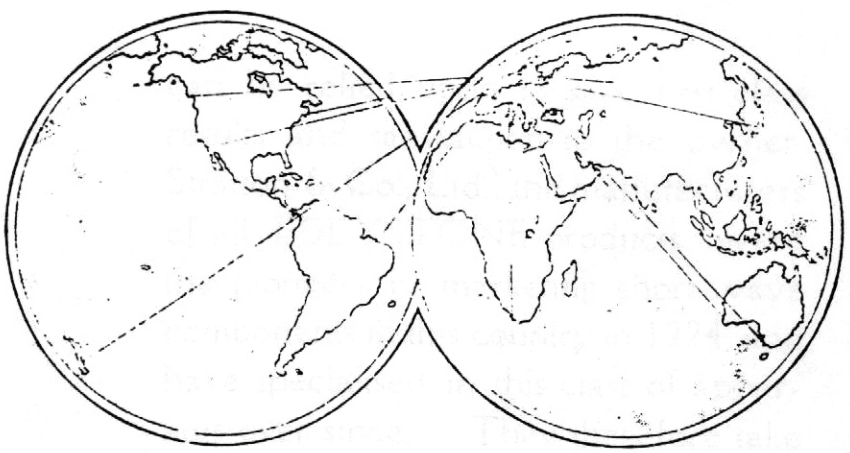
HOW to BUILD

. . A . .

SHORT WAVE RECEIVER WITH WORLD-WIDE RANGE.



The

EDDYSTONE

HOMELAND FOUR

PRICE:

SIXPENCE.

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Preface.

The short wave side of wireless has been a centre of interest to the wireless enthusiast for several years. Now, however, with improved receivers for this type of reception, it is being considered and adopted by an ever growing public. Particularly is this the case in overseas countries where wireless reception on the ordinary medium wavelengths is rendered impracticable due to the absence of local broadcasting facilities and the interference caused by atmospherics.

Under such conditions the short wave receiver comes to the fore ; it is capable of the reception of wireless programmes over vast distances and atmospheric disturbances are much reduced. Thus thousands of residents in remote tropical parts may enjoy the benefits of modern broadcasting and keep in direct touch with the world's news and music.

So important is this matter now considered that the erection of a new and powerful short wave station in England, using two wavelengths, is in progress and consideration is being given to the broadcasting of a 24 hours' service from it, so that it will cater for the whole British Empire and the world at large. Special arrangements have also been made with the news agencies for this station to broadcast news bulletins containing the latest items of news of interest to those overseas.

The advent of the screened grid high frequency valve has been a most important contribution to the progress of short wave receiver design and it is now possible to construct such a receiver that is easy to operate, is reliable and is capable of really first-class results. The " Homeland Four " employs such a valve and is offered as a kit of parts which can be assembled easily and efficiently without previous wireless experience. It is the result of six years' experience in short wave receiver design and is particularly recommended because of its simplicity of operation and its freedom from chance of breakdown or trouble.

We do not think that anyone who decides to build the receiver, either for experimental purposes or for the reception of short wave broadcast concerts, will regret the time and outlay spent in its construction, because we are confident it will give every satisfaction to its owner.

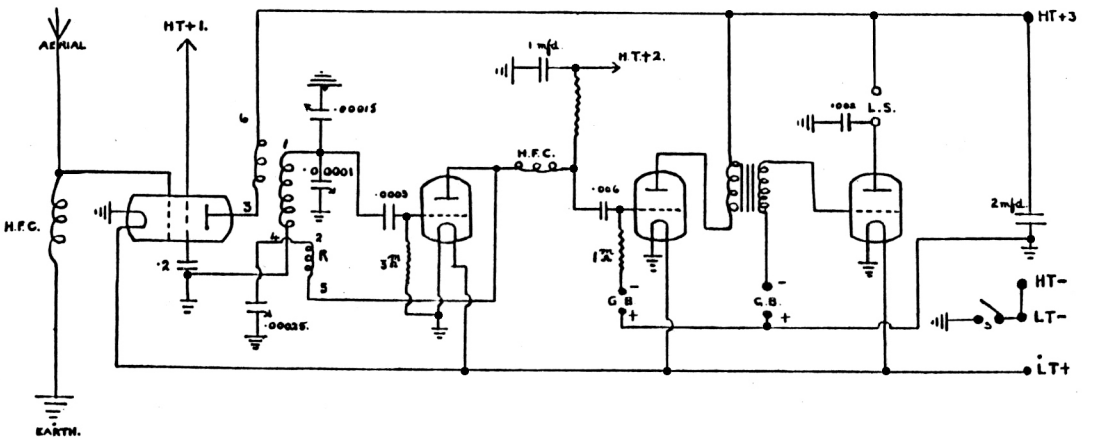
The Eddystone HOMELAND FOUR Short Wave Receiver.

CIRCUIT DESCRIPTION.

The receiver employs four valves of the latest construction. In the first stage of the set is the screened grid high frequency valve. This type of 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 opposite, 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. Leaky grid detection is employed and the detector 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 AF4 Transformer, which feeds the final output valve. This last valve can consist of an ordinary output valve, or where extra volume is required, a Pentode valve may be used. It will be observed that all the valves are of the high amplification type and since the circuit is arranged so that full use is made of this, the receiver has a very great overall amplification factor.

All components have been most carefully selected and chosen from experience of the bad climatic conditions which exist in some countries, so that immunity from breakdown under such conditions is assured.

The Eddystone Homeland Four Screened Grid H.F. Short Wave Receiver.



All connections marked thus ⏚ signify that either the component connection itself or the lead from the part concerned is taken direct to the metal chassis and the return lead is via this.

The metal chassis is common connection for L.T.—, H.T.—, Earth and G.B.+

THEORETICAL DIAGRAM OF CONNECTIONS.

CONSTRUCTION.

Unpack all the components and parts, laying them out so that a general idea of the assembly is obtained. Take the front panel, the metal baseboard and side-wings and fasten these together by means of the six screws and nuts which are necessary. Next the wooden strip which runs the whole length of the baseboard underneath at the extreme back should be screwed to the metal with three wood screws. Three holes for this will be found already punched in the metal chassis. This strip strengthens the baseboard and gives clearance room for certain wiring and the screw ends which clamp down the components; the terminal strip is also fastened to it. Next take one of the "EDDYSTONE" valve-holders, the 1 meg. grid leak, the .006 condenser and the 100,000 ohm resistance. These are all assembled together in the following manner. Bend the tags of the condenser gently at right angles to the condenser, one to the left and one to the right. Remove the terminal head from the grid terminal of the valve-holder. The grid socket is the one directly opposite the plate socket which is marked P on the wiring diagram, the other sockets being for the filament of the valve. The grid socket is in the centre of these last named and is spaced nearer to them than is the plate socket. Place one of the .006 condenser tabs over this grid terminal and then on top of this thread one side of the 1 meg. grid leak at right angles to the valve-holder and in line with the condenser, slip on a spring washer and clamp the whole down with the terminal top. The 100,000 ohm resistance is then fastened by one end, by means of a screw and nut and spring washer, to the other top tab of the condenser. This resistance points away from the valve-holder and is at right angles to the grid leak. The wiring diagram and lay-out diagrams of the set will also make this assembly clear. Now take another valve-holder, the .0003 grid condenser and the 3 meg. grid leak. Mount the grid leak across the grid and low tension negative terminals of the valve-holder (see wiring diagram). The terminal holes in the leak just fit the terminal spacing. One tab of the .0003 grid condenser is assembled on the grid terminal of the valve-holder over the leak and the two components are then fastened down with the terminal top.

The terminals should be mounted on the terminal strip, which can then be screwed on to the wooden strip supporting the baseboard at the back, by means of the three wood screws.

All the components can now be mounted to the panel and baseboard, this latter being drilled for each item makes the assembly one of no difficulty. The baseboard components are all clamped down directly by means of the spring washers, nuts and screws, with the exception of the 6 pin base and the valve-holders. These are mounted on insulating pillars, the coil having two ½" pillars under each end, raising it 1". In mounting the valve-holders to the baseboard, the negative filament socket connection is used as one of the fastening down screws, and the metal chassis itself forms the conductor for the negative filament supply to all valve-holders. It will be observed that one side of the switch is fastened to the chassis. The chassis also forms the earth connection for a number of the other components. Thus, only one wire is taken to the variable condensers, the return to earth being carried out where the fastening comes in contact with the panel. For the high tension negative connection from the fixed condensers, a wire is taken down from the top terminal of the condenser and fastened to the clamping screw which holds the component down to the baseboard. The low tension negative filament lead to the screened grid valve-holder is taken to the top terminal of the high frequency choke and is then connected to the metal stand which carries the choke, by means of the screw which goes right through. This filament feed then travels through the metal bracket of the choke to the chassis.

A certain number of wires are taken through and run along under the baseboard and then up again for the sake of convenience. For these leads, the rubber covered wire must be used and the leads themselves are shown in dotted lines on the wiring diagram. The .002 condenser which runs from the plate of the last valve to earth is connected by means of its tabs to the plate terminal of the valve and to one of the end plate screws on the .00035 reaction condenser. This condenser is the one on the right hand side of the panel, the .00015 on the left being the grid tuning condenser and the small vernier in the middle is in parallel. If a Pentode valve is to be used in the output stage, the extra lead from this

is taken from the high tension plus terminal of the loud speaker jack, as shown dotted in the diagram. Care should be taken when this lead is fitted to see that it does not hang loose and touch any of the other components or the high tension battery may be short circuited.

In mounting the condensers, metal packing washers are provided for use behind the panel so that the screw bush does not protrude beyond the front clamping nut. The dials are fixed by first inserting in the hole immediately under the spindle centre the small screw provided with them, the head of which slightly protrudes in front of the panel. The front end of the dial itself is then slacked off so that the collett slips over the spindle of the condenser. The dial is then put in position, the condenser vanes being full in and the dial reading 100°, when the collett is locked up tight so that it grips the spindle. The collett is locked by means of the spanners which are provided with each dial. Should the dial show any signs of being too tight or slipping, it can be adjusted by means of the small screws which hold the friction drive washers.

VALVES.

The valves for use with the receiver have been most carefully selected and are of the types specified below. The choice of valves is a most important matter, and we cannot guarantee the performance of the receiver if variation is made. It will be noticed that they are of 2 volt filament construction, and this is because the range of valves chosen are absolutely non-microphonic, which is not the case with the corresponding types in 4 volt and 6 volt.

Screened Grid H.F.	Detector	1st L.F.	2nd L.F.
Mazda S.G.215.	Mazda H.L.210.	Mazda H.L.210.	Mullard P.M.2.

The total filament current of all four valves is .5 amps. and the high tension current consumption, 11 to 12 milliamperes.

Increased volume can be obtained by using a Pentode valve in place of the P.M.2, the increase being approximately 33⅓%. If a gramophone pickup adaption is to be fitted, the Pentode

valve is a big advantage. The valve to use in place of the Mullard P.M.2 is the Mullard type P.M.22 Pentone. The use of this valve increases the filament consumption by .15 amps. and the high tension flow by 3 to 4 milliamperes.

ACCUMULATOR.

For use overseas, we recommend an Exide glass accumulator. The capacity will depend upon requirements, but an Exide type WZG4 at 22/-, 80 amp. actual capacity, will give 180 hours of use when the set is used for 3 hours each day. Type WZG3 at 17/6, 60 amp. capacity, 130 hours use, and type WZG2 at 13/-, 40 amp. capacity, 90 hours use. These batteries are designed to stand a slow discharge and will hold their charge over long periods. For ordinary use, any of the standard Exide batteries are suitable.

HIGH TENSION SUPPLY.

A 120 volts high tension supply is essential and up to 150 volts can be used with safety. The higher voltage is a slight advantage, and particularly for grampohone pickup work with the Pentode, but since the high tension consumption of the receiver is increased when the higher voltage is employed, when batteries are used, the lower voltage (120) is much more economical.

The tapping H.T.+1 should be taken to 75 to 80 volts, tapping H.T.+2 to 100 volts and the whole of the voltage in use to H.T.+3.

High tension accumulators form a very satisfactory source of supply for a short wave receiver and have the advantage of being rechargeable; they need, however, reasonable attention periodically to keep them in good order. They should not be totally exhausted and left in this condition for long periods. When dry high tension batteries are used, these should be of a large capacity. Small size cells are not economical in the long run and results are affected adversely when they begin to run down. Two Hellesen 60 volt triple capacity type units at 19/- each will give several months' hard service and are recommended.

The set can be operated from electric mains for H.T. supply or with the special " EDDYSTONE " eliminators which have been designed for the purpose.

FOR USE WITH D.C. MAINS 200-250 VOLT.

" EDDYSTONE " Eliminator type D.C.4 .. £3 16s. 0d.

FOR USE WITH A.C. MAINS 100-150 VOLT OR 200-250 VOLT.

" EDDYSTONE " Eliminator type A.C.4. . £7 5s. 0d.

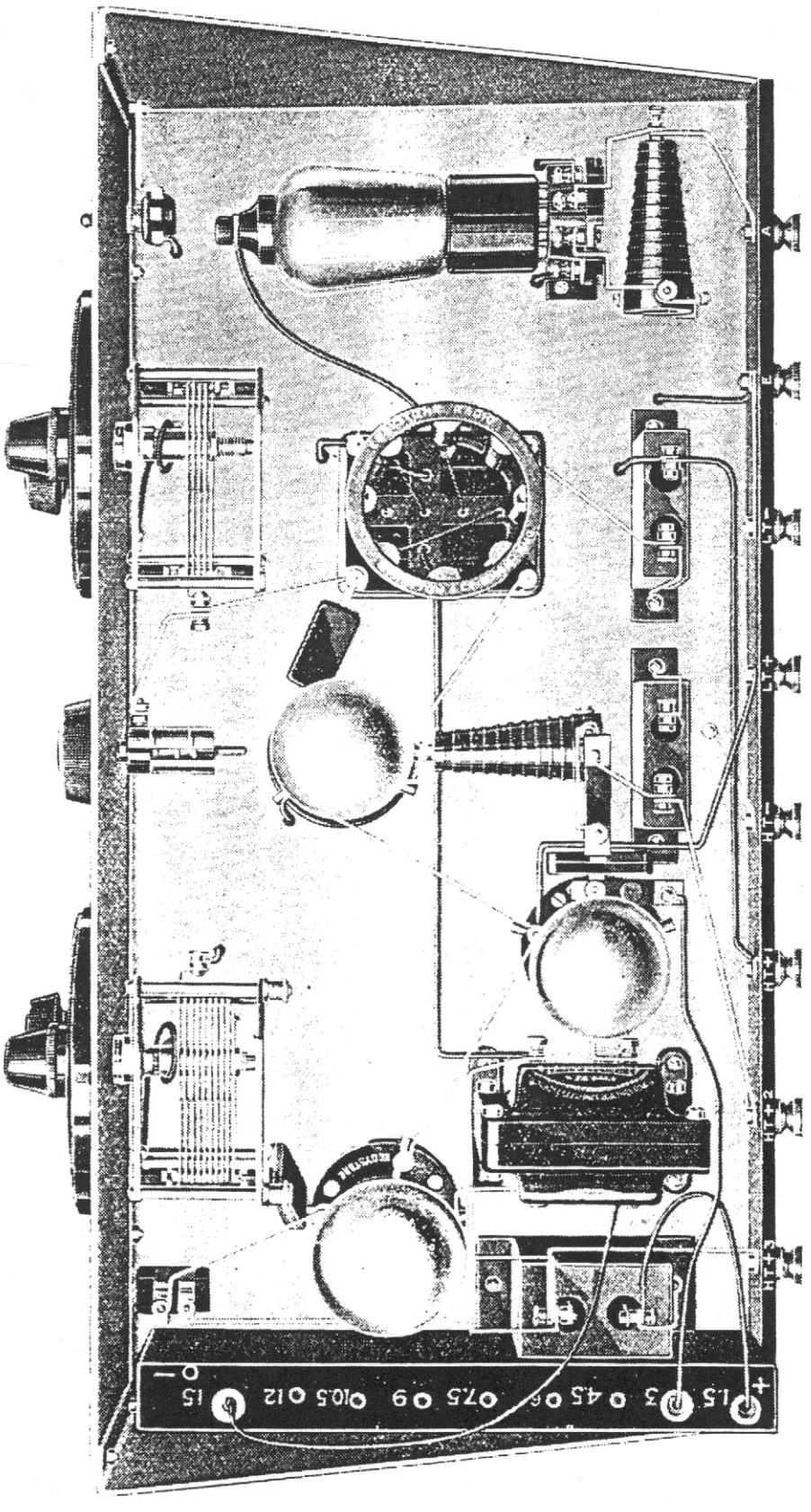
GRID BIAS.

When the P.M.2 output valve is used, the grid bias battery can consist of a 9 volt unit, the lead marked G.B.+ is taken to the positive terminal of this battery, the lead marked G.B.—1 is taken to the first tapping in the battery, which is 1.5 volts negative, while the G.B.—2 lead is taken to the socket at the extreme end of the battery, which is 9 volts negative. These settings are applicable when high tension voltages between 120 and 150 volts are used.

When the P.M.22 Pentode valve is used in place of the P.M.2, a 15 volt grid bias battery must be used. G.B.+ is taken to the positive of the battery, G.B.—1 to 1½ volts negative and G.B.—2 should be taken to the 10.5 or 12 volt socket, with 120 volts H.T., or if 150 volts are used, 13.5 or 15 volts will be necessary. The grid bias plugs should not be adjusted in the battery while the receiver is switched on. On very powerful signals, or when a gramophone pickup is in use, the G.B.—2 tapping may be reduced slightly with advantage, but it should always be remembered that the more grid bias that is used, the less high tension consumption is taken by the valves.

A .9 volt cell can be inserted in series with the first high frequency choke at the earth end, with the negative side to the choke and the positive connected to earth if desired. This does not materially affect results, but a saving of 1 milliamp H.T. current is obtained. On a very powerful local signal, it is an advantage. This cell is not shown on the diagrams.

THE EDDYSTONE HOMELAND FOUR SHORT WAVE RECEIVER.

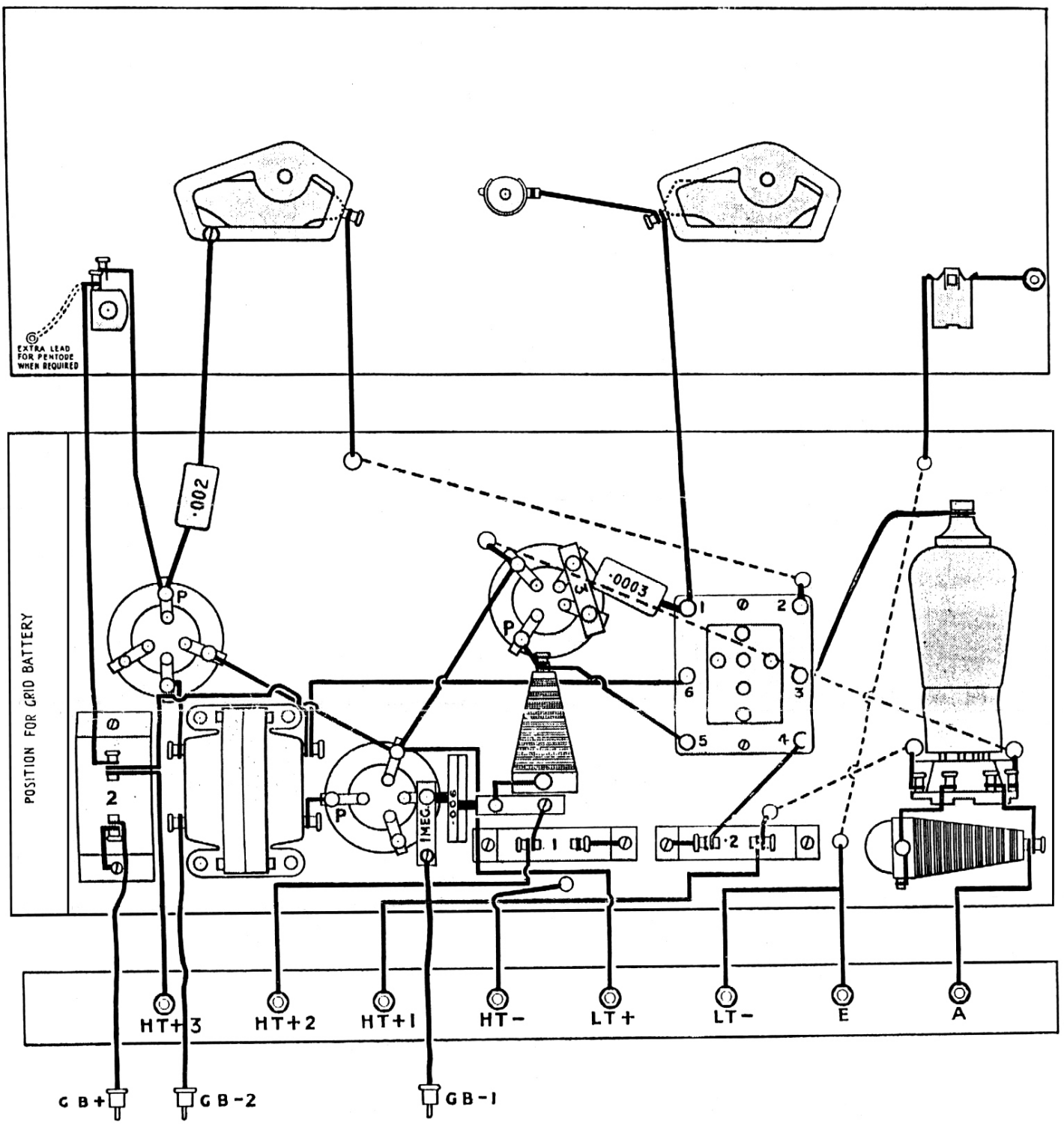


Photograph showing Wiring and Baseboard layout.

THE EDDYSTONE

HOMELAND FOUR

Short Wave Receiver.



COMPLETE WIRING DETAILS SHOWING PANEL, BASEBOARD AND TERMINAL STRIPS.

COIL RANGE TABLE.

COIL	WAVELENGTH IN METRES FOR TUNER DIAL READINGS. 0°	20°	40°	60°	80°	100°
No. 4LB Blue Spot	12.5 metres	15 metres	17.5 metres	20.25 metres	24 metres	28.75 metres
No. 4Y Yellow Spot	28.75 metres	30.5 metres	35.5 metres	42.5 metres	50.25 metres	56 metres
No. 4R Red Spot	44.75 metres	48.75 metres	57.5 metres	66 metres	76.5 metres	90 metres
No. 4G Green Spot	258 metres	275 metres	336 metres	382 metres	439 metres	503 metres

The above table may vary slightly in the accuracy of the figures given, owing to varying circumstances such as different valves, but will always be approximately correct, and serves as a useful guide.

Extra coils for other wavelengths :—

No. 4W	80—170 metres	.. .. ..	5/-
No. 4P	160—270 ,,	.. .. ..	5/-
No. 4BR	490—1000 ,,	.. .. ..	5/6
No. 4GY	900—2000 ,,	.. .. ..	5/6

ABOVE NUMBERS SHOULD READ

2LB. 2Y. 2R. 2G.
2W. 2P. 2BR. 2GY.

CONNECTING UP.

Before connecting the batteries, the connections should be carefully checked to see that these are all in order. First of all, plug in the grid bias connections, then connect the low tension positive and negative terminals to the respective terminals on the accumulator, when, this being done, the high tension connections can be made. The voltages in the high tension supply to which these should be connected have already been described in the notes under high tension supply. As a precautionary measure, before inserting the valves, the voltage across the filament terminals of the valve-holders can be tested to make sure that no more than 2 volts is present. It is also advisable before actually putting in the valves to disconnect the high tension battery, and when they have all been correctly inserted in the valve-holders, these connections can be remade. It only remains to put on the aerial and earth and to plug in the loud speaker or headphones, when the set is ready for trial.

OPERATING THE SET.

First of all, the suitable coil for the wavelength range which is desired, should be inserted, then starting with both dials at zero on the degree scales, switch the receiver on by means of the low tension switch. A distinct click should be heard when the filaments are switched on. Increase the reaction dial, which is the one on the right hand side, slowly. 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 just in this oscillating condition. The reaction control should never be turned any more than is necessary for the first rushing sound to be heard. Now commence turning the tuning dial, that is the left hand one, 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, although for reception of morse signals, this oscillating condition is always necessary.

The centre knob which operates the small vernier condenser, will be found useful for fine tuning of telephony stations. It works in parallel with the main tuning condenser, and increasing or decreasing its capacity is the same as altering the tuning condenser dial. The coils will require changing to cover the various wavelength ranges. A chart showing the approximate wavelength ranges and condenser settings will be found on page 12, the position of the small vernier condenser will, however, alter slightly the setting on the main tuning dial.

RESULTS.

The receiver, when tested on an aerial 45 feet long and 35 feet high which was quite open and in no way screened, gave excellent loud speaker results on many stations. The American stations 2XAF and 2XAD and 8XK came in at good strength, each of them varying according to the time of day, as would be expected from their wavelength. The Atlantic telephony transmissions on several wavelengths and the Dutch telephony service between Java and Holland, from both ends, were also received clearly. The Dutch short wave transmitter PCJ, which was about 600 miles away, and the German short wave sender at Königswusterhausen, about 1,000 miles away, were easily received and both taxed the loud speaker fully. A large number of amateur transmissions on the 40 metre band were also well heard. On the

broadcast waveband, the set did not prove ultra selective on account of the small value tuning condenser which must be employed. Although this is only of .C0015 capacity, the special broadcast coil covers a range of from 250 to 500 metres. Stations were, however, heard all round the dial, and when no powerful local interference is present, the receiver is capable of reception on the medium wavelengths over very large distances. Eight or nine of the principal European stations were received on the loud speaker without interference. Stations immediately near the wavelengths of the local English stations suffered, however, from interference due to the facts already mentioned.

AERIAL AND EARTH SYSTEM.

Since the amount of signal current that is conveyed to the receiver depends entirely on the efficiency of the aerial earth system, it is always worth the extra trouble and initial expense to arrange for this to be as efficient as circumstances will permit. The main essentials are to arrange that the aerial is open and not screened by surrounding trees or buildings, that it shall be of good height and of good insulation. An inverted L type aerial is suitable for short wave reception with the horizontal portion at least 30 feet high, although 40 feet is better. If sloping, the highest end should be the end away from the receiver. The lead-in from the aerial should be kept well away from the house and go direct to the lead-in tube. It should be taken from the aerial quite close to the insulators and not from several yards away. If a T aerial is most convenient, of course the lead-in will come from the centre. The receiver should be placed as near the lead-in wire as convenient, a long lead to the set running round a room tacked to the wall is very detrimental.

The total length should be not more that 60 feet and not less than 30 feet ; if the latter short length is used, it can be erected vertically. A soft copper aerial wire cannot be bettered, and 7/22's enamelled wire is very suitable. At least two good insulators should be placed at each end where it is supported, and if a metal

mast is used, it is a good plan to insulate it at the bottom. Similarly, metal stay wires supporting a mast should be insulated from the ground. Loose or dirty connections in the aerial or lead-in, or even a broken strand of wire, may cause unpleasant noises in reception and should be guarded against.

The earth lead should consist of insulated wire from the receiver to the point where the earth connection is actually made. This is because if bare wire is used, it may through partial earthing on the way to the ground, cause unsteady tuning or noises in the receiver. The earth should consist of a large metal object well buried ; if in a damp soil it is always better, or an earth to a water pipe, if one is available, is usually excellent.

How to cure trouble.

NOISY RECEIVER.

(1) Take off aerial and earth, leaving receiver switched on ; if the noise disappears, check all the aerial and earth system to see if every joint is clean and tight. If the receiver is quite quiet without aerial and earth and everything in the receiving system is in order, it can be assumed that the disturbance is electrical or atmospherical—that is, being picked up and cannot be eliminated at your end.

(2) If the noise or crackle persists when the aerial is disconnected check the connections to the H.T. supply and see that accumulator terminals and connections are all clean, bright and tight. Shake each lead and loud speaker feeds to make sure no intermittent joint exists in these.

(3) Open out and clean valve pins and sockets, coil pins and sockets.

(4) Make sure no loose joints or connections exist in the wiring of the receiver and that there are no loose metal parts such as nuts or terminals. These will cause noise even though no connection is made to them.

(5) Test the windings of all components such as transformers, coils, chokes, with a pair of headphones and battery in series; if a faulty winding is present, it will cause crackling.

(6) Similarly test fixed condensers, which, if they should have broken down in insulation, will also cause crackling noises.

(7) Make sure the moving vanes of the variable condensers are not bent and touching the fixed ones.

NO SIGNALS.

(1) Check valves to ensure all are O.K.

(2) Check H.T. and L.T. batteries, loud speaker and leads.

(3) Test all components with windings for continuity.

(4) Test all condensers for insulation.

(5) To find out which part of the receiver is faulty, proceed as follows: Take out H.T.+3 wander plug and reinsert, if a loud click is heard in the speaker, the last valve and speaker are O.K. Then touch the grid terminal of the valve immediately preceding the last valve, if this is heard in the speaker, this valve and the transformer are working. Repeat touching the grid of the two preceding valves until the portion of the set which is causing the trouble can be localised and the part at fault found.

List of Principal Short Wave Stations

Metres	Kilocycles	Alterations.	
80	3750		Constantine (Algeria) 8KR.
80	3750		Rome (Italy), 3RO, 9 kW. (aerial).
70.1	4280		Khabarovsk (U.S.S.R.)
67.65	4434		Döberitz (AFK), 5 kW.
58	5172		Prague.
52	5769		Bergedorf (Germany), AFL, 3 kW.
50	6000		Moscow.
49.05	6096		Tegucigalpa (Honduras) KRB.
49.83	6020		Chicago (Ill.) W9XF.
49.5	6060		Philadelphia (Pa.) W3XAU. 0.5 kW.
49.34	6080		Newark (N.J.) W2XCX.
49.18	6105		Bound Brook (N.J.) W3XAL.
49.02	6120		Richmond Hill, N.Y. (W2XE).
48.86	6140		Pittsburgh East (W8XK).
48.3	6147		Manila (Philippine Islands) KZRM.
48.4	6198		Bogota (Colombia) HKC.
47	6382		Funchal (Madeira) CT3AG.
44	6818		San Lazaro (Mexico) XDA. 3 kW.
43.86	6840		Georgetown (British Guiana) VRY.o.12kW.
43	6976		Madrid (EAR110).
41.7	7194		Canary Islands.
40.2	7463		Lyons (Rhone) YR.
37.02	8100		Bangkok (Siam) HS4PJ.
32.5	9230		Sydney (2BL).
32.5	9230		Paris, Eiffel Tower (FL).
32	9375		San Lazaro (Mexico) XDA, 20 kW.
31.48	9530		Schenectady N.Y. (W2XAF). 10 kW. (Aer.).
31.38	9560		Zeesen (Germany).
31.28	9590		Eindhoven (Holland) PCJ. 25 kW.
31.28	9590		Sydney 2FC.
31.25	9600		Bergen LGN.
31.1	9677		Nairobi (Kenya) 7LO.
30.5	9836		Heredia (Costa Rica) NRH.
29.5	10167		Bangkok (Siam) HS2PJ. 0.5 kW.
25.6	11718		Winnipeg (Canada) CJRX, 2 kW.
25.53	11751		Chelmsford (G5SW), 15 kW. (Aer.).
25.4	11810		Rome (Italy), 3RO, 9 kW. (aerial).
25.26	11880		Pittsburgh East (W8XK).
24.5	12240		Manila (Philippine Islands) K1XR.
19.72	15210		Pittsburgh East W8XK.
19.56	15340		Schenectady (W2XAD).
16.9	17750		Bangkok (Siam) HS1PJ, 20 kW.
16.8	17850		Bandoeng (Java) PLF, 30 kW.
16.3	18404		Kootwyk (Holland) PCK.
16	18750		San Lazaro (Mexico) XDA, 20 kW.
15.94	18818		Bandoeng (PLE).
15.02	19937		Buenos Aires (Monte Grande) LSG.

Station Log.

Station	Wavelength	Tuner Condenser Reading	Reaction Condenser Reading	Remarks

Note.—The reaction dial reading will vary with the H.T. −2 voltage.

EDDYSTONE
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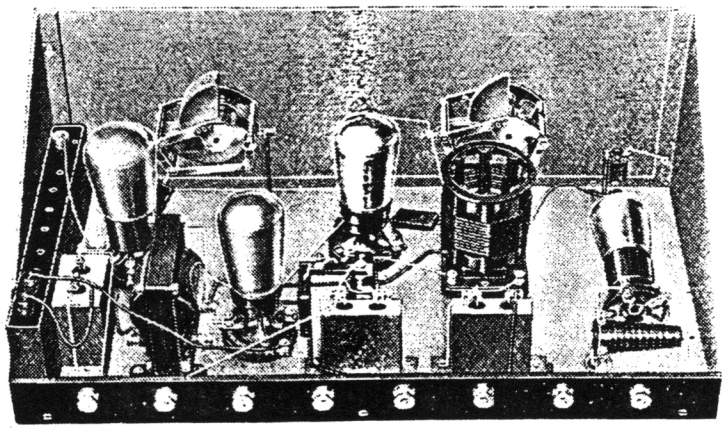

THIS SHOWS THE RECEIVER AS IT WILL APPEAR WHEN COMPLETED AND VALVES, COIL AND GRID BATTERY INSERTED.

It is our hope that when the assembly is completed it will give every satisfaction and no trouble. We would mention, however, that should you experience any difficulty in assembling, trouble in operating, or poor working, we shall always be very pleased to advise you.

When writing to us concerning any trouble, always give as much information as possible.

If the trouble is indifferent results, give details of aerial, earth, valves and batteries, and condition of the latter that are in use.