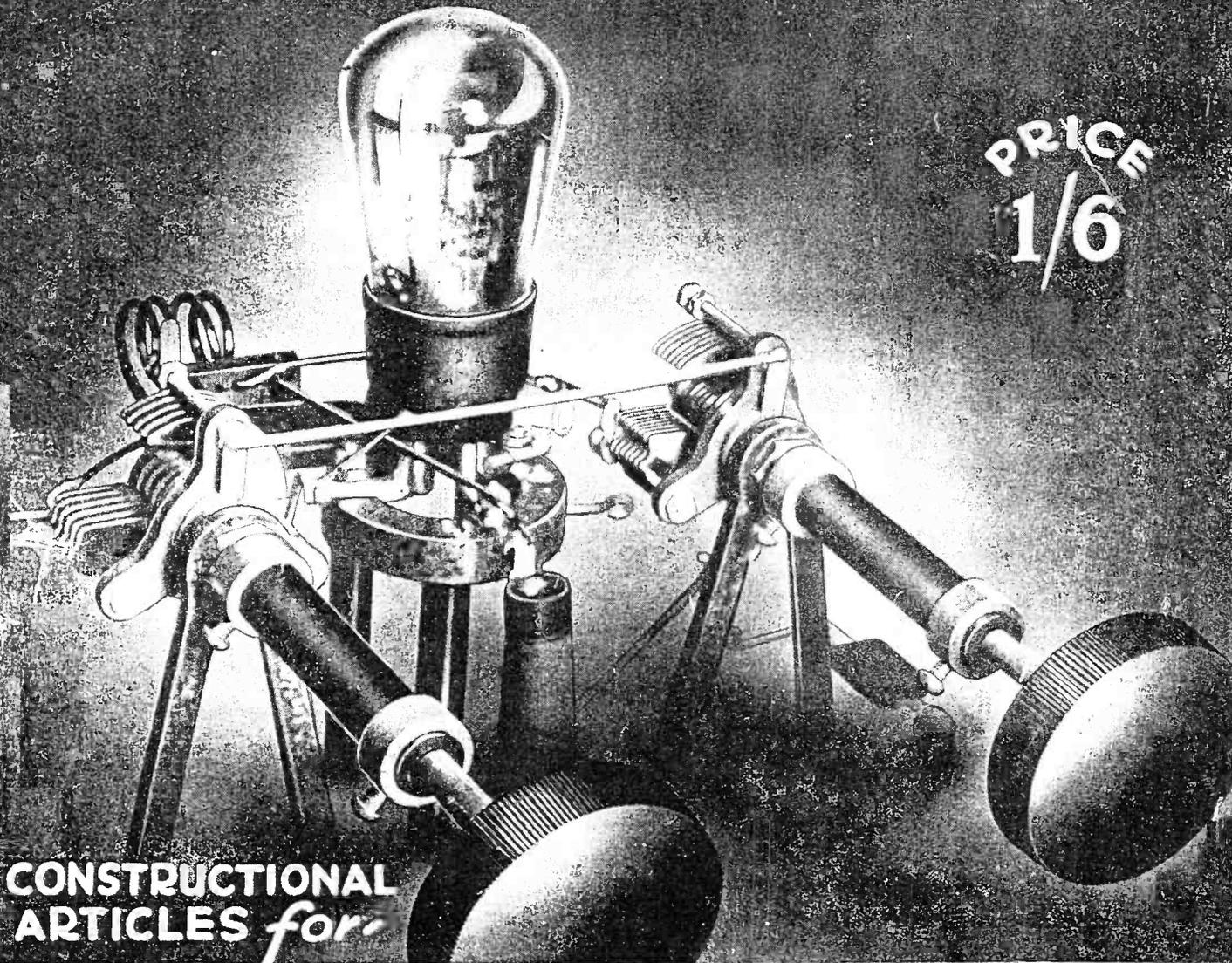


EDDYSTONE

Short Wave MANUAL

PRICE
1/6



CONSTRUCTIONAL
ARTICLES *for*

SHORT WAVE SETS • ADAPTERS • WAVEMETERS

EDDYSTONE

SHORT WAVE MANUAL

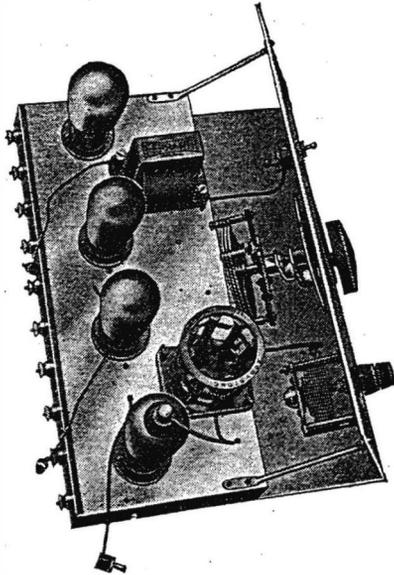
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THE KILODYNE FOUR

A One Dial Tuning, 4 Valve Short Wave Receiver with Screened High Frequency Amplification and Pentode Output, for Loud Speaker Reception.



This is a powerful short wave receiver which gives loud speaker reception of all the main short wave stations in the world. In addition it is adaptable by fitting extra coils to any waveband up to 1,800 metres. The receiver employs a stage of S.G. high frequency amplification, and this valve with its high amplification factor and needing no external neutralising devices simplifies the construction of the receiver very much. It enables an untuned aerial circuit to be used with success, thus reducing the tuning controls of the receiver to one. It also increases the efficiency of the set so that the reaction control from the detector valve gives smooth control and is practically constant while all unpleasant capacity effects are absent. As will be seen from the theoretical diagram, the aperiodic aerial stage consists of a high frequency choke between the grid of the valve and earth. The valve is coupled to the detector by means of a high frequency transformer with a tuned secondary winding. This form of coupling is very efficient, and with only a light damping due to the load of its secondary winding on the detector valve grid circuit, selectivity is also good. A reaction winding is fed from the detector plate by the Reinartz method to this transformer. The detector valve is of the metallised type, which assists the performance of the receiver materially. Leaky grid detection is employed and this valve is coupled to the first L.F. valve by means of a resistance coupling stage. This is so arranged that maximum use of the

amplification factor of the detector valve is obtained. The first low frequency valve, also of a high amplification type, is followed by a Ferranti AF8 transformer, which feeds the final output valve. This last valve is a high amplification pentode. It should be appreciated that the Kilodyne has been primarily designed for short wave reception and the adaption to broadcast is a matter of convenience if required. Although the performance on the broadcast bands is exceptionally good, selectivity is not of a very high order, this is particularly the case on the wavelengths over 1,000 metres.

CONSTRUCTIONAL DETAILS.

Get together all the components, laying them out so that a general idea for assembly is obtained. The metal chassis will be found to have the following parts mounted:—wooden end pieces, panel brackets, terminal strip, fuse holder and ebonite supports. Care should be taken to use the same screws as already fitted in the ebonite supports, if longer screws are substituted short circuits may occur. The components can now all be mounted, and since the metal chassis is used for many earth return leads, in every case the paint should be scraped away so that the contact part of the component in question makes first class contact with the chassis. Examples of this chassis earth return will apply in the case of the fixed condensers which have only one terminal at the top, the variable tuning and reaction condensers, the 3 meg. grid leak and the screws to which the L.T. neg. terminals of the valve holder are connected.

When all the components and terminals have been mounted on the underside of the chassis and wired, there will, of course, be a considerable number of leads passing through to the top part of the instrument and the assembly on top can now be commenced. The transformer and 6 pin coil base present no difficulties except that this latter item is raised on two ebonite bushes. This is not raised for insulation purposes but to facilitate ease of wiring and to lessen damping of the coil by the metal baseboard. The reaction condenser can next be mounted. This again is quite straightforward except that it will be found necessary to employ three metal spacing washers at the back of the panel so that the knob of this component mounts relatively flush at the front.

THE KILODYNE FOUR—continued

In mounting this component and the main tuning condenser, carefully scrape paint away from the back of the metal chassis where the condensers are clamped to the panel since this connection forms the earth return from these two components. The main tuning condenser should then be mounted to the disc drive before fastening to the panel. This condenser is clamped to the metal bracket of the drive by means of the fastening down nut and should be clamped into position tightly. At the same time, the spindle of the condenser will enter the bush of the disc drive and should again be secured firmly with the grub screw at the side of the bush. The escutcheon and the disc drive and condenser can then be mounted in position, a further two of the thick metal packing washers being used on the underside of the panel. The switch is then placed in position and the remainder of the wiring completed.

VALVES.

The set has been designed for maximum efficiency round the valves which are specified for use with it and it is important to adhere to our choice, otherwise we cannot guarantee satisfactory operation of the receiver. The use of the Mazda H.L.210 metallised is particularly important in the detector stage.

1st Valve	.....	Screened Grid, Mullard P.M.12.
Detector Valve		Mazda H.L.210 Metallised.
Low Frequency Valve	.....	Mazda H.L.210 Plain.
Pentode Valve		Mullard P.M.22. 5 pin.

BATTERIES.

The low tension accumulator should be of 2 volts, and a good form of high tension supply of 120-150 volts is needed. If dry batteries are used, a triple capacity unit will prove the most economical and efficient in the long run.

H.T.- to Negative of Battery.

H.T.+1 to 70/80 volts.

H.T.+2 to 100/120 volts.

H.T.+3 to 120/150 volts.

GRID BIAS.

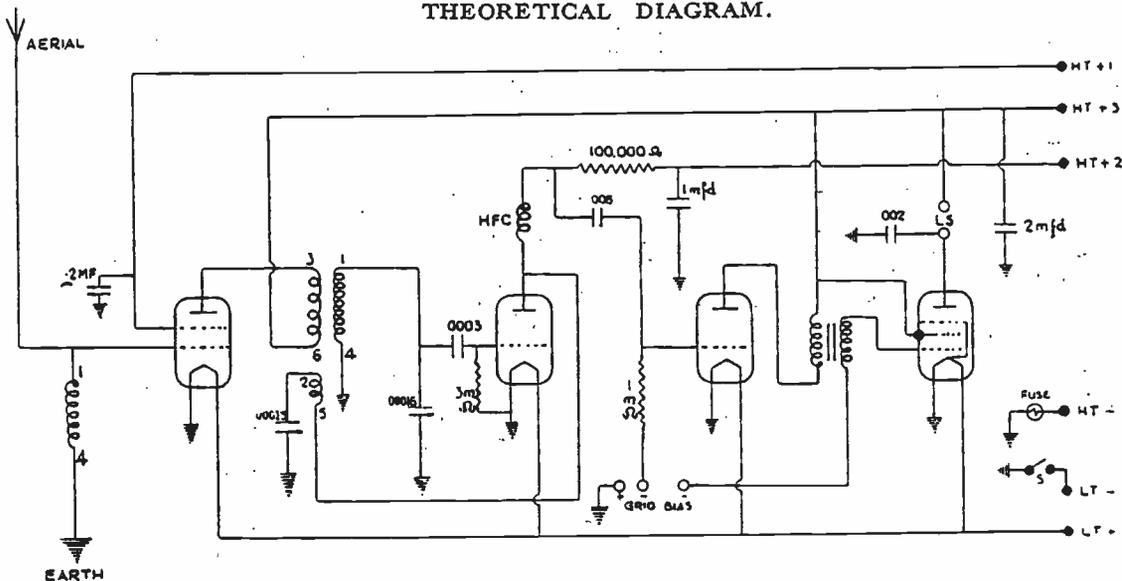
The grid bias positive plug should be plugged into the positive socket of the battery, while the grid bias minus connections are as follows:—

With 120 volts H.T.	Grid-1. 1.5 volts neg.
	Grid-2. 13.5 volts neg.
With 150 volts H.T.	Grid-1. 3 volts neg.
	Grid-2. 15 volts neg.

CONNECTING UP.

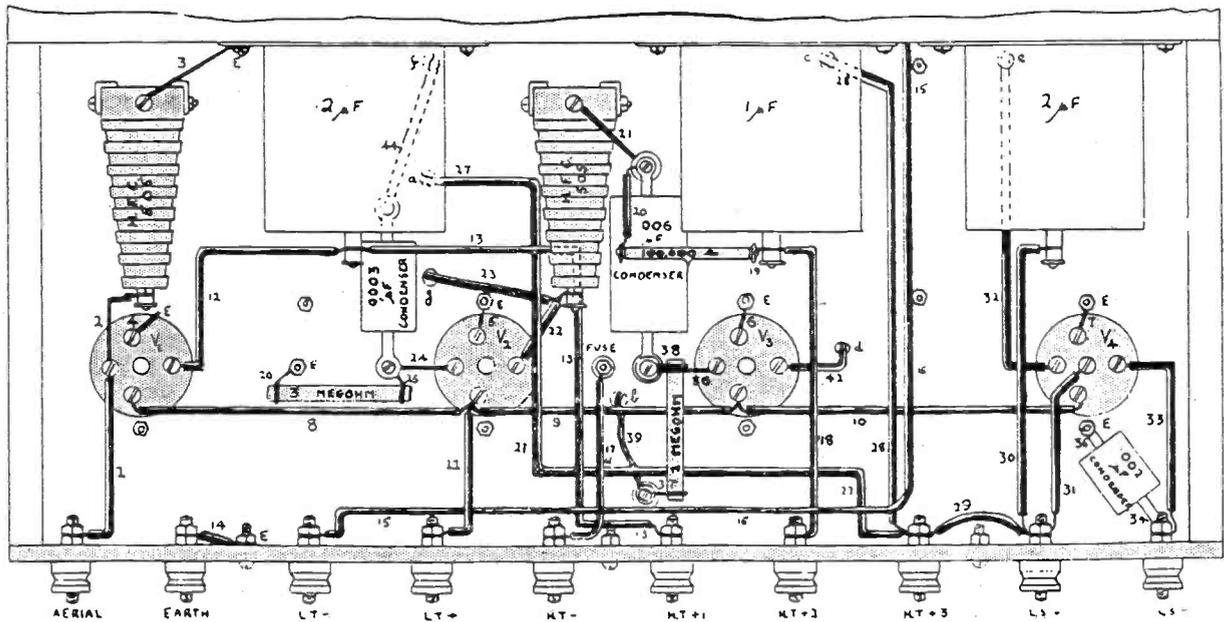
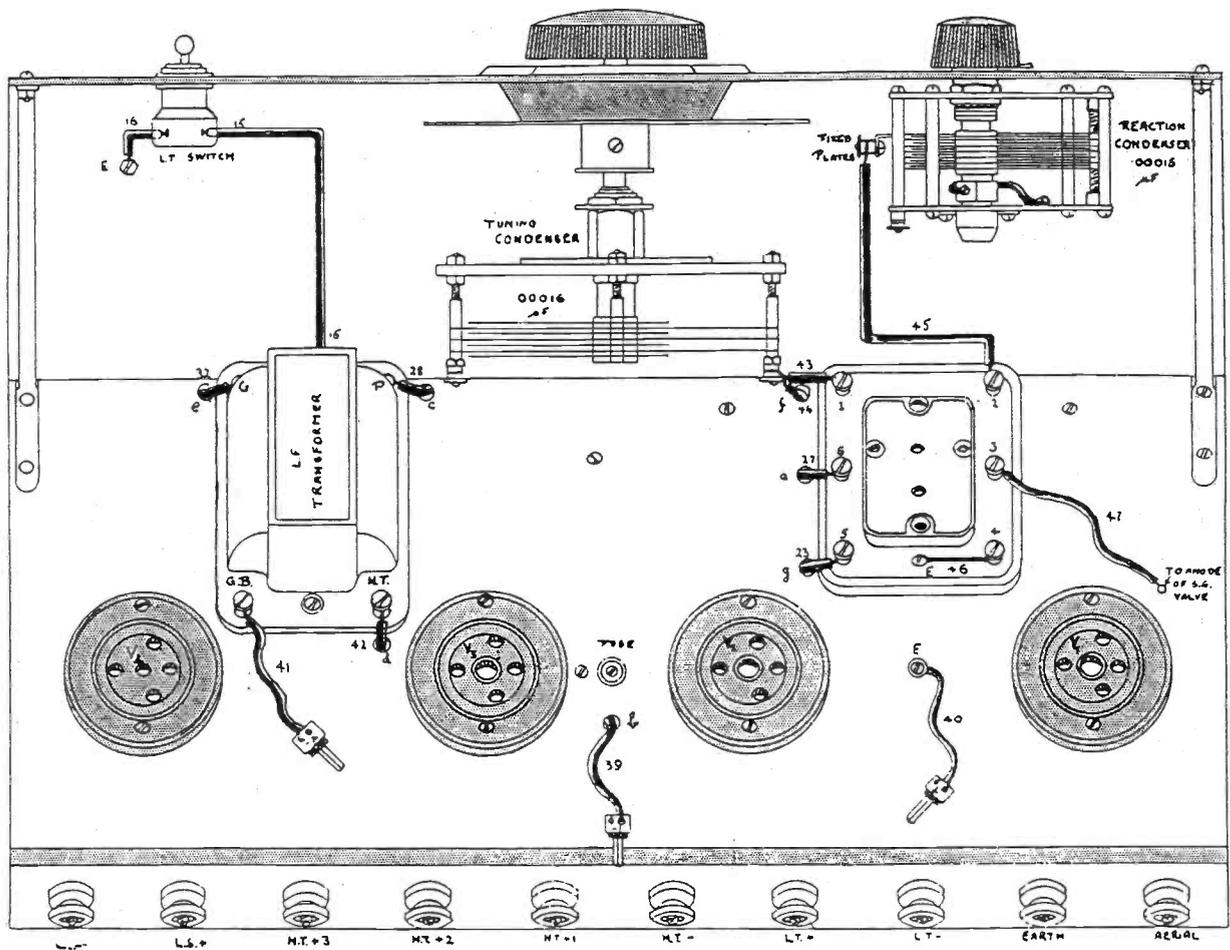
The leads supplied will be found very suitable for this purpose and are of sufficient length so that the batteries can be put away out of sight. Before actually connecting the batteries to the set, check over to make sure that all connections are in order and then connect the low tension leads first and the high tension leads last. There only remains to attach the aerial, earth and loud speaker connections and to insert the fuse bulb and the set should be ready to work upon switching on. Great care should be taken to see that the fuse bulb is screwed well home and that the filament of this is intact.

THEORETICAL DIAGRAM.



All connections marked \perp are taken to metal chassis for earth return.

KILODYNE FOUR. WIRING PLAN.



THE KILODYNE FOUR—continued

OPERATING THE SET.

Insert a suitable coil and then starting with both tuning condenser dial and the reaction condenser at minimum, switch the receiver on. Increase the reaction control by means of the vernier knob gently until at a certain point the set will begin to oscillate; this will be noticeable immediately since a low rushing sound will be heard. Throughout the whole tuning operations, this reaction control should be so adjusted that the set is always only just in this oscillating condition. The reaction control should never be turned any more than is necessary for the first reaction sound to be heard. Now commence turning the tuning dial slowly, increasing the reaction control gently if necessary to keep the set in the oscillating condition. Probably the first signals to be heard will be morse code. When a telephony transmission is reached, this will also be heard as a shrill whistle similar to morse code because the set is in an oscillating condition. To receive telephony, the dial should be turned until the silent point is reached and then the reaction control gradually eased off. The tuning dial will perhaps now require slight readjustment, when the speech or music should be quite clearly heard. It simplifies the operation of the receiver when searching for stations, to keep it in the oscillating condition, but it should be borne in mind that clear telephony can never be received with the receiver oscillating.

POINT TO POINT CONNECTIONS.

- 1—Aerial Terminal to Grid of V1.
- 2—Grid of V1 to top of H.F. Choke.
- 3—Bottom of H.F. Choke to Earth E.
- 4—Filament of V1 to E.
- 5—Filament of V2 to E.
- 6—Filament of V3 to E.
- 7—Filament of V4 to E.
- 8—+ Filament of V1 to + Filament of V2.
- 9—+ Filament of V2 to + Filament of V3.
- 10—+ Filament of V3 to + Filament of V4.
- 11—+ Filament of V2 to L.T. + Terminal.
- 12—Anode of V1 Holder to .2 mfd. Condenser.
- 13—.2 mfd. Condenser to H.T. +1 Terminal.
- 14—Earth Terminal to Chassis E.
- 15—L.T. — Terminal to L.T. Switch.
- 16—L.T. Switch to Earth E.
- 17—H. T. — Terminal to bottom of Fuseholder.
- 18—H.T. +2 Terminal to 1 mfd. Condenser.
- 19—1 mfd. Condenser to 100,000 ohm Resistance.
- 20—100,000 ohm Resistance to end of .006 mfd. Condenser.
- 21—.006 mfd. Condenser to bottom of H.F. Choke.
- 22—Top of H.F. Choke to Anode of V2.
- 23—Top of H.F. Choke through hole g to No. 5 of Coil Holder.
- 24—Grid of V2 to .0003 mfd. Condenser.
- 25—.0003 mfd. Condenser to 3 megohm Grid Leak.
- 26—3 megohm Grid Leak to Earth E.
- 7—H.T. +3 Terminal through hole a to No. 6 of Coil Holder.

- 28—H.T. +3 Terminal to P of L.F. Transformer through hole c in chassis.
- 29—H.T. +3 Terminal to L.S. + Terminal.
- 30—L.S. + Terminal to 2 mfd. Condenser.
- 31—L.S. + Terminal to auxiliary Grid of V4.
- 32—Grid of V4 through hole e to G terminal of L.F. Transformer.
- 33—L.S. — Terminal to Anode of V4.
- 34—L.S. — Terminal to .002 mfd. Condenser.
- 35—.002 mfd. Condenser to Earth E.
- 36—Grid of V3 to .006 mfd. Condenser.
- 37—1 megohm Resistance to Insulating Bush.
- 38—Other end of 1 meg. Res. to .006 mfd. Condenser.
- 39—Bottom of 1 megohm Resistance through hole b to G.B. —1 plug.
- 40—G.B. + Plug to Earth E.
- 41—G.B. —2 Plug to G.B. Terminal of Transformer.
- 42—Anode of V3 through hole d to H.T. Terminal of Transformer.
- 43—Fixed Terminal of tuning Condenser to No. 1 Terminal of Coil Holder.
- 44—Fixed Plates through Hole f to .0003 mfd. Condenser.
- 45—Fixed Plates of Reaction Condenser to No. 2 Terminal of Coil Holder.
- 46—No. 4 Terminal of Coil Holder to Screw of Coil Base (E).
- 47—No. 3 Terminal of Coil Holder to Anode of S.G. Valve.

LIST OF PARTS.

	Price.
1 Metal Chassis, finished brown, drilled complete with panel brackets, wood ends, engraved terminal strip and terminals, with pillars for mounting fixed condensers and fuseholder ..	35/-
3 Eddystone Valveholders, type 920 ..	3/9
1 Eddystone Valveholder, type 921 ..	1/6
1 Eddystone S.W. Variable Condenser, .00016 mfd. ..	9/6
1 Eddystone Disc Drive ..	7/6
1 Eddystone Slow Motion Reaction Condenser, .00015 mfd. ..	8/6
2 Eddystone Scientific H.F. Chokes ..	9/-
1 Eddystone 6 pin Coil, type 2LB, 12.5/28 metres ..	5/-
1 Eddystone 6 pin Coil, type 2Y, 24/50 metres ..	5/-
1 Eddystone 6 pin Coil, type 2R, 40/85 metres ..	5/-
1 Eddystone 6 pin Coil, type 2G, 260/550 metres ..	6/-
1 Eddystone 6 pin Coil Base ..	2/-
1 Eddystone 2 mfd. Condenser, 1 terminal type, 500v. A.C. test ..	4/-
1 Eddystone 1 mfd. Condenser, 1 terminal type, 500v. A.C. test ..	3/-
1 Eddystone .2 mfd. Condenser, 1 terminal type, 500v. A.C. test ..	2/-
1 Ferranti AF8 Transformer ..	11/6
1 T.C.C. Fixed Condenser, .006 mfd. Type M ..	1/9
1 T.C.C. Fixed Condenser, .002 mfd. Type M ..	1/4
1 T.C.C. Fixed Condenser, .0003 mfd. Type M ..	1/-
1 Loewe Resistance, 100,000 ohms, 1/2 watt type, FG.66. ..	2/2
1 Erie Grid Leak, 1 meg. ..	1/-
1 Erie Grid Leak, 3 meg. ..	1/-
3 Spare Fuse Bulbs ..	1/6
1 Igranic On and Off Switch ..	1/6
Screws, Nuts, Wire, Washers, etc. ..	1/6
1 Set 6 way Battery Leads ..	3/6
1 Hellesen 15 volt G.B. Battery ..	3/-
Cost of parts, £6 17s. 6d.	

THE KILODYNE ALL ELECTRIC FOUR

A short wave receiver for all electric working from A.C. mains.

CONSTRUCTIONAL DETAILS.

The all electric Kilodyne is an adaption of the battery set previously described, provision having been made for the use of A.C. valves. The S.G. valve is of the vari-mu type and variable bias to this and fixed bias to the L.F. valves is fitted. The construction is straightforward if the point to point wiring details are followed out. The remarks previously made about the battery receiver in connection with the assembly and the need for making sure that all chassis earth return leads are scraped clean and well made, together with the special remarks for mounting components, still apply and should be carefully noted. The heater leads, which are shown twisted in the wiring plan, should be twisted together quite closely and not loosely as shown for the purpose of clearness in the plan.

The lay-out in general remains the same as the battery model, the difference being the volume control, which gives 20 volts variable bias to the S.G. valve, functioning not only as a volume control but an effective method of obtaining increased selectivity as the negative bias to the valve is increased. This same volume control is used to apply bias to the pentode valve, but in this case the whole of the resistance is always in circuit and the 20 volts bias always applied to the grid of the valve. There is also the cathode resistance in the circuit of the first L.F. valve for bias to this valve and a small humdinger across the heater connections which must be adjusted to reduce hum to a minimum. The adjustment screw of this humdinger must make contact with the metal baseboard and actually comes through the top behind the L.F. transformer, although unfortunately it has not been shown so in the wiring plan. The fixed condenser placed near the volume control on the top of the baseboard contains two separate 1 mfd. condensers with the case as a common earth. One side of this condenser shunts the volume control and the other side, the cathode resistance biasing the first L.F. valve.

VALVES.

The valves given below should not be substituted, since the working of the set may be impaired and the grid bias values altered.

S.G. Valve	..	Osram VMS4.
Detector Valve	..	Osram MH4 or Mazda AC/HL.
First L.F. Valve	..	Mullard 354V or Mazda AC/HL.
Pentode Valve	..	Mullard PM24M.

Continued on page 8.

POINT TO POINT CONNECTIONS.

- 1—Aerial Terminal to G Terminal of V1.
- 2—G Terminal of V1 to Top of H.F. Choke.
- 3—Bottom of H.F. Choke to 100,000 ohm Res.
- 4—100,000 ohm Res. under the two .2 mfd. Condensers and the two .2 mfd. Condensers, through Hole a in Side of Chassis to Slider of Volume Control.
- 5—One Side of Volume Control to Earthed Chassis Point E.
- 6—Other Side of Volume Control to 1 mfd. Condenser.
- 7—1 mfd. Condenser to G.B. Terminal of L.F. Transformer.
- 8—Volume Control, through Hole b in Side of Chassis, under 2 mfd. Condenser to H.T. — Terminal.
- 9—C Terminal of V3 under 2 mfd. Condenser, through Hole c in Side of Chassis to 1 mfd. Condenser.
- 10—C Terminal of V3 to One End of 1,500 ohm Bias Res. (Yellow Spot).
- 11—1,500 ohm Res. to One Side of 1 megohm Res.
- 12—1 meg. Res. to Earthed Point E.
- 13—Other Side of 1 meg. Res. to .006 mfd. Coupling Condenser.
- 14—Coupling Condenser to G of V3.
- 15—Earthed Point E to Earth Terminal and C Terminal of V1.
- 16—Twisted Lead from L.T. Terminal to F Terminal of V2.
- 17—Twisted Lead from F of V1 to F of V2.
- 18—Twisted Lead from F of V2 to F of V3.
- 19—Twisted Lead from F of V3 to F of V4.
- 20—Other L.T. Terminal to F of V2.
- 21—Twisted Lead from F of V1 to F of V2.
- 22—Twisted Lead from F of V2 to F of V3.
- 23—Twisted Lead from F of V3 to F of V4.
- 24—H.T. + Terminal to L.S. + Terminal.
- 25—H.T. + Terminal to 30,000 ohm Res.
- 26—Other End of 30,000 ohm Res. to 2 mfd. Condenser
- 27—2 mfd. Condenser to 40,000 ohm Res.
- 28—40,000 ohm Res. to Earthed Point E.
- 29—H.T. + Terminal to 50,000 ohm Res. (near V2).
- 30—H.T. + Terminal, under 2 mfd. Condenser, through Hole d in Chassis to P of L.F. Transformer.
- 31—H.T. + Terminal through Hole e in Chassis to No. 6 Terminal of Coil Holder.
- 32—One Side of "Humdinger" to one F Terminal of V3.
- 33—Other F Terminal of V3 to other side of "Humdinger."
- 34—L.S. + Terminal to 2 mfd. Condenser.
- 35—2 mfd. Condenser to C Terminal of V4.
- 36—Tag of .002 mfd. Condenser under L.S. — Terminal.
- 37—Other Tag of .002 mfd. Condenser to Earthed Point E.
- 38—L.S. — Terminal to A Terminal of V4.
- 39—G Terminal of V4 under 2 mfd. Condenser, through Hole f in Chassis to Terminal of L.F. Transformer.
- 40—Terminal A of V3, through Hole g in Chassis, to H.T. Terminal of L.F. Transformer.
- 41—Terminal A of V2 to top of H.F. Choke.
- 42—Top of H.F. Choke through hole h to No. 5 Terminal of Coil Holder.
- 43—3 megohm Grid Leak to Ebonite Bush holding .0003 mf. Grid Condenser.
- 44—C Terminal of V2 to Earthed Point E.
- 45—3 megohm Grid Leak to Earthed Point E.
- 46—.0003 mfd. Grid Condenser, under both 0.2 mfd. Condensers, through Hole i to Fixed Plates of Tuning Condenser.
- 47—Fixed Plates of Tuning Condenser to No. 1 Terminal of Coil Holder.
- 48—G Terminal of V2 to .0003 mfd. Condenser.
- 49—A Terminal of V1 to Bottom .2 mfd. Condenser.
- 50—Lower .2 mfd. Condenser to 30,000 ohm Res.
- 51—Lower .2 mfd. Condenser to 40,000 ohm Res.
- 52—40,000 ohm Res. to Earthed Point E.
- 53—Bottom of Left-hand H.F. Choke to Upper .2 mfd. Condenser.
- 54—Bottom of other H.F. Choke to One Side of .006 Coupling Condenser.
- 55—Bottom of H.F. Choke to One Side of 100,000 ohm Res.
- 56—Other Side of 100,000 ohm Res. to 2 mfd. Condenser.
- 57—No. 3 Terminal of Coil Holder to Anode of S.G. Valve.
- 58—No. 2 Terminal of Coil Holder to Fixed Plates of Reaction Condenser.
- 59—No. 4 Terminal of Coil Holder to Earthed Point E.

THE ATLANTIC THREE

12.5-85 METRES

A three valve short wave receiver of simple and inexpensive design that gives really good results.

For the many experimenters who prefer to build a separate receiver for the reception of the short waves, and while not willing to use as many as four valves, consider that two valves are not quite sufficient for their requirements, the Atlantic Three is available and will be found to give every satisfaction. The design has been so arranged that although a stage of S.G. amplification is incorporated only one tuning dial is necessary. Handling the receiver, therefore, presents no complications and with the specially designed disc drive for accurate short wave tuning and the slow motion reaction control, the finest adjustments are possible. Reaction is smooth without any trace of blind holes or overlap and hand capacity effects are absent. The use of a pentode output valve gives sufficient signal strength for a loud speaker to be utilized and the receiver on test gave excellent reproduction of several American short wave transmissions. Although primarily designed for short wave reception, the receiver can be converted for use on the normal broadcast wavelengths up to 1,800 metres by the addition of extra coils.

CONSTRUCTION.

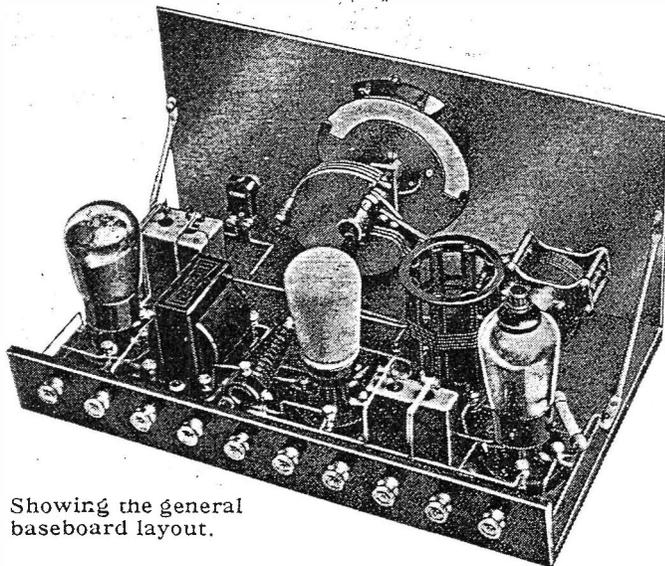
Follow the wiring diagrams and point to point details, making sure that connections are all strongly and cleanly made, and no trouble should be experienced as the design has been kept as simple as possible. Take care that connections Nos. 4 and 9 are well made to the left hand panel bracket and that this in turn has a good contact with the metal panel. Be sure also that the contact made by the reaction condenser and disc drive to the panel are similarly well made. The .002 condenser across A and F of the last valveholder is fastened in place by bending the tags of the condenser and slipping them over the terminals. The L.F. transformer and 6 pin coil base are both raised slightly from the baseboard with $\frac{1}{8}$ " pillars. This is done so that most of the wiring can pass underneath these components, facilitating the design.

VALVES.

Mullard	Mazda	Mullard
P.M.12.	H.L.210, metallised.	P.M.22.

BATTERIES.

A 2 volt accumulator is required and 120 volt H.T. supply.



Showing the general baseboard layout.

H.T. +1 should be 60-80 volts; H.T. +2, 40-60 volts; H.T. +3, 120 volts.

A 15 volt grid bias battery is needed with 12-15 volts negative bias on G.B.—

OPERATING THE SET.

First of all, the suitable coil for the wavelength range which it is desired to receive upon should be inserted and then starting with both tuning condenser dial and the reaction condenser at minimum, switch the receiver on. Increase the reaction control by means of the vernier knob gently until at a certain point the set will begin to oscillate; this will be noticeable immediately since a low rushing sound will be heard. Throughout the whole tuning operations, this reaction control should be so adjusted that the set is always only just in this oscillating condition. The reaction control should never be turned any more than is necessary for the first reaction sound to be heard. Now commence turning the tuning dial slowly, increasing the reaction control gently if necessary to keep the set in the oscillating condition. Probably the first signals to be heard will be morse code. When a telephony transmission is reached, this will also be heard as a shrill whistle similar to morse code because the set is in an oscillating condition. The difference, however, between a morse signal and a telephony signal is that the first named is a constant note, whereas

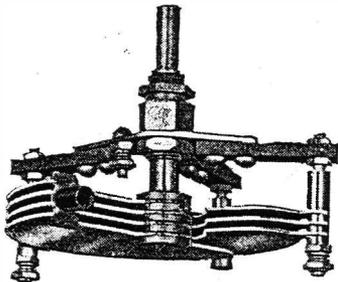
Continued on page 11.

THE SHORT WAVE VARIABLE CONDENSER

An Article of interest to all Short Wave enthusiasts.

The importance of correct design in a tuning condenser for use in a short wave receiver is not generally realized. It is one of the most important components in a short wave set and upon whether the condenser is of suitable capacity and efficient design depend the results that will be achieved. The main failings of condensers for this use are, high series resistance, dielectric losses and noise. Dealing with high series resistance first, at a wavelength of 20 metres, when the frequency is 15,000,000 cycles per second, the condenser can have considerable resistance if of bad design and a metal having as low a H.F. resistance as possible should be used for the plates. Brass is much better than aluminium in this respect, and it does not oxidise so quickly and is therefore also more efficient after long use. The vanes should preferably be soldered together since, if spacing washers are used, due to burr or fray on these, the plates cannot always be clamped together dead tight and after a period they oxidise and a high resistance contact develops between the vanes.

AN EXAMPLE OF CONSIDERED SHORT WAVE CONDENSER DESIGN.



Note the one bearing spindle, a minimum of insulation with long leakage path. The vanes are of brass soldered together.

In order to prevent dielectric losses the insulation should be of a special type for high frequency work, the leakage path as long as possible, and it should be kept well out of the strongest part of the electrostatic field.

Noise in a short wave condenser should be avoided at all cost, and it is surprising how often this factor is completely ignored. Frequency is again responsible for the care in design necessary to make a perfectly silent instrument. It will be readily appreciated that at a frequency like 15,000,000 cycles a second it is easy to get a potential difference between each side of a bearing, especially on a condenser of the double end plate type, and also, since the condenser may have considerable resistance with currents flowing along the spindle and round the frame, unless the bearings are really good there will be a great amount of noise when the moving vanes are rotated. A pig tail is not a complete solution as it may have a comparatively high resistance at H.F. This trouble cannot occur on the single end plate type of condenser, and this type should be used for short wave working. Models which are invariably very noisy in use are condensers employing ball bearings and slow motion devices. It is always better to use a condenser with a separate slow motion dial of correct design. An extension spindle to the dial is often useful even with this arrangement, more to prevent noise than hand capacity.

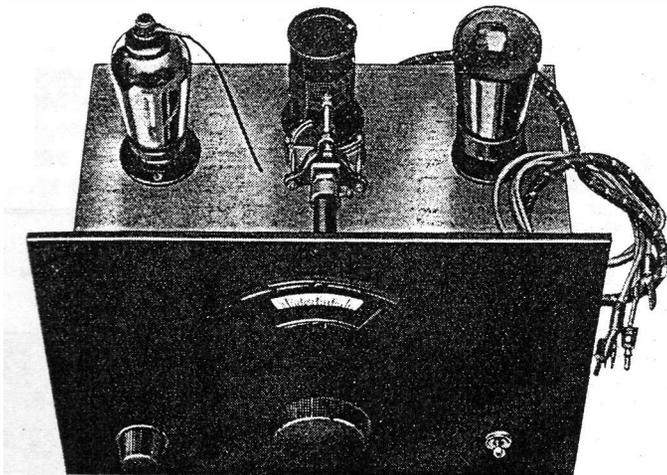
As regards the maximum and minimum capacity of the condenser, it must be remembered that the larger the inductance and the smaller the capacity, the greater the efficiency. It is therefore necessary to compromise between efficiency and a reasonable wave coverage per coil unless the receiver is intended for a special limited waveband or a considerable number of coils used. In practice a .00016 mfd. is about the ideal size for general use, this covering a wave range of from 13-80 metres with three coils. At this point the minimum capacity of the condenser has importance since if not very small the wave coverage can be seriously reduced.

Condensers for ultra short waves below 10 metres call for special care in design as the frequency of these signals is from 30,000,000

Continued on page 16.

"AMATEUR BAND'S" TWO

A Special High Efficiency 2 Valve Set designed for reception of the 14, 7 and 3.5 MC Amateur Bands. Easily convertible for general short wave use with a range of 14 to 80 metres.



The clean layout and simplicity of the "Amateur Band's" Two strikes a distinctive note.

DESIGN.

The object in the design of this set was to provide the ideal receiver for amateur use. In the first place, a very high degree of amplification with a silent background was essential. To obtain the second qualification, it was decided to use only two valves and the problem remained how to get a receiver with a really powerful kick, more than sufficient for ordinary requirements. This was solved by using a S.G. valve with its high amplification factor as detector, followed by a high efficiency pentode. In order to make full use of the characteristics of the S.G. valve, it was essential to have a suitable coupling to the second valve. A L.F. transformer would not be of much use in view of the high impedance of the valve and resistance coupling suggested itself. This method has the disadvantage, however, that the large voltage drop across the resistance is detrimental and makes the set erratic in operation. It was therefore decided to employ a L.F. choke coupling, using a choke with a high inductance of 300 henries. This method was found admirable and answered all requirements. Automatic grid bias and drop fed H.T. tapping are further refinements.

REACTION CONTROL.

Next came the important question of reaction control, and after trying various known ways, the rather unusual method of obtaining a definite amount of reaction by means of a pre-set condenser and reaction coil, on the Reinartz principle, was adopted, with the final adjustment made by a potentiometer control of the H.T. voltage to the S.G. of the detector valve. This method ensures that there is no movement of wavelength when reaction adjustment is completed, thus obtaining smooth control right up to the maximum point.

TUNING RANGE.

With only limited wavebands to cover, the tuning needs to be very open. There are two ways of doing this: one is by using a smaller number of inductance turns and shunting a fairly large fixed capacity across the tuning condenser, which is the inefficient method; and the other, to use the largest inductance possible and a condenser of very small capacity and low minimum so that the band is just covered. The latter method was adopted, and with the coils and condenser specified, the bands are spread out over the greater portion of the dial.

HAND CAPACITY.

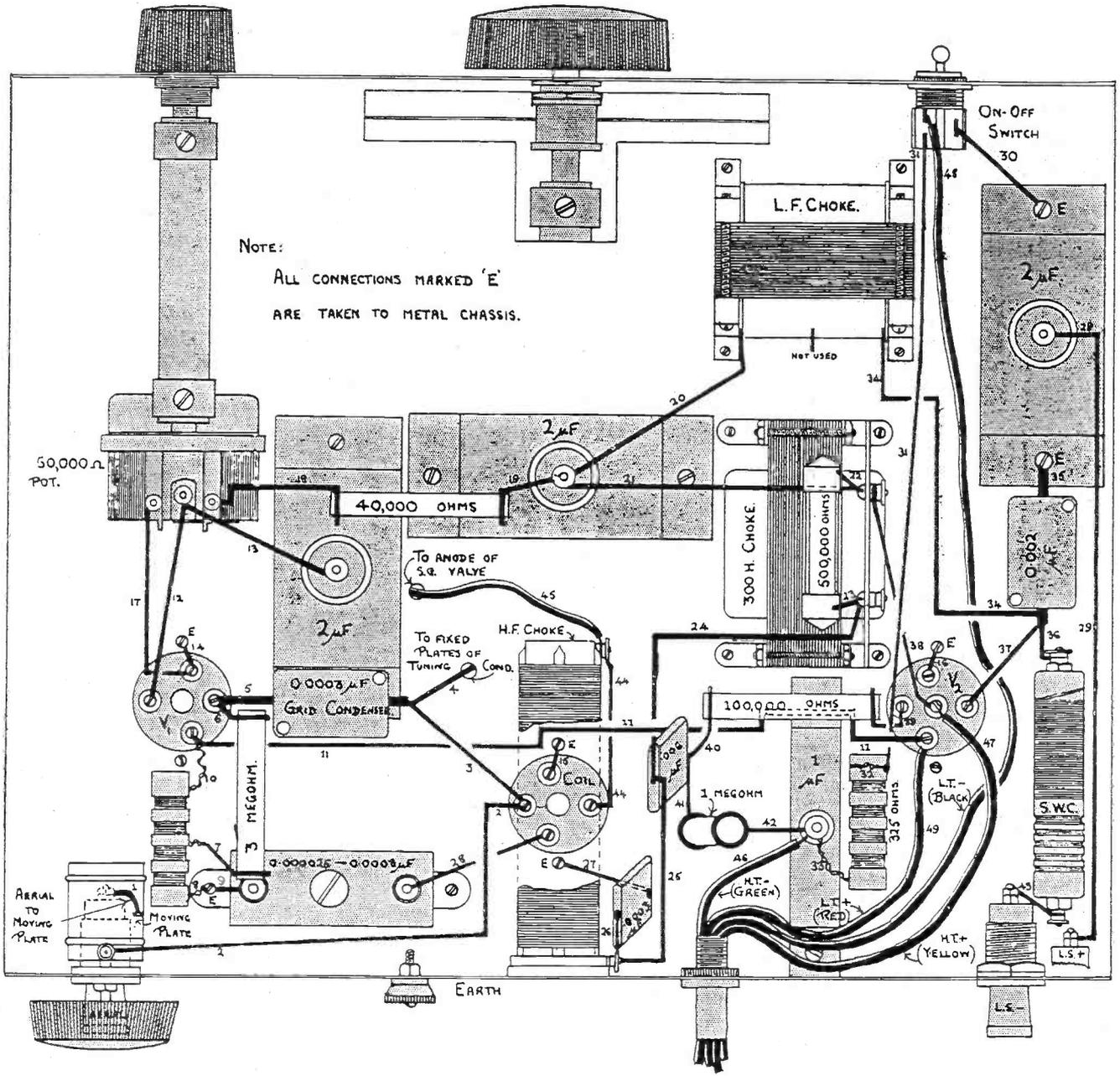
This trouble cannot be tolerated in the efficient amateur receiver, and the design of the "Amateur Band's" Two has eliminated this trouble entirely, even when headphones are in use. It is almost possible to place the hands on the metal chassis when wearing headphones, without moving a signal being received.

RESULTS.

The volume from the set is surprising, and a loud speaker can be substituted for 'phones on most stations. The set will work a moving coil speaker on American broadcast when conditions are good. Three out of the first five competitors, including the winner, used this receiver in this year's B.E.R.U. cup contest, in which amateurs all over the world participated.

"AMATEUR BAND'S" TWO

WIRING PLAN.



"AMATEUR BAND'S" TWO—continued.

ADAPTION FOR GENERAL USE.

This is an exceedingly simple matter since the only part affected is the tuning arrangement. Either the 15 m.mfd. microdenser can be substituted by one of the 100 m.mfd. capacity, in which case the range of the receiver, using coils type LB, Y, and R, will be 13.5 to 24 metres, 22 to 42 metres, and 40 to 75 metres. Or, if it is still desired to use the set as an amateur band receiver, the extension spindle may be taken out, allowing the 100 m.mfd. condenser to be connected in its place to the disc drive and coupled to the 15 m.mfd. condenser by means of a universal coupling. The lead to the fixed vanes can then be so arranged that it can be connected to either condenser at will according to requirements.

ADDITIONAL PARTS REQUIRED.

1 Eddystone Microdenser, 100 m.mfd., with brass coupling piece 7/-
1 Ormond Universal Coupler 1/6

CONSTRUCTION.

The construction of the receiver, with the help of the diagrams and point to point wiring connections, should be a straightforward matter. Capacity caused by No. 2 lead going too close to the metal chassis should be watched, as this affects the tuning range. Leads Nos. 8 and 9 utilize the screw which clamps down the one side of the Formodenser as their earth return. Similarly, leads Nos. 14, 15, 16 and 27 use one of the valveholder fastening down screws. The condenser and leaks in the grid circuit of V2 should be kept away from the H.F. end of the H.F. choke. The end of the S.W. choke by lead 36 should be kept down low to the chassis. All the components on the underside of the chassis should be mounted first, the variable condenser and disc drive following, the panel is fitted last of all. The brass spindle for the disc drive is pushed in from the front before the panel is fitted.

POINT TO POINT CONNECTIONS.

- 1—Aerial Terminal to Moving Plate of Aerial Series Condenser.
- 2—Fixed Plate of Series Condenser to Coil Holder.
- 3—Coil Holder to Grid Condenser.
- 4—.0003 mf. Grid Condenser to Fixed Plates of Tuning Condenser.
- 5—Other side of Grid Condenser to Grid of V.1.
- 6—One end of 3 megohm Grid Leak to Grid of V.1.
- 7—Other end of Grid Leak to tapping of Potentiometer.
- 8—Blue end of Fixed Potentiometer to Earthed Screw E.
- 9—One Terminal of Formodenser to Earth E.
- 10—Yellow end of Potentiometer to Plus Filament Terminal of V.1.
- 11—Plus Filament Leg of V.1. to Plus Leg Filament of V.2.
- 12—Anode of V.1. to Slider of 50,000 ohm Potentiometer.
- 13—Slider of latter Potentiometer to 2 mfd. Condenser.
- 14—Filament of V.1. to Earthed Point E.
- 15—Coil Holder Terminal to E.
- 16—Filament of V.2. to E.
- 17—Filament of V.1. to one end of 50,000 ohm Potentiometer.
- 18—Other side of latter Potentiometer to 40,000 ohm resistance.
- 19—40,000 ohm Resistance to 2 mfd. Condenser.
- 20—2 mfd. Condenser to L.F. Choke.
- 21—2 mfd. Condenser to 300 Henries Choke.
- 22—300 Henries Choke to .5 megohm Resistance.
- 23—.5 megohm Resistance to end of 300 Henries Choke.
- 24—300 Henries Choke to Top of .006 mfd. Condenser.
- 25—.006 mfd. Condenser to bottom of H.F. Choke.
- 26—Bottom of H.F. Choke to .0003 mfd. Condenser.
- 27—.0003 mfd. Condenser to Earth E.
- 28—Formodenser to Coil Holder.
- 29—Bottom L.S. Terminal to 2 mfd. Condenser.
- 30—On-Off Switch to Earth E.
- 31—Switch to one end of 325 ohm Resistance.
- 32—End of Bias Resistance to Connection 31.
- 33—End of Bias Resistance to 1 mfd. Condenser.
- 34—L.F. Choke to .002 mfd. Condenser.
- 35—.002 mfd. Condenser to Earth E.
- 36—Top of H.F. Choke to .002 mfd. Condenser.
- 37—.002 mfd. Condenser to anode of V.2.
- 38—Auxiliary Grid of V.2. to 300 Henries Choke.
- 39—Grid of V.2. to 100,000 ohm. Resistance.
- 40—100,000 ohm Resistance to bottom of .006 mfd. Condenser.
- 41—Bottom of .006 mfd. Condenser to 1 megohm Resistance.
- 42—1 megohm Resistance to 1 mfd. Condenser.
- 43—Top L.S. Terminal to H.F. Choke.
- 44—Top of H.F. Choke in Anode of S.G. Valve to Coil Holder.
- 45—Top of H.F. Choke to Anode of S.G. Valve.

BATTERY CORD.

- 46—1 mfd. Condenser to H.T. — (Green).
- 47—Auxiliary Grid of V.2 to H.T. + (Yellow).
- 48—L.T. — direct to Third Contact on Switch.
- 49—L.T. + Terminal of V.2. to L.T. + (Red).

VALVES:

Detector—Mazda, S.G.215.
Output—Osram, P.T.2.

It is important that these valves be used, since the set has been designed round them. A detector of different type may give bad reaction control and an alteration of output valve will upset the grid bias voltage applied to this valve.

H.T. SUPPLY:

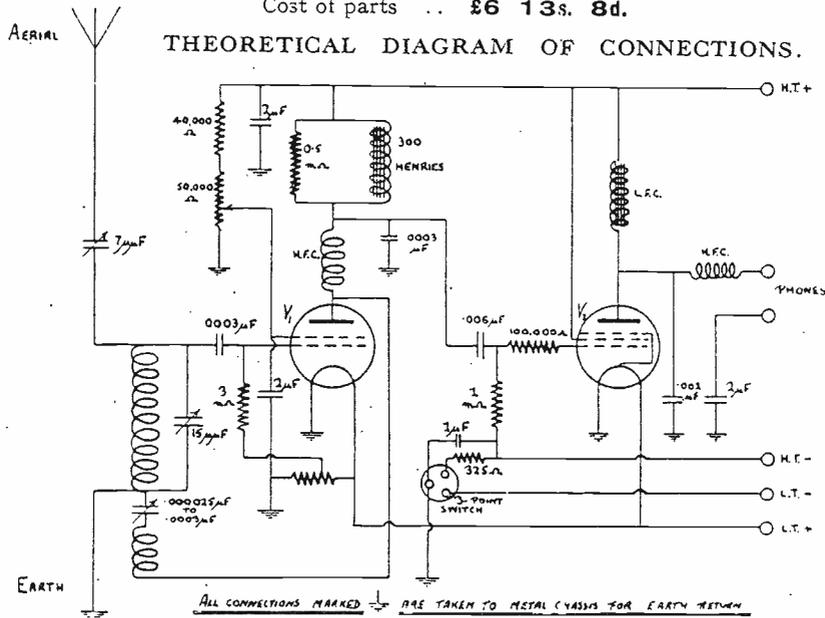
120 volts are required.

"AMATEUR BAND'S" TWO—cont'd

LIST OF PARTS.

	Price		Price
1 Black Bakelite Panel, drilled, 11" x 8"	5/-	1 Eddystone 4 pin Coil, type R, for 7 M.C.	3/6
1 Aluminium Chassis, blanked and drilled	17/6	1 Eddystone 4 pin Coil, type W, for 3.5 M.C.	4/-
1 Eddystone Disc Drive, type 933B	7/6	1 Variable Colverstat, 50,000 ohms	5/6
1 Eddystone 15 m.f.d. Microdenser	4/6	1 Formodenser, type J	1/6
1 Eddystone Valve Holder, type 921	1/3	1 300 Henries L.F. Choke, R.I.	1/11/-
2 Eddystone Valve Holders, type 920	2/6	1 Dubilier 500,000 1 watt Resistance	1/-
2 Eddystone 3" Extension Spindles without Bracket	3/-	1 Dubilier 40,000 1 watt Resistance	1/-
1 Bracket for Colverstat	1/-	1 Ferranti type B.8. Choke	7/-
1 Bracket for Microdenser	9d.	1 Bulgin 3 point Switch, type S.87	2/-
1 Eddystone H.F. Choke, type 911	2/-	1 T.C.C. Condenser, .006 Type M	1/9
1 Eddystone H.F. Choke, type 923	2/6	1 T.C.C. Condenser, .002 Type M	1/4
3 Eddystone 2 mfd. Condensers, 1 terminal, type 500 v. A.C. Test	12/-	2 T.C.C. Condensers, .0003 Type M	2/-
1 Eddystone 1 mfd. Condenser, 1 terminal, type 500 v. A.C. Test	3/-	1 Erie 3 meg. Grid Leak	1/2
1 Eddystone Midget Condenser	2/9	1 Erie 1-meg. Grid Leak	1/2
1 Eddystone Fixed Potentiometer, type 938	1/6	1 100,000 ohm Resistance	1/2
1 Eddystone G.B. Resistance, 325 ohms	1/6	3 Clix all in Terminals—1 aerial, 2 phones	1/6
1 Eddystone 4 pin Coil, type Y, for 14 M.C.	3/6	1 W.O. Terminal, brass N.P.	1d.
		1 Ebonite Bush for leads	3d.
		1 Set of 4 Way Leads	2/6
		Wire, Screws, Nuts, etc.	2/6

Cost of parts .. £6 13s. 8d.

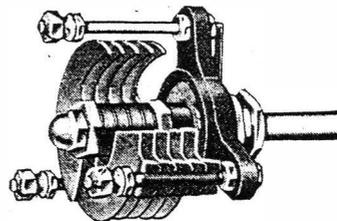


THE SHORT WAVE VARIABLE CONDENSER —continued.

to 300,000,000 cycles per second. Size is also of significance here because since the electrostatic field of a condenser extends to roughly $2\frac{1}{2}$ times its size, so the condenser must be of small dimensions. One cannot do better than use the "EDDYSTONE" Microdenser, which has been specially designed for these wavelengths.

The tuning dial is also of great importance. It must have a smooth silky movement, be free from back lash, have a sufficiently slow movement to make tuning easy but not slow

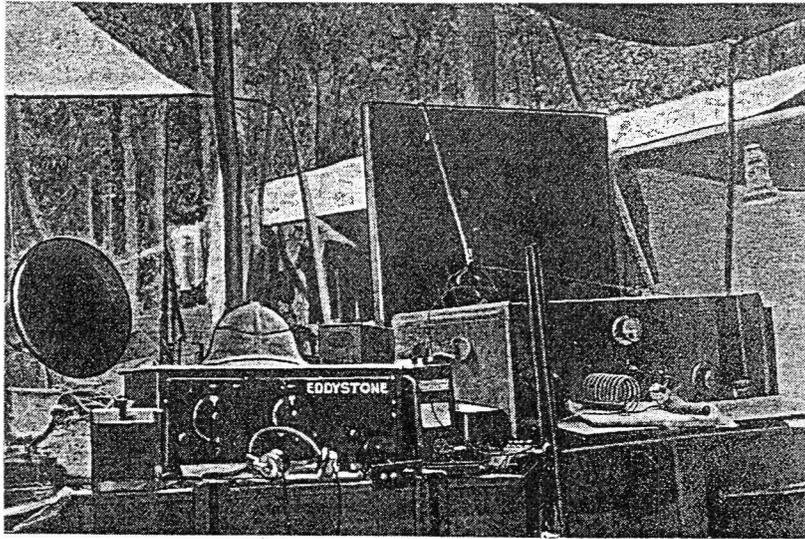
A CONDENSER FOR ULTRA SHORT WAVES



One endplate only of special ISOLEX insulation for high frequency work. Soldered brass vanes, special silent one contact bearing. Small compact size.

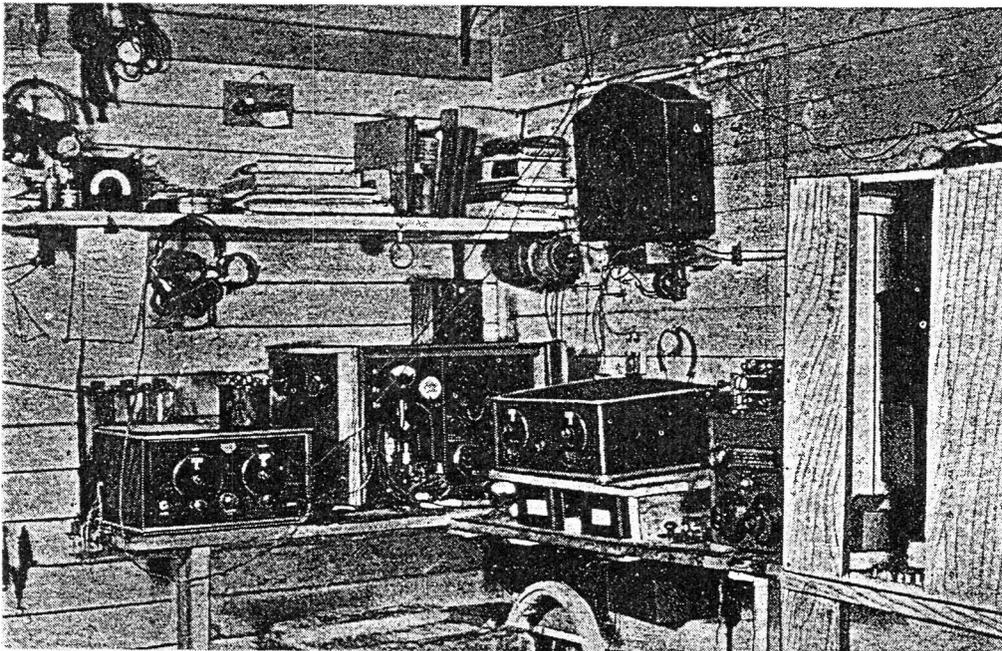
enough to make it tiresome. After considerable experiment, we have come to the conclusion that a ratio of about 20:1 with a large tuning knob is the most suitable.

EXPEDITIONS TO ALL PARTS OF THE WORLD USE EDDYSTONE RECEIVERS



IN THE TROPICS.

The wireless installation comprising receiver and transmitter used by the Oxford University Expedition to British Guiana, practically on the equator, in the tropical jungle



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IN THE ARCTIC.

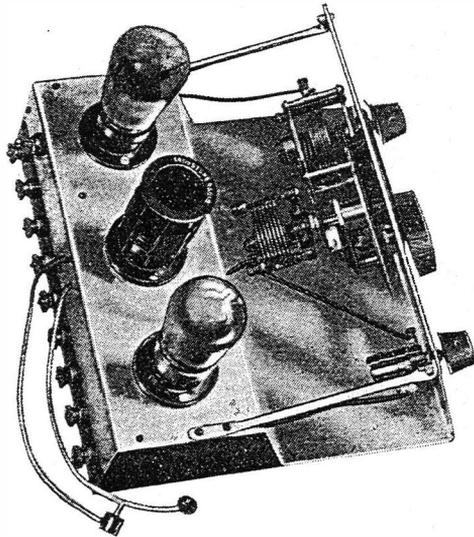
The radio cabin of the British Arctic Air Route Expedition, who remained in Arctic regions for 12 months. The equipment worked throughout without failure.

Other expeditions who are carrying Eddystone short wave equipment are:—

- Captain Malins, England to Capetown, by road.
- Hudson Strait Settlement Expedition.
- Oxford University Expedition to Sarawak.
- Yacht Vigilant Treasure Hunt Expedition to the South Seas.

THE EMPIRE TWO

A SHORT WAVE RECEIVER WITH A RANGE OF 13/78 METRES.



Note the neat layout and special chassis construction.

The object in view in designing the Empire Two receiver was to provide an effective short wave set which could be assembled simply and at a comparatively low cost. Considerable thought and care has been extended on it to achieve these two aims and the result is one which is wholly satisfactory. The assembly of the set is simple and inexpensive, yet it conforms to true short wave practice and gives excellent results. The finished receiver makes a compact and smart looking instrument and the sloping front, while adding to the appearance, also makes tuning easier and more pleasant.

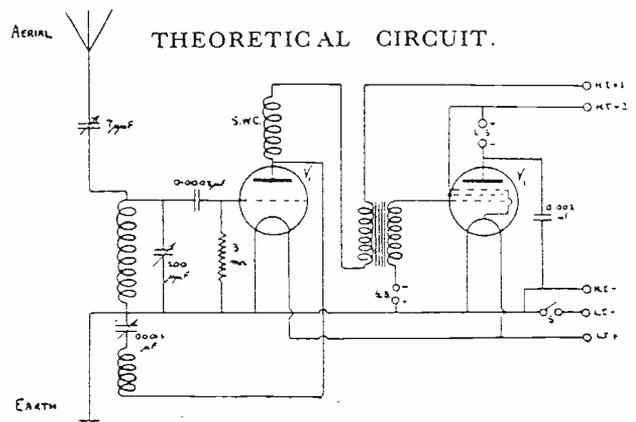
The well-known Reinartz circuit is used with a 4-pin interchangeable coil as the inductance portion. This coil carries a grid and reaction winding. The aerial is fed to the grid end of the aerial coil, through a small variable condenser which is brought on to the front panel so as to be instantly adjustable to remove any blind tuning spots. The main tuning control utilises the special Eddystone disc drive with hair-line scale and wide vision escutcheon which is ideal for the accurate setting which is necessary for short wave reception. Reaction is perfectly smooth without overlap and the reaction condenser used is of the slow motion type so that the full benefit of a maximum adjustment can be obtained.

CONSTRUCTION.

The wiring plan and point to point connecting instructions can be easily followed and give all the information necessary. For the sake of clearness, the terminal strip on the underside chassis view has been turned at right angles to its actual position. The grid condenser and grid leaks are self supporting, being wired directly into the receiver while the high frequency choke is also not fastened down in any way and is supported entirely by the two leads which run from the anode of the first valveholder and the anode connection on the transformer. These two leads should be of stout wire so that the component is held well in place. The R.I. transformer is mounted on two small insulating pillars instead of being clamped directly on to the chassis, this is to avoid the fixing screws of the valveholder and also to make the wiring a little more convenient. An important point to watch in the assembly of the receiver is that all connections which are made to the chassis and where the circuit is completed through the metal chassis to earth, should be well made and the paint of the chassis scraped well away so that an actual metal to metal contact is obtained.

VALVES.

A fairly wide choice of valves for use in the receiver are available. The chief consideration, however, should be that the detector valve must be silent in operation and non-microphonic. In this latter respect, we have always found that 2 volt valves are very much superior to the corresponding types in 4 or 6 volts. For the detector position, we recommend



THE EMPIRE TWO—continued

a Mullard PM1HL, a Mazda H.L.210, an Osram H.L.210 or a Cossor 210 H.L., while for the output position, the ordinary power valve or pentode valve is quite suitable. The actual valve used in the test receiver was an Osram type L.P.2. This is a steep slope output valve which gives results almost equal to a pentode and is very suitable for use with headphones. A 5-pin valveholder has been fitted in the output stage of the set so that a pentode valve can be used when additional power is required.

HIGH TENSION SUPPLY.

A voltage from 100 to 120 volts is necessary and the tapping H.T. + 1 should be varied between 50 and 70 volts, the H.T. + 2 lead utilizes the whole of the available voltage.

GRID BIAS.

With the ordinary type of output valve, a negative bias of from $7\frac{1}{2}$ to 9 volts will be necessary, using 120 volts high tension supply. With the steep slope type of output valve, 3 volts negative is usually sufficient, while with a pentode, a larger grid bias battery is necessary and up to 15 volts may be employed. It will be usually found that if the set is being used with headphones, slightly more than the grid bias voltage recommended by the valve makers can be employed without loss of strength or quality and a corresponding saving in high tension current is obtained.

OPERATING THE SET.

First of all, the suitable coil for the wavelength range (see list of parts) which it is desired to receive upon should be inserted and then starting with both tuning condenser dial and the reaction condenser at minimum, switch the receiver on. Increase the reaction control gently until the set begins to oscillate; this will be noticeable immediately since a low rushing sound will be heard. Throughout the whole tuning operations, this reaction control should be so adjusted that the set is always only just in this oscillating condition. Now commence turning the tuning dial slowly, increasing the reaction control gently if necessary to keep the set in the oscillating condition. Probably the first signals to be heard will be morse code. When a telephony transmission is reached, this will also be heard as a shrill whistle similar to morse code because the set is in an oscillating condition. The difference, however, between a morse signal and a telephony signal is that the first named is a constant note, whereas telephony, when the dial is moved very slowly, will be heard as

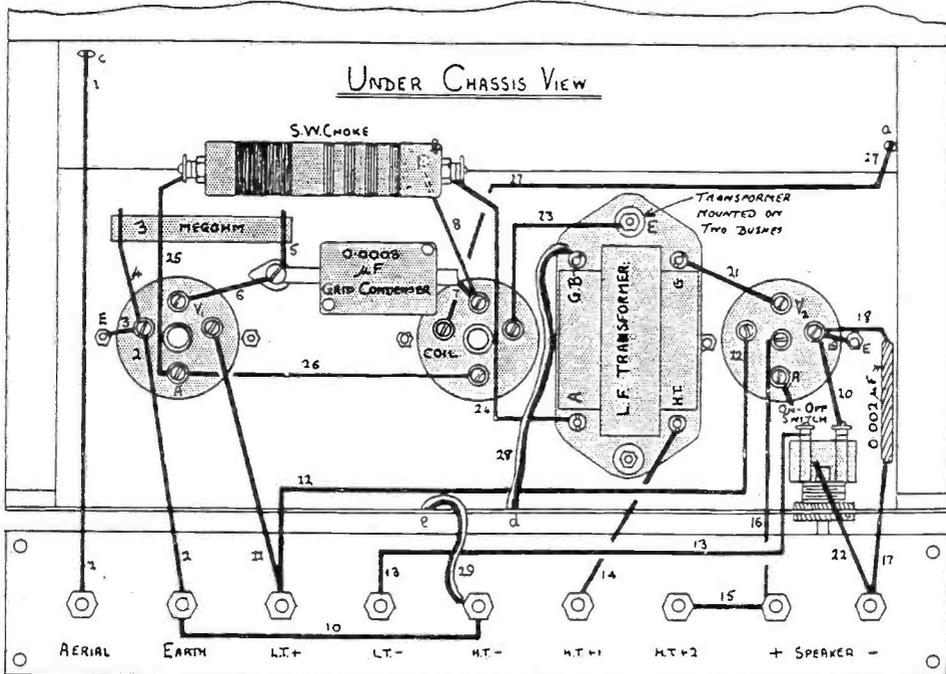
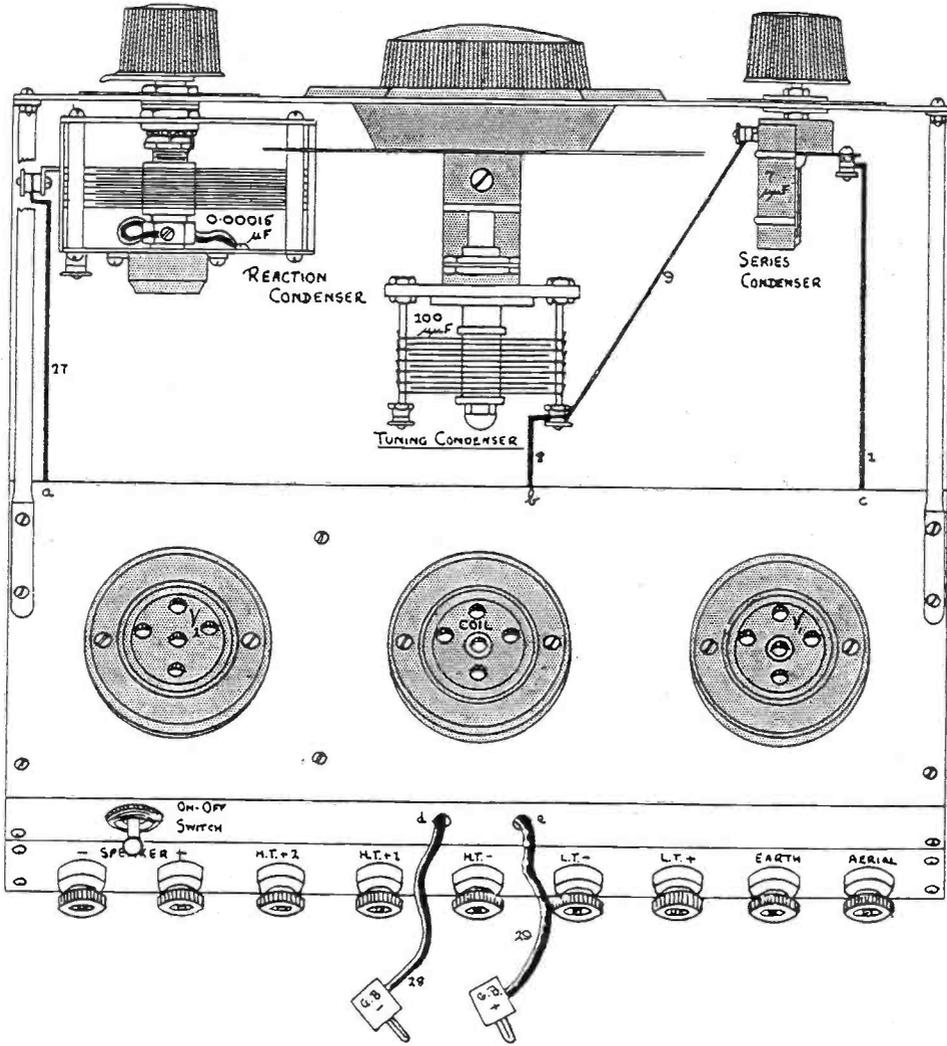
a high pitched whistle which builds up, reaches a silent point and then appears again as a high pitched note which gradually dies away. To receive telephony, the dial should be turned until the silent point is reached and then the reaction control gradually eased off. The tuning dial will perhaps now require slight readjustment, when the speech or music should be quite clearly heard. It simplifies the operation of the receiver when searching for stations, to keep it in the oscillating condition, but it should be borne in mind that clear telephony can never be received with the receiver oscillating.

The position of the aerial coupling condenser is not very important and adjustment is only necessary if blind spots, due to the natural wavelength of the aerial in use, are encountered. Maximum volume will usually be obtained with it fully in, but it should be noted that as the capacity of this aerial coupling condenser is varied, the main tuning condenser setting for any given station will also vary.

LIST OF PARTS.

	Price
1 Eddystone Chassis, ripple, brown finish, drilled and pierced for mounting all components, assembled with brackets and end plates, engraved terminal strip	18/6
2 Eddystone Valveholders, type 920	2/6
1 Eddystone Valveholder, type 921	1/3
1 Eddystone Disc Drive, type 933W	7/6
1 Eddystone Microdenser, 100 m.mfd.	6/6
1 Eddystone S.M. Reaction Condenser, .00015 mfd., type 940	8/6
1 Eddystone Midget Condenser with scale, type 502S	3/3
1 Eddystone H.F. Choke, type 911	2/-
1 Eddystone 4-pin Coil, type LB, 13/25 metres	3/6
1 Eddystone 4-pin Coil, type Y, 22/41 metres	3/6
1 Eddystone 4-pin Coil, type R, 39/78 metres	3/6
1 R.I. Hypermite Transformer	12/6
1 Eric 3 meg. Grid Leak	1/-
1 T.C.C. .0003 mfd., type M, Condenser	1/-
1 T.C.C. .002 mfd., type M, Condenser	1/4
1 Igranic Switch	1/6
9 Terminals, N.P.	1/2
Flex. Wire, Wander Plugs, Screws, Nuts, Brushes, etc.	1/6
Cost of parts, £4 0s. 6d.	

EMPIRE TWO. WIRING PLAN.



LOGGING STATIONS ON YOUR SHORT WAVE RECEIVER

SOME ADVICE TO BEGINNERS.

When first trying out your short wave set remember that the tuning is much more delicate than with an ordinary broadcast receiver and quite powerful stations may be missed if the dials are turned too hurriedly. Once the right "feel" of the controls has been acquired however, the working of the short wave set becomes quite easy and it is just a matter of a little care and practice before the beginner becomes really "au fait" with his instrument.

When tuning the set it should be borne in mind that, unless the setting for a station is known, it makes station finding easier to have the receiver in a state of oscillation, but when the signal is actually picked up the set should be brought from the point of oscillation by decreasing reaction and retuned, otherwise perfectly clean reception will never be obtained. A little extra care taken in slow and even rotation of the tuning dial will be well repaid by results and an increased number of stations received, always remembering that there are many interesting stations on the short wave bands and these can be missed quite easily if the tuning is haphazard.

If you want to make your set as reliable as possible and get plenty of enjoyment at the same time, it is a good plan to compile a log of stations received, and this could show the call sign, dial reading and corresponding

wavelength, times of working and any personal notes which may be of interest. These, then provide a guide for the calibrations of other transmissions. The wavelength of the principal stations can be obtained from the list in this booklet.

Commencing at the bottom of the wave-band, the first station of note works on 14.47 metres with the call sign LSY. This is situated at Buenos Aires and is principally used for 'phone communication with London, with an occasional concert of gramophone records.

The next station of interest is PLE, at Bandoeng, Java, working on 15.93 metres with a power of 80 Kw on Tuesdays, from 2-40 to 4-40 p.m. During this time gramophone music is transmitted, although the station maintains a regular commercial telephony service with Amsterdam. PLE comes in remarkably well in Gt. Britain and announcements are given in several languages, including English.

We then come to the popular American station W2XAD, at Schenectady, New York, on 19.56 metres. The National Broadcasting Company's programmes are relayed from station WGY, and this transmitter is one of the most consistent of the Americans received in England. As a point of interest, American stations give their call letters every 15 minutes, this being a State regulation.

THE EMPIRE TWO—continued

POINT TO POINT CONNECTIONS.

- | | |
|---|---|
| 1—Aerial Terminal through hole c in chassis to Moving Plate of Aerial Series Condenser. | 16—L.S. + Terminal to Centre Socket of V2. |
| 2—Earth Terminal to Neg. L.T. Socket of V1. | 17—L.S. — Terminal to .002 mfd. Condenser. |
| 3—Neg. L.T. Socket to Earthed Point E. | 18—.002 mfd. Condenser to Filament Socket of V2. |
| 4—Neg. L.T. Socket to one end of 3 meg. Grid Leak. | 19—Neg. L.T. Socket of V2. to Earthed Point E. |
| 5—Other End of Grid Leak to Grid Condenser. | 20—Neg. L.T. Socket to On-Off Switch. |
| 6—Grid Condenser to Grid of V1. | 21—Grid of V2. to G Terminal of L.F. Transformer. |
| 7—Other side of Grid Condenser to Coil Holder. | 22—Anode of V2. to L.S. — Terminal. |
| 8—Coil Holder through hole b in chassis to Fixed Plates of Aerial Tuning Condenser. | 23—Coil Holder Socket to Earthed Point E of L.F. Transformer. |
| 9—Fixed Plates of Tuning Condenser to Fixed Plate of Aerial Series Condenser. | 24—A Terminal of L.F. Transformer to one end of S.W. Choke. |
| 10—Earth Terminal to H.T. — Terminal. | 25—Other End of S.W. Choke to Anode Socket of V1. |
| 11—L.T. + Terminal to L.T. + Socket of V1. | 26—Anode Socket of V1. to Coil Holder. |
| 12—L.T. + Terminal to L.T. + Socket of V2. | 27—Coil Holder through hole a in chassis to Fixed Plates of Reaction Condenser. |
| 13—L.T. — Terminal to On-Off Switch. | 28—G.B. Terminal of L.F. Transformer through hole d to G.B. — Plug. |
| 14—H.T. + 1 Terminal to H.T. Terminal of L.F. Transformer. | 29—H.T. Terminal through hole e in chassis to G.B. + Plug. |
| 15—H.T. + 2 Terminal to Loud Speaker + Terminal. | |

LOGGING STATIONS—continued

W8XK, at Pittsburg East, transmits on 19.72 and 25.25 metres, the first named always relaying the programmes from KDKA.

Nearer home we have HVJ, at the Vatican City, on 19.84 metres. The principal use for this station is to maintain communication with the Roman Catholic Church Overseas, and it operates daily at irregular intervals with a power of 10 Kw.

Coming even more locally, we find Radio-Colonial, at Paris, on 25.2 metres and G5SW at Chelmsford, on 25.53 metres. The first named was installed primarily to afford publicity to the French Exhibition held at Paris, last year, but the transmissions are now continued for the benefit of overseas listeners.

5SW is the short wave transmitter of the B.B.C. and is used for an Empire service which relays the programme from the London National Station. Owing to the close proximity of these two stations, however, they will be received very poorly in some parts of England, which is caused by natural phenomena known as "skip effect."

On 31.28 metres is the Australian station VK2ME, at Sydney, which can be heard on Sundays when conditions are favourable. The power is 20 Kw, and this station usually relays the programmes from Melbourne.

Zeesen, Germany, comes in on 31.38 metres at very great strength and W2XAF, at Schenectady, on 31.48. The latter takes the same programme as W2XAD and is also very

well received in England. Above these bands the most interesting stations are REN, Russia, on 45.38; and Rome, 2RO, on 48.2. Both stations are well received in Gt. Britain, although on these waves fading and distortion is sometimes apparent.

By far the most interesting wavebands are from 16 to 45 metres, as they not only provide the more powerful long distance stations but are also more reliable from the point of view of consistent and good quality reception. Above 50 metres it will usually be found that signals suffer from static and atmospherical disturbances; also they are frequently distorted and subject to intermittent fading.

Therefore it is only under favourable conditions that the programmes from the higher wave North American stations, such as Winnipeg, VE9CL, 48.8 metres; Bound Brook, W2XAL, 49.18 metres; Chicago, WCFL, 49.34 metres, and Cincinnati, W8XAL, 49.5 metres, etc., are well received in England, but when conditions are favourable, these stations are usually remarkably good.

It may be mentioned that the short wave bands at times give most erratic reception, and the listener is advised not to be disappointed if from time to time he cannot bring in the long distance programme he wants. As a general rule when long distance reception is bad the nearer short wave stations come in much better. There is, however, always something interesting to be heard on the Short Waves.

1 VALVE SUPER HET. S.W. CONVERTER—cont'd

LIST OF PARTS.

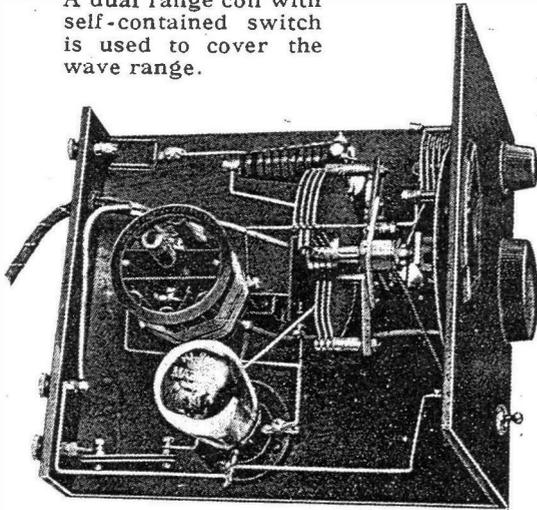
	Price.		Price.
1 Eddystone S.W. Variable Condenser, .00016 mfd.	9 6	1 Eddystone Bakelite Panel, drilled	2 9
1 Eddystone S.W. Disc Drive, type B933	7 6	1 Eddystone Baseboard, 7 ply, stained and polished	1 6
1 Eddystone S.W. Reaction Condenser, .00025 mfd.	9 6	1 Igranite On and Off switch	1 6
1 Eddystone Scientific H.F. Choke	4 6	1 T.C.C. Condenser, .002 mfd. Type M.	1 4
1 Eddystone H.F. Choke, type 911	2 -	1 Resistance, 5,000 ohms, 1 watt type	1 -
1 Eddystone Dual Range Coil	7 -	1 Set 4 way Leads	2 6
1 Eddystone Valveholder, type 501	1 3	1 Insulating Pillar, No. 2P	1d.
1 Eddystone Terminal Strip with 3 terminals	1 3	Screws, Wire, etc.	6d
1 Eddystone Condenser, 12 m.mfd. type	1 -		

Cost of kit of parts. **£2 14s. 8d.**

ONE VALVE SUPER HET SHORT WAVE CONVERTER

For converting any broadcast receiver which employs one or more H.F. valves for use on the short wavelengths.

A dual range coil with self-contained switch is used to cover the wave range.



There are two methods of converting the standard broadcast receiver to receive short wave signals. When the existing set has no H.F. valves, an adaptor which plugs into the detector valveholder is suitable, but if the set should employ one or more H.F. stages, if this method is used, all benefit from the H.F. stages is lost. For such cases, a super-heterodyne type of converter is most efficient and the present design can be highly recommended. It consists of a single valve unit, working as a combined detector and oscillator, and it is only necessary to connect it in the aerial lead to the present receiver, which must be tuned to a wavelength of about 1,800 metres, to obtain the equivalent of a short wave super-heterodyne receiver. The existing H.F. valves in the broadcast set become the intermediate amplifiers, the detector becomes the second detector and the L.F. stages work in the normal manner. The smallest type of broadcast set which can be used is therefore the H.F., detector and one L.F. type.

CONSTRUCTION.

Providing that the diagrams and point to point wiring details are strictly observed, this is an absolutely straightforward matter. The only two points which may be further explained are (1) that connection No. 11 is made by bending the tag on the .002 condenser at

right angles and then fastening direct to the terminal; (2) that the ebonite pillar which carries leads Nos. 17 and 21 is simply screwed down on to the wood baseboard and the fastening down screw is used for joining the two leads together.

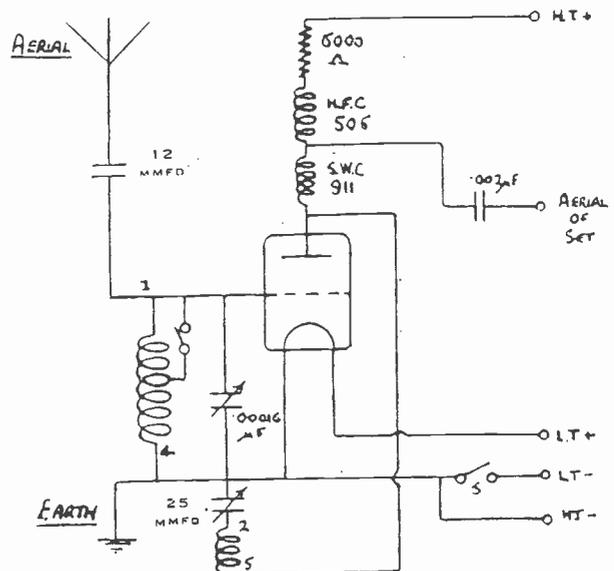
VALVE AND BATTERIES.

The valve should be a Mullard PM2DX, this needs a 2 volt L.T. supply. The H.T. supply should be 60 volts. Existing batteries used with the broadcast receiver may be utilized, or if desired, separate batteries can be built into the same cabinet as the converter, making the unit one self-contained whole. In this latter case, the converter can be used with an all electric broadcast receiver.

INSTRUCTIONS FOR OPERATING.

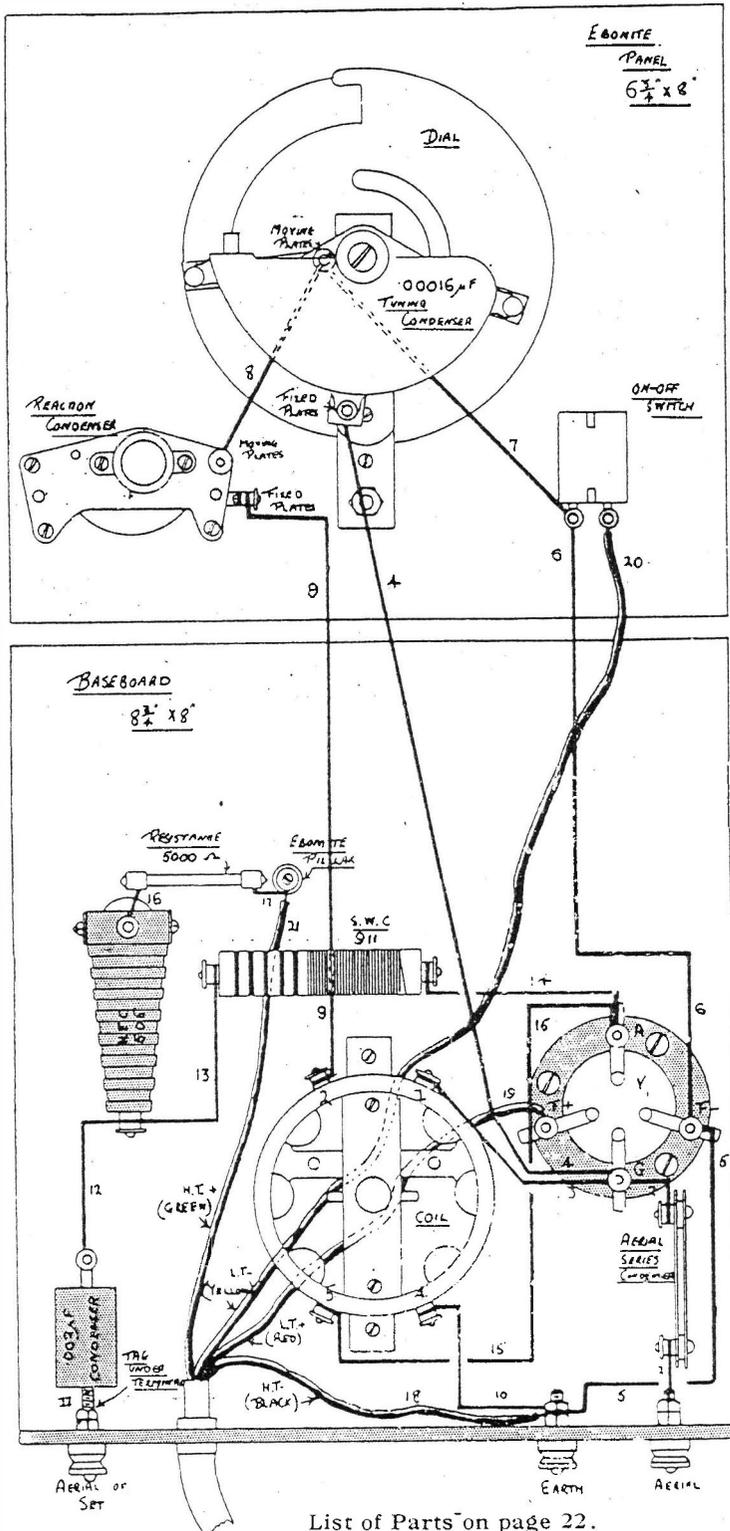
The valve and batteries having been connected, the converter is now ready to use with the receiver, from which the aerial lead must be disconnected and joined to the aerial terminal of the converter. An additional lead must then be used to join the aerial of the set to the output terminal of the converter. The converter terminal marked "Earth" must be joined to earth, or in the case of a portable receiver, to L.T.—.

THEORETICAL CIRCUIT.



ONE VALVE SUPER HET. S.W. CONVERTER—cont'd

WIRING PLAN.



List of Parts on page 22.

The receiver must be switched to long waves and tuned to between 1800 and 2000 metres, that is, slightly higher on the dial than Daventry 5XX and Radio Paris. The actual position is not critical, but a point should be selected on which no long wave transmission can already be heard. To increase the amplification in the receiver, reaction may be increased in the ordinary manner.

The converter can now be switched on, by means of the switch, on the left hand of the centre tuner knob. The tuner dial reading is then set at zero, and before commencing to tune, the converter must be brought into an oscillating condition, by increasing the reaction control. As soon as the valve in the converter begins to oscillate, the resulting sound of the short wavelength being received will be heard in the loud speaker. Increasing the reaction still a little further from this point, may strengthen the received signal, but there is no object in increasing this control more than necessary, because the only effect is to increase the amount of current the valve is drawing from the H.T. battery. This, however, cannot increase to its full extent, because a limiting device is arranged in the converter.

Tuning can now be proceeded with, and short wave signals, both telegraphy and telephony, will be heard as the setting is increased. Tuning on the short wavelengths is exceedingly sharp, and the tuner knob should be rotated slowly, or stations will be missed. Each short wave station will be heard at two distinct settings of the dial, which is usual in the super heterodyne type of reception, the two settings being known as the top and bottom tuning points. Sometimes, one of these two settings may be found to give better results or more freedom from interference than the other, so that the best one can always be selected.

WAVELENGTH RANGE.

The total waverange covered, is from 18 to 64 metres, and this is obtained by using a switched coil. When the knob is pushed in, the waverange, covered by the complete revolution of the dial, is from 34-64 metres. When pulled out, from 18-35 metres.

WAVELENGTH OR FREQUENCY?

The term "wavelength" as applied to broadcast transmissions does not convey such a true picture of the actual position as the lesser used word "frequency." This is particularly true in connection with the "short wavelengths," which can always be regarded much more profitably as the "high frequencies." This is because a broadcast transmission irrespective of its wavelength requires a definite amount of room or band spread in kilocycles (frequency). The amount of room necessary in order that stations shall not interfere with or heterodyne each other is about 10 kilocycles. But a station using a band-spread of this amount will spread over 5.37 metres at the wavelength used by the Midland Regional transmitter, operating on 398.9 metres, over 80.3 metres in the case of Daventry National programme on 1554.4 metres, while turning to the short waves, only about .0198 metres will be covered if the English short wave station at Chelmsford on 25.53 metres is taken as an example. The significance of these figures is perhaps better realised if it is pointed out that with the frequency range that exists between 20 and 21.2 metres, it is possible for all the European broadcast stations on both the medium and long wavebands to work with the same kilocycle separation as at present.

When the ultra short waveband is considered, a difference of 1 metre wavelength, which does not sound very much, can instantly

be appreciated when considered in terms of frequency, the frequency difference between 5 and 6 metres being 10,000,000 cycles or 10,000 kilocycles. Enough room for all the broadcast stations in the world to work comfortably with a 10 kilocycle separation. Thus only by using the term "frequency" instead of "wavelength" do we begin to get a clear idea of the fundamental differences in components which are necessary for short wave reception.

Only a very queer minded person would consider using a small coil and a variable condenser of sufficient size so that the whole of the medium and long wavebands were covered in one sweep of the dial. Apart from the loss in efficiency, tuning would be exceedingly critical. Yet, beginners and designers of short wave sets cheerfully use variable condensers up to .0005 mfd. capacity to cover a waverange of 20 to 70 metres, a frequency range 10 times the size of the broadcast bands! No wonder tuning is critical and results bad. The ideal of a very small tuning capacity and a large number of inductances is, of course, hardly attainable in practice and a compromise must be struck, but once the idea of considering short wave problems in terms of frequency and not wavelength is arrived at, many short wave difficulties which puzzle the beginner will be solved.

Divide 300,000 by the wavelength in question to obtain the frequency in kilocycles.

1 VALVE SUPER HET. S.W. CONVERTER—cont'd

POINT TO POINT CONNECTIONS.

- | | |
|--|--|
| 1—Aerial Terminal to Aerial Series Condenser. | 12—.002 mfd. Condenser to Top of H.F. Choke. |
| 2—Aerial Series Condenser to G of Valveholder. | 13—Top of H.F. Choke to End of S.W. Choke |
| 3—G of Valveholder to No. 1 Terminal of Coil. | 14—S.W. Choke to A of Valveholder. |
| 4—G of Valveholder to Fixed Plates of Aerial Tuning Condenser. | 15—A of Valveholder to No. 5 Terminal of Coil. |
| 5—Earth Terminal to F — of Valveholder. | 16—Bottom of H.F. Choke to 5,000 ohm Resistance. |
| 6—F — of Valveholder to On-Off Switch. | 17—5,000 ohm Resistance to Ebonite Pillar. |
| 7—On-Off Switch to Moving Plates of Aerial Tuning Condenser. | 18—Black Battery Wire from Earth Terminal to H.T. —. |
| 8—Moving Plates of Aerial Tuning Condenser to Moving Plates of Reaction Condenser. | 19—Red Battery Wire from F + of Valveholder to L.T. +. |
| 9—Fixed Plates of Reaction Condenser to No. 2 Terminal of Coil. | 20—Yellow Battery Wire from On-Off Switch to L.T. —. |
| 10—Earth Terminal to No. 4 Terminal of Coil. | 21—Green Battery Wire from one side of 5,000 ohm Resistance to H.T. +. |
| 11—Tag of .002 mfd. Fixed Condenser under "Aerial of Set" Terminal. | |

THE SHORT WAVELENGTHS

It is not very many years ago since wavelengths under 50 metres were little used and thought to have very little commercial value. To-day, not only are they an interesting and fascinating study, but they are employed for numerous and important commercial services in addition to the transmission of broadcast programmes over enormous distances. The wavelengths under consideration we would class between 12 and 50 metres, because the ultra short wavelengths below this seem to have rather different characteristics and uses.

The difference between the ordinary broadcast wavelengths of 200 metres upwards and the short wavelengths is due to the fact that as the wavelength decreases the frequency increases very rapidly and the result from the propagation of the wave from the transmitting aerial is much altered.

Thus the ordinary broadcast transmission has a general maximum range of perhaps a thousand miles, getting gradually weaker the more the distance increases, until however powerful the receiver there is a point when atmospheric and other interference picked up with the signal and amplified with it becomes so strong that it either drowns the signal completely or renders it not worth listening to. This type of transmission may be said to travel in a plane parallel to the earth's surface and is gradually absorbed. Short wave transmissions, on the other hand, do not travel in this parallel plane, they radiate upwards from the transmitting aerial at an angle which varies according to the frequency of the wave and time of day. They then come into contact with a reflecting layer in the ether which is termed the Heaviside layer, which reflects them earthwards again.

There is, therefore, an initial zone in the vicinity of the transmitter in which the direct signal is not heard at all. This distance of silence will vary, due to the factors previously stated, and is known as the skip distance. Normally the skip distance increases as the

wave decreases and during the hours of darkness. On the wavelengths under discussion this distance is in the region of 800-1000 miles; it may be more at times, but is often less. This process of reflection is continued throughout the whole process of propagation, and so the wave travels round the earth. Since the rays of the original transmission form a very large number of angles, and the angles of reflection also alter, it is generally heard at all points outside the skip distance, although there can be certain distances where a greater signal strength is received. This method of travel enables the wave to go much greater distances than the longer broadcast wavelengths at first referred to, without anything like the corresponding loss of strength. It is therefore possible, for example, to pick up the Chelmsford short wave transmission in Singapore and reproduce it on the loud speaker, whereas the London stations operating on the higher wavelengths with considerably more power are quite impossible to receive. It will also be appreciated that physical features of the surrounding country, such as a range of mountains, will not have the same absorbing or screening effect on the short wave transmission as on the longer wave one.

Another important feature of the short wavelengths is that as the wavelength decreases the amount of interference from atmospheric or static disturbances in the ether is also considerably decreased. Thus in the tropics, where this class of trouble can be very bad indeed, the short wavelength is a great advantage. Listeners, therefore, who are remote from any ordinary wavelength broadcasting station or are in the tropics can receive and enjoy broadcast programmes by means of shortwave transmissions, without which wireless reception would be for all general purposes impossible.

It is the short wavelength transmission which has developed and perfected the present long distance telephone by wireless link, by means of which it is possible for telephone conversations from one end of the world to another to be carried out.

ONE VALVE SHORT WAVE ADAPTOR

13.5 TO 87 METRES.

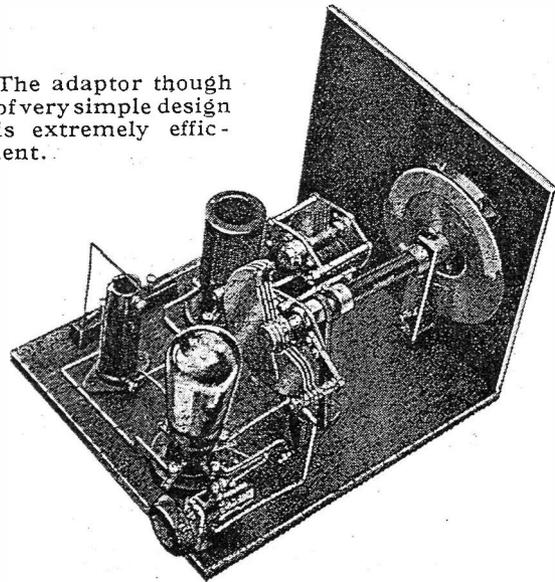
The use of this adaptor forms a very simple and convenient method of receiving short wave signals on any battery operated broadcast receiver. It is the only type of adaptor which can be used if the set does not employ one or more H.F. stages, and it is to be preferred to the super-heterodyne type of converter if the broadcast receiver only has one stage of H.F. which is not very efficient. The method of use is to remove the detector valve from the standard set, employing it in the adaptor, which is then coupled into the empty valveholder by means of a suitable plug. When the connections are made into the detector valveholder, the existing grid terminal of this is not used, thus cutting off the permanent aerial tuning part of the broadcast set, which is replaced by the short wave tuning circuit in the adaptor itself.

Considerable care has been extended to the design of this piece of apparatus in order that really good short wave results shall be obtained. A first class variable condenser is incorporated, and to prevent hand capacity and noise, resort is made to an extension spindle. The Eddystone disc drive which is used for driving the condenser through this latter is free from back-lash and has a suitable slow and smooth motion, which renders tuning a pleasure. The reaction control, so important if the most is to be obtained from the adaptor, has also a slow motion movement which permits of a really delicate adjustment. To prevent blind spots and bad reaction, a special short wave H.F. choke is utilized and the aerial is coupled by means of a midget variable condenser. The coils are of the interchangeable plug-in type so that no efficiency shall be lost through tapped coils and dead end effects. First class results are therefore possible, since the adaptor conforms to the best short wave practice.

CONSTRUCTION.

There are no difficulties whatever in this respect if the point to point connections and wiring plan are carefully followed. It is strongly urged, however, that the present components should not be substituted. The

The adaptor though of very simple design is extremely efficient.

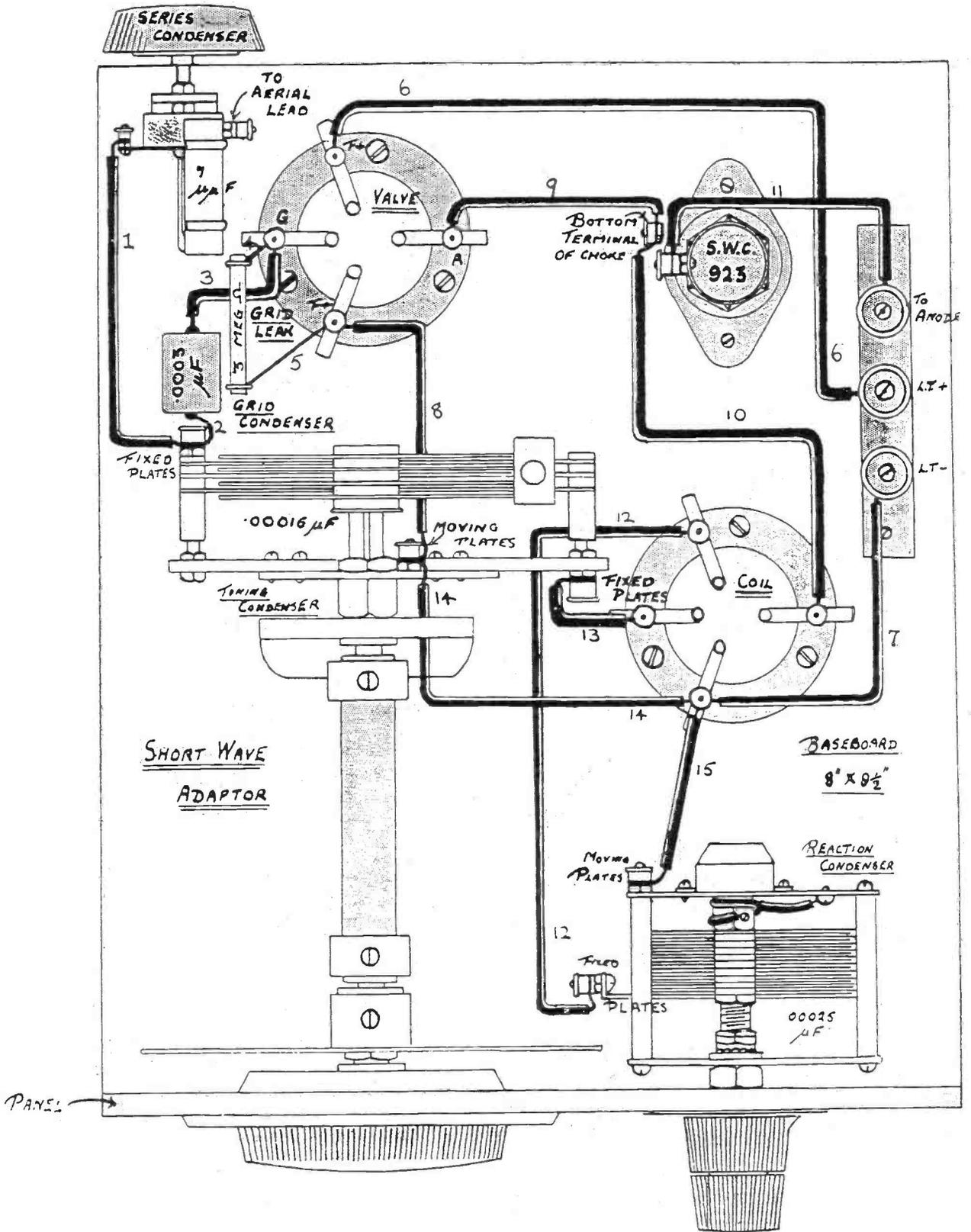


three leads from the adaptor terminals to the valve plug, for insertion into the detector valveholder of the set, should not be twisted together and must be of the shortest possible length. The lead from the terminal marked "To anode" is taken to the pin of the plug corresponding to the plate of the valveholder and the L.T.+ and L.T.— terminals to the two corresponding connections. Make sure that these two leads are not reversed.

OPERATING THE ADAPTOR.

The adaptor being ready for use, the detector valve from the set having been removed and inserted in its new position, and the adaptor plugged into the vacant holder with connections properly made, the set is switched on and tuning on the short wavelengths can commence. Insert one of the 4 pin coils of the wavelength desired and set both reaction condenser and tuning condenser at zero with the midget aerial condenser of the adaptor set at about half capacity. Increase the reaction condenser until oscillation is heard and then turn the main tuning dial slowly. There are plenty of morse stations which should be heard at once and search can then be made for telephony signals. Keep the

ONE VALVE SHORT WAVE ADAPTOR. WIRING PLAN.



ONE VALVE SHORT WAVE ADAPTOR—cont'd

adaptor just oscillating all the time by increasing the reaction control if necessary, since this simplifies tuning, but as soon as a telephony transmission is heard, slack the reaction control slightly and readjust tuning so that the transmission is heard without distortion. Careful setting of both reaction and tuning controls is essential for the best results. Never use the reaction control more than to just keep the adaptor oscillating. The aerial midget condenser can then be tried to find the best position, maximum signal strength probably being obtained with it at full capacity. This control is made variable so that any blind spots which may occur through the aerial in use can be avoided by an alteration of its setting.

LIST OF PARTS.

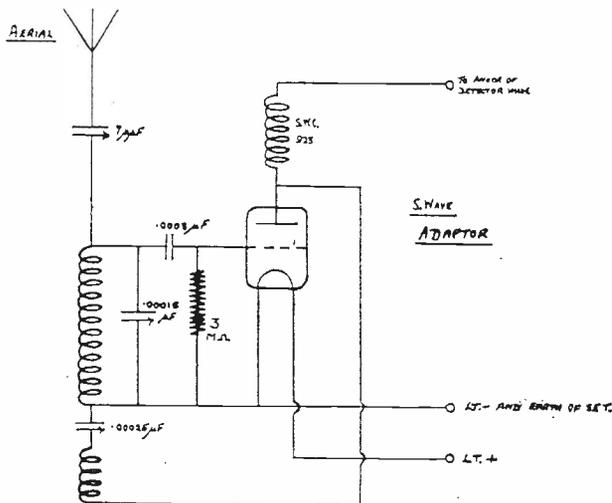
	Price
1 Bakelite Panel, 7½" × 8", drilled	4/-
1 Polished Baseboard, 9½" × 8", 7 ply	1/6
2 Eddystone Valveholders, type 501	2/6
1 Eddystone .00016 mfd. Condenser	9/6
1 Eddystone Disc Drive, type 933B	7/6
1 Eddystone Slow Motion Reaction Condenser, .00025 mfd.	9/6
1 Eddystone Midget Condenser	2/9
1 Eddystone Bracket for above	6d.
1 Eddystone 3" Extension Handle Outfit, No. 925	2/6
1 Eddystone H.F. Choke, type 923	2/6
1 Eddystone 4 Pin Coil, type LB., 13.5-29 metres	3/6
1 Eddystone 4 Pin Coil, type Y., 22.5-47 metres	3/6
1 Eddystone 4 Pin Coil, type R., 41-87 metres	3/6
1 T.C.C. .0003 Condenser Type M	1/-
1 Erie 3 meg. Grid Leak	1/-
1 Terminal Block with 3 terminals	1/-
1 Bulgin 4 Pin Adaptor Plug, type P.9.	2/-
Wire, Screws	6d.

Cost of parts, £2 18s. 9d.

POINT TO POINT CONNECTIONS.

- 1—Moving Plates of Aerial Series Condenser to Fixed Plates of .00016 mfd. Tuning Condenser.
- 2—Tag of .0003 mfd. Grid Condenser on to Fixed Plates.
- 3—Other end of Grid Condenser to Grid Terminal of Valveholder.
- 4—End of 3 megohm Grid Leak to Grid Terminal of Valveholder.
- 5—Other End of Grid Leak to Negative Filament Terminal.
- 6—Positive Filament Terminal to L.T.+ of Terminal Strip.
- 7—L.T. Neg. on Terminal Strip to Coil Holder Terminal.
- 8—Moving Plates of Tuning Condenser to F— of Valveholder.
- 9—A, Terminal of Valveholder to Bottom Terminal of H.F. Choke.
- 10—Bottom Terminal of Choke to Coil Holder.
- 11—Top Terminal of Choke to Anode of Terminal Strip.
- 12—Fixed Plates of Reaction Condenser to Coil Holder.
- 13—Fixed Terminal of Tuning Condenser to Coil Holder.
- 14—Moving Plates of Tuning Condenser to Coil Holder.
- 15—Moving Plates of Reaction Condenser to Coil Holder.

THEORETICAL CIRCUIT.



TROUBLE LOCATING

There are a number of troubles peculiar to short wave receivers, and these hints will provide a useful line of action which may be followed by beginners to locate and clear any faults arising. To simplify matters, troubles are grouped under different headings, but it should be borne in mind that one defect frequently has a direct bearing on another and it is always advisable to carry the investigations to all possible sources.

NOISES, CRACKLING, ETC.

First disconnect the aerial and earth leads from the receiver and if the trouble disappears the fault can be looked for outside the set. It may be that the noise is electrical interference coming from some external source such as a motor, electric fan, electric sign or bad atmospherical static. In the former case, it is sometimes possible to effect a remedy by tracing the source of the trouble and then getting permission to add apparatus to reduce it. In the second case, no complete remedy is possible. Static can, however, often be reduced by the use of a very small aerial, if possible indoors, although signal strength may also suffer. A very long outside aerial is definitely likely to bring in more atmospheric.

Severe noises, however, can be caused by the aerial and earth system itself. Check this over for loose joints, frayed or broken strands of wire, shake all wires to make sure that there is no intermittent break in the conductor. All contacts should be clean and well made and no intermittent contacts with buildings or trees should occur. It is worth remembering that when listening on the short waves, the ignition system of passing cars can often be picked up strongly. Check the earth lead and see that this is not responsible for noise. It is advisable to use insulated wire for this and see that a really good short earth return is obtained.

If the noises persist when the aerial and earth are removed, the trouble lies in the instrument, batteries or associated wiring. See that the terminals on the accumulators and the connectors are clean and free from corrosion—dirt here is a prevalent cause of trouble. Similarly, the H.T. connections. The H.T. battery or unit may be noisy, this can be checked by putting a pair of 'phones across sections of 20v. of it when, if in good silent working order, after the initial click at contact, nothing more will be heard. Do not hold the

telephone tags when making this test and test the battery in sections.

Shake every flexible lead to ensure no intermittent connection exists. Examine points where spade terminals, plugs, etc., join leads. Check 'phone and loud speaker cords. All the external causes of noise having been eliminated, we come to the receiver itself. Occasionally a valve may be noisy in operation, this can best be checked by substitution. Clean all coil and valve pins and with the aid of a knife blade, open out all pin leaves so that they make more positive contact with their sockets.

Make sure that no loose connections or badly soldered high resistance joints exist in the receiver wiring. Loose metal parts such as screws, nuts or terminals even, if not connected, will cause noise. Any components which have their earth returns made by being bolted or fastened to a metal chassis should be well tightened up and care taken to see that the two bearing surfaces are clean.

The component parts of the set now come under examination, and in order to locate which part of the receiver is causing the noise, remove the valves one at a time, commencing at the H.F. or detector end. If the noise ceases when the H.F. valve is pulled out, the trouble obviously lies in the parts associated with it; if the noise persists, obviously the trouble is in the detector or L.F. stages. Having located the portion of the circuit which is noisy, it remains to test the components likely to be at fault. A simple method is to use a pair of headphones in series with a small dry battery—a 15 volt G.B. battery is ideal, one tag of the 'phones and one lead from the battery forming the two testing ends.

All components which have continuity to a direct current, such as transformers, chokes, coils, resistances, grid-leaks, should show that continuity is intact by a distinct click when test connections are made. If no click is heard, they have broken down completely; if crackling is heard, the part is faulty and should be replaced. The click at contact will, of course, vary according to the resistance of the circuit and will be very much smaller in the case of a grid leak than a transformer winding. Fixed condensers can be tested with the same arrangement. In the case of small value condensers, no noise will be noticed at

TROUBLE LOCATING—continued

contact, but if they have short circuited or broken down, in insulation, a definite click or crackling noise will be heard. By-pass condensers of larger capacity will show the same symptoms if faulty, and though a click will appear at first contact, once they are charged to the same potential as the battery, no further click should be heard if the testing ends are taken off and then applied again. If the 'phone tags only are applied to the condenser some time after, and the insulation of the condenser is perfect, the noise of condenser discharging itself should be heard.

HAND CAPACITY, INSTABILITY.

These troubles often occur through bad lay-out of the components, coupling between different parts of circuit taking place. Do not lay-out your S.W. receiver in any haphazard manner but follow expert design and use only first class components. Grid and plate leads should be kept short and away from each other and the position of the H.F. choke should be carefully watched. The moving vanes of variable condensers must always be connected to the low potential side of the circuit. If both sides of a condenser are at high frequency potential, screening or extension rods should be used. An excessively long earth lead will cause hand capacity and this should be kept as short as possible. Sometimes no earth lead at all gives better results than a long poor one. If headphones are in use, it is sometimes desirable to use an output transformer or choke output, particularly if there is no H.F. valve in the set. It may also be necessary to use H.F. chokes and a by-pass condenser in the leads to the output. One choke in the plate lead itself usually suffices. All the remarks re connections, contacts, high resistance joints, poor earth returns, previously mentioned under the heading of noise apply here also.

THRESHOLD HOWL AND FIERCE REACTION.

Bad lay-out and components unsuitable for short wave use again cause these troubles. High resistance in the H.T. supply due to the battery running down will cause threshold howl, and by-pass condensers across the main supply and tappings will reduce this. Any high resistance joint in the set or to the batteries can be inspected. The grid condenser may be faulty, having high resistance connections inside, giving only a very small capacity

value. A faulty on and off switch with poor or dirty contacts will give bad threshold howl. The 'phones or loud speaker leads should be kept well away from the aerial, coupling between these will give very bad reaction. Damping the circuit with resistances across L.F. chokes or transformer windings will often cure threshold howl but reduces efficiency, and should be unnecessary with a well designed set. Reversing the connections to the primary or secondary of the transformer may be tried.

An unsuitable valve in the detector position is often employed with bad results, and this should be chosen very carefully and can really only be selected by trial. Good detector valves for S.W. receivers are the Mazda or Osram H.L.210 plain or metallised, both these valves are entirely non-microphonic.

Make sure the grid bias battery is up to full voltage.

Keep set boxed to exclude dust and dirt.

Test variable condensers to make sure vanes are not touching at any one point, this may account for the set not oscillating with a certain condenser setting. Clean out dust from between condenser vanes with a pipe cleaner.

Blind spots are often due to a H.F. choke with resonant peaks, or due to the same trouble in the aerial circuit. The latter can be overcome by the adjustment of a small midget condenser in series with the aerial lead to the set.

HETERODYNE WAVEMETER. LIST OF PARTS.

	Price
1 Eddystone Short Wave Condenser, .00016 mfd.	9/6
1 Eddystone Disc Drive	7/6
2 Eddystone Valveholders, Type 501	2/6
1 Eddystone 3" Extension Spindle with Bracket	2/6
1 Eddystone 4 pin Coil, type LB, 13/29 metres	3/6
1 Eddystone 4 pin Coil, type Y, 22/47 metres	3/6
1 Eddystone 4 pin Coil, type R, 41/87 metres	3/6
1 Eddystone 4 pin Coil, type W, 80/220 metres	4/-
1 Eddystone 4 pin Coil, type G, 210/520 metres	4/6
1 T.C.C. Fixed Condenser, .006 mfd. Type M.	1/9
1 Terminal Block with 2 terminals	9d.
1 On and Off Switch	1/6
1 Variable Colverstat, 2,500 ohms	5/6
1 Milliammeter, 0-2 m.amps.	£1/9/-
1 Battery Clip	1/-
1 Ebonite Panel, drilled for dial and meter	4/-
1 7 ply Baseboard	1/-
Wire, Screws, Wander Plugs, etc.	1/-
Cost of parts, £4 6s. 6d.	

GENERAL PURPOSE HETERODYNE WAVEMETER.

13-520 METRES RANGE.

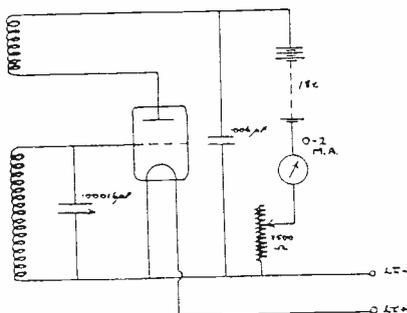
This is an exceedingly useful piece of apparatus which can be built up quite simply and inexpensively. It will be found a most helpful adjunct to all short wave enthusiasts and the extra coils for the medium waveband are available if desired. When once calibrated, the wavelengths of any unknown stations can be instantly determined, or by its means, the receiver can be adjusted to any required wavelength to find a station which it is desired to receive. In this latter way, much needless searching is avoided. The instrument also forms a most useful piece of testing gear, for since it is in reality a small transmitter in itself, there are many uses to which it can be put.

The H.T. voltage needed to make the valve oscillate can be of quite a low value and two 9 volt batteries have been incorporated in the apparatus itself for this purpose. This voltage can be drawn from an external battery if desired and the value is not critical. Since the calibrations of the meter can vary according to the emission of the valve, it is advisable to include a milliammeter in circuit. The potentiometer can then always be adjusted so that the valve emission is constant on the milliammeter and no variation in the calibrations takes place.

CONSTRUCTION AND CALIBRATION.

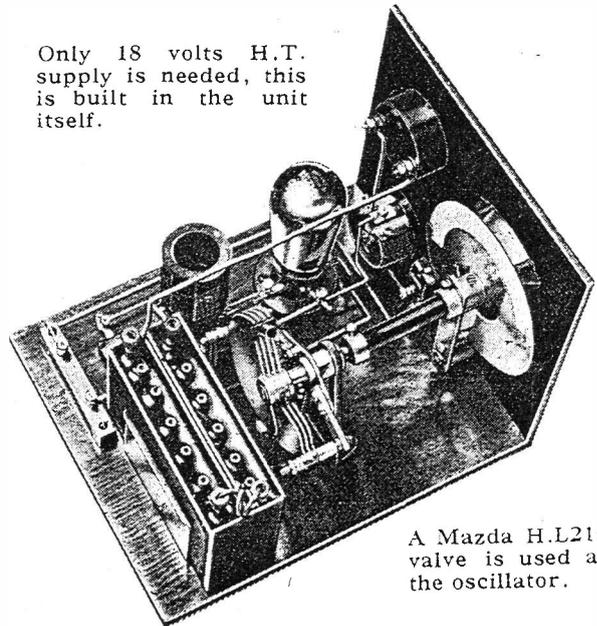
The construction presents no difficulties provided the wiring plan is followed out. Care should be taken, however, to make sure the extension spindle joining the disc drive and the variable condenser is in line, otherwise the dial action will be stiff and rough.

THEORETICAL CIRCUIT.



For list of parts see page 31.

Only 18 volts H.T. supply is needed, this is built in the unit itself.



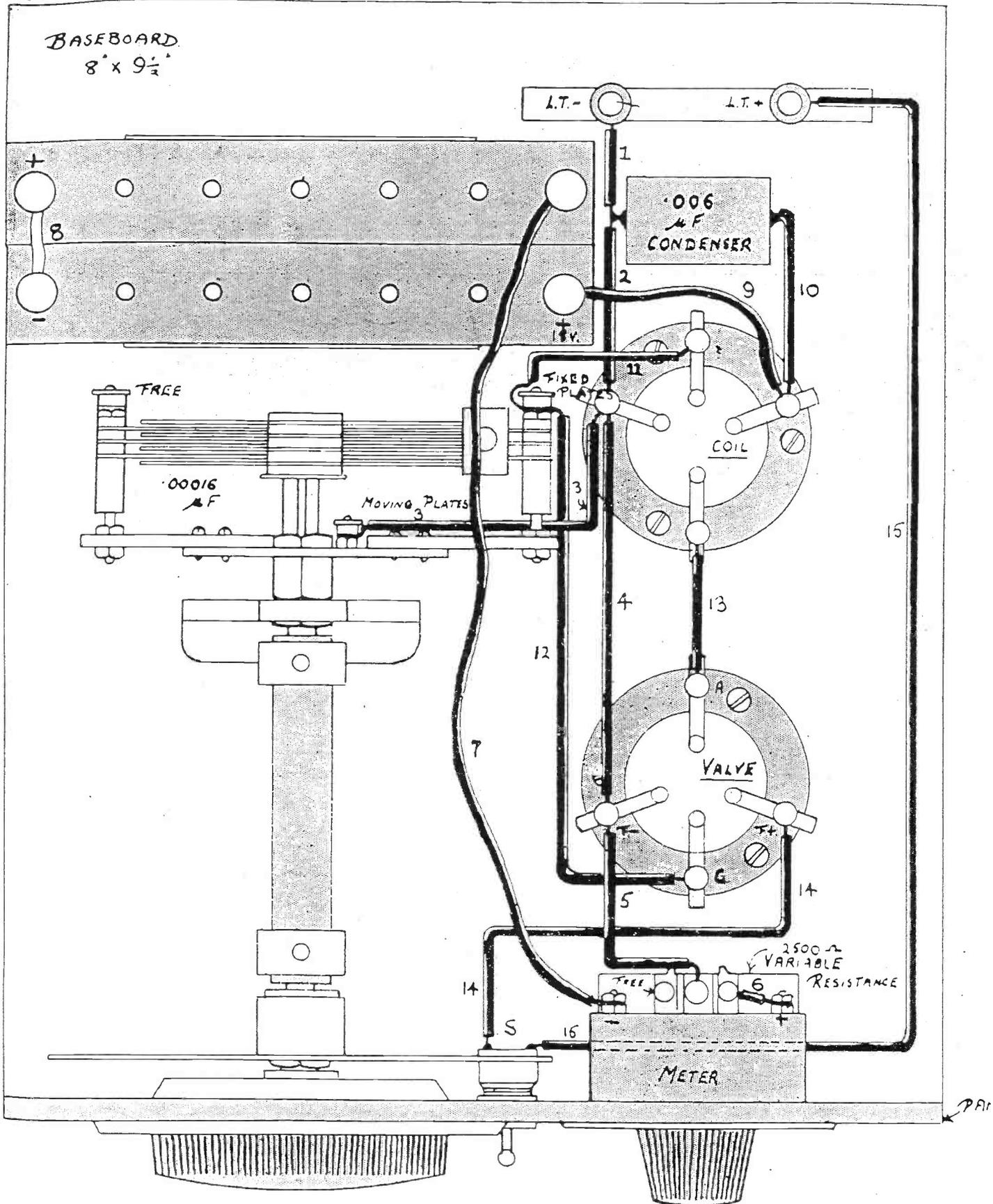
A Mazda H.L210 valve is used as the oscillator.

To calibrate, a graph for each coil range should be drawn on squared paper. The bottom co-ordinate being used for condenser degrees and the upright one for wavelength. The receiver should be tuned to five or six stations on each waveband, whose wavelengths are well known, the wavemeter adjusted until its note coincides with the transmission and then a point marked on the graph corresponding to the readings. The wavemeter should be placed at some little distance away from the receiver when making readings, which become more accurate as the distance is increased. Calibrating the instrument is an interesting and fascinating task.

POINT TO POINT CONNECTIONS.

- 1—L.T. — Terminal to one end of .006 mfd. Condenser.
- 2—.006 mfd. Condenser to Coil Holder.
- 3—Coil Holder to Moving Plates of Grid Condenser.
- 4—Coil Holder to F — of Valveholder.
- 5—F — of Valveholder to Slider of Variable Resistance.
- 6—End of Resistance to Plus Terminal of Meter.
- 7—Negative Terminal of Meter to Negative Plug of H.T. Battery.
- 8—Series connection for two 9 volt Batteries.
- 9—Plus of H.T. Battery to Coil Holder.
- 10—Coil Holder to .006 mfd. Condenser.
- 11—Fixed Plates of Condenser to Coil Holder.
- 12—Fixed Plates of Condenser to G of Valveholder.
- 13—A of Valveholder to Coil Holder.
- 14—F + of Valveholder to Switch S.
- 15—Switch S to L.T. + Terminal on Strip

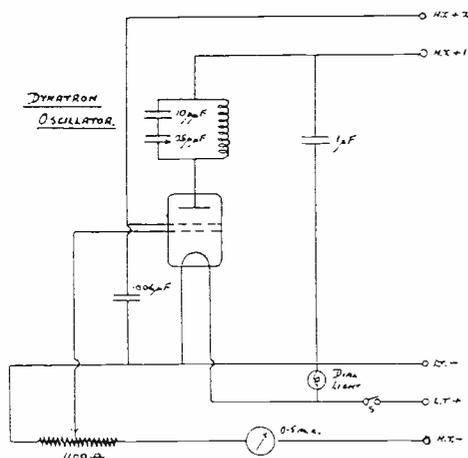
WIRING PLAN. HETERODYNE WAVEMETER.



DYNATRON FREQUENCY METER FOR THE AMATEUR WAVEBANDS

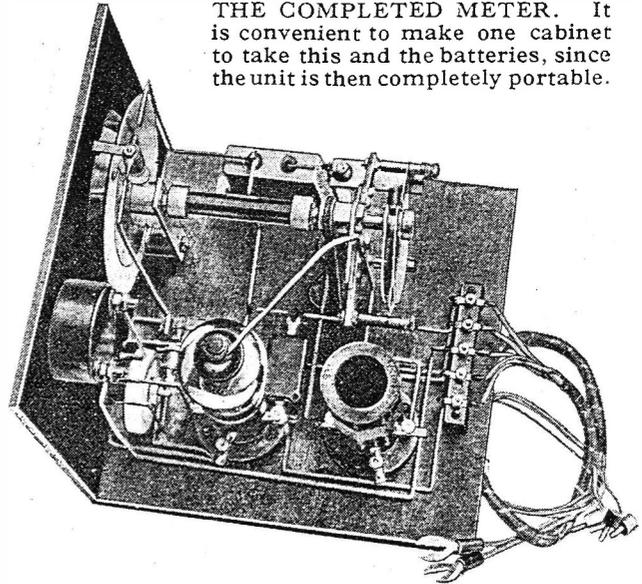
BY G BROWN, G.S.B.J.

As all amateur transmitters are aware, we are allowed only a very narrow band of frequencies in which to radiate. Therefore, we must have some sort of apparatus upon which we can depend, and the dynatron oscillator such as described in this article lends itself admirably for the purpose. This is because the dynatron arrangement is only exceeded in its stability by a crystal controlled valve. Further, only one single wound coil is necessary, and with carefully selected parts one can make up a meter with a very big dial spread, to give a calibration of about 2 K.C. in the 14 MC band, which is better than the Post Office demand of .1 per cent. Its construction is simple and with the help of a 0.5 millimeter, it is possible to be sure of one's frequency at all times, whatever the state of the batteries. Since, if the oscillator is calibrated at a determined value, usually about 4 milliamps, one can then always adjust the instrument by a potentiometer to that value and be sure of its setting for exact frequency. To calibrate the instrument, those of us who live here in England, can pick up the frequency signals sent out by the R.S.G.B. and also the A.R.R.L. signals sent out for the same purpose. There are also other methods one can adopt; the commercial stations which are just outside our bands, such as the Transatlantic 'Phone (Rugby) JN1 and JNA in the case of the 14 MC band. Having found a number of settings for known wavelengths it is quite an easy matter to make a graph with one co-ordinate for condenser degrees and the other for frequency or wavelength. The



Showing the theoretical circuit. The valve should be Mazda S.C 215 with 2v. L.T. supply and H.T. +1, 30-40 volts; H.T. +2, 100 volts.

THE COMPLETED METER. It is convenient to make one cabinet to take this and the batteries, since the unit is then completely portable.



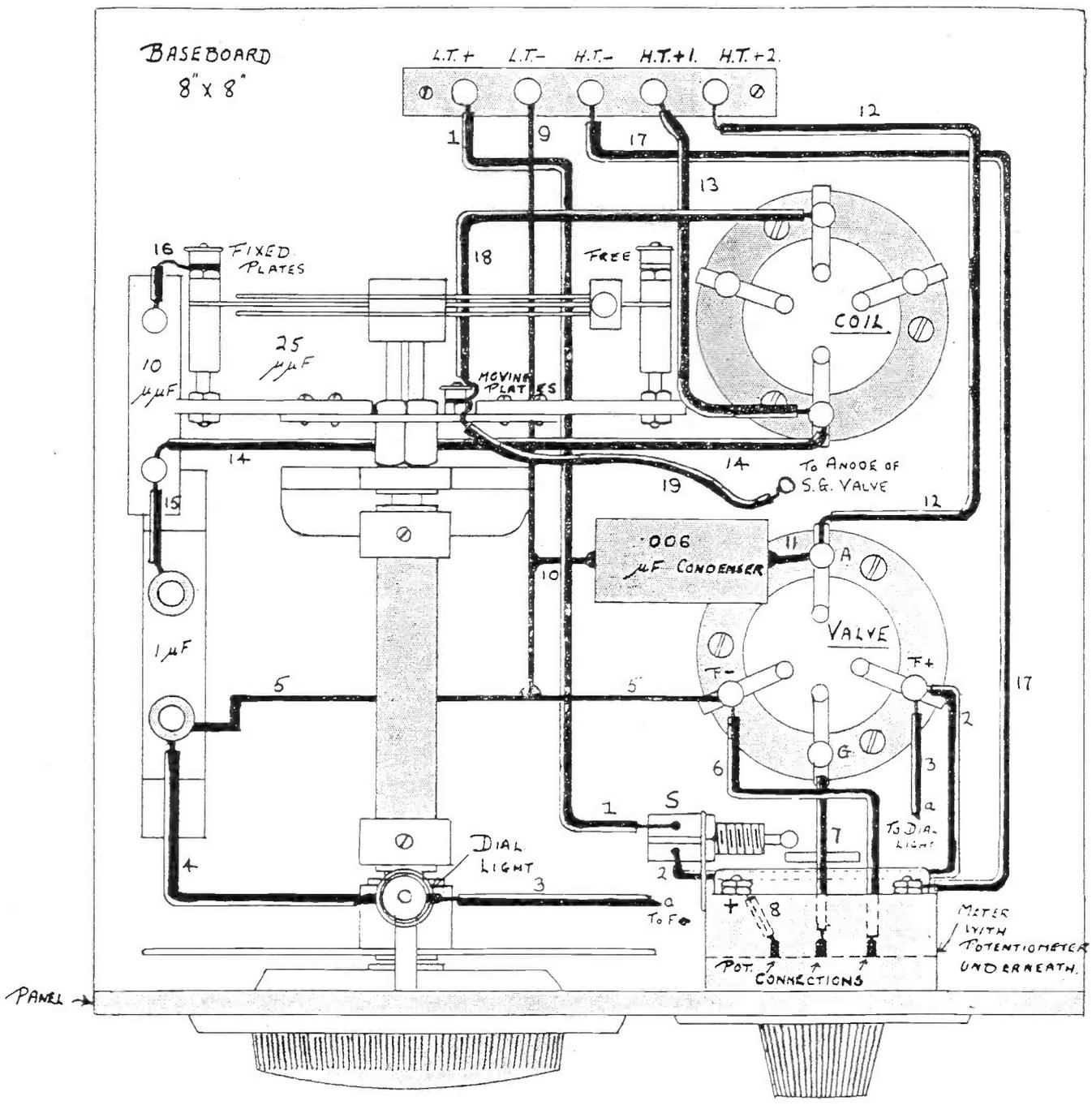
greater the number of known station frequencies the better for accuracy, but a comparative few will suffice since the curve of the condenser employed has no nasty dips or humps. The 3.5, 7, 14 and 28 MC bands can be plotted separately from known stations, or, since all fall in harmonic relationship with each other, curves for the remaining bands can be drawn from the first graph done. As can be seen from the illustrations and theoretical circuit herewith, the meter is a very simple one to build and the cost for such a useful precision instrument is a very moderate one. The construction is quite straightforward except that it might be mentioned that the switch is combined with the potentiometer.

LIST OF PARTS.

	Price
1 Eddystone Variable Condenser, type 922D	9/6
1 Eddystone Fixed Condenser, type 929	1/-
1 Eddystone 3" Extension Spindle and Bracket	2/6
1 Eddystone Disc Drive, type 933B	7/6
2 Eddystone Valveholders, type 501	2/8
1 Eddystone special 80 Metre Coil for Dynatron Frequency Meter	3/6
1 Eddystone Potentiometer with Combined Switch	9/-
1 Eddystone Terminal Block with Terminals	1/6
1 Fixed Condenser, .006, Type M.	1/9
1 Fixed Condenser, 1 mfd.	2/6
1 Milliammeter, 0.5 m.amps	£1,4-
1 Bakelite Panel, drilled for meter and disc drive, 8" x 7 1/2"	4/-
1 Baseboard, 7 ply, 8" x 8"	1/-
1 Set 5 way Leads	3/-

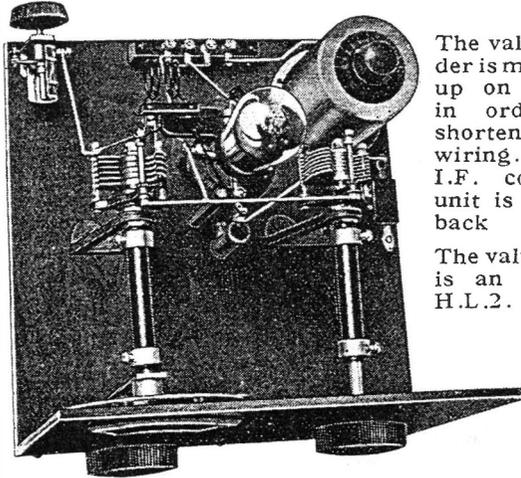
Cost of parts, £3 13s. 3d.

WIRING PLAN OF DYNATRON FREQUENCY METER



SEVEN METRE CONVERTER.

A converter for adapting the standard broadcast receiver to receive the experimental transmissions which are now being carried out on the ultra short wavelengths.



The valve holder is mounted up on pillars in order to shorten the wiring. The I.F. coupling unit is on the back right.

The valve used is an Osram H.L.2.

Although the present ultra short wave experiments being carried on by the B.B.C. are of a purely experimental nature, there is no doubt that these wavebands are full of possibilities for future development. The progress being made in this direction in other countries and their invaluable characteristics for television work ensure this. Moreover, the amateur transmitters of the country are now seriously turning their attention to the 5 metre band they are allotted and many private stations are conducting regular 5 metre transmissions. We know of no branch of wireless which is at present more worthy of interest to the really keen radio enthusiast, and we think that this converter, which enables the ultra short wave transmissions to be picked up without building costly and elaborate apparatus, will meet a definite need.

The converter works on the super-heterodyne principle and can only be used with a receiver employing one or more H.F. stages. It needs a small 2 volt accumulator and a 60 volt H.T. supply, which can be derived from present batteries in use or which must be provided if the receiver is an all electric one.

The circuit, though designed in the special way necessary for ultra short wave work, follows a conventional circuit which has proved the most satisfactory after much experimental

work. A good method of coupling to the standard receiver was found to be of prime importance and the special I.F. unit employed was produced for this purpose. It has a variable frequency over the medium broadcast band from 240-500 metres and the set must be tuned to a wavelength within this range.

CONSTRUCTION.

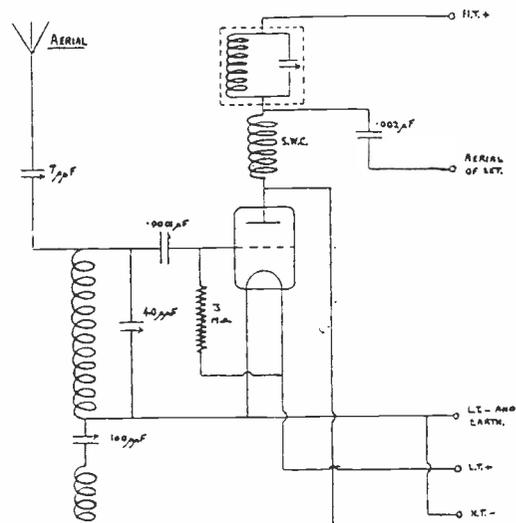
The construction is absolutely straightforward and needs no further amplification than the wiring plans given.

OPERATION.

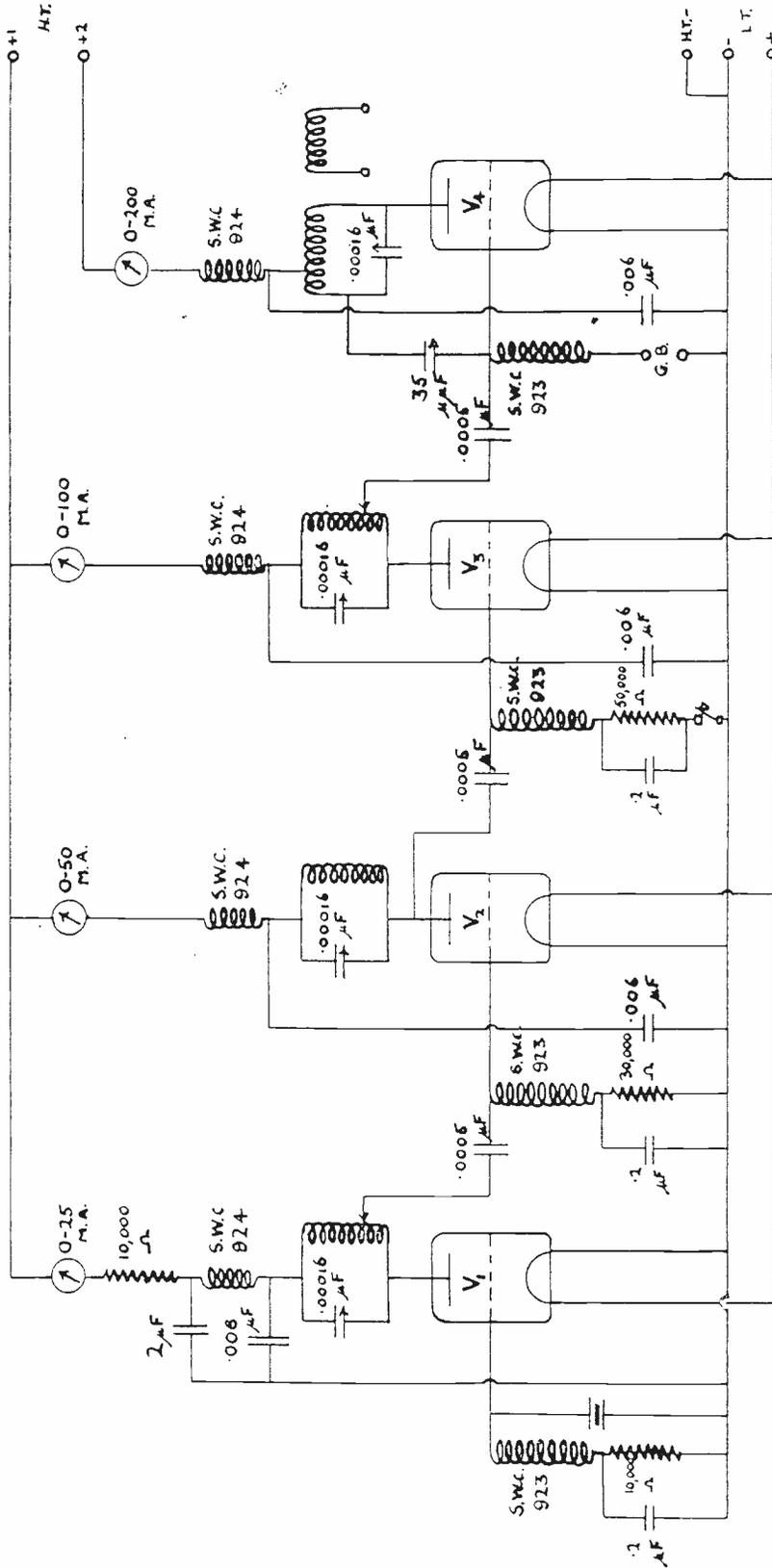
The operation is exactly similar to that already described in the 1 valve super het. converter for the standard short waves and is coupled to the receiver in the same manner. The reaction condenser should be set so that the converter is in an oscillating state and tuning, which will be found exceedingly fine, is then carried out in the usual manner. The wave-range covered by one coil is very limited and if it is desired to listen on the 5 or 10 metre bands, a suitable coil must be fitted.

THEORETICAL CIRCUIT.

We have to apologise for our draughtsman's enthusiasm regarding inductance turns.



CRYSTAL CONTROLLED TRANSMITTER FOR 14 MC WAVE BAND



LIST OF PARTS.

- | | | | |
|--|---|--|---|
| <ul style="list-style-type: none"> 3 Eddystone Valveholders, type 501. 1 Special Holder for Mullard D.O.40. 1 Eddystone 6 Pin Coil Base. 9 Stand-off Insulators. 4 Eddystone Variable Condensers, .00016 mfd. 4 Eddystone H.F. Chokes, type 924. 4 Eddystone H.F. Chokes, type 923. 3 Fixed Condensers, mica type, .0005 mfd. 3 Fixed Condensers, .2 mfd. (Helsby). 1 Milliammeter, 25 m/a. 1 Milliammeter, 50 m/a. 1 Milliammeter, 100 m/a. 1 Milliammeter, 200 m/a. | <ul style="list-style-type: none"> 1 80 metre Crystal and Holder. 3 Fixed Condensers, .006 mfd. (Dubilier) 1 Fixed Condenser, .006 mfd. working 1500 volts D.C. 1 Fixed Condenser, .2 mfd., 250 volts D.C. working. 1 10,000 ohm Resistance (Colvern strip type). 1 Eddystone Microdenser, 35 m.mfd. 1 10,000 ohm leak type Resistance (Mct.-Vick.) and Clip. 1 30,000 ohm leak type Resistance (Varley) and Clip. 1 50,000 ohm Resistance (Colvern strip type). 3 Osram L.S.5.B. 1 Mullard D.O.40. | <ul style="list-style-type: none"> Coils : 1 Eddystone 6 pin type Coil, 18 turns. 1 Transmitting Inductance, 9 turns $\times \frac{3}{16}$" tube. 1 Transmitting Inductance, 5 turns $\times \frac{3}{16}$" tube. 1 Transmitting Inductance, 7 turns $\times \frac{1}{4}$" tube. 1 Aerial Coupling Coil, 3 turns $\times \frac{1}{4}$" tube. 1 Slotted Strip for above. 2 Tapping Clips. | <ul style="list-style-type: none"> Power : 100 watts keyed. H.T. Supply : <ul style="list-style-type: none"> { H.T. +1 400/500 volts. { H.T. +2 1000 volts. |
|--|---|--|---|

SHORT WAVE STATIONS

IN ORDER OF WAVELENGTH

STATION	LOCATION	WAVE-LENGTH METRES	SCHEDULE	ALTERATIONS
LSY	Buenos Aires	14.47	'Phone to GB, 10 a.m.-2 p.m.	.....
GBA ..	Rugby	14.70	'Phone to ships. Irregular .. ..	.....
DHO ..	Nauen	14.97	'Phone to ships. 7 a.m.-11 a.m. .. ..	.....
CEC ..	Santiago	15.24	Commercial 'phone. 11 a.m.-4 p.m.	.....
DFA ..	Nauen	15.58	Commercial 'phone. 10 a.m.-2 p.m.	.....
PLE ..	Bandoeng, Java	15.93	Tues., 2.40-4.40 p.m. .. ..	.....
GBS ..	Rugby	16.38	Commercial 'phone. 6 a.m.-2 p.m. .. ..	.....
SHIPS ..	At Sea	17.05	Telephony. Daily .. ..	.....
W2XAD ..	Schnectady, N.Y.	19.56	Daily, 8-11 p.m. Sundays, 6-11 p.m.	.....
PARIS/COL	ONIAL	19.68	Daily, 1-4 p.m. .. ..	.....
ZEESEN	Germany	19.70	Monday, 8-6 p.m. .. ..	.....
W8XK ..	Pittsburg East	19.72	Relays KDKA, Wed., Sat., 12-4 p.m.	.....
HVJ ..	Vatican State	19.84	Daily, 12 noon .. ..	.....
AMATEURS	Worldwide	20.9-21.3	Daily .. ..	.....
RABAT ..	Morocco	23.38	Sunday, 12.30 p.m. .. ..	.....
CT3AQ ..	Radio Eddystone, Madeira	24	Thurs., Sundays, 11 p.m.-3 a.m.	.....
PARIS/COL	ONIAL	24.20	Daily, 4.30-7.30 p.m. .. ..	.....
W8XK ..	Pittsburg East	25.25	Daily, 5 p.m.-3 a.m. .. ..	.....
W9XAA	Chicago	25.34	Relays WCFL .. ..	.....
I2RO ..	Rome	25.4	Daily .. ..	.....
G5SW ..	Chelmsford	25.53	Relays B.B.C. National Programme ..	.....
LSX ..	Buenos Aires	28.98	'Phone and records, 9.30 p.m.-1.30 a.m.	.....
EAQ ..	Madrid	30.1	Daily Concerts, 12.30-2 p.m. .. ..	.....
VK2ME ..	Sydney and Melbourne	31.28	Sun., Wed., Sat., 6-8 a.m. 3.30-5.30 p.m.	.....
ZEESEN	Germany	31.38	Daily, 1 p.m.-1.30 a.m. .. ..	.....
W2XAF ..	Schnectady	31.48	Relays, WGY daily, 10 p.m.-4 a.m. ..	.....
CT3AQ ..	Radio Eddystone, Madeira	32.0	Tues., Thurs., 11 p.m.-3 a.m. .. ..	.....
RABAT ..	Morocco	32.26	Sunday, 8-10 p.m. .. ..	.....
SHIPS ..	At Sea	33.95	Telephony .. ..	.....
VE9BY ..	Canada	34.68	Irregular, Mon., 3-4 p.m. .. ..	.....
J1AA ..	Japan	38.07	Irregular 'phone .. ..	.....
HKF ..	Bogota	39.7	Daily .. ..	.....
HSP2 ..	Bangkok	41.10	Mondays, 2-5 p.m. .. ..	.....
AMATEURS	Worldwide	41.3-42.5	Daily .. ..	.....
CT1AA ..	Lisbon	42.90	Friday, 11 p.m. .. ..	.....
I2RO ..	Rome	43.0	Irregular .. ..	.....
REN ..	Moscow	45.38	Daily .. ..	.....
CN8MC ..	Casablanca	48.0	Mon., Tues. .. ..	.....
X1F ..	Mexico City	48.65	Irregular .. ..	.....
VE9CL ..	Winnipeg	48.8	Daily, 12.30-2.30 ex. Sunday .. ..	.....
W2XAL ..	Bound Brook, N.J.	49.18	Daily, 10 p.m.-6 a.m. .. ..	.....
W9XAA	Chicago	49.34	Daily, 2-5 a.m. .. ..	.....
UOR2 ..	Vienna	49.4	Experimental .. ..	.....
JOHANNES	BURG, S.A.	49.4	Daily, 4.30-9.30 p.m. .. ..	.....
VE9CS ..	Vancouver, B.C.	49.43	Irregular .. ..	.....
7LO ..	Nairobi, Kenya	49.5	Daily .. ..	.....
W8XAL ..	Cincinnati	49.5	Relays WLW .. ..	.....
W9XF ..	Chicago	49.93	Relays WENR .. ..	.....
VE9DR ..	Drummondville	49.96	Irregular .. ..	.....
MOSCOW	U.S.S.R.	50.0	Thurs., Suns. .. ..	.....

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 and read with consideration the article on trouble location 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.





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