SECTION B TUNERS

SUB-SECTION BA TUNERS

SUB-SECTION BB D/F TUNERS

GENERAL NOTES ON TUNERS A4, A5, A9 AND A11.

Tuners A4, A5, A9 and A11 are similarly designed; the small differences in each tuner will be found in the separate notes on each instrument which follow.

Each tuner has two positions, viz., "stand-by" and "tune".

The "stand-by" position is for use when searching for signals since only the A.T.C. handle need be moved. In this position variations of voltage across the aerial tuning inductance (19) are directly impressed between grid and filament of the first valve, via the terminals (36) and (37); hence there is less selectivity as the secondary is cut out. (See Admiralty Handbook of W/T (1931) paragraph 508). The "tune" position is for use when the required signal has been found and it is desired to increase its strength and cut out interference. As the secondary circuit is in use the model is much more selective, but a second adjustment (the secondary condenser) must be made. (See Admiralty Handbook of W/T (1931) paragraph 509).

In this position it is often advantageous to use coupling much weaker than the optimum value, thus sacrificing signal strength to gain selectivity. It is most important to note that the coupling must never be made so tight that it passes the optimum point, as if this occurs the result will be great loss of selectivity and no gain in signal strength.

The valve equivalent condenser (30) is automatically inserted in parallel with the aerial circuit, when switching over to the "tune" position to compensate for the loss of grid filament capacity of the first valve which is in circuit in the "stand-by" position. (See Admiralty Handbook of W/T (1931) paragraph 589). It is semi-adjustable and its value may be adjusted by removing the tuner from its box in the case of the older models. In later models the V.E.C. is fitted on the face of the tuner and can be adjusted without removing the tuner from its box. With D.E. valves its maximum value has been increased to 0.06 jars.

The setting of the V.E.C. can be checked by noting whether it is necessary to alter the aerial tuning condenser to read loudest signals on switching over from "stand-by" to "tune". If it is necessary the V.E.C. is out of adjustment and should have its setting altered accordingly.

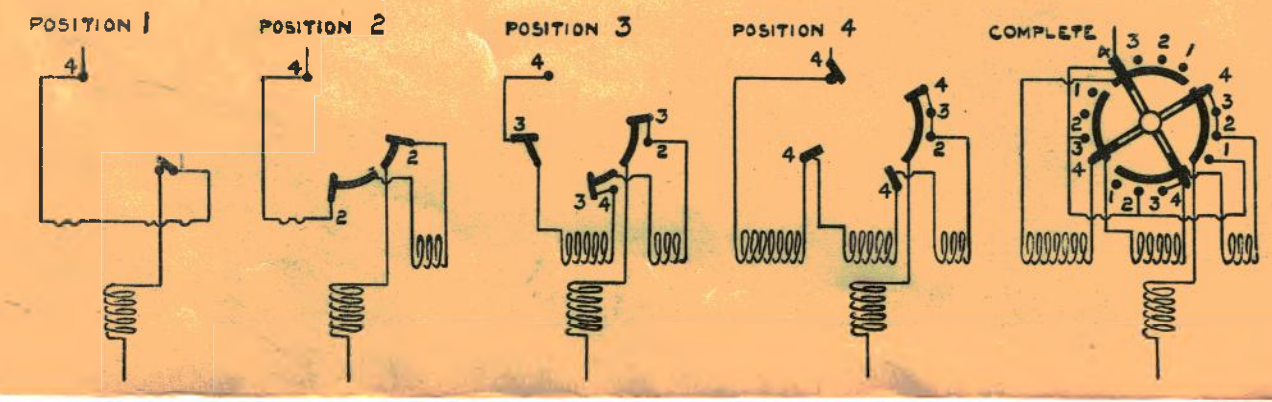
The 40-jar condenser (21) is fitted to avoid an earth on the filament negative and the leak (22) to prevent accumulation of charge on the condenser. Without this system, were an earth to develop on the filament positive of the common battery system, it would short-circuit the L.T. battery and if positive H.T. were accidentally earthed all the valves in the model might be burnt out. In A4 the 40-jar condenser and leak are joined between the aerial circuit and earth terminal (24). In the later tuners the condenser and leak are inserted between the "To Filament" terminal (37) ~~(36)~~ and earth terminal (24). In the latter case the grid would be insulated from the filament in the stand-by position by the 40-jar condenser if the leak were removed, as is clearly shown in the equivalent circuit sketches. The amplifier, however, continues to function, since the grid is connected to earth and there is a certain leak over insulation.

Lightning arresters (14) are fitted to provide an easier path to earth for high voltages which might otherwise damage the receiving circuits. These voltages may be due to another ship transmitting near by, a hang up of the operating circuits or a heavy atmospheric or lightning discharge. Care should be taken that they do not get dirt in them and so short-circuit the aerial tuning inductance. Gas tube arresters are gradually replacing the old type.

It should be noted that in the stand-by-tune switches (25) fitted in all tuners except A4, the centre stud is earthed in the "tune" position. This is to avoid capacity coupling between the studs. (See Admiralty Handbook of W/T (1931) paragraph 589).

It must be clearly understood that the tuning will vary according to the aerial which is being employed. If the tuner is used in conjunction with a small receiving aerial (e.g., in C.R.P.) the tuner and aerial circuits tune as one acceptor circuit. When using a transmitting aerial for receiving, the tuner circuit is tuned as a separate acceptor circuit, provided the aerial coil, etc. of the transmitter is also approximately tuned to the same wave. In the case of A11, however, when receiving waves of the order of 16 kc/s the whole circuit, aerial and tuner, is tuned as one acceptor circuit by inserting the aerial tuning condenser (16) in the parallel position by means of the series parallel switch (18).

<u>Details of Switches.</u> In the sketches of tuners the range switches have been drawn to show the functions which they carry out. Actually they are either of the dial or barrel type. An explanation of how the A.T.I. range switch of the A4 functions is shown in the following sketches, as an example of a dial type of switch. The barrel type of switch is much simpler since the contacts shown in the sketches of A7, A8 and A11 are merely mechanically depressed by the revolving drum.



Aux. Office B.S.+C.R. Destroyer F.C. waves

TUNER A4

Date of design:- 1924.

Frequency range:- 1,500 - 6,000 kc/s.

Where fitted:- RECEIVER ~~Model~~ Outfits CE, CG.

In "stand-by" position the secondary circuit (26) (27) is left on open circuit, by the "stand-by-Tune" switch (25).

The Aerial Tuning (19) and secondary (26) inductances are mounted at right angles to each other, so there is only small constant mutual induction between them. The coupling coil (20) and secondary inductance are mounted on the same spindle and coupling is varied by varying the distance apart of the coils, by means of a rack and pinion (31).

The Aerial Tuning Inductance (19) is constructed in three sections, which can be switched into circuit by a range switch (marked (34) on photograph). The Coupling Coil (20) is always in circuit and forms a fourth section. The four positions of the range switch give the following total values of inductance:-

Position 1.	8.2 mics.	Position 3.	22.8 mics.
" 2.	11.6 "	" 4.	51.3 "

The Secondary Inductance has only two sections and the range switch (35) has, therefore, only two positions, as follows:-

Position 1.	6 mics.	Position 2.	52 mics.

Double Earth Terminals (23) and (24) are fitted in case the 40 jar condenser (21) and 0.1 megohm leak (22) should be punctured, in which case the earth connection could be moved from (24) to (23). This necessitates double lightning arresters (14). The system has not been found necessary in later tuners.

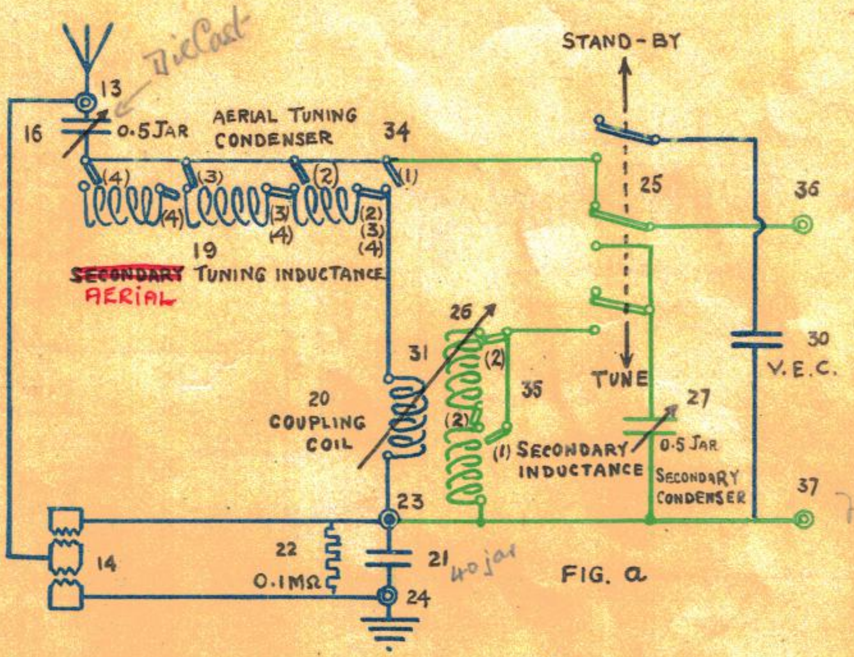


FIG. a

EQUIVALENT CIRCUITS

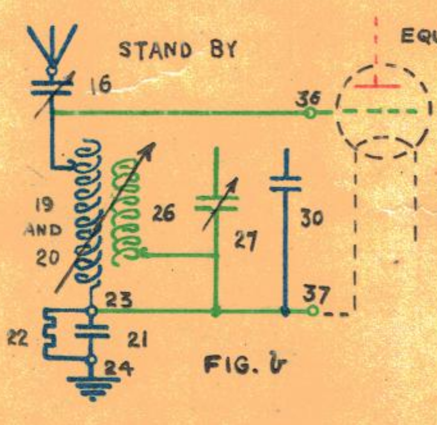


FIG. b

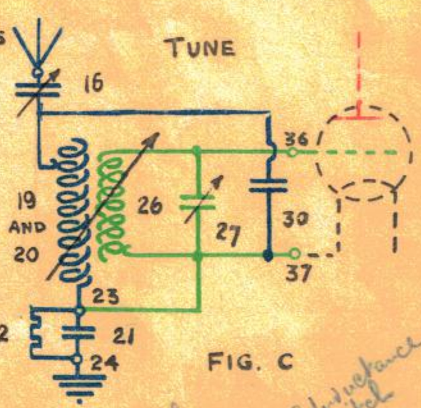


FIG. c

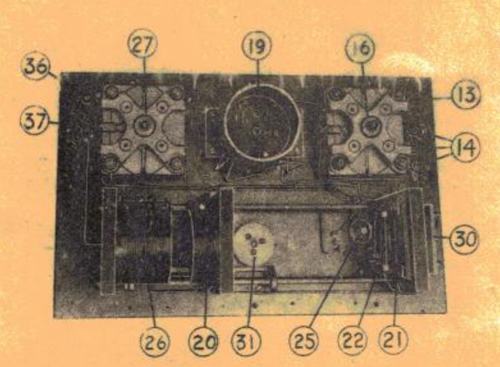


FIG. d

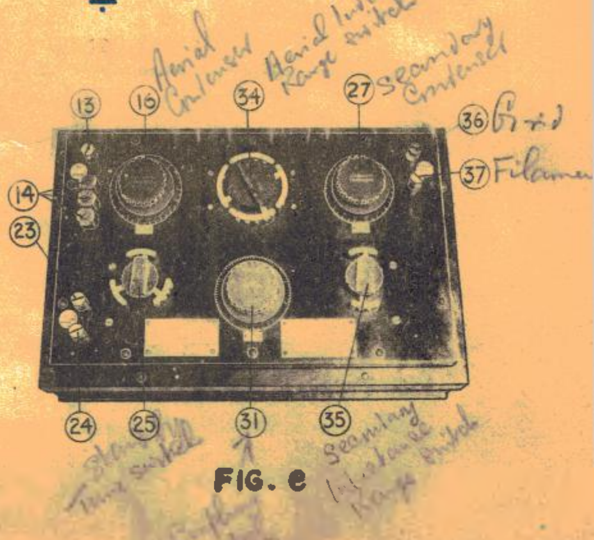


FIG. e

Main Office - BS CR+DE.

BA 4

TUNER A5

Date of design:- 1926.
Frequency range:- 450 - 2,000 kc/s. — In "Stand by" Position lower limit is 270 Kcs.
Where fitted:- RECEIVER ~~Model~~ Outfits CH, CI and CL.

In the "stand-by" position the secondary circuit (26), (27) is short-circuited ~~and earthed~~ by ~~the action of~~ the "stand-by-tune" switch (25). (this circuit is of course already earthed.) The aerial Tuning (19) and secondary (26) inductances are mounted at right angles to one another so that there is only small constant mutual induction between them. Coupling is varied by varying the angle between the coupling coil (20) and secondary inductance, which is done by turning handle (31).

The Aerial Tuning Inductance (19) is constructed in five sections, which can be switched into circuit by a range switch (marked (34) on photograph). The Coupling Coil (20) is always in circuit and forms a sixth section. The six positions of the range switch give the following total values of inductance:-

Position 1.	30 mics.		Position 4.	210 mics.	
"	2.	60 "	"	5.	400 "
"	3.	110 "	"	6.	780 "

The Secondary Inductance has only four sections and the range switch (35) has, therefore, only four positions as follows:-

Position 1.	35 mics.		Position 3.	220 mics.	
"	2.	90 "	"	4.	490 "

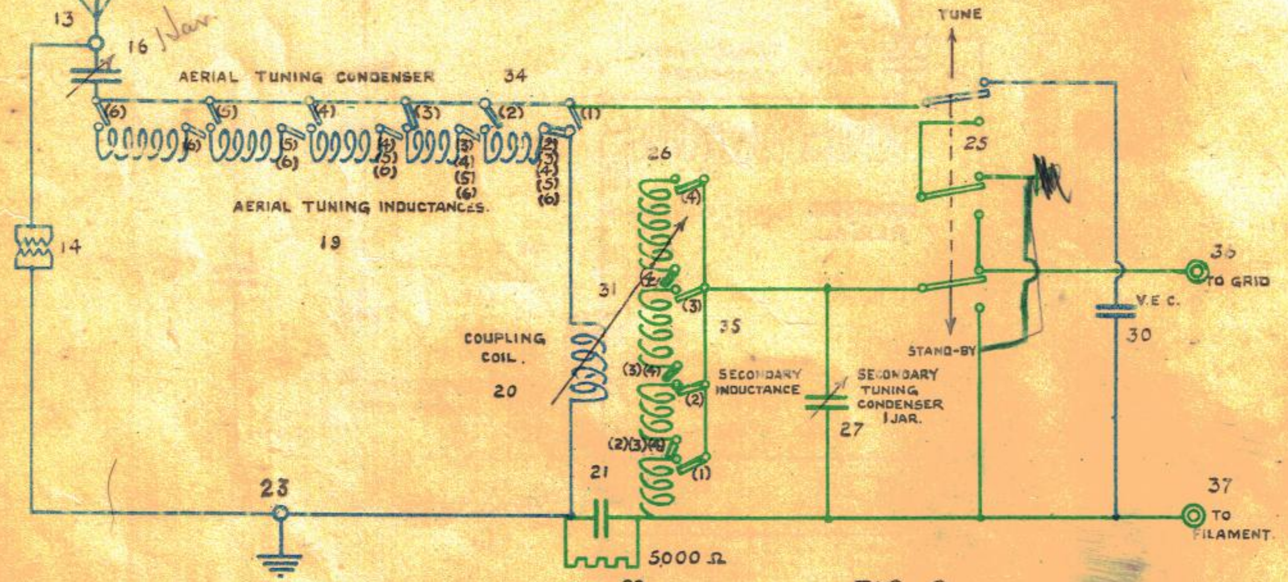


FIG. a

EQUIVALENT CIRCUITS

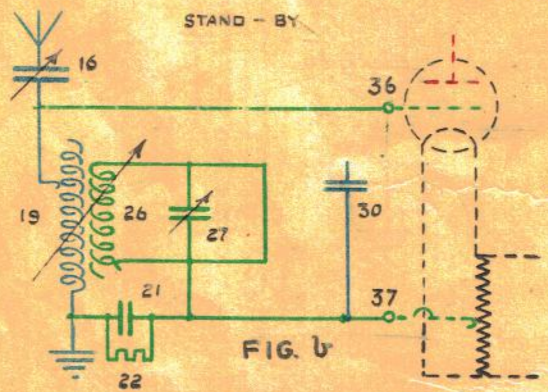


FIG. b

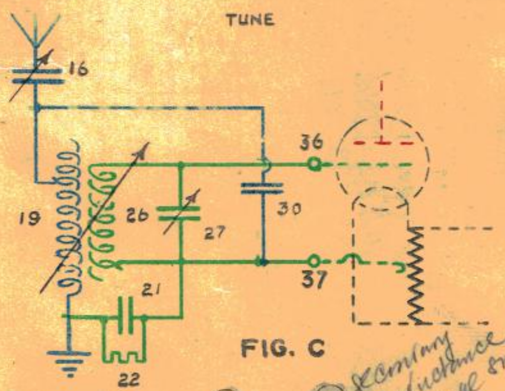


FIG. C

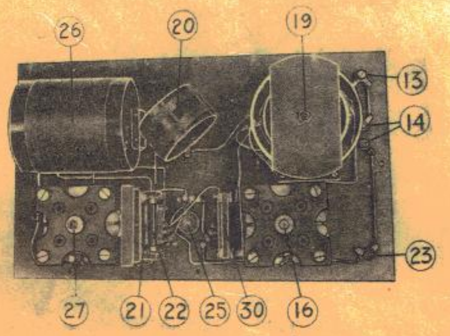


FIG. d

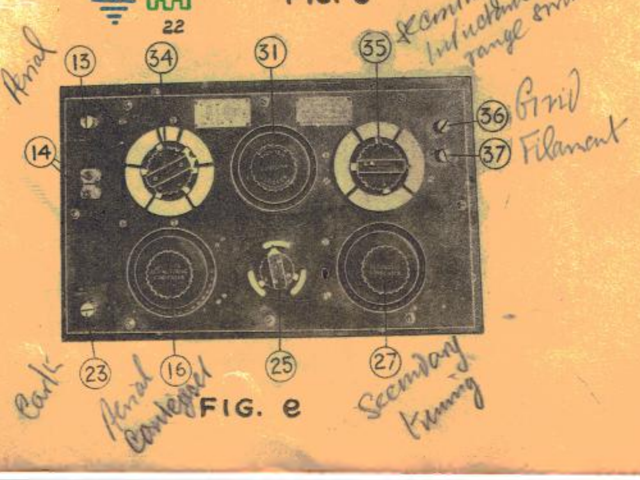


FIG. e

TUNER A7

Date of design:- 1928
Frequency range:- 60 - 170 kc/s.
Where fitted:- D/F Outfit SF. (see sub-section 1A).

A7 is a very simple tuner fitted in conjunction with Amplifier M9 for use with a horizontal frame aerial. As can be seen from the equivalent circuit diagram, the tuner merely places an LC circuit in series with the framecoil (13), both the inductance and capacity being variable.

The aerial tuning inductance (16) is constructed in four sections, which can be switched into circuit by a range switch (22) or cut out of circuit in Position 0. The four other positions of the range switch give the following total values of inductance:-

Position 1 - 310 mics. Position 3 - 1,220 mics.
" 2 - 520 " " 4 - 2,190 "

The capacity consists of a variable condenser (17) which is always in circuit and three fixed condensers (18), (19) and (20), which can be switched in to circuit by means of a range switch (23). The five positions of the range switch give the following total values of capacity:-

Position 1 - 0 - 0.5 jar Position 3 - 1 - 1.5 jars
" 2 - 0.5 - 1 " " 4 - 1.5 - 2 "
Position 5 - 2 - 2.5 jars

The figures in brackets against the small switches in the sketch indicate the position number at which they are closed by the range switch concerned (22) or (23).

Reaction i.e., regenerative amplification, is obtained from M9 and is used solely to increase strength of signals (see Admiralty Handbook of W/T (1931), paragraph 569.) A separate heterodyne unit (K5) is always to be used for C.W. reception.

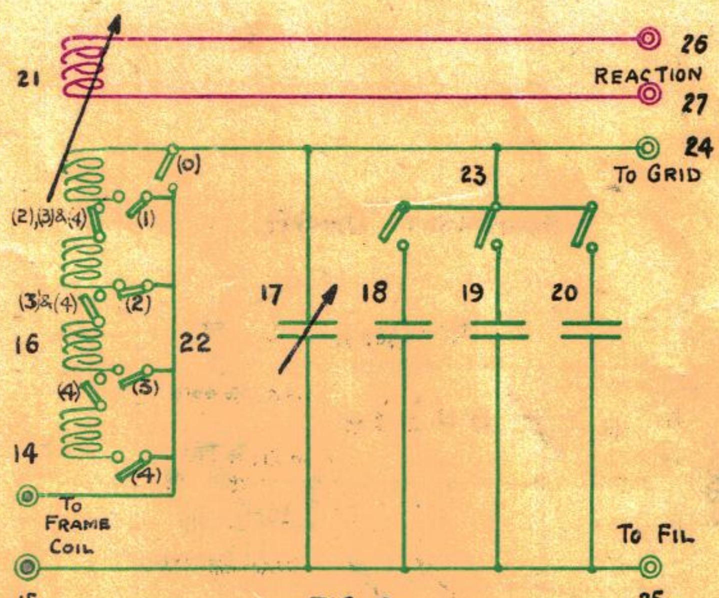


FIG. a

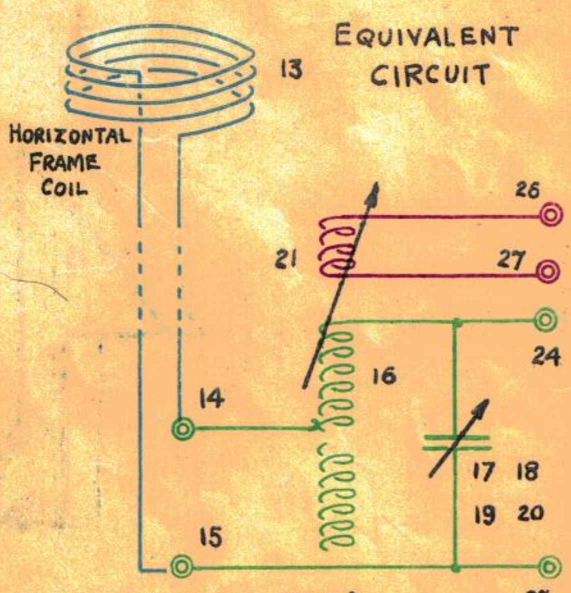


FIG. b

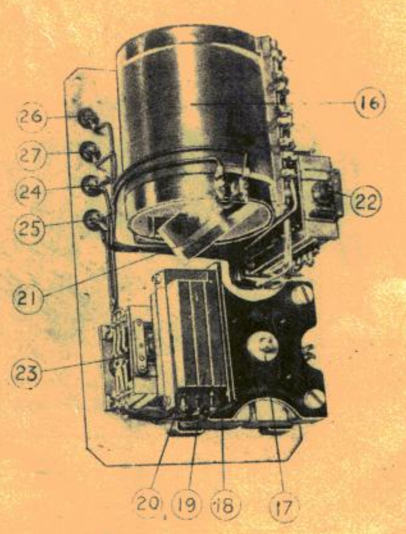


FIG. C

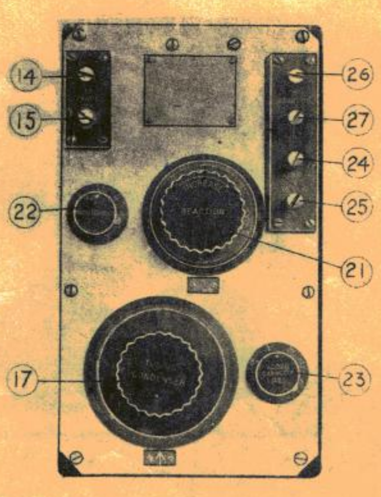


FIG. d

TUNER A8.

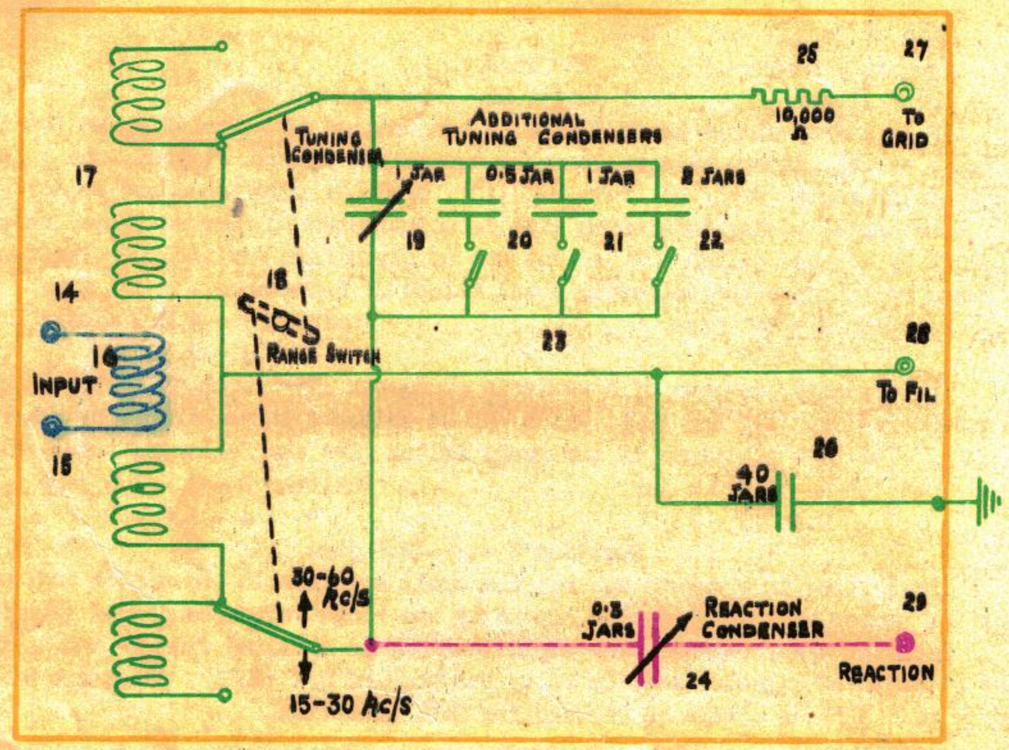


FIG. a

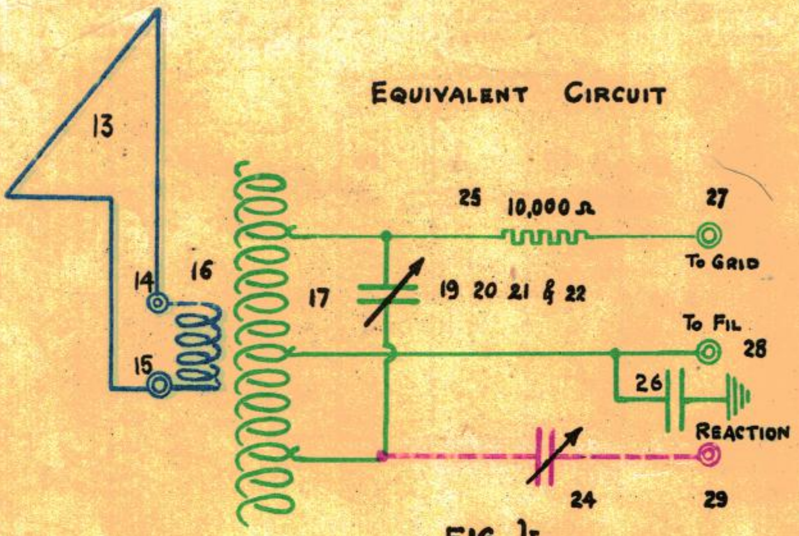


FIG. b

FIG. e

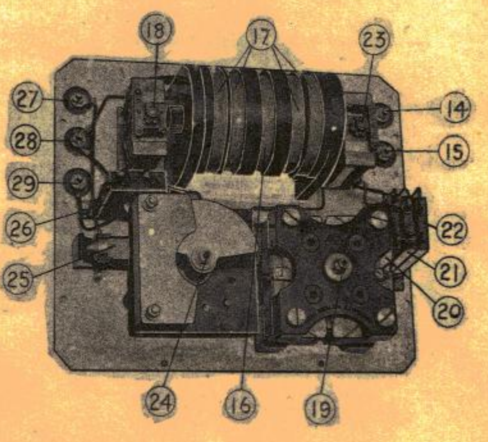


FIG. f

TUNER A8

Date of design 1929.
Frequency range: 15 - 60 kc/s.
Where fitted:- D/F Outfit SF. (See sub-section LA).

Tuner A8 is fitted in conjunction with amplifier M13 for use with a vertical loop aerial (13). Under various conditions capacity of the loop aerial may have a value of 8 - 10 jars and A8 has been designed to meet these conditions. This is accomplished by using a symmetrical split secondary circuit, with the centre point earthed, through a 40-jar condenser (26), and by winding the coupling coil (16) on the same former as, and in the geometrical centre of, the split secondary inductance (17). This has two results -

(a) The turns nearest the centre of the secondary inductance are permanently at earth potential and partially screen the turns at the high potential ends.

(b) Any remaining capacity coupling to the high potential ends of the secondary inductance produces E.M.F's at the two ends of the coils, which oppose one another in trying to send a current round the secondary circuit. These opposing E.M.F's are equalised by this symmetrical arrangement.

The secondary inductance (17) is constructed in four sections, the total value being variable in two stages by a range switch (18). In the "15 - 30 kc/s" range all four sections are in circuit, giving 37,000 mics. In the "30 - 60 kc/s" range only the inner two sections are in circuit (though the outer sections are left connected at one end), giving 8,800 mics.

The capacity of the secondary circuit consists of a variable 1 jar condenser (19), which is always in circuit and three fixed condensers (20), (21) and (22) which can be switched in in parallel with (19) by means of a switch (23) marked "Additional Tuning Condensers". There are eight positions of this switch, each position being marked with the total value of the fixed condensers being used. The total capacity, however, can be varied by a further 1 jar upwards, by varying the value of condenser (19) from 0 to 1 jar. This gives the following ranges of capacity to correspond with the marking of the switch.-

Position	0	gives	0 - 1 jar	Position	2	gives	2 - 3 jars.
"	0.5	"	0.5 - 1.5 "	"	2.5	"	2.5 - 3.5 "
"	1	"	1 - 2 jars.	"	3	"	3 - 4 "
"	1.5	"	1.5 - 2.5 "	"	3.5	"	3.5 - 4.5 "

The variable 0.3 jar condenser (24) is ~~really a neutrodyne condenser to reduce the reaction already introduced through the interelectrode capacity of the first valve of the amplifier (see Admiralty Handbook of W/T (1931) paragraphs 600 and 603). As it is variable it can be~~ used for controlling reaction and is therefore used solely to increase strength of signals and NOT to heterodyne the incoming wave (which is done in the amplifier by means of a separate heterodyne(K5)).

The 10,000 ohm resistance (25) is inserted for the following reason. To a very high Radio Frequency the tuning condenser (19), etc., is of such a value that it practically becomes a short circuit. Hence, the two halves of the tuning inductances may be considered to be in parallel with a short circuit between them. These two inductances, combining with the grid-filament capacity of the valve (Cgf) form an L.C. circuit as shown in figures c and d which would oscillate at its own natural (high) frequency. The reaction condenser (24) would feed back enough energy into this circuit to maintain these unwanted oscillations. To prevent this occurring, the 10,000 ohm resistance is inserted in this circuit and effectively damps them out; but, not being in the tuned secondary circuit, has little effect on the desired frequency.

It must be remembered that when employing this model, better reception will be obtained when the loop is pointed approximately in the direction of the transmitting station. Good signals will, in fact, only be obtained if the transmitting station is on or before the receiving vessel's bow, or on or abaft her quarter. (See Admiralty Handbook of W/T (1931), paragraph 783).

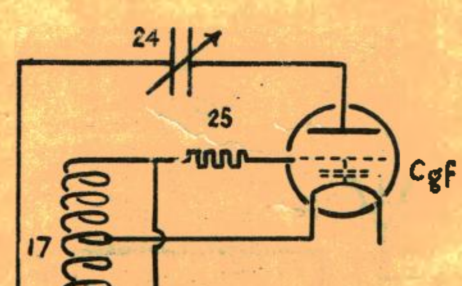


FIG. C

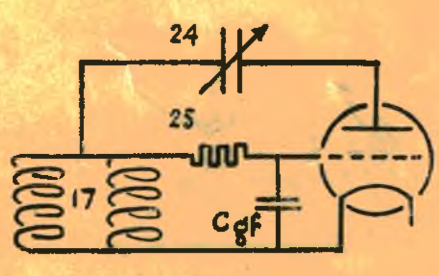


FIG. d

TUNER A9.

BA8

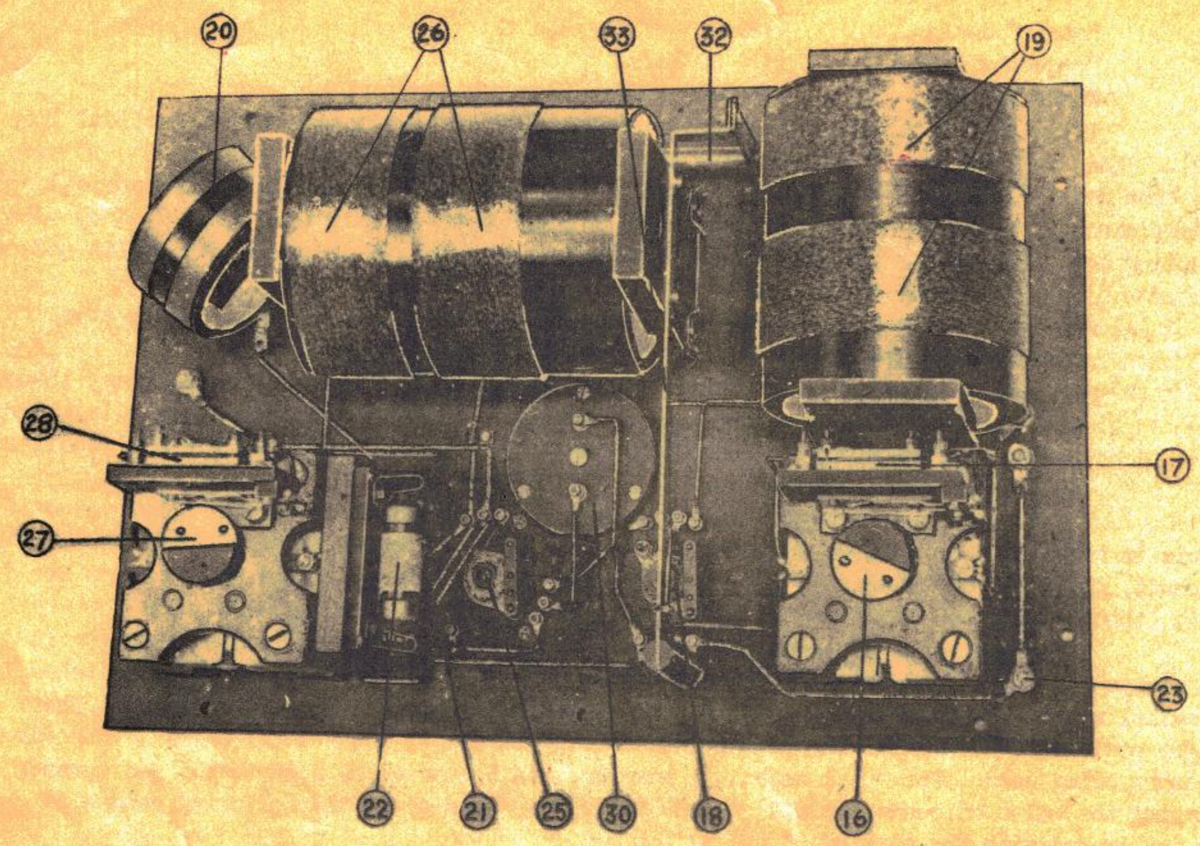


FIG. d

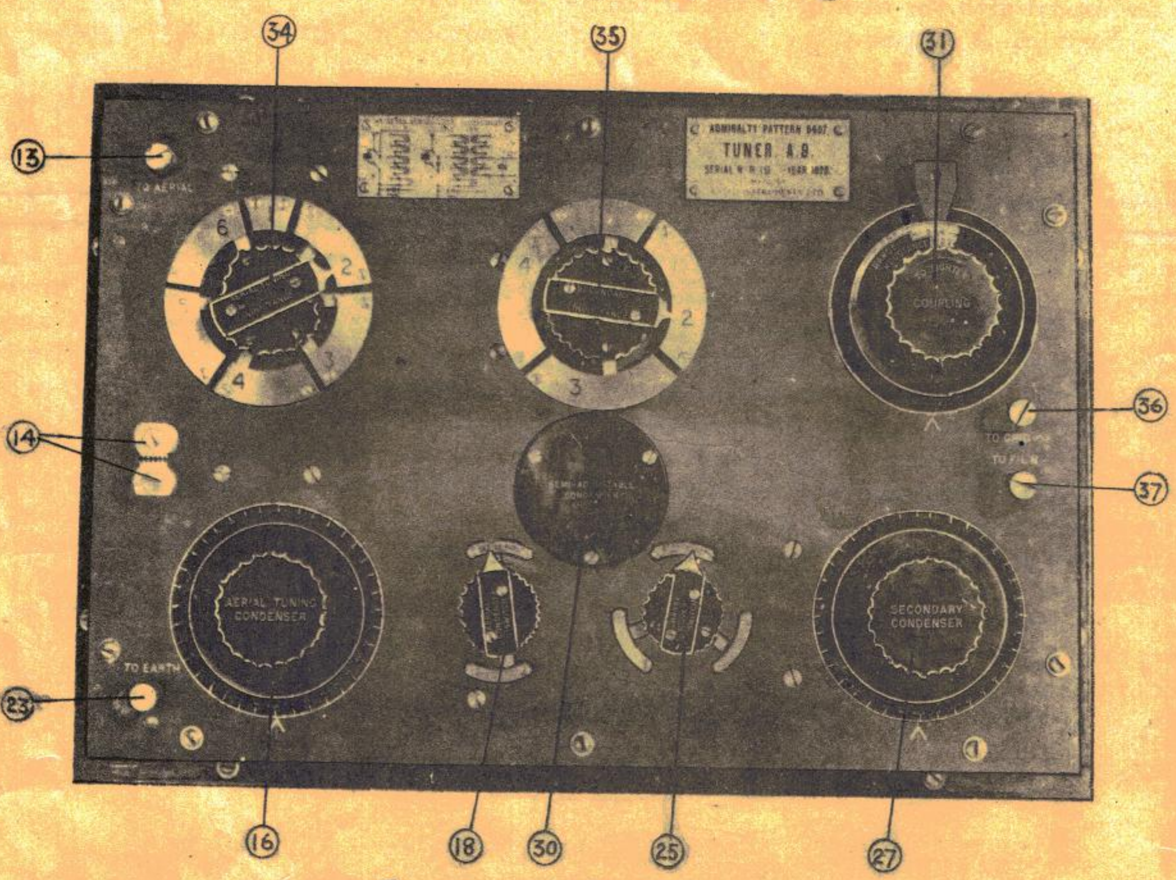


FIG. e

EQUIVALENT CIRCUITS

STAND BY

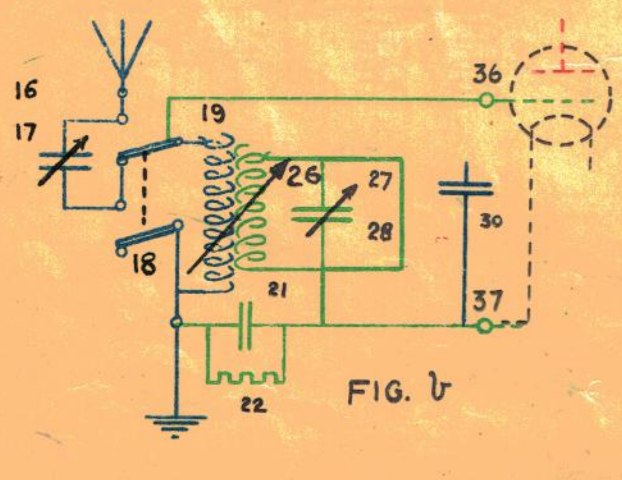


FIG. b

TUNE

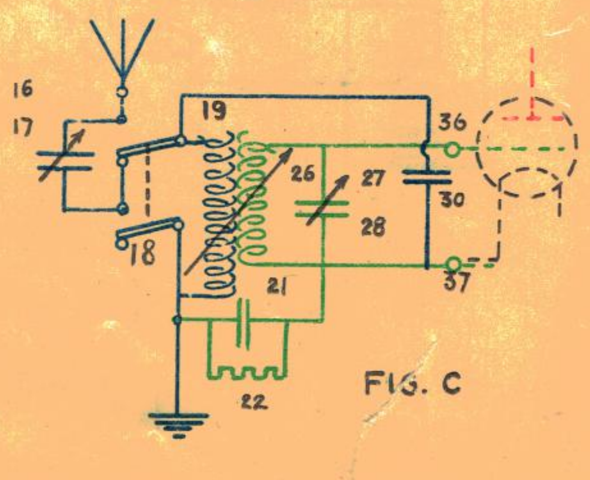


FIG. C

TUNER A 9

Date of design:- 1928.
Frequency range:- 60 - 670 kc/s.
Where fitted:-RECEIVER [redacted]-Outfit CK.

In the "stand-by" position the secondary circuit (26) to (28) is short-circuited and earthed by the action of the "stand-by-tune" switch (25). The aerial tuning (19) and secondary (26) inductances are mounted at right angles to one another with a screen bar(33) between them so there is practically no mutual induction. Coupling is varied by varying the coupling between the coupling coil (20) and secondary inductance, which is done by turning handle (31). The coupling handle (31) is marked with red and white sectors (as in the case of A11) to show clearly the values of coupling which may be employed with each range of A.T.I. The "normal" amount of coupling (which position is marked on the dial) is that position at which signals can always be received without danger of the circuit being over-coupled.

The aerial tuning inductance (19) is constructed in five sections, which can be switched into circuit by a range switch (marked (34) on photograph). The coupling coil (20) is always in circuit and forms a sixth section. The six positions of the range switch give the following total values of inductance:-

Position 1.	180 mics.	Position 4.	950 mics.
" 2.	230 "	" 5.	1,330 "
" 3.	440 "	" 6.	3,530 "

The aerial tuning condenser (16) automatically switches in a fixed condenser (17) at 180° on the scale. A series-parallel switch (18) is provided for connecting the A.T.C. (and its fixed condenser, if in) in series or parallel with the aerial (series for high frequency, parallel for low frequency). This is necessary due to the large frequency range of the model. The secondary inductance has only four sections and the range switch (35) has, therefore, only four positions as follows:-

Position 1.	200 mics.	Position 3.	440 mics.
" 2.	320 "	" 4.	3,700 "

The secondary condensers (27) and (28) are similar to the aerial tuning condensers (16) and (17), the fixed condenser (28) being automatically connected when the dial reads 180°.

Due to the small dimensions of this Tuner in relation to the frequency ranges covered, the coils had to be placed in such a relative position that there is a rather high capacity coupling between them. Moreover this capacity coupling is not the same on all ranges due to the fact that the distance apart of the working parts of the coils changes. To reduce this capacity coupling it was found necessary to introduce an electrostatic screen (33) between the coils and also to run the lead between the A.T.I. and coupling coil in a screen (32).

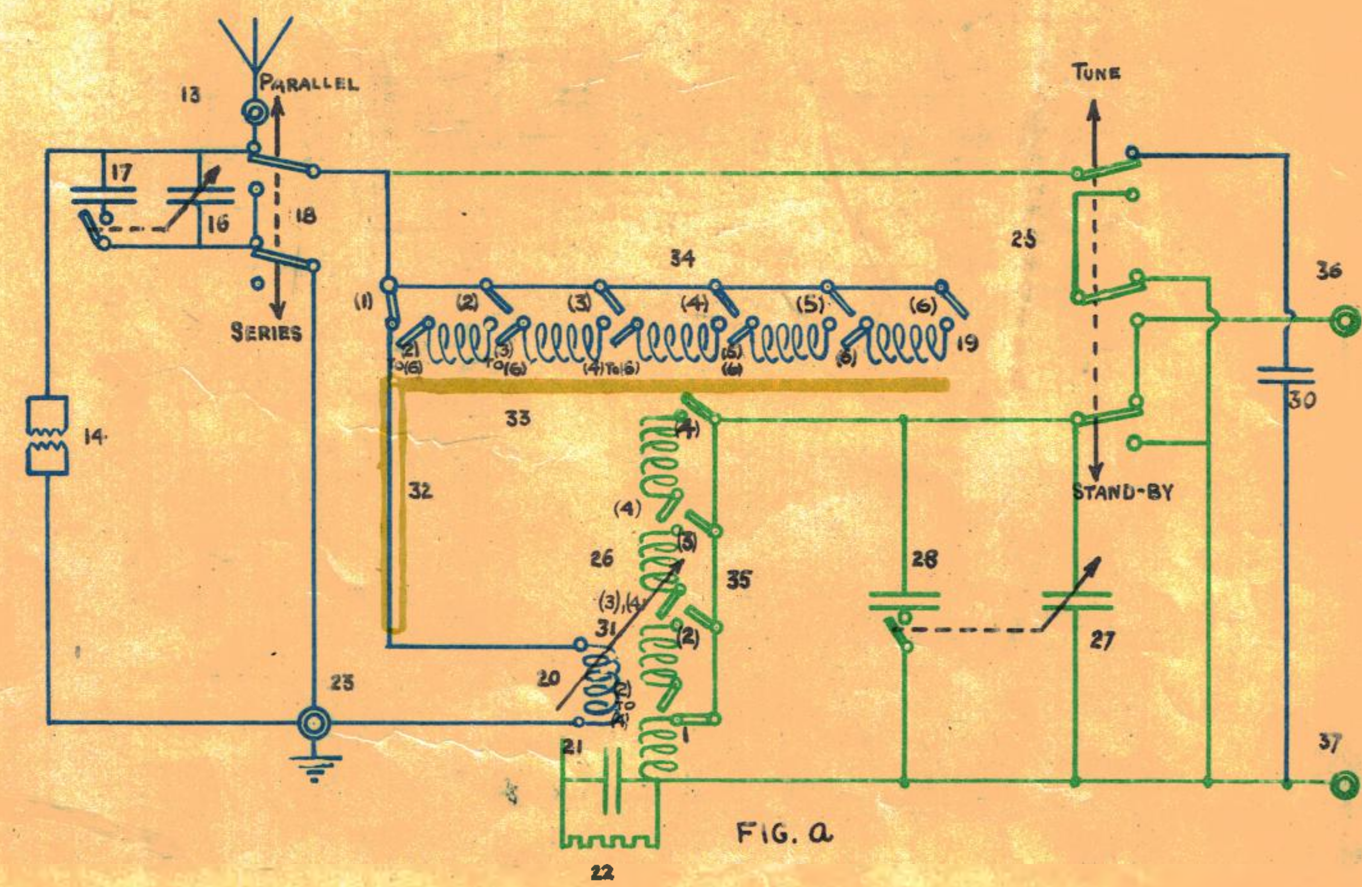


FIG. a

TUNER A II

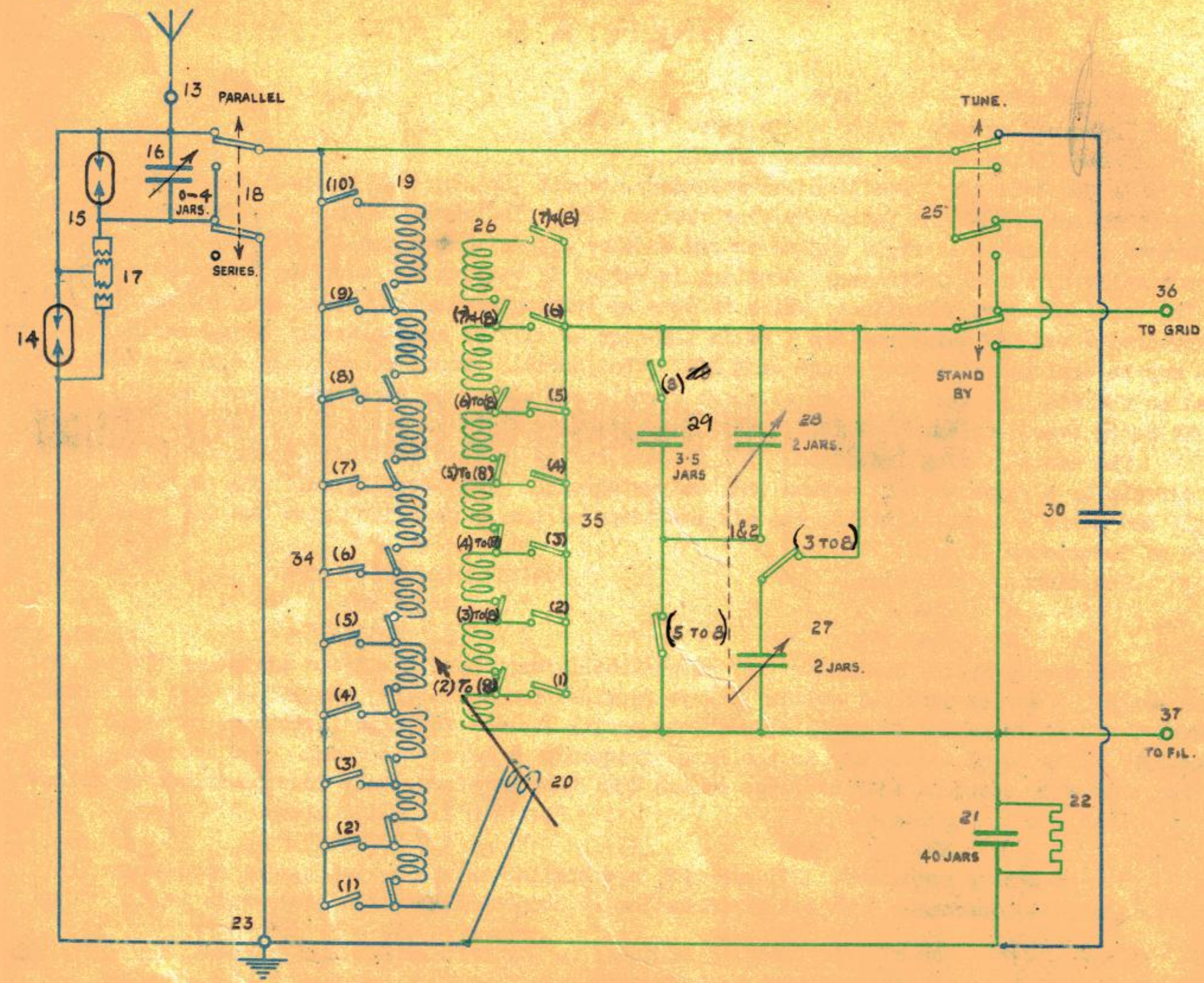


FIG. a

EQUIVALENT CIRCUITS

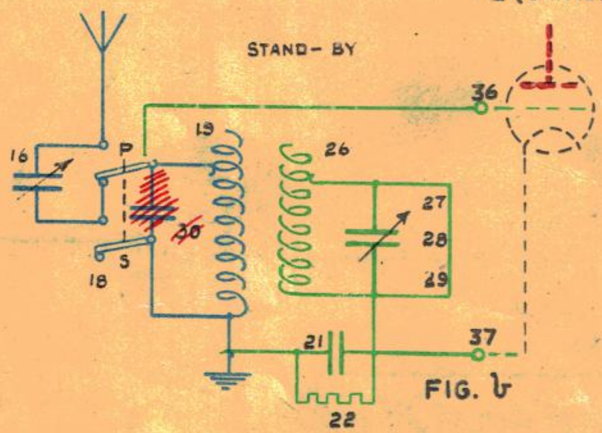


FIG. b

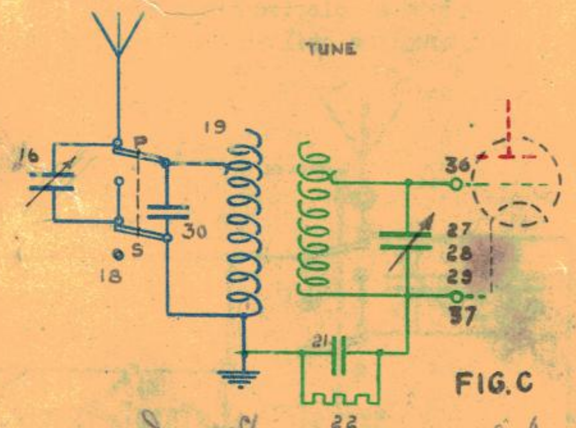


FIG. C

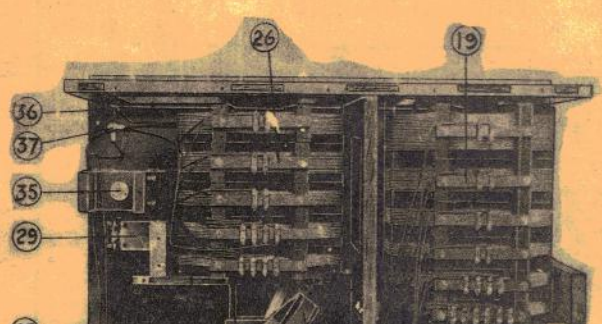


FIG. e

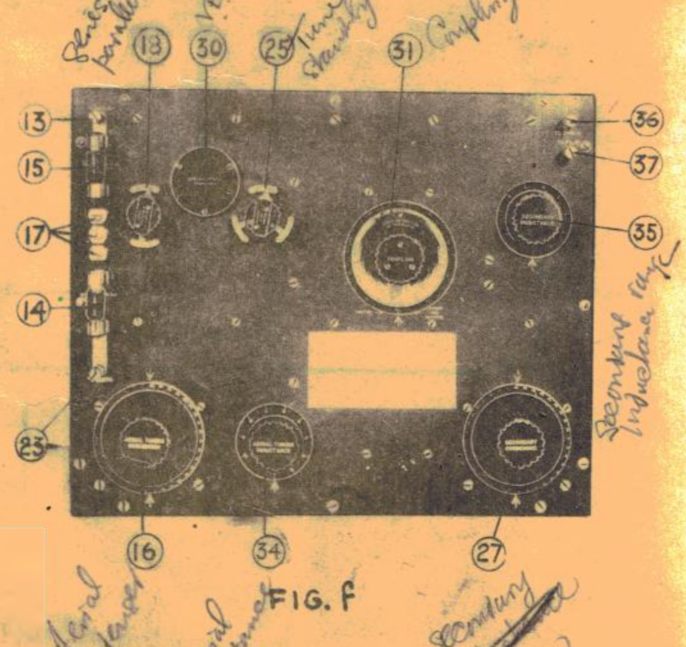


FIG. f

TUNER A11

Date of design:- 1927.
Frequency range:- 12 - 550 kc/s.
Where fitted:- ~~Model~~ Receiver Outfits CI and CJ.

In the "stand-by" position the secondary circuit (26) to (29) is short-circuited and earthed by the action of the "stand-by-tune" switch (25). The aerial tuning (19) and secondary (26) inductances are mounted with their axes parallel, so as to give a definite fixed mutual induction between them. Both inductances are constructed in sections which can be switched into circuit by their respective range switches. The coupling coil (20) is always in circuit and, in fact, in position 1 it is the only inductance left in the A.T.I. It follows that in this position a slight movement of the coupling coil has a large effect on coupling, whereas in position 10 there are nine other sections of inductance permanently coupled to the secondary, so that the coupling coil only has a very small effect. In order, therefore, to give the necessary range of coupling a mechanical device (31) has been introduced by which the coupling coil in the position of maximum coupling is exactly co-axial with and adjacent to the secondary inductance; as the coupling handle is turned the coupling coil not only rotates about its axis but recedes from the secondary inductance until there is room for it to be turned through 90°. A further movement of the coupling handle continues to rotate the coil in the direction of reverse coupling and approaches the coil until it is once more adjacent to the secondary inductance. By this means it has been found possible to vary the coupling from zero to the optimum value for all frequencies except the very lowest dealt with. In order to avoid over-coupling and consequent tuning difficulties on the higher frequencies, the dial of the coupling coil handle (31) is marked with white and red sectors indicating the arcs in which coupling is safe or too tight. The different sectors correspond to the various positions of the A.T.I. range switch and are engraved accordingly. In general the best value of coupling is about 60°.

The aerial tuning inductance (19) is constructed in nine sections, which can be switched into circuit by a range switch (34). The coupling coil (20), as previously stated, is always in circuit and forms a tenth section. The ten positions of the range switch give the following total values of inductance:-

Position 1.	200 mics.	Position 5.	1,990 mics.	Position 8.	11,630 mics.
" 2.	350 "	" 6.	3,500 "	" 9.	20,000 "
" 3.	620 "	" 7.	6,480 "	" 10.	36,900 "
" 4.	1140 "				

The secondary inductance has only seven sections, but the range switch (35) has eight positions as an additional condenser (29) can be added in. In order to obtain a suitable stiffness in the secondary circuit on all frequencies, a variable capacity consisting of two 0 - 2 jar variable condensers mounted on the same spindle is used. These two condensers (27) and (28) can be connected in four different ways according to the frequency required:-

Both in series:- 0 - 1 jar. Condenser (27) in circuit alone:- 0 - 2 jars.
Both in parallel:- 0 - 4 jars.
Both in parallel with the additional 3.5 jar fixed condensers - 3.5 - 7.5 jars.

The switching for these condensers is performed automatically by the secondary inductance range switch (35). The following table gives the total values of inductance and capacity for each position of the range switch:-

Position 1.	420 mics	0 - 1 jar.	Position 5.	6,840 mics	0 - 4 jar.
" 2.	840 "	" "	" 6.	13,760 "	" "
" 3.	1,770 "	0 - 2 "	" 7.	21,300 "	" "
" 4.	3,490 "	" "	" 8.	" "	3.5 - 7.5 jars.

In the sketch the figures (in brackets) shown against the small switches indicate the number on the range switch concerned at which the small switch closes. Where only one figure is given the switch is only closed for this one position; where two figures are given (e.g., 3 to 8) the switch remains closed for all position between and including the figures given.

The aerial tuning condenser (16) may be placed either in series or parallel with the aerial circuit (series for high frequencies, parallel for low frequencies). This is necessary due to the large frequency range of this tuner (see general notes on tuners, page BA2).

Two lightning arresters of the gas type (14) and (15) are fitted in parallel with the open arresters (17). Fig. d. shows the equivalent circuit when the tuner is tuned as a separate acceptor circuit in series with the main transmitting aerial circuit of a ship. It will be seen that the points marked "L" are at earth or low potential for a resonant frequency. If only one arrester were provided between the two points marked "L" there would be no tendency for a high voltage to be set up across it by a resonant high voltage and there will be danger of either the condenser (16) or the inductance (19) being damaged, by resonant high voltages such as might be caused by a hang-up in the operating circuits or a ship nearby transmitting on power on the same frequency. In practice it has been found that the condenser is more likely to suffer and an arrester (15) has accordingly been fitted across it. The arrester originally fitted alone (14) is of course still necessary for non-resonant frequencies such as atmospherics etc.

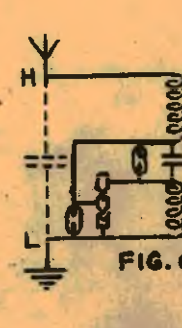


FIG. d

TUNER A19

Date of design:- 1932.
Frequency range:- 15 – 550 kc/s.
Where fitted:- Receiver Outfits CM, CN.
Valves used:- None in A19, but one aerial isolating valve in N19.

Tuner A19 is used in conjunction with Amplifier M19 (see page H24) and Note Magnifier N19 (see page I5) and is designed to replace Tuner A11 (see page BA11). It is enclosed in an aluminium box, the primary and secondary circuits each being enclosed in a separate screened compartment.

Two alternative methods of connecting the aerial to the set are provided. In one case the aerial is plugged into an aerial isolating unit situated in the same box as Note Magnifier N19 (see page I5) and in the other case into the socket (13) on the Tuner A19.

In the former case (figure a.) the aerial is coupled by a differential condenser (52) to the grid of the screen grid isolating valve (8). The output of this valve is connected to the coupling coil (36) which is coupled to the primary coil (34) of the A19. This arrangement allows a number of receivers to be used on the same aerial without mutual interference. The coupling coil (36) is wound in four sections outside the primary coil (34). The H.T. and L.T. supplies for the aerial isolating unit are described under Note Magnifier N19, page I9.

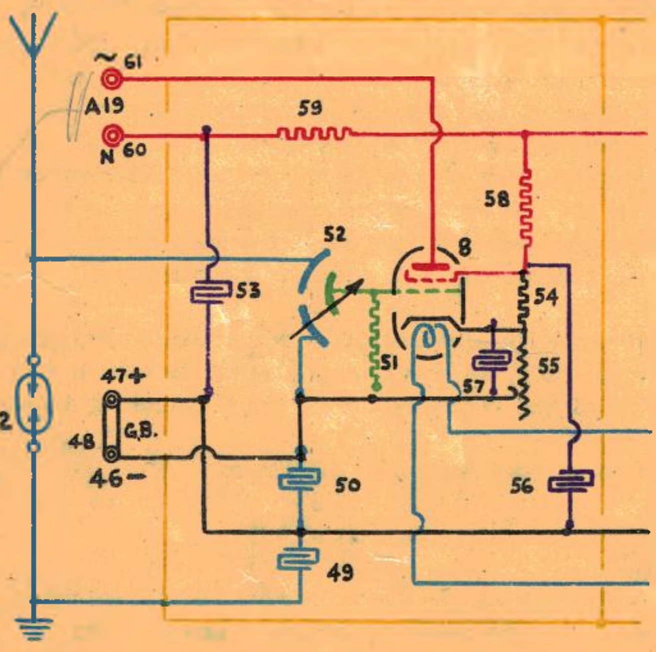


Fig. a.

When the aerial is plugged into the socket (13) of the A19, it is connected through a 0.3 jar variable condenser (38) to the primary circuit of the A19. An additional 0.2 jar fixed condenser (37) is connected in parallel with the aerial coupling condenser (38) on the lowest frequency range as described below. The variable condenser (38) is ganged to the primary tuning condenser (41).

Two gas gap arrestors (14)(15) are fitted to protect the receiving circuits when using the aerial connection (13) on the A19. One arrestor (15) is connected across the primary coil (34) and one across the aerial condensers (37)(38). The two arrestors are connected in this manner similar to the tuner A11, and the reason is described on page BA11.

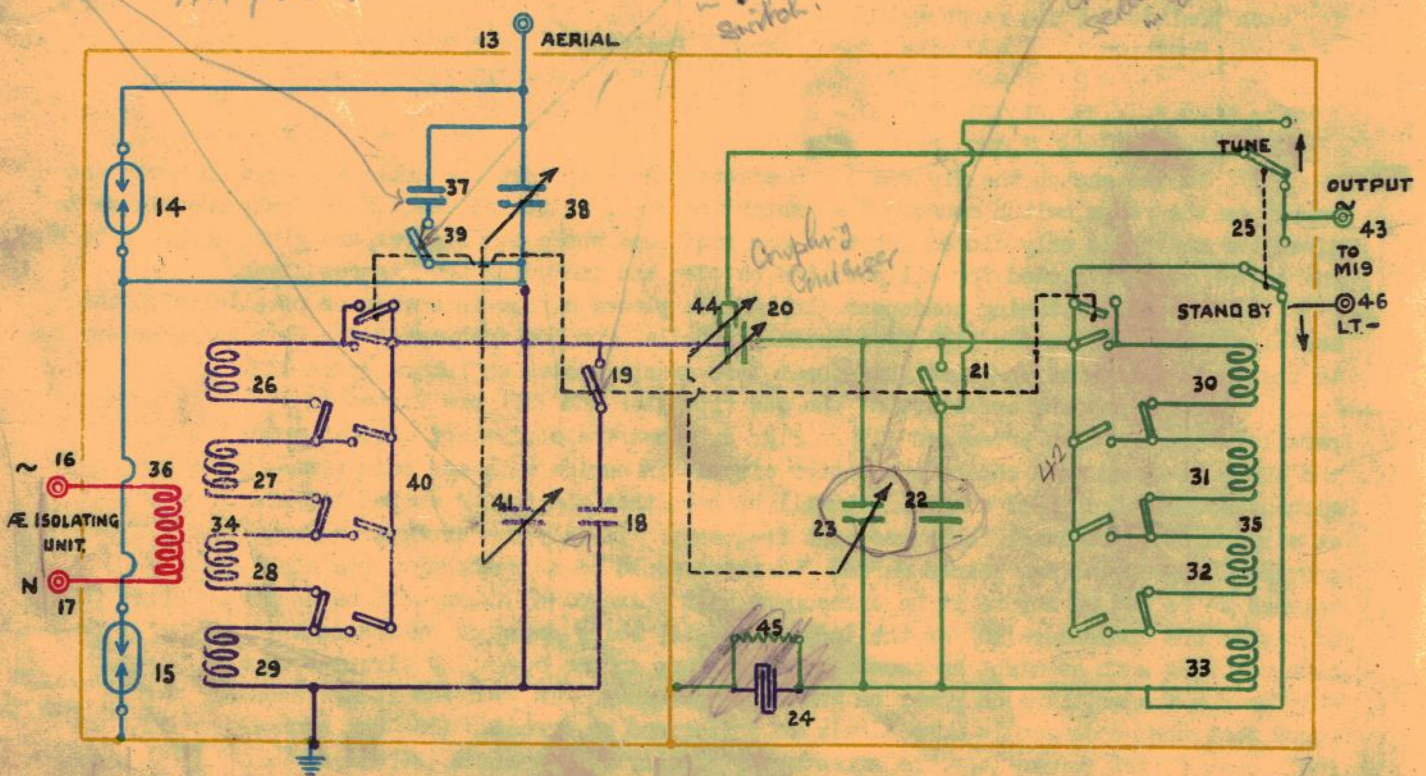
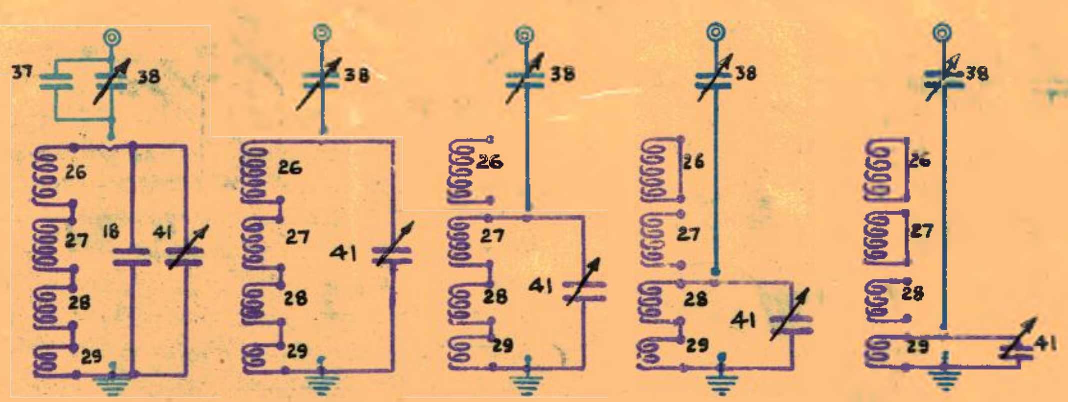


Fig. b.

The primary circuit consists of all or part of the coil (34) and either one or both condensers (41)(18). The secondary circuit (35)(22)(23) is similar to the primary. The coils (34)(35) are in four sections of different values, sections (29) and (33) being the smallest. The different switching positions of each section are controlled by a twenty two contact barrel switch (40)(42). The tuning condensers (41)(23) are 1.2 jars and the fixed condensers (18)(22) 1 jar.

The range switches (40)(42) are so designed that the following arrangements of sections of the coils (34)(35) and condensers are used in the primary and secondary circuits for each range. As the two circuits are identical the primary circuit only is described in the table below and shown in figure c.

Range	Frequency range	Arrangement of sections of the coil.			Tuning Condenser.	Aerial Condenser.
		In circuit	Open circuit.	Disconnected and short circuited.		
1	15 – 20 kc/s	(26)(27)(28)(29)	–	–	(18)(41)	(37)(38)
2	20 – 55 kc/s	(26)(27)(28)(29)	–	–	(41)	(38)
3	45 – 110 kc/s	(27)(28)(29)	(26)	–	(41)	(38)
4	90 – 230 kc/s	(28)(29)	(27)	(26)	(41)	(38)
5	200 – 550 kc/s	(29)	(28)	(27)(26)	(41)	(38)



RANGE 1. RANGE 2. RANGE 3. RANGE 4. RANGE 5. Fig. c.

"Standby" Position. When the "Standby – Tune" switch (25) is in the "Standby" position the secondary circuit of the tuner is short circuited and the primary circuit is coupled to the Amplifier M19 through the capacity between the moving plate ~~and the screen~~ of the coupling condenser (20) and the screen (44). The equivalent circuit is shown in fig. d.

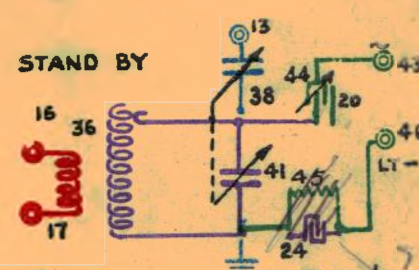


Fig. d.

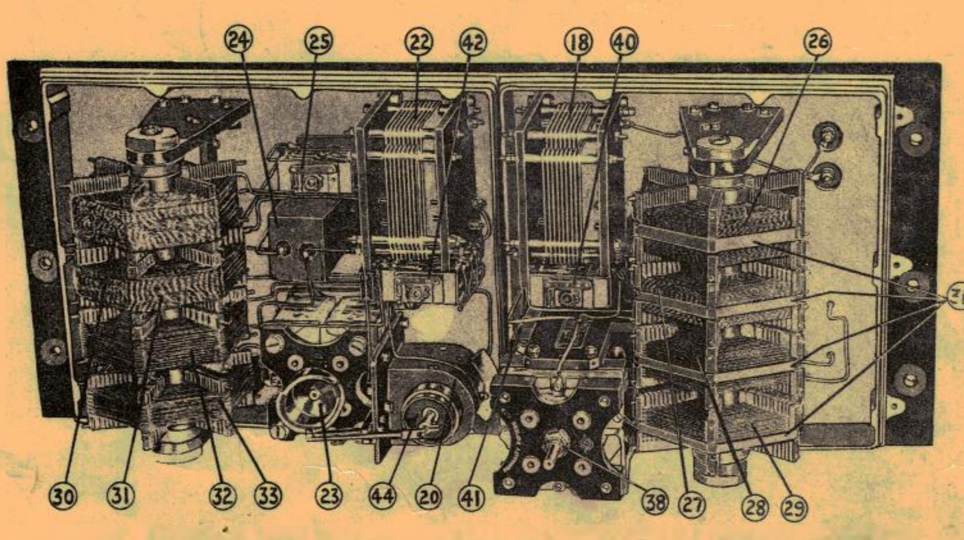


Fig. e.

TUNER A19

"Tune" Position. When the "Standby-Tune" switch (25) is in the "Tune" position the tuned primary and secondary circuits are coupled by a small capacity condenser (20) ~~which is ganged to the secondary tuning condenser (23)~~ (see figures f. and g).

The fixed and moving plates of the condenser (20) are half cylinders, and the inner or moving plate is adjustable by an external dial. Between the fixed and moving plates a cylindrical screen (44) is fitted. The control of this screen is ganged to the secondary tuning condenser (23), and is so arranged that the effective capacity of the coupling condenser (20) varies with the tuning of the secondary circuit to give practically constant selectivity over the whole range of the receiver. At the same time the selectivity can be varied by adjusting the moving plate of the condenser by the external dial (20).

On range 1 (see figures c. & f.) the effective capacities of the condensers (23)(41) are increased by the inclusion of the 1 jar condensers (18)(22) in parallel, and the coupling condenser (20) by itself is too small. On this range, therefore, the coupling capacity is increased by adding to it the capacity between the moving plate and the coupling condenser screen. This is done by connecting the condenser screen permanently to one side of the condenser (22) and, as the condenser (22) is connected in the circuit by the switch (21) on range 1, the screen is connected to the fixed plate of the condenser (20).

In other positions of the range switch (40)(42) the switch (21) is broken, and the 1 jar condenser (22) provides an effective earth path for the screen of the coupling condenser (20).

EQUIVALENT CIRCUITS

TUNE

RANGE 1.

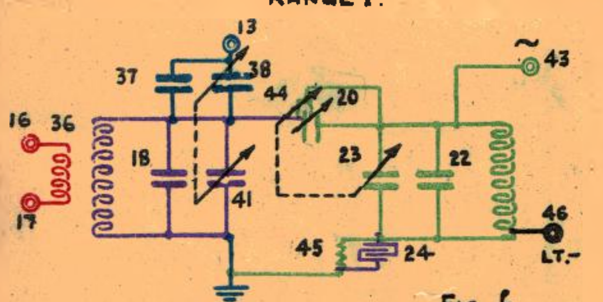


Fig. f

RANGES 2,3,4,5.

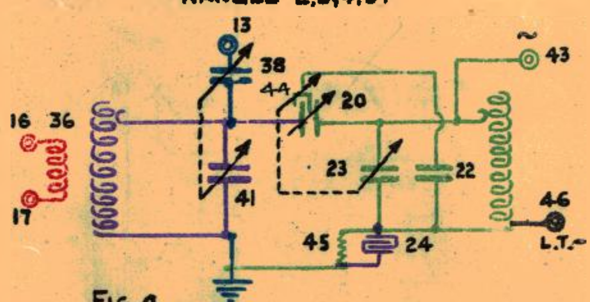


Fig. g

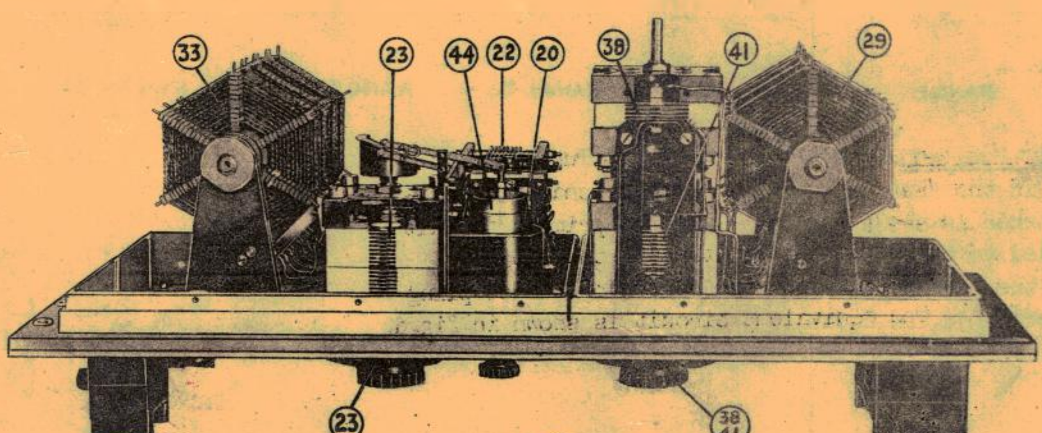


Fig. h.

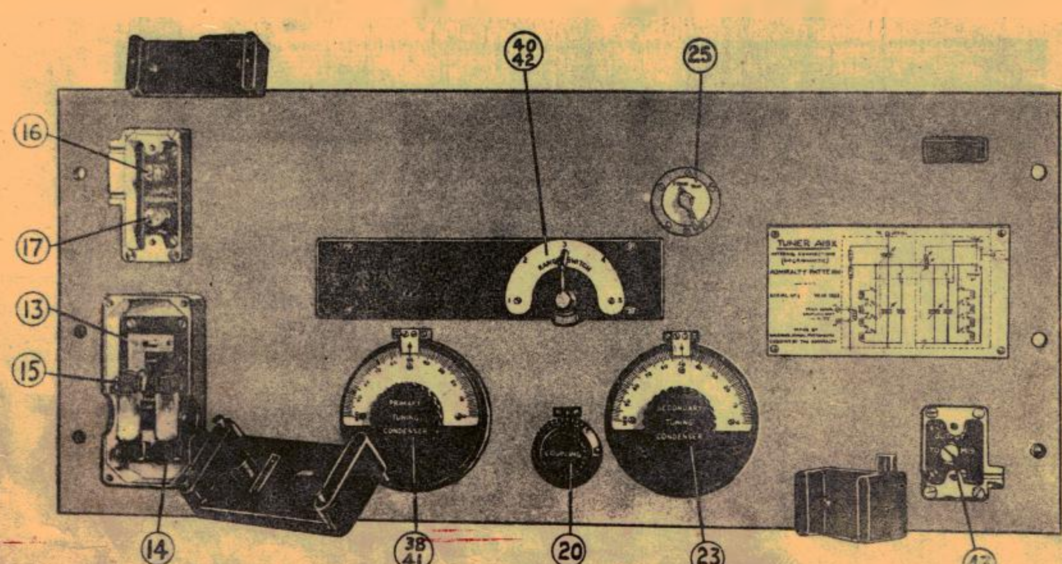


Fig. i.