

EDDYSTONE

Short Wave

MANUAL



CONSTRUCTIONAL
ARTICLES *for* -

PRICE
1/-

SHORT WAVE RECEIVERS AND TRANSMITTERS

THIS Fourth number of the Eddystone Short Wave Manual caters exclusively for the real amateur wireless enthusiast. Its contents include fully illustrated articles for building a complete amateur transmitting station as well as apparatus for the short wave experimental listener.

The articles have been contributed by members of our staff, most of whom have long experience of the "Ham" game to their credit. The apparatus described is a result of their experience of what is wanted, and this, plus the practical help afforded by our factory technical staff and test equipment has resulted in the production of the well proven and reliable gear described.

We hope that this Manual will be of real help and service.

Stratton & Co. Ltd.,
Eddystone Works,
Bromsgrove Street,
BIRMINGHAM 5

EDDYSTONE

SHORT WAVE MANUAL

No. 4

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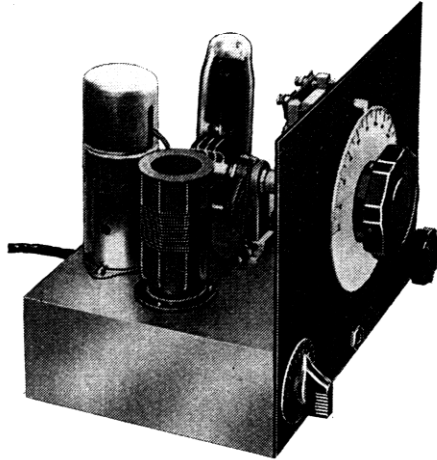
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ENGLAND

AMATEURS SHORT WAVE TWO.

WAVERANGE 8.8 METRES TO 100 METRES WITH BANDSPREAD TUNING
AND FOR A.C. MAINS OPERATION.



Top view of chassis.

This is a particularly efficient two valve Receiver for A.C. mains operation which includes the now popular 10 metre Amateur experimental band in its wave coverage. It makes use of two of the latest Mullard "E" series type valves which are particularly suitable for shortwave Receiver construction due to their small losses, high gain and low noise level. The circuit of the Receiver uses a screened H.F. Pentode type E.F.6 as detector with an electron coupled regeneration which is controlled by a variable potentiometer varying the screen grid voltage. This type of regeneration has many advantages, it gives smooth control, does not shift the main tuning and yet permits of maximum detector efficiency. It is followed by a high gain resistance coupled stage to the E.L.3 Pentode valve which has an audio output of 3 watts. This valve has a choke filter output circuit to deal with the 30 mA plate current so that phones can be safely used.

Tuning is by the bandspread method with a 160 mmfd. microdenser for band-setting and an 18 mmfd microdenser which is used for the vernier or bandspread tuning. This latter condenser is rotated by a large instrument type dial with slow motion drive, entirely free from backlash and permitting finely graded tuning control on all frequencies.

The mains supply for the Receiver is provided by the standard power pack described in the Manual on page 35 and the value of the drop resistors used in the construction of the set have been chosen accordingly.

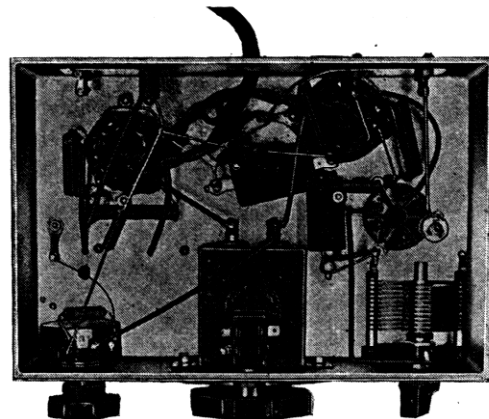
The performance of the Receiver is superior to the usual two valve set. It has good sensitivity, is completely stable without hand capacity and is easy and nice to handle. It is capable of giving all-World range for headphone reception and due to the large output will operate a loudspeaker on the more powerful transmissions.

The Receiver is built on a standard Eddystone die-cast Chassis and panel which gives extreme rigidity to the assembly and the finished unit can be housed in a metal cabinet No. 1061 which is available for this purpose.

The construction and wiring present no difficulty if the photographic layout and theoretical circuit are closely followed. All joints in the wiring must be well soldered, each lead being kept short and rigid to prevent circuit variation.

A front view of the panel shows the bandspread tuning dial in the centre with the band-set condenser dial at the bottom of the panel on the left, and the regeneration control on the right. The socket in the centre of the panel permits easy connection of headphones and should be wired in parallel with the two output sockets fitted to the paxolin terminal strip at the back of the Chassis.

The valves, coil base, bandspread condenser, choke-condenser output are mounted above the Chassis. The Detector valve is enclosed in a metal shield to prevent coupling with the tuning circuit. The remainder of the parts are housed beneath the Chassis and the wiring should closely follow the photograph shown below. In particular, the wire from the earth pin of the coil holder to the band-set condenser earthing tag forms part of the tapped coil circuit and its length should be as short and straight as possible.



Underside view showing layout and wiring of components.

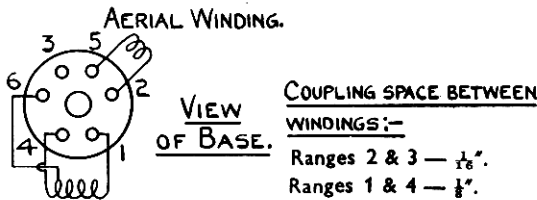
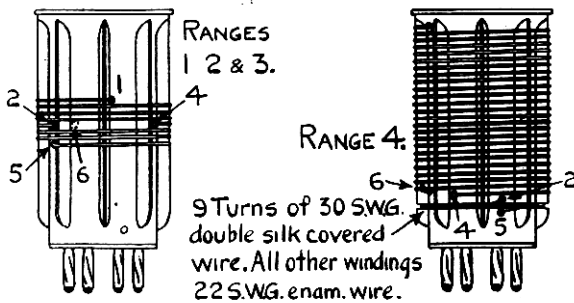
AMATEURS SHORT WAVE TWO (continued).

COILS.

The receiver has a tuning range of 8.8 metres to 96 metres. Low-loss interchangeable coils are used and wound in accordance with the table below. The waveranges are as follows :—

- Range 1 — 8.8 to 20.25 metres.
- Range 2 — 11.75 to 27 metres.
- Range 3 — 20.25 to 47 metres.
- Range 4 — 40 to 96 metres.

These waveranges are approximate only, as different settings of the aerial condenser will affect them to a small degree.



Turns Required.

RANGE	AERIAL	GRID	TAP ON GRID COIL (From end 4).
1	2	2 ³ / ₈	Wire direct from pin 4 to pin 6.
2	3	3 ⁷ / ₈	"
3	4 ¹ / ₈	8 ³ / ₄	¹ / ₈ Turn.
4	9	23 ⁷ / ₈	⁷ / ₈ "

COIL DATA.

From rib to rib of former is one-eighth its circumference, thus for example 2 ³/₈ turns will be twice round former and three ribs extra. Windings should be arranged to occupy the centre of the former. This can be achieved by starting range 1 winding about 13 slots from the top of the former ; range 2 about 12 slots, range 3 about 10 slots and range 4 about 2 slots. For ranges 1, 2 and 3, threaded 6-pin formers will be required, and for range 4 a threaded one-slot 6-pin former.

All windings are made with 22 gauge enamelled wire except the aerial winding of range 4 which consists of 30 gauge double silk. If preferred 22 gauge tinned wire can be used in place of the 22 gauge enamelled as this will obviate the necessity for careful scraping before soldering. In each coil the grid and aerial windings should start as near as possible above the pin to which they are connected, leaving the finish to look after itself. Ready wound coils will also be marketed.

BANDSPREAD TUNING.

As shortwave signals are difficult to tune when one large capacity tuning condenser only is used the receiver has two condensers in parallel, the principle being to connect a tuning condenser of very small capacity in parallel with the large tuning condenser so that equal movement on each condenser will cover considerably different sections of the band. The large condenser is for coarse tuning, or bandsetting and the small one for the vernier or bandspread tuning. In the Amateur's Shortwave Two the bandset condenser has a capacity of 160 mmfd and the bandspread 18 mmfd. With this arrangement in use tuning is remarkably easy with signals well spread out and well apart from each other on the bandspread scale.

OPERATION.

After the wiring has been checked, fit the valves, tuning coil and connect up power supply unit, 'phones and aerial-earth system. The receiver is then switched on but before it can be brought into use the aerial trimmer condenser under the chassis should be set at a position which gives freedom from " blind spots " over the ranges 1 and 2. A " blind spot " is a position of the bandset or bandspread condensers where no reaction is obtainable. As individual aerials will " pull " to varying degrees, this is a matter for experiment ; a position about half way is usually nearly correct.

Commence working the receiver with the bandset, bandspread and reaction controls at zero. Then slowly increase reaction by turning the control in a clockwise direction until at a certain point the set will commence to oscillate ; this will be easy to detect as a low " rushing " sound will be heard. Tuning is then carried out with the bandspread condenser in the usual manner. Throughout the whole tuning operations the reaction control should be so adjusted that the set is always just in the oscillating condition. The reaction control should never be turned any more than is necessary for the first reaction sound to be heard.

AMATEURS SHORT WAVE TWO (continued).

Probably the first signals to be heard will be morse code transmissions, a series of dots and dashes of high pitched note. With the set in the slightly oscillating condition previously mentioned telephony signals will also be heard as a high pitched whistle similar to the morse signals with the difference however that as the tuning is varied the note will appear to consist of a double peak signal with a silent point in the centre.

To receive the telephony clearly, leave the set tuned to the silent point then slacken off the reaction control very slightly until the set is just out of oscillation. Afterwards retune a little if necessary and the speech or music will be quite clearly heard.

It simplifies the operation of the receiver when searching for stations to keep it in an oscillating condition but it must be remembered that clear telephony can never be heard while the receiver continues to oscillate.

For best all-round reception a well insulated single wire aerial between 40 and 60 feet long should be used.

The general purpose power supply unit on page 35 provides sufficient output to work both units satisfactorily.

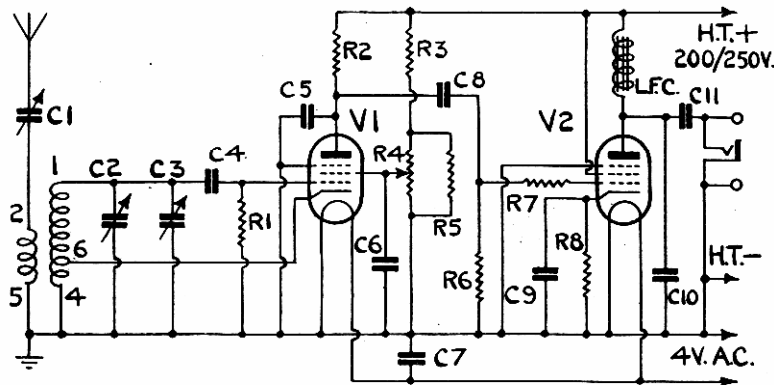
If, at a later date it is desired to improve the performance of this set, the Shortwave pre-selector described on page 14 is an ideal addition.

EDDYSTONE COMPONENTS.

1 Die-cast Aluminium Chassis with Terminal panels, No. 1117	5/6
1 Metal Panel, black ripple finish, No. 1118	1/9
1 Microdenser, 160 mmfd C2, No. 1131	6/-
1 " 18 mmfd C3, No. 1094	3/9
1 Pointer Knob and Dial, No. 1044	1/-
1 Slow Motion Dial, No. 1115	10/-
1 6-pin Coil Base DL9, No. 964	1/3
1 Insulated Bracket, No. 1116	1/3
1 S.W. Air Trimmer, C1, No. 1100	1/3
1 Choke L.F.C., No. 980	8/6
1 Condenser 1 x 1 C6 and C9, No. 991	4/-
1 Instrument Knob, No. 1086	9d.
1 Valve Screening Can, No. 1121	1/3
1 Steel Cabinet, black ripple finish, No. 1061	9/6
3 DL9 Formers, 6-pin type, threaded ribs, No. 1003 at 2/6 each	7/6
1 DL9 Former 6-pin, threaded ribs, with one slot No. 1124	2/6

MISCELLANEOUS PARTS.

1 Resistor 150 ohms 1 watt R8	..
2 " 100,000 ohms 1/2 watt R2 and R3	..
1 " 40,000 " " R5	..
1 " 50,000 " " R7	..
1 " 0.25 Megohms 1/2 watt R1	..
1 " " " R6	..
1 Potentiometer 50,000 ohms R4	..
1 Condenser .0001 mfd 200V wkg. C4	..
1 " .0003 " " " C5	..
1 " .005 " " " C7	..
1 " .006 " " " C8	..
1 " .002 " " " C10	..
1 " 1 mfd 2 Terminal type C11	..
1 Igranic Jack P71	..
1 " Plug, P40	..
2 Valveholders side contact E type for valves specified	..
Length of 4-way Cable	..
2 Insulating Pillars 1/4" long tapped 6BA	..
Wire, Screws, Nuts, Valve clip, Cable bush, etc.	..
Approximate cost of miscellaneous parts	£1
2 Mullard Series "E" Valves types EF8 and EL3 are required.	

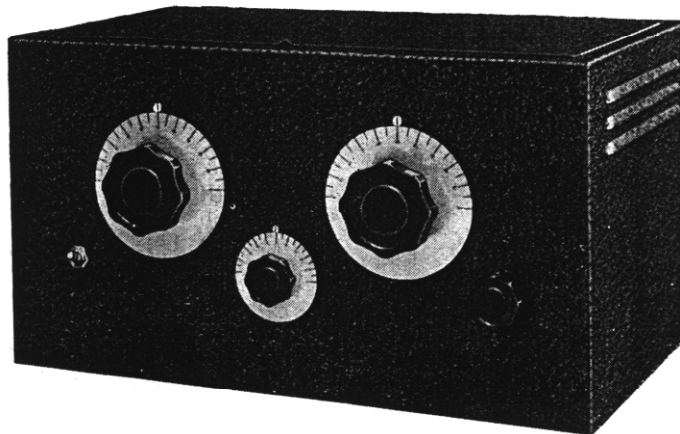


Theoretical circuit. Amateurs Short Wave 2.

THE IMPROVED EVERYMAN SHORT WAVE RECEIVER.

FOR BATTERY OPERATION.

9.85 metres to 2000 metres.



The Completed Receiver.

This receiver will find favour with the short-wave experimenter who is looking for a set which does not present the technical difficulties necessary to obtain satisfactory working from the more complicated and expensive shortwave Superheterodyne. At the same time although this Receiver is simple to construct and put into operation it gives a splendid all-round performance and has the professional appearance of the latest communication type sets.

The circuit has been based on a previous "Eddystone" model which has already achieved a World-wide reputation for performance and reliability. It comprises an aperiodic high frequency valve, a screened grid detector and a two-stage audio amplifier section. The aperiodic high frequency circuit is fitted with a specific purpose in mind. The stage does not in itself afford much degree of gain but it ensures completely stable operation with freedom from blind tuning spots and hand capacity, and a smooth consistent reaction control. It prevents re-radiation on the aerial when regeneration is applied so that no interference is caused. It also enables much greater gain and selectivity to be obtained from the high magnification screen grid detector stage.

The first audio stage is resistance coupled and is followed by an L.F. transformer. The band-spread method of tuning makes the receiver easy to handle and facilitates the thrill of long distance reception on the short wavebands.

A standard Eddystone panel No. 1122 is used and the baseboard is made from 5 ply plywood. It is raised $2\frac{1}{2}$ " by means of two side supporting battens. The baseboard is covered with a thin sheet of polished aluminium which is easily perforated with a sharp pointed tool when the parts are fitted into place.

The Receiver will bring in many American, European, Far Eastern and other long distance shortwave broadcast and amateur experimental stations at good loudspeaker strength and quality. It tunes from 9.8 metres to 2000 metres and covers all popular wavebands including the Empire transmitters at Daventry, such stations as Rome, Moscow, Berlin, Pittsburg, Schenectady, and also ships at sea, coast stations, aircraft, trawlers, police and medium and longwave broadcast. Further, the set can be used for receiving morse signals which puts at the owner's fingertips many more interesting stations.

BATTERIES.

A 2 volt battery is used for low tension supply, the Exide DFG or larger capacity being suitable. High tension should be at least 120 volts and can with advantage be increased to 150 volts. Low tension current consumption is .5 of an ampere and high tension 8 milliamperes at 120 volts. The L.T. battery is connected by two spade terminals and the H.T. by two wander plugs. Grid bias to the last two valves is automatically provided so no grid bias battery is needed.

IMPROVED EVERYMAN SHORT WAVE RECEIVER (continued).

CONSTRUCTION.

The photographic view of the baseboard clearly shews layout of the components and the general wiring positions. This, in conjunction with the circuit diagram on the next page makes the construction quite straightforward.

The assembly comes next and for ease of wiring it will be advantageous to tin or give the connecting points a coat of solder before the parts are fixed in place. Lay out the components as shewn in the photograph and proceed to fasten them down. It should be noted that the coil base and ceramic reaction pre-set condenser are mounted on insulating pillars and the two tuning condensers on insulated adjustable brackets. The top and underside fixing holes of the T.C.C. condensers must be scraped to give sound contact with the aluminium on the baseboard and one tag of each of these condensers is bent over and soldered to its own case. Three metal spacing washers are needed between the panel and 50,000 ohm and .25 megohm potentiometers and here again the panel must be scraped clean so that they make good contact with it.

The aluminium base covering is bent at right-angles over the front of the baseboard and clamped between that and the back of the metal panel. The lower part of the panel should be scraped clean to give good contact with the aluminium.

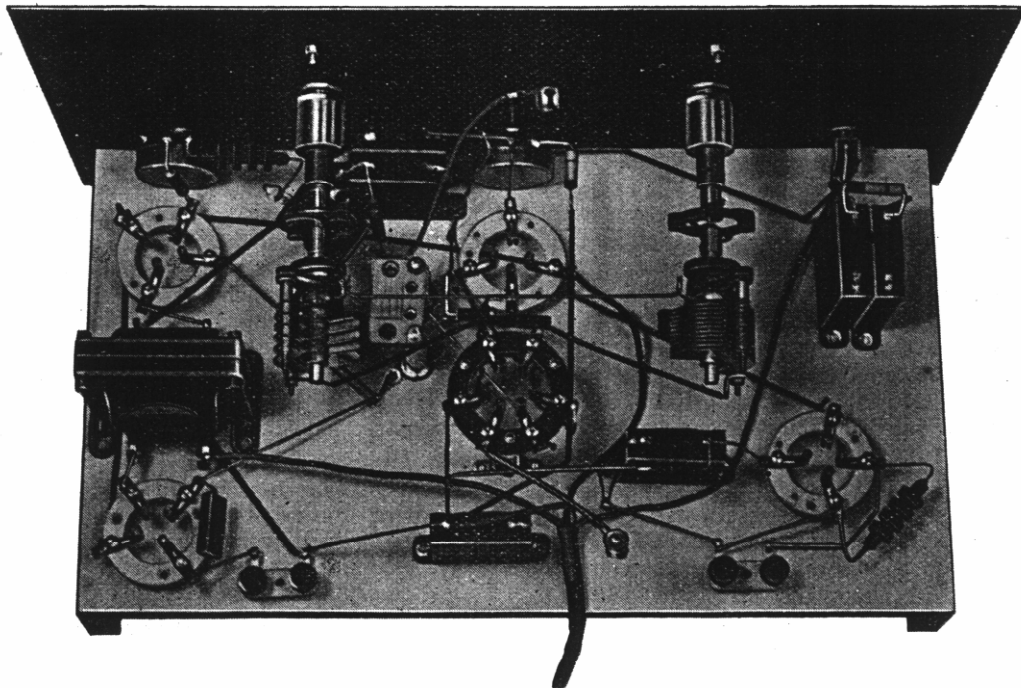
Be sure in wiring that all joints are strongly made. One poor or high resistance joint can adversely affect the performance or alternatively

may give the set a very high background noise level which is most undesirable.

A front view of the panel shews the bandset and bandspread condenser dials, the reaction control in the centre and the volume control on the right. On the extreme left is the master switch by which the receiver is switched "on" or "off." The aerial and earth terminals are at the back of the chassis immediately behind the bandset condenser. The output terminals for telephones or loud-speaker are those nearest the AF4 low frequency transformer. The high and low tension batteries are connected through the flexible lead which is fitted with two spade terminals for L.T. and two wander plugs for H.T.

BANDSPREAD TUNING.

As shortwave signals are difficult to tune when one large capacity tuning condenser only is used this receiver has two condensers in parallel, the principle being to connect a tuning condenser of very small capacity in parallel with the large tuning condenser so that equal movement on each condenser will cover considerably different sections of the band. The large condenser is for coarse tuning, or bandsetting and the small one for the vernier or bandspread tuning. In the Improved Everyman Receiver the bandset condenser has a capacity of 160 mmfd and the bandspread 18 mmfd. With this arrangement in use tuning is remarkably easy with signals well spread out and well apart from each other on the bandspread scale.



Baseboard photograph showing component layout and wiring.

IMPROVED EVERYMAN SHORT WAVE RECEIVER (continued).

OPERATION.

After checking wiring, insert valves, tuning coil and connect up batteries, aerial and earth and loudspeaker. The set is then switched on but before it can be brought into use the correct setting of the ceramic reaction pre-set condenser must be determined. This is done by turning the reaction control potentiometer on the front panel approximately three quarters clockwise. The pre-set condenser is then adjusted until the receiver is just oscillating. After this setting has been decided, variation of the potentiometer will give sufficient control of reaction.

Commence working the receiver with the bandset, bandspread and reaction controls at zero and the volume control at least half-way. Then slowly increase reaction by turning the control in a clockwise direction until at a certain point the set will commence to oscillate; this will be easy to detect as a low "rushing" sound will be heard. Tuning is then carried out with the bandspread condenser in the usual manner. Throughout the whole tuning operations the reaction control should be so adjusted that the set is always just in the oscillating condition. The reaction control should never be turned any more than is necessary for the first reaction sound to be heard.

Probably the first signals to be heard will be morse code transmissions, a series of dots and dashes of high pitched note. With the set in the slightly oscillating condition previously mentioned telephony signals will also be heard as a high pitched whistle similar to the morse signals with the difference however that as the tuning is varied the note will appear to consist of a double peak signal with a silent point in the centre. To receive the telephony clearly, leave the set tuned to the silent point then slacken off the reaction control very slightly until the set is just out of oscillation. Afterwards retune a little if necessary and the speech or music will be quite clearly heard.

It simplifies the operation of the receiver when searching for stations to keep it in an oscillating

condition but it must be remembered that clear telephony can never be heard while the receiver continues to oscillate.

To obtain the highest selectivity the maximum amount of reaction should be used and volume decreased if necessary with the volume control.

For best all-round reception a well insulated single wire aerial between 40 and 60 feet long should be used.

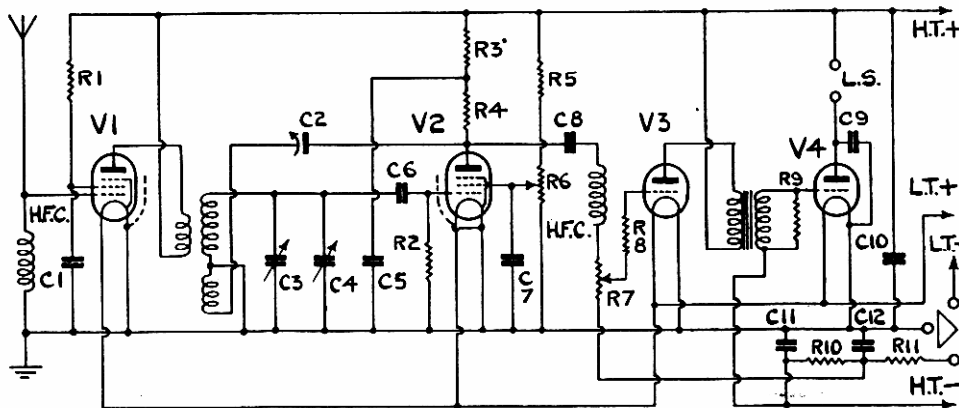
EDDYSTONE PARTS.

	Price
4 4-pin Valveholders, No. 949 at 1/5d. each	5/8
1 6-pin Coil Holder No. 969	2/3
2 H.F. Chokes HFC, No. 1010 at 2/- each	4/-
2 Terminal Saddles, No. 1046 at 1/- each	2/-
5 Insulating Pillars, 1 1/2", No. 1029 at 4 1/2d. each	1/10 1/2d.
2 Flexible Couplers, No. 1009 at 1/6 each	3/-
2 Adjustable Mounting Brackets, No. 1007 at 1/6 each	3/-
1 160 mmfd Microdenser, C3, No. 1131	6/-
1 18 mmfd C4, No. 1094	3/9
1 Cabinet and Panel, No. 1034	18/6
1 Knob, No. 1086	9d.
1 Knob and Dial, No. 1099	2/-
2 S.M. Driving Head with Knob and standard 4" Dial, No. 1115 at 10/- each	20/-
1 6BB Tuning Coil 9.8 to 21 metres No. 959	3/3
1 6LB " " 12 to 28 " No. 959	3/3
1 6Y " " 20 to 49 " No. 959	3/3
1 6R " " 40 to 96 " No. 959	3/3

Coils for further ranges are available.

MISCELLANEOUS PARTS.

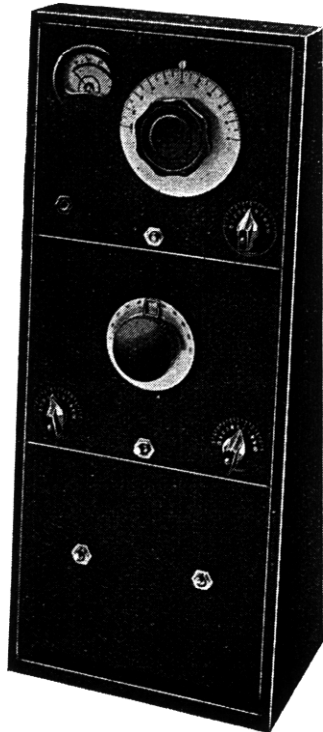
6 T.C.C. 1 mfd type 65 Condensers C1, C5, C7, C10, C11 and C12	
1 Ferranti A.F.4 Transformer	
1 N.S.F. 50,000 ohms Potentiometer R6	
1 .25 Megohms R7	
1 Dubilier 0.006 mfd Condenser Type, No. 691, C8	
1 " 0.001 " " No. 690, C9	
1 " 0.0001 mfd " " No. 690, C6	
1 Eerie 20,000 ohms 1/2 watt resistor, R3	
1 " 40,000 " " R5	
1 " 100,000 " " R1	
3 " .25 megohms " R4, R8 and R9	
1 " 400 ohms " R10	
1 " 200 " R11	
1 Dubilier .001 mfd Fixed Condenser, Type 690	
1 Cyldon 140 mmfd Trimmer Condenser Type C2	
1 3 point on-off switch	
2 Valve Top Connectors	
1 Erie 1 megohm 1/2 watt Resistance R2	
1 Baseboard 15 1/2" x 9" x 1/2"	
2 Corner Pieces 9" x 1 1/2" x 1/2"	
Wire, Screws, Tags, etc.	
1/2 Doz. Washers for Potentiometers	
1 sheet aluminium 15 1/2" x 9 1/2" x .012"	
1 4-way Battery Cable	
Approximate cost of miscellaneous parts	£2 16 6
Valves required :-	
2 Osram Z21 4-pin metallised Valves V1 and V2	
1 Mazda HL2 metallised Valve V3	
1 Mazda P220 Valve, V4	



Theoretical circuit diagram. Improved Everyman Short Wave Receiver.

A MINIATURE AMATEUR STATION

FOR 10 TO 20 WATTS OUTPUT ON 7 AND 14 Mc/s.

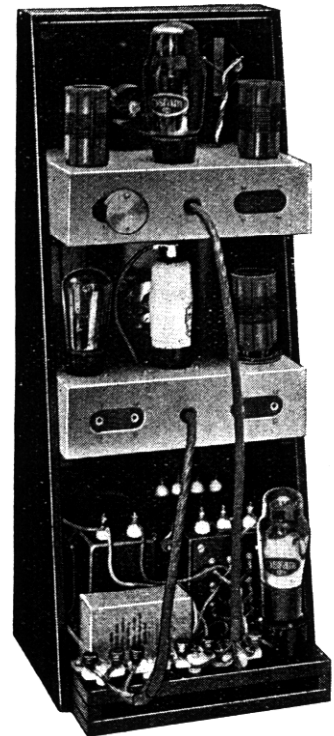


Showing neat front layout.

Here is a complete Amateur experimental station in miniature form for the beginner. It is easy to construct at a cost quite modest for a station designed to a professional layout and built in the conventional rack form of a high power transmitter. The finished job presents an efficient and workmanlike appearance and is worthy of a place in any Amateur station.

With this small scale equipment good two-way communication with other Amateurs in all parts of the World is possible. It also offers full scope for tests in low power transmission, an extremely interesting field of experiment for the beginner and expert alike.

It is ideal for construction by the beginner because even when the time comes for a more advanced station to be built this miniature outfit continues to be useful as it is an excellent medium for "home" contacts. For this purpose the use of high power, quite apart from the interference it causes, is often-times an unnecessary waste of current. Again, the flexibility and performance of both transmitter and receiver make them a valuable "stand-by" in case of breakdown on the part of the higher powered equipment.



Showing the back view.

The miniature station consists of three separate units which are mounted into a simple wooden rack construction. There is the power supply which provides current for operating both Transmitter and Receiver. The Receiver, which is the well-proven Eddystone "All-World Two" modified for all mains A.C. operation. The Transmitter, which is a single valve crystal controlled Unit working on 40 or 20 metres. The valve used is an Osram KT.66, which is the British equivalent of the American 6L6. The change of wavebands on Receiver and Transmitter is the work of a few seconds so that quick and easy operation is obtained.

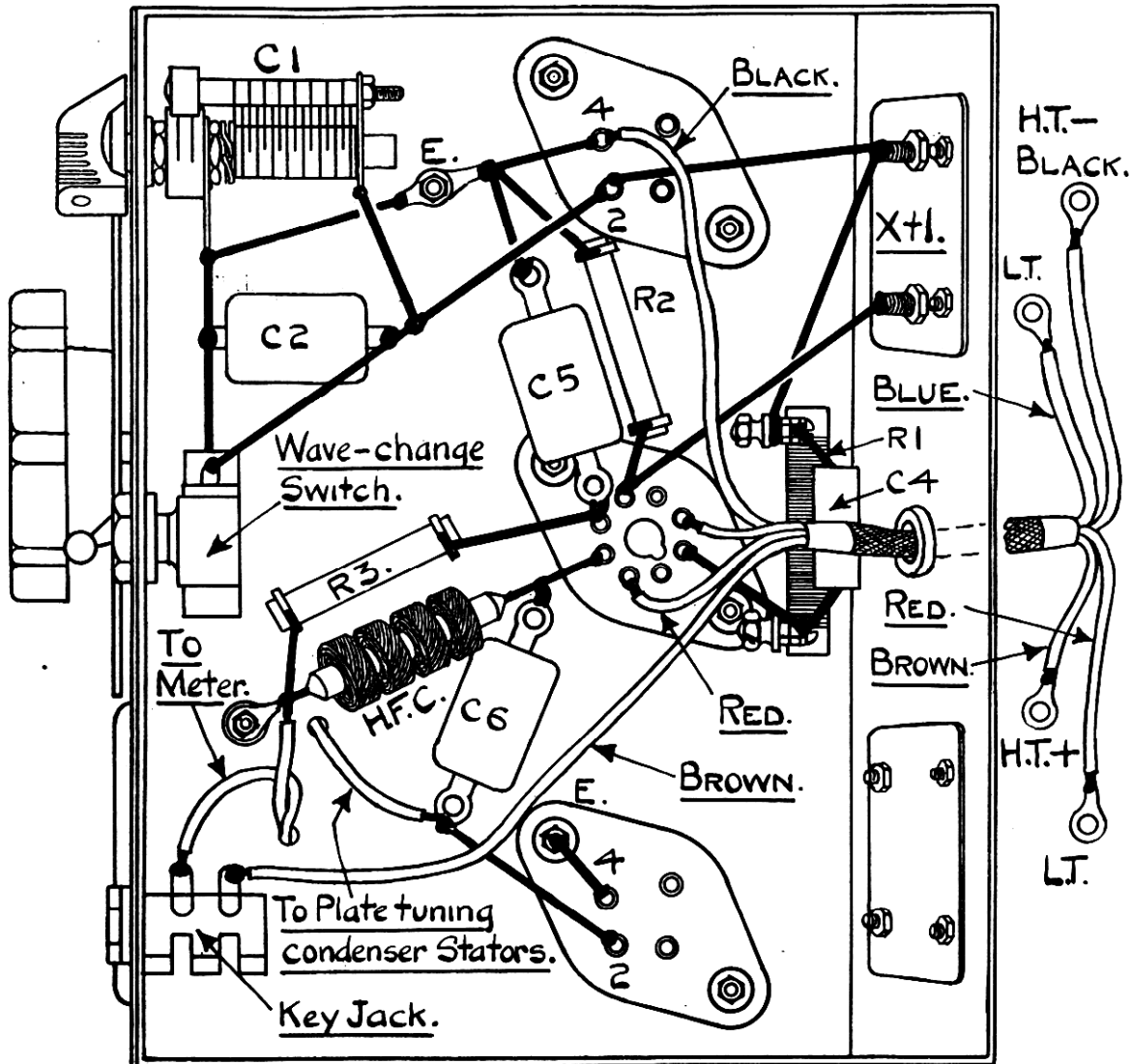
The Rack assembly can be built quite cheaply and makes a compact and presentable unit measuring approximately 9" wide, 22½" high, 8½" deep. A constructional sketch is shown on page 12, but any alternative form of mounting such as steel channel iron could be adapted if preferred.

THE TRANSMITTER SECTION.

The circuit of the Transmitter functions as a Tritet for 20 metres and a straight-through crystal oscillator on 40 metres. The panel layout shows in the centre an instrument type dial for tuning plate circuit with the Tritet cathode tuning condenser below on the right-hand side. The switch when in the right-hand position, short-circuits the Cathode coil for 40 metre working, and when moved to the left-hand side it opens the cathode coil circuit so that the Transmitter can be operated on 20 metres. The keying jack is on the left-hand side of the panel immediately below the anode current milliammeter. The coil holder behind this meter accommodates the 4-pin Yellow spot tank coil for 20 metre operation and the 4-pin Red spot tank coil for 40 metres use. The cathode coil for 20 metres is a 4 pin Yellow Spot from which two turns must be removed from the top of the large winding. This arrangement ensures greater C/L ratio in the cathode circuit which gives a larger harmonic output in the anode circuit.

A MINIATURE AMATEUR STATION,

UNDER CHASSIS WIRING AND LAY-OUT TRANSMITTER SECTION.



EDDYSTONE COMPONENTS.

1 Diecast Aluminium Chassis with terminal panels No. 1117	5/6
1 Metal panel, black ripple finish, No. 1118	1/9
2 Frequentite Valvholder 4-pin, No. 1073 at 9d. each	1/6
1 Frequentite Valvholder Octal, No. 1120	1/3
1 Precision Dial 4", No. 1098	4/6
1 Pointer Knob and Dial, No. 1044	1/-
2 Microdeners 60 mmfd C1 and C3, No. 1093 at 4/6 each	9/-
1 S.W. H.F. Choke, No. 1022	3/-
1 Insulating Pillar, 1 1/2", No. 1029	4d.
2 Four-pin Coils, type Y, No. 932 at 2/9 each	5/6
1 Four-pin Coil, type R, No. 932	2/9

Price

MISCELLANEOUS PARTS.

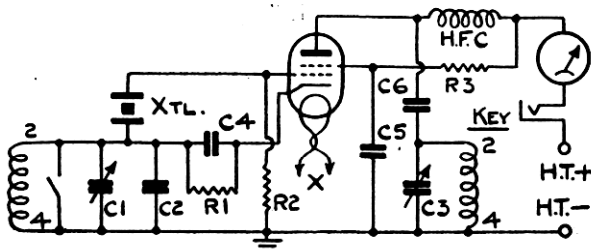
1 Two-point on/off Switch	..	..	..
1 Jack (Igranic Type P.71)	..	..	..
1 Plug (Igranic Type P.40)	..	..	..
1 Fixed Condenser .0001 mfd. C2	..	..	..
2 Fixed Condensers .001 mfd. C5, C6	..	..	..
1 Fixed Condenser .01 mfd. C4	..	..	..
1 Resistor 20,000 ohms 1 watt	..	..	..
1 Resistance 500 ohm 10 watt (Webb's Radio)	..	..	..
1 Resistor 50,000 ohm 1 watt	..	..	..
1 Moving Iron 0-100 milliammeter (Webb's Radio)	..	..	..
1 Crystal 7 m/c (7005-7197 mc/s) (Webb's Radio)	..	..	..
2 Clix Sockets	..	..	..
Length Four-way Lead	..	..	..
Wire, Screw, Nuts, Tags and Octal Valve Clip, etc.	..	..	..

1 Valve, type Osram KT66 or equivalent if required.

Approximate cost of miscellaneous parts £1 15 6

A MINATURE AMATEUR STATION (continued).

The power supply is mounted on a plywood baseboard at the bottom of the rack with a front metal panel carrying the control switches. The Receiver and Transmitter sections are built on a standard Eddystone die-cast chassis with coils, condensers and valves mounted on top, and all small components housed underneath. Not only is the construction rigid but the appearance workman-like and impressive. The assembly is completed by neat crystalline finished metal front panels which accommodate the tuning dials and associated controls.



Theoretical Circuit. Transmitter Section.

THE RECEIVER SECTION.

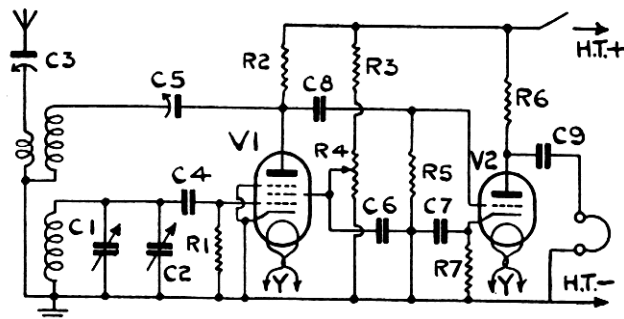
The receiver is equally suitable for amateur band reception or shortwave broadcast since it is fitted with the special Eddystone bandspread tuning unit which allows continuous bandspreading on all wavelengths. The band required is selected by the tank or band-set condenser which is a small air dielectric unit having a capacity of 140 mfd divided into 10 equal steps of 14 mfd — by a patented stop device. Bandspreading is obtained with a Vernier condenser slightly larger in tuning range than the capacity difference between the tank condenser steps. By this means each 14 mfd. section of the tank condenser is spread over the full 180° of the Vernier Condenser scale. Tuning is thus easy with signals well spread out and well apart from each other on the scale. This arrangement has an important advantage over the usual method of bandspreading as the patented stop device in the tank condenser permits its continued re-setting at the same point.

Thus once the receiver is correctly adjusted the calibration for any given station can be readily found at the same condenser settings. The setting of the aerial trimmer condenser affects the calibrations if altered in capacity. Therefore when once set it should not be further adjusted.

The best setting of the aerial trimmer condenser will be found by experiment. With the condenser set at minimum, the selectivity will be greatest and there will be no places where the Receiver will not oscillate due to aerial load. With the trimmer fully "in" the Receiver will have greater sensitivity although increased aerial load may cause one or two dead spots. Once the most suitable position has been found (usually about two-thirds in) this condenser should be left set and the receiver calibrated. Its further variation will necessitate re-calibration of the tuning settings.

The final control of reaction is obtained by varying the S.G. voltage with a variable potentiometer which is operated from the front panel. There is, however, another component which first needs adjustment. This is a small pre-set trimmer condenser located beneath the chassis at the rear of the reaction control potentiometer. It is set by switching on the receiver and turning the reaction control potentiometer approximately three-quarters clockwise. The pre-set trimmer condenser is then adjusted until the set is just oscillating. It is generally found that the trimmer has to be screwed almost fully clockwise to obtain oscillation. After this setting has been decided, variation of the potentiometer will give sufficient control of reaction.

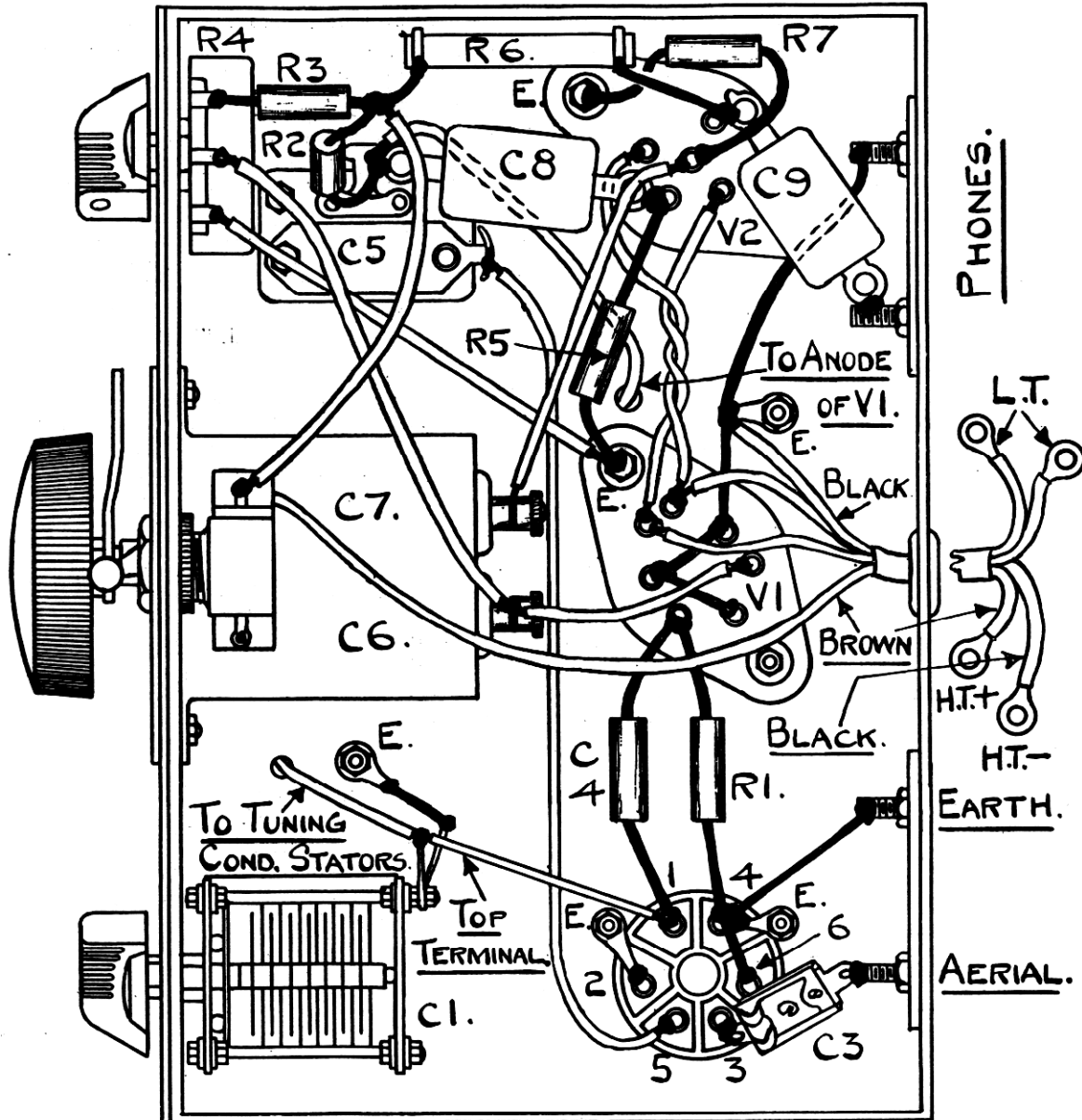
A front view of the panel shows the band-spread tuning dial in the centre with the tank condenser control knob on the left. The reaction potentiometer is on the right-hand side of the panel and the switch is used to break the high tension circuit and render the Receiver inoperative during transmission. The output circuit is isolated by a .002 mfd condenser and thus headphones can be used with complete safety.



Theoretical Circuit. Receiver Section.

A MINIATURE AMATEUR STATION,

UNDER CHASSIS VIEW
RECEIVER SECTION.



EDDYSTONE COMPONENTS.

1 diecast aluminium chassis with terminal panels, No. 1117	5/6
1 Metal Panel, black ripple finish, No. 1118	1/9
1 Tank Unit, C1, No. 1042	6/-
1 Bandsread Unit, C2, No. 1043	6/6
1 Pointer Knob and Dial, No. 1044	1/-
1 6-pin Base, No. 963	1/3
1 Frequentite Valveholder 5-pin, No. 1074	10d.
1 Frequentite Valveholder 7-pin, No. 1075	1/-
1 S.W. Mica Trimmer C3, No. 1023	1/-
1 Condenser 1x1 mfd. C6 and C7, No. 991	4/-
Eddystone 6-pin coils to wave range required No. 959 from each	3/3

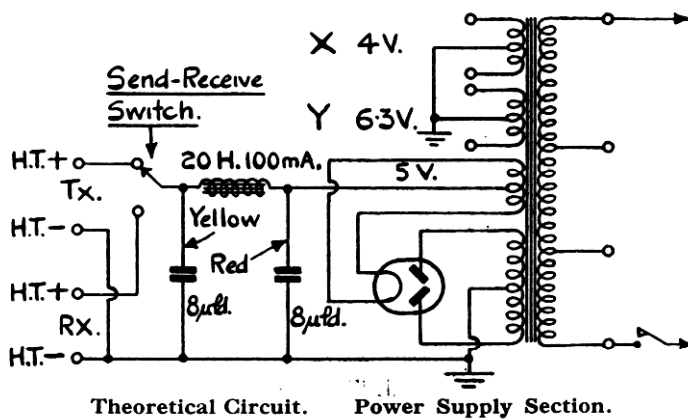
Price

MISCELLANEOUS PARTS.

1 Potentiometer 50,000 ohms R4	..
1 Capacitor Cyldon 70-140 mmfd. C5	..
1 Fixed Condenser .0001 mfd. C4	..
2 .002 mfd. C8 and C9	..
1 Resistor 1,000 ohm 1 watt, R7	..
1 .10,000 ohm 1 watt, R6	..
1 .40,000 ohm 1 watt, R3	..
1 .100,000 ohm 1 watt, R2	..
1 1 megohm, R5	..
1 3 megohm, R1	..
1 On/Off Switch Two-point	..
4 Clix Sockets	..
Assorted 6 B.A. Screws and Nuts, Wire, Tags and Valve Clip, etc.	..
Length Four-way Lead	..
Approximate cost of miscellaneous parts	18/9

Mazda Valves, types AC/HL and AC/VP1 are required.

A MINATURE AMATEUR STATION (continued).



Theoretical Circuit. Power Supply Section.

OPERATION ON 40 METRES.

With all power switches in the "off" position insert the 7 Mc/s crystal in the sockets at the rear of the chassis. The Red spot plate coil is fitted in the holder immediately behind the milliammeter. A cathode coil is unnecessary on this frequency and the setting of the cathode tuning condenser may be ignored. The centre switch should be in the right-hand position and the keying plug removed until the transmitter is ready for operating. At this point the power is switched on and the centre dial tuned until the circuit is brought into resonance with the crystal frequency. The point of true resonance is indicated by minimum current in the milliammeter. The aerial is then coupled to the plate coil and adjusted for the desired input.

OPERATION ON 20 METRES.

Put power switches in the "off" position, turn centre switch to left-hand side and remove keying plug from socket. Insert Yellow spot cathode coil in corresponding holder and Yellow spot plate coil immediately behind the milliammeter. Switch on and tune cathode circuit condenser to fundamental frequency of the 7 Mc/s crystal, this point again being indicated by minimum current in the meter. Then tune Yellow spot plate coil into resonance which setting is ascertained by a further minimum reading on the milliammeter. Afterwards, aerial load is applied and adjusted for the desired input.

AERIAL.

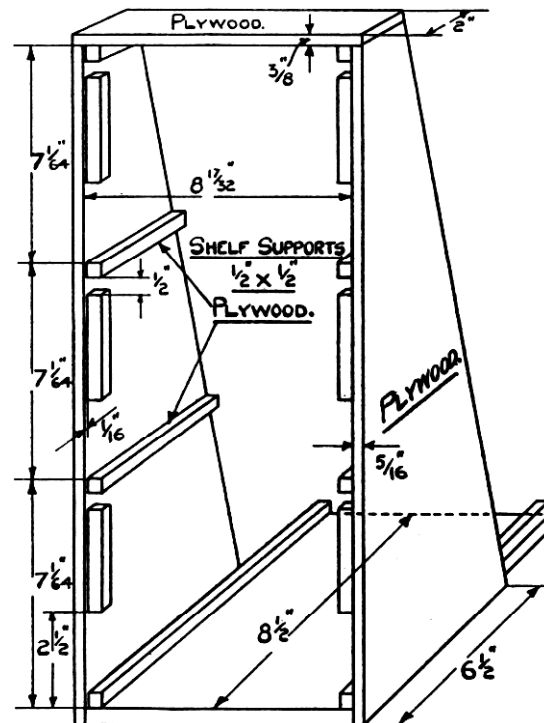
Upon the coupling and tuning of the aerial depends the amount of power dissipated by the valve. This coupling should be varied to draw sufficient current consistent with the characteristic of the valve used. As transmitting aeriels are usually a question of personal taste no special provision has been made but a tuned link coupling is suggested as being the most suitable for general efficiency on the bands covered by the transmitter.

POWER SUPPLY SECTION.

The power unit is at the base of the rack. It is arranged to give sufficient current for an input up to 20 watts on the H.F. stage.

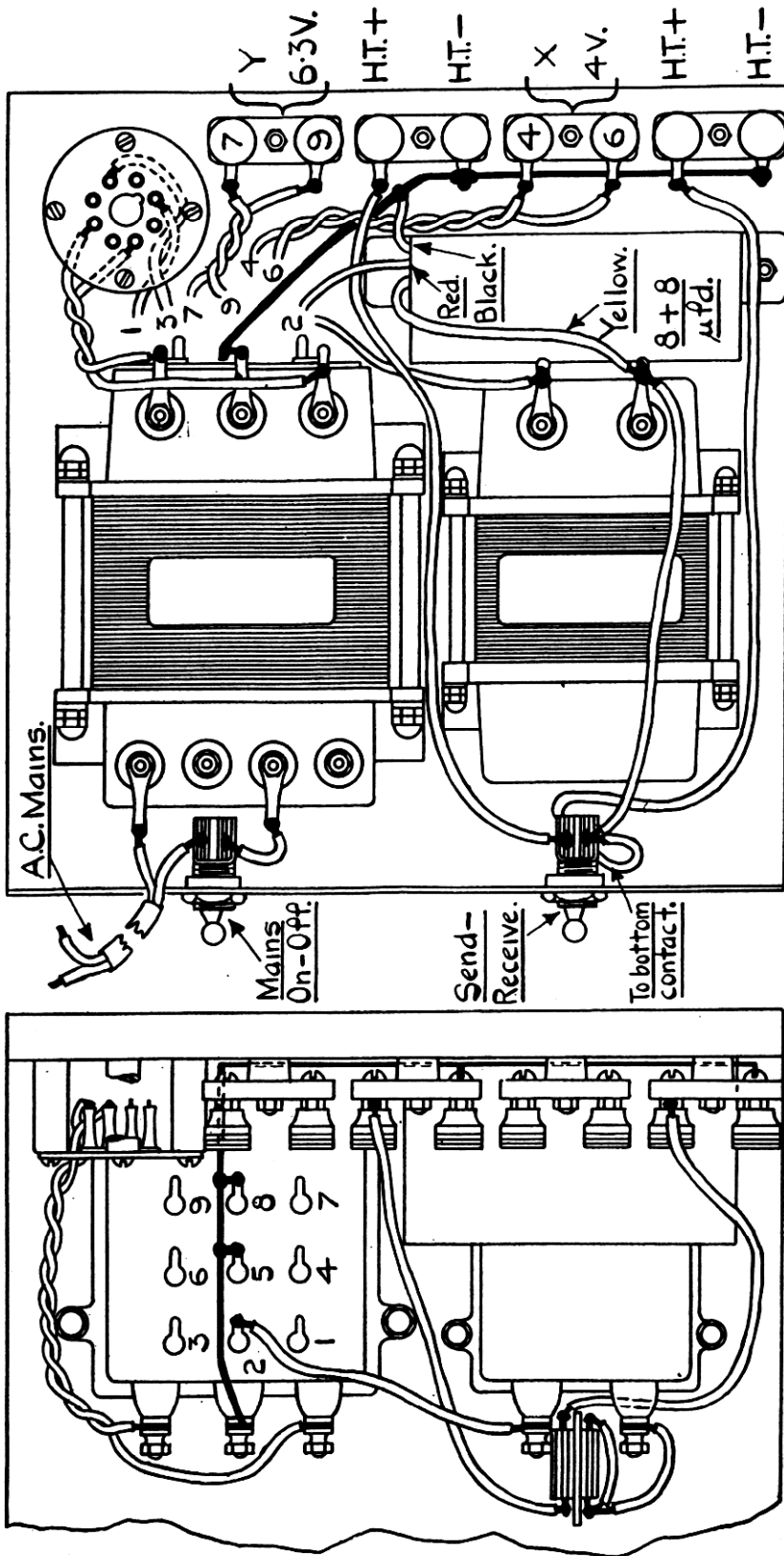
The power supply consists of a 350-0-350 volt 120 m/A Transformer with a 4 volt winding for heating the receiving valves. There is also a 6 volt winding for the transmitter valve heater and a 5 volt winding for the rectifier. A 20 Henry Smoothing Choke is required and should be capable of carrying a current of 100 m/A. The smoothing condenser has a capacity of 8+8 mfd. and is arranged for easy mounting on the base-board.

There are two switches on the front panel. The left-hand switch is the master control for the A.C. mains input and the right-hand one changes high tension from transmitter to receiver. When in its top position high tension is fed to the transmitter and in the bottom position to the receiver.



The above drawing shows the dimensions and construction of the wooden rack for mounting the three units of the station. Wood has been used, since it is easily obtained and worked but an alternative metal construction may be used if desired.

A MINATURE AMATEUR STATION (continued).



LIST OF PARTS (Power Supply).

EDDYSTONE COMPONENTS.		Price
1	Metal Panel, black ripple finish, No. 1118	1/9
4	Frequentie Terminal Saddles, No. 1046 at 1/- each	4/-
4	Insulating Filars 1 1/2, No. 1029 at 4fd. each	1/6
MISCELLANEOUS PARTS.		
1	Transformer, Output 350-0-350 V. 120 m/a 5V 2A C.T.	
1	6.3V. C.T. 4V. 2A. C.T. (Webb's Radio)	
1	Choke 20 Hys (Webb's Radio)	
1	On/Off Switch, type S.P.D.T.	
1	Condenser 8 x 8 mfd. T.C.C. type 83039	
1	Clx Octal Base	
1	Assorted Screws, Bolts and Nuts, Wire and Tags, etc.	
1	Baseboard	
1	Approximate cost of miscellaneous parts	2 9 0
1	Ooram Rectifier Valve, Type U50 is required.	

POWER SUPPLY.

WIRING AND LAYOUT PLANS.

The diagram on the left shows a direct back view of the unit, while on the right is a view from the top of the baseboard. The correct connections to the transformer are shown by the numbers on the wires and on the transformer although in the drawing for the purpose of clarity the actual connections have not been completed

SHORTWAVE PRESELECTOR

A H.F. AMPLIFIER UNIT WITH REGENERATION FOR A.C. MAINS OPERATION
WAVERANGE 9.7 to 66.6 METRES OR 31 TO 4.5 Mc/s.

The existing performance of any shortwave Receiver can be much improved by the addition of an efficient pre-selector unit. The one here described will have particular appeal to all listeners desirous of securing better shortwave reception for an outlay well within the scope of most pockets. At the same time the die-cast chassis and instrument type appearance make it a worthy acquisition to every Amateur station.

Its utility lies in the way it allows weak and almost inaudible signals to be brought up to sufficient strength to make them easily readable; it increases selectivity and sensitivity and improves the signal-to-noise ratio. It also reduces to a minimum second channel repeat points and in some cases eliminates them entirely. Further, it is extremely valuable in assisting the control of fading as the increased signal input brought about by the pre-selector considerably improves efficiency in the existing automatic volume control circuit.

Probably the most essential feature of the design is the inclusion of a regeneration control which increases the effectiveness of a one valve pre-selector to such an extent that it bears favourable comparison with other types of pre-selectors using two or more valves but not fitted with regeneration.

The advantage of a regenerative pre-selector does not rest at only improving receivers which are several years old or without an R.F. stage. It can be successfully used with modern sets especially of frequencies between 28 and 14 Mc/s, as circuit losses on these ranges are particularly high and quite often there is surprisingly little gain from the existing H.F. stage.

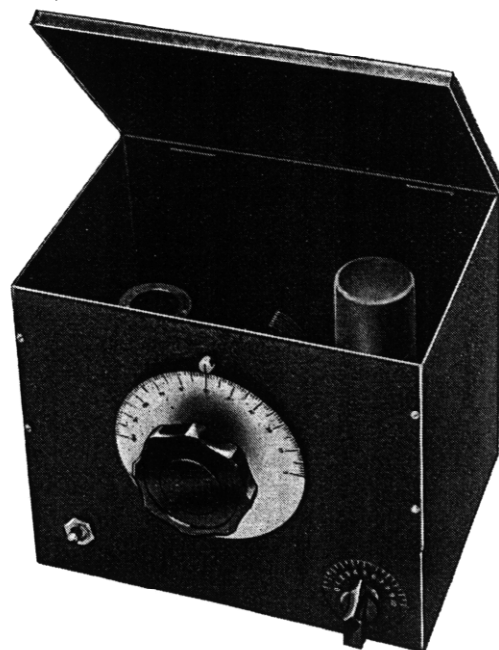
The valve used in this circuit is a 6 J7G which is in a screening can to prevent its input and output circuits coupling. Cathode regeneration is employed, control being obtained by variation of the screen grid voltage with a 50,000 ohm variable potentiometer. The tuned grid circuit is coupled by an aperiodic aerial coil and for regeneration purposes the grid coil is tapped a quarter turn from the earth end.

As the high tension current taken by the pre-selector valve is practically negligible it has been considered unnecessary to incur the extra cost of a separate high tension supply. The small current required can easily be drawn from the existing supply in the Receiver and so a separate filament heater transformer only is fitted.

The coils are arranged for home construction and for simplicity they are interchangeable in preference to the more complex switched assembly. Details of the windings, pin connections and tapings are given later. The circuit is tuned by a 100 mmfd Condenser fitted with a precision movement Vernier dial. Sharp and accurate tuning is obtained by means of the Vernier ratio reduction gear built into the driving head and characterised by its complete freedom from backlash. The dial scale is engraved 0-100 divisions and provided with a single line indicator segment. The pre-selector is built on a rigid die-cast aluminium chassis with sprayed metal panel which makes up into a workmanlike assembly. To complete the job the unit can be used in a smart metal case for which purpose the Eddystone welded steel cabinet No. 1061 is available.

CONNECTIONS.

The aerial is disconnected from the shortwave receiver and transferred to input terminal No. 1 of the unit. The lead from the output of the unit is then attached to the input aerial terminal of the shortwave receiver. If there are any special aerial arrangements on the shortwave receiver they should be so adjusted as though an orthodox "L"



Showing the complete Amplifier in Cabinet.

SHORT WAVE PRESELECTOR (continued).

type aerial were in use. The H.T.— socket of the pre-selector unit is joined to the receiver earth terminal. Unless a Dipole aerial is in use terminal No. 2 is connected to the earth terminal.

If a Dipole type aerial is already in use the two leads are connected to terminals 1 and 2 of the pre-selector unit. The only other remaining connection is the mains supply to the filament heating transformer.

OPERATION.

With all connections made the pre-selector unit is switched on and the regeneration potentiometer should be practically fully anti-clockwise. Since the tuning on the pre-selector is not very sharp when regeneration is not used, signals can be tuned in on the receiver proper. Tuning to resonance on the pre-selector will now intensify the signal and after a little experience the approximate dial settings, when the pre-selector and the receiver proper are in tune, will become known.

When the pre-selector is roughly in tune with the main receiver, regeneration can be applied which will increase the gain and selectivity of the pre-selector stage enormously. The point of regeneration should be reached in which maximum gain is obtained without actual oscillation taking place and at this stage a final slight re-tune should be made for best results.

The regeneration control should never be used so that the pre-selector unit is actually in a state of oscillation as this will prevent proper signals being received. The whole idea of the control is to obtain regeneration up to a point when the gain from this cancels out and equals the losses in the circuit. At this point selectivity and gain are at a maximum. Increasing the controls still further means that regeneration is greater than the circuit losses and oscillation takes place.

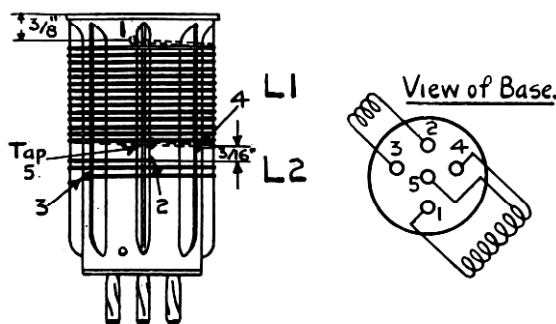
The correct use of the pre-selector to obtain really good results on weak and distant stations is acquired with practice and the results that will be obtained will well compensate for the extra small outlay and trouble the addition of a pre-selector occasions.

The assembly and wiring should present no difficulty if the layout plan and theoretical circuit are closely followed. All joints in the wiring should be well soldered, each lead kept short and rigid to prevent circuit variations. Extra care taken in the initial assembly and wiring will be amply repaid by consistent reception and freedom from noisy connections.

NOTE.

The coil numbers on the theoretical circuit diagram opposite are incorrect, the numbering of the coil diagrams above should have been used.

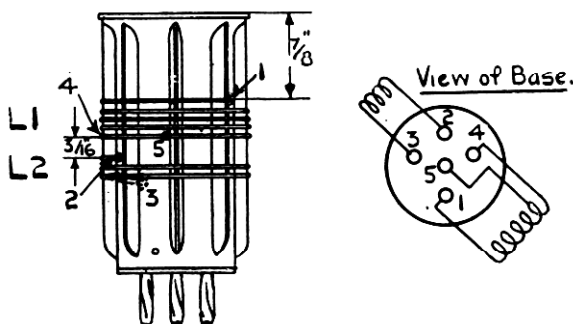
Details of coil winding and connections are as the following sketches. 22g tinned copper or enamelled wire is used throughout on all windings.



COIL 13 Mc/s — 5.4 Mc/s.

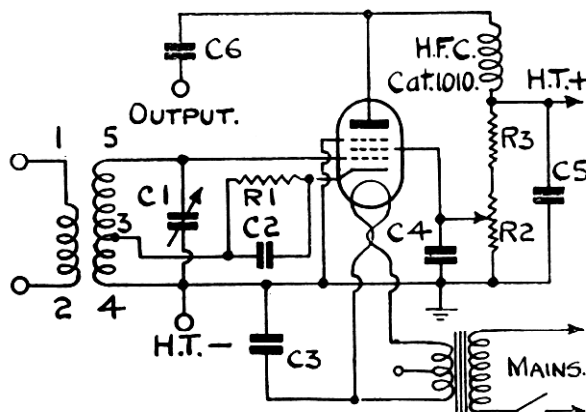
Winding L1 commences at 1 and finishes at 4, it consists of 14 1/2 turns and is tapped at 5, 1/4 turn from earth end. The tapping is taken through the coil former to the centre pin.

Winding L2 consists of 2 1/2 turns.



COIL 31 Mc/s — 12 Mc/s.

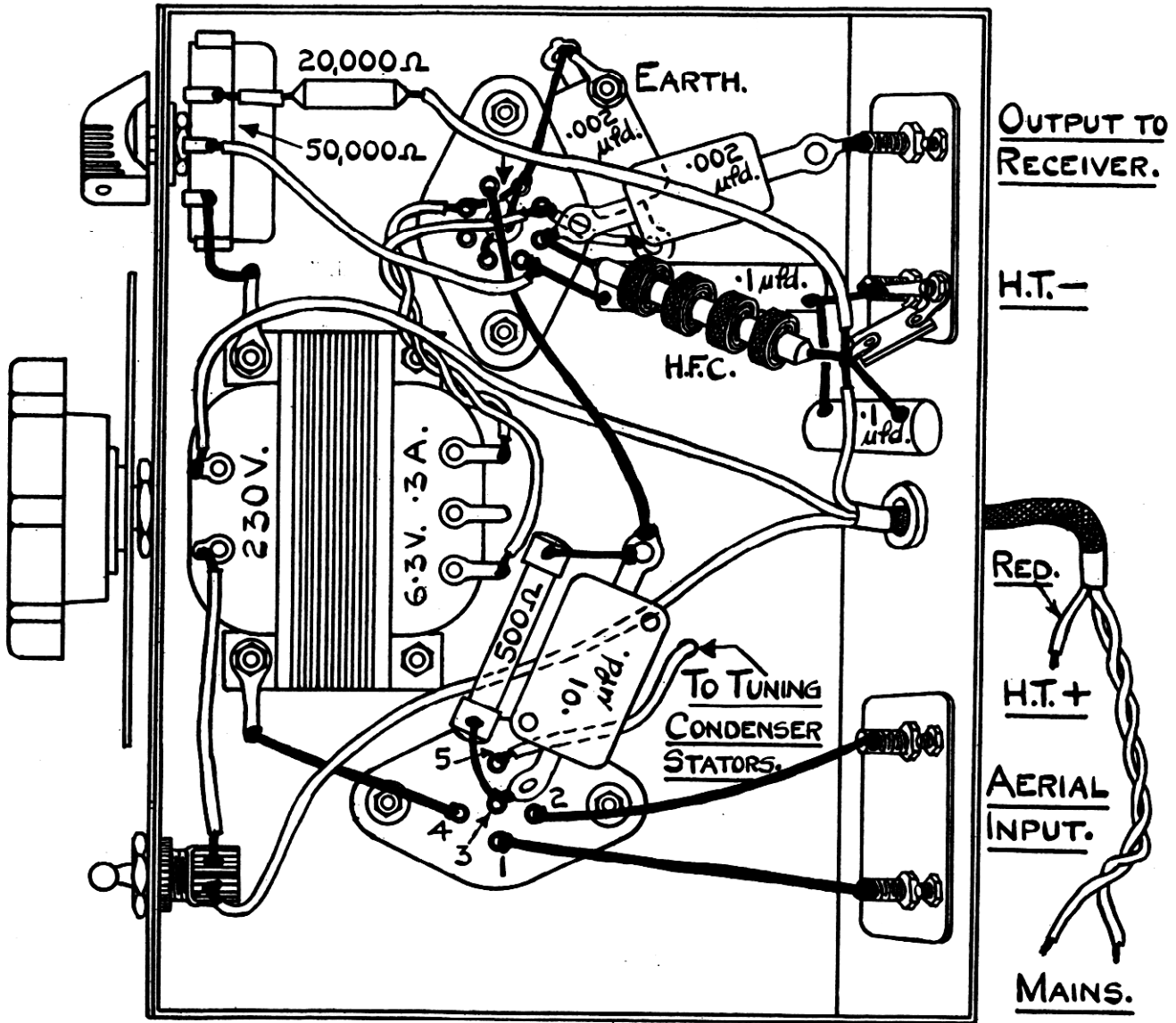
Is identical to the first coil but L1 consists of 4 1/2 turns tapped 1/4 turn from earth end, with L2 comprising 2 1/2 turns.



Theoretical Circuit. S.W. Preselector.

SHORTWAVE PRESELECTOR.

WIRING AND LAYOUT PLAN. UNDERSIDE OF CHASSIS.



EDDYSTONE COMPONENTS.

	Price
1 Diecast aluminium chassis with terminal panels, No. 1117	5/6
1 Metal panel, black ripple finish, No. 1118	1/9
1 Microdenser 100 mmfd (C1), No. 1130	5/-
1 S.W. H.F. Choke, No. 1010	2/-
1 Popular Slow Motion Dial, No. 1115	10/-
1 Pointer Knob and Dial, No. 1044	1/-
1 Frequentite Valveholder 5-pin, No. 1074	10d.
1 Frequentite Valveholder Octal, No. 1120	1/3
1 Insulated Bracket, No. 1116	1/3
2 D.L.9 5-pin coil formers threaded, No. 1001 at 2/6 each	5/-
1 Valve Screening Can, No. 1121	1/3
1 Steel Cabinet, black ripple finish, No. 1061	9/6

MISCELLANEOUS PARTS.

1 Two point On-Off Switch	..
1 Potentiometer 50,000 ohms R.2	..
1 Resistor 500 ohms 1 watt R.1	..
1 Resistor 25,000 ohms 1 watt R.3	..
2 Tubular Condensers .1 mfd. C.4 and C.5	..
2 Fixed Condensers .002 mfd. C.3 and C.6	..
1 Fixed Condenser .01 mfd. C.2	..
1 Filament Transformer 6.3 volts 3 amp output (Webb's Radio)	..
Length Three-way Connecting Cable	..
Wire, Screws, Nuts, Tags and Octal Valve Clip, etc.	..
Approx. cost of miscellaneous parts	24/-
1 Valve, type 6J7G.	..

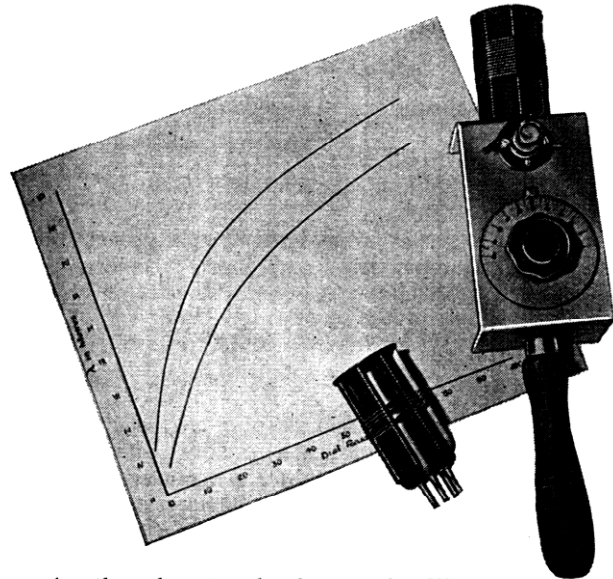
A GENERAL PURPOSE ABSORPTION WAVEMETER.

The variety of purposes served by a simple absorption type wavemeter makes it indispensable to the Amateur. It is particularly useful for checking harmonics from a crystal oscillator or frequency doubler. It can also be used for determining the wavelength of power amplifiers and to locate the presence of R.F. oscillations. The meter described has the advantage of being free from harmonics which are usually present where the valve heterodyne circuit is employed. Further, it is fitted with interchangeable coils which permit it to cover most frequencies in general use.

It consists of a simple tank circuit which is loosely coupled with the coil under measurement. The circuit is tuned by 100 mmfd Microdenser in parallel with the main winding. To sharpen the tuning and lessen damping the bulb or resonance indicator is connected in parallel with a step down aperiodic winding. The indicator is usually a flashlamp bulb but a neon tube or R.F. meter can be used if preferred.

The assembly is mounted in an aluminium frame measuring 9" x 2 3/4", each end being bent at right-angles 2 1/4" deep. This frame forms a screen and also acts as a protective stand when put down. A hand-grip is fitted at one end of the frame and provides the convenient method of manipulation.

The wavemeter can be calibrated against stations of known frequency tuned in on the receiver. When the set uses a regenerative circuit the meter should be placed with its coil close and parallel with the receiver detector coil. The dial is then rotated until a "click" is heard at which point the volume of signal is considerably reduced or disappears entirely. If the coupling between



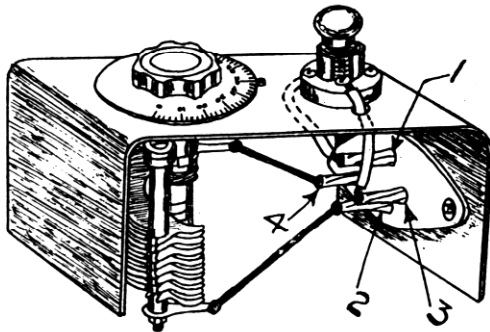
As the photograph shows, the Wavemeter is extremely handy and has a neat appearance.

the meter and the coil is then gradually loosened by moving the meter away, a more accurate calibration setting can be obtained. When this is finally decided a note should be made of the reading for later transference to the calibration chart.

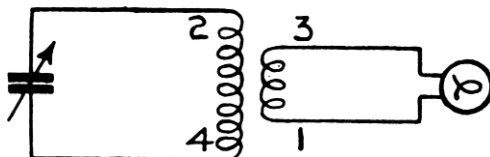
When checking with a Superheterodyne receiver using screened coils, it is best to wind a turn of the aerial lead-in wire around or near the base of the wavemeter coil. The meter dial is then tuned for minimum signal as shown by the tuning indicator in the set or the volume judged aurally.

If the receiver is re-set on a number of stations of known frequency, several points of calibration can be obtained for each coil and with these a wavelength chart can be drawn up by transferring the dial readings to graph paper and drawing a line through the different settings.

When the meter is loosely coupled to the plate coil of the transmitter, it will draw off a certain amount of R.F. energy which lights the lamp. Maximum brilliancy in the lamp indicates that the transmitter and meter are in resonance and that highest efficiency is being obtained.



Showing Component Assembly and Connections.



Theoretical Circuit.

LIST OF PARTS

EDDYSTONE COMPONENTS.

	Price
1 Microdenser 100 mmfd. No. 1130	5/-
1 Precision Dial, No. 1099	2/-
1 Frequentite Valveholder 4-pin, No. 1073	9d.
Eddystone 4-pin Coils to waverangerequired, Type No. 932	2/9 each

MISCELLANEOUS PARTS.

1 Bulb Holder and Bulb, 2v. .3A	
1 Hardwood File Handle	
1 Aluminium chassis 4 1/2" long x 2 1/4" wide x 2 1/4" high approx.	
Approx. cost of miscellaneous parts	2/3

25 WATT TRANSMITTER.

FOR TELEPHONY AND C.W. OPERATION ON 7, 14 AND 28 Mc/s.

This transmitter is an up-to-date example of a complete amateur station modulating up to 25 watts output on telephony and capable of correspondingly greater power when used for continuous wave transmission.

It is built on professional lines in a steel rack of standard dimensions occupying $31\frac{1}{2}$ " panel space ($18 \times 1\frac{3}{4}$ " Rack Units) and is so arranged that it can be extended to full standard size ($36 \times 1\frac{3}{4}$ " Rack Units) for future development without alteration except the addition of an extension outfit.

Other salient features are World wide range of communication, crystal control of frequency, H.F. stability and high speech quality with 100% modulation. The transmitter is arranged to work on the 7, 14 and 28 megacycle amateur wavebands and change of frequency can be carried out speedily and with a minimum of re-adjustment. The input power supply is approximately 100 watts, 230 volts 50 cycles, A.C.

CIRCUIT DESCRIPTION.

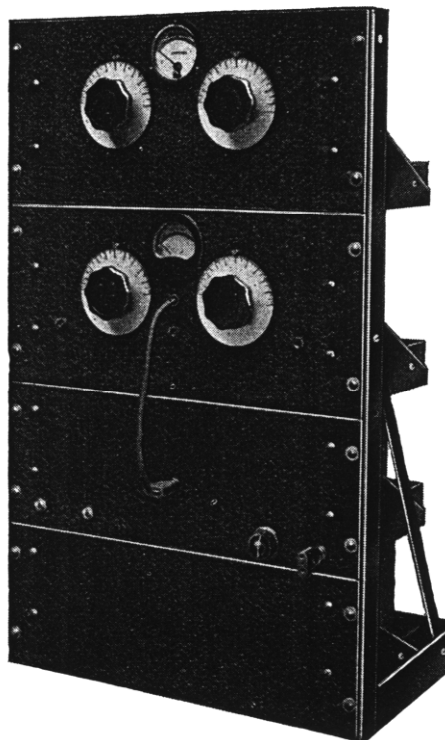
The transmitter comprises 4 units, each built on a steel tray with front panel. There is an aerial tuning unit, an H.F. and crystal oscillator stage, a modulator and speech amplifier with mains unit, and a power pack which supplies high tension and heater current for the H.F. and crystal valves.

Two beam power tetrode valves are used in the H.F. unit; these valves have features which will appeal to the experimenter. They work freely as a crystal oscillator and have a good harmonic content. Further, they need only small excitation to be fully driven when used as H.F. Amplifiers.

One tetrode functions as the crystal oscillator, the other as the H.F. amplifier. This latter valve serves as the final amplifier and could be used to drive a higher powered stage if the Transmitter is extended at a later date.

Two crystals are used, one with a fundamental in the 3.5 Mc/s band, the harmonic of which controls the transmitter on 7 Mc/s. The other crystal has a 7 Mc/s fundamental and is used for controlling the frequency of the 14 and 28 Mc/s transmissions. When operating on 28 Mc/s the final stage is working as a frequency doubler with practically the same power output.

The conventional series-parallel method of switching has been adopted in the aerial tuning unit. This allows any type of radiating system to be employed. A link line is used for conveying the R.F. output from the final Amplifier to the aerial tuning unit.



A front view of completed Transmitter shewing Panel layout and Rack construction.

The modulator employs three double-triode valves — the first as a two-stage R.C. coupled amplifier; the second as a driver stage and the final as a class "B" Amplifier. The output of the modulator will fully modulate 25 watts in the final stage of the transmitter. Adequate sensitivity and amplification is available to permit the use of a crystal microphone with all its advantages, this being the type recommended. There is, however, no objection to the use of any good quality microphone providing the microphone transformer is not mounted on the Transmitter.

EDDYSTONE RACK. COST OF PARTS.

1 Complete Relay Rack, No. 1107	25/-
4 Steel Chassis, No. 1109 at 4/6 each	18/-
4 Pairs Brackets, No. 1110 at 2/6 pair	10/-
2 Panels, 19" x 7" No. 1112 at 3/- each	6/-
2 Panels 19" x 8 $\frac{1}{2}$ ", No. 1112 at 3/9 each	7/6
3 Dozen Bolts and Nuts, No. 1111 at 1/3 doz	3/9
1 $\frac{1}{2}$ dozen Bolts and Washers No. 1113 at 1/3 each	1/10 $\frac{1}{2}$

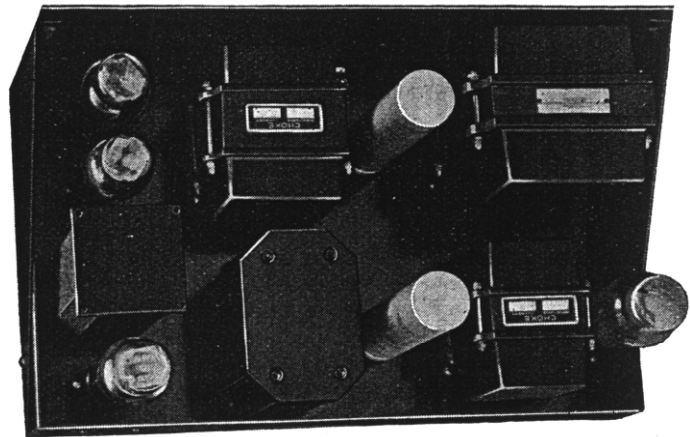
25 WATT TRANSMITTER (continued)

The modulator is built on a steel tray with panel 19" x 7". It is arranged for class "B" working and gives sufficient output to fully modulate the final amplifier when working at its 25 watt rating. The valves comprise three 6A6 double triodes. The first valve is used as a two-stage R.C. coupled amplifier. The second has its two sections wired in parallel and functions as the driver stage for the third valve which is used as a class "B" modulator. The circuit arrangement of this modulator ensures adequate amplification and sensitivity for the use of a crystal type microphone without the necessity of additional and external amplifiers. The microphone jack is fitted to the front panel of this chassis and alongside it is the microphone volume control. The other fittings on this panel are two control switches and the meter jack for reading the modulator current. The switch on the extreme left of the panel controls the A.C. mains input to the modulator and the right hand one breaks the negative high tension circuit of the modulation equipment. These switches are "on" when the transmitter is used for telephony and "off" when C.W. is used. The use of two switches enables the filaments to be left running with the H.T. current off.

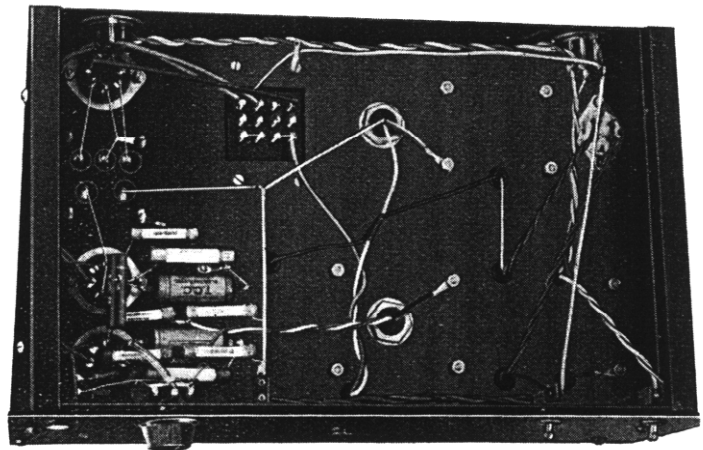
A top view of the chassis from the back shows the driver transformer on the extreme left and to the right the class "B" output transformer behind the 20 Henry Smoothing Choke. There are also two 8 x 8 mfd. electrolytic condensers, the mains transformer and the reverse flux shunt. This latter item is more popularly known as a "swinging choke" and its main purpose is to keep the D.C. output voltage on the plate of the class "B" valve constant within reasonable limits. In an amplifier of this type the anode current varies considerably so that special precaution is needed to maintain the voltage steady. This is satisfactorily attained with a "swinging" choke whose inductance will vary widely with the load taken from the power supply.

The parts and wiring of this unit are clearly shown in the photographs and circuit diagram.

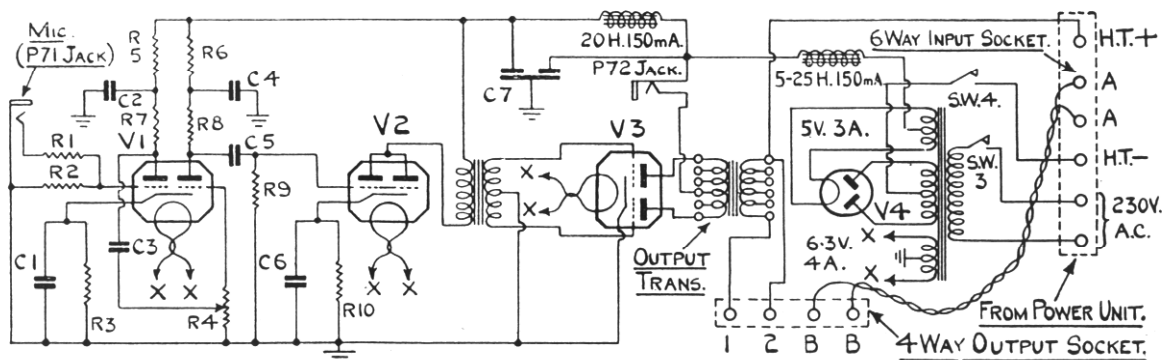
MODULATOR AND SPEECH AMPLIFIER STAGE.



Top view of Modulator Chassis.

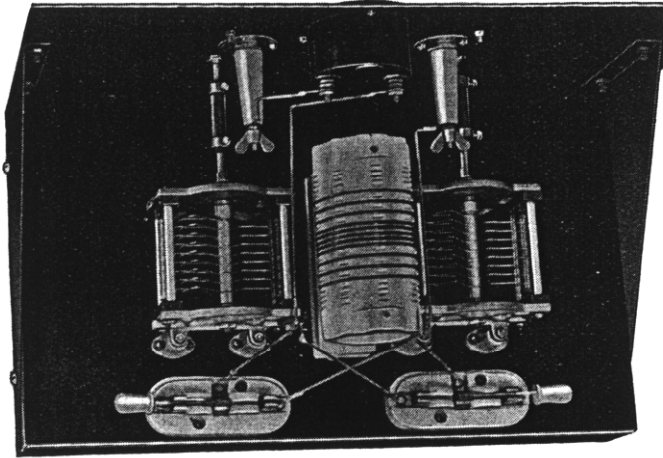


Showing underside wiring of Modulator and speech Amplifier.

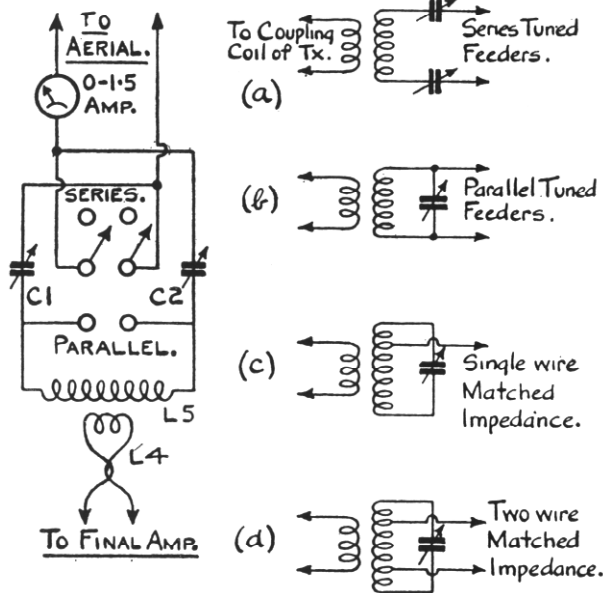


Theoretical circuit of Modulator and Speech Amplifier stage.

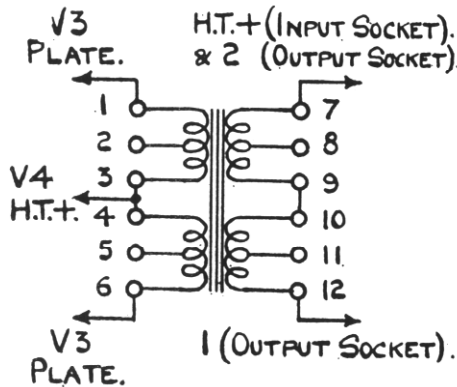
25 WATT TRANSMITTER (continued).



Showing Aerial Tuning Unit Layout.



No. 2. Theoretical circuit diagram of aerial coupling unit and alternative methods of aerial coupling.



No. 3. Theoretical circuit of connections for modulator output transformer and speech amplifier stage (See opposite page).

AERIAL TUNING UNIT.

This is arranged so that all types of conventional transmitting aerials can be used. By means of switches the two condensers can be used for series or parallel tuning as required. When parallel tuning is in use only one condenser is normally needed and one switch is left open. The aerial tuning coil is wound with 14G bare copper wire on an Eddystone Interchangeable Frequentite Former and details of the turns required for each band are shown in the table below. The link coil is wound between the turns of the aerial tuning inductance. Here, however, the usual experiment will be necessary to ascertain the number of link turns which give required coupling. The transmission feeder line is connected to the aerial tuning unit at the terminal heads of the two frequentite pillar insulators attached to the back of the metal panel. An aerial current ammeter is wired permanently in one feeder line. This meter reads from zero to 1.5 amperes and is graduated .3, .6, .9, 1.2 and 1.5 amperes.

The two Eddystone Tuning Condensers are high voltage double spaced condensers of 100 mmfd. each and they are mounted above the metal base on pillar stand-off insulators.

COIL TURNS. (Refer to circuit diagram).

WAVE	L1	L2	L3	L4	L5
40M.	15 1/2	18	2	2	17
20M.	7 1/4	8	1	2	9
10M.	7 1/4	4	1	2	4

The coil turns table shown above covers the coils unit in the transmitter for the three wavebands. The inductances L1 L2, etc. are so numbered in the theoretical diagrams Nos. 1 and 2.

L1.—22 SWG. Enam. wire wound on cat. 936 former. Remainder:—14 S.W.G. bare copper wire wound on cat. 1090 former.

L2 and L3:—Windings end coupled. L4 is interwound at the middle of L5. All 20 and 10M windings double spaced.

LIST OF PARTS

EDDYSTONE COMPONENTS.

- 2 Transmitting Condensers .0001 mfd C1 and C2, No. 1082 at 16/6 each 33/-
- 2 Precision Dials 4" dia. No. 1098 at 4/6 each 9/-
- 3 Frequentite Formers, No. 1090 at 4/- each 12/-
- 3 " Sub Bases, No. 1091 at 3/6 each 10/6
- 1 " Base, No. 1092 at 3/9
- 2 Extension Control Outfits, No. 1008 at 1/3 each 2/6
- 2 Pillar Insulators, No. 1049, at 1/6 each 3/-

MISCELLANEOUS PARTS.

- 8 Apex Stand-off Insulators 1 1/4" (Webb's Radio)
- 2 S.P.D.T. Porcelain Switches
- 1 Johnson 1 1/4" Lead-through Insulator (Webb's Radio)
- 1 Hot wire type ammeter 0-1.5 Amps.
- Approximate cost of miscellaneous parts £1 1 10

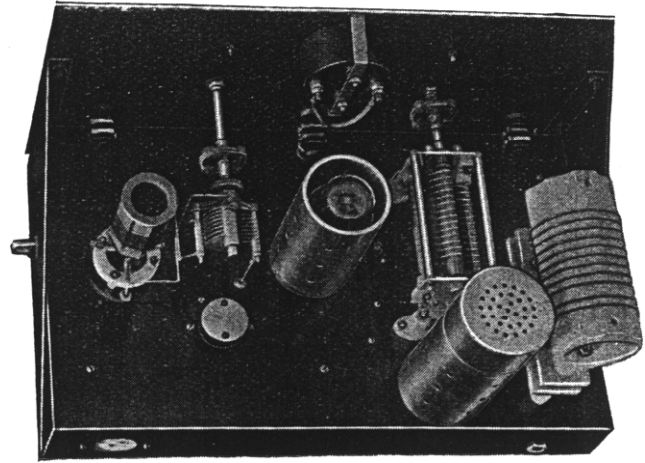
25 WATT TRANSMITTER (continued).

H.F. AMPLIFIER AND CRYSTAL OSCILLATOR STAGE.

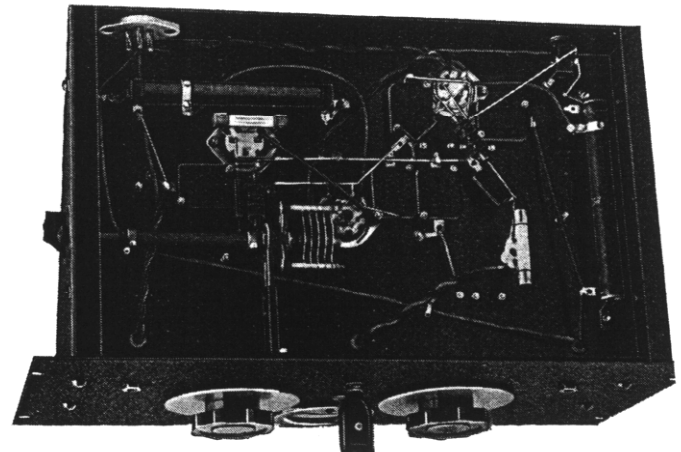
This comprises the crystal and final amplifier stages with their associated controls. The circuit of the crystal oscillator is tuned by a 60 mmfd. microdenser and the coil is wound on a 4-pin interchangeable former of DL9 low-loss dielectric. The valve in this stage is an Osram KT66 which is the British equivalent of the 6L6G. The final amplifier valve is a type 807 of which we understand a British equivalent will be shortly available. Both valves are in screening cans. The circuit of the final stage is tuned with an all brass high voltage condenser of 65 mmfd and the coils consist of 14G bare copper wire wound on Eddystone Frequentite low-loss interchangeable formers.

Winding data for crystal and final coils is given in the table on page 20. There is the flexible lead from the base of the final amplifier coil which is used to feed R.F. energy from the transmitter to the aerial array as already mentioned. (See also description of aerial tuning unit).

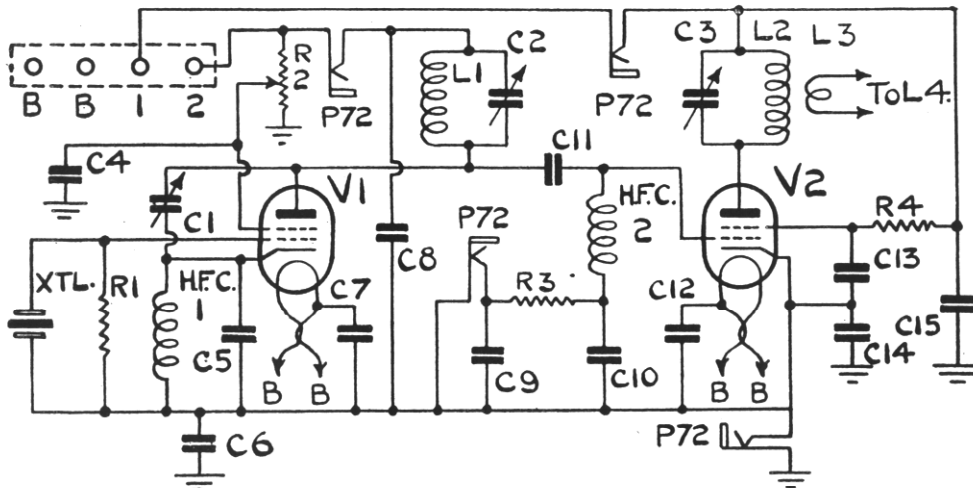
Taking a front view of the panel the crystal oscillator tuning dial is on the right and the final amplifier dial on the left. There is a milliammeter reading 0-100 mA and by means of a jack connected in each anode circuit this meter can be plugged into any stage thereby saving the cost of separate meters for each circuit. At the back of the chassis is the keying jack and 4-pin plug-socket fitting which is used to feed power supply through from the preceding stage. A regenerative 18 mmfd. Microdenser is mounted at the righthand under side of the chassis. The placing of this component away from the panel gives rise to no inconvenience as once the correct setting has been determined no further adjustment is necessary on any band. The purpose of this regenerative condenser is to adjust the degree of feedback from plate to cathode which in turn controls the harmonic output. The method of using regeneration is referred to under notes on tuning.



A top view — the Chassis and Component Layout.



Showing underside wiring and Component layout.



No. 1.
Theoretical circuit diagram of H.F. Amplifier and Crystal Oscillator Stage.

The list of parts for this stage is given on page 22.

25 WATT TRANSMITTER (continued).

TUNING AND OPERATING PROCEDURE.

When working the transmitter on the 7 megacycles band the crystal with the 3.5 Mc/s frequency should be used. It is fitted in the two pin sockets provided in the chassis of the H.F. unit. The corresponding crystal oscillator coil is then inserted in its 4-pin holder and the milliampere check meter plug is fitted into the right hand socket of the R.F. unit. The regeneration condenser on the righthand side of the chassis tray is set at zero dial reading.

The two screen voltage adjusting resistors on the underside of the R.F. chassis should be set about half-way, and when the following instructions have been carried out they can be set in their proper position which when measured with a voltmeter should show a reading of 200 volts. It is advisable to do this so that excessive plate current is avoided.

Next the heater current should be switched on and a matter of 30 seconds allowed for the heaters to attain normal working temperature. Following this, the high tension switch is closed and the dial of the crystal oscillator tuning condenser rotated until minimum current reading is observed on the scale of the check meter. The high tension should then be switched off and the correct plate coil put into its socket in the final amplifier, and the meter plug transferred to the left hand jack. H.T. is again applied and this stage tuned for minimum current on the meter scale. At this juncture the regeneration condenser needs adjusting to obtain an increase in grid drive. Proceed as follows :—

Insert meter plug into centre jack and note grid current registered. Then slightly advance setting of the regeneration condenser and immediately afterwards re-adjust the crystal oscillator tuning condenser for minimum current as the alteration of regeneration setting always affects crystal stage plate tuning to a small extent. Re-plug into centre jack. The grid current reading will now show an increase.

The same procedure can be repeated but when regeneration is carried too far, the C.O. stage will oscillate everywhere irrespective of the crystal frequency or the dial setting. A closed loop indicator with bulb will soon show when this is happening.

Only a slight degree of regeneration will be needed as the 807 valve requires very small drive.

The regeneration adjustments referred to in the preceding paragraph will bring about a fall in the previous minimum plate current registered in the crystal oscillator stage, although the output from the stage will actually increase.

WAVE	CRYSTAL	CRYSTAL OSC. COIL. L1.	FINAL AMP. COIL. L2 & L3.	AE. TUN. COIL. L4 & L5.
40M.	80M.	40M.	40M.	40M.
20M.	40M.	20M.	20M.	20M.
10 M.	40M.	20M.	10 M.	10M.

Shewing Tuning Coil and Crystal combinations for the three wave ranges.

For working on 14 megacycles the 7 Mc/s crystal is required. The same tuning procedure is then followed, remembering to insert the suitable crystal and final amplifier coils in their respective holders. *It is not necessary to alter the setting of the regeneration condenser again.*

Operation on the 28 megacycle band is very simple, the only difference from 14 Mc/s being that the final amplifier plate coil is substituted for the 28 Mc/s one and the stage then tuned for minimum current in the final amplifier plate meter.

When the transmitter is working on 28 Mc/s the final stage acts as a frequency doubler but this arrangement causes no noticeable loss in efficiency.

All that is now necessary is to couple up the link line from the final amplifier plate coil to the terminals provided at the base of the aerial tuning-link coil assembly on the top tray. After the correct link coupling has been determined and the type of radiating array decided it only remains to tune the aerial system for the desired load and the Transmitter is ready for service.

A good earth connection is essential to the satisfactory operation of this Transmitter.

LIST OF PARTS.
MODULATION UNIT.

	Price
1 Eddystone 6-pin Coil Base, No. 964	1/3
1 4-pin Valveholder, No. 1073	9d.
3 Amphénol 7-pin Valveholders	
1 4-pin Valveholder	
1 Potentiometer 0.5 megohm, R4	
1 Two point Toggle Switch	
1 Igranic P72 Jack	
1 P71	
1 Resistor 1,000 ohms 2 watt R10	
1 350 " 2 " R3	
3 " 0.25 Megohms 1 watt R5, R8, R9	
1 " 0.5 " 1 " R7	
1 " 25,000 ohms 1 " R6	
1 " 5 Megohms " R2	
1 " 50,000 ohms " R1	
1 Condenser 50 mfd 12V. wkg. electrolytic C1	
1 25 mfd 25V. " " C6	
2 Condensers 8 x 8 500V. " " C2, C4 and C7	
2 0.1 mfd. Tubular C3, C5	
1 U.T.C. Varimatch Transformer Type VM1 (Webb's Radio)	
1 Transformer 400-0-400V 120mA 6.3V 3A. 5V 3A (Webb's Radio)	
1 Class B. Driver Transformer (for 6A6 Valves) (Webb's Radio)	
1 L.F. Choke 5-25 Hys. 150 mA (Webb's Radio)	
1 L.F. " 20 Hys. 150 mA	
Approximate cost of miscellaneous parts	£7 3 0
3 Type 6A6 Valves V1, V2 and V3 also an 83 V4 Type Rectifier are required	

FIELD STRENGTH INDICATOR AND MODULATION MONITOR

Every Amateur Transmitter who wishes to have a well-equipped and up-to-date station should look upon this type of instrument as an essential part of the gear in view of the many useful purposes it serves. In the first place it is a practical method for tuning transmitting aerials and arrays for maximum output while giving also an accurate indication of field strength from the transmitted wave in the immediate area of the aerial system.

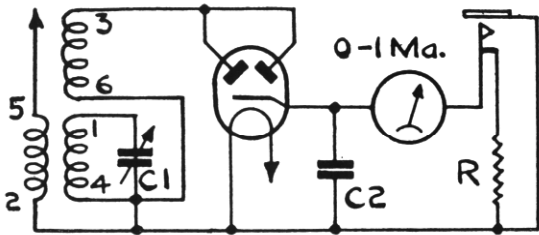
Again, it simplifies the tricky job of neutralising H.F. Amplifier stages and is a valuable aid for checking transmitter and aerial adjustments under radiating conditions.

All amateurs will appreciate the reassuring effect a modulation check meter has if always in use during telephony transmissions for it permits the operator to obtain a constant indication of modulation without reference to an external observer.

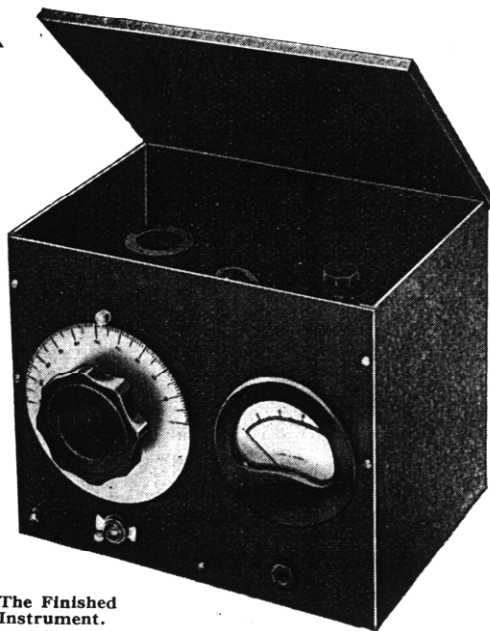
The instrument is designed so that it can be simply and quickly constructed at a modest cost. It uses a single tuned circuit with diode rectification in which the third winding of the coil is arranged to provide a step down ratio and thus relieve the tuned circuit from diodeload. The strength of the incoming signal carrier is indicated by the degree of deflection obtaining on the scale of the 0-1 mA milliammeter.

Special coils do not have to be wound, the circuit being designed to accommodate standard Eddystone 6-pin low loss interchangeable coils which permit the meter to cover the 10, 20, 40, 80 and 160 metre amateur bands without modification to their windings. The diode rectifier valve is a Cossor 220D/D and it is operated from a small 2-volt accumulator housed inside the metal cabinet. No high tension supply is required with the circuit used.

The circuit is tuned by a 100 mmfd condenser fitted with a direct drive instrument type dial marked 0-100 divisions and with indicator segment for easy reference. A telephone jack in series with the milliammeter allows the instrument to be used as a modulation monitor and a single "on-off" switch enables the unit to be brought into immediate service on any of its functions.



Theoretical Circuit. Field Strength Indicator;



The Finished Instrument.

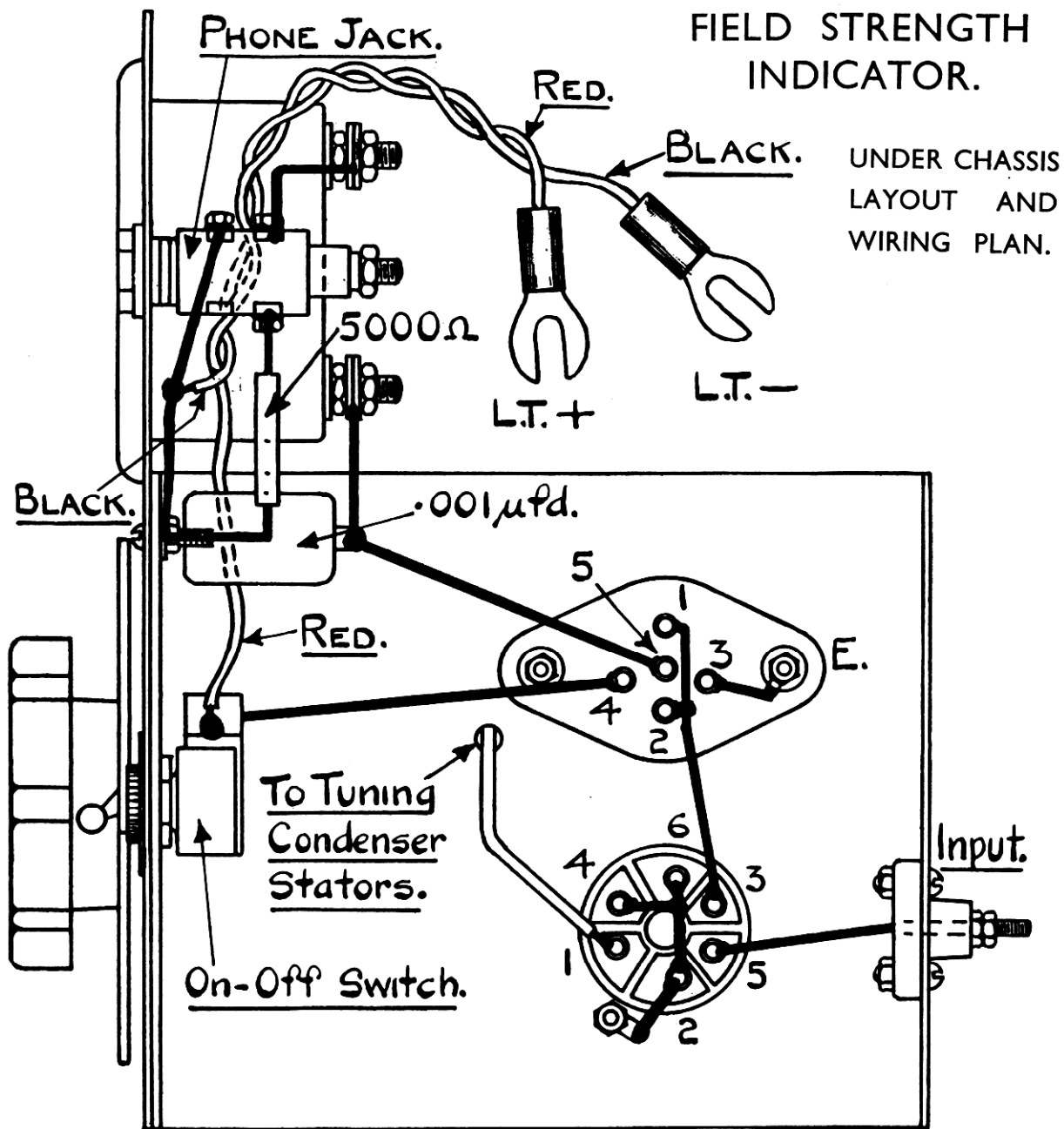
The unit is built upon a 14 gauge "U" shaped aluminium chassis measuring $5 \times 5\frac{3}{4} \times 2\frac{1}{2}$ ", the controls and indicator meter being fitted on a sprayed metal panel $8\frac{1}{2} \times 7$ ".

A conventional form of "pick-up" consisting of an 18" length of insulated wire is necessary or alternatively the meter is more portable if a copper rod is used. The "pick-up" is connected to the input terminal at the rear of the chassis. It serves all general requirements but when very low powered transmitters are being tuned it can be increased in length to give greater pick-up in compensation for the weaker field strength of the transmission.

The indicator gives best results if it is tuned to resonance and then placed at such a distance from the transmitter that there is only a small deflection of the meter scale. As the transmitter and aerial are more accurately tuned the meter reading is correspondingly increased. Once the meter has been tuned to resonance it is not advisable to alter its setting while the best transmitter and aerial positions are being found.

When neutralising H.F. Amplifiers the "pick-up" wire should terminate in a one or two turn loop which is loosely coupled to the amplifier plate coil. The indicator dial is then tuned for maximum deflection on the scale; afterwards the usual neutralising procedure is followed until the meter gives no indication of R.F. current irrespective of the setting of the tank circuit condenser.

When making field strength measurements or neutralising H.F. amplifiers the sensitivity of the indicator will be improved if the 'phone jack is shortcircuited.



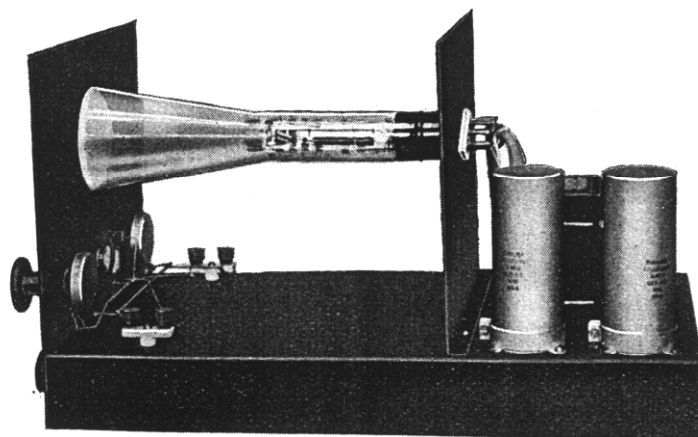
EDDYSTONE COMPONENTS.

	Price.
1 Metal cabinet, black ripple finish	No. 1061 .. 9/6
1 Metal Panel, black ripple finish .. .. .	.. 1118 .. 1/9
1 Microdenser, 100 mmfd. .. .. .	.. 1130 .. 5/-
1 Precision Dial, 4-in. .. .. .	.. 1098 .. 4/6
1 Coil Base, 6-pin .. .. .	.. 964 .. 1/3
1 Valveholder, 5-pin .. .. .	.. 1074 .. 10d.
1 Midget Insulator .. .. .	.. 1019 .. 4½d.
Eddystone 6-pin coils to waverange Type 959 from 3/3 each.	required

MISCELLANEOUS PARTS.

- 1 Meter 0—1 milliamps (Webbs Radio).
- 1 Two-point On-off Switch.
- 1 Fixed Condenser .001 mfd.
- 1 Jack (Igranic type P.72).
- 1 Plug (" " P.40).
- 1 each red and black Spades.
- 1 Sheet Aluminium, 11-in. long x 5-in. wide.
- Screws, Nuts, Wire, etc.
- Approximate cost of miscellaneous parts £1/15/6.
- 1 Cossor Valve, type 220DD, and 2 V. Accumulator are required.

CATHODE RAY OSCILLOSCOPE.



One of the most useful measuring and testing instruments for the transmitting amateur is the cathode ray oscilloscope. Its initial expense is justifiable when consideration is given to the numerous instances when it can be used in the place of less satisfactory types of measuring and testing equipment. It is particularly suited for studying the effect of audio frequency voltages on the radio frequency carrier and thus gives an accurate indication of modulation. A cathode ray oscilloscope can also be used for lining up the transmitter, for neutralising amplifier stages, for measuring R.F. voltages across grid circuits and for fault checking in transmitters.

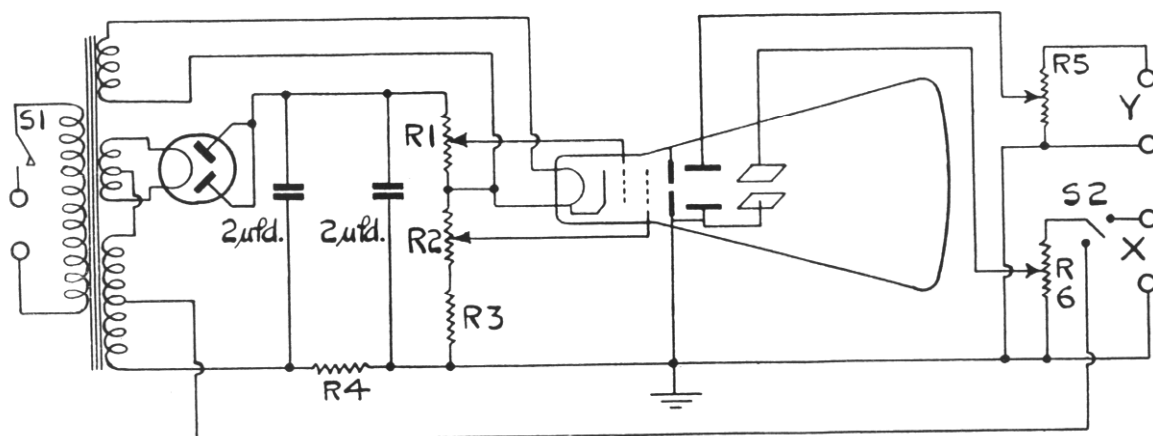
With the advent of the Hivac 3" cathode ray tube the construction of an oscilloscope for amateur use is possible at a low cost, without difficulty in making, plus the advantages of operating with comparatively low voltages.

The instrument described is built on a steel tray with the addition of a front panel of 16G steel sheet and a bracket of similar material carrying the tube holder and acting as a shield between power unit and screen.

The photograph and diagram show clearly the simple layout and ease of construction; the important points to watch are the care that should be taken to use well insulated wire; that the high tension positive is earthed and finally that the high tension should be regarded with respect as it is capable of a severe shock if carelessly handled.

The 3" screen of the tube is in the centre of the front panel which also carries the controls.

The bottom switch is the main on and off switch while the top centre switch carries the voltage from the centre tap of the 400-0-400 volts transformer to the horizontal plates. This provides a simple horizontal sweep circuit which will be useful for elementary audio frequency tests and should always be switched in when no signals or voltage are supplied to either pair of plates. If this is not done the spot will remain stationary causing puncture of the glass envelope or in any case, will ruin the screen material. The bottom left hand knob is the 10,000 ohm potentiometer which controls the bias to the shield and



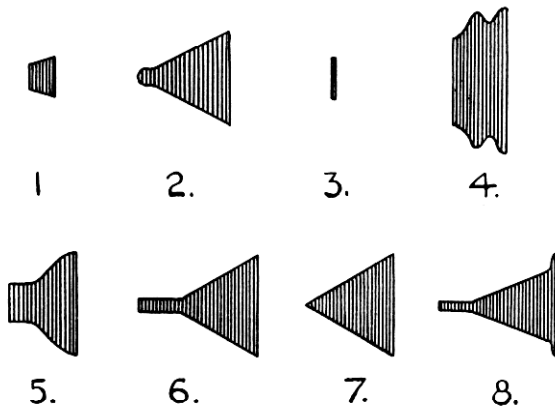
Theoretical circuit diagram.

CATHODE RAY OSCILLOSCOPE (continued)

varies the brilliancy of the beam. Never use a greater brilliancy than necessary so that the life of the tube is prolonged. The knob at the right hand bottom is the .25 megohm potentiometer controlling the voltage on the second anode so that the beam can be focussed to a spot. At the top left hand a 1 megohm potentiometer adjusts the input voltage to the pair of vertical plates so that the amplitude of the variable sweep can be varied.

To the right of this is a further 1 megohm potentiometer which, when the centre top switch is down, thus connecting the right hand pair of input terminals to the horizontal plates, controls the amplitude of the horizontal sweep caused by the input signal. As previously mentioned, when the switch is up the mains sweep circuit is controlled.

The method of use and connecting up is shewn in the theoretical diagram opposite. R.F. or A.F. inputs can be applied to either set of input terminals. For R.F. a link line is used terminating in a one turn loop. For A.F. connection is made via two 1 mfd condensers. When the modulated carrier voltage is applied to one set of plates and the audio modulation voltage to the other set, a formation of trapezoidal shape is produced in the screen during modulation. The following trapezoidal shapes indicate the modulation conditions.



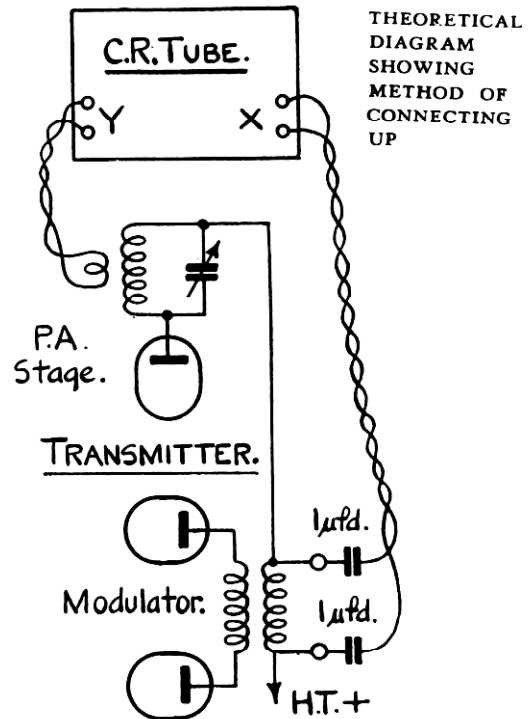
- No. 1. Grid or plate modulation with no distortion but less than 100% modulated.
- No. 2. Suppressor modulated telephony with separate R.F. Driver Valve. Showing approximately 100% modulation.
- No. 3. An unmodulated carrier-wave.
- No. 4. Showing plate modulation with modulator overloaded or improperly matched.
- No. 5. Showing plate over-modulation with wrong matching of impedance in Class B. Modulator.
- No. 6. Grid or plate over-modulation. Audio input too great.
- No. 7. Showing 100% grid or plate modulation with no distortion.
- No. 8. Over-modulation. Audio input too great with plate modulation.

The actual modulation percentage can be calculated by measuring the length of N1 and N2 shewn in sketch and using the following formulae

Modulation percentage

$$N1 \quad N2 = \frac{N1 - N2}{N1 + N2}$$

Correct interpretation of the trapezoidal shapes will often lead to the discovery of such faults as may exist in the transmitter.



EDDYSTONE COMPONENTS.

1 Steel Chassis, No. 1109	.. .. .	4/6
1 Frequentite 7-pin Valveholder No. 1075	.. .. .	1/-
1 " Octal No. 1120	.. .. .	1/3
3 " Terminal Saddles, No. 1046 at 1/- each	.. .. .	3/-
4 Instrument Knobs, No. 1086 at 9d. each	.. .. .	3/-

MISCELLANEOUS PARTS.

1 Switch 2 point Toggle type	.. .. .
1 SPDT	.. .. .
1 Potentiometer 10,000 ohms R1	.. .. .
1 " 0.25 Megohms R2	.. .. .
2 " 1 Megohm R5 and R6	.. .. .
1 Resistor 0.5 " 1 Watt R3	.. .. .
1 " 0.25 " 1 " R4	.. .. .
2 Condensers 2 mfd 1000V wkg. Dubilier type 26-8	.. .. .
1 Mains Transformer 400-0-400V 5V 3A CT and 2.5V 2A (Webb's Radio)	.. .. .
1 Sheet Mild Steel 10" x 10" 16 gauge	.. .. .
1 " 10" x 8 1/2" 16	.. .. .
Approximate cost of miscellaneous parts	.. .. .	£3 11 0
A Hivac type CR3 and a Rectifier Valve type 5Z4 or U50 are required	.. .. .

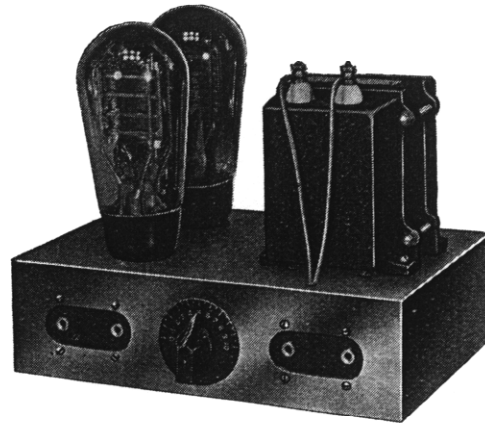
KEY CLICK ELIMINATOR

A keying device for the Amateur Station.

Key-clicks are deprecated by all Amateurs who respect their fellow experimenters and broadcast listeners. Further, the terms of the official transmitting licence insist that the keying shall be carried out in a manner that ensures the risk of "clicks" being reduced to a minimum.

The keying unit described in this article has been proved by practical experience to fulfil the above requirements admirably. It utilizes the valve method of keying and will handle up to 50 milliamperes per valve. The circuit is arranged so that two valves can be used in parallel for 100 mA when desired. The whole of the components, including filament transformer and 20 Henry choke are mounted on a standard Eddystone die-cast chassis No. 1117, which results in a neat, compact and strong assembly. Briefly the keying valve (or valves) in the unit with its associate circuit is in series with the H.T. negative supply to the keyed stage. The valve (or valves) in the circuit is biased back to cut off by the voltage developed across the .25 megohm resistance when the key is open. Immediately it is closed, however, the bias is removed and the keyed stage is operated. Since there is no breakage of any electrical connection, it only requires correct adjustment of the time constant circuit which is incorporated for the keying impulses to be absorbed. H.F. Chokes in the input and output feeds prevent radiation on the leads between the unit and the transmitter.

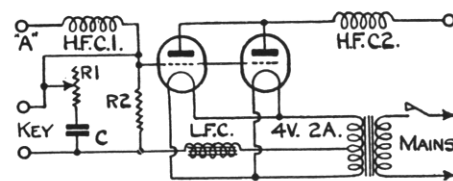
The following method of connections should always be observed: The high tension negative of the power supply feeding the stage to be keyed is connected to the output terminal marked "A." The other terminal is connected to the baseline of the centre tap of the heater transformer of the keyed stage. It is essential that the high tension negative does not reach the keyed stage other than



The completed unit.

through the keying unit. Thus in addition to the use of the filter unit the keyed stage itself must have either an independent filament heater transformer or an individual H.T. supply if this is not already existent. The small additional expense of the filter unit will be fully justified by the personal satisfaction of knowing that the station is being operated without causing external interference and annoyance to nearby listeners.

When the unit has been built and connected to the transmitter in keeping with the circuit shown below, it is brought into operation by closing the switch which allows heater current to reach the keying valve or valves. A receiver is then brought into use and tuned somewhere near the operating frequency while the transmitter is being keyed. The variable potentiometer on the filter is now adjusted to the point where the key-clicks are eliminated. Afterwards no further adjustment is necessary on any waveband.



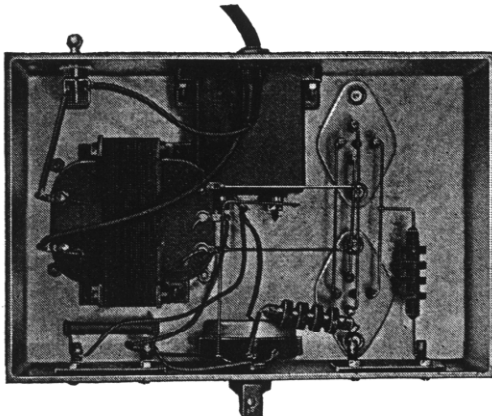
Theoretical circuit diagram.

EDDYSTONE COMPONENTS.

1 Die-cast Aluminium Chassis with Terminal Panels, No. 1117	5/6
2 Frequentite Valveholders 4-pin, No. 1073 at 9d. each	1/6
2 S.W.H.F. Chokes HFC1 and HFC2, No. 1010 at 2/- each	4/-
1 Pointer Knob and Dial, No. 1044	1/-

MISCELLANEOUS PARTS.

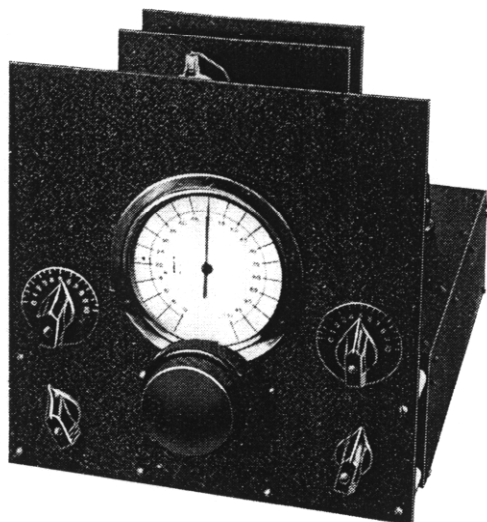
1 L.F. Choke 20 Hys. 60 mA (Webb's Radio)	..
1 Mains Transformer output 4V 2A (Webb's Radio)	..
1 On-Off Switch Toggle type	..
1 Condenser 1 mfd 200V wkg. non-inductive type	..
1 Potentiometer (or variable resistance) 10,000 ohms	..
1 Resistor 25,000 ohms 1 watt	..
4 Clix Parallel type sockets	..
Length two-way cable, wire, nuts, bolts, tags and Insulating bush, etc.	..
Approximate cost of miscellaneous parts	£1 10 9
1 or 2 Osram PX4 type Valves are required.	



Under chassis layout and wiring.

ULTRA SHORT WAVE RECEIVER.

COVERING THE 5 METRE AMATEUR BAND. 68 Mc/s. TO 51.4 Mc/s.



The five metre band after some years of tardy recognition, is now enjoying deserved popularity amongst Amateurs, offering as it does facilities for experimental directional aerial arrays and great scope for originality in low-loss transmitter circuit layout and design.

With the improvement in modern equipment the range of useful communication is being steadily increased and while at the time of writing we are still awaiting the first two-way contact with U.S.A., the D.X. possibilities are fascinating, and in the meantime the band is being used for C.W. and telephony contacts up to distances of 100 miles with consistent working.

The super-regenerative receiver has done yeoman service, and still has its uses for light-weight portable work, but for the weakest signals where extreme sensitivity is necessary it suffers from limitations. The receiver to be described gives facility for reception of both the weakest long distance crystal-controlled C.W. or telephony and also with an optional quench or super regenerative circuit ensures intelligibility from self-excited transmitters. Interesting comparisons can be made between the "straight" receiver and the "super-regenerative. When using a straight receiver on 5 metres, aerial-resonance or "blind spots" on the reaction control can be very troublesome, but a properly designed H.F. stage will eliminate them, and to ensure H.F. amplification at high frequencies an Acorn valve is used. Any attempt to use an ordinary type of valve as H.F. amplifier usually

results in a loss of signal-strength rather than a gain, but the Acorn H.F. stage does give an exceedingly good increase in sensitivity, in fact it literally makes the receiver. The regenerative detector uses an ordinary type of H.F. Pentode, with the cathode-tap method of regeneration, controlled by potentiometer in the screen-voltage supply, followed by one stage of audio amplification primarily intended for headphone reception, though on strong signals sufficient gain is obtainable for a small loud speaker.

ACORN H.F. STAGE.

The whole secret of obtaining worth-while H.F. gain is embodied in the method of coupling the H.F. stage to the detector, and after considerable experiment it was found that transformer coupling gave greatest all round satisfaction.

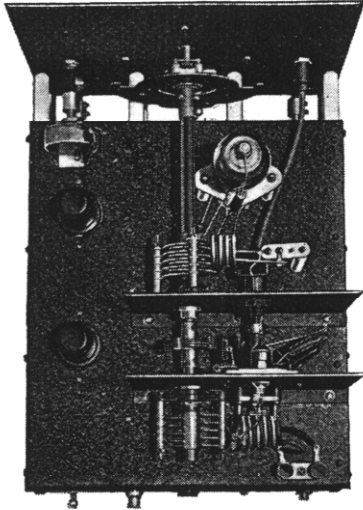
The detector coil assembly is as follows. Secondary or tuned-detector coil comprises four turns of No. 14 guage wire wound on $\frac{3}{4}$ " former, self supported in wiring, while the primary uses six turns of 24 guage wire, $\frac{1}{8}$ " inside diameter air spaced and carefully centred within the secondary coil. The support for this primary winding is by means of a Frequentite strip taken from an Eddystone U.S.W. coil and is shewn in top layout photograph.

The H.F. grid coil uses five turns of 14 guage wire, with a two-turn link for doublet-aerial connection, and to ensure this circuit being in resonance with the detector a small trimmer is used, brought out to front panel control by means of an Eddystone flexible shaft-coupler, thus obviating long leads between the trimmer and the main tuning condenser. The trimmer is made from a standard Eddystone 978 air-dielectric trimmer, cut down so that only two moving and two fixed vanes are used.

A front metal panel size 9" x 9" is used, and this is completely isolated from the chassis by means of $1\frac{1}{2}$ " insulated spacing pieces. A metal chassis $10\frac{1}{4}$ " long x 9" wide x 3" deep carries the general components. As an alternative construction, instead of an all-metal chassis it can be constructed from wood, but a thin sheet of aluminium must be used on the top baseboard.

The panel lay-out covers the main tuning dial in the centre, at the left of this is the knob, operating the insulated flexible shaft driving the high frequency trimmer condenser. Underneath this is the main H.T. on/off switch, which is mounted on the chassis itself, and has a small insulated coupling to the control knob. On the right of the dial is the volume control knob. This

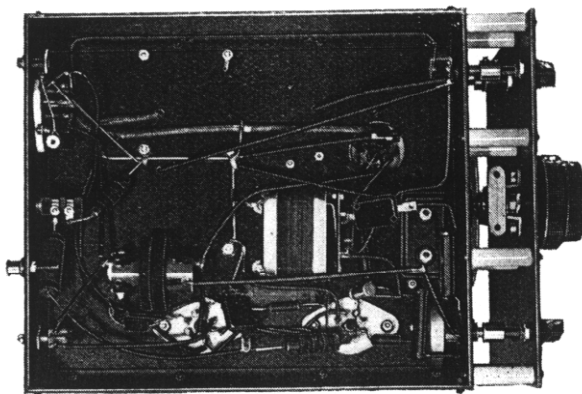
ULTRA S.W. RECEIVER (continued).



has an insulated shaft to the 500,000 ohm potentiometer which is bracket mounted to the top of the chassis. Underneath this potentiometer and mounted under the chassis is a 25,000 ohm regeneration potentiometer, the knob control for this again being brought to the front panel by an insulated shaft.

Two metal screens 6" wide x 5" high are used on top of the chassis, as shown in the photograph.

The layout of components above the chassis should closely follow the photographs, but the under chassis wiring is naturally not so important, but great care is necessary in making earth returns, the best plan being to bring all earth connections for the H.F. and Detector stages to one common earthing tag on the chassis. The switch in the cathode lead of the quench valve for operating optional super regenerative device is best accommodated at the back of the Chassis. The heater



wiring to H.F. and detector valves is enclosed in screened tubing which should be earthed at several points.

The standard power supply unit described in the manual is suitable for use with this receiver.

LIST OF PARTS

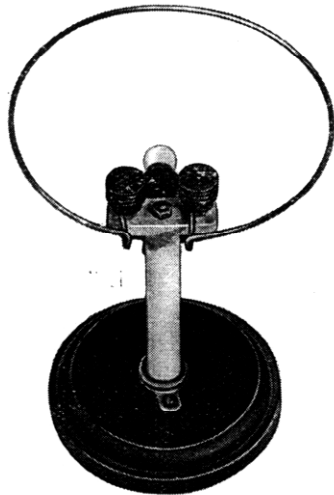
EDDYSTONE COMPONENTS.

1 Improved Dual Speed Dial, No. 1070	10/6
2 Microdensers 18 mmfd, No. 1094 at 3/9 each	7/6
2 Extension Control Outfits, No. 1008 at 1/3 each	2/6
1 Flexible Coupler, No. 1009 at	1/6
1 " " 1096	3/6
10 Insulating Pillars, 1½", No. 1029, at 4½d. each	3/9
1 " " 2¼", No. 1028	6d.
2 Pointer Knob and Dial, No. 1044, at 1/- each	2/-
2 " " Knobs only, Type No. 1044K, at 6d. each	1/-
2 H.F. Chokes HFC2 and HFC3, No. 1010, at 2/- each	4/-
1 H.F. Choke HFC1, No. 1011	1/3
1 Frequentite Valveholder 4-pin, No. 1073	9d.
3 " " Valveholders Octal, No. 1120 at 1/3 each	3/9
1 Quench Coil Unit, No. 958 at	4/6
1 Midget Condenser No. 1013,	4/3
1 Frequentite Terminal Saddle, No. 1046	1/-
1 4-pin Lead Connector, No. 1030	1/2

MISCELLANEOUS PARTS.

1 Acorn type Valve Socket Hammarlund S900	..
1 L.F. Choke 300 Hys (Webb's Radio)	..
1 Igranic Jack P71	..
1 Plug P40	..
1 Set Panels and Chassis to specification (Webb's Radio)	..
1 Humdinger Resistance R15	..
1 0.5 megohms Resistor, ½ watt R6	..
1 500 ohms Resistor ½ watt R13	..
1 10,000 " " " R10	..
1 50,000 " " " R12	..
1 1,000 " " " R2	..
1 2,000 " " " R4	..
1 0.25 megohms " " " R3	..
1 3 " " " R5	..
1 10,000 ohms 1 watt " R9	..
1 35,000 " " " R14	..
1 75,000 " " " R7	..
1 8 ohms 10 watts " R1	..
1 Potentiometer, 25,000 ohms R8	..
1 " " 0.25 megohms R11	..
6 Condensers .001 mfd Type " M " C4, C5, C6, C9, C10, C13	..
1 " " .001 mfd. Wire end type C7	..
1 " " 2 mfd. 2 Terminal type C12	..
1 " " .01 mfd Type " M " C14	..
3 " " .0003 " " " C8, C11, C16	..
1 " " .25 " 25 volt D.C. wkg. C15	..
1 " " .2" " Tubular C17	..
1 Two Point Switch Toggle type	..
1 " " Rotary	..
3 Extension Rod with fixed Coupler (Webb's Radio)	..
1 Earth Terminal, Potentiometer Mounting Bracket, Insulating Bush and Strip, Wire, Slewing, etc. (Webb's Radio)	..
VALVES,	..
V1 Mullard AP4 Acorn Valve	..
V2 Mullard 6K7G type Valve	..
V3 and V4 6C5 " Valves	..

RESONANCE INDICATOR.



The unit consists of a 4" diameter coil of 14 gauge bare copper wire which is supported by an Eddystone frequentite terminal strip No. 1046. This in turn is mounted on a standard Eddystone insulating pillar with base No. 1029. In parallel with the loop is wired a flash lamp bulb in a Bulgin holder No. F.5. The whole assembly is mounted on a small wooden plinth for ease of handling. The photograph and circuit need no elaboration and the complete unit can be built for a few pence.

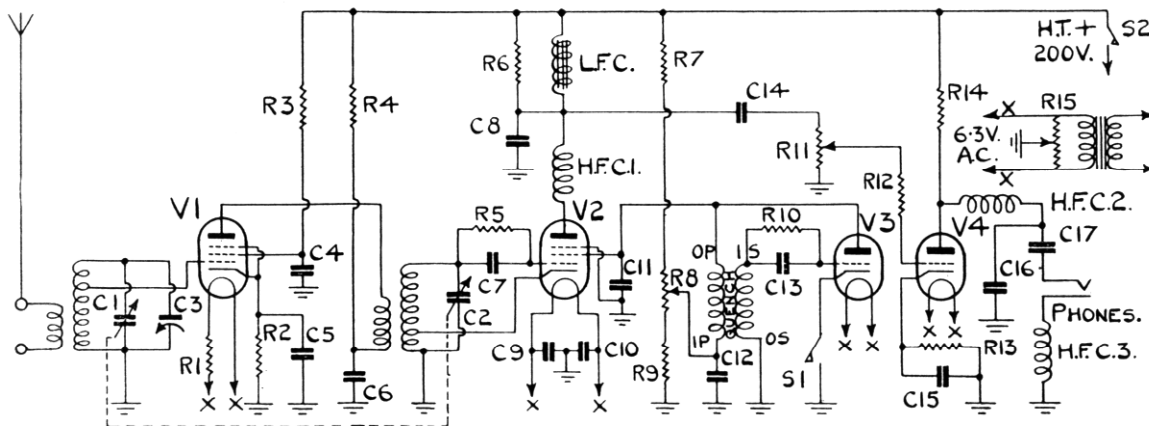
When coupled to the plate coil of the Transmitter under adjustment the loop draws off R.F. energy which lights the filament on the pilot bulb, maximum brilliancy indicating true resonance. A looser coupling gives greater accuracy.

This simple piece of apparatus is always useful for tuning or adjusting the various stages of a short-wave Transmitter. It is a quick method for locating the presence of R.F. and in facilitating neutralising.

LIST OF PARTS.

	Price
1 Frequentite Terminal Saddle No. 1046	1/-
1 Insulating Pillar 2½", No. 1028	6d.
A Wire Loop approximately 4" in diameter, 14 SWG. Bare Copper is required, also Bulb Holder holder and Bulb 2.5V.	
Circular Wood Base (Flat Switch Block).	
Approx. total cost	2/9.

ULTRA S.W. RECEIVER (continued).

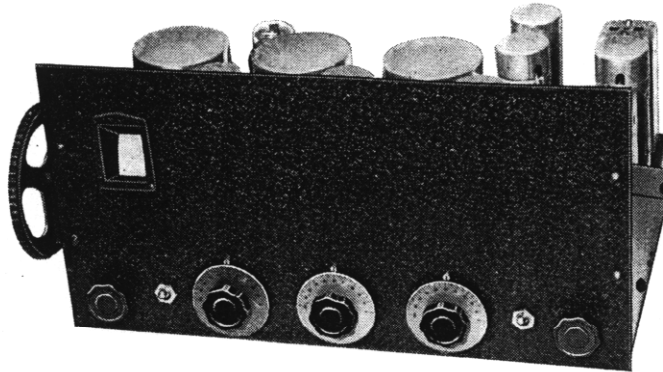


Theoretical circuit diagram of connections.

AMATEUR COMMUNICATION RECEIVER.

A NINE VALVE SUPERHETERODYNE, WAVERANGE 9-200 METRES, R.F. AMPLIFIER, 1600 Kc/s I.F.'s., BANDSPREAD TUNING AND WITH BEAT FREQUENCY OSCILLATOR, FOR A.C. MAINS OPERATION.

Front View
of the
Completed
Chassis.



This is a sensitive and selective Superheterodyne receiver with novel features and a first-class performance that has been designed so that its construction is within the reach of any one with a reasonable knowledge of short-wave practice and the usual amateur's tools.

All complicated ganging, tracking, padding and lining up difficulties have been removed by employing three interchangeable coils tuned with variable bandset tank condensers, and then a 3-gang bandspread condenser for the final tuning. This gang-condenser is built up using the new "Eddy-stone" condenser cradle and three microcondensers coupled with flexible couplers. Thus instead of a common shaft the three spindles are isolated which is a great advantage in obtaining H.F. gain and general stability. The condenser is driven by a powerful slow-motion driving head mounted through the side of the receiver chassis, and so that it can be operated from the front a 5" milled edge knob is fitted. This projects in front of the panel and gives a degree of tuning control that is delightful to experience. A drum scale is carried on the spindle with front escutcheon reading. The usual right angle drive necessary for a set of this layout is thus eliminated although the same result is perfectly and simply obtained.

A further important feature of this receiver is the use of 1600 Kc/s intermediate frequency transformers. Much time has been spent in obtaining the correct design of these. By using this frequency the image ratio is nine times better than the usual 465 Kc/s frequency and second-channel interference reduced accordingly. The same feature

renders bandsetting with the bandset condensers much easier as the second tuning point is so far removed it cannot be confused.

A single high frequency stage which provides adequate pre-selection feeds a 6L7 mixer-valve which has a separate oscillator (6J7). The resulting signal at intermediate frequency is fed to a two-stage I.F. amplifier consisting of 2 6K7's while from here it passes to the 6H6 or D63 double-diode valve which provides automatic volume control voltage for both I.F. stages and also the 6K7 H.F. valve, as well as rectification.

Next is a 6C5 L.F. stage in whose anode circuit is a jack for phones and for loud speaker operation a 6F6 pentode gives about 3 watts of undistorted output. A 6J7G valve is used as beat frequency oscillator.

Injection to the signal diode from the output of the B.F.O. is capacity coupled, since the capacity (C.30) required is very small it is obtained by twisting a pair of systoflex covered wires until the desired amount of injection is obtained.

The power supply is separate and the standard power unit described in the Manual is perfectly suitable.

As will be seen from the photographs the bandspread condensers are in line along the front edge of the chassis with their respective band-sets immediately underneath, and their associated coil and valve close in the rear, making a tidy layout with very short connections. The other controls on the bottom of the panel when viewed from the front are, reading from left to right first:—The R.F. volume control, 2nd: A.V.C. on and off, then the three band-set condensers fitted with

AMATEUR COMMUNICATION RECEIVER (continued).

small dials, next the B.F.O. switch, and lastly the audio volume control.

Three coils are necessary for each wave band covered, the first carries a primary winding for use with a dipole aerial brought out by flexible leads. If an L type aerial is favoured then the blue lead should be connected to the earth terminal. The second coil is an H.F. transformer and like the first has five pins, while the third coil, that of the oscillator circuit has only four pins, this latter being tapped for cathode reaction, and all three coils have a tapping about half-way for the band-spread condensers. The number of turns in each case is clearly shown in the coil-winding data. Although each set of coils covers a good range of wave lengths, only a few metres may be explored at a time on the band-spread condensers and it will be necessary to move the band-sets when a wider coverage is required. This is no disadvantage for most enthusiasts have a pet section of the frequency spectrum in which they are interested, such as one of the amateur bands, broadcast or R.N.W.A.R. frequencies, etc.

When first put into operation the R.F. and A.F. volume controls should be turned full on, the A.V.C. off and B.F.O. switched in. Turn the aerial and H.F. band-set tuning condensers to a similar reading and search very slowly with the oscillator band-set for a strong signal either telephony or morse. This should then be accurately

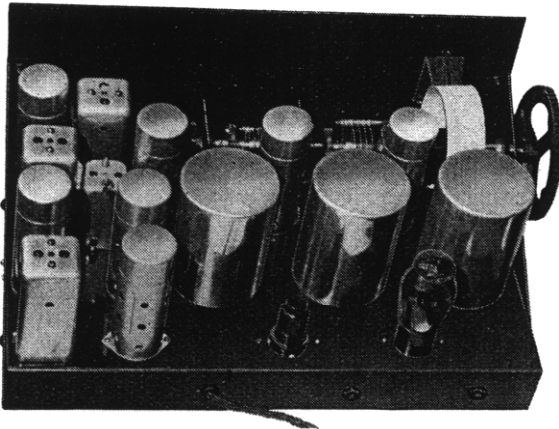
tuned on aerial and H.F. knobs and attention transferred to the I.F. circuits, starting with the trimmer nearest the 6H6 and working towards the mixer, each trimmer adjusted in turn (with the tool supplied) to give maximum volume. It should be noted that in trimming without an output meter it is advisable to turn down the R.F. control to a very low level of volume in phones or speaker as trimming progresses, for small changes are not evident at greater intensities.

As previously mentioned, since the high frequency circuits are only ganged by the small band-spread capacity any errors in coils, etc., can be made up by moving the aerial or H.F. band-set condensers very slightly while tuning over the range of the main dial. The oscillator knob should not of course, be moved except when a fresh wave length band is desired and since it is very sharp a careful note of readings should be taken as stations are identified so that they may be used as a reference for future settings.

Only one adjustment remains, that of the B.F.O. which should be switched in only for receiving morse or when searching for weak stations, the pitch of the note produced can be set to the operator's choice by moving the right hand trimmer screw in the top of the B.F.O. coil can.

NOTE.—The illustration of the underneath chassis layout and wiring and also the full coil winding data were not ready in time for inclusion in the Manual. We much regret this but anyone who is considering the construction of the instrument will be gladly sent all necessary further details upon request. Address your application to: Stratton & Co., Ltd., Bromsgrove Street, Birmingham.

(Continued on next page).



The completed top chassis view shows a smart and professional appearance with all small components and wiring concealed underneath. The three coils and all valves but the L.F. valves are in screening cans. The side drive is unconventional but exceedingly easy and convenient for tuning. The layout is one that results in short direct leads and consequent efficiency and stability.

AERIAL SYSTEMS (continued).

convenient and is again easily faced in the required direction. The radiators are shown in front, reflectors behind with diagram 16b underneath giving the feeder connections necessary to keep all the aerials in phase. Another smaller array on the same lines is illustrated on page 12.

Lengths of aerials and reflectors for the systems described above are shown in the table below for the 5-metre amateur band frequencies:—

Freq. Mc/s.	W.L. Metres	Aerial Length A	Ref. Length R	Aerial Spacing, D	Aerial to Ref. D.2
56	5.36	8' 4"	8' 7"	8' 9"	4' 4½"
57	5.26	8' 2¾"	8' 5½"	8' 7½"	4' 3¾"
58	5.17	8' 0½"	8' 3¾"	8' 5¾"	4' 2¾"
59	5.09	7' 10¾"	8' 2"	8' 4"	4' 2"
60	5.00	7' 9"	8' 0½"	8' 2½"	4' 1¼"

AMATEUR COMMUNICATION RECEIVER (continued).

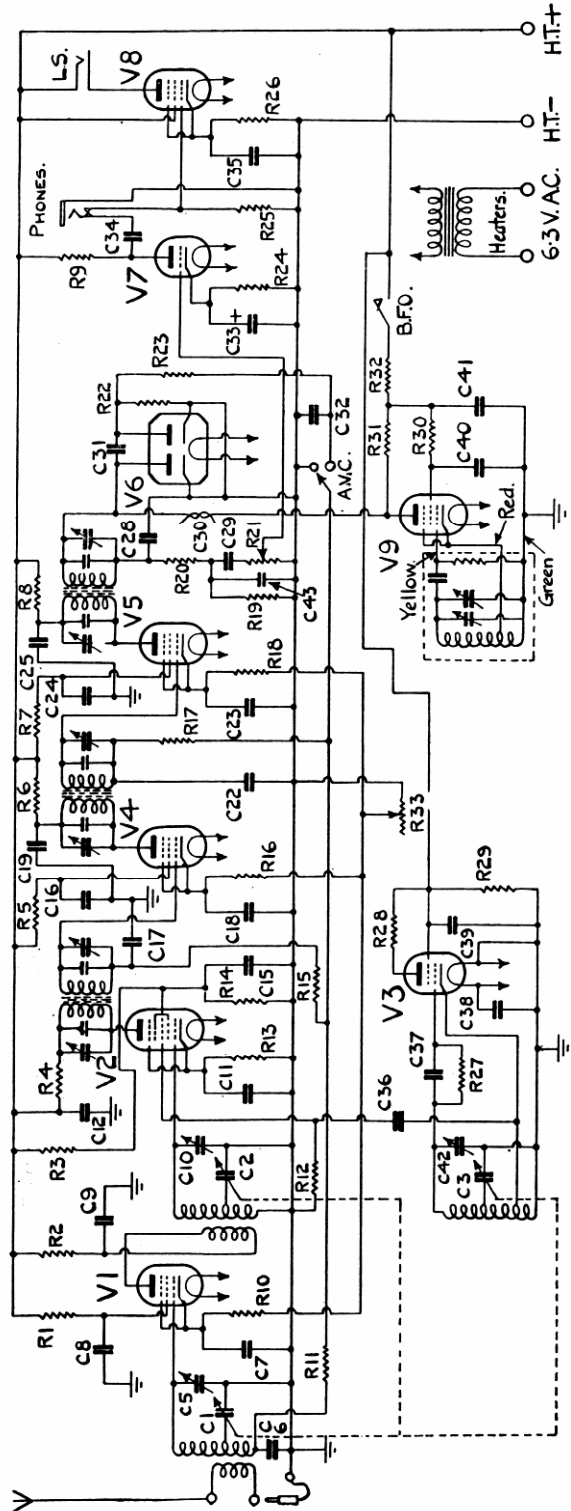
LIST OF PARTS.

EDDYSTONE COMPONENTS.

1 Steel Chassis, No. 1109	4/6
1 pair Brackets, No. 1110, per pair	2/6
8 Bolts and Nuts, No. 1111 per dozen	1/3
1 Condenser Cradle, No. 1114	3/6
2 Screens for Cat. No. 1114, No. 1125, per pair	8d.
3 Microdensers 18 mmfd. C1, C2 and C3, No. 1094 at 3/9 each	11/3
3 Flexible Couplers, No. 1009, at 1/6 each	4/6
7 Valve Screening Cans, No. 1121, at 1/3 each	8/9
2 DL9 Coil Formers, 5-pin Threaded, No. 1101, at 2/6 ea.	5/-
1 4-pin No. 936, at 2/3 each	2/3
3 Instrument Dials, 2 1/2", No. 1099 at 2/- each	6/-
2 Small Instrument Knobs, No. 1086, at 9d. each	1/6
3 Microdensers, 100 mmfd. C5, C10 and C42, No. 1130, at 5/- each	15/-
1 Set of three I.F. Units 1,600 K/cs., No. 1126, per set	52/6
1 B.F.O. Unit 1600 K/cs., No. 1127	10/6
2 Midget Stand-Off Insulators, No. 1019 at 4 1/2d. each	9d.
1 Frequentite four-pin Valveholder, No. 1073	9d.
2 five-pin Valveholders, No. 1074 at 10d. each	1/8
9 Octal Valveholders, Frequentite, No. 1120 at 1/3 each	11/3
1 Drum Drive Outfit, No. 1128	17/6

MISCELLANEOUS PARTS.

1 Panel, 17" x 8 1/2"	
3 Coil Screening Cans, 4" high, 3" dia. (Webb's Radio)	
6 Octal Valve Clips	
1 1 megohm R21	
1 Igranite P71 Jack	
1 P72	
1 Threaded Erinoid Bush	
2 ft. 2-way Screen Cable	
1 Tubular Electrolytic Condenser 25 mfd. 25V, C35	
3 Wire end type Condensers, .01 mfd. C6, C22 and C32	
19 " " " .1 mfd. C7, C8, C9, C11, C12, C15, C16, C18, C19, C23, C24, C25, C29, C31, C36, C39, C40, C41 and C43	
1 "M" type Condenser .01 mfd. C34	
1 Tubular Electrolytic Condenser, 50 mfd. 12V. C33	
2 "M" type Condensers .0001 mfd. C28 and C37	
1 Wire end type Condenser .003 mfd., C17	
1 .002 mfd., C38	
1 Resistor 500 ohms 1 watt, R13	
1 " 15,000 ohms, 1 watt, R3	
1 " 3,000 " R24	
4 Resistors, 2,000 " R2, R4, R6 and R8	
3 " 300 " R10, R16 and R18	
2 " 1 Megohm R22, R25	
7 " 50,000 ohms R9, R12, R20, R27, R28, R29 and R32	
4 " 100,000 R1, R5, R7 and R30	
5 " .5 Megohms R11, R15, R17, R19 and R23	
1 " 10,000 ohms R31	
1 " 400 ohms R26	
1 " 15,000 ohms R14	
Tinned Wire, Sleeveing, Screws, Tags, etc.	
Approximate cost of miscellaneous parts	£3 14 6
The following Valves are required:—	
3 6K7G V1, V4 and V5	
1 6L7G V2	
2 6J7G V3 and V9	
1 6H6G V6	
1 6C5 V7	
1 6F8G V8	



POWER SUPPLY UNIT.

FOR GENERAL USE AND WITH ALL THE MAINS RECEIVERS DESCRIBED IN THIS MANUAL.

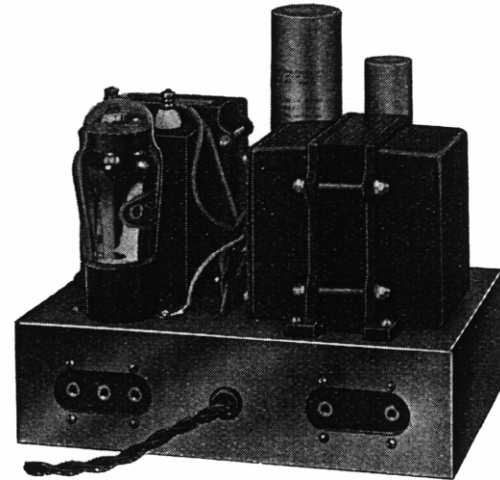
This is a conventional power supply unit giving high tension output as shown in table and 6.3 volts at 4 amperes and 5 volts at 3 amperes for heater current. It is suitable for operating all-mains receivers, speech amplifiers, pre-selectors and other equipment requiring similar inputs.

The design is simple yet efficient and the complete unit can be constructed at modest cost. Special care has been taken to ensure complete freedom from "hum" and the unit can confidently be used to supply power to the most sensitive of receivers without fear of "hum" or other troubles.

The assembly is mounted upon a diecast chassis which gives extreme rigidity of construction and also houses the associated fixed resistances and condensers, etc. The transformer has good regulation while there is ample reservoir capacity to cope with fluctuating loads. The smoothing choke is of generous size and has an inductance of 20 henries at 60 milliamperes. Apart from the main H.T. output there is an H.T. tapping having variable output controlled by a potentiometer. This is intended for screen grid voltages and not more than a 5 milliampere load should be drawn.

Photographs of the top and underside shew layout of components and wiring.

The unit is suitable for use with the 2 valve mains short wave receiver, the pre-selector unit, the amateur communication receiver and the ultra short wave receiver described in this Manual and the drop resistors in the receivers are arranged accordingly. Drop resistors of the correct value should be added for any other use to which the unit may be put.



Showing the completed unit.

THE POWER OUTPUT IS AS FOLLOWS :

295 volts at 40 mA.	233 volts at 80 mA.
265 " " 60 mA.	205 " " 100 mA.
6.3 volt filament winding, 4 amperes.	
5 volt filament winding, 3 amperes.	

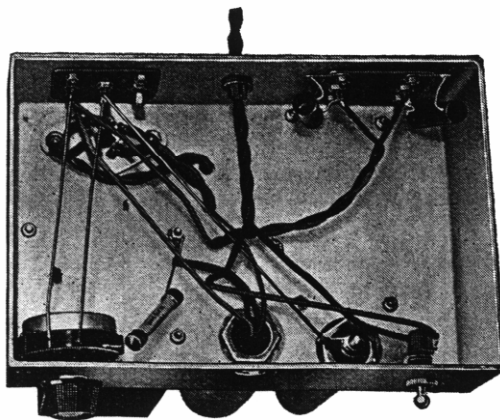
LIST OF PARTS.

EDDYSTONE COMPONENTS.

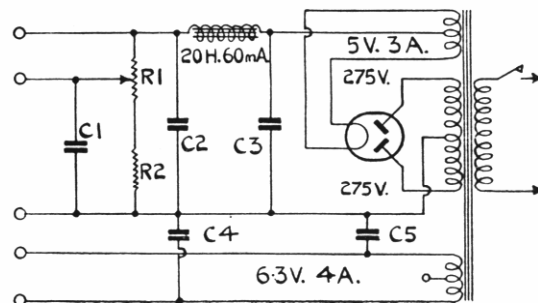
1 Die-cast Aluminium Chassis with Terminal Panels, No. 1117	5/6
1 Frequentite Octal Valveholder, No. 1120	1/3
1 Small Instrument Knob, No. 1086	9d.

MISCELLANEOUS PARTS.

1 Condenser 8 x 8 mfd. Electrolytic type 0289, Dubilier C2, C3	
1 " 4 mfd. Electrolytic type 0283 Dubilier C1	
2 " .01 mfd. Tubular type, C4, C5	
1 Mains Transformer 275-0-275V. 60mA	
" " 5V. C.T. 3Amp.	
" " 6.3V C.T. 4Amp. (Webb's Radio)	
1 Smoothing Choke 20 Hys 60 mA	
1 Resistance 30,000 ohms 1 watt R2	
1 Potentiometer 50,000 ohms, R1	
5 Clix " Parallel " Sockets	
1 Erinoid Threaded Bush	
1 Two point On-Off Switch Toggle Type	
1 Length two way cable	
Wire, Screws, Nuts, etc.	
Approximate cost of miscellaneous parts	£3
1 Osram U50 Rectifier or equivalent is required.	



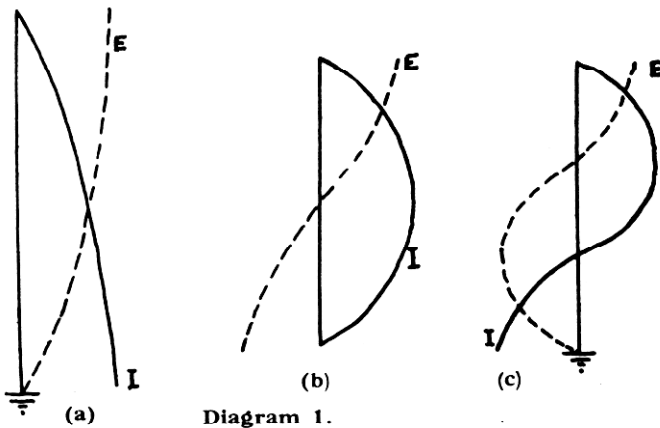
Under chassis showing wiring.



AERIAL SYSTEMS FOR ULTRA SHORT WAVE USE.

Aerial systems for ultra short wave transmission and reception can form a most interesting subject for experiment. Apart from the numerous types already in existence, there is still much scope for originality. Due to the small physical proportions of U.S.W. aerial arrays, experiments with these can be carried out in limited space and without great expense. Since aerial lengths can be arranged to resonate to the frequencies in use, they operate efficiently and give a high percentage of radiation using small power. It should be noted that a good transmitting aerial will also prove a good receiving aerial. With ultra short waves height plays as important part as far as reception and transmission range is concerned, and it is therefore desirable to erect the aerial in as high a position as possible and out of the way of nearby objects which may cause screening.

For transmission purposes, it is essential to bear in mind the distribution of voltage and current in the aerial, and for this purpose diagrams 1a, 1b, and 1c show this for $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ wave aerials. Radiation is greatest from those parts of an aerial where the change of current is most, and it will be noticed that whatever type of aerial is used the top of the radiator is always at maximum voltage.

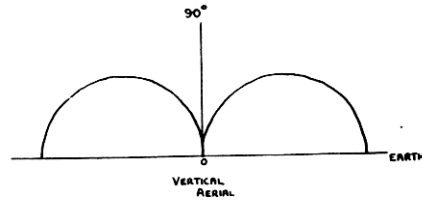


The exact length of a $\frac{1}{4}$ or a $\frac{1}{2}$ wave radiator is not exactly a $\frac{1}{4}$ or a $\frac{1}{2}$ the wavelength in use, but more nearly

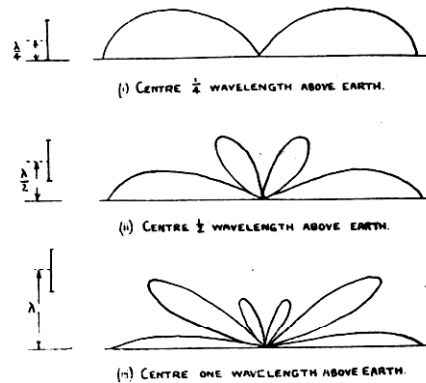
$$\frac{\text{wavelength}}{4.3} \text{ or } \frac{\text{wavelength}}{2.1} \text{ respectively.}$$

because the distribution of capacity and inductance is not uniform. The exact figure is dependent on diameter of the conductor and its proximity to surrounding objects.

The sky wave which on the lower short wave frequencies is reflected back to earth by the Ionised Appleton layers, is not able to be utilised for ultra short wave working. It is thought that either the ionization of the reflecting layers is not sufficiently great to reflect the rays back and penetration occurs, or that the angle of incidence is below that of the critical angle required for reflection.



It is possible that under freak ether conditions, reflection may take place and also that extreme long distance working may at some future date be found possible. Our present aim, however, is to find aerial systems which enable us to make maximum use of the direct ray. We therefore need an aerial which will radiate most of the energy in a horizontal plane to the earth's surface, i.e., low angle radiation. To obtain this, a vertically polarized wave is known to be more effective than a horizontally polarized one, so that a vertical aerial is the first requirement. The length of aerial can next be considered, and in practice a length of radiator which is cut to resonate at half the wavelength in use gives the greatest radiation parallel to the earth and is therefore generally used in modified forms. Vertical polar diagrams for a half-wave vertical aerial, showing the radiation patterns for different heights above earth, are illustrated in diagrams 2 and 3.



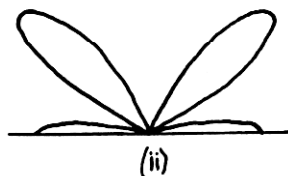
AERIAL SYSTEMS (continued).

It will be seen that the effect of increasing the height of the aerial above earth is to concentrate the radiation into upward beams which increase in number as the aerial is raised. The radiation characteristics of an aerial are distorted by nearby objects, such as buildings, guy wires, telephone or power lines.

When more than one half-wave is present on the aerial, the aerial is said to be operating on a harmonic. The number of the harmonic is the same as the number of half-waves in use, so that with an aerial three half-waves long, we are said to be operating on the third harmonic with full-wave aerial on the second harmonic.



Diagram 4.



The radiation pattern using three half-waves on the aerial is shown in diagram 4 (i) and (ii). The currents at points X and Y are in antiphase, and the effect is to give maximum radiation in an upward direction, which is undesirable. If, however, the alternative half-waves can be arranged so that they can be prevented from radiating energy and the other radiating portions are operating in phase, a much better result can be obtained. This is done in the Franklin uniform current aerial where phasing coils which are arranged to resonate at half the wavelength in use and have practically no radiation, are interposed between half-wave radiators.

An example of this with the resultant radiation pattern is shown in diagram 5 (i) and (ii).



Diagram 5.

A number of aerials used for ultra short wave work are described in the following matter. In all cases a vertical half-wave aerial is used and the fundamental difference lies in the methods in which the feeder or lead down lines are connected

to the transmitter or receiver. Maximum results are obtained when the impedance of the aerial is matched to the load impedance of the tuned receiver or transmitter circuit.

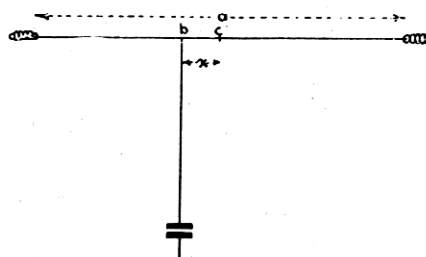


Diagram 6.

Diagram 6 illustrates the Windom aerial, sometimes known as the single wire matched impedance feed system. With this aerial correct matching is obtained by neutralising the standing waves on the feeder by tapping the aerial a short distance away from its exact centre. The length of aerial "a" and the tapping distance "bc" for different frequencies is calculated from the following formulae :

We have frequency in Mc/s. (f) by wavelength in metres (λ) is equal to 300,

but wavelength is equal to 2.1λ,

therefore 2.1 af = 300,

$$\text{or } a = \frac{300}{2.1 f} \text{ metres}$$

$$a = \left(\frac{300}{2.1} \times \frac{39.37}{12} \right) \frac{1}{f} \text{ feet}$$

$$\text{or length of aerial } a = \frac{468}{f} \text{ feet}$$

The tapping distance b c is given by :-

$$\frac{a \times \beta}{180} \text{ feet.}$$

When β is a factor which depends largely on the diameter of the wire used.

For 16g. wire, β = 25.

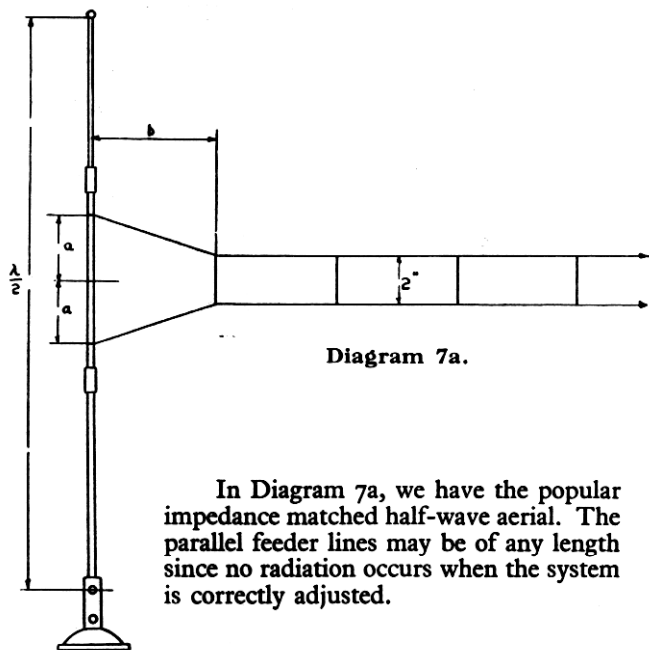
$$\text{Therefore } b c = \frac{a \times 25}{180} \text{ feet} = \frac{a}{7.2} \text{ feet}$$

AERIAL SYSTEMS (continued).

For the 5-metre amateur waveband, the values of a and b c are as follows :—

Freq.	λ	a (feet)	b c
50	6.00	9' 4"	1' 4"
52	5.77	9' 0"	1' 3"
54	5.56	8' 8"	1' 2½"
56	5.37	8' 4"	1' 2"
58	5.17	8' 0½"	1' 1½"
60	5.00	7' 9"	1' 1"

There are two points to remember in the erection of this aerial, firstly the feeder must be kept straight and at right angles for a quarter-wavelength, secondly when the aerial is erected vertically, the feeder should be tapped on the lower half-section of the aerial.



In Diagram 7a, we have the popular impedance matched half-wave aerial. The parallel feeder lines may be of any length since no radiation occurs when the system is correctly adjusted.

Since an aerial, even though it is a straight length, has inductance and the two opposite ends have capacity to each other, the whole system can be compared to a tuned circuit with a definite impedance. For a half-wave aerial, this impedance will be in the order of 12,000 ohms across the ends. This impedance decreases as the centre is approached, when it is about 75 ohms. Therefore, with a two-wire feeder spaced 2" apart with an impedance of about 440 ohms, to obtain a matched system each feeder must be tapped into the aerial at two points equidistant from the centre where the aerial impedance is approximately this figure.

The length of the vertical wire can be calculated as described for the Windom aerial. The distance (a) in inches of the tapping points from the centre is given by the formula :—

$$\frac{678}{\text{frequency in Mc/s.}}$$

frequency in Mc/s.

The distance b is also important and is equal to :—

$$\frac{1771}{\text{frequency in Mc/s.}}$$

frequency in Mc/s.

Diagram 7b shows five different types of coupling for use with this aerial.

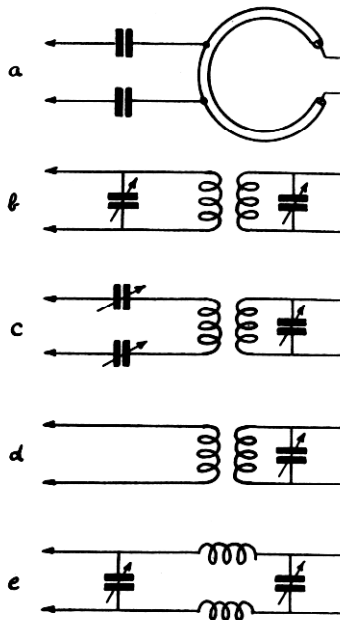


Diagram 7b.

In Diagram 8 a half-wave Hertz aerial with Zepp feeders is shown. The length of the aerial in feet can be directly calculated from the simplified formulae :—

$$\text{Length in feet} = \frac{\text{wavelength in metres}}{\text{by } 1.56}$$

$$\text{or Length in feet} = \frac{468}{\text{frequency in Mc/s.}}$$

The feeder line consists of two parallel wires spaced 2" apart. Eddystone Bar Insulators, No. 1017, can be used for this purpose. One side of the line is connected to the bottom of the aerial and the other connected to the other side of an insulator. This feeder line must be tuned and for lengths under a quarter wavelength

AERIAL SYSTEMS (continued)

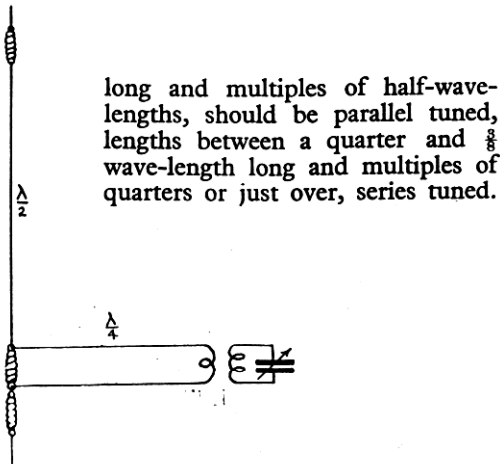


Diagram 8.

In Diagram 9 a doublet type of aerial is shown the half-wave aerial being split in the centre by an insulator. The length of the quarter-wave sections at each side can be arrived at by using the formula given for the half-wave Hertz and cutting the length into two equal parts. When used for transmitting, the current antinode is at the centre and the feeders must be a half-wave or a multiple of half-wave long. They should be series tuned.

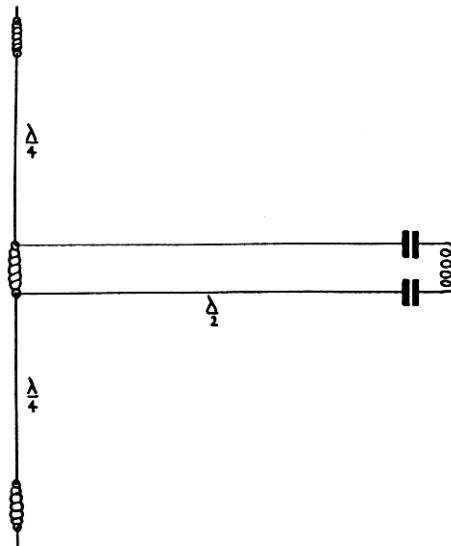


Diagram 9.

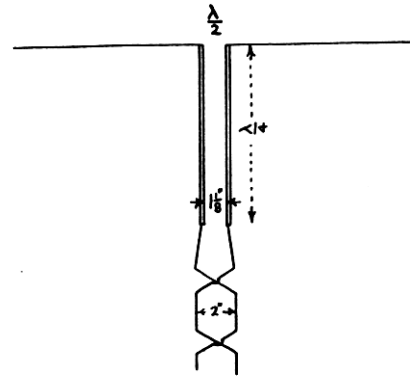


Diagram 10.

In Diagram 10, an aerial known as the Johnson "Q" is shown. This is similar in operation to the previous type of aerial with the exception that an untuned transposed transmission line is employed, and the matching of the tuned circuits to the half-wave doublet is accomplished by means of a quarter-wave section of parallel copper tube.

Now, a half-wave doublet aerial erected more than a quarter-wave above earth has an effective impedance of anything between 70 and 80 ohms. An average value would therefore be 75 ohms. A transposed 16g. feeder line using Eddystone Crossfeeder Blocks has an effective impedance of about 440 ohms, and to match this impedance to the doublet, we require the parallel copper tubes to form a series impedance of 182 ohms. This is computed from the formula:—

$$Z_0 = \sqrt{Z_d \times Z_t}$$

where Z_0 is the characteristic impedance of the quarter-wave section.

Z_d is the doublet impedance.

Z_t is the transposed feeder impedance.

We have, therefore,

$$Z_0 = \sqrt{75 \times 440} = 182 \text{ ohms}$$

Such an impedance is offered by two $\frac{1}{2}$ " copper tubes placed $1\frac{1}{8}$ " centres apart. These must be at right angles to the aerial and the transposed feeder line can be any length. The doublet length is calculated from the formula already given and the length in feet of the copper tubing is given by:—

$$l = \frac{246}{f \text{ (megacycles)}}$$

For 56, 58 and 60 megacycle operation, the length of the copper tubes will be 4' 4 $\frac{1}{4}$ ", 4' 3" and 4' 0 $\frac{1}{2}$ " respectively.

AERIAL SYSTEMS (continued)

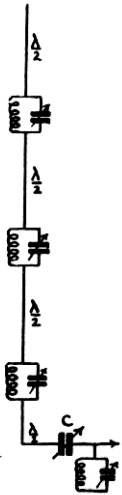


Diagram 11.

In Diagram 11, the Franklin uniform current aerial with phasing coils between each half-wave section, as already described, is shown. The length of the half-wave sections is calculated from the formula for the Hertz aerial. The phasing coils, which must resonate at 2.5 metres, can consist of 3 turns of 14g. copper wire wound with a $\frac{1}{8}$ " internal core and tuned with a 18 mmfd Microdenser. This type of aerial can be voltage fed as shown or current fed in the centre if three radiators are used. A twin 2" spaced feeder line, as mentioned earlier, should be employed. For receiving, the single feeder arrangement as shown is ideal.

AERIAL ARRAYS.

It has already been mentioned that the range of an ultra short wave transmission can be considerably extended if the radiation is beamed in the desired direction. Fortunately, the construction of small arrays for ultra short wave working is by no means difficult and with the aid of telescopic aerials, they can even be made portable.

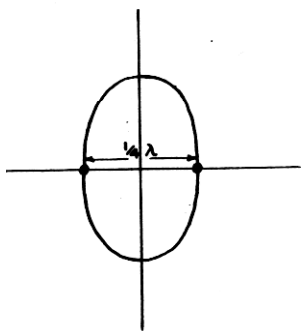


Diagram 12.

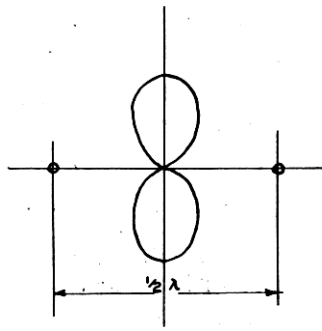


Diagram 13.

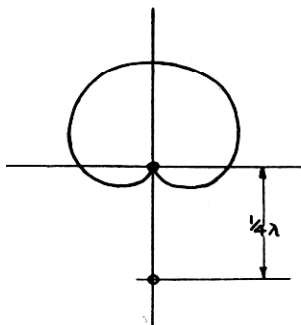


Diagram 14.

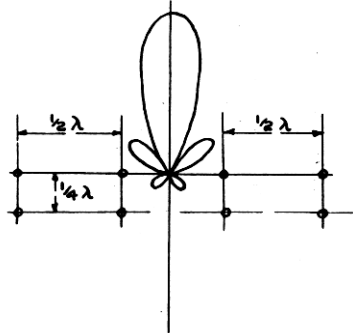


Diagram 15.

Diagrams 12, 13, 14 and 15 show the radiation diagrams for a selection of directional arrangements. Diagram 12 shows two-half wave radiators placed one quarter-wave-length apart giving maximum radiation directly in front and behind. If the aerials are spaced one half-wavelength apart, as in Fig. 13, the polar diagram will be in the form of a figure eight. The loops can be still more concentrated if four or eight aerials are arranged, each a half-wavelength apart. To obtain maximum radiation in one direction only reflectors can be used behind the aerials. These reflectors are entirely free with no connections to them, but must be placed an exact distance behind the aerial and cut to a slightly longer length as shown in the table, and the aerial must be placed centrally in respect to them.

Diagram 14 shows the pattern for a half-wave aerial with one reflector placed a quarter-wavelength behind it. This arrangement lends itself well for portable use. A piece of 4" x 2" wood, 4' 6" long, mounted on a pivot arrangement with two telescopic aerials fixed upon it, makes a directional arrangement which can be pointed in any direction.

Fig. 15 shows the greatly increased directional effect obtained using a larger number of radiators and reflectors. In this case, four half-wave aerials spaced a half-wavelength apart with four reflectors a quarter-wave behind, are used. A pictorial arrangement of this array built with eight telescopic aerials on wood battens, 4" x 2" x 6' long, is illustrated in diagram 16a. This arrangement can be erected very quickly, in two sections of four if more

(continued on page 33)

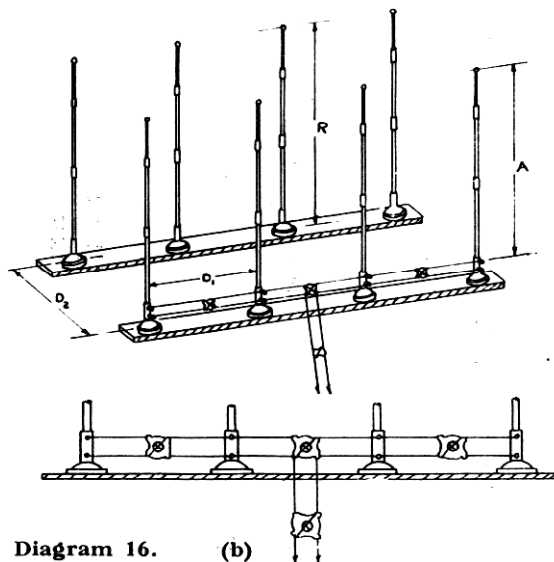


Diagram 16.

(b)

COMPILER'S NOTE.

All the sets and apparatus described in this Manual have been subjected to thorough tests and trial before inclusion, with satisfying results. Much as we desire that they should give equal satisfaction to all who make use of the articles herein, we would point out that we cannot enter into long correspondence concerning difficulties which may arise through faulty construction or the substitution of different components. With the assurance that, if built exactly according to instructions without errors, they are capable of first class results, we would request that constructors who may have any troubles in the initial instances should check their apparatus over carefully before writing to us. Finding out the cause of one's own troubles is, moreover, not only a reason for self-satisfaction but is highly instructive.

