GA1
MISSING

GA2

MISSING

WAVEMETER PATTERN 1492 B. CA 3

Date of design:- 1918.
Frequency range:- 20 - 3,000 kc/s.

This is the old wavemeter for tuning L/F sets which is being superseded by Wavemeter 09.

The tuning inductance consists of eleven different interchangeable coils (1) to (11), only one of which is inserted at a time. The coupling coil (12) consists of a single turn of copper tubing and is directly connected into the L.C. circuit by a long flexible lead and pair of terminals (22). The capacity consists of a variable one-jar condenser (13) and two fixed condensers (of 0.5 jar approximately each) known as the Fixed Upper (14) and Fixed Lower (15) condensers. The Fixed Upper condenser can be connected in parallel with the variable condenser by means of switch (16), and the Fixed Lower by means of switches (16) and (17). The Fixed Lower can thus only be used in conjunction with the Fixed Upper.

The indicating device consists of a galvanometer (19) operated by a thermo-junction (18) of steel and eureka wires, connected directly into the circuit by means of a pair of terminals (20). The oscillatory current heats the thermo-junction, the heat causing a small D.C. current to be generated, which flows through the galvanometer by virtue of the Seebeck effect (see Admiralty Handbook of W/T (1922) paragraph 822 (c)).

When using the wavemeter to tune a powerful set an open thermo-junction is employed, spare wire being allowed to the ship for renewing the junction when necessary. When the terminals (20) are facing you the steel wire is to your Left and the eureka wire to your Right. After renewing the wire the correct tension to the junction can be put on the steel wire by screw (20) and on the eureka by screw (20). For tuning low power sets, a junction enclosed in a small evacuated glass bulb (23) is provided, which is many times more sensitive than the open junction.

Calibration curves are supplied in a book (33) with each instrument, the calibration being carried out in Signal School. The first and last ten degrees of the moving condenser scale are not used. The last curve in the book is a curve of the variable condenser reading against jars. The exact value of the fixed condensers is also given on this page. It should be noted that, owing to the variable condenser vanes being of semi-circular shape and not of the "Square Law" type, it is only possible to produce "straight line" graphs in the calibration book if condenser readings are plotted against L.C. values. For this reason an "Abac" is provided in each book for conversion of L.C. values into wavelengths. A new type of "Abac" has been produced to convert L.C. values into frequencies which should be quoted alongside the old "Abac". It will be observed that the obsolete notation for L.C. (i.e., L.C.) is still used in these "Abacs".

To minimise the effect of hand-capacity:-

(a) The wavemeter must always be connected to earth by an external lead (32) from terminal (21). Other terminals should NOT be used for this purpose.

(b) An extension is fitted to the condenser handle (24)

It is important that the operator should always be in the same position relative to the wavemeter when tuning (at the condenser end) as a large alteration of position causes a small alteration in reading. The coupling coil should be placed sufficiently close to the transmitting circuit to give about half-scale reading. If placed too close, the thermo-junction may possibly be burnt out. A holder (27) is provided to hold the coupling when it is required to be stood up, and if reversed the holder will clip on the Type 2 mutual coil sliding bar. An additional coupling coil (31) is provided in each box, which was originally intended for obtaining greater accuracy by dispensing with the flexible lead, but this method is no longer used.

When using the open junction, care must be taken to screen it from draughts, since the action of the thermo-couple depends upon its temperature. The efficiency of the junction may be tested by holding a match near it; the heat thus applied should register a small swing. The needle of the galvanometer should always be locked when finished with, to prevent damage when carrying the wavemeter about.

Where it is possible to obtain the required frequency with more than one coil, it is important to use that one which will give the greatest accuracy. This can readily be seen by comparing the curves, the most accurate one being that which, for a given variation of condenser reading gives a smaller change of L.C. value. Pattern 1492B does not give the same percentage accuracy on all frequencies - this defect has been overcome in the new instrument 09. The variable condenser is set in Signal School during calibration by the adjusting nut, which is held in position by a key plate and two screw studs over which the extension handle (24) fits. This key plate must never be removed.

The tuning inductance and fixed condensers are placed within a brass screen, which is made in two parts, one (29) round the former, the other (28) containing the latter.

The lower photograph shows the wavemeter set up in a Type 27 office ready for use. It will usually be found convenient to place the instrument on its box (34). The earth lead (32) is shown connected to the earthed screen of the set. A receiving watch should always be set on the wave on which tuning is being carried out to observe if any interference is being caused to traffic (as is shown in the photograph).

WAVEMETER G 2.

Date of design:- 1930.
Frequency range:- 46,000 - 130,000 kc/s.

G2 is a light, handy little instrument, which can be held in one hand, while the thumb of the same hand operates the condenser handle (5). There is no objection to steadying the wavemeter with the other hand, provided it is kept at the handle end to avoid introducing inaccuracy due to stray capacity effects.

The instrument is unscreened, employs no mutual coil, and has as indicating device a pea lamp (3) inserted midway in the inductance (1). Spare pea lamps (7) and (8) are stowed in the box. The condenser scale (3) is marked in degrees, which can be read off to the nearest tenth by means of a vernier; calibration curves of condenser readings against frequency being supplied. The wavemeter should be accurate to within 2%.

The instrument can be removed from its box by slipping the rubber coupling ring (4) towards the handle into the spare groove provided. The two large screws would then be removed from the back. It should never normally be necessary to take the instrument out of its box, as new pea lamps can be inserted by slipping the cover back, as shown in the photograph.

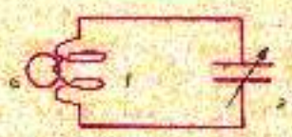

Fig. A.

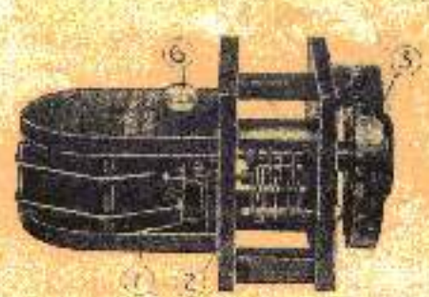

Fig. B

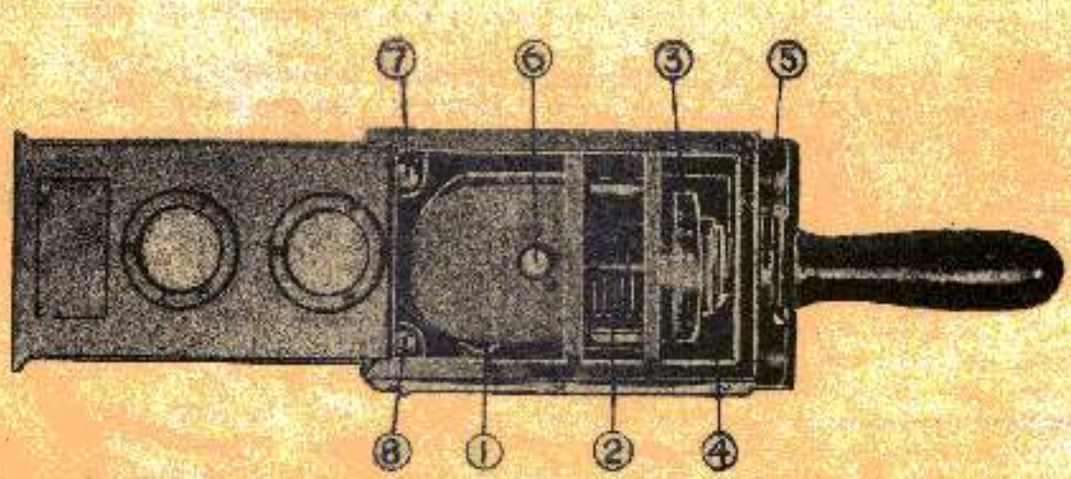

Fig. C

Date of design:- 1920.
Frequency range:- 24,000 - 83,000 kc/s.

G3 is a light, handy little instrument, similar (except for using a coupled pea lamp) to G2. It can be held in one hand while the thumb of the same hand operates the condenser handle (5). There is no objection to steadying the wavemeter with the other hand, provided it is kept at the handle end to avoid introducing inaccuracy due to stray capacity effects.

The instrument is unscreened, employs no mutual coil, and has as indicating device a pea lamp (6), which is coupled to the inductance (1) by means of a single turn coupling coil (7). Spare pea lamps (8) and (9) are stowed in the box. The condenser scale (3) is marked in degrees, which can be read off to the nearest tenth by means of a vernier; calibration curves of condenser readings against frequency being supplied. The wavemeter should be accurate to within 5%.

The instrument can be removed from its box by slipping the rubber coupling ring (4) towards the handle into the spare groove provided. The two large screws should then be removed from the back. It should never normally be necessary to take the instrument out of its box, as new pea lamps can be inserted by slipping the cover back, as shown in the photograph.

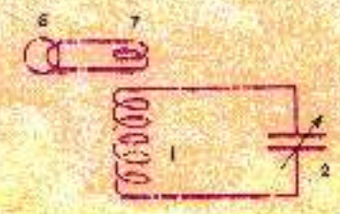

Fig. a.

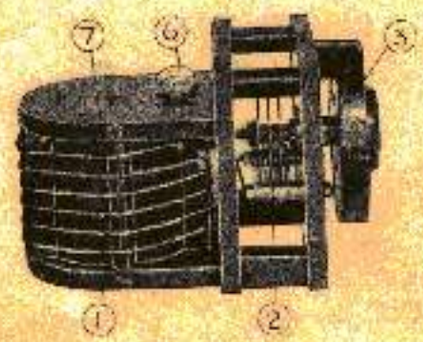

Fig. b

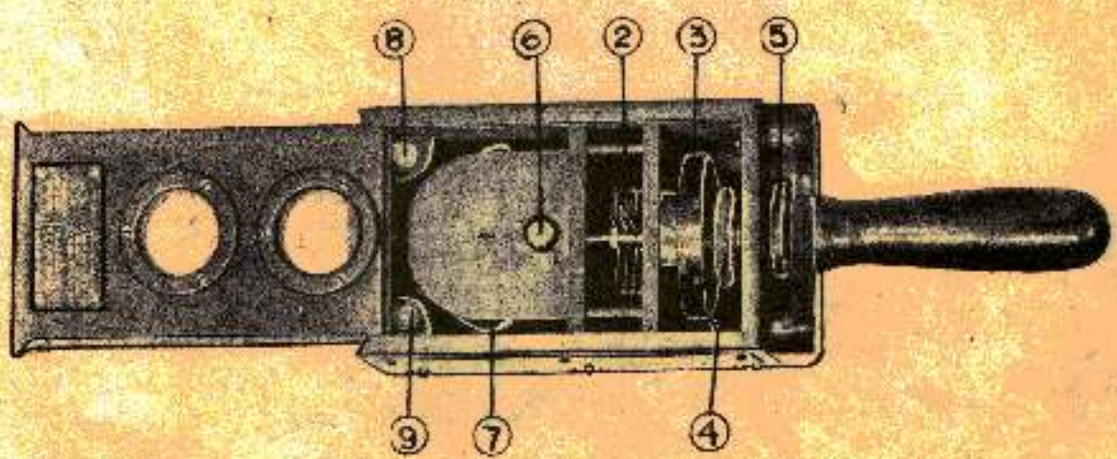

FIG. C

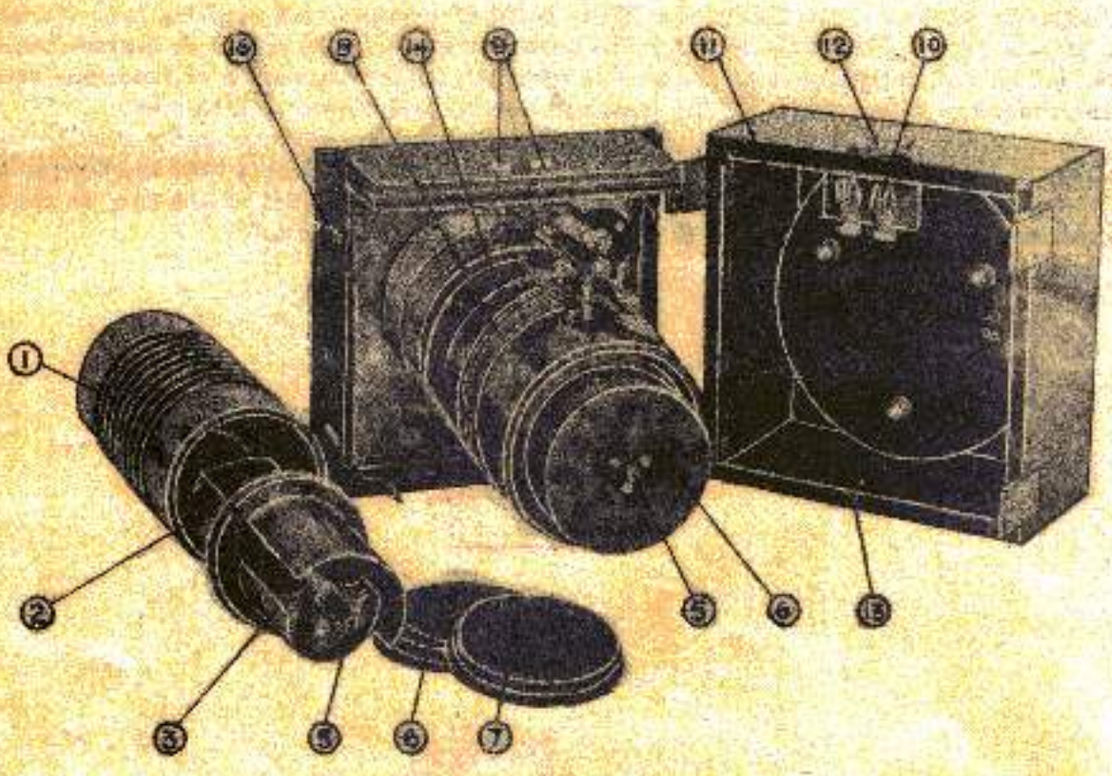

FIG. B

FIG. C

WAVEMETER G 6.

Date of design:- 1927.

Frequency range:- 16,750 - 33,300 kc/s.

G6 employs a unique form of condenser for tuning in which the capacity is varied by moving two plates connected to the copper screen (16) between two fixed plates which are connected to the tuning inductance (1). The fixed plates are of semi-cylindrical form and are mounted inside the former carrying the inductance (1). The moving plates, which are of tapered semi-cylindrical form, are mounted on and electrically connected in series by a common spindle (5) which carries the condenser handle (4) and which is maintained at zero R/F potential by being joined to the copper screen, thus avoiding hand capacity effects. They may be shown as two condensers (2) and (3) connected in series.

The photograph shows part of a second G6 wavemeter stripped to reveal the inductance (1), condensers (2) and (3), the handle (4) and spindle (5) with the two bearing plates (6) and (7), which are all mounted inside a concentric former carrying the mutual coil (8) and the pea lamp coupling coil (14). The wavemeter coupling coil (11) is mounted in the lid (15) which lifts off and fits on the side of the box (as shown in the right hand photograph), being kept in position by a locking device (12). In this position electrical contact is made between the mutual and coupling coils by means of studs (9) and spring contacts (10); the lid of course being unscreened.

The condenser handle (4) can be rotated only through 180°. There are two arrows, the upper one reading off against a scale graduated in metres, the lower one against degrees, but as no calibration curves are supplied only the upper scale is used. Being marked in metres no great accuracy can be obtained in reading off although the instrument is designed to give a high degree of accuracy (coupled pea lamp (14), coupled coupling coil and copper screen). The condenser dial of new instruments will be graduated in kc/s.

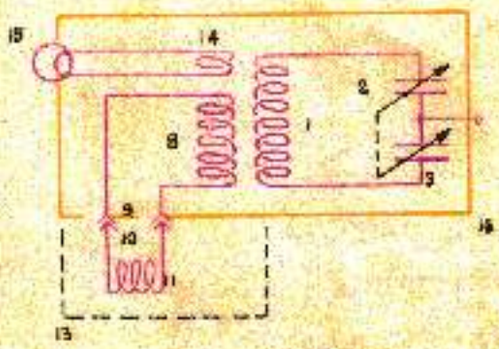

FIG 1.

GAB

WAVEMETER G 7.

Date of design:- 1933.
Frequency Range:- 5,000 - 25,000 kc/s. in two ranges:-
Lower range:- 5,000 - 12,000 kc/s.
Higher range:- 12,000 - 25,000 kc/s.
Reference:- Admiralty Handbook of W/T (1931) paragraph 852.

G7 has been designed to supersede G13, since greater accuracy can be obtained with the former as it is placed in an aluminium screen (15), employs a coupled mutual coil and coupled pea lamp, and calibration curves are provided.

The tuning inductance is wound in two unequal parts (1) and (2), well spaced apart. The tuning capacity consists of two variable condensers of unequal value (3) and (4) mounted on the same spindle, which completes electrical contact between them. A range switch (5) marked in kc/s. switches in on the higher frequency range the smaller inductance (1) and smaller condenser (3). On the lower frequency range the larger inductance (2) is switched in in series while the larger condenser (4) is placed in parallel with condenser (3), thus maintaining the ratio of L to C.

The condenser scale is fitted with a mechanical vernier (16) which can be clutched in or out by means of a disengaging arm (17). The condenser scale is graduated in arbitrary divisions, one hundred occupying one semi-circle of the scale. By means of the vernier tangent screw one twentieth of each division can easily be read so that a very high accuracy of reading off is obtainable.

G7 can be used either as an ordinary wavemeter for tuning transmitters, or in conjunction with oscillator G31 for obtaining receiving adjustments. For this reason the rectangular coupling coil (9) is provided with two alternate sets of sockets, one set being for the "transmitter" position (8), with the coil down, the other for the "receiver" position (7), with the coil up. These pairs of sockets (7) and (8) are connected in parallel to the mutual coil (6), which is coupled to inductance (1). It is important to keep these sockets clean as dirt affects the calibration.

The coupling coil (9) carries a small metal contact (10) which is insulated from the coil. In the "transmitter" position this contact (10) makes on the spring contacts (11) and so completes the circuit to operate the pea lamp (14), since a visual indication of tuning is required. In the "receiver" position, an aural indicating device in the G31 is used and the pea lamp circuit is therefore broken to avoid damping. The pea lamp is coupled to both inductances (1) and (2) by single turns (12) and (13) respectively.

The use of these two positions of the coupling coil necessitates two separate calibrations and the calibration book supplied will be found to have two sets of curves, one marked "Transmitter Position" and the other "Receiver Position". These books contain curves of condenser scale readings against frequency in kc/s.

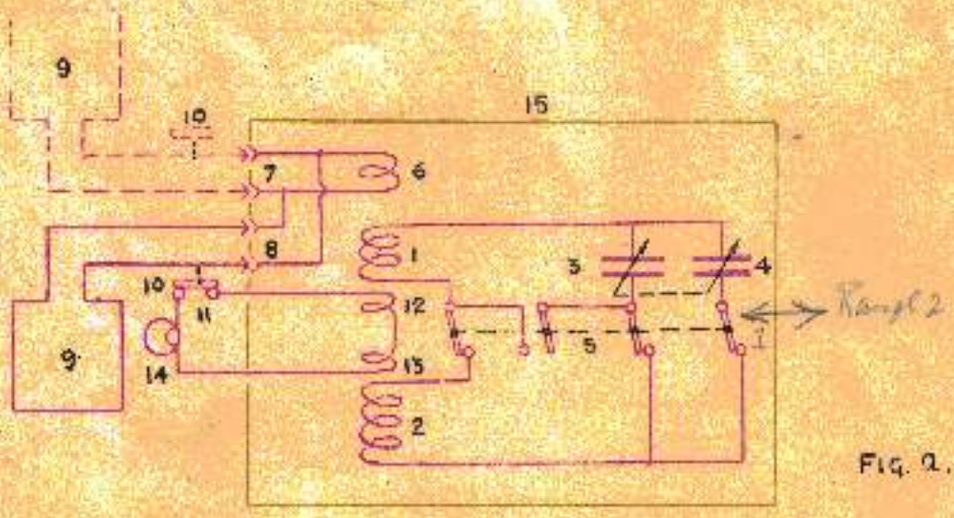

FIG. A.

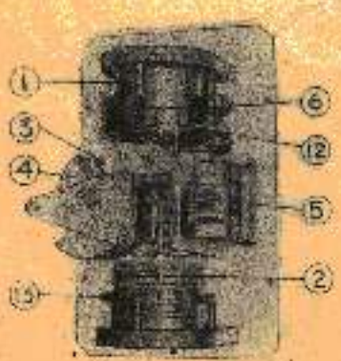

FIG. B

FIG. C

WAVEMETER G 8. GA 9

Date of design:- 1930.
Frequency range:- 1,500 - 6,000 kc/s, in two ranges:-
Lower range:- 1,500 - 3,000 kc/s.
Higher range - 3,000 - 6,000 kc/s.

G8 has been designed to supersede G10, since greater accuracy can be obtained with the former as it is placed in an aluminium screen (15), employs a coupled mutual coil and coupled pea lamp and calibration curves are provided. G8 is very similar to G7, as can be observed from the notes.

The tuning inductance is wound in two equal parts (1) and (2), well spaced apart. The tuning capacity consists of two variable condensers of equal value (3) and (4) mounted on the same spindle, which completes electrical contact between them. Two small semi-adjustable condensers(18) and (19) are permanently connected in parallel, one across each variable condenser, and are used for controlling the overlap between the two ranges obtainable by the range switch (5). After adjustment in Signal School they are securely clamped and must not be altered. A range switch(5), marked in kc/s., switches in on the higher frequency range inductance (1) and condensers (3) and (19). On the lower frequency range the inductance (2) is switched in in series while the condensers (4) and (19) are placed in parallel with condensers (3) and (18). A mechanical vernier (16) with a dinen%ging arm (17) is fitted to the condenser scale for accurate reading of?, as with G7.

G8 can be used either as an ordinary wavemeter for tuning transmitters, or in conjunction with oscillator G11 for obtaining receiving adjustments. For this reason the rectangular coupling coil (9) is provided with two alternate sets of sockets, one set being for the "transmitter" position (6) with the coil down, the other for the "receiver" position (7) with the coil up. These pairs of sockets (7) and (6) are connected in parallel to the mutual coil (8), which is coupled to inductance (1). It is important to keep the sockets clean, as dirt affects the calibration.

The coupling coil (9) carries a small metal contact (10) which is insulated from the coil. In the "transmitter" position this contact (10) makes on the spring contacts (11) and so completes the circuit to operate the pea lamp (14), since a visual indication of tuning is required. In the "receiver" position, an aural indicating device in the G11 is used and the pea lamp circuit is therefore broken to avoid damping. The pea lamp is coupled to both inductances (1) and (2) by single turns (12) and (13) respectively.

The use of these two positions of the coupling coil necessitates two separate calibrations and the calibration book supplied will be found to have two sets of curves, one marked "Transmitter Position" and the other "Receiver Position". These books contain curves of condenser scale readings against frequency in kc/s.

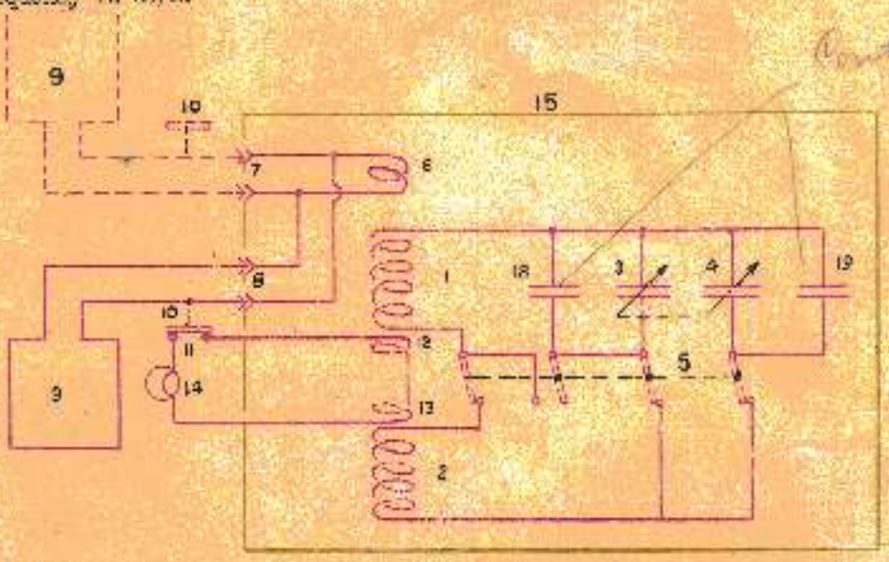

FIG a

FIG. b

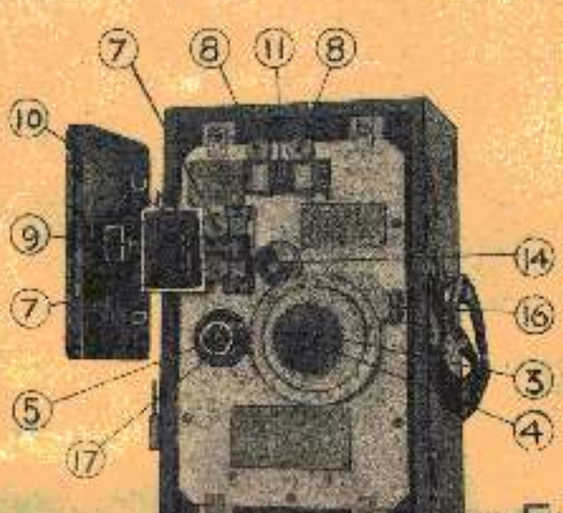

FIG. C

WAVEMETER G 9.

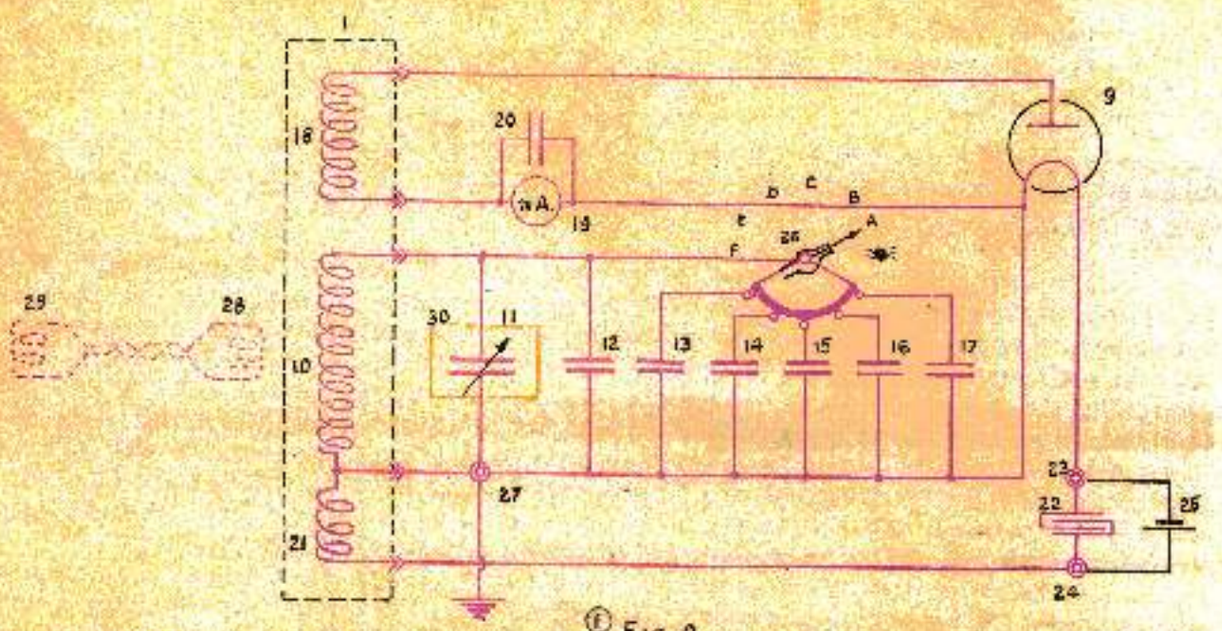

Fig. a

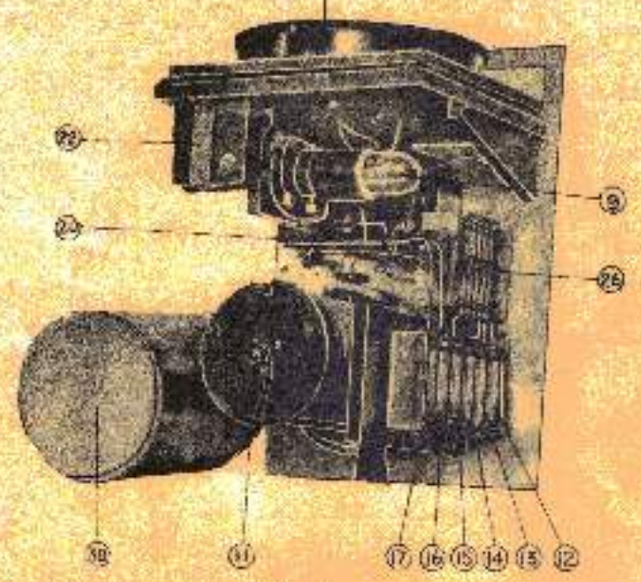

Fig b

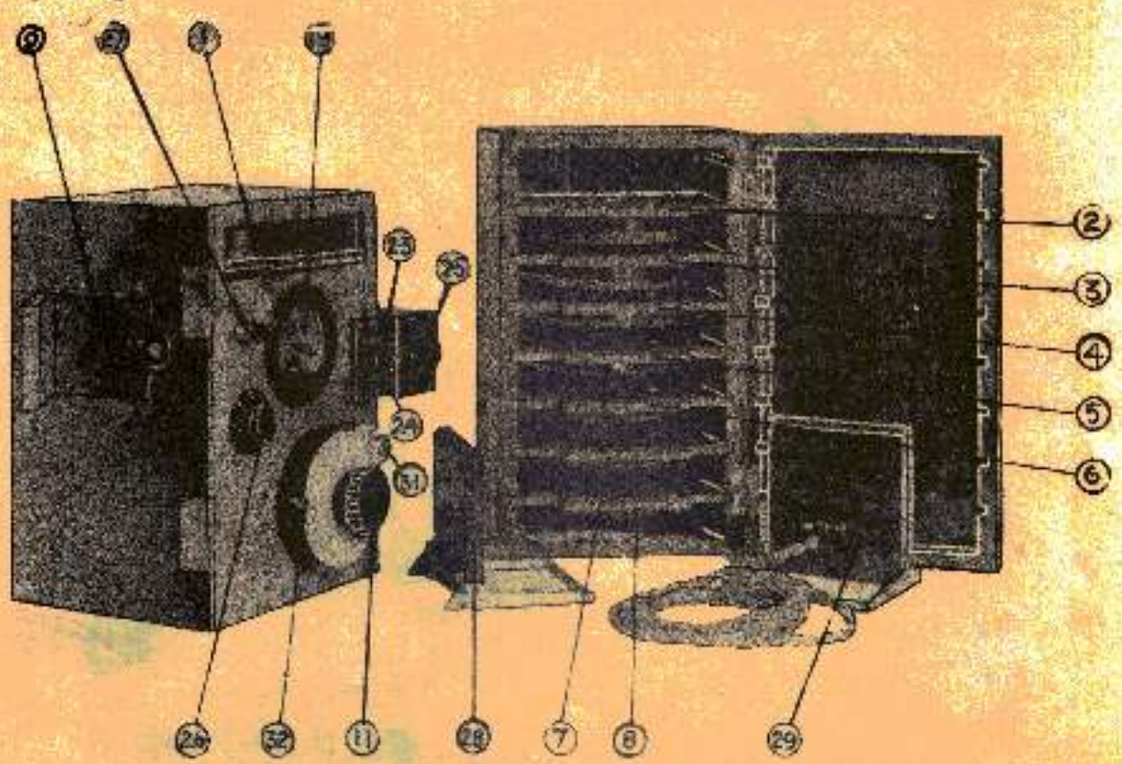

Fig. C

WAVEMETER G9.

Date of design:- 1930.

Frequency range:- 80 - 3,000 kc/s.

G9 has been designed to replace Wavemeter Pattern 1482B and has three principal advantages over it:-

(a) The absence of lag (see below).

(b) The percentage accuracy obtainable is the same for all frequencies.

(c) The diode valve used in G9 is much cheaper than the vacuum thermo-couple used in pattern 1482B.

In order to make the instruments as compact as possible, the wavemeter itself and the coils to be used with it are contained in separate boxes. It is essential that the coils for one wavemeter should always be used with that wavemeter and no other, otherwise the calibration curves will be of little value. This can be checked by comparing serial numbers of coils and instruments.

The indicator used in the instrument comprises a small diode valve (9) and milliammeter (19) The filament of the valve is lit by means of a small coil (21) of one or two turns coupled to the main inductance (20) of the wavemeter and connected to it at one end. H.T. voltage for the diode valve is supplied by means of a second coil (18) of several hundred turns also coupled to the main wavemeter coil. The D.C. milliammeter (19) shunted by a condenser (20) is placed in the anode circuit of the valve and indicates the value of the rectified current. This value will obviously be a maximum when the wavemeter circuit is in tune with the wave that is being measured.

The advantage of this arrangement is the absence of lag between the deflection of the milliammeter pointer and the changes in the wavemeter condenser value. Readings can therefore be obtained more quickly than with the old type and also to a considerably higher degree of accuracy. The scale of the variable condenser (11) is fitted with a mechanical vernier (31) which can be clutched in or out by means of a disengaging arm (32). The condenser scale is graduated in arbitrary divisions, 100 occupying one semi-circle of the scale. By means of the vernier tangent screw one-twentieth of each division can easily be read so that a very high accuracy of reading off is obtainable.

Eight range coils (1) to (8), numbered in ascending order of kc/s, are supplied, having suitable filament and anode coils permanently attached. A range switch (26) is employed to switch in one or more fixed condensers (13) to (17) in parallel with the variable condenser (11) and fixed condenser (12) the latter being always in circuit. The positions of the switch are lettered. In position A all fixed condensers are switched in in parallel with the variable condenser (11), in position B one fixed condenser (13) is cut out and so on until in position F only the variable condenser (11) and fixed condenser (12) are left in circuit. With coil (1) the five positions of the range switch, A to E, give five ranges. With coil (2) only positions D and E of switch (26) may be used, giving two ranges. With the remaining coils (3) to (8), which cover the higher frequencies (85 to 3,000 kc/s) the switch must be left in position F, only the variable condenser being used. It will be seen that this gives a total of 13 ranges.

When in use, the instrument must be placed on a table or bench and not held in the hand, since any variation in coupling between the wavemeter coil and transmitter would make it impossible to get accurate settings. It is also essential that the earth terminal (27) on the instrument should be connected to earth by a wire of low resistance so that hand capacity effects can be eliminated. The variable condenser (11) is also surrounded by a screen (30) to reduce hand capacity effect. The wavemeter coil can be coupled to a high power transmitter some distance away (that is to say, inside a cage) by means of two three-turn mutual coils (22) (24) with a length of flexible lead connecting them.

When this wavemeter is used with transmitters of low power, the filament of the diode valve is lit by a single inert cell (33) of 1.4 volts in addition to the voltage derived from the filament coil. This cell is shunted by a condenser (23) of capacity 0.2 mfd., which obviates the necessity of providing a switch for the cell, the condenser allowing R/F current to pass when the cell is disconnected.

With certain transmitters of very low power, satisfactory operation of Wavemeter G9, when used alone, cannot be obtained owing to the difficulty of getting the coupling coil sufficiently close to the aerial coil to operate the wavemeter, even when using an inert coil to energise the valve filament. For such transmitters Wavemeter G8 has to be used (see page 284).

GA 12

WAVEMETER G 12.

Date of design:- 1928.
Frequency range:- 2,500 - 5,500 kc/s. in 2 ranges.
Range 2:- 2,000 - 2,500 kc/s.
Range 1:- 3,900 - 5,500 kc/s.

G12 is unscreened, employs no mutual coil, uses as indicating device a neon lamp (5) connected across the tuning capacity. It has a condenser scale on which wavelength is engraved. The idle turns of the tuning inductance (1), which is tapped to give two ranges, are connected at one end to the rest of the inductance used for range 1. It will be observed that these conditions do not conduce to accuracy, and this wavemeter is therefore being replaced by G8.

The neon lamp (5), being voltage operated (as opposed to a current-operated pea lamp) requires a certain D.P. across it before it will operate. A small fixed condenser (3) is therefore permanently wired in parallel with the variable condenser (2), and across the neon lamp, to ensure some capacity being left in the circuit when the variable condenser is at its minimum position. The fixed condenser is also necessary to obtain the required frequency range, its value, in conjunction with the inductance used on range 1, determines the maximum frequency of this range.

Terminals (6) were provided for connecting telephones in series with the neon lamp, in case it were desired to tune by aural reception. The insertion of the telephones will alter the calibration; the terminals are therefore to be kept short circuited and this method is not to be used.

The condenser dial has the two ranges engraved in metres on each side. The range switch (4), besides altering the inductance value, changes the metre reading-off arrow (7) from one side of the dial to the other. Another arrow (8) is provided for reading off in degrees, but this is not used since no calibration curve is supplied.

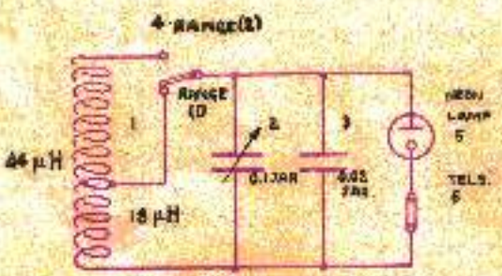

Fig. a.

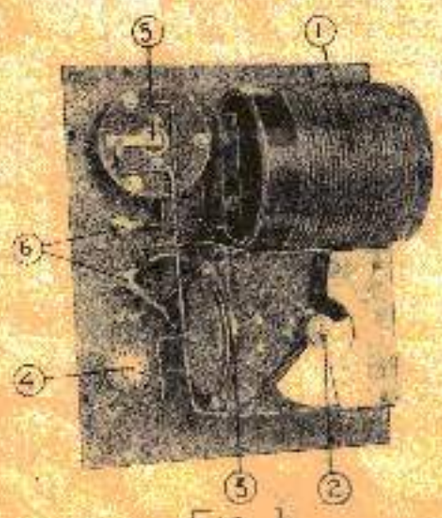

FIG. b

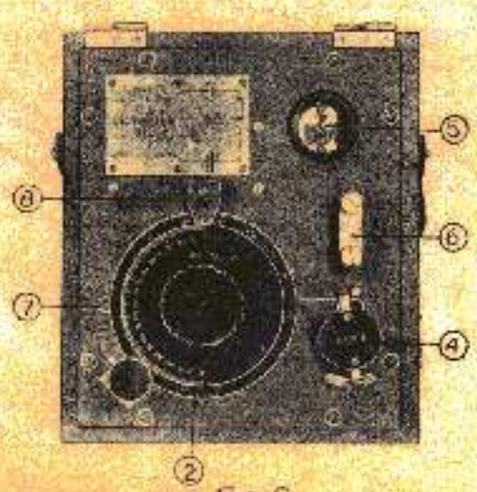

FIG. C

WAVEMETER G 13.

Date of design:- 1926
Frequency range:- 8,000 - 20,000 km/s. in 2 ranges.
Range 2:- 8,000 - 12,000 km/s.
Range 1:- 12,000 - 20,000 km/s.

G13 is slightly superior in design to G12 since it employs as indicating device a pea lamp (6) coupled by a coupling coil (5) while the inductance (2) is isolated when not in use for range 2. For all that, the accuracy is not much greater than that obtainable with G12, since G13 is uncreased, employs no mutual coil and has a condenser scale on which wavelength is graduated with wide spacing. G13 is, therefore, being replaced by wavemeter G7.

It should be noted that there is a definite gap of 500 km/s. between the frequency ranges covered by G12 and G13.

The only capacity in the circuit is the variable condenser (3), the dial of which has the two ranges engraved in metres on each side. The range switch (4), besides altering the inductance value by adding coil (2) to coil (1) for the lower frequency range changes the metre reading-off arrow (7) from one side of the dial to the other. Another arrow (8) is provided for reading off in degrees, but this is not used since no calibration curve is supplied.

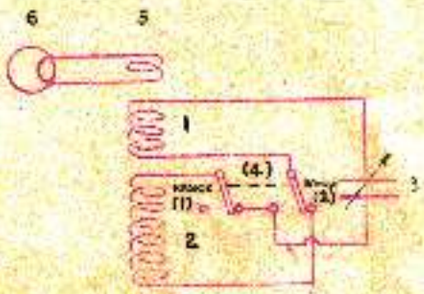

Fig. a

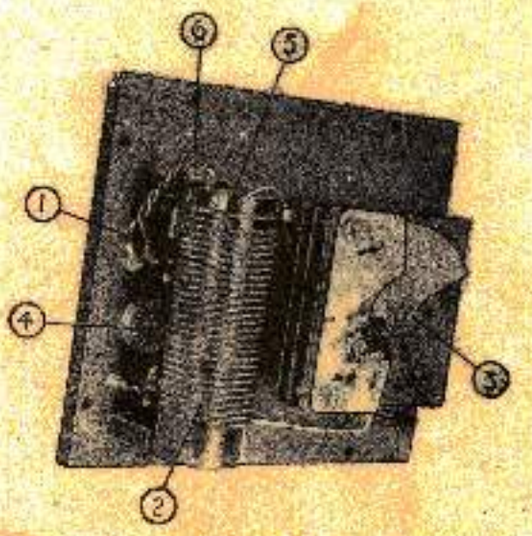

Fig b

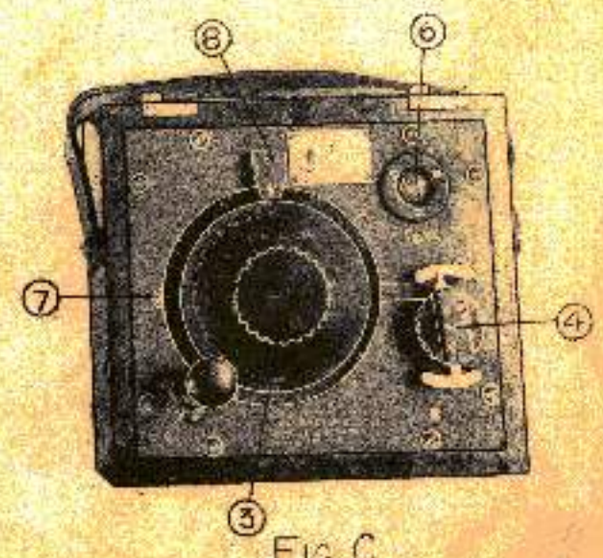

Fig. C