*
		100 A.C.	*100 A.C.*			*0*	*0*	*0*		
		100 A.C.		*100 A.C.*						
	200 A.C.	*100 A.C.*	*200 A.C.*		*100 A.C.*					
TB24			NC	NC	NC	*2.3 A.C.‡*	*2.3 A.C.‡*	*2.3 A.C.‡*	*17 A.C.*	*17 A.C.*
						0	*0*	*0*		
TB25	*115 A.C.*	*115 A.C.*								
	115 A.C.					*115 A.C.*				
		115 A.C.				*115 A.C.*				
			115 A.C.	*115 A.C.*						
			115 A.C.		*115 A.C.*					
					115 A.C.	*115 A.C.*				
								115 A.C.	*115 A.C.*	

TABLE 77—VOLTAGE READINGS AT TERMINAL BOARDS—(Continued)

Terminal Board	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10
TB26	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	*105 A.C.‡* *0*	*105 A.C.‡* *0*
TB27		*105 A.C.§* *0*	*105 A.C.§* *0*	*105 A.C.§* *0*	*105 A.C.§* *0*	*105 A.C.§* *0*	*105 A.C.§* *0*	*105 A.C.§* *0*	*105 A.C.§* *0*	*105 A.C.§* *0*

(a) Test these telephone circuits by means of telephones from the jacks on the side of the junction box to those on the data panel.

TABLE 78—RESISTANCE READINGS AT TERMINAL BOARDS

Terminal Board	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10
TB16	Inf. *25*	Inf. *25*	Inf. *25*	Inf. *30*	Inf. *30*	Inf. *28*	Inf. *28*	Inf. *28*	Inf. *1*	Inf. *1*
TB17	4.5K *5†*	3.5K *5†* *0.75†*	3.5K *0.75†* *0.75†*	3.5K *0.75†*	1.4K	0	Inf.	3.5K *4.7*	3.5K *1.5*	3.5K *4.7* *1.5*
TB18	Inf.	Inf.	Inf.	Inf.	Inf.	Inf.	Inf.	300K	32K	60K
TB19	*25*	*25*	*25*	*30*	*30*	3.5K	Inf. *14*	Inf. *14*	Inf. *14*	NC
TB20	3.5K	3.5K	32K	30K	30K	3.5K	32K	Inf.	Inf.	Inf.
TB21	3.5K	3.5K	30K	Inf.	Inf.	Inf.	3.5K	3.5K	32K	32K
TB22	NC	32K	32K	32K	Inf.	Inf.	Inf.	Inf. *14*	Inf. *14*	Inf. *14*
TB23	240	0	255	255	240	*14*	*14*	*14*	Inf.	Inf.
TB24	Inf.	Inf.	NC	NC	NC	53K *22.5*	53K *22.5*	53K *22.5*	1	14
TB25	Inf. *0*	Inf. *0*	Inf. *0*	Inf. *0*	Inf. *0*	Inf. *0*	Inf. *0*	Inf. *0*	Inf. *0*	NC
TB26	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	Inf. *14*	Inf. *14*
TB27	Inf.	*29*	*29*	*29*	*14*	*14*	*14*	*14*	*14*	*14*

(a) Test these telephone circuits by means of telephone from the jacks on the side of the junction box to those on the data panel.

FAULTFINDING BASED ON STARTING PROCEDURE

Preliminary

143. Check the precautionary settings listed in para. 7.

144. Check that relays K303, 304 and 306 of the high voltage rectifier are set to trip at 35A and relay K305 is set to trip at 50mA.

145. Check that relays K204 and K205 of the modulator are set to 9 on the calibrated scale for A sets and to 4 for B sets.

146. Check that the right-hand discs at the top of relays K204 and K205 of B sets (located above the relay bellows) are set to 1.

147. Where main line switch is fitted.

(a) Switch on the main line switch.
Check that:
(i) The voltmeter below the main line switch indicates 115V.
(ii) The control rack blower motor starts.
(iii) The dial lights of the antenna position indicator glow.

(b) Throw the LINE CIRCUIT BREAKER on the high voltage rectifier rack to ON and set the voltage adjuster to read 115V on the voltmeter below the main line switch.
Check that:
(i) The green pilot lights.
(ii) The high voltage rectifier rack blower motor starts.
(iii) The FILAMENT VOLTMETER indicates.

(d) The LINE VOLTMETER reads 115V.

148. Where main line switch is not fitted.

(a) Plug in the power cable to the data panel.
Check that:
(i) The control rack blower motor starts.
(ii) The dial lights of the antenna position indicator glow.

(b) Throw the LINE CIRCUIT BREAKER on high voltage rectifier rack to ON and set the voltage adjuster to read 115V on the LINE VOLTMETER.
Check that:
(i) The green pilot lights.
(ii) The high voltage rectifier rack blower motor starts.
(iii) The FILAMENT VOLTMETER indicates.

149. Set the line switch on the front of the dedydrator to the ON position.
Check that:
(a) The red pilot on the dehydrator lights.
(b) The dehydrator motor starts
(c) The air pressure builds up to 5 pounds.

150. Press the PHASE BC push-button.
Check that:
(a) The line voltmeter reads 115V ±2V.

151. Press the PHASE AC push-button.
Check that:
(a)The LINE VOLTMETER reads 115V ±2V.

152. Press the LOWER push-button if the amber light is not glowing.
Check that:
(a) The amber light glows after holding down the button for 20 seconds.

153. Rotate the FILAMENT CONTROL until the FILAMENT VOLTMETER reads 105V.
Check that:
(a) The filaments of the valves can bee seen to glow if the doors are opened.

154. Set the FILAMENT switch of the local oscillator unit to the UP position.

155. Set the POWER switch of the modulator to the ON position.
Check that:
(a) The white POWER pilot lights.
(b) The filament voltmeter indicates.
(c) The filament of V106 can be seen to glow if the Modulator rack door is opened.
(d) The 3 blower motors start.
(e) After 30 seconds the green pilot lights.
(f) The VOLTAGE meter indicates between the two red lines when the switch is in the DRIVER GRID position.

156. Throw the toggle switch to the KEYER FILAMENT position and adjust the KEYER FILAMENT control until the voltmeter reads 100V.
Check that:
(a) The keyer filament valves can be seen to glow if the doors are opened.

157. Throw the toggle switch to the OSCILLATOR FILAMENT position and adjust the OSCILLATOR FILAMENT control until the voltmeter reads 100V.

158. Set the toggle switches to the up position on the P.P.I. power supply unit, receiver power supply unit, range power supply unit, automatic tracking unit, and altitude converter power supply unit.
Check that:
(a) The red pilots adjacent to the above switches light, the red pilots on the receiver and range units glow when the switches on the respective power supplies are thrown, and the bezel lights around the P.P.I. oscilloscope glow.
(b) The sweep traces on the P.P.I. and range indicator oscilloscopes become visible after 20 seconds.
(c) The PLATE CURRENT meter reads full scale deflection.

159. Set the PLATE switch on the local oscillator to the ON position.

Check that:
(a) The red pilot lights.
(b) The CRYSTAL CURRENT meter indicates between 0.15mA and 0.5mA.

160. Provided that the green READY pilot is on, press the START push button of the modulator.

Check that:
(a) The amber BIAS pilot lights.
(b) The VOLTAGE meter reads between the red marks in the KEYER GRID position.

161. Push the CLOSE push-button of the high voltage rectifier.

Check that:
(a) The red pilot lights.
(b) The green pilot extinguishes.
(c) The contactor is heard to operate.

162. Press and hold the RAISE push-button until the DC VOLTMETER reads 20KV, and the OSC. PLATE current meter reads 22mA and the DC MILLAMMETER reads about 30mA.

Check that:
(a) The high voltage begins to rise as indicated by the DC VOLTMETER.
(b) The amber pilot extinguishes at about 2KV.
(c) At about 10KV the red DRIVER PLATE pilot on the modulator lights.
(d) The VOLTAGE meter of the modulator indicates between the red marks for DRIVER PLATE and DRIVER SCREEN positions.
(e) The CURRENT meter in indicates both DRIVER PLATE and KEYER GRID positions about 22mA and 17ma respectively.
(f) Provided the local oscillator is tuned and the antenna is pointed at a target, echoes appear on the 32,000 yard range indicator tube, and on the P.P.I.

NOTE: It is to be expected that switching surges may operate the overload relays as the voltage passes through the point that operates the contactor of the modulator. If this happens, repeat paras. 160-162, two or three times to be certain that trouble exists.

163. Throw the ELEVATION MOTOR, AZIMUTH MOTOR, and SPINNER MOTOR switches in the switch box to the ON position.

Check that:
(a) The elevation motor-generator, the azimuth motor-generator, and the spinner motor are running. (This may be evidenced by sounds from the motor generators and by observing the spinning of the antenna and its plastic housing).

164. Reset the voltage adjuster for a reading of 115V ±2V on the LINE VOLTMETER.

NOTE: Reduce the high voltage slightly by pressing the LOWER push-button before resetting the voltage adjuster to raise the line voltage.

165. Recheck the OSCILLATOR PLATE current and the high voltage.

Adjust for 22mA and 20KV respectively.

166. Recheck the KEYER FILAMENT voltage on the modulator (100V) and the FILAMENT VOLTAGE on the high voltage rectifier (105V).

167. Turn the control switch to the AUTOMATIC position and set the SAFETY switch to the RUN position.

Check that:
(a) The antenna does not move.

NOTE: If the antenna slews, turn the SAFETY switch to the STOP position.

168. Turn the control switch to the MANUAL position.

Check that:
(a) The antenna may now be controlled by the handwheels of the antenna position control unit.

NOTE: The antenna may slew slightly as the control selsyns take over positioning control. If the antenna slews violently turn the SAFETY switch to the STOP position.

(b) The antenna, the antenna position indicator dials and the sweep on the P.P.I. all indicate the same azimuth.

169: With the paraboloid oriented on a known local echo, check that:
(a) There are signals and noise on the range oscilloscopes and P.P.I. tube.
(b) That the amplitude of the large signals decreases when the AGC switch is set to ON and the range cursor is on an echo.
(c) That the VOLUME control is working.
(d) That the PLATE CURRENT meter reads approximately 6mA.

170. Raise the key switch under the meters on the azimuth and elevation tracking unit to the AZIMUTH position.

Check that:
(a) The meters read between 25 and 28 mA.
(b) Both meters show the same reading.

171. Rotate the azimuth (right) handwheel to the left and then to the right.

Check that:
(a) The pointers on the meters on the azimuth and elevation tracking units move in opposite directions by an amount depending on the rapidity of movement of the handwheel.
(b) The antenna moves in the same direction as the handwheel as indicated by the movement of the local index on the antenna position indicator unit.
(c) The trace moves smoothly on the P.P.I. oscilloscope face.

172. Correct azimuth hunting by means of the A.H. GAIN control.

Check that:

(a) The antenna responds smoothly to a smooth movement of the azimuth handwheel without oscillating when the handwheel is stopped.

173. Depress the key switch under the meters on the azimuth and elevation tracking unit to the ELEVATION position.

Check that:

(a) The FIELD CURRENT meters read between 25 and 28mA.

(b) Both meters show the same reading.

174. Rotate the elevation (left) handwheel to the left and then to the right.

Check that:

(a) The pointers on the meters on the azimuth and elevation tracking unit move in opposite directions by an amount depending on the rapidity of movement of the handwheel.

(b) The antenna moves in the same direction as the handwheel as indicated by movement of the local index on the antenna position indicator unit.

(c) The trace moves smoothly on the P.P.I. oscilloscope face.

175. Correct elevation hunting by means of the A.H. GAIN control.

Check that:

(a) The antenna responds smoothly to a smooth movement of the elevation handwheel and does not oscillate when the handwheel is stopped.

176. Observe the face of the range oscilloscopes and operate the SLEWING handwheel.

Check that:

(a) Operating the SLEWING handwheel moves the cursors smoothly to the desired position.

(b) The narrow strobe follows the 2,000 yard range cursor.

177. Place the RANGE MOTORS switch in the up position.

Check that:

(a) The RANGE MOTORS pilot on the range power supply lights. (The cursors on the oscilloscopes may start moving in a few seconds).

178. Turn the TRACKING handwheel and observe the motion of the cursors. The cursors will probably be moving in one direction or another when first observed. Move the TRACKING handwheel slowly in the direction, opposite to the motion of the cursors.

Check that:

(a) The cursors slow down and stop.

(b) Additional turning of the TRACKING handwheel, causes the cursors to reverse their direction of motion.

(c) The speed of the cursors is proportional to the amount of turning of the TRACKING handwheel.

179. Track a target as detailed in paras. 29-33.

180. Measure the voltage at TEST 4 on the altitude converter unit.

Check that:

(a) The voltage reads ±300V D.C. Adjustment of the VOLTAGE CONTROL on the altitude converter power supply should correct this if slightly off; variations in line voltage of about 5V should not affect the output.

181. Measure the voltage at TEST 2 on the altitude converter unit.

Check that:

(a) The voltage is 25V A.C.; adjustment of the OSCILLATOR OUTPUT on the altitude converter unit should correct any slight variation.

182. Measure the voltage at TEST 6 on the altitude converter power supply unit.

Check that:

(a) The voltage is 15V A.C.; adjustment of the FIXED FIELD V on the altitude converter unit should correct any slight variations.

183. With the switch on the altitude converter unit in the SL. RANGE position, measure the voltage at TEST 5 on the altitude converter unit.

Check that:

(a) The voltage is 2.8±0.8V A.C.

184. Set the range indicator to 9,000 yards and set the switch on the altitude converter to the SL RANGE position. Observe the indication of the data unit.

Check that:

(a) The altitude data unit indicates approximately 9,000 yards.

185. With the antenna elevation at zero hold the FREQUENCY TEST switch down and throw the other switch to ALTITUDE. Observe the dial of the altitude data unit.

Check that:

(a) The dial remains stationary.

186. Set the range cursors at 9,000 yards, the antenna elevation at 56½ degrees (1,000 mils) and switch to the ALTITUDE position. Measure the voltage at TEST 5.

Check that:

(a) The reading is less than 1.0V A.C. Adjust the PHASE BAL control on the altitude converter unit for minimum voltage.

TABLE 79—FAULT FINDING BASED ON STARTING PROCEDURE.

NOTE: — The numbering in this table corresponds to the numbering of the paragraphs in the starting procedure (paragraphs 143-185), and it should be used in conjunction with that section.
In all cases where a fault is discovered which is beyond the possibility of a first line repair, it must be reported to the Officer in charge of First Line Maintenance.

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
147(a)	No indications of power.	(a) Defective power cable or connector. (b) Main line switch tripped.	(a) Repair or replace. (b) (i) Reset once. If it trips again look for a short circuit in the wiring between the main line switch and the fuses and switches which it feeds. (ii) If it does not trip again one of F1901-1909 will probably blow and will be discovered later.
	Voltmeter below main line switch not reading but blower is heard and antenna position indicator light is on.	(a) Defective meter.	(a) Check by switching on LINE CIRCUIT BREAKER and comparing with reading of phase BC on LINE VOLTMETER. Switch off LINE CIRCUIT BREAKER.
	Control rack blower not running.	(a) Fuse F1901, 1902 or 1903 in switch box blown. (b) Phase AC or AB open circuit. (c) Defective wiring to control rack. (d) Defective blower motor.	(a) (i) Replace. (ii) If fuse blows again check motor circuit. (b) Check whether high voltage rectifier blower motor will run. (c) Check wiring. (d) Check input to motor.
	Antenna position indicator dial lights do not glow.	(a) Fuse F1905 or F1906 in switch box. (b) F1201 faulty. (c) R1201 or T1201 open circuit.	(a) Replace. (b) Check. (c) Check.
	One of antenna position indicator dial lights does not glow.	(a) Defective lamp.	(a) Replace.
147(b)	Voltmeter below main line switch does not indicate 115V.	(a) Output from power unit incorrect. (b) Voltage adjuster defective.	(a) Adjust output from power unit. (b) Check phase BC on LINE VOLTMETER. From this it can be deduced whether the voltmeter or the voltage adjuster is faulty.
	Neither green pilot nor voltmeter on high voltage rectifier rack functioning.	(a) Fuse F301, 302, 303 blown.	(a) Replace.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
	High voltage rectifier rack blower motor not running.	(a) Fuse F304, 305, 306 blown. (b) Defective motor.	(a) Replace. (b) Check input to motor.
	Green pilot on high voltage rectifier rack does not light.	(a) Defective lamp. (b) Faulty lamp circuit. (c) Faulty contacts 7 and 8 of K302.	(a) Replace. (b) Check transformer T303. (c) Check.
	FILAMENT voltmeter on high voltage rectifier rack does not indicate.	(a) Defective voltmeter M303 or FILAMENT CONTROL.	(a) (i) Rotate FILAMENT CONTROL and check that high voltage rectifier filaments light. If they do not light and no reading on voltmeter then FILAMENT CONTROL is faulty. (ii) If they do light and no reading on voltmeter, then voltmeter is defective.
	No reading on LINE VOLTMETER.	(a) Defective meter. (b) Faulty PHASE BC or PHASE AC press button. (c) Faulty wiring to meter.	(a) Check using volt multimeter. (b) Clean. (c) Check.
148(a)	No indications of power.	(a) Defective power cable or connector.	(a) Repair or replace.
	Control rack blower not running.	(a) Fuse F1901, 1902 or 1903 in switch box blown. (b) Phase AB or AC open circuited. (c) Defective wiring to control rack. (d) Defective blower motor.	(a) (i) Replace. (ii) If fuse blows again check motor circuit. (b) Check whether high voltage rectifier blower motor will run. (c) Check wiring. (d) Check input to motor.
	Antenna position indicator dial. lights do not light.	(a) Fuse F1905 or F1906 in switch box blown. (b) T1201 faulty. (c) R1201 open circuited.	(a) Replace. (b) Check. (c) Check.
	Some of the antenna position indicator dial lights do not light.	(a) Defective lamp or lamps.	(a) Replace.
148(b)	LINE VOLTMETER does not read.	(a) Defective meter. (b) Faulty PHASE AC or PHASE BC push-button. (c) Faulty wiring to meter.	(a) Check using multimeter. (b) Clean. (c) Check.

Table 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
	LINE VOLTMETER does not indicate 115V.	(a) Output from power unit incorrect. (b) Faulty meter or voltage adjuster.	(a) Adjust output from power unit. (b) Check, using multimeter. If this gives same reading, voltage adjuster is at fault. If reading differs from that of LINE VOLTMETER then meter or its circuit is faulty.
	Neither green pilot nor voltmeter on high voltage rectifier rack functioning.	(a) Fuse F301, 302, 303 blown.	(a) Replace.
	High voltage rectifier rack blower motor not running.	(a) Fuse F304, 305, 306 blown. (b) Defective motor.	(a) Replace. (b) Check input to motor.
	Green pilot on high voltage rectifier rack does not light.	(a) Defective lamp. (b) Faulty lamp circuit. (c) Faulty contacts 7 and 8 of relay K302.	(a) Replace. (b) Check transformer T303. (c) Check.
	FILAMENT VOLTMETER on high voltage rectifier rack does not indicate.	(a) Defective voltmeter M303 or FILAMENT CONTROL.	(a) (i) Rotate FILAMENT CONTROL and check that the high voltage rectifier filaments light. If they do not light and no reading on voltmeter then FILAMENT CONTROL is faulty. (ii) If they do light and no reading on voltmeter then voltmeter is defective.
149	Dehydrator — No indications of power.	(a) Fuse F1907, 1909 of switch box. (b) Fuse of dehydrator.	(a) Replace. (b) Replace.
	Dehydrator gives no pressure but red pilot glows.	(a) Bleeder cap off antenna assembly. (b) Control circuits of dehydrator. (c) Motor of dehydrator.	(a) Replace. (b) Check. (c) Check input to motor.
150	No indication of phase BC on LINE VOLTMETER when push-button PHASE BC on high voltage rectifier rack is pressed.	(a) Defective push-button S305 or wiring.	(a) Clean or re-wire.
151	No indication of phase AC on LINE VOLTMETER when push-button PHASE AC on high voltage rectifier rack is pressed.	(a) Defective push-button S306 or wiring.	(a) Clean or re-wire.

TABLE 79—CONTINUED

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
152	Amber pilot on high voltage rectifier rack does not light.		(a) Read DC VOLTMETER. If this indicates below 10KV: (i) Check lamp by replacement. (ii) Check S314 for clean contact. (iii) Check transformer T304 and wiring. If meter indicates above 10KV and the meter reading does not alter when either the RAISE or LOWER push-button is pressed: (iv) Check limit switches. (v) Check input to motor. (vi) Check open circuit to C302. (vii) Check push-button circuits.
153	Neither FILAMENT VOLTMETER nor rectifier filaments functioning.	(a) FILAMENT CONTROL R305 open circuit.	(a) Check.
	FILAMENT VOLTMETER not reading, but rectifier filaments light.	(a) Defective voltmeter circuit.	(a) Check.
	Voltmeter reads but none of rectifier filaments lights.	(a) Open circuit in power supply between meter and the input of T301D.	(a) Repair.
	One rectifier filament does not light.	(a) Defective valve.	(a) Trial replacement.
		(b) Faulty secondary of one of the filament transformers.	(b) Check.
	Two rectifier filaments do not light.	(a) Open circuit primary of one of the filament transformers.	(a) Check.
	FILAMENT VOLTMETER cannot be adjusted to 105V.	(a) Faulty voltmeter.	(a) Check using multimeter.
155	White pilot on the modulator rack does not light.	(a) Defective lamp.	(a) Replace.
		(b) T207 or wiring defective.	(b) Check.
	Blower motor(s) does not run.	(a) Defective motor(s).	(a) Check input to motor(s).
	FILAMENT VOLTMETER on the modulator rack does not indicate.	(a) See paras. 156 and 157.	
	Green pilot on the modulator rack does not light in 20 seconds.	(a) Defective lamp. (b) Defective transformer T206 or wiring. (c) Defective relay K201. (d) Defective relay circuit. (e) Insufficient driver bias voltage.	(a) Replace. (b) Check. (c) Check. (d) Check. (e) Check V106 and power pack.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
	VOLTAGE meter on modulator rack does not indicate with switch in DRIVER GRID position.	(a) Driver chassis disconnected. (b) Faulty driver bias power pack. (c) Faulty meter. (d) Faulty meter circuit.	(a) Connect J102 and P102. (b) (i) Check F101 and F102. (ii) Check V106. (iii) Check power pack circuit. (c) Check by ohmmeter. (d) Check R102 and wiring.
	VOLTAGE meter indicates with switch in DRIVER GRID position but not between red marks.	(a) Defective driver bias valve V106 or circuit. (b) Final driver V104 or V105 soft.	(a) Replace or check. (b) Replace.
	No indications on FILAMENT voltmeter with switch in KEYER FILAMENT position and keyer filaments do not glow.	(a) Defective KEYER FILAMENT control T210. (b) Primary T209 open circuit.	(a) Check. (b) Check.
156	No indications on FILAMENT voltmeter with switch in KEYER FILAMENT position and keyer filaments do light.	(a) Defective voltmeter. (b) Defective toggle switch S209. (c) Defective meter transformer windings on T209.	(a) Check with multimeter. (b) Check. (c) Check.
	FILAMENT voltmeter indicates but rectifier filaments do not glow.	(a) Defective valves. (b) Defective secondary circuit T209.	(a) Replace. (b) Check.
157	FILAMENT voltmeter on modulator rack does not read with switch in OSCILLATOR position.	(a) Defective toggle switch S209. (b) R219 open circuit.	(a) Check. (b) Check by rotating R219. Meter will suddenly read if R219 is open circuited.
158	Any one lamp does not glow.	(a) Defective fuse adjacent to offending lamp. (b) Defective lamp. (c) Power disconnected from chassis. (d) Defective transformer or wiring.	(a) Replace. (b) Replace. (c) Check plug and socket on back of chassis. (d) Check.
	No 2000 yd. sweep, 32,000 yd. sweep distorted, blurred and small. Unstable and faint P.P.I. sweep.	(a) Defective crystal. (b) Defective crystal oscillator, V601.	(a) Switch in spare crystal. If fault is cleared, original crystal is defective. (b) Replace.
	No 2000 yd. sweep even when intensity is turned up.	(a) Cable between J601 and J908.	(a) Check.
	No 32,000 yd. sweep, even when intensity is turned up.	(a) Defective 5KC amplifier V605. (b) Cable between J602 and J906.	(a) Replace. (b) Check.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
158 (cont'd)	Blurred 2,000 and 32,000 yd. sweeps, unstable and faint P.P.I. sweep but transmitter can be made to operate though unstable.	(a) Defective 20KC multivibrator V602. (b) 5KC multivibrator V603 out of step.	(a) (i) Adjust 20KC MV as detailed in para. 46. (ii) Replace. (b) Adjust 5KC MV as detailed in para. 46.
	2,000 yd. sweep blurred. No 32,000 yd. sweep. Transmitter if switched on is unstable. P.P.I. sweep unstable and faint.	(a) Defective 5KC multivibrator V603.	(a) Replace.
	No 2,000 yd. or 32,000 yd. sweeps unless intensity is turned up. Transmitter inoperative. P.P.I. sweep faint and unstable.	(a) Defective 1.7KC multivibrator V604. (b) Defective 1.7KC amplifier V606.	(a) Replace. (b) Replace.
	Sweeps and strobes normal on range indicator unit. P.P.I. sweep unstable and faint. Transmitter inoperative.	(a) Maladjustment. (b) Trigger pulse selector gate delay kipp relay V611. (c) Trigger pulse selector gate delay kipp relay V612. (d) Cathode follower V613A or pip amplifier V613B. (e) Trigger pulse selector V614.	(a) Adjust TRIGGER DELAY control as detailed in para. 48. (b) Replace. (c) Replace. (d) Replace. (e) Replace.
	No 2,000 yd. sweep unless intensity is turned up. Transmitter can be put on. 32,000 yd. sweep normal. P.P.I. sweep normal but no strobe.	(a) Narrow strobe delay kipp relay V607. (b) Narrow strobe generator V608.	(a) Replace. (b) Replace.
	No 2,000 yd. sweep unless intensity is turned up. Transmitter can be put on. 32,000 yd. sweep normal.	(a) Cable between J603 and J909.	(a) Check.
	2,000 yd. and 32,000 yd. sweeps normal. Transmitter can be put on. P.P.I. sweep normal but no strobe.	(a) Cable between J604 and J1607.	(a) Check.
	No 32,000 yd. sweep unless intensity is turned up.	(a) Wide strobe delay kipp relay V609. (b) Wide strobe generator V610. (c) Cable between J607 and J907.	(a) Replace. (b) Replace. (c) Check.
	Range indicators normal. Transmitter will operate normally. P.P.I. sweep unstable and faint.	(a) Trigger amplifier V1614. (b) Cable between J606 and J1606.	(a) Replace. (b) Check.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
158 (cont'd)	Insufficient intensity on range indicator C.R.T.'s	(a) 2000V range indicator power supply faulty.	(a) Check.
	Everything normal but no P.P.I. range markers even if RANGE MARKER control is advanced.	(a) Range marker oscillator V1604B. (b) Clipper V1604A. (c) Range marker generator V1605A. (d) Square wave inverter V1605B.	(a) Replace. (b) Replace. (c) Replace. (d) Replace.
	Range indicators normal. Transmitter will operate normally. P.P.I. sweep normal but no markers or strobe.	(a) Mixer V1609. (b) Cable between J1604 and J1701.	(a) Replace. (b) Check.
	All normal except no P.P.I. sweep unless intensity is turned up. Then all O.K.	(a) Beam release cathode follower V1602. (b) Cable between J1604 and J1701.	(a) Replace. (b) Check.
	Range indicators normal. Transmitter normal. No P.P.I. sweep.	(a) P.P.I. keying multivibrator V1603. (b) Sweep generator V1602B. (c) Selsyn driver V1601. (d) Cable between J1601 and terminal board in pedestal. (e) 270V P.P.I. power supply.	(a) Replace. (b) Replace. (c) Replace. (d) Check. (e) (i) Check voltage at J1602 J & K. (ii) Check cable between J1602 and J1503.
	All normal except breathing straight line P.P.I. sweep.	(a) One phase splitter (If sweep is vertical, suspect horizontal phase splitter — vice versa).	(a) Replace.
	P.P.I. sweep is off centre.	(a) Maladjustment. (b) Maladjustment of focus or deflection coils. (c) One push-pull amplifier.	(a) Adjust as detailed in para. 62. (b) Adjust as detailed in para. 104 or 105. (c) Replace.
	Everything normal but no 2,000 yard sweep unless intensity is turned up.	(a) Narrow strobe amplifier V710. (b) Cathode follower V712.	(a) Replace. (b) Replace.
	Spots only on range indicator C.R.T.'s if INTENSITY is increased. CENTERING controls will not operate. Transmitter inoperative. P.P.I. sweep unstable and faint. No strobe. Range markers present.	(a) No. 400V or 250V power supply. (b) Interlock circuit broken.	(a) (i) Replace V804. (ii) Check circuit. (b) Check that V908 is in its socket.
	As above, but CENTERING controls operate.	(a) Faulty 250V power output.	(a) (i) Check secondary (terminals 6, 7 and 8) of T806. (ii) Check circuit.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
158 (cont'd)	Nothing at all on range indicator units even with intensity advanced.	(a) 2000V power supply. (b) T901 on range indicator.	(a) (i) Replace V810. (ii) Check circuit. (iii) Check.
	Nothing at all on one range indicator C.R.T. even with intensity advanced.	(a) Faulty C.R.T.	(a) Replace as detailed in paras. 130 and 131.
	Spot on one range C.R.T. will not focus.	(a) Defective focus control R907 or R908.	(a) Check.
	Spots on both range C.R.T.'s will not focus.	(a) Range indicator power supply voltage incorrect. (b) Faulty voltage divider.	(a) Check V810 and circuit. (b) Check R904, R905, R906 and R909.
	Spot on one of range C.R.T.'s dim or bright and INTENSITY control has no effect.	(a) Defective intensity control R910 or R911.	(a) Check.
	Spot on one of range C.R.T.'s dim at maximum setting of INTENSITY control.	(a) Low emmision C.R.T. V901 or V902.	(a) Replace as detailed in paras. 130 and 131.
	Nothing on P.P.I. C.R.T. even when INTENSITY is advanced. No valves alight in P.P.I. unit or power supply.	(a) Interlock open.	(a) Check that: (i) V1507 is in place. (ii) Cable connecting J1503 to J1602 is in place. (iii) Cable from J1603 to J1702 is in place. (iv) Rear cover of P.P.I. shield is in place. (v) J1601 is not disconnected from P1601.
	Nothing on P.P.I. C.R.T. even when INTENSITY control is advanced.	(a) 4KV power pack faulty. (b) P.P.I. C.R.T. faulty. (c) C.R.T. cut off. (d) Excessive current in a deflector coil.	(a) (i) Check V1503 and circuit. (ii) Check high voltage cable between J1502 and J1703. (b) Replace as detailed in paras. 132 and 133. (c) Check sweep intensifier V1602A and circuit. (d) (i) Check by short circuiting deflector coils in turn. (ii) Trial replacement of V1615, V1616, V1617 and V1618.
	P.P.I. sweep unfocussed. Focus control will not correct it.	(a) Faulty focus control R1674. (b) Maladjustment of focus coil assembly. (c) Maladjustment of deflection coil assembly.	(a) Check. (b) Adjust as detailed in para. 104. (c) Adjust as detailed in para. 105.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
159	Red pilot fails to light and no reading on CRYSTAL CURRENT meter.	(a) Fuses F1801 & 1802. (Ensure the FILAMENT switch is in the up position). (b) Primary T1801. (c) Secondary terminals 8 and 9 of T1801.	(a) Replace. (b) Check. (c) Check.
	No red pilot but CRYSTAL CURRENT meter reads.	(a) Defective lamp. (b) R1801 defective.	(a) Replace. (b) Check.
	No reading on CRYSTAL CURRENT meter.	(a) Local oscillator improperly adjusted. (b) V1801 or circuit faulty. (c) V1802 or circuit faulty. (d) V1803 faulty. (e) Faulty crystal mixer. (f) CRYSTAL CURRENT meter faulty.	(a) Adjust local oscillator as detailed in paras 54 and 55. (b) Replace or check. (c) Replace or check. (d) Replace as detailed in paras. 128 and 129. (e) Replace as detailed in paras. 126 and 127. (f) Check using multimeter.
160	No VOLTAGE meter reading in KEYER GRID position. No amber pilot light. No click from contactor.	(a) Dirty contacts of START button. (b) Dirty contacts of STOP button. (c) Doors open. (d) Magnetron compartment high voltage shield not secured. (e) Over-load relay operating on 4KV or keyer bias power-packs. (f) Faulty operation or dirty contacts of K204 or K205.	(a) Clean. (b) Clean. (c) Close. (d) Secure. (e) Check circuit. (f) Check.
	No amber pilot. Meter reading correct.	(a) Faulty lamp or transformer T205.	(a) Replace or check.
	Amber pilot lights but no meter reading.	(a) T214 primary. (b) T213. (c) L202. (d) R221. (e) R238 or R220.	(a) Check. (b) Check. (c) Check for open circuit. (d) Check for short circuit. (e) Check for open circuit.
	Amber pilot lights. Meter reading low.	(a) V208 or V209.	(a) Replace.
	Amber pilot lights but meter reads full scale.	(a) R221.	(a) Check for open circuit.
161	Red pilot lights only while CLOSE button is pressed. Contactor is not heard to close. Green light does not extinguish even while CLOSE button is pressed.	(a) Door open. (b) K308.	(a) Close. (b) Check.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
	Red pilot does not light. Contactor is not heard to operate. Green light stays on.	(a) Dirty CLOSE or TRIP contacts.	(a) Clean.
162	OSCILLATOR PLATE current meter will not indicate 22mA when DC VOLTMETER indicates 20KV.	(a) Magnet gap out of adjustment. (b) Faulty magnetron.	(a) Set up as detailed in paras. 49-51. (b) Replace.
	No indications.	(a) Dirty contacts on RAISE push-button. (b) LOWER button sticking. (c) Motor condenser C302. (d) Motor B301 faulty.	(a) Clean. (b) Press LOWER button sharply. (c) Check. (d) Check.
	DC VOLTMETER does not indicate but red light is on.	(a) R301. (b) R306-310. (c) Meter faulty. (d) Film cut-out SG301 short circuit.	(a) Check for open circuit. (b) Check for open circuit. (c) Report. (d) Replace paper.
	OSCILLATOR PLATE meter and DC MILLIAMETER do not indicate. No echoes.	(a) Transformer T208 faulty. (b) Magnetron faulty. (c) Transformer T105 faulty. (d) V101 faulty. (e) V102 faulty. (f) V103 faulty. (g) V104 or V105 faulty. (h) V107 or circuit. (i) V108 or circuit. (j) Secondary of T103.	(a) Check terminals 5 and 6. (b) Replace, as detailed in paras. 120 and 121. (c) Check. (d) Replace. (e) Replace. (f) Replace. (g) Replace. (h) Replace or check. (i) Replace. (j) Check terminals 3 & 4 or 5 & 6.
	OSCILLATOR PLATE meter does not indicate. Echoes appear. DC MILLIAMMETER indicating correctly.	(a) Film cut-out SG202 short circuited. (b) C209 short circuited. (c) Meter faulty.	(a) Replace paper. (b) Check. (c) Check using multimeter.
	High voltage cannot be made to stay on. Relay trips.	(a) Open circuited R212, R213 or R214.	(a) Check.
	Low DRIVER PLATE and KEYER GRID current.	(a) V104 or V105 faulty.	(a) Replace.
	OSCILLATOR PLATE CURRENT meter reads high.	(a) V206, V207 or V210 faulty.	(a) Replace.
	Red pilot does not light.	(a) Faulty pilot. (b) Faulty T204.	(a) Replace. (b) Check.
163	One motor does not run.	(a) Motor winding open circuited. (b) No power to motor.	(a) Check continuity of windings. (b) (i) Check inputs to motor. (ii) Check terminal boards in junction box.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
167	Antenna drifts slowly e.g. in azimuth. SEE ALSO para. 170.	(a) Residual magnetism in the motor generator. (b) Maladjustment. (c) V401, V402, V403 and V404.	(a) Will remedy itself after operation on MANUAL. (b) Align system as detailed in paras. 64 and 67. (c) Replace.
168	Antenna slews in azimuth or elevation.	(a) Follow-up system.	(a) Note whether antenna slews in azimuth or elevation. e.g.: if it slews in azimuth: (i) Check follow-up motor windings. (ii) Check T1302, T1301 and C1301.
	Antenna will not move in one plane, e.g. azimuth.	(a) Open circuit in the control field of the exciter. (b) Faulty drive motor. (c) Faulty servo generator. (d) Clutch slipping on hand-wheel shaft.	(a) (i) Set FIELD CURRENT meter switch to AXIMUTH to check for control field current. (ii) Check brushes on armature of DC exciter. (iii) Check output. (iv) Check continuity between pairs of brushes with one lifted. (b) Check inputs and brushes. (c) (i) Check generator output. (ii) Check generator brushes. (d) Tighten as detailed in para. 107.
	Antenna will not move in either plane.	(a) Safety relay circuit defective. (b) Power supply section lf automatic tracking unit. (c) Field power supply.	(a) (i) Check pedestal safety switch. (ii) Check azimuth and elevation stowing switches. (iii) Check upper limit switch of elevator. (iv) Check continuity of coil of K502. (b) (i) Replace V501. (ii) Check C505 and C506. (iii) Check J508 and J410. (c) (i) Check F1153 and F1154. (ii) Replace V1152. (iii) Check J1151.
	P.P.I. trace and antenna position indicator not aligned with antenna.	(a) Maladjustment of selsyns.	(a) Orient as detailed in paras. 63 and 81.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
169	No signals or noise on any indicator.	(a) VOLUME control.	(a) Turn up VOLUME.
		(b) Local oscillator V1803.	(b) (i) Tune local oscillator as detailed in paras. 54 and 55. (ii) Check frequency of local oscillator by Echo box and set it at approximately the correct frequency as determined by the frequency of the magnetron. Repeat (i).
		(c) Receiver power supply.	(c) (i) Replace V1001 or V1002. (ii) Check circuit. (iii) Check that V1004 is in its socket. (iv) Check fuses F1001 and F1002.
		(d) Receiver.	(d) (i) Check I.F.'s detector and video stages by using the remote video amplifier as a tester. Disconnect J706 the output of the receiver, and use it as a test prod to the output of these stages observing results on the range indicator C.R.T.'s. (ii) Check R916. (iii) Check V713B.
	No signals or noise on range tubes.	(a) Faulty cable.	(a) Check J1102 to J911.
	No signals or noise on one range tube.	(a) Faulty C.R.T.	(a) (i) Check centre electrode. (ii) Check connection between C.R.T. central electrodes.
	No signals on P.P.I.	(a) Faulty cable. (b) V1608. (c) V1609.	(a) Check J1104 to J1605. (b) Replace. (c) Replace.
	Low signal to noise ratio.	(a) Receiving system off tune.	(a) Tune as detailed in para. 54 or 55.
		(b) Faulty cables between crystal mixer and local oscillator, crystal mixer to pre-amplifier and pre-amplifier to receiver.	(b) Check.
		(c) Poisoned crystal.	(c) Replace as detailed in para. 125.
		(d) Faulty TR tube.	(d) Replace as detailed in paras. 122, 123 and 124.
		(e) Faulty magnetron.	(e) Replace as detailed in paras. 120 and 121.
		(f) Faulty klystron.	(f) Replace as detailed in paras. 128 and 139.
		(g) Faulty V706.	(g) Replace.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
169 (cont'd)	No signals, noise, range markers or strobe on P.P.I.	(a) V1609. (b) Cable J1604 – J1701.	(a) Replace. (b) Check.
	Noise level on P.P.I. C.R.T. disappears in presence of strong signals.	(a) Faulty D.C. restorer V1608.	(a) Replace.
	A.G.C. not working.	(a) Setting of A.G.C. ADJUST control R743. (b) V713 faulty. (c) Relay K1751.	(a) Adjust as detailed in para. 56. (b) Replace or check circuit. (c) Check.
	VOLUME control not working.	(a) Control switch or A.G.C. switch. (b) V1003 faulty. (c) Faulty VOLUME control R738. (d) C741 faulty.	(a) Check that the control switch is at MANUAL and the A.G.C. switch is off. (b) Replace or check circuit. (c) Check. (d) Check.
	A.G.C. always operates when a break is strobed even when control switch is at MANUAL.	(a) A.G.C. relay K701. (b) A.G.C. switch S701. (c) Cable J701 to J1751 faulty. (d) Defective contacts on relay K1751.	(a) Check. (b) Check. (c) Check. (d) Check.
	High gain, not variable, on both A.G.C. and MANUAL.	(a) C735 and C736.	(a) Check for short circuit.
170	One FIELD CURRENT meter does not indicate, e.g. AZIMUTH.	(a) Switch S401. (b) Control field of exciter open circuited. (c) V403 or V404 not conducting. (d) R425 or R426. (e) Faulty meter.	(a) Clean or adjust as detailed in para. 106. (b) Check. (c) Replace. (d) Check for short circuit. (e) Check by switching meter switch to ELEVATION.
	FIELD CURRENT meters do not read equally.	(a) Maladjustment of the azimuth and elevation tracking unit. (b) Faulty V403, V404, V405, V406 or V407. (c) Smoothing circuits in grids of DC amplifiers.	(a) Adjust as detailed in para. 64. (b) Replace. (c) Check.
171	Paraboloid moves the wrong way in relation to the handwheel and the antenna position indicator.	(a) Reversed connections on a control field on the azimuth servo generator. (b) Reversed connection between output of servo generator and input to drive motor.	(a) Check. (b) Check.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
171 (cont'd)	Range markers trace out pattern other than a circle.	(a) Maladjustment of CIRCLE ADJUST and CENTRE ADJUST controls. (b) Y resistor network or P.P.I. selsyn. (c) Faulty clamping triode in the circuit of the push-pull amplifier which provides the component of deflection in the direction of the longer axis of the ellipse. (d) V1606, V1607, V1615, V1616, V1617, V1618 faulty.	(a) Adjust as detailed in para. 62. (b) Check. (c) Replace. (d) Replace.
	Intermittent trace on P.P.I. C.R.T. as sweep rotates.	(a) Dirty sliprings in P.P.I. slesyn B2005.	(a) Report.
	The outer extremity of the P.P.I. trace is not visible during a portion of the P.P.I. scan.	(a) Shift in position of the deflection coil.	(a) Adjust the position of the deflection coil as detailed in para. 105.
172	Paraboloid hunts e.g. in azimuth.	(a) Maladjustment of A.H. GAIN control. (b) Faulty V405 anti-hunt amplifier or circuit. (c) Faulty cable 43. (d) Brushes in servo generator worn and chattering. (e) Voltage divider R413, 414, 415, 416.	(a) Adjust A.H. GAIN control as detailed in para. 64. (b) Replace or check. (c) Disconnect cable 43 from J409 and check continuity between sockets D and L. (d) Check. (e) Check voltage (30V) at J413.
	Erratic or jerky operation.	(a) Faulty V405, V406 or V407 or circuit. (b) Faulty cable 43. (c) TORQUE CONTROL circuit.	(a) Replace or check. (b) Disconnect cable 43 from J409 and check for continuity between pins C and D, and H and either C or D. (c) Adjust as detailed in para. 64.
	Sluggish response to movement of handwheel.	(a) V406 anti-hunt limiter or circuit. (b) A.H. GAIN control set too high.	(a) Check. (b) Adjust as detailed in para. 64.
173, 174, 175	See fault-finding in azimuth channel: paras. 170, 171, 172.		
176	Cursors do not move when SLEWING handwheel is turned.	(a) Lucite disc dragging on face of C.R.T.	(a) Adjust C.R.T. as detailed in para. 131.

TABLE 79—Continued

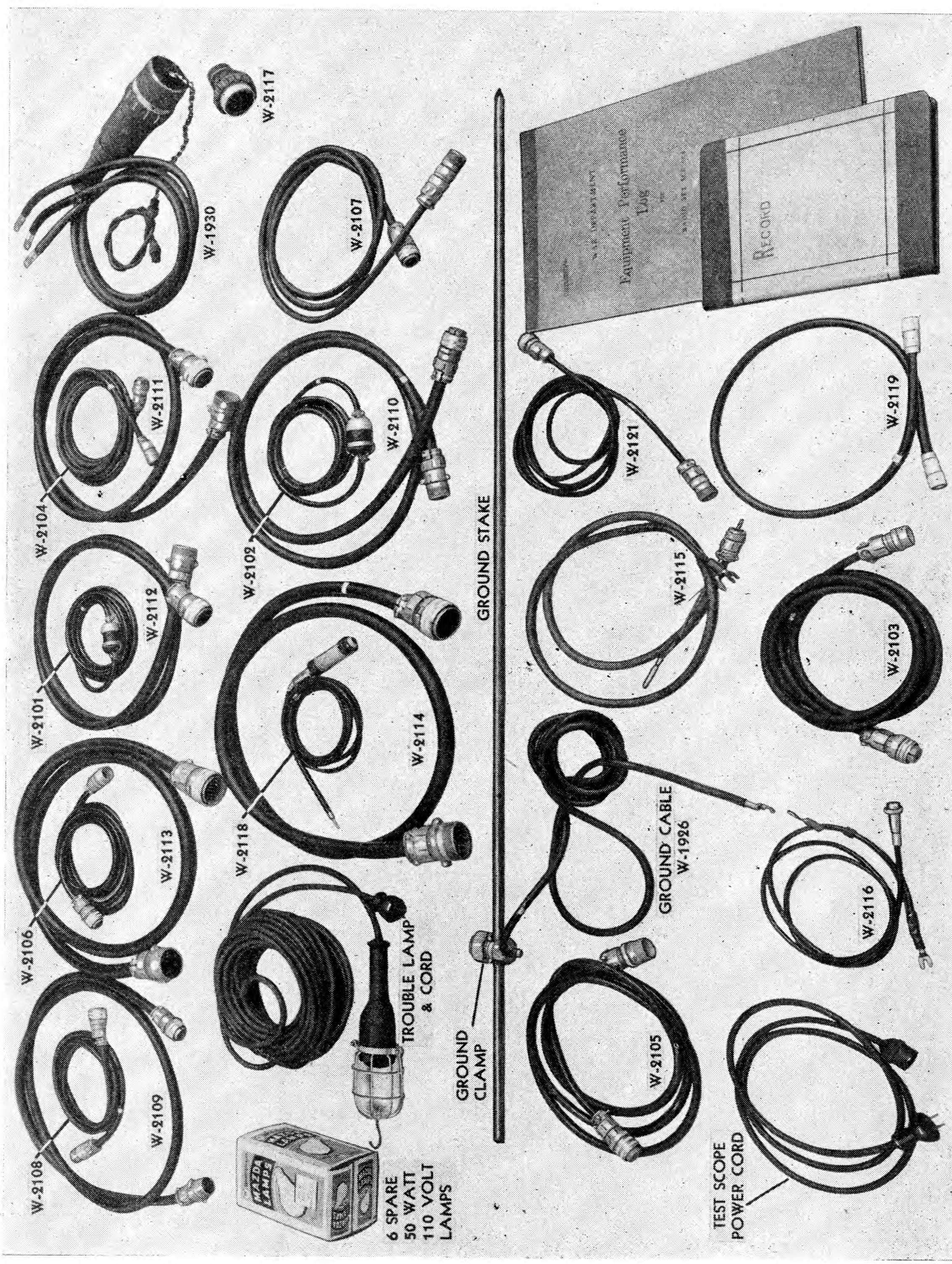
PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
176 (cont'd)	Narrow strobe does not track reasonably with fine range cursor.	(a) Maladjustment of NARROW GATE and NARROW GATE DELAY controls. (b) Faulty V607, narrow strobe delay kipp relay. (c) Faulty R636 NARROW GATE. (d) Faulty R634 NARROW GATE DELAY. (e) Faulty R635, R637 or R638.	(a) Adjust as detailed in para. 60. (b) Replace. (c) Rotate control and note if strobe moves. (d) Rotate control and note if strobe moves. (e) Check.
	Narrow strobe jumps.	(a) Faulty R901 narrow gate range potentiometer.	(a) Check.
	Narrow strobe remains at beginning of range sweep until, after a certain range, it jumps to the end of the range sweep.	(a) R901 open circuited.	(a) Check.
	Narrow strobe stays at minimum range.	(a) R638 open circuit. (b) Connection to terminal 1 of R901 open circuited.	(a) Check. (b) Repair.
	Narrow strobe stays at maximum range.	(a) R635 open circuit. (b) Connection to terminal 3 of R901 open circuited.	(a) Check. (b) Repair.
	Cursors follow the TRACKING handwheel irregularly.	(a) Range motors B901 and B902 faulty.	(a) Check brushes.
	When the TRACKING handwheel is turned the cursors turn to the end of their travel and stop, but the motor continue to run. The RANGE MOTORS pilot on the range power unit does not extinguish.	(a) Maladjustment of limit switch S901. (b) Defective limit switch S901.	(a) Adjust switch S901 as detailed in para. 102. (b) Check.
177	Pilot does not light.	(a) Fuse F801, or 802. (b) Faulty lamp. (c) J802. (d) Faulty switch S902.	(a) Replace. (b) Replace. (c) Check. (d) Check.
	Cursors do not move.	(a) V801 faulty. (b) Terminals 17, 18, 19 of T801. (c) R902. (d) VR901.	(a) Replace. (b) Check. (c) Check for open circuit. (d) Check for open circuit.
	Cursors move violently in one direction to the limit of their travel and will not reverse.	(a) Faulty V802 or V803, range motors rectifiers. (b) T802 or T803 faulty. (c) Terminals 11, 12 and 13, or 14, 15 and 16 of T801. (d) Faulty motor B901 or B902.	(a) Replace. (b) Check. (c) Check. (d) (i) Check input to motor. (ii) Check brushes.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
179	On switching to automatic antenna immediately loses target.	(a) Wrong connections between outputs of reference generator and inputs to respective channels of tracking unit. (b) V503 or V504 faulty. (c) Antenna not firmly seated in transmission line. (d) Incorrectly phased reference generator. (e) GAIN control on automatic tracking unit set at zero.	(a) Check. (b) Replace. (c) Replace correctly. (d) Phase reference generator as detailed in para. 69. (e) Adjust as detailed in para. 70.
	PLATE CURRENT meter M501 does not read zero when COAST button is pressed.	(a) Coast relay K501 not operating.	(a) Check.
180	No voltage at TEST 4.	(a) Faulty V1452, altitude converter rectifier, or circuit. (b) Fault in terminals 8, 9 and 10 on secondary of T1451. (c) Cable J1451 to J1406.	(a) Replace or check. (b) Check. (c) Check.
	Low voltage at TEST 4.	(a) Faulty V1452. (b) C1454, C1455 or C1456 short circuited. (c) Faulty V1453 or V1454 in altitude converter power supply.	(a) Replace. (b) Check. (c) Replace or check circuit.
	High voltage at TEST 4.	(a) Faulty V1451, regulator valve. (b) Faulty V1456 and V1455 in altitude converter power supply.	(a) Replace or check circuit. (b) Replace or check circuit.
181	No output at TEST 2.	(a) V1401 or V1402 wein bridge oscillator or circuit.	(a) Replace or check.
	Low output at TEST 2.	(a) V1401, V1402 or circuits.	(a) Replace or check.
182	No voltage at TEST 6.	(a) V1402 inverter, V1457 or V1458 field amplifier or circuits.	(a) Replace or check.
	Low voltage at TEST 6.	(a) V1402 inverter, V1457 or V1458 field amplifier or circuits.	(a) Replace or check.
	High voltage at TEST 6.	(a) R1421 or R1476 high.	(a) Check.
183	Incorrect voltage at TEST 5.	(a) V1404, V1405 or V1406 and circuits. (b) R1457 or R1458.	(a) Check or replace. (b) Check.

TABLE 79—Continued

PARA.	SYMPTOM (all other indications normal)	POSSIBLE CAUSE	ACTION
184	Indication not correct within 60 yds.	(a) Altitude data potentiometer faulty. (b) V1404, V1405 or V1406 faulty.	(a) Check. (b) Replace.
185	Dial of altitude data unit rotates rapidly. Cannot be stopped by adjustment of FREQ. TEST.	(a) V1401 or bridge circuit off tune.	(a) Check or replace.
	Dial of altitude data unit oscillates rapidly backward and forward.	(a) Faulty V1402. (b) Faulty V1405.	(a) Check circuit. (b) Replace.
186	Voltage at TEST 5 cannot be reduced below 1V by PHASE BAL. control.	(a) Faulty V1403. (b) C1422 or C1412. (c) No output from range potentiometer. (d) Output of isolation amplifier. (e) Cable between J1405 and J905. (f) Cable between J1405 and elevation potentiometer terminal blocks.	(a) Replace. (b) Check for short circuit. (c) Check for AC voltage at J1403. (d) Check for AC voltage at pin B of J1405. (e) Check. (f) Check.



T $\frac{\text{OY-103}}{\text{1-29}}$

Fig. 29—Test cables provided with equipment

TABLE 80—TEST CABLES AND THEIR USES

Name	Description	Use
W2101 W2102	Length 8 feet. General Electric plug on each end.	Connects: Range Power Supply RA-72 to A.C. source. Receiver Power Supply RA-66 to A.C. source. Altitude Converter Power Supply RA-70 to A.C. source. Field Power Supply RA-71 to A.C. source. P.P.I. Power Supply RA-69 to A.C. source. Local Oscillator BC-1086 to Modulator BC-984.
W2103	Length: 8 feet, 1½ inches. Amphenol receptacle on one end, Amphenol plug on the other end.	Connects: Receiver BC-1056 to Control Panel PN-24.
W2104	Length: 8 feet, 1½ inches. Amphenol receptacle on one end, Amphenol plug on the other end.	Connects: Range Unit BC-1062 to Range Indicator Unit BC-1088. Field Power Supply RA-71 to Junction Box JB-71.
W2105	Length: 8 feet, 3 inches. Amphenol receptacle on one end, Amphenol plug on the other end.	Range Unit BC-1062 to Range Indicator Unit BC-1088. Connects: Field Power Supply RA-71 to Junction Box JB-71.
W2105	Length: 8 feet, 3 inches. Amphenol receptacle on one end, Amphenol plug on other end.	Connects: Range Unit BC-1062 to Range Indicator Unit BC-1088. P.P.I. BC-1092 to Plan Position Unit BC-1058.
W2106	Length: 8 feet, 3 inches. Receptacle on one end and plug on the other end.	Connects: Range Unit BC-1062 to Range Indicator Unit BC-1088. Plan Position Unit BC-1058 to P.P.I. BC-1092.
W2107	Length: 8 feet, 3 inches. Amphenol receptacle on one end, Amphenol plug on other end.	Connects: Range Power Supply RA-72 to Range Indicator Unit BC-1088. P.P.I. Power Supply RA-69 to P.P.I. BC-1092.
W2108	Length: 8 feet, 3 inches. Amphenol receptacle on one end, Amphenol plug on other end.	Connects: Range Indicator Unit BC-1088 to Data Panel PN-22. P.P.I. BC-1092 to P.P.I. Power Supply RA-69. Range Indicator Unit BC-1088 to Range Power Supply RA-72.
W2109	Length: 8 feet, 2½ inches. Amphenol Plug on one end, Amphenol receptacle on other end.	Connects: Automatic Tracking Unit BC-1086 with Azimuth and Elevation Tracking Unit BC-1090. Receiver BC-1056 to Pre-Amplifier BC-1078. Range Power Supply RA-72 to Range Unit BC-1062. Receiver Power Supply RA-66 to Receiver BC-1056. Antenna Position Indicator Unit BC-1076 to Data Panel PN-22. Altitude Converter Control Unit BC-1094 to Altitude Converter Power Supply RA-70. Altitude Converter Control Unit BC-1094 to Data Panel PN-22. Plan Position Unit BC-1058 to Junction Box JB-71.

TABLE 80—Continued

Name	Description	Use
W2110	Length: 8 feet, 2½ inches. Amphenol receptacle on one end, Amphenol plug on other end.	Connects: Azimuth and Elevation Tracking Unit BC-1090 to Automatic Tracing Unit BC-1086. Automatic Tracking Unit BC-1086 to Control Panel PN-24. Range Unit BC-1062 to Range Power Supply RA-72. Receiver BC-1056 to Receiver Power Supply RA-66 Range Indicator Unit BC-1088 to Data Panel PN-22. Receiver Power Supply RA-66 to Remote Video Amplifier BC-1074. Antenna Position Indicator Unit BC-1076 to Data Panel PN-22. Altitude Converter Control Unit BC-1094 to Altitude Converter Power Supply RA-70. Pre-Amplifier BC-1078 to Receiver BC-1056.
W2111	Length: 8 feet, 2½ inches. Amphenol receptacle on one end, Amphenol plug on other end.	Connects: Antenna Position Indicator Unit BC-1076 to Azimuth and Elevation Tracking Unit BC-1090. Antenna Position Indicator Unit BC-1076 to Control Panel PN-24. Altitude Converter Control Unit BC-1094 to Altitude Data Unit BC-1075. P.P.I. Power Supply RA-69 to Plan Position Unit BC-1058. Plan Position Unit BC-1058 to P.P.I. BC-1092.
W2112	Length: 8 feet, 2½ inches. Amphenol receptacle on one end, Amphenol plug on other end.	Connects: Azimuth and Elevation Tracking Unit BC-1090 to Antenna position Indicator Unit BC-1076. Plan Position Unit BC-1058 to P.P.I. Power Supply RA-69. P.P.I. BC-1092 to Plan Position Unit BC-1058.
W2113	Length: 8 feet, 2½ inches. Amphenol receptacle on one end, Amphenol plug on other end.	Connects: Range Power Supply RA-72 to Range Indicator Unit BC-1088. Antenna Position Indicator Unit BC-1076 to Junction Box JB-71.
W2114	Length: 8 feet, 2½ inches. Receptacle on one end, Amphenol plug on other end.	Connects: Azimuth and Elevation Tracking Unit BC-1090 to Junction Box JB-71. Range Indicator Unit BC-1088 to Range Power Supply RA-72. Antenna Position Indicator Unit BC-1076 to Antenna Position Control Unit BC-1085.
W2115	Length: 5 feet, 2 inches. Amphenol plug on one end, two spade terminals on other end.	Used with Test Oscilloscope.
W2116	Length: 5 feet. Amphenol connector on one end, two open lugs on other end.	Used with Test Oscilloscope.

TABLE 80—Continued

Name	Description	Use
W2117	Adaptor.	Used to plug into either A or B receptacle on Data Panel PN22 to enable the equipment to be operated without the predictor.
W2118	Length: 6 feet, 10 inches. Amphenol connector on one end, Test prod on other end.	Used with Test Oscilloscope.
W2119	Length: 3 feet. Selectar plug on both ends.	Connects Echo Box ("S" Band) to Terminal Box.
W2120	Length: 25 feet. Selectar plug on both ends.	Connects Echo Box to Dipole Antenna.
W2121	Length: 8 feet, 2 inches. Amphenol plug on each end.	Connects: Automatic Tracking Unit BC-1086 to Receiver BC-1056. Range Unit BC-1062 to Driver Unit BC-1080. Range Unit BC-1062 to Plan Position Unit BC-1058. Range Unit BC-1062 to Receiver BC-1056. Receiver BC-1056 to Pre-Amplifier BC-1078. Receiver BC-1056 to Remote Video Amplifier BC-1074. Range Indicator Unit BC-1088 to Data Panel PN-22. Altitude Converter Power Supply RA-70 to Altitude Converter Control Unit BC-1094. Altitude Converter Control Unit BC-1094 to Data Panel PN-22. Altitude Converter Control Unit BC-1094 to Altitude Data Unit BC-1075. Range Unit BC-1062 to Range Indicator Unit BC-1088.

ROUTINE MAINTENANCE

187. (a) Routine maintenance is intended to minimise the possibility of faults by frequent cleaning and lubrication of the equipment.

(b) The procedures will be carried out regularly as detailed during the maintenance periods which are allocated by operational authorities.

(c) The instructions are divided into two sections:

(i) Tasks to be carried out by the Tels. Mechanic.

(ii) Tasks which may be performed by the Radio Operator under the supervision of the Tels. Mechanic.

(d) The tasks as indicated in the tables must be completed in their respective periods.

(e) In all cases where a fault is discovered which is beyond the possibility of a First Echelon repair it should be reported to the Officer in charge of First Line Maintenance.

(f) At the completion of each day's routine maintenance period Tests and Adjustments will be carried out to obtain optimum performance of the equipment.

Maintenance procedure on individual chassis

188. Remove the screws from around the front and the plugs from the back of the unit and withdraw the unit from the rack. Inspect the plugs for damage, corrosion and good fit. Report any faults to the Officer in charge of First Line Maintenance. Clean the chassis and inspect it for damaged wiring, corroded valve pins, overheated components, loose connections and dry soldered joints. Also inspect the unit for any of the following which it may contain: faulty switches, relays, pilot lights, meters, control knobs.

TELECOMMUNICATIONS

MECHANIC'S TASKS

WEEKLY

Trailer

189. Check that the colour of the silica-gel which can be seen through the transparent window, is blue. If the indicator starts to turn pink after switching on, adjust the DEW POINT control. If the colour does not turn back to blue within an hour, report to the Officer in charge of First Line Maintenance.

190. Clean the trailer exhaust ventilators and tighten all assembly screws.

191. Clean the control rack air filter as detailed in para. 91.

192. Clean the fuel filter of the petrol heater as detailed in para. 85.

193. Inspect and replace the brushes in the line voltage regulator if they are worn to about ⅛ inch of the brush holder, as detailed in para. 119. (A sets only). Tighten all loose connections, mounting screws and shaft clamps. Clean all contacts, the brush assembly and the variac windings (A & B sets).

194. Remove the access plate to the control rack blower motor. Feel the bearings and the housing of the motor after it has been running for one hour, and while it is still running, and check that the hand can be borne on any part of it for five seconds. Inspect the fan blades to see that they are securely fastened to the shaft and tighten the mounting screws and assembly bolts if necessary. Clean and tighten the terminal board connections if they require it. Clean the exterior of the motor and the motor compartment.

195. Clean the trailer intake ventilator filter as detailed in para. 90. Inspect the front panel assembly of the ventilator, particularly the springs, mounting screws, motor mounting clamps, power connector plugs and the A.C. switch. Feel the bearings and the housing of the motor after it has been running for one hour and while it is still running, and check that the hand can be borne on any part of it for five seconds. Inspect the fan blades to see that they are securely fastened.

Modulator

196. Remove the magnetron as detailed in para. 120, and check the bullet for tightness and the output pin for signs of burning or pitting. Clean the bullet and the output pin with a damp rag and polish with a dry cloth. Corrosion caused by burning may be removed with very fine grade sandpaper. Replace the magnetron as detailed in para. 121.

197. Feel the housings and the bearings of the three blower motors after they have been running for one hour and while they are still running, and check that the hand can be borne on any part of them for five seconds. Clean the motor and blower assemblies. Inspect the fan blades to see that they are securely fastened to the shafts of the motors. Tighten all mounting screws and examine the air ducts from blower BL202 to the bases of the keyer valves. Examine the brushes of blower BL202 (A sets only), and if they require replacement, report to the Officer in charge of First Line Maintenance. Ensure in any case that the brushes are replaced exactly as they were found.

198. Inspect condensers C201, C202, C203, C208, C209 and C210 for swelling, oil leaks, cracked insulators or bushings, perished gaskets, loose connections and insecure mountings. Clean the condenser cases and bushings with a cloth dipped in carbon tetrachloride. Examine the grid and plate parasitic suppressor resistors R209-R214 of the keyer valves V203-V205 for signs of breakdown or over-heating and, if necessary, report to the Officer in charge of First Line Maintenance.

199. Remove the two air filters from the rear of the modulator and clean them as detailed in para. 88 (c) to (f).

High voltage rectifier

200. Examine condensers C301 and C302 for swelling, oil leaks, cracked insulators or bushings, perished gaskets, loose connections and insecure mountings. Clean the condenser cases and bushings with a cloth dipped in carbon tetrachloride.

201. Clean the high voltage rectifier air filter as detailed in para. 99.

202. Feel the housing and the bearings of the blower motor after it has been running for one hour and while it is still running, and check that the hand can be borne on any part of it for five seconds. Examine the motor and blower frame assembly, the mounting screws and the blower fan assembly for looseness or damage.

Antenna

203. Remove the antenna from the transmission line and the spare antenna from its storage rack and examine the plastic housing for cracks or looseness, the rubber air sealing washer for signs of perishing.

Range indicator unit

204. Examine the brushes of the range motors and, if they are worn, within ¼ inch of the spring report to the Officer in charge of First Line Maintenance. Ensure in any case that the brushes are replaced exactly as they were found.

Antenna position control unit

205. Examine the brushes of the P.P.I. scan motor and, if they are shorter than ¼ inch, report to the Officer in charge of First Line Maintenance. Ensure in any case that the brushes are replaced exactly as they were found.

Pedestal.

206. Remove the cover over the azimuth compartment of the pedestal. Ensure that the azimuth clamping handle is tight and that the P.P.I. selsyn cable is so placed that it will not entangle with the clamping handle but is loose enough to permit full rotation of the selsyn when orienting the set. Check all terminal boards for loose terminals, all cables for loose cabling cord and the connections to the safety switch. Clean the interior of the compartment.

207. Remove the cover over the azimuth drive motor compartment. Examine the brushes of the motor and, if they are worn to less than ½ inch, report to the Officer in charge of First Line Maintenance. Ensure in anycase that the brushes are replaced exactly as they were found. Check that all mounting studs are tight.

208. Examine the brushes of the elevation drive motor and, if they are worn to less than ½ inch, report to the Officer in charge of First Line Maintenance. Ensure in any case that the brushes are replaced exactly as they were found. Check that all mounting screws are tight.

209. Remove the cover over the elevation compartment of the pedestal. Check all terminal boards for loose or corroded terminals and cables for loose cabling cord and the tightness of all mounting screws. Clean the interior of the compartment.

FORTNIGHTLY

Modulator

210. Age any spare magnetrons which have been out of use for more than 14 days as detailed in para. 95.

211. Proof any spare 6C21 valves which have been out of use for more than 14 days as detailed in para. 96.

MONTHLY

Trailer

212. Remove the cover over terminal board TB11 and tighten all loose connections and cable clamps. Clean all corroded terminals. Inspect all moving parts of the elevator such as the elevating screws, sprockets, drive chain and the assembly mounting plates. Clean off any rust. Lower the pedestal as detail in para. .38 (a)—(c) and raise it again as detailed in paras. 13 (d)—(j) and 14. Check the levelling as detailed in para. 15. If any trouble is encountered, or if either of the limit switches fails to operate, report to the Officer in charge of First Line Maintenance.

213. On the underside of the pedestal base check the mounting screws and connections, cabling rings and cable clamps. Remove the cables from their sockets for inspection and if necessary report to the Officer in charge of First Line Maintenance.

214. Remove the cover over junction box JB71, inspect the terminals for signs of rust or corrosion, tighten the terminals if necessary and clean the inside of the box thoroughly.

215. Clean the fresh air intake ventilator filter of the petrol heater as detailed in para. 88.

216. Check the petrol heater fuel line for leaks, and the whole assembly for loose mounting screws.

Driver

217. Carry out the procedure outlined in para. 188. Examine the insulation and supports of high voltage and pulse circuits (e.g. R126, R127, C110). Report any signs of breakdown to the Officer in charge of First Line Maintenance.

Modulator

218. Clean the vitreous resistors, insulators and bushings as detailed in para. 12. Tighten all loose mounting screws and nuts. Check film cutouts SG201-203 as detailed in para. 94. Examine the voltage adjuster T210. Tighten all mounting screws, tighten and clean all loose connections and contacts and replace the brushes if necessary (A sets only) as detailed in para. 119 (b) to (f) for the line voltage regulator. Examine rheostat R219 after it has cooled for excessive wear of the brush and the condition of the resistor windings. Increase the tension of the slider arm of the brush if it does not make good contact. Clean the assembly, any corroded connections and dirty contact surfaces. Check the contacts of such of the relays and contactors as can be seen without dismantling and report any signs of pitting to the Officer in charge of First Line Maintenance. Check all terminal boards for loose or corroded connections and all cables for loose cabling cord. Clean the contacts of the yaxley switches below the CURRENT and VOLTAGE meters and the POWER switch, using a brush dipped in carbon tetrachloride. Check all switches for tension of springs, connections and firm mountings. Check the action of the safety shorting switches and the magnetron-shield interlock mechanism. Clean out the modulator rack thoroughly including the magnetron compartment.

High voltage rectifier

219. Clean the vitreous resistors and insulators as detailed in para. 92, and carefully tighten all loose mounting screws and nuts. Check the contacts of such relays and contactors as can be seen without dismantling and report any signs of pitting to the Officer in charge of First Line Maintenance. Check the condition of the brush and resistor winding on rheostat R305. Increase the tension of the spring slider arm if necessary. Check film cut-out SG301 as detailed in para. 98. Check all terminal boards for loose or corroded terminals and all cables for loose cabling cord. Inspect, and adjust if necessary, the air filter retaining clips, cover plates and cover plate latch mechanism. Check the action of the safety shorting switches. Clean the contacts of the LINE CIRCUIT BREAKER with a brush dipped in carbon tetrachloride. Check all switches for tension of springs, connections and firm mountings. Clean out the high voltage rectifier rack thoroughly.

R.F. transmission line

220. Dismantle, inspect and clean the fixed joints of the R.F. transmission line which are inside the trailer, as detailed in para. 100.

221. Dismantle, inspect and clean the fixed joints of the R.F. transmission line which are outside the trailer as detailed in para. 100.

222. Dismantle, inspect and clean the elevation low speed rotating joint of the R.F. transmission line as detailed in para. 101.

223. Dismantle, inspect and clean the azimuth low speed rotating joint of the R.F. transmission line as detailed in para. 101.

TR box

224. Remove the TR box as detailed in para. 122. Replace the TR tube with a new tube and clean the inside of the cavity as detailed in para. 124. Replace the TR box as detailed in para. 124.

Local oscillator and power supply

225. Carry out the procedure outlined in para. 188.

Receiver

226. Carry out the procedure outlined in para. 188.

Receiver power supply

227. Carry out the procedure outlined in para. 188.

Range unit

288. Carry out the procedure outlined in para. 188.

Range indicator unit

229. Carry out the procedure outlined in para. 188. (Two men will be required to handle this unit).

230. Check the level of the oil as seen through the window of the range potentiometer. If it is below the center of the gauge:—

(a) Clean the fittings and the couplings on the oil pan.
(b) Fill a Western Electric type No. D166057 oil pump and associated hose No. D166058 with Bayol D oil, and pump a small amount of the oil through the hose to remove any dirt.
(c) Connect the hose to the filler and drain cock at the bottom edge of the pan.
(d) Open both the filler and drain cock and the vent cock.
(e) Pump oil into the pan until the oil level is at the centre of the gauge.
(f) Close both the vent cock and the filler and drain cock.
(g) Remove the oil pump hose and place the free end in the fitting provided.
(h) Inspect the potentiometer case and gasket for dirt and leakage. Clean the case and tighten all loose studs.

Range power supply

231. Carry out the procedure outlined in para. 188.

P.P.I. unit

232. Carry out the procedure outlined in para. 188.

P.P.I. power supply

233. Carry out the procedure outlined in para. 188.

Automatic tracking unit

234. Carry out the procedure outlined in para. 188.

Azimuth and elevation tracking unit.

235. Carry out the procedure outlined in para. 188.

Motor generators

236. Feel the bearings and the housings of the motor generators after they have been running for one hour and while they are still running and check that the hand can be borne on any part of them for five seconds. Examine the brushes of the motor generators and, if they are worn shorter than ½ inch, report to the Officer in charge of First Line Maintenance. In any case ensure that the brushes are replaced exactly as they were found. Tighten and clean any of the connections on the terminal boards which require it. Tighten any loose mounting screws. Inspect and clean the housing ventilation openings.

Antenna position control unit

237. Carry out procedure outlined in para. 188.

Control panel

238. Carry out procedure outlined in para. 188. Clean the control switch with a brush dipped in carbon tetrachloride.

Field power supply and remote video amplifier

239. Carry out the procedure outlined in para. 188.

Antenna position indicator unit

240. Carry out the procedure outlined in para. 188.

Data panel

241. Switch off the power at the generator. Remove the cover in the floor over the upper side of the data panel by removing the securing screws. Check the terminal boards for loose connections and signs of corrosion, the cables and the insulation and clean out the compartment thoroughly. Clean the contacts of the SLANT RANGE-ALTITUDE switch with a brush dipped in carbon tetrachloride. Replace the cover and the securing screws.

Altitude converter control unit

242. Carry out the procedure outlined in para. 188.

Altitude data unit

243. Check the oil level in the altitude potentiometer and refill if necessary as detailed in para. 230. Inspect the potentiometer for dirt and oil and tighten any loose studs.

Switch box

244. Open the door of the switch box and inspect the components and wiring for overheating, loose assemblies, dry soldered joints, loose terminals etc. Inspect the mechanical action and the contacts of contactor K1901 and switches S1901-1904 through the openings near them with the aid of a flashlight. If the contacts appear to be corroded or pitted report to the Officer in charge of First Line Maintenance.

Pedestal

245. Observe the level of the oil in the window of the azimuth potentiometer and if necessary refill as detailed in para. 230. Inspect the potentiometer for dirt, oil leakage and loose studs.

246. Check the action of the elevation limit switches as detailed in para. 110.

247. Remove the elevation potentiometer filler plug and add oil to the level of the filler plug hole using a funnel. If they are fitted, the oiling fittings should be used and the procedure detailed in para. 230 followed.

QUARTERLY

Trailer

248. Remove the de-hydrator power cable cleats from the wall of the trailer. Take the de-hydrator from its mounting by removing the two mounting bolts and unscrewing the air line at the elbow joint. (Two men will be required for this and great care must be exercised). Remove the top and back covers of the de-hydrator. If the de-hydrator has just been in use, feel the temperature of the housing and the bearings of the motor making allowances for the cooling which will naturally have taken place. Check the tightness of all assembly screws and bolts and the condition of the motor belt and pulleys. Examine the brushes of the de-hydrator motor and, if they require replacement, report to the Officer in charge of First Line Maintenance. In any case ensure that the brushes are replaced exactly as they were found. Apply about six drops of O.E. 10 H.D. to the oil cup at each end of the motor. Replace the top and back covers and re-install the de-hydrator in the reverse order of its removal and re-apply pressure to the R.F. line as detailed in para. 26.

Modulator

249. Remove the rectifiers V201, V202, V208, and V209, the damping diodes V206, V207, V210 and the keyer valves V203, V204, V205 after they have cooled. Check the tension of the contact springs and check the valve pins, caps and contact springs for dirt or corrosion. Clean the glass envelopes with a rag dipped in carbon tetrachloride and polish with a clean cloth. Inspect the case frames, exposed windings and assembly and mounting screws of all transformers. Clean the exterior cases and any corroded connections.

High voltage rectifier

250. Examine the oil level in the high voltage transformer and if necessary add Wemco type C oil to the required level using a funnel. Wipe the transformer case clean and tighten the filler plug securely.

251. Remove the high voltage rectifier valves V301-306 after they have cooled. Check the tension of the contact springs, and check the valve pins, caps and contact springs for dirt or corrosion. Check the socket mounting screws for looseness. Clean the glass envelopes with a rag dipped in carbon tetrachloride and polish with a clean cloth. Inspect the case frames, exposed windings and assembly and mounting screws of all transformers. Clean the exterior of the cases and any corroded connections.

Azimuth and elevation tracking unit

252. Clean the contacts of switch S401 as detailed in para. 106.

Pedestal

253. Remove the cover over the azimuth compartment and the cover over the sliprings. Elevate the paraboloid to 90 degrees (1600 mils). Slowly rotate the pedestal through 360 degrees in azimuth meanwhile examining the condition of the sliprings. If necessary report to the Officer in charge of First Line Maintenance. **Do not attempt to clean the sliprings.**

OPERATOR'S TASKS

DAILY

Trailer (Inside)

254. Clean out the interior of the cabin thoroughly using a broom.

255. Check that the fire extinguishers are in place with their seals intact.

256. Place the DIRECTOR SIGNAL switch in the ON position and ascertain by telephone that the pilot lights in the predictor.

257. Check the telephone communication between the cabin and the roof. Check the working of the A.C. light switches.

258. Check all A.C. outlets by inserting the plug of the inspection lamp.

WEEKLY

Trailer (Inside)

259. Check the efficiency of the power intake ventilator and the exhaust ventilators.

260. Examine the operators' seats for weakness and breakages.

261. Check the essential spares, tools and test cables.

262. Inspect the drain hoses for leaks, good fit and stoppages.

263. Examine the storage racks of the spare antenna and the R.F. lines.

Trailer (Outside)

264. Examine the condition of the earthing pin. If necessary clean off dirt and corrosion from the lugs and contact screws and coat thinly with vaseline. Moisten the ground around the pin if it is dry.

265. Check the condition of the roof hand grilles and the roof ladders.

266. Check the condition of the tyres including the spare. Check the tyre pressures and inflate if necessary to 65 pounds.

267. Check the condition of the jacks.

268. Check the condition of the external ventilator grilles.

269. Check the condition of the data panel. Remove the plugs and report any signs of looseness and corrosion to the Tels. Mechanic.

270. Check the condition of the petrol heater fuel tank, fuel line and chimney.

271. Check the condition of the pedestal hatch seal.

272. Check the condition of the stabilisers and turnbuckles. Clean off any rust and coat with Grease G.P.

273. With one Operator on the roof able to see the levels, rotate the paraboloid and check that the total movement of the bubbles is less than 1 division. If it is not, level the trailer as detailed in para. 15.

MONTHLY

Trailer (Outside)

274. Check the condition of the hoisting rings.

275. Check the condition of the coupler release and handle, the towing vehicle connection and the brake couplings.

276. Check the condition of the external paint work. Clean the rust and corrosion from any bare spots and touch up with an under coat of priming paint and a top coat of khaki paint.

277. Clean out and check the contents of the storage compartment.

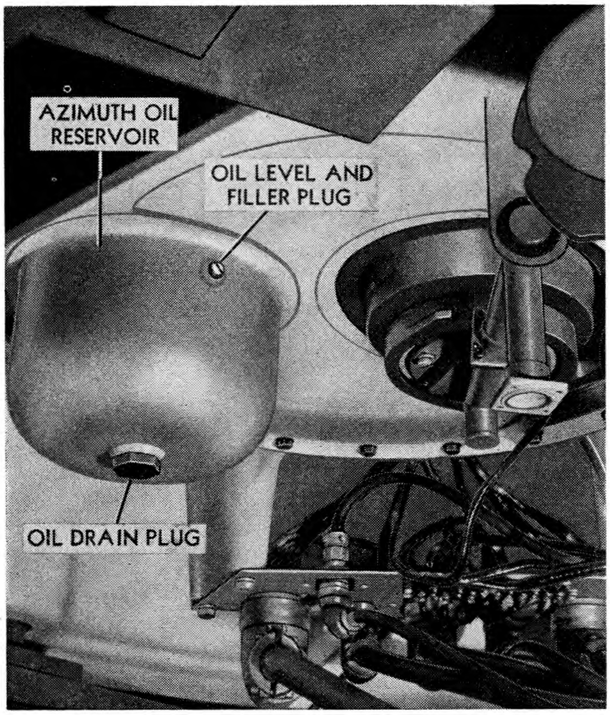
278. Check the running gear chassis bolts, spring shackles, wheel stud nuts, slack adjusters, parking brake linkage, cross shaft bushings, pintle hook, coupling plate and road reflector.

279. Check the elevation gear housing for oil leakage and loose studs.

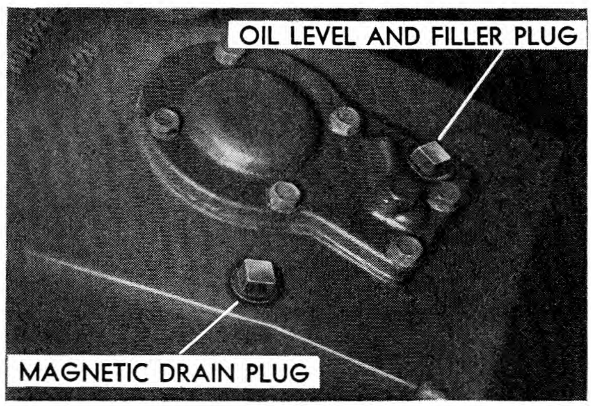
280. Inspect the exterior of the pedestal, clean it if necessary and tighten any loose studs or bolts.

LUBRICATION

281. Tables 81, 82 and 83 detail the lubrication of the complete equipment, giving approximate British equivalents of the specified U.S. lubricants. The days on which lubrication should be carried out on those points requiring attention monthly and quarterly are detailed in the Tels. Mechanics Routine Maintenance Schedule, Table 84. It is essential that semi-annual and annual lubrication as detailed in Tables 81—83 is carried out regularly. The completion of the lubrication should be recorded in the AB.20.A.



T $\frac{\text{OY-103}}{\text{1-30}}$ **Fig. 30—Azimuth oil reservoir showing oil level and filler plug.**



T $\frac{\text{OY-103}}{\text{1-31}}$ **Fig. 31—Elevation gear housing showing oil level and filler plug.**

TABLE 81—GENERAL LUBRICATION

Item	Fig. Ref.	Location	Instructions	Lubricant to be used	
				Predominating Temperature above 32°F.	Predominating Temperature below 32°F.
1	Fig. 30	Azimuth oil reservoir.	Check monthly. Remove filler plug and add oil to level of filler hole.	O.E. 10 H.D.	O.E. 10 H.D. with 10% kerosene vaporising oil by volume added for every 10 degrees below zero degrees F.
2	Fig. 31	Elevation oil reservoir. Paraboloid at zero degrees elevation.	Check monthly. Remove filler plug and add oil to level of filler hole.	O.E. 10 H.D.	O.E. 10 H.D. with 10% kerosene vaporising oil by volume added for every 10 degrees below zero degrees F.
3		High voltage rectifier blower motor BL 30L1.	¼ turn of grease cups quarterly or ½ thimbleful in oil cups quarterly.	Greese lubricating, low temperature, DTD 577.	Grease lubricating, low temperature, DTD 577.
4		High voltage rectifier filament rheostat, R305.			
		Contact surfaces.	Monthly.	White Vaseline, CS 863.	White Vaseline, CS 863.
		Shaft.	Monthly.	Oil anti-freezing DTD 44D.	Oil anti-freezing DTD 44D.
5		High voltage rectifier.			
		Cabinet hinges and latches.	Monthly.	Oil anti-freezing DTD 44D.	Oil anti-freezing DTD 44D.
6		Modulator.			
		Cabinet blower motors, BL 201 and BL 203.	¼ turn of grease cups quarterly or ½ thimbleful in oil cups quarterly.	Grease lubricating, low temperature, DTD 577.	Grease lubricating, low temperature, DTD 577.
7		Keyer filament blower motor BL202.	4 drops in each oil tube weekly.	O.E. 10 H.D.	O.E. 10 H.D.
8		Magnetron filament rheostat R219.			
		Contact surfaces.	Monthly.	White Vaseline CS 863.	White Vaseline CS 863.
		Shaft.	Monthly.	Oil, anti-freezing DTD 44D.	Oil, anti-freezing DTD 44D.

TABLE 81—GENERAL LUBRICATION—(Cont'd)

Item	Fig. Ref.	Location	Instructions	Lubricant to be used	
				Predominating Temperature above 32°F.	Predominating Temperature below 32°F.
9		Modulator. Cabinet hinges and latches.	Monthly.	Oil, anti-freezing, DTD 44D.	Oil, anti-freezing, DTD 44D.
10		Control rack blower motor B1978.	¼ turn of grease cups quarterly or 1 thimbleful in oil cups quarterly.	Grease lubricating, low temperature, DTD 577.	Grease lubricating, low temperature, DTD 577.
11		Range Indicator Unit Gearing.	Clean with brush dipped in carbon tetrachloride.		
		Gears.	Brush on liberally Semi-annually.	Oil, anti-freezing, DTD 44D.	Oil, anti-freezing, DTD 44D.
		Ball bearings:			
		A Sets.	Semi-annually.	Oil, anti-freezing, DTD 44D.	Oil, anti-freezing, DTD 44D.
		B Sets.	Semi-annually.	Grease lubricating, low temperature, DTD 577.	Grease lubricating, low temperature, DTD 577.
12		Antenna Position Control Unit Gearing.	Clean with brush dipped in carbon tetrachloride.		
			Brush on liberally Semi-annually.	Oil, anti-freezing, DTD 44D.	Oil, anti-freezing, DTD 44D.
		Ball Bearings:			
		A Sets.	Semi-annually.	Oil, anti-freezing, DTD 44D.	Oil, anti-freezing, DTD 44D.
		B Sets.	Semi-annually.	Grease lubricating, low temperature, DTD 577.	Grease lubricating, low temperature, DTD 577.
13		Antenna Position Indicator Unit Gearing.	Clean with brush dipped in carbon tetrachloride.		
		Gears.	Brush on liberally Semi-annually.	Oil, anti-freezing, DTD 44D.	Oil, anti-freezing, DTD 44D.
		Ball bearings:			
		A Sets.	Semi-annually.	Oil, anti-freezing, DTD 44D.	Oil, Anti-freezing, DTD 44D.
		B Sets.	Semi-annually.	Grease lubricating, low temperature, DTD 577.	Grease lubricating, low temperature, DTD 577.

TABLE 81—GENERAL LUBRICATION—(Cont'd)

Item	Fig. Ref.	Location	Instructions	Lubricant to be used	
				Predominating Temperature above 32°F.	Predominating Temperature below 32°F.
14		Trailer intake ventilator motor.	4 drops in each oil cup monthly.	O.E. 10 H.D.	O.E. 10 H.D.
15		Trailer door hinges, locks, handles.	Monthly.	Oil, anti-freezing, DTD 44D.	Oil, anti-freezing, DTD 44D.
16		Motor.			
		Generators:			
		A Sets.	1 thimbleful of oil in each of the four oil holes whilst the generator is running quarterly, or every 1000 hours of operation.	Oil, anti-freezing, DTD 44D.	Oil, anti-freezing, DTD 44D.
		B Sets.	Annually by Second Line Maintenance.		

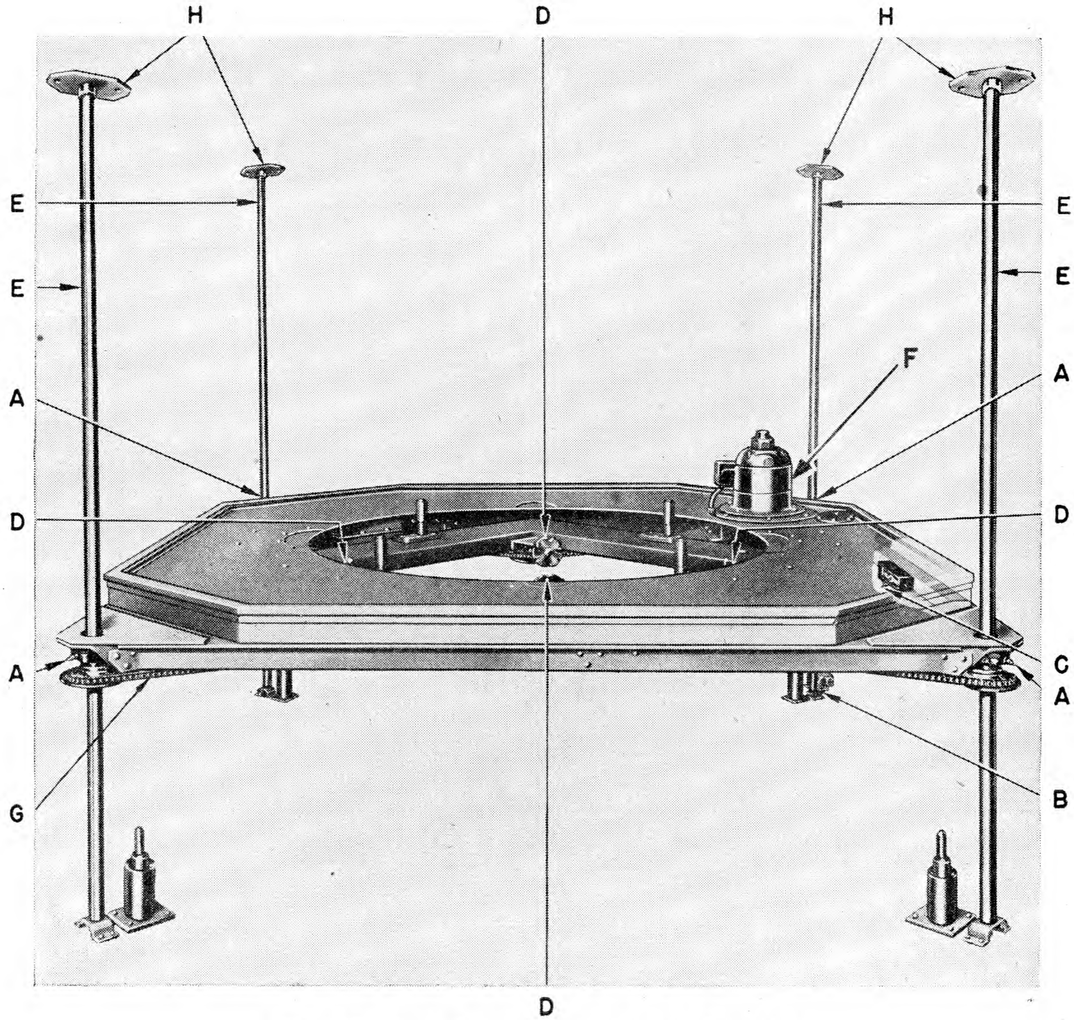


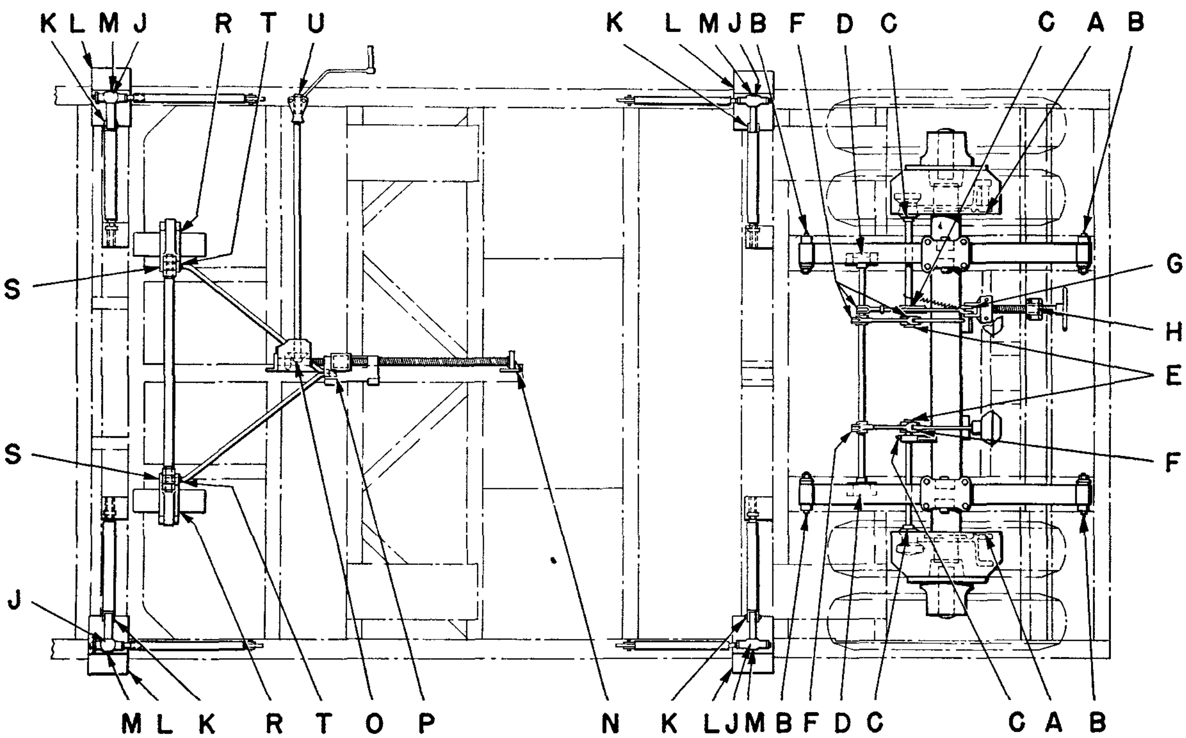
Fig. 32—Lubrication points on elevator.

TABLE 82—LUBRICATION OF ELEVATOR

Item	Fig. Ref.	Location	Instructions	Lubricant to be used	
				Predominating Temperature above 32°F.	Predominating Temperature below 32°F.
1	A. Fig. 32	1 fitting on each drive sprocket bearing.	Monthly.	Grease G.P. No. 1.	Grease G.P. No. 0.
2	B. Fig. 32	1 oiling point on the lever bearing of the lower travel limit switch.	Monthly.	O.E. 30 H.D.	O.E. 10 H.D.
3	C. Fig. 32	1 oiling point on the lever bearing of the upper travel limit switch.	Monthly.	O.E. 30 H.D.	O.E. 10 H.D.

TABLE 82—LUBRICATION OF ELEVATOR—(Cont'd)

Item	Fig. Ref.	Location	Instructions	Lubricant to be used	
				Predominating Temperature above 32°F.	Predominating Temperature below 32°F.
4	D. Fig. 32	1 oiling point on the screw of each idler sprocket.	Monthly.	O.E. 30 H.D.	O.E. 10 H.D.
5	E. Fig. 32	The threads of each elevating screw.	Monthly. Apply with brush.	Oil, M80.	Oil, M80.
6	F. Fig. 32	Plug in the reduction gear bottom cover.	Annually, with 44 ozs. Flush with kerosene & refill.	Grease, lubricating, low temperature, DTD 577.	Grease, lubricating, low temperature, DTD 577.
7	G. Fig. 32	Drive Chain.	Monthly. Apply with brush.	Oil, M80.	Oil, M80.
8	H. Fig. 32	Underside of elevating screw anchor plate.	Monthly. Apply with brush.	Grease G.P. No. 1.	Grease G.P. No. 0.



T OY-103/1-33

Fig. 33—Lubrication points on trailer chassis.

TABLE 83—LUBRICATION OF TRAILER CHASSIS

Item	Fig. Ref.	Location	Instructions	Lubricant to be used	
				Predominating Temperature above 32°F.	**Predominating Temperature below 32°F.**
1	A. Fig. 33 (See also Fig. 34 A & B).	1 lubricant nipple on each wheel brake shoe anchor pin.	Monthly.	Grease, G.P. No. 1.	Grease, G.P. No. 0.
2	B. Fig. 33 (See also Fig. 35 A-D)	1 lubricant nipple on each spring shackle bolt.	Monthly.	Grease, G.P. No. 1.	Grease, G.P. No. 0.

TABLE 83—LUBRICATION OF TRAILER CHASSIS—(Cont'd)

Item	Fig. Ref.	Location	Instructions	Lubricant to be used	
				Predominating Temperature above 32°F.	Predominating Temperature below 32°F.
3	C. Fig. 33 (See also Fig. 36 A & B)	1 lubricant nipple on each brake cam-shaft bearing.	Monthly.	Grease, G.P. No. 1.	Grease, G.P. No. 0.
4	D. Fig. 33 (See also Fig. 37 A & B).	1 lubricant nipple on each parking brake cross shaft bearing.	Monthly.	Grease, G.P. No. 1.	Grease, G.P. No. 0.
5	E. Fig. 33 (See also Fig. 38)	1 lubricant plug on each brake slack adjuster.	Semi-annually.	Grease, G.P. No. 1.	Grease, G.P. No. 0.
6	F. Fig. 33 (See also Fig. 39)	7 oiling points on the linkage.	Monthly.	O.E. 30 H.D.	O.E. 10 H.D.
7	G. Fig. 33 (See also Fig. 40)	1 lubricant nipple on the parking brake bell crank.	Monthly.	Grease, G.P. No. 1.	Grease, G.P. No. 0.
8	H. Fig. 33 (See also Fig. 41)	1 lubricant nipple on the parking brake hand-wheel screw bracket.	Monthly.	Grease, G.P. No. 1.	Grease, G.P. No. 0.
9	J. Fig. 33 (See also Fig. 42)	1 lubricant nipple on each levelling jack gear housing.	Monthly.	Grease, G.P. No. 2.	Grease, G.P. No. 2.
10	K. Fig. 33 (See also Fig. 42)	1 oiling point in each levelling jack brace hinge pin.	Monthly	O.E. 30 H.D.	O.E. 10 H.D.

TABLE 83—LUBRICATION OF TRAILER CHASSIS—(Cont'd)

Item	Fig. Ref.	Location	Instructions	Lubricant to be used: Predominating Temperature above 32°F.	Lubricant to be used: Predominating Temperature below 32°F.
11	L. Fig. 33 (See also Fig. 42)	1 oiling point on each levelling jack foot hinge pin.	Monthly.	O.E. 30 H.D.	O.E. 10 H.D.
12	M. Fig. 33 (See also Fig. 42)	1 lubricant nipple on each levelling jack outer tube.	Monthly.	Grease, G.P. No. 1.	Grease, G.P. No. 0.
13	N. Fig. 33 (See also Fig. 43)	1 lubricant nipple on each support riser screw rear bearing.	Semi-annually.	Grease, G.P. No. 1.	Grease, G.P. No. 0.
14	O. Fig. 33 (See also Fig. 44)	1 lubricant on each support riser gear housing.	Monthly	Grease, G.P. No. 1.	Grease, G.P. No. 0.
15	P. Fig. 33 (See also Fig. 45)	1 oiling point on each support connecting rod upper pin.	Monthly.	O.E. 30 H.D.	O.E. 10 H.D.
16	R. Fig. 33 (See also Fig. 46)	1 lubricant nipple on each support wheel.	Semi-annually.	Grease, G.P. No. 1.	Grease, G.P. No. 0.
17	S. Fig. 33 (See also Fig. 47)	1 oiling point on each support strut adjusting bar hinge pin.	Monthly.	O.E. 30 H.D.	O.E. 10 H.D.
18	T. Fig. 33 (See also Fig. 48)	1 oiling point on each support connecting rod lower pin.	Monthly.	O.E. 30 H.D.	O.E. 10 H.D.
19	U. Fig. 33 (See also Fig. 49)	1 lubricant nipple on the support operating shaft bracket.	Monthly.	Grease, G.P. No. 1.	Grease, G.P. No. 0.

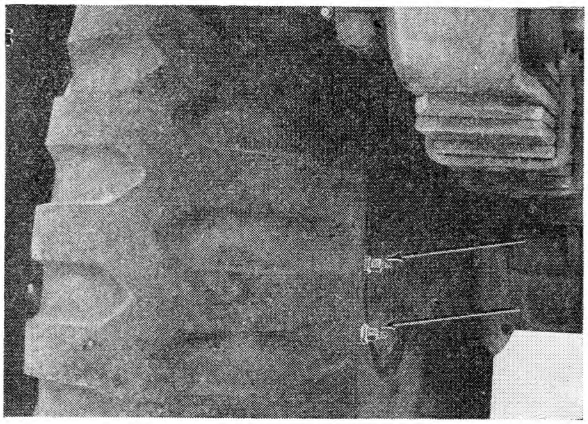


Fig. 34A

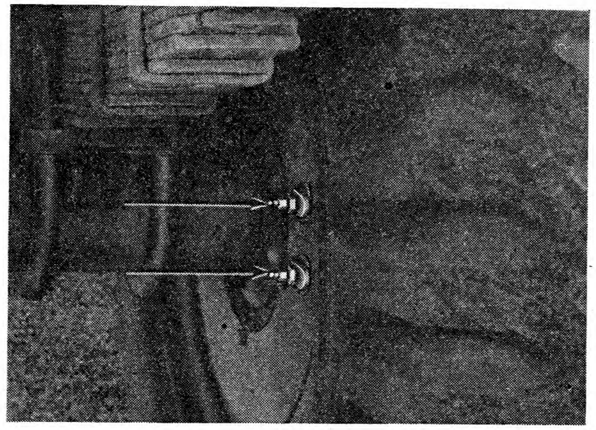


Fig. 34B

$T\frac{OY-103}{1-34}$ Fig. 34A and B—Lubrication points on wheelbrake shoe anchor pins.

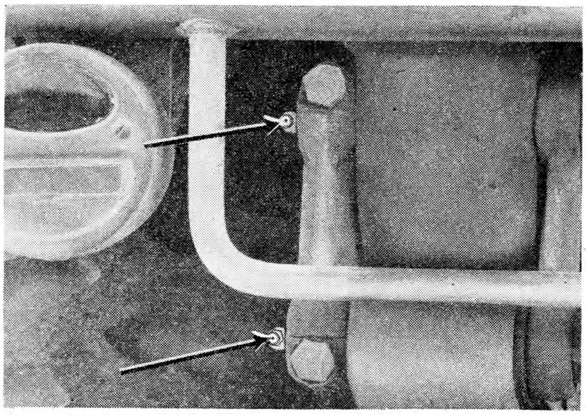


Fig. 35A

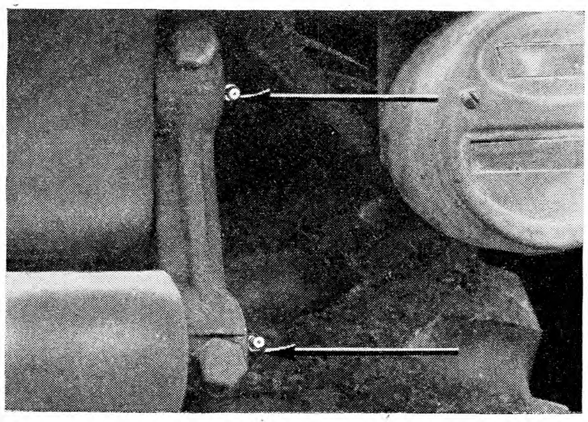


Fig. 35B

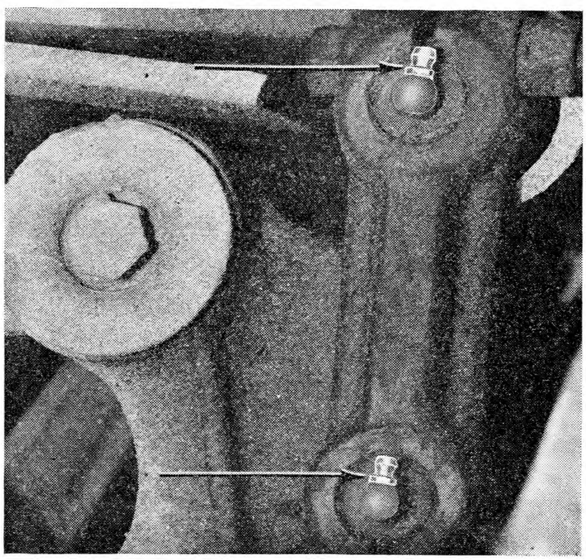


Fig. 35C

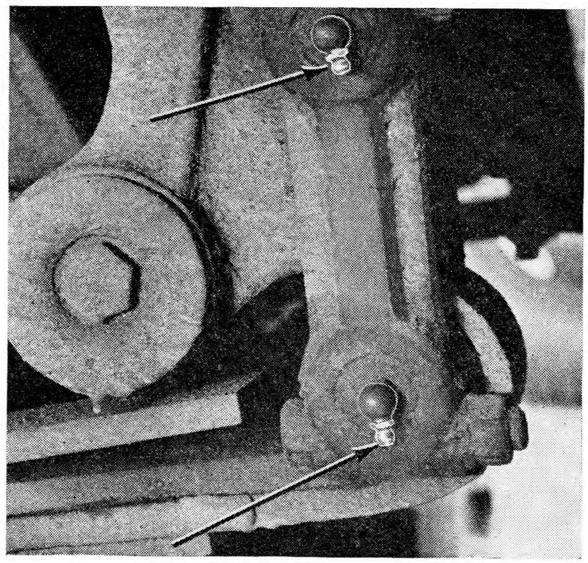


Fig. 35D

$T\frac{OY-103}{1-35}$ Fig. 35 A, B, C and D—Lubrication points on front and rear spring shackle bolts.

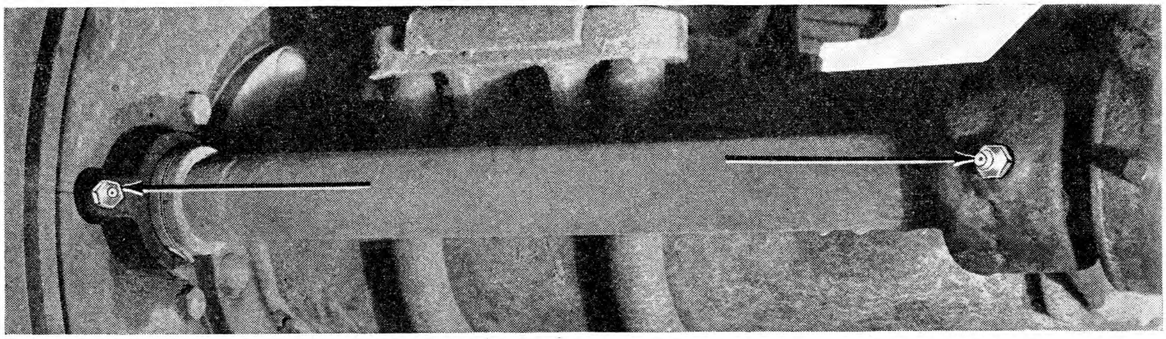


Fig. 36A

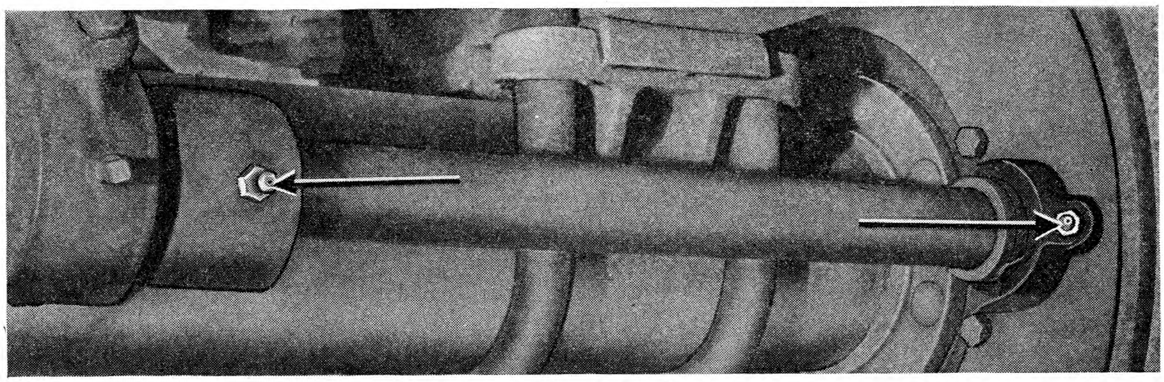


Fig. 36B

$T\frac{OY\text{-}103}{1\text{-}36}$

Fig. 36A and B—Lubrication points on brake cam shaft bearings.

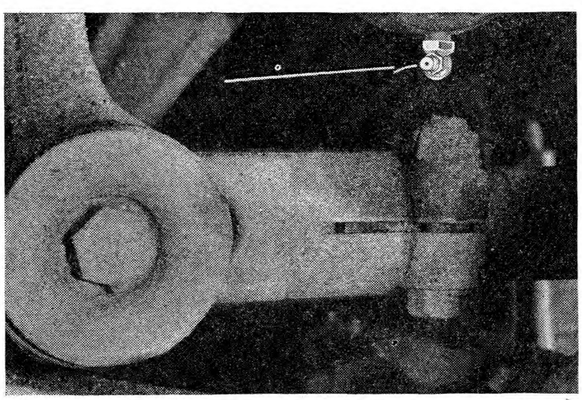


Fig. 110A

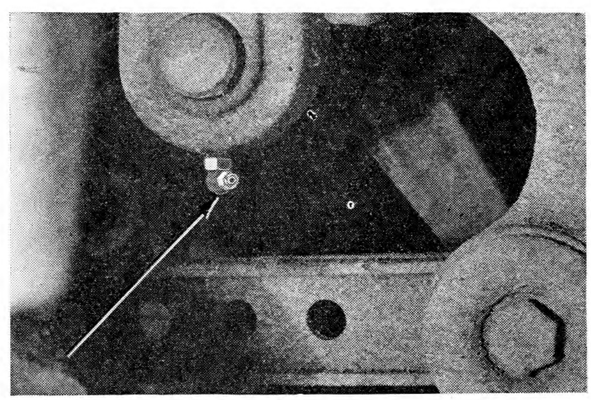
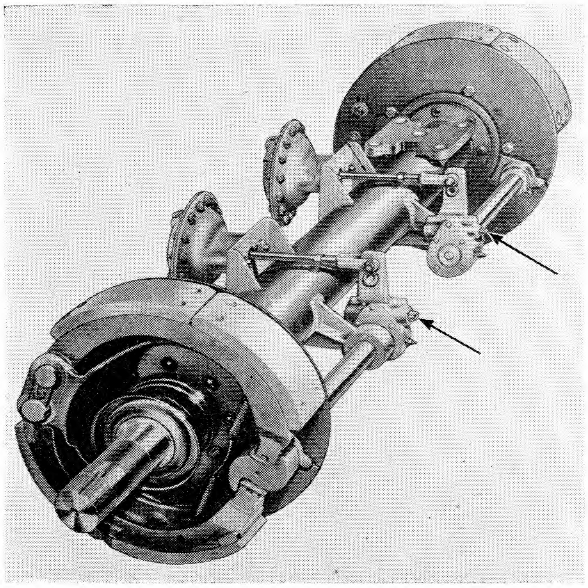


Fig. 110B

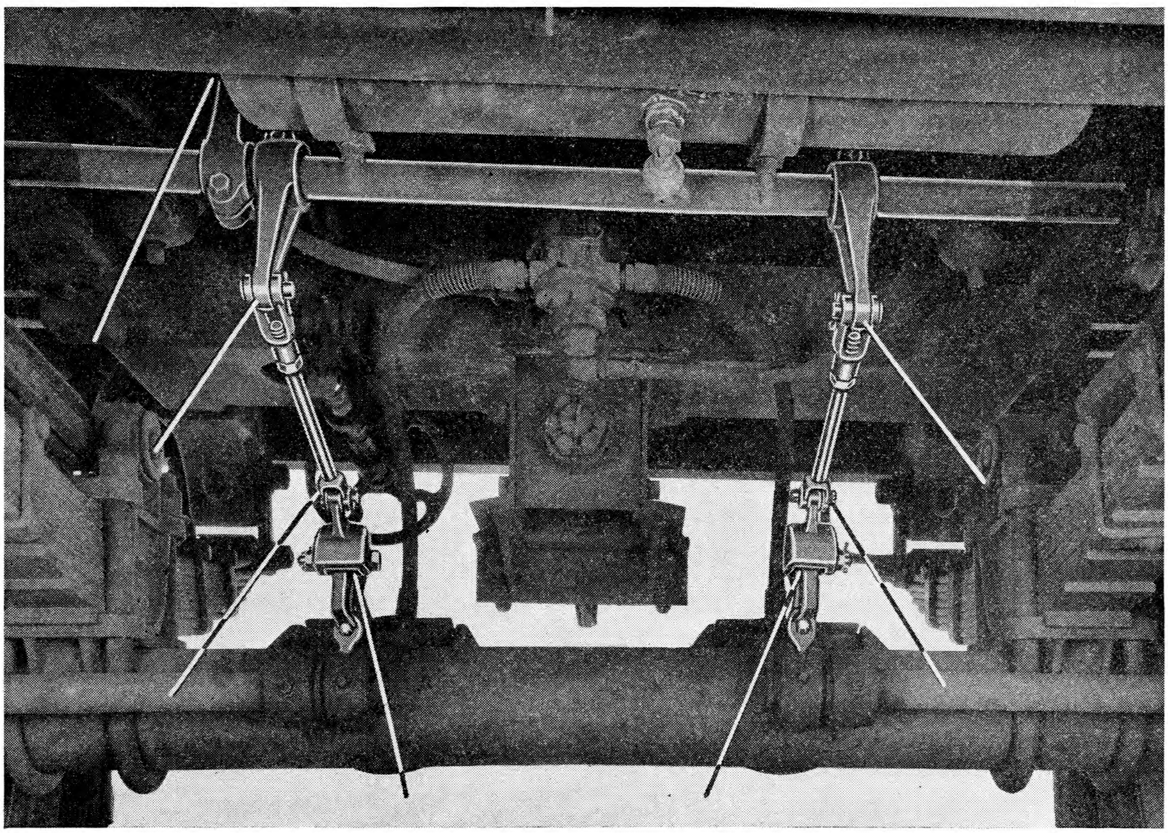
$T\frac{OY\text{-}103}{1\text{-}37}$

Fig. 37A and B—Lubrication points on parking brake cross shaft bearings.



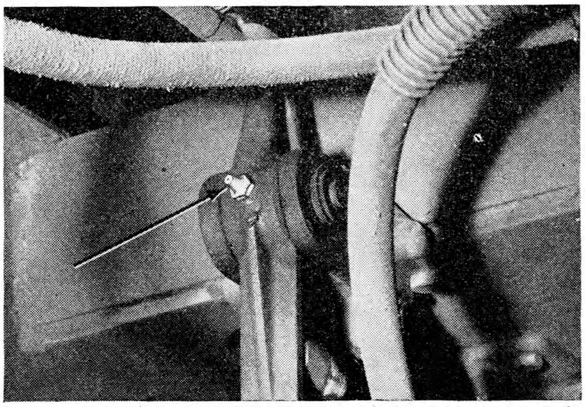
T $\frac{\text{OY-103}}{\text{1-38}}$

Fig. 38—Lubrication points on brake slack adjusters.

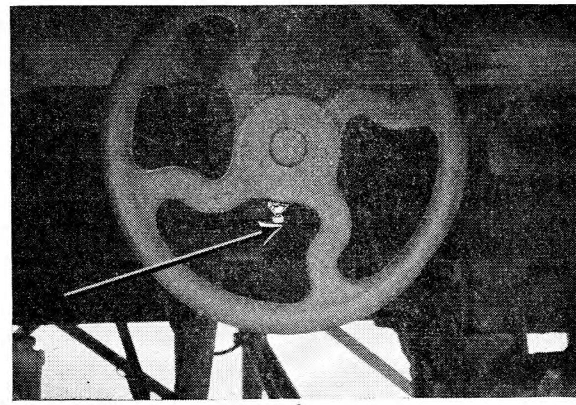


T $\frac{\text{OY-103}}{\text{1-39}}$

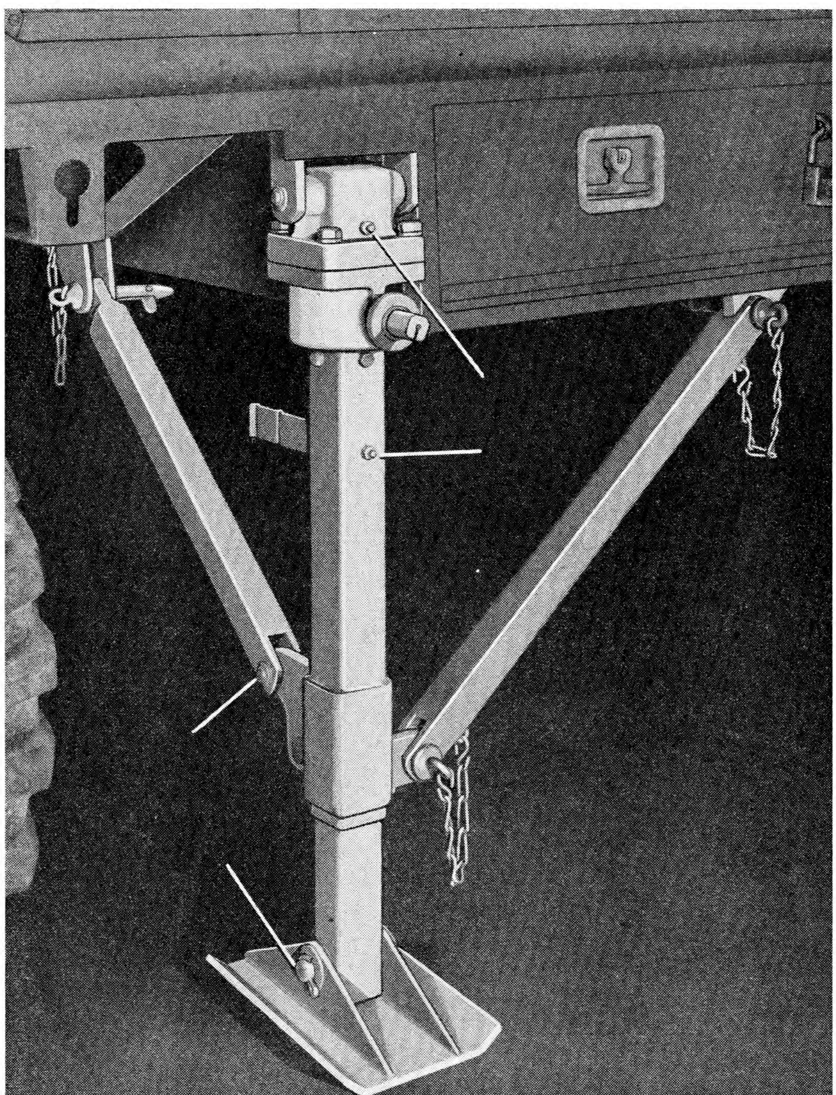
Fig. 39—Lubrication points on parking brake linkage.



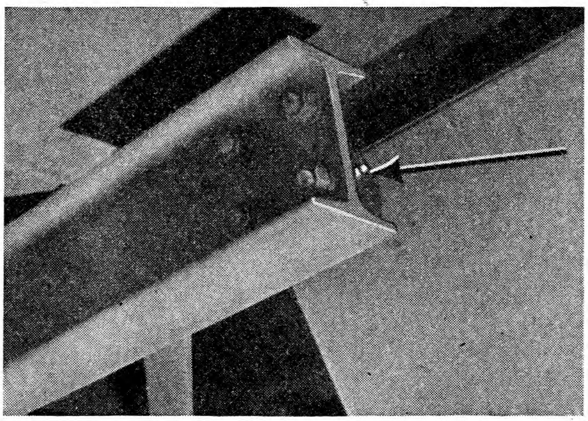
T OY-103/1-40 **Fig. 40—Lubrication point on parking brake bell crank.**



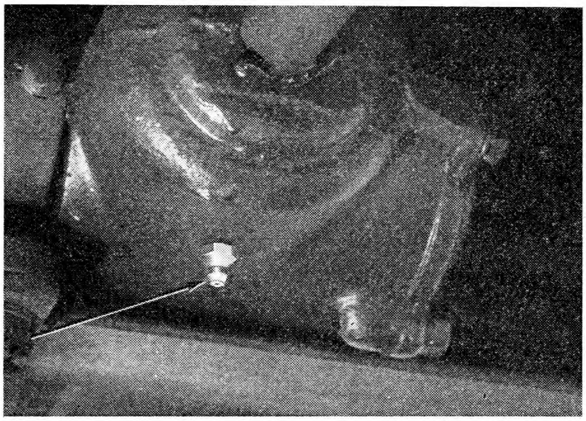
T OY-103/1-41 **Fig. 41—Lubrication point on parking brake handwheel screw bracket.**



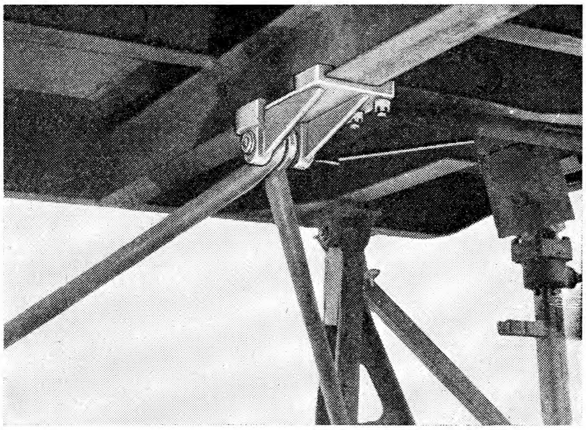
T OY-103/1-42 **Fig. 42—Lubrication points on leveling jacks.**



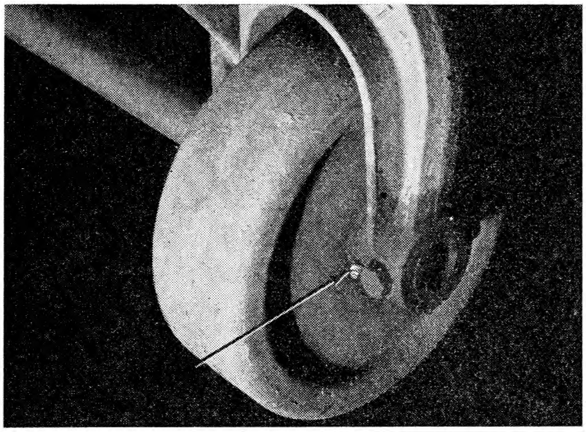
T $\frac{\text{OY-103}}{\text{1-43}}$ **Fig. 43—Lubrication point on support riser screw rear bearing.**



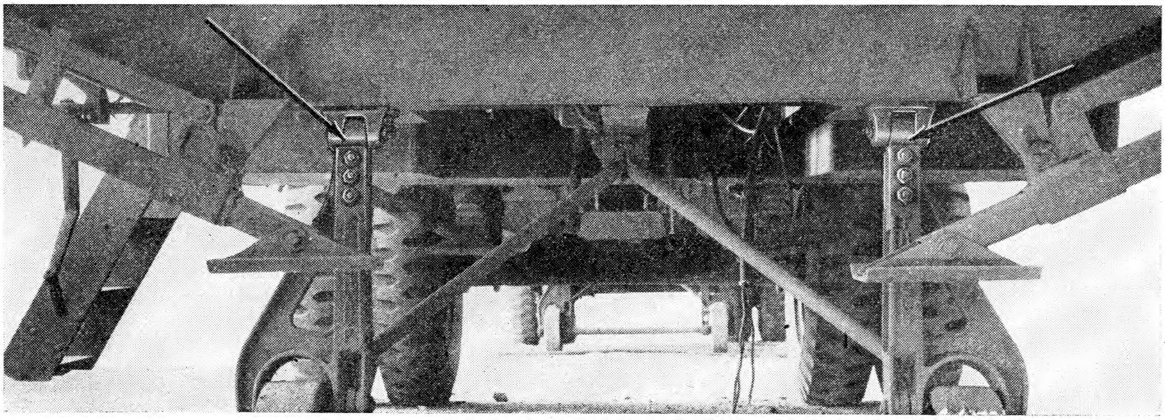
T $\frac{\text{OY-103}}{\text{1-44}}$ **Fig. 44—Lubrication point on support riser gear housing.**



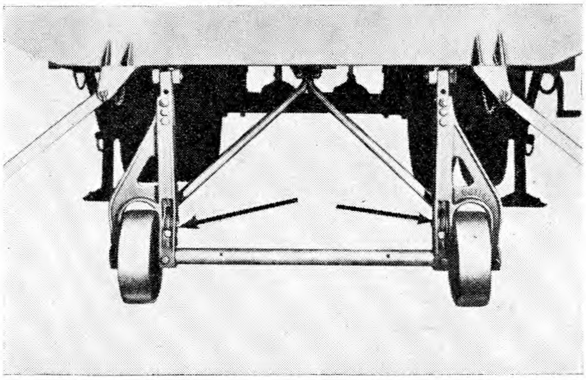
T $\frac{\text{OY-103}}{\text{1-45}}$ **Fig. 45—Lubrication point on support connecting rod upper pin.**



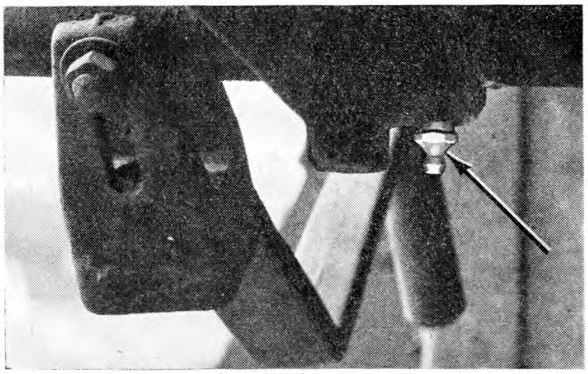
T $\frac{\text{OY-103}}{\text{1-46}}$ **Fig. 46—Lubrication points on support wheels.**



T $\frac{\text{OY-103}}{\text{1-47}}$ **Fig. 47—Lubrication points on support strut adjusting bar hinge pins.**



T $\frac{\text{OY-103}}{\text{1-48}}$ **Fig. 48—Lubrication points on support connecting rod lower pins.**



T $\frac{\text{OY-130}}{\text{1-49}}$ **Fig. 49—Lubrication point on support operating shaft bracket.**

ROUTINE MAINTENANCE SCHEDULE

282. Tables 84 and 85 detail the frequency with which the various routine maintenance procedures indicated in paras. 189—280 are to be carried out. The quarterly tasks should be performed on the day indicated only every third month. Completion of the day's tasks will be entered in the Record of Maintenance of the equipment.

283. The letters in the body of table 84, together with the footnotes, give reference to the items in lubrication, tables 81–83, which can most conveniently be performed whilst the unit concerned is accessible for routine maintenance. Details of semi-annual and annual lubrication are not included in the Tels. Mechanics Routine Maintenance Schedule, and arrangements must be made to keep a note of when it is performed in the History Book AB.20.A.

ELECTRICAL AND MECHANICAL ENGINEERING REGULATIONS

TELECOMMUNICATIONS OY 104

EQUIPMENT RADAR A.A. NO. 3, MK. 5

(SCR-584 A and B)

ADJUSTMENT AND REPAIR IN SECOND TO FOURTH ECHELON

Issue 1, January 1946 DISTRIBUTION-CLASS 830. CODE NO. 6

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ELEVATION SELSYN DRIVE GEARS

To remove the elevation selsyn drive gears

58. Refer to figs. 1012 and 1013.

(a) Remove the elevation potentiometer as detailed in para. 56, but instead of removing the screws securing the potentiometer to the cover remove the 10 screws securing the cover to the gear housing and remove the potentiometer and cover.

(b) Remove the three screws 123456, which secure the drive gear, 338, and the main drive gear, 223, to the drive shaft, 354. Pull the gears off the shaft.

To replace the elevation selsyn drive gears

59. Replace in the reverse order of removal. Replace the potentiometer as detailed in para. 57.

To remove the elevation drive shaft

60. Refer to figs. 1013 and 1014.

(a) Remove the selsyn drive gears as detailed in para. 58.

(b) Remove the nut from the end of the shaft within the elevation yoke. Remove the lockwasher, plain washer and the elevation limit switch cam.

(c) Hook on to the paraboloid support with a crane or lifting tackle and take the load off the drive shaft.

(d) Unscrew the elevation adjusting nut, 329, from the threads on the drive shaft. Relieve the lock-screw pressure on the adjusting arm by slackening the locknuts, 120238, and backing off the screw, 579.

(e) Drift the drive shaft and bearing, 240, from the reflector support and through the yoke and gear housing.

To replace the elevation selsyn drive shaft

61. (a) If the dust seal, 281, requires replacement, drive the old seal out of the hole in the yoke and tap the new seal into position using a round wooden block 4-11/16 ins. in diameter against the metal retainer of the seal. Freezing equipment should be used if available.

(b) Replace the selsyn drive shaft in the reverse order of removal.

SPINNER MOTOR AND GENERATOR ASSEMBLY

To remove the spinner motor and generator

62. (a) Rotate the paraboloid in azimuth till it faces the rear of the trailer and tilt it to an angle of about 20 degrees. Set the safety switch in the azimuth selsyn compartment to SAFE.

(b) Remove the plug from J2007 on the underside of the azimuth base. Remove the cover from the spinner motor terminal box and disconnect the 6 wires from the motor and generator terminals. Slacken the nut on the clamp holding the cable on the outside of the terminal box and withdraw the cable from the box.

(c) Remove the antenna assembly.

(d) Uncouple the R.F. line at the connection outside the elevation gear case cover and remove the screws securing the flange of the R.F. line to the spinner motor housing cover. Rotate the line about the motor axis sufficiently to release the bullet of the joint at the gear case cover. Withdraw the line from the spinner motor.

(e) Unscrew the 7 bolts securing the motor and generator assembly to the paraboloid support and remove the assembly. The assembly weighs approximately 53 pounds.

To dismantle the spinner motor and generator assembly

63. Refer to figs. 1015 and 1016.

(a) Set the assembly in a vice and remove the shield from the front of the housing.

(b) Remove the snap ring, 501, from the rear of the assembly. The shield spring will throw the ring and retainer out of the seal assembly when the snap ring is removed. Catch these parts.

(c) Using the key SL18, unscrew and remove the seal assembly, 497. Remove the cover, 437, from the rear end of the housing by removing the 6 bolts. The adjusting pinion, 436, is attached to the cover.

(d) Carefully remove the carbon sealing ring and, if it is in good condition, keep it in a safe place.

(e) Hold the motor drive flange and R.F. line at the front of the assembly with the wrench SL19 which fits over the bolt heads to prevent the armature shaft from turning, and remove the nut, 1061764, with the key, SL15. The sleeve, 463, pilots on the nut and will probably stick to it and be removed with it since the rubber gasket, 1061748, between the parts may become sticky due to the heat of the motor. The rubber gasket, 1061763, which lies between the nut and the end of the armature shaft may also be removed with the nut. Remove both rubber gaskets. If the centring ring, 1061612, does not come off with the rubber gasket, slide it back off the R.F. line.

(f) Hold the armature shaft from turning by means of wrench SL19 and remove the nut, 480, at the rear of the assembly with the key, SL15.

(g) Unscrew the four bolts securing the R. F. line flange to the drive flange and withdraw the R.F. line from the hollow armature shaft through the front of the housing.

(h) Replace the bolts in the drive flange and hold it from turning with the wrench SL19. Unlock the nut, 480, at the front of the assembly and remove it using the key SL14. Remove the lock-washer. Remove the drive flange, the key and the shims.

(i) Remove the 4 screws securing the generator field coil to the retainer plate. Remove the stop screw, 417, from the housing.

(j) Remove the housing from the vice and set it on end with the front end upwards. Knock the housing on the bench to free the armature shaft and the front ball bearing, 235. Lift the housing off the armature assembly.

(k) Disconnect the generator and motor leads from the terminal box and withdraw the generator shield through the rear of the housing.

(l) Remove the screw, 122119, and lockwasher which lock the motor field in the housing and withdraw the coil and sleeve assembly from the rear of the housing.

(m) Remove the dust seal, 459, from the front bearing bore of the housing by carefully drifting it from the rear using a wooden block.

To reassemble the spinner motor and generator

64. (a) Reassemble in the reverse order of dismantling.

(b) The motor field coil must be installed with the tapped screw hole indexed with the hole in the housing. The leads will then fit into the groove provided for them in the top of the housing.

(c) Install the generator field with the leads near the top. When installing the armature with the retainer 466 assembled to it, insert it with the quadrant between the two stop pins downwards so that the stop screw, 417, will permit only 90 degrees rotation of the generator field instead of 270 degrees.

(d) Install the armature shaft with bearings assembled in the housing before replacing the front bearing dust seal 459. Then press the seal against the outer race of the front ball bearing.

(e) After replacing the drive flange and the R.F. line measure the distance between the rear end of the outer section of the R.F. line and the face on the cover, 437, against which the rear R.F. flange is secured. This distance should be 1.056 ins. ± 0.010 ins. The distance may be adjusted by means of shims (Stock No. 2A2704-61B/S26 or 2A2704-61B/S27) placed between the front bearing, 235, and the drive flange.

(f) Replace all rubber gaskets with new ones whenever possible.

(g) When reassembling the sleeve, 463, and nut, 1061764, on the armature shaft, coat the gaskets thinly with grease. Insert the gasket, 1061763, into the nut, 1061764, and the gasket, 1061748 into the sleeve, 463. Push the sleeve over the nut from the threaded end. Push the centring ring over the line and up against the end of the armature shaft. Screw the nut and sleeve assembly on to the shaft and coupling.

(h) When installing the carbon ring in the bellows seal, *make sure that all the sealing surfaces are clean.*

(i) When installing the bellows seal make sure that the dampers which prevent the folds from vibrating are in place and have not slipped off one fold of the bellows.

(j) To prevent the gasket between the bellows seal and the cover 437, from creasing, apply a thin coat of grease to the shoulder on the cover but not to the lip on the seal retainer. Place the gasket against the lip of the retainer, ensure that it is smoothly in place and screw in the retainer. The gasket will then stick to the retainer, slide on the shoulder and will not crease.

(k) When installing the spring, 1061723, the retainer, 500, and the snap ring, 501, inside the bellows, place the spring in the bellows with the retainer over the exposed joints. Ensure that the end of the spring is seated in the nose of the shield and is not twisted or resting against a fold in the bellows.

(l) On completion of the assembly connect the motor to a 115 V three phase 60 c/s supply and insert the antenna assembly in the R.F. line. Switch on the motor and check the eccentricity of dipole shaft rotation. The maximum allowable eccentricity is $\frac{1}{32}$ ins. measured just behind the dipole plastic housing. If the eccentricity is outside this tolerance remove the front shield, 462, slacken the drive flange bolts and adjust the Allen head setscrew located beside each bolt. Tighten the bolts, replace the shield and recheck the eccentricity of the shaft rotation. Repeat until within tolerance.

To replace the spinner motor

65. Replace in the reverse order of removal. If the assembly has been dismantled, align and check the reference generator as detailed in paras. 68, 69 and 71 of Tels. OY-103.

To replace a carbon cup bearing in the high speed joint

66. (a) Remove the stationary section of the high speed joint as detailed in para. 62 (d).

(b) Using a No. 5 drill, drill out the old bearing, or carefully chip it out of the inner conductor. Remove all carbon dust from the R.F. line.

(c) Place the new carbon bearing in position and using a steady pressure push it into the inner conductor.

(d) Replace the stationary section of the high speed joint.

PARABOLOID AND YOKE

To remove the paraboloid assembly

67. Refer to fig. 1017. Two men are required to support the paraboloid during removal and to remove it when free. These men should be in position, one on each side of the paraboloid for removal of the bolts. The paraboloid assembly weighs 120 pounds.

(a) Elevate the paraboloid to approximately 20 degrees, set the safety switch in the azimuth selsyn compartment to SAFE. Remove the antenna assembly.

(b) Remove the three lower bolts holding the paraboloid to its support. Ensure that the paraboloid is properly supported, and slacken the five upper bolts. When all five bolts are loose, remove them. Ensure that the paraboloid does not tip off the pilot shoulder.

(c) When all bolts are removed, carefully lift the paraboloid off the seating flange and clear of the spinner motor.

To replace the paraboloid assembly

68. Replace the paraboloid in the reverse order of removal. Ensure that the surfaces on the paraboloid support on which the paraboloid is mounted and the paraboloid flange are absolutely clean before replacement.

To remove the paraboloid support

69. (a) Remove the paraboloid as detailed in para. 67.
(b) Remove the spinner motor and generator as detailed in para. 62.
(c) Remove the elevation drive case as detailed in para. 48.
(d) Remove the elevation hub as detailed in para. 52.
(e) Remove the elevation selsyn drive shaft as detailed in para. 60.
(f) Lift the support free of the yoke. The approximate weight of the support is 113 pounds.

To replace the paraboloid support.

70. Replace in the reverse order of removal.

To remove the elevation yoke

71. Refer to fig. 1014.
(a) Remove the plugs from J2003, J2004, J2006, J2007 and J2008 on the underside of the azimuth base.
(b) Remove the paraboloid support as detailed in para. 69.
(c) Remove the bracket supporting the R.F. line at the bottom of the yoke and remove the section of the line within the yoke.
(d) Disconnect from terminal boards TB7, TB8, TB9 and TB10 all leads from the azimuth drive shaft.
(e) Remove the screws fastening the two terminal board brackets to the heads of the yoke mounting screws, 453. Push the brackets away from the azimuth drive shaft.
(f) Attach a crane or lifting tackle to the holes in the ears of the yoke using chain, SL13. Pull the chain tight.
(g) Remove the six yoke mounting screws, 453, and lift the yoke off the drive shaft flange and off the dowel pins until it is clear.

To replace the elevation yoke

72. Replace in the reverse order of removal.

AZIMUTH PEDESTAL

To remove the azimuth drive shaft

73. Refer to figs. 1018 and 1019.
(a) Remove the plugs from J2003, J2004, J2006, J2007 and J2008 on the underside of the azimuth base.
(b) Remove the azimuth drive and selsyn input gears as detailed in para. 29. Remove the washer, 176, and felt seal, 1061745, from the azimuth shaft.
(c) Remove the section of the R.F. line within the yoke. Disconnect from terminal board TB7, TB8, TB9 and TB10 the group of leads from the azimuth drive shaft. Remove the screws fastening the two terminal board brackets to the heads of the yoke mounting bolts 453. Push the brackets away from the azimuth drive shaft.
(d) Attach a crane or lifting tackle to the holes in the ears of the yoke using chain SL13. Pull the chain tight. Remove the 6 yoke mounting screws and lift the upper section of the pedestal assembly off the drive shaft flange and off the dowel pin until it is clear.
(e) Screw the two eyebolts SL11 into opposite holes in the azimuth drive shaft flange and using chain SL13 attach them to the crane or lifting tackle. Pull the chain tight.
(f) Remove the panel over the slipring compartment and remove the slipring cover. Remove the three bolts holding each of the terminal blocks TB1 and TB2 to the pedestal and swing the boards out to bring the brushes clear of the sliprings.
(g) Using the wrench, SL8, remove the bearing retainer nut, 215, from the lower end of the drive shaft. Remove the washer, 1061743, and slide the bearing cone, 199, of the lower roller bearing from the shaft.
(h) Carefully lift the drive shaft vertically out of the pedestal and remove it clear of the azimuth base. Ensure that the shaft is kept vertical during removal in order to avoid damage to the insulators of the sliprings. The approximate weight of the drive shaft is 90 pounds.
(i) If necessary remove the bearing cups from the pedestal using the puller, SL1.

To replace the azimuth drive shaft

74. Before replacement, wash the roller bearings and repack them with Grease No. 1. Replace the drive shaft in the reverse order of removal. Tighten the nut, 215, with wrench, SL8, to pull the roller bearings up tight. No clearance is permissible in these bearings. After replacing the terminal boards TB1 and TB2 check the slipring brush pressure which should be between 18 and 24 ounces.

To remove the sliprings from the drive shaft

75. Refer to fig. 1020.
(a) Suspend the drive shaft at a convenient height by a chain looped through the eyebolts, SL11, screwed into opposite holes in the drive shaft flange.
(b) Raise the plastic support ring, 366, far enough on the shaft to free the 4 pins, 362. Remove the pins and carefully lower the sliprings and insulators in a stack.
(c) To remove a slipring and insulator from the stack, remove the insulators above it in sequence, lifting them clear of the wires running through the stack until the required ring is removed.

To replace the sliprings on the drive shaft

76. (a) Check that the leads are properly soldered to the rings.
(b) Replace the rings on the stack in the correct order moving one space anticlockwise (as viewed from the top) with each successive ring.

TABLE 2—SLIPRING CONNECTIONS

Slipring No.	Wire No.	Hole No.	Slipring No.	Wire No.	Hole No.
1	84	12	25	59	4
2	Spacer		26	79	5
3	85	14	27	58	6
4	Spacer		28	80	7
5	86	16	29	57	8
6	Spacer		30	81	9
7	87	2	31	56	10
8	Spacer		32	82	11
9	88	4	33	55	12
10	Spacer		34	83	13
11	89	6	35	54	14
12	72	7	36	60	15
13	67	8	37	53	16
14	73	9	38	61	1
15	68	10	39	52	2
16	74	11	40	62	3
17	69	12	41	51	4
18	75	13	42	63	5
19	70	14	43	50	6
20	76	15	44	64	7
21	71	16	45	49	8
22	77	1	46	65	9
23	90	2	47	48	10
24	78	3	48	66	11

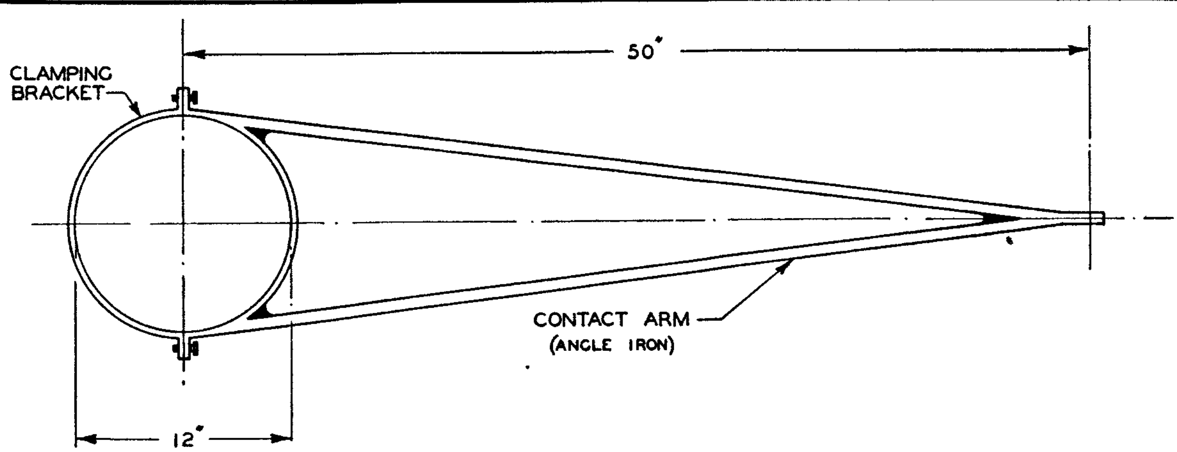

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Fig. 2—Backlash analyser contact arm

(c) Place the spacer, 635, on the stack and lower the drive shaft into the stack. Group the slipring leads and pass them through the holes in the top of the azimuth drive shaft according to the above table.

(d) Raise the stack on the shaft and raise the support ring sufficiently to insert the pins, 362.

To remove the azimuth control housing

77. Refer to fig. 1021.

(a) Remove the elevation yoke and assembled parts as detailed in para. 73 (a) to (d).

(b) Remove the housing panel below the azimuth stowing lock. Remove the bolts, 122162, and lockwashers securing the stowing lock bracket to the housing. Lift the bracket and stowing lock off the stowing switch pin, 633. Remove the stowing switch pin from the hole in the housing.

(c) Remove the six bolts securing the top flange of the housing frame to the azimuth pedestal and the twenty-four bolts securing the bottom flange to the azimuth base.

(d) Lift the housing vertically over the azimuth pedestal.

To replace the azimuth control housing

78. Replace in the reverse order of removal.

To remove the azimuth pedestal

79. (a) Remove the azimuth drive shaft as detailed in para. 73.
(b) Remove the azimuth control housing as detailed in para. 77.
(c) Disconnect the leads from the safety switch and the azimuth stowing switch.
(d) Remove the six bolts securing the pedestal to the azimuth base and remove the pedestal from the base.

To replace the azimuth pedestal

80. Replace in the reverse order of removal.

BACKLASH ANALYSER

General

81. The principle of the backlash analyser is to use a voltage generator in the rotor of the azimuth or elevation control transformer, suitably amplified, to act as an accurate position marker indicating the azimuth or elevation of the paraboloid. After rotation, the pedestal is returned to its original position, as indicated by a centre-zero meter on the analyser and any mechanical displacement is read on a clock gauge. Fig. 1022 gives the circuit diagram of the analyser and fig. 2 gives details of the contact arm to be fitted to the pedestal. Both should be made in workshops when required.

To check azimuth backlash

82. (a) Remove the azimuth stowing lock and switch.
(b) Assemble the clamping bracket of the contact arm around the skirt at the bottom of the elevation yoke. It is essential that the contact arm be absolutely rigid.
(c) Remove the leads connecting to the azimuth control transformer, B2004, and connect it to the analyser as indicated in fig. 1022.
(d) Remove the azimuth drive motor as detailed in para. 11.
(e) Mount a suitable clock gauge rigidly in a position that will enable the contact arm to operate the plunger of the gauge.
(f) Rotate the pedestal until the contact arm is almost touching the plunger of the clock gauge. Turn the sun gear until the contact arm just produces a positive reading on the clock gauge. Note this reading.
(g) Turn the rotor of the selsyn generator on the analyser for the sharpest null as indicated on the centre zero meter. Adjust the control RV2 to increase the sensitivity if necessary.
(h) Adjust the ZERO SET control, RV1, accurately to centre the meter pointer.
(i) Rotate the pedestal 50 to 70 degrees away from the clock gauge and back again. Rotate the sun gear until the meter on the analyser is exactly centered.
(j) Note the new reading on the clock gauge. The difference between this reading and the reading noted in (f) gives the mechanical displacement of the pedestal. With a 50 in. arm, 0.05 ins. equals a backlash of 1 mil.
(k) Slacken the contact arm clamping bracket and rotate the pedestal through 60 degrees. Tighten the bracket and repeat (f) to (j). Repeat until six readings have been taken.
(l) Turn the clock gauge so that its plunger may be operated from the other direction. Rotate the pedestal in this other direction and repeat (f) to (k).

83. The elevation system may be similarly checked by attaching the contact arm to the elevation drive case and connecting the analyser to the elevation control transformer, B2054.

84. Manufacturing backlash tolerances are as follows:

B2002	1 mil	B2052	1.2 mils
B2003	1 mil	B2053	3 mils
B2004	1 mil	B2054	1 mil
B2005	3 mils	B2055	3 mils

Potentiometers—1 mil.

READINGS AT PEDESTAL TERMINAL BOARDS

Voltage readings

85. (a) See paras. 2 to 7, and Table 3.
(b) Voltages measured to earth, unless otherwise stated with all power on and equipment operating.
(c) Similar readings on the same terminal board printed in italics on the same horizontal line indicates that the readings are taken between those points and not from each to earth.

Resistance readings

86. (a) See paras. 2 to 7, and Table 4.
(b) Resistances measured to earth unless otherwise stated, with all power off.
(c) Similar readings on the same terminal board printed in italics on the same horizontal line indicates that the readings are taken between the points and not from each to earth.

ELEVATOR AND OPERATING MECHANISM

To remove a broken driving chain

87. **NOTE: After the replacement of a driving chain, sprocket or screw, before attempting to operate the elevator, check the synchronisation of the elevator screws as detailed in para. 91.**

If damage occurs to the chain while the platform is at or near the **down** position, removal will be much more difficult than if the platform were high enough to provide sufficient room for working. The procedure outlined below is given on the assumption that the chain has broken at the lowest travel of the platform.
(a) Remove the azimuth base boot holding strips over the four chain-inspection hole covers.
(b) Remove the four crescent-shaped chain-inspection hole covers from the platform. (Fig. 1024).
(c) Remove the four chain-shield inner attaching screws.
(d) Remove the four chain-shield outer attaching screws located in the platform diagonal member,

TABLE 3—VOLTAGE READINGS AT PEDESTAL TERMINAL BOARDS

Ter. Board	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10	Ter. 11	Ter. 12
3	105 A.C.(a) 0	105 A.C.(a) 0	105 A.C.(a) 0	115 A.C.	115 A.C.	2.3 A.C. (a) 0	2.3 A.C. (a) 0	2.3 A.C. (a) 0	17 A.C.	17 A.C.	N.C.	N.C.
4	105 A.C.(a) 0	105 A.C.(a) 0	105 A.C.(a) 0	115 A.C.	115 A.C.	105 A.C.(a) 0	105 A.C.(a) 0	105 A.C.(a) 0	0	0	N.C.	N.C.
5	210D (b)	210D (b) 1A (b)	1A (b) 1A (b)	1A (b)	300D	300D	1A (b)	N.C.	N.C.	N.C.	N.C.	N.C.
8	......	......	......	....	300D	300D	45 A.C.	45 A.C. 45 A.C.	45 A.C.	115 A.C.	115 A.C.	115 A.C.
9	105 A.C.(c) 0	105 A.C.(c) 0	105 A.C.(c) 0	115 A.C.	115 A.C.	0	0	0	0	0	0	0
10	105 A.C.(c) 0	105 A.C.(c) 0	105 A.C.(c) 0	115 A.C.	115 A.C.	105 A.C.(c) 0	105 A.C.(c) 0	105 A.C.(c) 0	0	0	0	0

(a) Voltage varies as the pedestal is rotated in azimuth by means of the azimuth handwheel. Maximum and minimum voltages given.
(b) Voltage measured with the pedestal rotating in P.P.I. scan.
(c) Voltage measured with the pedestal moving in elevation by means of the elevation handwheel.

TABLE 4—RESISTANCE READINGS AT PEDESTAL TERMINAL BOARDS

Ter. Board	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10	Ter. 11	Ter. 12
3	25	25	25	100	100	50K 25	50K 25	50K 25	13	13	N.C.	N.C.
4	30	30	30	1	1	15	15	15	0 (a)	0 (a)	N.C.	N.C.
5	3K	3K	3K	3K	1.5K	0	3K	N.C.	N.C.	N.C.	N.C.	N.C.
7	11K	1.8K	0	N.C.	10.3K	N.C.	200	N.C.	14.5K	N.C.	7.6K	Inf.
8	3K	3K	3K	3K	1.7K	0	Inf. 20	Inf. 20 20	Inf. 20	Inf. 5	Inf. 5	Inf. 5
9	25	25	25	30	30	0 (b)	0 (b)	Inf. (b)	Inf. (b)	0 (c)	0 (c) 0 (d)	0 (d)
10	30	30	30	1	1	15	15	15	3K	Inf.	Inf.	Inf.

(a) With the azimuth safety switch in the run position and the azimuth stowing lock in the unlocked position.
(b) With the elevation stowing lock in the unlocked position.
(c) With the elevation upper limit switch closed.
(d) With the elevation lower limit switch closed.

between the corner gusset and the platform floor. The chain shields will then drop to the floor of the trailer.

(e) Remove the short chain shield near the side door. The fastening screws are readily accessible from the side-door opening.

(f) With the aid of a flat board manoeuvre the eight shields out from underneath the platform through the side door.

(g) The chain can now be removed, provided it is free from all sprockets. If the chain is still holding to the sprockets, it must be disengaged through the hand holes.

To replace a new or repaired driving chain

88. (a) Loosen all clamping screws in the four adjustable idler-sprocket supports and turn the handwheels until the clamping screws contact the back of the slotted holes. See fig. 1030.

(b) Break the driving chain at the removable connection link.

(c) Lay the chain on the trailer floor around the four elevator-operating screws with the protruding ends of the connecting link pins upwards and with the joint near the side door opening.

(d) Wire the rear end of the chain to the platform temporarily. The short chain shield attaching hole is a convenient spot for this purpose.

(e) Starting with the tied end, thread the chain around the stationary idler sprocket, counterclockwise and, keeping the chain as tight as possible, continue around the right rear operating-screw sprocket in a clockwise direction. From this point on, the chain is not accessible from the side door opening and the operation must be continued from inside the trailer.

(f) Push the chain by means of a stick toward the next adjustable idler sprocket, reach through the hand holes in the platform and engage the chain on the sprocket. Continue in this manner until the chain is around all the sprockets, following the path shown in fig. 1023.

(g) The two loose ends are now accessible for joining at the side door. Remove the temporary wire fastening and, if all the appreciable slack has been removed from the chain, make the joint.

(h) Adjust all four idler sprockets successively by means of the handwheels to tighten the chain until the correct tension has been achieved, as in para. 90.

(i) Tighten the adjustable sprocket support clamping screws.

(j) Check the synchronization of the operating screws and adjust if required as in para. 91.

(k) Make a final check of all sprockets to ensure the chain is properly engaged and, if everything is satisfactory, start the motor and raise the platform sufficiently to facilitate replacement of the chain shields. Replace the chain-inspection covers. Replace the azimuth-boot holding strips

NOTE: *Be sure that the elevator is not clamped to the shock mounts before the starting button is pressed.*

89. The repair and replacement of a broken chain when the elevator platform is at or near its raised position is carried out in substantially the same manner, except that the chain shields, other than the short one, need not be removed, and the tension adjustment is accessible from underneath the platform. There is no necessity for the removal of the chain-inspection hole covers, etc. The chain must be placed in the chain shields first, approximating the path around the sprockets and then lifted on to various sprockets in succession, keeping all slack out of the chain.

To adjust the driving chain

90. (a) As the elevator is being raised watch the section of chain between the stationary idler sprocket and the right front operating screw.

(b) The handwheels of the adjustable idler sprockets should be adjusted so that the whip in the chain at this point is just perceptible giving a lateral movement of about half the width of the chain at the centre point between the two sprockets.

To synchronize the elevator-operating screws

91. Normally the four operating screws are set by the manufacturer to provide a minimum endwise free movement of $\frac{1}{4}$ inch. This setting is such that when the platform is lowered onto the shockmounts, all four screws simultaneously move upwards $\frac{1}{4}$ inch, at which time the current to the driving motor is broken by the lower travel limit switch. This setting can only be disturbed by a loose chain skipping teeth on the sprockets or by chain breakage. In either case, the screws must again be synchronized. Otherwise, damage may occur to the mechanism. This adjustment is best carried out with the platform lowered on the shockmounts, as follows:

(a) After the lower travel-limit switch has tripped, shutting off the driving motor, remove the four triangular operating-screw cover plates from the roof. (Fig. 1025).

(b) Check the height of the anchor plates on each screw above the body gusset. From the gusset to the underside of the anchor plate should measure $\frac{1}{4}$ inch to $\frac{5}{16}$ inch. Any screws not within these limits are unsynchronized and must be adjusted.

(c) Remove the lock-plate screw and lock-plate from the slot in the top of the unsynchronized operating screw.

(d) Turn the operating screw in a counterclockwise direction until it is turned out of the elevator-screw sprocket and bearing assembly on the platform. This operation will raise the screw approximately $4\frac{1}{2}$ to 5 inches above the anchor plate. (Fig. 1026).

(e) Grasp the screw and raise it sufficiently to place a $\frac{1}{4}$ inch spacer either side of the operating screw ($\frac{1}{8}$ inch thick flat washers will serve the purpose) on the body gusset, spaced so as to support the anchor plate without interfering with the engagement of the dowels in the plate. (Fig. 1027).

(f) Lower the operating screw so that the anchor plate rests on the spacers and the dowels are engaged in the anchor plate.

(g) Turn the operating screw down until the lower end engages the threads in the elevator-screw sprocket and bearing sprocket-hub assembly. At the same time ensure that the anchor plate is not raised above the spacing washers in this operation. Continue turning the screw until the top end is flush with the top side of the anchor plate and the slots are in line.

(h) Reassemble the lockplate and screw and remove the spacers from underneath the anchor plate.

(i) Adjust all unsynchronized screws in the same manner, and when all four are corrected, replace the operating-screw cover plates, and the elevator is again ready to operate.

(j) Replace the four triangular operating-screw cover plates.

To replace a damaged operating screw

92. If it is necessary to replace an operating screw which has been bent or of which the threads have been damaged, the method of replacement will necessarily be governed by the location of the damaged portion in relation to the elevator platform. If the damaged portion of the screw is above the platform, the elevator should be run down to the lower limit. The screw can now be removed by following the instructions in para. 93 (a) to (d).

93. If the damaged portion of the screw is below the platform and is damaged to such an extent that it cannot be threaded through the elevator-screw sprocket hub without damage to the hub, the elevator should be run up to the upper limit and fixed in place with the four clamping-screw nut assemblies. Then proceed as follows:

(a) Cut off the screw as near the underside of platform as possible.

(b) Remove the triangular operating screw cover from the roof. Remove the anchor-plate lockscrew and lock from the top of the screw. The stub end of the screw can be threaded out of the sprocket hub and removed from the anchor plate.

(c) Remove the bottom section of the screw.

(d) Before the new screw is installed, check the condition of the threads in the sprocket hub. If they are damaged replace the hub.

(e) To synchronize the screw, place the anchor plate in position with the dowel pins engaged and anchor plate resting on one-quarter inch spacers, as described in para. 91.

(f) Thread the new screw, bottom end first, through the anchor plate and continue turning the screw through the elevator-screw sprocket hub on the platform until the top of screw is flush with top of surface of the anchor plate and the slots are in line. Guide the lower end of the screw into the guide bracket on the body floor.

(g) Replace the lockplate and the lockscrew and remove the spacers from under the anchor plate.

(h) Replace the operating-screw covers on the roof of the trailer, remove the four clamping-screw nut assemblies and the elevator is ready to operate.

To remove an operating-screw sprocket and bearing assembly.

94. (a) If the assembly is in a sufficiently good condition to raise the elevator to the desired height and place a jack under the edge of the platform near the corner. Adjust the jack to take the weight of the elevator and mount. Leave the jack in this position until the unit is reassembled.

(b) Remove the operating screw as in para. 91 (c) and (d).

(c) Loosen one of the four adjustable idler sprockets by the handwheel until the chain tension is removed.

(d) Using a screwdriver and a suitable socket wrench, remove the four slotted-head screws and nuts holding the elevator-screw sprocket and bearing assembly to the platform. The complete assembly can then be disengaged from the loosened chain and removed. Tie the slack in the chain temporarily so as not to disturb synchronization of the remaining screws.

95. Removal of this assembly is possible while the platform is clamped in the DOWN position, although more difficulty will be experienced since very little room is available underneath the platform to hold the fastening nuts while unscrewing the slotted head screws. However, with suitable wrench equipment, it is possible. The routine follows the method outlined in para. 94, except that the use of a jack is not required.

96. Removal of the assembly while the platform is clamped in the upper position is not possible since the slotted screw heads are covered by the edge of the hatch opening, and the nuts could not be removed once the screws started to turn.

To replace an operating-screw sprocket and bearing assembly

97. (a) Replace in the reverse order of removal.

(b) Adjust the chain tension as in para. 90.

(c) Synchronize the operating screw as in para. 91.

To dismantle an operating-screw sprocket and bearing assembly

98. Refer to fig. 1028.

(a) After the assembly has been removed from the platform, remove the four hex-head screws holding the sprocket chain guard to the hub. The guard and the sprocket may then be removed.

(b) Remove the hub locking ring, being careful not to damage the ring.

(c) Loosen the setscrew in the hub locking collar and turn the collar until the hub can be withdrawn from the housing and bearing assembly.

To reassemble an operating-screw sprocket and bearing assembly

99. Reassemble in the reverse order of removal.

To remove an adjustable idler sprocket assembly

100. Assuming that the platform is resting on the shock mounts and it is necessary to replace a damaged bearing, chain guard or sprocket, proceed as follows:

(a) Remove the azimuth base boot-holding strips over the idler sprocket assembly.

(b) Remove the chain inspection hole cover.

(c) Lift up the canvas boot and remove the two hex. head clamping screws from the idler sprocket support, freeing the support block.

(d) Turn the adjusting handwheel clockwise until the stud is disengaged from the support block. This loosens the chain allowing the support block, bearing and sprocket to be dropped as a unit. Remove the unit from underneath the platform with a hooked wire or stick.

To replace an adjustable idler sprocket assembly

101. Replace in the reverse order of removal.

NOTE: Difficulty will be avoided in any operation involving removal of the chain from a sprocket if care is taken to keep the chain taut at all times. A slack chain may fall off the other sprockets and involve considerable work to replace it, plus the effort necessary to check synchronization of the screws. A block of wood of suitable size inserted in each hand hole in the platform members, in contact with the chain will serve to prevent the chain from loosening to such an extent as to fall off other sprockets while the damaged unit is being repaired.

To dismantle the idler-sprocket assemblies

102. Refer to figs. 1030 and 1031. All idler sprockets are basically the same in construction and these instructions apply, therefore, to both the stationary and the adjustable idler-sprocket assemblies once they are removed from the platform.

(a) Remove the bearing-retaining screw. This frees the chain guard and sprocket.

(b) Two holes are provided in the back flange of the idler sprocket for use in knocking out the bearing. Tap lightly with a hammer and soft drift alternately through each hole, and the bearing will be pushed out of the sprocket.

(c) The support block and bearing hub are welded together and cannot be serviced separately.

To reassemble the idler-sprocket assemblies

103. Replace in the reverse order of removal.

To remove the driving motor from the platform

104. (a) Back off the adjustable idler-sprocket assembly nearest the driving motor to relieve the tension from the chain. The adjusting handwheel can be reached from the double-door opening by reaching underneath the platform and turning the handwheel clockwise.

(b) Remove the inspection-hole cover over the stationary idler sprocket.

(c) Remove the two cap screws holding the stationary-idler sprocket support assembly to the bracket. Disengage the assembly from the chain and remove it. Keep the chain as taut as possible so as to prevent its slipping off the other sprockets. Reach underneath the platform to the motor-driving sprocket, disengage the chain and take up the slack and tie it with a wire or other means so that the chain does not disengage itself from the other idler and driving sprockets.

(d) Disconnect the wiring to the motor at the motor terminal box and loosen the upper nut of the wiring conduit and drop it free.

(e) Remove the four large hex. head screws holding the motor flange down to the platform. The motor is now free and can be lifted out of the platform.

To replace the driving motor

105. (a) Replace in the reverse order of removal.

(b) Adjust the chain tension as in para. 90.

General

106. (a) If it becomes necessary to install new platform rubber seals, use rubber cement on the sides and bottom of the platform channel to hold the new sealing strips in place.

(b) The threads and the conical end of the platform clamping-nut assemblies should be well greased as detailed in Table 82 of Tels. OY-103.

(c) Do not allow grease or oil to remain in contact with the operating screw guides or the rubber shockmounts.

(d) If it is necessary to remove the azimuth-base boot, ensure when replacing it that the drain comes in its original location, so as to line up with the drain pipes on the platform.

(e) If the telephone jack is replaced, ensure that the joint between the jack and the platform is made water-tight by the use of sealing compound.

(f) In the event of failure of the electrical connections at the junction box when the platform is in the lowered position, it is possible to raise the elevator by utilizing temporary wiring to the motor-terminal box which is accessible above the platform.

(g) In the event of failure of the interlock switch, S1977, when the platform is in the lowered position, it may be shorted out by connecting terminals 4 and 5 on TB55 in the switch box, SW214.

JUNCTION BOX JB-71

107. A key to connections in the junction box is shown in Table 5.

TABLE 5—KEY TO CONNECTIONS IN JB-71

TERMINAL	FROM	TO
TB 16-1	Azimuth control transformer B2004-S3.	Azimuth selsyn, B1301-S3 in P.P.I. SCAN and MANUAL positions OR Data panel socket J1926-8 in REMOTE position.
TB 16-2	Azimuth control transformer B2004-S2.	Azimuth selsyn, B1301-S2 in P.P.I. SCAN and MANUAL positions OR Data panel socket J1926-7 in REMOTE position.
TB 16-3	Azimuth control transformer B2004-S1.	Azimuth selsyn, B1301-S1 in P.P.I. SCAN and MANUAL positions OR Data panel socket J1926-6 in REMOTE position.
TB 16-4	Azimuth control transformer B2004-R1.	Azimuth follow-up transformer T1301 via C1301. Error voltage Transformer T401-1.
TB 16-5	Azimuth control transformer B2004-R2.	Error voltage transformer T401-2 in P.P.I. SCAN, MANUAL and REMOTE positions. Follow-up transformer T1301-2 in AUTOMATIC.
TB 16-6	Azimuth H.S. selsyn gen. B2003-S3.	Data panel socket J1927-3.
TB 16-7	Azimuth H.S. selsyn gen. B2003-S2.	Data panel socket J1927-2.
TB 16-8	Azimuth H.S. selsyn gen. B2003-S1.	Data panel socket J1927-1.
TB 16-9	Azimuth L.S. selsyn gen. B2002-R1. Azimuth H.S. selsyn gen. B2003-R1. Elevation L.S. selsyn gen. B2052-R1. Elevation H.S. selsyn gen. B2053-R1. Telescope lamp transformer, T2051-1.	Data panel socket J1926-4. Data panel socket J1926-14. Data panel socket J1927-4. Data panel socket J1927-14.
TB 16-10	Azimuth L.S. selsyn gen. B2002-R2. Azimuth H.S. selsyn gen. B2003-R2. Elevation L.S. selsyn gen. B2052-R2. Elevation H.S. selsyn gen. B2053-R2. Telescope lamp transformer T2051-2.	Data panel socket J1926-5. Data panel socket J1926-15. Data panel socket J1927-5. Data panel socket J1927-15.
TB 17-1	Azimuth drive motor B2001-A1+.	Azimuth servo gen. B1976-C4. R434 Anti-hunt voltage divider.
TB 17-2	Azimuth drive motor B2001-A2C1.	V407—pin 1 (Torque voltage).

TABLE 5—KEY TO CONNECTIONS IN JB-71—Continued

TERMINAL	FROM	TO
TB 17-3	Azimuth drive motor B2001-C2C3. Elevation drive motor B2051-C2C3.	Test jack J413 (+30 V).
TB 17-4	Azimuth drive motor B2001-C4. Azimuth servo gen. B1976-C1.	V407—pin 4 (Torque voltage).
TB 17-5	Azimuth drive motor B2001-F1+. Elevation drive motor B2051-F1+.	Socket J1153-B.
TB 17-6	Azimuth drive motor B2001-F2–. Elevation drive motor B2051-F2–.	Socket J1153-C.
TB 17-7	Azimuth stowing switch S2002-C.	Safety switch S1753.
TB 17-8	Elevation drive motor B2051-A1+.	TB 21-7, Elevation servo gen. B1977-C4. R484 Anti-hunt voltage divider.
TB 17-9	Elevation drive motor B2051-C4. Elevation servo gen. B1977-C1.	V457—pin 4 (Torque voltage).
TB 17-10	Elevation drive motor B2051-A2C1.	V457—pin 1 (Torque voltage).
TB 18-1	Interlock switch S2053-A.	Pedestal upper limit switch S2007-4.
TB 18-2	Reference gen. B2056-G1.	Reference voltage transformer T1901-2.
TB 18-3	Reference gen. B2056-G3G4.	Reference voltage transformers T1901-1, T1902-1.
TB 18-4	Reference gen. B2056-G2.	Reference voltage transformer T1902-2.
TB 18-5	Spinner motor B2056-T1.	Spinner motor switch S1902-T1.
TB 18-6	Spinner motor B2056-T2.	Spinner motor switch S1902-T2.
TB 18-7	Spinner motor B2056-T3.	Spinner motor switch S1902-T3.
TB 18-8	Upper elevation limit switch S2056-A.	Rectifier CR1902-2.
TB 18-9	Lower elevation limit switch S2055-A.	TB21-9, Elevation servo gen. B1977-F1. Test jack J457.
TB 18-10	Lower elevation limit switch S2055-O.	Rectifier CR1901-1.
TB 19-1	Elevation control transformer B2054-S3.	Elevation selsyn B1351-S3 in P.P.I. SCAN and MANUAL positions. OR Data panel J1926-18 in REMOTE position.
TB 19-2	Elevation control transformer B2054-S2.	Elevation selsyn B1351-S2 in P.P.I. SCAN and MANUAL positions OR Data panel J1926-17 in REMOTE position.

TABLE 5—KEY TO CONNECTIONS IN JB-71—Continued

TERMINAL	FROM	TO
TB 19-3	Elevation control transformer B2054-S1.	Elevation selsyn B1251-S1 in P.P.I. SCAN and MANUAL positions OR Data panel J1926-16 in REMOTE position.
TB 19-4	Elevation control transformer B2054-R1.	Follow-up transformer T1351-2. Error voltage transformer T451-1.
TB 19-5	Elevation control transformer B2054-R2.	Error voltage transformer T451-2 in P.P.I. SCAN, MANUAL and REMOTE positions. Follow-up transformer T451-2 via C1351 in AUTOMATIC position.
TB 19-6	Elevation drive motor B2051-C4. V457—pin 4. TB 17-9.	Elevation servo gen. B1977-C1.
TB 19-7	Azimuth L.S. selsyn gen. B2002-S3.	TB26-9 Data panel, J1927-8. TB22-8 Azimuth local selsyn B1201-S3.
TB 19-8	Azimuth L.S. selsyn gen. B2002-S2.	TB 26-10 Data panel J1927-7. TB22-9 Azimuth local selsyn B1201-S2.
TB19-9	Azimuth L.S. selsyn Gen. B2002-S1.	TB27-1 Data panel J1927-6. TB 22-10 Azimuth local selsyn B1201-S1.
TB 19-10	Spare	Spare
TB 20-1	TB 17-1.	Azimuth servo Gen. B1976-C4.
TB 20-2	V407—pin 1 (Torque voltage).	TB 17-1.
TB 20-3	Test jack J407 CONTROL FIELDS.	Azimuth servo gen. B1976-F1.
TB 20-4	Safety relay K502-5.	TB 20-5.
TB 20-5	TB 21-3 Elevation servo gen. B1977-F2.	Azimuth servo gen. B1976-F2.
TB 20-6	Azimuth drive motor B2001-C4. V407—pin 4 (Torque voltage).	Azimuth servo gen. B1976-C1.
TB 20-7	Test jack J406 CONTROL FIELDS.	Azimuth servo gen. B1976-F4.
TB 20-8	Azimuth servo motor switch S1903-T1.	Azimuth servo gen. B1976-AT1.
TB 20-9	Azimuth servo motor switch S1903-T2.	Azimuth servo gen. B1976-BT2.
TB 20-10	Azimuth servo motor switch S1903-T3.	Azimuth servo gen. B1976-CT3.
TB 21-1	R422 Anti-hunt voltage divider.	Azimuth servo gen. B1976-C2A1.
TB 21-2	R472 Anti-hunt voltage divider.	Elevation servo gen. B1977-C2A1.
TB 21-3	TB20-5 Azimuth servo gen. B1976-F2.	Elevation servo gen. B1977-F2.

TABLE 5—KEY TO CONNECTIONS IN JB-71—Continued

TERMINAL	FROM	TO
TB 21-4	Fuse F502.	Fuse F1904-1.
TB 21-5	Fuse F501. Control switch S1751-5 via relay K701-1 to AGC relay K1751.	Fuse F1905-1.
TB 21-6	Via COAST button S1752 to relay K501, Relays K1751, K1201-2, K1202-2. Scan motor B1302-A1F1. Error signal relay K401-1.	Fuse F1906-1.
TB 21-7	R484 Anti-hunt voltage divider.	TB 21-8.
TB 21-8	TB17-8 Elevation drive motor B2051-A1+.	Elevation servo gen. B1977-C4.
TB 21-9	TB18-9 Lower elevation limit switch S2055-A.	Elevation servo gen. B1977-F1.
TB 21-10	Test jack J457.	TB 21-9.
TB 22-1	Spare.	Spare.
TB 22-2	TB 22-3, 4.	Elevation servo gen. B1977-F4.
TB 22-3	Test jack J456 CONTROL FIELDS.	TB 22-2, 4.
TB 22-4	Rectifier CR1902-1.	TB 22-2, 3.
TB 22-5	Elevation servo motor switch S1904-T1.	Elevation servo gen. B1977-AT1.
TB 22-6	Elevation servo motor switch S1904-T2.	Elevation servo gen. B1977-BT2.
TB 22-7	Elevation servo motor switch S1904-T3.	Elevation servo gen. B1977-CT3.
TB 22-8	Azimuth local selsyn B1201-S2.	TB 19-7 Azimuth L.S. selsyn gen. B2002-S3. TB 26-9 Data panel J1927-8.
TB 22-9	Azimuth local selsyn B1201-S2.	TB 19-8 Azimuth L.S. selsyn gen. B2002-S2. TB 26-10 Data panel J1927-7.
TB 22-10	Azimuth local selsyn B1201-S1.	TB 19-9 Azimuth L.S. selsyn gen. B2002-S1. TB 27-1 Data panel J1927-6.
TB 23-1	V408—pin 4 (Reference voltage) in AUTOMATIC.	Azimuth ref. volt. transformer T1901-3.
TB 23-2	Earth in azimuth and elevation tracking unit.	Az. ref. volt. transformer T1901-4. El. ref. volt. transformer T1902-4.
TB 23-3	V408—pin 1 (Reference voltage) in AUTOMATIC.	Az. ref. volt transformer T1901-5.
TB 23-4	V458—pin 1 (Reference voltage) in AUTOMATIC.	El. ref. volt. transformer T1902-5.

TABLE 5—KEY TO CONNECTIONS IN JB-71—Continued

TERMINAL	FROM	TO
TB 23-5	V458—pin 4 (Reference voltage) in AUTOMATIC.	El. ref. volt. transformer T1902-3.
TB 23-6	El. local selsyn B1251-S3.	TB 27-8 Data panel J1927-18. TB 27-5 El. L.S. selsyn gen. B2052-S3.
TB 23-7	El. local selsyn B1251-S2.	TB 27-9 Data panel J1927-17. TB 27-6 El. L.S. selsyn gen. B2052-S2.
TB 23-8	El. local selsyn B1251-S1.	TB 27-10 Data panel J1927-16. TB 27-7 El. L.S. selsyn gen. B2052-S1.
TB 23-9	TB 25-8. Fuse F1907-1.	Data panel I 1926-1, J1931-1.
TB 23-10	TB 25-9. Fuse F1909-1.	Data panel S1926-C,D, J1931-2.
TB 24-1	TB 26-1. J1979-1 INTERPHONE. Telephone term. board TB 48-1.	J2009 INTERPHONE socket on roof.
TB 24-2	TB 26-2. J1979 INTERPHONE. Telephone term. board TB 48-2.	J2009 INTERPHONE socket on roof.
TB 24-3	Spare.	Spare.
TB 24-4	Spare.	Spare.
TB 24-5	Spare.	Spare.
TB 24-6	P.P.I. selsyn gen. B2005-S3.	R1643.
TB 24-7	P.P.I. selsyn gen. B2005-S2.	R1640 and V1606—pin 4.
TB 24-8	P.P.I. selsyn gen. B2005-S1.	R1641 and V1607—pin 1.
TB 24-9	P.P.I. selsyn gen. B2005-R1.	Earth in P.P.I. unit.
TB 24-10	P.P.I. selsyn gen. B2005-R2.	Junction C1601 and R1601.
TB 25-1	Fuse F1908-1.	Socket J1985-1. TB 25-3.
TB 25-2	Fuse F1909-1.	Socket J1985-1. TB 25-4, 5, 9.
TB 25-3	Switch S1978-1 (By control rack).	TB 25-1.
TB 25-4	Switch S1978-2 (By control rack).	TB 25-2, 5, 9.
TB 25-5	Socket J1986-1 (Under control rack).	TB 25-2, 4, 9.
TB 25-6	Fuse F1907-1.	TB 25-7, 8.

TABLE 5—KEY TO CONNECTIONS IN JB-71—Continued

TERMINAL	FROM	TO
TB 25-7	Socket J1986-2 (Under control rack).	TB 25-6, 8.
TB 25-8	Socket J1984-1 (Ventilator and dehydrator).	TB 25-6, 7. TB 23-9.
TB 25-9	Socket J1984-2 (Ventilator and dehydrator).	TB 25-1, 3, 5. TB 23-10.
TB 25-10	Spare.	Spare.
TB 26-1	TB 24-1. Socket J1979-1 INTERPHONE.	Data panel telephone term. board TB 48-1.
TB 26-2	TB 24-2. Socket J1979-2 INTERPHONE.	Data panel telephone term. board TB 48-2.
TB 26-3	Socket J1978-1 LINE 1.	Data panel term. board TB48-3.
TB 26-4	Socket J1978-2 LINE 1.	Data panel term. board TB48-4.
TB 26-5	Socket J1977-1 LINE 2.	Data panel telephone term. board TB48-5.
TB 26-6	Socket J1977-2 LINE 2.	Data panel telephone term. board TB48-6.
TB 26-7	Socket J1976-1 LINE 3.	Data panel telephone term. board TB48-7.
TB 26-8	Socket J1976-2 LINE 3.	Data panel telephone term. board TB48-8.
TB 26-9	Data panel J1927-8.	TB 22-8.
TB 26-10	Data panel J1927-7.	TB 22-9.
TB 27-1	Data panel J1927-6.	TB 22-10.
TB 27-2	Data panel J1927-13.	El. H.S. selsyn gen. B2053-S3.
TB 27-3	Data panel J1927-12.	El. H.S. selsyn gen. B2053-S2.
TB 27-4	Data panel J1927-11.	El. H.S. selsyn gen. B2053-S1.
TB 27-5	TB 27-8. TB 23-6.	El. L.S. selsyn gen. B2052-S3.
TB 27-6	TB 27-9. TB 23-7.	El. L.S. selsyn gen. B2052-S2.
TB 27-7	TB 27-10. TB 23-8.	El. L.S. selsyn gen. B2052-S1.
TB 27-8	TB 27-5. TB 23-6.	Data panel J1927-18.
TB 27-9	TB 27-6. TB 23-7.	Data panel J1927-17.
TB 27-10	TB 27-7. TB 23-8.	Data panel J1927-16.

TABLE 6—VOLTAGE READINGS AT TERMINAL BOARDS

Ter. Board	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5
16	0-105 A.C. (c)	0-105 A.C. (c)	0-105 A.C. (c)	0	0
17	30C (a) 25C (b) 170D (d)	30C (a) 25C (b) 170D (d) 1A	30C (a) 25C (b) 1A	30C (a) 25C (b) 1A	300D
18	....	45 A.C.	45 A.C.	45 A.C.	115 A.C.
19	0-105 A.C. (e)	0-105 A.C. (e)	0-105 A.C. (e)	0	0
20	....	....	240D	300D	300D
21	30C (a) 25C (b)	30C (a) 25C (b)	300D	115 A.C.	115 A.C.
22	N.C.	240D	240D	240D	115 A.C.
23	90 A.C. 180 A.C.	90 A.C. 90 A.C. 90 A.C. 90 A.C.	 90 A.C. 180 A.C.	180 A.C. 90 A.C.	180 A.C. 90 A.C.
24			N.C.	N.C.	N.C.
25	115 A.C. 115 A.C.	115 A.C. 115 A.C.	 115 A.C. 115 A.C.	 115 A.C.	 115 A.C. 115 A.C.
26					
27	0-105 A.C. (c) (f)	 0-105 A.C. (e)	 0-105 A.C. (e)	 0-105 A.C. (e)	 0-105 A.C. (e)

Ter. Board	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10
16	0-105 A.C. (c)	0-105 A.C. (c)	0-105 A.C. (c)	115 A.C.	115 A.C.
17	300D	....	30C (a) 25C (b)	30C (a) 25C (b)	30C (a) 25C (b)
18	115 A.C.	115 A.C.	180D (a) 165D (b)	225D (a) 245D (b)	225D (a) 245D (b)
19	30C (a) 25C (b)	0-105 A.C. (c)	0-105 A.C. (c)	0-105 A.C. (c)	N.C.
20	30C (a) 25C (b)	240D	115 A.C.	115 A.C.	115 A.C.
21	115 A.C.	30C (a) 25C (b)	30C (a) 25C (b)	225D (a) 245D (b)	225D (a) 245D (b)
22	115 A.C.	115 A.C.	0-105 A.C. (c)	0-105 A.C. (c)	0-105 A.C. (c)
23	0-105 A.C. (e)	0-105 A.C. (e)	0-105 A.C. (e)	115 A.C.	115 A.C.
24	0-2 A.C. (d)	0-2 A.C. (d)	0-2 A.C. (d)	15 A.C.	15 A.C.
25	115 A.C. 115 A.C. 115 A.C.		 115 A.C.	 115 A.C.	 N.C.
26				0-105 A.C. (c) (f)	0-105 A.C. (c) (f)
27	0-105 A.C. (e)	0-105 A.C. (e)	 0-105 A.C. (e)	 0-105 A.C. (e)	 0-105 A.C. (e)

(a) A sets. (b) B sets. (c) Value varies as pedestal is rotated in azimuth. (d) Value varies as pedestal is rotated in P.P.I. SCAN. (e) Value varies as pedestal is moved in elevation. (f) 0-105 V A.C. between TB26-9, 10 and TB27-1 when pedestal is rotated in azimuth.

TABLE 7—RESISTANCE READINGS AT TERMINAL BOARDS

Ter. Board	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5
16	Inf. *28*	Inf. *28*	Inf. *28*	Inf. *40* (a) *105* (b)	Inf. *40* (a) *105* (b)
17	3.9K (a) 2.9K (b) *4.5*	3.9K (a) 2.9K (b) *4.5* *0.75*	3.9K (a) 2.9K (b) *0.75*	3.9K (a) 2.9K (b) *0.75*	1.7K
18	Inf.	Inf. *20* *40*	Inf. *20*	Inf. *20* *40*	Inf. *5* (a) *2* (b)
19	*28*	*28*	*28*	*40* *105*	*40* *105*
20	3.9K (a) 2.9K (b)	3.9K (a) 2.9K (b)	30K	30K	30K
21	3.5K	3.5K	30K	Inf.	Inf.
22	N.C.	30K	30K	30K	Inf.
23	270 (a) 70 (b)	0	280 (a) 80 (b)	280 (a) 80 (b)	270 (a) 70 (b)
24	Inf.	Inf.	N.C.	N.C.	N.C.
25	Inf. *0*	Inf. *0*	Inf. *0*	Inf. *0*	Inf. *0*
26	Inf. (f)	Inf. (f)	Inf. (f)	Inf. (f)	Inf. (f)
27	Inf. *14* (e)	Inf. *28*	Inf. *28*	Inf. *28*	Inf. *14*

Ter. Board	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10
16	Inf. *28*	Inf. *28*	Inf. *28*	Inf. *1*	Inf. *1*
17	0	Inf.	3.9K (a) 2.9K (b) *4.5*	3.9K (a) 2.9K (b) *1.5*	3.9K (a) 2.9K (b) *1.5* *4.5*
18	Inf. *5* (a) *2* (b)	Inf. *5* (a) *2* (b)	30K (a) 45K (b)	30K	120K/45K (a) (c) (A.C.) 1M/50K (c) (d) (b.d.)
19	3K	Inf. *14*	Inf. *14*	Inf. *14*	N.C.
20	3.5K	30K	Inf.	Inf.	Inf.
21	Inf.	3.5K	3.5K	30K	30K
22	Inf.	Inf.	Inf. *14*	Inf. *14*	Inf. *14*
23	Inf. *14*	Inf. *14*	Inf. *14*	Inf.	Inf.
24	50K *23*	50K *23*	50K *23*	1	14
25	Inf. *0*	Inf. *0*	Inf. *0*	Inf. *0*	N.C.
26	Inf. (f)	Inf. (f)	Inf. (f)	Inf. *14* (e)	Inf. *14* (e)
27	Inf. *14*	Inf. *14*	Inf. *14*	Inf. *14*	Inf. *14*

(a) A sets. (b) B sets. (c) Avo positive lead to earth. (d) Avo negative lead to earth. (e) 14Ω between any combination of TB26-9, TB26-10 and TB27-1. (f) Test telephone circuits by means of telephone from the jacks on the side of the junction box to those on the data panel.

VOLTAGES AND RESISTANCES AT TERMINAL BOARDS

Conditions of measurement

108. (a) See paras. 2 to 7.

(b) *Voltages*

(i) All voltages measured with the complete equipment operating.

(ii) D.C. voltages measured to earth.

(iii) A.C. voltages measured between terminals showing the same values in italics on the same line.

(c) *Resistances*

(i) Resistances measured to earth, unless otherwise stated, with all cables disconnected.

SWITCH BOX SW 214

SWITCH BOX SW 214

109. A key to connections in the switch box is given in Table 8.

TABLE 8—KEY TO CONNECTIONS OF TB 55-56

TERMINAL	FROM	TO
TB 55-1	J2009 Interphone.	Interphone.
TB 55-2	J2009 Interphone.	Interphone.
TB 55-3	Fuse 1907-1.	TB 25-6.
TB 55-4	S1977-1 Interlock.	S1901-4 RAISE-LOWER.
TB 55-5	S1977-2 Interlock.	S1901-12 STOP.
TB 55-6	S2007-T113 upper limit switch and ped. interlock.	TB 55-5.
TB 55-7	S2007-T2 upper limit switch and ped. interlock.	S1901-8 RAISE-LOWER.
TB 55-8	S2007-T4 upper limit switch and ped. interlock.	TB 55-9.
TB 55-9	S2053-A Interlock switch.	TB 55-8.
TB 55-10	Interlock S2053-A.	CR1901-1 rectifier.
TB 56-1	Rectifier CR1902-1.	Elevation motor gen. B1977-F4.
TB 56-2	Rectifier CR1902-2.	Upper elevation limit switch S2056-A.
TB 56-3	Ref. voltage transformer T1901-1, T1902-1.	Reference generator B2056-G3, G4.
TB 56-4	Ref. voltage transformer T1901-2.	Reference generator B2056-G1.
TB-56-5	Ref. voltage transformer T1901-3.	V408 pin 4 (ref. voltage) in AUTOMATIC.
TB 56-6	Ref. voltage transformer T1901-4, T1902-4.	Azimuth and elevation tracking unit.
TB 56-7	Ref. voltage transformer T1901-5.	V408—pin 1 (ref. voltage) in AUTOMATIC.
TB 56-8	Ref. voltage transformer T1902-2.	Ref. generator B2056-G2.
TB 56-9	Ref. voltage transformer T1902-3.	V458—pin 4 (ref. voltage) in AUTOMATIC.
TB 56-10	Ref. voltage transformer T1902-5.	V458—pin 1 (ref. voltage) in AUTOMATIC.

Voltages and resistances at terminal boards

110. (a) See paras. 2-7.

(b) A.C. voltages taken between terminals having the same value in italics on the same line.

(c) Resistances taken to earth. Terminals having same value in italics on same line indicates resistance between those terminals.

TABLE 9—VOLTAGE READINGS AT TERMINAL BOARDS

Ter. Board	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10
55	0	0	0	0	0	0	0	0	0	0
56			*45 A.C.*	*45 A.C.*					*180 A.C.*	*180 A.C.*
					90 A.C.	*90 A.C.*	*90 A.C.*			
					180 A.C.		*180 A.C.*			
			45 A.C.					*45 A.C.*		

TABLE 10—RESISTANCE READINGS AT TERMINAL BOARDS

Ter. Board	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10
55	18M	15M	1.2M	2M	1.2M	1.2M	2M	1.2M	1.2M	60K
56	30K	30K	25M	25M	65	0	75	25M	65	75
			27	*27*	*700*	*700*				
			27			*700*	*700*	*27*		
						700			*700*	
						700				*700*

TRAILER 6 V LIGHTING

111. The SCR-584 trailer road lighting and cabin dome lights draw their supply from the prime mover via the four prong socket in the front of the trailer. Of these four prongs, one, designated No. 2 in fig. 1032 is normally not connected.

112. The normal LIGHTS switch on the dashboard of the prime mover plus a BLACK OUT switch also on the dashboard and the application of the brake pedal determine what supplies are fed from the prime mover to the plug on the SCR-584 trailer. A double-pole, double-throw switch, labelled B.O. Switch operated by a screwdriver control on the side of the SCR-584 and located at the side of the lifting hook at the right of the double doors, determines whether cabin wall lights (dome lights) or trailer black-out lights shall receive the 6 V supply.

113. The four prong plug has one prong earthed and the two adjacent prongs receive 6 V D.C. If the prime mover has a positive earth, the supply will be –6 V D.C. and vice versa. Fig. 1032 shows the four prong socket and its supply.

114. From the socket the wiring goes to a fuse board via the B.O. switch. The fuse board is located under the front of the trailer. From there the wiring goes to the trailer and cabin lights as shown in fig. 1032. A second four prong socket, located at the rear of the SCR-584 trailer is wired in parallel with the socket already shown.

115. Fig. 1032 shows the layout of the fuses as they appear on the board underneath the trailer. Fig. 1033 shows the actual wiring layout of the trailer.

LINE VOLTAGE ADJUSTER T1976

116. There are two types of voltage adjuster in use. That employed with A sets consists of a variable auto-transformer which, with an input of 115 V, 3 phase, has an output variable between 97 V—125 V across any two phases. B sets have a variable inductor which, with an input of 115 V, 3 phase, has a variable output of 107 V—128 V across any two phases. The layout of the terminal boards is shown in fig. 1034 and the circuit diagram of the A-type regulator is shown in fig. 1035.

A-TYPE LINE VOLTAGE ADJUSTER

To remove the variac

117. (a) Switch off the power at the main switch, S1976, or if not fitted, remove the power plug, P1930, from the data panel.
(b) Remove the four holding down bolts from the floor of the trailer and turn the adjuster to expose the terminal connections.
(c) Remove all leads and tag for replacement.
(d) Remove the combined front and side cover and remove the handwheel and pointer from the shaft.
(e) Disconnect and remove the transformer directly under the variac and tag the leads for replacement.
(f) Remove the two rubber covered leads from the upper terminals on the rear of the terminal block and tag for replacement.
(g) Untie the cable form from the vertical rod supporting the variac.
(h) Remove the three nuts from the top of the adjuster compartment and lower the variac which is now exposed for inspection.

To replace the variac

118. Replace in the reverse order of removal.

To check the variac windings

119. (a) Remove the variac as detailed in para. 117.
(b) Disconnect the leads and measure the following resistances between terminals using WYO482, Test Sets, Good Companion No. 2.
Ter. 1 to Ter. 3—0.3 Ω.
Ter. 2 to Ter. 4—0.2 Ω.
Ter. 1 to Ter. 4—0.5 Ω.
(c) Check for continuity between terminal 2 and the brush.

To check the transformer windings

120. Disconnect the leads from the transformer and measure the following resistances using WY0482. Test Sets, Good Companion, No. 2.
Primary winding—0.01 Ω.
Secondary winding—0.15 Ω.

B-TYPE LINE VOLTAGE ADJUSTER

121. This is similar to the B-type voltage regulator in the high voltage rectifier rack except that:
(a) There is no timing mechanism.
(b) The regulator is hand driven.

To check the windings

122. (a) Switch off the power at the main switch, S1976, or if not fitted, remove the power plug, P1930, from the data panel.
(b) Remove the four holding down bolts from the floor of the trailer and turn the adjuster to expose the terminal block.
(c) Remove the cover from the terminal box, disconnect the external leads and tag for replacement.
(d) Check that the following resistances are obtained using WY0482. Test Sets, Good Companion, No. 2.
Ter. 11 to Ter. 21—0.25Ω.
Ter. 21 to Ter. 31—0.25Ω.
Ter. 11 to Ter. 31—0.25Ω.
Ter. 18 to Ter. 38—0.25Ω.
Ter. 28 to Ter. 38—0.25Ω.
Ter. 18 to Ter. 38—0.25Ω.
(e) Replace in the reverse order of removal.

RELAYS AND CONTACTORS

To construct special relay cleaning tools

123. (a) Use a piece of wood or suitable substitute $\frac{1}{32}$ in. thick, ⅜ in. wide and 3¾ ins. long and two pieces ¼ in. thick, 1 in. wide and 8 ins. long.
(b) Cut one piece of crocus cloth 1 in. wide and 2½ ins. long and one piece each of crocus cloth and No. 0000 sandpaper 1 in. wide and 5¼ ins. long.
(c) Cement the small piece of crocus cloth to the small piece of wood placing the stock in a vice until the cement hardens. Trim off the excess cloth with a knife.
(d) Cement the large piece of crocus cloth and the large piece of sandpaper to the large sticks in the same manner.

To clean relay contacts

124. (a) *Hard alloy contacts (as in telephone type relays K305, K401, K402, K1201 and K1202.)*
(i) Dirty hard alloy contacts are cleaned by drawing a strip of clean wrapping paper between them while holding them together. It may be necessary in some cases to moisten the paper with carbon tetrachloride. A dry paper or paper strip is used for polishing.
(ii) Corroded, burned or pitted contacts must be cleaned with the crocus cloth strip or the polishing stick described in para. 123.
(b) *Solid silver contacts.*
(i) Dirty solid silver contacts are easily cleaned with a cloth or brush dipped in carbon tetrachloride. After being cleaned, the contacts are polished with a dry cloth.
NOTE: The brown discolouration that is found on silver and silver-plated relay contacts is silver oxide and is a good conductor. It should be left alone unless the contacts must be cleaned for some other reason. It may be removed, at any time, with a cloth moistened with carbon tetrachloride.
(ii) Dress corroded contacts first with crocus cloth, using either the stock or the strip of material. When all of the corrosion has been removed, wipe with a clean cloth moistened with carbon tetrachloride, and polish with a piece of folded cloth. Make certain that the shape of the contacts has not been altered from the original.

(iii) Re-surface burned or pitted contacts, if necessary with No. 0000 sandpaper, making certain that when the work is completed, the shape of the contact has not been changed. Then smooth the surface with crocus cloth. After a high polish has been obtained, wipe thoroughly with clean cloth, using carbon tetrachloride.

(iv) For very badly burnt or pitted contacts (replacement not available) the small fine cut file or No. 0000 sandpaper is used, remembering that the original shape of a contact must be retained or restored during cleaning.

(c) **Silver plated contacts (K301 and K307).**

(i) Dirty silver plated contacts are cleaned with a cloth or brush dipped in carbon tetrachloride. After being cleaned, the contacts are polished with a dry cloth.

(ii) Dress corroded contacts first with the crocus cloth using either the stock or a strip of material. The work must be done very carefully so as not to remove an excessive amount of silver plating. When all of the corrosion has been removed, polish with the cloth. Make certain that the shape of the contacts has not been changed.

(iii) Dress burned or pitted contacts with crocus cloth until the burned or pitted spots are removed. This may require an appreciable amount of time, but it is to be preferred to the use of a file or sandpaper. (If it is found that crocus cloth does not remove burns or the pits, then use the sandpaper tool very carefully). If the sandpaper is used, follow with crocus cloth to polish the contact, wipe thoroughly with a cloth moistened with carbon tetrachloride, and dry with a clean cloth.

DRIVER UNIT

K101, driver bias rectifier overload relay

125. (a) Resistance of operating coil: 108 Ω.
(b) Pick-up current: 20 mA.
(c) Drop-off current: 10 mA.
(d) Non-adjustable.

MODULATOR UNIT

K201, 30 sec. delay relay (A & B sets)

126. (a) Resistance of operating coil.
(i) Relay 58 Ω.
(ii) Motor field 470 Ω.
(b) Operating current.
(i) Motor running 240 mA A.C.
(ii) Hold on (motor stopped) 190 mA A.C.

To adjust K201

127. (a) Slacken the locking nut to the right of the milled edge wheel.
(b) Free the adjustment claw from its slot and rotate to the 30 sec. position. (The figs. above the slots represent delay in seconds).
(c) Press home the claw in the 30 sec. slot.
(d) Tighten the locking nut.

To remove K201

128. (a) Remove the driver unit from the modulator.
(b) Remove and tag for replacement the three sets of connections behind the relay panel.
(c) Remove the four retaining screws and the relay from the panel.

To replace K201

129. Replace in the reverse order of removal.

K202, Contactor relay (B sets)

130. (a) Resistance of operating coil 75 Ω.
(b) Pick-up current 500 mA A.C.
(c) Operating current 150 mA A.C.
(d) Non-adjustable.

To clean the contacts of K202 (B sets)

131. (a) The contacts of this relay may be cleaned without removing the baseplate from the panel.
(b) Take off the nameplate at the bottom of the relay and unscrew the square brass nut. This will allow the contacts, spacers and springs to be slid off.

Relay K202, contactor relay (A sets)

132. (a) Resistance of operating coil 55 Ω.
(b) Pick-up current 270 mA A.C.
(c) Operating current 110 mA A.C.
(d) Non-adjustable.

To remove the contacts of K202 (A sets) for cleaning

133. (a) Remove one of the split pins locating the spindle on which the moving contacts are pivoted and withdraw the spindle.
(b) Remove the four connections to the moving contacts at the screws on the backplate.
(c) Unhook the tension spring and remove the moving contacts.
(d) Remove the four round head screws securing the fixed contacts to the bakelite baseplate.
(e) Remove the two screws securing the bakelite bar through which the fixed contacts are passed and remove the bar together with the fixed contacts.

To remove K202

134. (a) Remove all the connections to the terminals on the front of the relay and tag for ease of replacement.
(b) Unscrew the two bolts attaching the baseplate to the panel and remove the relay.

To replace K202

135. Replace in the reverse order of removal.

Relay K203 (B sets)

136. (a) Resistance of operating coil 135 Ω.
(b) Pick-up current 170 mA A.C.
(c) Operating current 100 mA A.C.
(d) Non-adjustable.

To remove K203 (B sets)

137. (a) Remove and tag for ease of replacement the leads to the rear of the relay.
(b) Remove the relay from the panel by removing the two screws inserted from the rear.

To dismantle relay K203 (B sets) for cleaning

138. (a) Remove and tag for replacement the leads to all the terminal screws on the back of the relay panel except those of the operating coil.

(b) Removal of four of the screws will allow removal of the stationary contacts.
(c) Removal of the other two screws and of the central screw holding the nameplate will allow removal of the bakelite cover, the springs and contact fingers.

To reassemble K203 (B sets)

139. reassemble in the reverse order of dismantling.

Relay K203 (A sets)

140. (a) Resistance of operating coil 180 Ω.
(b) Pick-up current 135 mA.
(c) Operating current 90 mA A.C.
(d) Non-adjustable.

To remove K203 (A sets)

141. (a) Remove and tag for replacement the leads to the contacts on the front of the relay.
(b) Remove the relay from the panel by withdrawing the three securing screws.

To remove contacts of K203 (A sets) for cleaning

142. (a) The contacts of this relay may be cleaned without removing the baseplate from the panel by detaching the spring from the tongue.
(b) The moving contacts may then be removed by disconnecting the two attached leads.
(c) The fixed contacts are removed by removing the double hex. nuts, two lockwashers and the bakelite spacer on the securing screws.

Relay K204 and K205 (B sets)

143. (a) Pick-up current 4 A A.C.
(b) Operating current 3.5 A A.C.
(c) *Adjustment* The valve adjustment at the top should have the figure 1 pointing forward. The solenoid adjustment on the bottom should be set at 4.

To remove K204 and K205 (B sets)

144. (a) Remove attached leads at the rear of the main relay panel.
(b) The relay is held by two screws through the rear of the panel. Unscrew these and the relay can be lifted away.

To remove the contacts of K204 and K205 (B sets) for cleaning

145. (a) Unscrew the retaining screw sufficiently to allow the contacts to be lifted out.
(b) Adjustment of the contacts can be made by slackening off the screw and moving the contacts within the retaining slot.

Relays K204 and K205 (A sets)

146. (a) Pick-up current 7 A A.C. (Affected by age of rubber diaphragm).
(b) Operating current 5.3 A A.C.
(c) *Adjustment* The delay is adjusted by screwing the knob on the bottom of the relay. The number 9 should be opposite the white dot.

To remove K204 and K205 (A sets)

147. (a) Remove V203.
(b) Remove the four leads from the back of the relay mounting panel and tag for replacement.
(c) Remove the four leads from the front of the panel.
(d) Slide off the cover over the relay.
(e) Remove the relay by undoing the two securing nuts from beside the operating coil.

To replace the diaphragm of K204 and K205 (A sets)

148. (a) Continual tripping of the relay may be due to perishing of the rubber diaphragm. This is not intended to be replaced as a single item. However, if replacement is imperative, the following procedure may be adopted.
(i) Remove the 8 screws holding the bakelite moulding to the frame of the relay exposing the rubber diaphragm.
(ii) Remove the two screws holding the diaphragm assembly to the lower moving arm. This will allow the diaphragm, together with its holding washers to be removed from the relay.
(iii) Removal of the clamping washers from the diaphragm is best done by filing the under washer sufficiently to allow the spindle to be withdrawn.
(iv) Using $\frac{1}{16}$ ins. rubber sheet construct a new diaphragm.
(v) Replace this diaphragm between the holding washers centre punching the periphery of the spindle to secure the washers.

Relay K206

149. See para. 125 concerning K101 in the driver unit.

HIGH VOLTAGE RECTIFIER

Relay K301 (B sets)

150. (a) Resistance of operating coil 12 Ω.
(b) Pick-up current 1.8 A A.C.
(c) Operating current 110 mA A.C. (with spring and copper braid lead disconnected).
(d) Non-adjustable.

To remove K301 (B sets)

151. (a) Disconnect the braided lead and the tensioning spring.
(b) Remove the leads from the operating coil, tagging them for ease of replacement.
(c) Remove the four hex. nuts, when the relay can be removed.

Relay K301 (A sets)

152. (a) Resistance of operating coil 3.5 Ω.
(b) Pick up current 1.7 A A.C.
(c) Operating current 210 mA A.C. (with spring and copper braid disconnected).
(d) Non-adjustable.

To remove K301 (A sets)

153. As for the removal of General Electric type except that the relay is secured by four screws instead of the hex. nuts.

Main contactor K302 (B sets)

154. (a) Resistance of operating coil 6 Ω.
(b) Pick-up current 5 A A.C.
(c) Operating current 0.5 A A.C.

To remove K302 (B sets)

155. (a) Remove the blinker cover by unscrewing the black knob.
(b) Remove all the connections to the contactor and relay, tagging them for ease of replacement.

(c) Remove the outside front panel (this necessitates the removal of three nuts on the inside right-hand edge) and locate the two large hex. nuts holding the contactor to the base panel.

(d) With one person supporting the contactor, remove these nuts to allow removal of the unit.

To dismantle K302 (B sets)

156. (a) Unscrew the two screws holding the pivot supports at each end of the contactor moulding to the baseplate.

(b) Withdraw the contact breaker with a downward and outward motion.

(c) The micro switches can be removed individually by unscrewing the two round head screws, care being taken not to damage the bakelite rods.

(b) Remove the two screws at the base of the coil frame which hold the plunger retaining yoke.

(c) Pull the metal yoke away from the frame, lifting it slightly at the same time.

(d) The armature plunger and moving contacts will drop when the yoke is pulled away, so care must be taken in this operation.

To replace K302 (A sets)

160. Replace in the reverse order of removal.

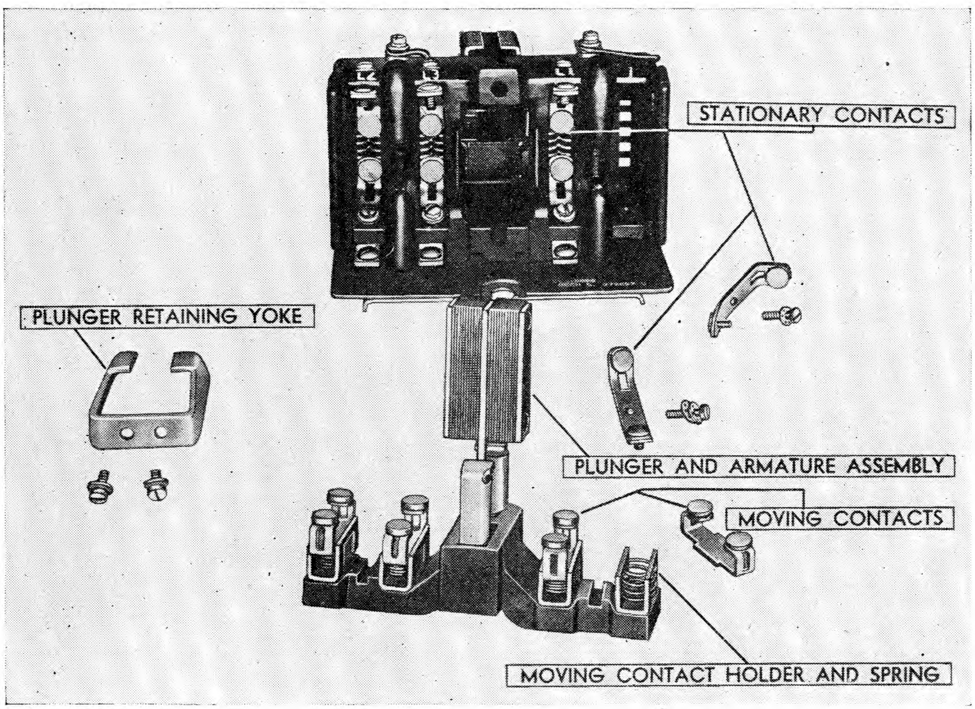
Relays K303, K304, and K306 (B sets)

161. (a) Resistance of operating coil 1 Ω.

(b) Operating current 20 to 80 A A.C. (adjustable).

(c) *Adjustment.*

(i) Remove the cover and turn the knurled rod inside the vertical tube to the setting of 35 A.



T OY-104/1-3

Fig. 3—Contactor K302 stripped

Main contactor K302 (A sets)

157. (a) Resistance of operating coil 43 Ω.

(b) Pick-up current 480 mA A.C.

(c) Operating current 190 mA A.C.

(d) Non-adjustable.

To remove K302 (A sets)

158. (a) Remove the lower front panel from the high voltage rectifier rack. This will expose the mounting screws and connection at the rear of the relay.

(b) Remove all the leads from the relay and tag for ease of replacement.

(c) Remove the relay from the panel.

To dismantle K302 (A sets)

159. (a) Refer to fig. 3. Remove from the bottom of the relay the micro switch, held in place by a screw and hexagonal nut.

To remove K303, K304 and K306 (B sets)

162. (a) Remove the lower front panel of the H.V. compartment by removing the seven screws along the front top and bottom edges and the three hex. nuts along the rear left-hand inner edge.

(b) Remove the leads to the relay.

(c) Remove the relay from the panel by removing the two securing hex. nuts.

Relays K303, K304 and K306 (A sets)

163. (a) Resistance of operating coil 1 Ω.

(b) Operating current 10-40 A A.C. (adjustable).

(c) *Adjustment.*

(i) Remove the glass cover by unscrewing the knurled nut in the centre.

(ii) Press the release lever on the left side of the solenoid and turn the bevelled knurled grip until the horizontal line on the brass cylinder is opposite the 35 A graduation.

(iii) Adjust the position of the stationary contacts, if necessary, so that they just touch the moving contacts when the latter are raised $\frac{1}{32}$ ins. above their position when the coil is de-energized.

To remove K303, K304 and K306 (A sets)

164. (a) Remove the lower front panel of the high voltage rectifier rack by removing the 16 screws around the edges.

(b) Detach the leads from the terminals and remove the relay by removing the two round head mach. screws.

Relay K305.

165. (a) Resistance of operating coil (other shunts detached) 2300 Ω.

(b) *Adjustment.*

(i) Loosen the screw which passes through the armature and withdraw it until it does not extend past the armature.

(ii) Insert a piece of note paper between the core of the coil and the armature.

(iii) Press the armature against the paper and turn the screw down until it touches the paper. Draw the screw down tight enough to compress the paper but not hard enough to punch a hole in it. Tighten the locknut on the screw.

(iv) Insert three sheets of paper between the armature and the core, and press the armature down. The breaking contacts should just open.

(v) Remove one of the three pieces of paper and press the armature down against the remaining two pieces. The making contacts should just close.

(vi) If the contacts do not close and open properly, the tension of the contact springs must be adjusted until they do. Do not bend the contact springs. Grip the spring near its mounting, with a pair of long-nose pliers. Twist the pliers slightly in the direction in which tension is desired. Move the pliers along the spring toward the contacts, twisting slightly in three or four places. The result will be a slight bow in the spring. (Repeat the foregoing operations until the contacts open and close properly).

To remove K305

166. (a) This relay may usually be removed by unscrewing the four round head screws at the corners at the front cover on which the knob adjustment is mounted. Pulling this cover forward and removing four leads from the terminal board frees the relay completely.

(b) If these four screws cannot be removed owing to the supporting pillars turning, the lower front panel of the H.V. rectifier must be removed. The four round head securing screws may then be located and removed and the four leads disconnected to free the relay.

Relay K307 (B sets) (finger-up type)

167. (a) Resistance of operating coil 40 Ω.

(b) Pick-up current 350 mA A.C. (may vary with tension of spring).

(c) Operating current 170 mA A.C.

Relay K307 (A sets) (finger-down type)

168. (a) Resistance of operating coil 30 Ω.

(b) Pick-up current 0.7 A A.C. (may vary with tension of spring).

(c) Operating current 0.2 A A.C.

Relay K308

169. (a) Resistance of operating coil 560 Ω.

(b) Pick-up current 50 mA A.C.

(c) Operating current 35 mA A.C.

To remove K308 (B sets)

170. (a) Remove the relay from the stand-off bracket by unscrewing the two round head screws. This will allow the four leads to the relay to be unsoldered and the whole relay to be removed.

To remove K308 (A sets)

171. (a) Remove the two round head mach. screws holding the relay sub-panel to the H.V. compartment.

(b) Unsolder the four leads to the relay and remove it.

DRIVER UNIT BC-1080

General

172. Voltage and waveform measurements necessary for servicing and repairing driver units are given for three types of operating condition.

(a) Static operation with no trigger applied.

(b) Dynamic operation with trigger and normal voltages applied with output fed into a dummy load.

(c) Free running operation in which dynamic conditions may be simulated when external trigger or normal voltage supplies are not available.

Static operation

173. (a) If the driver unit is to be tested with the complete equipment:

(i) Using test cable W2112, joint P102 to J102.

(ii) Earth the driver unit chassis to the modulator frame.

(iii) Carry out the starting procedure for the modulator and H.V. racks until the red DRIVER PLATE pilot lights.

(b) If the complete equipment is not available:

(i) Connect the end tags of F101-F102 in parallel with the end tags F103-F104 and a suitable length of twin cable.

(ii) Earth the driver unit chassis.

(iii) Connect the twin cable to a 115 V 60 c/s supply.

Dynamic operation

174. (a) If the driver unit is to be tested with the complete equipment:

(i) Using test cables W2112 and W2121, join P102 to J102 and P101 to J101 respectively.

(ii) Using a cable having suitable insulation, extend the 4000 V lead to TB101-1 taking care that the cable is suspended clear of earthed objects and other cables.

(iii) Connect a dummy load of 250 Ω 60 W between TB101-2 and TB101-3. Connect TB101-3 to the chassis.

(iv) Earth the driver unit chassis to the modulator frame.

(v) Carry out the starting procedure for the modulator and H.V. units until the red DRIVER PLATE pilot lamp glows.

(vi) Adjust R101 for stable operation at approx. 20 mA driver plate current as noted on M202.

(b) If the complete equipment is not available.

(i) Connect the end tags of F101-F102 in parallel with the end tags of F103-F104 and a suitable length of twin cable.

(ii) Connect the output of a pulse generator capable of generating a negative pulse 1 to 2 μS in width and 10 V in amplitude, at a recurrence frequency of 1700 c/s, to J101.

(iii) Connect the positive lead from a 4000 V power pack to TB101-1 with a cable having suitable insulation, taking care that the cable is suspended clear of earthed objects and other cables.

(iv) Connect the negative lead from the power pack in series with a 0-50 mA meter to the chassis of the driver unit and earth the chassis. Shunt the meter with a 0.02 μF condenser.

(v) Connect a dummy load of 250 Ω 60 W between TB101-2 and TB101-3 and connect TB101-3 to the chassis.

(vi) Connect the twin cable to a 115 V 60 c/s supply and switch on the pulse generator.

(vii) After allowing 1 minute for the unit to warm up switch on the 4000 V power pack and adjust R101 for stable operation at approximately 20 mA as noted on the 0-50 mA meter.

Free running operation

175. (a) Connect the end tags of F101-F102 in parallel with the end tags of F103-F104 and a suitable length of twin cable.

(b) Join terminal 2 of T104 to the terminal of R126 which is visible from the underside of the chassis.

(c) Remove the lead from TB101-1 and insulate the lead.

TABLE 11—DRIVER UNIT. VOLTAGE READINGS AT VALVE BASES

Valve	ANODE			SCREEN			CATHODE			GRID		
	Static	Dynamic	Free Running	Static	Dynamic	Free Running	Static	Dynamic	Free Running	Static	Dynamic	Free Running
V101A	187D	180D	120D	.....	.....	.....	0	0	0	....	....	....
V101B	95C	95C	60C	.....	.....	.....	0	0	0	....	....	–1B
V102	90C	90C	95C	90C	90C	95C	0	0	0	....	....	–1B
V103	750E (a)	733E (a)	520E (a)	750E	733E	515E	0	0	0	–145D (b)	–145D (b)	–165D (b)
V104	....	3925G (a)	315D (a)	715E	650E	190D	0	0	0	–195D (b)	–195D (b)	–222D (b)
V105	....	3925G (a)	315D (a)	715E	650E	190D	0	0	0	–195D (b)	–195D (b)	–222D (b)
V106	375C A.C. (c)	370C A.C. (c)	389C A.C. (c)	.....	.....	.....	0	0	0	....	....	....
V107	835D A.C. (c)	820D A.C. (c)	809D A.C. (c)	.....	.....	.....	470E	468E	400E	....	....	....
V108	475D A.C. (c)	455D A.C. (c)	420D A.C. (c)	.....	.....	....	750E	733E	520E	....	....	....

(a) Each anode.
(b) Each grid.
(c) Between anodes.

(d) Connect a 0.003 μF 500 V D.C. working condenser between pins 2 and 4 of V101. Spare condensers type C103 or C104 would be suitable.
(e) Short-circuit R128.
(f) Connect a dummy load of 50 Ω 20 W between TB101-2 and TB101-3 and connect TB101-3 to the chassis.
(g) Connect the twin cable to a 115 V 60 c/s supply.

VOLTAGES

Conditions of measurement

176. (a) See paras. 2-7.
(b) All voltages +D.C. to chassis except where otherwise stated.

TABLE 12—VOLTAGE READINGS AT MISCELLANEOUS COMPONENTS

COMPONENT	*STATIC*	*DYNAMIC*	*FREE-RUNNING*
T101 terminals 3 & 5	375C A.C.	370C A.C.	389C A.C.
T102 terminals 3 & 5	835D A.C.	820D A.C.	809D A.C.
T102 terminals 6 & 8	475D A.C.	455D A.C.	420D A.C.
L103 terminal 1	–198D	–200D	–222D
L103 terminal 2	–208D	–210D	–227D
L104 terminal 1	470E	468E	400E
L104 terminal 2	450E	450E	353E
C117	715E	650E	190D
TB101-1	....	4065G	....

RESISTANCES

Conditions of measurement

177. (a) Unit removed from rack with all external cables disconnected.
(b) All resistances taken with respect to chassis except where otherwise stated.
(c) Resistances at transformers taken with the windings isolated from the remainder of the circuit and measured between the terminals indicated.

TABLE 13—RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE	SCREEN	CATHODE	GRID
V101A	Inf.	...	0	.16M
V101B	Inf.	...	0	15K
V102	Inf.	Inf.	0	47K
V103	Inf.	Inf.	0	90K
V104	Inf.	Inf.	0	7.4K
V106	7.7K (a)	...	100	....
V107	100 (b)	...	Inf.	....
	180 (c)	...	Inf.	....
V108	Inf.	...	Inf.	....

(a) Each anode.
(b) Each anode on A sets.
(c) Each anode on B sets.

TRANSFORMER CURRENTS

Conditions of measurement

178. (a) ON load currents, unit connected for normal operation.
(b) OFF load currents, taken with rectifiers removed.

TABLE 14—RESISTANCE READINGS AT TRANSFORMERS

TRANSFORMER		1–2	3–4	4–5	5–6	6–7	7–8
T101	A type	13.5	100	100	...	0.1	...
	B type	12	170	170	...	0.1	...
T102	A type	9	105	105	...	295	295
	B type	6.5	175	175	...	460	460
T103	A type	1.9	0	...	0	.....	0
	B type	1.9	0	...	0	.....	0
T104	A type	2.5	1.3	...	...	.....	...
	B type	2.5	1.3	...	...	.....	...
T105	A type	0.7	0.7	...	...	.....	...
	B type	0.7	0.7	...	...	.....	...

TABLE 15—TRANSFORMER PRIMARY CURRENTS

Transformer	Off Load	On Load
T101	54 mA	230 mA
T102	74 mA	350 mA
T103	......	850 mA

WAVEFORMS

179. Due to the very short duration of the pulses in this unit, WY0212 Oscillograph C.R. No. 1 Mk. 2 is unsuitable for displaying the waveforms obtained under dynamic conditions as in fig. 4, but may be used for waveforms taken under free running conditions. Waveforms under dynamic conditions are better taken with the oscilloscope issued with the equipment. Exact time measurements can only be made on a high speed oscilloscope.

Dynamic conditions

180. Refer to fig. 4. Connect the unit as in para. 174 (a) or (b) and check that the following waveform specifications are obtained.

(a) *Pin 5 of V102.*
- (i) Time of rise to 80% amplitude less than 0.4 μS.
- (ii) Time of fall from 80% amplitude less than 0.4 μS.
- (iii) Pulse width at 80% amplitude 0.8 to 1.2 μS.
- (iv) Peak amplitude greater than 125 V.
- (v) Top of pulse should be free from oscillation.

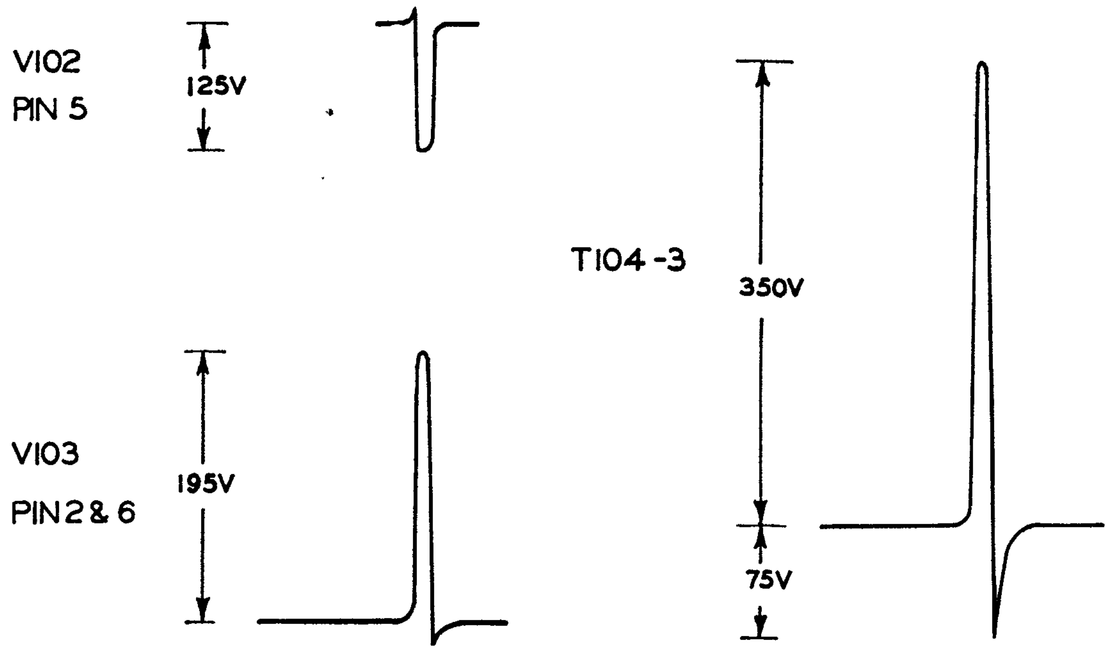
(b) *Pins 2 or 6 of V103.*
- (i) Time of rise to 80% amplitude less than 1 μS.
- (ii) Time of fall at 80% amplitude less than 0.4 μS.
- (iii) Pulse width at 80% amplitude greater than 0.4 μS.
- (iv) Peak amplitude greater than 195 V.

(c) *Terminal 3 of T104.*
- (i) Time of rise to 80% amplitude less than 0.3 μS.
- (ii) Time of fall from 80% amplitude less than 0.2 μS.
- (iii) Pulse width at 80% amplitude 0.6-0.8 μS.
- (iv) Peak amplitude 325-405 V.
- (v) The leading edge and top of the pulse should be free of oscillation. The peak amplitude of the first oscillation on the pulse tail should be less than 125 V below the base line.

(d) *Output pulse.*
- (i) Connect the oscilloscope directly across a 10 Ω non-inductive resistor placed in series with the 250 Ω dummy load.
- (ii) Time of rise to 80% amplitude less than 0.3 μS.
- (iii) Time of fall from 80% amplitude less than 0.2 μS.
- (iv) Pulse width at 80% amplitude 0.6-0.7 μS.
- (v) Peak current greater than 11 A.
- (vi) The pulse should be free from oscillation.

(e) *Delay line check.*
- (i) Short circuit R137.
- (ii) Observe the output pulse as in (d).
- (iii) The pulse width should be at least 0.1 μS and not greater than 1.2 μS longer than the width obtained in (d) (iv).

(f) *Stability check.*
- (i) Connect a variac in the primary circuit of the 4000 V power pack.
- (ii) Decrease the primary voltage and determine the point at which the output pulse



T $\frac{\text{OY-104}}{\text{1-4}}$ **Fig. 4—Waveforms of driver unit under dynamic conditions**

as obtained in (d) starts to widen.

(iii) The secondary voltage at this point should not exceed 2400 V.

(iv) Connect the variac so that it controls the 115 V 60 c/s A.C. supply to the driver unit power packs and the 4000 V power pack (if carrying out this test in the complete equipment use T1976).

(v) Vary the input from 105 V to 125 V A.C.

(vi) The position of the leading edge of the output pulse as obtained in (d) should not vary.

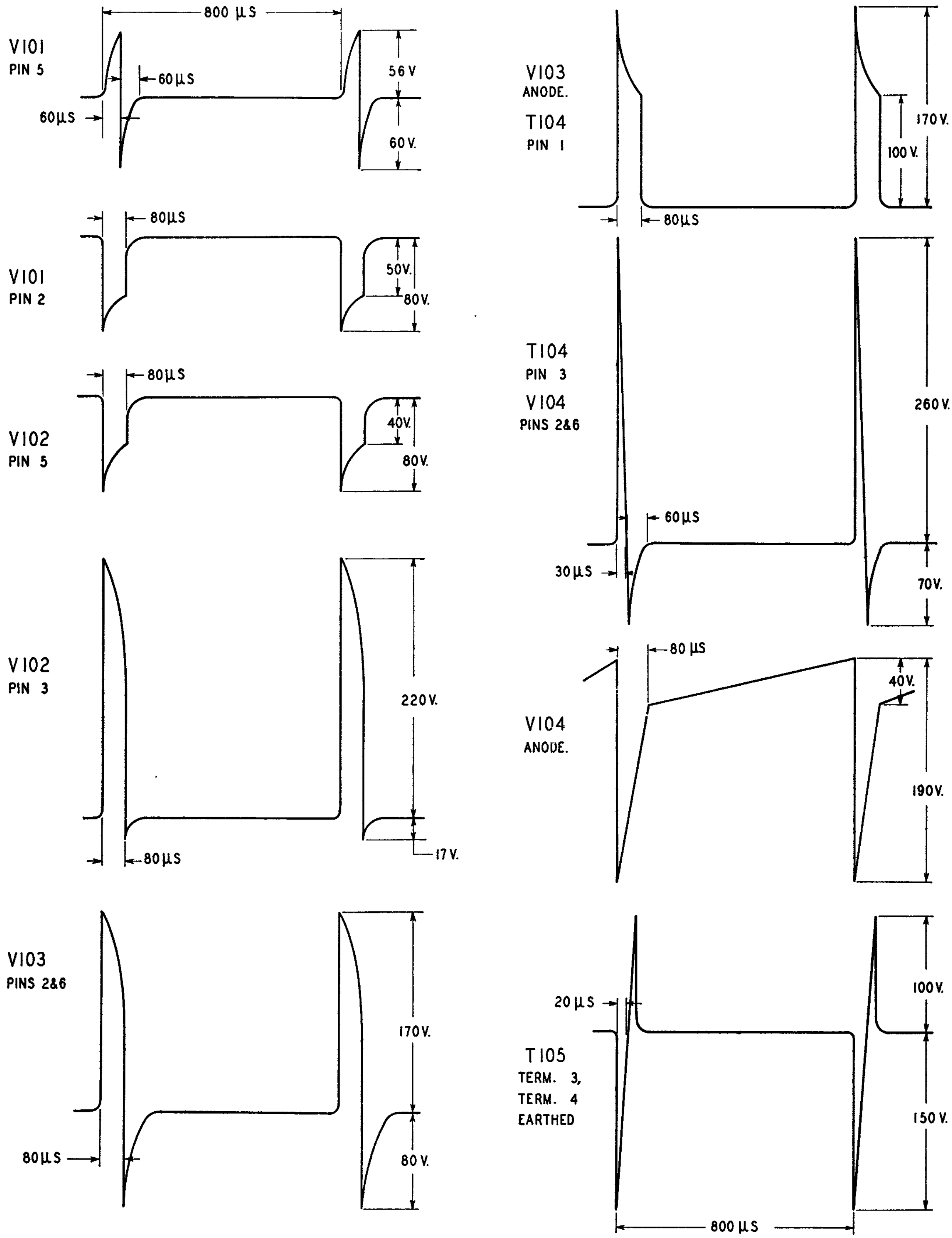
Free running operation

181. The waveforms shown in fig. 5 were obtained from a unit known to be in good operating condition and modified for free running operation as detailed in para. 175.

Testing miscellaneous components

182. (a) *Transformers T104 and T105.* The primary and secondary winding of T104 and the secondary winding of T105 should withstand 4 KV for 30 seconds applied between the winding and case of the transformer without indication of leakage.

(b) *K101.* The relay should close with 90 V 60 c/s A.C. applied to terminals 1 and 2 of transformer T101.



T $\frac{\text{OY-104}}{\text{1-5}}$

Fig. 5—Waveforms of driver unit under free-running conditions

MODULATOR BC-984

VOLTAGE AND RESISTANCE TABLES

Conditions of measurement

183. (a) See paras. 2 to 7.

(b) *Voltages.* All voltages taken to chassis unless otherwise stated.

(c) *Resistances.* Resistance readings on transformers taken at the transformer terminals with windings isolated.

(d) *Currents.*

(i) ON load current measurements taken with all valves in position.

(ii) OFF load current measurements taken with all valves removed.

TABLE 16—VOLTAGE READINGS AT MISCELLANEOUS POINTS

	ON LOAD	OFF LOAD
L202 Ter. 1	—1,500F	—1,460F
Junction R221, R222	—720E	—715E
T214 Ter. 8-10	2,510E A.C.	2,530E A.C.
TB101 Ter. 1	3,900G	4,300G
TB202 Ter. 5-7	6,000F A.C.	6,100F A.C.

TABLE 17—RESISTANCE READINGS AT TRANSFORMERS

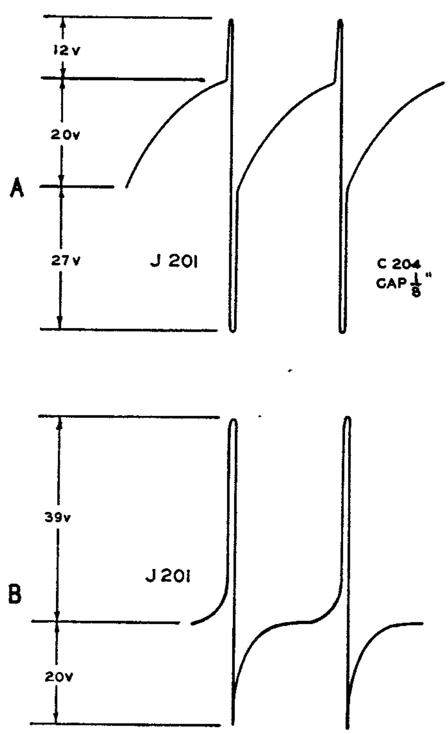
TRANSFORMER	RESISTANCE IN OHMS		
T201	Ter. 1 to ter. 2	Ter. 3 to ter. 4	
G.E.	2.8	0.01	
W	5.0	0.01	
T202	Ter. 1 to ter. 4	Ter. 5 to ter. 6	Ter. 6 to ter. 7
G.E.	0.25	280	280
W	0.62	325	370
T204	Primary	Secondary	
G.E.	285	1.5	
W	260	1.5	
T205	Primary	Secondary	
G.E.	285	1.5	
W	260	1.5	
T206	Primary	Secondary	
G.E.	285	1.5	
W	260	1.5	
T207	Primary	Secondary	
G.E.	285	1.5	
W	260	1.5	

TABLE 17—RESISTANCE READINGS AT TRANSFORMERS—Continued

TRANSFORMER	RESISTANCE IN OHMS		
T208	Primary	Secondary	
G.E.	11.5	0.25	
W	17.5	0.33	
T209	Ter. X_1 to X_2	Ter. H_1 to H_4	Ter. A to D
G.E.	0	0.2	36
W	0	0.5	24
T212	Ter. 1 to ter. 4	Ter. 5 to ter. 6	
G.E.	1.5	0.01	
W	3.7	0.01	
T213	Ter. 1 to ter. 2	Ter. 3 to ter. 4	
G.E.	8.5	0.01	
W	18.5	0.02	
T214	Ter. 1 to ter. 7	Ter. 8 to ter. 9	Ter. 9 to ter. 10
G.E.	1.1	150	150
W	2.0	150	150

TABLE 18—PRIMARY CURRENTS OF TRANSFORMERS

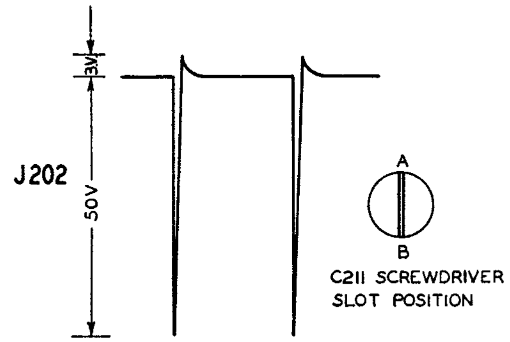
TRANS-FORMER	ON LOAD	OFF LOAD
T201	.67A	
T202	1.5A	.97A
T204	17 mA	
T205	17 mA	
T206	17 mA	
T207	17 mA	
T208		.15A
T214	1.11A	.92A



T OY-104/1-6 **Fig. 6—Waveforms at modulator, J201**

Modulator waveforms

184. Fig. 6A shows waveform taken at J201 for the setting of C204 with ⅛ ins. gap, using an Oscillograph C.R. No. 1 with connections for amplifiers at 2Y1. Fig. 6B shows the same waveform viewed directly on the Y1 plate. Increasing the width of the condenser gap decreases the size of the waveform. Set the gap to ⅛ ins.



T $\frac{\text{OY-104}}{\text{1-7}}$ **Fig. 7—Waveforms at modulator, J202**

185. Fig. 7 shows the waveform at J202 using Oscillograph C.R. No. 1 on amplifiers 2Y1, with the screwdriver control of C211 in the position indicated. Rotation of the control clockwise through 90 degrees slightly decreases the amplitude of the pulse.

REMOVAL AND REPLACEMENT OF COMPONENTS

Blower BL-201 (B sets)

186. (a) *Type.*
2 phase A.C. 1/5 H.P., 110 V. Field windings 6.5 Ω each.

(b) *To remove.*
- (i) Remove the driver unit from the modulator rack.
- (ii) Remove the six screws holding the relay panel to the supports and pull the panel forward. (The bottom left-hand screw looking from the front holds three leads, two brown and a yellow-and-green).
- (iii) Remove the four nuts and bolts holding the blower to the baseplace. (The right-hand bolt carries an earthing lead). This can best be done by inserting the head and shoulders well through the opening left by the removal of the driver unit.
- (iv) Release the three leads from terminals 1, 2 and 3 of TB201 and tag for ease of replacement.
- (v) The blower is now free and can be lifted out through the driver panel opening.

(c) *To replace.*
Replace in the reverse order of removal.

Blower BL-201 (A sets)

187. (a) *Type.*
3 phase A.C. ⅙ H.P. 110 V. Field windings 7.5 Ω each.

(b) *To remove.*
As for BL-201 (B sets) with the exception that five leads must be removed from the relays K202 and K205.

(c) *To replace.*
Replace in the reverse order of removal.

Blower BL-202

188. (a) (i) Resistance of windings 25 Ω (modified).
(ii) Resistance of windings 10 Ω (unmodified).

(b) *To remove.*
- (i) Remove the driver unit and the keyer valves.
- (ii) Pull the relay panel forward as detailed for blower BL-201.
- (iii) Loosen the cable clamp and slip the power lead out.
- (iv) Remove the power lead from terminals 1 and 2 of TB201.
- (v) Remove the clip securing the canvas duct around the blower outlet.
- (vi) The blower is fastened to the rear wall of the modulator compartment by two or four bolts, nuts, lockwashers and spacers, removal of which allows the blower unit to be removed.

(c) *To replace.*
Replace in the reverse order of removal.

Blower BL-203

189. (a) *Type.*
3 phase A.C. ⅙ H.P. 115 V. Field windings 3.5 Ω each (B sets), 12.5 Ω each (A sets).

(b) *To remove.*
- (i) Remove the magnetron air duct by the removal of four screws and lockwashers.
- (ii) This will allow the removal of TB202 by unscrewing the two screws behind the right of the T/R box.
- (iii) Disconnect the two leads between the motor and TB202 at TB202 and the earthing lead at the motor baseplate.
- (iv) The fan and spindle of the motor are visible through the hole left by the removal of the magnetron air duct. Loop a rope around the spindle of the motor and secure it to the large eye bolt to the left of the duct. This rope will be used to take some of the weight when the motor is eventually lowered.
- (v) Remove the driver unit, the keyer valves and the damping diodes.
- (vi) Remove sufficient screws to allow displacement of the air filter cover at the rear of the modulator compartment to permit one man to assist in the removal from that side.
- (vii) A second man should now remove from the top side of the magnetron rack the double locknuts and lockwashers which secure the baseplate of the motor to the top of the modulator compartment.
- (viii) A third man should prepare to take the weight from the door-opening of the rack.
- (ix) The man who removed the securing nuts should slowly lower the motor by slackening off the rope until the other two can take the weight. The motor is then passed across the bases of the keyers and out through the driver panel opening.
- (x) Mark with a sharp instrument the exact

position of the motor with respect to the baseplate. Unless this is done the air duct will not fit correctly into the panel when the motor is replaced.

(xi) Remove the baseplate from the motor.

(c) *To replace.*
Replace in the reverse order of removal. It is essential that the baseplate be attached to the motor correctly and not 180 degrees out, since in the latter case the earthing terminal would be concealed.

To remove line circuit breaker S201

190. (a) Remove the leads from the terminals on the rear of the circuit breaker and tag them for replacement

(b) Remove the four screws from the front panel and the breaker is free.

To dismantle the line circuit breaker S201

191. The following applies to B sets only; S201 in A sets is not designed to be dismantled.

(a) Remove the four screws, two in the top edge at the rear between the contact terminals and two in the bottom rear edge between the contact terminals. (These are not covered with pitch).

(b) Remove the front cover of the circuit breaker together with the four tubular pillars.

(c) Remove the pitch covering the two screws in the face of the breaker which is now revealed.

(d) Remove the two screws and separate the two parts of the breaker.

(e) This reveals the thermal overload strips located underneath the switch mechanism at the base of the switch. These may be removed when necessary by scraping away the pitch covering the retaining screws and unscrewing. NOTE: *The circuit breaker mechanism is secured to the baseplate by rivets, not screws. This switch is fitted with a reset mechanism for readjustment after tripping by the thermal overloads. The switch is reset by pressing to the full extent of the downward position when the overload switch will be heard to click and reset. The clearance between the thermal overload strips and the trip arm should be $\frac{1}{32}$ ins.*

HIGH VOLTAGE RECTIFIER RA-68

REMOVAL AND REPLACEMENT OF COMPONENTS

To remove H.V. transformer T301

192. (a) Take out V301 to V306.

(b) Disconnect high voltage bushing, W301.

(c) Disconnect and remove the assembly holding K307 and R311 and R312.

(d) Remove R301.

(e) Disconnect and remove assembly carrying R306 to R310.

(f) Disconnect and remove assembly carrying R303, R304 and K301.

(g) Disconnect and remove C301.

(h) With all precautions taken to exclude dust and moisture run off the 15 gallons of oil from T301 into clean dry containers.

(i) Disconnect the primary input leads and the lead to S310 (shorting bar).

(j) Remove the blower motor BL301 as detailed in para. 195 (b) or 196 (b).

(k) Carry out the modification to cut a hole in the rear of the high voltage rectifier rack as detailed in Tels OY-107, Mod. Inst. No. 27.

(l) Unscrew the four holding down bolts of the transformer.

(m) Using a crowbar or other lever, raise the front of the transformer sufficiently to insert a ⅝ in. roller bar. Work this to a mid-position and insert two other rollers.

(n) Build up the space between the high voltage rectifier and modulator compartments to take the transformer when removed.

(o) Edge the transformer about 1 ins. to the left to clear the righthand door and pull it clear of the rack.

To remove H.V. transformer, T301 (alternative method)

193. (a) Carry out (a) to (j) of para. 192.

(b) Remove the six ¼ ins. bolts holding the angle iron at the bottom of the compartment to the frame.

(c) Remove the six nuts and bolts holding the same angle iron to the base of the compartment. Remove the angle iron and fronting piece.

(d) Remove the three holding down bolts which are readily accessible.

(e) Using a socket wrench with a 2 ft. 8 ins. extension bar (this can be compounded from two pedestal tool kits or made from any piece of metal of sufficient length and not more than 1 in. cross section on which ½ in. square flats have been filed at each end) remove the fourth rear holding down bolt.

(f) Continue as in para. 192 (m) to (o).

To replace

194. Replace in the reverse order of removal.

Blower BL-301 (B sets)

195. (a) *Type.*
3 phase, 60 c/s, ⅙ H.P., 110 V A.C. Resistance of windings 5.5 Ω.

(b) *To remove.*

(i) Remove the 8 screws along the top and bottom edges of the front panel of the high voltage rectifier rack.

(ii) Remove the three nuts which are along the left-hand inner upright edge of the high voltage rectifier rack which also secure the front panel and remove the panel.

(iii) Remove the three leads from the terminal block TB40 close to the rectifier blower

motor which connect to the voltage regulator and tag them for ease of replacement.
(iv) Remove the four nuts and bolts which secure the mounting plate of the motor to the two cross braces on the floor of the rack and lift out the motor.
NOTE: To remove the two rear bolts the motor must be levered against its rubber mountings to allow the insertion of a Spintite wrench.
(c) *To replace.*
Replace in the reverse order of removal.

Blower BL-301 (A sets)

196. (a) *Type.*
3 phase, 60 c/s, 1/6 H.P., 115 V A.C. Resistance of windings 7.5 Ω.
(b) *To remove.*
(i) For convenience, remove the 16 screws around the lower front panel of the high voltage rectifier rack and remove the panel.
(ii) Remove the three leads to the voltage regulator from terminals 1, 2 and 3 of TB40 and tag for ease of replacement.
(iii) Remove the four slotted head screws, lockwashers and nuts securing the motor plate to the two cross braces and remove the motor and the mounting plate together.
(c) *To replace.*
Replace in the reverse order of removal.

Voltage regulator VR-301 (B sets)

197. *To remove.*
(a) Remove BL301 as detailed in para. 195 (b).
(b) Switch off the main line switch or remove the power cable from the data panel.
(c) Remove and tag for replacement the following:
(i) Cable 100.
(ii) Cable 87, insulate its leads. Switch on the main line switch or reinsert the power cable. An inspection lamp may now be used.
(iii) Cable 71.
(iv) The leads to TB39.
(v) The bottom row of leads to TB38.
(d) Place cables 71, 87 and 100 out of the way to the right of the regulator.
(e) Remove the four bolts holding the regulator to the angle irons in the bottom of the rack. The two bolts facing the doors are easy of access. The two bolts at the rear can best be removed by one man holding the nut with a flat spanner and a second turning the bolt from the front of the rack with a socket wrench, extension bar and 7/16 ins. twelve point from the pedestal took kit.
(f) Looking into the rack through the doors, move the regulator over to the right in order to clear the cableform as the regulator is pulled towards the doors.
(g) Ease the cable form over the driving motor so that it is completely to the rear of the regulator.
(h) To remove the regulator from the rack, turn it slightly anticlockwise and tilt it forward to clear the base of C301. One man can then lift the regulator clear.
NOTE: The regulator weighs 140 lbs.

198. *To remove regulator motor B301*
(a) Remove the three bolts and lockwashers securing B301 to the regulator. Pull the motor gently upwards to free it from the gearing and support it beside the regulator.
(b) Free the motor by removing and noting for replacement, two leads to the upper terminal of C301, one to the lower terminal of C301, one lead from TB38 terminal 2, and the one to the lower limit switch S312.

199. *Maintenance*
(a) Grease the worm gear at the end of the regulator motor shaft with Grease No. 0.
(b) Lubricate the regulator motor ball races with Grease No. 0.
(c) Lightly smear the cams with Grease G.S. This can be done by removal of the inspection plate on the top of the regulator cover.
(d) Check the horizontal worm gear in the head of the regulator for end play and/or backlash. If necessary tighten the two end bearings of the shaft carrying the worm and pinion.

200. *Voltage regulator check*
(a) The following checks can be done with the regulator in the H.V. rack or as a bench test. In the latter case the following supplies are necessary:
(i) 115 V A.C., three phase, connected to terminals 11, 12 and 31 of TB39.
(ii) 115 V A.C., single phase, connected between terminal 2 of TB38 and either terminal 1 or terminal 3 of TB38 depending on whether it is required to lower or raise the output of the regulator.
(b) Close the modulator and high voltage rectifier line circuit breakers, press the START button on the modulator and, with the amber light glowing on the H.V. rectifier, press the CLOSE button.
(c) The voltages between terminals 18, 28 and 38 on TB39 should read less than 12 V. If necessary adjust limit switch S312 in the voltage regulator. See fig. 1036.
(d) Press the RAISE button, S303, when indicator I303 should go out. The voltages between terminals 18, 28 and 38 on TB39 should read between 15 and 20 V.
(e) Continue pressing the RAISE button, S303; when the voltage between terminals 18, 28 and 38 on terminal board TB39 lies between 40 and 50 V, micro switch S313 should open and the red pilot on the modulator rack should light.
(f) With the RAISE button still pressed, the motor driving the regulator VR301 should shut off

when the voltage between terminals 18 and 28 of terminal board TB39 reads 215 to 230 V. NOTE: *This test is best done with the regulator out of the H.V. rack. If adjustment has to be made with the regulator in the rack it is best done by removing the front panel of the rack and the inspection plate on the top of the voltage regulator.*

Voltage regulator R301 (A sets)

201. *To remove*

See removal of VR301 (B sets) para. 197. The following differences should be noted:

(a) The regulator is held to the cross members by four screws.

(b) The cable form to terminal boards TB38 and 39 splits in two so that there is no need to ease it over the top of the motor.

(c) The micro switches are removed by unscrewing two screws in the top switches.

(d) The driving motor assembly is held by two bolts only.

202. *Maintenance*

As for VR301 (B sets) para. 199.

203. *Voltage regulator check*

As in para. 200 (a) to (f) with the following exceptions. Reference should be made to fig. 1037.

(a) Para. 200 (c), the voltage when the amber light goes out should be 20 to 30 V.

(b) Para. 200 (d), the voltage should read 60 to 80 V.

(c) Para. 200 (f), the voltage should read 214 to 245 V.

Resistance data VR301 (A & B)

204. (a) B sets. Regulator motor coils 19 Ω each. Regulator coils 0.75 Ω each.

(b) A sets. Regulator motor coils 38 Ω each. Regulator coils between 0.25 and 0.5 Ω each.

Time totaliser M305

205. (a) *Type.*

(i) Synchronous motor: 115 V, 60 c/s A.C.

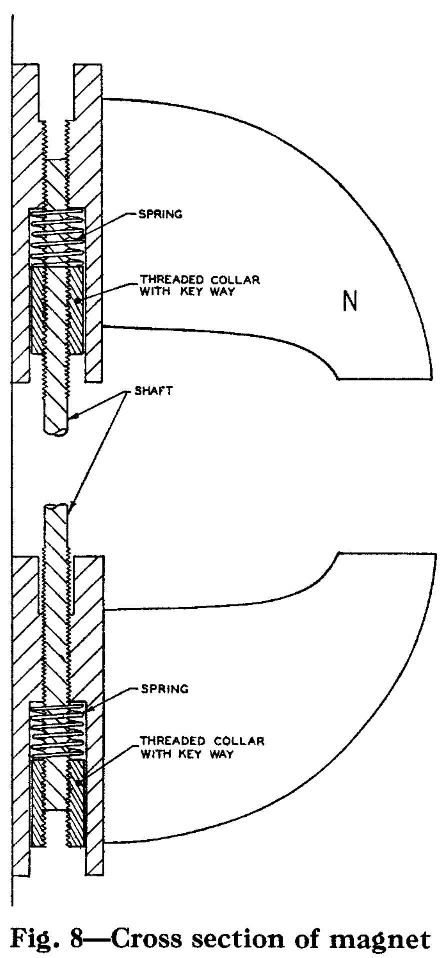
(ii) Resistance of coil (B sets) 750 Ω—operating current 39 mA.

(iii) Resistance of coil (A sets) 2500 Ω—operating current 16.5 mA.

(b) *Maintenance—6 monthly*

Inspect the meter and ensure that the disc is properly centred. Lubricate if necessary with oil, watch, HA0159.

FIELD MAGNET ASSEMBLY



T OY-104 / 1-8 **Fig. 8—Cross section of magnet**

Mechanical description

206. The pole pieces slide in a dove-tailed groove formed by four brackets fitted to the side of the baseplate. Each bracket is secured by two bolts and, in addition to this, the two brackets on the near side (as the magnet is viewed in its mounting) each have two bolts and locknuts giving adjustment to the width of the groove to permit free travel of the pole pieces as the pole spacing is adjusted. There is an adjustable stop between the two pole pieces which is set to ensure that the minimum pole spacing is in excess of the width of the magnetron. The maximum travel of the upper pole piece is limited by a stop bolted to the top of the base-plate. The manual control knob drives through a worm on to a worm wheel fitted to the main shaft which is threaded with right and lefthand threads respectively into the two pole pieces. See fig. 8. To eliminate backlash and give positive movement to the manual control, the threads on each pole piece are loaded by a spring and collar threaded over the shaft, the collar being engaged in a key in the pole piece.

To measure the field strength

207. Remove the magnetron as detailed in Tels. OY-103, Para. C120. Using WY0023 Flux Meter No. C1, ensure that the field strength lies between the limits specified on the manufacturer's nameplate.

To remove the field magnet assembly

208. Remove the magnetron as detailed in Tels. OY-103, Para. 120. Support the magnet and remove the three bolts from the rear of the mounting bracket.

To replace

209. Replace in the reverse order of removal.

To adjust the pole pieces for symmetry with respect to the magnetron

210. If the pole pieces are not equidistant from the magnetron in the position of optimum field strength it will be necessary to adjust the position of one pole piece with respect to the other.

(a) Remove the magnetron as detailed in Tels. OY-103, Para. 120.

(b) Remove the field magnet assembly from its mounting as detailed in para. 208.

(c) Take off the two near side brackets by removing the two inner bolts in each.

(d) Remove the control knob and unscrew the worm from the wormwheel.

(e) Remove the bolts from the bracket securing the shaft to the baseplate, and slide the pole pieces and shaft from the baseplate.

(f) Screw the pole piece in question in the required direction while holding the shaft.

(g) Replace in the reverse order.

Lubrication

211. (a) Remove the magnetron as detailed in Tels. OY-103, Para. 120.

(b) Remove the manual control knob, the washer behind the control knob and unscrew the worm from the wormwheel.

(c) Lubricate the washer, worm, wormwheel and the exposed threads on the shaft with Grease, G.S. Graphited, HA6092 after adjusting the pole pieces to their upper limits by the wormwheel.

(d) Replace in the reverse order but before replacing the magnetron adjust the pole pieces by the wormwheel to minimum and maximum displacement.

(e) If after lubrication the pole pieces show any tendency to stick when the manual control is operated, unscrew the inner bolts on the two nearside brackets of the dovetail groove and adjust the two outer clamping bolts with locknuts until the pole pieces travel freely.

(f) Secure the locknuts and tighten the inner bolts.

TRANSMISSION LINE AND R.F. SYSTEM

Cleaning of transmission lines

212. (a) Immerse the section requiring treatment in a 3% caustic soda solution at 180°F for approximately one hour.

(b) Immerse the section in a 10% solution of commercial grade hydrochloric acid for one half-hour.

(c) Apply about eight hot and sold water rinses to remove the acid.

Re-plating inside of T/R box

213. Should it become necessary to replate corroded T/R boxes the final coat should be gold. The sequence of operations, as used by the manufacturer, is given below for the information of a qualified electro-plater.

(a) Immerse in concentrated potash for one half-hour.

(b) Cold clear water rinse.

(c) Pickle in hot solution 60% sulphuric acid for one half-hour.

(d) Cold clear water rinse.

(e) Bright dip.

(f) Cold clear water rinse.

(g) Quick potash dip.

(h) Cold water rinse.

(i) Light copper plate.

(j) Colder water rinse.

(k) Silver strike.

(l) Silver plate to 0.005 ins.

(m) Cold water rinse.

(n) Hot water rinse.

(o) Colour buffed.

(p) Cold water rinse.

(q) Hot water rinse.

(r) Gold plate to 0.00002 ins.

(s) Hot water rinse.

(t) Colour buffed.

(u) Hot water rinse.

(v) Dry.

LOCAL OSCILLATOR BC-1096

Adjustment of coarse frequency tuning

214. Slacken the hexagonal locknuts on the three adjusting screws. Turning the screws in a clockwise manner increases frequency. Turn each screw successively, not more than one quarter turn at a time until the desired frequency, as measured on the echo box, is obtained. Tighten the locknuts and recheck the frequency. The obtainable frequency band should cover 2670-2930 Mc/s.

VOLTAGE AND RESISTANCE MEASUREMENTS

Conditions of measurement

215. (a) See paras. 2 to 7.

(b) Voltage readings taken with respect to chassis, 115 V A.C. input.

(c) Resistance readings taken to chassis with all cables disconnected unless otherwise stated.

TABLE 19—VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE A		ANODE B		CATHODE	
	Volts	Ohms	Volts	Ohms	Volts	Ohms
V1801	–483E	33K	–485E	33K	37C	1.5K
V1802	–950E	2M	–950E	2M	–485E	33K
V1804	–525E	1.6M (a)	......	...	–630E	2M (a)
V1805	–420E	800K (a)	......	...	525E	1.6M (a)
V1806	–320E	1M (a)	......	...	–420E	800K (a)
V1807	–210E	23K (a)	......	...	–320E	1M (a)
V1803	Reflector volts (Top Cap)		......	...	529E 700-500 (b)	....
	Filament voltage		......	...	6.3 A.C.	....
	Resistance cathode		......	...	33K	....
	Resistance grid		......	...	33K	....

(a) Measured with 500 V megger with valves V1804, V1805, V1806 and V1807 removed.

(b) Varies with setting of REFLECTOR VOLTS.

TABLE 20—VOLTAGES, RESISTANCES AND PRIMARY CURRENTS AT TRANSFORMERS

Trans.	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Primary Current
T1801 Ω	*6* (a) *4* (b)	*6* (a) *4* (b)	*74* (a) *58* (b)	*74* (a) *58* (b) *53* (a) *41* (b)	*53* (a) *41* (b) *126* (a) *99* (b)	*0.1*	*0.1*	*0.1*	*0.1*	130 mA (c) 755 mA (d)
			126 (a) *99* (b)							
V	*115* A.C.	*115* A.C.	*530E* A.C.		*530E* A.C.	*470E* A.C.	*470E* A.C.			
T1802 Ω	*15* (a) *30* (b) *115* A.C.	*15* (a) *30* (b) *115* A.C.	*0.1* (a) *0.2* (b) *6.3* A.C.	*0.1* (a) *0.2* (b) *6.3* A.C.	....	....	....	....	....	112 mA (a) (d) 85 mA (a) (c) 97 mA (b) (d) 37 mA (b) (c)

(a) For Westinghouse equipments.
(b) For G.E. Equipments.
(c) OFF load readings (all valves removed).
(d) ON load readings.

Ripple voltages

216. Between pin 8 of V1803 and ground should not exceed 2.5 V peak to peak (0.9 V r.m.s.). Between the centre tap of R1822 and ground should not exceed 5 V peak to peak (1.8 V r.m.s.). These voltages may either be measured on the oscilloscope or measured across a 1 M ohm resistor with a valve voltmeter, using a 1 μF, 2000 V D.C. working blocking condenser.

RECEIVER SYSTEM

VOLTAGE AND RESISTANCE MEASUREMENT

Conditions of measurement

217. (a) *Voltage*

(i) Units connected by standard test cables. Input voltage 115 V A.C. to Receiver Power Supply RA-66.
(ii) Units adjusted for normal operation.
(iii) All readings +D.C. to chassis unless otherwise stated.
(iv) A.G.C. off unless otherwise stated. With the receiver out of the rack K701 requires to be mechanically closed for manual control.
(v) Gain control fully clockwise unless otherwise stated.
(vi) R727 set to give 120 V D.C. at pin 8 of V708. R743 set to give 0 V D.C. at pin 4 of V701. R749 set to give 1.5 V D.C. at pin 5 of V704, unless otherwise stated.
(vii) No narrow strobe applied.

(b) *Resistance.*

(i) Measurements taken with all cables disconnected.
(ii) Resistances measured to chassis.

TABLE 21—VOLTAGE AND RESISTANCE READINGS AT PRE-AMPLIFIER VALVE BASES

VALVE	ANODE		SCREEN		CATHODE		CONTROL GRID OHMS
	Volts	Ohms	Volts	Ohms	Volts	Ohms	
V1851	106D	Inf.	117D	Inf.	...	120	0
V1852	102D	Inf.	117D	Inf.	...	120	0

TABLE 22—VOLTAGE AND RESISTANCE READINGS AT RECEIVER VALVE BASES

VALVE	ANODE		SCREEN		CATHODE		GRID	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V701	108D	100K	117D	100K	.....	130	0	100K
V702	108D	100K	117D	100K	.....	125	0	0
V703	109D	100K	117D	100K	.....	104	0	0
V704	.....	3.9K	.....	2.5K	.....	1K (a)		
						56 (b)	0	280
V705	290D	110K	119D	100K	.....	100	0	0
V706A	0	0	.....	.....	0	0	0	·4.6K
B	218D	120K	.....	.....	.....	1K	0	4.6K
V707	304D	110K	310D	110K	.....	3.3K	0	100K
V708	310D	110K	308D	110K	120D	100K	92D	600K
V709	92D	600K	120D	100K	0	0	13C (c)	125K (c)
							3C (d)	130K (d)
V710	57C	120K	57C	120K	0	0	0	100K
V711	105D	100K	116D	98K	.....	100	0	0
V712	310D	115K	310D	110K	34C (c)	3.5K	......	500K
V713A	.....	6M	.....	.....	17C	133K	......	6M
B	120D	100K	.....	.....	.....	.....	......	1.5M-1.8M (e)
								0-3K (f)
								3K-13K (g)
V714A	.....	500K	.....	.....	120D	100K	......	500K
B	.....	500K	.....	.....	120D	100K	......	500K

(a) SENSITIVITY control fully clockwise.
(b) SENSITIVITY control fully anti-clockwise.
(c) VOLT. REG. ADJ. control fully clockwise.
(d) VOLT. REG. ADJ. control fully anti-clockwise.
(e) With relay K701 in A.G.C. on position. Varies with setting of A.G.C. ADJUST.
(f) With relay K701 in A.G.C. off position and VOLUME control fully clockwise. Varies with setting of A.G.C. ADJUST.
(g) With relay K701 in A.G.C. off position and A.G.C. ADJUST control fully clockwise. Varies with setting of VOLUME control.

TABLE 23—VOLTAGE AND RESISTANCE READINGS AT REMOTE VIDEO AMPLIFIER VALVE BASES

VALVE	ANODE		SCREEN		CATHODE		CONTROL GRID
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Ohms
V1101	290D	54K	140D	33K	...	150	0
V1102A	.....	5.5K	.....	.....	...	8.0K	5.5K
B	197D	85K	.....	.....	0	0	8.0K
V1103	183D	70K	63C	175K	...	100	500K
V1104	243D	60K	249D	75K	0	0	17.5K

TABLE 24—READINGS AT TRANSFORMERS

Transformers	Ter. 1–Ter. 2		Ter. 3–Ter. 4		Ter. 5–Ter. 7		Primary
	Volts A. C.	Ohms	Volts A. C.	Ohms	Volts A. C.	Ohms	Current mA
T701	115	5	6.5	0.05	6.5	0.2	280
T702	115	5	6.4	0.05	6.5	0.2	330
T1851	115	...	6.6	....	..	...	90

RECEIVER ALIGNMENT

Test equipment required

218. 2—AVO Meters Model 7.
Source of 230 V A.C. single phase
U.H.F. Signal Generator No. 5 Mk. 3.
2—0.001 μF condensers.
Boonton B.F.O. Type 140-A.
1—75 ½ watt resistor.
Cossor D.B. Oscilloscope.
1—450 ½ watt resistor.

General

219. In the alignment of the I.F. stages of the pre-amplifier and servo and range channels it is essential to take the following precautions:

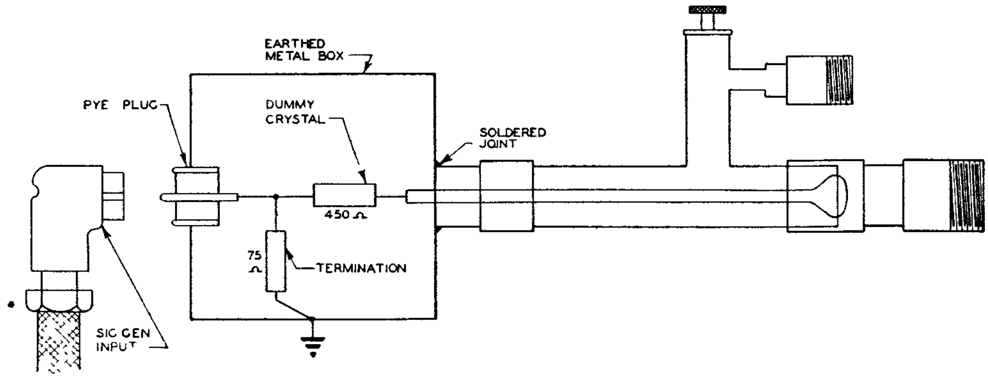
(a) All units, including the signal generator and AVO meters must be earthed, using the shortest possible leads—preferably about 1 in. long. AVO meters with non-metal cases should be screened.

(b) All meter leads must be made with screened cable, the screen earthed at both ends.

(c) The metal plate covering the base of each unit must be in position.

(d) When aligning the preamplifier, main I.F. and remote video panels together on a bench, a distance of not less than 8 feet should separate the preamplifier and the main I.F. units. Since the connecting co-axial cables play a part in the tuning and damping of the first stages, the actual cables as used in the SCR 584 should be used. It is infinitely more preferable to conduct the whole alignment with the three units actually in the set, where the correct cables and adequate earthing and screening are available. If this is done, a source of power, 210-230v A.C. will be required for the signal generator.

(e) On no account should the preamplifier, main I.F. or remote video stages be treated as separate units. By so doing, inaccuracies of the order of ± 1 Mc/s can be introduced into the tuning of the various units. For the same reason it is useless to tune, say, the servo I.F's without noting the effect, as shown on a meter, on the range channel I.F's. Hence, two meters must be used to record changes in the servo and range channels.



T OY-104 1-9

Fig. 9—Signal generator connection to receiver system

Signal generator input

220. The first stage of the preamplifier unit is tuned and loaded normally by the resistance and capacity of the crystal mixer and cable. Since this stage affects the overall performance more than any other, it is essential to simulate these conditions during the alignment. The signal generator input lead is terminated in 75 Ω and the signal is fed through a dummy crystal of 450 Ω as shown in Fig. 9.

Suppression of regeneration

221. A 0.001 μF condenser is necessary across the terminals of each AVO. This is best fitted at the output from the valves so that only D.C. is present in the leads.

Output measurement

222. The output is measured as current through V706 and V1102. The meter is connected in series at the junction of R746 and L707 for the servo channel and R1124 and L1103 for the range channel.

Tuning

223. Tuning is best done at high gain setting but with a small enough signal to avoid saturation. When tuning T1852 on the preamplifier, care must be taken to tune the secondary of the transformer and not the primary. If the tuning slug is too far out it will be in the primary coil. If the main I.F. unit is removed from the rack, the A.G.C. relay must be mechanically closed for manual control.

Sensitivity

224. Table 25 shows figures for each section of the receiver. In the case of the preamplifier, a sufficiently accurate check can be made by connecting the output direct to the remote video amplifier and measuring output through V1102, since V1101 is an untuned stage of low gain.

Method of alignment

225. (a) Set up the signal generator No. 5 for input with dummy crystal of 450 Ω into the preamplifier, as given in para. 220.

(b) Connect the two AVO meters, Model 7 in series with the diode loads as indicated in para. 222.

(c) Remove the lead from the junction of C728 and R732 and connect it to pin 5 of V713 in sets not modified for N² gate. For sets modified for N² gate, disconnect the lead from the junction of R 2557 and R 2556 and connect it to pin 5 of V713.

(d) Set the voltage at pin 5 of V713 to 120V D.C. by means of R727, VOLT. REG. ADJUST. Adjust R749, SENSITIVITY, to give ±1.5V at pin 5 of V704. Set the voltage at pin 4 of J701 to 0V. with A.G.C. OFF and gain control at maximum by means of R743, A.G.C. ADJUST.

(e) Set the signal generator for 30 Mc/s, and with gain at maximum adjust the attenuator of the signal generator to give 800 μA receiver output using the 0.002A AVO scale with ÷2 button depressed.

(f) Beginning with L1102, carefully tune for maximum current on the AVO in series with V1102 cathode. Repeat on L708.

(g) Tune L706 and L705 for maximum current on the servo channel AVO *at the same time* noting any change on the range channel meter. Tune L704 for maximum reading on *both* meters.

(h) Repeat (f) and (g) to give simultaneous peaking in both channels.

(i) Tune, L703, L702, L1856, L1853 and T1852 in that order.

(j) If any appreciable increase in output current occurs during (f) to (i), decrease the signal generator output to avoid saturation.

(k) To check alignment, note the reading of both meters, swing the signal generator frequency between 27 and 33 Mc/s. and ensure that there is only one peak at 30 Mc/s.

Preamplifier and main I.F. sensitivity check

226. (a) After alignment as in para. 225, switch off the signal generator.

(b) With gain at maximum record the reading of both meters, measuring total noise plus diode current.

(c) Turn the gain to minimum and again read both meters, measuring diode current.

(d) Check that the 6AC7 in V1851 is the best available from a signal to noise ratio point of view. Similarly ensure that the 6SN7 valves in V706 and V1102 are the best available from the point of view of low diode current together with high signal current, with the gain at maximum.

(e) Switch on the signal generator, set it to 30 Mc/s CW and allow it to warm up. With gain at maximum adjust the signal generator attenuator to give 500 μA signal above noise level on each of the meters in turn. Record the signal generator input required for each channel. Values should not be less than those given in Table 25.

Preamplifier sensitivity

227. (a) After alignment as in para. 225 connect P705 to J1101. This is possible in the set if the position indicator unit is temporarily removed from the rack and the receiver power supply and remote video amplifier panels are moved down one stage.

(b) This connection will include V1101 in the check of the preamplifier but it can be seen from Table 25 that the gain for this stage is little more than unity.

(c) Increase the signal generator input to give 500 μA above noise and diode current and check the value against Table 25.

Main I.F. sensitivity

228. (a) Remove the 450 Ω dummy crystal and the 75 Ω terminating resistor from the signal generator input. Connect the signal generator directly to J705 and earth the outer sheath.

(b) Adjust the signal generator input to give 500 μA increase above diode current. Check that the input required is not greater than that given in Table 25.

Overall sensitivity

229. (a) *Input.* Square wave modulated 30 Mcs from Signal Generator No. 5 Mk. 3 fed through 75 Ω termination and 450 Ω dummy crystal as in para. 220.

(b) *Output.* From J702 for servo channel and J1102 for range channel.

(c) *Conditions.*

(i) Using a sheathed cable, connect the lead from J702 or J1102 to Y1 and the sheath to the earth terminal of the Oscillograph, C.R. No. 1.

(ii) With gain at maximum measure the noise level.

(iii) Switch on the signal generator and adjust the attenuator for maximum output on the C.R.O. without saturation, after allowing time for the signal generator to warm up. Measure the height of the waveform and record the input voltage.

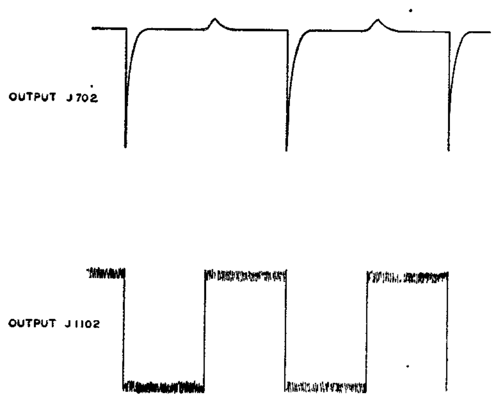
(iv) Calibrate the C.R.O. from an A.C. source and calculate the overal sensitivity.

NOTE: The waveforms on the C.R.O. from J702 and J1102 should be as in Fig. 10, that from J702 being due to differentiation of the square wave through C725 and R717. The overall gain should be not less than that given in Table 25.

TABLE 25—RECEIVER SENSITIVITIES

Input at:	Output at:	Voltage Input μV.	db down on Sig. Gen. No. 5	Gain db.	Voltage on C.R.T. Waveform
Pre-amp. P1951	J1853 via Cable 38 to J1101 and Range Detector	20,000*	20	36	....
J705	Servo Detector V706	2,500*	38	60	....
J705	Range Detector V1102	3,100*	36	52	....
Pre-amp. P1951	Servo Detector V706	40*	74	96	....
Pre-amp. P1951	Range Detector V1102	43*	73	89	....
Pre-amp. P1951	Servo Video Amp J702	20	80	130	60V.
Pre-amp. P1951	Range Video Amp J1102	18	81	135	104V.
7th IF (Range) J1101	Range Detector V1102	100,000 for 42μA signal increase	6	0.1	.....

* Voltage required to produce 500μA signal current above noise.



T $\frac{\text{OY-104}}{\text{1-10}}$ **Fig. 10—Receiver waveforms at J702 and J1102**

Response curves and bandwidth

230. Response curves for preamplifier (see para. 227 (b)), servo and range IF and preamplifier plus servo and range IF are given in Fig. 11. These were taken in the usual manner by increasing signal generator output for a constant total diode current of 800 μA. From these curves, bandwidth limits for 3db and 6db down are given in Table 26. For a quick check, response curves may be dispensed with and with the frequency swung about 30 Mc/s, measure for a 3db and a 6db increase of signal input. It is again emphasized that the bandwidth is very closely related to the loading of the first pre-amplifier stage and any variation from the conditions given will result in different values for bandwidth being obtained.

231. In general, the response curves are not symmetrical, a steeper fall existing on the higher frequency side of 30 Mc/s. Moreover, response curves for any one of the units alone may show a peak slightly away from 30 Mc/s, which emphasizes the need to treat all three units as a single receiver.

Signal to noise check

232. (a) *Input.* Square wave modulated 30 Mc/s through 75 Ω termination and 450 Ω dummy crystal to V1851.

(b) *Output.* Shielded co-axial line from J1102 to Y1 and earth of Oscillograph, C.R. No. 1.

(c) *Method.*

(i) Switch on the signal generator and with gain at maximum adjust the input to give a waveform of a reasonable size (1 in.) on the C.R.O. for the purpose of setting correct time base COND. and SYNC. controls. Switch off the signal generator.

(ii) With gain at maximum measure the height of the noise on the C. R. O. Reduce the VOLUME control to give one-third of the height as at maximum gain; this will avoid saturation in (iii).

(iii) Switch on the signal generator and adjust the attenuator to give a pulse waveform of twice the height of the reduced noise in (ii). Input at the point where the pulse is twice as high as the noise should be 10 μV or less.

Diode splash current and noise

233. Diode valves from different manufacturers and also different valves from the same manufacturer vary considerably in the amount of splash current they produce.

234. A good diode will produce about 40 μA splash current and a bad one as much as 150 μA. An average valve is about 60 μA.

235. Diode splash current and noise may be measured as follows:

(a) With the signal generator switched off and the manual gain at maximum, read the diode current. This represents noise plus splash current.

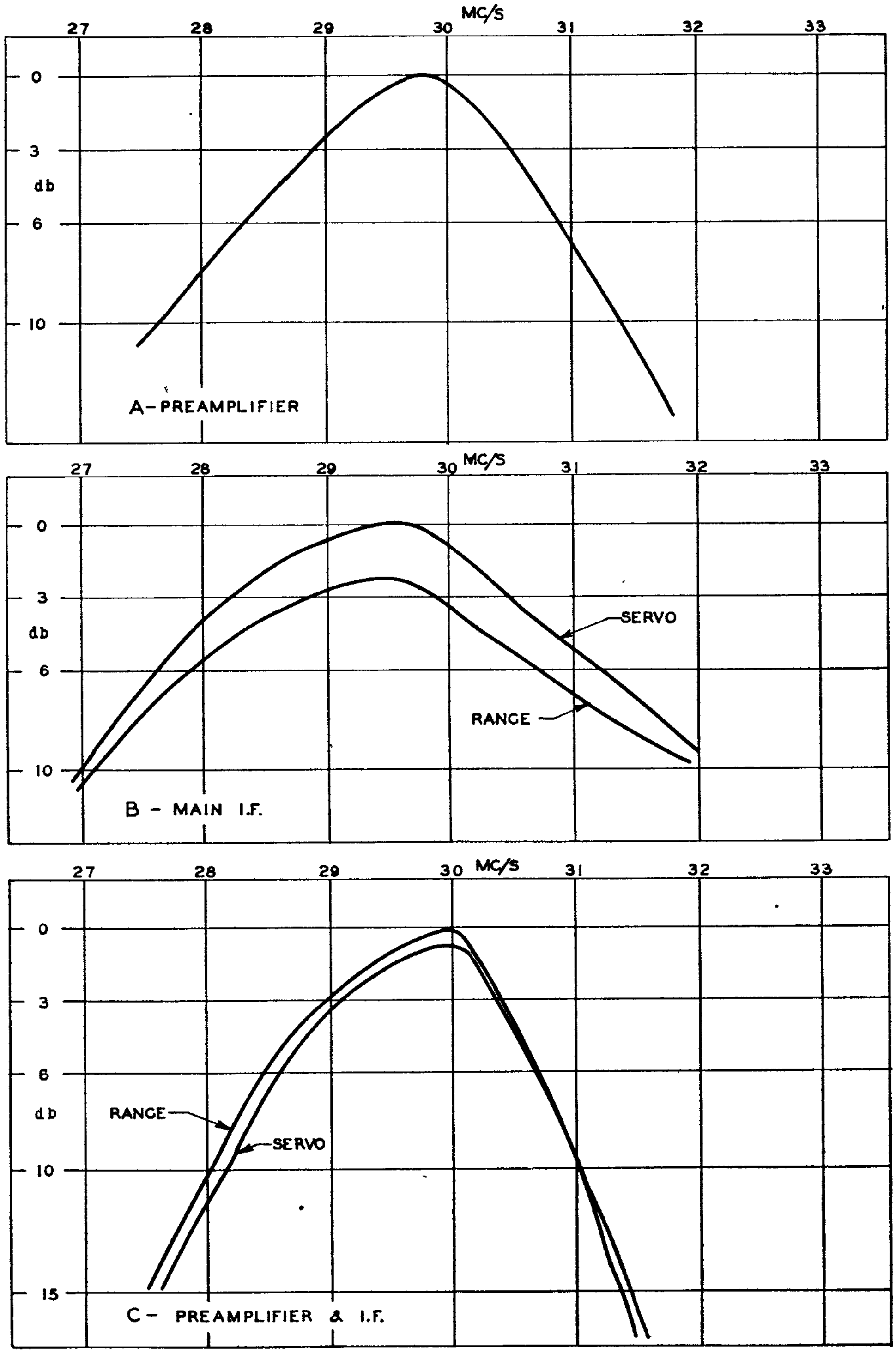
(b) Turn the manual gain to zero or remove V705 for the servo channel, or V1101 for the range channel. Read the diode current again. This second reading represents diode splash current. Subtraction of the second from the first reading gives the current due to noise. This again varies between wide limits, with an average value of about 150 μA. The two preamplifier valves, V1851 and V1852, contribute almost all the noise and should first be changed if the value is excessive.

A.G.C. performance

236. (a) *Input.* Square wave modulated 30 Mc/s through 75 Ω termination and 450 Ω dummy crystal to V1851.

TABLE 26—BANDWIDTHS

STAGE	BANDWIDTH AT: 3db.	BANDWIDTH AT: 6db.
Pre-amp. (see para. 227 (b))	1.6 Mc/s.	2.6 Mc/s.
Servo I.F.	2.5 Mc/s.	3.9 Mc/s.
Range I.F.	2.8 Mc/s.	4.2 Mc/s.
Overall (Pre-amp. and Servo I.F.)	1.6 Mc/s.	2.4 Mc/s.
Overall (Pre-amp. and Range I.F.)	1.5 Mc/s.	2.3 Mc/s.



T $\frac{\text{OY-104}}{\text{1-11}}$

Fig. 11—Response curves of receiver system

(b) *Output.* Screened co-axial lead from J702 to Y1 and earth of the oscilloscope. Screened co-axial lead from pin 6 of V713 to the negative terminal of the AVO meter. Screen earthed at V713 and connected to AVO positive. AVO on 10V. D.C. range.

(c) *Method.*

(i) Remove the wedge from the A.G.C. relay and apply 115V A.C. to A and B of J701.

(ii) Switch A.G.C. ON.

(iii) Switch on the signal generator and adjust the attenuator until a pulse can just be seen above or in the noise. Record the signal generator input, bias volts and amplitude of pulse.

(iv) Increase the signal generator input by 5-10db stages, recording input, bias voltage and signal amplitude. The results should correspond to within about 20% of the figures given in Table 27.

A.G.C. filtering

237. (a) *Input.* J705 direct from Boonton B.F.O. Type 140-A at 30 c/s. 35V.

(b) *Output.* Screened lead from pin 6 of V713 to AVO on A.C. 10V range.

(c) *Method.* Inject 30 c/s from B.F.O. and measure A.C. ripple voltage at V713 Pin 6. Limit—0.02V A.C. for 35V input.

Servo channel gating

238. (a) *Input.* 75V negative pulse at 1707 c/s. recurrence frequency and variable in width between 1 and 10 μS. (narrow gate output should be used if available).

(b) *Output.* Screened lead from pin 8 V712 to Y1 plate of Oscillograph, C.R. No. 1 Mk. 2.

(c) *Method.* Disconnect the lead connected to pin 5 of V713 in para. 225 (c) and reconnect it to the junction of C728 and R732. Inject the pulse at J703 and check that the output at pin 8 of V712 is of the order of 120V with a steep leading edge.

TABLE 27—A.G.C. PERFORMANCE

Input in μV at V1851	db down on Sig. Gen. No. 5	Output at J702 volts	Neg. Bias. volts
11	85	0	–1.4
20	80	26	–1.5
35	75	31	–1.6
63	70	55	–1.7
200	60	57	–2.4
630	50	57	–2.9
2000	40	57	–3.3
6300	30	57	–3.7
20000	20	60	–3.9
63200	10	60	–4.2
200000	0	62	–4.5

RECEIVER BC-1056 MODIFIED WITH N^2 GATE

Voltage and Resistance measurements

239. (a) *Conditions of voltage measurement.*

(i) Units connected by standard test cables. Input voltage to Receiver Power Supply RA-66, 115V.

(ii) Units adjusted for normal operation.

(iii) All readings D.C. to ground unless otherwise stated.

(iv) A.G.C. off, unless otherwise stated.

(v) VOLUME control fully clockwise unless otherwise stated.

(vi) R727 set to give 120V D.C. at pin 8 of V708. R743 set to give +1V D.C. at pin 4 of V701. R749 set to give +2.3V D.C. at pin 5 of V704.

(vii) No narrow or N^2 gate applied.

(b) *Conditions of resistance measurement.*

(i) All cables disconnected.

(ii) All readings taken to earth.

TABLE 28—VOLTAGE AND RESISTANCE READINGS AT RECEIVER VALVE BASES AFFECTED BY THE N^2 GATE MODIFICATION

VALVE	ANODE		SCREEN		CATHODE		GRID	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V704	310D	110K	–9C	9K	....	56	.....	270
V706A	0	0	.....	.....	....	....	.....	4.6K
B	218D	120K	.....	.....	....	1.1K	.....	4.6K
V707	298D	110K	310D	110K	....	950	.....	100K
V711	115D	100K	118D	100K	2.3B 1.2-2.5 (a)	815 100-1K (a)	.....	0
V712	310D	110K	310D	110K	....	1.5K	.....	480K

(a) Value varies with setting of SENSITIVITY control.

Receiver Sensitivities

240. Introduction of the N^2 Gate modification has no appreciable effect on the receiver sensitivity or bandwidth. It should be noted that the setting of the SENSITIVITY control R749, can cause a change of approximately 10 db in over-all output gain in the range channel.

A.G.C. Check

241. The A.G.C. action is stronger after the N^2 Gate modification and the figures given for negative bias volts in Table 27 should all be increased by –0.2 V. It will probably be found necessary to turn the SENSITIVITY control fully clockwise to overcome this increased A.G.C. action.

RECEIVER POWER SUPPLY RA-66

VOLTAGE AND RESISTANCE READINGS

Conditions of Measurements

242. (a) *Voltage*

(i) Unit connected by the standard test cable. Input voltage 115V A.C.

(ii) All readings D.C. to earth unless otherwise shown.

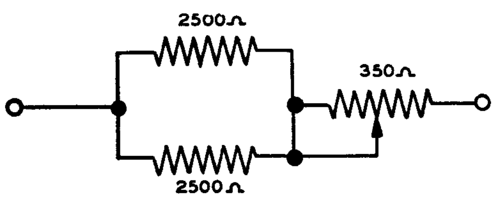
(iii) ON LOAD readings taken with J1001 and J1002 connected to the receiver, (plus preamplifier) and remote video amplifier. All units properly set up and switched on.

(iv) OFF LOAD readings taken with J1001 and J1002 disconnected and pins A and G of J1002 shorted together.

(b) *Resistance*

(i) All readings taken to earth unless otherwise shown.

(ii) All cables disconnected.



T $\frac{\text{OY-104}}{\text{1-12}}$ **Fig. 12—Dummy load for receiver power supply and field power supply**

Conditions for dummy load bench test

243. (a) *300 V output*

(i) A.A. No. 3 Mk. 5 spares should be connected as follows: 2 x 2,500 Ω connected in parallel, R215, R216, R217 or R218, in series with a 350 Ω variable resistor, R1674. This gives a load variable between 1250 and 1600 Ω with a dissipation greater than 75W, as in Fig. 12.

(ii) Connect the load between pin H of J1002 and earth. When the variable resistor is set to give the following currents, the voltages across the load corresponding to each current should be obtained to within ±5%.

192 mA..........313V
212 mA..........305V
236 mA..........296V

(b) *–105 V output*

Connect a 10,000 Ω, 10W resistor, R718, between pin B of J1002 and earth. A current of 12 mA D.C. at 107 V ±5V should be obtained.

(c) *6.3 V heater supply to remote video amplifier unit.*

Connect 4 x 10 Ω resistors in parallel, R209, R210, or R211, giving a load 2.5 Ω, 32W, between pins A and G of J1001. A current of 2.6 A A.C. at 6.3V A.C. ±0.3V should be obtained.

Voltage regulation on 120V supply

244. A variation of $\pm 10\%$ input voltage to the receiver power supply should not cause a variation of greater than 1% in the 120V D.C. supply as measured at pin G of P707, with the elbow cover removed.

TABLE 29—VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE—1		ANODE—2		CATHODE	
	Volts	Ohms	Volts	Ohms	Volts	Ohms
V1001	450D A.C. (a)	25 (c)	450D A.C. (a)	25 (c)	400D (a) 5.0 A.C. (a)	12.3K
	425D A.C. (b)	60 (d)	425D A.C. (b)	60 (d)	340D (b) 5.0 A.C. (b)	
V1002	455D A.C. (a)	25 (c)	455D A.C. (a)	25 (c)	400D (a) 5.0 A.C. (a)	12.3K
	425D A.C. (b)	60 (d)	425D A.C. (b)	60 (d)	340D (b) 5.0 A.C. (b)	
V1003	740D A.C. (a) 710D A.C. (b)	100K	740D A.C. (a) 710D A.C. (b)	100K	5.0 A.C. (a) 5.0 A.C. (b)	0
V1004	0 (a) 0 (b)	0	....	.....	–108D (a) –105D (b)	106K

(a) OFF load readings.
(b) ON load readings.
(c) B sets.
(d) A sets.

TABLE 30—VOLTAGE READINGS AT CONDENSERS

CONDENSER	VOLTAGE
C1001	396D (a) 320D (b)
C1002	392D (a) 292D (b)
C1003	–298D (a) –290D (b)
C1004	–285D (a) –280D (b)

Explanation of suffixes is given at end of Table 29.

TABLE 31—VOLTAGE READINGS AT MISCELLANEOUS POINTS

T1003	6.7 A.C. (a) 6.3 A.C. (b)	Terminals 5 to 7 Terminals 5 to 7
J1001	392D (a) 292D (b)	At pin H At pin H
J1002	–285D (a) –280D (b)	At pin B At pin B
	392D (a) 292D (b)	At pin H At pin H

Explanation of suffixes is given at end of Table 29.

TABLE 32—RESISTANCE READINGS AT TRANSFORMERS AND CHOKES

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7
T1001	*0.5* (c) *2.5* (d)	*0.5* (c) *2.5* (d)	*50* (c) *120* (d)	....	*50* (c) *120* (d)	....	....
T1002	*3.6* (c) *8* (d)	*3.6* (c) *8* (d)	*140* (c) *310* (d)	....	*140* (c) *310* (d)	*0.1* (c) *0.1* (d)	*0.1* (c) *0.1* (d)
T1003	*4* (c) *2.3* (d)	*4* (c) *2.3* (d)	*0.06* (c) *0.05* (d)	*0.06* (c) *0.05* (c)	*0.1* (c) *0.06* (d)	....	*0.1* (c) *0.06* (d)
L1001	*112* (c) *92* (d)	*112* (c) *92* (d)	....	....	....	....	....
L1002	*116* (c) *115* (d)	*116* (c) *115* (d)	....	....	....	....	....
L1003	*375* (c) *350* (d)	*375* (c) *350* (d)	....	....	....	....	....
L1004	*355* (c) *350* (d)	*355* (c) *350* (d)	....	....	....	....	....

Explanation of suffixes is given at end of Table 29.

TABLE 33—TRANSFORMER PRIMARY CURRENT READINGS

Component	Off Load Current	On Load Current
T1001	380 mA (c) 260 mA (d)	1.1A (c) 950 mA (d)
T1002	310 mA (c) 308 mA (d)	310 mA (c) 315 mA (d)
T1003	350 mA (c) 400 mA (d)	480 mA (c) 510 mA (d)

Explanation of suffixes is given at end of Table 29.

RANGE UNIT BC-1062

VOLTAGE AND RESISTANCE TABLES

Conditions of Measurement

245. (a) *Voltage.*

(i) See paras. 2-7.

(ii) All voltages taken to chassis.

(iii) Voltage readings taken with all cables connected.

(iv) If the range unit is set up, removed from the rack and connected solely to the range unit power supply via the cable from J803 to J609, and provided that a 20,000 Ω resistor is connected between B & C of J610 with a lead from A to B or C to simulate the 0 or 32,000 yd. position of the SLEWING handwheel, the only voltage which varies from those given in the table is V613 cathode which becomes 37 V.

(b) *Resistance.*

(i) All resistances taken to chassis with all cables disconnected.

TABLE 34—VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

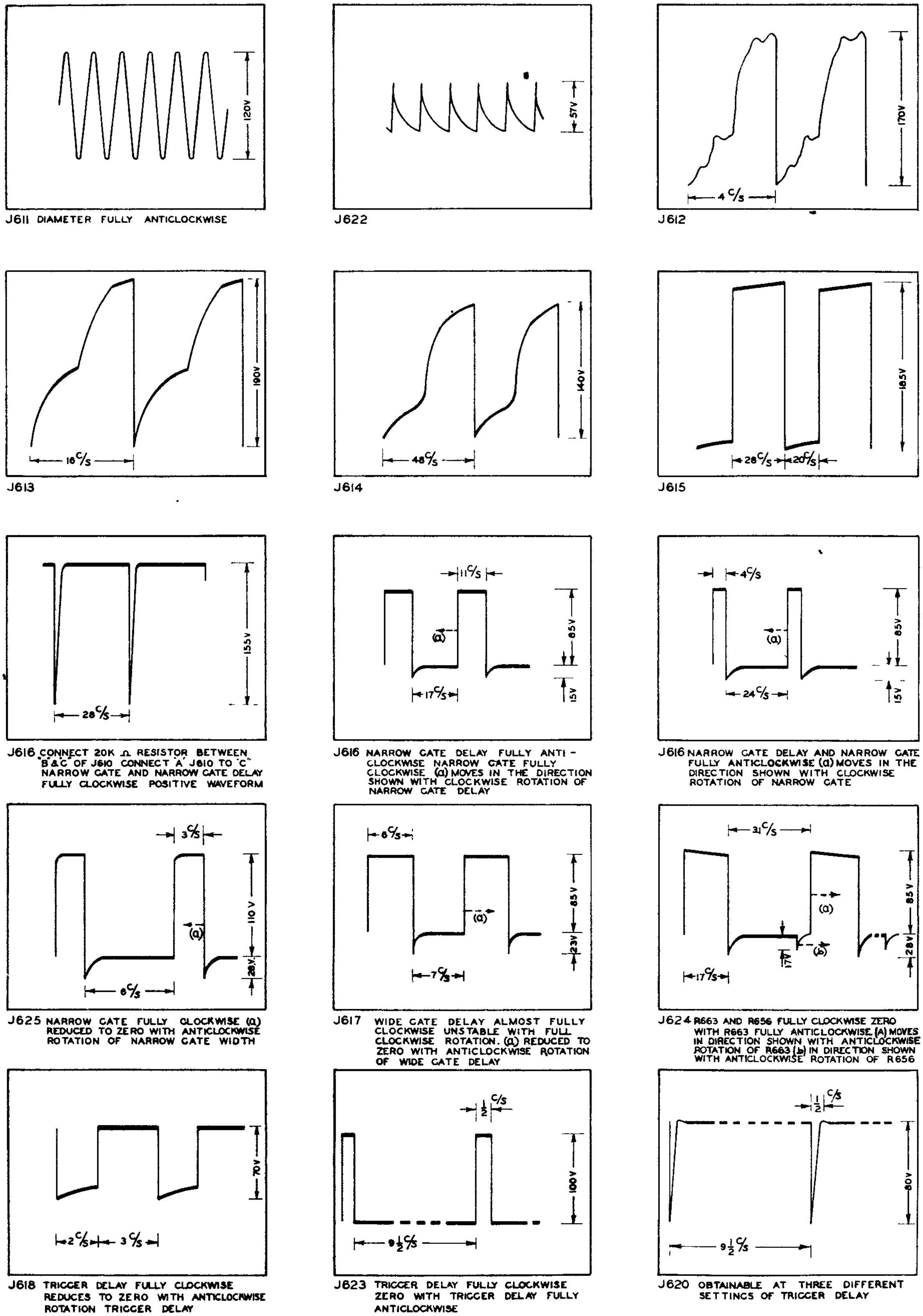
VALVE	ANODE		SCREEN		CATHODE		GRID	
	VOLTS	OHMS	VOLTS	OHMS	VOLTS	OHMS	VOLTS	OHMS
V601	250D	30K	56E 40-118 (b)	360K 130K- 630K (b)	...	530	......	2.2M
V602A	167D	52K	....	....	...	0	......	47K
B	190D	52K	....	....	...	0	......	120K
V603A	150D	52K	....	....	...	.....	......	47K
B	170D	52K	....	....	...	.....	......	125K 27K-127K (f)
V604A	166D	52K	....	....	...	.....	......	47K
B	146D	52K	....	....	...	.....	......	20K 15K-40K (g)
V605	250D	30K	45E 0-95 (c)	110K 0-140K (c)	...	1K	......	470K
V606	157D	40K	75E	77K	...	150	......	100K
V607A	235D-245D (a)	36K	....	....	...	2.7K	......	3.3
B	165D-185D (a)	36K	....	....	...	2.7K	......	Inf.
V608A	125D	37K	....	....	...	0	......	45K 2.7K-500K (d)
B	245D	34K	....	....	...	0	–17D 0-24 (d)	Inf.
V609A	242D	35K	....	....	...	2.7K	......	65K 24K-100K (h)
B	165D	35K	....	....	...	2.7K	......	3.3M
V610A	165D	37.5K	....	....	...	0	......	360K 1.5K-500K (i)
B	225D	34K	....	....	...	0	–8	4.7M
V611A	243D	35K	....	....	...	2.7K	12 7-13 (e)	125K 92K-167K (e)
B	165D	35K	....	....	...	2.7K	......	3.3M
V612A	240D	37.5K	....	....	...	820	......	27K
B	135D	37.5K	....	....	...	820	......	3.3M
V613A	250D	30K	....	....	12E	10K	......	100K
B	250D	30K	....	....	45E	8.2K	......	1M
V614	244D	35K	–11E	33K	...	0	......	180K

(a) Varies with rotation of SLEWING handwheel.
(b) Varies with rotation of R698, 2,000 YD. DIAMETER.
(c) Varies with rotation of R699, 32,000 YD. DIAMETER.
(d) Varies with rotation of R646, NARROW GATE WIDTH.
(e) Varies with rotation of R673, TRIGGER DELAY.
(f) Varies with rotation of R624, 5 KC MV.
(g) Varies with rotation of R616, 1.7 KC MV.
(h) Varies with rotation of R656, WIDE GATE DELAY.
(i) Varies with rotation of R663, WIDE GATE WIDTH.

TABLE 35—VOLTAGE AND RESISTANCE READINGS AT JACKS

JACK	VOLTS	OHMS	JACK	VOLTS	OHMS
J601A	....	0	J609B	....	30K
B	....	0	C	....	Inf.
C	7E	420K	D	....	Inf.
	(−50)−60 (b)	380K-120K	E	....	0
D	0	....	F	....	Inf.
	(−50)−60 (a)	380K-120K	G	....	Inf.
J602A	....	0	H	....	440K
B	....	0			
C	30E	420K	J610A	....	Inf.
	+60−(−50) (c)	120K-380K (c)	B	....	5K
D	0	480K			9K-4K (f)
	+60−(50) (d)	120K-380K (d)	C	....	10K
					14K-9K (f)
J603	....	1M			15K-10K (g)
J604	....	1M	J619	250D	30K
J605	....	1M	J621	−11C	Inf.
J606	....	0	J622	−35C	Inf.
J607	....	1M	J623	−11C	Inf.
J608	....	0	J624	....	1M
J609A	....	380K	J625	....	1M

(a) Varies with rotation of R629, 2000 yd. CENTERING.
(b) Varies with rotation of R628, 2000 yd. CENTERING.
(c) Varies with rotation of R622, 32,000 yd. CENTERING.
(d) Varies with rotation of R623, 32,000 yd. CENTERING.
(e) Becomes less negative by 8 V when output cables are disconnected.
(f) NARROW GATE control set in the operating position, value varies with NARROW GATE DELAY control.
(g) NARROW GATE DELAY control set in the operating position, value varies with the NARROW GATE control.



T $\frac{\text{OY-104}}{\text{1-13}}$

Fig. 13—Range unit waveforms

WAVEFORMS

246. The waveforms in fig. 13 were taken on a range unit which had been set up in the control rack. It was then removed and connected to the range power supply unit only. The narrow gate range potentiometer, R901, was simulated by a 20,000 Ω resistor inserted between pins B and C of J610 with A joined to C.

247. The outputs at the various points were applied direct to the Y1 terminal of the oscillograph C.R. No. 1 and checked for duration against the sinusoidal output of the crystal oscillator obtained by connecting J611 to the Y2 terminal.

SETTING-UP WITHOUT THE RANGE INDICATOR

248. The following tests employing bench set-ups are intended to be used only when a range indicator unit is not available. After a range unit has been set up by these methods it should be re-checked when replaced in a set.

249. Oscillograph C.R. No. 1 modified to permit grid modulation as detailed in War Office (DMM) Modification Circular (Telecoms. Misc.) T/M 1 dated 23 Feb. 42, is required in the following tests.

NOTE: *For better brilliance under normal conditions, when grid modulation is not required, the 10,000 Ω resistor should be short-circuited.*

To modify the Oscillograph C.R. No. 1 to permit X amplification

250. (a) Remove the C.R.T. from its' case.
(b) Mount two tip jacks about half an inch apart between the two fuses on the bakelite panel at the rear of the C.R.T.
(c) Run a lead from one of these tip jacks to the lower end of the two tags marked XI.
(d) Run another lead from the other tip jack through the hole in the rear left-hand corner of the chassis and join it to the tag of C38 which is closer to the rear of the chassis.

NOTE: *When the instrument is to be used on X amplification the rear cover plate is removed and the two jacks are short-circuited. The services switch on the front panel is set to Y1Y2 and terminals A1 and A2 are used.*

To set up the multivibrators using the Dumont or G.E. Oscillograph

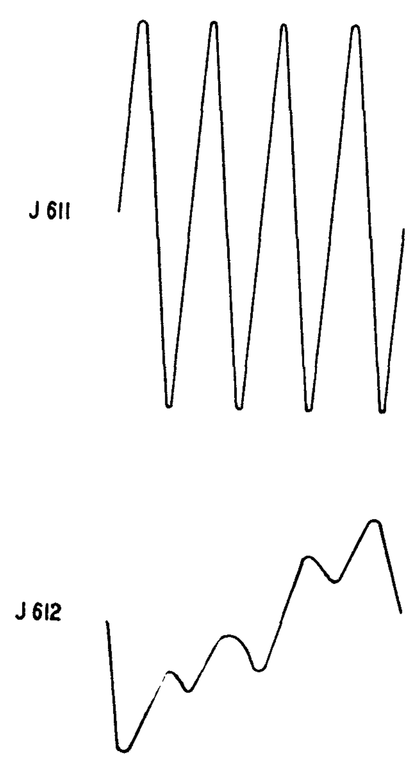
251. (a) Connect the range power supply to the range unit by cable W2110 between J803 and J609.
(b) Switch on the units and allow 20 minutes for warming up. Check that the voltage at J619, is 250 V D.C. Adjust VOLT. REG. ADJ. control on the range power supply if necessary.
(c) With a common earth between the oscillograph and the range unit, plug in to J611 and J612 and apply the signals through a 500,000 Ω resistor to the X and Y terminals of the C.R.T.
(d) Adjust C606, 20 KC MV, if necessary, for a 4:1 Lissajou figure. Set control to the centre of the range of travel over which this figure is obtainable.
(e) Plug in to J612 and J613 and tune R624, 5 KC MV, for a 4:1 Lissajou figure leaving the control set as in (d).
(f) Plug in to J613 and J614 and tune R616, 1.7 KC MV, for a 3:1 Lissajou figure leaving the control set as before.
(g) Recheck each pair to ensure that no change has taken place.

To set up the multivibrators using an Oscillograph C. R. No. 1 modified to permit X amplification

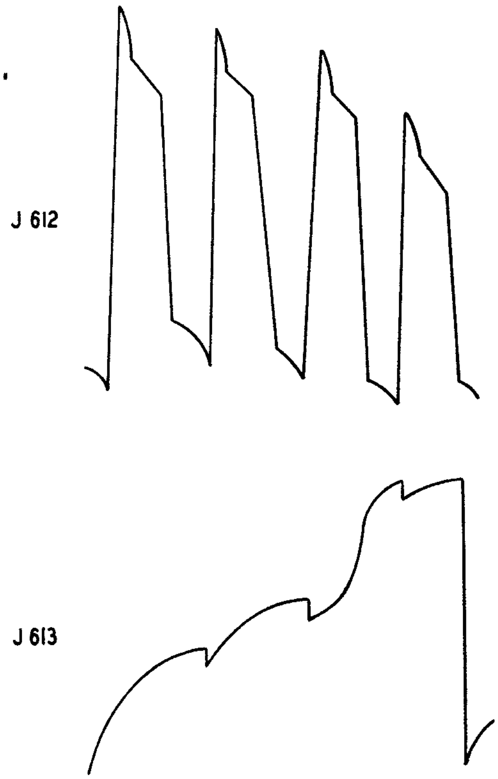
252. (a) Proceed as in para. 251 except that in para. 251 (c) the resistor is omitted and the signals applied to terminals A1, A2 through 10 pF condensers.
(b) Set the main switch at Y1Y2, the condenser switch in position 1 and the trigger off.

To set up the multivibrators using an Oscillograph C.R. No. 1 unmodified

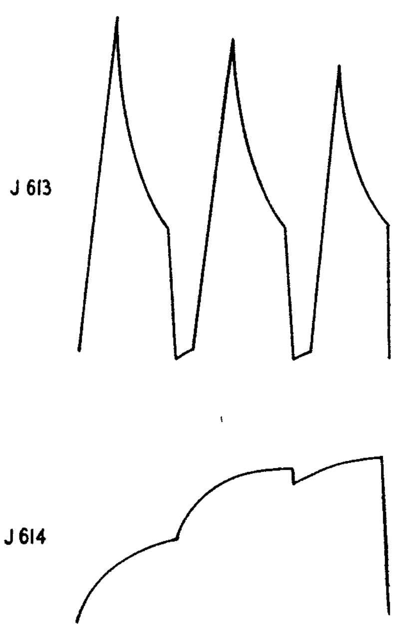
253. (a) Proceed as in para. 251 (a) and (b).
(b) In this method signals are applied through 10 pF condensers to terminals A1 and A2, switch at Y1Y2, trigger on and condenser switch in the position indicated in the following subparas.
(c) Apply the output from J611 and J612 to terminals A1 and A2 respectively, with condenser switch to position 6. Adjust VELOCITY and SYNC. to lock pattern on the upper timebase as in fig. 14. Adjust the C606, 20 KC MV, until the pattern as shown in fig. 14 is locked on the lower timebase giving a 4:1 ratio. Leave



T $\frac{\text{OY-104}}{\text{1-14}}$ **Fig. 14—Crystal oscillator compared with 20 KC MV**



T OY-104 1-15 **Fig. 15—20 KC MV compared with 5 KC MV**



T OY-104 1-16 **Fig. 16—5 KC MV compared with 1.7 KC MV**

the control set in the centre of the range of travel giving this result.

(d) Apply the output from J612 and J613 to A1 and A2 respectively, condenser switch to position 5 and adjust VELOCITY and SYNC. to lock the pattern on the upper timebase as in fig. 15.

(e) Adjust R624, 5KC MV, to lock the pattern on the lower trace as in fig. 15 leaving the control set as before for a 4:1 ratio.

(f) Apply the outputs from J613 and J614 to A1 and A2 respectively. With condenser switch to position 4 adjust VELOCITY and SYNC. to lock the upper pattern as in fig. 16 and adjust R616, 1.7 KC MV, for a 3:1 ratio leaving the control set as before.

(g) Recheck the waveforms in pairs.

To check the operation of the controls on the 2,000 yd. sweep

254. *Apparatus required*

Range power supply, test cable W2110, Oscillograph C.R. No. 1 with grid modulation and X amplification modifications and spare sweep transformers T902, T903.

255. (a) Connect the power supply to the range unit by cable W2110 between J803 and J609.

(b) Set up the multivibrators by one of the methods described in para. 251 to 253.

(c) Connect J601 A and B to pins 2 of T902 and T903 respectively.

(d) Connect pin 1 of T902 to A2 and pin 1 of T903 to A1.

(e) Connect pins 4 and 5 and the chassis of the transformers to the common earth.

(f) Switch the oscillograph to Y1Y2 and trigger off.

(g) Unless the controls are in adjustment an elliptical trace will appear on the C.R.T. Vary the DIAMETER control to ensure that it is operating correctly and adjust for a suitable size of ellipse.

(h) Ensure that variation of the BALANCE control alters the shape of the ellipse. Similarly ensure that variation of PHASE alters the shape of the ellipse and adjust both of these controls in turn for circularity of the trace.

(i) Vary OSCILLATOR TUNING for maximum size of the circular trace and reduce the trace to a convenient size by the DIAMETER control.

To check the operation of the controls on the 32,000 yd. sweep

256. *Apparatus required*

As for para. 254 substituting T904-T905 forT 902-T903.

257. (a) After setting up the multivibrators by one of the methods described in paras. 251 to 253 connect J602 A and B to pins 2 of T904 and T905 respectively.

(b) Connect pin 1 of T905 to A2 and pin 1 of T904 to A1.

(c) Connect pins 4 and 5 and the chassis of the transformers to the common earth.
(d) Switch the Oscillograph to Y1Y2, trigger off.
(e) Unless the controls are in adjustment an elliptical trace will appear on the C.R.T. Vary the DIAMETER control to ensure that it operates correctly and adjust for a suitable size of ellipse.
(f) Ensure that variation of the BALANCE and PHASE controls alters the shape of the ellipse and adjust these controls in turn for circularity of the trace. If necessary, adjust the primary and secondary cores of T602 to improve the circularity.

NOTE: No standard setting of A1 A2 gain can be given to ensure the equality of amplitude of the signals applied to the plates of the C.R.T.

(g) Apply the output from J624 to the grid modulation socket on the rear of the oscillograph. Turn the WIDE GATE WIDTH control fully clockwise and adjust the brilliance on the oscillograph so that as the WIDE GATE WIDTH control is turned anticlockwise the circular trace is reduced. Check that the limits are zero to 1¾ sweeps for overall variation of the WIDE GATE WIDTH control. Adjust the WIDE GATE WIDTH control so that one half of a sweep is illuminated and ensure that WIDE GATE DELAY varies this half sweep over a range of ⅓ of a sweep. Reset the WIDE GATE WIDTH control so that nearly one sweep is illuminated.

To check the operation of the trigger circuit

258. (a) Apply the output from J620 to the grid modulation socket on the rear of the oscillograph.
(b) Starting with the TRIGGER DELAY control fully anticlockwise, turn the control clockwise and ensure that there are at least three positions where a bright spot appears on the trace. Leave the control set so that the second spot remains on the trace. Mark the position of the commencement of this spot on the face of the C.R.T.
(c) In place of the output from J620 apply the output from J624 to the grid modulation socket and position the WIDE GATE DELAY control so that the WIDE GATE commences at the same point as the second trigger.

To adjust the narrow gate circuit

259. (a) Apply the output from J625 to the grid modulation socket of the oscillograph.
(b) Insert a 20,000 Ω resistor between pins B and C of J610 with a lead from A to B in the first instance.
(c) Turn the NARROW GATE WIDTH control fully clockwise and adjust the brilliance of the oscillograph so that a quarter of the timebase is illuminated by the narrow gate.
(d) As NARROW GATE WIDTH is turned anticlockwise this bright patch should be reduced to zero.
(e) Set the NARROW GATE WIDTH at its mid-position and vary NARROW GATE DELAY. Ensure that the narrow gate completes about two revolutions of the timebase as NARROW GATE DELAY is varied from minimum to maximum. Leave control at its mid-position.
(f) With A of J610 connected to B, variation of NARROW GATE should produce a movement of about $\frac{1}{16}$ of a revolution.
(g) Transfer the lead from B of J610 to C of J610. Variation of the NARROW GATE control should now produce an overall movement of about ¾ of a revolution.

RANGE INDICATOR BC-1088 (ELECTRICAL)

RESISTANCE READINGS

Conditions of measurement

260. (a) See paras. 2 to 7.
(b) Resistances taken with all cables disconnected.

TABLE 36—RESISTANCE READINGS AT TUBE BASES

VALVE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14
V901 V902	0.7M	0.7M	1.5M	N.C.	0.6M 0.45-0.75M(a)	N.C.	Ind.	1M	0	Inf.	1M	N.C.	N.C.	0.7M

(a) Varies with rotation of R907, R908 FOCUS.

TABLE 37—RESISTANCE READINGS AT JACKS

JACK	Pin C/D	E/L	S/T	I/O	J/O	J/K	J/M	J/N
J901	115	115	62	400-650 (a)	16 (b)	0-15(c)	17 (d)	16 (e)
	Pin A/B	B/C	A/C	D/E	E/F	D/F	G/H	....
J902	29	29	29	29	29	29	7	....
	Pin A/B	B/C						
J904	0-20K (f)	20K	...	....	....	......	....	....
	A	B						
J906	0.1 (g)	0.1 (g)						
J907	Inf.	.....	...	....	....	......	....	....
	A	B						
J908	0.1 (g)	0.1 (g)	...	....	....	......	....	....
J909	Inf.	.....	...	....	....	......	....	....
J910	0.8M	.....	...	....	....	......	....	....
J911	.1M	.....	...	....	....	......	....	....

(a) Varies with rotation of MOTOR SPEED ADJ.
(b) TRACKING RATIO switch at ⅓.
(c) Varies with rotation of TRACKING handwheel.
(d) TRACKING RATIO switch at 1.
(e) TRACKING RATIO switch at ½.
(f) Varies with rotation of SLEWING handwheel.
(g) Measured to chassis.

ADJUSTMENTS

Setting up the narrow gate potentiometer

261. (a) Turn the SLEWING handwheel until the range dials read exactly 0 yds.
(b) Measure and record the resistance between C and A of J904.
(c) Turn the SLEWING handwheel until the range dials read exactly 32,000 yds.
(d) Measure and record the resistance between pins A and B of J904.
(e) The resistance measured in (b) and (d) should be equal. If not, slacken the coupling to the narrow gate potentiometer and adjust the slider until the resistances measured in (b) and (d) are equal.

RANGE INDICATOR BC-1088 (MECHANICAL)

General

262. Armanent Artificers, instrument (A.A.), R.E.M.E. and Armament Artificers, electrical, R.E.M.E. may carry out the operations detailed in this section of the regulation.

NOTE: Slight differences exist between equipments manufactured by Westinghouse (A sets) and those manufactured by General Electric (B sets).

APPARATUS AND TOOLS

263. In addition to the apparatus and tools normally found in second to fourth echelon workshops the following will be required:

(a) Predictor A.A. No. 10 Null voltage tester (Ordnance part No. D74219, manufacturer's part No. D-163561), for accurately testing the co-ordination and backlash of the range potentiometer to the range dials.
(b) Set of Allen key wrenches.

CARE AND MAINTENANCE

Cleaning

264. The interior of the unit should not be exposed to dust or dampness. When inspection, adjustment or repair necessitates the removal of the unit, suitable precautions must be taken to protect the interior.

265. As far as possible all traces of dust, moisture, and corrosion must be removed. All electrical connections and leads should be clean and free from any trace of oil or grease. High voltages are present in certain parts of the unit and if an oil spray is used on the mechanical gearing great care should be taken to screen the electrical leads and connections.

Lubrication

266. The following standard lubricants will be used whenever available and unless otherwise authorized by an E.M.E.

Oil—Oil, mineral, hydraulic buffer (Specification C.S. 1117A or B, Cat. No. HA0148).
Grease—Grease No. 0.

EXAMINATION

267. Examine the interior components of the unit paying particular attention to the following:

(a) All parts should be free from moisture, corrosion and rust. Screws and taper pins should be secure, all electrical connections tight and leads held clear of moving parts. All gears, differentials, slides, ballraces, etc. should be adequately lubricated for preservation as well as lubrication, but the amount of lubricant present should not be excessive or endanger the electrical connections.

(b) All moving parts should be free and the effort required to turn the gearing consistent with the load. Backlash in gearing transmitting a definite value between components, such as that connecting the range dials, selsyns and potentiometer should be at a minimum consistent with freedom. Backlash in gearing transmitting a rate, such as the aided-tracking mechanism is permissible provided it is not excessive and does not interfere with the operator or cause undue wear.

268. Apply all tests detailed in paras. 269 to 288. The unit will be considered mechanically efficient only if the results of all tests are satisfactory and within tolerance.

TESTS AND ADJUSTMENTS

269. The tests and adjustments contained in the following paragraphs are designed only to ensure the mechanical efficiency of the unit.

Clutch settings

270. There are three clutches in the mechanism. One is fitted to the slewing handwheel and another is mounted at the end of the handwheel shaft. Both clutches protect the gearing when the stops are reached. A third clutch protects the variac in the aided tracking mechanism.

271. *Test*

(a) Turn the slewing handwheel until the mechanism comes to the stops. Apply a spring balance to the handwheel knob and measure the tangential pull necessary to slip the clutch. The pull required should be 4-6 lbs. If adjustment is required it should be carried out before proceeding further. Turn the slewing handwheel away from the stops and note that the rear clutch slips without the handwheel clutch slipping. Turn the aided tracking handwheel and check that the rear clutch does not slip. To fulfill these conditions the rear clutch must be set lighter than the handwheel clutch.

(b) Check the variac clutch by turning the aided tracking handwheel and noting that there is no slip in the drive to the variac until the drive coupling reaches the stops. After reaching the stops, the clutch should slip smoothly.

272. *Adjustment*

The adjustment of the slewing handwheel clutch and the rear clutch is shown clearly in figs. 1049 and 1050. The variac clutch is adjusted by tightening or slackening the screws securing the driving dog to its shaft, (See fig. 1046), and is accessible through the lower right-hand side of the chassis. If judder is present apply a few drops of oil to the clutch surfaces.

Mechanical stop and dial co-ordination

273. The mechanical stops should allow movement through the range of 0 yds. to 32,000 yds. and the readings of the coarse and fine dials must agree.

274. *Test.*

Turn the slewing handwheel to drive the range cursors to 0 yds. In this position both cursors should be vertical and should read against the 0 yds. graduation. Continue turning the handwheel until the minimum stops are reached. Note the dial reading. Turn the handwheel in the opposite direction until the maximum stops are reached. Note the reading. The stops should allow equal movement below 0 yds. and beyond 32,000 yds.

275. *Adjustment*

The distance between the stops is not adjustable. Remove the front panel as detailed in para. 291. Turn the slewing handwheel until the stop engages at the minimum end. Remove the large spur wheel driving to the coarse dial. Do not allow the shaft carrying the spur wheel to slide back as this will upset the relationship of the limit switch to the mechanical stop. Position the fine dial to read the correct value (i.e. half the actual dial movement—16,000, below 0 yds.) by turning the SLEWING handwheel. Replace the large spur wheel temporarily, ensuring that the stop is still in operation. Turn the SLEWING handwheel until the fine dial reads exactly 0 yds. Remove the spur wheel without allowing its shaft to rotate and set the coarse dial to read 0 yds. Replace the spur wheel. Repeat the test in para. 274.

Limit switch

276. The limit switch should operate before the mechanical stops are reached in order to prevent the motors from driving against the stops.

277. *Test*

Connect an ohmmeter to the terminals of the limit switch to indicate when the switch is closed. Turn the slewing handwheel in each direction until the switch operates. The switch should operate approximately 500 yds. inside the mechanical stops, but must come into effect outside 0 yds. and 32,000 yds.

278. *Adjustment*

Re-position the switch as required by turning the eccentric mounting bolts as shown in fig. 1047. Repeat para. 277.

Co-ordination of potentiometer to dials

279. The potentiometer must be adjusted so that the correct slant range is transmitted to the predictor.

280. *Test*

Two methods are given. (a) gives an accurate setting but requires the use of the Predictor A.A. No. 10, null voltages tester. (b) is less accurate and should only be used when the null voltage tester is not available.

(a) Connect the null voltage tester to the terminals of the range potentiometer as follows: BAT—H, V TEST—A, GRD—L. Connect a D.C. supply of approximately 350 V to terminals BAT and GRD. Set BAT 2 key to RATIO TEST. Set the range cursors to the values given in Table 38 and measure the potentiometer ratio.

TABLE 38—RANGE POTENTIOMETER TEST DATA

Slant Range Dial Setting Yds.	Test Set Reading	Tolerance Yds.
3,750	9,463	±45
7,500	19,047	
11,250	28,669	
15,000	38,244	
18,750	47,689	
22,500	56,945	
26,250	65,913	
28,000	70,000	

(b) Connect a D.C. supply of 100-350 V to terminals H and L of the range potentiometer. Connect a sensitive D.C. voltmeter between terminals L and B of the potentiometer. Turn the slewing handwheel to reduce range and, at the same time, alter the voltage range of the meter until the lowest range is reached. Note the reading of the range dial when the voltmeter reads zero. Decrease the range setting and then turn the handwheel clockwise until the voltmeter again reads zero. The mean range reading must be 0 yds. ±10 yds.

281. *Adjustment*
Remove the cover plate from the co-ordinating gear on the potentiometer. See fig. 1045. Loosen the clamping screws and adjust the relationship of the potentiometer to the dials until the requirements of the test are satisfied.

NOTE: If co-ordination is adjusted by the method given in para. 280 (b) a check by the method given in para. 280 (a) must be made at the first opportunity.

Backlash—potentiometer to dials

282. Backlash must be kept within specified limits if accuracy of the data transmitted is to be maintained.

283. *Test*
Two methods are given using the set-up as detailed in para. 280.

(a) Set a range of 15,000 yds., turning the slewing handwheel only in a clockwise direction until the exact dial setting is obtained. Note the reading of the null voltage tester. Set the same range, turning the slewing handle only in an anti-clockwise direction until the exact dial setting is obtained. Again note the reading of the null voltage tester. The difference between the two readings must not exceed 50 yds.

(b) Turn the slewing handwheel in a clockwise direction only until the voltmeter reads exactly full scale on the lowest voltage range. Note the reading of the range dials. Set the same voltmeter reading, turning the slewing handwheel in an anti-clockwise direction only and note the reading of the range dials. The difference between the dial readings must not exceed 20 yds.

284. *Adjustment*
The only specific adjustment is provided in the potentiometer unit. The meshing of the drive pinion with the potentiometer gear can be adjusted by re-positioning the idler wheel. The adjustment is made by loosening the castellated nut securing the idler. See fig. 1045.

Aided tracking mechanism

285. The aided tracking mechanism is fitted with a ratio switch which has three positions and varies the amount of aided laying for a given displacement of the variac.

286. A Range Power Supply RA-72 will be required to provide power for this test.

287. *Test*

(a) Connect the power jack, J901 on the range indicator unit to the output jack, J802, of the range power supply.

(b) Set the range dials to the centre of their travel and the RANGE MOTORS switch to the ON position. The two range motors should rotate in opposite directions. Rotate the TRACKING handwheel until the range dials are stationary.

(c) Set the TRACKING RATIO switch to position 1. Move the switch to the ½ and ⅓ positions, the speed of the two motors should appreciably increase with each setting.

(d) Turn the TRACKING handwheel slowly clockwise. The range dials should move slowly in a corresponding direction with increasing speed as the handwheel is displaced, reaching maximum speed after approximately four revolutions of the handwheel. Turn the handwheel until the fine range dial rotates at about 2 r.p.m. The dial should move smoothly without visible fluctuations in rate. Return the handwheel to the neutral position.

(e) Repeat (d) in the reverse direction.

288. If the unit fails to answer the above test correctly, examine the electrical connections to the variac, range motors and switches for broken or reversed leads. Check that the gearing is free and smooth in its movement. If the fault is not apparent remove and check the variac and range motors as detailed in paras. 297 and 300.

REMOVAL AND REPLACEMENT OF COMPONENTS

289. NOTE: If the unit is fitted with N^2 gate assembly this may be removed if necessary, by disconnecting the plugs, releasing the Allen head set screw in the collar on the input drive shaft, and removing the wing nuts which secure the subassembly. When replacing the assembly to the range indicator the N^2 gate coupling shaft may be

connected, but its final alignment must be made when the range indicator unit is installed in the equipment.

Front panel plate

290. NOTE: Since the front feet are not provided on B units it will be necessary to support the front of the unit on blocks in order to protect the range motors before removing the front panel.

291. *Removal*

Remove the RANGE MOTORS switch and the TRACKING RATIO switch from the panel. Remove the slewing and aided tracking handwheels. On A sets replace the nut on the slewing handwheel shaft after removing the handwheel. This will prevent the clutch mechanism from coming adrift. Remove the screws securing the front panel to the bearing plate and lift off the panel.

292. *Replacement*

Replace the components in the reverse order. On A sets, ensure that the slewing handwheel clutch goes together correctly, see fig. 1049. Re-adjust clutch tension in accordance with para. 272.

Range potentiometer

293. *Removal*

It is advisable to drain the oil from the unit before removal. Remove the bracket carrying the two sockets J903 and J905. (Fig. 1044). Remove the cover plate from the potentiometer gearing and remove the drive pinion. See fig. 1045. Remove the bolts holding the potentiometer to the frame. Lift the potentiometer off and note any spacing washers between the potentiometer and the frame. Repair and overhaul of the potentiometer is detailed in Instruments and Searchlights E703 and E704.

NOTE: The potentiometer brush is connected by a pigtail. It is essential that the brush arm is not permitted to turn through more than one revolution, otherwise the pigtail will be damaged.

294. *Replacement*

Replacement components in the reverse order. Fill the potentiometer with oil until the oil level is half way up the sight gauge, and align the potentiometer to the range dials as detailed in paras. 279 to 281.

Selsyns

295. *Removal*

Disconnect the selsyn leads from the terminal strip noting the position of each wire for replacement. Remove the screws and clamps which secure the selsyn. Draw the selsyn out carefully to avoid damaging the gear which is fixed to the selsyn shaft. It may be necessary to detach the gear to facilitate removal. Repair and overhaul of the selsyn is detailed in Instruments and Searchlights I504.

296. *Replacement*

Replace in the reverse order ensuring that the gears mate correctly with a minimum of backlash.

Variac

297. *Removal*

Remove the screws securing the rear triangular plate to the support pillars and withdraw the plate and variac. Disconnect the leads noting the position of each for replacement. Mark the relative position of the variac to the triangular plate before separating them. Remove the driving dog by loosening the clamping screw and drawing it off the shaft. See fig. 1046.

298. *Overhaul*

Examine the winding for signs of damage or distortion, the brush and track should be clean and lightly lubricated. The resistance of the winding should be approximately 16 Ω and the brush approximately ⅛ in. long. Check that the internal stops operate to prevent the brush moving off the winding. Adjust the stops if necessary by repositioning the collars carrying the stop pins.

299. *Replacement*

Fit the variac to the triangular plate in the same relative position from which it was removed. Replace the driving dog so that there is about $\frac{7}{16}$ in. of shaft projecting. Do not tighten the driving dog. Turn the shaft clockwise (looking at the shaft end) until the stop is reached. Turn the TRACKING handwheel clockwise until it is seen that the variac drive has reached its stop. Replace the variac so that the driving pin engages with the driving dog. Tighten the clamping screw on the driving dog. Replace the leads.

Range motors

300. *Removal*

Remove the front panel as detailed in para. 291. Stand the unit on two runners so that the bottom of the unit is accessible or, alternatively drain the oil from the potentiometer and lay the unit on its side. Each motor is secured by a mounting bracket. The four screws securing this bracket to the unit may be masked by the 120 tooth spur wheel which gears with the motor pinion. Certain units have holes in the spur wheel giving access to the screws. Where no such holes are provided the spur wheel must be removed before the motor can be removed. Disconnect the wiring and remove the motor, noting any shims that may be used. The resistance of the armature should be approximately 115 Ω and the field approximately 750 Ω. Brushes should be replaced if less than ¼ in. long. (See Fig. 1048)

301. *Replacement*

Replace components in the reverse order and check free meshing of the motor pinion with its spur gear. If a new motor is being fitted dowel the motor base using the mounting plate as a template. Do not drill more than ¼ in. into the motor base.

RANGE POWER SUPPLY RA 72

BENCH TEST

Components required

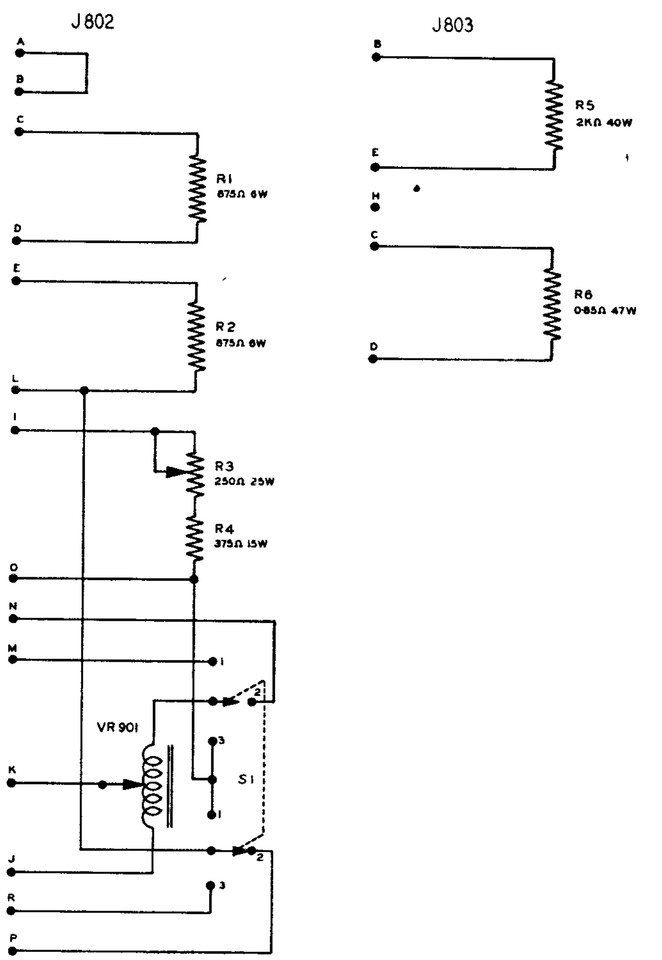
302. Resistors: R1 875 Ω, 6 W
R2 875 Ω, 6 W
R3 Rheostat 250 Ω, 25 W
R4 375 Ω, 15 W
R5 2,000 Ω, 40 W
R6 0.85 Ω, 47 W
R7 0.5 M Ω, 10 W
Variac: VR901
Switch: Double pole, three position.
Meter: Avometer No. 7.

Connections

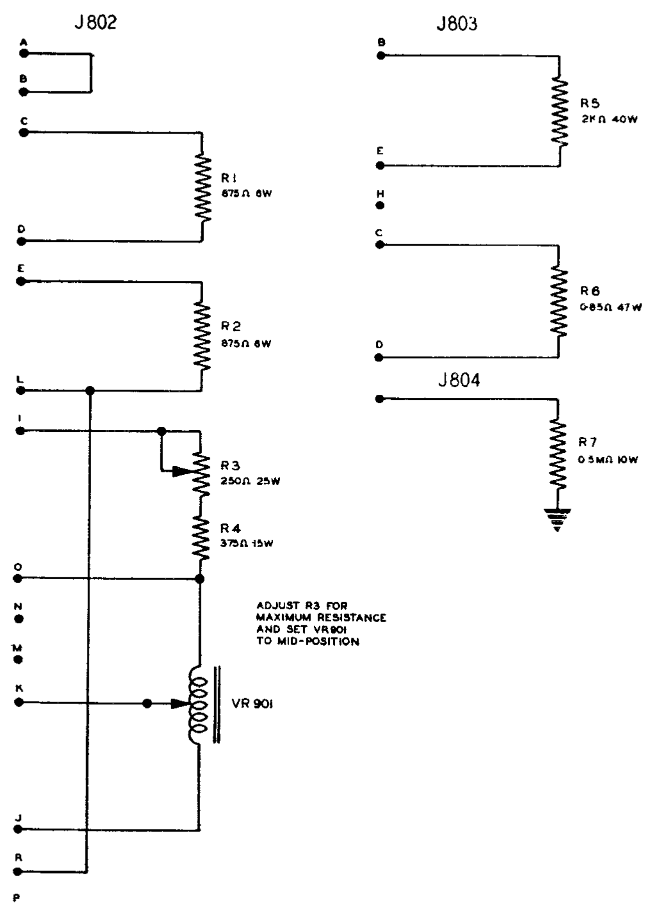
303. (a) Connect 115 V 60 c/s A.C. supply to the unit via J801.
(b) Connect J802 and J803 according to the circuit shown in fig. 17.

Range motors supply

304. (a) Insert the Avometer (1A D.C. range) between I of J802 and R3 and adjust R3 for a reading of 200 mA. Measure the voltage between pins I and O of J802. A reading of 80 V ±8V should be obtained.
(b) Turn the switch S1 to position 1 and insert the Avometer to read D.C. between pin C of J802 and R1, and pin E of J802 and R2 in turn. Adjust the variac to give equal currents through R1 and R2. Measure the voltages across R1 and R2. A reading of 50 ±5 V D.C. should be obtained.
(c) With the Avometer between pin C of J802 and R1 rotate the variac from fully clockwise to fully anticlockwise, the current should increase from 23 to 89 mA D.C. With the Avometer between pin E of J802 and R1 repeat the test; the current should show the same variation in the opposite direction.
(d) Turn the switch S1 to position 2. With the Avo inserted between pin C of J802 and R1 the current should increase from 23 to 73 mA D.C. when turning the variac from the fully anticlockwise to the fully clockwise position.



T $\frac{\text{OY-104}}{\text{1-17}}$ **Fig. 17—Dummy load for range power supply**



T $\frac{\text{OY-104}}{\text{1-18}}$ **Fig. 18—Dummy load for range power supply**

Similarly with the Avo between pin E of J802 and R2 the current should show a decrease by the same amount.

(e) Turn the switch S1 to position 3 with the Avo inserted between pin C of J802 and R1, or pin E of J802 and R2, the current reading should vary between 23 and 56 mA D.C. for extreme settings of the variac.

Range unit filament supply

305. The voltage across R6 should be 6.3 V A.C. ±3%.

C.R.T. and range unit supplies

306. (a) The voltage between pin E of J803 and J804 should be —2,000V D.C. ±10%.

(b) The voltage between E and H of J803 should be 430V D.C. ±10%.

(c) The voltage between E and A of J803 should be —105V to —135V; between E and G —18V to —30V and between E and F —8V to —14V D.C.

To check voltage regulation

307. (a) Connect J802, J803 and J804 as in fig. 18.

(b) Set the voltage across R5 to 250 V D.C. by means of the VOLT REG ADJ control.

(c) With the Avo inserted between B of J803 and R5 the current should be 160 mA D.C.

(d) Vary the input volts between 105 and 125 V A.C. The D.C. voltage should not vary by more than 1.5 V.

(e) Remove R5. The voltage between B and E of J803 should not vary by more than 1.5 V.

VOLTAGE AND RESISTANCE READINGS

Conditions of measurement

308. (*a*) *Voltage* (*OFF load*)

(i) Pins A and B of J802 connected.
(ii) Unit connected to 115 V A.C.
(iii) All other cables disconnected.

(b) *Voltage* (*ON load*)

(i) Unit operating with dummy loads as detailed in paras. 302 and 303.

(c) *Resistance*

(i) All valves in; the two pilot lights removed.
(ii) All cables disconnected.

TABLE 39—VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE		SCREEN		CATHODE		GRID	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V801A	......	Inf.	....	....	....	Inf.	....	....
V802A	......	Inf.	....	....	....	Inf.	....	....
V803A	......	Inf.	....	....	....	Inf.	....	....
V804A	480E A.C. (c)	70	....	....	620-630E (b) (c) 480-505E A.C. (b) (d)	66K	....	....
V805	......	66K	....	....	....	110K	160-115D (b) (c) 130-132D (b) (d)	550K
V806	......	66K	....	....	....	110K	160-115D (b)	550K
V807	......	66K	....	....	....	110K	160-115D (b)	550K
V808	160-115D (a)	550K	220-180D (a) (b) (c) 140-130D (a) (b) (c) 140-130D (a) (b) (d) 205-180D (a) (b) (d)	110K-145K (a)	106D	135K (b)	130-132D (b) (d)	45K 40K-50K (b)
V809	106D	125K	....	....	....	....	....	....
V810	-2700F	1.5M	....	....	....	75K	....	....

(a) There are two possibilities for this reading as R803, is 3.9K in some sets, and 39K in others.
(b) Varies with rotation of R807, VOLT REG. ADJ.
(c) OFF load readings.
(d) ON load readings.

TABLE 40—VOLTAGES AT JACKS

JACK	Pin A	Pin B	Pin F	Pin G	Pin H
J803	–105E (b) (c) –75E (b) (d)	280-230D (a) (c) 280-230D (a) (d)	–10E (b) (c) – 7E (b) (d)	–20E (b) (c) –15E (b) (d)	620-630E (c) 460-480E (d)
J804	–2700F (c) –2000F (d)	....	....	....	....

(a) Varies with rotation of R807, VOLT REG. ADJ.
(b) ÷ 2 button pressed.
(c) OFF load reading.
(d) ON load reading.

TABLE 41—VOLTAGES AND CURRENT READINGS AT TRANSFORMERS

Trans.	Ter. 1 to 2	Ter. 1 to 3	Ter. 1 to 4	Ter. 1 to 5	Ter 1 to 6	Ter. 1 to 7	Ter. 1 to 8	Ter. 1 to 9	Ter. 1 to 10	Primary Current (Amps)
T801	33.5B A.C. (a) 33.5B A.C. (b)	61.5B A.C. (a) 61.2B A.C. (b)	68B A.C. (a) 68B A.C. (b)	85B A.C. (a) 85.5B A.C. (b)	100C A.C. (a) 100C A.C. (b)	115C A.C. (a) 115C A.C. (b)	116C A.C. (a) 117C A.C. (b)	135C A.C. (a) 134C A.C. (b)	204C A.C. (a) 203C A.C. (b)	0.48 (a) 0.76 (b) (c) 0.69 (b) (d) 0.13 (f)
T804	Ter. 3 to 5	950D A.C. (a)	940D A.C. (b)	....	....	....	....	....	....	0.28A (a) 0.83A (b) 0.18A (f)
T805	Ter. 3 to 4	2418E A.C. (a) 2340E A.C. (b)	....	....	....	....	....	....	....	0.08A (a) 0.2A (b) 0.04A (f)
T806	....	....	....	....	....	....	....	....	....	0.46A (a) 0.88A (b) (e) 0.16A (f)

(a) OFF load readings. Valves in and J802 connected.
(b) ON load readings. See fig. 18.
(c) R3 fully clockwise.
(d) R3 fully anticlockwise.
(e) Loaded with filaments of range unit.
(f) All valves removed.

N[2] GATE UNIT

VOLTAGE AND RESISTANCE READINGS

Conditions of measurement

309. (a) *Voltages*
(i) All voltages taken to chassis.
(ii) Unit set up under proper operating conditions.

(b) *Resistance.*
(i) All resistances taken to chassis, with all cables disconnected, after having been set up for proper operating conditions.

TABLE 42—VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE		SCREEN		CATHODE		GRID	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V2501A	90D 93D (a)	280K	....	.....	......	10K	......	100K
V2501B	246D 246D (a)	105K	....	.....	......	1K	......	470K
V2502	136D 136D (a)	115K	122D 122D (a)	160K	......	150	......	1M
V2503A	190D 194D (a)	115K	....	.....	......	1.5K	......	470K
V2503B	115D 93D (a)	120K	....	.....	......	0	......	35K
V2504	235D 228D (a)	115K	42D 108D (b)	210K	......	2.2K	......	11
V2505	365D 365D (a)	Inf.	....	.....	......	6.8K	......	10K

(a) With J2507 and J2509 disconnected and no input.

TABLE 43—VOLTAGES AND RESISTANCE READINGS AT JACKS

JACK	VOLTS	OHMS	JACK	VOLTS	OHMS
J2504	0	380 165-380 (a)	J2505G	NC	NC
J2505A	-45D	Inf.	J2505H	375D	Inf.
J2505B	245D	107K	J2506A	....	Inf.
J2505C	NC	NC	J2506B	....	Inf.
J2505D	NC	NC	J2507	....	Inf.
J2505E	0	0	J2508	....	Inf.
J2505F	NC	NC	J2509	....	Inf.

(a) Varies with rotation of R2528 INTENSITY MARKER.

TABLE 44—RESISTANCE READINGS AT TRANSFORMERS AND CHOKES

TRANS-FORMER	Terminals 1-2	Terminals 3-4	Terminals 5-6
T2501	14 Ω	14 Ω	15 Ω
T2502	0.5 Ω	0.5 Ω	
T2503	25 Ω	0.2 Ω	
Z2501	14 Ω		
L2501	320 Ω		

WAVEFORMS

310. (a) The waveforms given in fig. 19 (a)-(h) are taken on the Oscillograph C.R. No. 1 with the unit set up and operating in the rack.

(b) The waveforms given in fig. 20 (a)-(f) are taken by joining the point in question to J911 on the range indicator unit by cable W2118, and viewing the result on either the coarse or fine range tube as indicated.
The arrows denote the direction of rotation of the waveform as the SLEWING handwheel is rotated clockwise.

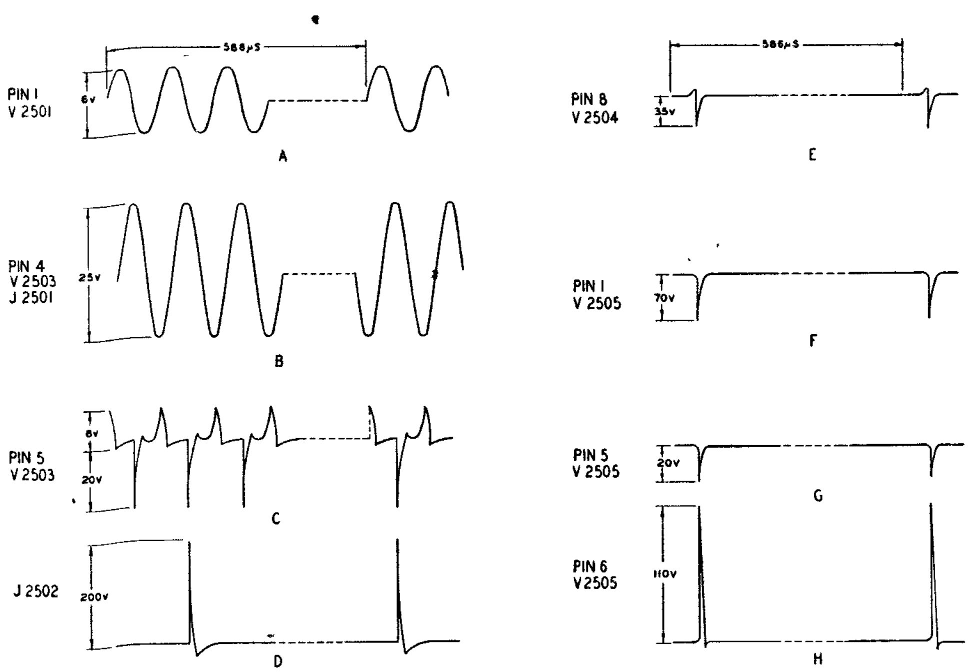
TO ADJUST THE PHASE SPLITTING NETWORK

311. When the coupling between the phase rotating and the slewing handwheel shaft of the range indicator is correctly adjusted, the N^2 gate should remain 50 yds. ahead of the cursor as the cursor is rotated. If the N^2 gate does not remain 50 yds. ahead of the cursor, the phase splitting bridge requires realignment as follows:

(a) Check that the locknuts on R-2507, R-2509, R-2510 and C-2507 are tight, but loose enough to allow adjustment with a screwdriver. Check that the coupling is tight. (The relationship between the shafts is adjusted later). Remove the N^2 gate chassis cover and the 2,000 yd. C.R.T. outer cover.

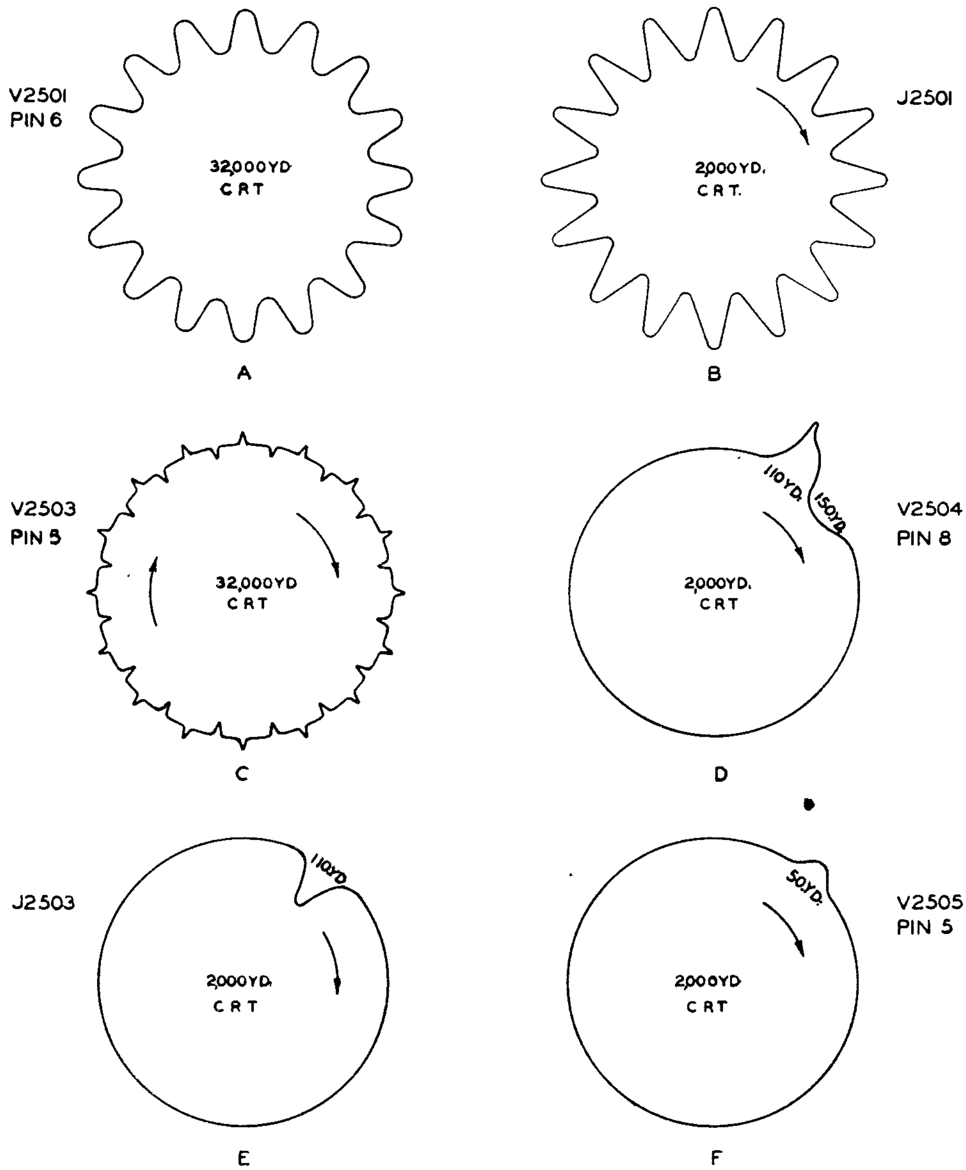
(b) The voltages on plates 1 and 3 of C2509 must be equal in magnitude. To check this, turn the handwheel until the slot on the phase-splitting capacitor shaft and hub line up, and the notch on the shaft is near terminal No. 5. Read the range indicated by the cursor. This range will be called test point 1. With the oscilloscope, measure the amplitude of the sine wave voltage at J-2501. Turn the handwheel to the point (test point 3) where the range indicated by the cursor is 1,000 yds. greater than at test point 1. Again measure the amplitude of the voltage at J-2501. Adjust R-2507 until the voltage is the average of these two readings. Repeat this step until the amplitudes at the two points are within 5% of each other. Remove the oscilloscope.

(c) In addition to being equal, the voltages on plates 1 and 3 of C-2509 must be 180 degrees out of phase. This is adjusted by observing the position of the N^2 gate pulse on the 2,000



T OY-104 / 1-19

Fig. 19—N^2 gate waveforms on oscillograph



T $\frac{\text{OY-104}}{\text{1-20}}$

Fig. 20—N² gate waveforms on range indicator unit

yd. scope at two range settings. Connect test cable W-2118 to J-911 and J-2503. With the cursor at test point 1, make a mark with the grease pencil on the inner C.R.T. cover at the leading edge of the gate. Turn the cursor to test point 3 and measure the distance from the leading edge of the gate to the pencil mark. Adjust C-2507 until the leading edge of the gate is half of this distance from the pencil mark on the C.R.T. cover. This will have moved the gate so that the leading edge is no longer at the pencil mark when the cursor is turned again to test point 1. Make a new mark on the C.R.T. cover with the cursor at test point 1 and repeat the entire step. Repeat as many times as necessary to make the leading edge of the gate line up with the pencil mark at both test points.

(d) The voltage on plate 2 of C-2509 must be 90 degrees out of phase with the voltage on plate 1. To adjust this turn the handwheel until the cursor indicates the range of test point 2, a range 500 yds. greater than that of test point 1. Adjust R-2509 until the leading edge of the gate lines up with the pencil mark established in (c).

(e) The voltage on plate 4 of C-2509 must be 270 degrees out of phase with the voltage on plate 1. To adjust this, turn the handwheel until the cursor indicates the range of test point 4, a range of 1,500 yds. greater than that of test point 1. Adjust R-2510 until the leading edge of the gate lines up with the pencil mark established in (c).

(f) Some interaction is possible between these controls and it may be necessary to repeat (b) to (e) several times before the marker and gate line up within 10 yds. at each test point. No attempt must be made to align the cursor and gate when the cursor is between test points.

After the bridge has been aligned, orient the shaft coupling so that the N^2 gate is 50 yds. ahead of the cursor as explained in the original N^2 gate fitting instructions. Mounting the chassis cover may change the adjustment at test points 2 or 4. They can be readjusted through the hole in the cover.

PLAN POSITION UNIT BC-1058

VOLTAGE AND RESISTANCE MEASUREMENTS

Conditions of measurement

312. (a) See paras. 2-7.

(b) Taken on units set up in accordance with para. 62 of Tels OY-103.

(c) Power supply RA-69 connected via J1602. Voltage at J1608, 270 V and at J1609, 300 V.

(d) (i) A & B J1601 short-circuited.

(ii) L & M J1603 short-circuited.

(iii) A, B, C, J and K of J1603 short-circuited together.

(e) Resistance measurements taken with power cable and the above short circuits removed but with K of J1602 short-circuited to chassis.

TABLE 45—VOLTAGE AND RESISTANCES AT VALVE BASES

VALVE	ANODE		SCREEN		CATHODE		GRID	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V1601	256D 249D (f)	20K	270D	20K	45.5C (a) 35C (b)	1K	25C (a) 14C (b)	125K (a) 220K (b)
V1602A	145D 194D (a) (f) 213D (b) (f)	40K	....	...	54C	7K-2.1K (c)	......	4.7M
V1602B	25C (a) 14C (b) 44C (a) (f) 28.5C (b) (f)	125K (a) 220K (b)	....	...	0	0	......	4.7M
V1603A	91C 126D (a) (f) 141D (b) (f)	40K	....	...	0	0	0	300K (a) 800K (b)
V1603B	162D 123D (a) (f) 107D (b) (f)	50K	....	...	0	0	0	4.7M
V1604A	89C 100D (a) (f) 113D (b) (f)	20K	....	...	7.5B	64	......	27K

(a) 35,000 yds. range.
(b) 70,000 yds. range.
(c) Varies with setting of INTENSITY control.
(d) Varies with setting of NARROW GATE and RANGE MARKERS controls.
(e) Varies with setting of CENTRE ADJ.
(f) Trigger applied.

TABLE 45—VOLTAGE AND RESISTANCES AT VALVE BASES—Cont'd

VALVE	ANODE		SCREEN		CATHODE		GRID	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V1604B	55C 98D (a) (f) 108D (b) (f)	20K	....	...	....	340	......	4.7M
V1605A	105D 124D (a) (f) 135D (b) (f)	......	....	...	0	0	......	1M
V1605B	90C	20K	....	...	7.5B	64	0	100K
V1606A	232D	30K	....	...	152D	25K	122D	50K
V1606B	230D	30K	....	...	152D	25K	122D	50K
V1607A	232D	30K	....	...	152D	25K	122D	50K
V1607B	230D	30K	....	...	152D	25K	122D	50K
V1608A	109D	35K	....	...	0	0	0	180K
V1608B	0	0	....	...	0	1M	0	0
V1609A	125D	31K	....	...	5.9B	1K	0	1M
V1609B	125D	31K	....	...	5.9B	1K	0	13.5K-35K (d)
V1610A	107D 124D (a) (f) 135D (b) (f)	10K	....	...	....	Inf.	......	470K
V1610B	....	Inf.	....	...	5.3B 0-15B (e)	0-70 (e)	......	470K
V1611A	107D 124D (a) (f) 135D (b) (f)	10K	....	...	....	Inf.	......	470K
V1611B	....	Inf.	....	...	7.5B	64	......	470K
V1612A	....	Inf.	....	...	10.5C 15-0B (e)	70-0 (e)	......	470K

(a) 35,000 yds. range.
(b) 70,000 yds. range.
(c) Varies with setting of INTENSITY control.
(d) Varies with setting of NARROW GATE and RANGE MARKERS controls.
(e) Varies with setting of CENTRE ADJ.
(f) Trigger applied.

TABLE 45—VOLTAGE AND RESISTANCES AT VALVE BASES—Cont'd

VALVE	ANODE		SCREEN		CATHODE		GRID	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V1612B	107D 124D (a) (f) 135D (b) (f)	10K	....	...	....	Inf.	......	470K
V1613A	....	Inf.	....	...	7.5B	64	......	470K
V1613B	107D 124D (a) (f) 135D (b) (f)	10K	....	...	....	Inf.	......	470K
V1614A	45E* 55E* (f)	120K	....	...	0	0	0	220K
V1614B	190E* 179E* (f)	240K	....	...	19C	88	0	220K
V1615	300D	Inf.	260D	20K	28C	290	......	Inf.
V1616	300D	Inf.	260D	20K	30C	290	......	Inf.
V1617	300D	Inf.	260D	20K	32C	290	......	Inf.
V1618	300D	Inf.	260D	20K	28C	290	......	Inf.

(a) 35,000 yds. range.
(b) 70,000 yds. range.
(c) Varies with setting of INTENSITY control.
(d) Varies with setting of NARROW GATE and RANGE MARKERS controls.
(e) Varies with setting of CENTRE ADJ.
(f) Trigger applied.
* Avometer ÷ 2 button pressed.

Transformer data

313. Transformer T1601. Primary winding: resistance 2 ohms, current on load 0.8 amps.

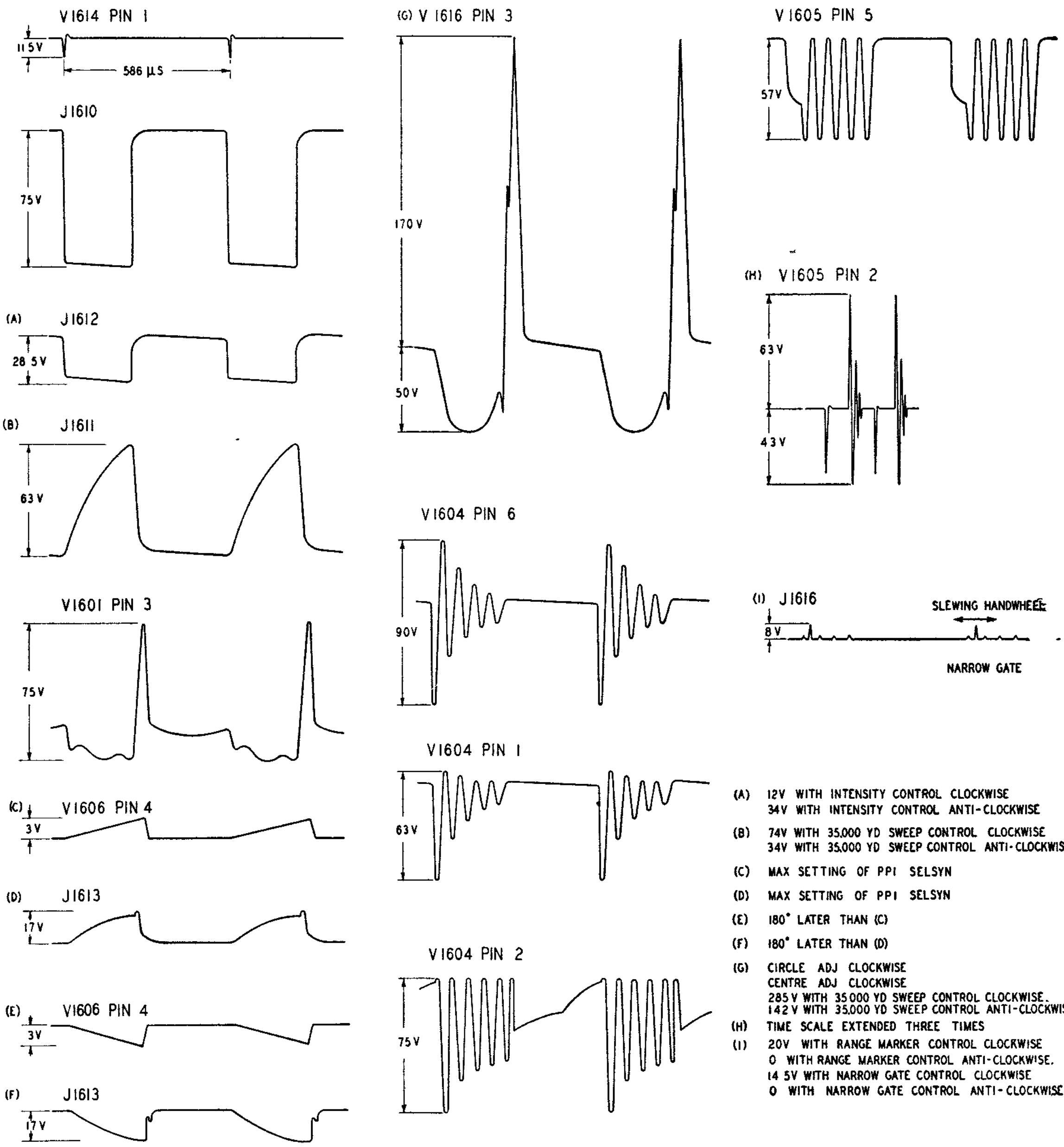
WAVEFORMS

314. The waveforms given in figs. 21 and 22 were taken with an Oscillograph C.R. No. 1 under the following conditions:

(a) Unit set up in accordance with para. 62 of Tels. OY-103 using a trigger pulse from the range unit. If an external trigger source is used, a negative pulse of amplitude 15 volts, 1.5 μS wide and recurrence frequency 1.7 Kc/s should be applied to J1606.

(b) Voltage at J1608: 270 V.
Voltage at J1609: 300 V.

(c) All external cables connected.



T $\frac{\text{OY-104}}{\text{1-21}}$

Fig. 21—Waveforms of P.P.I. unit, 35,000 yds.

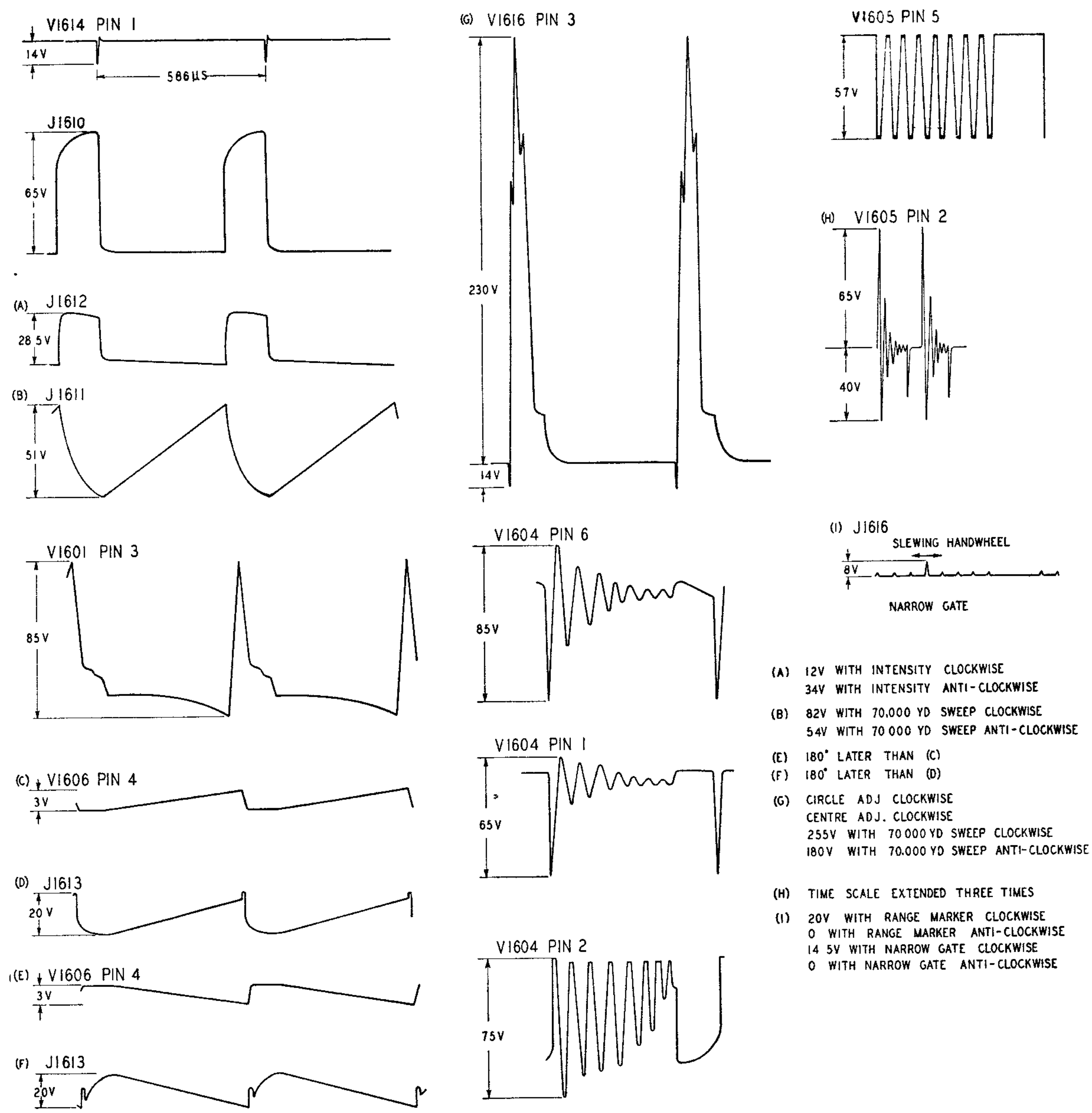


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Fig. 22—Waveforms of P.P.I. unit, 70,000 yds.

P. P. I. POWER SUPPLY UNIT RA-69

BENCH TEST

Components required:

315. (a) R1—Variable resistor 1500—1200 Ω, 70W.
(b) R2—Variable resistor 3000—2000 Ω, 35W.

Connections

316. (a) Connect L to M on J1503.
(b) Connect F of J1503 to earth.
(c) Connect R1 between K of J1503 and earth and set it to approximately 1350 Ω.
(d) Connect R2 between J of J1503 and earth and set it to 2540 Ω.

Dummy load test

317. (a) Insert a meter between the lower end of R1 and earth and switch on S1501. Adjust R1 for the meter to read 225 mA D.C.
(b) Insert the meter in the R2 line, ensure that the input voltage is 115 V A.C., and adjust VOLT REG. ADJ., R1506, for the meter to read 110 mA D.C.
(c) Measure the filament voltages. The voltage should not vary more than ±5% from 5 V for V1501 and V1502; 6.3 V for V1504, V1505 and V1506, and 2.5 V for V1503.

(d) With R1 set for 225 mA, measure the voltage across it. This should not vary more than ±20V from the rated value of 300V D.C.

(e) With R2 set at 2540 Ω set the voltage across it to read 270V by means of R1506. Vary the load resistance so that the current drawn varies from 105 mA to 110 mA D.C. Over this range the voltage should not vary more than 1 volt.

(f) Measure the voltage from J1502 to earth. It should be 4.5 KV ±10%.

VOLTAGE AND RESISTANCE MEASUREMENTS

Conditions of measurement

318. (a) ON load readings taken with loads connected as detailed in paras. 315 and 316, R1 set for 225 mA and R2 and R1506 set for 270V at 110 mA measured between pin J of J1503 and chassis.

(b) OFF load readings taken with R1 and R2 removed and R1506 set up as in (a).

(c) Resistance readings taken with V1507 removed.

TABLE 46—VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE		SCREEN		CATHODE		CONTROL GRID	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V1501	....	2M	....	.....	358D (b) 555E (a)	2M	....	....
V1502	....	2M	....	.....	510E (b) 622E (a)	2M	....	....
V1503	....	......	....	.....	5080G (a)	6M	....	....
V1504	495E (b) 620E (a)	2M	....	.....	270D (b) 268D (a)	300K	225E (b) 171D (a)	2.5M
V1505	495E (b) 620E (a)	1.9M	....	.....	270D (b) 268D (a)	300K	225E (b) 171D (a)	2.5M
V1506	155D (b) 170D (a)	2.5M	198D (b) 197D (a)	300K	107D (b) 107D (a)	300K	102E (b) 91D (a)	100K 125K-90K (e)
V1507	107D (b) 107D (a)	300K	....	.....	....	.....	....	0

(a) OFF load readings.
(b) ON load readings.
(c) G.E. equipments.
(d) Westinghouse equipments.
(e) Value varies with setting of VOLT. REG. ADJ. control.

TABLE 47—VOLTAGE READINGS AT JACKS AND MISCELLANEOUS COMPONENTS

COMPONENT	VOLTAGE	COMPONENT	VOLTAGE
J1502	3980G	C1503	623E (a) 510E (b)
J1503	270D at J 552E at K (a) 320D (b)	C1504	621E (a) 494E (b)
T1505	–80E at Ter. 3	C1505	5040G
C1501	555E (a) 343D (b)	Junction of R1503 and R1508	18C (c) 12.8C (d)
C1502	554E (a) 321D (b)		

(a) OFF load readings.
(b) ON load readings.
(c) G.E. equipments.
(d) Westinghouse equipments.
(e) Value varies with setting of VOLT. REG. ADJ. control.

TABLE 48—RESISTANCE READINGS AT MISCELLANEOUS COMPONENTS

COMPONENT	RESISTANCE	COMPONENT	RESISTANCE
L1501	74	L1503	155 (c)
L1502	74		103 (d)

COMPONENT	A.	B.	C.	D.	E.	F.	G.	H.	J.	K.	L.	M.
J1503	0	0	0	Inf.	Inf.	2M	0	0	250K	2M	Inf.	Inf.

(a) OFF load readings.
(b) ON load readings.
(c) G.E. equipments.
(d) Westinghouse equipments.
(e) Value varies with setting of VOLT. REG. ADJ. control.

TABLE 49—RESISTANCE, VOLTAGE AND PRIMARY CURRENT READINGS AT TRANSFORMERS

Trans.	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Primary Current
T1501 Ω	*5.75*	*5.75*	*<1*	*<1*			....	0.36 A (a) (c)
Ω					*<1*	*<1*		
V			*5 A.C.* (b)	*5 A.C.* (b)				0.30 A (a) (d)
					5 A.C. (b)	*5 A.C.* (b)		
T1502 Ω	*1.5* (c)	*1.5* (c)	*127* (c)	....	*127* (c)	....	....	0.23 A (a) (b) (c)
Ω	*3.5* (d)	*3.5* (d)	*147* (d)		*147* (d)			0.17 A (a) (b) (d)
V			*940 A.C.* (a)		*940 A.C.* (a)			
			920 A.C. (b)		*920 A.C.* (b)			
T1503 Ω	*7.9*	*7.9*	*<1*	*<1*				0.212 A (a) (c)
Ω					*<1*	....	*<1*	
V			*6.3 A.C.*	*6.3 A.C.*				0.178 A (a) (d)
					6.3 A.C.		*6.3 A.C.*	
T1504 Ω	*2.65* (c)	*2.65* (c)	*159*	....	*159*	....	....	0.66 A (a)
Ω	*5.0* (d)	*5.0* (d)						0.185 A (b) (c)
V			*945 A.C.* (a)		*945 A.C.* (a)			0.211 A (b) (d)
			915 A.C. (b)		*915 A.C.* (b)			
T1505 Ω	*6.5* (c)	*6.5* (c)	*10K* (c)	*10K* (c)	....	....	....	0.239 A (a) (c)
Ω	*10.0* (d)	*10.0* (d)	*8.6K* (d)	*8.6K* (d)				0.213 A (a) (d)
V			*4750 A.C.*	*4750 A.C.*				
T1506 Ω	*30.0* (c)	*30.0* (c)	*<1*	*<1*	....	....	....	0.073 A (a) (c)
Ω	*110* (d)	*110* (d)						
V			*2.5 A.C.*	*2.5 A.C.*				0.068 A (a) (d)

(a) OFF load readings.
(b) ON load readings.
(c) G.E. equipments
(d) Westinghouse equipments.
(e) Value varies with setting of VOLT. REG. ADJ.

AUTOMATIC TRACKING UNIT BC-1086

To check the overall operation and adjustment of the unit

319. (a) Set R514, VOLTAGE, to the mid-position.

(b) Connect 115V A.C. across the outside of the fuses, F501, F502.

(c) Mechanically close relay K502.

(d) Connect a dummy load consisting of 1250 Ω, 100 W. between pin H of J508 and earth.

(e) Switch on S501.

(f) Measure the voltage across the dummy load. It should be 300 V D.C. ±5%.

(g) Measure the voltage at pin 6 of V503. It should be between 103 and 113V D.C.

(h) Measure the voltage from J506 to earth. It should be one quarter of the voltage measured in (f) ±5%.

(i) Measure the voltage from pin 3 of V504 to earth. Set it to 2.9V D.C. by means of R514, VOLTAGE.

(j) Measure the voltage at the slider of R516, BALANCE. It should be 148V ±10%.

(k) Measure the voltage between each plate of V504 and ground. It should be 100V ±10%. Balance the two voltages by means of R516, BALANCE.

(l) Connect the output of the Boonton B.F.O., Type 140A between pin 8 of V502 and earth. Set the B.F.O. to the RES. X1 position and adjust the output to 15V, 30 c/s.

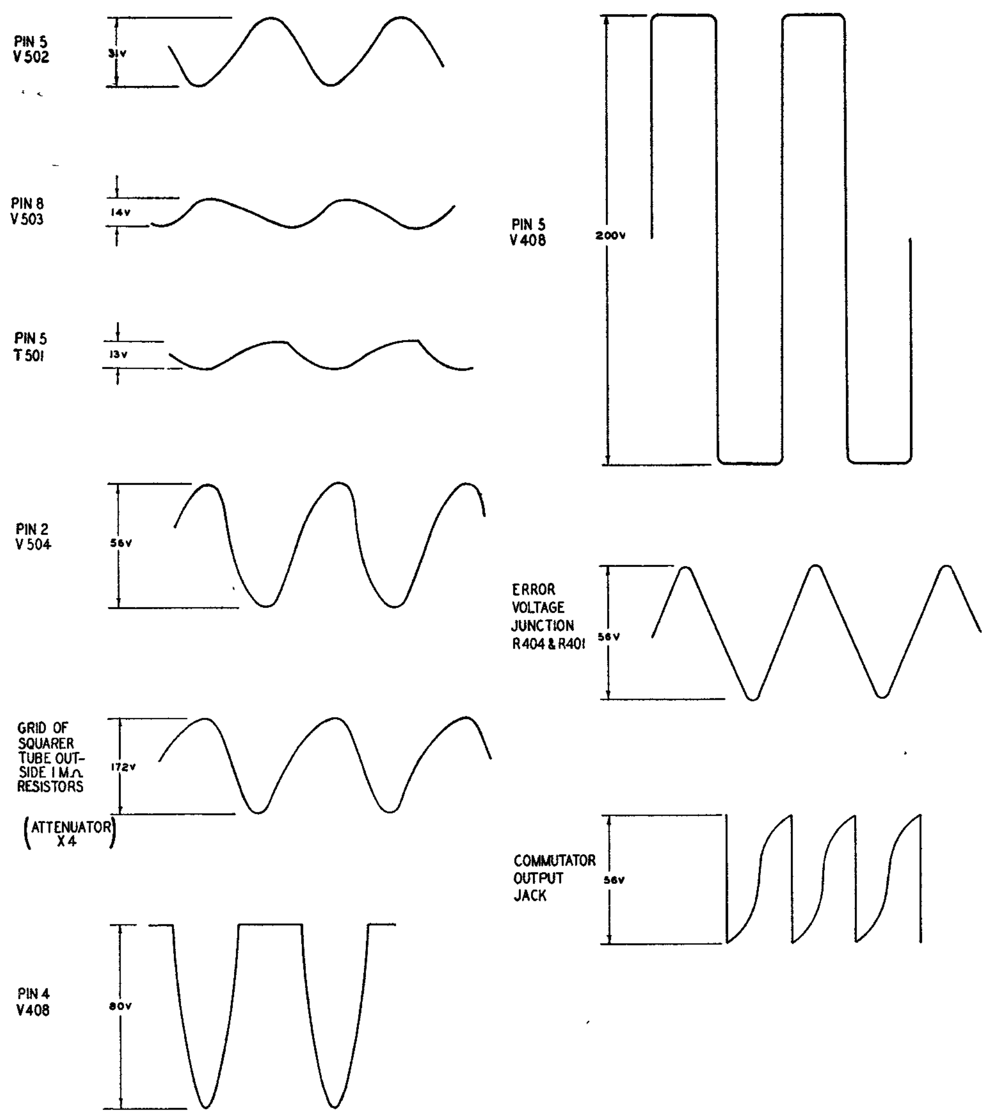
(m) Turn R504 AVC fully anticlockwise. Meter M501 should read more than 11 mA. Set R504 to produce a reading of 6 mA. Turn the GAIN control, R505-R506, fully clockwise.

(n) Adjust R516, BALANCE, until the alternating voltage measured on an oscilloscope between J504 and earth is equal to the alternating voltage between J505 and earth.

(o) Slowly vary the input frequency from 8 to 80 c/s. Measure the voltage from J505 to earth with an oscilloscope. This should reach a peak between 25 and 35 c/s. The voltage should be down to half of peak voltage at the low end between 9 and 13 c/s and again at the high end between 50 and 70 c/s.

(p) Readjust the frequency to 30 c/s. Turn R504, AVC, to obtain the maximum 30 c/s output at J505. This maximum should occur when the meter M501, reads between 5 and 9 mA and should be between 20 and 25V rms.

(q) Check the voltage from J504 to earth. If it is not equal to the voltage from J505 to earth re-balance by means of R516, and recheck maximum readings for M501 and J505.



T $\frac{\text{OY-104}}{\text{1-23}}$

Fig. 23—Waveforms of automatic tracking unit

Waveforms

320. The waveforms in fig. 23 were taken with the unit set up as in para. 319 with the B.F.O. output set at 30 c/s.

VOLTAGE AND RESISTANCE MEASUREMENTS

Conditions of measurement

321. (a) See paras. 2 to 7.

(b) All measurements taken to chassis.

(c) Static measurements taken with unit set up as detailed in para. 319 (a) to (k) but with dummy load removed.

(d) Dynamic measurements taken with unit set up as detailed in para. 319.

TABLE 50—RESISTANCE AND STATIC VOLTAGE READINGS AT VALVE BASES

Valve	ANODE A		ANODE B		SCREEN		CATHODE		GRID A		GRID B	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V501	....	....	....	....	....	....	415D	......	..	......	..	...
V502	0	1M	0	1M	....	....	......	10K	..	......	..	...
V503	235D 241-229D (a)	110K	....	....	105D	120K	......	0	..	1.8K 1M-0 (a)	..	...
V504	135D 137-132D (b)	120K	137D 133-139D (b)	120K	....	....	4.2B 4.6-0 (c)	450 500-0 (c)	..	50K	..	50K
V505	105D	120K	....	....	....	....	......	0	..	......	..	...

(a) Varied within these limits by A.V.C. control.
(b) Varied within these limits by BALANCE control.
(c) Varied within these limits by VOLTAGE control.

TABLE 51—STATIC VOLTAGE READINGS

COMPONENT	VOLTS	COMPONENT	VOLTS
C505	412D	J506	82C
C506	309D	T502	Ter. 3 to 5—911 A.C. Primary Current—0.56 A.

TABLE 52—DYNAMIC VOLTAGE READINGS AT VALVE BASES

VALVE	ANODE A	ANODE B	SCREEN	CATHODE
V501	....	....	....	338
V502	–5.4	–5.4	....	....
V503	213 238-123 (a)	....	106	....
V504	91 95-89 (b) 90-95 (d)	98 97-103 (b) 98-97 (d)	....	2.9 3.3-0 (c)
V505	106	....	....	....

(a) Varied within these limits by A.V.C. control.
(b) Varied within these limits by BALANCE control.
(c) Varied within these limits by VOLTAGE control.
(d) Varied within these limits by GAIN control.

TABLE 53—DYNAMIC VOLTAGE READINGS

COMPONENT	VOLTS	COMPONENT	VOLTS
C505	315D	T502—3 to 5	950 A.C. (Off load)
C506	289D	T502—6 to 8	5.0 A.C.
J506	75C	T502—9 to 10	6.3 A.C.
T502—3 to 5 902 A.C. (ON load) T502—Primary current—1.43A (ON load), 0.6A (OFF load)			

TABLE 54—RESISTANCE READINGS MISCELLANEOUS

COMPONENT	~~VOLTS~~ Res	COMPONENT	VOLTS
T501	Ter. 1 to 2—700 Ter. 3 to 5—3.5K	J507	Pin B to C—550 Pin B to D—550
T502	Ter. 1 to 2—1.5 Ter. 3 to 4—69 Ter. 4 to 5—69	L501 L502	90 90

AZIMUTH AND ELEVATION TRACKING UNIT BC-1090

Overall check

322. (a) Connect the automatic tracking and the azimuth and elevation tracking units by the cable joining J508 and J410.

(b) Mechanically close relay K502. Join C, D, and H of J409.

(c) Connect 115V A.C. to the outside of the fuses of the automatic tracking unit.

(d) Connect a lead from terminal 5 of relay K502 to the centre tap of two 1000 Ω, 5 W resistors and connect the free ends of these resistors to one pair of CONTROL FIELDS jacks.

(e) Connect the primary of a 60 c/s reference voltage transformer, T1202, to 115 V A.C. and the centre tap of the secondary to earth. Connect the other two secondary terminals to the outside of the two 1 MΩ resistors in the grid circuits of the switching valve in the channel to be tested, V408 or V458.

(f) Turn the A.H. GAIN controls fully clockwise.

(g) Adjust the VOLTAGE control for a reading of 2.9V D.C. between pin 3 of V504 and chassis.

(h) Check that the voltage between the +30 jack, J413, and chassis is between 26 and 32V D.C.

(i) Adjust the A.H. LIMITING CONTROL to equalise the voltages between the respective A.H. LIMIT jacks and the +30 jack.

(j) Adjust the TORQUE CONTROL to obtain a voltage of 3.5V between the TORQUE jack and the +30 jack measured on the 10 V range of the Weston Analyser voltmeter or on the 400 V scale of the Avometer, using the ÷2 button.

(k) Adjust the BALANCE and CURRENT controls so that both meters read 25 mA.

(l) Connect a selsyn generator, with the rotor to 115V A.C. and with the stator terminals paralleled with the stator terminals of a control transformer. Connect the rotor of the latter to terminals 1 and 2 of the respective azimuth or elevation voltage transformer.

(m) Adjust the stator of the selsyn generator until the field current readings are again equal.

(n) The readings in Table 55, taken under the above conditions, should be obtained.

(o) Adjust the stator of the selsyn generator until the field current meters show a difference of 40 mA, the left-hand meter showing the greater reading.

(p) The readings in Table 56, taken under these conditions, should be obtained.

TABLE 55—DYNAMIC VOLTAGES AT VALVE BASES (BALANCED)

VALVE	ANODE A	ANODE B	SCREEN	CATHODE
V401 and V451	125D	125D	....	70C
V402 and V452	125D	125D	....	69C
V403 and V453	286D	....	257D	83C
V404 and V454	286D	....	258D	83C
V408 and V458	125D	125D	....	....

TABLE 56—DYNAMIC VOLTAGES AT VALVE BASES (UNBALANCED)

VALVE	ANODE A	ANODE B	SCREEN	CATHODE
V401 and V451	134D	134D	....	61C
V402 and V452	134D	134D	....	78C
V403 and V453	309D	....	259D	85C
V404 and V454	260D	....	249D	85C
V408 and V458	134D	134D	....	....

Voltage and resistance measurement

323. (a) See paras. 2 to 7.

(b) Voltages taken with the unit set up as detailed in para. 322 (a) to (k).

(c) Resistances taken with the unit set up as in para. 322 (a) to (k) with the A.H. GAIN control set at 5. All cables and pins C, D, and H of J409 disconnected.

TABLE 57—STATIC VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE A		ANODE B		SCREEN		CATHODE		GRID A		GRID B	
	Volts	Ohms	Volts	Ohms	Vo'ts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V401 and V451	127D	50K	127D	50K	.....	....	67C	25K	..	Inf.	....	Inf.
V402 and V452	127D	50K	127D	50K	.....	....	67C	25K	..	Inf	....	Inf.
V403 and V453	287D	Inf.	.....	....	256D	40K	82C	1.7K 1.2K-1.7K (a)	..	250K	....	....

(a) Varied within these limits by CURRENT control.

(b) Varied within these limits by A.H. GAIN control.

(c) Varied within these limits by BALANCE control.

(d) Varied within these limits by A.H. LIMITING control.

(e) Varied within these limits by TORQUE control.

TABLE 57—STATIC VOLTAGE AND RESISTANCE READINGS AT VALVE BASES—Continued

VALVE	ANODE A		ANODE B		SCREEN		CATHODE		GRID A		GRID B	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V404 and V454	287D	Inf.	.....	....	252D	40K	82C	1.7K 1.2K-1.7K (a)	..	250K	....	....
V405 and V455	270D	40K	252D	40K	.....	....	38C	10K	..	800K 1.2M-550K (b)	29C	3K 2.9K-1.9K (c)
V406 and V456	19C	1.5K	19C	800K 1.2M-550K (b)	.....	....	C1:19C C3:34C	C1:800K 1.2M-550K (b) C2: 3.4K 5.8K-2.6K (d)	...	....	....	....
V407 and V457	14C	250K	14C	250K	.....	....	31C	10K 3.5K-15K-3.5K (e)	...	....	....	....
V408 and V458	127D	50K	127D	50K	.....	....	0	....	....	Inf.	....	Inf.

(a) Varied within these limits by CURRENT control.
(b) Varied within these limits by A.H. GAIN control.
(c) Varied within these limits by BALANCE control.
(d) Varied within these limits by A.H. LIMITING control.
(e) Varied within these limits by TORQUE control.

Tracking circuit tester

324. Refer to fig. 1051. This circuit consists of a 30 c/s Wien bridge oscillator feeding a pair of triode-connected 6V6's in push-pull to provide a fixed phase reference voltage. A 6SN7, with change-over switch, acting as a phase-shift network for the error voltage, enables both the automatic and azimuth and elevation tracking units to be tested under simulated automatic conditions. Since the operating frequency is so low, the smoothing in the power pack must be very thorough.

(a) Connect the power cable between J410 and J508 on the azimuth and elevation tracking and automatic tracking units.

(b) Connect 115 V A.C. to the outside of the fuses of the automatic tracking unit and to pins A and B of J408.

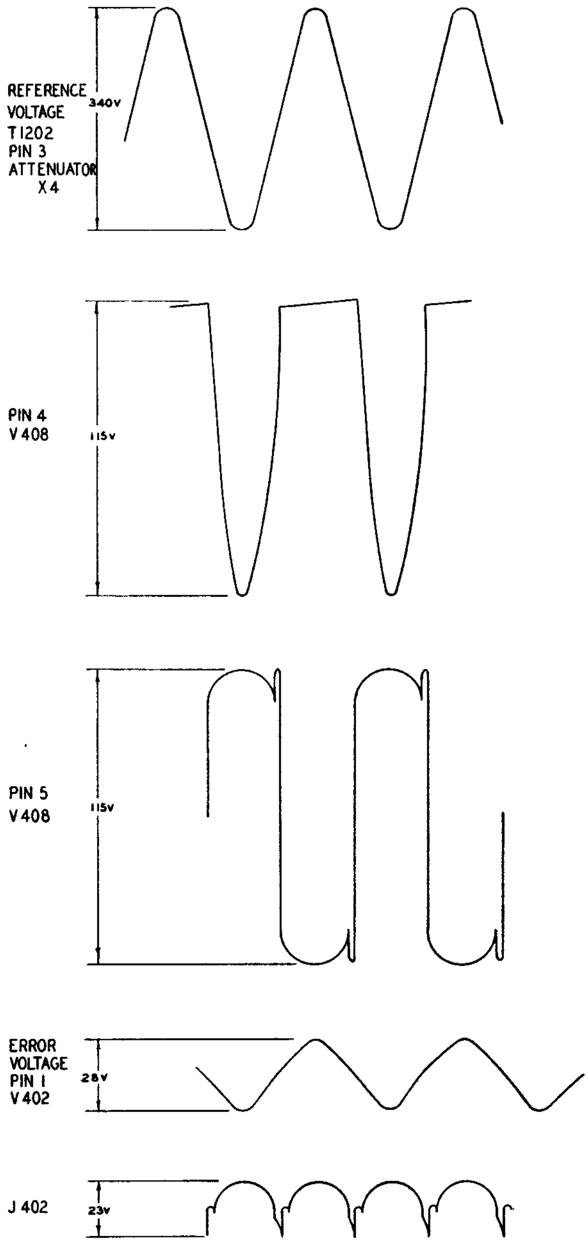
(c) Connect the centre tap of two 1000 Ω, 5 W resistors to terminal 5 of K502, and the other ends to one pair of CONTROL FIELDS jacks.

(d) Connect the two reference voltage jacks on the tester to the outside of the 1 M Ω resistors in the grids of the switching valves, V408 or V458 and apply the error voltage to pin 5 of V502 in the automatic tracking unit.

Waveforms

325. (a) The waveforms shown in fig. 24, were taken with the units set up under simulated manual conditions as given in para. 322 with an unbalanced current of 40 mA.

(b) The set of waveforms given in fig. 25 was taken using the tracking circuit tester set up in the manner indicated in para. 324. Set the GAIN control on the automatic tracking unit to 8 and adjust the A.V.C. control for a reading of 5 mA on the PLATE CURRENT meter.



T $\frac{\text{OY-104}}{\text{1-24}}$ **Fig. 24—Waveforms of azimuth and elevation tracking unit**

To test the commutator filter

326. (a) Apply the waveform at either J404, or J405 obtained by either of the two methods mentioned above, to the A1 terminal of the Oscillograph C.R. No. 1 with the selector switch at Y1Y2 and A1 gain at a conveniently low setting. Measure the peak to peak amplitude of the ripple.

(b) Calibrate the oscillograph using the voltage at pin 6 of T502 and an Avometer Model 7.

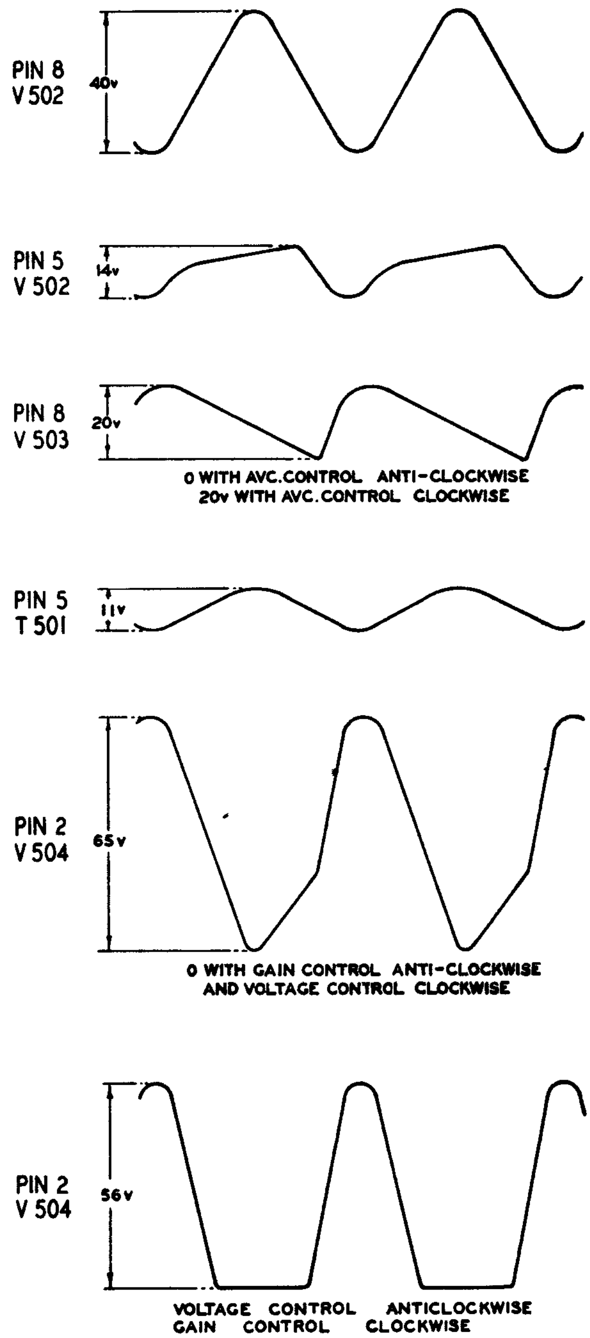
(c) The ripple voltage should not exceed 1V r.m.s. **NOTE: A set units may show no ripple at all.**

To test the anti-hunt circuit

327. (a) Set up the units as detailed in (a) to (k) of para. 322.

(b) With a Boonton B.F.O. Type 140A, set at the 1000 Ω output position, inject a 10 c/s signal across C406.

(c) Measure the voltages on a calibrated Oscillograph, C.R. No. 1 between the junction of C406 and L403, and the point indicated in Table 58.



T $\frac{\text{OY-104}}{\text{1-25}}$ **Fig. 25—Waveforms of azimuth and elevation tracking unit**

TABLE 58—ANTI-HUNT CIRCUIT TEST

SETTING OF A.H. GAIN CONT.	B.F.O. INPUT (V. RMS)	V405 Pin 1 A	V405 Pin 1 B	V405 Pin 2 A	V405 Pin 2 B	V405 Pin 5 A	V405 Pin 5 B	V404 Pin 3 A	V404 Pin 3 B	V404 Pin 4 A	V404 Pin 4 B	V403 Pin 3 A	V403 Pin 3 B	V403 Pin 4 A	V403 Pin 4 B
5	20	6	8	22	25	22	22	13	13	19	22	11	13	20	26
	10	5	5	18	17	15	14	10	9	15	14	10	8	19	16
	5	2.5	2.5	11	10	9	9	6	5	10	9	6.5	6	12	10
	2	1.0	1.0	4	4	3.5	4	3	3.5	3.5	4	3	3	4	4
10	20	6	8	23	27	21	22	11	13	20	22	12	13	27	27
	10	6	8	24	26	22	22	11	13	20	21	10	12	26	26
	5	5	5	23	19	20	16	11	10	19	16	11	10	19	19
	2	2	2	8	8	7	7	5	5	6.5	7	4.5	5	7.5	7.5

A readings on A sets.
B readings on B sets.

MOTOR GENERATORS

Resistance data
328.

TABLE 59—RESISTANCE DATA ON MOTOR GENERATORS

UNIT	AMPLIDYNE	SERVO
3 Phase Drive Motor	1.5Ω across phases	1.1Ω across phases
Compensator coils	2.3Ω each	5Ω each
Control Field Coil		
F1 to F2	1.2KΩ	2.3KΩ
F3 to F4	1.1KΩ	2.2KΩ
Generator armature (across brushes)	9Ω	6Ω
Exciter armature (across brushes)	....	2.3Ω

Bench test
329. *Equipment required:*
2—model 7 Avo meters.
3—100Ω 80 W resistors (3 — R301 from A.A. No. 3 Mk. 5 spares)
1—20KΩ potentiometer (R901 from A.A. No. 3 Mk. 5 spares)
1—65V dry battery.

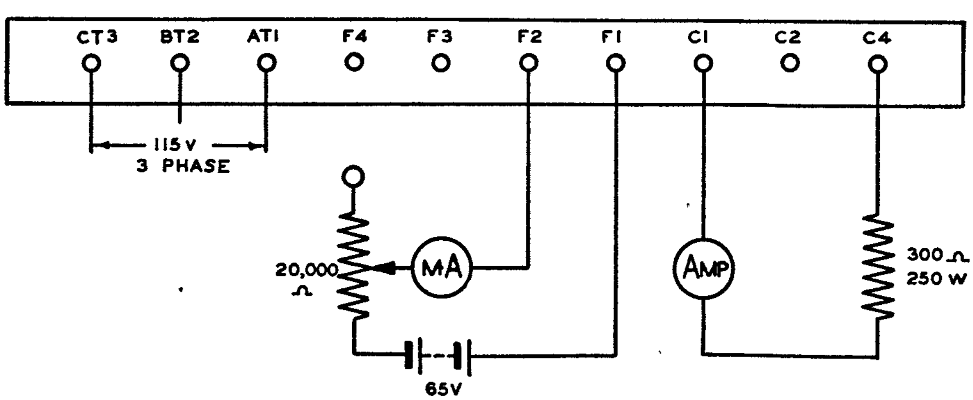


Fig. 26—Motor generator test circuit

T $\frac{\text{OY-104}}{\text{1-26}}$

TABLE 60—MOTOR GENERATOR TEST DATA

CURRENT IN F1-F2 OR F3-F4	CURRENT IN C1-C4 LOAD CIRCUIT			
	Amplidyne mA		Servo mA	
	Used (a)	New	Used (a)	New
4	300	470	100	150
6	440	600	200	280
8	560	690	300	410
10	680	770	400	550

(a) Approximately 1000 hrs. running time.

330. (a) Connect up the circuit as in fig. 26:

(b) Turn the 20KΩ potentiometer for maximum resistance and switch on the power to the drive motor momentarily to ensure that all meters are giving positive readings. Adjust any meter connections, if necessary.

(c) Switch on the drive motor and apply currents varying from 0-10 mA to the control field F1-F2, by altering the setting of the 20KΩ potentiometer. Record the values of current in the dummy antenna drive motor load for each off-balance current.

(d) Repeat with the off-balance current applied through F3-F4 coil. The readings for the two halves of the control field coils should be the same and both readings should be within plus or minus 10% of the values given in Table 60.

NOTE: (i) Motor generators which have been in use as azimuth units for some time tend to show lower readings than elevation units. This is particularly true of Amplidyne Generators.

(ii) This test can be made with the motor generators *in situ*. In that case disconnect C1, C2, C4, F1, F2, F3 and F4 and switch off the automatic tracking unit.

To dismantle an amplidyne

331. (a) Release all leads to the terminal board and pull clear. Remove the terminal board housing.

(b) Remove four hexagonal nuts and washers from the end opposite the drive motor and separate the end bell from the control field winding.

(c) Separate the housing of the control field winding from the centre casing. Care must be taken here since leads connecting the compensating coils, which are located in the centre housing, are connected to the field coil housing.

(d) Remove four hex. nuts and washers from the drive motor end and separate the drive motor from the central housing. Withdraw the rotary shaft.

(e) Reassemble in the reverse order.

To dismantle a servo generator

332. (a) Release all leads to the terminal board and pull clear. Remove the terminal board housing.

(b) Remove the dust cover from the drive motor end. Remove the four hex. nuts and washers now visible and separate the three phase drive motor.

(c) Remove the dust cap from the exciter end and unscrew the four long screws holding the exciter to the generator. Separate and remove the exciter.

(d) Unscrew the four 3 in. bolts securing the two halves of the generator housing and separate the two halves. The central shaft is joined at this point with a keyway and slot. Withdraw the armature carrying shaft.

(e) Reassemble in the reverse order.

Maintenance

333. (a) Inspect all brushes and commutators for wear and dirt. Clean and replace brushes where necessary.

NOTE: The generator brushes on the Servo are accessible when the centre 1 in. band is unscrewed and removed.

(b) Inspect all bearings for grease packing. Clean and repack if necessary.

(c) Check keyway and slot in Servo shaft for excessive wear.

(d) Lubricate as directed in Tels. OY-103, Table 81.

ANTENNA POSITION CONTROL UNIT BC-1085

CARE, MAINTENANCE AND EXAMINATION

334. In general the notes contained in paras. 262 to 267 for the care, maintenance and examination of the range indicator unit are applicable to the antenna position control unit and should be referred to as required.

TESTS AND ADJUSTMENTS

Flywheel brakes

335. The flywheel brakes prevent the handwheels turning excessively after they have been released by the operator.

336. *Test*

Apply this test to both elevation and azimuth handwheels. Turn the handwheel at approximately 1 r.p.s. After overcoming the inertia of the flywheel, the drive should be smooth and free from judder. Release the handwheel and it should come to rest within a quarter of a revolution.

337. *Adjustment*

Increase or decrease the brake pressure by altering the brake spring tension. The adjustment is accessible through holes in the base of the chassis and is clearly shown in fig. 1052. If the brakes cause judder or uneven movement, apply a few drops of oil to the brake surfaces.

Solenoid brakes

338. When the follow-up motor is not energised, its gear train should be held by the solenoid brake so that the selsyn rotor remains stationary when the selsyn stator is rotated. When the follow-up motor is energised, the brake should be held off. The solenoid brake is shown in fig. 1053.

339. *Test*

Apply this test to both elevation and azimuth brakes. Rock the handwheel through about ½ a turn and see that the pinion on the follow-up motor does not move. Connect 115V A.C. to pins M and N of the power receptacle, J1301, at the rear of the unit and the solenoid should operate to release the brakes.

340. *Adjustment*

To increase brake pressure, release the two screws securing the solenoid bracket to the chassis and move the solenoid closer to the spur wheel. If this adjustment is insufficient, remove the solenoid as detailed in para. 356, and replace the solenoid spring. Only very light pressure should be necessary. If the fault persists examine the selsyn for binding between the stator and rotor. If the solenoid does not operate, check the resistance of the solenoid winding which should be approximately 550Ω. Replace the solenoid if defective.

Follow-up motors

341. The follow-up motors must accurately position the rotors of the control selsyns on automatic control to prevent violent slewing of the pedestal when switching to manual control. The design of the motors is such that the rotor torque is comparatively small. It is therefore essential that the load imposed by the follow-up gearing is light.

342. *Azimuth.*

(a) Connect the stators of a 2J5FB1 selsyn control transformer (it is essential that this type be used in this test) to the corresponding stators of the azimuth control selsyn, B1301.

(b) Connect the rotor leads of the control transformer to pins A and B of J1301. Clamp the rotor of the control transformer to the stator so that the rotor will not turn.

(c) Connect 115V 60 c/s A.C. supply to pins O and P of J1301.

(d) Connect an A.C. voltmeter to R1 and R2 of the control transformer.

(e) Rotate the azimuth handwheel to obtain zero voltage on the voltmeter. (One rotation of the azimuth handwheel corresponds to 10 degrees rotation of the stator of the selsyn generator.)

(f) Rotate the stator of the selsyn generator, B1301, 3 degrees and note the reading on the voltmeter. Record this reading as a 3 degree error voltage. Repeat for 5 degrees and 8 degrees.

(g) Connect 115V 60 c/s A.C. to pins M and N of J1301 to release the solenoid brakes.

(h) Rotate the azimuth handwheel 36 revolutions, stopping every revolution to take a reading of the error voltage. 22 of the readings must have an error voltage not greater than that corresponding to a 3 degree error and 14 of the readings may have an error voltage no greater than that corresponding to a 5 degree error.

(i) Connect the 115V supply across R1302 to operate the scan motor, B1302.

(j) The dynamic error voltage measured on the voltmeter should not exceed the voltage corresponding to an 8 degree error.

(k) Disconnect pin M of J1301 from the 115V line and remove the supply from R1302.

343. *Elevation.*

(a) Connect the selsyn control transformer to the elevation control selsyn B1351 and pins C and D of J1301. Connect the voltmeter to the rotor of the control transformer.

(b) Measure the voltages corresponding to 3, 5 and 8 degree errors as detailed in para. 342 (e) and (f). (One revolution of the elevation handwheel corresponds to 23.6 degrees rotation of the stator of the elevation control selsyn.)

(c) Connect pin M of J1301 to one side of the 115V line to open the solenoid brake.

(d) Check the static error by turning the elevation handwheel 16 revolutions stopping to take a reading every ½ revolution. 19 readings must have an error voltage less than that corresponding to an error of 3 degrees. 13 readings may have an error voltage less that that corresponding to an error of 5 degrees.

(e) Connect 115V supply across R1302 to operate the scan motor B1302. Set the elevation scan throw-out lever to the IN position.

(f) Check the dynamic error voltage. This should not exceed the voltage corresponding to an 8 degree error.

344. *Adjustment.*

If the mechanism fails to answer the test to within the specified tolerance the follow-up motor must be removed as detailed in para. 353 or 354 and examined as in paras. 345 to 347. The effort required to rotate the follow-up gearing must be extremely small and the drive should be free from stickiness or binding.

Follow-up motor test

345. To run a motor on the bench connect a 20V single phase 60 c/s supply to terminals 1 and 3. Connect terminals 2 and 4 in series with a 30 μF condenser to the same supply. Terminals 3 and 4 should be connected to the same side of the supply. Switch on the power supply and the motor should rotate clockwise. Gradually reduce the supply voltage and note the value at which the motor becomes stationary. Slowly increase the voltage and note the value at which the motor commences to turn.

346. The motor should not stop with an input above 3 volts and should commence to run before the input reaches 6V.

347. Resistance of windings between 1 and 3, and 2 and 4 should be approximately 10 Ω.

REMOVAL AND REPLACEMENT OF COMPONENTS

Azimuth or elevation control selsyn

348. *Removal.*

Remove the selsyn leads from the terminal strip noting the position of each wire for replacement. Remove the tubular support stay. Remove the three screws and clamps which secure the selsyn in its mounting. Carefully withdraw the selsyn to avoid damaging the gears which are fixed to the rotor and stator. Repair and overhaul of the selsyn are detailed in Instruments and Searchlights I504.

349. *Replacement.*

Replace in the reverse order ensuring that the gears mate with a minimum of backlash.

P.P.I. scan motor

350. The method for removal of this motor in the case of B units is obvious.

351. *Removal (A units).*

Remove the tubular support stays. Remove the elevation control selsyn as detailed in para. 348. Separate the chassis from the main frame as follows:

(a) Remove the leads from both follow-up motors and the azimuth control selsyn, noting the position of each for replacement.

(b) Turn the unit upside down and unsolder the scan motor leads from the MOTOR SPEED control noting the position of each for replacement.

(c) Remove the screws securing the chassis to the main frame from the bottom and sides of the unit.

(d) Carefully lift the chassis away from the frame. Remove the two bolts which secure the motor to its mounting bracket. Slide the motor away from the worm reduction unit, lift off and note any shims which may be used. Brushes should be replaced if less than ¼ in. long.

352. *Replacment.*

Replace in the reverse order ensuring that the packing shims are replaced to the motor base. If a new scan motor is being fitted it may be found necessary to reduce or increase the packing shims to obtain a smooth drive. Connect 115V 60 c/s A.C. supply to pins K and N of power receptacle J1301. Check that the motor turns the azimuth control selsyn stator at approximately 5 r.p.m. Adjust the MOTOR SPEED control if necessary. Check the operation of the elevation motor scan clutch if fitted.

Follow-up motors

353. *Removal (A units).*

Remove the chassis from the main frame as detailed in para. 351 (a) to (d). Remove the four screws securing the follow-up motor and lift it off.

354. *Removal (B units).*

Remove the leads from the transformer beside the motor to be removed noting the position of each for replacement. Remove the transformer. Remove the leads from the follow-up motor noting the position of each for replacement. Remove the four screws securing the follow-up motor and carefully withdraw the motor.

355. *Replacement.*

Replace in the reverse order. Ensure that the follow-up motor drive is perfectly free. Test as detailed in para. 342 and 343.

Solenoid brakes

356. *Removal.*

Remove the two screws securing the solenoid bracket to the baseplate. Unsolder the two connecting leads and lift out the solenoid.

357. *Replacement.*

Replace in reverse order. Carry out the test of the solenoid brakes detailed in para. 339.

FIELD POWER SUPPLY RA-71

Bench test

358. (a) Components from A.A. No. 3 Mk. 5 spares should be connected as follows: 2 — 2500 Ω connected in parallel (R215, R216, R217 or R218) in series with a 350 Ω variable resistor, R1674. This gives a load variable between 1250 and 1600 Ω with a dissipation greater than 75 W. (See fig. 12).

(b) With the load connected between pins B and C of J1153, the variable should be set to give the following conditions:
200 mA D.C.
300V D.C. +10% —0%

NOTE: This test is useful generally for testing 5U4G rectifying valves.

Voltage and resistance measurements

359. *Conditions of measurement.*
(a) 115V A.C. input.
(b) All voltage readings D.C. to chassis except filaments or where otherwise stated.
(c) All resistance readings taken to chassis with cables disconnected.

TABLE 61—VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE—1		ANODE—2		CATHODE	
	Volts	Ohms	Volts	Ohms	Volts	Ohms
V1152	424D A.C. (a) 410D A.C. (b)	26 (c) 41 (d)	424D A.C. (a) 410D A.C. (b)	23 (c) 38 (d)	372D (a) 311D (b) 5.1 A.C.	29K (c) 28K (d)

(a) OFF load readings.
(b) ON load readings.
(c) B sets.
(d) A sets.

TABLE 62—RESISTANCE READINGS AT TRANSFORMERS

Transformer	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6
T1152	*5.5* (c) *12.5* (d)	*5.5* (c) *12.5* (d)	*0.1* (c) *0.1* (d)	*0.1* (c) *0.1* (d)	*0.1* (c) *0.1* (d)	*0.1* (c) *0.1* (d)
T1153	*1.5* (c) *1.4* (d)	*1.5* (c) *1.4* (d)	*23* (c) *38* (d)	*23* (c) *26* (c) *38* (d) *41* (d)	*26* (c) *41* (d)	....

(a) OFF load readings.
(b) ON load readings.
(c) B sets.
(d) A sets.

TABLE 63—PRIMARY CURRENT AND VOLTAGE READINGS AT TRANSFORMERS

Trans.	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Primary Current
T1152	*115* A.C.	*115* A.C.	*5.1* A.C.	*5.1* A.C. *5.2* A.C.	.... *5.2* A.C.	100 mA (a) (c) 90 mA (a) (d) 215 mA (b) (c) 180 mA (b) (d)
T1153	*115* A.C.	*115* A.C.	*424*D A.C. (a) *410D* A.C. (b)	*424D* A.C. (a) *424D* A.C. (a) *410D* A.C. (b) *410D* A.C. (b)	*424D* A.C. (a) *410D* A.C. (b)	480 mA (a) (c) 1100 mA (b) (c) 280 mA (a) (d) 920 mA (b) (d)

(a) OFF load readings.
(b) ON load readings.
(c) B sets.
(d) A sets.

ANTENNA POSITION INDICATOR UNIT BC-1076

CARE, MAINTENANCE AND EXAMINATION

360. In general the notes contained in paras. 262 to 267 for the care, maintenance and examination of the range indicator unit are applicable to the antenna position indicator unit and should be referred to as required.

To clean and relubricate the gears

361. Refer to figs. 1054 and 1055. Remove the two dial windows. Note the position of the four pointers against their respective hubs and remove the inner and outer pointer dials. Remove the two outer dial supports marking their positions relative to the gears.

362. The gears are now accessible through the dial openings and should be cleaned with a brush or non-fluffy cloth. Lubricate the gears with a fine coat of oil, mineral, hydraulic buffer using a brush or spray and taking care not to contaminate the leads or connections.

363. Replace the components in the reverse order. Ensure that the pointers and dial supports are replaced in the marked positions so that the pointers are balanced and free to rotate without fouling.

REMOVAL AND REPLACEMENT OF COMPONENTS

Azimuth and elevation remote receiving selsyns (lower elements)

364. *Removal.*

Remove the selsyn leads from the terminal strip noting the position of each for replacement. Remove the six screws which secure the front panel to the tubular bars and chassis. Remove the four screws which secure the gear and selsyn housing to the bottom of the chassis. Withdraw the chassis from the housing and panel as far as the leads will permit. Remove the thumb-screw and clamp securing the selsyn. Remove the two remaining selsyn clamps noting their shims for replacement. Draw the selsyn out carefully to avoid damaging the gearing. Repair and overhaul of selsyns is detailed in Instruments and Searchlights I504.

365. *Replacement.*

Replace in the reverse order ensuring that the gears mate correctly with minimum of backlash. The size and positioning of the shims beneath the two selsyn clamps should be such that when the thumbscrew of the third clamp is released the selsyn stator rotates freely without end-play.

Azimuth and elevation local receiving selsyns (upper elements)

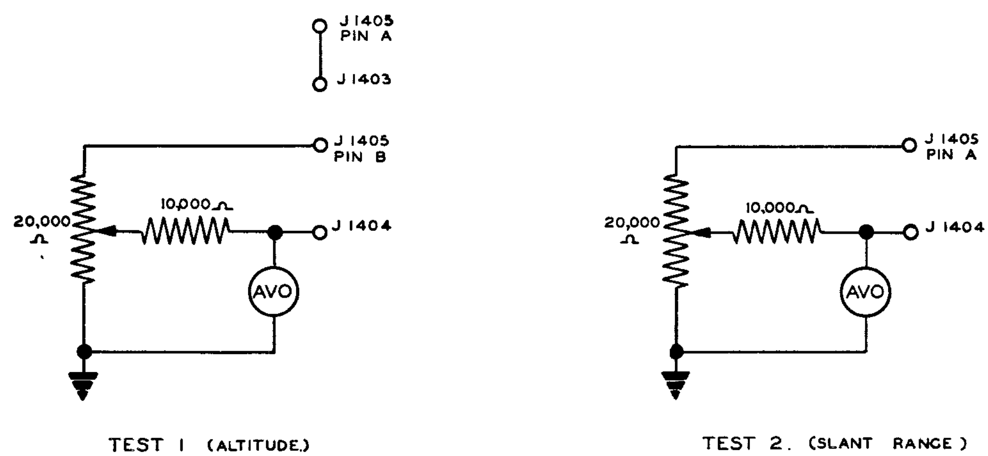
366. *Removal.*

Remove the selsyn leads from the terminal strip noting the position of each for replacement. Remove the thumbscrew and clamp securing the selsyn. Remove the two remaining clamps noting the position of their shims for replacement. Carefully withdraw the selsyn to avoid damaging the gearing. Repair and overhaul of the selsyn is detailed in Instruments and Searchlights I504.

367. *Replacement.*

Replace in the reverse order ensuring that the gears mate correctly with a minimum of backlash. The size and positioning of the shims beneath the two selsyn clamps should be such that when the thumbscrew of the third clamp is released the selsyn stator rotates freely without end-play.

ALTITUDE CONVERSION SYSTEM



T $\frac{\text{OY-104}}{\text{1-27}}$ **Fig. 27—Dummy load for altitude converter**

BENCH SET-UP

368. The following is a method enabling an altitude converter unit to be set up approximately and to attain normal working conditions without the use of the range and elevation potentiometers.

369. The equipment required is as follows:

(a) Altitude converter unit.
(b) Altitude converter power supply.
(c) Data unit.
(d) 1—20K Ω potentiometer (R901).
(e) 1—10K Ω resistor (R1668).
(f) AVO Model 7.

To test operation on both slant range and altitude, the external connections require slight rearrangement as shown in fig. 27 A and B.

NOTE: It is essential to keep the AVO in circuit during all test measurements as it forms part of the potentiometer circuit.

Setting up

370. (a) Switch on the altitude converter power supply.
(b) Connect the AVO (400V D.C. range) between jack TEST 4 (pos.) and chassis.
(c) Adjust the VOLTAGE CONTROL for 300V.
(d) Connect the AVO (100V A.C. range) between jack TEST 2 and chassis. Adjust the OSC. OUTPUT control for 25V. As the control is varied, the meter pointer will oscillate for several cycles. Allow the circuit to stabilise before taking a final reading.
(e) Connect the AVO (100V A.C. range) between jack TEST 6 on the power supply unit and chassis. Adjust the FIXED FIELD V control on the control unit for 15V.
(f) Connect pin A, J1405 to J1403.
(g) Measure the voltage between TEST 3 and chassis with AVO (100V A.C. range). The reading should be 40V ±5V. Remove the connection given in (f).
(h) Set S1402, ALTITUDE/SLANT RANGE, to SLANT RANGE and connect as in fig. 27 B.
(i) Adjust the 20KΩ potentiometer to give 4V input and adjust the PHASE BAL. control for minimum reading on the altitude data dial.
(j) Remove the test set up in (h) and re-connect as in fig. 27 A. Adjust the 20KΩ potentiometer to give 7V input, set the ALTITUDE/SLANT RANGE switch to ALTITUDE, press the FREQ. TEST switch down and adjust either or both FREQ. TEST and COARSE FREQ. until the data unit dial stops moving.
(k) Carry out the data test given in Table 64.

TABLE 64—ALTITUDE CONVERTER TEST DATA

Circuit	S1402 position	Voltage on AVO range C	Altitude yds.
A	Altitude	1.0	1160
A	Altitude	3.0	2650
A	Altitude	5.0	4100
B	Slant range	2.0	3000
B	Slant range	4.0	5400
B	Slant range	6.0	7600

Altitude tolerance ±5%.

250 C/S OSCILLATOR TEST

371. *Equipment required:*
Boonton B.F.O. Type 140-A.
Oscillograph C.R. No. 1 Mk. 2.

Frequency check

372. (a) Set the B.F.O. for 250 c/s and display on Y1 beam of the oscillograph.
(b) Connect J1409 (TEST 2) to Y2 beam of the oscillograph.
(c) Check that FREQ. TEST and COARSE FREQ. give a frequency range of approx. 240-320 c/s.
(d) Adjust FREQ. TEST and COARSE FREQ. to give 250 c/s.

Amplitude check

373. With 250 c/s set as in (d), check the amplitude of oscillation. The following readings should be obtained.
(a) Set up conditions—57V peak to peak.
(b) OSC. OUTPUT fully clockwise to limit of stability—115V peak to peak.
(c) OSC. OUTPUT fully anticlockwise to limit of stability—27V peak to peak.
NOTE: There should be no appreciable interaction between the FREQUENCY and OSC. OUTPUT controls.

Amplifier gain checks

374. (a) *Field amplifier.*
With the oscillator output at 25V A.C. to earth (TEST 2), output at J1454 (TEST 6) to be 15V A.C. to earth.
(b) *Summing amplifier.*
Output at J1412, 26V to earth. This voltage is not affected by changes in voltage input so long as the data unit is not driven to stops.
(c) **Isolation amplifier.**
Gain—1.6 Input at J1403 25V A.C.
Output at J1410 40V A.C.

ALTITUDE CONVERTER CONTROL UNIT BC-1094

VOLTAGE AND RESISTANCE MEASUREMENTS

Conditions of measurement

375. (a) See paras. 2 to 7.
(b) *Voltages.*
(i) Unit set up.
(ii) Unit connected to altitude converter power supply unit.
(iii) Voltages measured to earth except where otherwise stated.
(c) *Resistance.*
(i) Unit in set-up condition. All connections removed.
(ii) Resistances taken to earth except where otherwise stated.

TABLE 65—VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE		SCREEN		CATHODE		CONT. GRID	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V1401	45D 55-9 (a)	250K	70D	50K	2B	3K 3.3K-1K (a)	0	83K 80K-85K (b)
V1402A	287D	150K	.....	......	10C	1K	0	550K
V1402B	288D	210K	.....	......	9C 3-11 (c)	5.8K 1K-8.5K (c)	0	17.3K
V1403A	60D	250K	.....	......	2B	1K	0	400K
V1403B	288D	150K	.....	......	9B	1K	0	1.1M
V1404	70E	400K	31E	1.3M	......	850	...	2.5M-230K (d)
V1405	70E	400K	35E	1.3M	......	900	...	1M
V1406	298D	150K	300D	150K	......	290	...	260

(a) Varies with OSC. OUTPUT.
(b) Varies with COARSE FREQ. and FREQ. TEST.
(c) Varies with FIXED FIELD V.
(d) Varies with ALTITUDE/SLANT RANGE switch.
(e) Varies with OPERATE/TEST switch.

TABLE 66—VOLTAGE AND RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H	Pin J
J1401 Ω	Inf.	Inf.	Inf.	Inf.	2	0	0	NC	155-110/130K (a) (e)
J1402 Ω	2.8M/500K (d)	..	..	..	..	..	..	..	....
J1403 Ω	640K	..	..	..	..	..	..	..	....
J1404 Ω	2.7M/Inf. (e)	..	..	..	..	..	..	..	....
J1405 Ω	155-110/130K (a) (e)	166	0	0	NC	NC	NC	NC	....
J1406 Ω	150K	Inf.	NC	NC	Inf.	Inf.	0	Inf.	....
J1407 Ω	18.5K	..	..	..	..	..	..	..	....
J1408 V Ω	2 A.C. 18.5K	..	..	..	..	..	..	..	....
J1409 V Ω	25B A.C. 155-110 (a)	..	..	..	..	..	..	..	....
J1410 Ω	166	..	..	..	..	..	..	..	....
J1411 V Ω	300D 150K	..	..	..	..	..	..	..	....
J1412 V Ω	2.6B A.C. 2	..	..	..	..	..	..	..	....

(a) Varies with OSC. OUTPUT.
(b) Varies with COARSE FREQ. and FREQ. TEST.
(c) Varies with FIXED FIELD V.
(d) Varies with ALTITUDE/SLANT RANGE switch.
(e) Varies with OPERATE/TEST switch.

TABLE 67—VOLTAGE AND RESISTANCE READINGS AT TRANSFORMERS AND CHOKES

Component		Pin 1	Pin 2	Pin 3	Pin 4
T1401	V	0	25B A.C.	300D	288D
	Ω	*153*	*153*	*9.6K*	*9.6K*
T1402	V	0	0	300D	288D
	Ω	*167*	*167*	*10.1K*	*10.1K*
T1403	V	0	26B A.C.	298D	300D
	Ω	*1.6*	*1.6*	*18*	*18*
Z1401	Ω	*260*	*260*	......	......
Z1402	Ω	*260*	*260*	......	......

(a) Varies with OSC. OUTPUT.
(b) Varies with COARSE FREQ. and FREQ. TEST.
(c) Varies with FIXED FIELD V.
(d) Varies with ALTITUDE/SLANT RANGE switch.
(e) Varies with OPERATE/TEST switch.

ALTITUDE CONVERTER DATA UNIT BC-1075

Mechanical details

376. A mechanical schematic of the unit is shown in fig. 1056, and the internal mechanism is shown in figs. 1057 and 1058. The altitude spinner motor drives the contact brush arm of the height potentiometer through a train of gears and a disc type clutch. The potentiometer brush arm in turn is connected through a pair of gears to the data unit dial and selsyn. The gear train between the altitude spinner motor and brush arm consists of a train of six gears having a total gear ratio of 614:1. The last gear in this train is the large gear shown on fig. 1058 which is attached to the potentiometer brush-arm shaft through the disc-type clutch.

377. For details of this clutch see fig. 1058. The lower clutch disc and spring assembly is permanently fastened to the large gear, which is free to rotate about its shaft. Two springs are mounted on the clutch disc which exert an upward force to cause the clutch discs to exert pressure against each other and to compress the cork lining which is fastened to the driven disc. As the large gear rotates, it drives the potentiometer brush arm through this clutch. The brush arm shaft, however, is prevented from rotating through the entire arc of 360° and rotates only through an arc equivalent to slightly more than that covered by the dial readings from 300 to 10,000 yards. Beyond this range the cam shown on the brake disc assembly engages a roller which operates the limit switch. The limit switch shunts a resistance across one of the motor windings to reduce the motor torque. If the shaft continues to rotate beyond the limit switch, the lug on the upper clutch disc encounters a stop screw mounted on the bridge casting and brings the potentiometer brush arm shaft to rest. After engaging the stop, the motor and gear train, due to their inertia, may continue to rotate without harm for a short interval, due to the slipping action of the clutch. The gear train connecting the potentiometer brush arm of the altitude selsyn transmitter and the data unit dial is a 1:1 ratio two-gear train. The dial and selsyn are therefore directly connected to the potentiometer brush arm and do not operate through the clutch mechanism.

VOLTAGE AND RESISTANCE MEASUREMENTS

Conditions of measurement

378. (a) *Voltages.*
- (i) Taken with unit connected to altitude converter and altitude converter power supply, with all supplies properly set up.
- (ii) Voltages taken between terminals, NOT to earth.

(b) *Resistances.*
- (i) Taken with unit completely disconnected.
- (ii) Resistances taken between terminals, NOT to earth.

TABLE 68—RESISTANCE AND VOLTAGE READINGS AT TERMINAL BOARDS

T.B.	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter.8	Ter. 9
TB 60	*0* (a) *6.3 A.C.*	*0* (a) *6.3 A.C.*	*8* *15 A.C.* (b)	*8* *15 A.C.* (b)	*8* *22 A.C.*	*8* *22 A.C.*	*26K* *25 A.C.*	....	*26K* *25 A.C.*
TB 61	*29*	*29*	*29*	.... *12.5*	.... *12.5*	....	....	....	....

(a) S1492 ON.
(b) Varies with FIXED FIELD V. control.

ALTITUDE CONVERTER POWER SUPPLY—RA 70

VOLTAGE AND RESISTANCE MEASUREMENTS

Conditions of measurement

379. (a) *Voltage.*
- (i) 115 V A.C. input.
- (ii) Unit set up.
- (iii) Voltages taken to earth except where stated.
- (iv) ON load voltages taken with unit connected to altitude converter unit.
- (v) OFF load voltages taken with unit disconnected from altitude converter unit.

(b) *Resistance.*
- (i) Unit set up with external connections removed.
- (ii) Resistances taken to earth except where stated.

(c) *Current.*
- (i) OFF load conditions given for power unit disconnected from altitude convertor unit and also with all power unit valves removed.

Dummy loads

380. To test the power unit without connection to its correct output use the following dummy loads:

(a) Across pin F and E to J1451 connect 2Ω, 20 W. Correct functioning of power unit will give a current of 2.9-3.0 A A.C. through the load, with primary transformer currents as stated.

(b) Across pins A and H of J1451 connect 3.3KΩ, 30 W. Correct functioning of power unit will result in current of 88-90 mA. D.C. through the load, with transformer primary currents as stated. This load can be made up from 3-R718 or R737 or R1668 in parallel".

TABLE 69—VOLTAGE AND RESISTANCE READINGS AT VALVE BASES

VALVE	ANODE A		ANODE B		SCREEN		CATHODE		GRID A		GRID B	
	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
V1451	105D	120K	....	....	....	....	0	0	....	....	....	....
V1452	550D A.C.	53	550D A.C.	51	....	....	435D (d) 525E (c)	1.3M	....	....	....	....
V1453 and V1454	425E (d) 525E (c)	1.4M	....	....	....	....	300D	80K	202E (d) 243E (c)	280K	....	....
V1455	300D	80K	202E	280K	....	....	180E	100K	180E	320K	162E 174-150 (b)	68K
V1456	300D	80K	180E	320K	....	....	106D	50K	71E	360K	106E	49K 47K-52K (b)
V1457	32D (d) 26D (c)	350K	....	....	21D	1.1M	....	660	....	1.1M	....	....
V1458	350D (d) 430E (c)	1.3M	....	....	255D (d) 260D (c)	90K	....	285	....	470K	....	....

(a) V1451 removed.
(b) Varies with VOLTAGE CONTROL.
(c) OFF load readings.
(d) ON load readings.
(e) All plugs disconnected.
(f) All power pack valves removed.

TABLE 70—VOLTAGE AND RESISTANCE READINGS AT TRANSFORMERS AND CHOKES

Component	Ter. 1	Ter. 2	Ter. 3	Ter. 4	Ter. 5	Ter. 6	Ter. 7	Ter. 8	Ter. 9	Ter. 10	Ter. 11	Ter. 12	Ter. 13	Primary Current
T1451 Ω	*0.8*	*0.8*	*104*	......	*104*	*0.05*	*0.05*	*0.2*	....	*0.2*	..... *0.05*	....	..... *0.05*	1.3A(d)
V	*115A.C.*	*115A.C.*	*560A.C.*	*560A.C.* *560A.C.*	..... *560A.C.*	*5.3A.C.* 535E(c) 435 (d)	*5.3A.C.*	*6.3A.C.*	.... 300D	*6.3A.C.*	*6.6A.C.*	.... 180D	*6.6A.C.*	1.0A(c)(e) 400mA(c)(f)
T1452 Ω	*7*	*7*	*0.06*	*0.06*	*0.8*	*0.8*	.....	.....	....	.....	.....	....	.....	290mA(d)
V	*115A.C.*	......	..... *6.8A.C.*	...... *6.8A.C.*	.....	*115A.C.*	.....	.....	....	.....	.....	....	.....	108mA(e) 46mA(f)
T1453 Ω	*1.8*	*1.8*	*25*	*25*	.....	.....	.....	.....	....	.....	.....	....	.....	....
L1451 Ω	*27*	*27*	.....	......	.....	......	.....	.....	....	.....	.....	....	.....	....
V	526E(c) 435E(d)	525E(c) 440E(d)												

(a) V1451 removed.
(b) Varies with VOLTAGE CONTROL.
(c) OFF load readings.
(d) ON load readings.
(e) All plugs disconnected.
(f) All power pack valves removed.

TABLE 71—RESISTANCE READINGS AT JACKS

Jack	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F	Pin G	Pin H
J1451	60K	3	NC	NC	0	0.1	0	0
J1452	1.1M	....	.....	.....	....	.....	....	....
J1454	3	....	.....	.....	....	.....	....	....

CONTROL PANEL PN-22

VOLTAGE AND RESISTANCE TABLES

Conditions of measurement

381. (a) *Voltage.*

(i) All measurements made to earth unless otherwise stated, with the trailer operating.

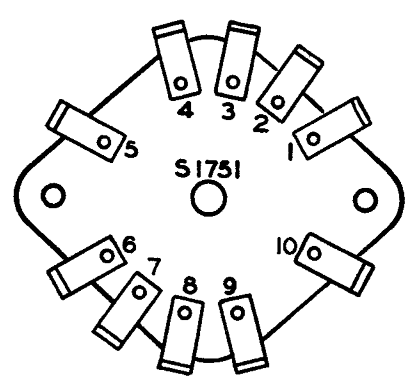
(b) *Resistance.*

(i) All measurements made to earth except where otherwise shown.

(ii) All power off and cables to J1751, J1752 and J1753 disconnected.

(c) Key to contact numbering of S1751 as used in Tables 72 and 73 is shown in fig. 28.

TOP OF CONTROL PANEL



T OY-104 1-28

Fig. 28—Underside of control switch showing numbering of contacts

LIST OF TABLES—Continued

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS—Continued

LIST OF ILLUSTRATIONS—Continued

EQUIPMENT RADAR A.A. NO. 3 MK. 5

(SCR-584 A & B)

ADJUSTMENT AND REPAIR IN SECOND TO FOURTH ECHELON

General

1. (a) The aim has been to establish, wherever possible, test procedures for each unit which require only the associated power supply unit and not the whole set.

(b) Where this has not been possible, it will be necessary to service the unit either in the set using the extension cables provided or in the workshop in conjunction with the other required units.

(c) For some units which are normally pulse triggered, additional test data has been given for the free-running state as an aid where no trigger pulse is available.

Voltage and resistance tables

2. Voltage and resistance tables given in this regulation have been compiled from units set up in accordancé with Tels OY-103 with a view to carrying out maintenance and location of faults using the normal methods of servicing, i.e. voltage and resistance checks.

3. Where a voltage or resistance value is affected by a variable control, three readings are given. The first reading indicates the value of the component with the control in a set-up, working position; the two values directly below it show the extreme values, first with the control fully clockwise, second with the control fully anticlockwise.

NOTE: In testing a circuit which includes variables, all controls should first be adjusted to give the set-up values; the two limits of each control should then be checked and finally the control returned to the set-up condition.

4. Certain differences in component manufacture exist between Westinghouse and General Electric sets and where voltages and resistances due to these differences are large enough to be significant, both values have been included. In general, the values shown in the tables are the mean of several sets from each manufacturer.

5. The two halves of double triode valves are indicated by the letters A and B after the valve number. Pins 2, 1 and 3 being the anode, grid and cathode respectively of the A half, Pins 5, 4 and 6 being the anode grid and cathode respectively of the B half.

6. Identical voltage or resistance readings printed in italics and on the same line denote values taken between those points and NOT to earth or chassis.

7. Avometer voltage readings vary according to the scale used. In the voltage tables the capital letter following a reading refers to the Avometer scale, as shown in Table 1. Throughout the tables, voltage readings were taken with WY-0759 Avometer Universal 46 Range, Mk. I (AVO 7).

TABLE 1—SCALES OF AVOMETER UNIVERSAL MODEL 7

DC	SCALE	AC
1V	A	10V
10V	B	100V
100V	C	400V
400V	D	1000V
1000V	E	4000V
4000V	F	8000V
8000V	G	......

NOTE: 4000V and 8000V external multipliers were used on scales F and G.

PEDESTAL MP 61

REMOVAL AND REPLACEMENT OF PEDESTAL PARTS

Tools

8. Certain tools and jigs were originally provided to facilitate removal and replacement of various parts of the pedestal. These tools are shown in figs. 1001 and 1002. The use of these tools and jigs has been detailed in the relevant paragraphs. Should they not be available, equivalents must be procured or constructed.

To remove the pedestal from the trailer

9. The equipment used to raise the pedestal from the roof must be capable of lifting more than 2200 pounds. Remove the pedestal as follows:

(a) Ensure that the elevator is firmly locked in the raised position. Adjust the paraboloid to 0 degrees elevation. Tighten the azimuth stowing lock.

(b) Remove the plugs from J2003 to J2008 located on the bracket underneath the pedestal. Disconnect from terminals 11 and 12 of TB6 the two leads from TB11.

(c) Disconnect and remove the removable section of R.F. transmission line from underneath the pedestal and secure it in the stowing rack.

(d) Hook the crane or lifting tackle on to the ears of the elevation yoke with the lift chain SL13, and pull up tight.

(e) Remove the bolts securing the canvas boot to the elevator platform. Remove the large reinforcing ring.

(f) Remove the locknuts and washers from the lockscrews adjacent to the four levelling screws.

(g) Lift the pedestal clear of the lockscrews.

To replace the pedestal on the trailer

10. Replace in the reverse order of removal. Coat the threads of the levelling screws and the locking screws heavily with Grease No. 4.

To remove the azimuth drive motor

11. (a) Open the door of the azimuth selsyn compartment and set the safety switch to SAFE. Remove the panel over the azimuth drive motor compartment.

(b) Remove the five hex. hd. bolts in the motor flange and the nut on the stud adjacent to the motor terminal box.

(c) Lift the motor vertically out of its pilot hole and clear of the stud. The approximate weight of the motor is 41 pounds. If the neoprene sealing gasket is still on the shoulder of the motor, remove it.

(d) Remove the coupling from the shaft with the puller SL22 if the motor is to be changed.

(e) Switch off the main switch S1976 or, if not fitted, remove plug P1930 before disconnecting the motor leads.

To replace the azimuth drive motor

12. Replace in the reverse order of removal. The flat on the motor flange must face the pedestal so that the stud is inserted in the hole under the motor terminal box.

To remove the azimuth potentiometer

13. (a) Remove the plug from J2004 and disconnect from TB6 the leads 198, 199, 200, 201 and 202 connecting to the potentiometer.

(b) In order to establish a known relationship between the potentiometer slider and the azimuth shaft, switch on the antenna positioning circuits and rotate the paraboloid until the resistance measured between leads 200 and 201 connected to the potentiometer is approximately 10K Ω. Note the azimuth of the pedestal.

(c) Remove the three screws securing the potentiometer to the underside of the pedestal base and lower the potentiometer. The approximate weight of the assembly is 50 pounds.

To replace the azimuth potentiometer

14. (a) Rotate the potentiometer shaft until the resistance measured between leads 200 and 201 connecting to the –R and –X terminals respectively of the potentiometer is approximately 10K Ω. This avoids an 180 degree error when meshing the potentiometer coupling 289. Rotate the pedestal to the azimuth noted in para. 8(b).

(b) Replace the potentiometer in the reverse order of removal detailed in para. 13(a) and (c).

(c) Check the orientation of the potentiometer as detailed in paras. 80 and 81 of Tels. OY-103.

To remove the azimuth low speed joint

15. (a) Remove the cover over the elevation yoke.

(b) At the bottom of the compartment, remove both halves of the bracket which holds the R.F. line in the upright position. Break the line at the connection just below the bracket.

(c) Remove the section of line which extends inside the trailer from the azimuth base and stow it in its rack.

(d) Unscrew the transmission line clamping nut, 578. Press the line sideways sufficiently to free it from the supporting bracket on the cover plate.

(e) Lower the joint and the R.F. line out of the drive shaft and remove the clamping nut from the line.

To replace the azimuth low speed joint

16. Replace in the reverse order of removal.

To remove the azimuth oil reservoir and cover assembly

17. (a) Remove the azimuth potentiometer as detailed in para. 13.

(b) Remove the section of line extending from the azimuth base inside the trailer. Remove the line support bracket and remove the right-angle section of line beneath the cover assembly.

(c) Drain the oil from the oil reservoir and replace the drain plug.

(d) With the main line switch in the OFF position disconnect the leads to the azimuth stowing switch.

(e) Remove the screws securing the cover to the base of the pedestal and lower the cover. Care must be taken to avoid damage to the gasket.

To replace the azimuth oil reservoir and cover assembly

18. Replace in the reverse order of removal. Refill the reservoir according to the lubrication table, Table 81, Tels. OY-103. Replace the potentiometer as detailed in para. 14.

AZIMUTH DRIVE GEARS

To remove the planet carrier and the stationary annulus

19. Refer to figs. 1003 and 1004.

(a) Remove the azimuth drive motor as detailed in para. 11.

(b) Remove the centre block, 229, of the Oldham coupling from the sun gear, 158, and lift out the sun gear.

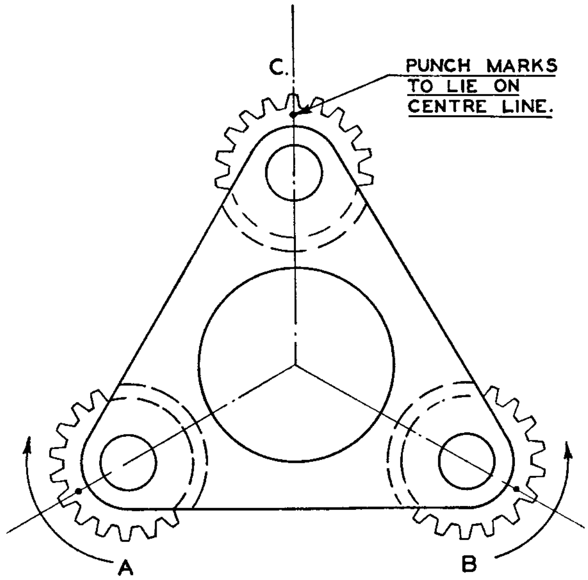
(c) Insert the fingers of both hands in the space left by the sun gear and pressing against the carrier, lift the carrier until the second set of planet teeth strike the stationary annulus. Tap the annulus gently with the carrier assembly until the carrier and the annulus can be removed. If necessary remove the annulus with the puller SL17.

To replace the planet carrier and stationary annulus

20. The following alignment of the planet gears must be carried out precisely or it will be found impossible to mesh the planet gears in the output annulus after the sun gear is in position.

(a) Lay the carrier on a flat surface with the 19T planets uppermost arranged as in fig. 1.

(b) In most cases the tooth of the 19T planet which lines up with a tooth on the 18T end of the planet



T $\frac{\text{OY-104}}{\text{1-1}}$ **Fig. 1—Alignment of planet carrier**

is punch marked. If the planet is not so marked it should be punched at the point where the teeth on each end are coincident. Arrange the planets so that the punch marks lie on a straight line passing through the planet shaft and the centre of the carrier.

(c) Locate a tooth on the 18T planet of the gear A (fig. 1) and mark the surface on which the carrier is resting. Rotate the gear A exactly six teeth clockwise counting on the 18T section. Repeat on the gear B but rotate the gear anti-clockwise. Both planets are rotated towards the gear C around their outer rim.

(d) Mesh the sun gear with the 19T gear. If (b) and (c) have been carried out correctly the sun gear will mesh without moving the planet gears. Slight misalignment may be overcome by a small movement of the planets.

(e) Place the planet carrier and sun gear assembly on the shaft, 160, and mesh the 18T planets with the output annulus. If the planets have been correctly aligned they will mesh with the annulus. Slight misalignment may be corrected by rotation of the sun gear. Do not force the carrier into mesh.

(f) If the gears do not mesh correctly repeat (a) to (e) until the carrier can be inserted in the annulus.

(g) Replace the stationary annulus and the centre block 229, of the Oldham coupling. Replace the drive motor as detailed in para. 12.

To remove a planet from the carrier

21. Refer to figs. 1003 and 1004.

(a) Remove the planet carrier and stationary annulus as detailed in para. 19.

(b) Cut and remove the wire, 1061715, which locks the planet gear shaft, 141, in the carrier, 582.

(c) Use the dummy shaft SL10 to drive the pinion shaft, 141, out of the carrier. This will prevent the rollers, 144, of the bearings from falling out of place as the pinion shaft, 141, is displaced. Drive the dummy shaft flush with the wall of the carrier and then drift it to clear the inside of the wall. Remove the pinion and the dummy shaft.

To replace a planet in the carrier

22. (a) Reassemble the thrust washers, 143; rollers, 144, and spacer, 142 in the planets using the dummy shaft SL10. Dip the rollers in Grease, Special H.M.P. for lubrication and to keep them in place during assembly.

(b) Insert the planet in the carrier and drive out the dummy shaft with the pinion shaft, 141. Ensure that the holes for the locking wire line up in the carrier and shaft. Insert a new wire and bend it as in fig. 1003.

(c) Replace the carrier and stationary annulus as detailed in para. 20.

To dismantle the azimuth oil pump

23. Refer to figs. 1003 and 1004.

(a) Remove the azimuth reservoir and cover assembly as detailed in para. 17.

(b) Slacken the three bolts, 122017 securing the pump housing to the azimuth base and allow the output annulus and the attached parts to move down slowly until they rest against the recess in the azimuth base. (On some units the fit of the bearings may be sufficiently tight to prevent this movement). When the housing is free of the weight of the other parts remove the bolts and the lockwashers, 120214.

(c) Lower the housing vertically until the oil tube, 232, projecting up into the gear train is clear.

(d) Pour the oil from the pump housing. The pump plunger, 509, the plunger spring, 154, and the retainer, 510 are loose after removal of the pump from the pedestal base.

(e) The ball, 147485 and valve spring, 155, in the pump valve can be dismantled by removing the bolt, 156.

(f) The oil pump cam is held by a light press fit on to the end of the annulus hub and secured by the drive pin, 141149. The cam can be removed with a chisel.

To replace the azimuth oil pump

24. (a) Replace in the reverse order of removal.

(b) Refill the azimuth oil reservoir as detailed in the lubrication table, Table 81, Tels OY-103.

To remove the output annulus

25. Refer to figs. 1003 and 1004.

(a) Remove the planet carrier and stationary annulus as detailed in par. 19.

(b) Remove the oil pump housing as detailed in para. 23 (a) to (d).

(c) Using the circlip pliers, C484, remove the snap ring from the outer race of bearing, 619288.

(d) Lift the annulus and attached parts out through the motor pilot hole. If the fitting of the bearings is sufficiently tight to prevent the withdrawal of the assembly, use a brass sleeve against the outer race of bearing 619288 and lightly drift the bearing from its bore.

To dismantle parts on the output annulus hub

26. Refer to figs. 1003 and 1004.

(a) The lower bearing, 619288, has a light fit on the hub and, after removal of the snap ring, may be jolted from its position by its own weight. After removing the bearing take off the washer 1061735.

(b) Remove the oil pump cam with a chisel before removing the azimuth drive pinion, 225. Remove the pinion with the gear puller SL7.

(c) The upper ball bearing will probably come loose if the end of the hub is struck on a wooden block. If necessary drift the bearing through the small holes in the annulus.

To reassemble the parts on the annulus hub

27. Replace in the reverse order of removal. Ensure that the side of the pinion having the tapped holes is away from the annulus and towards the end of the hub. Three sizes of drive pinion keys are available (Stock Nos. 2A2704-61B/K2, 2A2704-61B/K4 and 2A2562-88/K1). When replacing the ball bearing, 619288, ensure that the groove in the outer race is on the side away from the drive pinion.

To replace the output annulus

28. Thoroughly lubricate the output annulus and its assembled parts before replacement. Replace in the reverse order of removal. Replace the planet carrier and stationary annulus as detailed in para. 20.

To remove the azimuth drive and selsyn input gears

29. Refer to figs. 1003 and 1018.

(a) Remove the azimuth oil reservoir and cover assembly as detailed in para. 17 and remove the azimuth low speed joint as detailed in para. 15.

(b) Remove the snap ring 1061741, below the gear on the azimuth drive shaft.

(c) Remove the azimuth drive and selsyn input gears from the drive shaft with the gear puller SL6. Do not separate the gears before removal.

(d) Remove the flat washer, 176, and the felt seal, 1061745.

To replace the azimuth drive and selsyn input gears

30. (a) Replace in the reverse order of removal. The bolts fastening the two gears together should be left loose to permit alignment of the selsyn input gear after replacement. Three thicknesses of the drive shaft key are available (Stock Nos. 2A2704-61B/K3, 6L996-44B and 6L996-44W) and two thicknesses of snap ring (Stock Nos. 2A2704-61B/R18 and 2A2562-88/R4). During manufacture the drive gear is heated to 250°F. for fitting to the drive shaft.

(c) Replace the azimuth oil reservoir and cover assembly as detailed in para. 18.

AZIMUTH SELSYN GEARS

To remove the azimuth selsyn clamping handle

31. Refer to figs. 1005 and 1006.

(a) Remove the cover over the azimuth selsyn compartment. Turn the clamping handle anticlockwise until it is loose. Remove the three screws, 123435, securing the stem to the nut, 188, and remove the handle.

(b) Remove the retainer, 173, the felt gasket, 174, and the C washer, 193. Unscrew and remove the left-hand nut, 188.

To replace the azimuth selsyn clamping handle

32. Replace in the reverse order of removal.

To remove the hub and selsyn gears

33. Refer to figs. 1005 and 1006.

(a) Remove the cover over the azimuth selsyn compartment. Remove the clamps holding the azimuth selsyns in place and withdraw the selsyns from their positions in the base.

(b) Remove the azimuth selsyn clamping handle as detailed in para. 31.

(c) Remove the azimuth drive and selsyn input gears as detailed in para. 29.

(d) Remove the four screws 122007, fastening the hub, 186, to the azimuth base. Ease down the hub, drive-shaft, 163, and attached parts until the selsyn-driven gear, 171, rests on the flange of the azimuth base forming the bottom of the gear compartment.

(e) Pull downward on the hub, 186. The shaft, 163, will move down bringing the key, 349, with it, until the end of the key reaches the top of the washer, 178. The keyways in gears 345 and 172 are in line, since these gears are bolted together. The keyway in washer 178 may not be in line with those in the gears, since the washer floats when the locking handle is loose. Reach into the case from below and rotate the gears 171 and 172 slowly in opposite directions by pushing against the teeth with thumb and forefinger, meanwhile lifting and lowering the hub 186 slightly and feeling for the indexed position of the keyway in the washer. When the key slips through the washer, put a slight downward pressure on the hub 186 and rotate the two gears as before, until the key slips into the keyway of gear 171. The hub and shaft assembly will now drop free.

(f) Slide the stack of gears still remaining in the gear case gently towards the azimuth drive shaft, keeping gears 171 and 172 approximately concentric. As they approach the azimuth shaft, tilt them down on that side and ease them over until they clear the end of the shaft. They can then be slipped entirely out of the gear case. Maintain a slight pressure between the gears during their extraction to keep the washer from sliding out.

(g) Complete the dismantling of the gears by removing the four bolts, 123737, holding the sleeve, 187, and gears 345 and 172 together.

(h) Remove the needle bearing, 168, from the counterbore in the azimuth base by pushing through the bore and catching it through one of the selsyn holes as it falls.

To dismantle the hub and selsyn drive shaft

34. Refer to figs. 1005 and 1006.

(a) Remove the key, 349, and the slip washer, 203, from the end of the shaft. Push or lightly drift the shaft through the bearing, 167.

(b) Remove the snap ring 1061768 from its groove in the hub and drift the bearing from the hub. Push the oil seal out through the bottom of the hub.

To reassemble the hub and selsyn drive shaft

35. Reassemble in the reverse order of removal.

To replace the hub and selsyn gears

36. Refer to figs. 1005 and 1006.

(a) Lubricate all working surfaces and lightly cover all non-working surfaces with Grease No. 0.

(b) Insert the bearing, 168, in the azimuth base from the top.

(c) Bolt the sleeve, 187, and gears 345 and 172 together. Ensure that the keyways on the gears line up and that the teeth on gear 345 adjoin the sleeve.

(d) Place the washer 178 between the adjusting gear and the driven gear and line up the keyways. Insert a short hardwood plug through the driven gear, washer and adjusting gear in order to position the washer and to keep the gears aligned when replacing them in the base.

(e) Insert the assembly into the base reversing the procedure used for removal. Carefully knock out the hardwood plug from the top when the gears are in position.

(f) With the gears still resting on the bottom of the gear case, slip the shaft, 163, and key in from below so that the key will begin to enter the snug fitting keyway in gear, 345, before the hub has reached its close fit in the case. If the key resists entering the keyway, push the gears upward and push the sleeve into place in the needle bearing. Start the hub screws into the azimuth base far enough to hold the shaft and gears in position. Screw the left-hand nut, 188, into the sleeve as far as possible. Tap on the upper face of the nut until the key moves into the keyway. Tighten the hub screws and the lefthand nut. Insert the C washer.

(g) Replace the clamping handle and the azimuth selsyns.

(h) Replace the azimuth drive and selsyn input gears as detailed in para. 30. Orient the potentiometer and the selsyns as detailed in paras. 80 and 81 of Tels. OY-103.

TO REMOVE THE ELEVATION LOW SPEED JOINT

37. Remove the cover over the elevation yoke and disconnect the R.F. line at the joint near the elevation hub. Disconnect the line at the joint above the elevation yoke and to the rear of the spinner motor. Remove the screws securing the transmission line flange to the end of the elevation hub and carefully withdraw the assembly from the hub.

To replace the elevation low speed joint

38. Replace in the reverse order of removal.

TO REMOVE THE ELEVATION DRIVE MOTOR

39. (a) Drain the oil from the elevation drive case.

(b) Remove the elevation drive motor using the method detailed for removal of the azimuth drive motor, para. 11.

To replace the elevation drive motor

40. Replace in the reverse order of removal. Refill the elevation drive case according to the lubrication table, Table 81, Tels. OY-103.

ELEVATION DRIVE GEARS

To remove the planet carrier and stationary annulus

41. Block up the paraboloid to prevent it from dropping when the gears are removed. Remove these parts according to the method detailed for removal of the azimuth planet carrier and stationary annulus para. 19. Refer to figs. 1008 and 1009.

To replace the planet carrier and stationary annulus

42. Replace as detailed in para. 20.

To remove the output annulus

43. Refer to figs. 1008 and 1009.

(a) Remove the elevation drive motor as detailed in para. 39.

(b) Remove the planet carrier and stationary annulus as detailed in para. 41.

(c) Remove the six bolts securing the elevation oil pump to the wall of the drive case and remove the oil pump. Catch the ball check inlet valve and spring when the pump housing is removed.

(d) Remove the snap ring from the outer race of the ball bearing, 619288, and push the output annulus with its assembled drive pinion and two ball bearings out of the drive case.

44. Dismantle the parts on the output annulus hub according to the detail given in para. 26. Reassemble as detailed in para. 27.

To replace the output annulus

45. Replace in the reverse order of removal. Replace the planet carrier and stationary annulus as detailed in para. 20.

To remove the elevation main drive gear

46. Refer to figs. 1008 and 1009.

(a) Block up the paraboloid to prevent it from dropping when the drive gear is removed.

(b) Remove the elevation low speed joint as detailed in para. 37.

(c) Remove the 12 bolts securing the cover to the upper end of the elevation drive case and remove the cover.

(d) Remove the snap ring which retains the main drive gear on the hub.

(e) Pull the drive gear from the hub using the gear puller SL6.

To replace the elevation drive gear

47. Replace in the reverse order of removal. The elevation drive gear may be turned through 180 degrees if the section in use is damaged or worn. Press the drive gear and keys on to the hub together. The keys as well as the gear are a press fit on the hub. Three thicknesses of hub keys are available (Stock Nos. 2A2704-61B/K3, 6L996-44B and 6L996-44W). During manufacture the drive gear is heated to 250°F. before fitting to the hub.

To remove the elevation drive case

48. Refer to figs. 1008 and 1010.
- (a) Attach a crane or lifting tackle to the drive case end of the paraboloid support by looping around the paraboloid support flange. Pull up tight. This support is necessary in order to take the weight normally carried by the bearing 239 to prevent damage to the bearing on the opposite side of the yoke when the drive case is removed.
- (b) Remove the elevation drive motor as detailed in para. 39.
- (c) Remove the counterweight (64 lbs.) from the lower end of the drive case.
- (d) Remove the drive gear as detailed in para. 46.
- (e) Remove the 7 bolts securing the drive case to the paraboloid support and remove the drive case and bearing 239 from the hub using the puller SL16. The drive case weighs approximately 73 pounds without the idler gear and planetary system.

To dismantle the drive case

49. Refer to fig. 1008.
- (a) Remove the planetary system as detailed in paras. 41 and 43.
- (b) Remove the elevation oil pump plunger from the drive case by removing the C-shaped spring retainer and pulling out the plunger. Lift out the spring and washer which will then be loose in the case.
- (c) Drive out the idler shaft, 246, from the drive case. The bar used in removing the shaft will hold the idler gear approximately in place. Stand the drive case on edge and hold the gear while withdrawing the bar. Slide the gear upward and withdraw it from the case through the large hole in the upper end. Keep the bore of the gear as nearly horizontal as possible to prevent loss of roller bearing parts.

To reassemble the drive case

50. (a) Coat the bearing rollers, 862155, the spacer, 255, and thrust washers, 251, with Grease No. 0 and set them in the idler gear bore. Push the dummy shaft SL9 in the bearing and, with the drive case on edge, slide the gear into place. Insert the key into place in the idler shaft, 246, and drive the shaft into the drive case bearing displacing the dummy shaft.
- (b) Reassemble the remainder of the components in the reverse order of removal.

To replace the elevation drive case

51. Replace in the reverse order of removal.

To remove the elevation hub

52. (a) Remove the elevation drive case as detailed in para. 48.
- (b) Remove the 6 bolts securing the hub to the elevation yoke. Drift the hub out of its bore in the wall of the yoke from the inside of the yoke compartment.

To replace the elevation hub

53. Replace in the reverse order of removal.

TO REMOVE THE ELEVATION STOWING LOCK

54. Refer to fig. 1011.
- (a) Remove the bolt, 121920, and unscrew the handle until it is free of the case. Pull the lock and shaft from the opposite side of the case.
- (b) If it is necessary to remove the spring loaded plunger, 294, push the plunger into its hole as far as it will go. Insert a screwdriver in the hole in the boss on the drive case and push the spring, 586, downwards until its upper end has moved sufficiently from the plunger hole to allow the outer end of the plunger to be moved to the side of the hole under the retaining washer, 587.
- (c) Insert a screwdriver through the hole in the washer, push the blade under the washer and pry it out. Withdraw the plunger and spring from its seating.

To replace the elevation stowing lock

55. Replace in the reverse order of removal. If a new washer, 587, is required this must be sprung into place with a tube which fits over the plunger, 294. If a new washer is not available the old one should be burred in the hole.

TO REMOVE THE ELEVATION POTENTIOMETER

56. (a) Remove the plugs from J2003 and J2004 on the underside of the azimuth base. Open the door of the azimuth selsyn compartment and set the safety switch to SAFE.
- (b) Remove the cover from the elevation yoke and disconnect leads 32, 38, 39, 40, 41, 42 and 43 from the terminal board TB7.
- (c) Remove the four bolts securing the elevation potentiometer to the cover of the elevation selsyn gear housing. Support the potentiometer before the screws are fully removed. Pull the unit straight out from the cover until the anti-blacklash gear is clear.

To replace the elevation potentiometer

57. (a) Rotate the shaft of the potentiometer through its complete travel and note the position of the upper and lower limits. Locate the centre of travel of the slider and set the shaft to this point.
- (b) Elevate the paraboloid to 41 degrees. Replace the potentiometer in the reverse order of its removal.
- (c) Orient the potentiometer as detailed in paras. 80 and 82 of Tels. OY-103.

TABLE 72—VOLTAGE READINGS AT CONTROL PANEL

	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10
S1751	67 A.C. (b) 67 A.C. (a)	67 A.C. (b) NC (a)	NC (b) 67 A.C. (a)	67 A.C. (b) 67 A.C. (a)	67 A.C. (b) 67 A.C. (a)	0 0	0 0	0 (b) NC (a)	NC (b) NC (a)	NC (b) 0 (a)

TABLE 73—RESISTANCE READINGS AT CONTROL PANEL

	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10
S1751	Inf. (b) Inf. (a)	Inf. (b) NC (a)	NC (b) Inf. (a)	Inf. (b) Inf. (a)	Inf. (b) Inf. (a)	Inf. (b) *0* (a)	*0* (b) *0* (a)	*0* (b) NC (a)	NC (b) NC (a)	NC (b) Inf. (a)

	A	B	C	D	E	F	G	H	J	K	L	M
J1751	NC	To J1752-C Inf. (c) 0 (d)	NC	....	....	....	.....	.....	.....	.....	....	..
J1752	To J1753-D 0	To J1753-E 0	To J1753-F Inf. (c) 0 (d)	To J1753-L 0 (f) Inf. (e)	0	0	0	0	.....	.....	....	..
J1753	To J1753-E 0 (g)	To J1753-F 520 To J1753-E 0 (l)	To J1753-E 0 (m)	To J1752-A 0	To J1753-A 0 (g) To J1753-B 0 (l)	To J1753-C 0 (m)	*0* (k) *Inf.* (j)	*0* (k) *Inf.* (j)	*0*(g)(h)	*0*(g)(h)	To J1752-D 0 (f) Inf. (e)	0

(a) A sets.
(b) B sets.
(c) COAST button up.
(d) COAST button down.
(e) SAFETY switch at STOP.
(f) SAFETY switch at RUN.
(g) CONTROL SWITCH in P.P.I. SCAN position.
(h) CONTROL SWITCH IN MANUAL position.
(j) DIRECTOR SIGNAL switch OFF.
(k) DIRECTOR SIGNAL switch ON.
(l) CONTROL SWITCH in AUTOMATIC position.
(m) CONTROL SWITCH in REMOTE position.

CONTROL RACK

To remove the control rack

382. (a) Remove all panels and the P.P.I. tube.

(b) Remove all incoming cables and electrical connections including those to the rack blower.

(c) Remove the four screws, two at the front and two at the rear, securing the canvas bellows to each side of the control rack.

(d) Remove the six large hex. bolts holding the rack to the support pillars.

(e) Remove the four bolts holding the rack to the cabin.

(f) Using four to six men, lift the control rack over the bellows brackets and ease the rack into a diagonal position for withdrawing either through the rear or double doors.

To replace the control rack

383. Replace in the reverse order of removal.

To remove the control rack blower motor (A sets)

384. (a) Remove the control rack as detailed in para. 382.

(b) Remove the inner side panel and the ventilation duct cover.

(c) Undo the motor leads from the terminal board.

(d) Remove the four nuts and bolts holding the mounting to the rack.

(e) Remove the eight screws holding the fan duct to the flared portion and pull the fan and motor clear.

To separate the blower motor from the fan

385. (a) Remove the four nuts and bolts holding the motor to the mounting.

(b) Drive the key as far as possible towards the boss and, using a driving wedge complete the separation of the fan and motor.

To replace the fan

386. Replace in the reverse order ensuring that a good packing joint is made at the fan inlet end.

To remove the control rack blower from the rack (B sets)

387. (a) Remove the inner side panel over the motor compartment.

(b) Remove the motor leads from the terminal board.

(c) Remove the two Allen head screws securing the fan to the motor shaft.

(d) Insert a long rod into one of the Allen screw holes to prevent the fan from falling into the blower duct.

(e) Remove the nuts and washers from the holding down studs and remove the motor.

To replace control rack blower

388. Replace in the reverse order of removal.

INSPECTION SCHEDULE

Trailer (Outside)

389. Check the condition of the following items:

(a) The earthing pin and the moisture-content of the surrounding earth.
(b) The roof hand grilles and ladders.
(c) The tyres including the spare, and check that the pressure is 65 pounds.
(d) The jacks.
(e) The external ventilator grilles.
(f) The data panel.
(g) The petrol heater fuel tank, fuel line and chimney.
(h) Pedestal hatch seal.
(i) The roof doors.
(j) The stabilizers and turnbuckles.
(k) The hoisting ring.
(l) The coupler release and handle, the towing vehicle connection and the brake couplings.
(m) The external paintwork.
(n) The contents of the storage compartment.
(o) The running gear chassis bolts, spring shackles, wheel stud nuts, slack adjusters, parking brake linkage, cross shaft bushings, pintle hook, coupling plate and road reflector.

Trailer (Inside)

390. Check the condition of the following items:

(a) Trailer exhaust ventilators.
(b) Control rack air filter.
(c) Control rack blower motor.
(d) Trailer ventilator filter.
(e) Junction box JB 71.
(f) All telephone circuits.
(g) Trailer intake ventilator.
(h) Drain hoses.
(i) Storage racks for spare antenna and R.F. lines.
(j) Data panel.

Check that the following equipment is in the trailer:

(a) Two operator's chairs.
(b) Multimeter.
(c) Oscillograph.
(d) Valve tester.
(e) Fire extinguisher.
(f) Spare antenna.

Lubrication

391. Check as far as possible that the lubrication detailed in Tables 81-83 of Tels. OY-103 has been carried out.

Meters

392. Check the readings of the meters of the set, as already set up, against Table 1001. Check the generator voltage on and off load. It should be 115/123 V A.C. Check the calibration of all meters.

Line Voltage Regulator

393. (a) Inspect the interior of the line voltage regulator for cleanliness and condition of brushes in the case of A Sets.

(b) Check that the input to the regulator is 115V.

(c) Vary the setting of the control to ensure that the output on each phase varies from 97V to 125V on A Sets and 107V to 128V on B Sets.

(d) Measure between each phase and earth on the output side of the regulator for zero voltage.

(e) Set the regulator for 115V on meter M1976.

Fuses

394. Check all fuses for correct values as in Table 1002.

115V Lighting

395. Check the cabin lighting, data panel light, telescope light and 115V supply to all socket outlets.

6V Lighting

396. (a) Apply 6V D.C. to the light connection on the front end of the trailer as in fig. 1032 and check the operation of the auxiliary cabin lights, tail and stop lights and the blackout switch.

(b) Check the operation of the tail and stop lights and the blackout switch on the dolly.

Dehydrator

397. (a) Remove the dehydrator from its stand.

(b) Connect the power cable to the 115V A.C. supply.

(c) Remove the cover from the top of the unit and the cover from the back of the programme timer. Simulate the conditions throughout the 24 hour period by insulating where necessary any contacts which are already closed and shorting out where necessary those contacts indicated as closed during the periods specified in the following table. Contacts are numbered 1 to 6 left to right as viewed from the front of the dehydrator.

TABLE 74—CYCLE OF DEHYDRATOR CLOCK TIMER

Indicator reading	Position of contacts	
	Closed	Open
0 to less than 7	4, 5 and 6	1, 2 and 3
7 to less than 12	4	1, 2, 3, 5 and 6
12 to less than 19	1, 2 and 3	4, 5 and 6
19 to less than 24	3	1, 2, 4, 5 and 6

398. Plug the output to the coaxial line, switch on the dehydrator and check that the red supply light comes on. Check that the driving motor is running and increase the line pressure by turning the regulator clockwise to ensure that pressure builds up as indicated on the pressure gauge.

(a) *Conditions as at time 0.*
Check that the left-hand gel chamber becomes warm to the touch within 10 minutes while the right-hand gel chamber remains cold. Check that the left-hand amber light is on. Check that moist air is being exhausted from the left-hand exhaust orifice and that no air is being exhausted from the right-hand orifice. Increase the line pressure to 50 lbs. per sq. in. and check that the pressure switch trips the unloader valve without cutting out the driving motor.

(b) *Conditions as at time 7.*
Check that neither amber light is on and that starting from cold conditions both gel chambers remain cold. Check that no air is exhausted from either exhaust orifice. Increase the line pressure to 50 lbs. per sq. in. and check that the pressure switch trips the unloader valves and also cuts out the driving motor.

(c) *Conditions as at time 12.*
The checks in this case are similar to those at time 0 with the right-hand amber light on, the right-hand gel chamber warming up, the left-hand gel chamber remaining cold and moist air coming from the right-hand exhaust orifice while the left-hand exhaust orifice remains closed.

(d) *Conditions as at time 19.*
The checks in this case are identical to those at time 7.

(e) Replace the dehydrator for normal operation.

(f) Operate the unit until a pressure of 5 lbs. per sq. in. has been built up. Switch off the unit and check that the leakage is not greater than 2 lbs. per square in. in 30 secs.

Petrol heater

399. Inspect the petrol heater for dirt, leaks, drainage and operation on both forced and natural draught.

Pedestal

400. (a) Check the levelling of the pedestal throughout 360 degrees in azimuth.

(b) Check that the antenna is rotating concentrically and that the spinner motor, reference generator and high speed joint are free from excessive noise at all setting of the elevation handwheel.

(c) Check the operation of the safety switches on the pedestal and control panel.

(d) Check the selsyn compartments for dirt, moisture and condition of the cables, and the slip-rings for dirt and grease. Test that the pressure of the fingers is between 18 to 24 ounces.

Range system

401. (a) Remove the range unit, range indicator unit and the range power supply from the rack. Inspect the plugs for corrosion, damage and good fit. Inspect the chassis for damaged wiring, corroded valve pins, overheated components, loose connections and dry soldered joints. Inspect the units for faulty switches, pilot lights and control knobs. Replace the units in the rack.

(b) Disconnect the cables from J802, J803, J804 and J2505.

(c) (i) Check that the resistance from J804 to earth is 1.7 MΩ.
(ii) Check that the resistance from J803 Pin B earth is 105 KΩ.
(iii) Check that the resistance from J803 Pin H to earth is 70 KΩ.
(iv) Check that the resistance from J802 Pins C, D, E & I to earth is Inf.
(v) Check that the resistance from P804 to earth is 750 KΩ.
(vi) Check that the resistance from P803 Pin B to earth is 30 KΩ.
(vii) Check that the resistance from P803 Pin H to earth is 440 KΩ.
(viii) Check that the resistance from P802 Pins D & E to earth is Inf.
(ix) Check that the resistance from J2505 Pin A to earth is Inf.
(x) Check that the resistance from J2505 Pin B to earth is Inf.
(xi) Check that the resistance from J2505 Pin H to earth is 106 KΩ.

(d) Reconnect the cables to J802, J803, J804 and J2505.

(e) (i) Check the voltage from the junction of C901, C902, and C903 to earth is —2000V.
(ii) Check the voltage from J619 to earth and if necessary adjust R807 for 250V.

(iii) Check that the voltage from V805, V806 or V807 pin 3 to earth is 470V.

(f) Check that the range unit is properly set up in accordance with para. 44-48 of Tels OY-103.

(g) (i) Check that the voltage from J621 to earth is —11V with AVO Model 7 (1000V D.C. Range).

(ii) Check that the voltage from J622 to earth is —35V with AVO Model 7 (1000V D.C. Range).

(h) Check that R656, WIDE GATE DELAY, varies the wide gate over a range of 10,000 yds.

(i) Check the tracking of the narrow gate between 1000 yds. and 32,000 yds.

(j) Check that the range indicator unit gearing is free and that there is no slipping of clutches. A 5 lb. weight hung on the handle of the slewing handwheel should just cause it to slip on its shaft when the handle is in a horizontal plane.

(k) Check the operation of range motor limit switches.

(l) Check the range motor speed in clockwise and counterclockwise directions. This should be 22000, 17000, and 11000 yds. per minute clockwise and 21000, 15000 and 10000 yds. per minute anticlockwise according to the setting of the TRACKING RATIO switch.

Modulator

402. (a) Examine the interior of the modulator rack for damaged wiring, corroded or ill-fitting valve pins, loose connections, dry joints, ill-fitting plugs, leaking condensers, cracked bushings, overheated resistors. Check also for faulty switches, relays, pilot lights and control knobs.

(b) Check that K204 and K205 are set to scale readings of 9 on A Sets and 4 on B Sets. Check that the right-hand disc above the bellows on B Sets is set to 1.

(c) Check the operation of all door interlock switches and earthing switches.

(d) Check that the gap on SG204 is set for 0.025 ins.

(e) Check that three 6-C21 valves are in use, and that taps H3 and D on T209 are in use.

(f) Check the filament voltage of V203, V204 and V205. This should be 7.5V A.C. when the needle of M204 is on the red line with S209 switched to KEYER FILAMENT.

(g) Check the voltage between terminals 5 and 6 on T208. This should be 6.3V A.C. when the needle of M204 is on the red line with S209 switched to OSCILLATOR FILAMENT.

(h) Check that K201 operates after 30 secs.

(i) (i) Check the resistance of R209, R210 and R211. This should be 10Ω.

(ii) Check the resistance of R212, R213 and R214. This should be 50Ω.

(j) (i) Check that the voltage between terminal 1 of L202 to earth is —1500V.

(ii) Check that the voltage between the junction of R221 and R222 to earth is —720V.

(k) Check the magnetron bullet and the fixed and low speed R.F. joints for signs of arcing or burning.

(l) Check the T.R. box for tightness of tuning screws and signs of corrosion. Examine the T/R tube for signs of sputtering.

High voltage rectifier

403. (a) Examine the interior of the high voltage rectifier rack for damaged wiring, corroded or ill-fitting valve pins, loose connections, dry joints, ill-fitting plugs, leaking condensers, cracked bushings, overheated resistors. Check also for faulty switches, relays, pilot lights and control knobs.

(b) Check that K303, K304 and K306 are set to trip at 35A.

(c) Check that K305 is set to trip at 50 mA.

(d) Check the operation of all door interlock switches and earthing switches.

(e) Check that M301 reads less than 2 KV with the regulator VR301 at minimum setting.

(f) Check that K203 closes when HT is 10KV on A Sets and 6KV on B Sets.

Driver unit

404. (a) Remove the driver unit from the rack. Inspect the plugs for corrosion damage and good fit. Inspect the chassis for damaged wiring, corroded valve pins, overheated components, loose connections and dry soldered joints. Inspect the unit for faulty relays, and signs of breakdown of transformers and resistors. Replace the unit in the rack.

(b) Check that the voltage between term. 1 of L103 and earth is —200V D.C.

(c) Check that the voltage between V103 pin 3 and earth is 730V D.C.

(d) Check that the voltage between the top caps of V104 and V105 and earth is +4000V.

(e) Check that the amplitude of the waveform at J103 is 12V.

(f) Check that R101 is adjusted in conjunction with R673 TRIGGER DELAY to give stable operation of the driver unit with M202 reading between 12 and 22 mA driver plate current and between 11 and 17 mA keyer grid current.

Overall transmitter checks

405. (a) Check that C204 is set to give a waveform of amplitude 53V peak to peak at J202—positive peak 3V; negative peak 50V. Refer to fig. 7.

(b) Check that C211 is set to give a waveform of amplitude 59V peak to peak at J201—positive peak 39V; negative peak 20V. Refer to fig. 6.

(c) Check that the magnetron field is adjusted to give between 20 and 27 mA oscillator plate current at about 20KV.

(d) Check that, magnetron field and/or H.T. are adjusted for maximum output as indicated on the echo box.

(e) Check the frequency spectrum of the magnetron by the echo box..

Receiving system

406. (a) Remove the receiver, receiver power supply, remote video amplifier and local oscillator units from the rack. Inspect the plugs for corrosion, damage and good fit. Inspect the chassis for damaged wiring, corroded valve pins, overheated components, loose connections and dry soldered joints. Inspect the units for faulty switches, relays, pilot lights, control knobs. Replace the units in the rack.

(b) Disconnect cables from J707, J1001 and J1002.

(c) (i) Check that the resistance from J1001 pin B to earth is 105KΩ.

(ii) Check that the resistance from J1001 pin H to earth is 12 KΩ.

(iii) Check that the resistance from P1002 pin B to earth is 75 KΩ.

(iv) Check that the resistance from P1002 pin H to earth is 100 KΩ.

(v) Check that the resistance from P1001 pin B to earth is 27 KΩ.

(vi) Check that the resistance from P1001 pin H to earth is 60 KΩ.

(vii) Check that the resistance from P707 pin G to earth is Inf.

(d) Reconnect the cables to J707, J1001 and J1002.

(e) (i) Check that the voltage across R1003 is 300V D.C.

(ii) Check that the voltage between V1004 pin 2 and earth is —105V D.C.

(iii) Check that the voltage between V701 pin 6 and earth is adjusted to +120V D.C.

(iv) Check that the voltage between V701 pin 4 and earth is adjusted for OV with gain control fully clockwise if N^2 gate modification is not fitted. Check for +1V if N^2 gate is fitted.

(f) Check the setting up of the local oscillator as in Tels OY-103 para. 52.

(g) Check the tuning of the RF stages as in Tels. OY-103, para. 53 if an echo box is fitted and para. 54 if no echo box is fitted.

(h) Check by means of a local break or target that R749, SENSITIVITY, is set to its optimum position.

(j) Check that the crystal current is set for optimum performance of the receiver.

(k) Check sensitivity, bandwidth and signal to noise ratio as detailed in paras. 229-232.

P.P.I. System

407. (a) Remove the P.P.I. unit, P.P.I. power supply and the indicator tube from the rack. Inspect the plugs for corrosion, damage and good fit. Inspect the chassis for damaged wiring, corroded valve pins, overheated components, loose connections and dry soldered joints. Inspect the units for faulty switches, pilot lights, control knobs. Replace the units in the rack.

(b) Disconnect cables from J1502 and J1503.

(i) Check that the resistance from J1502 to earth is 5.2 MΩ.

(ii) Check that the resistance from J1503 pins F & K to earth is 2 MΩ.

(iii) Check that the resistance from J1503 pin J to earth is 250 KΩ.

(iv) Check that the resistance from P1503 pin K to earth is Inf.

(v) Check that the resistance from P1503 pin J to earth is 20 KΩ.

(vi) Check that the resistance from P1502 to earth is Inf.

(c) Reconnect cables to J1502 and J1503.

(i) Check that the voltage from J1502 to earth is +4000V.

(ii) Check that the voltage from J1608 to earth is +270V.

(iii) Check that the voltage from J1609 to earth is +300V.

(d) Check the operation of S1701.

(e) Check that the P.P.I. unit is properly set up as in Tels. OY-103 Para. 62.

Tracking system

408. (a) Remove the automatic and azimuth and elevation tracking units, the antenna position control and the antenna position indicator units and the field supply rectifier from the rack. Inspect the plugs for corrosion, damage and good fit. Inspect the chassis for damaged wiring, corroded valve pins, overheated components, loose connections and dry soldered joints. Inspect the units for faulty switches, relays, pilot lights, control knobs. Replace the units in the rack.

(b) Disconnect the cable from J508 and check that the resistance from J508 pin H to earth is inf.

(c) Reconnect the cable to J508 and check that the voltage from J508 pin B to earth is +300 V D. C.

(d) (i) Check that the voltage from K502 contact 1 to earth is +300V.

(ii) Check that the voltage from K501 contact 2 to earth is +105V.

(iii) Check that the voltage from J506 to earth is +75V.

(iv) Check that the voltage from V504 Pin 3 to earth is +2.9V.

(e) Check that when the COAST button is pressed, M501 reads zero.

(f) Check that with the CONTROL switch set to MANUAL and with no target covered by the narrow gate, M501 shows full scale deflection.

(g) Check that with S701 set to A.G.C. and with an echo covered by the narrow gate and/or N^2 gate, R504 AVC is adjusted for 6 mA reading on M501.

(h) (i) Check that the voltage from J413 to earth is 26-32V D.C.

(ii) Check that the voltage from J411 to J413 is +8V D.C.

(iii) Check that the voltage from J413 to J412 is +8V D.C.
(iv) Check that the voltage from J414 to J413 is +3.5V D.C.
(v) Check that the voltage from J406 and J407 to earth is +285V.

(i) Check that R412 and R462, azimuth and elevation BALANCE controls are correctly adjusted.
(j) Check that M401 and M402 both read 25 mA when switched to azimuth and elevation with no error voltage applied to the unit.
(k) Check the setting of R424 and R474, azimuth and elevation ANTI HUNT gain controls.
(l) Check the reference generator and interaction between azimuth and elevation channels as in Tels. OY-103, paras. 68-71.
(m) Check the gain of the azimuth and elevation servo generators or amplidynes as in paras. 329 and 330.
(n) Check the operation of the local selsyns.
(o) Check the gearing for ease of rotation of the handwheels on the position control unit.
(p) Check that R1302 is set so that the paraboloid rotates at 5 r.p.m. with the CONTROL switch set to P.P.I. SCAN. Check that the elevation scans over an arc of 20 degrees.
(q) Check the action of the follow up motors and the solenoid brakes.

Data system

409. Check the data system by means of the procedure n Tels OY-103 paras. 78-84.

Altitude conversion system

410. (a) Remove the altitude converter unit, the altitude converter power supply and the altitude data unit from the rack. Inspect the plugs for corrosion, damage and good fit. Inspect the chassis for damaged wiring, corroded valve pins, overheated components, loose connections and dry soldered joints. Inspect the units for faulty switches, pilot lights, control knobs. Replace the units in the rack.
(b) Remove the cable from J1451.
(c) Check that the resistance from J1451 pin A to earth is 60 KΩ.
Check that the resistance from J1411 to earth is 150 KΩ.
(d) Reconnect the cable to J1451.
(e) Check that the voltage from J1411 to earth is +300V.
(f) Check that the unit is properly set up as in Tels OY-103 para. 72.

Test equipment

411. (a) Check the calibration of the multimeter on all ranges.
(b) Check the oscilloscope for normal operation.
(c) Check the operation of the valve tester using valves known to be good.

Modifications

412. Check that all authorised modifications have been carried out.

TROPIC-PROOFING

General

413. The instructions on tropic-proofing contained herein deal only with those procedures which are peculiar to this equipment. The general procedure for the tropic-proofing of Telecommunications equipment is contained in Tels AY-751 and the guiding principles laid down in that E.M.E.R. should be followed closely.

NOTE: These procedures are in accordance with U.S.W.D. (Signal Corps) methods.

414. A varnish or lacquer containing a mercurial based fungicide must not be used when treating the switch box since, due to the volatile nature of the fungicide, it has a deleterious effect on the selenium rectifiers even after the ageing period.

415. In some cases synthetic rubber has been used in place of natural rubber in the insulation of cables. Since certain lacquers or varnishes have a harmful effect on synthetic rubber, care must be taken to avoid the application of varnish or lacquer to all rubber cables. Rubber covered cables which are contained in chassis which are to be sprayed should be masked before the unit receives treatment.

PROCEDURE

416. Carry out tests and adjustments and the overall R.F. performance. Check as detailed in paras. 40 to 77 of Tels OY-103 to determine that the equipment is in optimum operating condition. Any faults which are discovered must be eradicated before the moisture-proofing and fungi-proofing process is commenced.

417. Switch off the equipment completely and remove the power cable from the data panel.

Azimuth and Elevation Tracking Unit, BC-1090

418. Disconnect all external cables from the rear of the chassis. Withdraw the azimuth and elevation tracking unit from the rack after removing the securing screws. Replace the screws in their holes. Disconnect the leads to the FIELD CURRENT meters, M401 and M402. Replace the washers and nuts on the terminals of the meters. Remove the meters from the panel and replace the screws in the meter flanges. Clean the unit thoroughly. Unlace all cableforms and spread the wires.

419. Mask the following points some of which are shown in figs. 1059 and 1060.

(a) *Top of chassis*
(i) The bare ends of the meter leads.
(ii) All test jacks.
(iii) The moving parts and contacts of relays K401 and K402.
(b) *Front panel*
(i) All test jacks.
(ii) The AZIMUTH-ELEVATION meter switch, S401.
(c) *Underside of chassis*
(i) All potentiometers.
(ii) The undersides of all valve bases.
(iii) The contacts and moving parts of switch S401.
(iv) Resistors R413 and R467.
(d) *Rear of chassis*
(i) The amphenol connectors on the rear of the chassis.

420. Dry the unit. Spray the unit with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Relace all cableforms.

421. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner for cleaning contacts. Seal the following points on the meters with varnish using a brush.
(a) The joint between the back plate and the meter shell.
(b) All screw holes.
(c) The joint between the meter glass and the case.
(d) The zero adjusting screw.

422. Replace and reconnect meters M401 and M402. Mark the unit M.F.P. and date on the top rear of the chassis. Replace the unit in the control rack and reconnect the cables.

Automatic Tracking Unit, BC-1086

423. Disconnect all external cables from the rear of the chassis. Withdraw the unit from the rack after removing the securing screws. Replace the screws in their holes. Disconnect the leads to the PLATE CURRENT meter, M501. Replace the washers and nuts on the terminals of the meter. Remove meter M501 from the panel and replace the screws in the meter flange. Remove V501 and clean the unit thoroughly. Unlace all cable forms and spread the wires.

424. Mask the following points some of which are shown in figs. 1061 and 1062.
(a) *Top of chassis*
(i) The top of the exposed valve socket.
(ii) The terminals of the leads to the meter.
(iii) The contacts and moving parts of Relays K501 and K502.
(iv) The amphenol connectors on the rear of the chassis.
(b) *Front panel*
(i) All test jacks.
(ii) The ON-OFF switch, S501.
(c) *Underside of chassis*
(i) The underside of all valve bases.
(ii) The rear of pilot lamp I501.
(iii) All potentiometers.
(iv) The rubber-covered error-signal voltage cable.
(d) *Rear of chassis*
(i) All amphenol connectors.

425. Dry the unit. Spray the unit with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking except that on the rubber cable and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner for cleaning contacts. Relace all cableforms. Treat the meter M501 as detailed in para. 421.

426. Replace V501 and meter M501. Mark the unit M.F.P. and date on the top rear of the chassis. Replace the unit in the rack, and reconnect the cables.

Range Unit BC-1062

427. Disconnect all external cables from the rear of the chassis. Withdraw the unit from the rack after removing the securing screws. Replace the screws in their holes.

428. Remove the two screws in the front panel holding the bars over the shield cans covering transformers T601 and T602 and slide the bars to one side. Replace the screws on the bars. Remove the screws holding the cans covering T601 and T602, remove the cans and replace the screws. Remove the two crystals from the top of the chassis. Remove the cover over the bottom of the unit and clean the unit thoroughly. Unlace all cableforms and spread the wires.

429. Mask the following points some of which are shown in figs. 1063 and 1064.
(a) *Top of chassis*
(i) All test jacks.
(ii) Bases Y601-Y602.
(iii) Potentiometers R621, R625, R646, R656, R698, R699.
(iv) The core adjusting screws of T601 and T602.
(v) The OSCILLATOR TUNING condenser located between the panel and transformer T601.
(vi) The two PHASE condensers located between the panel and transformers T601 and T602.
(b) *Underside of chassis*
(i) The undersides of all crystal and valve bases.
(ii) Pilot lamp I601.
(iii) CRYSTAL SELECTOR switch S601.
(iv) 20 KC MV condenser, C606.
(v) All potentiometers.
(vi) The two rubber covered cables.
(c) *Rear of chassis*
(i) All amphenol connectors.

430. Dry the unit, the cans, and the cover. Spray them with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking except that on the rubber covered cables and touch up the varnish using a brush. Relace all cableforms.

431. Replace the cans over transformers T601 and T602 and the two crystals. Replace the protective bars. Mark the unit with M.F.P. and the date on the top rear of the chassis. Replace the chassis in the rack and reconnect the cables.

Radio Receiver, BC-1056

432. Disconnect all external cables from the rear of the chassis. Withdraw the receiver from the rack after removing the securing screws. Replace the screws in their holes.

433. Check the sensitivity and alignment of the unit as detailed in paras. 228 and 230. Realign the unit if necessary as detailed in para. 225.

434. Disconnect the leads of PLATE CURRENT meter, M701. Replace the washers and nuts on the terminals of the meter, remove the meter from the panel and replace the screws in the flange. Remove the shield from the underside of the chassis and replace the screws in their holes. Clean the unit thoroughly. Unlace all cableforms and spread the wires.

435. Mask the following points some of which are shown in figs. 1065 and 1066.

- (a) *Top of chassis*
  - (i) The meter lead terminals.
  - (ii) The threads of the core adjusting screws of the IF coils.
- (b) *Front panel*
  - (i) The AGC toggle switch.
- (c) *Underside of chassis*
  - (i) The ends of coils L701 to L706 inclusive, and L708.
  - (ii) The underside of all valve bases which are not effectively screened by components.
  - (iii) Relay K701.
  - (iv) Pilot lamp I701.
  - (v) The backs of potentiometers R749, R727, R743, and R738.
  - (vi) The rubber covered cables.
  - (vii) Resistors R718, R737, and R747.
- (d) *Rear of chassis*
  - (i) The amphenol connectors.

436. Dry the unit and the shield. Spray them with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking except that on the rubber covered cables and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner for cleaning contacts. Relace all cableforms.

437. Treat the CRYSTAL CURRENT meter as detailed in para. 421.

438. Replace meter M701 and the cover over the bottom of the unit. Mark the unit with M.F.P. and date on the top rear of the chassis.

439. Recheck the sensitivity and alignment of the unit after an ageing period of 36 hours. Correct if necessary.

440. Replace the unit in the control rack and reconnect the cables.

Range Power Supply Unit, RA-72

441. Disconnect all external cables from the rear of the chassis. Withdraw the range power supply unit from the rack after removing the securing screws. Replace the screws in their holes.

442. Remove valves V801 to V807 and V810 and clean the unit thoroughly. Unlace all cableforms and spread the wires.

443. Mask the following points some of which are shown in fig. 1067.

- (a) *Top of chassis*
  - (i) The tops of all exposed valve bases.
  - (ii) The white insulated top cap clip of V810.
- (b) *Front panel*
  - (i) The ON-OFF switch.
- (c) *Underside of chassis*
  - (i) The ceramic terminals on condensers C805 and C808.
  - (ii) Pilot Lamps I801 and I802.
  - (iii) The rear of plug J804.
  - (iv) The underside of all valve bases.
  - (v) The base of T805.
- (d) *Rear of chassis*
  - (i) The amphenol connectors.

444. Dry the unit and spray it with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner. Relace the cableforms.

445. Replace V801 to V807 and V810. Mark the unit M.F.P. and the date on the top rear of the chassis. Replace the unit in the control rack and reconnect the cables.

Range Indicator Unit, BC-1088

446. Disconnect all external cables from the rear of the chassis including those connecting to the N^2 gate chassis. Disconnect the flexible bellows coupling on the phasing condenser shaft from the slewing hand wheel extension shaft by slackening two Allen head set screws. Remove the N^2 Gate Unit from the range indicator chassis by removing the four wing nuts. Replace the wing nuts. Remove all valves from their sockets in the N^2 gate unit. Remove the four screws mounting the shield to the chassis and remove the shield. Withdraw the range indicator unit from the rack after removing the securing screws. Replace the screws in their holes.

NOTE: Four men will be required to remove the range indicator unit.

447. Clean the unit thoroughly. Unlace all cableforms and spread the wires. Mask the following points some of which are shown in figs. 1068 and 1069.

- (a) *Front panel*
  - (i) Range Motors switch S903.
  - (ii) The faces of the 2,000 yard and 32,000 yard range indicator C.R.T.s.
- (b) *Underside of chassis*
  - (i) Potentiometers R901 and R902.
  - (ii) The mounting plate and all the associated gearing and bearings.
  - (iii) The contacts of the tracking ratio switch S903.

(iv) The ventilating vents on the rear of range motors B901 and B902.
(v) All rubber covered cables.
(vi) The couplings and potentiometers R907, R908, R910 and R911.

(c) *Rear of chassis*
(i) The 11 amphenol connectors.

448. Dry the unit. Spray the unit with three coats of moisture-proofing and fungi-proofing varnish on the front panel, top, sides, and rear of the chassis. Spray three coats on the surfaces in the immediate vicinity of the masked mounting plate. Do not spray the gears. Brush-coat the wiring and components close to switches S902, and S903, selsyns B903 and B904, limit switch S901, transformer T901 and C.R.T.'s V901 and V902. Do not allow varnish to get on the gears. Remove all masking except that on rubber covered cables and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner for cleaning contacts. Relace all cableforms.

449. Lubricate the unit as detailed in Table 81 of Tels OY-103. Mark the unit M.F.P. and the date on the rear panel. Replace the unit in the control rack and reconnect the cables.

N² Gate Unit MC-581

450. Clean the unit thoroughly. Unlace all cableforms and spread the wires. Mask the following points.

(a) *Inside of chassis*
(i) Variable condenser C2507.
(ii) Potentiometers R2507, R2509, and R2510.
(iii) The moving parts of the phasing condenser, C2505.
(iv) The underside of all valve bases.

(b) *Underside of chassis*
(i) All jacks.

(c) *Top of chassis*
(i) All valve bases and jacks.

(d) *Front of chassis*
(i) The coupling shaft to condenser C2509.

451. Dry the unit and spray it with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner to clean contacts. Relace all cableforms.

452. Replace the shield on the chassis and the valves in their sockets. Mark the unit M.F.P. and the date on top of the chassis. Remount the N² gate unit on the range indicator unit and reconnect the cables. Do not tighten the Allen head set screws on the flexible coupling.

453. Remove the outer cover over the screen of the 2,000 yard C.R.T. and make a mark with the chinagraph pencil on the rotating plexiglass disc 50 yards before the cursor. Remove the cover at the back of the N² gate unit and turn the shaft of the phase rotating condenser until the slot in the hub coincides with the slot in the shaft.

454. Connect the test lead W2118 between J911 of the indicator and the right hand test jack, J2503, on top of the N² gate chassis (viewed from the rear). Switch on the range power supply and the receiver power supply. Adjust the range controls to bring the onset of the gate pulse to coincide with the 50 yard mark placed on the rotating disc. Ensure that the slots in the hub and shaft of the phase rotating condenser remain coincident while this alignment is being carried out.

455. Switch off the power supplies. By means of the two setscrews, secure the end of the flexible coupling connected to the shaft of the phase rotating condenser to the slewing handwheel coupling shaft. Ensure that the relationship between the range cursor and the phase rotating condenser is not disturbed while this is being done.

456. Switch on the supplies and check that the onset of the pulse is lined up with the chinagraph pencil mark. Rotate the handwheels and check that the N² gate pulse stays within 20 yards of the marker.

457. Switch off the supplies and erase the chinagraph pencil mark. Replace the oscilloscope cover and the cover at the rear of the N² gate unit. Replace the connection to J911 and remove the test lead connected to J2503.

Receiver Power Supply, RA-66

458. Disconnect all external cables from the rear of the chassis. Withdraw the receiver power supply unit from the rack after removing the securing screws. Replace the screws in their holes.

459. Remove rectifier valves V1001, V1002, and V1003 and clean the unit thoroughly. Unlace all cableforms and spread the wires.

460. Mask the following points some of which are shown in fig. 1070.

(a) *Top of chassis*
(i) The tops of the three exposed valve bases.

(b) *Front panel*
(i) The ON-OFF switch, S1001.

(c) *Underside of chassis*
(i) The underside of all valve bases.
(ii) The rear of pilot lamp I1001.
(iii) Resistors R1002, R1003.

(d) *Rear of chassis*
(i) Receptacle J1003 and the two amphenol connectors.

461. Dry the unit and spray it with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up with varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

462. Replace valves V1001, V1002, and V1003. Mark the unit M.F.P. and the date on the top rear of the chassis. Replace the unit in the control rack and reconnect the cables.

Field Power Supply RA-71 and Remote Video Amplifier BC-1074

463. Disconnect all external cables from the rear of the units. Withdraw the field power supply unit, together with the remote video amplifier from the rack after removing the securing screws. Replace the screws in their holes.

464. Remove the 14 screws which hold the remote video amplifier to the field power supply chassis, remove the amplifier and replace the screws in the chassis. Remove rectifier V1152.

465. Check the alignment and sensitivity of the remote video amplifier as detailed in para. 229. Realign the unit if necessary as detailed in para. 225.

466. Remove the 14 screws which secure the metal shield to the chassis of the remote video amplifier. Remove the shield and replace the screws in the amplifier chassis. Clean both the units thoroughly. Unlace all cableforms and spread the wires.

467. Mask the following points some of which are shown in fig. 1071.

- (a) *Top of field power supply chassis.*
  - (i) The top of the exposed valve base V1152.
- (b) *Underside of field power supply.*
  - (i) The underside of valve base V1152.
- (c) *Rear of field power supply.*
  - (i) Connectors J1151 and J1153.
- (d) *Top of remote video amplifier.*
  - (i) The core adjusting screws of coils L1101 and L1102.
- (e) *Underside of remote video amplifier.*
  - (i) The undersides of all valve bases.
  - (ii) The exposed ends of coils L1101 and L1102.
- (f) *Rear of remote video amplifier.*
  - (i) Connectors J1101-J1104.

468. Dry the units including the cover of the remote video amplifier and spray them with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

469. Replace the cover over the remote video amplifier. Check the sensitivity and alignment after an ageing period of 36 hours. Correct if necessary.

470. Replace the remote video amplifier on the field power supply chassis. Mark each unit M.F.P. and the date on the top rear of the chassis. Replace the units in the control rack and reconnect the cables.

Antenna Position Indicator, Unit BC-1076

471. Disconnect all external cables from the rear of the chassis. Withdraw the unit from the control rack after removing the securing screws. Replace the screws in their holes. Clean the unit thoroughly. Unlace all cableforms and spread the wires.

472. Mask the following points.

- (a) *Front panel.*
  - (i) The viewing windows of the dials.
- (b) *Top of chassis.*
  - (i) The contacts of the local-remote relay K1202.
  - (ii) The contacts of local-remote relay K1201.
  - (iii) Indicator lamps I1201, I1202, I1203, I1204, I1205 and I1206.
- (c) *Rear of chassis.*
  - (i) Receptacles J1201, J1202, J1203, J1204, J1205 and J1206.

473. Dry the unit and spray it with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner to clean contacts. Relace all cableforms.

474. Lubricate the unit as detailed in Table 81 of Tels. OY-103. Mark the unit M.F.P. and the date on the top rear of the chassis. Replace unit in the rack and reconnect all cables.

Antenna Position Control Unit, BC-1085

475. Disconnect all external cables from the rear of the chassis. Withdraw the unit from the rack after removing the securing screws. Replace the screws in their holes. Clean the unit thoroughly. Unlace all cableforms and spread the wires.

476. Mask the following points some of which are shown in fig. 1072.

- (a) *Top of chassis.*
  - (i) All bearings and gears by a strip of paper tape held in place around the edges of the two gear mounting plates. Cover the holes in the selsyn castings.
  - (ii) The motor speed control.
  - (iii) Cooling vents in the PPI scan motor.
- (b) *Underside of chassis.*
  - (i) Potentiometer, R1302.
  - (ii) All the gears.
  - (iii) The holes exposing the gearing in the underside of the chassis.
- (c) *Rear of chassis.*
  - (i) Receptacle J1301.

477. Dry the unit and spray it with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

478. Lubricate the unit as detailed in Table 81 of Tels. OY-103. Mark the unit M.F.P. and the date on the top rear of the chassis. Replace the unit in the control rack and reconnect the cables.

Altitude Converter Power Supply Unit, RA-70

479. Disconnect all external cables from the rear of the chassis. Withdraw the power supply from the rack after removing the securing screws. Replace the screws in their holes.

480. Remove rectifier V1452 and clean the unit thoroughly. Unlace all cableforms and spread the wires.

481. Mask the following points some of which are shown in fig. 1073.

- (a) *Top of chassis.*
  - (i) The top of V1452 valve base.
  - (ii) Jack J1454.
- (b) *Front panel.*
  - (i) Switch S1451.
- (c) *Bottom of chassis.*
  - (i) The underside of all valve bases.
  - (ii) Pilot lamp I1451.
  - (iii) Potentiometer R1462.

(d) *Rear of chassis.*
(i) The two amphenol connectors.
(ii) The power supply receptacle J1453.

482. Dry the unit and spray it with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover, any points which must make electrical contact. Relace all cableforms.

483. Replace V1452. Mark the unit M.F.P. and the date on the top rear of the chassis. Replace the unit in the control rack and reconnect the cables.

Altitude Converter Control Unit, BC-1094

484. Disconnect all external cables from the rear of the chassis. Withdraw the altitude converter control unit from the rack after removing the securing screws. Replace the screws in their holes. Remove the 10 screws securing the shield to the underside of the chassis, remove the shield and replace the screws. Clean the unit thoroughly. Unlace all cableforms and spread the wires.

485. Mask the following points as shown in fig. 1074.
(a) *Front panel.*
(i) FREQ. TEST and ALTITUDE-SL. RANGE switches.
(b) *Top of chassis.*
(i) Jacks J1408, J1409, J1410, J1411, and J1412.
(c) *Underside of chassis.*
(i) Variable air-dielectric condenser C1412.
(ii) Underside of all valve bases.
(d) *Rear of chassis.*
(i) Amphenol connectors.

486. Dry the unit and the cover. Spray them with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

487. Mark the unit M.F.P. and the date on the top rear of the chassis. Replace the unit in the control rack and reconnect the cables.

P.P.I. Power Supply Unit, RA-60

488. Disconnect all external cables from the rear of the chassis. Withdraw the unit from the rack after removing the securing screws. Replace the screws in their holes. Remove the cover over the bottom of the unit. Remove rectifiers V1501, V1502, and V1503. Clean the unit thoroughly. Unlace all cableforms and spread the wires.

489. Mask the following points.
(a) *Top of chassis.*
(i) The tops of valve bases V1501, V1502, and V1503.
(ii) The white insulator which holds the top cap of V1503.
(b) *Front panel.*
(i) Switch S1501 on the front panel.
(c) *Underside of chassis.*
(i) Pilot lamp I1501.
(ii) Undersides of all valve bases. (Mask the whole of the valve base of V1503.)
(iii) Terminals on condensers C1505 and C1506.
(iv) Terminals 3 and 4 of transformer T1506.
(v) Terminals 4 and 5 of transformer T1505.
(vi) Any rubber covered cables.
(vii) All high voltage cables.
(viii) The resistor panels mounting resistors T1512-1517 and R1518-1528.
(d) *Rear of chassis.*
(i) The connectors on the rear of the chassis.

490. Dry the unit and the cover. Spray them with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking except that over rubber covered cables and touch up the varnish using a brush. Brush coat the four edges of each of the resistor panels which were masked. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

491. Replace rectifiers V1501, V1502, V1503. Mark the unit M.F.P. and the date on the top rear of the chassis. Replace the unit in the control rack and reconnect the cables.

Plan Position Unit BC-1058

492. Disconnect the cables from the rear of the chassis. Withdraw the unit from the rack after removing the securing screws. Replace the screws in their holes. Clean the unit thoroughly. Unlace all cableforms and spread the wires.

493. Mask the following points some of which are shown in fig. 1075.
(a) *Top of chassis.*
(i) All test jacks.
(b) *Front panel.*
(i) Switch S1601.
(ii) INTENSITY control.
(c) *Underside of unit.*
(i) Potentiometers, R1614, R1674, R1679 and R1682.
(ii) Switch S1601.
(iii) Resistors R1602 and R1668.
(iv) The undersides of all valve bases.
(d) *Rear of unit.*
(i) All amphenol connectors.

494. Dry the unit and spray it with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

495. Mark the unit M.F.P. and the date on the top rear of the chassis. Replace the unit in the control rack and reconnect the cables.

Plan Position Indicator BC-1092

496. Disconnect the cables from J1701, J1702 and J1703. Remove the three large screws from the bearing scale cover and remove the cover. Remove the nine screws around the top of the shield of the P.P.I. tube. Lift out the shield from the control panel and replace the screws. Unscrew the lockscrew on the rear of the tube and remove the rear plate. Withdraw the socket from the tube. Gently slide the tube forward in its shield, disconnect the final anode lead and remove the tube from the shield. Remove the rubber cushions. Remove the four screws and nuts holding the plug bracket to the shield, remove the bracket and replace the screws. Loosen the clamp holding the high voltage lead, remove the screw on the clamp holding the leads to the tube socket and remove the clamp. Lift the bracket from the shield thus allowing access to the underneath wiring. Clean the unit thoroughly. Unlace all cableforms and spread the wires.

497. Mask the following points some of which are shown in fig. 1076.

(a) Connectors J1701, J1702, and J1703 on the bracket.
(b) The rear of connector J1703.
(c) The high voltage lead and its terminals.
(d) The tube base.
(e) The interlock switch plunger of switch S1701.
(f) Panel lights I1701, I1702, and I1703 on the front rim of the shield.

498. Dry the unit and spray it with three coats of moisture-proofing and fungi-proofing varnish. Remove the masking except that over the high voltage cable and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

499. Replace the bracket on the shield. Replace the clamp holding the leads to the tube base, tighten the clamp holding the high voltage lead. Replace the tube in the shield and reconnect the final anode lead. Replace the tube base. Replace the rear plate. Replace the plan position indicator in the control panel. Replace the bearing scale cover on the control panel. Reconnect the cables to J1701, J1702, and J1703. Mark the unit M.F.P. and the date on the left-hand side of the C.R.T. shield.

Control Panel PN-24

500. Remove the four screws from the control panel. Pull the panel, together with its attached wiring, out from the rack sufficiently to permit spraying. Replace the screws in the rack. Mask the following points:

(a) *Front of panel*
  (i) The COAST button S1752.
  (ii) Toggle switches S1753 and S1754.
(b) *Rear of panel*
  (i) The rear of CONTROL switch, S1751.
  (ii) The moving parts and contacts of K1751.

501. Dry the panel under heat lamps for 6 hours at 140° (or for 2 to 3 hours at 160°F. Spray the panel with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner to clean contacts. Relace all cableforms.

502. Mark the unit M.F.P. and the date on the inside of the panel. Replace the panel in its position on the rack and reinsert the securing screws.

Altitude Data Unit, BC-1075

503. Remove the four knurled holding screws securing the cover over the unit and remove the cover. Clean the unit thoroughly. Unlace all cableforms and spread the wires. Mask the following points some of which are shown in fig. 1077.

(a) *Front panel*
  (i) The window on the front panel of the altitude dial.
  (ii) The ON-OFF toggle switch, S1492 on the front panel.
  (iii) The HEIGHT-CALIBRATE potentiometer.
(b) *Top of unit*
  (i) The rear of the HEIGHT-CALIBRATE potentiometer.
  (ii) The four rubber cables.

504. Dry the unit and the cover under heat lamps as detailed in para. 501. Spray them with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking except that on the rubber covered cables and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

505. Mark M.F.P. and the date on the top of the unit and on the cover. Replace the cover over the unit.

Data Panel PN-22

506. Remove the cables from the data panel. Replace all metal receptacle covers. Remove the ten screws from the cover over the data panel in the floor of the inside of the trailer, remove the cover and replace the screws. Clean the panel thoroughly inside and out. Unlace all cableforms and spread the wires.

507. Mask the following points:

(a) *Outside of panel*
  (i) 2-point A.C. outlet.
  (ii) The 9 winged-nut terminals.
  (iii) Light I1926 and switch S1926.
(b) *Inside of panel*
  (i) The contacts of the SL. RANGE-ALTITUDE switch.
  (ii) All rubber covered cables.

508. Dry the unit under heat lamps as described in para. 501. Spray the unit with three coats of moisture-proofing and fungi-proofing varnish on all surfaces inside and out. Remove the masking except that on the rubber covered cables and touch up the varnish where necessary with a brush. Relace all cableforms.

509. Replace the cover over the unit and replace the cables. Mark the unit M.F.P. and the date on the inside of the data box underneath the trailer.

Junction box JB-71

510. Remove the cover from the junction box and replace the ten screws. Clean the unit thoroughly. Unlace all cableforms. Spread the wires.

511. Dry the junction box under heat lamps as described in para. 501. Spray the junction box with three coats of moisture-proofing and fungi-proofing varnish. Brush coat all plastic terminal boards and touch up the varnish where necessary. Relace all cableforms.

512. Replace the cover over the box.

High Voltage Rectifier RA-68

513. Open the side doors of the high voltage rectifier and clean the unit thoroughly. Remove the fuses F301-

F306, and remove the meters from the front panel. Replace the screws in the meter flanges. Unlace all cableforms. Spread the wires.

514. Mask the following points some of which are shown in fig. 1078.

(a) *Rear of the front panel*
  (i) Potentiometer R305.
  (ii) The contacts of switches S301, S302, S303, S304, S305 and S306.
  (iii) The hole in the top of relay K305.
  (iv) Spark gap SG301.
  (v) The contacts of fuseholders F301-F306.
  (vi) Moving parts and contacts of K302 and K308. (In the case of B sets first remove the arc shield over K302).
  (vii) The threads of the cover securing screws of relays K303, K304, and K305. (A sets only).
  (viii) The terminals of the meter leads.

(b) *Door of rack*
  (i) Both parts of interlock switches S308 and S309.

(c) *Interior of rack*
  (i) Knob and shaft of drive motor of VR301 and the motor ventilating holes in the case of B sets.
  (ii) Rubber cables below the level of the top of the H.V. transformer.

515. Dry the interior of the high voltage rectifier under heat lamps as described in para. 501. Spray the rear of the front panel and everything mounted below the level of the top of transformer T301 with three coats of moisture-proofing and fungi-proofing varnish. Brush coat the following points with three coats of varnish, drying the unit between each coating in the normal way.

(a) The wiring of the rear of switches S308 and S309.
(b) Resistors R306, R307, R308, R309 and R310.
(c) The phenolic parts and the winding and wiring of relays K301 and K307.

516. Remove the covers over relays K303, K304, K305 and K306 and brush coat the coils and wiring in the usual way.

NOTE: Caution must be observed in treating the interior of the high voltage rack. Endeavour to keep varnish off all rubber covered cables, ceramic insulators, rectifier valves and switch contacts even though they are not masked.

517. Scrape and clean with varnish remover any points which must make electrical contact and which have become coated in spite of the precautions listed above. Do not use varnish thinner for cleaning the contacts. Remove all masking and touch up the varnish. Seal the meters as detailed in para. 421. Relace all cableforms.

518. Replace the meters in the front panel and the fuses, F301-F306 and the covers on relays K303, K304, K305 and K306. Mark the unit M.F.P. and the date on the inside of the right-hand door.

Switch Box SW-214

519. Remove the covers over the SPINNER MOTOR, ELEVATION MOTOR and AZIMUTH MOTOR switches. Remove the screws holding the cover over the ELEVATOR SWITCH and replace the screws. Remove all fuses. Clean the switch box thoroughly. Unlace all cableforms. Spread the wires.

520. Mask the following points some of which are shown in fig. 1079.

(a) The two selenium rectifiers CR-1901 and CR-1902.
(b) All contacts on the motor switches and elevator switch.
(c) The two point A.C. outlet J1901.
(d) Switch S1905.
(e) All rubber covered cables.
(f) The contacts of the fuseholders.
(g) Relays K1901 and S1901.

521. Dry the unit under heat lamps as detailed in para. 501. Spray all parts inside and outside of the switchbox with three coats of moisture-proofing and fungi-proofing varnish taking care to keep the varnish off all the contacts and rubber cables. Remove all masking except that on rubber covered cables and touch up the varnish with a brush. Scrape and clean with varnish remover any points which must make electrical contact and which became covered in spite of the precautions listed above. Do not use varnish thinner for cleaning contacts. Relace all cableforms.

522. Replace the fuses and the covers over the elevator and the motor switches. Mark the unit M.F.P. and the date on the inside of the switch box door.

Voltage adjuster and main line switch

523. Remove the four screws securing the metal plate over the main line switch, pull the plate forward and remove the leads to the voltmeter. Remove the metal plate together with the meter and replace the screws. Remove the screws around the grill cover over the voltage regulator (A sets), remove the cover and replace the screws. In the case of B sets remove the screws holding the cover over the terminal board of the voltage regulator, remove the cover and replace the screws. Clean the units thoroughly.

524. Dry the units under heat lamps as described in para. 501. Brush coat with three coats of moisture-proofing and fungi-proofing varnish, drying the units in the normal way for 10 minutes after each coat, the following points.

(a) The interior of the switchbox. Keep varnish off the contacts of the circuit breaker.
(b) The front panel of the main line switchbox.
(c) All wiring and terminal boards of the voltage adjuster. Do not allow varnish to get on rubber cables or gears.
(d) The exterior of the voltage adjuster.

Scrape and clean with varnish remover any points which must make electrical contact and which became coated in spite of the precautions listed above. Do not use varnish thinner to clean contacts. Treat the main line switch meter as described in para. 421.

525. Replace the grille over the voltage adjuster in the case of A sets, or the terminal board cover in the case of B sets. Replace the leads on the meter and replace the metal panel. Mark the units M.F.P. and the date.

Transmitter compartment

526. Remove the local oscillator unit and replace the screws in the rack. Loosen the wing clamp bolts holding the shield over the magnetron compartment and remove the shield. Loosen the clamp bolts securing the high voltage cover over the magnetron and remove the cover. Remove the crystal from the crystal mixer. Clean the unit thoroughly.

527. Dry the unit under heat lamps as described in para. 501. Brush coat, with three coats of moisture-proofing and fungi-proofing varnish, all wiring and non-rubber covered cables, drying the unit after each coat for 10 minutes under the heat lamps.

> **NOTE: Do not allow varnish to get on the magnet adjustment, the fins of the magnetron, the contacts of the interlock switch, the large filament stand-off insulator or the glass insulator of the magnetron.**

Spray three coats of moisture-proofing and fungi-proofing varnish on the inside and outside of the high voltage protective cover and the transmitter compartment shield.

528. Replace the high voltage protective cover over the magnetron, the crystal in the crystal mixer and the shield over the transmitter compartment. Mark the unit M.F.P. and the date on the inside of the compartment.

Local Oscillator BC-1096 and Preamplifier BC-1078

529. Remove the ten screws which hold the preamplifier unit in the local oscillator chassis, remove the preamplifier and replace the screws. Remove the klystron oscillator as detailed in para. 128, of Tels. OY-103 and replace the screws. Remove rectifiers V1801 and V1802. Clean the units thoroughly.

530. Check the sensitivity and alignment of the preamplifier as detailed in para. 227. Realign the unit if necessary as detailed in para. 225. Unlace all cableforms and spread the wires.

531. Mask the following points, some of which are shown in figs. 1080 and 1081.

(a) *Front panel of local oscillator*
  (i) Monitor jack, J1804.
  (ii) BEAM CURRENT jacks J1805 and J1806.
  (iii) FILAMENT and PLATE toggle switches S1801 and S1802.
(b) *Top of local oscillator chassis*
  (i) The exposed terminal of the cable connected to J1804.
  (ii) The tops of all exposed valve bases.
  (iii) The top cap lead of the klystron.
  (iv) The complete tuner assembly on the rear of the front panel.
(c) *Underside of local oscillator*
  (i) Underside of all valve bases.
  (ii) The coupling, the coupling stand-off insulator and potentiometer R1822.
  (iii) The rear of pilot lamp I1801.
  (iv) Potentiometers R1806 and R1817.
  (v) Klystron valve base and cable entry hole.
(d) *Rear of local oscillator*
  (i) Plug J1801.
(e) *Top of preamplifier*
  (i) The core adjusting screws of L1853, L1856 and T1852.
  (ii) The end of the preamplifier input cable.
(f) *Underside of preamplifier*
  (i) The underside of all valve bases.
  (ii) The ends of coils L1853, and L1856.
  (iii) The end of transformer T1852.
(g) *Rear of preamplifier*
  (i) Two amphenol connectors J1851 and J1853.

532. Dry both units and spray them with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

533. Replace the klystron as detailed in para. 129 of Tels. OY-103. Replace the rectifiers V1801 and V1803. Check the sensitivity and alignment of the preamplifier after an ageing period of 36 hours and correct if necessary. Replace the preamplifier in the local oscillator chassis. Replace the klystron output cable. Do not connect the monitoring cable to the klystron. Mark the units M.F.P. and the date on the top rear of both chassis. Replace the local oscillator in the rack and connect the cables.

Driver Unit BC-1080

534. Disconnect all external cables from the rear of the chassis. Withdraw the driver unit from the rack after removing the securing screws. Replace the screws in their holes. Remove the shield over the top of the chassis and replace the screws. Remove the shield over the bottom of the chassis and replace the screws. Remove the three driver valves V103, V104, and V105. Remove the three rectifiers V106, V107, and V108. Clean the unit thoroughly. Unlace all cableforms. Spread the wires.

535. Mask the following points shown in figs. 1082 and 1083.

(a) *Front of chassis*
  (i) TRIGGER test jack, J103.
(b) *Top of chassis*
  (i) The terminals of condenser C110.
  (ii) The three exposed valve bases of V103, V104, V105.
  (iii) The three pairs of exposed top caps for the drivers.
  (iv) The valve bases of the three rectifiers, V106, V107, V108.
  (v) Resistors R126 and R127.
  (vi) The terminals and bushings of T105.
(c) *Underside of chassis*
  (i) All exposed valve bases including V103, V104, V105 and X109.
  (ii) The back of potentiometer R101.
  (iii) The high voltage terminal board TB101.
  (iv) R108 and R130.

(d) *Rear of chassis*

(i) The two amphenol connectors.

(ii) The terminal board and the three terminals.

536. Dry the unit and the covers. Spray them with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Brush coat the edges of TB101 and the paxolin panel mounting R126 and R127. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms.

537. Replace all valves. Replace the shield over the top and the underside of the chassis. Mark the unit M.F.P. and the date on the rear of the chassis.

Modulator BC-984

538. Remove fuses F201-F203 and resistor R221 and R222. Remove all meters from the front panel. Replace the screws in the meter flanges. Clean out the rack thoroughly. Unlace all cableforms. Spread the wires.

539. Mask the following points some of which are shown in figs. 1084 and 1085.

(a) *Rear of meter panel*

(i) The rear of variac T210.

(ii) Potentiometer R219.

(iii) Switches S202, S203, S204 and S208.

(iv) Resistors R223, R224, R225, R226.

(v) Lamps I201, I202, I203, I204.

(vi) The rubber covered high voltage lead and its insulator.

(vii) The terminals of the meter leads.

(viii) The contacts of the fuse holders.

(b) *Interior of rack*

(i) The terminals of the leads to the driver unit.

(ii) The ends of the plugs connecting to the driver unit.

(iii) Spark gaps SG 201, 202, 203.

(iv) Interlocks S205, 207, 210.

(v) The high voltage terminals of all condensers, transformers and chokes.

(vi) The plate connections of rectifiers V201, V202, V208, V209.

(vii) The plate and grid connections of valves V203, V204, V205, and the plate connections of V206, V207 and V210.

(viii) The clips of the resistors R221 and R222.

(ix) The contacts of relays K203, K204 and K205 and, in the case of B sets, K201.

540. Dry the unit under heat lamps as detailed in para. 501. Apply three coats of moisture-proofing and fungi-proofing varnish with a brush to the following parts, drying the unit for ten minutes after each coat. Keep varnish off rubber cables, the glass portion of all valves and all high voltage insulators.

(a) The wiring and all parts around blower motor BL201.

(b) The wiring and the terminals on the rear of the relay panel.

(c) The wiring, terminal connections and coil windings of relays K201, K202, K204, and K205 after the covers have been removed.

(d) The wiring and parts around the bases of valves V203, V204, V205, V206, V207, and V210.

(e) C208, R209, R210, R211 and their associated wiring.

(f) The wiring and terminals of transformer T208.

(g) Interlock switches S205, S207 and S210 and their associated wiring.

(h) Blower motor BL203. Keep the varnish out of the moving parts.

(i) All terminal boards cabling and wiring not previously mentioned. Replace the covers over relays K201, K202, K204, and K205.

Spray three coats of moisture-proofing and fungi-proofing varnish on all wiring cabling and components mounted on the rear of the front panel, both sides of the relay panel and all components mounted on the floor of the rack. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner to clean contacts. Relace all cableforms.

541. Treat the meters as described in para. 421 and replace them in the front panel. Replace the driver unit in the rack. Mark the modulator M.F.P. and the date on the inside of the right-hand door of the rack.

Dehydrator

542. Remove the dehydrator from its mounting as detailed in para. 248 of Tels. OY-103. Remove the covers over the top, sides and back of the dehydrator. Remove the covers from the programme clock and the line pressure switch. Remove the belt from the driver motor. Clean the unit thoroughly. Unlace all cableforms. Spread the wires.

543. Mask the following points:

(a) *Front panel*

(i) The ON-OFF switch.

(ii) The silica gel indicator.

(iii) The glass of the pressure indicator.

(iv) The screw thread of the line pressure adjusting knob.

(b) *Interior of unit*

(i) The gearing and contacts of the programme clock.

(ii) The contacts and the two exhaust vents of the line pressure switch.

(iii) The two silica gel containers.

(iv) The pulleys on the motor and compressor.

(v) The air vents on the motor.

(vi) All rubber covered cable.

(c) *Underside of unit*

(i) The whole of the condenser tube.

544. Dry the unit under heat lamps as detailed in para. 501. Spray it with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking except that on the rubber covered cable and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Do not use varnish thinner for cleaning electrical contacts. Relace all cableforms.

545. Replace the drive belt and the covers over the programme clock and the line pressure switch. Replace the external covers and replace the unit on its mounting. Mark the unit M.F.P. and the date on the right-hand side panel.

Motor generators

546. Remove the covers over the terminal boards of the motor generators. Clean the terminal boards thoroughly. Dry them under heat lamps as detailed in para. 501. Spray the terminal boards with three coats of moisture-proofing and fungi-proofing varnish. Touch up where necessary and replace the covers. Mark the unit M.F.P. and the date.

Trailer intake ventilator

547. Remove the whole front cover over the trailer intake ventilator and replace the screws in their holes. Clean the trailer intake ventilator thoroughly. Mask the rubber covered cable. Dry the ventilator under heat lamps as detailed in para. 501 and spray it with three coats of moisture-proofing and fungi-proofing varnish. Touch up where necessary and replace the cover.

Control rack blower

548. Remove the side panel over the compartment housing the blower. Clean the terminal board of the blower motor. Mask the following points:
- (a) The blower motor cable entry hole.
- (b) The rubber covered cable close to the terminal board.

549. Dry the terminal board under heat lamps. Spray the terminal board with three coats of moisture-proofing and fungi-proofing varnish. Touch up where necessary and replace the cover over the blower compartment.

Underside of pedestal base

550. Remove the cover over TB11 and replace the screws. Clean TB6 and TB11 and mask all rubber cables in the vicinity of these components. Unlace all cableforms. Spread the wires. Dry the terminal boards under heat lamps and spray them with three coats of moisture-proofing and fungi-proofing varnish. Touch up where necessary. Relace all cableforms. Replace the cover over TB11.

Echo box

551. Remove the echo box from the wall of the trailer after removing the input lead. Remove the three screws securing the cover over the meter compartment and remove the crystal and the meter. Replace the screws and the crystal connector cap. Clean the unit thoroughly.

552. Mask the following points:
- (a) The input lead connector.
- (b) The toggle switch on the front panel.
- (c) The meter lead terminals.
- (d) The gap between the tuning adjustment handle and the body of the echo box.

553. Dry the echo box and spray the unit with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Treat the meter as described in para. 421. Scrape and clean with varnish remover any points which must make electrical contact.

554. Replace the crystal, the meter and the front panel. Replace the echo box on the wall of the trailer and reconnect the input cable. Mark the unit M.F.P. and the date.

Compartments in base of pedestal

555. Remove the covers over the rear and the two side compartments of the pedestal base and replace the screws in their holes. Remove the cover over the azimuth drive motor terminal block and replace the screws. Remove the two hex. head bolts from the bracket holding S2001, remove the switch and replace the bracket. Clean the compartments thoroughly. Unlace all cableforms. Spread the wires.

556. Mask the following points:
- (a) The two holes in the floor of the slip ring compartment.
- (b) The rubber covered cable to the drive motor.
- (c) Switch S2001.

557. Dry the compartments under heat lamps and spray them with three coats of moisture-proofing and fungi-proofing varnish. Touch up the varnish where necessary using a brush. Relace all cableforms. Replace S2001 and the cover over the azimuth drive motor terminal block. Replace the covers over the pedestal base compartments.

Elevation selsyn compartment

558. Remove the screws around the cover plate over the elevation selsyn compartment, remove the plate and replace the screws. Clean the compartment thoroughly. Unlace all cableforms and spread the wires.

559. Mask the following points:
- (a) Switch S2055 and S2056 and the cam.
- (b) Telescope light socket J2002.

560. Dry the compartment under heat lamps as described in para. 501. Spray the compartment with three coats of moisture-proofing and fungi-proofing varnish. Remove all masking and touch up the varnish using a brush. Scrape and clean with varnish remover any points which must make electrical contact. Relace all cableforms. Replace the cover over the elevation selsyn compartment.

Terminal block for spinner motor, B2056

561. Remove the four screws from the housing plate and remove the plate. Replace the four screws. Dry the inside of the housing under heat lamps. Mask the space surrounding the terminal block. Spray three coats of moisture-proofing and fungi-proofing varnish over all surfaces of the terminal block. Touch up the varnish where necessary using a brush. Replace the cover over the housing.

Drive motors

562. Remove the azimuth drive motor as detailed in para. 11 and the elevation drive motor as detailed in para. 39.

563. On each motor:
- (a) Remove the brushes and mark them so that they can be replaced in the same holder the correct way round.

(b) Remove the bearing retainer screws in the commutator end of the motor.
(c) Remove the nuts from the tie-bolts.
(d) Support the motor with the shaft down and drive the lower end bell off, making sure that the armature goes with the lower bell and the shaft does not pull out of the grease seal.
(e) Remove the commutator end bell and disconnect the brush leads.
(f) Remove the junction box and terminal board.
(g) Remove the pole screws and lockwasher.
(h) Record the location of the shims, poles and coils.
(i) Plug the openings where leads come out of coils with cotton tape.

564. Heat the coils for one hour at a temperature between 220°F and 260°F, dip them in moisture-proofing and fungi-proofing varnish, and heat again for two hours at 225°F.

565. Cut washers of black varnished cambric and use them to separate the coils from the yoke, poles and interpoles.

566. Reassemble the fields and poles replacing the lockwashers with 0.388 in. O.D., 0.258 in. I.D., 0.030 in. thick copper washers and applying the varnish under the screw heads.

567. Clean the inside of the terminal box and replace it making sure that the rubber gasket and the rubber three-hole grommets are in place. Apply varnish under the screwheads before they are tightened. Restore the terminal board connections, replace the terminal board and replace the junction box cover. Dry the inside of the box under heat lamps as described in para. 501. Spray the inside of the box, the terminal board and the connections with three coats of moisture-proofing and fungi-proofing varnish. Touch up the varnish using a brush. Replace the cover over the terminal box.

568. Varnish the bottom rabbet and replace the field yoke, connect the brush leads, lacquer the rabbet and replace the end bell using a guide in the bearing retainer. Replace the bearing retainer screws using $\frac{7}{8}$ in. O.D., $\frac{1}{2}$ in. I.D., copper washers and lacquer. Replace tie-bolt nuts using $\frac{11}{32}$ in. O.D., $\frac{7}{32}$ in. I.D., 0.032 in. thick copper washers. Varnish around the screws. Replace the brushes. Repack both bearings if needed while the motor is dismantled. Replace the azimuth and elevation drive motors as detailed in para. 12 and 40, respectively.

AFTER TREATMENT

569. Allow the complete equipment an ageing period of 24 to 36 hours. After the ageing period carry out tests and adjustments and the overall R.F. performance check as detailed in paras. 43-77 of Tels. OY-103 in order to ensure that the complete equipment is operating efficiently.

570. Record the completion of the tropic-proofing in the A.B. 20A.

TABLE 1001—STANDARD METER READINGS

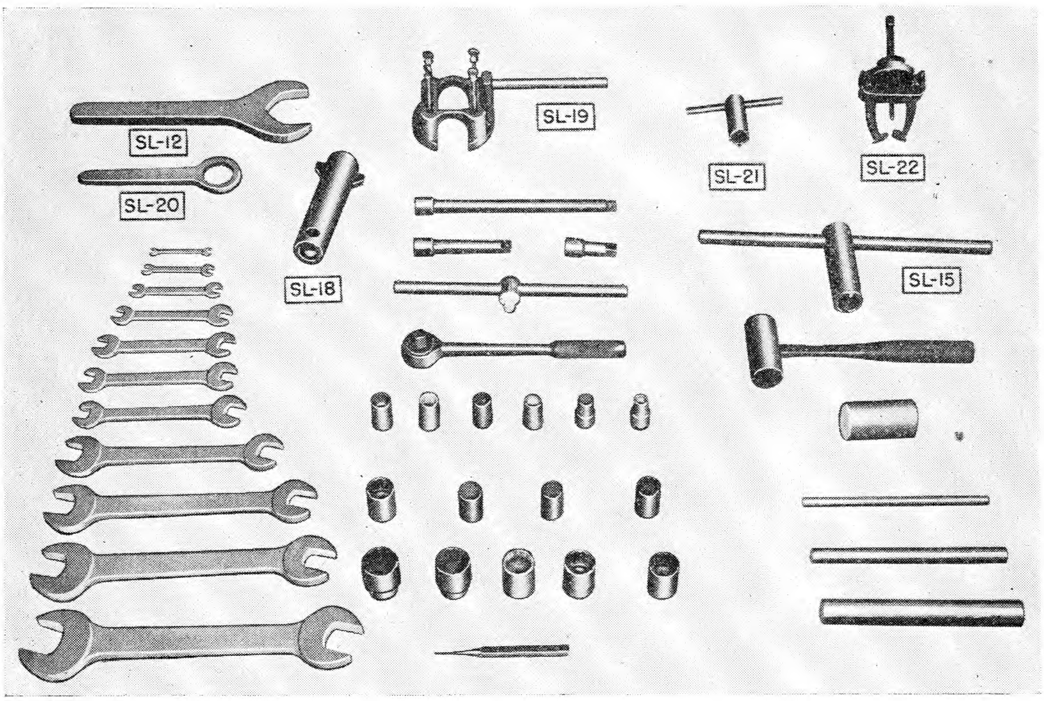
Main line switch meter volts	115
Line volts, Phase AB	115
Line volts, Phase BC	115
Line volts, Phase A.C.	115
Filament volts	105
Output K volts	18–22 KV
Output mA	30–35 mA
Driver grid volts	Red lines
Driver screen volts	Red lines
Driver plate volts	Red lines
Keyer grid volts	Red lines
Keyer filament volts	Red line
Driver plate current mA	12–22 mA
Keyer grid current mA	11–17 mA
Oscillator plate current mA	20–27 mA
Reflector volts setting	
Crystal current mA	0.15–0.5
Azimuth field current mA	25
Elevation field current mA	25
Tracking gain setting	
Azimuth A.H. gain setting	
Elevation A.H. gain setting	

TABLE 1002—FUSE RATINGS

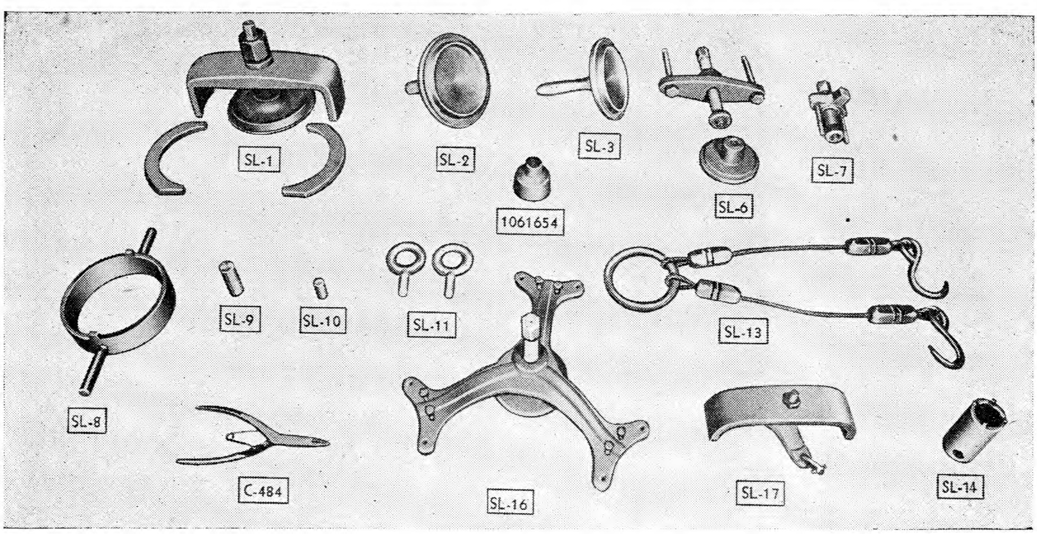
FUSES		RATINGS
Driver	F101, F102, F103, F104	3 A 250 V
Modulator	F201, F202, F203	25 A 250 V
H.V. Rectifier	F301, F302, F303, F304, F305, F306	10 A 250 V

TABLE 1002—FUSE RATINGS—Continued

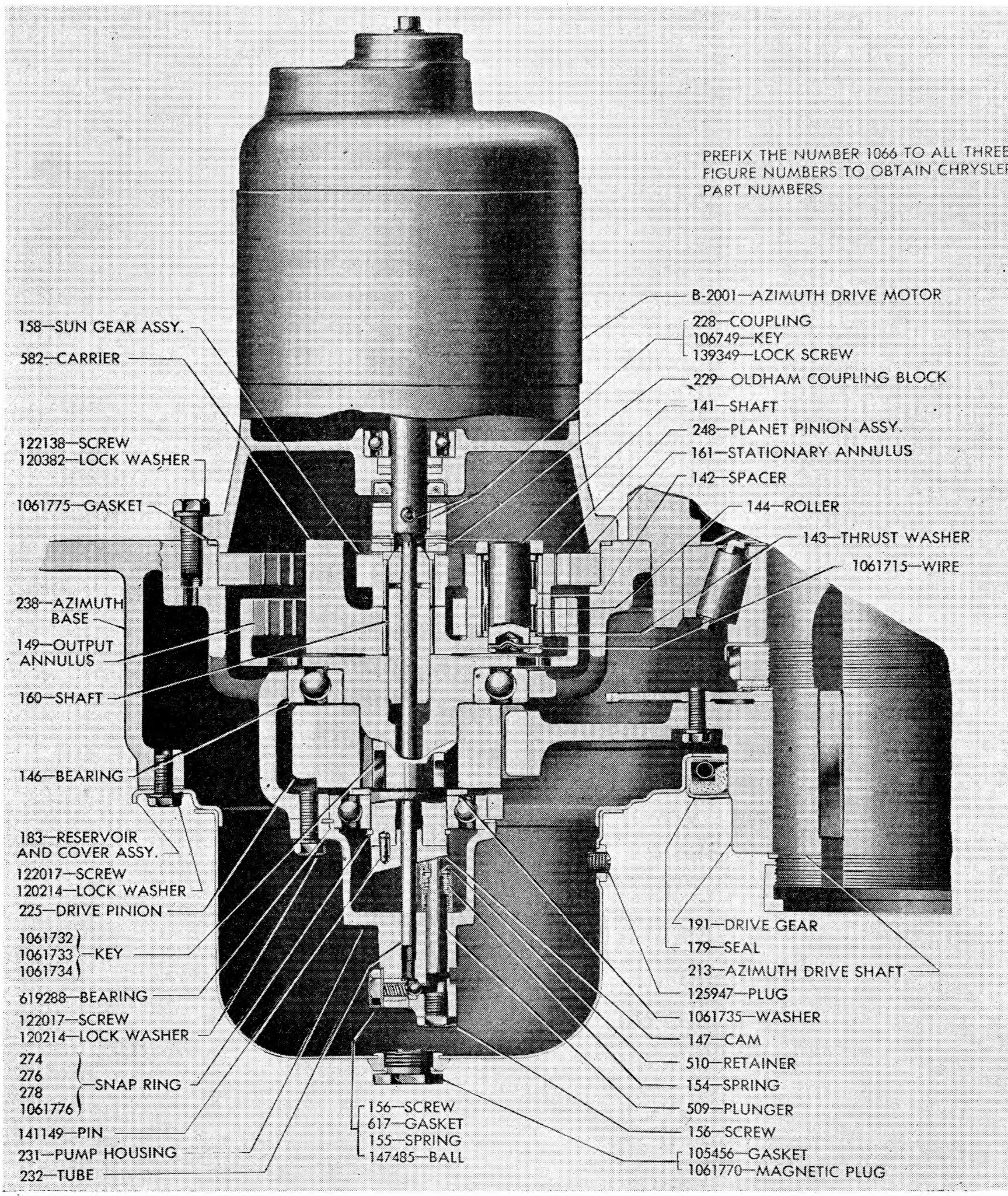
FUSES		RATINGS
Auto-tracking unit	F501, F502	5 A 250 V
Range power	F801, F802	3 A 250 V
	F803, F804	5 A 250 V
Receiver power	F1001, F1002	5 A 250 V
Field power supply	F1153, F1154	5 A
Altitude converter power	F1451, F1452	5 A
P.P.I. power	F1501, F1502	5 A 250 V
Local oscillator	F1801, F1802	3 A 250 V
Switch box	F1901, F1902, F1903, F1904, F1905, F1906, F1907, F1908, F1909	25 A 250 V
6 V lighting	F1, F2, F3, F4, F5, F6	20 A 1¼ ins.
Dehydrator		15 A
Oscilloscope		1.5 A



T $\frac{\text{OY-104}}{\text{1-1001}}$ **Fig. 1001—Pedestal tools provided with the equipment**

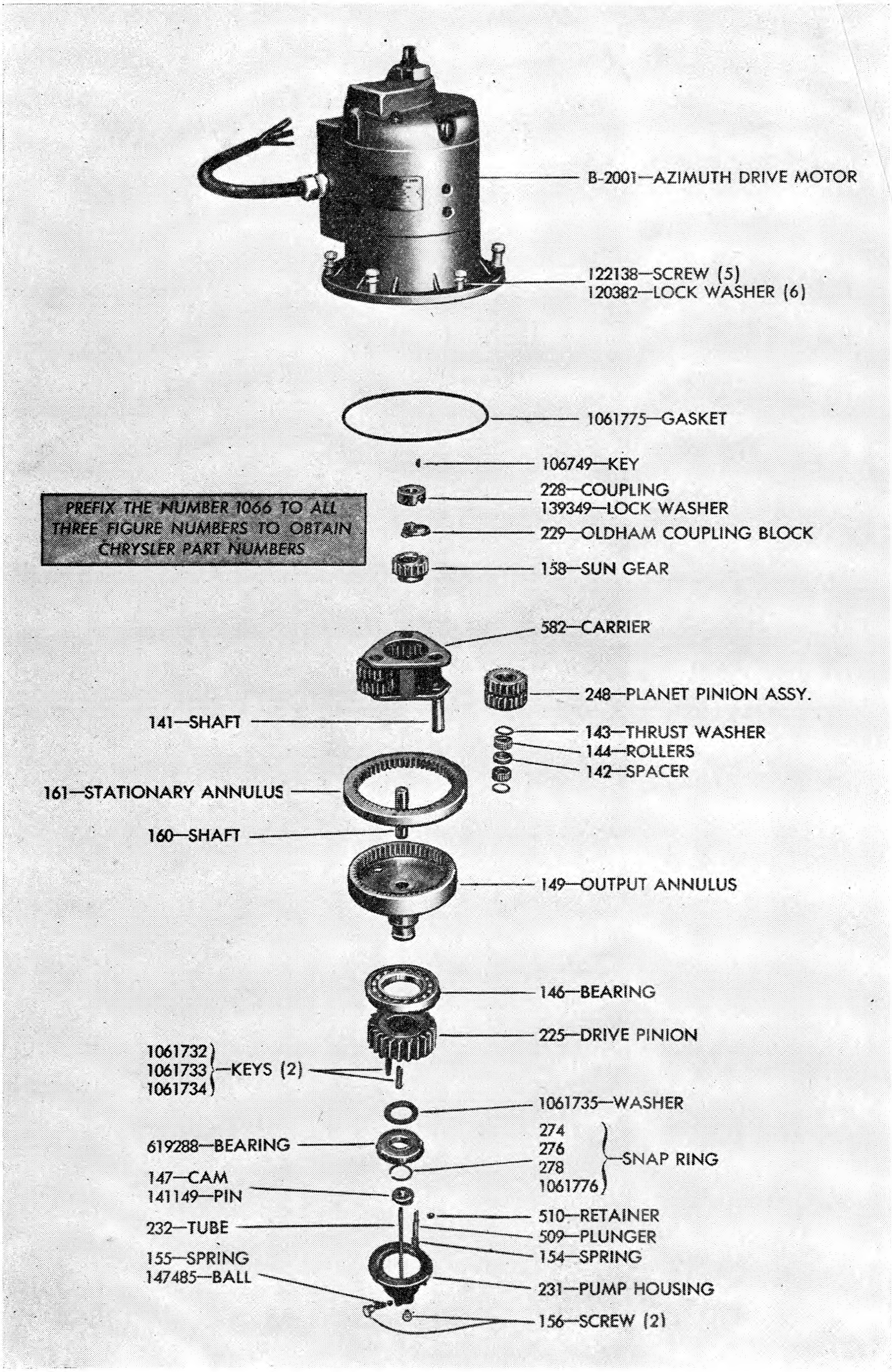


T $\frac{\text{OY-104}}{\text{1-1002}}$ **Fig. 1002—Pedestal tools**



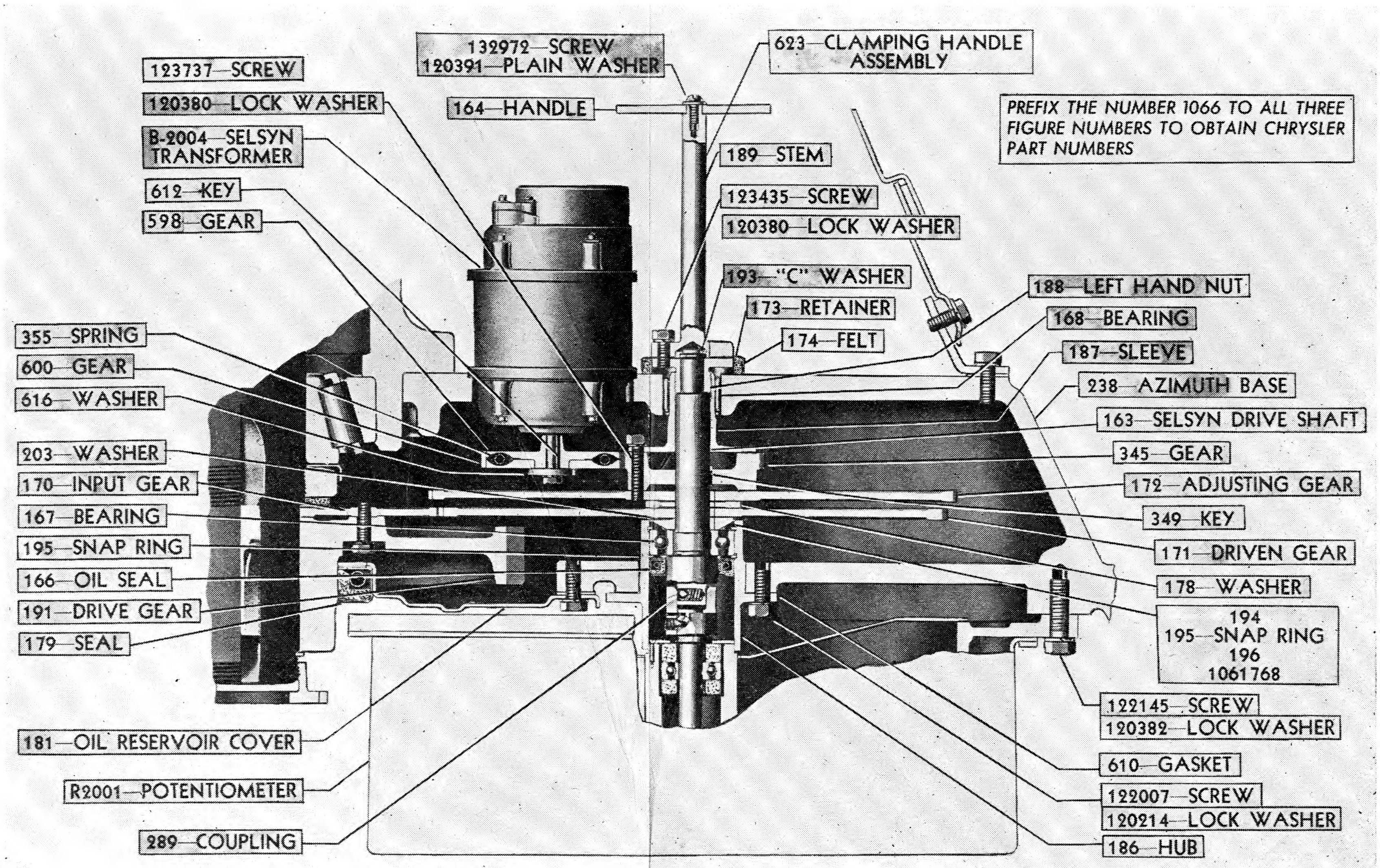
T $\frac{\text{OY-104}}{\text{1-1003}}$

Fig. 1003—Cutaway view of azimuth drive train



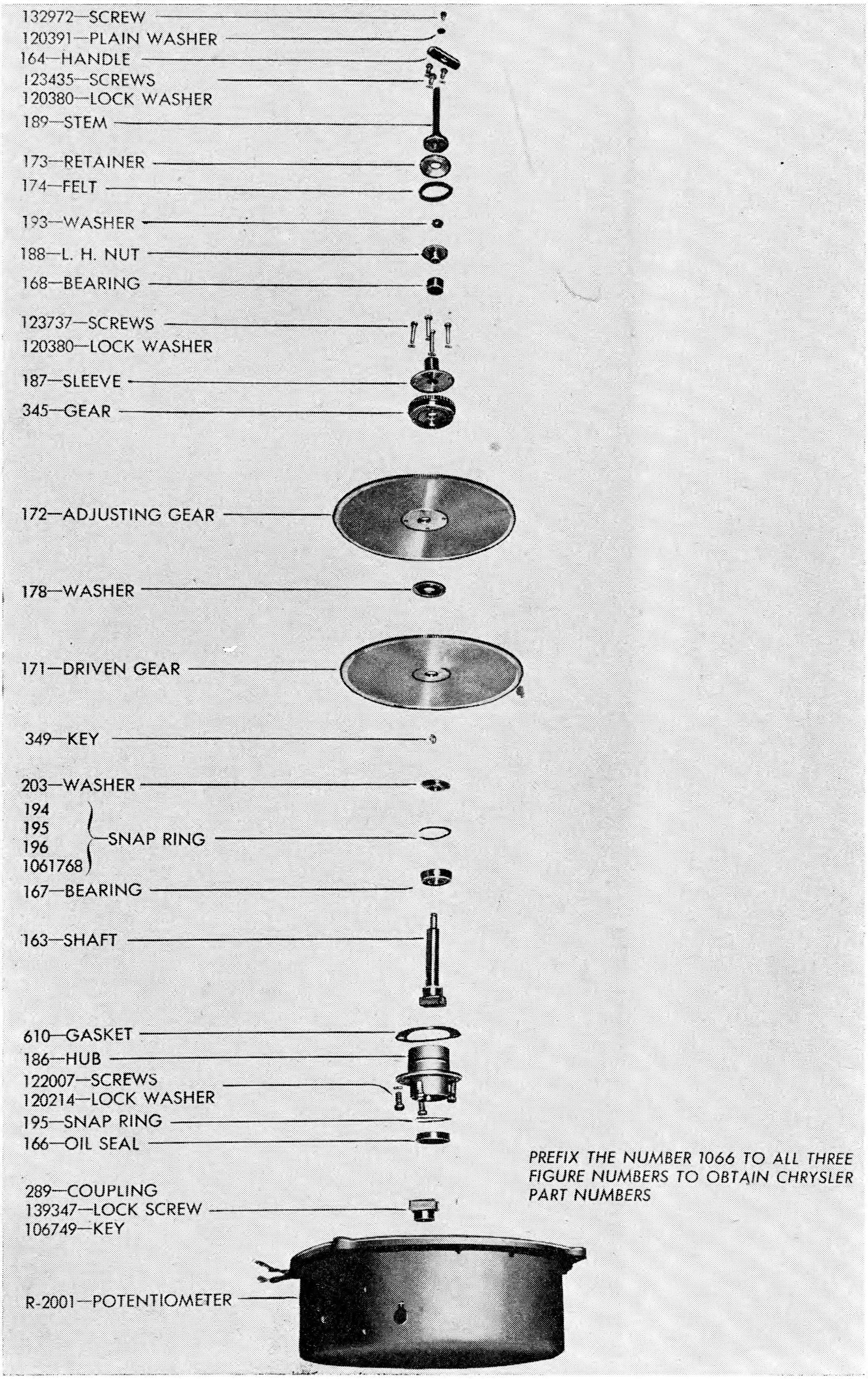
T $\frac{\text{OY-104}}{\text{1-1004}}$

Fig. 1004—Exploded view of azimuth drive train

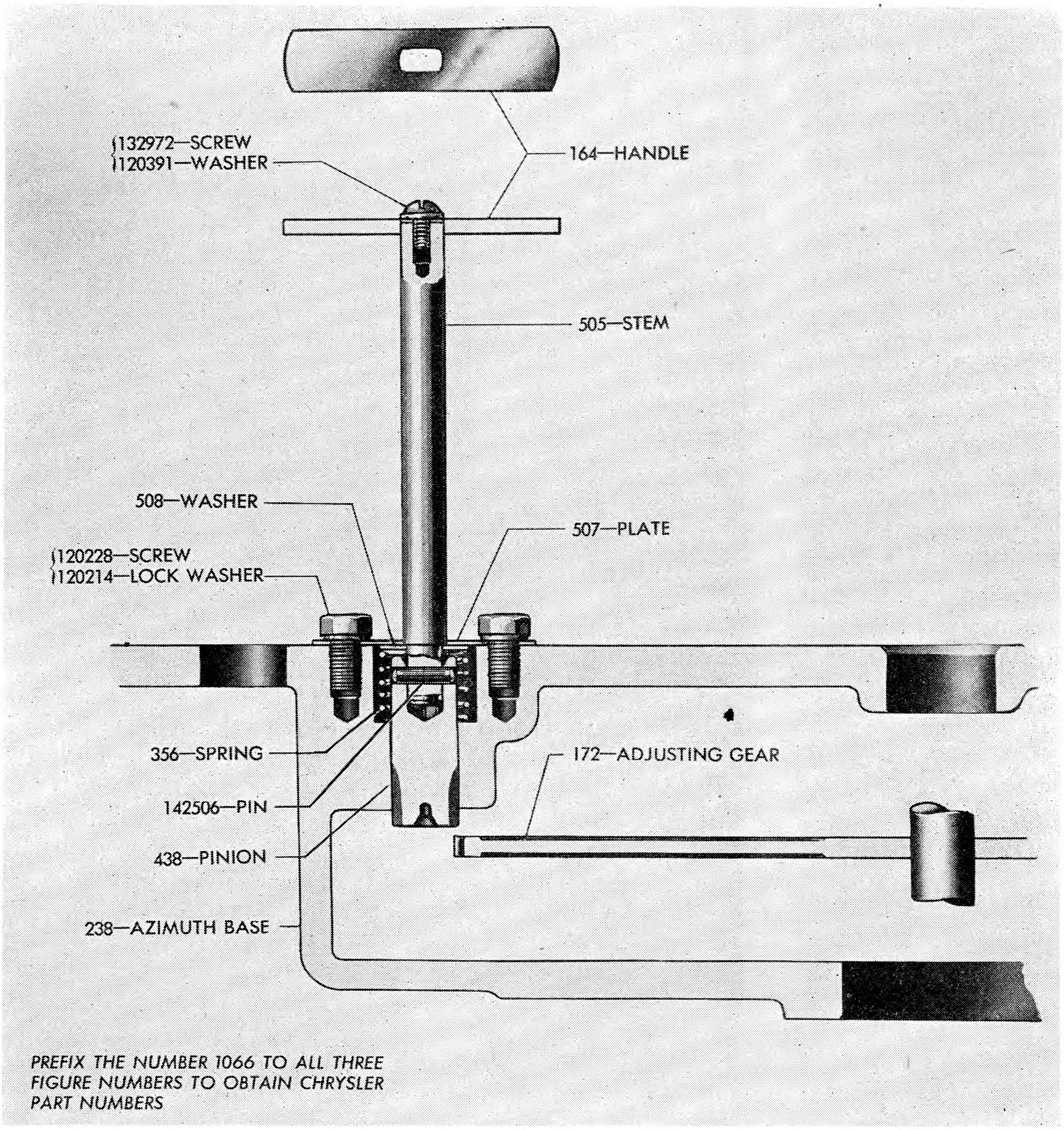


T $\frac{\text{OY-104}}{\text{1-1005}}$

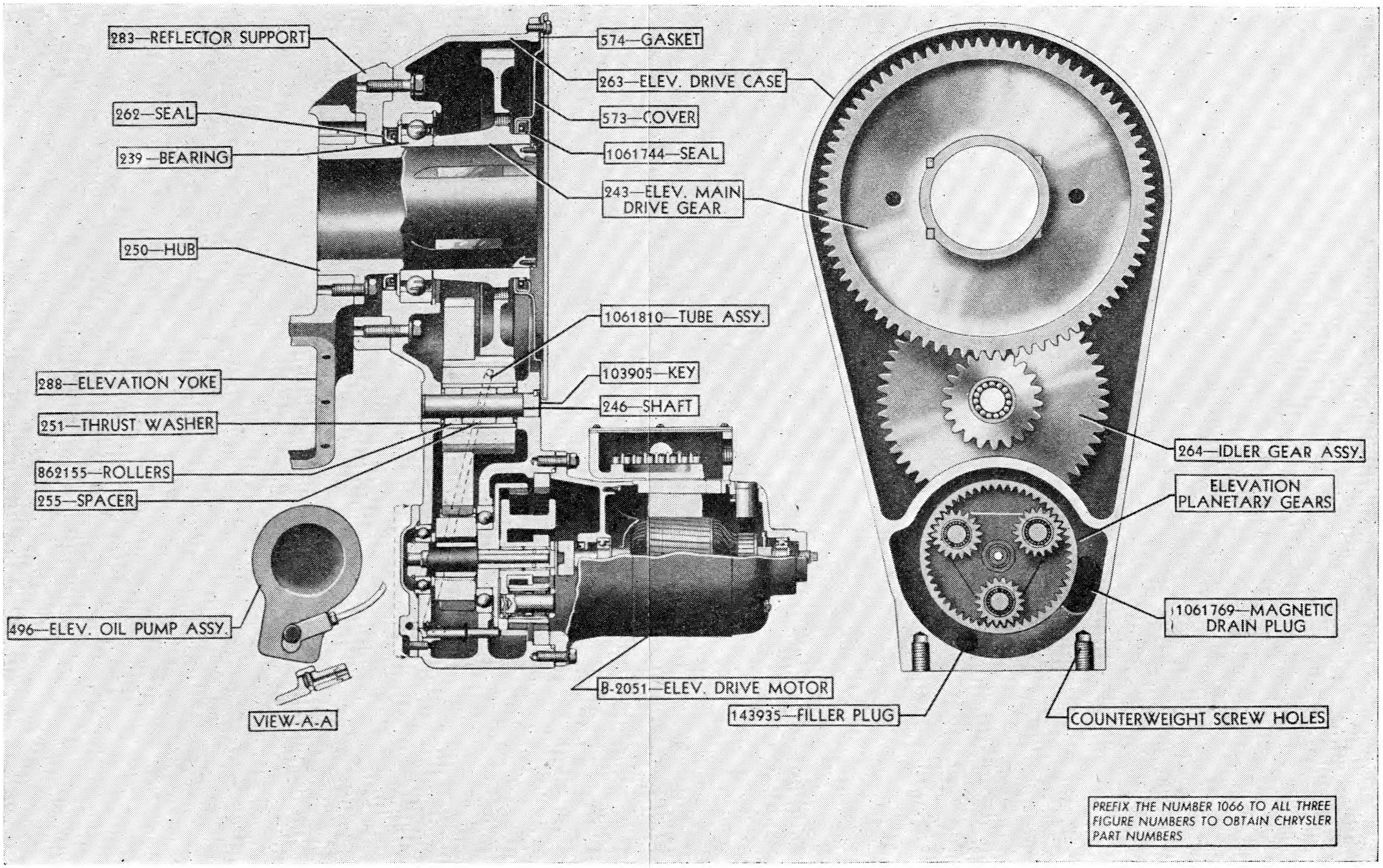
Fig. 1005—Cutaway view of azimuth selsyn drive train



T $\frac{\text{OY-104}}{\text{1-1006}}$ **Fig. 1006—Exploded view of azimuth selsyn drive train**

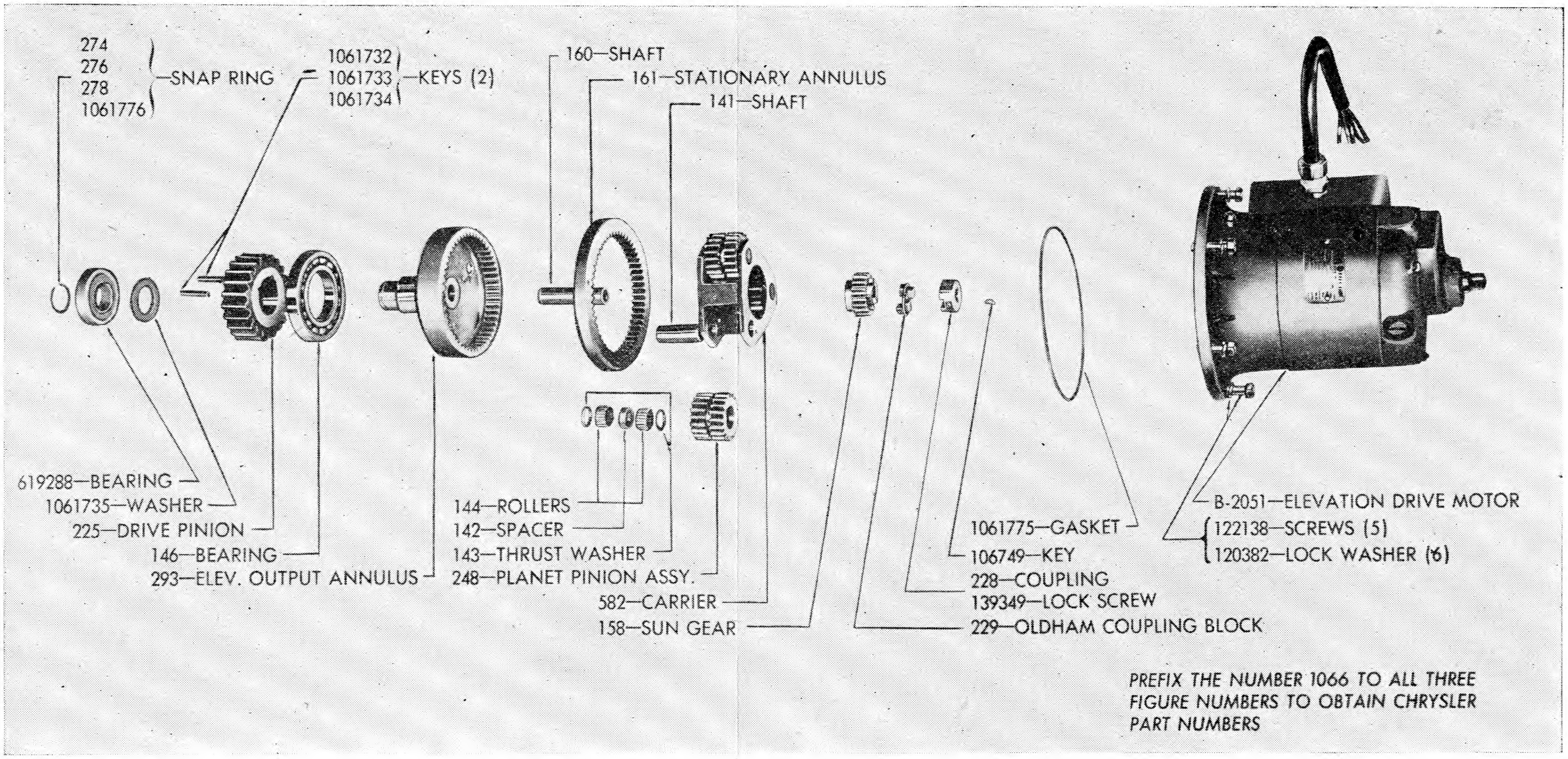


T $\frac{\text{OY-104}}{\text{1-1007}}$ **Fig. 1007—Cutaway view of azimuth selsyn adjusting handle**



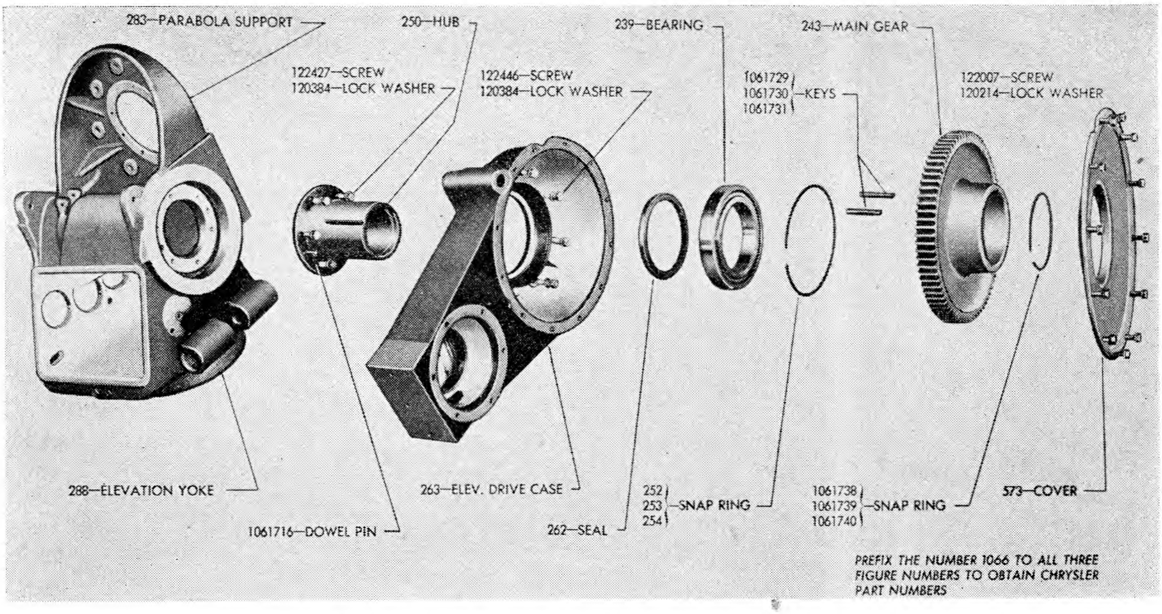
T $\frac{\text{OY-104}}{\text{1-1008}}$

Fig. 1008—Cutaway view of elevation drive train

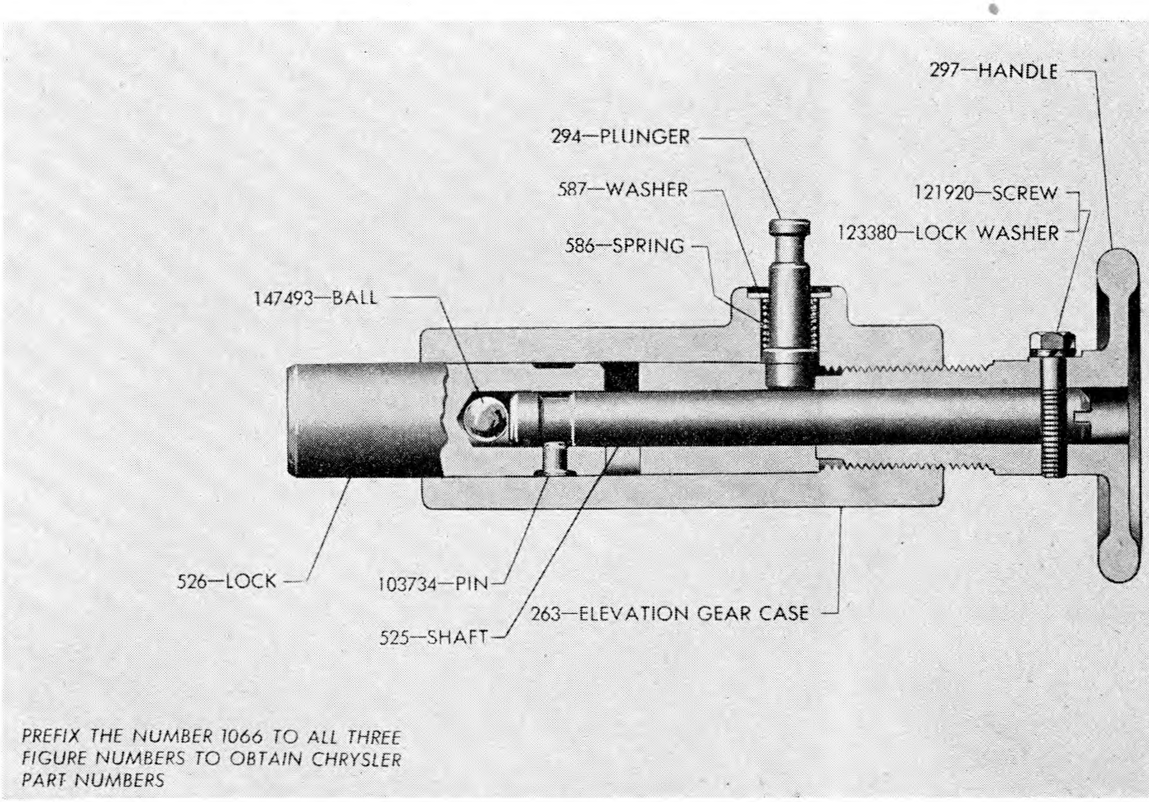


T OY-104/1-1009

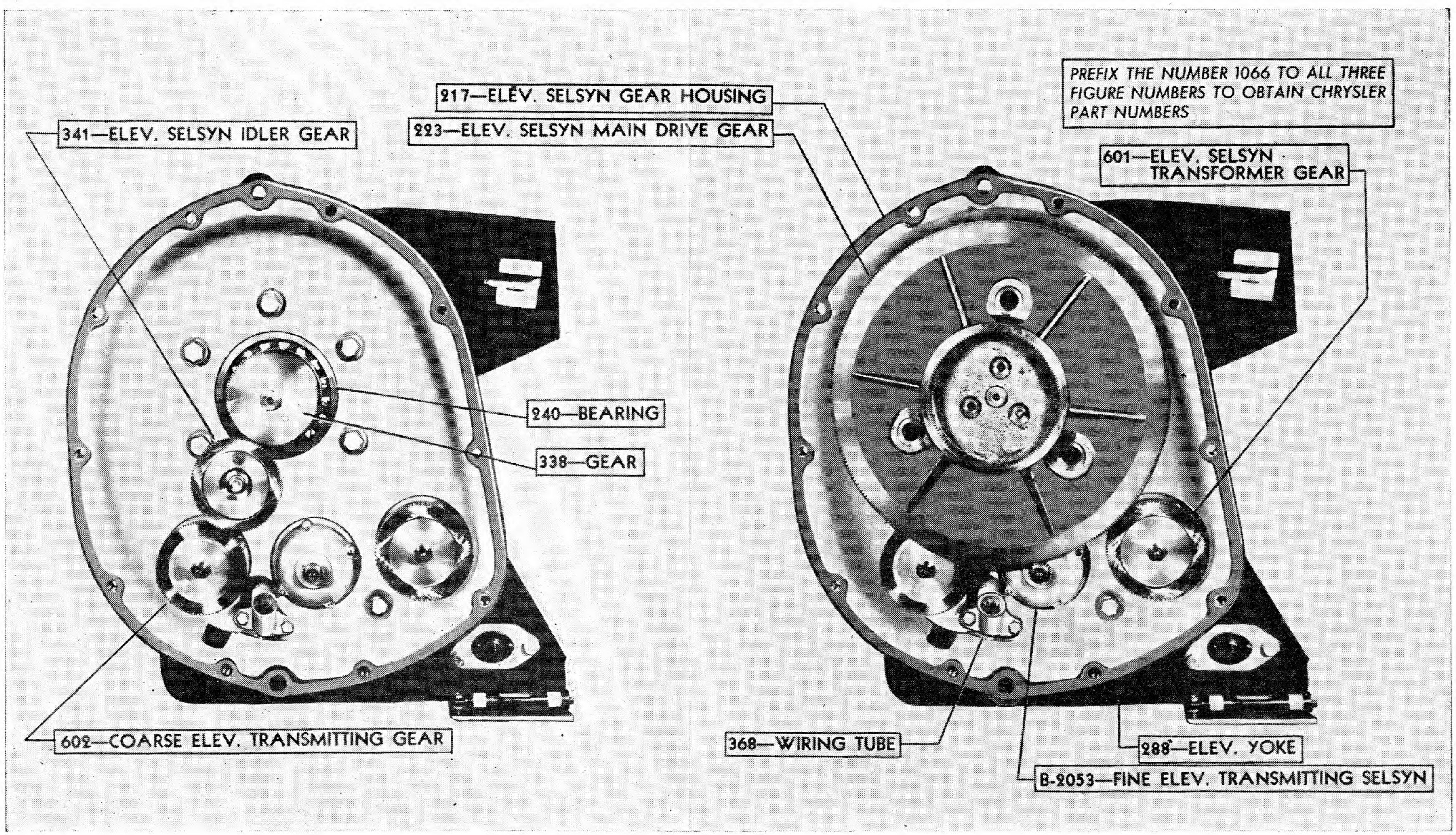
Fig. 1009—Exploded view of elevation drive motor and reduction gears



T $\frac{\text{OY-104}}{\text{1-1010}}$ **Fig. 1010—Exploded view of part of the elevation drive assembly**

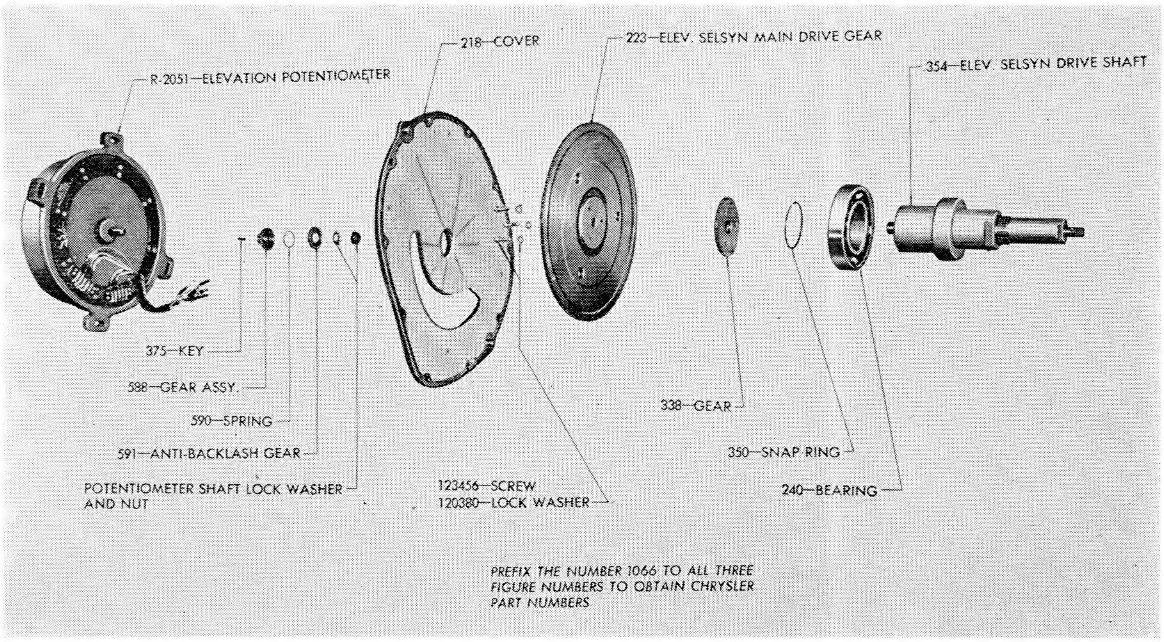


T $\frac{\text{OY-104}}{\text{1-1011}}$ **Fig. 1011—Cutaway view of the elevation stowing lock**

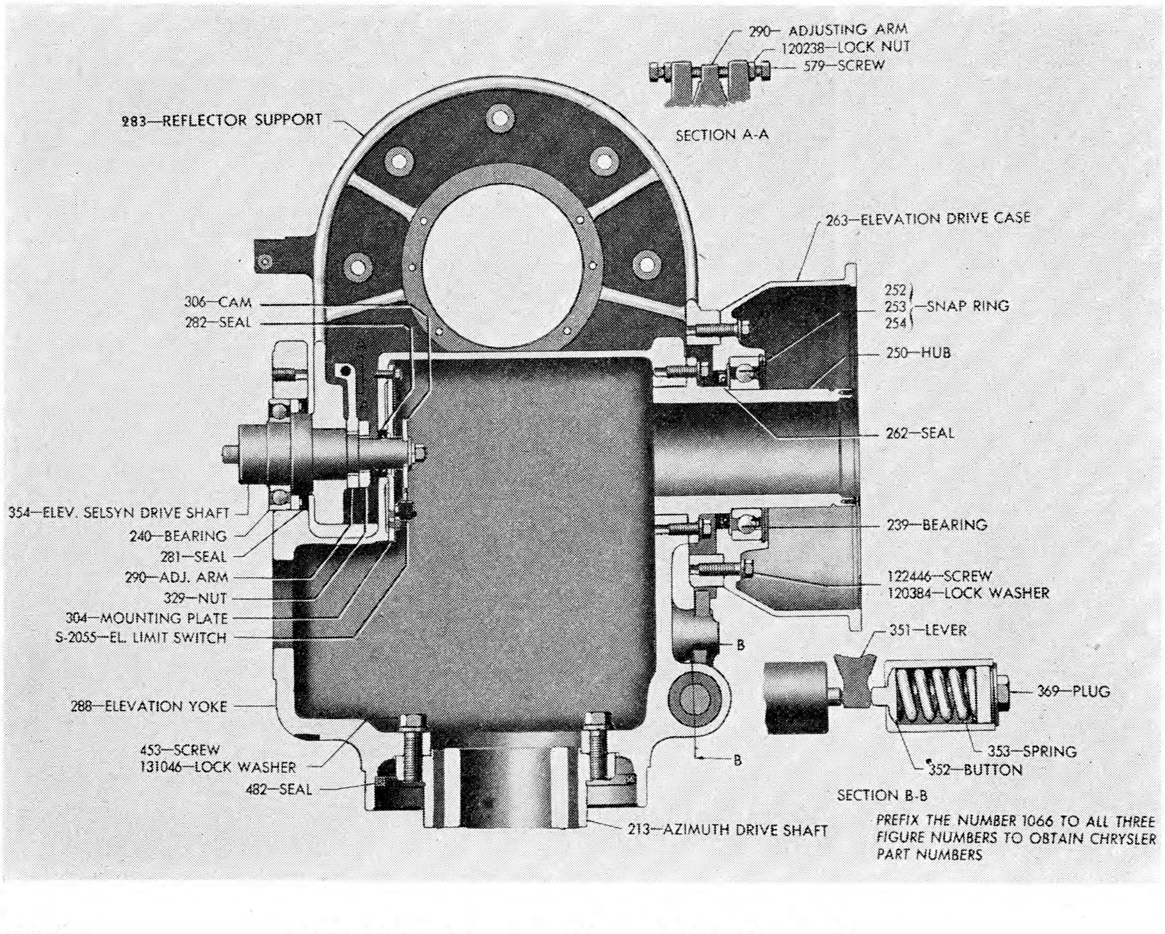


T $\frac{\text{OY-104}}{\text{1-1012}}$

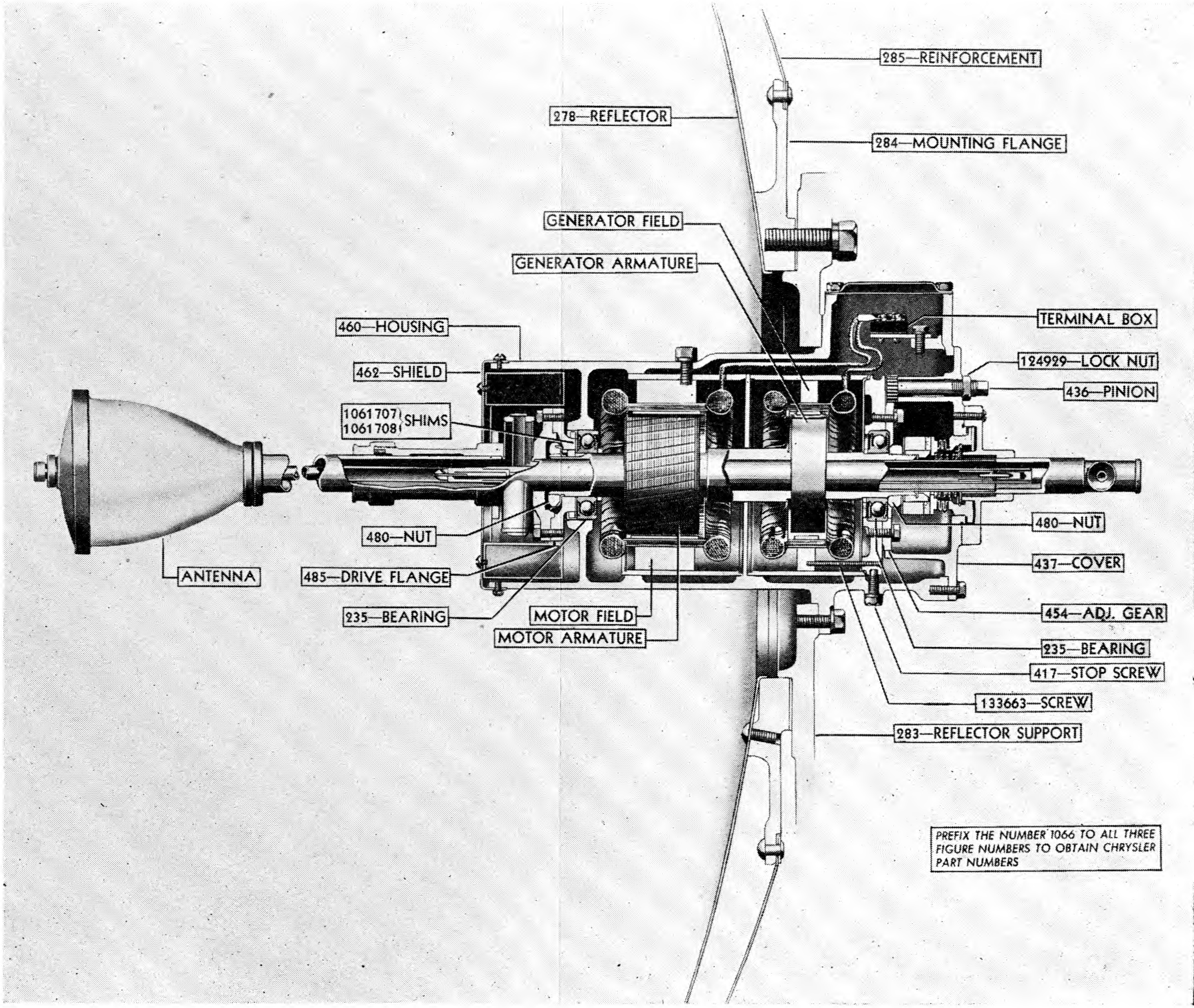
Fig. 1012—Elevation selsyn drive gears



T $\frac{\text{OY-104}}{\text{1-1013}}$ **Fig. 1013—Exploded view of part of the elevation selsyn drive train**

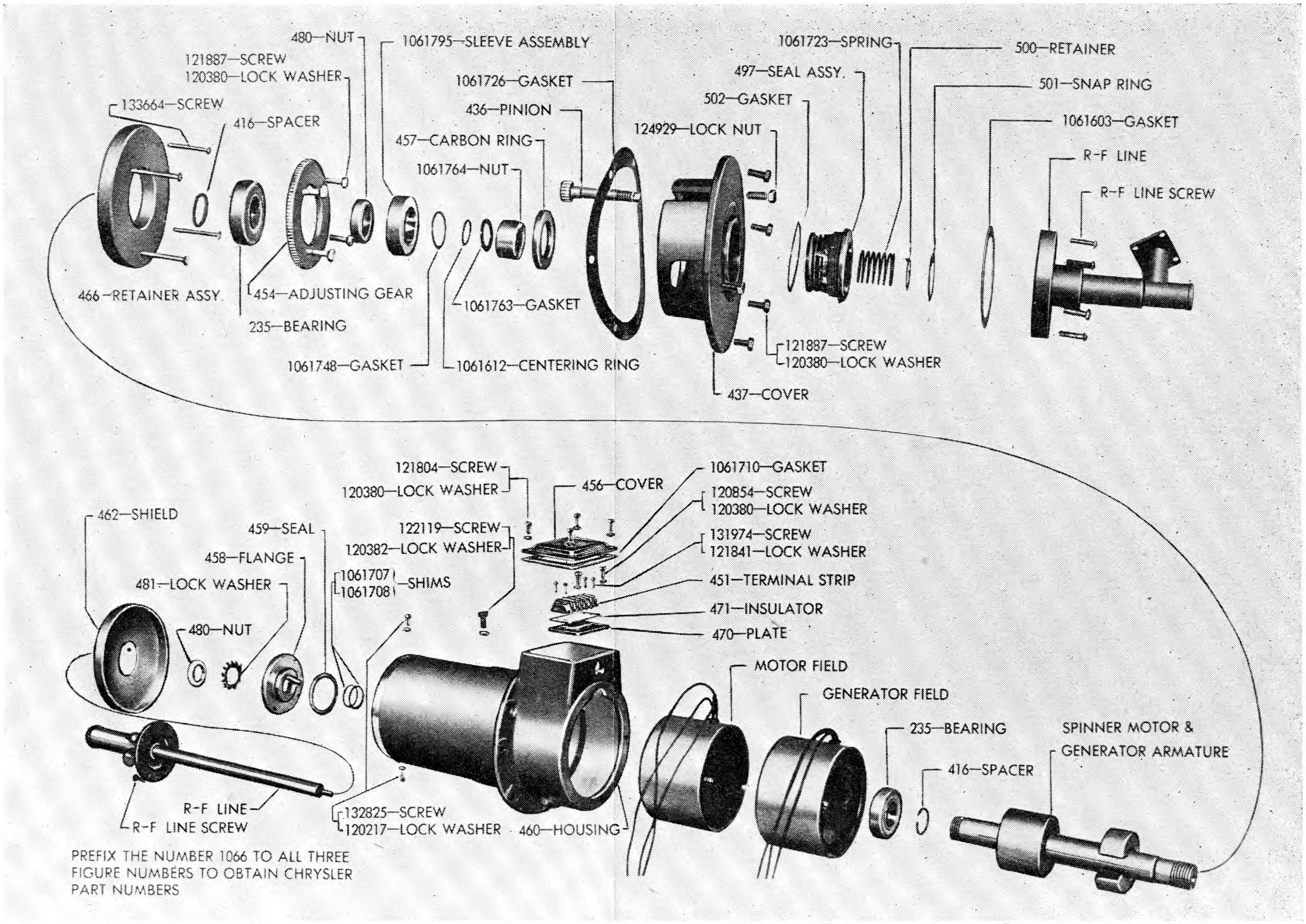


T $\frac{\text{OY-104}}{\text{1-1014}}$ **Fig. 1014—Cross section of elevation yoke**

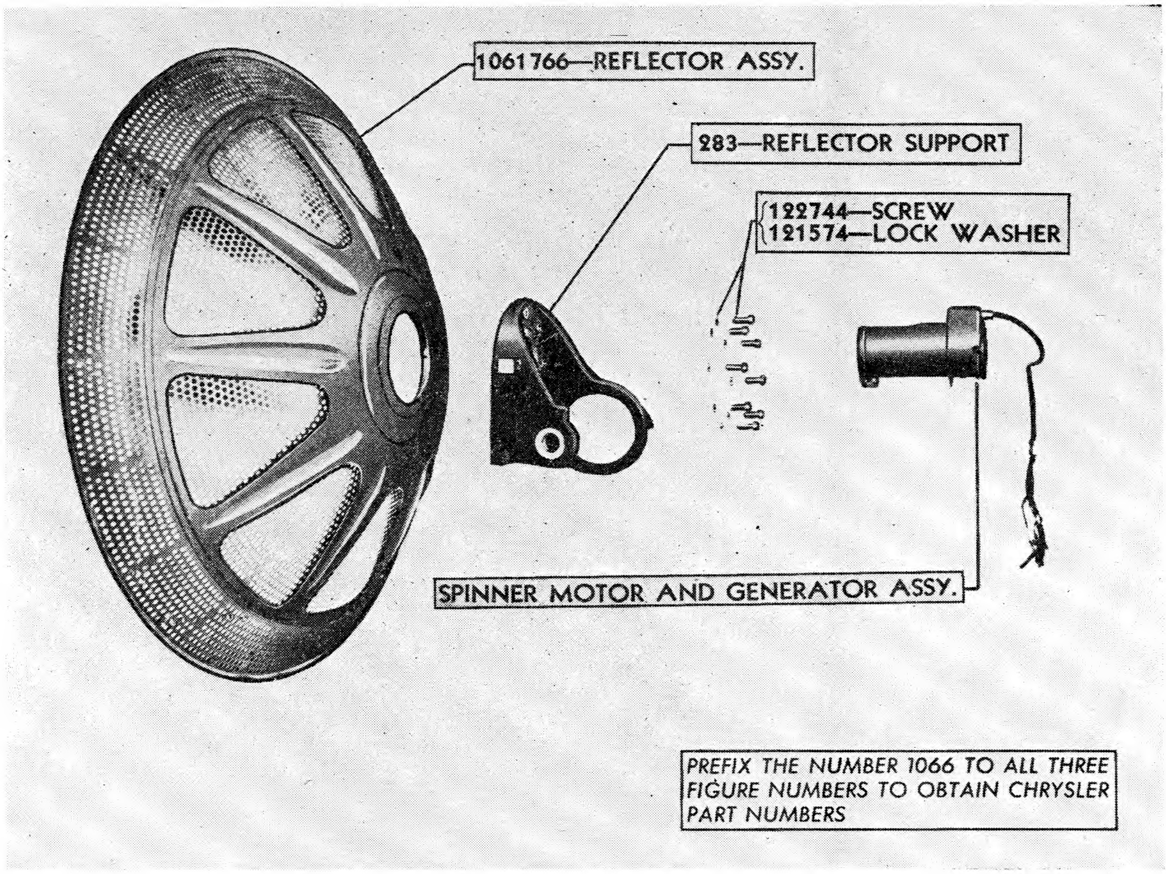


T $\frac{\text{OY-104}}{\text{1-1015}}$

Fig. 1015—Cutaway view of spinner motor and reference generator

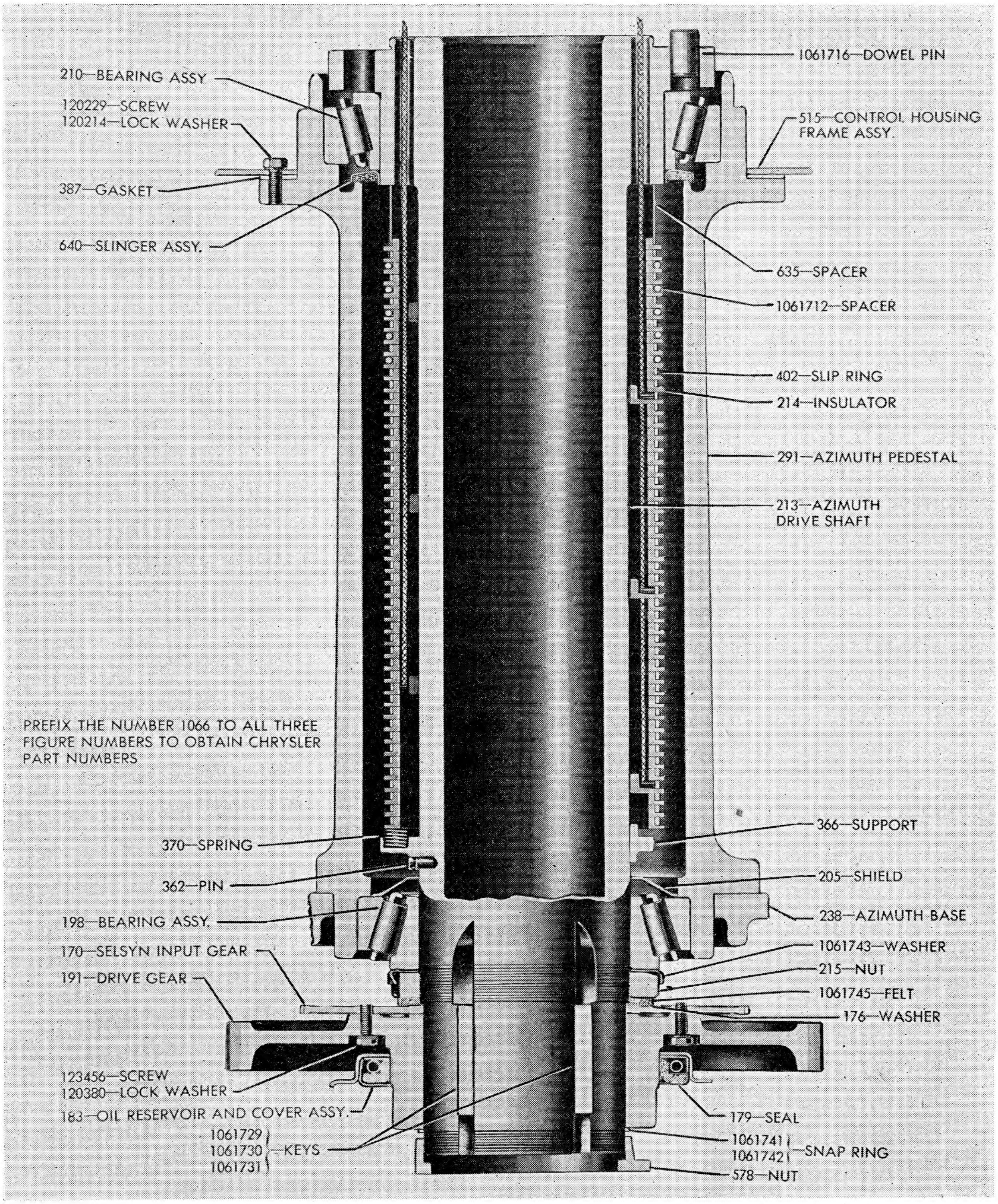


T $\frac{\text{OY-104}}{\text{1-1016}}$ **Fig. 1016—Exploded view of reference generator and spinner motor assembly**

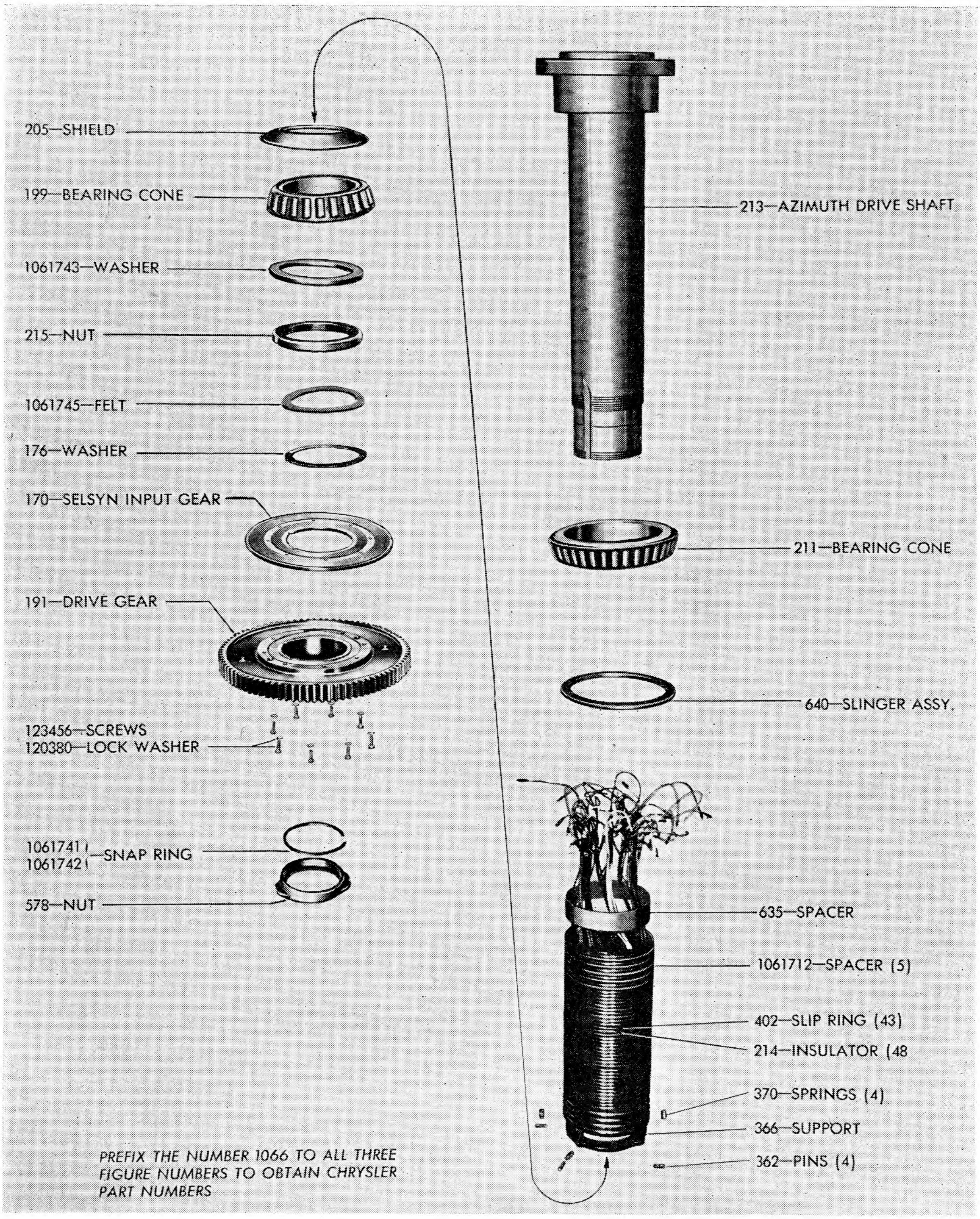


T $\frac{\text{OY-104}}{\text{1-1017}}$

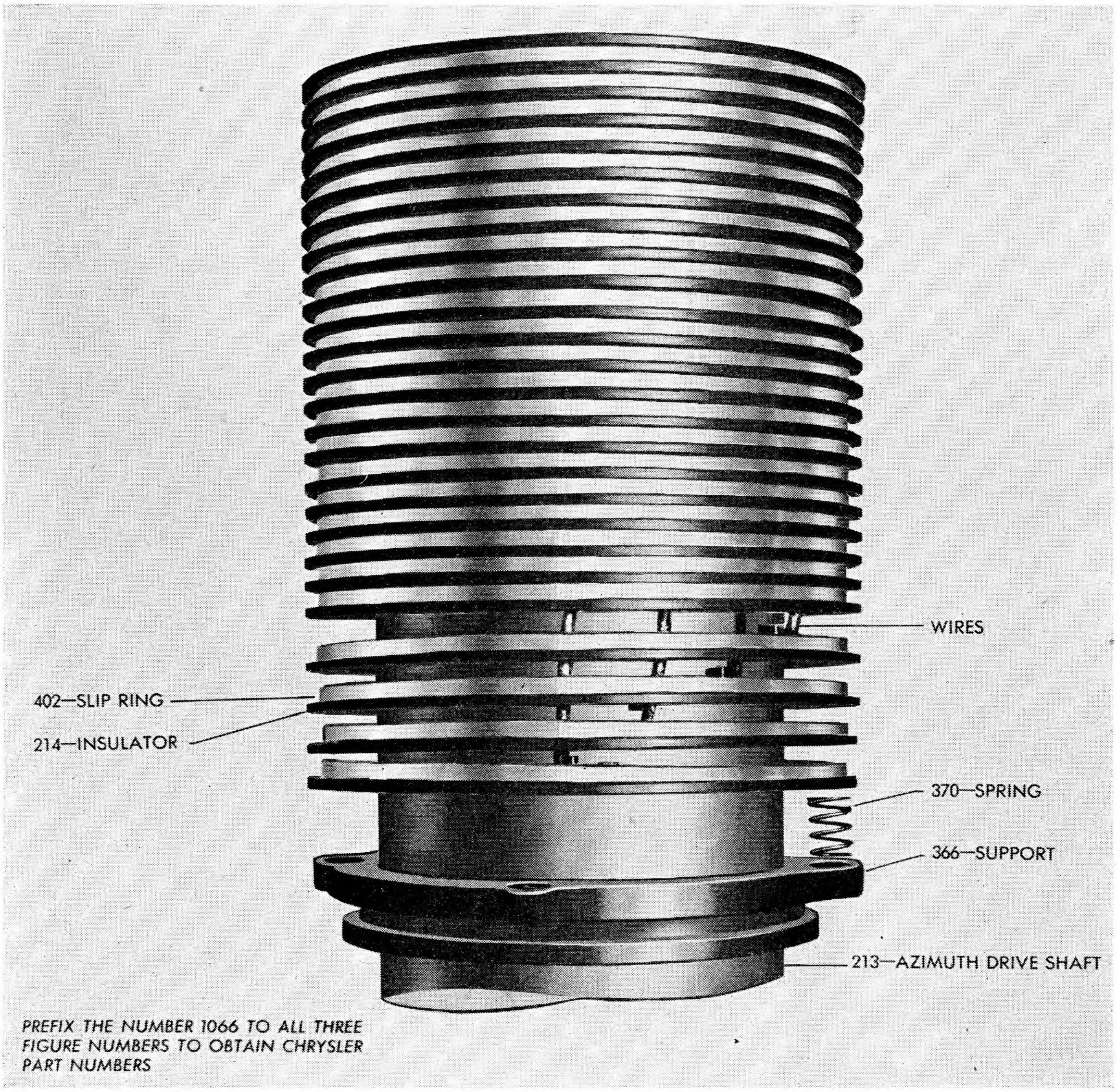
Fig. 1017—Exploded view of paraboloid assembly



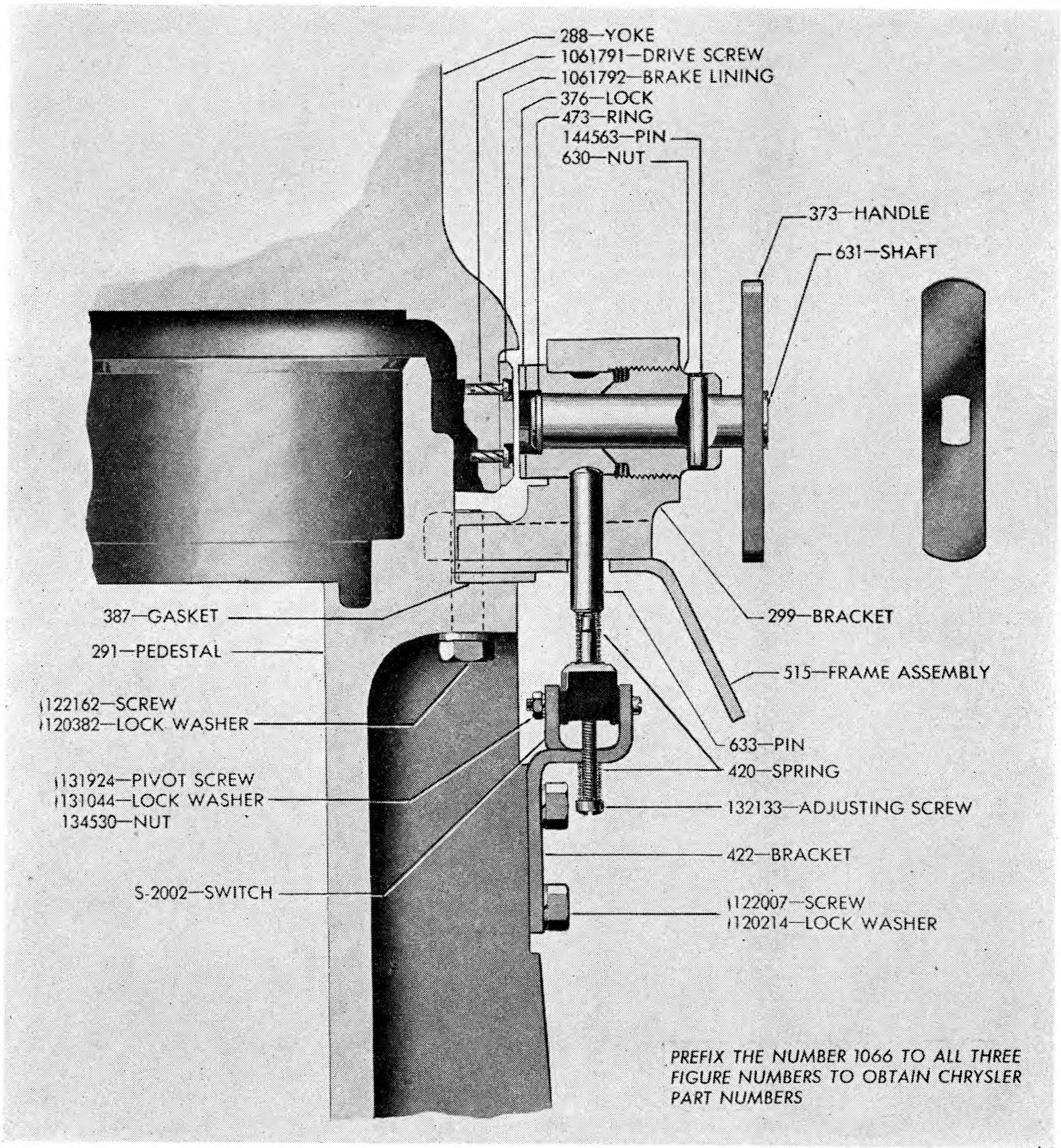
T $\frac{\text{OY-104}}{\text{1-1018}}$ **Fig. 1018—Cutaway view of azimuth drive shaft and pedestal**



T $\frac{\text{OY-104}}{\text{1-1019}}$ **Fig. 1019—Exploded view of azimuth drive shaft assembly**



T $\frac{\text{OY-104}}{\text{1-1020}}$ **Fig. 1020—Slipring assembly on azimuth drive shaft**

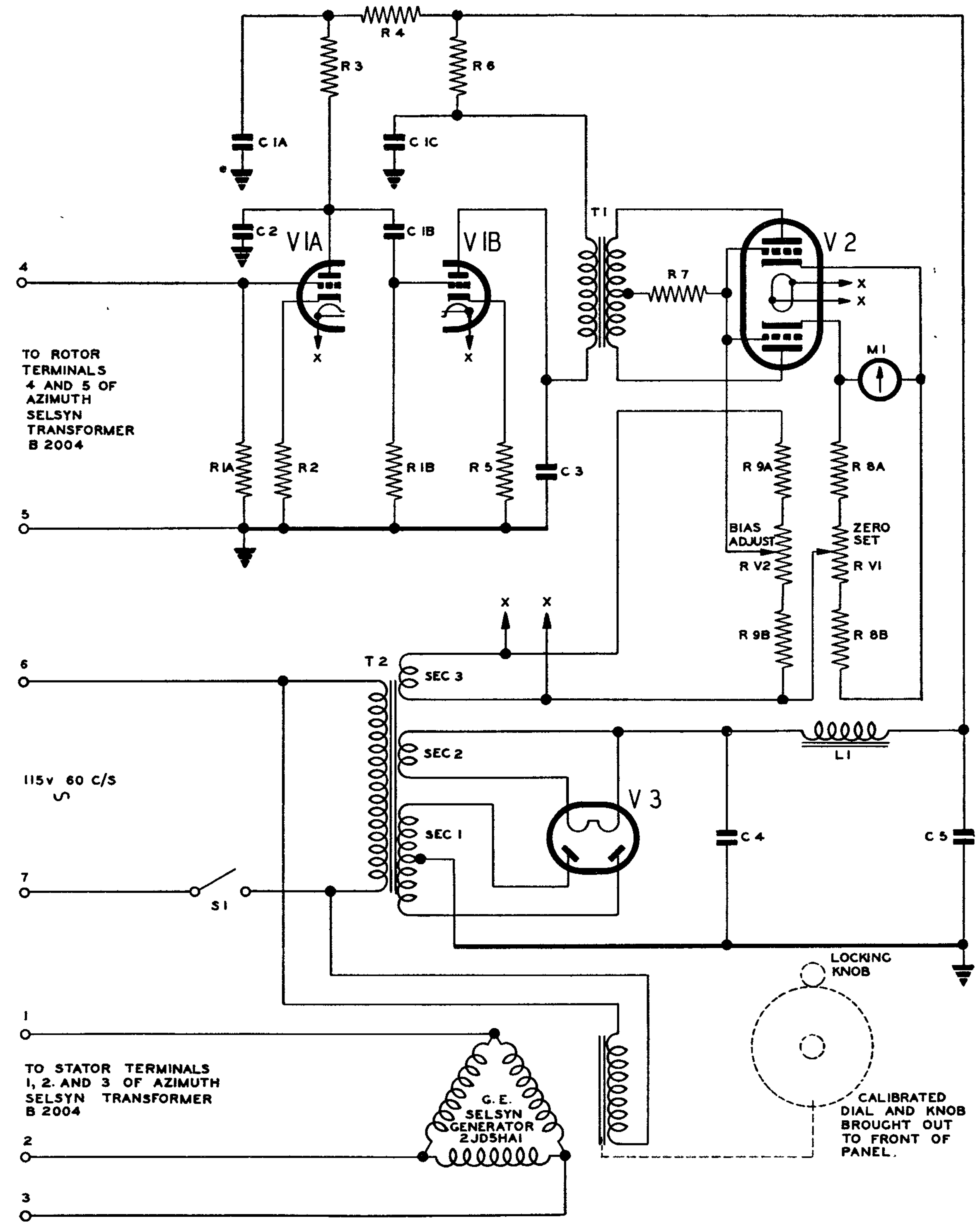


T $\frac{\text{OY-104}}{\text{1-1021}}$ **Fig. 1021—Cutaway view of azimuth showing lock and switch**

TABLE 1003—LIST OF COMPONENTS IN BACKLASH ANALYSER (FIG. 1022)

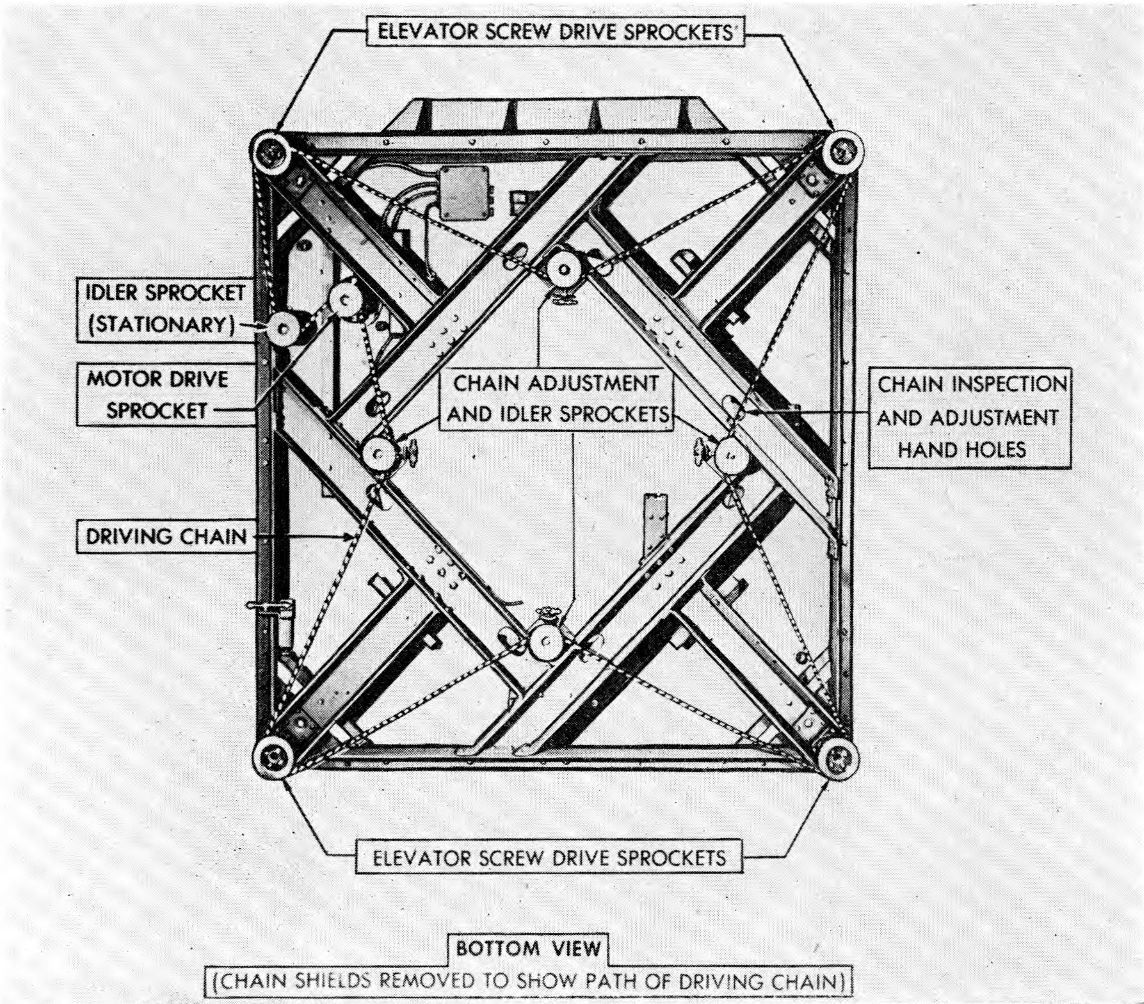
RESISTORS			CONDENSERS		
R1	1 MΩ	0.5 W	C1	0.25 μF	300 V D.C. W
R2	5 KΩ	0.5 W	C2	0.02 μF	300 V D.C. W
R3	50 KΩ	0.5 W	C3	0.05 μF	300 V D.C. W
R4	130 KΩ	0.5 W	C4	12 μF	450 V D.C. W
R5	1 KΩ	0.5 W	C5	16 μF	450 V D.C. W
R6	27 KΩ	10 W			
R7	3 MΩ	0.5 W	POTENTIOMETERS		
R8	2.7 KΩ	0.5 W	RV1	1 KΩ	
R9	470 Ω	0.5 W	RV2	500 Ω	
VALVES			METER		
V1	6SN7GT		M1	500 μA – 0 – 500 μA	
V2	6SN7GT				
V3	5Y3GT				

TRANSFORMERS & CHOKES			
T1	Primary	8 mA	Z = 10 KΩ
	Secondary	C.T.	Z = 90 KΩ
	Turns ratio	3:1	
T2	Primary	65 V.A.	
	Secondary 1	350 V – 0 – 350 V – 70 mA D.C.	
	Secondary 2	5 V – 3 A	
	Secondary 3	6.3 V – 2.5 A C.T.	
L1	15 H at 50 mA D.C. res. 350 Ω		

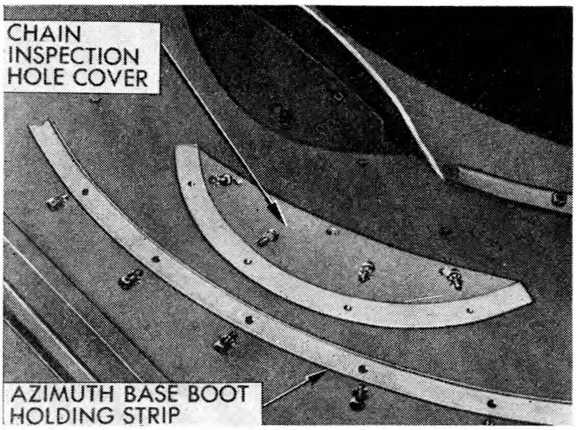


T $\frac{\text{OY-104}}{\text{1-1022}}$

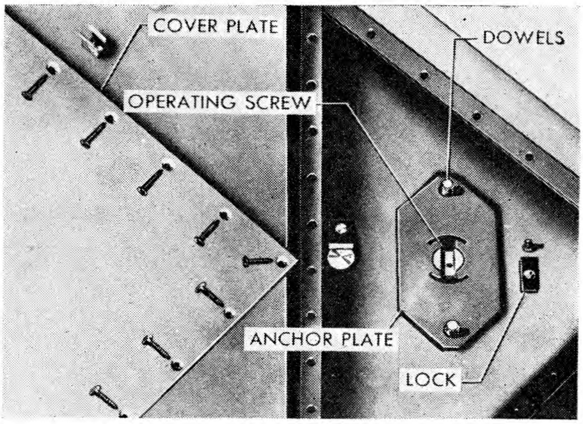
Fig. 1022—Circuit diagram of backlash analyser



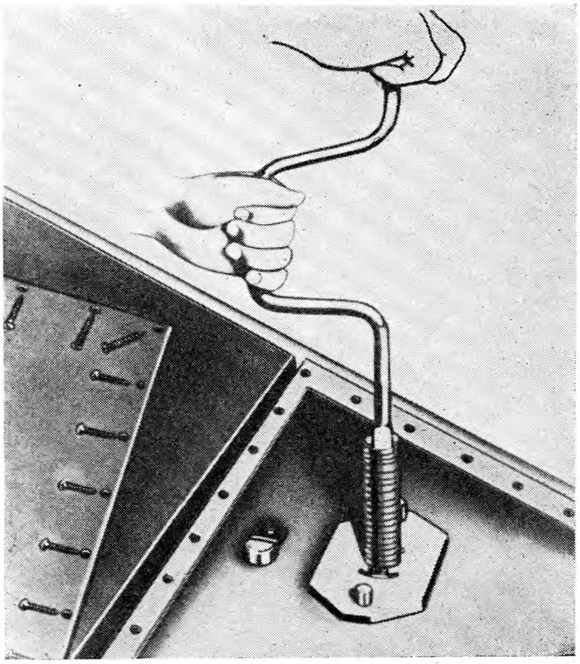
T $\frac{\text{OY-104}}{\text{1-1023}}$ **Fig. 1023—Bottom view of elevator platform showing drive chain assembly**



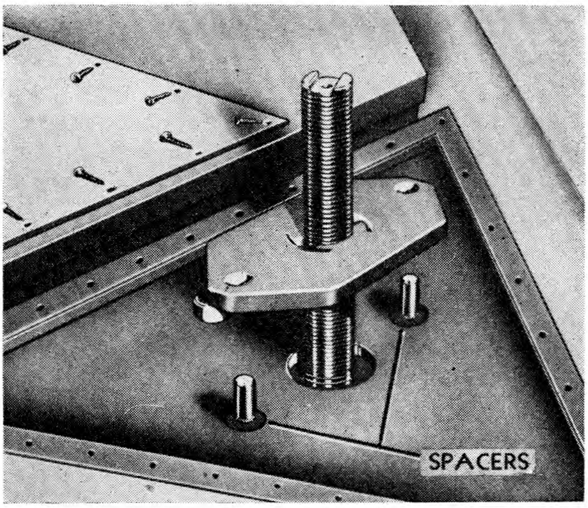
T $\frac{\text{OY-104}}{\text{1-1024}}$ **Fig. 1024—Removal of the segment of the azimuth base boot**



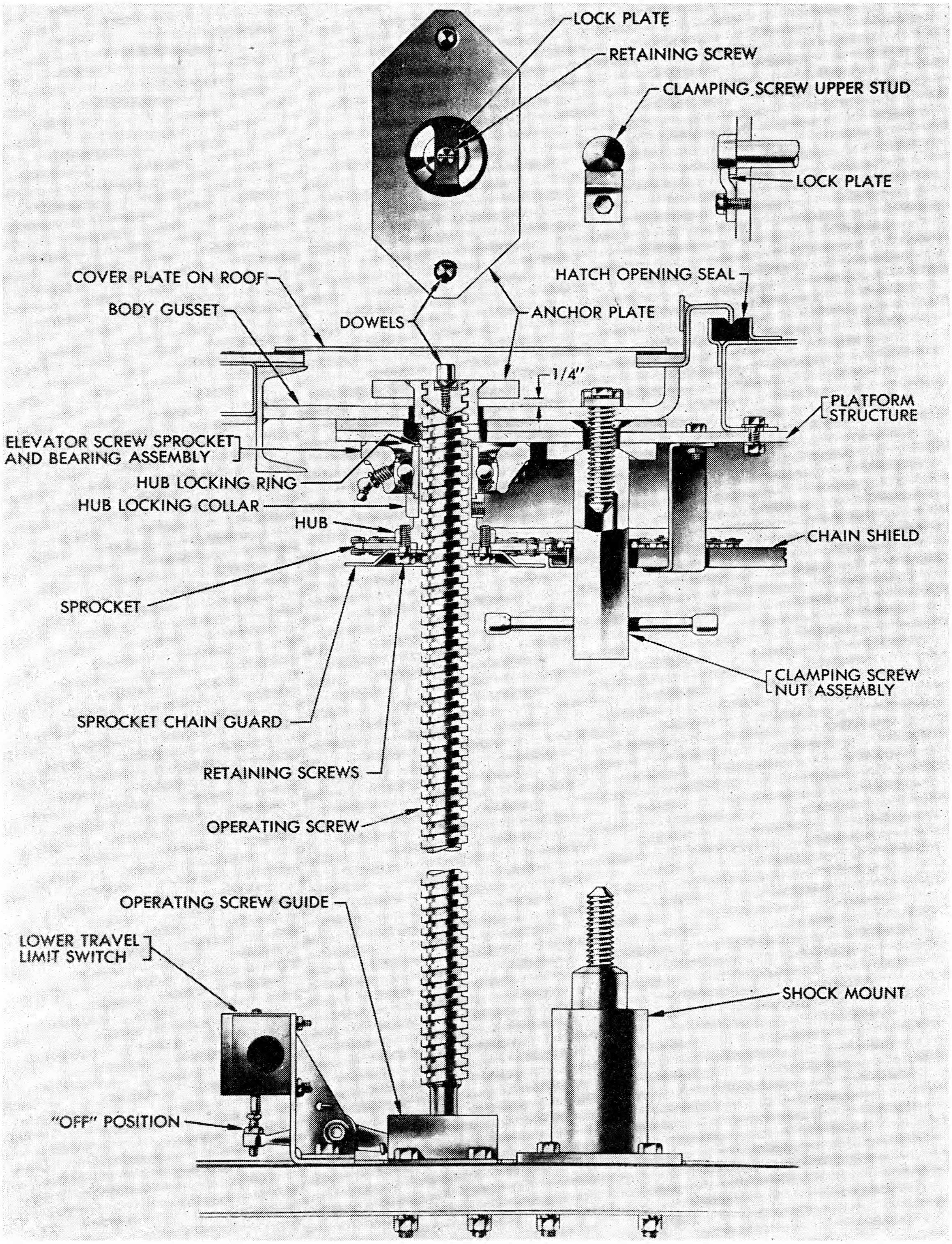
T $\frac{\text{OY-104}}{\text{1-1025}}$ **Fig. 1025—Cover plate removed to show the elevating screws**



T $\frac{\text{OY-104}}{\text{1-1026}}$ **Fig. 1026—Raising the elevating screws**

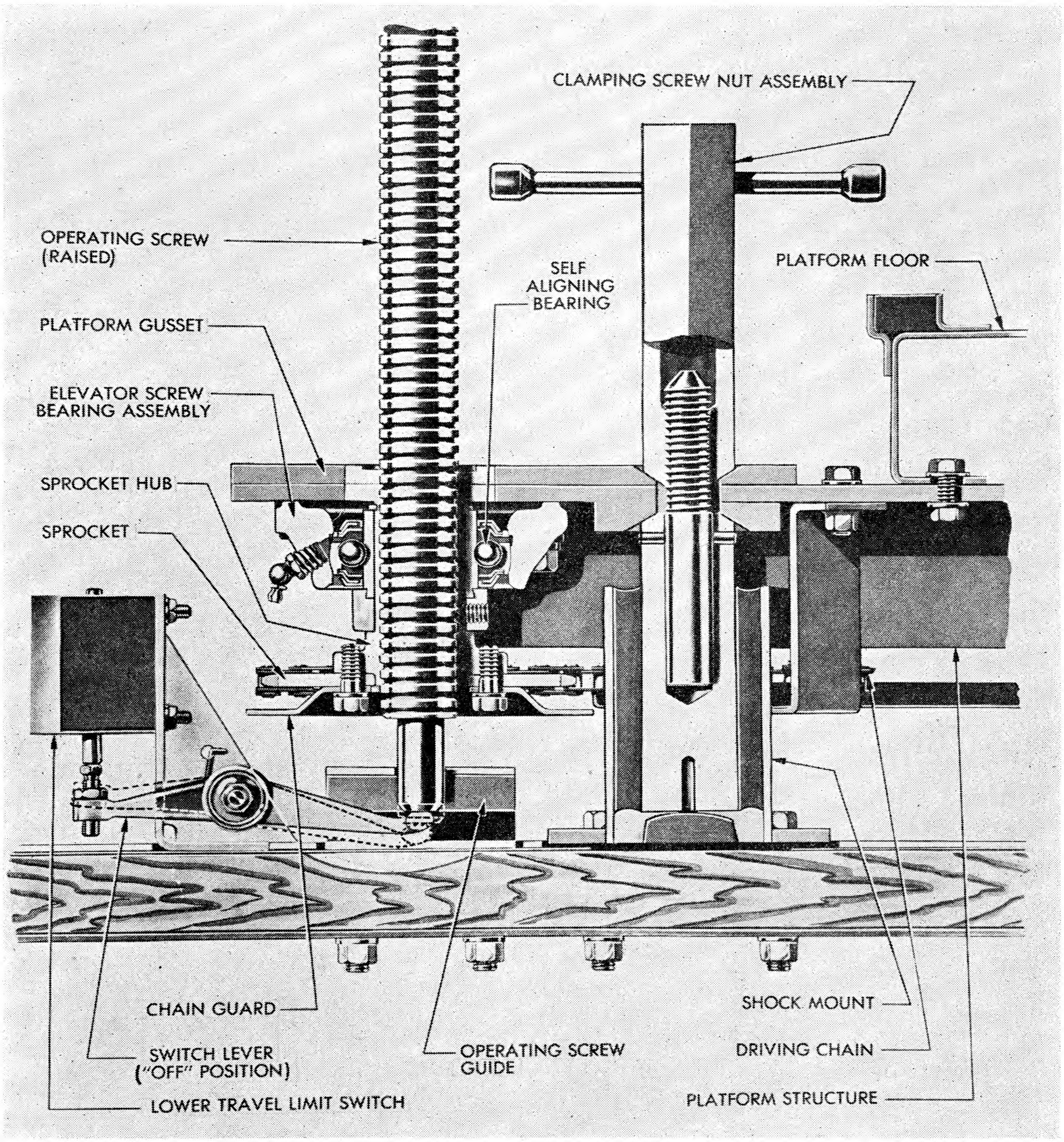


T $\frac{\text{OY-104}}{\text{1-1027}}$ **Fig. 1027—Location of the spacers under the elevating screw anchor plate**

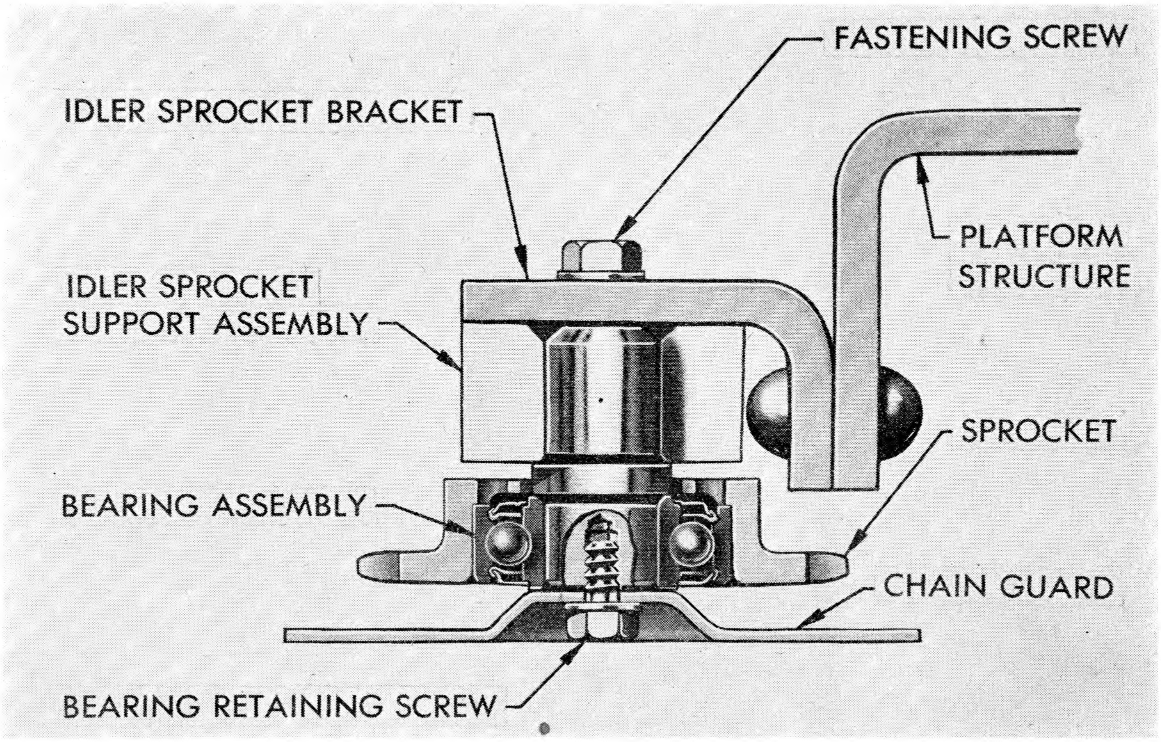


T OY-104/1-1028

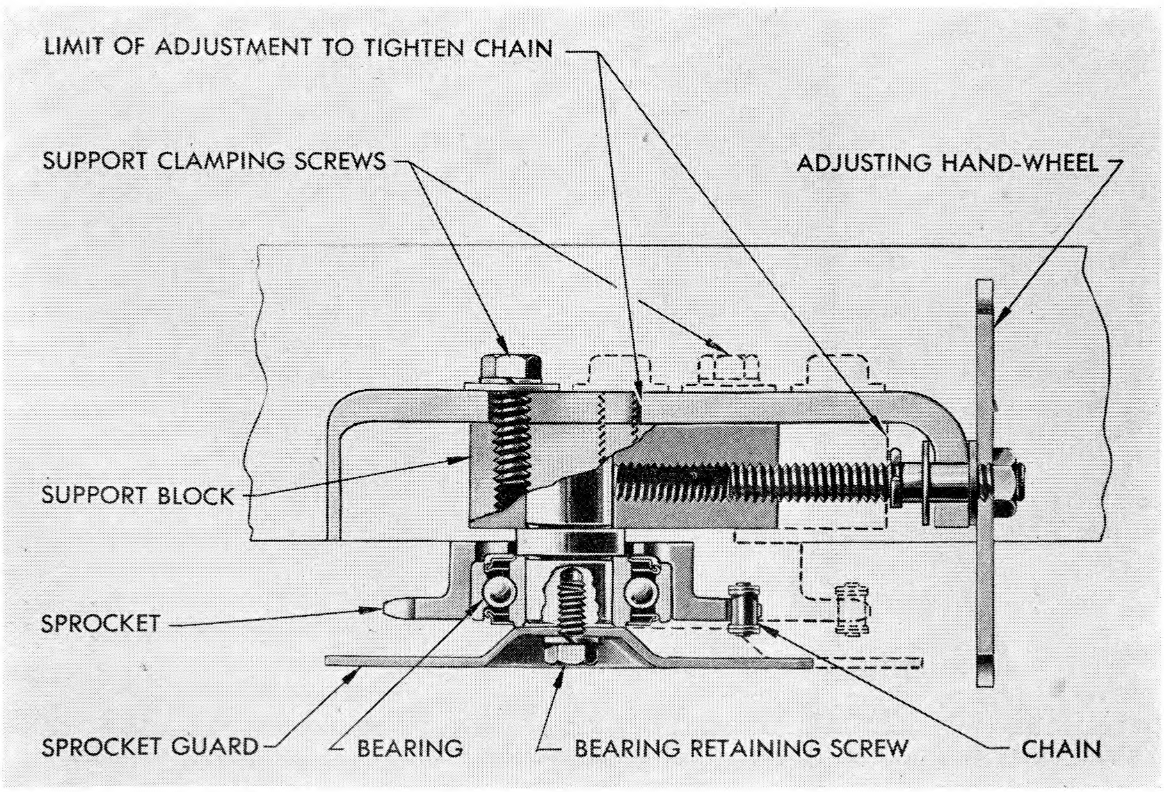
Fig. 1028—Cross section of elevator operating mechanism, platform in raised position



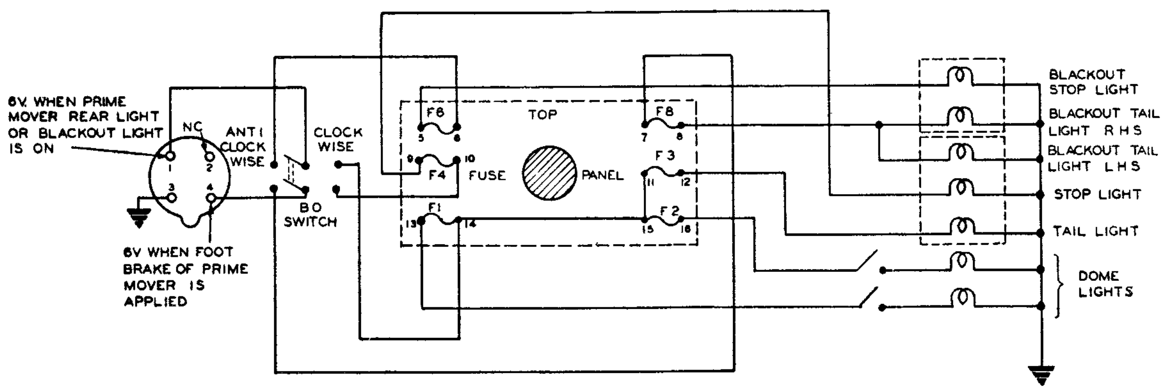
T $\frac{\text{OY-104}}{\text{1-1029}}$ **Fig. 1029—Cross section of elevator operating mechanism, platform lowered**



T $\frac{\text{OY-104}}{\text{1-1030}}$ **Fig. 1030—Cross section of idler sprocket assembly**

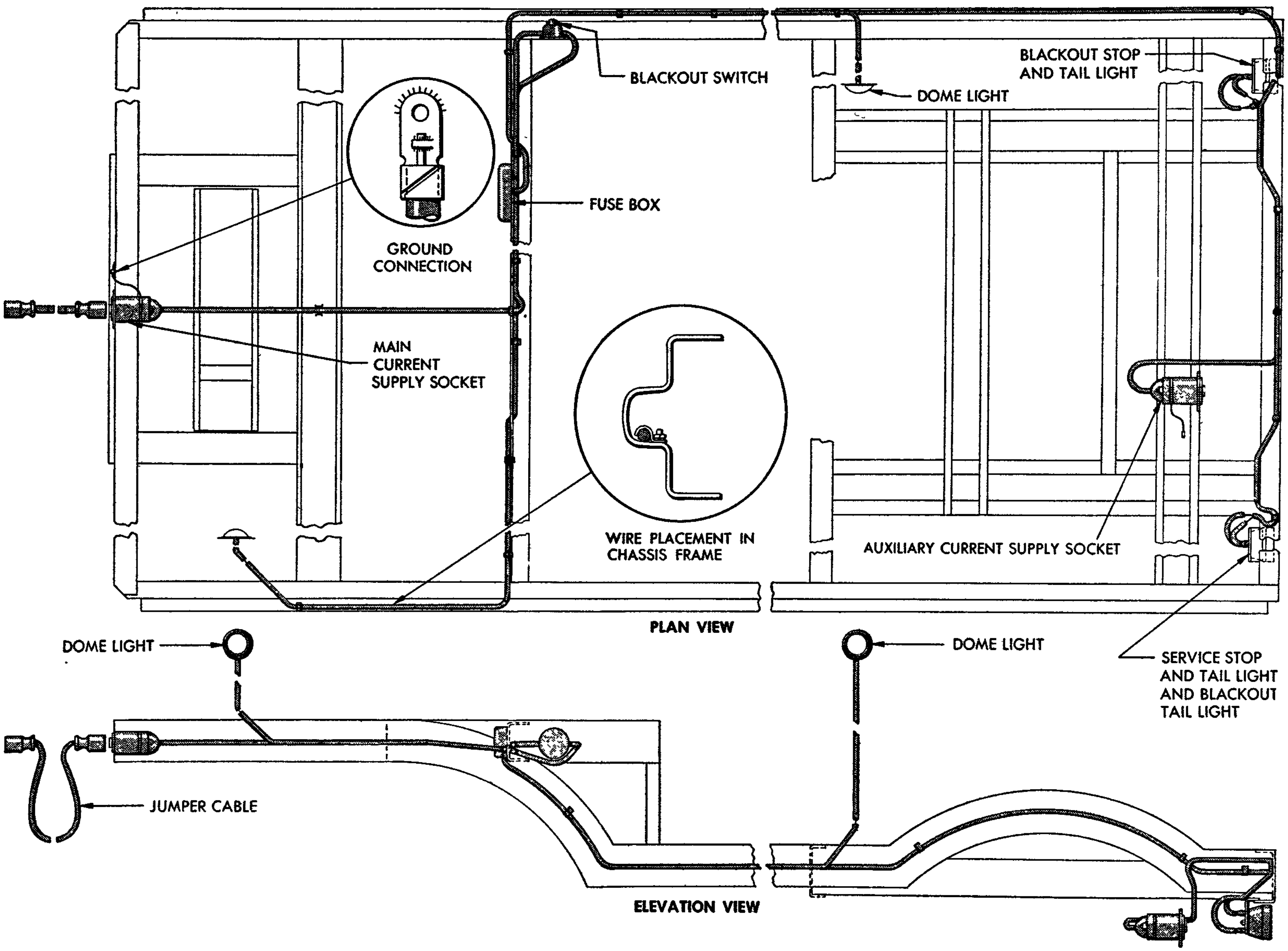


T $\frac{\text{OY-104}}{\text{1-1031}}$ **Fig. 1031—Cross section of stationary idler sprocket assembly**



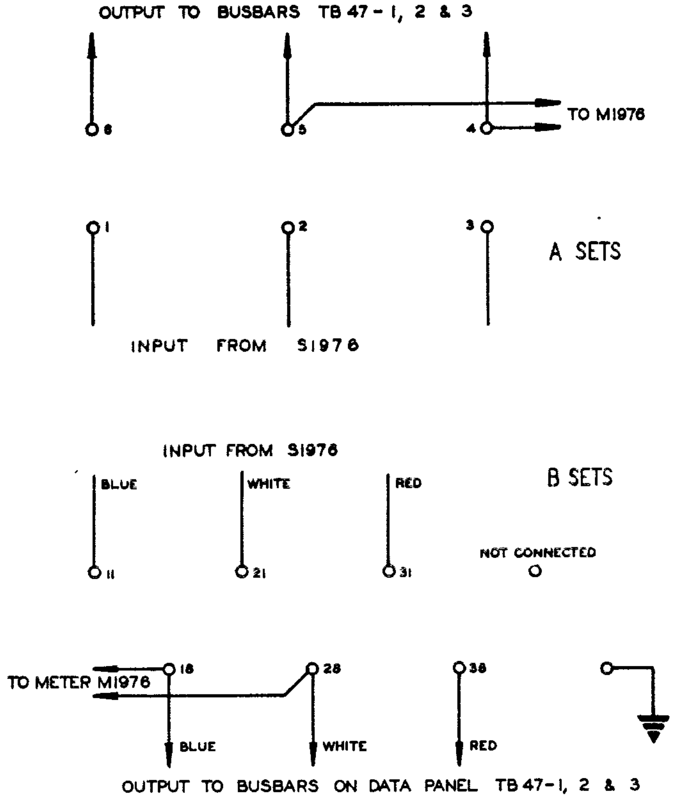
T $\frac{\text{OY-104}}{\text{1-1032}}$

Fig. 1032—Trailer 6V lighting system

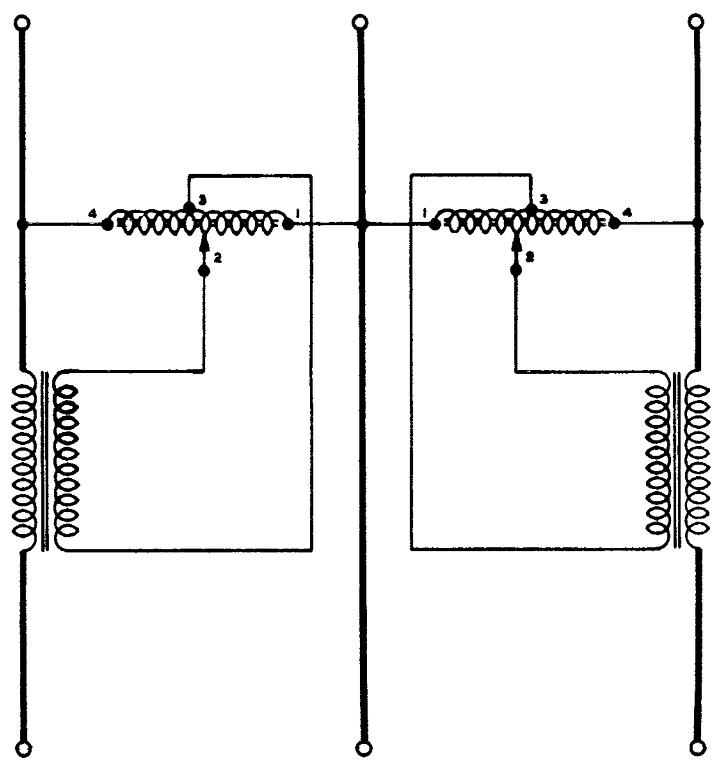


T $\frac{\text{OY-104}}{\text{1-1033}}$

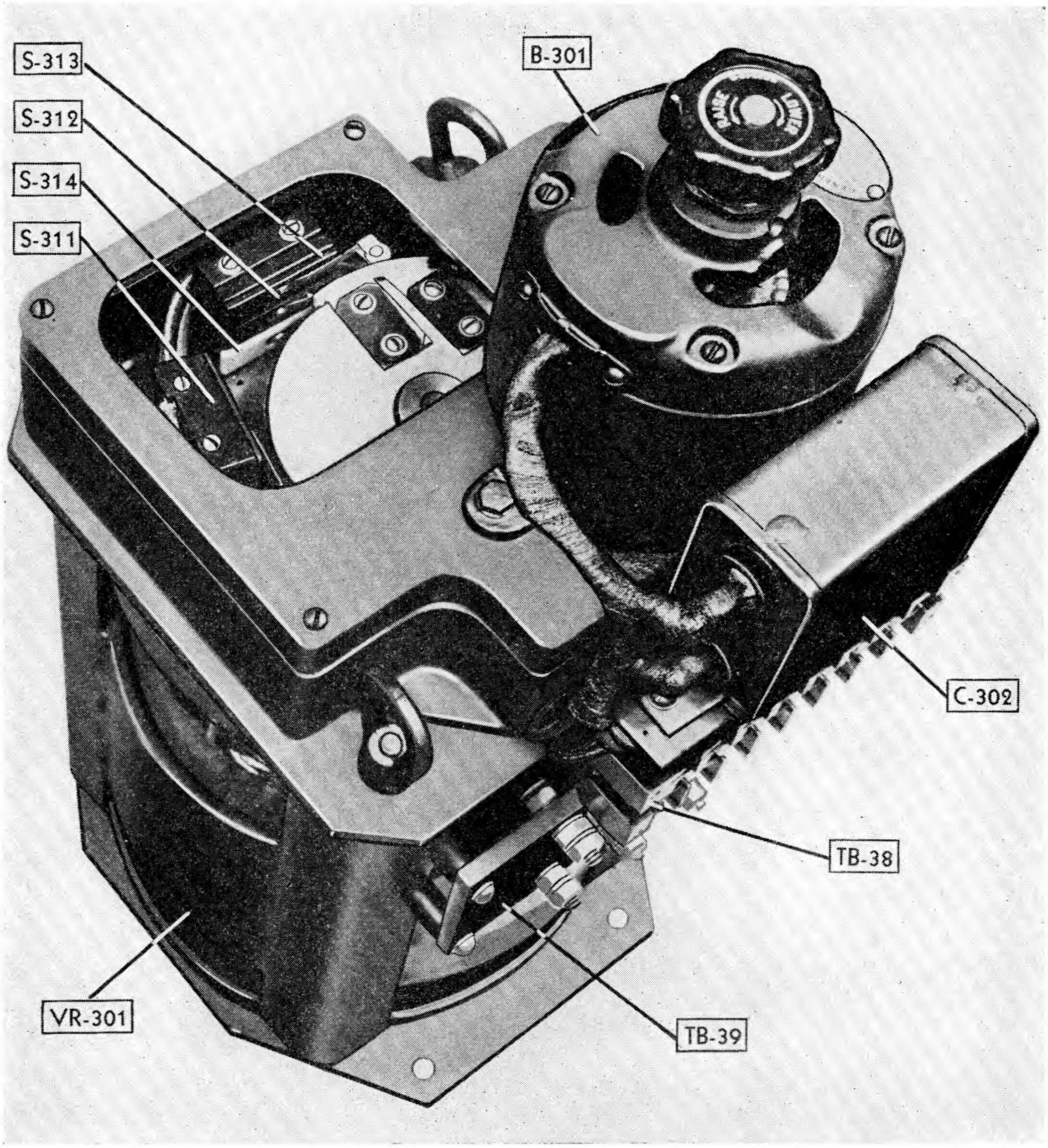
Fig. 1033—Wiring diagram of trailer 6V lighting system



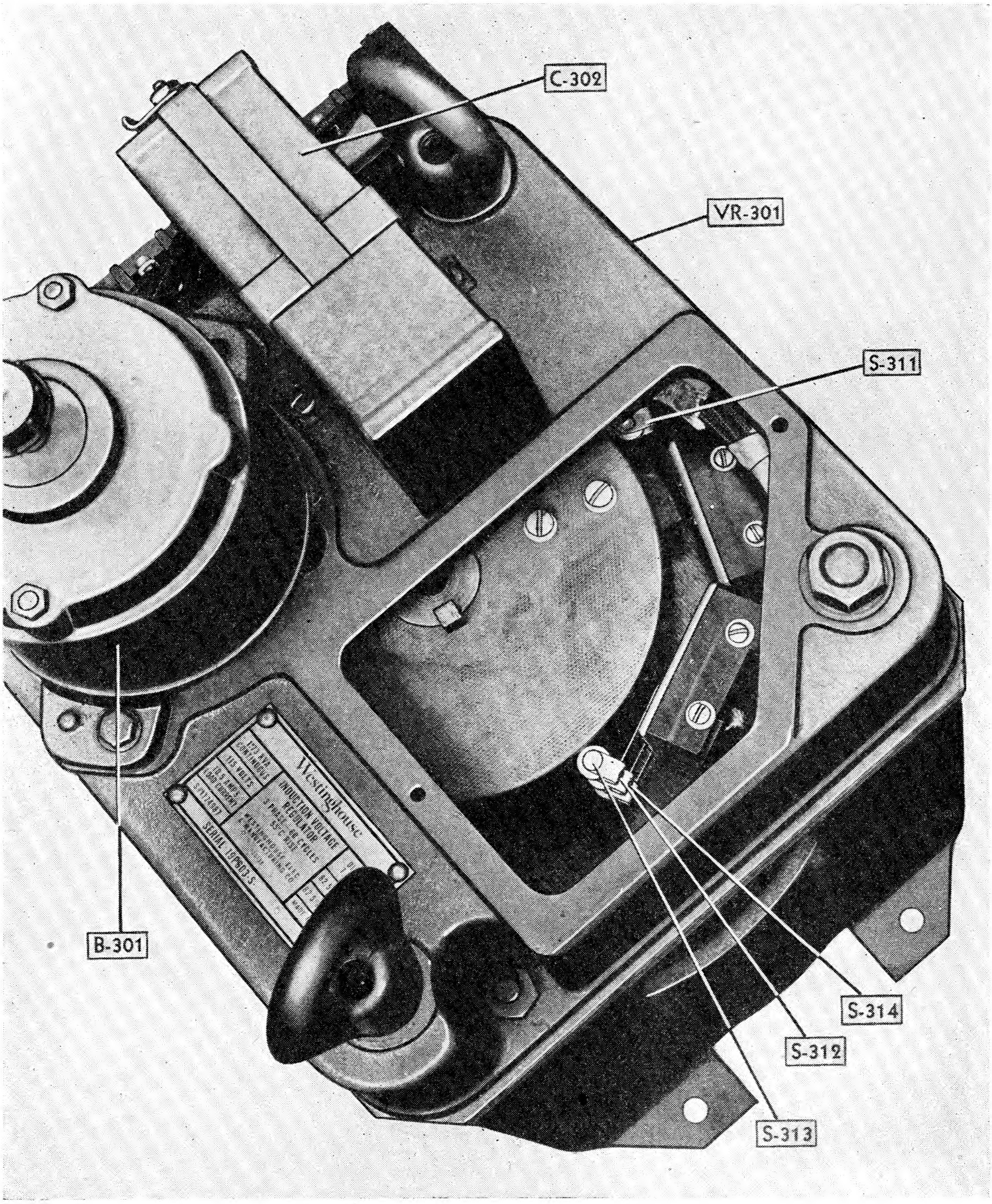
T $\frac{\text{OY-104}}{\text{1-1034}}$ **Fig. 1034—Line voltage regulator terminal boards**



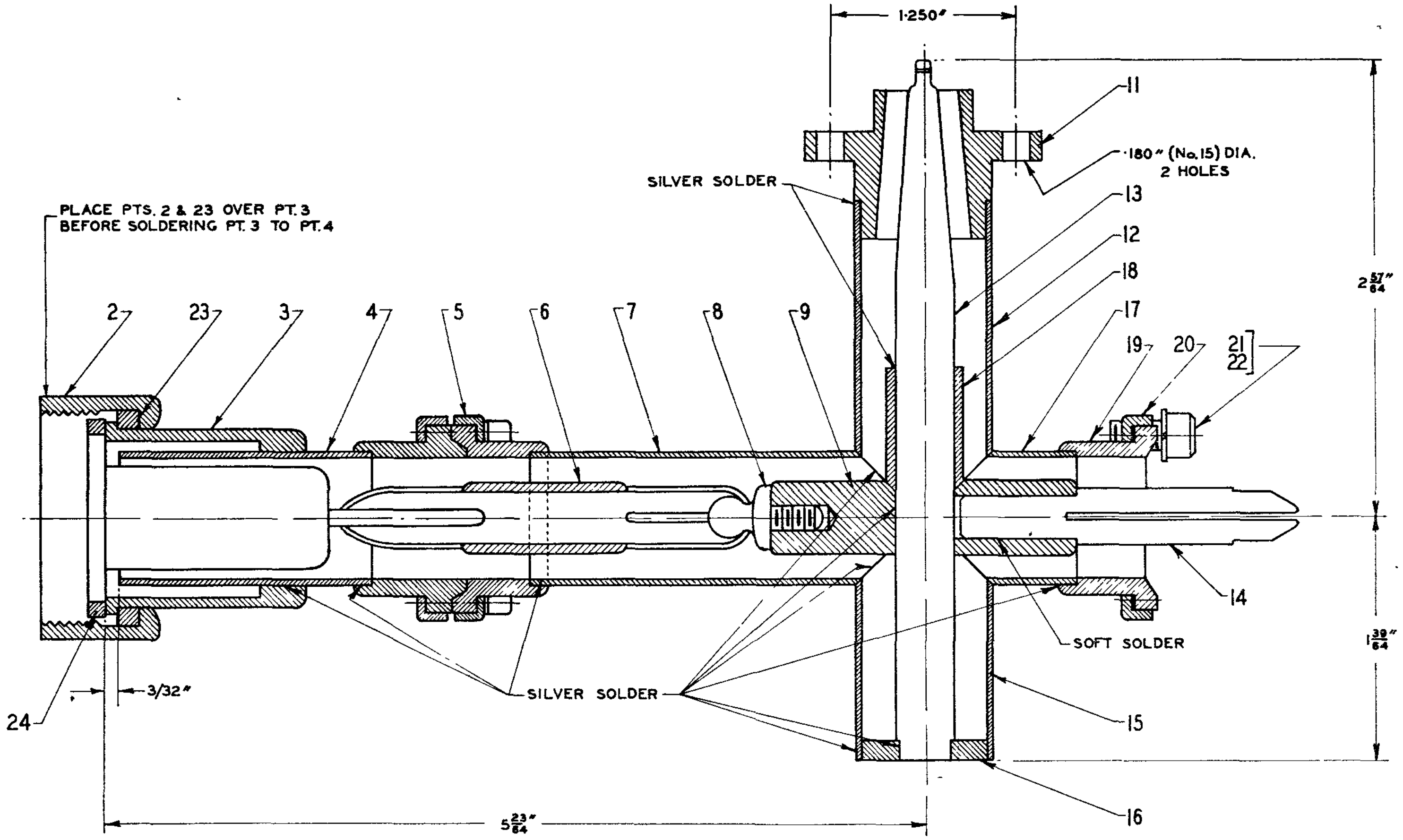
T $\frac{\text{OY-104}}{\text{1-1035}}$ **Fig. 1035—Line voltage regulator circuit diagram, A sets**

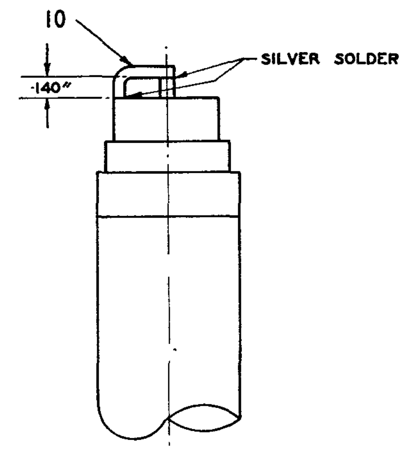


T $\frac{\text{OY-104}}{\text{1-1036}}$ Fig. 1036—Voltage regulator (B sets) showing switches



T $\frac{\text{OY-104}}{\text{1-1037}}$ **Fig. 1037—Voltage regulator (A sets) showing switches**





1	ASSEMBLY
2	NUT
3	COUPLING
4	OUTER CONDUCTOR
5	TRANSMISSION LINE COUPLING
6	CONNECTOR
7	OUTER CONDUCTOR
8	CONNECTOR STUD
9	CENTRE ROD
10	LOOP
11	CONNECTOR
12	OUTER CONDUCTOR
13	CENTRE CONDUCTOR
14	BULLET
15	OUTER CONDUCTOR
16	PLUG
17	OUTER CONDUCTOR
18	SLEEVE
19	RECEPTACLE
20	FLANGE
21*	Nº 10-32 HEX. SOCKET HD. CAP SCR. 1/2" LG.
22	Nº 10 LOCKWASHER
23	GASKET
24	GASKET

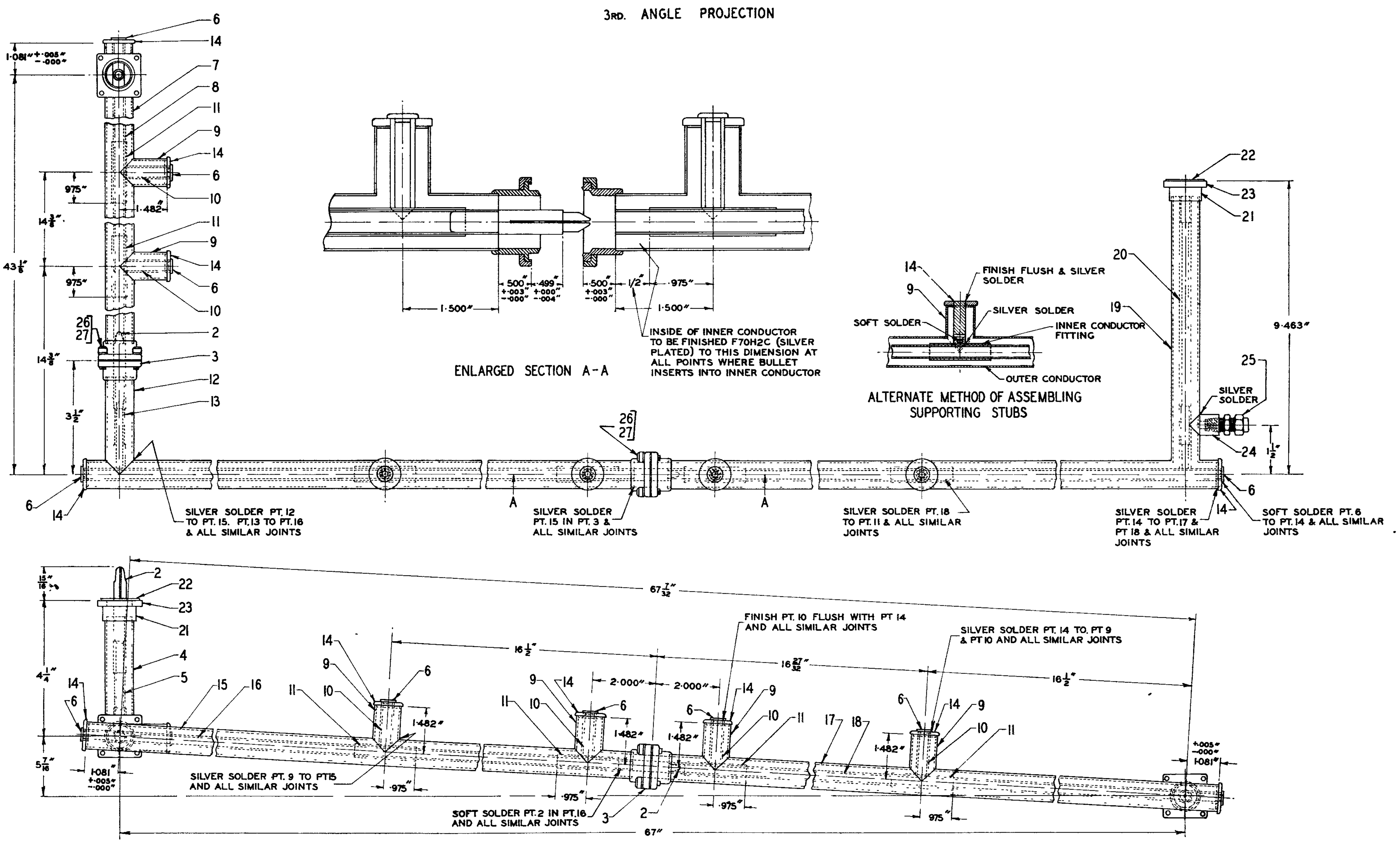
*NOTE 1 MATERIAL–BRASS
FINISH F70C1A (CAD PLATE)

NOTE 2: ALL PARTS ON WHICH FINISH IS NOT DESIGNATED TO BE FINISHED F70H2C (SILVER PLATE) INSIDE & OUTSIDE AFTER SOLDERING

3RD ANGLE PROJECTION

T $\frac{\text{OY-104}}{\text{1-1038}}$

Fig. 1038—Pre-plumbed assembly



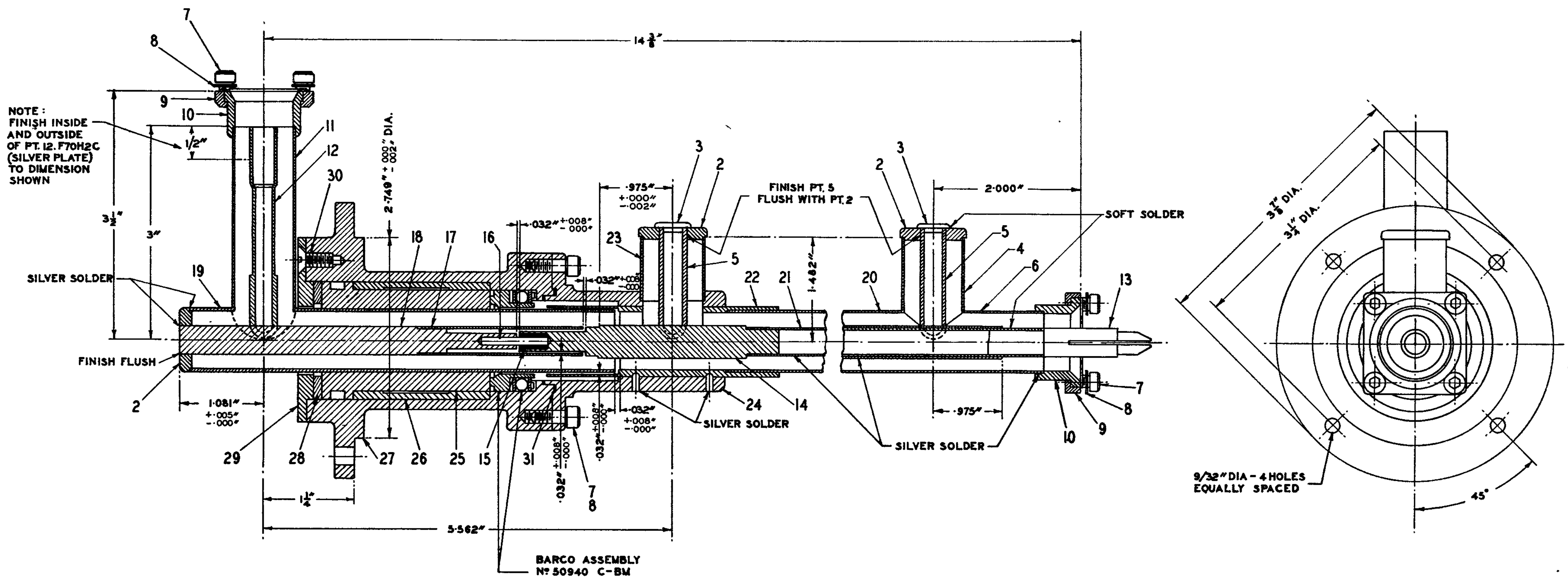
NOTE 1 ALL PARTS INSIDE AND OUTSIDE TO BE FINISHED WITH CHROMATE UNLESS WHERE OTHERWISE SPECIFIED.

NOTE 2. ALL COUPLING PARTS TO BE FINISHED INSIDE AND OUTSIDE WITH F70H2C (SILVER PLATE) AFTER SILVER SOLDERING TO OUTER CONDUCTORS.

1	ASSEMBLY	8	INNER CONDUCTOR	15	OUTER CONDUCTOR	22	GASKET
2	BULLET	9	OUTER CONDUCTOR	16	INNER CONDUCTOR	23	FLANGE
3	COUPLING	10	STUB	17	OUTER CONDUCTOR	24	STUB
4	OUTER CONDUCTOR	11	INNER CONDUCTOR FITTING	18	INNER CONDUCTOR	25	CONNECTION ASSEMBLY
5	STUB-TRANSFORMER	12	OUTER CONDUCTOR	19	OUTER CONDUCTOR	26	No.10-32 HEX. SOCKET HD. CAP SCR $\frac{1}{2}''$ LG.
6	PLUG	13	STUB-TRANSFORMER	20	STUB-TRANSFORMER	27	No.10 LOCKWASHER
7	OUTER CONDUCTOR	14	PLUG	21	PLUG		

T $\frac{\text{OY-104}}{\text{1-1039}}$

Fig. 1039—Transmission line assembly, transmitter to pedestal



3RD ANGLE PROJECTION

*NOTE 1 MATERIAL FOR PARTS 7 & 30 – BRASS. F70C1A (CADMIUM PLATE)

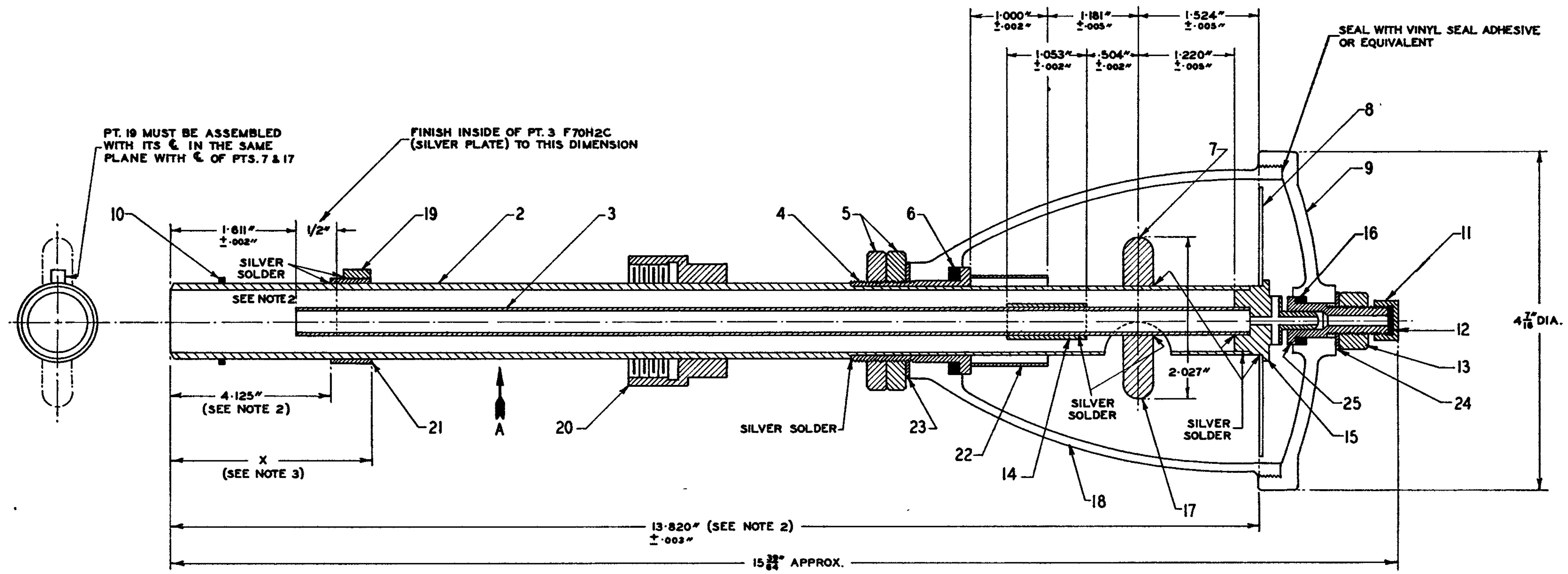
*NOTE 2 MATERIAL FOR PART 31 – NEOPRENE.
HARDNESS – 55-60 DUROMETER OVEN AGING 70 HRS AT 212°F. MUST RETAIN 75% OF ORIGINAL SIZE & BE FLEXIBLE & RESILIENT AFTER EXPOSURE TO 70°F. FOR 5HRS. & MUST MAKE 180° BEND OVER 1" DIA. WITHOUT FRACTURE.

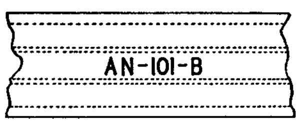
NOTE 3 ALL PARTS INSIDE & OUTSIDE TO BE FINISHED WITH CHROMATE WITH THE EXCEPTION OF RECEPTACLES PT 10, WHICH ARE TO BE FINISHED INSIDE & OUTSIDE F70H2C (SILVER PLATE) AFTER ASSEMBLY

1	ASSEMBLY	9	FLANGE	17	INNER CONDUCTOR	25	SLEEVE
2	"T" STUB PLUG	10	RECEPTACLE	18	INNER CONDUCTOR	26	CYLINDRICAL BEARING
3	PLUG	11	OUTER CONDUCTOR	19	OUTER CONDUCTOR	27	CASING
4	OUTER CONDUCTOR	12	INNER CONDUCTOR	20	OUTER CONDUCTOR	28	THRUST BEARING
5	STUB	13	BULLET	21	INNER CONDUCTOR	29	SPLIT FLANGE
6	INNER CONDUCTOR FITTING	14	STUB SECTION	22	INNER SLEEVE	30*	SCREW, FL. HD. Nº 10-32 x 1/2" LG.
7*	SOCKET HD. CAP SCREW Nº 10-32 x 1/2" LG.	15	BEARING	23	OUTER CONDUCTOR	31*	GASKET 1·453" $^{+.002"}_{-.000"}$ O.D. x 1·276" $^{+.002"}_{-.000"}$ I.D. x
8	LOCKWASHER No. 10	16	PIN	24	CASING		·025" $^{+.002"}_{-.000"}$ TH.

T $\frac{\text{OY-104}}{\text{1-1040}}$

Fig. 1040—Low speed joint assembly





VIEW "A"

STAMP TYPE NUMBER ON PT. 2 APPROX. HALFWAY BETWEEN PTS. 5 & 19 WITH WHITE WATERPROOF INK AND COAT WITH CLEAR LACQUER. CHARACTERS 1/8" HIGH.

* NOTE 1. MATERIAL: NEOPRENE.
HARDNESS: 55-60 DUROMETER
OVEN AGING: 70 HRS. AT 212°F, MUST RETAIN 75% OF ORIGINAL SIZE, AND BE FLEXIBLE AND RESILIENT AFTER EXPOSURE TO 70°F. FOR 5 HRS, AND MUST MAKE 180° BEND OVER 1" DIA. WITHOUT FRACTURE.

NOTE 2. ASSEMBLE PT. 14 TO PT. 3, THEN PTS. 3 & 8 TO PT. 15. ASSEMBLE PT. 2 TO PT. 15 & PTS. 7 & 17 TO PTS. 2 & 3. THEN FINISH THIS SUB-ASSEMBLY WITH CHROMATE INSIDE & OUTSIDE.
ASSEMBLE PTS. 6, 18, 22, 23, 25, 5, & 20 THEN SILVER SOLDER PTS. 19 & 21 TO PT. 2 TO DIMENSION SHOWN & IN DOING SO, PROTECT PORTION OF PT. 2 WITH SOME SORT OF COOLING BETWEEN PT. 21 & PT. 4 SO THAT PTS. 6, 22 & 18 WILL NOT BE DAMAGED BY HEAT, THEN FINISH PTS. 19 & 21 WITH CHROMATE. ASSEMBLE PT. 10 & PTS. 16, 9, 24, 13, 11 & 12

NOTE 3. FINISH ALL EXTERIOR METAL PARTS WITH OLIVE DRAB NON-LUSTRE FINISH EXCEPT PORTION FROM LEFT END ALONG "X" DIMENSION. CARE TO BE TAKEN THAT NO PAINT IS APPLIED TO THREADED PORTION OF PTS. 4 & 20.

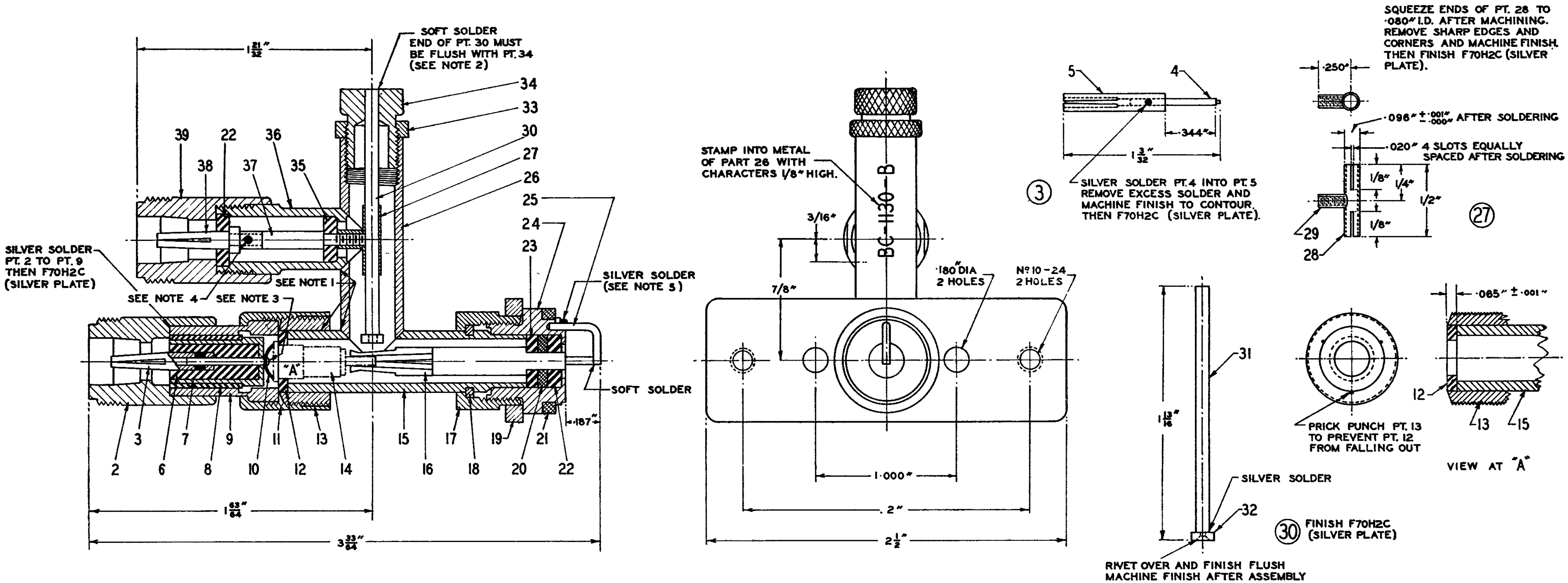
TOLERANCES: FRACTIONAL DIMENSIONS ±·010" DECIMAL DIMENSIONS ±·003" UNLESS OTHERWISE SPECIFIED

3RD ANGLE PROJECTION

1	ASSEMBLY	10*	GASKET 1 1/8" O.D. × 1" I.D. × 1/8" THICK	19	KEY
2	OUTER CONDUCTOR FRONT SECTION	11	CAP	20	COUPLING
3	INNER CONDUCTOR	12*	GASKET 3/8" O.D. × 3/16" I.D. × 1/16" THICK	21	RETAINER
4	CHOKE	13	NUT 3/8"-24 HEX. NUT. 3/8" THICK	22	
5	NUT	14	ANTENNA TRANSFORMER	23	WASHER 1 1/2" O.D. × 1 3/32" I.D. × 1/16" THICK
6*	GASKET 1 1/4" O.D. × 1 1/16" I.D. × 1/8" THICK	15	SUPPORT	24	WASHER 11/16" O.D. × 13/32" I.D. × 1/16" THICK
7	STUB	16*	GASKET 19/32" O.D. × 15/32" I.D. × 1/8" THICK	25	ANTENNA SUPPORT SOCKET
8	REFLECTOR	17	STUB		
9	FRONT HOUSING	18	REAR HOUSING		

T OY-104/1-1041

Fig. 1041—Antenna assembly



NOTE. 1. SILVER SOLDER PTS. 13, 15, 26, & 36 AT ALL SURFACES INDICATED. FINISH THIS SUB-ASSEMBLY F70H2C (SILVER PLATE).

NOTE. 2. ASSEMBLE PART 27 ON PART 30, THEN ASSEMBLE PTS. 35, 37, & 38 ON PT. 30. ASSEMBLE PART 33 ON PART 34, THEN SOFT SOLDER PART 34 TO PART 30.

NOTE. 3. ASSEMBLE PTS. 2, 6, 7, & 10 ON PT. 3 AND RIVET END OF PT. 3 OVER PT. 10 AS INDICATED.

NOTE. 4. SILVER SOLDER PART 37 TO PART 38. REMOVE EXCESS SOLDER AND FINISH FLUSH TO CONTOUR, THEN F70H2C (SILVER PLATE).

NOTE 5. AFTER ASSEMBLY OF POINTS 24 & 25, FINISH F70H2C (SILVER PLATE)

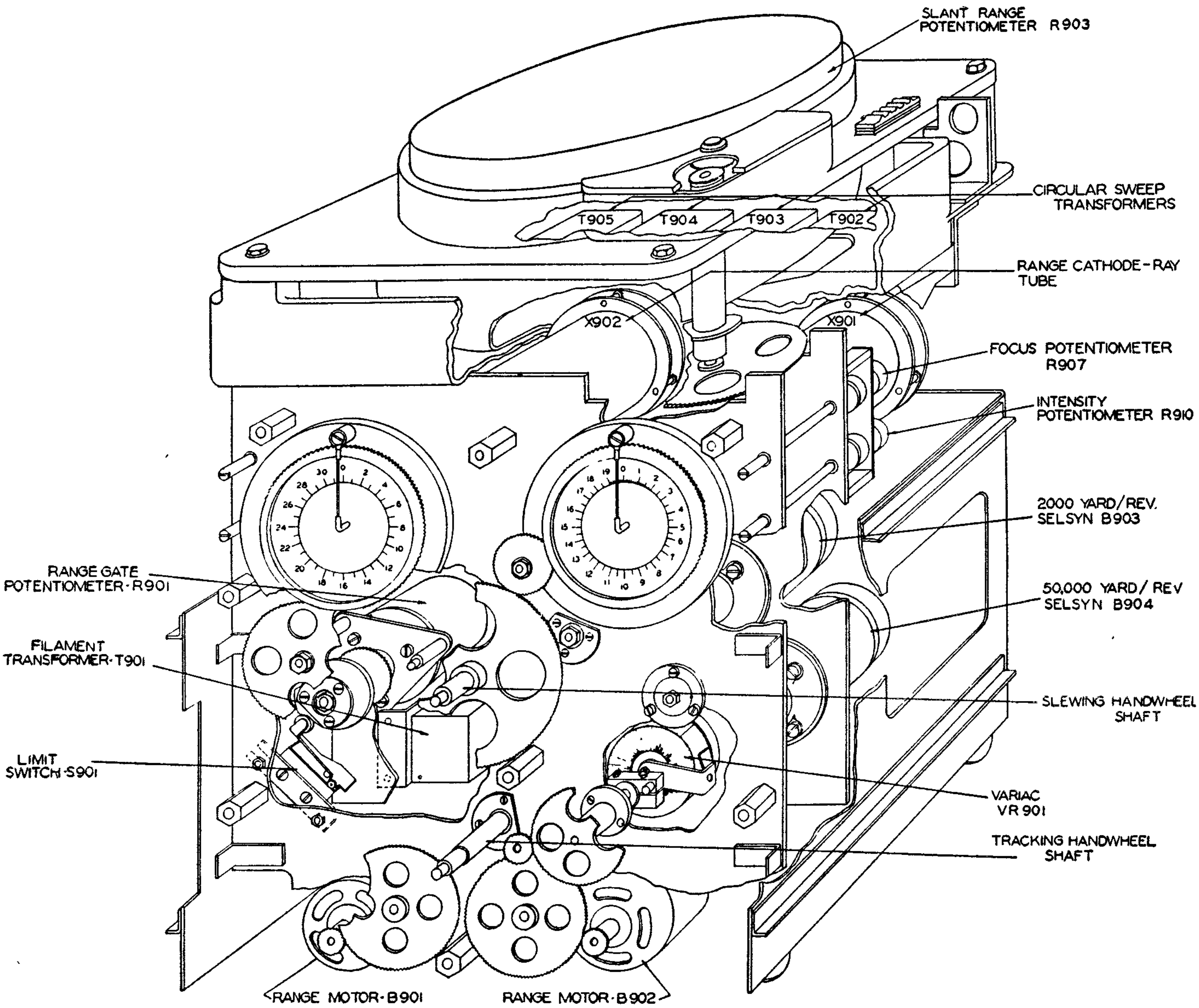
TOLERANCES: FRACTIONAL DIMENSIONS $\pm$·010" DECIMAL DIMENSIONS $\pm$·003" UNLESS OTHERWISE SPECIFIED

3RD. ANGLE PROJECTION

1	ASSEMBLY	11	COUPLING	21	GASKET	31	TUNING PLUG
2	JACK BODY	12	WASHER	22	WASHER	32	DISC
3	ASSEMBLY OF PTS. 4 & 5	13	BUSHING	23	WASHER	33	CHECK NUT
4	PIN	14	CRYSTAL	24	LOOP HOLDER	34	ADJUSTING SCREW
5	CONTACT	15	BODY	25	LOOP	35	WASHER
6	INSULATOR	16	CONTACT	26	OUTER CONDUCTOR	36	OUTER CONDUCTOR
7	CUP	17	COUPLING	27	ASSEMBLY OF PTS. 28 & 29	37	STUD
8	INSULATOR BUSHING	18	SNAP RING	28	CLAMP	38	CONTACT
9	COUPLING	19	FLANGE	29	BUSHING	39	JACK BODY
10	WEDGE	20	GASKET	30	ASSEMBLY OF PTS. 31 & 32		

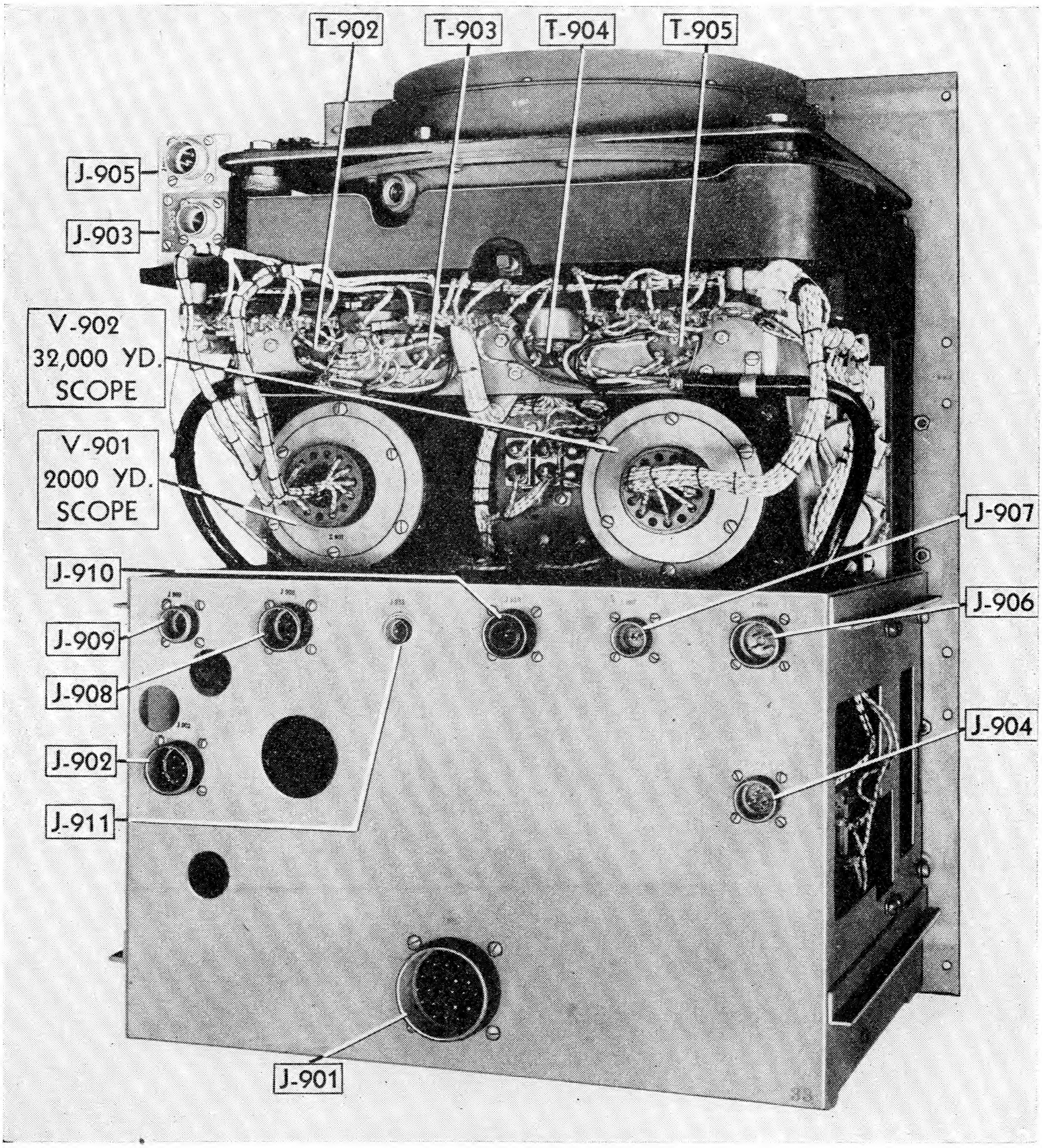
T $\frac{\text{OY-104}}{\text{1-1042}}$

Fig. 1042—Crystal mixer assembly

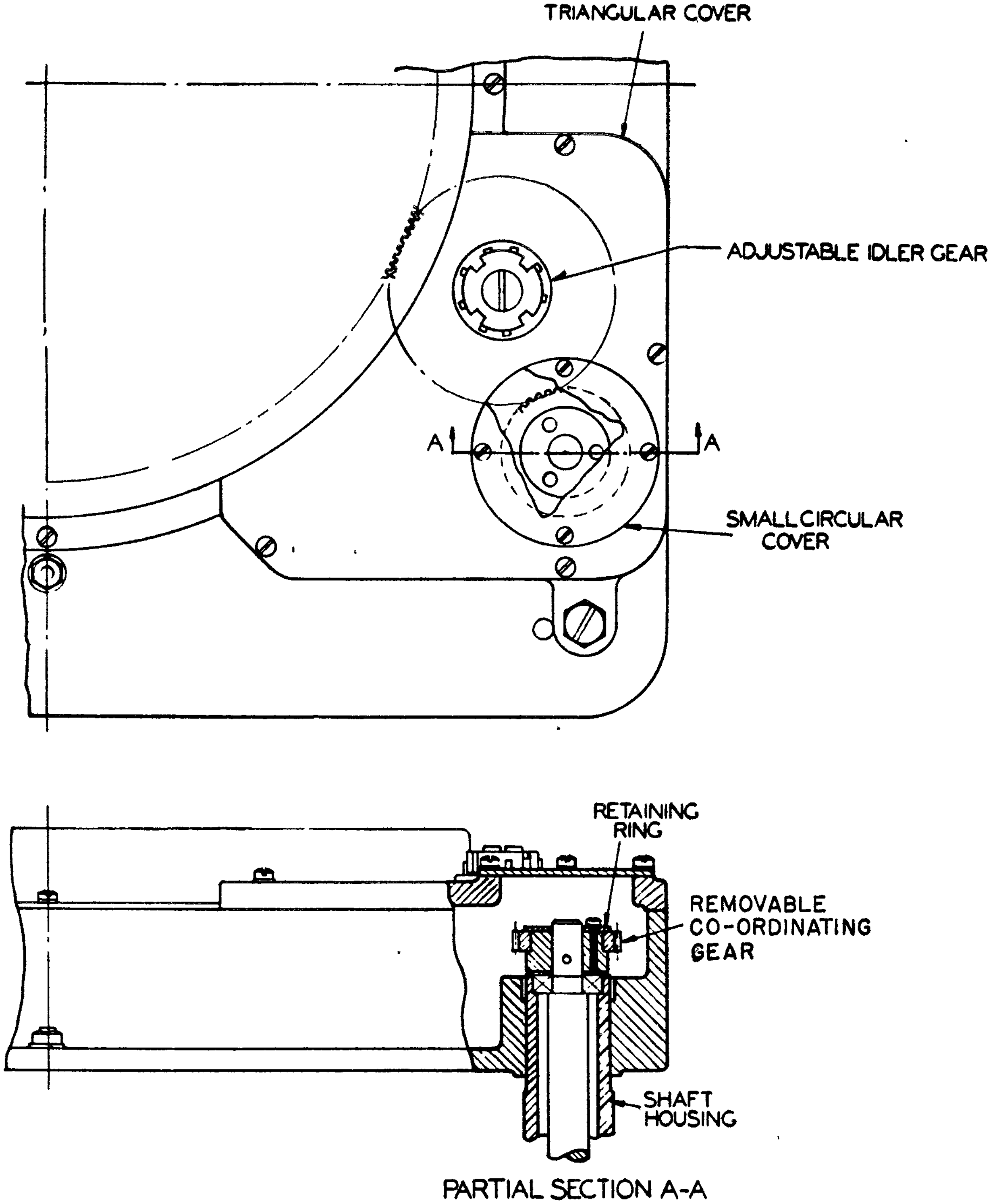


T $\frac{\text{OY-104}}{\text{1-1043}}$

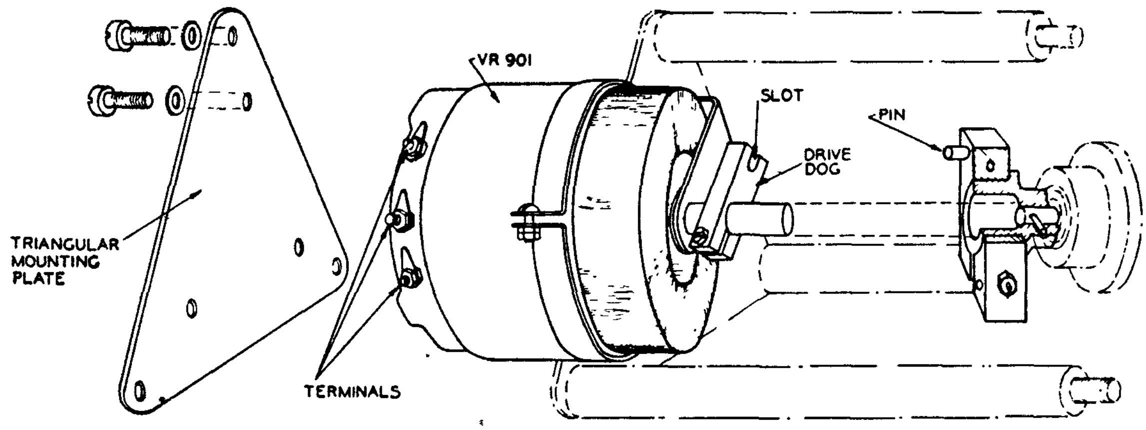
Fig. 1043—Isometric view of range indicator unit



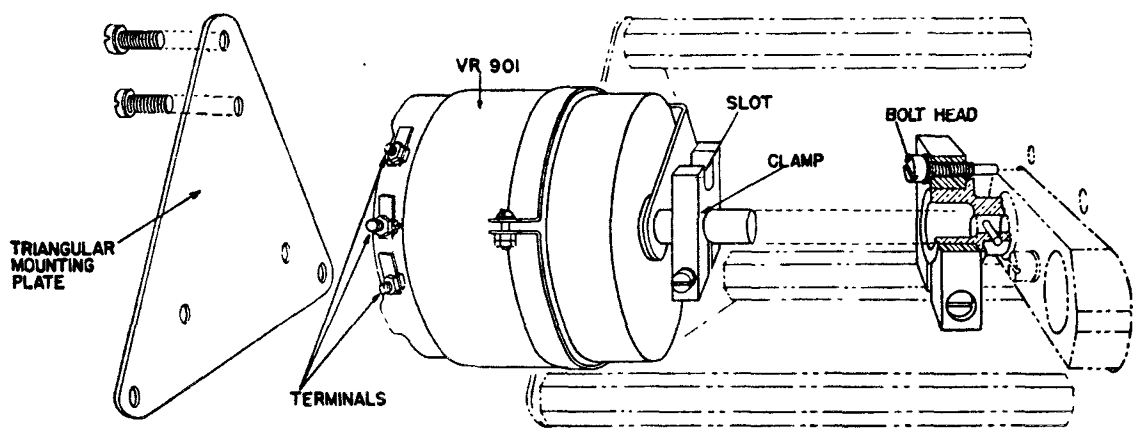
T $\frac{\text{OY-104}}{\text{1-1044}}$ Fig. 1044—Rear view of range indicator unit



T $\frac{\text{OY-104}}{\text{1-1045}}$ **Fig. 1045—Range indicator potentiometer gear assembly**



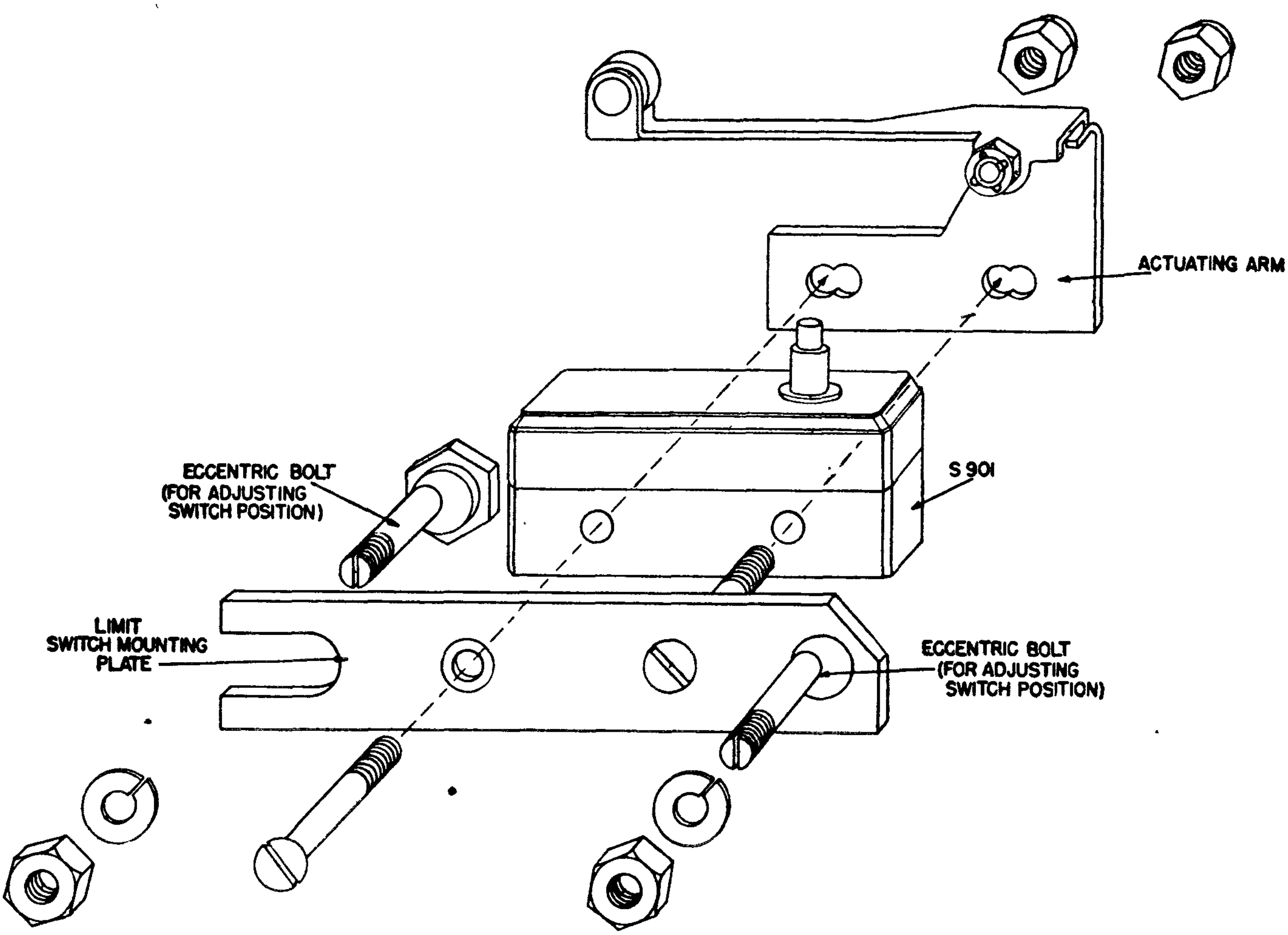
Westinghouse Equipments (Radio Set SCR-584-A)



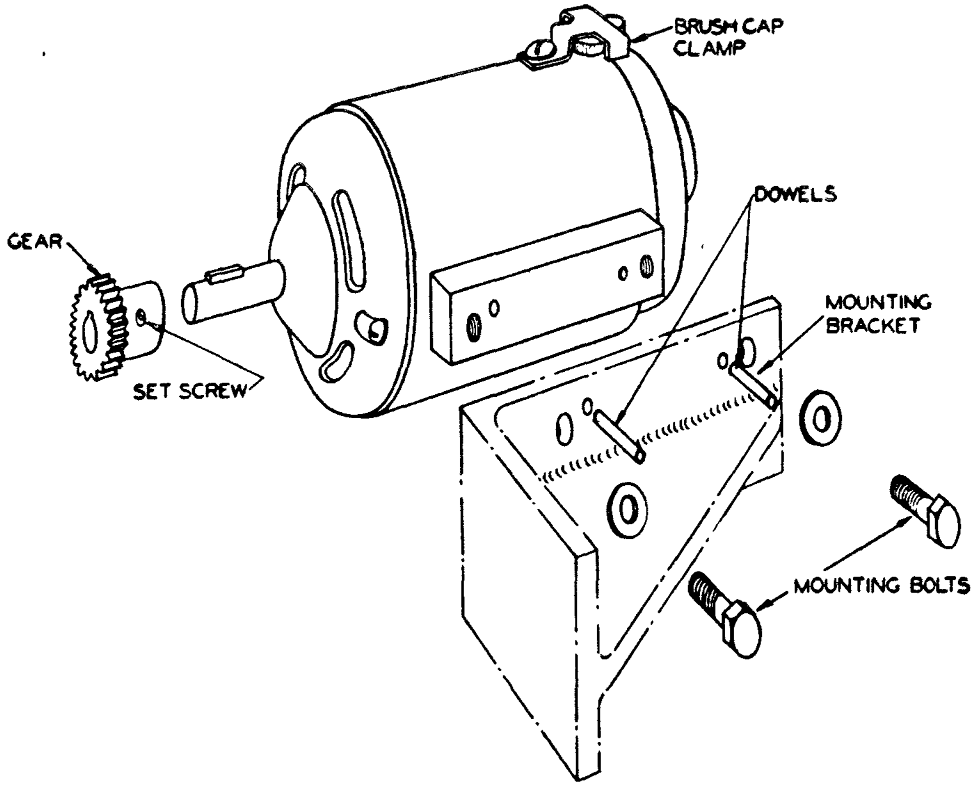
General Electric Equipments (Radio Set SCR-584-B)

T $\frac{\text{OY-104}}{\text{1-1046}}$

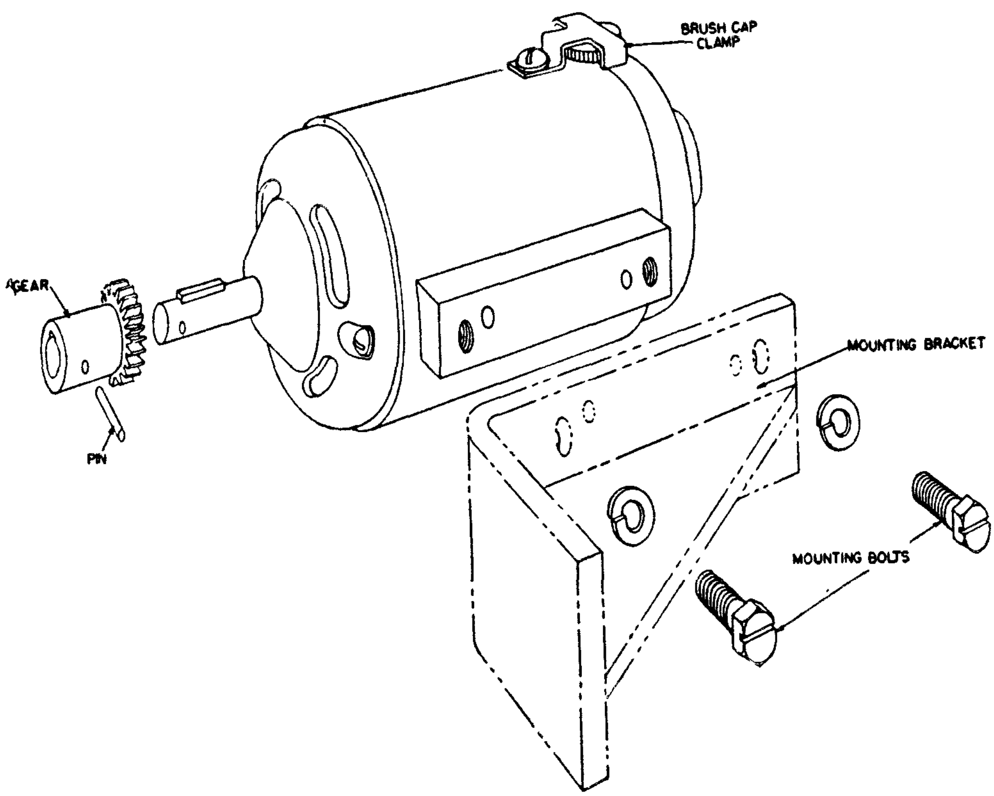
Fig. 1046—Range indicator variac assembly



T $\frac{\text{OY-104}}{\text{1-1047}}$ **Fig. 1047—Range indicator limit switch assembly**



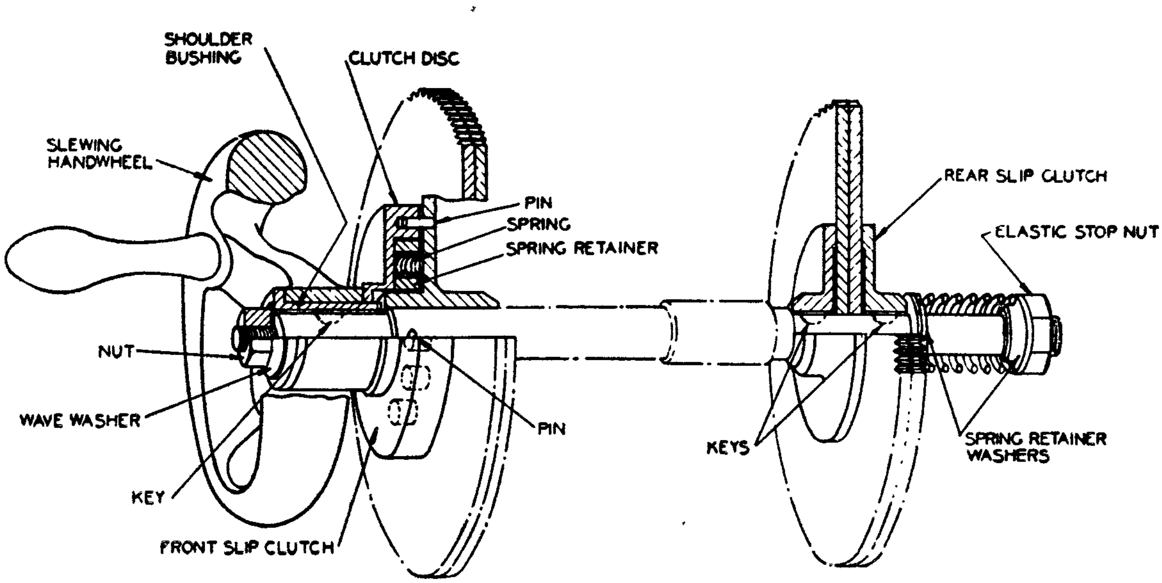
Westinghouse Equipments (Radio Set SCR-584-A)



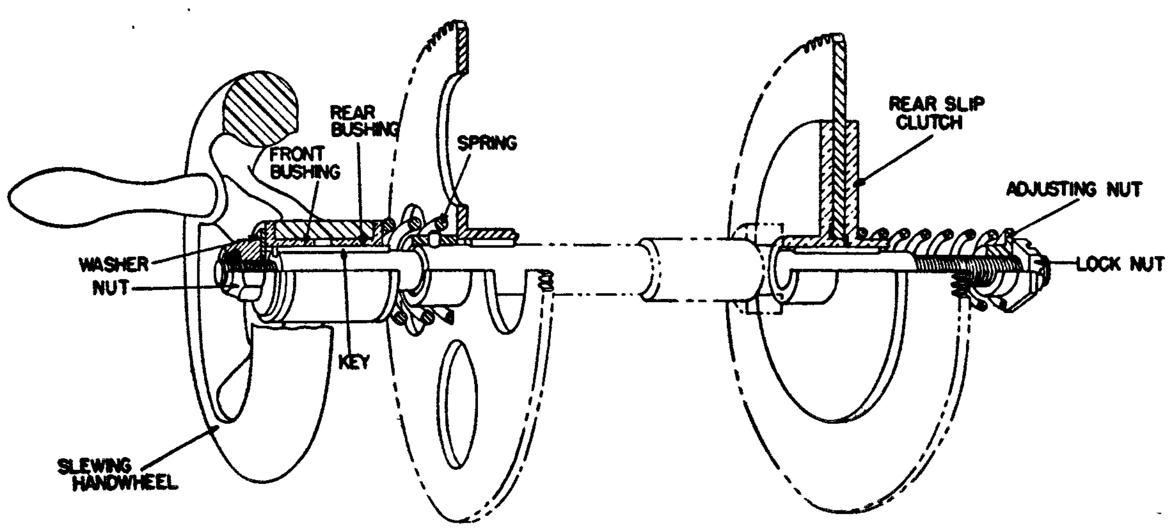
General Electric Equipments (Radio Set SCR-584-B)

T $\frac{\text{OY-104}}{\text{1-1048}}$

Fig. 1048—Range indicator range motors assembly



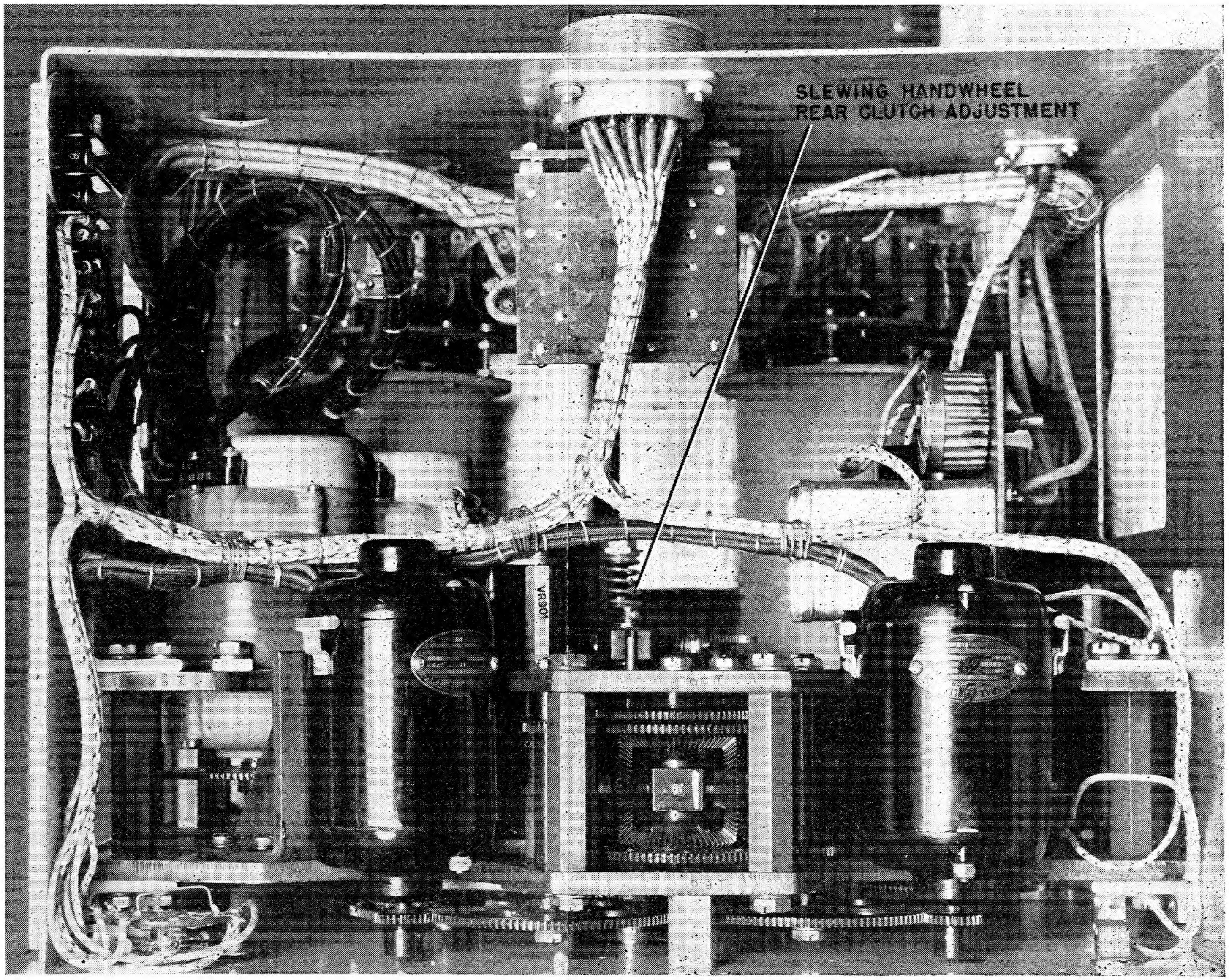
Westinghouse Equipments (*Radio Set SCR-584-A*)



General Electric Equipments (*Radio Set SCR-584-B*)

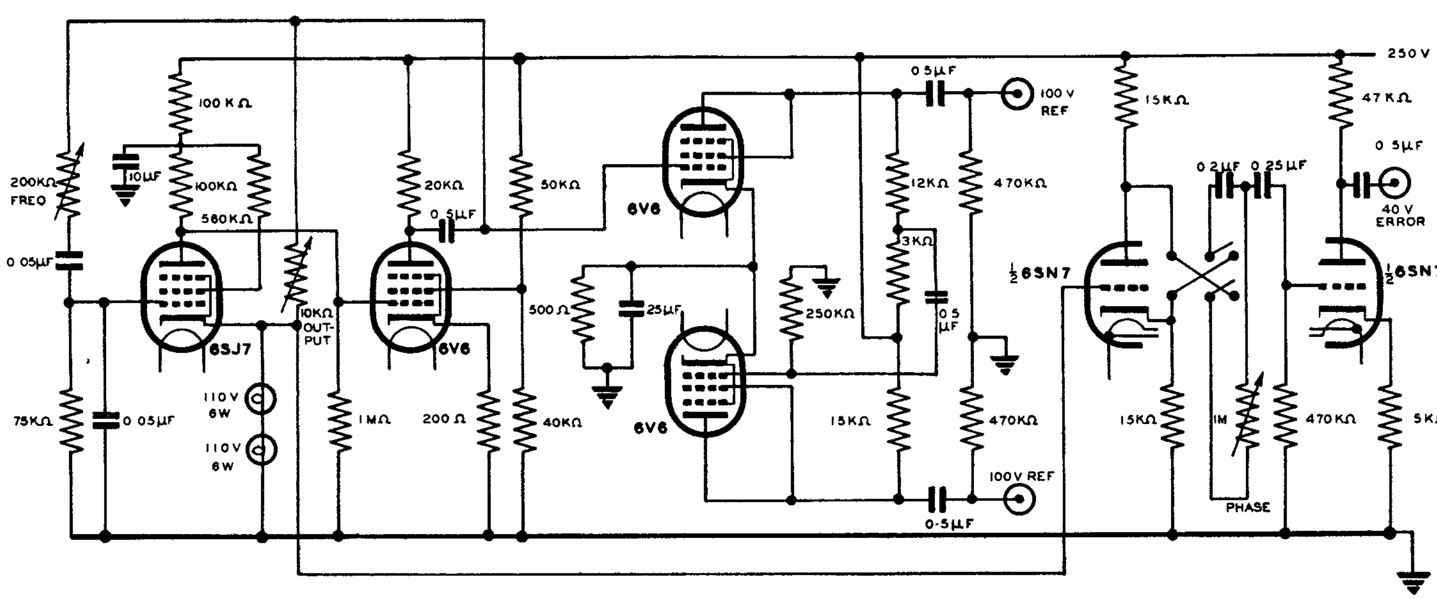
T $\frac{\text{OY-104}}{\text{1-1049}}$

Fig. 1049—Range indicator slewing handwheel clutch assembly



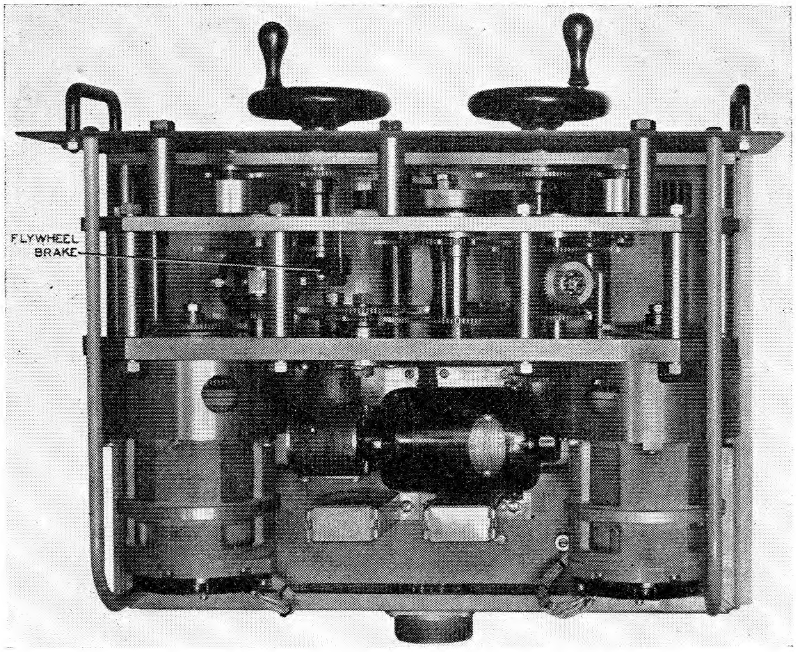
T $\frac{\text{OY-104}}{\text{1-1050}}$

Fig. 1050—Underside view of range indicator unit

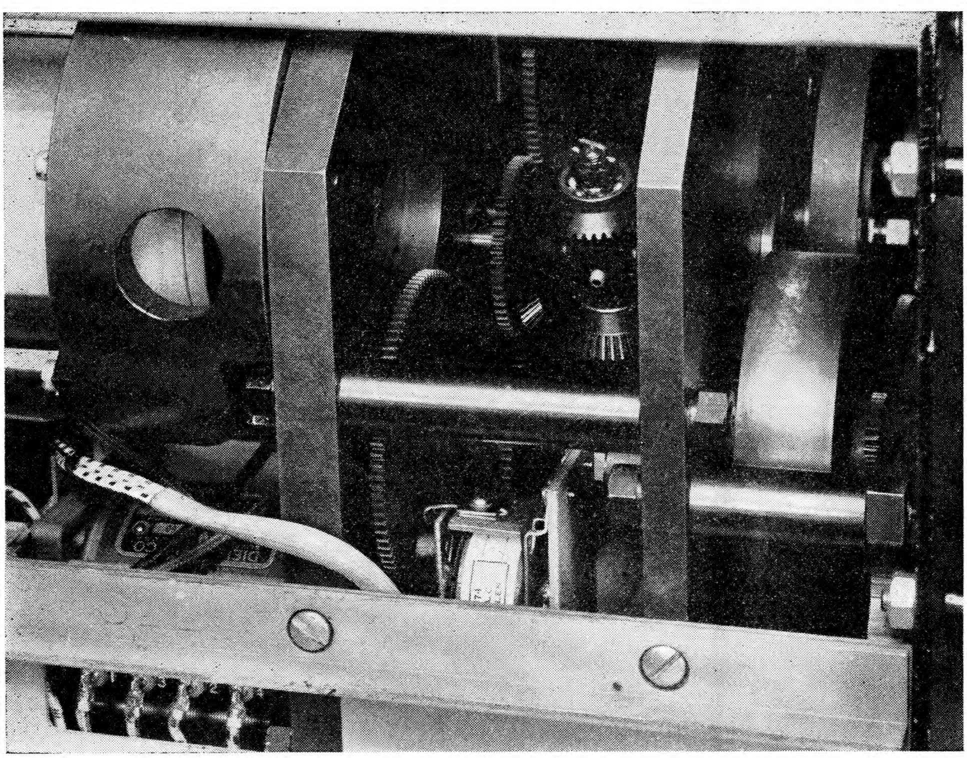


T $\frac{\text{OY-104}}{\text{1-1051}}$

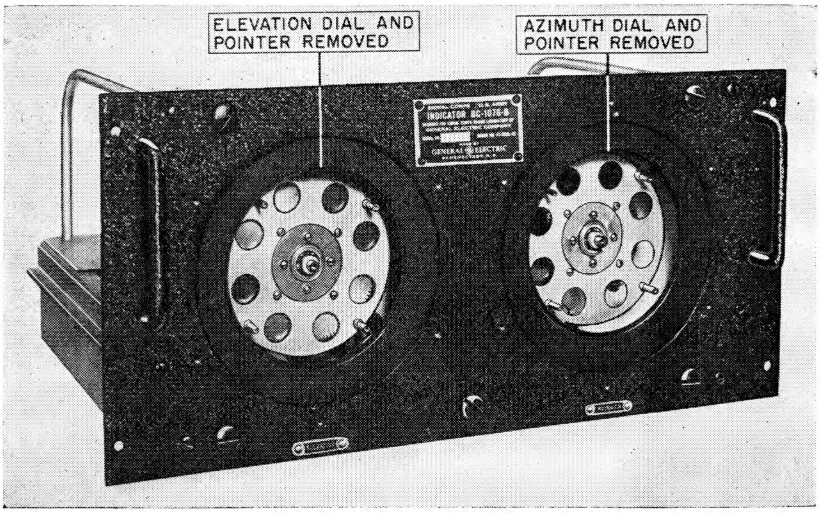
Fig. 1051—Tracking circuit tester



T $\frac{\text{OY-104}}{\text{1-1052}}$ **Fig. 1052—Antenna position control unit**

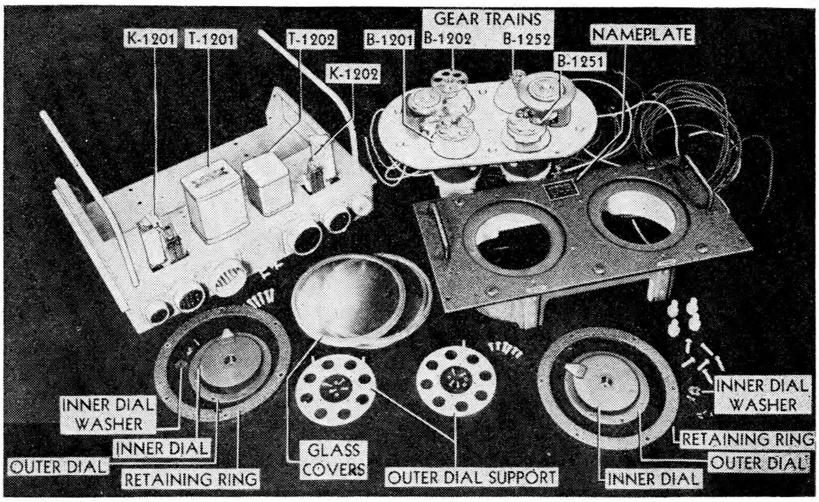


T $\frac{\text{OY-104}}{\text{1-1053}}$ **Fig. 1053—Antenna position control unit showing solenoid brake**



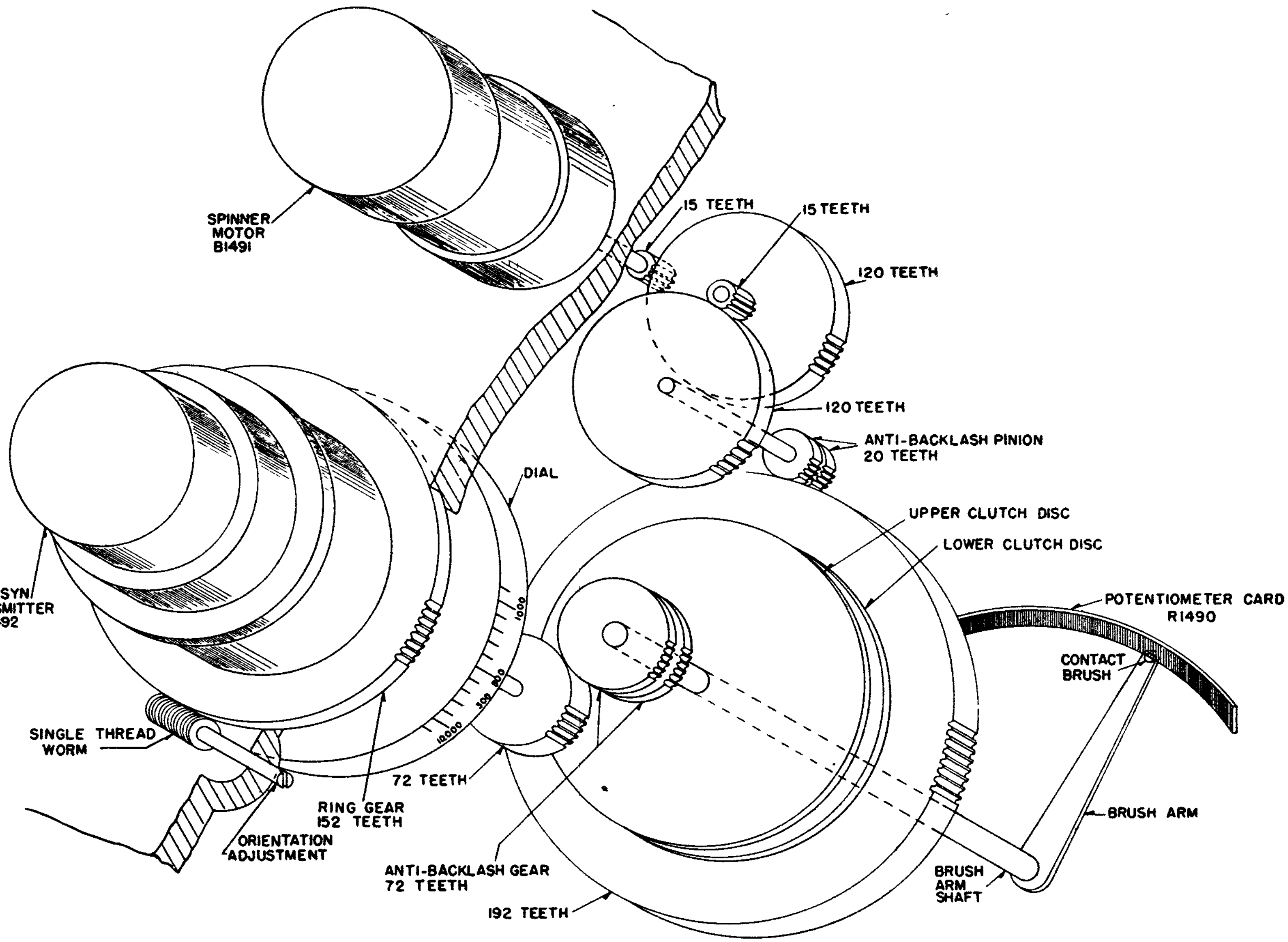
T OY-104 / 1-1054

Fig. 1054—Antenna position indicator unit with dials removed



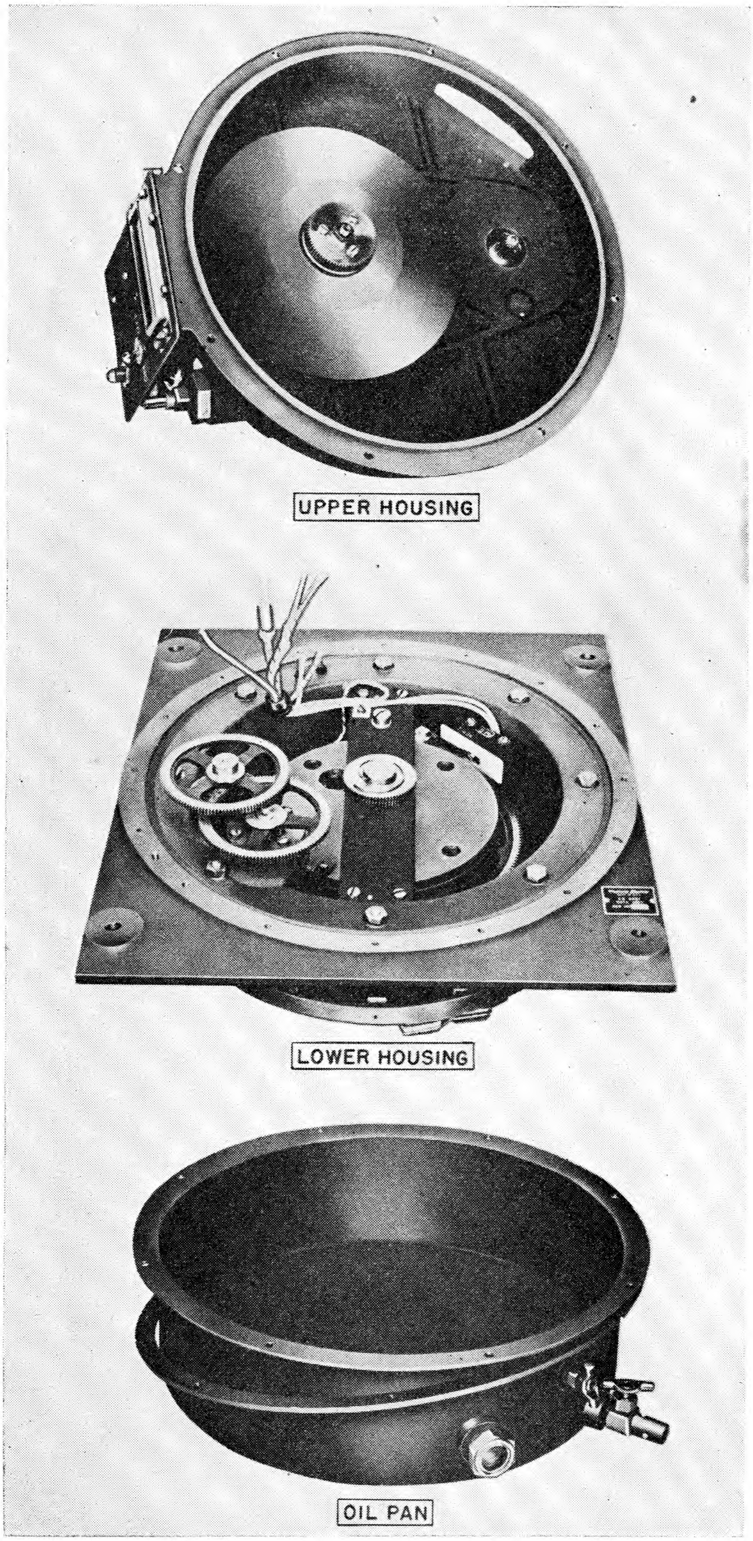
T OY-104 / 1-1055

Fig. 1055—Antenna position indicator unit dismantled



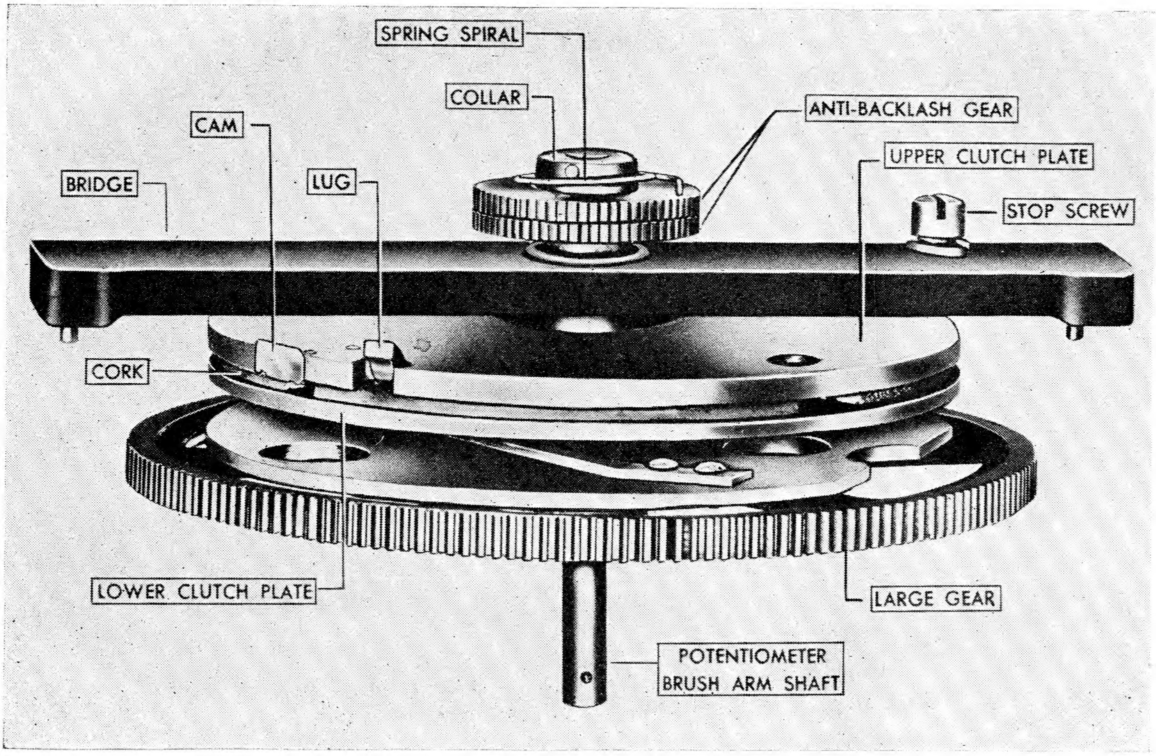
T $\frac{\text{OY-104}}{\text{1-1056}}$

Fig. 1056—Phantom view of altitude data unit



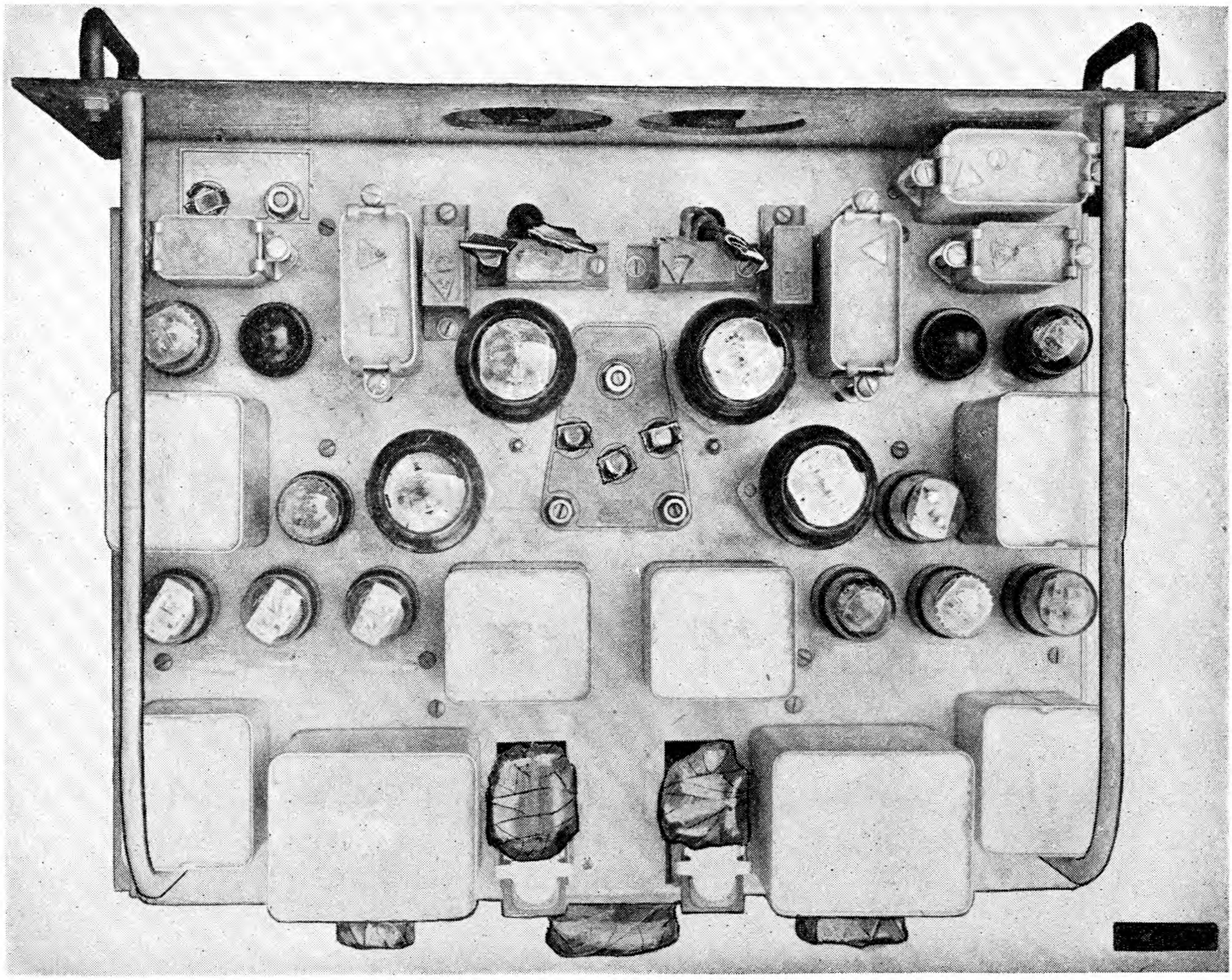
T $\frac{\text{OY-104}}{\text{1-1057}}$

Fig. 1057—Exploded view of altitude data unit

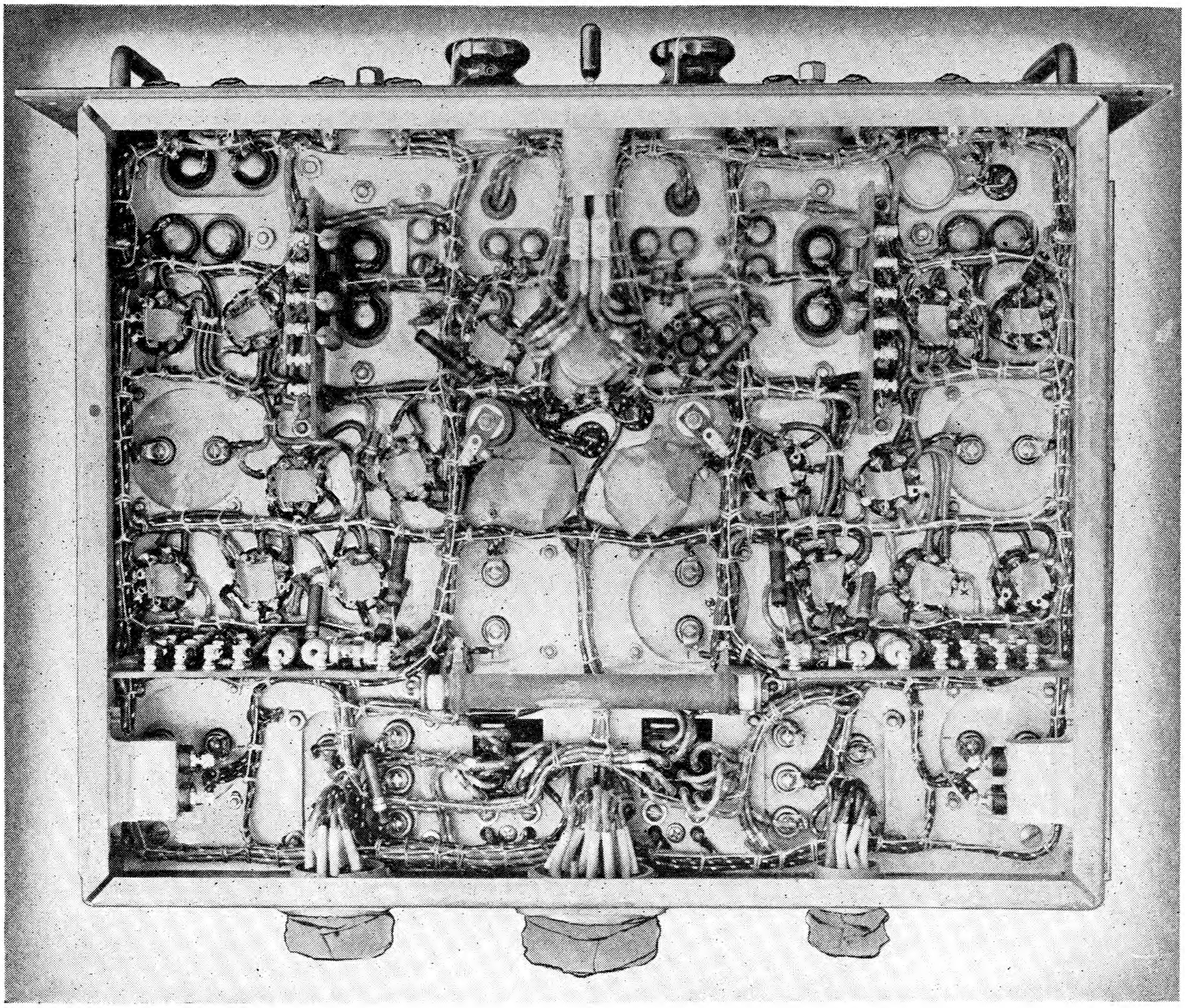


T OY-104 / 1-1058

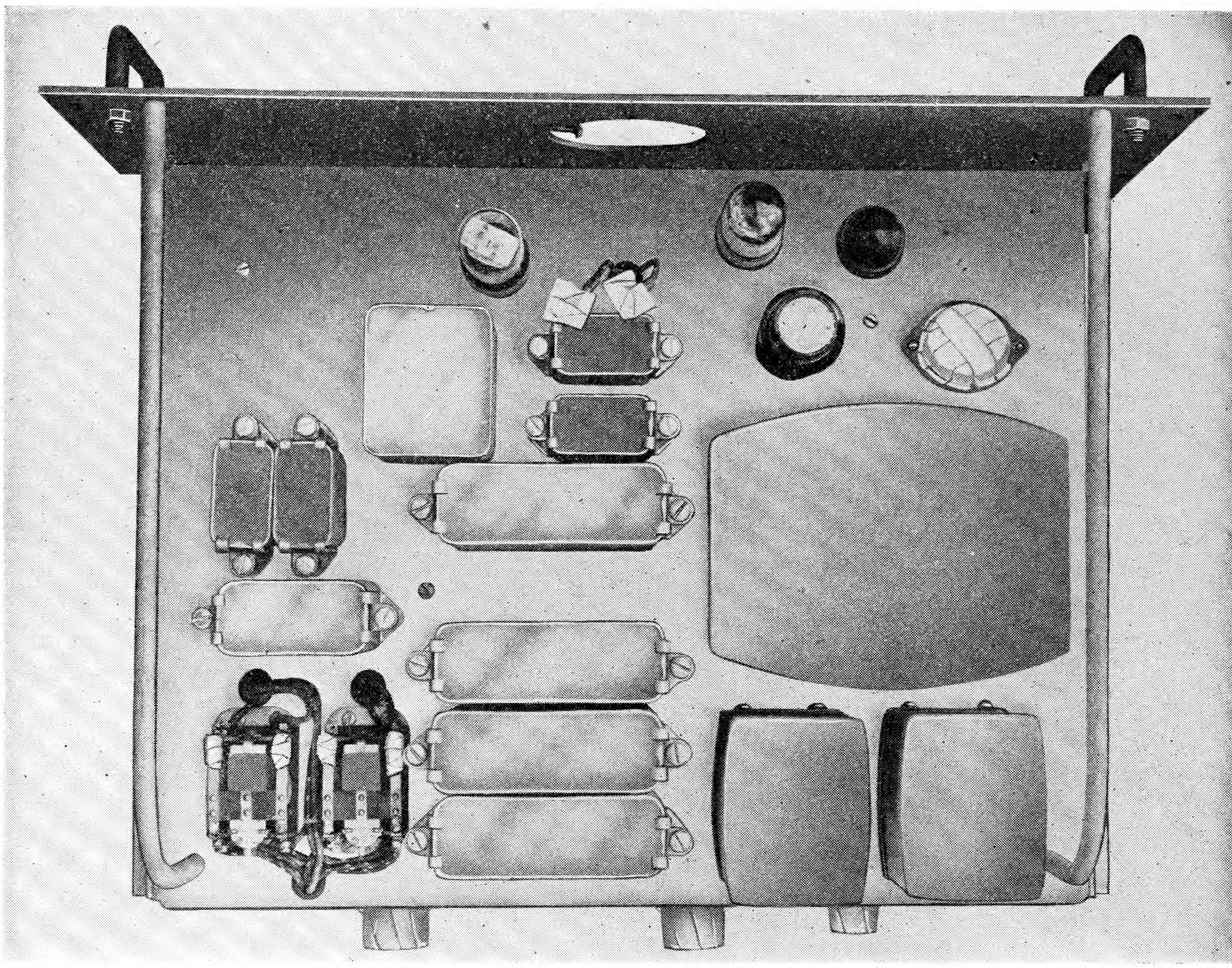
Fig. 1058—Main shaft assembly of altitude data unit



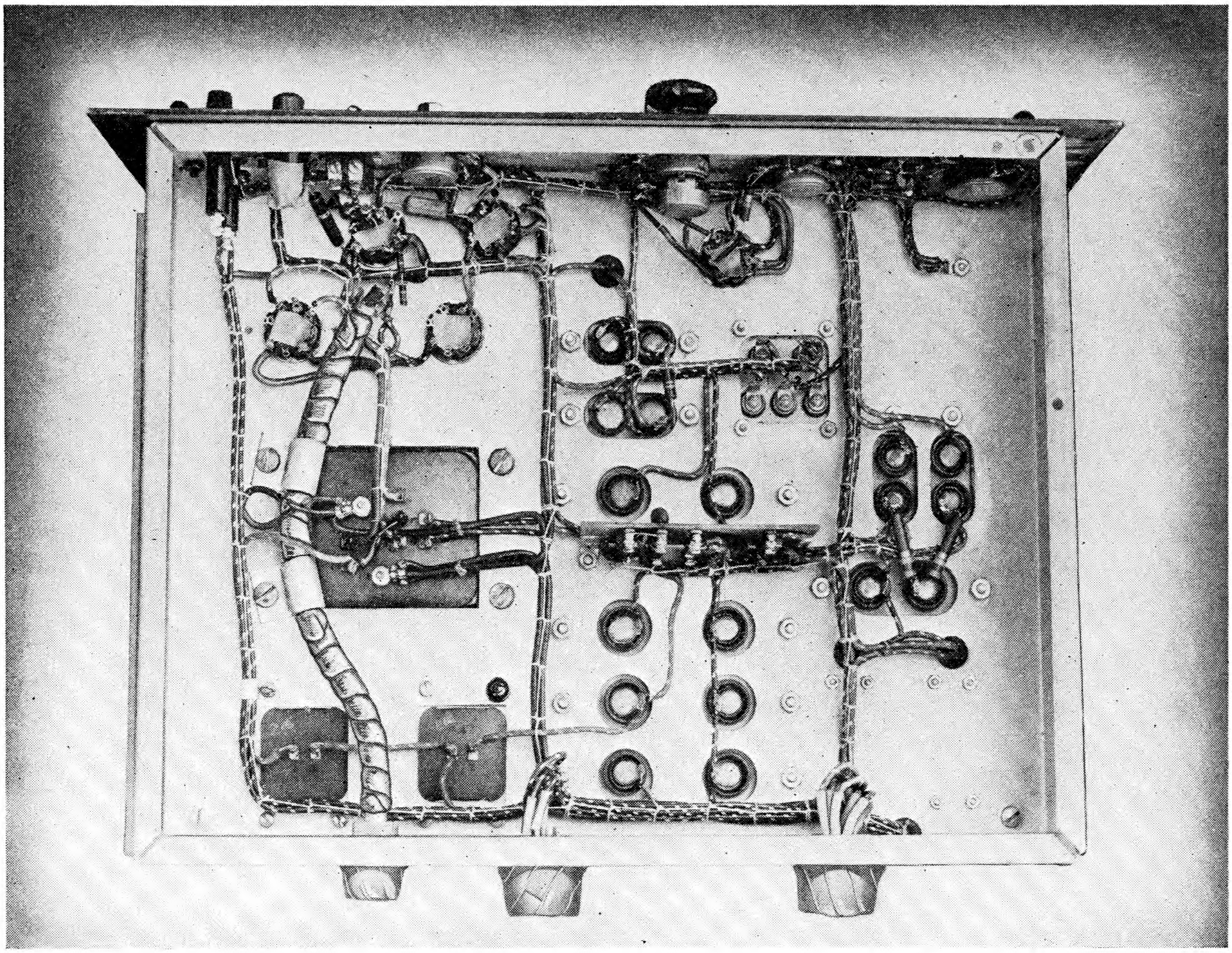
T $\frac{\text{OY-104}}{\text{1-1059}}$ **Fig. 1059—Masking on top of azimuth and elevation tracking unit**



T $\frac{\text{OY-104}}{\text{1-1060}}$ **Fig. 1060—Masking on underside of azimuth and elevation tracking unit**

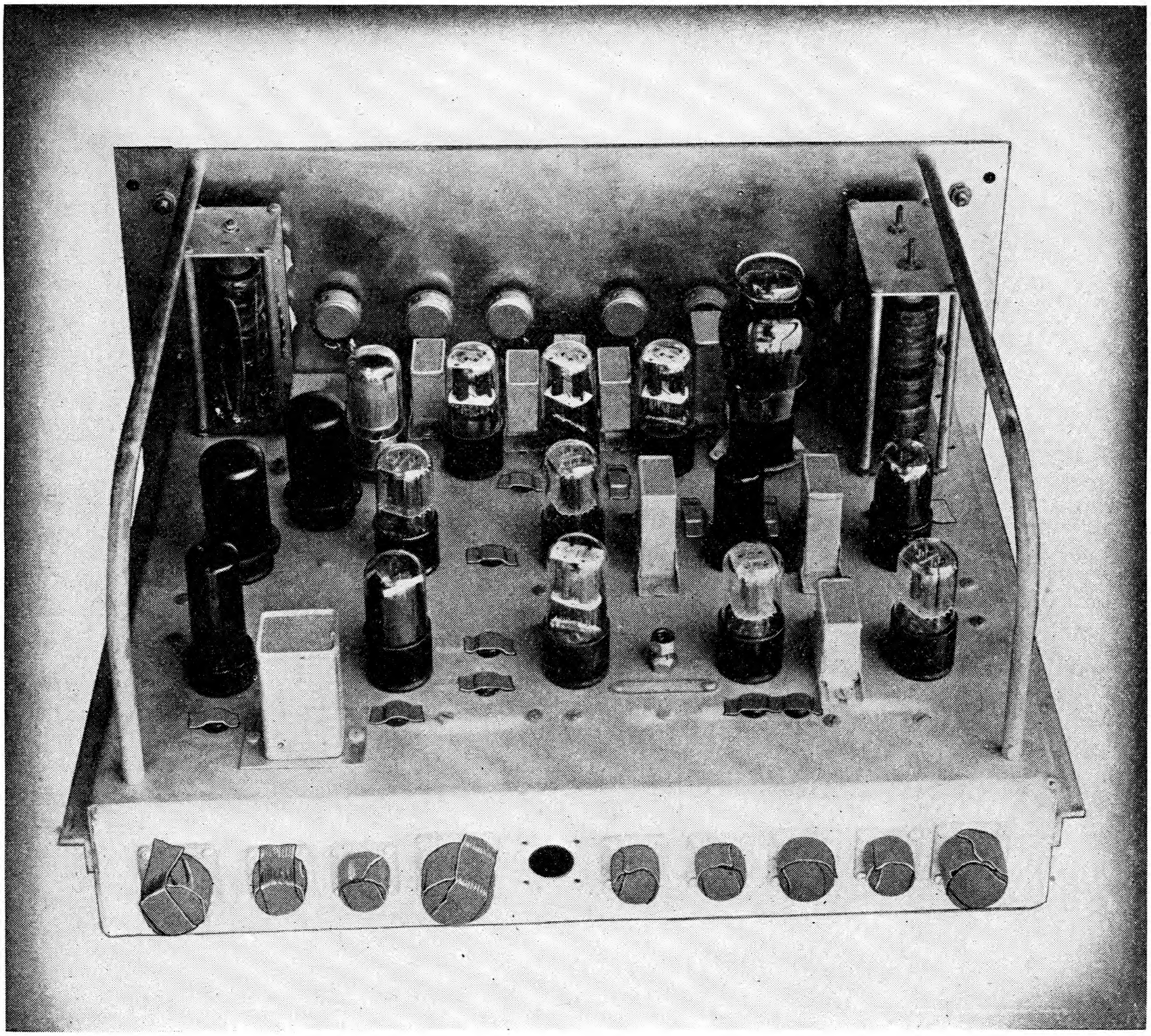


T $\frac{\text{OY-104}}{\text{1-1061}}$ **Fig. 1061—Masking on top of automatic tracking unit**



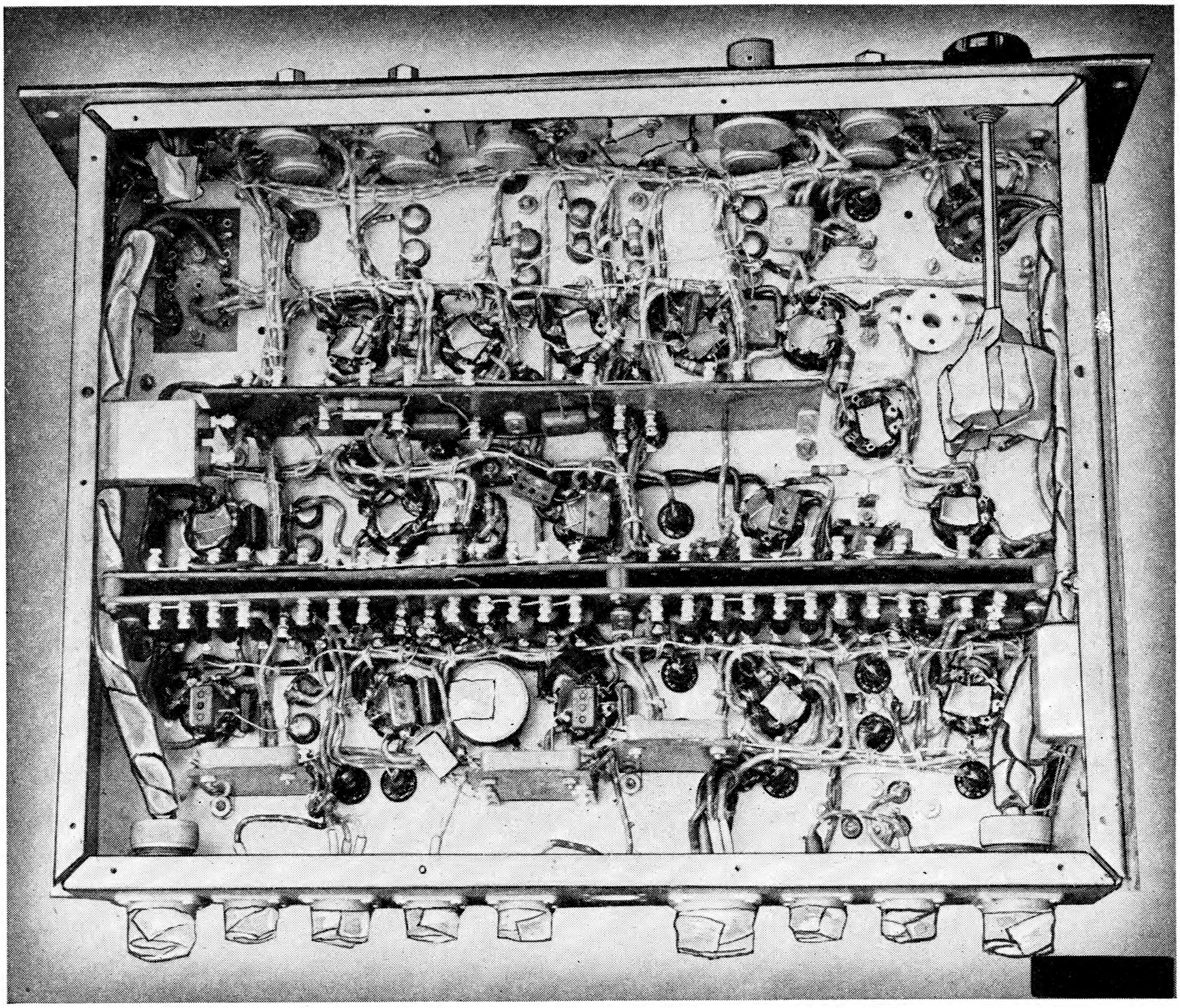
T $\frac{\text{OY-104}}{\text{1-1062}}$

Fig. 1062—Masking on underside of automatic tracking unit



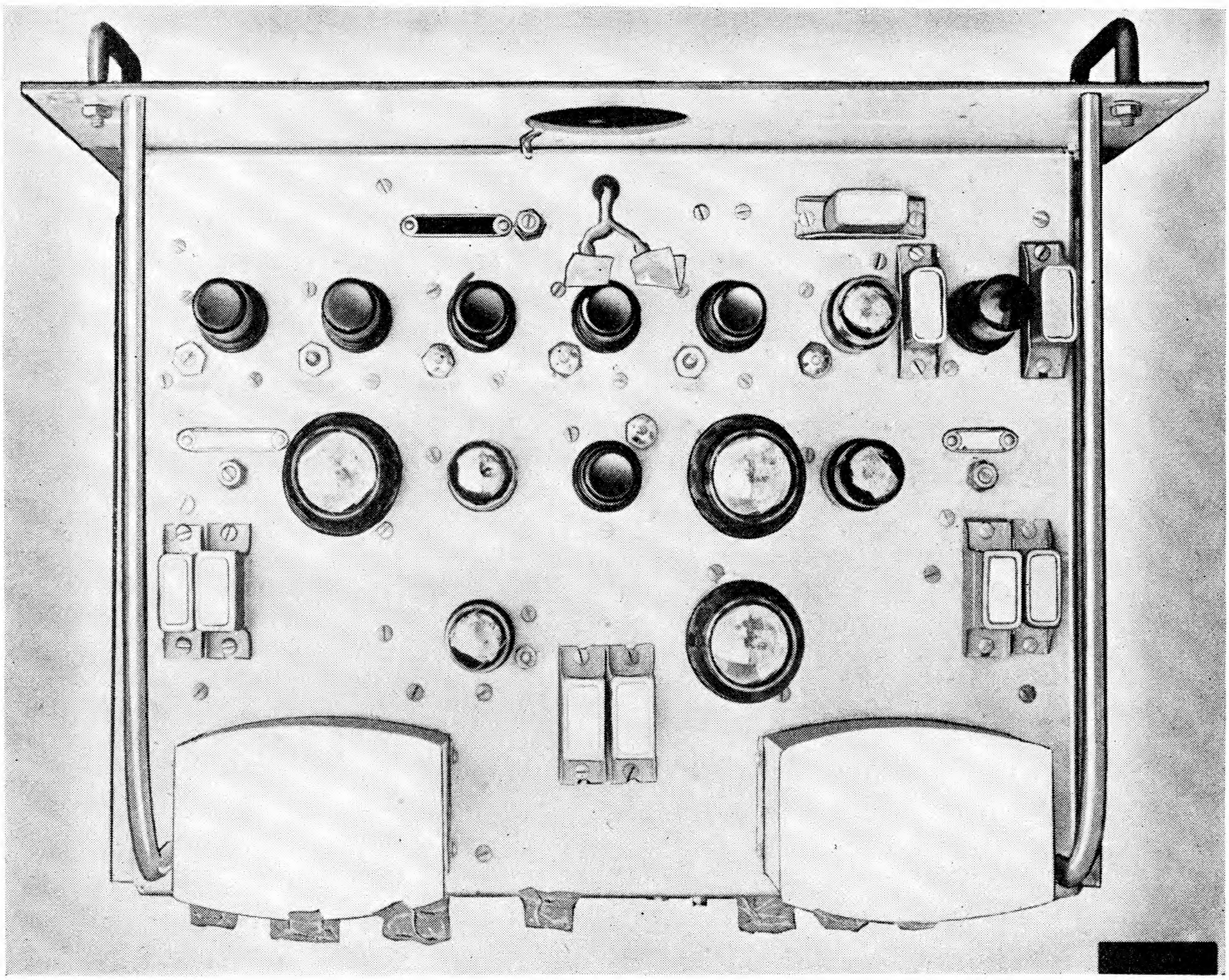
T $\frac{\text{OY-104}}{\text{1-1063}}$

Fig. 1063—Masking on top of range unit

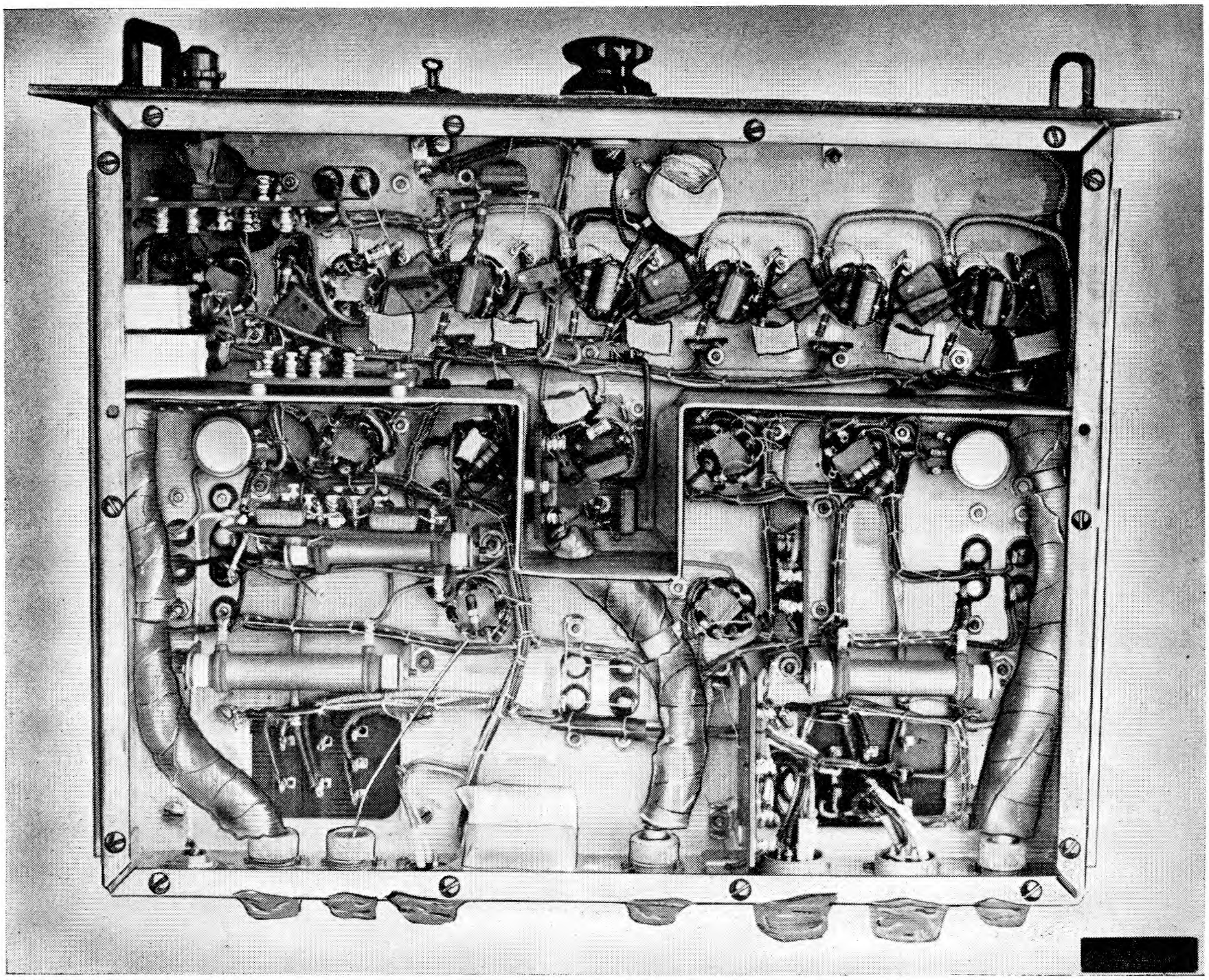


T $\frac{\text{OY-104}}{\text{1-1064}}$

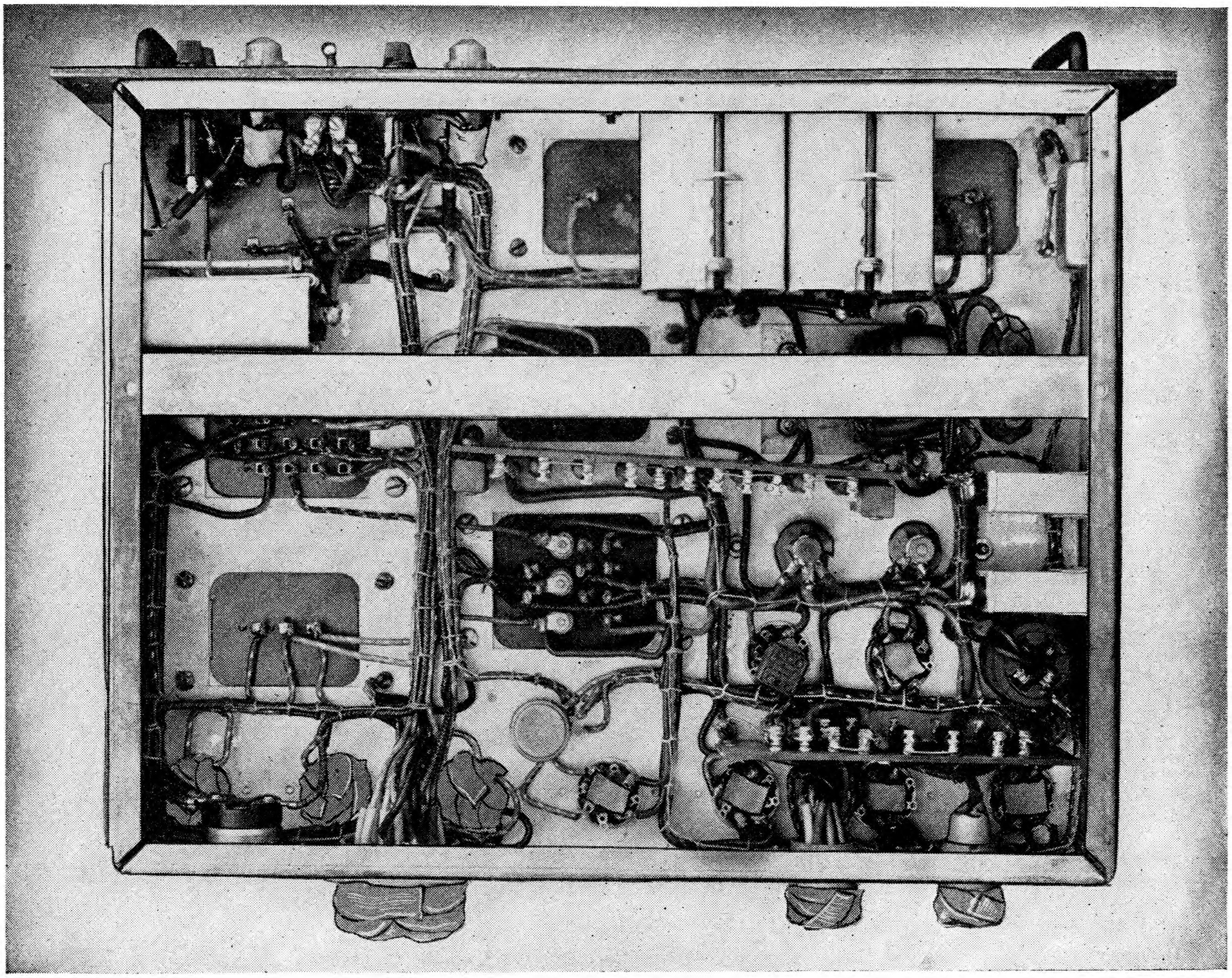
Fig. 1064—Masking on underside of range unit



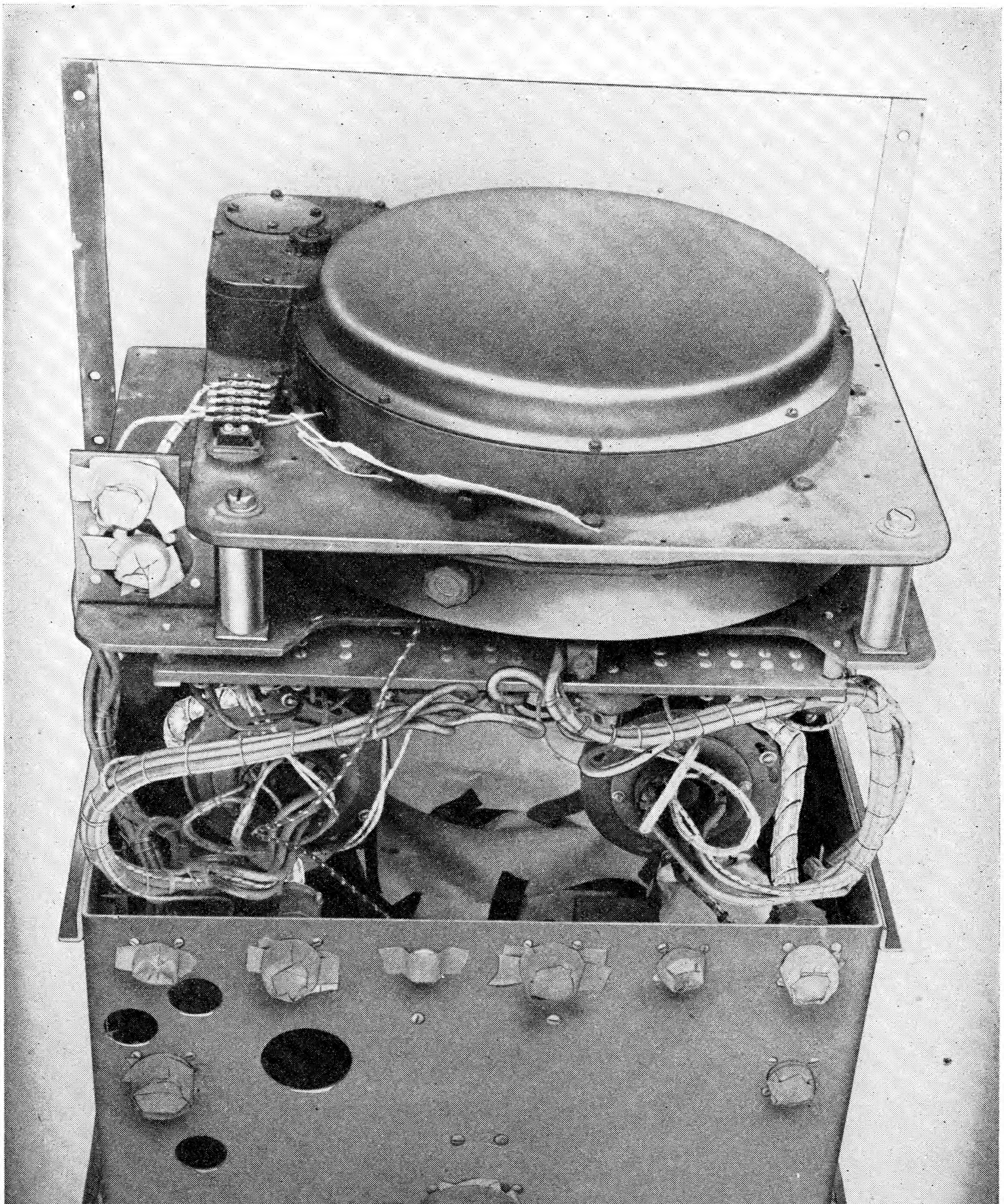
T $\frac{\text{OY-104}}{\text{1-1065}}$ **Fig. 1065—Masking on top of receiver unit**



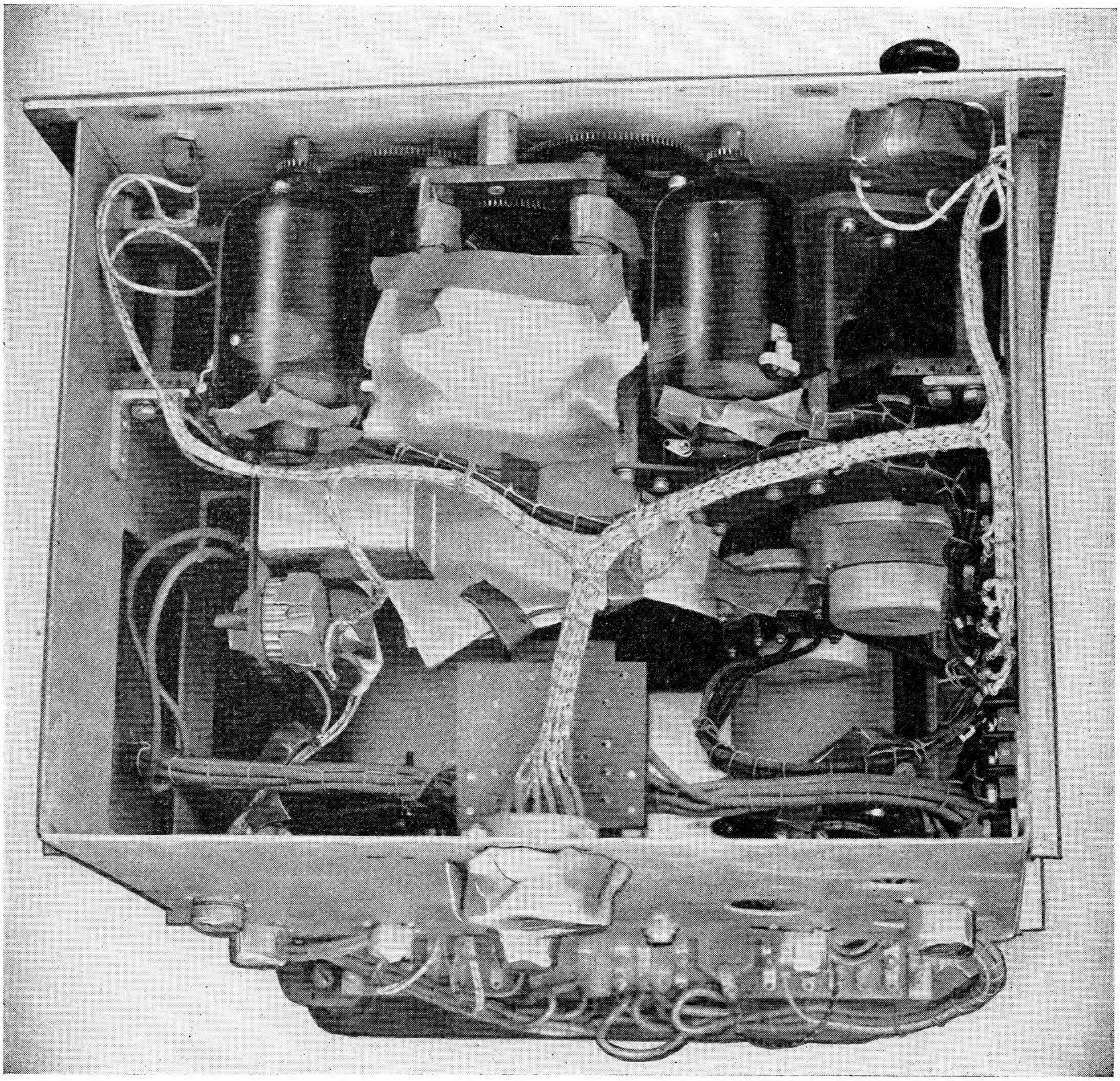
T $\frac{\text{OY-104}}{\text{1-1066}}$ **Fig. 1066—Masking on underside of receiver unit**



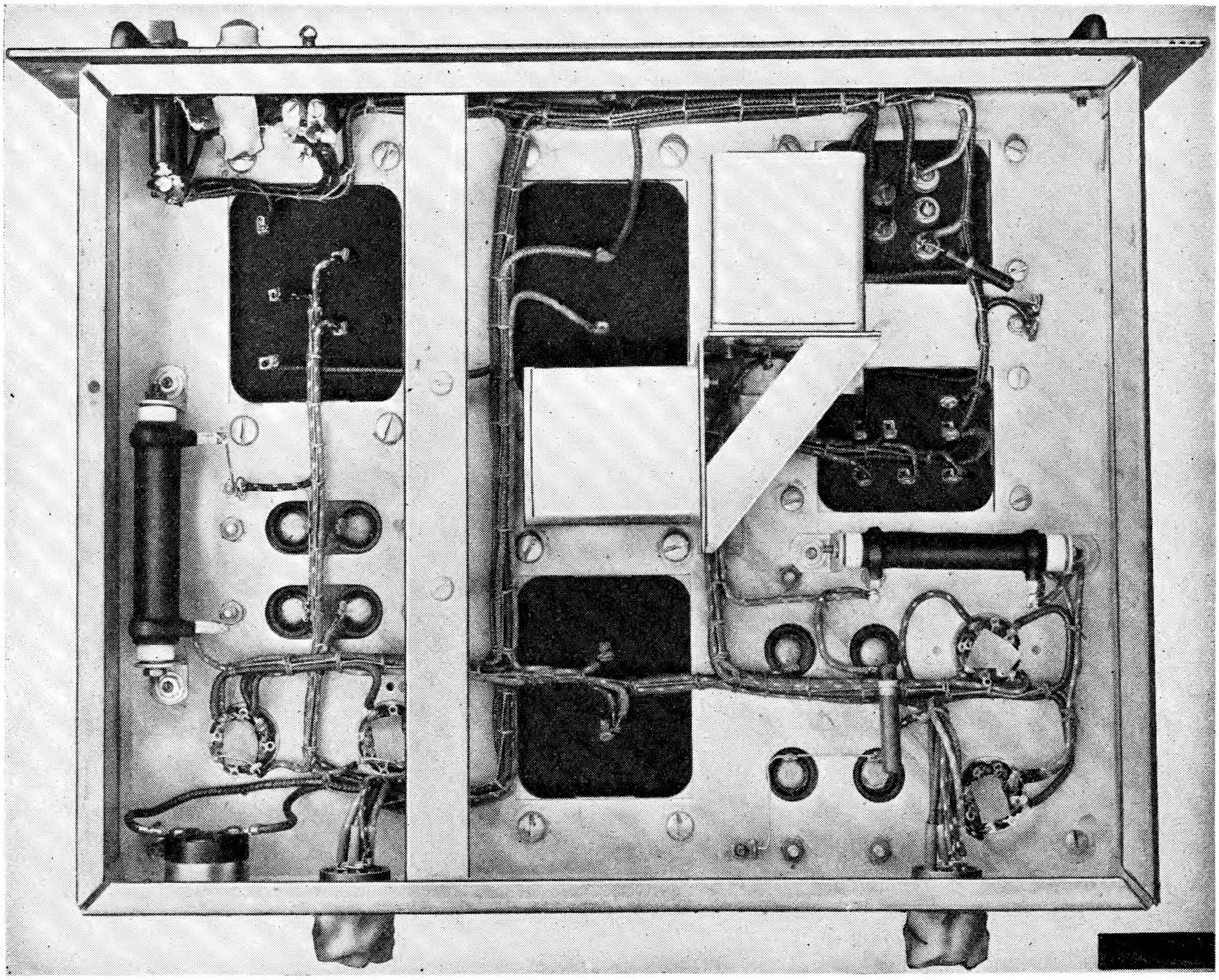
T $\frac{\text{OY-104}}{\text{1-1067}}$ **Fig. 1067—Masking on underside of range power supply unit**



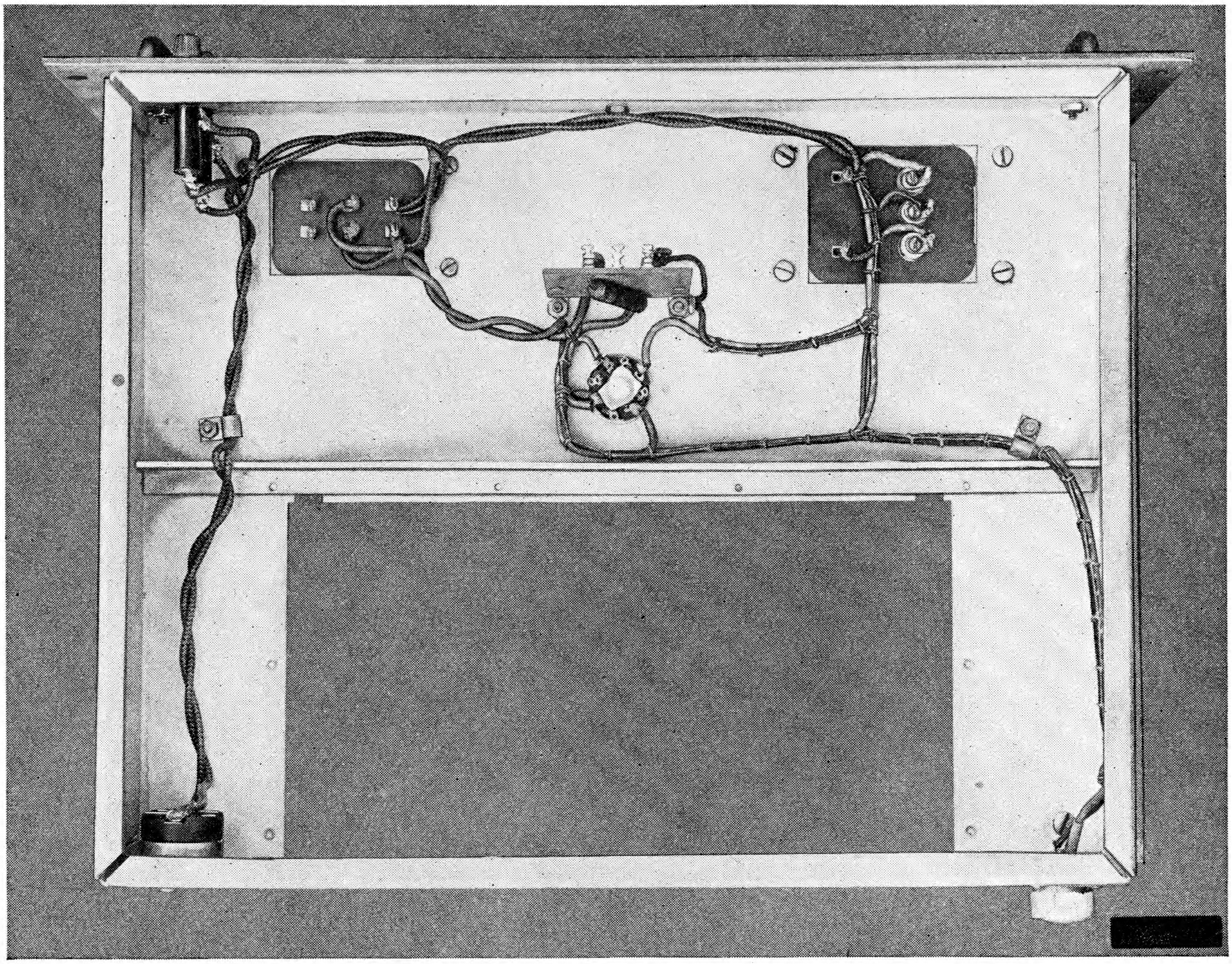
T $\frac{\text{OY-104}}{\text{1-1068}}$ **Fig. 1068—Masking on top and rear of range indicator unit**



T $\frac{\text{OY-104}}{\text{1-1069}}$ **Fig. 1069—Masking on underside of range indicator unit**

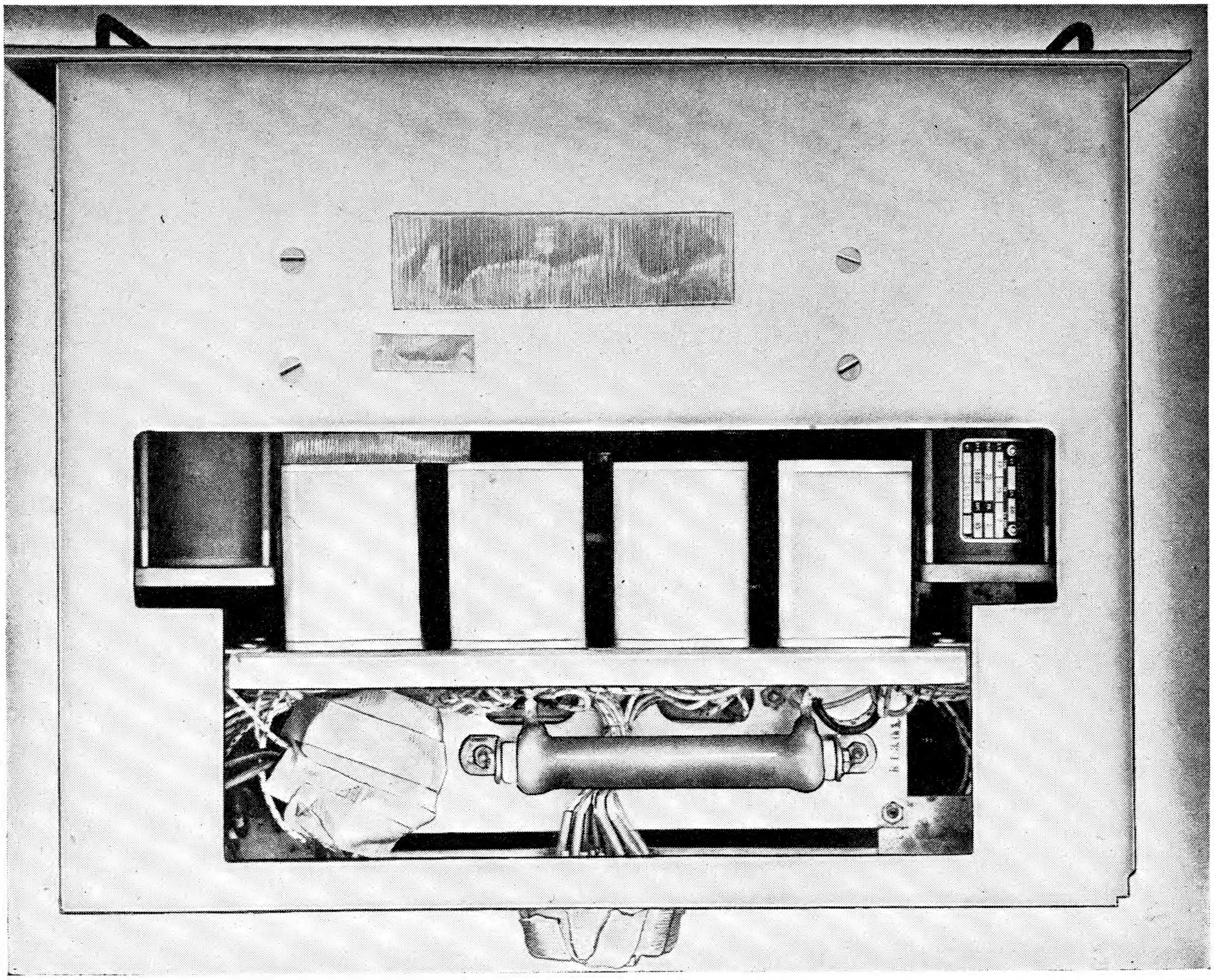


T $\frac{\text{OY-104}}{\text{1-1070}}$ **Fig. 1070—Masking on underside of receiver power supply**

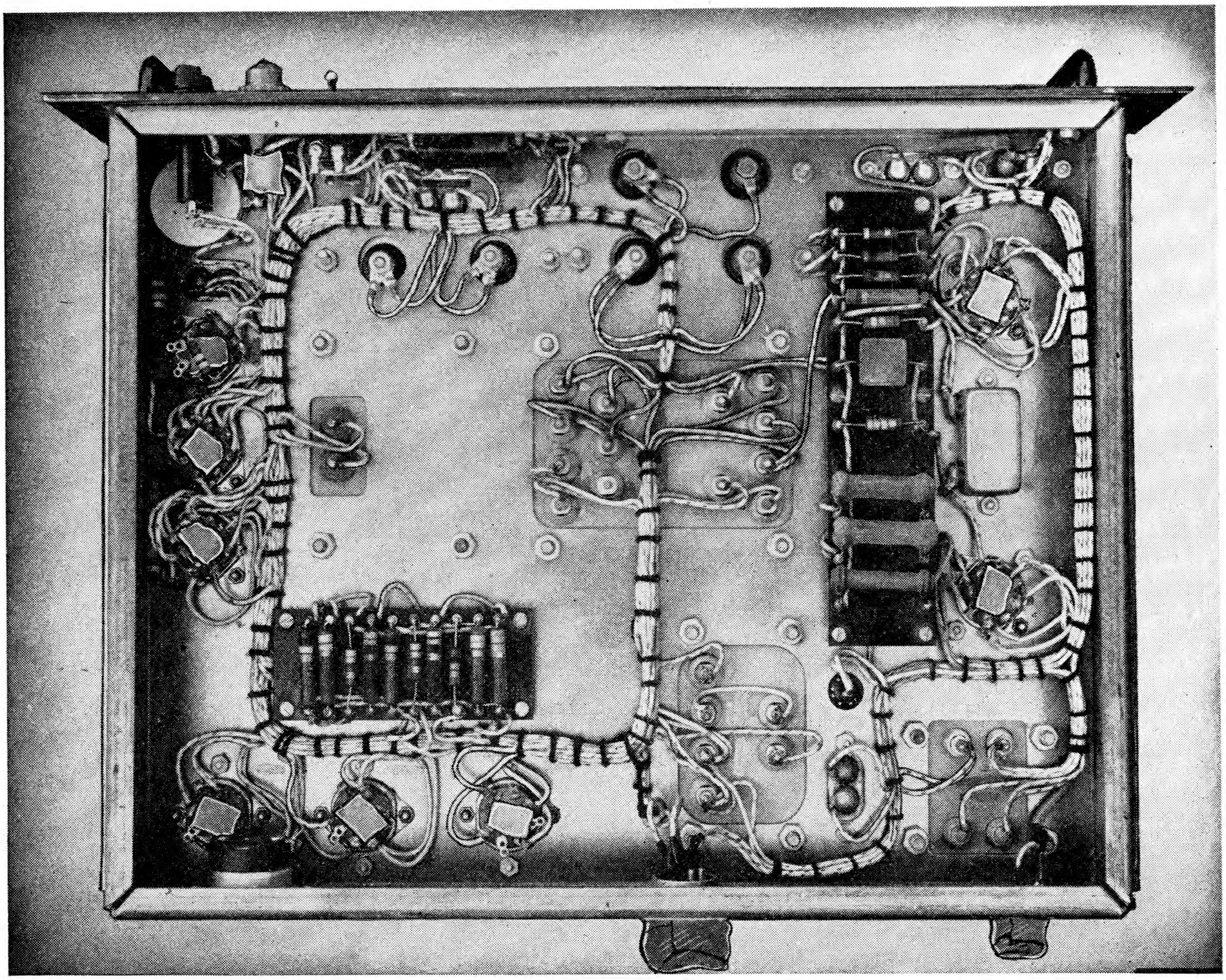


T OY-140/1-1071

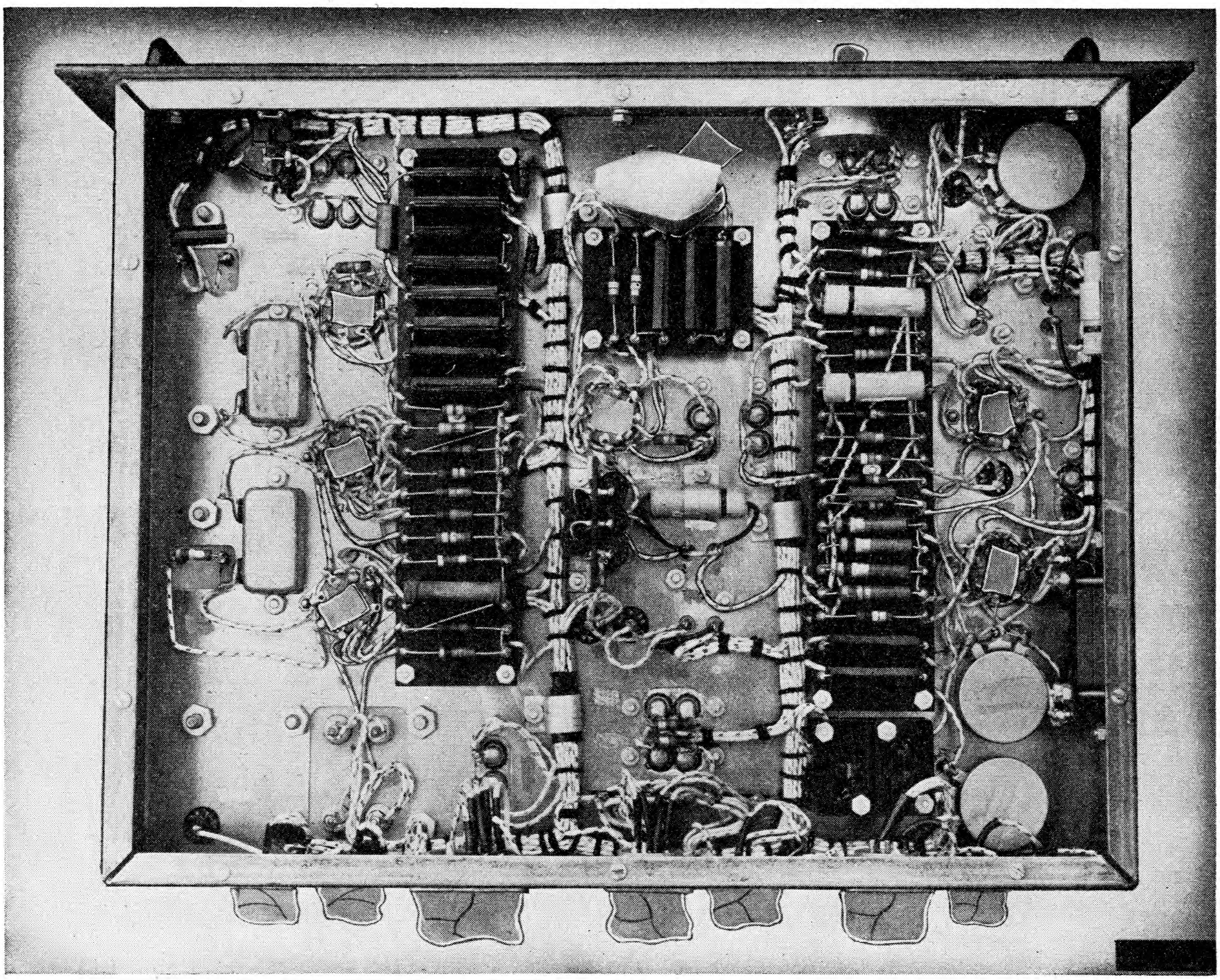
Fig. 1071—Masking on underside of field power supply



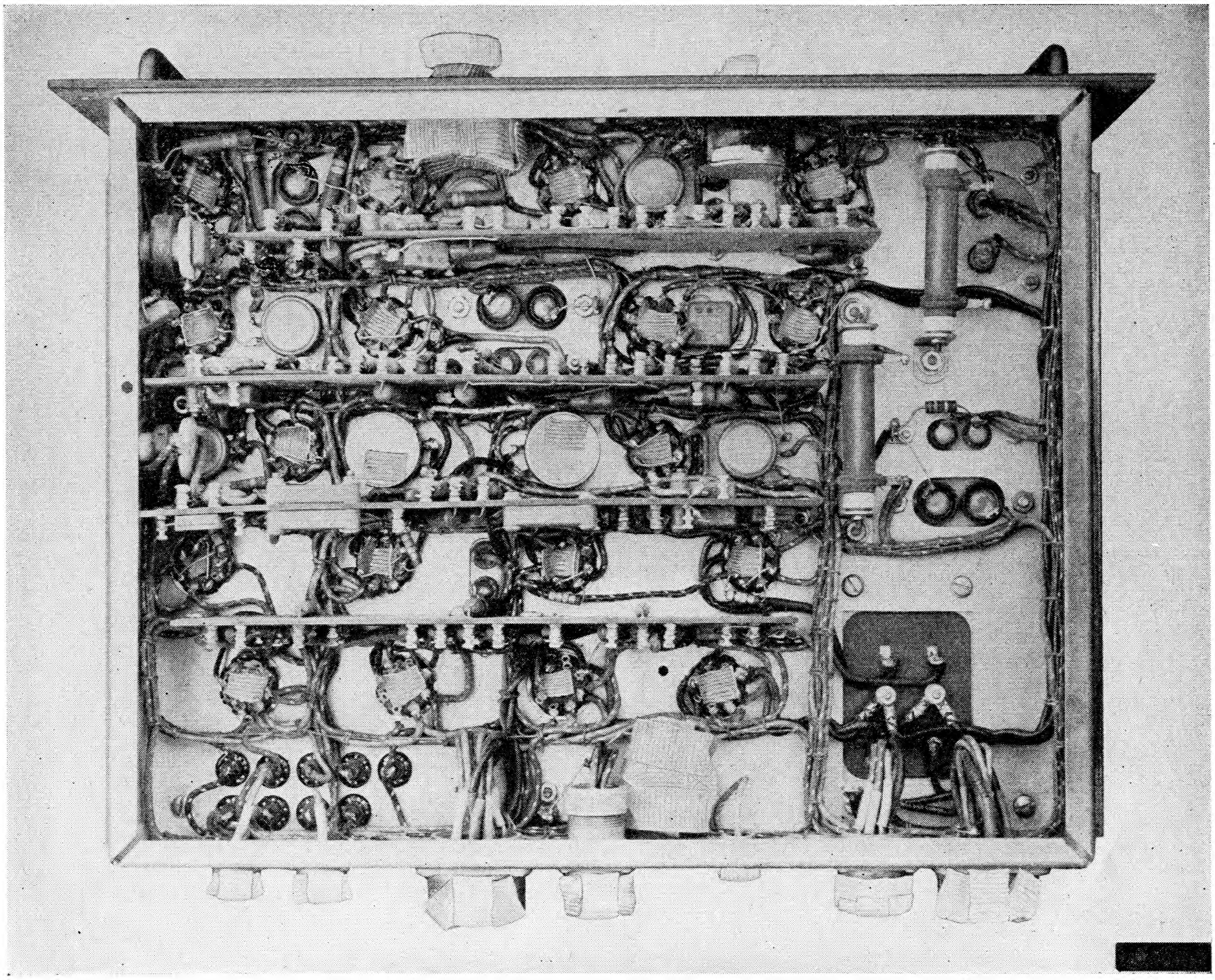
T $\frac{\text{OY-104}}{\text{1-1072}}$ **Fig. 1072—Masking on underside of antenna position control unit**



T $\frac{\text{OY-104}}{\text{1-1073}}$ **Fig. 1073—Masking on underside of altitude converter power supply**

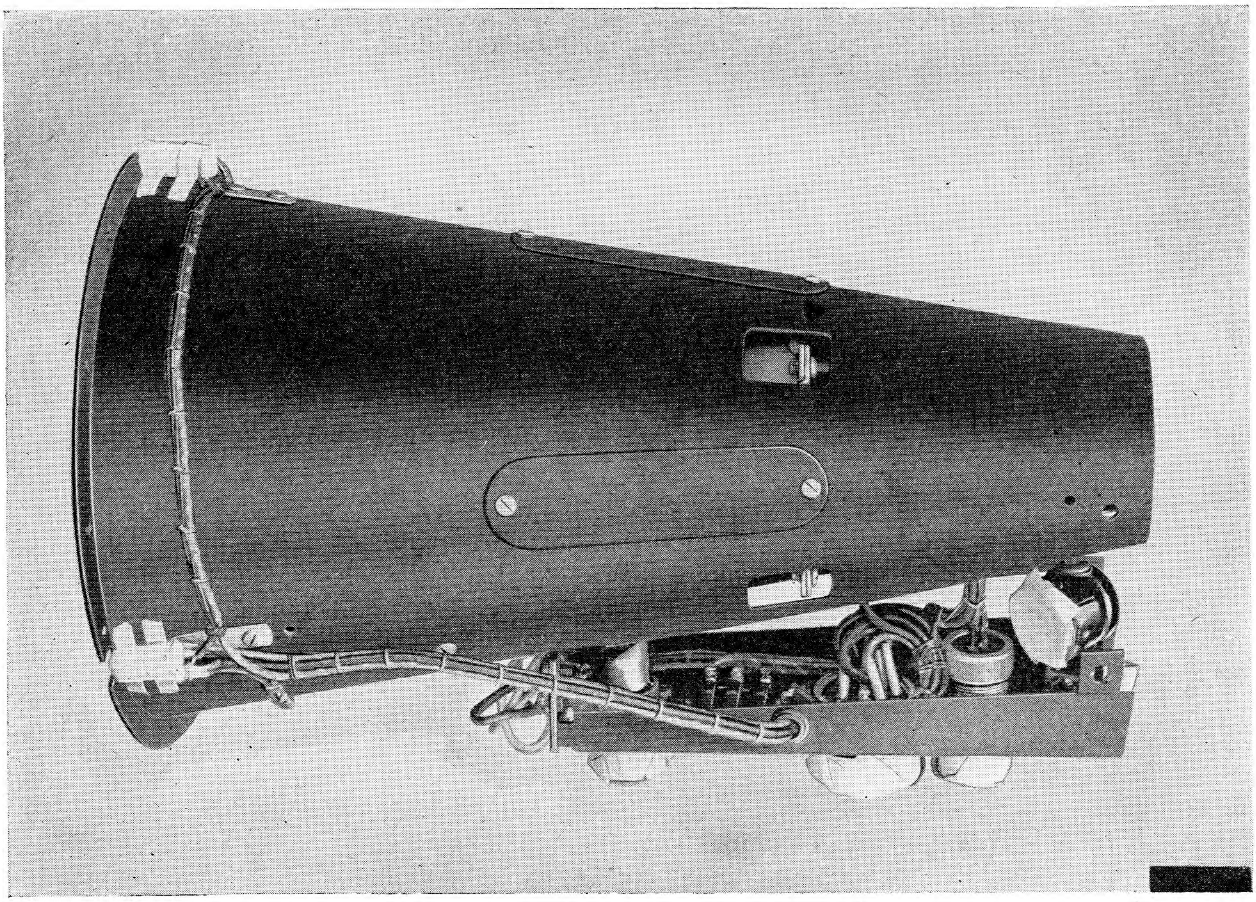


T $\frac{\text{OY-104}}{\text{1-1074}}$ **Fig. 1074—Masking on underside of altitude converter unit**



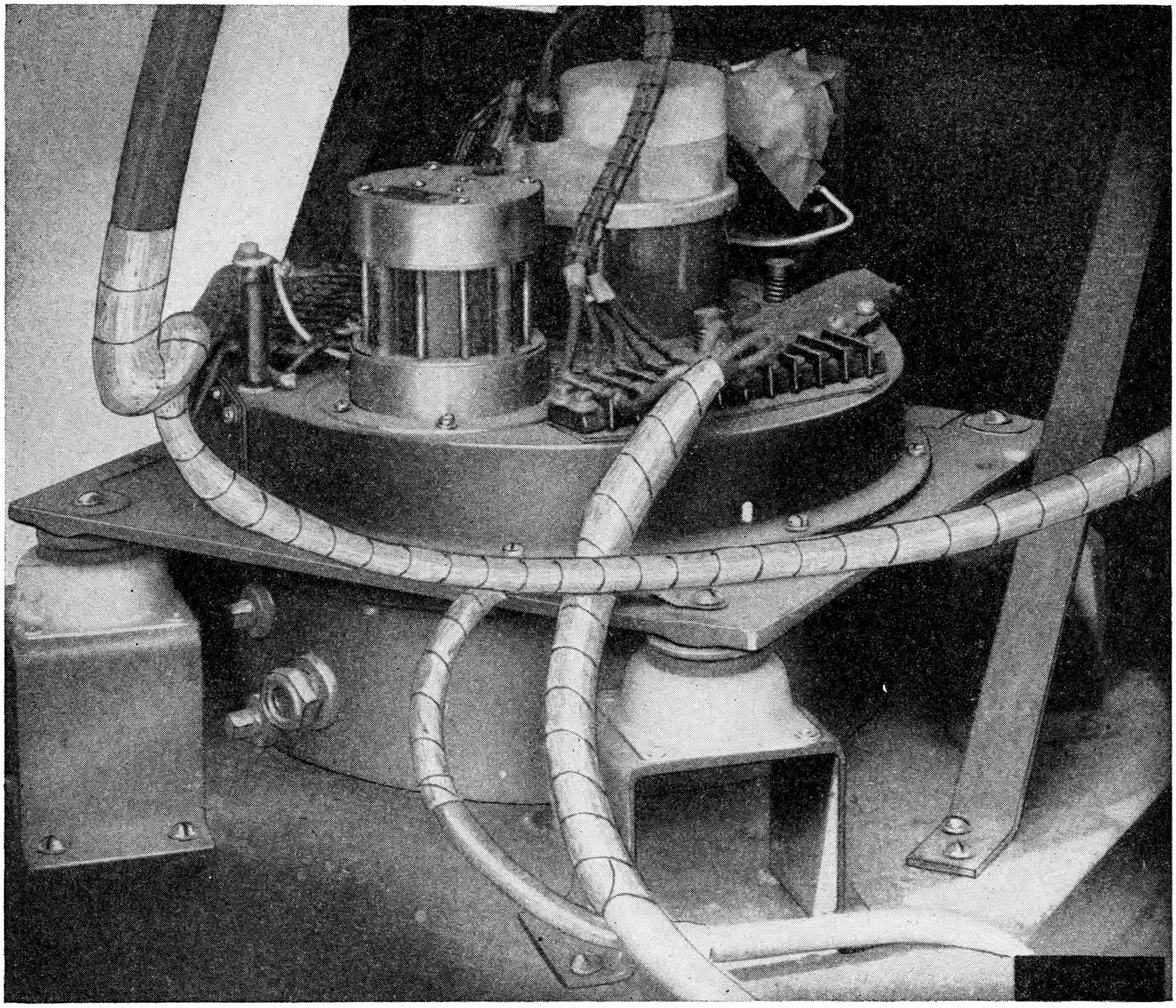
T $\frac{\text{OY-104}}{\text{1-1075}}$

Fig. 1075—Masking on underside of P.P.I. unit



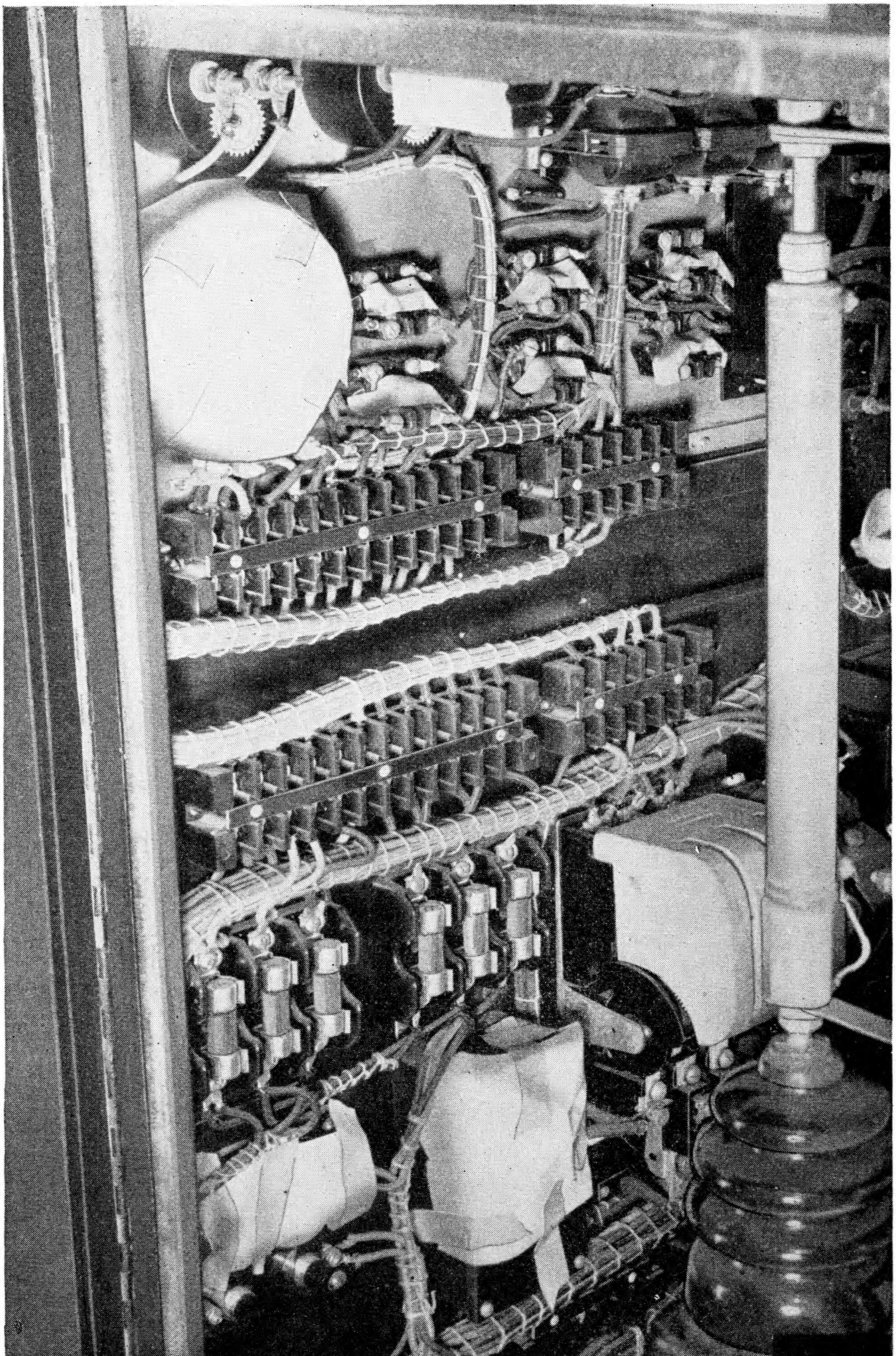
T $\frac{\text{OY-104}}{\text{1-1076}}$

Fig. 1076—Masking on P.P.I. tube

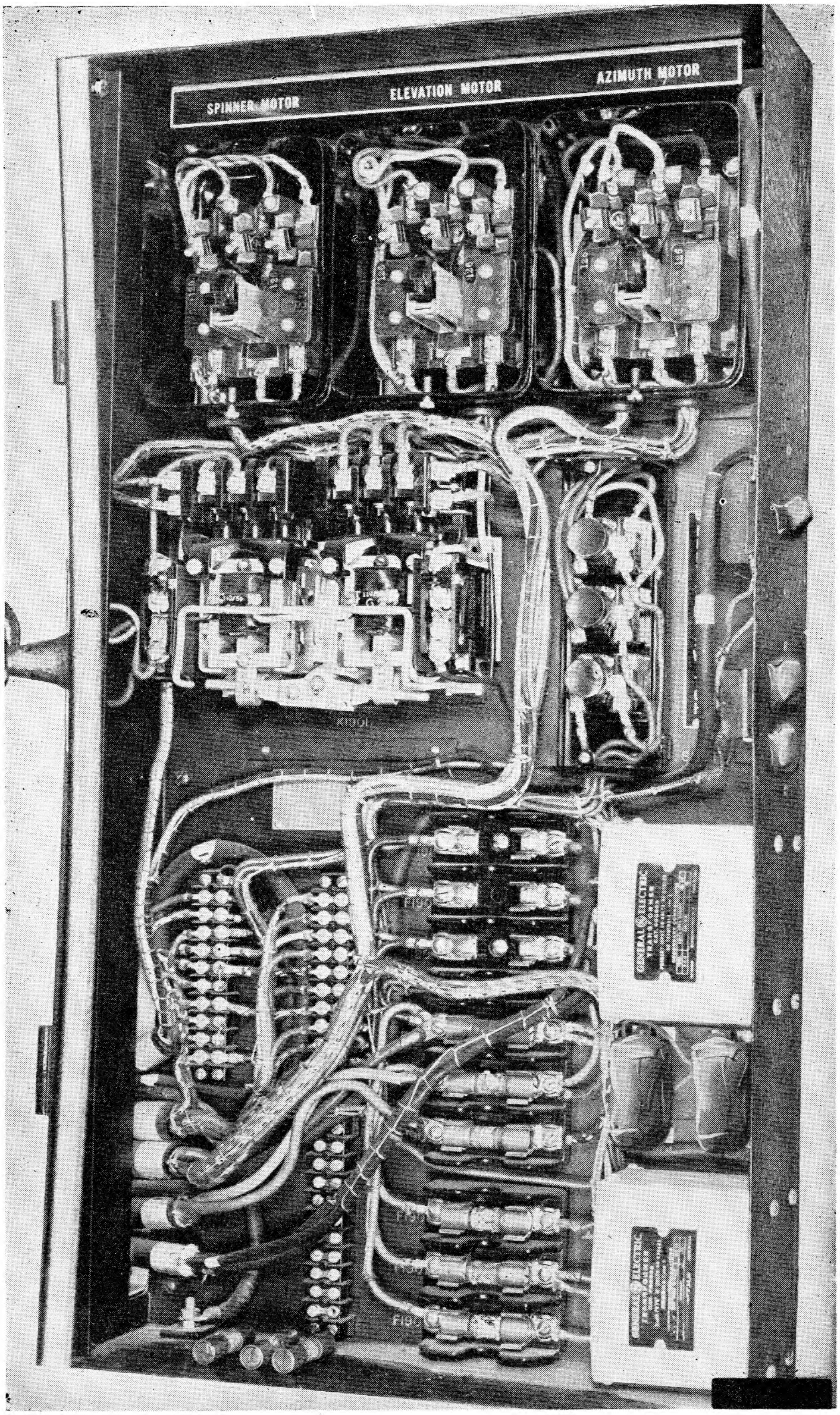


T OY-104/1-1077

Fig. 1077—Masking on altitude data unit

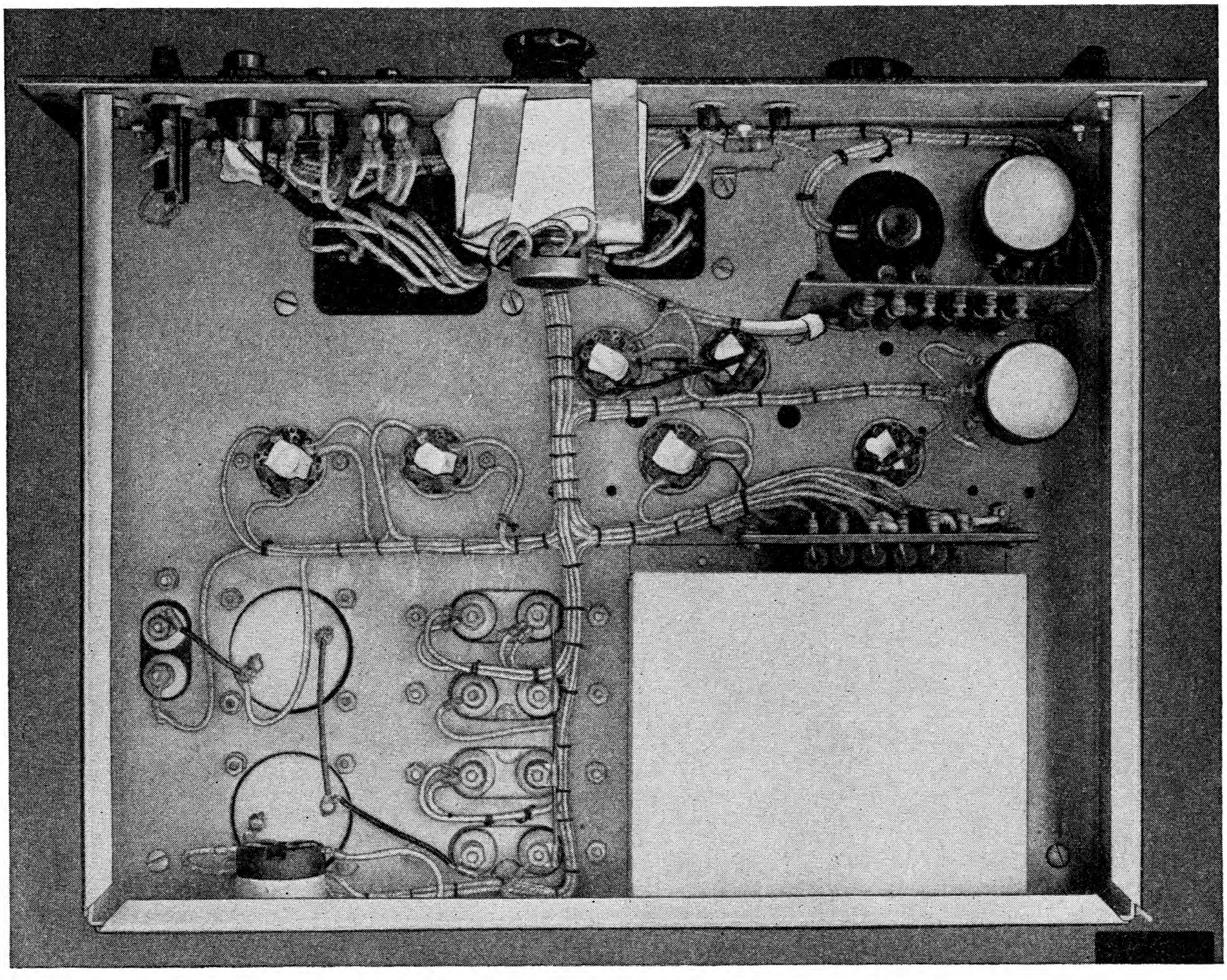


T $\frac{\text{OY-104}}{\text{1-1078}}$ Fig. 1078—Masking on rear of front panel of high voltage rectifier



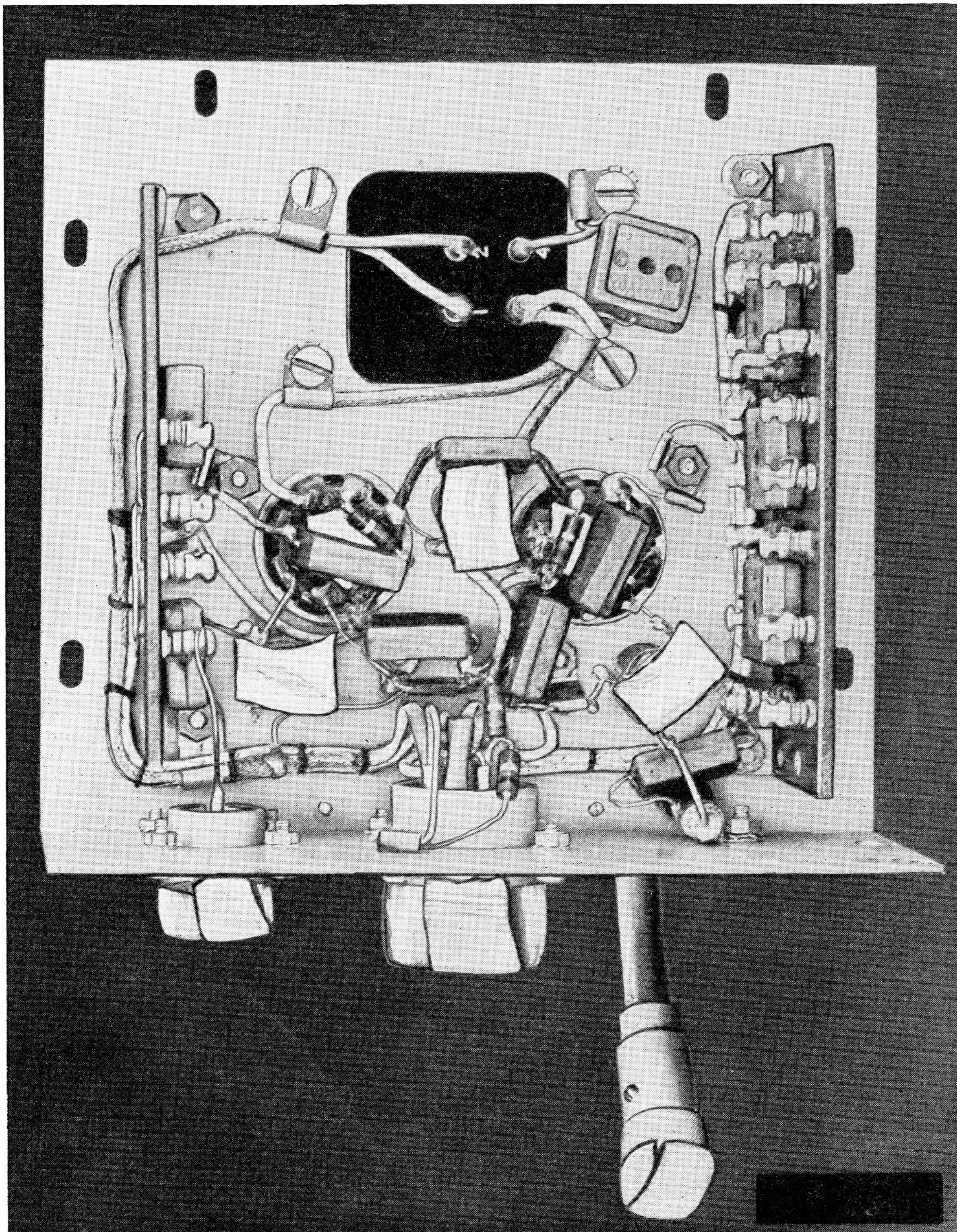
T $\frac{\text{OY-104}}{\text{1-1079}}$

Fig. 1079—Masking in switch box



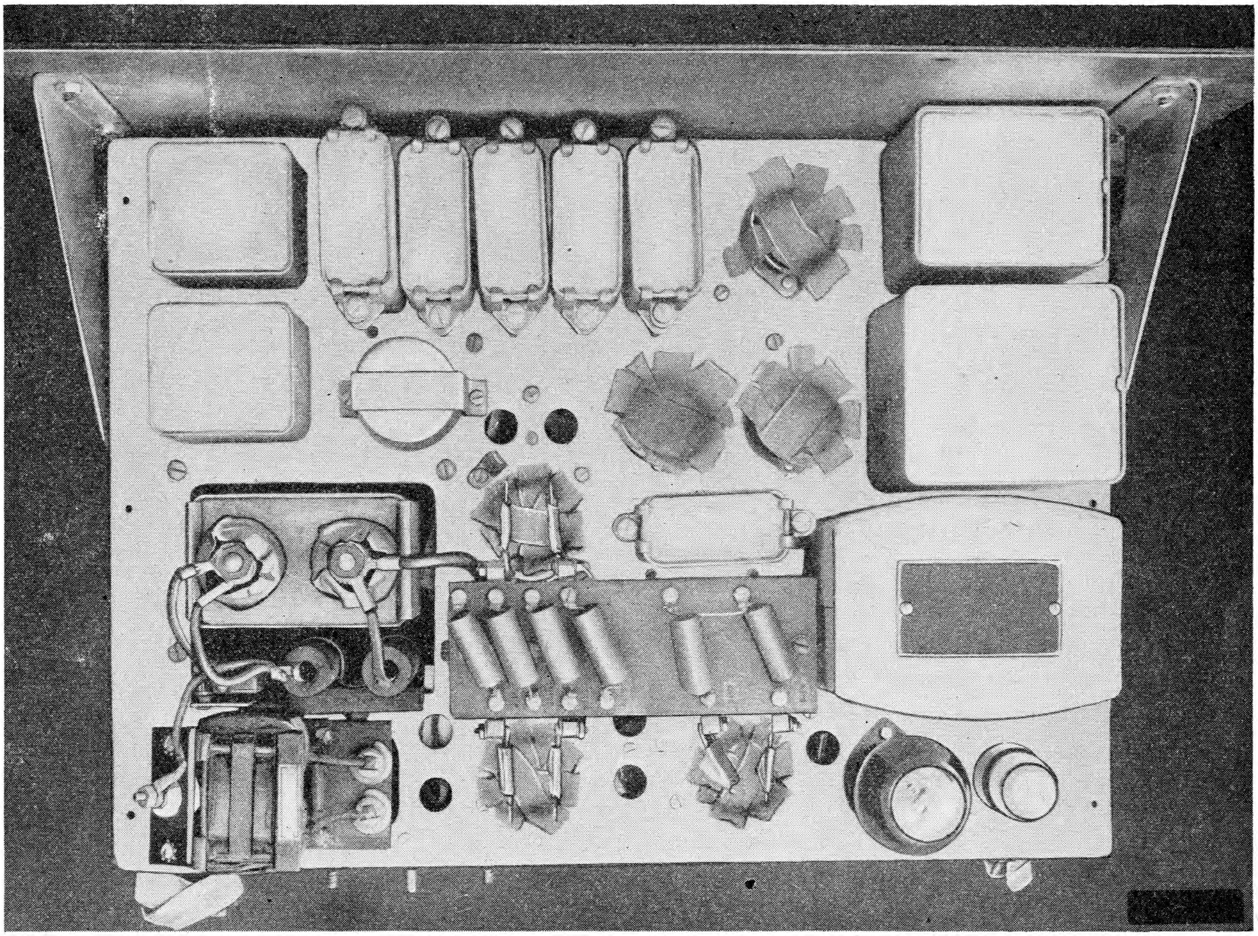
T $\frac{\text{OY-104}}{\text{1-1080}}$

Fig. 1080—Masking on underside of local oscillator



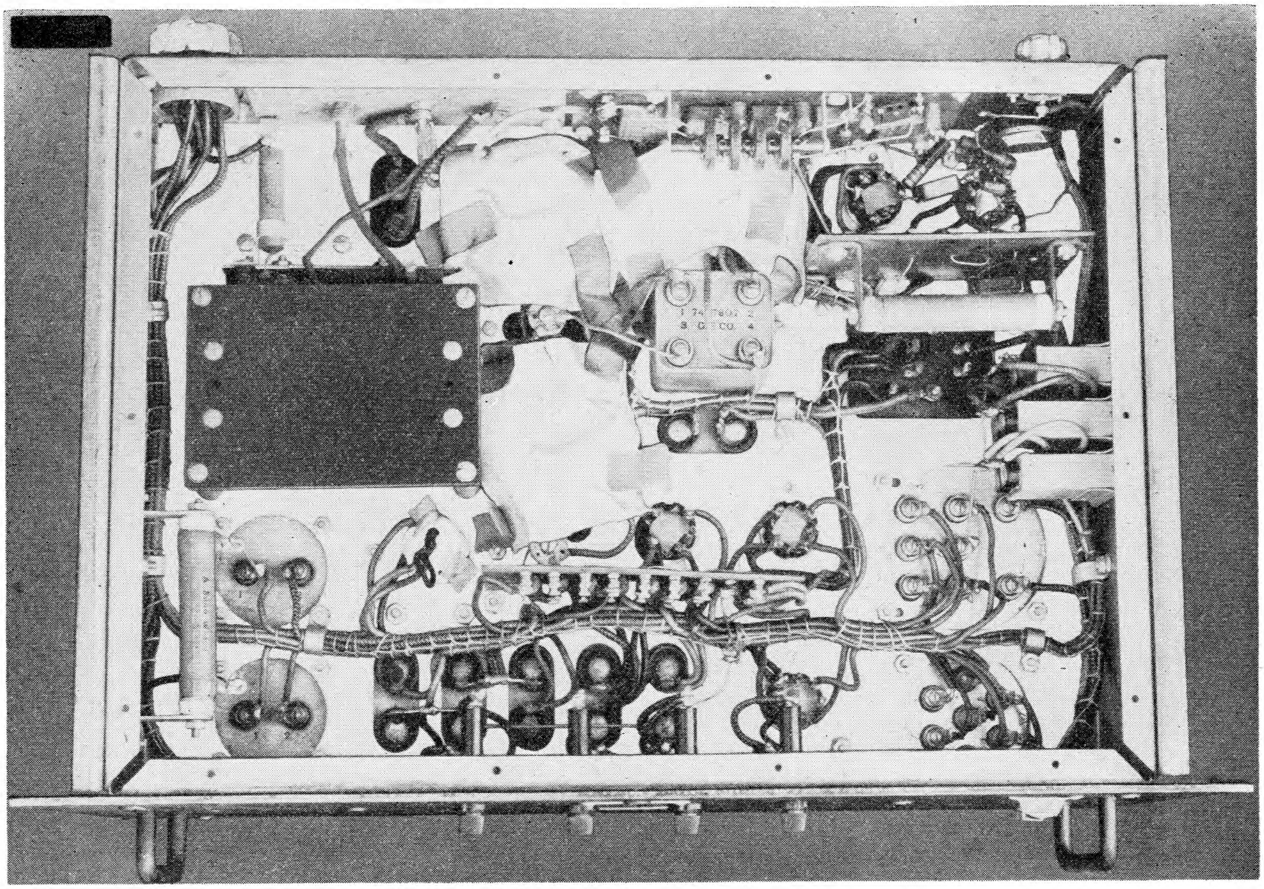
T $\frac{\text{OY-104}}{\text{1-1081}}$

Fig. 1081—Masking on underside of pre-amplifier unit

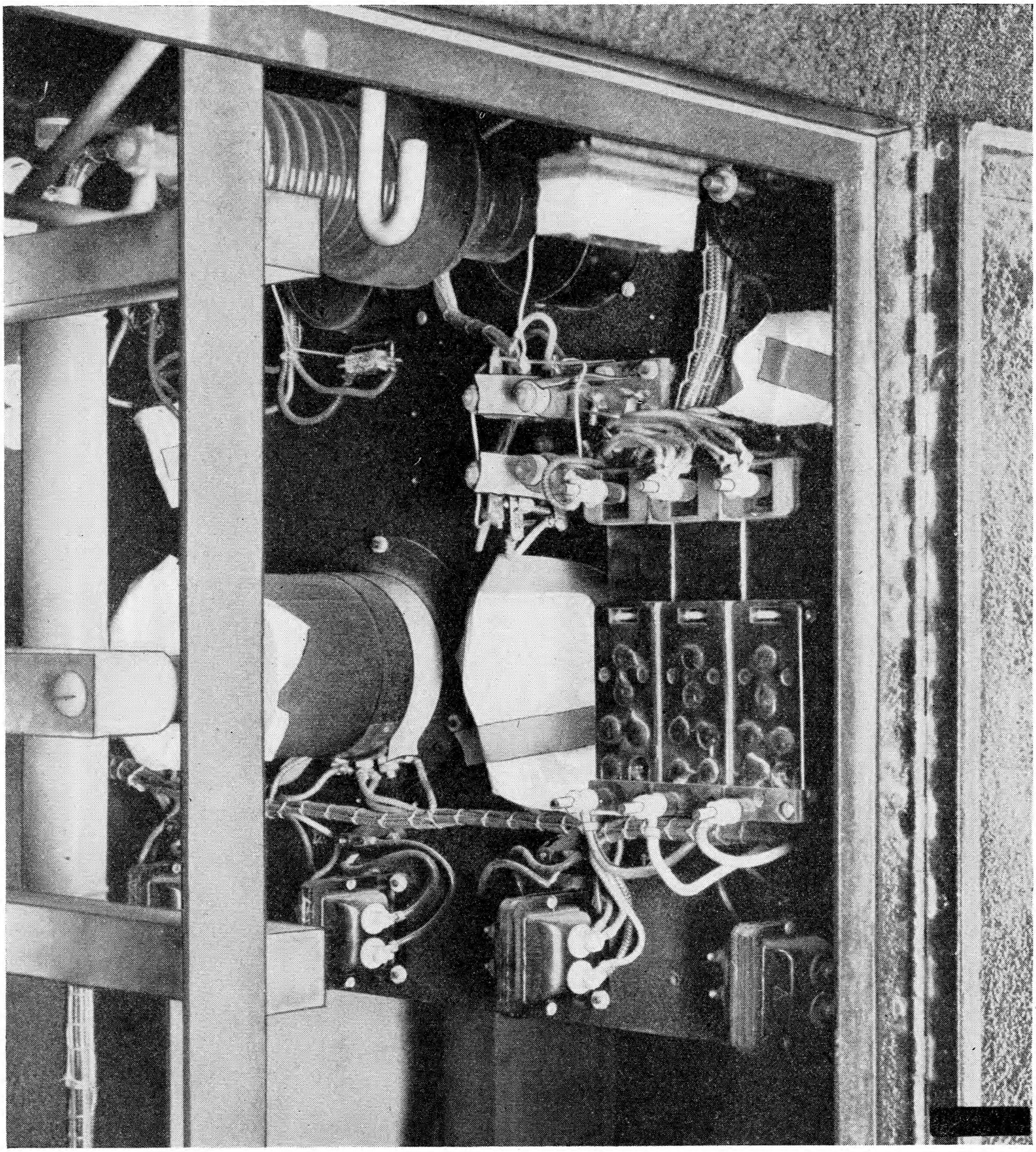


T OY-104/1-1082

Fig. 1082—Masking on top of driver unit

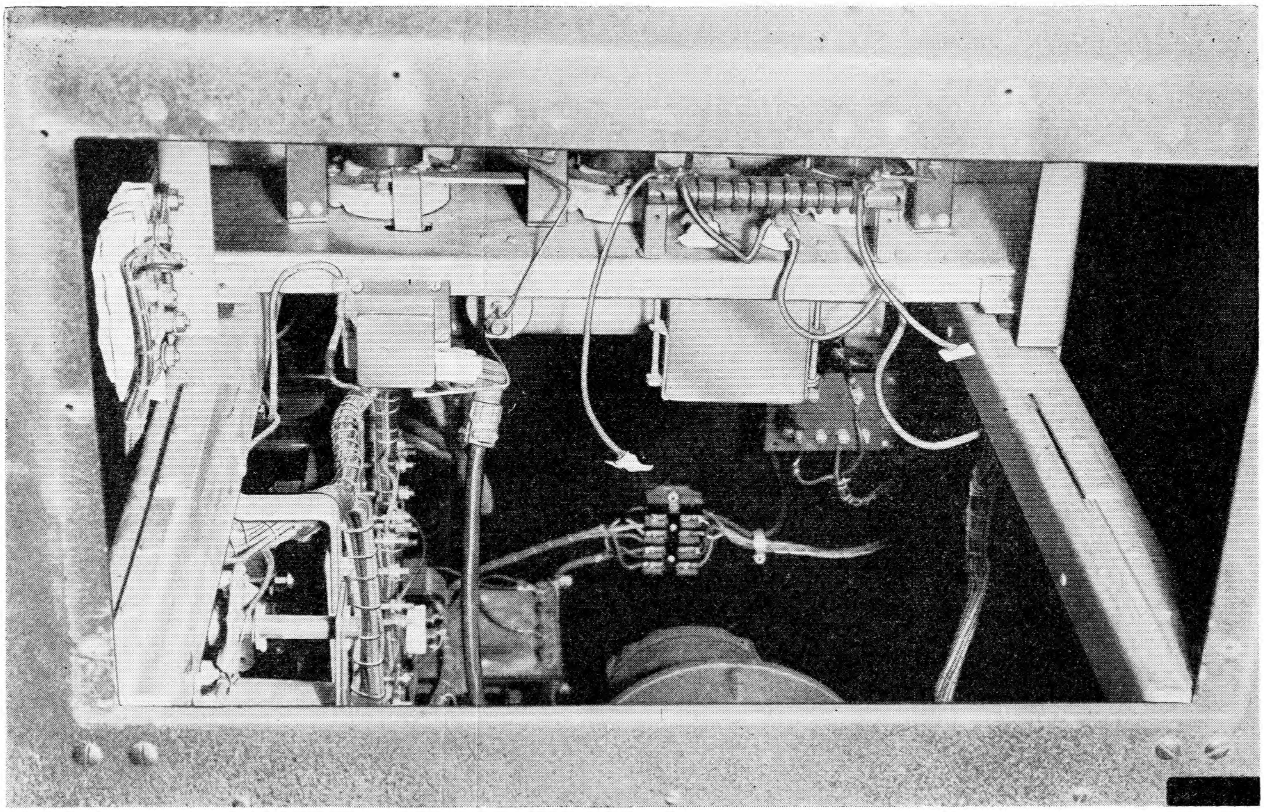


T $\frac{\text{OY-104}}{\text{1-1083}}$ **Fig. 1083—Masking on underside of driver unit**



T OY-104 / 1-1084

Fig. 1084—Masking on rear of front panel of modulator unit



T OY-104/1-1085

Fig. 1085—Masking on inside of modulator unit