SUB-SECTION BB D/F TUNERS

TUNER A 41

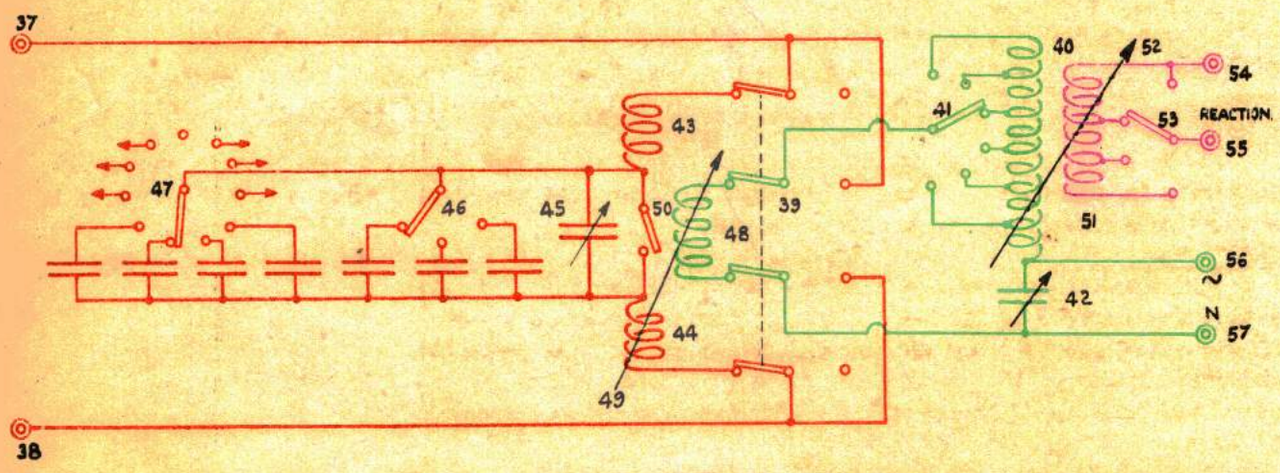


Fig. 2

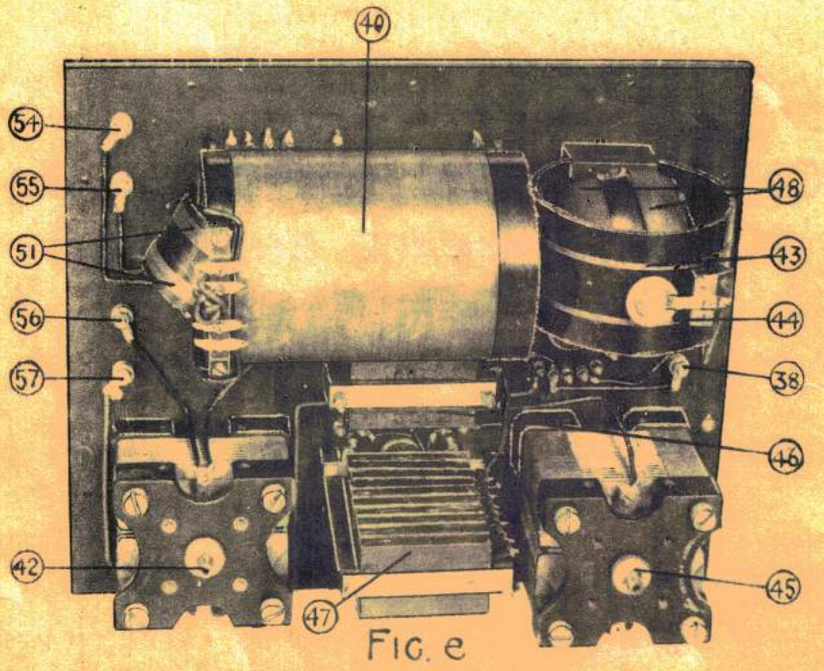


Fig. e

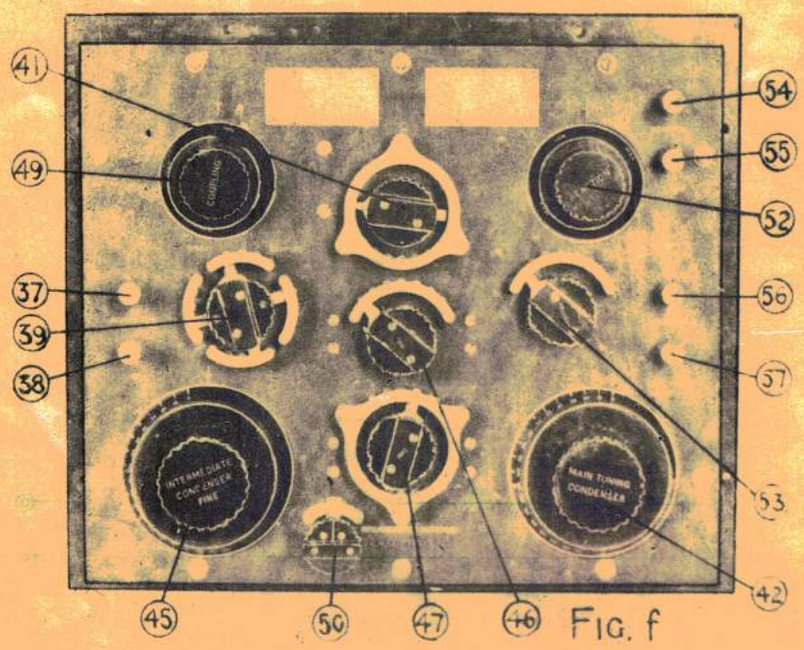


Fig. f

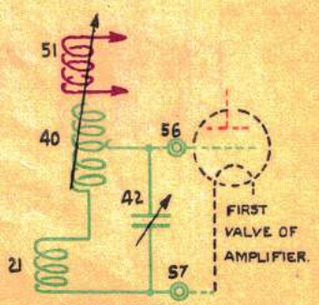
TUNER A41

Date of design:- 1926.
Frequency range:- 60 - 650 kc/s.
Where fitted:- D/F Outfit SD. See Sub-Section LA.

A41 is fitted with D/F Outfit SD. It has been found that when the Bellini Tosi system of aerials is connected to the D/F set by long lengths of lead cased cables, their capacity is usually between 1 and 2 jars and tunes with the aerial circuits to a natural frequency of the order of 450 kc/s.

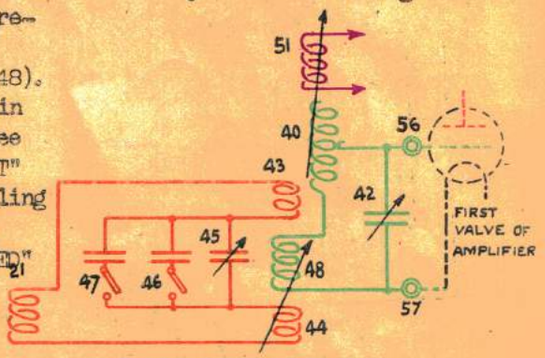
To avoid excessive interference from signals transmitted on 500 kc/s. a high degree of selectivity is necessary and this is obtained by tuning the search coil circuit and coupling it to the tuned grid circuit of the amplifier in use.

"DIRECT" Position. To enable rapid searching for signals over a band of frequencies the tuner is set to "DIRECT" by means of the "DIRECT-COUPLED" switch (39). In this position the search coil (21) of the goniometer is connected to the 6700 mic inductance (40) and main tuning condenser (42) and forms the tuned grid circuit of the amplifier. At each position of the inductance switch (41) tuning is effected by adjusting the main condenser (42) only. (See figure b.).



DIRECT POSITION
Fig. b.

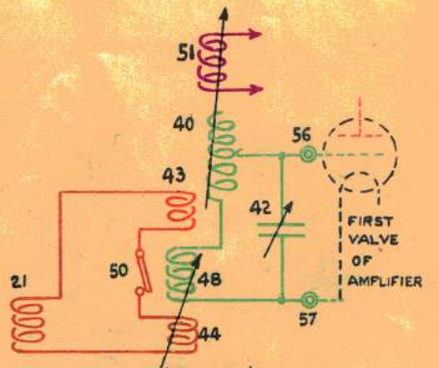
"COUPLED" Position. For greater selectivity the "DIRECT-COUPLED" switch (39) is set to "COUPLED" thus introducing a tuned intermediate circuit. In this position the search coil (21) is connected to the 10 mic inductances (43)(44) and the variable condenser (45). Fixed condensers may be switched in parallel with the variable condenser (45) by two switches (46) and (47). A coarse adjustment of 10, 20, or 30 jars is made by the condenser switch (46) and a finer adjustment of 1 to 10 jars by the condenser switch (47). In figure c. the fixed condensers inserted by switches (46) and (47) have been given the same numbers as the switches which insert them. The final adjustment of tuning is done by the variable condenser (45), the value of inductance remaining fixed. The two fixed inductances (43)(44) are coupled to the amplifier by the variable coupling coil (48). The coupling coil (48) adjustable inductance (40) and main tuning condenser (42) then form the tuned grid circuit (see figure c.). To avoid retuning when switching from "DIRECT" to "COUPLED", and vice versa, the inductance of the coupling coil (48) is made to equal that of the search coil (21), 180 mics. To get the best selectivity out of the "COUPLED" circuit the coupling should be very weak.



TUNED COUPLED POSITION.
Fig. C.

When bearings are being taken with very strong signals the quality of the D/F zeros may be improved by using an untuned intermediate circuit which can be achieved by setting the intermediate condenser switch (50) to "SHORT" and thus shorting the intermediate condensers (see figure d.) "Sense" bearings must not be taken with the switch (39) in the "COUPLED" position. It may be necessary to increase the coupling between the untuned intermediate circuit and tuned grid circuit to maintain sufficient signal strength for obtaining zeros.

A reaction coil (51) is coupled to the tuning inductance (40) and connected to the amplifier by terminals (54)(55). Four positions of the reaction switch (53) vary the number of turns in use thus providing suitable coupling over a large frequency range. Position 0 of the reaction switch (53) short circuits the reaction coil and completes the circuit between grid and filament of the detector valve in Amplifier MD when reaction is not required since the reaction coil is inserted between grid and filament in this particular model (see page H4).



COUPLED (UNTUNED) POSITION.
Fig. d.

The number of valves in use in Amplifier MD and MD can be varied and the phasing of reaction may in consequence be reversed (see Admiralty Handbook of W/T(1931) paragraph 601 (4)). Should this occur the phasing can be corrected by turning the reaction coil by means of the handle (52). It is capable of being turned through 180° though in practice this is rarely necessary.

TUNER A 42

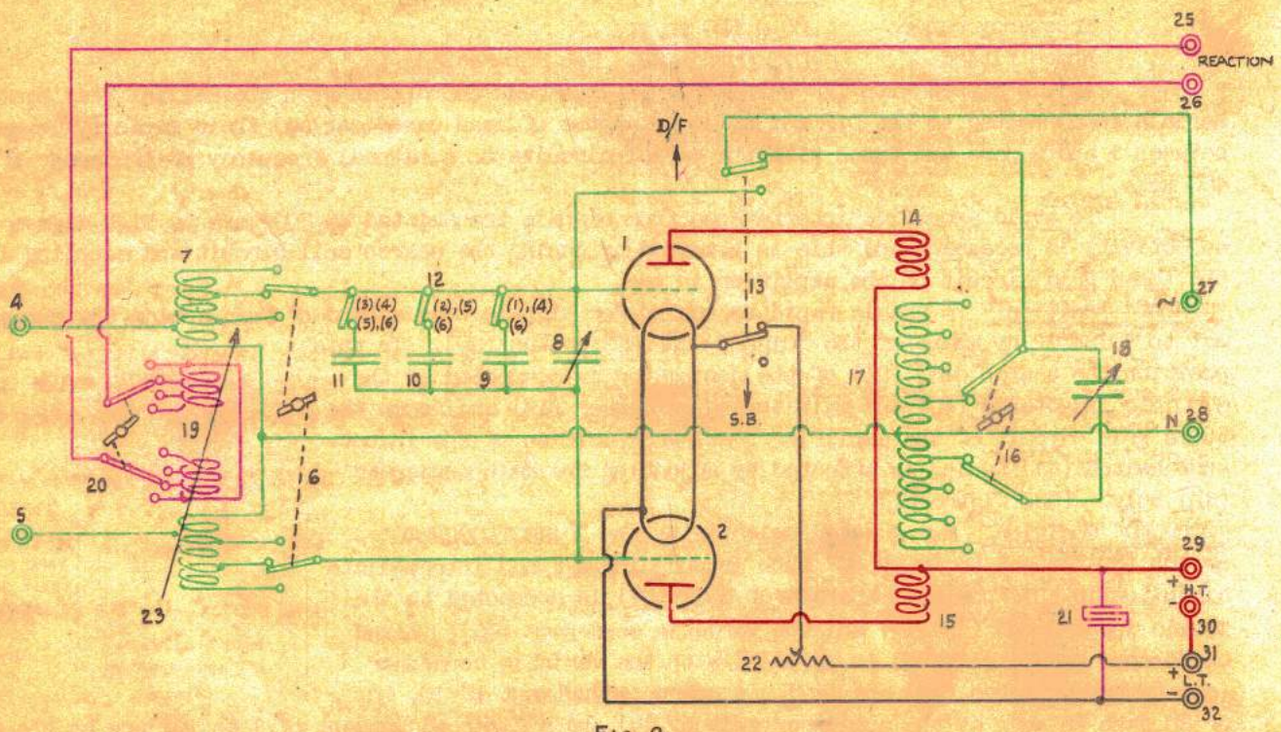


Fig. a.
EQUIVALENT CIRCUITS.

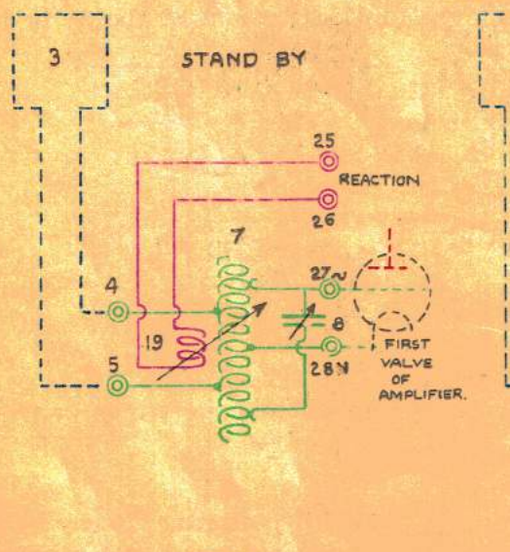


Fig. b.

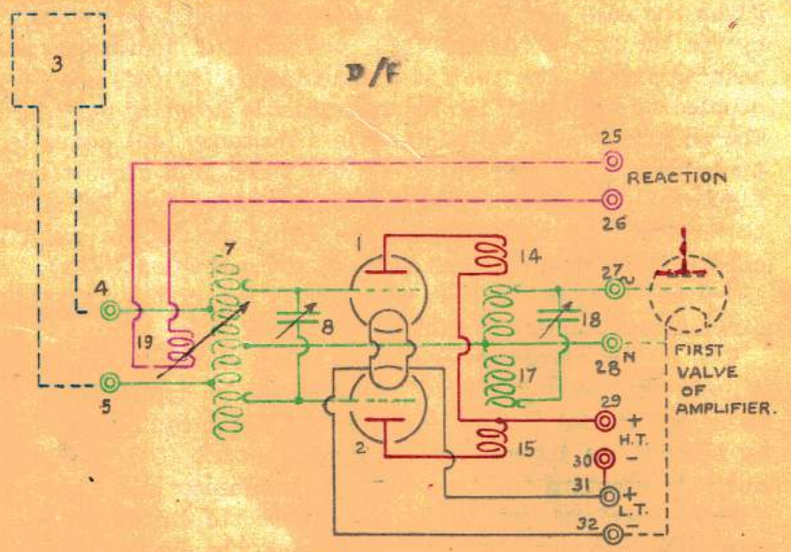


Fig. c.

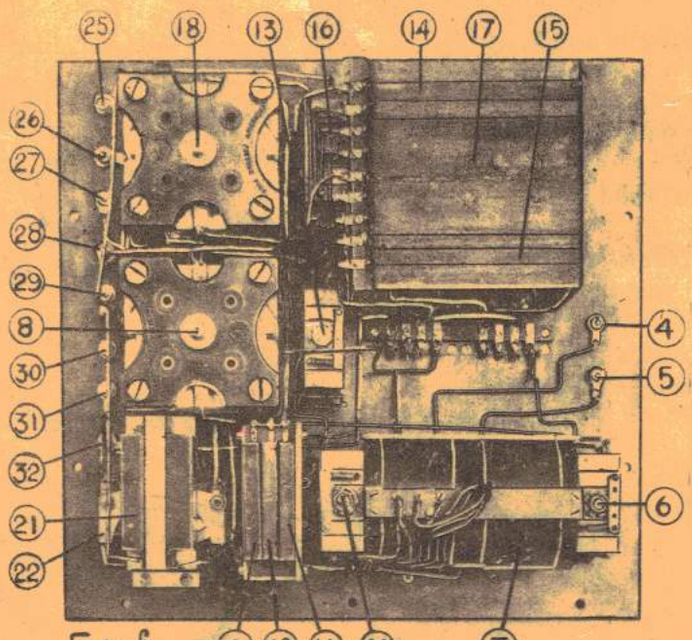


Fig. f

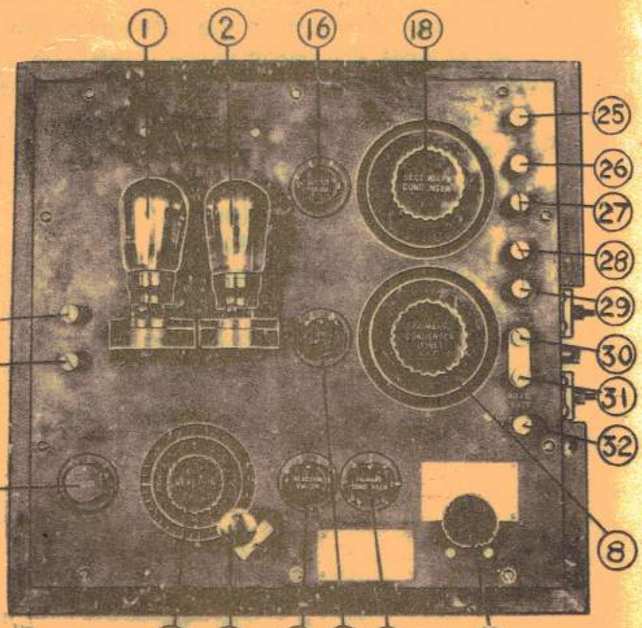


Fig. g

TUNER A 42

Date of design:- 1927.
Frequency range:- 60 - 670 kc/s.
Where fitted:- D/F Outfit SF. (See sub-section LA).
Valves used:- Two NR17 connected in push-pull.

A42 is fitted for direction finding with a rotating frame coil (3). The large capacity of the lead cased cables which connect the frame coil to the tuner prevents direct tuning of the aerial system to the higher frequency range desired and to step up the weak signals obtained in an aperiodic aerial circuit an auto transformer (7) with a fixed primary and variable secondary is used. (See Admiralty Handbook of W/T (1931) paragraph 796.)

STAND BY POSITION. To enable rapid searching for signals over a band of frequencies the tuner is set to "STAND BY" by the "S.B. - D/F" switch (13) (See figure b.) In this position the frame coil (3) is connected via terminals (4) and (5) to two fixed tappings on the inductance (7) forming the primary of the Input Transformer. The range switch (6) varies the inductance at the outer ends of the coil (7) an equal amount on each side of the fixed tappings, thus forming the secondary of the Input Transformer.

At each position of the range switch (6) tuning is effected by the 2 jar variable condenser (8) which, with the inductance in use forms the tuned grid circuit of the amplifier in use. Three fixed condensers (9) (10) and (11) of 1, 2 and 3 jars respectively may be switched in parallel with the 2 jar variable condenser (8) by the condenser switch (12).

The seven positions of the condenser switch give the following total values of capacity.

Position 0,	0 - 2 jars.	Position 4,	4 - 6 jars.
" 1,	1 - 3 "	" 5,	5 - 7 "
" 2,	2 - 4 "	" 6,	6 - 8 "
" 3,	3 - 5 "		

The figures in brackets against the small switches in the sketch indicate the position number at which they are closed by the condenser switch (12).

It will be seen that with this method of tuning illustrated in figure d. the two sides of the frame coil are connected to the grid and filament of the amplifier valve and are thus at different potentials to earth. D/F zeros taken in the "STAND BY" position, therefore, may not be 180° apart and consequently unreliable owing to the lack of symmetry in the frame coil circuit. (See Admiralty Handbook of W/T (1931) paragraph 789).

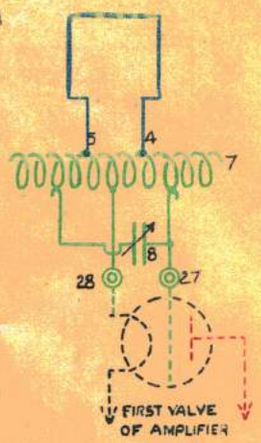


FIG d.

D/F POSITION. For greater selectivity and to give symmetry in the frame coil circuit (see figure e.) the tuner may be switched to the "D/F" position whereby an arrangement of balanced valves is employed (see figure c.) In this position the secondary inductance of the input transformer (7) is connected to the grids of two valves arranged in "push-pull" and tuned by the primary condensers (8)(9)(10)(11). The anodes of the two valves (1) and (2) are connected to two coils (14) and (15) which form the primary of the output transformer. The secondary of the output transformer has its centre point connected to the filament of the amplifier valve. The range switch (16) varies the inductance an equal amount on each side of this centre tapping. At each position of the "OUTPUT TRANSFORMER" switch (16) tuning is effected by the secondary condenser (18).

One contact of the "S.B. - D/F" switch (13) breaks the filament supply to the valves (1) and (2) when in the "S.B." position. The other contact connects the output terminal (27) to one end of the input transformer (7) in the "S.B." position and to one end of the secondary of the output transformer (17) in the D/F position.

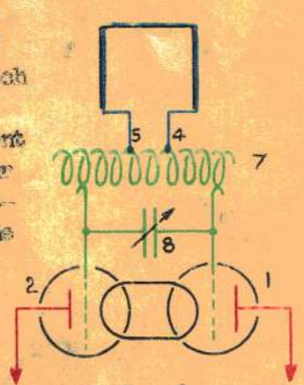


FIG. e.

The reaction coil (19) is coupled symmetrically to the input transformer and is therefore effective in either the "S.B." or "D/F" position. Four positions of the reaction switch (20) vary the number of turns in use thus providing suitable coupling over a large frequency range. Position 0 of the reaction switch (20) short circuits the reaction coil (19) when reaction is not required. The phasing and adjustment of reaction can be effected by turning the handle (23) to which a mechanical vernier (24) is fitted for finer adjustment.

TUNER A 43

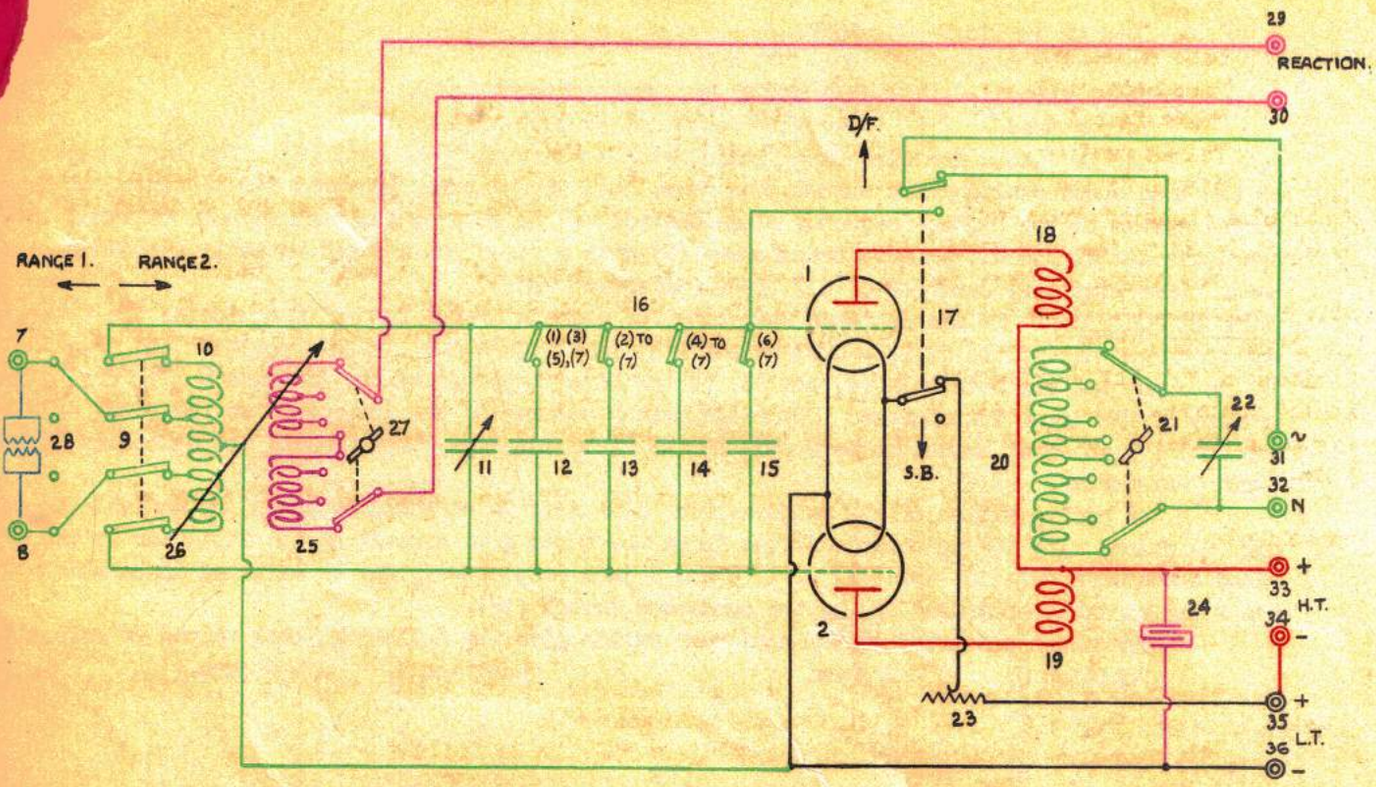


FIG. a.

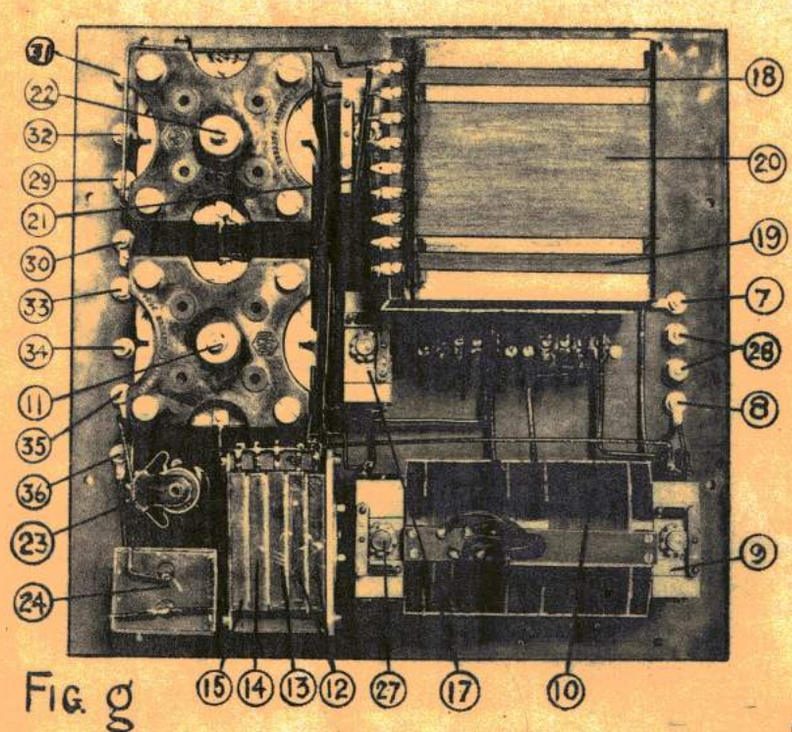


FIG. g

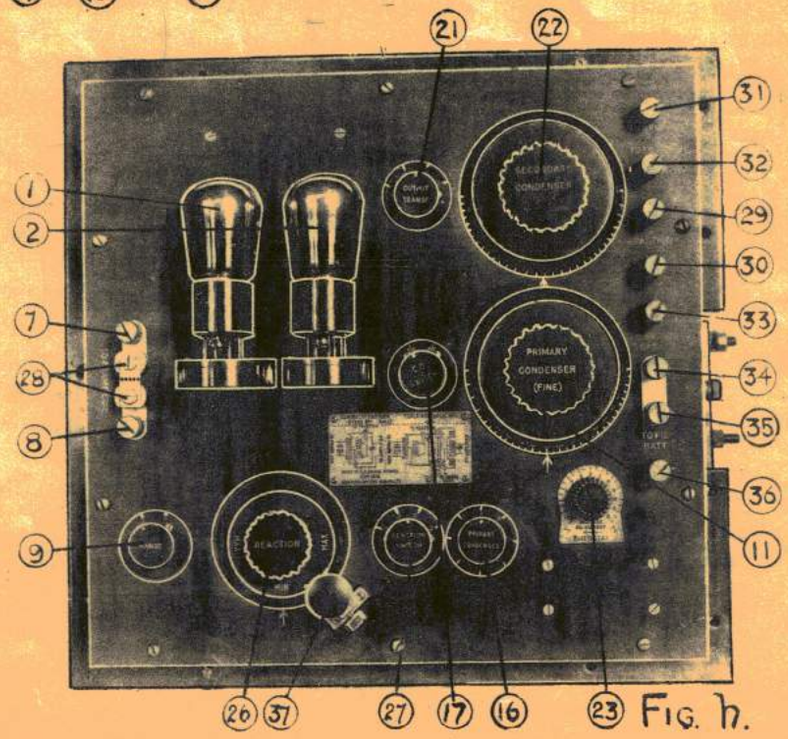


FIG. h.

TUNER A43

Date of design:- 1928.
Frequency range:- 55 - 690 kc/s.
Where fitted:- D/F Outfit SGX. See Sub-section LA.
Valves used:- Two NR17 connected in push-pull.

A43 is fitted in conjunction with amplifier M9 as part of D/F Outfit SGX. The aerial consists of a rotating frame coil (3) which is mounted directly above the D/F office and is connected by short leads to the receiving instruments.

Two ranges are provided for by means of a range switch (9). In range 1 position the switch connects the frame coil (3) direct to the 2 jar tuning condenser (11). In range 2 position the frame coil (3) is connected to two fixed tappings of an auto-transformer (10) (See Admiralty Handbook of W/T (1931) paragraph 796) and the outer ends of the coil (10) are then connected to the tuning condenser (11). Additional fixed condensers (12) of 1.5 jars and (13)(14)(15) of 3 jars each may be switched in parallel with the 2 jar variable condenser (11) by means of the condenser switch (16).

The eight positions of the condenser switch (16) give the following total values of capacity:-

Position	0	0 - 2	jars.	Position	4	6 - 8	jars.
"	1	1.5 - 3.5	"	"	5	7.5 - 9.5	"
"	2	3 - 5	"	"	6	9 - 11	"
"	3	4.5 - 6.5	"	"	7	10.5 - 12.5	"

The figures in brackets against the small switches in the sketch indicate the position numbers at which they are closed by the condenser switch (16).

The frequency ranges covered by the range switch are as follows:-

Range 2 60 - 350 kc/s. Range 1 330 - 670 kc/s.

"STAND BY" POSITION. To enable rapid searching for signals over a band of frequencies the tuner is set to "Stand By" by the "S.B. - D/F" switch (17). In this position the frame coil (3) and Primary Condenser (11) form the tuned grid circuit of the first valve of the amplifier for Range 1, a simplified circuit of which is shown in figure f. For Range 2 the secondary of the auto-transformer (10) and Primary Condenser (11)form the tuned grid circuit of this valve, as shown in the equivalent circuit figures c. and d.

Fairly good zeros may be obtained in the "Stand By" position.

"D/F" POSITION. For greater selectivity and to give symmetry in the frame coil circuit thus giving better D/F zeros the tuner may be switched to the D/F position whereby an arrangement of balanced valves is employed. In this position the frame coil (3) and primary condenser (11) are connected to the grids of two valves (1) and (2) arranged in "push-pull" for Range 1. For Range 2 the secondary of the auto transformer (10) and the primary condenser (11) are connected to the grids of the valves, the frame coil (3) being connected to the fixed tappings on the transformer (10) as shown in the equivalent circuit figures c. and e.

The anodes of the two valves (1) and (2) are connected to two coils (18) (19) which form the primary of the output transformer.

The secondary (20) of the output transformer is connected to a switch (21) which varies the number of turns in use an equal amount from the centre point outwards to maintain the balance of the circuit. At each position of the "output transformer" switch (21) tuning is effected by a 2 jar variable condenser (22).

The frequency ranges covered in the four positions of the switch are as follow:-

Position	4	55 - 185 kc/s.
"	3	100 - 320 kc/s.
"	2	200 - 550 kc/s.
"	1	360 - 690 kc/s.

A slight readjustment of the primary condenser (11) is sometimes found necessary when changing from "Stand By" to "D/F" to obtain accurate tuning.

One contact of the "Stand By - D/F" switch (17) breaks the filament supply to the valves (1) and (2) when in the "Stand By" position. The other contact connects the output terminal (31) to one side of the primary condenser (11) in the "Stand By" position and to one side of the secondary condenser (22) in the "D/F" position.

C.W. signals may be received by using the reaction coil (25) which is coupled symmetrically to the auto-transformer and is therefore effective in either the "Stand By" or "D/F" position when using Range 2. To receive C.W. on range 1 it is always necessary to use the K5.

Four positions of the reaction switch (27) vary the number of turns in use, thus providing suitable coupling over a large frequency range. Position 0 of the reaction switch short circuits the reaction coil when reaction is not required.

A further adjustment of reaction can be made by turning the handle (26) which rotates the coupling coil about an axis. A mechanical vernier (37) is fitted for finer adjustment.

It should be noted that although fairly reliable bearings can be taken when using the reaction coil in the Tuner the correct and accurate method is to use a Heterodyne Unit K5 coupled to the Amplifier.

TUNER A 43

STAND BY.

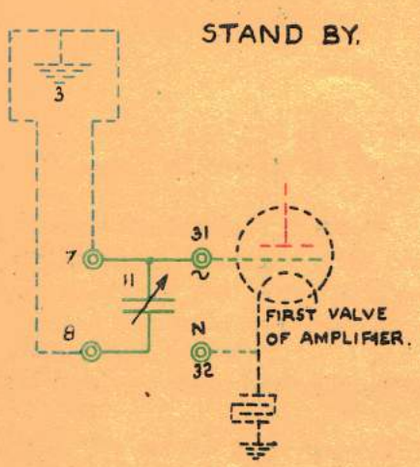


Fig. B.

D/F.

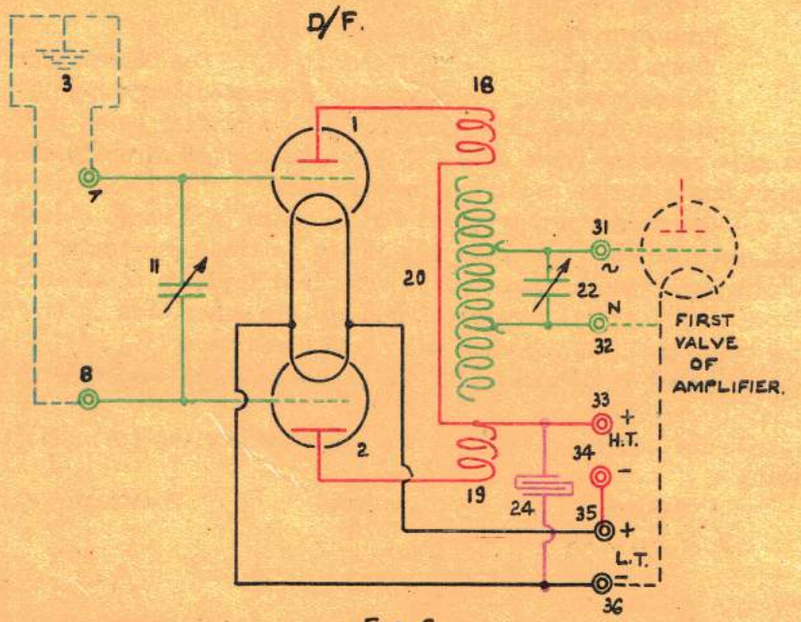


Fig. C.

RANGE 1.

STAND BY.

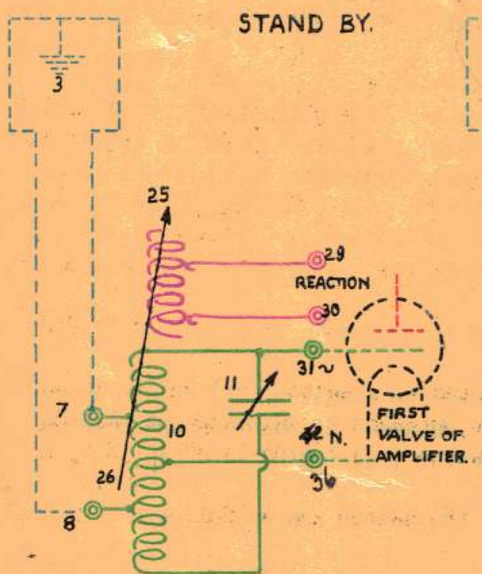


Fig. d.

D/F

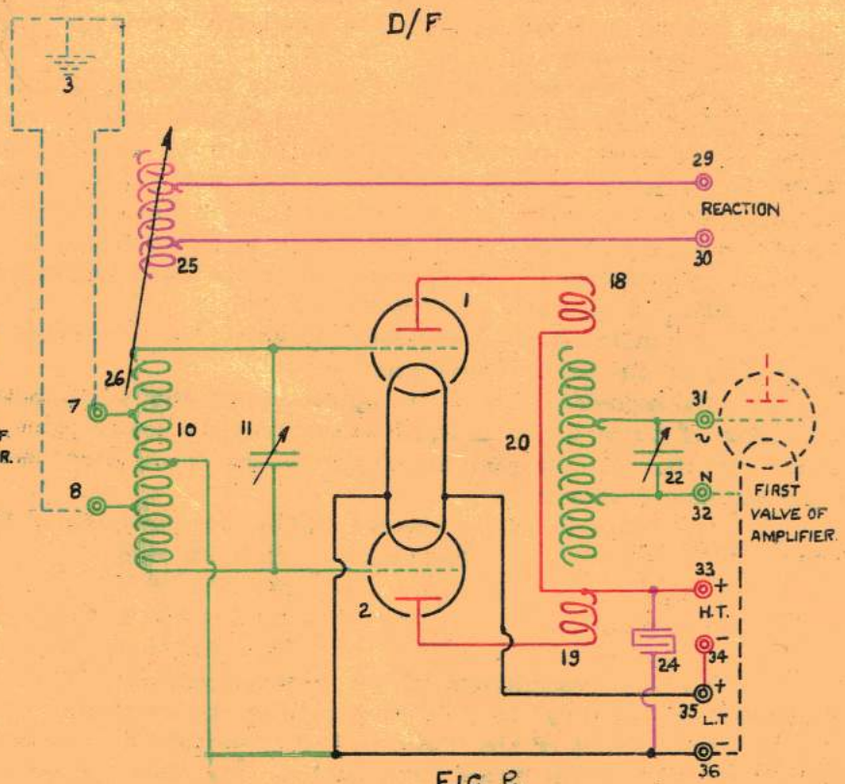


Fig. e.

RANGE 2.

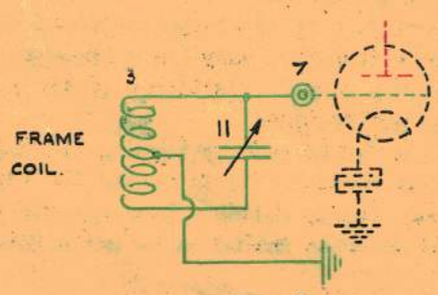


Fig. f.

TUNER A44

Date of design:- 1928.
Frequency range:- 460 - 1200 kc/s.
Where fitted :- D/F Outfit SGX. See Sub-Section LA.
Valves used:- Two NR17.

A44 is fitted in conjunction with Amplifier M5 as part of D/F Outfit SGX.

The rotating frame coil (3) is tuned by a 2 jar variable condenser (9) in both the "Stand-By" and "D/F" positions of the tuner. (See Admiralty Handbook of W/T (1931) paragraph 796).

"STAND-BY" POSITION. To enable rapid searching for signals over a band of frequencies the tuner is set to "Stand-By" by the "S.B. - D/F" switch (10). In this position the frame coil (3) and primary condenser (9) form the tuned grid circuit of the amplifier as shown in the equivalent circuit figure b., a simpler version of which is shown in figure d.

Fairly good D/F zeros may be obtained with the tuner in the "Stand By" position.

"D/F POSITION". For greater selectivity and to give symmetry in the frame coil circuit, the tuner may be set to "D/F" whereby an arrangement of balanced valves is employed.

In this position the frame coil (3) is tuned by the primary condenser (9) and connected to the grids of two valves (1) and (2) arranged in "push pull" as shown in the equivalent circuit figure c.

The anodes of the two valves (1) and (2) are connected to two coils (11) and (12) which form the primary of the output transformer.

The secondary of the output transformer (13) is tuned by a 2 jar variable condenser (14) one side of which is connected to the output terminal (15) by the "Stand By - D/F" switch (10). A centre tapping on the secondary is connected to the output terminal (16).

This method of coupling to the amplifier maintains the symmetry of the circuit through the tuner in the D/F position and D/F zeros taken in this position should therefore be superior to those taken in the stand by position.

A reaction coil is not fitted to the Tuner. Amplifier M5 may be used as an autodyne for the reception of C.W. signals.

One contact of the "Stand By - D/F" switch (10) breaks the filament supply to the valves (1) and (2) when in the "Stand By" position. The other contact connects the output terminal (15) to one side of the primary condenser (9) in the "Stand-By" position and to one side of the secondary condenser (14) in the "D/F" position.

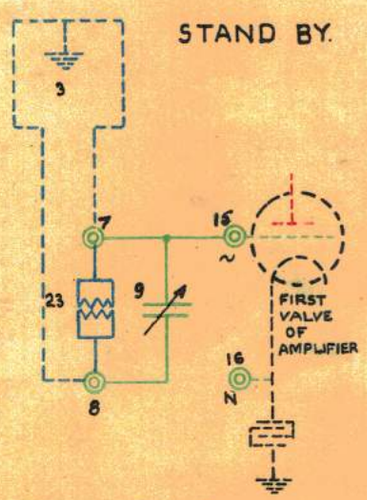


Fig. b.

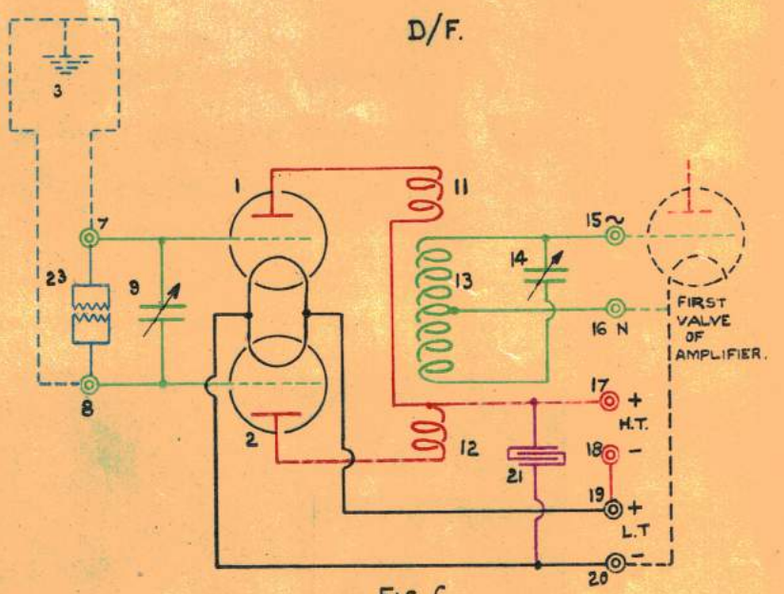


Fig. c.

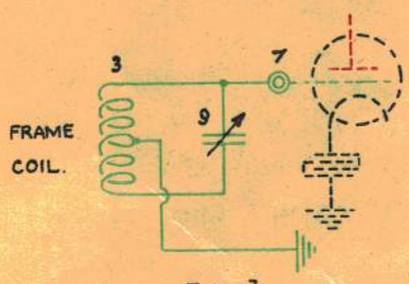


Fig. d.

TUNER A 44

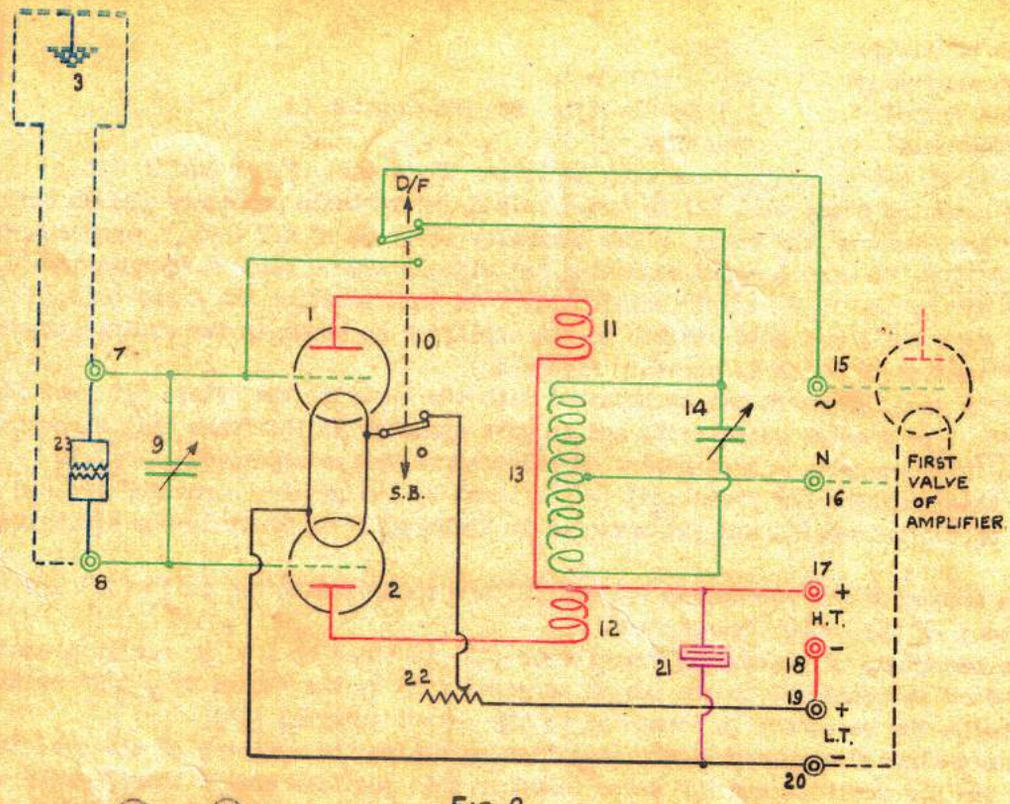


FIG. Q.

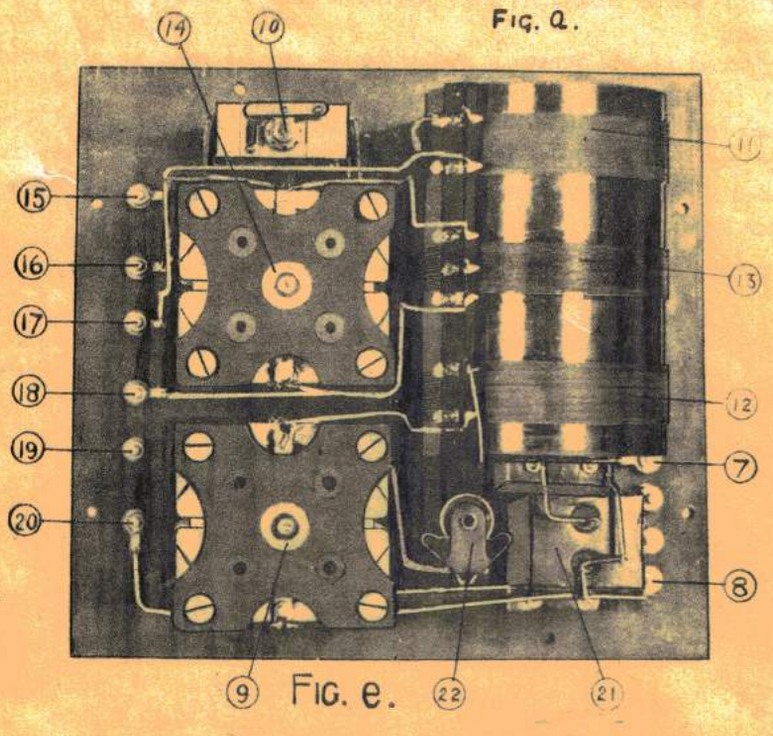


FIG. e.

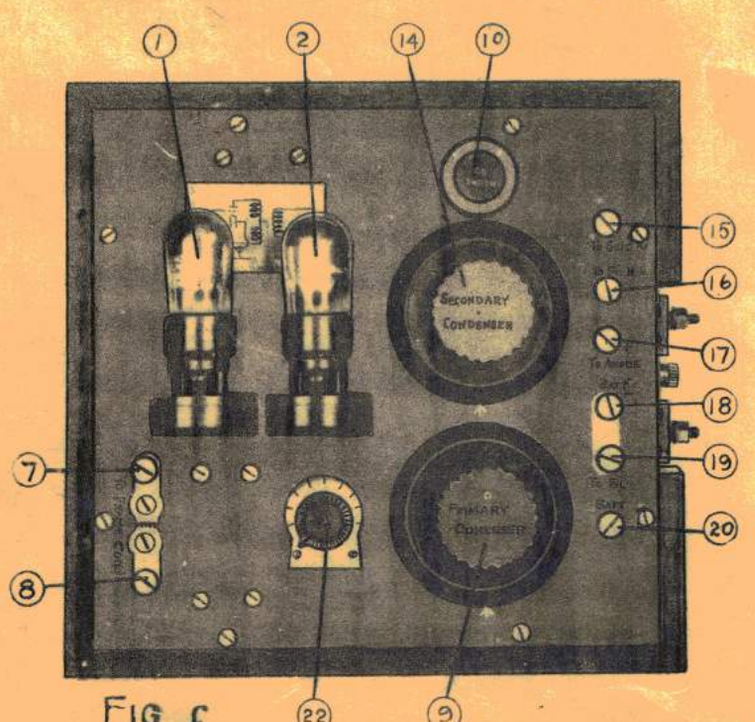


FIG f

TUNER A46

Date of design:-	1931.
Frequency range:-	60 - 600 kc/s.
Where fitted:-	D/F outfits SE, SG and RM.
Valves used:-	Two NR16A for secondary circuit.
	One NR15A for sensefinder.
Reference:-	Admiralty Handbook of W/T (1931), paragraph 796.

Tuner A46 has been designed for use in conjunction with Amplifier M9, Note Magnifier N20 and Heterodyne Unit K7 as part of D/F outfits where rotating frame-coil aerials are fitted.

A sense-finder S42 and semi-circular corrector S61 (described on pages LC3 and LD2 respectively) are incorporated in the tuner. The sensefinder or semi-circular corrector coils (21) or (20) are connected in circuit by the aerial switch (15) which can be set to "D/F", "Sense", "Corr.1" or "Corr.2" positions. The tuner is shown diagrammatically in figure c.

The four positions of the switch (15) make the following circuits:-

"D/F Position. The vertical aerial is earthed and the H.T. and filament supplies to the sensefinder valve (18) are broken.

"Sense" Position. The vertical aerial is connected to the coupling condenser (16) and the H.T. and filament supplies to the sensefinder valve (18) are made.

"Corr.1" and "Corr.2" Positions. The vertical aerial is connected through the corrector coil (20) to earth and the H.T. and filament supplies to the sensefinder valve (18) are broken. A 0.2 jar condenser (19) is connected in series with the corrector coil (20) in the "Corr.2" position.

Two inductances (9)(10) and a 0.7 jar condenser (6) are used when the tuner forms part of D/F outfit SG and are connected in the frame coil circuit by means of two links (7)(8) which are fitted inside the tuner. The additional inductance (9)(10) and capacity (6) are required owing to the fact that the natural inductance and capacity of the leads from the frame coil in D/F outfit SG (where the D/F office is immediately below the frame-coil) is much less than in D/F outfits where the frame-coil is remote controlled and has long connecting leads between the frame-coil and the D/F outfit.

The tuner has two tuning positions, "Stand-by" and "D/F", the change over being effected by the output switch (27).

"Stand-by" Position. To enable rapid searching for signals over a band of frequencies the tuner is set to "Stand-by". In this position the two balanced valves (1)(2) are not used and the frequency range of the circuit (and also the type of circuit) which connects the frame-coil (3) to the first valve of the amplifier M9 is determined by the primary range switch (22). This switch (22) has five positions which correspond with the five range positions of the heterodyne unit K7.

On ranges 1 and 2 the frame-coil (3) is connected to fixed tappings on the primary coil (23) which is used as an auto-transformer and, in conjunction with the condensers in use, forms the tuned grid circuit of the first valve of the amplifier (see figure a.)

On ranges 3, 4 and 5 the primary coil (23) is isolated and the frame-coil (3) is directly tuned by the condensers (24)(25)(26) according to the range in use. An additional shunt inductance (11) is connected across the frame-coil (3) for range 5 only (see figure b.)

STAND-BY POSITION

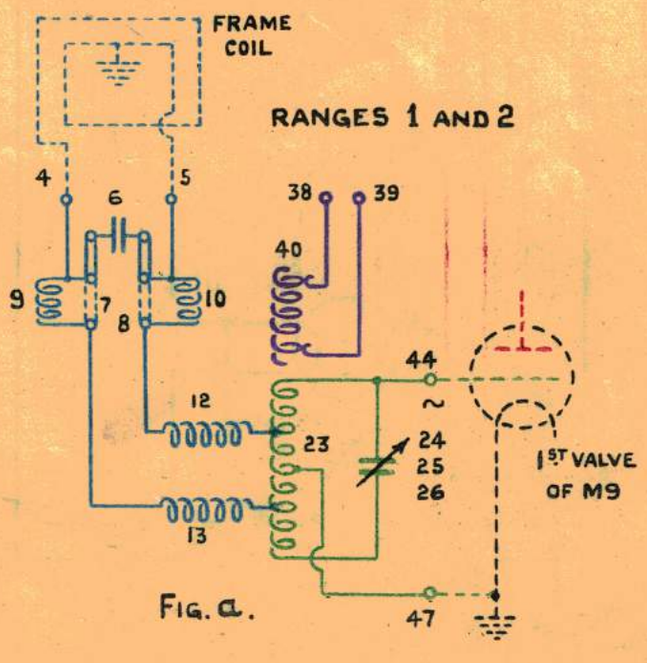


FIG. a.

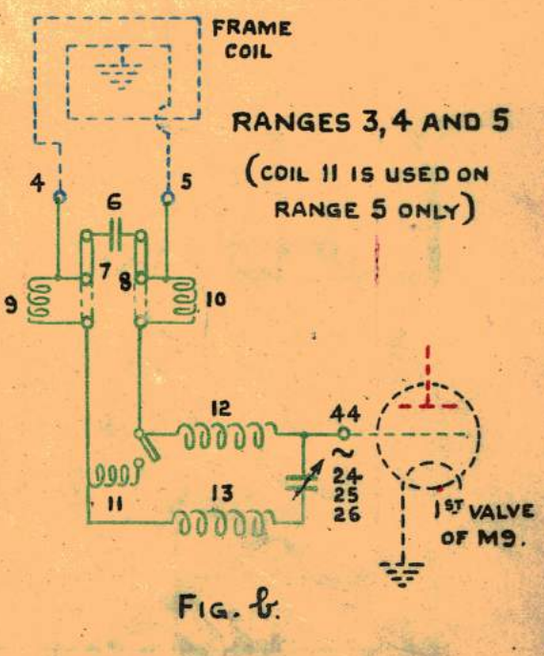
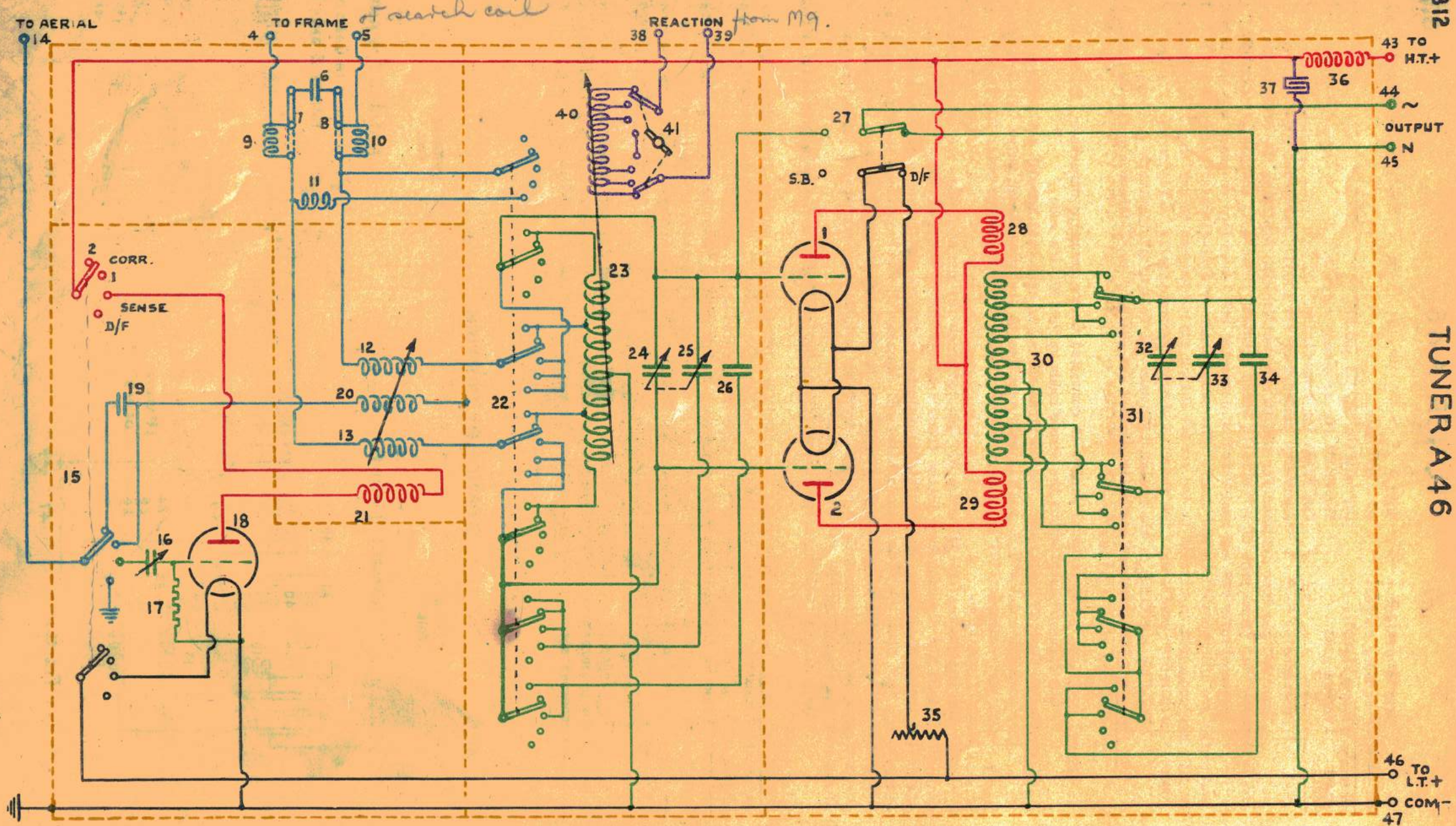


FIG. b.



BB12

TUNER A46

FIG. C.

The coils and condensers in use for each position of the primary range switch (22) are as follows:-

Primary Range Switch	Frequency Range kc/s.	Inductance.	Tuning Condensers.
1	60 - 90	Framecoil (3) and auto-transformer (23).	2-jars variable (24)(25). 1-jar fixed (26).
2	90 - 180	Framecoil (3) and auto-transformer (23).	2-jars variable (24)(25).
3	180 - 250	Framecoil (3).	2-jars variable (24)(25). 1-jar fixed (26).
4	250 - 350	Framecoil (3).	2-jars variable (24)(25).
5	350 - 600	Framecoil (3) and shunt-coil (11).	1-jar variable (24).

The coupling coils (12)(13) are connected in the frame coil circuit for all positions of the primary range switch (22).

"D/F" Position. In order to obtain greater selectivity and better D/F zeros, the tuner should be set to "D/F" by means of the output switch (27).

When the switch (27) is set to this position the primary circuit is disconnected from the input of amplifier M9 and connected to the grids of two valves (1)(2) arranged in push-pull (see figures d and e and Admiralty Handbook of W/T (1931), paragraph 790.) The output switch (27) also completes the filament supply to the two valves (1)(2) whose anodes are connected to the split coil (28)(29) which forms the primary of the output transformer. The secondary of this transformer is tuned by the two 1-jar variable condensers (32)(33) and 1-jar fixed condenser (34) and this tuned circuit is connected to the first valve of amplifier M9. The tuning of the secondary circuit is controlled by a five-position secondary range switch (31) which is similar to that in the primary circuit and is so arranged that, by means of tappings on the secondary inductance (30), the settings of the primary and secondary variable condensers (24)(25) and (32)(33) are, as nearly as possible, the same for any particular frequency.

The coils and condensers in use for each position of the secondary range switch (31) are as follows-

Secondary Range Switch	Frequency Range kc/s.	Inductance.	Tuning Condensers.
1	60 - 90	All transformer secondary (30).	2-jars variable (32)(33). 1-jar fixed (34).
2	90 - 180	All transformer secondary (30).	2-jars variable (32)(33).
3	180 - 250	Part of transformer secondary (30).	2-jars variable (32)(33). 1-jar fixed (34).
4	250 - 350	Part of transformer secondary (30).	2-jars variable (32)(33).
5	350 - 600	Part of transformer secondary (30).	1-jar variable (32).

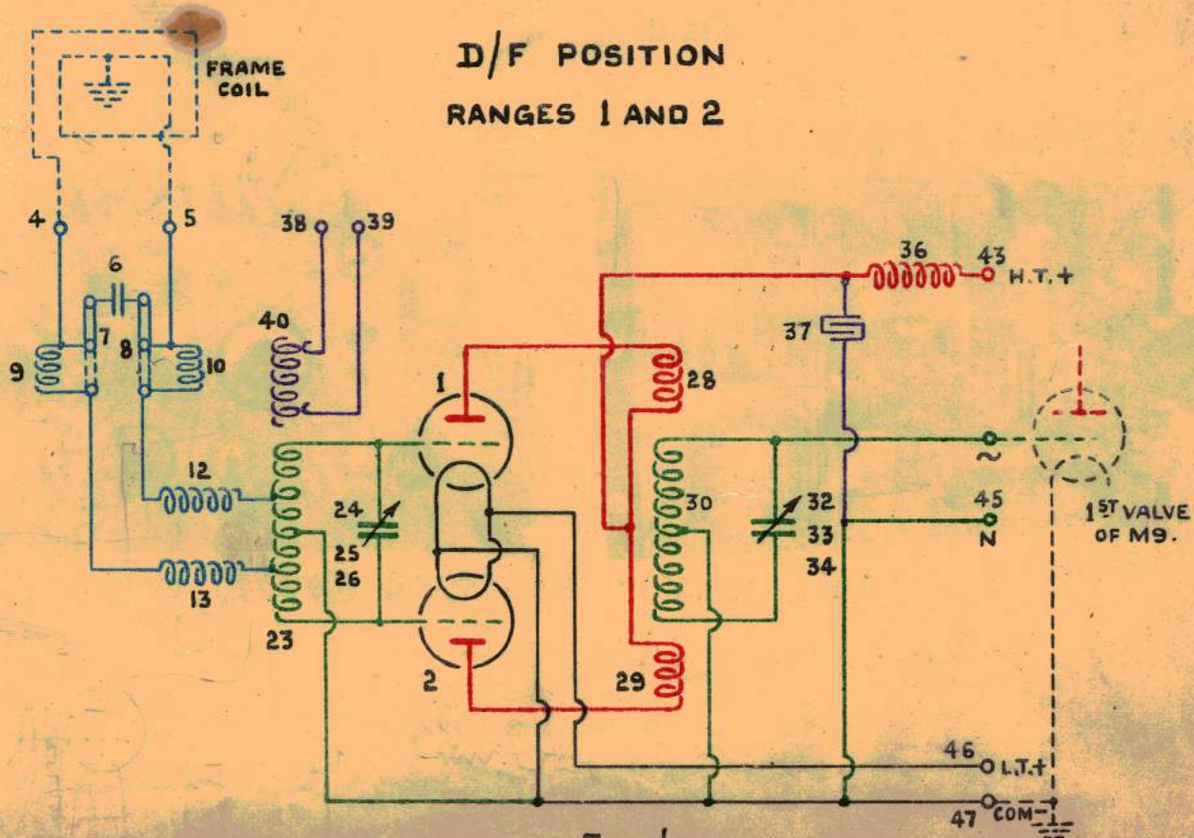


FIG. d

TUNER A46

C.W. signals can be received by using the reaction coil (40) connected to amplifier M9 which is used as an autodyne receiver. The reaction coil (40) is coupled to the auto-transformer (23) in the primary circuit and is, therefore, effective in either the "Stand-by" or "D/F" position, but only when using ranges 1 or 2. Four positions of the reaction switch (41) vary the number of turns in use, thus providing a suitable coupling over frequencies covered by ranges 1 and 2 of the range switches (22)(31). Position 0 of the reaction switch (41) disconnects the reaction coil (40) and short circuits the reaction terminals (38)(39) when reaction is not required. A further adjustment of reaction can be made by rotating the coil (40) by means of the reaction coupling handle (42). A mechanical vernier is fitted to the handle (42) for finer adjustment.

C.W. signals can also be received by using the Heterodyne Unit K7 which is connected to the Amplifier M9.

The autodyne method is provided to facilitate rapid searching for signals but it is preferable to use the Heterodyne Unit K7 method as this eliminates any possibility of change in pitch of the C.W. note when revolving the goniometer search coil and also gives maximum sensitivity and selectivity.

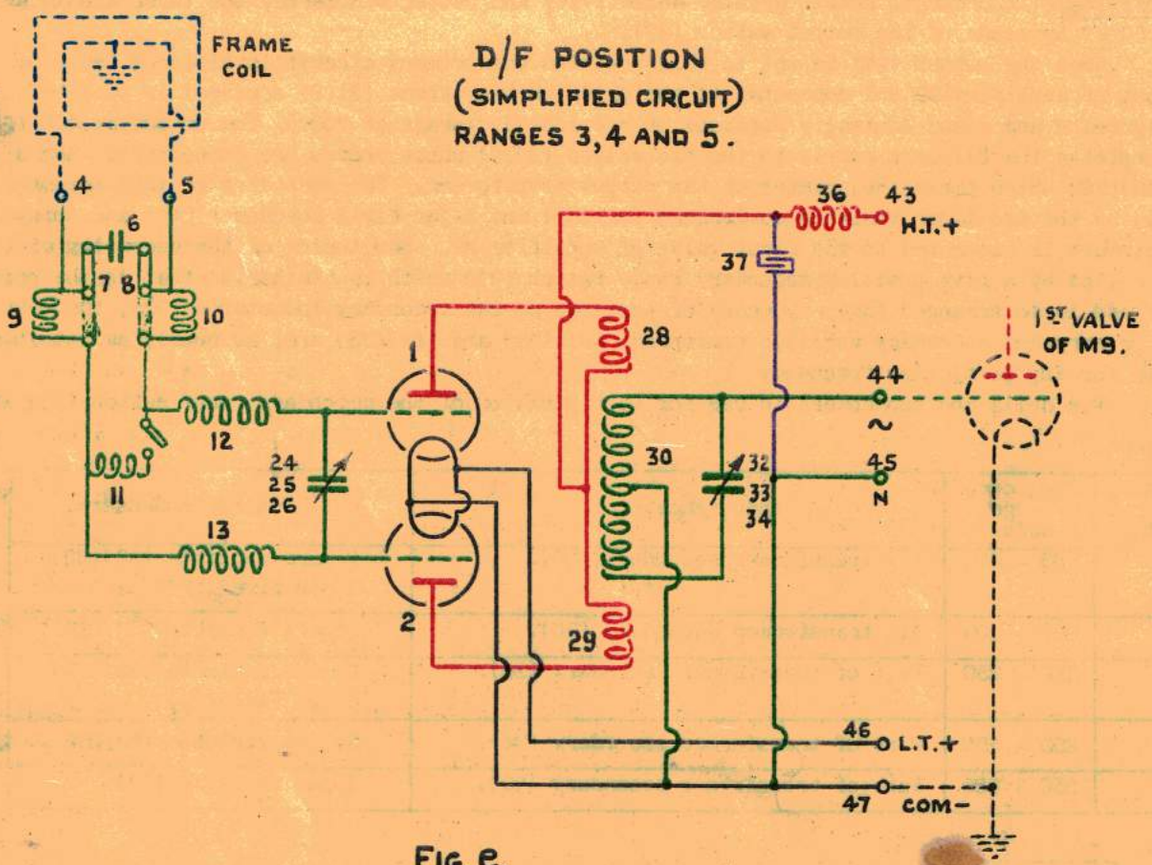


FIG. e.

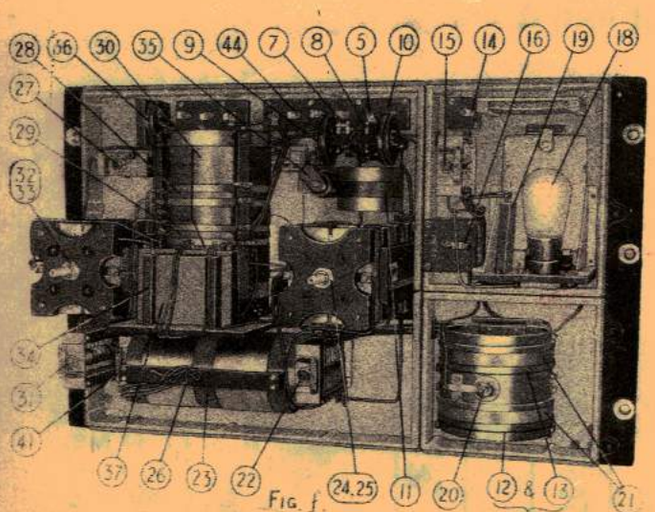


FIG. f.

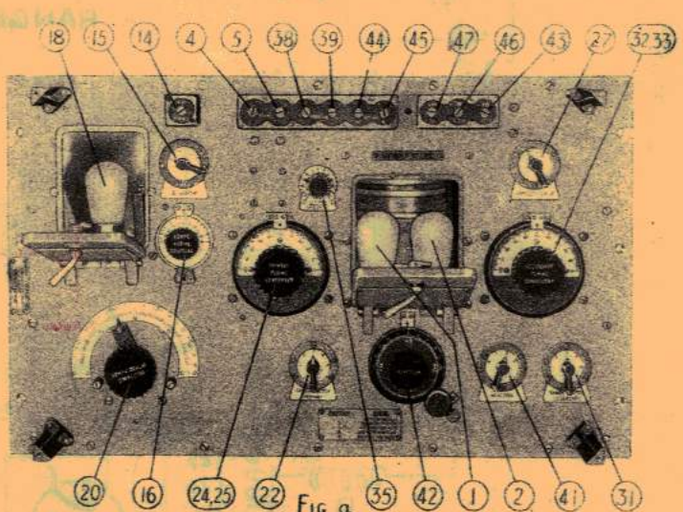


FIG. g.

TUNER A47

Date of design:- 1931.
Frequency Range:- 60 - 600 kc/s.
Where fitted:- D/F Outfits FA, FC, FH and LM.
Valves used:- Two NR16A for secondary circuit.
One NR15A for sensefinder.
Reference:- Admiralty Handbook of W/T (1931), paragraph 796.

Tuner A47 has been designed for use in conjunction with Amplifier M9, Note Magnifier N20 and Heterodyne Unit K7 as part of D/F outfits where a goniometer is connected to the aerial system.

A sensefinder and semi-circular corrector are incorporated in the tuner. The sensefinder or semi-circular corrector coils (12)(13) are connected in circuit by the aerial switch (6) which can be set to "D/F", "Sense", "Corr.1" or "Corr.2" positions. The tuner is shown diagrammatically in figure c.

The four positions of the aerial switch (6) make the following circuits:-

"D/F" Position. The vertical aerial is earthed and the H.T. and filament supplies to the sensefinder valve (1) are broken.

"Sense" Position. The vertical aerial is connected to the coupling condenser (8) and the H.T. and filament supplies to the valve (1) are made.

"Corr.1" and Corr.2" Positions. The vertical aerial is connected through the corrector coil (10) to earth and the H.T. and filament supplies to the sensefinder valve (1) are broken. A 0.2 jar condenser (7) is connected in series with the corrector coil (10) in the "Corr.2" position.

The circuits of the sensefinder and semi-circular corrector are identical with those of sensefinder S42 and semi-circular corrector S61, described on Pages LC2 and LD2 respectively.

The tuner has two tuning positions, "Stand-by" and "D/F", the change over being effected by the output switch (20).

"Stand-by" Position. To enable rapid searching for signals over a band of frequencies, the tuner is set to "Stand-by". In this position the two balanced valves (2)(3) are not used and the frequency range of the circuit (and also the type of circuit) which connects the Gonio (5) to the first valve of the amplifier M9 is determined by the primary range switch (14). This switch (14) has four positions, to cover four frequency ranges.

On ranges 1 and 2 the goniometer search coil (5) is connected to fixed tappings on the primary coil (16) which is used as an auto-transformer and, in conjunction with the condensers in use, forms the tuned grid circuit of the first valve of the amplifier (see figure a).

On ranges 3 and 4, the primary coil (16) is isolated and the goniometer search coil (5) is directly tuned by the condensers (17)(19) according to the range in use. An additional shunt inductance (15) is connected across the goniometer search coil (5) for range 4 only (See figure b.).

The variable primary tuning condensers (17)(19) are ganged and are, therefore, adjusted by one dial when either one or both of the condensers are connected in the primary circuit by the primary range switch (14).

STAND - BY POSITION.

RANGES 1 AND 2.
(CONDENSER (18) IS USED ON RANGE 1 ONLY).

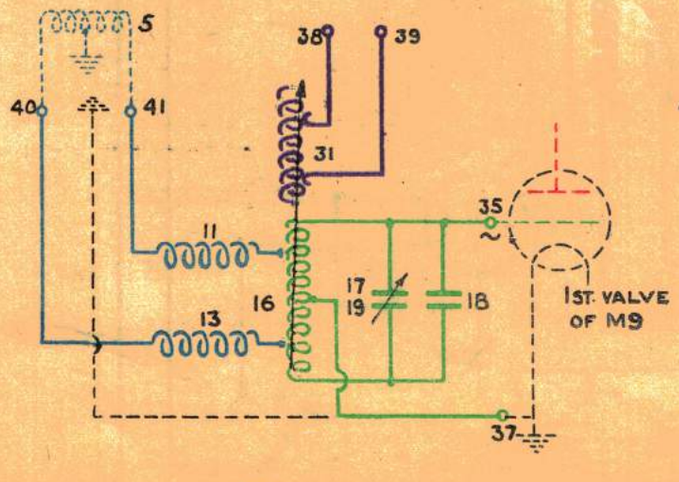


FIG. a.

RANGES 3 AND 4.
(CONDENSER (19) ON RANGE 3 ONLY).
(COIL (15) ON RANGE 4 ONLY).

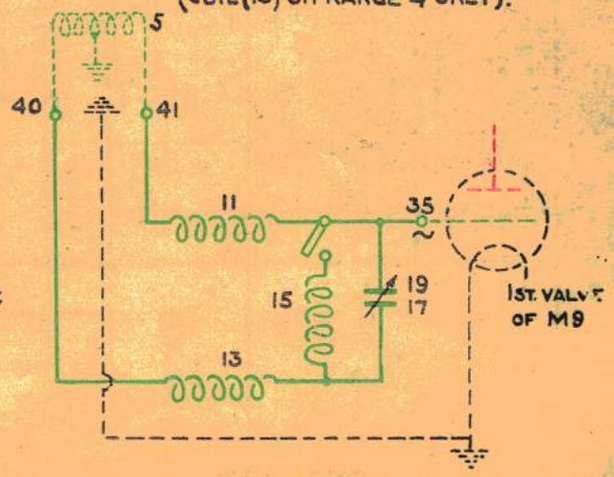


FIG. b.

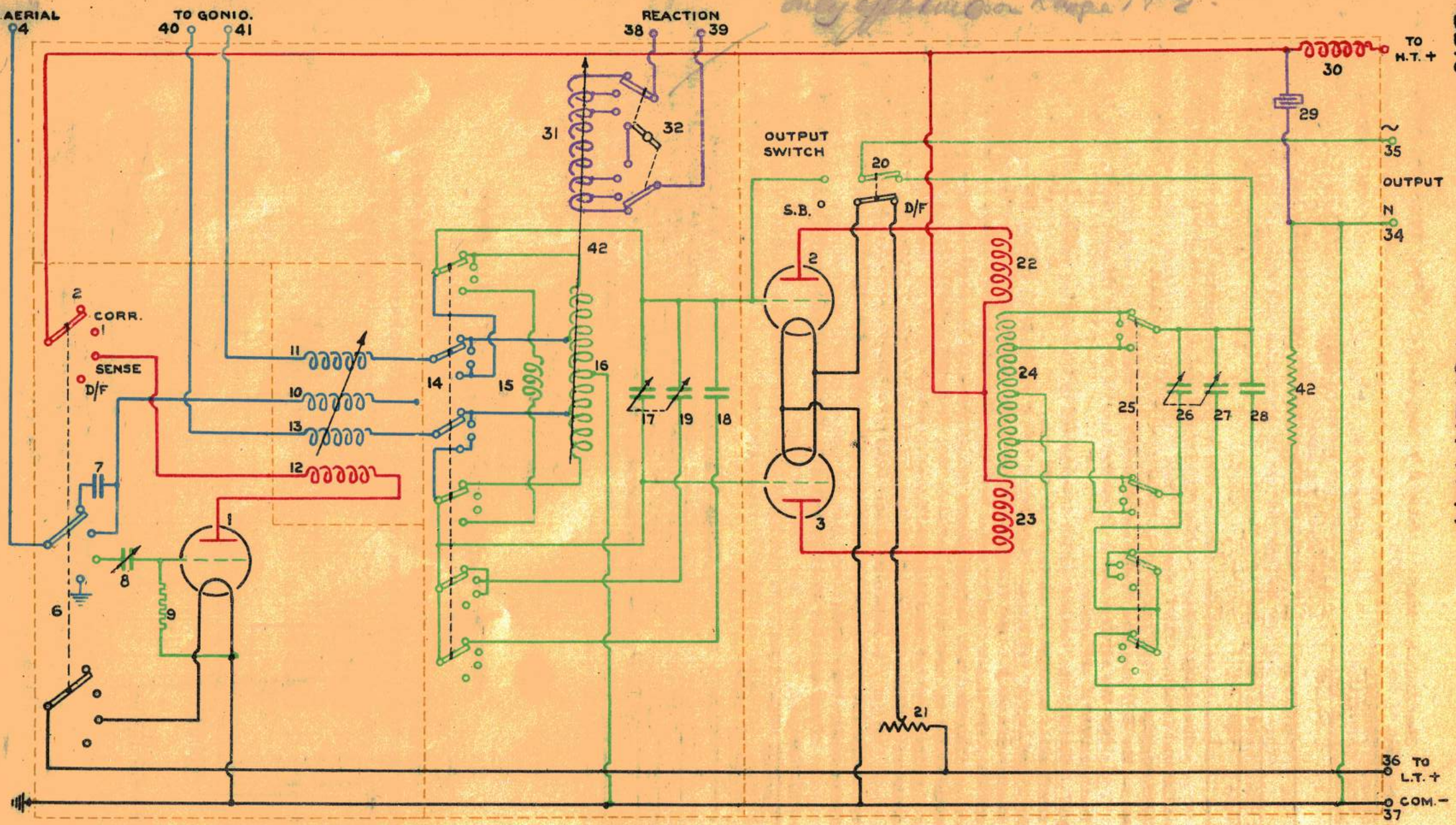


FIG. C.

BB16

TUNER A47

The coils and condensers in use for each position of the primary range switch (14) are as follows:-

Primary Range Switch.	Frequency Range kc/s.	Inductance.	Tuning Condensers.
1	60 - 90	Goniometer search coil (5) and auto-transformer (16).	2-jars variable (17) (19). 0.7-jar fixed (18).
2	90 - 180	Goniometer search coil (5) and auto-transformer (16).	2-jars variable (17) (19).
3	180 - 350	Goniometer search coil (5).	2-jars variable (17) (19).
4	350 - 600	Goniometer search coil (5) and shunt coil (15).	1-jar variable (17).

The coupling coils (11)(13) are connected in the goniometer coil circuit for all positions of the primary range switch (14).

"D/F" Position. In order to obtain greater selectivity and better D/F zeros, the tuner should be set to the "D/F" position by means of the output switch (20).

When the output switch (20) is set to this position the primary circuit is disconnected from the input of amplifier M9 and connected to the grids of two valves (2)(3) arranged in push-pull. (See figures d and e and Admiralty Handbook of W/T (1937) Vol.II, Section F). The output switch (20) also completes the filament supply to the two valves (2)(3) whose anodes are connected to the split coil (22)(23) which forms the primary of the output transformer. The secondary of this transformer is tuned by the two 1-jar variable condensers (26)(27) and 0.7-jar fixed condenser (28), according to range in use, and this tuned circuit is connected to the first valve of amplifier M9. The tuning of the secondary circuit is controlled by a four-position secondary range switch (25) which is similar to that in the primary circuit and is so arranged that, by means of tappings on the secondary inductance (24), the settings of the primary and secondary variable condensers (17)(19) and (26)(27) are, as nearly as possible, the same for any particular frequency.

The variable secondary tuning condensers (26)(27) are ganged and are, therefore, adjusted by one dial when either one or both of the condensers are connected in the secondary circuit by the secondary range switch (25).

The coils and condensers in use for each position of the secondary range switch (25) are as follows:-

Secondary Range Switch (25)	Frequency Range kc/s.	Inductance.	Tuning Condensers.
1	60 - 90	All transformer secondary (24).	2-jars variable (26) (27). 0.7-jar fixed (28).
2	90 - 180	All transformer secondary (24).	2-jars variable (26)(27).
3	180 - 350	Part of transformer secondary (24).	2-jars variable (26)(27).
4	350 - 600	Part of transformer secondary (24).	1-jar variable (26).

D/F POSITION.
(SIMPLIFIED CIRCUIT)
RANGES 1 AND 2.
CONDENSERS (18) AND (28) USED FOR RANGE 1 ONLY.

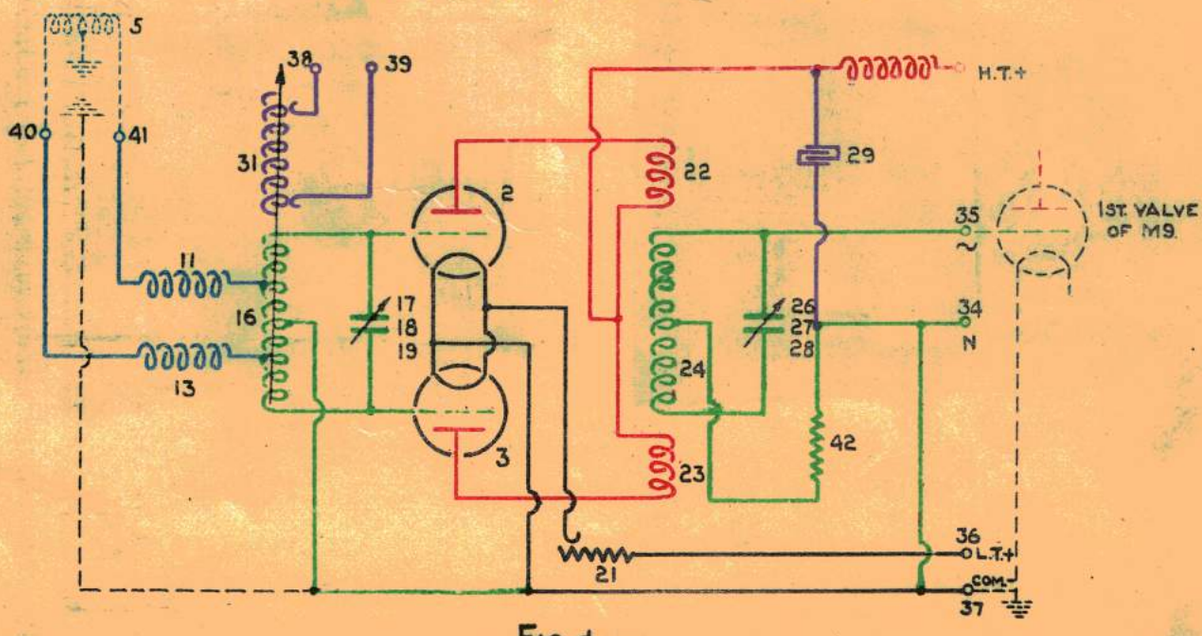


Fig d.

TUNER A47

C.W. signals can be received by using the reaction coil (31) connected to amplifier M9 which is used as an autodyne receiver. The reaction coil (31) is coupled to the auto-transformer (16) in the primary circuit and is, therefore, effective in either the "Stand-by" or "D/F" position but only when using ranges 1 and 2. Four positions of the reaction switch (32) vary the number of turns in use, thus providing a suitable coupling over frequencies covered by ranges 1 and 2 of the range switches (14)(25). Position 0 of the reaction switch (32) disconnects the reaction coil (31) and short circuits the reaction terminals (38)(39) when reaction is not required. A further adjustment of reaction can be made by rotating the coil (31) by means of the reaction coupling handle (42) for finer adjustment.

C.W. signals can also be received by using the Heterodyne Unit K7 which is connected to the amplifier M9.

The autodyne method is provided to facilitate rapid searching for signals but it is preferable to use the heterodyne unit K7 method as this gives maximum sensitivity and selectivity. (See Admiralty Handbook of W/T (1937) Vol. II, Section D).

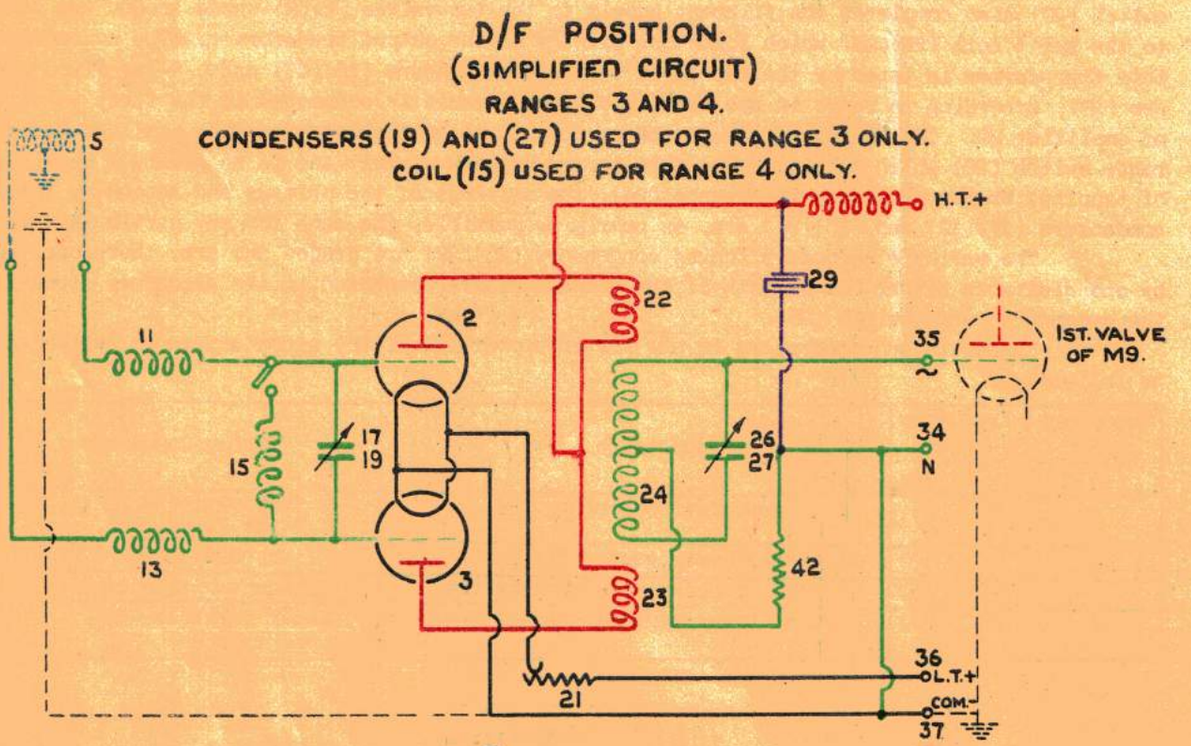


Fig. e.

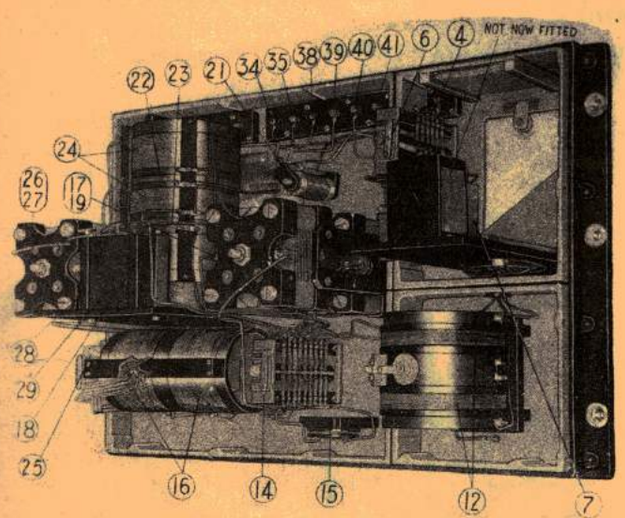


Fig. f.

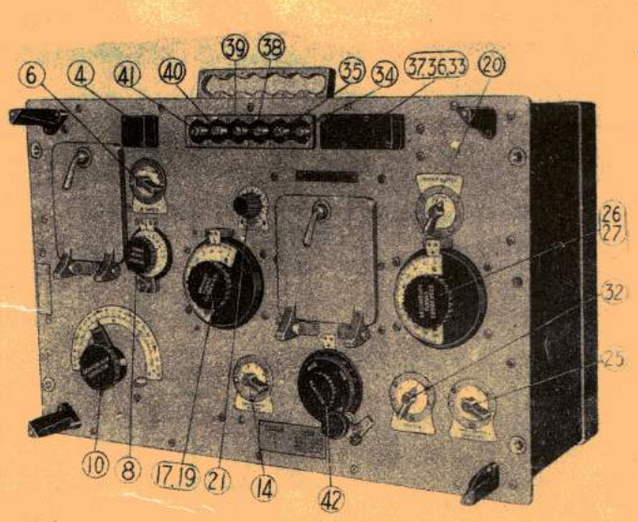


Fig. g.