CHAPTER 2

RECEIVERS, Types R.1155, R.1155A, B, C, D, E, F, L, M, and N

INTRODUCTION

1. The receivers of the R.1155 class have been designed primarily for use in aircraft, in conjunction with transmitters of the T.1154 class described in Chapter 1 of this publication. A separate publication (A.P.2548B) deals with the installation of the receivers R.1155L and R.1155N in Air-sea rescue launches. The parent type is the receiver R.1155, and later developments are indicated by the use of a suffix letter. The main points of difference are shown in the following table:—

Receiver type	*Type of case*	*Remarks*	*Frequency coverage*
R.1155	Aluminium	—	18·5 Mc/s to 3 Mc/s 1,500 kc/s to 600 kc/s 500 kc/s to 75 kc/s
R.1155D	Steel		
R.1155A	Aluminium	Filters fitted to prevent interference from M.F. transmitters (R.1155M is for use only at ground schools)	
R.1155E	Steel		
R.1155M	Aluminium		
R.1155B	Aluminium	As A or E, but H.F chokes added to prevent interference from radar transmitters	
R.1155F	Steel		
R.1155C	Aluminium	As A, but modified for H.F. D.F. Obsolete	
R.1155L	Aluminium	As B or F, but frequency ranges altered	18·5 Mc/s to 600 kc/s 500 kc/s to 200 kc/s
R.1155N	Steel		

Facilities

2. Provision is made for the reception of signals over a wide frequency band which is covered in five ranges. These ranges are as follows:—

Range No.	*Receivers R.1155 and R.1155A, B, C, D, E, F, M*	*Receivers R.1155L and R.1155N*
1 (H.F.)	18·5 Mc/s to 7·5 Mc/s	18·5 Mc/s to 7·5 Mc/s
2 (H.F.)	7·5 Mc/s to 3·0 Mc/s	7·5 Mc/s to 3·0 Mc/s
2A (H.F.)	not applicable	3·0 Mc/s to 1·5 Mc/s
3 (M.F.)	1,500 kc/s to 600 kc/s	1,500 kc/s to 600 kc/s
4 (M.F.)	500 kc/s to 200 kc/s	500 kc/s to 200 kc/s
5 (M.F.)	200 kc/s to 75 kc/s	not applicable

Modulated and unmodulated signals can be received on all ranges. Direction finding and homing on certain ranges (mentioned in para. 36) may be carried out by aural or visual means.

Power supplies

3. Detailed descriptions of the airborne power units are given in A.P.1186D, Vol. I, Sect. 8, and the ground power units are described in A.P.1186E, Vol. I, Sect. 6. When airborne, the power supplies are provided by a rotary transformer power unit driven from the aircraft electrical system. This power unit is also the L.T. supply for the associated transmitter of the T.1154 class. Switching on and off the receiver power supplies of a T.1154/R.1155 installation is normally effected by the *transmitter* master switch. The several types of power unit available for inputs of 12 volts and 24 volts are listed in para. 88 of this chapter.

4. For ground installations, a power unit type 114 may be used. This operates directly from 230-volt 50 c/s mains. Alternatively, a power unit type 115 may be used to provide, from 230-volt 50 c/s mains, the input for the power unit type 34, or 34A. On mobile installations, e.g., W.T. portable stations and radio vehicles, the L.T. supply is usually from accumulators and the H.T. supply from a power unit type 380.

Aerials

5. The receivers may be worked on either fixed or trailing aerials for communications; a fixed aerial, is normally used for the H.F. ranges, and a trailing aerial for the M.F. ranges. A suitable loop aerial, such as type 3, is required for direction finding purposes. Aerial switching is interlocked with that of the associated transmitter by a separate switching device, normally the aerial switching unit, type J. In some installations an aerial plug board may be used instead of the type J switch.

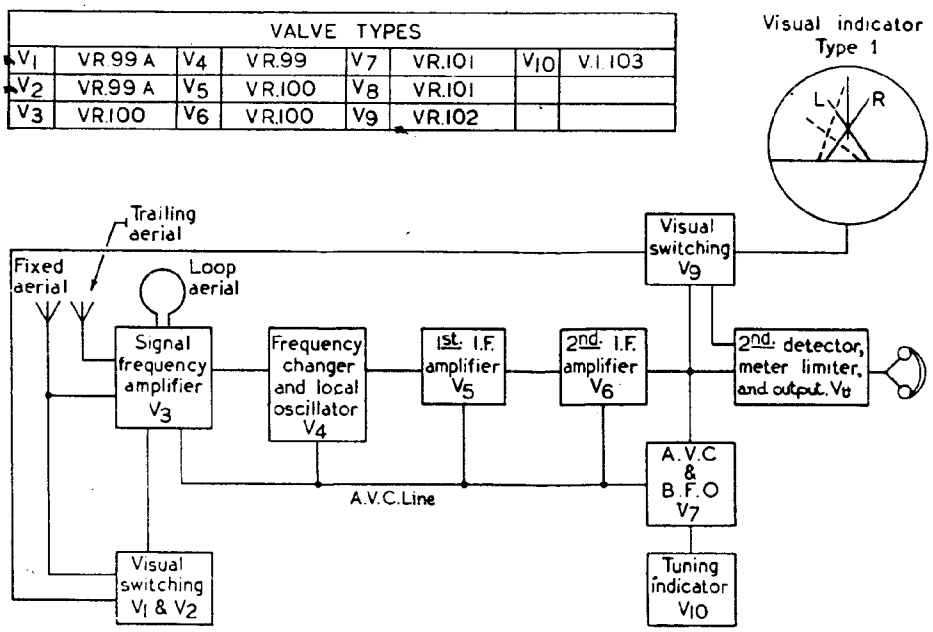


FIG. 2.—SCHEMATIC DIAGRAM

GENERAL DESCRIPTION

6. A ten-valve super-heterodyne circuit is employed, a schematic diagram of which is shown in fig. 2. The communications circuit comprises the valves V_3, V_4, V_5, V_6, V_7, V_8, and V_{10}. For direction finding the valves V_1, V_2, and V_9 are brought into use. The triode-hexode valves V_1 and V_2 electronically switch the input from the H.F. aerial into phase and antiphase relationship with the loop aerial at a predetermined frequency. Valve V_9 switches the rectified output to a visual indicator, type 1, in synchronism with the aerial switching. The input to the visual indicator is limited by one of the diode portions of the double-diode-triode valve V_8. More detailed information is given in paras. 7 to 53, which should be read in conjunction with figs. 3 to 14.

Note.—Paras. 10 to 29 deal with the basic communications circuit of the R.1155 and R.1155D (fig. 3). Variations in the communications circuits of later types are dealt with in paras. 30 to 35. In later sections of the chapter variations in different types are dealt with as they arise.

Frequency range switch

7. This switch is designated FS on the circuit diagrams and illustrations in this chapter. It is an Oak-pattern switch with four wafers, each having front and rear contacts. In the diagrams the individual wafers are annotated "w", "x", "y", and "z", with "f" or "r" added to indicate respectively the "front" or "rear" section of the wafer. Thus FS_{xf} indicates the front section of wafer "x" of the frequency range switch. The functions of this switch are to select the appropriate aerial for the range in use, to select the correct coils for the grid and anode circuits of the R.F. amplifier valve V_3 and the R.F. oscillator portion of the triode-hexode valve V_4, and to regulate the grid bias on the H.F. ranges to preserve constant amplification. The individual wafers involved are "w" (loop aerial input and grid bias adjustment), "x" (aerial and grid coils of valve V_3), "y" (anode coils of valve V_3 and grid coils of hexode portion of valve V_4) and "z" (grid and anode coils of triode portion of valve V_4).

Master switch

8. This switch is designated MS on the circuit diagrams and illustrations, and the wafer sections are denoted by subscripts used in the same manner as already described for the frequency range switch. There are five wafers, "a" (visual indicator, and manual and automatic volume control switching), "b" (fixed and trailing aerial circuits, and D.F. biasing), "c" (D.F. switching valves), "d" (communications aerial input) and "e" (loop aerial).

9. The five positions of the master switch provide the following facilities:—

(i) ⦿ ("OMNI") .Normal reception for communications purposes. The gain of the R.F. amplifier, frequency-changer and I.F. stages is manually controlled by a potentiometer $R_{8(1)}$. The A.V.C. circuit is inoperative.

(ii) A.V.C. The automatic volume control operates on the R.F. amplifier, frequency-changer and I.F stages. Manual volume control is by the potentiometer $R_{8(2)}$ which controls the audio input to the output stage.

(iii) BALANCE. This position is used when balancing the two needles of the visual indicator used for D.F. purposes to allow for slight differences in the constants of the switching valves and associated circuits.

(iv) VISUAL. The visual indicator circuits, including valves V_1, V_2, and V_9 are switched into circuit. A.V.C. is provided.

(v) ∞ ("FIGURE-OF-EIGHT"). In this position bearings may be taken aurally, using the switch S_3 for the determination of sense. A.V.C. is disconnected.

COMMUNICATIONS CIRCUITS, R.1155 and R.1155D

Aerial connections

10. The fixed aerial is connected to pin 1 of the 8-pin plug P_1, and the trailing aerial to pin 2 of the same plug. The fixed resistors R_{62} and R_{63} are connected across the aerials and earthed at their junction to provide leaks to prevent static charges accumulating on the aerials.

R.F. amplifier stage

11. The communications circuit commences at the R.F. amplifier stage, the basis of which is a variable-mu H.F. pentode valve V_3. For ranges 1 and 2 the fixed aerial is connected through the condenser C_{102} and coil L_2 or L_3 to the control grid of V_3. Similarly, the trailing aerial is connected through condenser C_{100} and coil L_4, L_5, or L_6 on ranges 3, 4, and 5. Switch sections MS_{bf}, MS_{df}, FS_{xf} and FS_{xr} perform the necessary switching. On all ranges the coils are tuned by a variable condenser C_{84}, which is ganged with condensers C_{83} and C_{82}, for ease of operation. Each grid coil has a pre-set trimmer condenser. These condensers are numbered C_{57} to C_{61}, and in addition C_{110} is used on range 1 (coil L_2) and in certain circumstances C_{104} is fitted on range 5 (coil L_6).

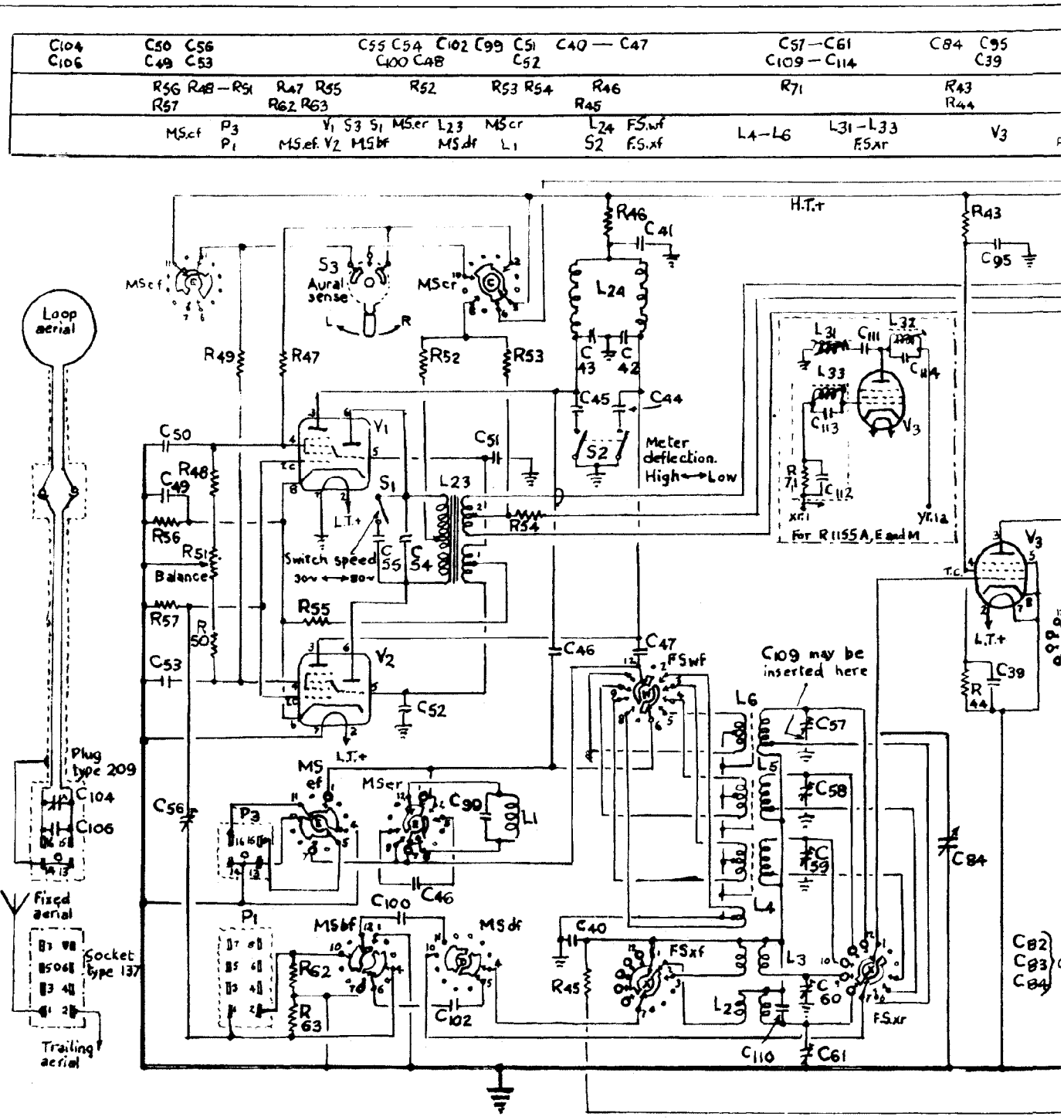
12. The variable-mu characteristic of the valve V_3 enables the gain to be controlled by varying the grid bias. In certain positions of the master switch this is done manually, and in others automatic volume control is provided. The screen voltage of V_3 is obtained from a potential divider comprising the resistors R_{43}, R_{44}, and R_1. Associated with these are the by-pass condensers C_{95}, C_{39}, and C_1. Bias for the control grid of the valve V_3 is provided by a resistance network in the A.V.C. circuit. By returning this network to the junction of R_3 and R_4, which are across R_1, a standing negative bias of 3·6 volts is provided during no-signal periods.

Frequency-changer stage

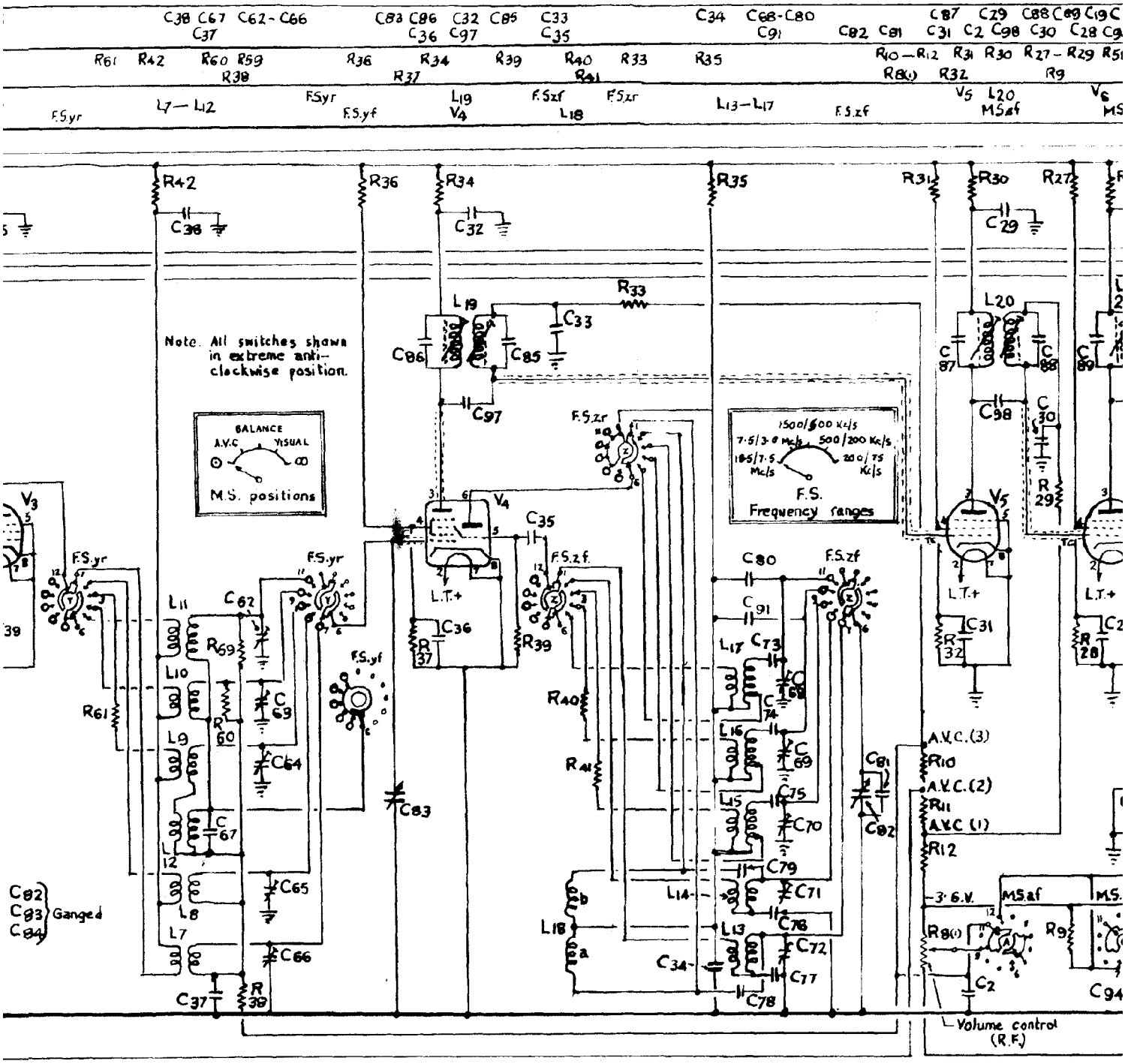
Hexode section

13. The triode-hexode valve V_4 operates as a frequency-changer. The output of the R.F. amplifier stage is inductively coupled to the signal grid of the hexode portion by one of the R.F. transformers L_7, L_8, L_9, L_{10} or L_{11}. Selection of the appropriate circuit for each range is made by the switch sections FS_{yf} and FS_{yr}. On all ranges the tuning of the grid circuit is effected by the variable condenser C_{83}. The secondary of each R.F. transformer is trimmed by one of the pre-set condensers C_{62} to C_{66}. A coil L_{12} and condenser C_{67} form a filter tuned to the I.F. of 560 kc/s. This filter is included in the circuit on ranges 3, 4, and 5, to eliminate possible instability due to feedback at the I.F.

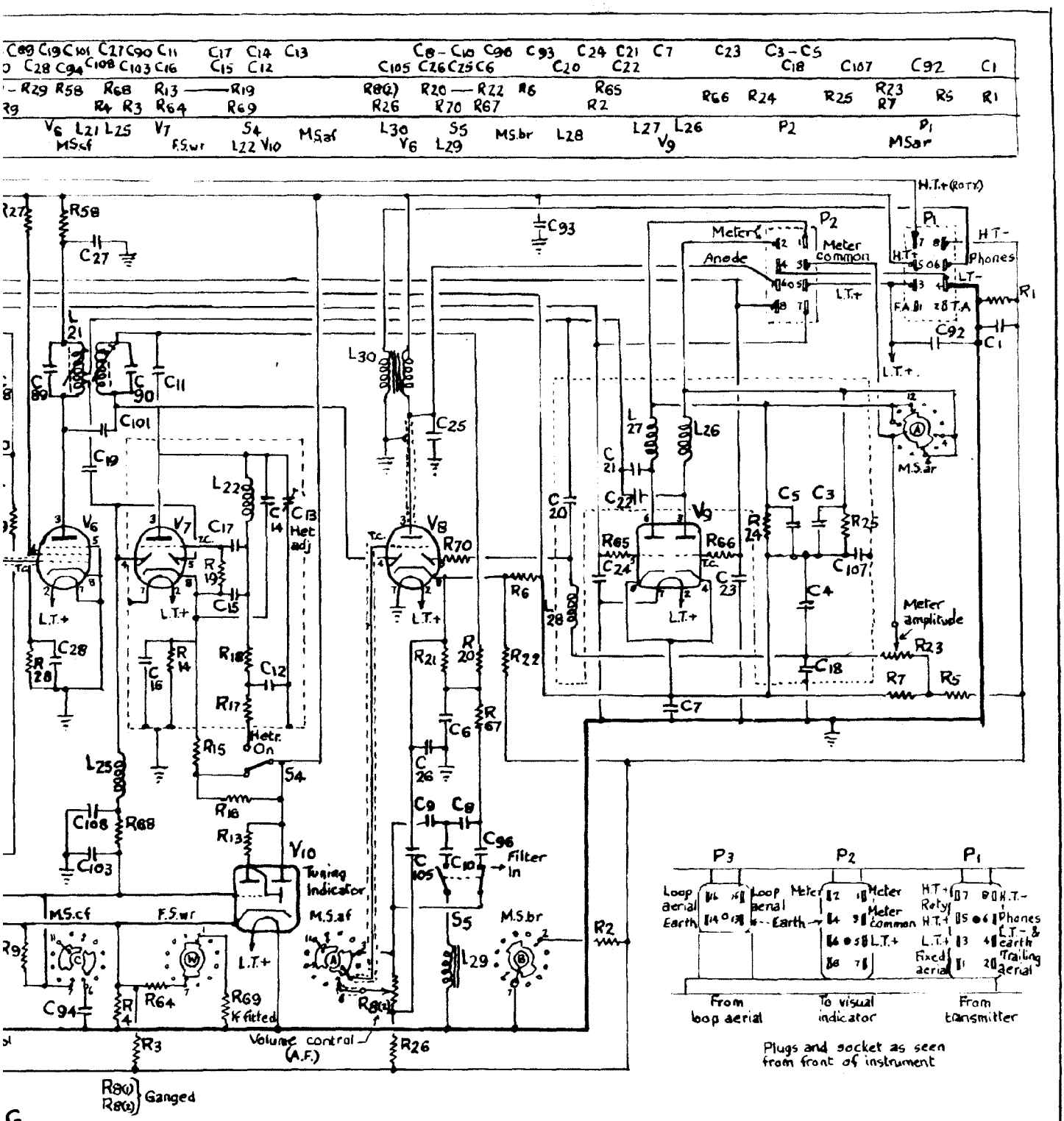
14. The incoming signal frequency is admitted at the signal grid G_1 of the hexode portion. The screen grids G_2 and G_4 are connected and form a screening electrode for the injector grid which is internally joined to the grid of the triode portion. This triode functions as an R.F. oscillator at a frequency greater than the signal frequency by 560 kc/s. The signal and oscillator frequencies are



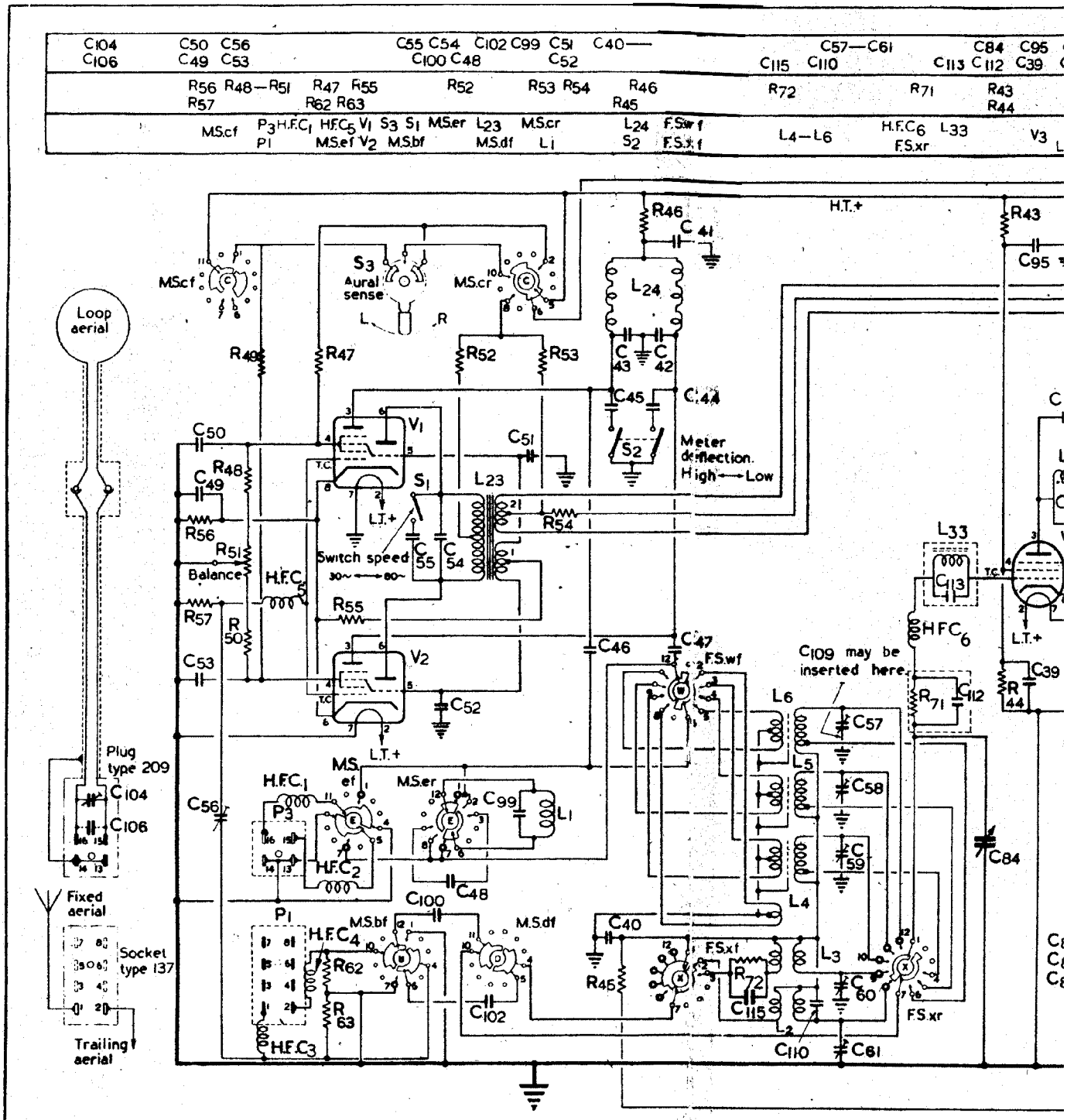
Note. Switch contacts shown thus O, denote front (f) a rear (r) contacts connected.
Important. In order to avoid excessive crossing of connecting wires certain switch wafers have been duplicated.



R.1155 AND R.1155D CIRCUIT DIAGRAM INCLUDING R.1155A, R.1155E, AND R.1155M MODIFICATIONS

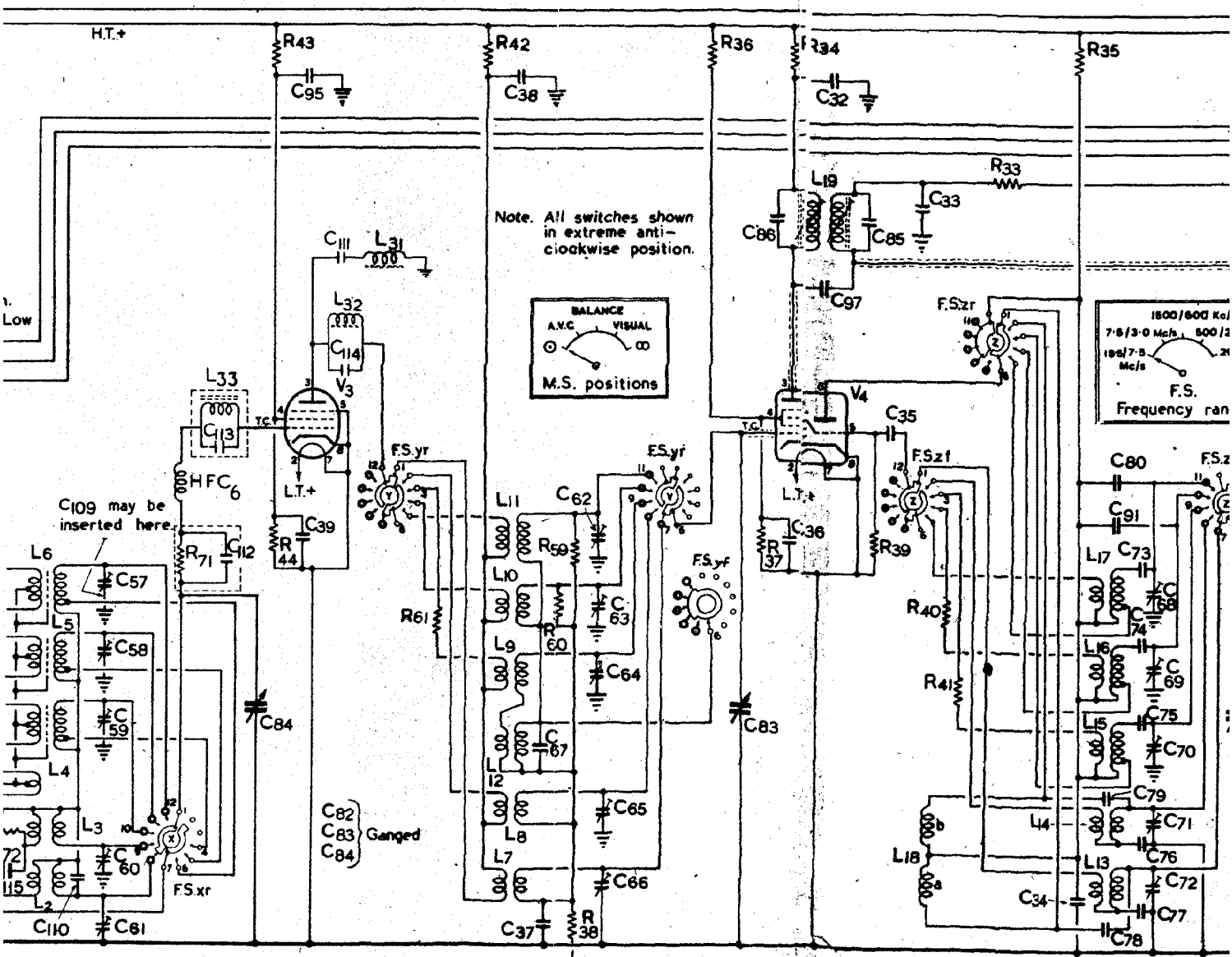

C89 C19 C101 C27 C90 C11 C17 C14 C13 C8-C10 C96 C93 C24 C21 C7 C23 C3-C5
C28 C94 C108 C103 C16 C15 C12 C105 C26 C25 C6 C20 C22 C18 C107 C92 C1
R29 R58 R68 R13 R19 R80 R20 R22 R6 R65
R9 R4 R3 R64 R69 R26 R70 R67 R2 R66 R24 R25 R23 R5 R1
V6 L21 L25 V7 S4 MS.af L30 S5 MS.br L28 L27 L26 P2 P1
MS.cf F.S.wr L22 V10 V6 L29 V9 MS.ar
H.T.+(Rotry)
Meter
P2
Meter common
Anode
P1
H.T.-
Phones
L.T.+
L.T.-
F.A.
T.A.
R1
C92
C1
M.S.ar
L30
C25
L27
L26
C21
C22
C20
V9
V8
V6
V7
C17
C13 Het adj
C14
L22
C19
C101
C11
C90
C89
R58
C27
R70
R65
R66
C24
C23
C5
C3
R25
C107
C4
R24
R6
R22
R21
R20
C6
R67
C26
C9
C8
C96
Filter In
C10
C105
S5
L29
M.S.br
Meter amplitude
R23
C18
R7
R5
C7
L.T.+
C28
R28
C16
R14
R18
C12
R17
R15
Metr. On
S4
L25
C108
R68
R16
R13
V10
Tuning Indicator
C103
M.S.cf
F.S.wr
M.S.af
R9
C94
R4
R64
R69
If fitted
R8(a)
R2
R3
Volume control (A.F.)
R26
R8(b)
Ganged
P3
P2
P1
Loop aerial
Earth
Loop aerial
Earth
Meter
Meter
Meter common
L.T.+
H.T.+ Retyl
H.T.+
L.T.+
Fixed aerial
H.T.-
Phones
L.T.- & earth
Trailing aerial
From loop aerial
To visual indicator
From transmitter
Plugs and socket as seen from front of instrument

G



Note. Switch contacts shown thus o, denote front (f) & rear (r) contacts connected.
Important. In order to avoid excessive crossing of connecting wires certain switch wafers have been duplicated.

FIG. 3A



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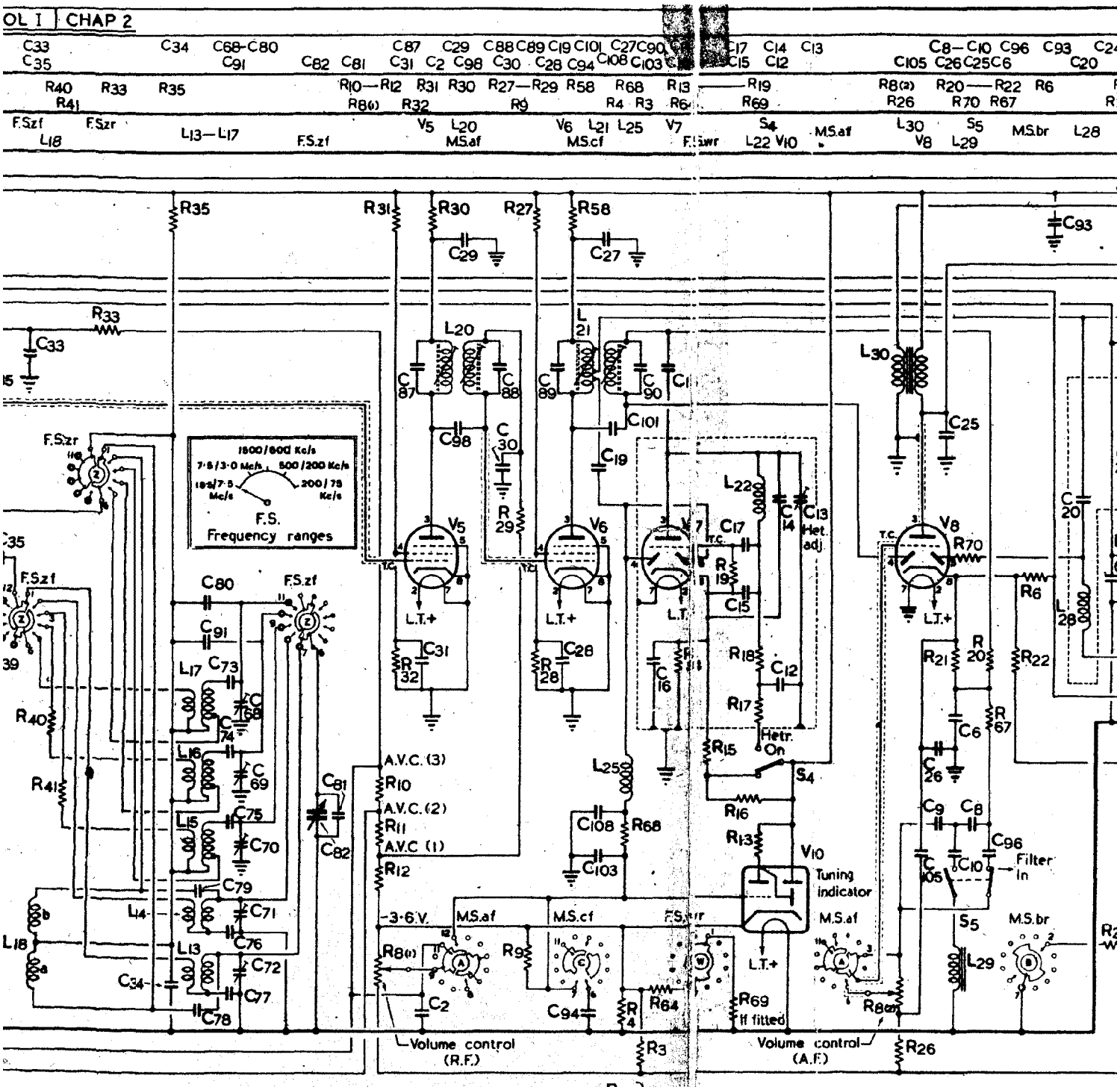
R.1155B AND R.1155F CIRCUIT DIAG



155F CIRCUIT DIAGRAM

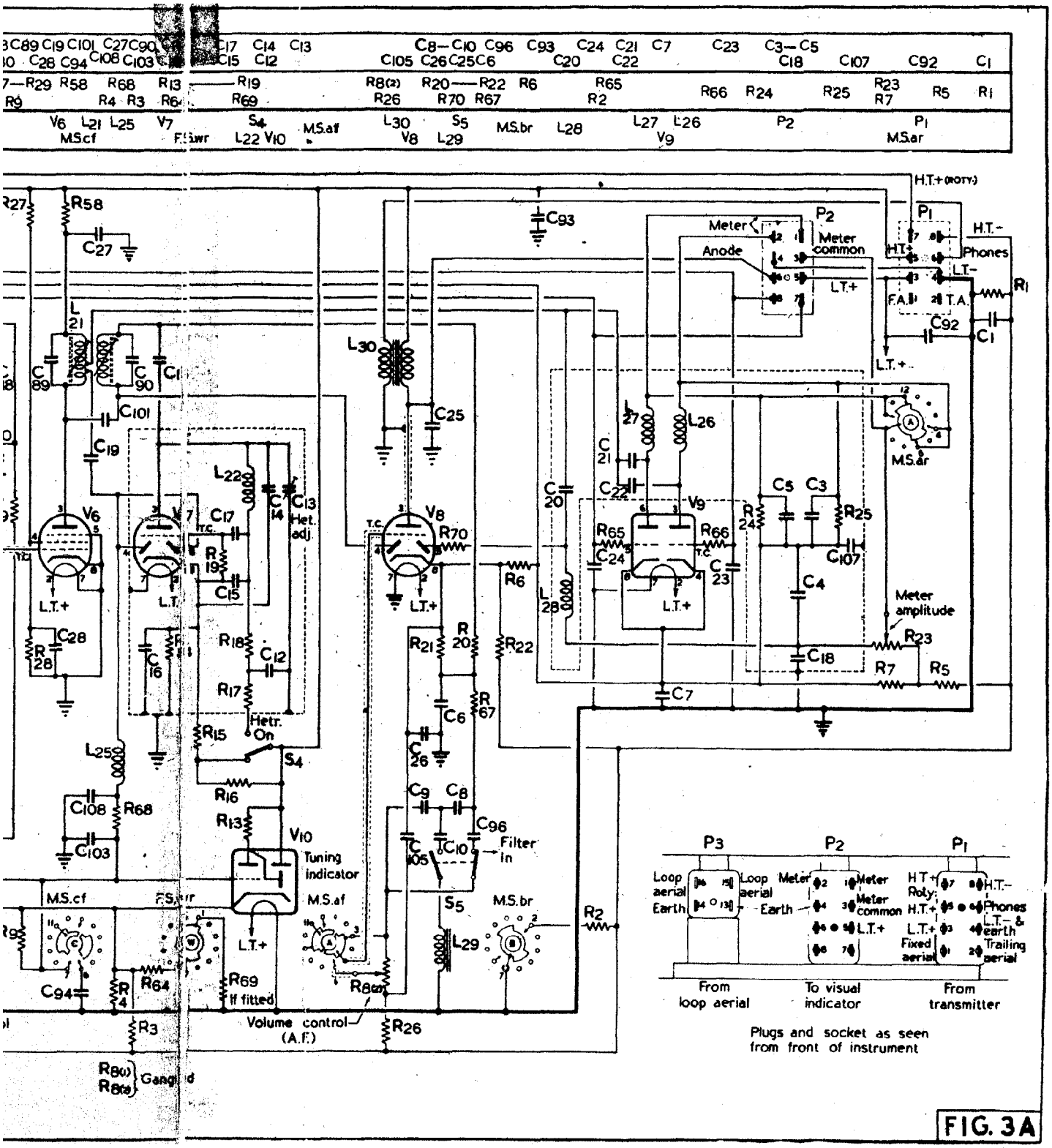

C89 C19 C101 C27 C90 C108 C103 C28 C94
C17 C14 C13 C15 C12
C8—C10 C96 C93 C24 C21 C7 C23 C3—C5 C105 C26 C25 C6 C20 C22 C18 C107 C92 C1
R29 R58 R68 R13 R19 R4 R3 R64 R69
R8(2) R20—R22 R6 R65 R26 R70 R67 R2 R66 R24 R25 R23 R7 R5 R1
V6 L21 L25 V7 S4 L22 V10 L30 S5 L28 L27 L26 P2 P1
M.S.cf F.S.wr M.S.af V8 L29 M.S.br V9 M.S.ar
H.T.+ (Rotry.)
Meter
P2
P1
Meter common
Anode
H.T.+
H.T.−
Phones
L.T.+
L.T.−
F.A.
T.A.
C92
C1
R1
L21
C89
C90
C101
C19
L22
C14
C13 Het. adj.
C17
T.C.
R19
C15
V6
V7
V8
R70
L30
C25
C93
R6
L28
C20
C21
C22
L27
L26
V9
R65
R66
C24
C23
R24
C5
C3
R25
C107
C4
C18
R7
R5
C7
M.S.ar
Meter amplitude
R23
L.T.+
C28
R28
C16
R18
C12
R17
R15
Hetr. On
S4
L25
R16
C108
R68
C103
R13
V10
Tuning indicator
M.S.cf
F.S.wr
M.S.af
M.S.br
S5
L29
R21
R20
R22
C6
R67
C26
C9
C8
C96
C105
C10
Filter In
R2
C94
R4
R64
R69
If fitted
R8(a)
R26
Volume control (A.F.)
R3
R8(1)
R8(3)
Gang
P3
P2
P1
Loop aerial
Earth
Loop aerial
Earth
Meter
Meter common
L.T.+
H.T.+ Rely
H.T.+
H.T.−
Phones
L.T.− & earth
Fixed aerial
Trailing aerial
From loop aerial
To visual indicator
From transmitter
Plugs and socket as seen from front of instrument

FIG. 3A