RECEPTION SET R 210

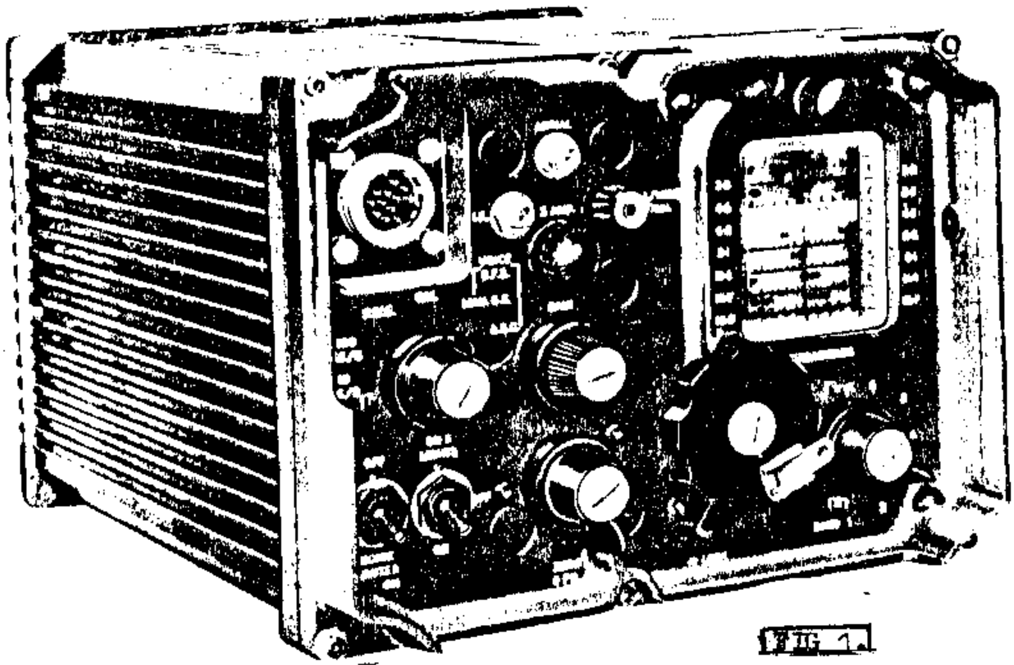
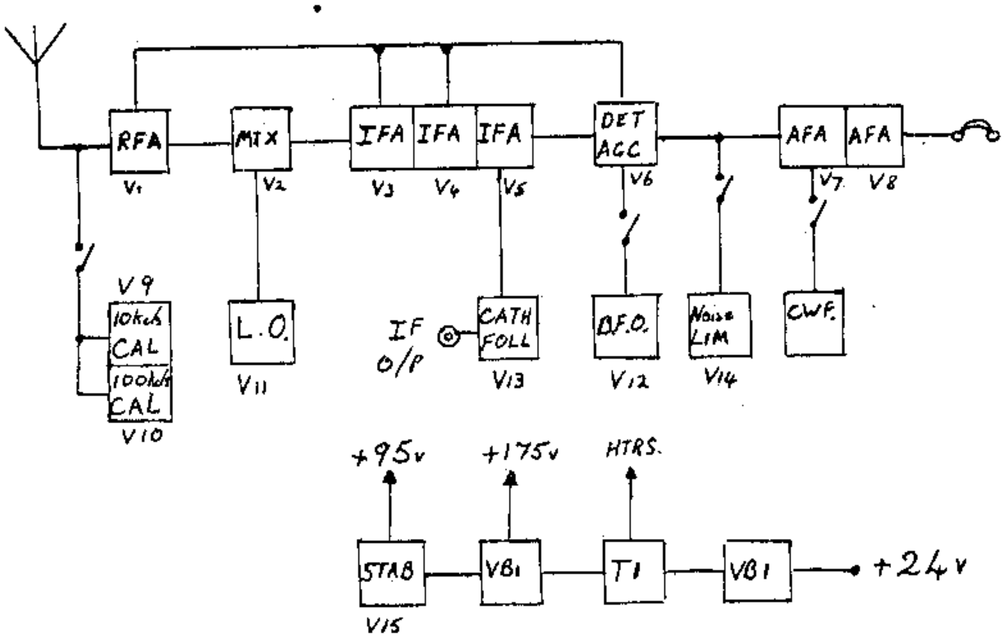


FIG 1.



VALVE	C.V. No.	OLD.No.
V1 V3 V4 V5	4015	131
V7 V8 V10 V11 V12 V13	4010	850
V6 V14	4025	140
V2	4012	653
V9	4003	491
V15	286	—

FIG 3A.

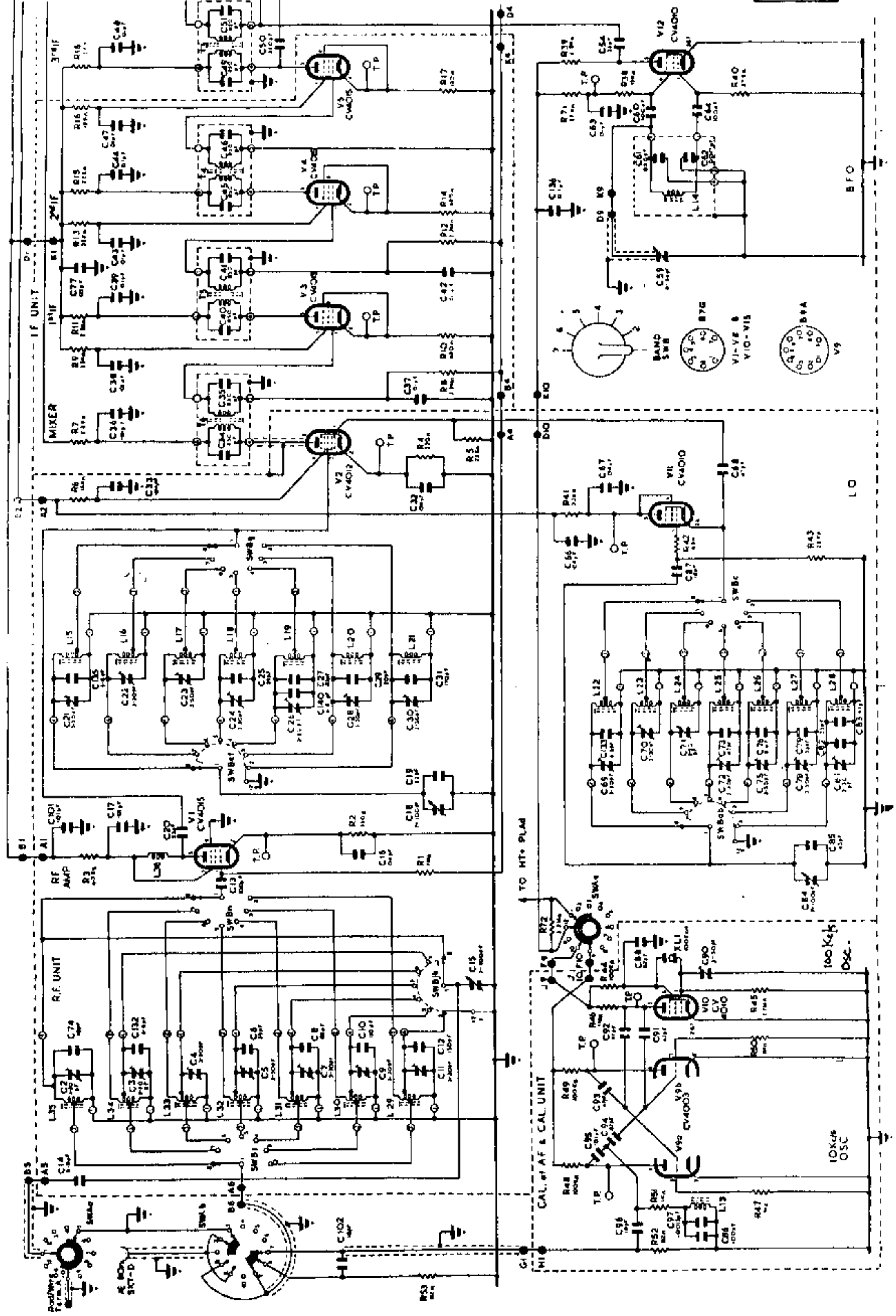
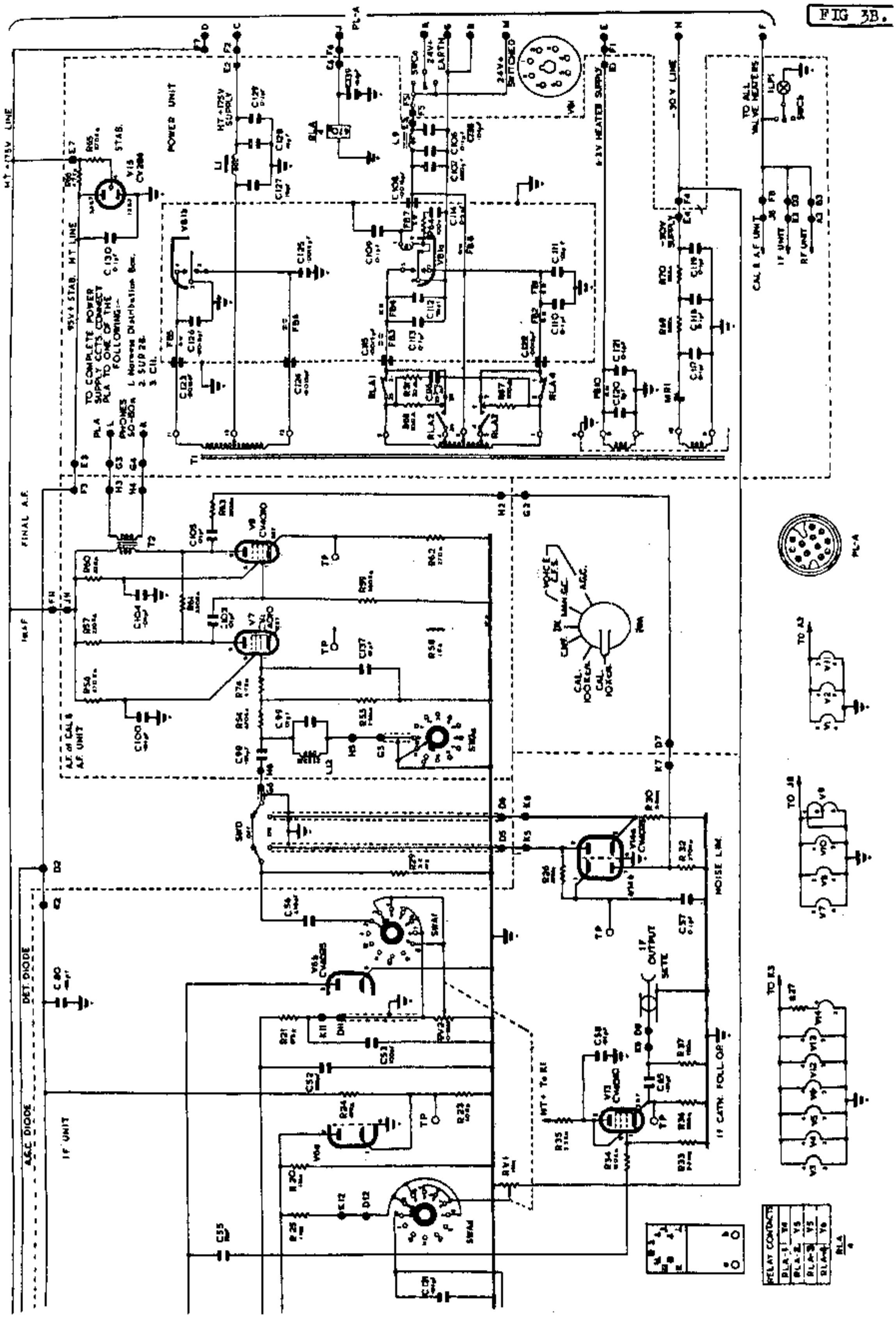

IF UNIT
MIXER
RF AMP
R.F. UNIT
B F O
L O
100 Kc/s OSC.
10Kc/s OSC
CAL. of AF & CAL UNIT
TO HT+ PLAN

FIG 3B.


POWER UNIT
HT +175V LINE
FINAL A.F.
NOISE LIM.
DET. DIODE
A.G.C. DIODE
IF UNIT
-30V LINE
6.3V HEATER SUPPLY
PL-A

ELECTRODE VOLTAGE READINGS

The following readings were taken with a model 8 AVO

VALVE	ANODE	SCREEN	CATHODE
V1	140V	140V	1.26V
V2	93.5V	52.5V	1.3V
V3	166V	146V	2.5V
V4	166V	146V	2.5V
V5	164V	143V	1V
V13	147V	-	2.9V
V7	73.5V	43.5V	1.23V
V8	170V	134V	2.5V
V9a	72V	-	-
V9c	112V	-	-
V10	8.5V	74V	-
V11	74V	74V	-
V12	(BFO ON)133V	134V	-

VALVE TESTING DATA (suitable for AVO Valve tester No. 3 and testers valve CT160)

CV No	SWITCH	HTRS	GI	Va	VS	MA Ia	MA/V GM
CV 4003	741 226 413	6	8.5	250	-	10.5	2.2
CV 4010	412 365 100	6	2	150	125	7.5	5
CV 4012	412 366 400	6	2	100	-	11	7
CV 4015	412 361 500	6	2.5	250	250	8	2.5
CV 4025	192 310 800	6	-	D	-		

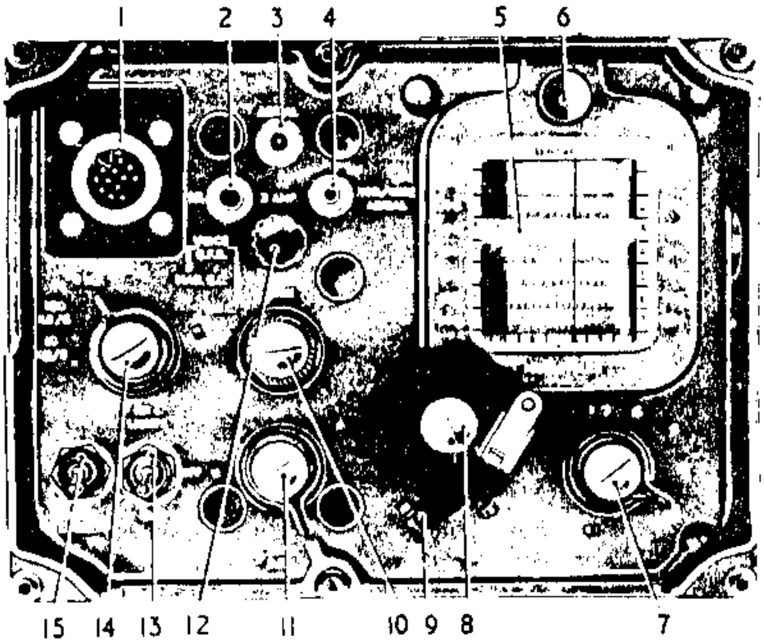


FIG 4.

Ref. No.	Control	Description and Purpose
1	Power Input Plug	12 point panel mounted Mk. 4 plug. Termination for connector from wireless sender, the adaptor unit (DC operation) or the AC PSU (AC operation).
2	IF	Coaxial socket for connection to ancillary equipment requiring IF output.
3	AE 80 ohm	Plug termination for low impedance aerials or feeders.
4	ROD/WIRE AE	Screwed terminal for connection to either rod or wire aerials.
5	Tuning Scale	Seven band scales in parallel on a strip of 70 mm film. The particular band in use is emphasized by the white background strip which moves into position behind the film by operation of the range switch.
6	Cursor control	Controls the position of the movable cursor..
7	BAND switch	7-position switch controlling the seven bands. Operation of this switch also controls the position of the white background strip behind the film scale.
8	Main Tuning Control	Controls variable tuning capacitors geared through a reduction drive to the frequency scale.
9	Tuning Control Lock	Locking device fitted to the tuning control drive. Enables the operator to secure the control in any desired position.
10	VOLUME Control	Ganged potentiometer. This component performs two functions. With the system switch at AM, 100 kc/s and 10 kc/s position, a variable resistor, used as an AF gain control, is in circuit. With the system switch at CW, CWF or MAN. GC, another resistor acts as an RF gain control, the AGC being disconnected.
11	BFO	Controls variable capacitor for adjustment of beat note.
12	FUSE	3 Amp cartridge type fuse for 24 volt DC input
13	ON-OFF-ON and LIGHTS	3-position switch. The receiver is switched on without dial lighting, at the ON position. At the ON and LIGHTS position, the receiver is on and the dial is illuminated. Other position is OFF.

Ref. No.	Control	Description and Purpose
14	System switch	6-position switch controlling system of operation, i.e. CW or AM. Position CWF switches in audio filter. Position 10 or 100 kc/s switches the calibrator in circuit with check points as indicated. The MAN. GC position is mainly used for frequency shift operation.
15	NOISE LIMITER	2-way ON-OFF switch; enables noise limiter to be switched into circuit when static interference, etc. is troublesome.
16 (Not Shown)	HUMIDITY INDICATOR and DESICCATOR	This is installed in the rear of the case. Contains a quicklime drying agent. Also gives visual indication of presence of moisture in interior of set.

VALVE LAYOUT.

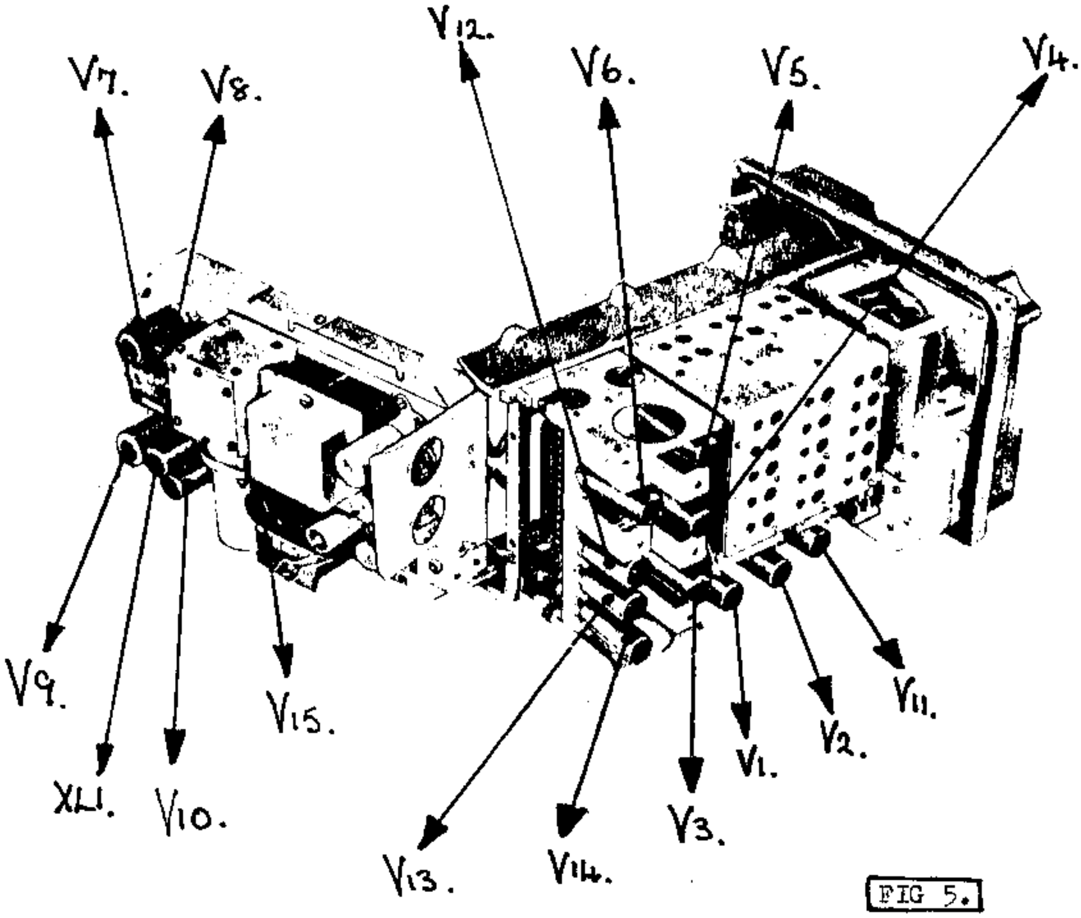


FIG 5.

KEY TO LAYOUT DIAGRAMS OF SUB UNITS.

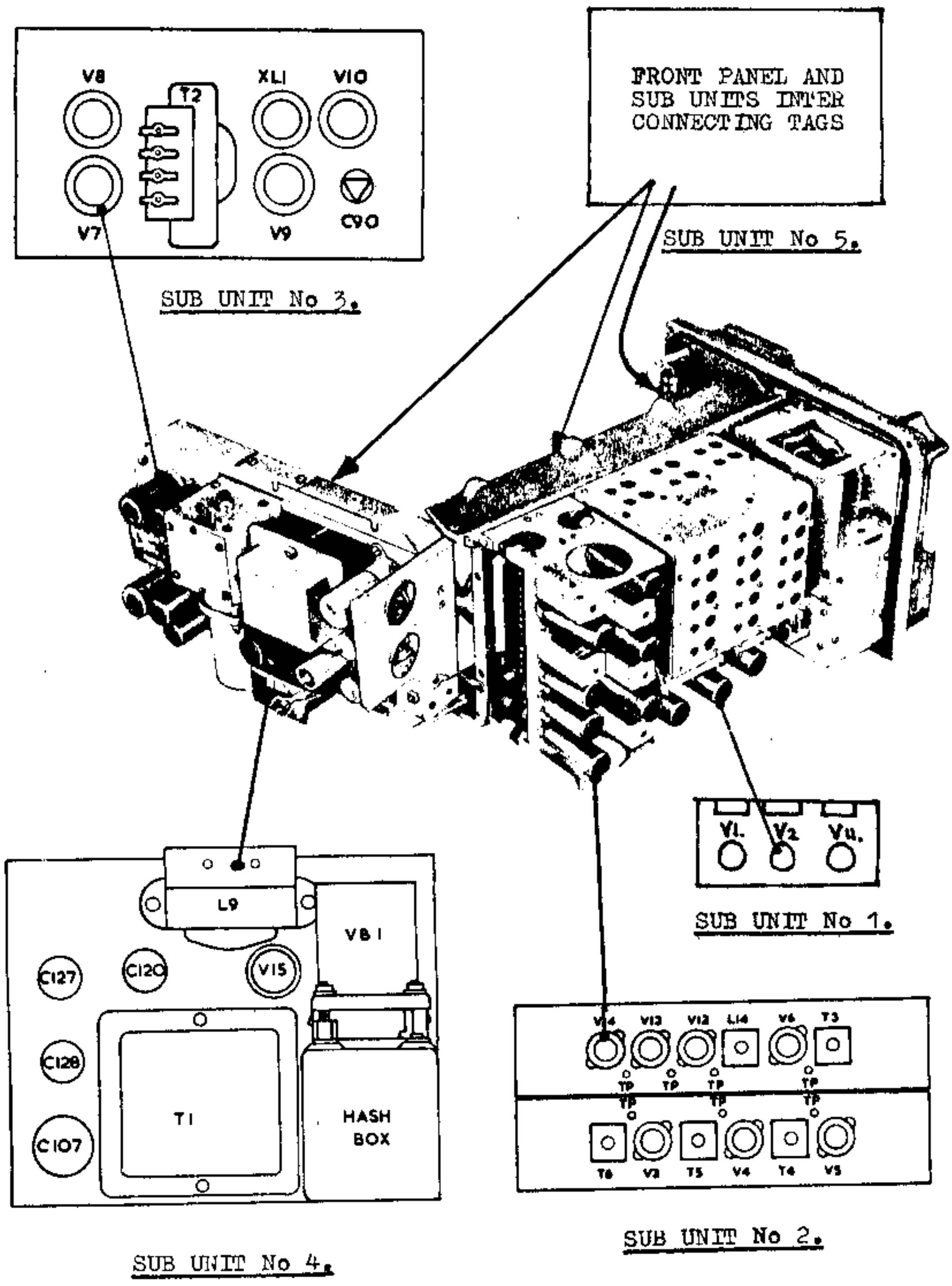


FIG 6.

SUB UNIT No 1.

RF CHASSIS.

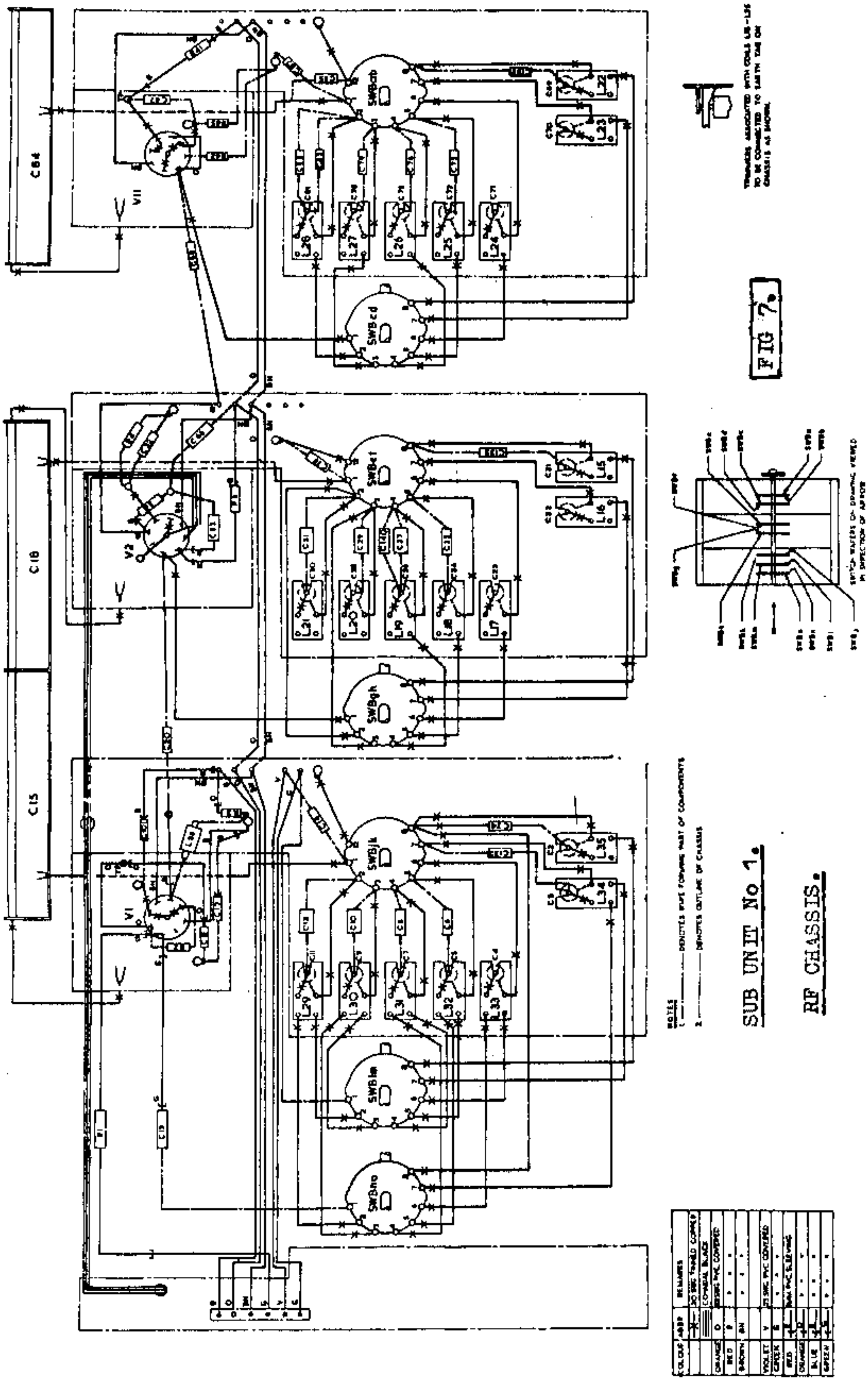


FIG 7.

SUB UNIT No 2.

IF CHASSIS.

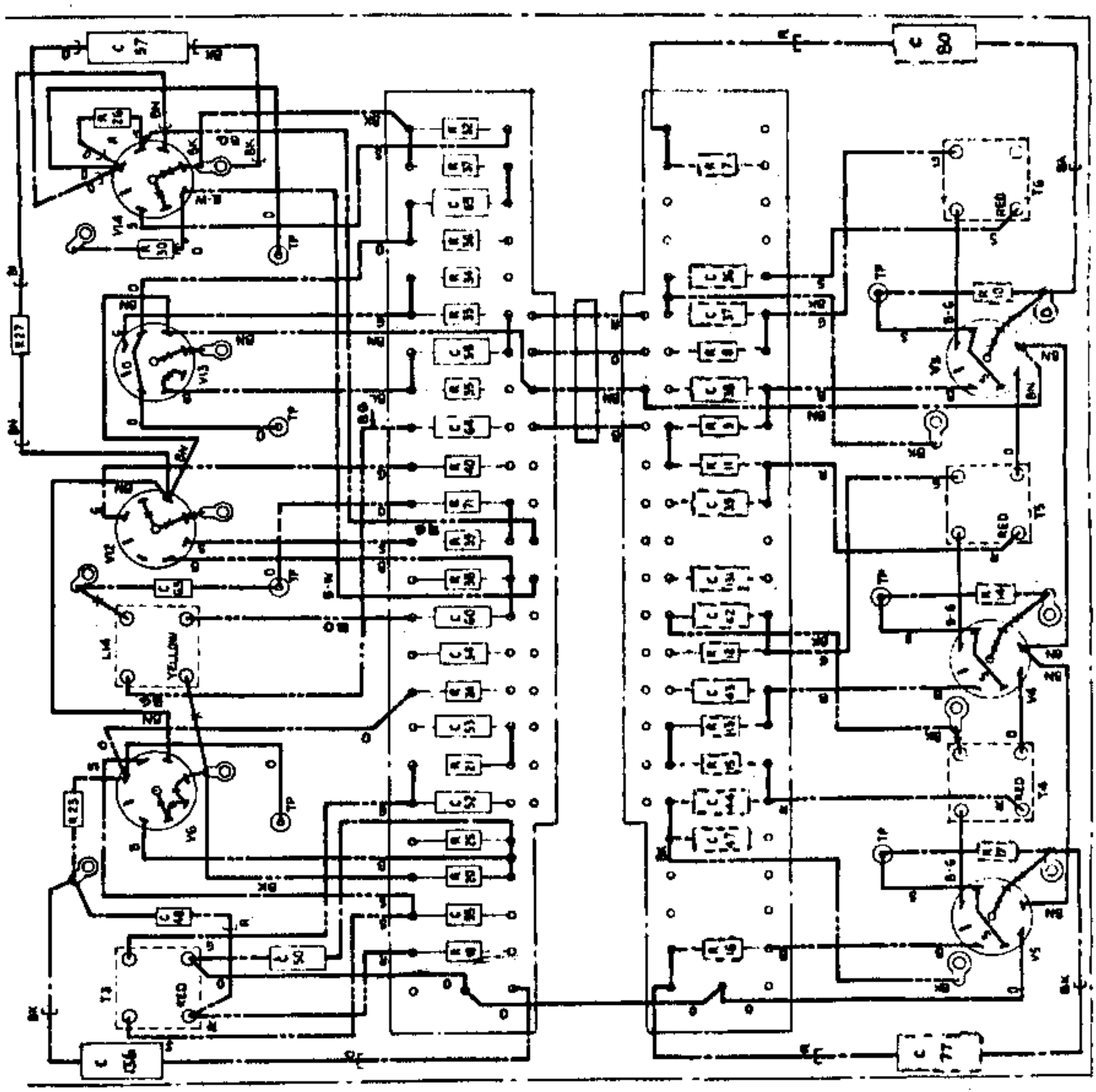
FIG 8.

COLOUR	ABBREVIATION AS SHOWN ON WIRE	REMARKS
BLACK	BK	14/40 BURA WRIT'S
BROWN	BN	• • •
RED	R	• • •
ORANGE	O	• • •
GREEN	G	• • •
BLUE	B	• • •
SLATE	S	• • •
BLUE ORANGE	B-O	• • •
BLUE GREEN	B-G	• • •
BLUE WHITE	B-W	• • •
	—+—	22 SWG TINNED COPPER
BLACK	BK	1MM PVC SLEEVING
RED	R	• • •
BROWN	BN	• • •
ORANGE	O	• • •
SLEEVE	——	HELLERMAN NYZ X 1

UNDERSIDE

SUB UNIT No 2.

IF CHASSIS.

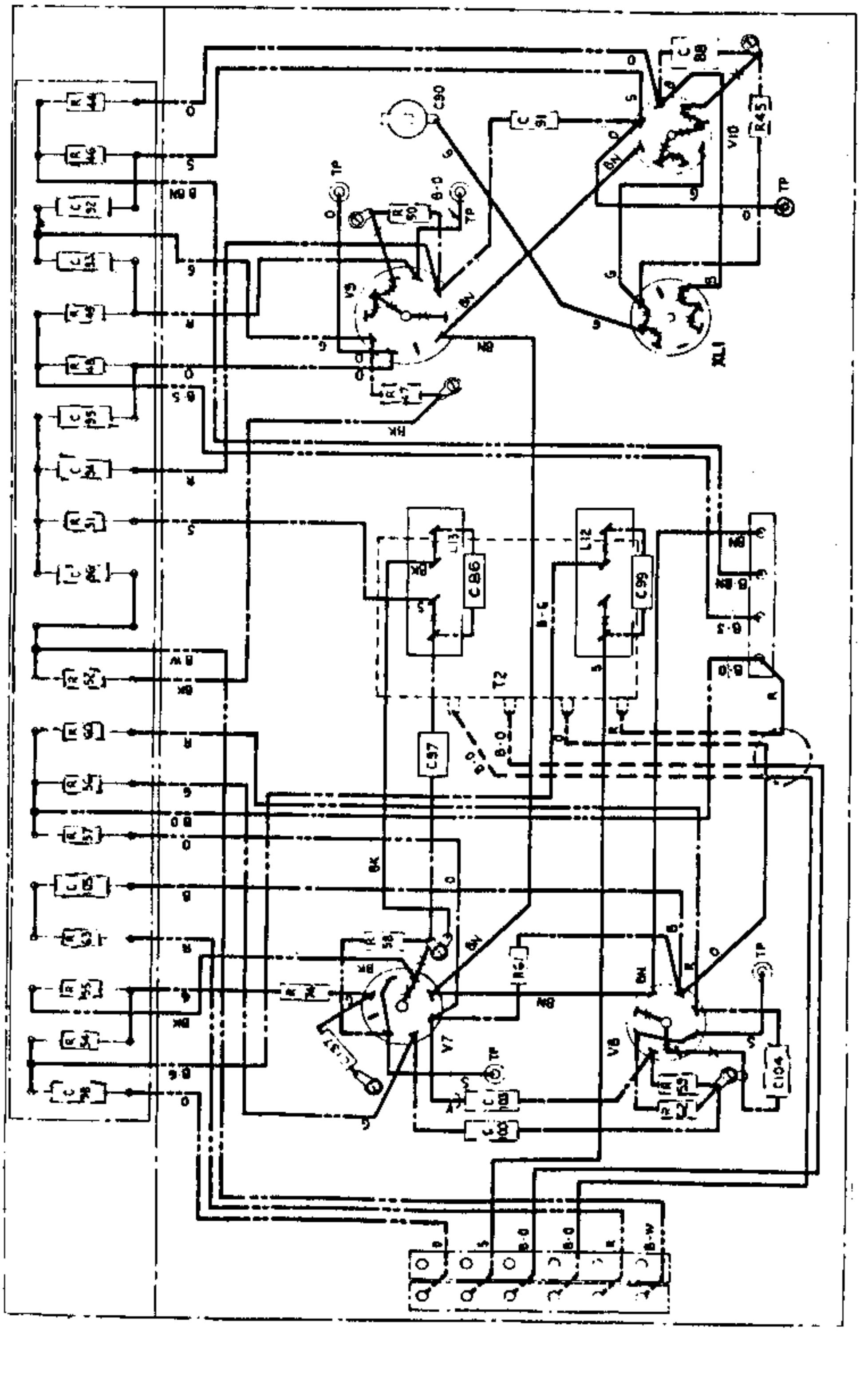


SUB UNIT No 3.

AF CHASSIS.

COLOUR	ABBREVIATION AS SHOWN ON WIRE	REMARKS		
		H/40	DURA	WIRE 3
BLACK	BK	•	•	•
GREEN	G	•	•	•
ORANGE	O	•	•	•
BLUE	B	•	•	•
SLATE	S	•	•	•
RED	R	•	•	•
BLUE-ORANGE	B-O	•	•	•
BLUE WHITE	B-W	•	•	•
BROWN	BN	•	•	•
BLUE-GREEN	B-G	•	•	•
BLUE SLATE	B-S	•	•	•
LT BROWN	B-BN	•	•	•
VIOLET	⟵	1MM PVC SLEEVING		
	⟵	22 SWG TINNED COPPER		

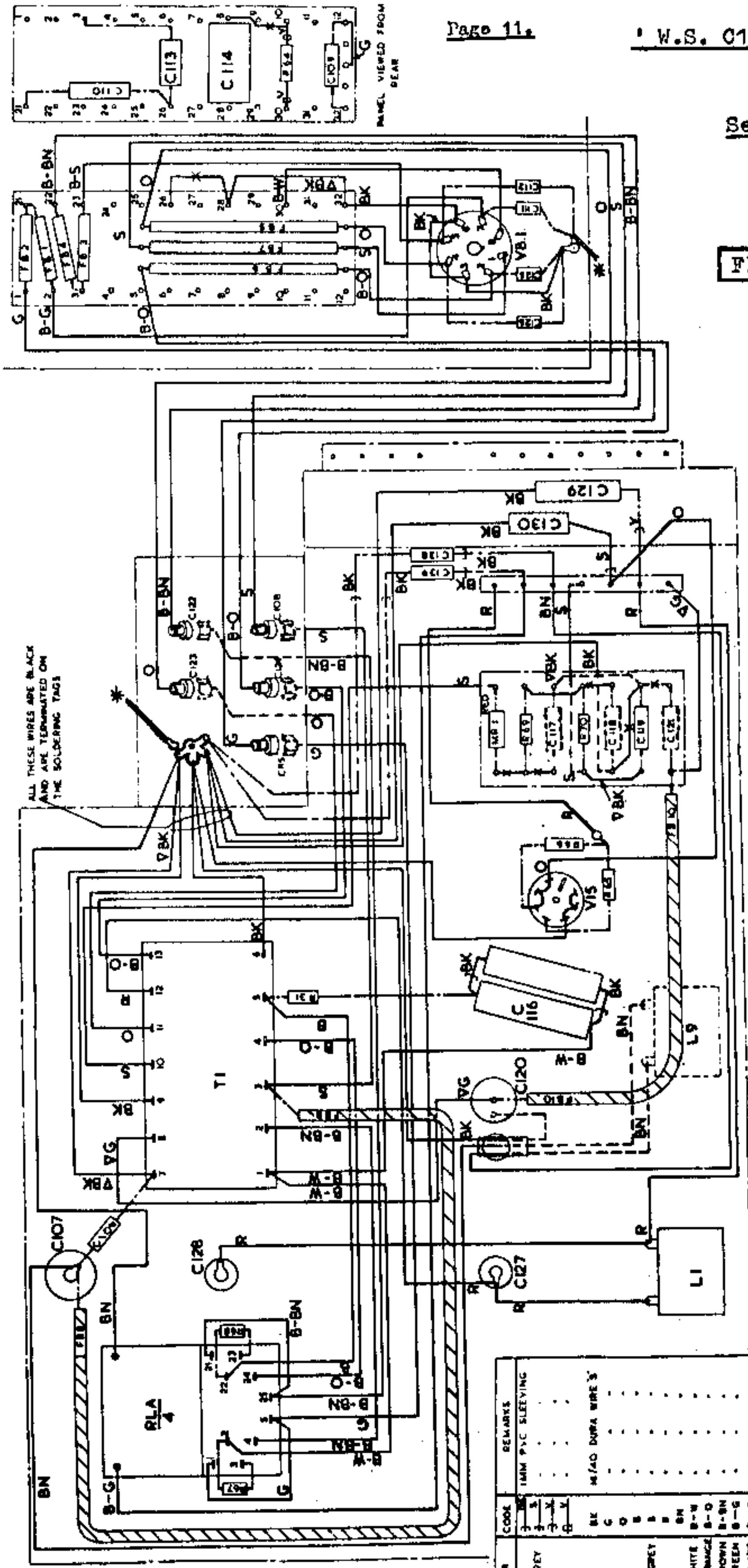
FIG 9.



AF CHASSIS.

SUB UNIT No 3.

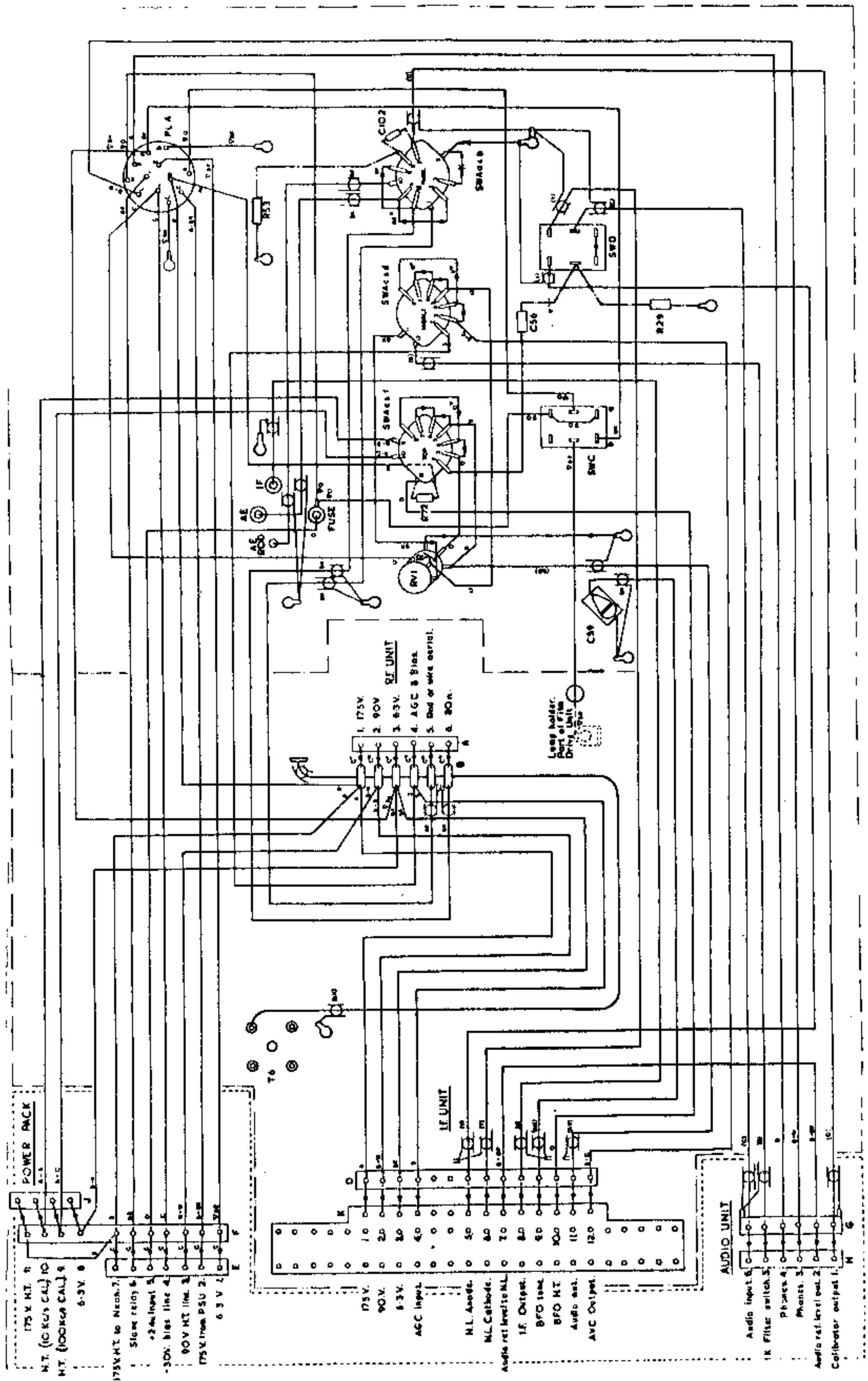
FIG 10.



DC PSU.

SUB UNIT No 4.

COLOUR	CODE	REMARKS
BLACK	BK	1MM P.V.C. SLEEVING
SLATE GREY	S	"
VIOLET	X	"
VIOLET	V	"
BLACK	BK	14/40 DURA WIRE'S
GREEN	G	"
ORANGE	O	"
BLUE	B	"
SLATE GREY	S	"
RED	R	"
BROWN	BN	"
BLUE - WHITE	B-W	"
BLUE - ORANGE	B-O	"
BLUE - BROWN	B-BN	"
BLUE GREEN	B-G	"
BLUE - SLATE	B-S	"
BLACK	▽BK	14/.0076 P.V.C. COVERED
GREEN	▽G	"
		22 SWG. TINNED COPPER WIRE
		COPPER BRAID

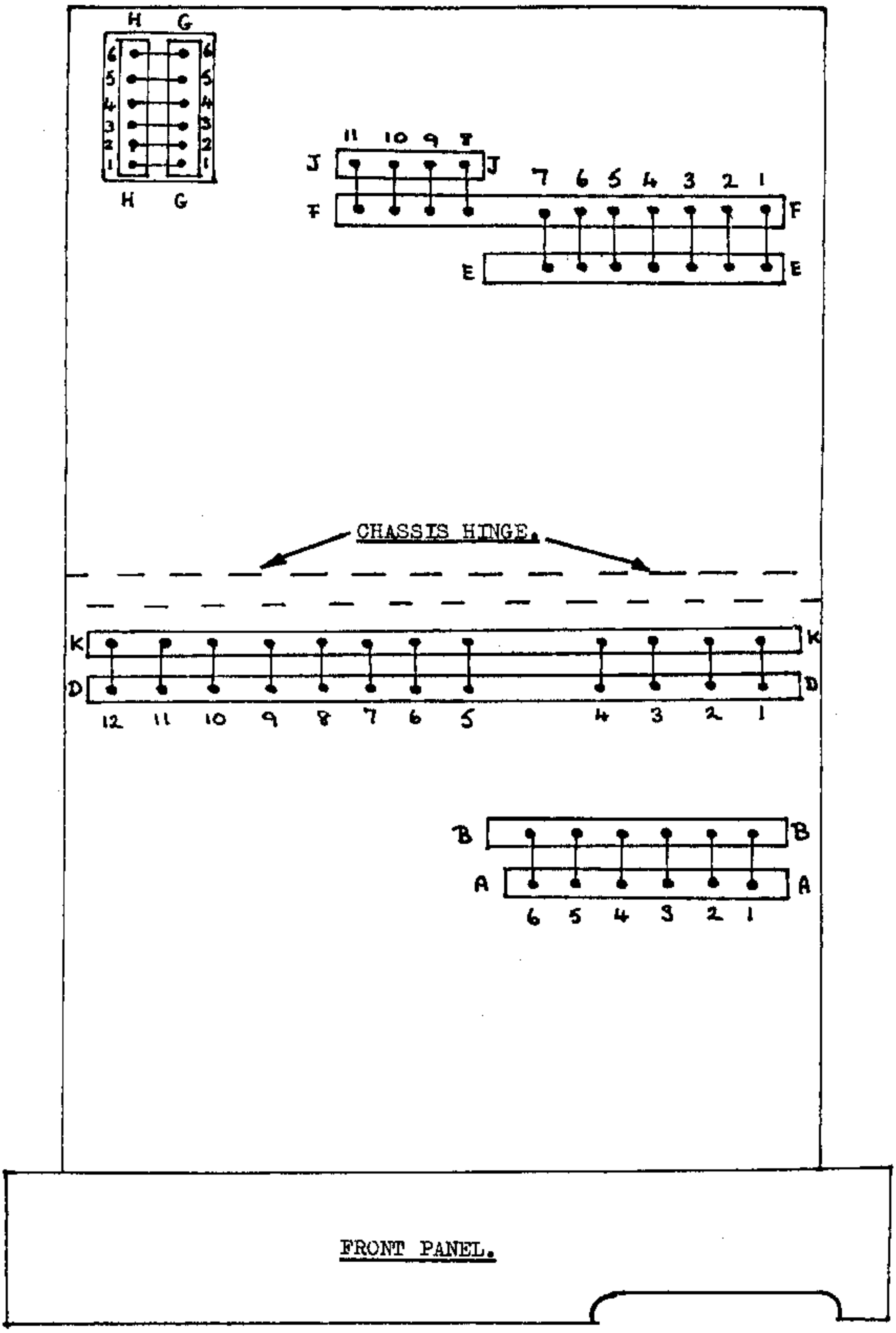


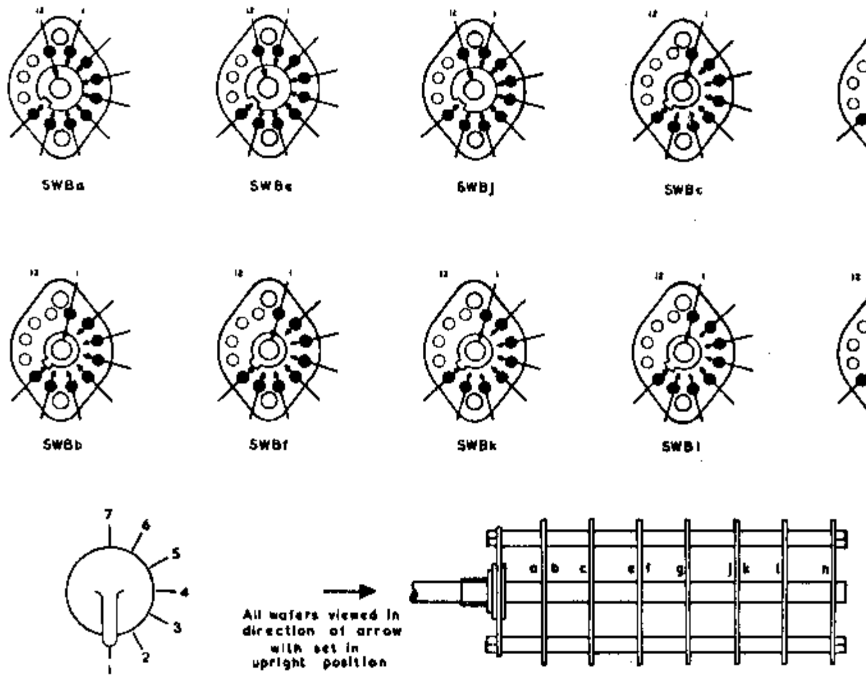
SUB UNIT No 5.

FIG 11.

FIG 12.

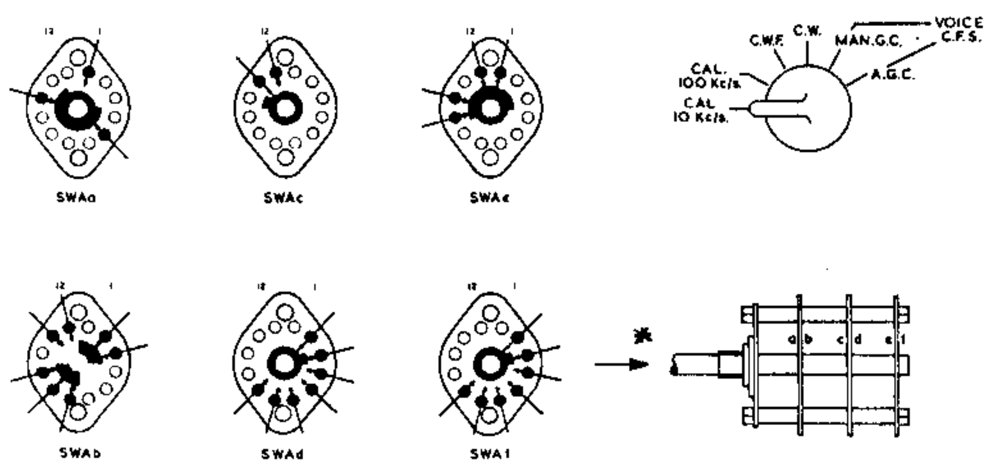
SUB UNIT No 5.





SWB
BAND SWITCH

FIG 13.



SWA
SYSTEM SWITCH

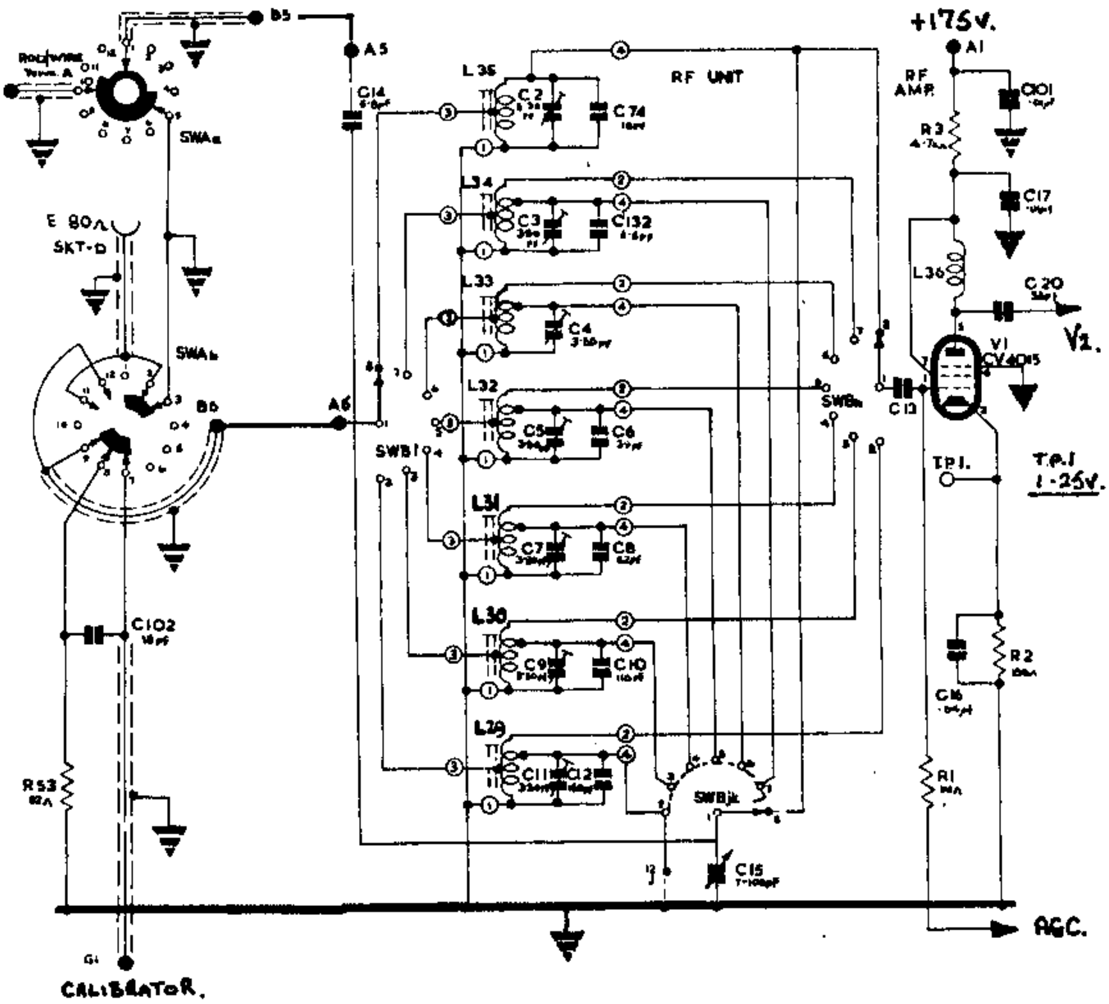
* AS FOR SWB.

FIG 14.

TECHNICAL DESCRIPTION.

RF Amplifier V1.

FIG 15.

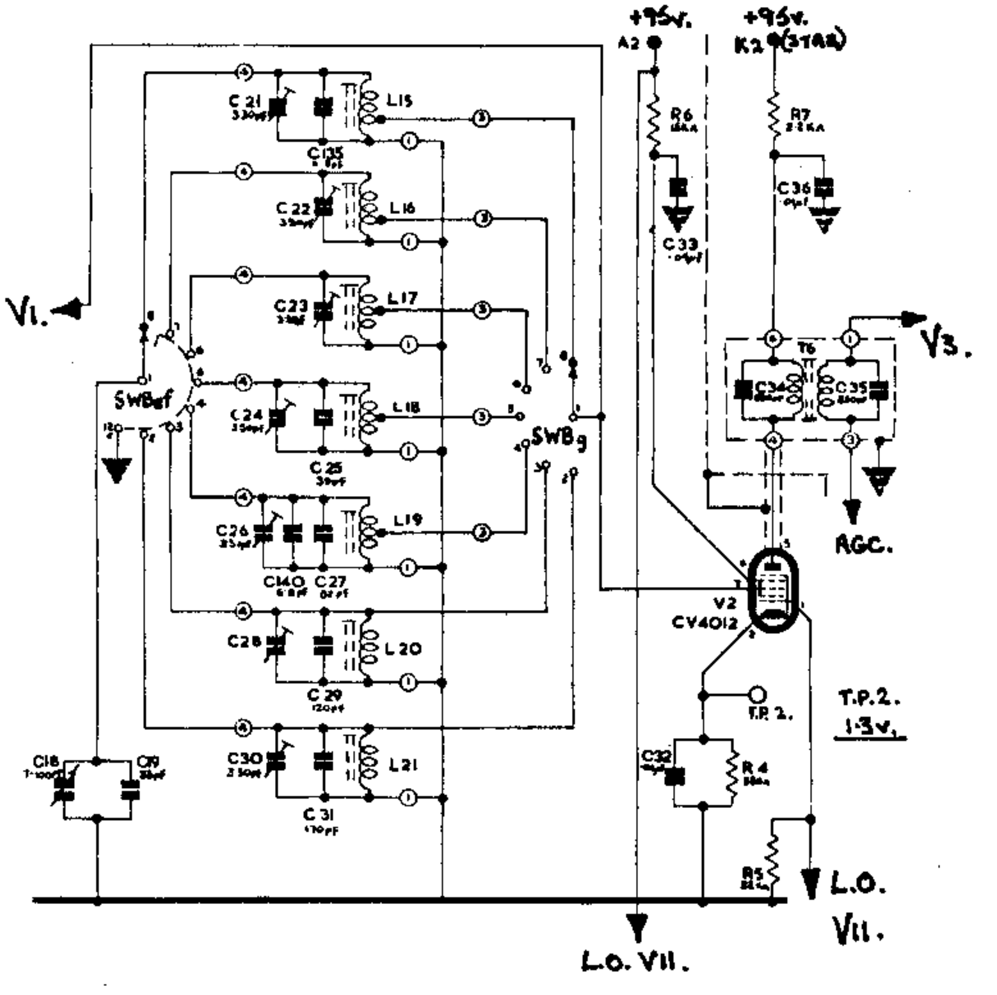


RF Amplifier V1

Provision is made for high and low impedance aerials, connected to terminal A for rod/wire and to coaxial socket SKTD for 80Ω feeders.
Both inputs are routed to the r.f. coils via contacts on SWA which cuts off aerial inputs on the two calibrate positions.
Signals from the low impedance feeder are fed from SWA through to contacts on BAND switch SWB to a low impedance tapping point on the appropriate aerial coil, whilst high impedance signals are fed directly via C14 to the fixed vanes of the first section (C15) of the gang tuning condenser and via further contacts on SWB to the aerial coil. All aerial coils not in use are shorted to earth by contacts on SWB (wafers j and k) to prevent unwanted absorption effects.
The grid circuit of V1 is connected to the appropriate aerial coil via contacts on SWB and in all cases except band 1 via a small auto winding, this assists in providing a good signal to noise ratio in the r.f. stage.
Parallel fed a.g.c. or manual bias is applied via R1 directly to the grid of V1, C13 provides a signal path to the grid and also acts as a blocking capacitor, thus allowing the gang section to be returned to earth.
The anode circuit is parallel tuned to avoid h.t. on the r.f. section of the gang, tuning coils, and switching. The anode load is L36 and r.f. decoupling is provided by C101, R3 and C17.

Mixer V2.

Fig 16.

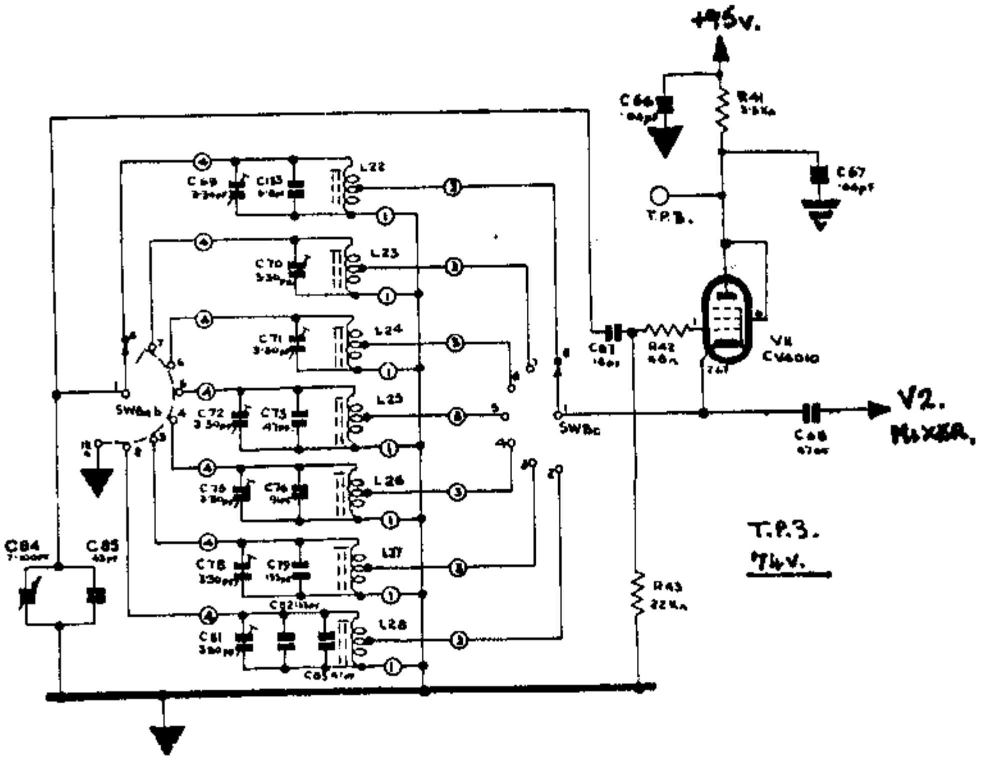


Mixer V2
Bands 1 to 5 have the grid connection tapped down to assist in maintaining constant overall gain on all bands. All coils not in use are shorted to earth by contacts on SWB (wafers e and f) this section also selects the operative coil in conjunction with SWBg. Tuning of this stage is carried out by the r.f. section of the gang C18 and the fixed shunt capacitor C19.

The mixer is a pentagrid working with a separate local oscillator V11. Input to the mixer signal grid is directly from the r.f. tuned circuits with injection from the oscillator cathode on grid 1 across the grid leak R5. Auto bias is obtained by R4 decoupled by C32.
Output at i.f. frequency (460c/s) is obtained from the anode circuit to which T6, the first i.f. transformer, is tuned. Anode r.f. decoupling is obtained by R7 and C36. R6 is the screen dropping resistor decoupled by C33. A test point is provided across V2 cathode circuit for checking purposes.

Local Oscillator V11.

FIG 17.

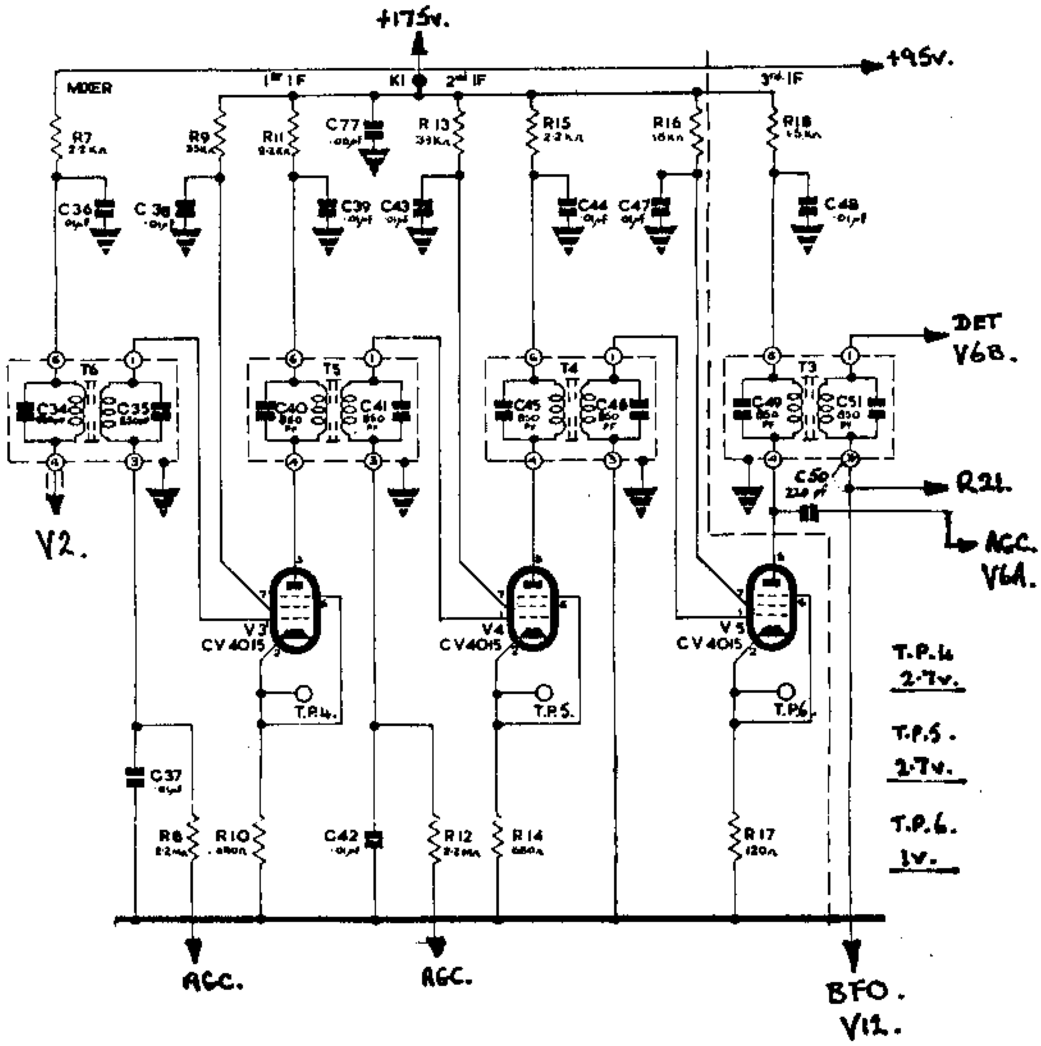


Local oscilator V11

The local oscillator is a triode connected r.f. pentode operating in an inverted Hartley circuit, self-biased by R43 and C87. R42 assists in maintaining level oscillator amplitude throughout the operating range. Frequency stability is maintained by using negative temperature co-efficient capacitors in positions C85 (N150), C133, C73, C76, C79, C82 and C83 (these are all N30) and by a stabilised H.T. supply. The oscillator tuning capacitor is the third gang section C84 in conjunction with the fixed capacitor C85. Two point tracking is used on all bands and the oscillator circuit operates 460 kc/s above the r.f. circuits. A test point is included in V11 anode circuit for use with an external meter.

IF Amplifiers V3 V4 V5.

FIG 18.

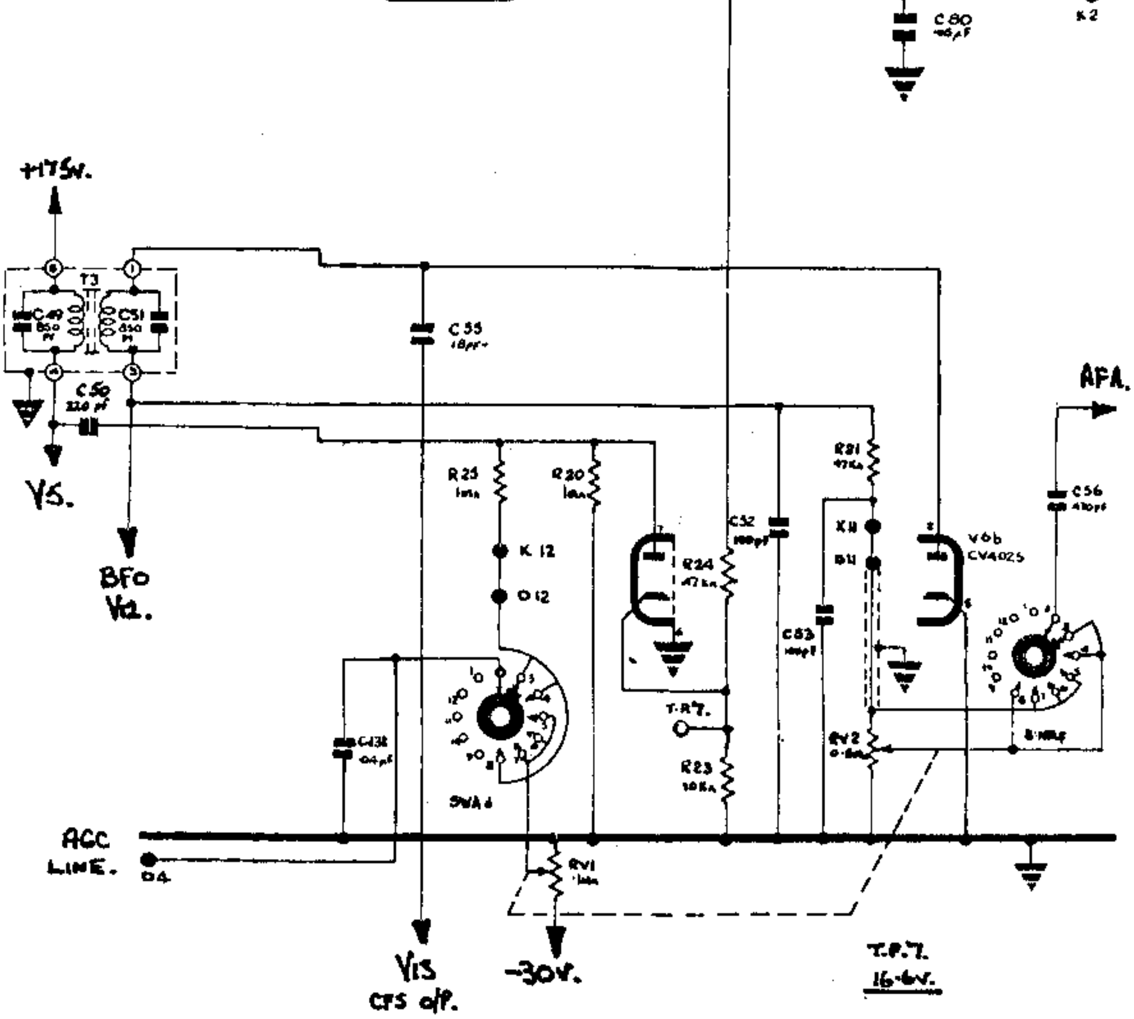


3-stage i.f. amplifier V3-V5

The first two stages of the i.f. amplifier are identical, the amplifier is conventional in design and series feed a.g.c. or manual gain control bias is applied to the first two stages. Slight changes in circuit values are used in the final stage to prevent overloading. Test points are provided across each cathode resistor to check correct operation and all cathodes are unbypassed to prevent excessive gain, and to improve stability.

Detector and A.G.C. diodes V6A and V6B.

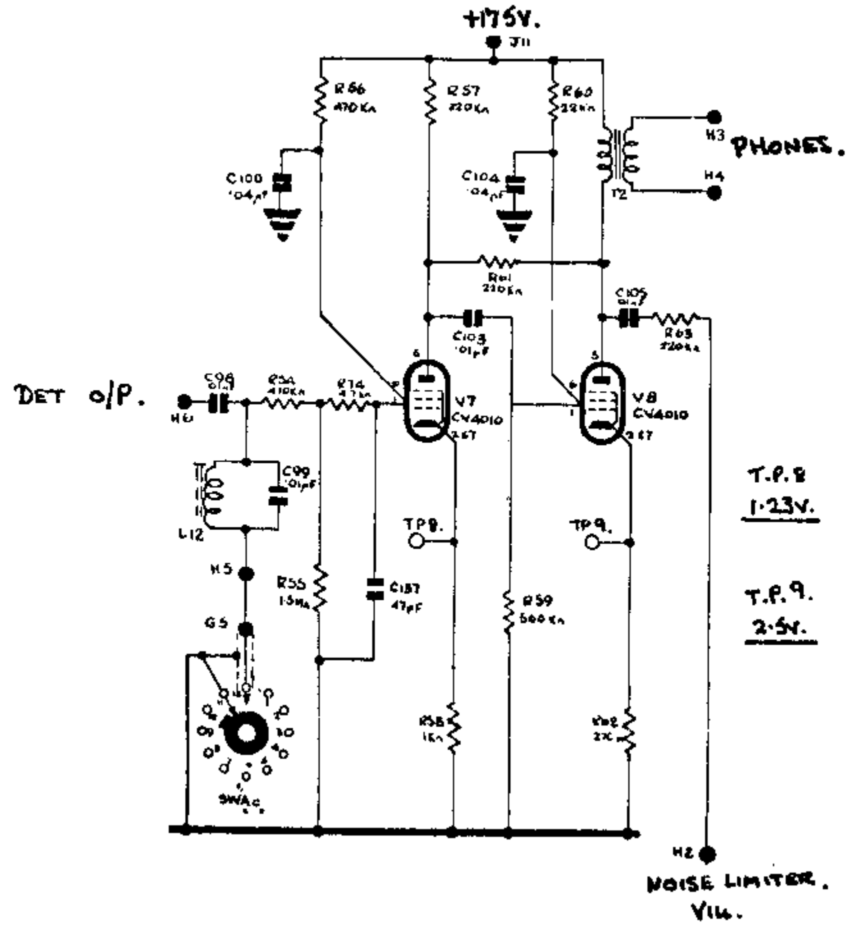
FIG 19.



Detector and a.g.c. diodes V6a and V6b
These stages consist of a double diode one half of which, V6a is used as the a.g.c. rectifier and V6b for detector. V6a diode anode receives the i.f. signal from V5 anode via the coupling capacitor C50, the diode load is R20, and the cathode is connected to the junction of R23, R24 which is a potential divider across the h.t. line, this provides approximately 17 volts delay in the a.g.c. network. The action of a.g.c. is controlled by contacts on SWAd which switches the developed a.g.c. voltage into the line on positions CAL 10kc/s, CAL 100kc/s and AGC. In the other three positions CWF, CW and MAN G.C. SWAd opens the a.g.c. line and substitutes the manual gain control RV1, this potentiometer is connected across the -30 volt bias line and the voltage tapped off by the slider is routed via SWAd to the grids of the stages normally controlled by a.g.c. The detector diode circuit is conventional in design, C52, R21 and C53 form an i.f. filter and RV2 forms the diode load and also the a.f. gain control when SWAf is in positions where a.g.c. is operative. In the other three positions of SWAf RV2 becomes the diode load only - the slider output being disconnected. A test point is provided in V6a cathode circuit, which enables a check to be made on the delay voltage.

AF Amplifiers V7 V8.

FIG 20.



1st a.f. stage V7

The first a.f. stage receives input to the grid via contacts on SWD and blocking capacitor C98 which is introduced to prevent V7 interacting with the noise limiter diode potentials. The grid circuit also includes the 1kc/s filter L12 tuned by C99, this is automatically switched into circuit by a contact on SWAc in position CWF, in all other positions the filter is out of circuit. The action of the filter, when in circuit, is to present a low impedance to frequencies above and below 1kc/s and to accentuate a narrow pass band around 1kc/s at which frequency it presents a high impedance between grid and earth. The grid is fed from the junction of R54 and R55 which form a potential divider across the signal path, R55 is also the grid leak. R74 and C137 together prevent parasitic effects. The anode load is R57 and bias is provided by R58 which is not decoupled and due to this provides an amount of current negative feedback. Voltage feedback from the anode of the final a.f. stage is also fed back to the anode of V7 via R61. A test point is provided across R58 to check correct operation of the stage.

Final a.f. stage V8

The final a.f. stage is r.c. coupled via C103 and R59 from the anode of V7. It is a r.f. pentode and provides approximately 150mW of a.f. Output is fed to low impedance phones via the output transformer T2, the output is fed to the front panel and terminates on pins L and K of the 12-way Mk 4 plug PLA.

Noise limiter V14.

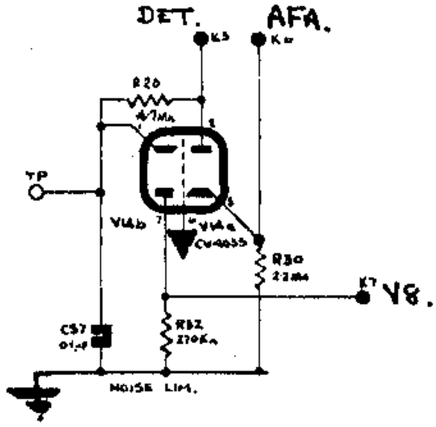


FIG 21.

Noise limiter V14

The noise limiter is the double diode V14a. V14b. Its operation is controlled by the front panel switch SWD, which in the OFF position switches V14a completely out of the signal path. When in circuit it is fed with modulation signals from the detector V6b, via contacts on SWAF and the coupling capacitor C56, this has a low value of 470pF to keep the l.f. gain of the audio stages down and so reduce hum effects. A.F. output from V8 is applied via C105 across the potential divider network R63 and R32. The voltage developed across R32 is applied to the diode anode V14b and C57 charges to a value approximately equal to the peak positive value of the signal at V14b anode. This voltage is fed to the anode of V14a via R26 thus rendering V14a conductive unless negative going pulses are received whose amplitude exceeds the voltage across C57, under these circumstances V14a becomes non-conducting and the noise pulses are suppressed. A dropping resistor R27 is wired in series with the heater of V14 to reduce hum level which would otherwise be introduced by the stage. Test points are provided at the cathode of V14a and V14b for checking correct operation.

IF Cathode follower V13.

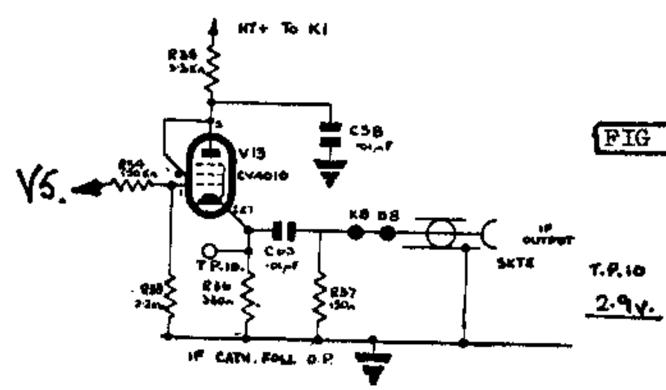
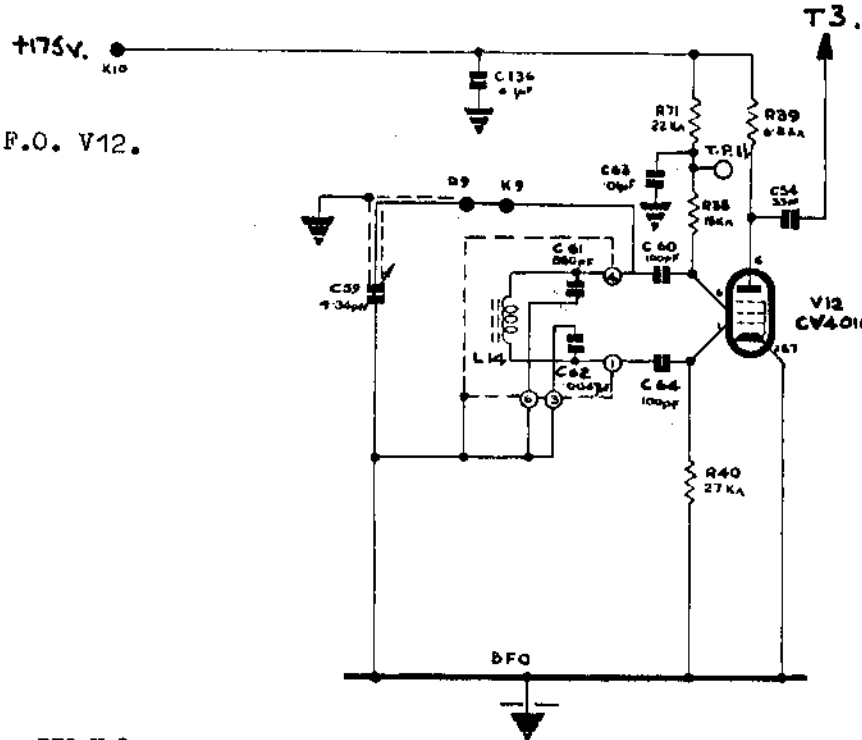


FIG 22.

I.F. cathode follower

This stage is provided primarily to fulfil the requirement for c.f.s. output via IF OUTPUT SKTE (80Ω coaxial line). Input to the stage, which is triode connected, is via the coupling capacitor C55, whilst the output is taken across the cathode load consisting of R36, C65 and R37. C65 is inserted in series with the signal path to prevent shorting the cathode load in instances where the signal is injected into a link coil.

B.F.O. V12.



T.P.11.
131V.

FIG 23.

BFO V12
The b.f.o. uses a Colpitts type oscillator circuit between the grid and screen. Frequency is controlled by the variable capacitor C59 giving a sweep of approximately ± 5kc/s. This is the front panel control B.F.O. Injection of b.f.o. signal into the demodulator is via C54 from the anode of the oscillator to the last i.f. secondary. Operation of the b.f.o. is controlled by the system switch SWA which stops the b.f.o. operating when receiving a.m. signals A 2.2MΩ resistor R72 is switched in series with the screen and anode supplies to render the stage inoperative and also prevent cathode poisoning.

Calibrators V9 V10.

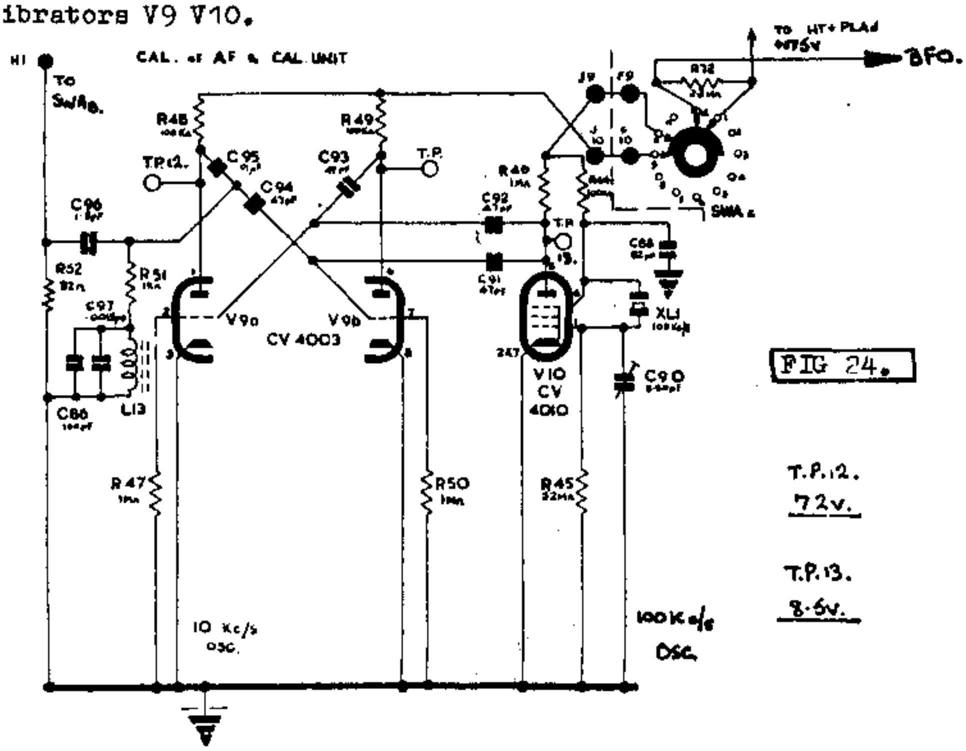


FIG 24.

T.P.12.
72v.

T.P.13.
8.6v.

Calibrator oscillators V10 and V9

The calibrator is two stage and consists of a crystal oscillator operating at 100kc/s and amultivibrator triggered from the 100kc/s source and dividing down to 10kc/s. With SWAe in position CAL 100kc/s the crystal oscillator only is in operation, the output signal is then fed via C91, C94 and via further contacts on SWA to the aerial circuits. A pre-set trimmer C90 is provided to accurately align the oscillator to 100kc/s. On position CAL 10kc/s the double triode multivibrator V9a, V9b is brought into operation in addition to the 100kc/s oscillator, the frequency of oscillation is held to 10kc/s by means of the tuned circuit L13 and C97 in the anode circuit of V9a. Test points are provided at the anodes of V9a, V9b and V10 for use with an external meter.

D.C. power unit

The built-in power unit supplies all the requirements of the receiver from a 24V battery, the power unit is used when the receiver is operating alone on d.c. and also when operating with the Sender C11 on d.c.

Supply is fed into the power unit across pins A and B of PLA. B is earthed and is the negative pole, whilst the positive side is fed via the three-way 2 pole toggle switch SWC. This switch provides an OFF position and two ON positions, one being ON with pilot lamp ILP1 on and the other with set ON and the pilot lamp off, this function is controlled by contacts b on SWC. The supply is then routed via the fuse FS1 through the r.f. filter L9 by-passed by C106 and smoothed by the high valuecapacitor C107 (500 μF), it is then fed into the hash box in which is contained the self-rectifying vibrator VB1 and various filter capacitors and ferrite bead filters, these components keep the hash generated by the vibrator contacts within the confines of the screened box. The ferrite beads are slipped over the leads in lieu of series h.f. chokes, they operate in a similar manner to chokes in that they develop a high impedance to r.f. at the point of insertion.

One set of contacts (VB1a) operate across the ends to earth of the centre tapped primary of the vibrator/power transformer T1 whilst the other pair of contacts (VB1b) switch alternately across the centre tapped h.t. secondary winding, thus providing undirectional d.c. pulses from the centre tap, this output is smoothed by the reservoir capacitor C127 in conjunction with L11 and C128, C129 is an r.f. filter capacitor. The smoothed supplies are fed out to pin C of PLA and thence to pin D and the main h.t. line.

The slave relay RLA is brought into circuit when the R210 is receiving its d.c. input from the C11 sender. Under these conditions the operating coil of the relay (RLA/4) is coupled to the C11 voltage control circuit via pin J of PLA. Under high input voltage conditions RLA/4 is not energised and the tapping points across T1 primary are switched on shown in Fig 25. If, however, the input of the C11 drops below 23.5V, RLA/4 is operated by the voltage control relay in the C11 and contacts RLA2 and 3 close and contacts RLA1 and 4 open, thus altering the primary/secondary ratio of T1 sufficiently to maintain correct secondary voltages. R67, R68 form a surge arrestor network as contacts RLA2 and 3 make before RLA1 and 4 break. R31 and C116 form a buffer network to prevent arcing at the vibrator contacts. When the R210 is used with its own d.c. supplies, the operating coil of RLA/4 is energised and contacts RLA2/RLA3 are permanently made. Heater supplies are 6.3V a.c. (developed by the vibrator) and are fed from a secondary winding on T1 to the heaters via a link between pins E and F on PLA, smoothing and filtering is carried out by C120 and C121. When heater supplies come from the C11 this link is disconnected and 6.3V a.c. is fed in at pin F. The same applies when the R210 is used with its own a.c. PSU. The 30 volt bias supply also originates from a secondary winding on T1, rectified by the half wave fectifier MR1 and smoothed by the network R69, R79, C117, C118 and C119. The output is applied across the r.f. gain control RV1. When the R210 receives its supplies from the C11, or its own a.c. PSU, the bias supply is fed in at pin H of PLA, across the existing circuit. The voltage stabiliser V15 is in use under all conditions, it provides a stable 90V h.t. line for the oscillator and mixer.

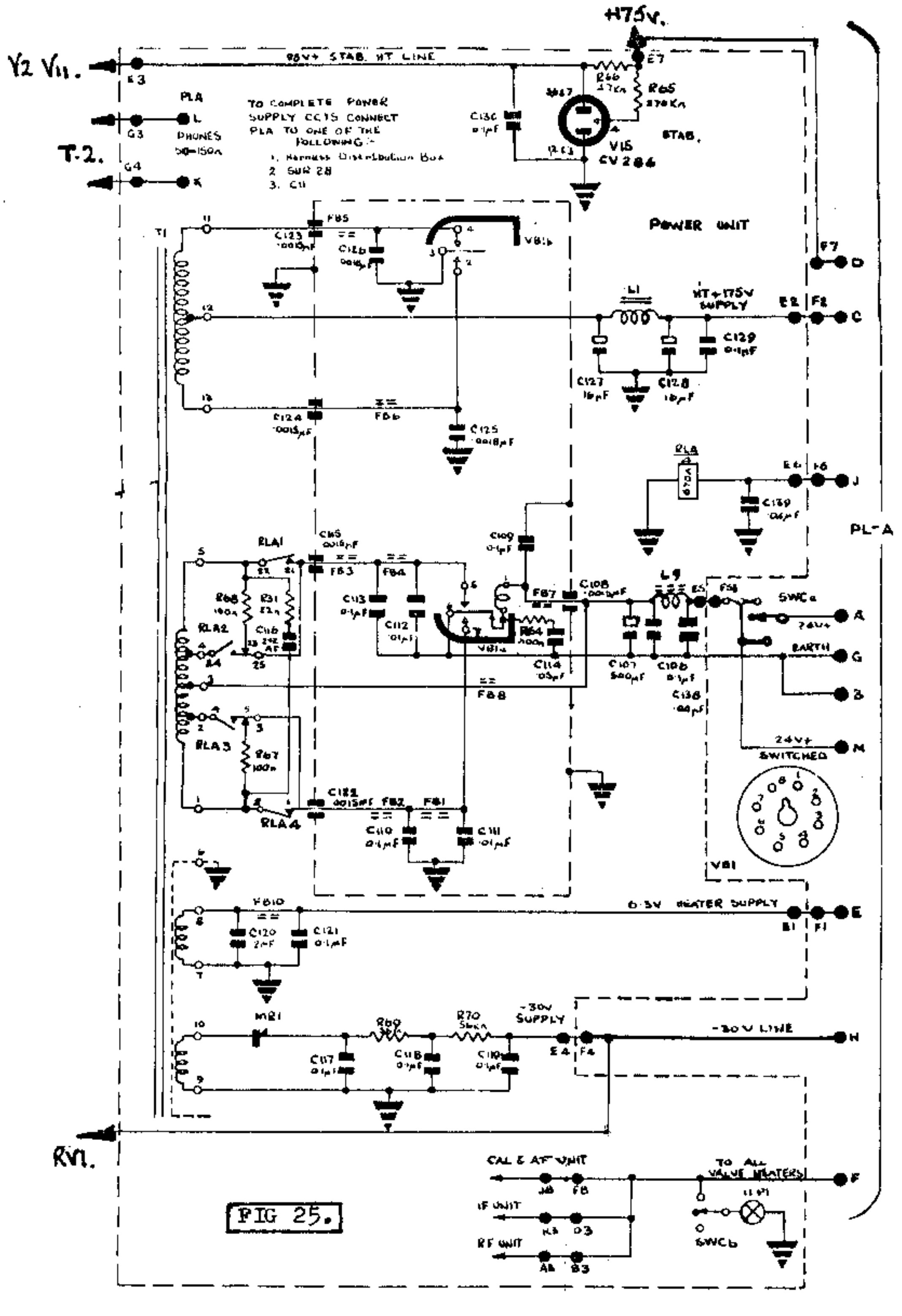

+175V.
Y2 V11.
95V+ STAB. HT LINE
E3
E7
R66 47Kn
R65 270Kn
C130 0·1µF
V15 CV286
STAB.
PLA
L
PHONES 50-150n
G3
T.2.
G4
K
TO COMPLETE POWER SUPPLY CCTS CONNECT PLA TO ONE OF THE FOLLOWING:-
1. Harness Distribution Box
2. SUR 28
3. C11
POWER UNIT
T1
FB5
C123 ·0015µF
C126 ·0018µF
VB1b
L1
HT+175V SUPPLY
E2
F2
F7
D
C
C129 0·1µF
C127 16µF
C128 16µF
C124 ·0015µF
FB6
C125 ·0018µF
RLA
E6
F6
J
C139 ·06µF
PL-A
RLA1
C115 ·0015µF
FB3
FB4
C113 0·1µF
C112 ·01µF
C109 0·1µF
FB7
C108 ·0015µF
L2
E5
F5
SWCa
A
24V+
EARTH
G
B
R68 100n
R31 22n
C116
RLA2
R64 100n
VB1a
C114 ·05µF
C107 500µF
C106 0·1µF
C138 ·06µF
FB8
RLA3
R67 100n
24V+ SWITCHED
M
C122 ·0015µF
FB2
FB1
RLA4
C110 0·1µF
C111 ·01µF
VB1
FB10
C120 2µF
C121 0·1µF
6·3V HEATER SUPPLY
E1
F1
E
MR1
R69
R70 5Kn
-30V SUPPLY
C117 0·1µF
C118 0·1µF
C119 0·1µF
E4
F4
-30V LINE
H
RV1.
CAL & AF UNIT
J8
F8
IF UNIT
K3
D3
RF UNIT
A6
B3
TO ALL VALVE HEATERS
F
SWCb

FIG 25.

Calibrator oscillators V10 and V9
The calibrator is two stage and consists of a crystal oscillator operating at 100kc/s and amultivibrator triggered from the 100kc/s source and dividing down to 10kc/s. With SWAe in position CAL 100kc/s the crystal oscillator only is in operation, the output signal is then fed via C91, C94 and via further contacts on SWA to the aerial circuits. A pre-set trimmer C90 is provided to accurately align the oscillator to 100kc/s. On position CAL 10kc/s the double triode multivibrator V9a, V9b is brought into operation in addition to the 100kc/s oscillator, the frequency of oscillation is held to 10kc/s by means of the tuned circuit L13 and C97 in the anode circuit of V9a. Test points are provided at the anodes of V9a, V9b and V10 for use with an external meter.

D.C. power unit

The built-in power unit supplies all the requirements of the receiver from a 24V battery, the power unit is used when the receiver is operating alone on d.c. and also when operating with the Sender C11 on d.c.

Supply is fed into the power unit across pins A and B of PLA. B is earthed and is the negative pole, whilst the positive side is fed via the three-way 2 pole toggle switch SWC. This switch provides an OFF position and two ON positions, one being ON with pilot lamp ILP1 on and the other with set ON and the pilot lamp off, this function is controlled by contacts b on SWC. The supply is then routed via the fuse FS1 through the r.f. filter L9 by-passed by C106 and smoothed by the high valuecapacitor C107 (500 μF), it is then fed into the hash box in which is contained the self-rectifying vibrator VB1 and various filter capacitors and ferrite bead filters, these components keep the hash generated by the vibrator contacts within the confines of the screened box. The ferrite beads are slipped over the leads in lieu of series h.f. chokes, they operate in a similar manner to chokes in that they develop a high impedance to r.f. at the point of insertion.

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The slave relay RLA is brought into circuit when the R210 is receiving its d.c. input from the C11 sender. Under these conditions the operating coil of the relay (RLA/4) is coupled to the C11 voltage control circuit via pin J of PLA. Under high input voltage conditions RLA/4 is not energised and the tapping points across T1 primary are switched on shown in Fig 15. If, however, the input of the C11 drops below 23.5V, RLA/4 is operated by the voltage control relay in the C11 and contacts RLA2 and 3 close and contacts RLA1 and 4 open, thus altering the primary/secondary ratio of T1 sufficiently to maintain correct secondary voltages. R67, R68 form a surge arrestor network as contacts RLA2 and 3 make before RLA1 and 4 break. R31 and C116 form a buffer network to prevent arcing at the vibrator contacts. When the R210 is used with its own d.c. supplies, the operating coil of RLA/4 is energised and contacts RLA2/RLA3 are permanently made. Heater supplies are 6.3V a.c. (developed by the vibrator) and are fed from a secondary winding on T1 to the heaters via a link between pins E and F on PLA, smoothing and filtering is carried out by C120 and C121. When heater supplies come from the C11 this link is disconnected and 6.3V a.c. is fed in at pin F. The same applies when the R210 is used with its own a.c. PSU. The 30 volt bias supply also originates from a secondary winding on T1, rectified by the half wave fectifier MR1 and smoothed by the network R69, R79, C117, C118 and C119. The output is applied across the r.f. gain control RV1. When the R210 receives its supplies from the C11, or its own a.c. PSU, the bias supply is fed in at pin H of PLA, across the existing circuit. The voltage stabiliser V15 is in use under all conditions, it provides a stable 90V h.t. line for the oscillator and mixer.