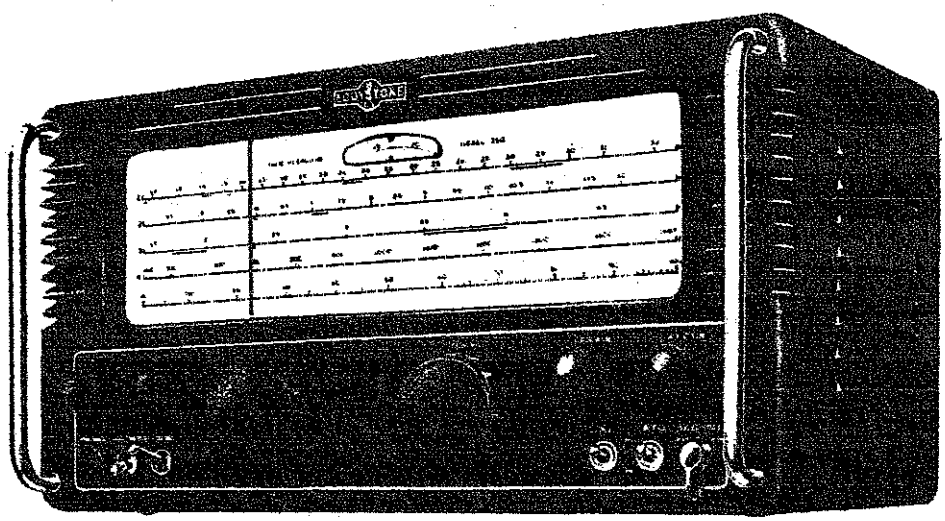

EDDYSTONE

COMMUNICATIONS RECEIVER

Model "750"

Instruction Manual

The Eddystone "750" receiver is of the double superhetrodyne type and combines high sensitivity with an unusually good signal-to-noise ratio. All but two of the eleven valves are of the miniature type, details being provided with the circuit diagram. The selectivity is continuously variable over wide limits and this feature, in conjunction with the separate RF, IF and AF gain controls, enables maximum results to be secured under varying conditions of operation.

The four ranges are as follows :

Band 1	....	32 Mc/s. to 12 Mc/s.
Band 2	....	12 Mc/s. to 4·5 Mc/s.
Band 3	....	4·5 Mc/s. to 1·7 Mc/s.
Band 4	...	1465 Kc/s. to 480 Kc/s.

The fifth position of the wavechange switch desensitises the RF section of the receiver to permit a pick-up to be used without break-through.

The Amateur Bands are distinctively marked in green, on the basis of the International allocations made at the Atlantic City Conference in 1947. The broadcast bands are shown in red. It should be noted that the scale markings (all in frequency) are linear and also that the International Distress frequency of 500 Kc/s. is covered.

INSTALLATION and OPERATION

The receiver has been carefully aligned and calibrated, and thoroughly tested before despatch. The only adjustment that may be necessary is the mains input voltage. The plug in the selector panel on the transformer is fitted normally in the 230 volt position, where it should remain for voltages between 220 and 250 volts. If the mains voltage is between 195 and 215 volts, the plug should be changed to the 200 volt position. The 110 volt tap is suitable for mains supplies between 100 and 125 volts.

D.C. mains supplies are entirely unsuitable and if connected will cause serious damage. **Ensure that the octal plug is in place** in the octal socket " B " (nearest the side of the cabinet) as shown in the drawing, Fig. 2.

A loudspeaker of 2·5 to 3 ohms impedance should be connected to the two upper terminals at the rear (the Eddystone Cat. No. 688 is especially recommended for use with this receiver), or alternatively high resistance (2,000 to 4,000 ohms) telephones plugged into the jack at the left of the front panel.

The fuse fitted between the H.T. secondary centre tap and chassis is a " Magnickel " delayed type. A standard type of fuse is liable to blow if the receiver is switched off (mains switch) and immediately switched on again without giving the rectifier valve time to cool.

AERIAL CONNECTIONS.

If a single long wire is used or any aerial with a single wire type of feeder, connection is made to the rear terminal marked " A," the other terminal marked " AE " remaining strapped to the chassis. A good earth connected by a short lead to the second terminal will improve results, particularly on the lower frequencies, but if there is any doubt about the efficiency of the earth, it may be better to leave it off.

For optimum performance, both as regards bringing in weak signals and for keeping noise down to a minimum, an aerial cut to resonate over the frequency band in which the user is mainly interested is strongly recommended. The lengths for dipole aerials to give optimum results at certain frequencies are tabulated below. For details of other types of aerials and feeder systems, the reader is advised to consult the various Handbooks which deal with these specialised subjects.

	Broadcast							Amateur		
Wavelength (Metres) ..	49	31	25	19	16	13	11	40	20	10
Frequency (Megacycles) ..	6·1	9·6	11·8	15·1	17·8	21·5	26	7	14	28
Length of each arm (feet)	40	26	20	15·5	13	10·5	9	33	16·5	8·25

RECEPTION OF TELEPHONY.

With the BFO switch in the " off " position, the automatic gain control circuits become operative and for full effectiveness, both RF and IF gain controls should be set at maximum (full clockwise rotation) and the volume controlled with the audio gain potentiometer on the extreme right. On very strong signals, particularly with a large aerial and on medium waves, it is possible for overloading to occur and it then becomes necessary to reduce the RF gain.

To begin with, the variable selectivity control should be to the extreme right, giving minimum selectivity. In this position, reasonably good quality of speech and music will be obtained but, as the selectivity is still considerably higher than that of an average receiver, a certain amount of side-band cutting occurs and high fidelity reproduction is not to be expected. A minor point to be noted is that the loudspeaker or telephones should be capable of responding to low audio frequencies (down to 100 or 150 cycles), otherwise the middle audio register is likely to be unduly emphasised.

When heterodyne interference is experienced, the selectivity should be increased by rotating the control to the left, thereby reducing the bandwidth and weakening the strength

of the interfering whistle. It is not advisable to operate on telephony with the selectivity control at maximum (except perhaps on a very crowded amateur band) because sideband cutting then becomes severe and speech quality deteriorates in consequence.

Because of the high selectivity, it is important to tune carefully to the centre of the received carrier. It should be remembered also that the AGC action results in the sensitivity increasing as the receiver is tuned slowly away from the centre of the carrier, giving rise to distortion and apparently reducing the actual selectivity. The Cat. No. 669 "S" Meter is a valuable adjunct when the main interest lies in telephony reception since it aids correct tuning and also gives a comparative idea of the strength of the received carrier.

RECEPTION OF CW SIGNALS.

Switching on the BFO (also thereby cutting out AGC) applies H.T. to the beat oscillator valve (V9) and reception of CW Morse signals is then possible.

The adjustment of the controls depends on a number of factors including the strength of incoming signals, amount of interference present and the efficiency of the aerial. If the latter is poor, it will be advisable to use maximum RF gain at all times but, if good, often the RF gain can be reduced somewhat with advantage, particularly on strong signals.

A certain amount of skill will be called for in adjusting the IF gain and selectivity controls. When receiving telephony, the IF gain is automatically controlled according to the strength of the signal but, with CW, manual control of IF is important.

The IF gain varies to some extent with the setting of the selectivity control and is greatest when selectivity is minimum. It will rarely be desirable to employ full IF gain with minimum selectivity. As the degree of selectivity is increased, gain should be maintained by advancement of the IF gain control.

It is advantageous to employ a high degree of selectivity because the noise output from the receiver is partly dependent on the IF bandwidth and the narrower this is made, the less the noise for the same amount of gain. When the receiver is operated with the selectivity control at maximum, signals very close to one another can be separated and weak signals made to stand out clearly against the extraordinarily quiet background. Naturally the tuning control must be handled gently under such conditions.

Another control which calls for attention is the BFO pitch. This gives a swing of 3 Kc/s. each side of the centre point (white spot at the top). Normally it will be set to give a beat note of 1,000 cycles (or near) but careful handling of this control will often enable a desired signal to be separated from an interfering one. Also, it is sometimes of benefit to rotate the knob from one side of zero beat to the other when interference comes up on a signal.

BANDSPREAD.

The mechanical bandspread device is available over the whole range covered by the receiver. The vernier logging scale gives an effective length per range of approximately 32 feet. This scale is graduated from 0 to 100 divisions and is read in conjunction with the lowest scale on the main dial, the latter being marked off with 25 major divisions, each representing 100 divisions of the vernier scale (i.e., one complete revolution).

The actual amount of bandspread on the amateur bands depends of course on the width of each individual band. The following details apply :

Band (Mc/s.)	*Vernier Scale Length (inches)*	*Number of Vernier Divisions*
29·7 — 28	34·375	208
21·45 — 21	7·5	45·5
14·35 — 14	6·45	39
7·3 — 7	15	91
4·0 — 3·5	61	364
2·0 — 1·8	30	182

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NOISE LIMITER.

In a quiet situation, it will not be necessary to make use of the noise limiter but when electrical interference of a staccato nature is experienced (on telephony or CW), switching on the noise limiter will effectively remove a high percentage of the interfering noise, with little effect on the strength of the signal and without introducing distortion. The noise limiter must not be expected to act effectively with noise of a mushy type, as generated by vacuum cleaners and other electrical equipment incorporating motors — these should be filtered with suppressors at the source.

In a noisy location, it is well to erect an aerial well in the clear and as far as possible from electric light wiring. The stronger the incoming signal, the more the gain of the receiver can be reduced (automatically on telephony, manually on CW) thereby reducing also the effect of any interference being picked up.

USE OF THE STANDBY SWITCH.

The Standby switch, in the "off" position, desensitises the receiver very considerably. This system is considered preferable to cutting the H.T. supply, for several reasons. The oscillator valves continue to operate under normal conditions, thereby preventing any change of frequency during standby periods and, since the audio stages remain "alive," a monitor signal can be fed into the pick-up terminals and become audible on the loudspeaker or telephones.

The receiver itself also becomes available as a monitor of the outgoing signal. It is necessary to prevent excessive RF voltage reaching the receiver aerial terminals during transmission and the wires to these terminals should be kept as short as possible. If a separate aerial is used for reception, arrangements should be made for disconnecting or earthing it during periods of transmission.

CONNECTION OF "S" METER.

The Eddystone Cat. No. 669 "S" Meter is recommended for use with the "750" Receiver. It incorporates a sensitive moving-coil meter of 200 microamperes full scale deflection.

The flexible lead from the meter terminates in an octal plug which should be inserted in the socket marked "A" in Fig. 2 at the rear of the receiver.

Reference to the circuit diagram of the receiver will show that one half of the double-diode V7 is in series with the meter movement. This prevents reverse current flowing through the meter when the balance is disturbed and the meter can be left in circuit under all conditions of operation without likelihood of damage. The bottom bend characteristic of the diode results in sluggish action at low signal strengths and, to overcome this, the needle of the meter is purposely offset below the zero mark on the scale by means of the mechanical adjuster.

With the receiver controls set for reception of telephony, the aerial and earth terminals (or doublet terminals) should be shorted and the "S" Meter needle made to coincide with zero by adjustment of the electrical balance control at the rear of the meter. On removing the short, the meter will indicate comparative carrier strength.

OPERATION FROM 6 VOLT ACCUMULATOR.

The "750" receiver may be operated from a 6 volt accumulator in conjunction with a special Vibrator Power Unit, Cat. No. 687/1, which is fitted with leads and plugs ready for immediate use. Installation details are provided with the Power Unit.

STRATTON & Co., Ltd., West Heath, Birmingham, 31

Cables : "STRATNOID" Birmingham Telephone : PRIory 2231-2-3-4

EDDYSTONE '750'

ALIGNMENT INSTRUCTIONS

It is assumed that test instruments are available — in particular, a Signal Generator covering 85 Kc/s. to 32 Mc/s. and provided with internal modulation (30%) and a calibrated attenuator ; and an audio output meter, calibrated in milliwatts and decibels and adjustable to match an impedance of 2.5 ohms. Trimming should be carried out with a non-metallic tool such as the Eddystone Cat. No. 122T.

IF STAGES.

The controls should be set as follows :

RF Gain minimum	Band Selector Range 1
IF Gain maximum	BFO Off
AF Gain maximum	Noise Limiter Off

Selectivity maximum.

A 30% modulated input, at 85 Kc/s., is applied between chassis and the grid of V4* (the second frequency changer), and the four cores in the IF transformers marked "2nd" and "3rd" in Fig. 1 adjusted to give maximum output, as indicated on the output meter. The attenuator of the S.G. should be adjusted as necessary to prevent the needle of the output meter going off the scale. An input of about 280 microvolts will normally be required to give 50 milliwatts at the speaker terminals.

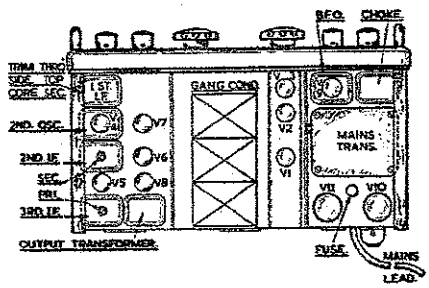


Fig. 1

Leaving the controls and connections undisturbed, the input frequency should be changed to 1620 Kc/s. and the second oscillator adjusted, by moving the core in the V4 screening can (see Fig. 3), until output is maximum. Because of the slight loss in conversion, a greater input (by some 2 or 3 db) will be required to give 50 milliwatts output. The change to 85 Kc/s. can be obtained with the oscillator on either the high or the low side of 1620 Kc/s. and two positions of oscillator core will give output — the lower frequency position, with the core furthest in, is the correct one.

The band selector switch should now be moved to "G" and the 1620 Kc/s. input applied between chassis and the stator of the centre section of the gang condenser. The primary and secondary cores in the first IF transformer (see Fig. 1) are then adjusted to give maximum output and a further very slight and very careful adjustment of the V4 oscillator core may give an improvement. The final IF sensitivity should be such that 50 milliwatts output is produced for an input (at 1620 Kc/s.) of between 5 and 10 microvolts.

BFO ADJUSTMENT.

With the BFO switch at "off," a modulated signal should be applied and tuned in accurately on the receiver. The modulation is switched off, the BFO switched on and, with the pitch control at half-mesh (white spot at top), the core in the BFO unit (see Fig. 3) is set to give zero beat.

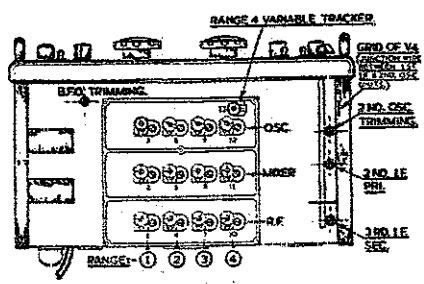


Fig. 3

RF ALIGNMENT.

The controls remain as before but with the RF gain also turned to maximum. Should it be found necessary to correct discrepancies in the scale calibration, the output from a Crystal Frequency Standard should be applied to the aerial terminals (the calibration of most Signal Generators is not accurate enough). Adjustment is then made to the cores and trimmers appropriate to each range, in the oscillator section of the coil box (see Fig. 3). Checks and adjustments should be made at the frequencies given below, using the TRIMMER CONDENSER at the higher frequency end of the scale and the CORE at the lower frequency end. The BFO should be switched on for these tests, with the pitch control at "12 o'clock." The ceramic tracker condenser shown in Fig. 3 has been very carefully adjusted for proper tracking on Range 4 and it is not advisable to touch it.

Range 1.	13 Mc/s.	and 31 Mc/s.
Range 2.	5 Mc/s.	and 11 Mc/s.
Range 3.	2 Mc/s.	and 4 Mc/s.
Range 4.	500 Kc/s.	and 1400 Kc/s.

To proceed with the alignment of the RF and Mixer stages, the BFO is switched off, the crystal oscillator removed and the modulated output from the Signal Generator connected to the aerial and earth terminals, via the dummy aerial. The attenuator is set to give an output of between 10 and 20 microvolts.

A signal on 13 Mc/s. should be injected and tuned in on Range 1 of the receiver. The CORES in the RF and Mixer stages are then adjusted for maximum output as indicated by the output meter. Next, the S.G. is set to 30 Mc/s. and the output peaked by adjustment of the TRIMMER CONDENSERS. Adjustment is again made at 13 Mc/s. and the procedure repeated until no further improvement is possible.

The other ranges are aligned in the same way, using the following high and low frequency alignment points on each range :

Range	*Trimmer Frequency*	*Core Frequency*	*RF Coil*	*Mixer Coil*
1	30 Mc/s.	13 Mc/s.	1	2
2	11 Mc/s.	4·7 Mc/s.	4	5
3	4·2 Mc/s.	2 Mc/s.	7	8
4	1350 Kc/s.	550 Kc/s.	10	11

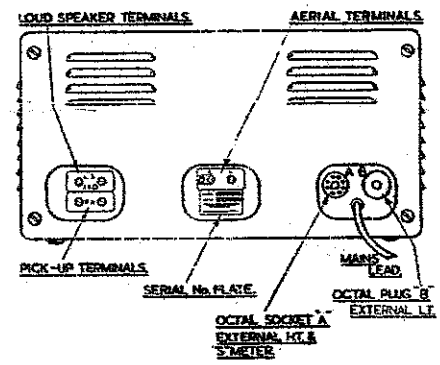


Fig. 2

VOLTAGE VALUES.

The voltages are between the point indicated and the chassis. Set the receiver at 28 Mc/s. on Range 1 with the aerial shorted out, IF and RF controls set at maximum. AF gain control set at minimum with BFO on. Two sets of values are given using different meters as shown. It will be evident that the actual voltage indicated depends on the meter employed. A tolerance of plus or minus 5% should be allowed on the values given.

Circuit Reference	*Weston 1,000 ohms/Volt*	*Avo Model 40*
A	225 volts	225 volts
B	98 "	90 "
C	1·0 "	·95 "
D	82 "	80 "
E	235 "	236 "
F	1·6 "	1·5 "
G	98 "	73 "
H	78 "	75 "
J	232 "	230 "
K	1·4 "	1·2 "
L	85 "	80 "
M	235 "	235 "
N	85 "	80 "
P	0·9 "	0·9 "
Q	65 "	13 "
R	1·0 "	0·7 "
S	235 "	235 "
T	227 "	225 "
U	4·2 "	4·1 "
V	150 "	150 "
W	235 "	235 "
X	275 "	272 "
Y	75 "	70 "
Z	2·0 "	0·9 "
A—	250 " A.C.	250 " A.C.
B—	250 " A.C.	250 " A.C.

HT Consumption - 96 mA

EDDYSTONE "750" RECEIVER

The following alterations to the circuit should be noted:-

A resistor of 100,000 ohms ($\frac{1}{2}$ watt) has been inserted between the HT line and the junction of R18/R19, to give greater control of RF gain.

The range 4 oscillator circuit is modified. C37 becomes 2-40 pF ± 5%, silvered micas, and C39 a 3/23 pF air trimmer. The primary winding on the coil no longer exists, the lead from the switch wafer (oscillator grid) being connected to the point where C37/C39 join the tuned winding.

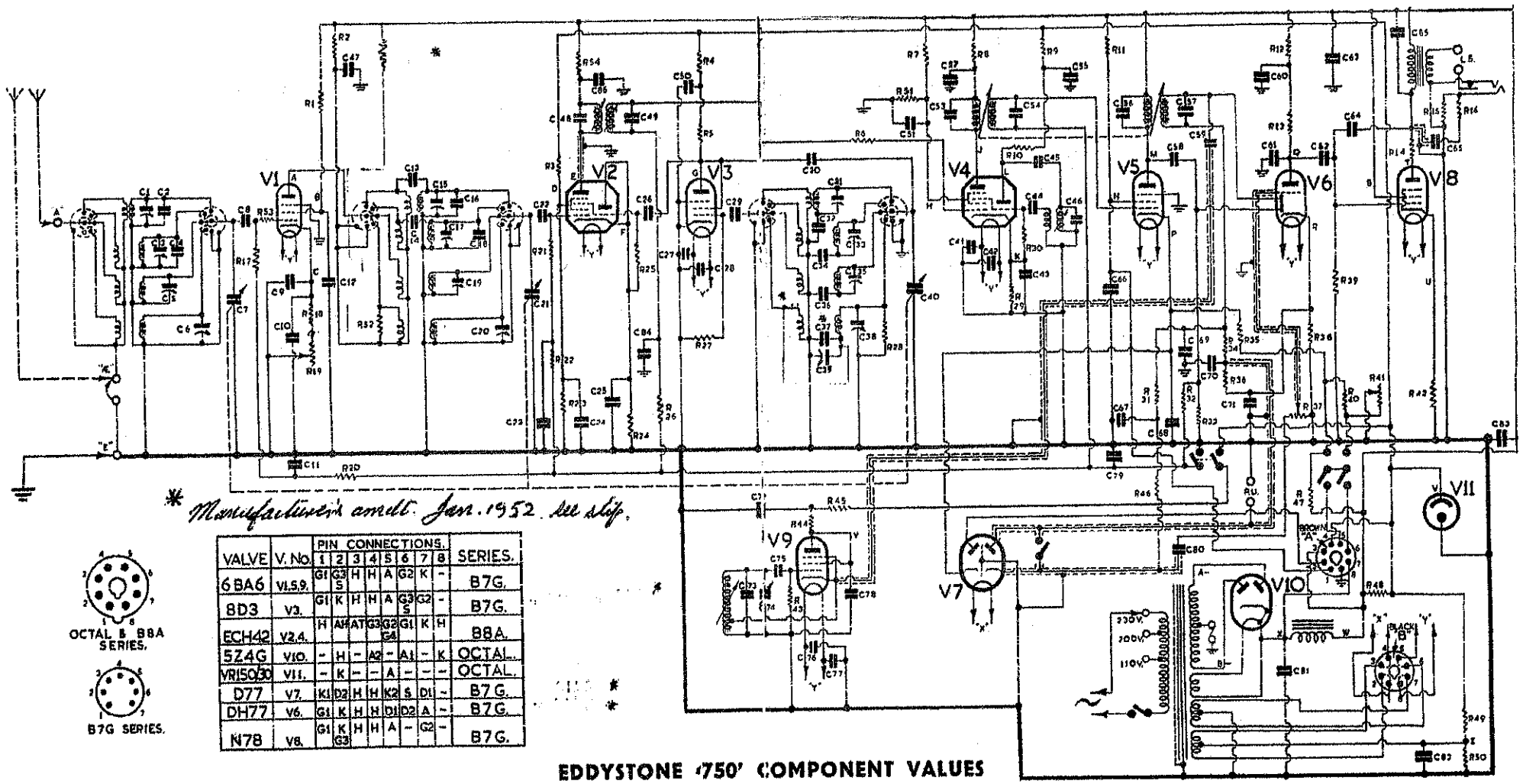
Owing to variations in the valve supply position, equivalents to the valves specified in the Instruction Manual may be fitted, as follows:-

V3	Oscillator	6AM6(8D3)	Brimar
		or	
		Z77	Osram
V6	Audio Amplifier etc.	DH77	Osram
		or	
		6AT6	Brimar
V7	Noise Limiter etc.	D77	Osram
		or	
		6AL5	Brimar

The performance is not in any way affected by the use of these equivalents.

January.1952.

Stratton & Co. Ltd.
Birmingham 31



* Manufacturer's amdt. Jan. 1952. See slip.

VALVE	V. No.	PIN CONNECTIONS. 1	2	3	4	5	6	7	8	SERIES.
6BA6	VI.S.9.	G1	G3 S	H	H	A	G2	K	-	B7G.
8D3	V3.	G1	K	H	H	A	G3 S	G2	-	B7G.
ECH42	V2.4.	H	A1	A2	G3	G2 G4	G1	K	H	B8A.
5Z4G	V10.	-	H	-	A2	-	A1	-	K	OCTAL.
VR150/30	V11.	-	K	-	-	A	-	-	-	OCTAL.
D77	V7.	K1	D2	H	H	K2	S	D1	-	B7G.
DH77	V6.	G1	K	H	H	D1	D2	A	-	B7G.
N78	V8.	G1	K G3	H	H	A	-	G2	-	B7G.

OCTAL & B8A SERIES.

B7G SERIES.

EDDYSTONE '750' COMPONENT VALUES

RESISTORS.

R1	33,000 ohms.	½W.
R2	1,000 ohms.	Type 16.
R3	10,000 ohms.	½W.
R4	1,000 ohms.	Type 16.
R5	10,000 ohms.	Type 16.
R6	12 ohms.	½W.
R7	27,000 ohms.	1W.
R8	1,000 ohms.	Type 16.
R9	1,000 ohms.	Type 16.
R10	10,000 ohms.	Type 16.
R11	33,000 ohms.	1W.
R12	27,000 ohms.	Type 16.
R13	270,000 ohms.	Type 16.
R14	47 ohms.	½W.
R15	1,000 ohms.	½W.
R16	33,000 ohms.	½W.
R17	470,000 ohms.	Type 16.
R18	68 ohms.	Type 16.
R19	10,000 ohms.	Potentiometer.
R20	470,000 ohms.	Type 16.
R21	470,000 ohms.	Type 16.
R22	470,000 ohms.	Type 16.
R23	15,000 ohms.	1W.
R24	330 ohms.	½W.
R25	100,000 ohms.	Type 16.
R26	470,000 ohms.	Type 16.
R27	22,000 ohms.	Type 16.
R28	10,000 ohms.	Type 16.
R29	220 ohms.	½W.
R30	47,000 ohms.	Type 16.
R31	1,000,000 ohms.	Type 16.
R32	470,000 ohms.	Type 16.
R33	470,000 ohms.	Type 16.
R34	100,000 ohms.	Type 16.
R35	68 ohms.	Type 16.
R36	100,000 ohms.	Type 16.
R37	500,000 ohms.	Potentiometer.
R38	3,000 ohms.	Type 16.
R39	470,000 ohms.	Type 16.
R40	51,000 ohms.	½W.
R41	10,000 ohms.	Potentiometer.
R42	150 ohms.	½W.
R43	47,000 ohms.	Type 16.
R44	47,000 ohms.	Type 16.
R45	1,000 ohms.	½W.
R46	2,000,000 ohms.	Type 16.
R47	100,000 ohms.	Type 16.
R48	2,700 ohms.	± 5% WW.
R49	100,000 ohms.	Type 16.
R50	6,800 ohms.	½W.
R51	27,000 ohms.	1W.
R52	3,900 ohms.	Type 16 or Type T.
R53	12 ohms.	Type T.
R54	1,400 ohms.	½W.

CONDENSERS.

C1	3-23 pF.	Air Trimmer.
C2	20 pF.	Silvered Mica.
C3	3-23 pF.	Air Trimmer.
C4	6 pF.	Silvered Mica.
C5	3-23 pF.	Air Trimmer.
C6	3-23 pF.	Air Trimmer.
C7	10-386 pF.	(RF Sect. Gang Cond.)
C8	100 pF.	Silvered Mica.
C9	·1 mfd.	Tub. Paper.
C10	·01 mfd.	Tub. Paper.
C11	·01 mfd.	Tub. Paper.
C12	·1 mfd.	Tub. Paper.
C13	20 pF.	Silvered Mica.
C14	6 pF.	Silvered Mica.
C15	3-23 pF.	Air Trimmer.
C16	20 pF.	Silvered Mica.
C17	3-23 pF.	Air Trimmer.
C18	6 pF.	Silvered Mica.
C19	3-23 pF.	Air Trimmer.
C20	3-23 pF.	Air Trimmer.
C21	10-386 pF.	(Mixer Sect. Gang Cond.)
C22	100 pF.	Silvered Mica.
C23	·01 mfd.	Tub. Paper.
C24	·1 mfd.	Tub. Paper.
C25	·1 mfd.	Tub. Paper.
C26	10 pF.	Silvered Mica.
C27	·0005 mfd.	Moulded Mica.
C28	·0005 mfd.	Moulded Mica.
C29	50 pF.	Silvered Mica.
C30	200 pF.	± 2% Silvered Mica.
C31	3-5-20 pF.	Ceramic Trimmer negative temp. coefficient.
C32	2,100 pF.	± 1% Silvered Mica.
C33	3-23 pF.	Air Trimmer.
C34	900 pF.	± 1% Silvered Mica.
C35	3-23 pF.	Air Trimmer.
C36 *	385 pF.	± 1% Silvered Mica.
C37 *	100 pF.	Silvered Mica.
C38 *	3-23 pF.	Air Trimmer.
C39 *	15-45 pF.	Ceramic Trimmer
C40	10-386 pF.	(Osc. Sect. Gang Cond.)
C41	·01 mfd.	Tub. Paper.
C42	·01 mfd.	Tub. Paper.
C43	·01 mfd.	Tub. Paper.
C44	100 pF.	Silvered Mica.
C45	100 pF.	Silvered Mica.
C46	200 pF.	± 2% Silvered Mica.
C47	·1 mfd.	Tub. Paper.
C48	200 pF.	± 2% Silvered Mica.
C49	200 pF.	± 2% Silvered Mica.
C50	·1 mfd.	Tub. Paper.
C51	·1 mfd.	Tub. Paper.
C52	·1 mfd.	Tub. Paper.
C53	800 pF.	± 2% Silvered Mica.
C54	800 pF.	± 2% Silvered Mica.
C55	·1 mfd.	Tub. Paper.
C56	800 pF.	± 2% Silvered Mica.
C57	800 pF.	± 2% Silvered Mica.
C58	20 pF.	Silvered Mica.
C59	20 pF.	Silvered Mica.
C60	8 mfd.	Tub. Elect. 350v. D.C. wkg.
C61	·0005 mfd.	Moulded Mica.
C62	·01 mfd.	Moulded Mica.
C63	·01 mfd.	Moulded Mica.
C64	6 pF.	Silvered Mica.
C65	·01 mfd.	Moulded Mica.
C66	·1 mfd.	Tub. Paper.
C67	·1 mfd.	Tub. Paper.
C68	·1 mfd.	Tub. Paper.
C69	100 pF.	Silvered Mica.
C70	100 pF.	Silvered Mica.
C71	30 mfd.	Elect. 15v. D.C. wkg.
C72	·01 mfd.	Tub. Paper.
C73	400 pF.	± 2% Silvered Mica.
C74	BFO	Pitch Condenser.
C75	100 pF.	Silvered Mica.
C76	·01 mfd.	Tub. Paper.
C77	·01 mfd.	Tub. Paper.
C78	·01 mfd.	Tub. Paper.
C79	·1 mfd.	Tub. Paper.
C80	·01 mfd.	Moulded Mica.
C81	50 mfd.	Elect. 450v. D.C. wkg.
C82	30 mfd.	Elect. 15v. D.C. wkg.
C83	50 mfd.	Elect. 450v. D.C. wkg.
C84	·01 mfd.	Tub. Paper.
C86	·01 mfd.	Tub. Paper.

EDDYSTONE "750" RECEIVER.

The primary winding of Range 4 oscillator coil (No. 12 coil) is now deleted. The wire from the switch wafer to this winding is now taken to the lower end of the remaining winding which joins C37 & C39.

The tracking condenser C37 (situated below C39) nwo consists of two parallel capacitors, one a 50pF silver mica and the other a 40pf N. T. C. ceramic.

The following components are changed or added:-

C26, C29 and C30 changed to Ceramic type (negative temp. coefficient)
C87, *10pF Ceramic (N. T. C.) placed in parallel with C40
R55 100,000 ohms ½ watt. placed in between HT line and junction of R18 and R19.

TSD/JMW/PBT/237. * 12pF

THE EDDYSTONE '750' COMMUNICATIONS RECEIVER.

BY

J. N. WALKER (G5JU)

Introduction.

The Eddystone '640' Receiver introduced in 1947, is well known in Arabia and has earned excellent reputation for good sensitivity, low background noise and well-engineered construction. Production of the '640' ceased some time ago and the manufacturers, Messrs. Stratton & Co. Ltd., Birmingham, England, have introduced an improved receiver, the model '750'. The following paragraphs discuss present-day amateur requirements and show how they have been met in the '750' receiver.

Selectivity.

Undoubtedly, with the considerable increased activity on practically all amateur bands in many countries, a most essential requirement is selectivity of a very high order.

As many readers will know, the overall selectivity depends (in a superheterodyne receiver) to a large extent on the design of the IF stages and such design covers many factors, including number of stages, frequency, degree of coupling between coils, and types of valves used.

By suitably designing the coils, a very steep IF response curve can be secured if the frequency is made rather low, that is, in the region of 80 to 110 Kc/s. It is not feasible, however, to employ low frequency IF stages immediately following the frequency changer for the reason the image interference will then be so serious as to be intolerable, particularly on the higher frequencies, where the RF stage,

no matter how well designed, will not tune sharply enough to permit adequate rejection of the image signals.

One of the best methods of eliminating image interference is to employ a fairly high intermediate frequency and 1.6 Mc/s is in common use. This is the IF in the '640' Receiver and although, because of their exceptionally good design, the IF stages in the '640' give better-than-average selectivity, a still higher degree is desirable.

The answer to the problem of obtaining high adjacent channel selectivity with freedom from image interference is to adopt the double superhet principle as has been done in the '750' Receiver. The first IF is 1629 Kc/s and the second 85 Kc/s. In the 85 Kc/s transformers, the coupling between the coils can be varied mechanically to give a wide range of selectivity. At the extreme, the response is 60 db down at 5 Kc/s off resonance, giving a very sharp "noie" and almost the highest usable degree of selectivity. This position is for CW reception—telephony is still readable but the side bands are cut to a considerable extent.

With the selectivity control at minimum, the response is 30 db down at 5 Kc/s off resonance. This still represents a much higher the average selectivity and telephone stations only a few kilocycles apart can be separated easily, whilst maintaining moderately good audio quality. As a matter of interest, provided a loudspeaker of adequate size is used, properly mounted, the quality of speech and music from broadcast stations will satisfy all but the most critical.

Problem associated with the Double Superhet.

The construction of a double superhet receiver is not quite such a straightforward job as it might seem. It must be remembered that there are altogether three oscillators operating when CW signals are being received—one variable according to the signal frequency, one at 1535 Kc/s and the BFO at 84/86 Kc/s. Obviously, very careful attention is necessary to avoid interaction between

the fundamental and harmonic frequencies and the screening and decoupling must be beyond reproach. The manufacturers do not claim that the '750' is completely free from occasional heterodyne beat—it would involve vast expense to ensure complete immunity—but they do claim that on the two higher frequency ranges, spurious signals are to all intents and purposes non-existent and so weak on the other two ranges as to cause no difficulty.

Sensitivity and Signal-to-Noise Ratio.

These two features are being dealt with as one, since it is pointless to quote only sensitivity, without reference to the noise level. By adding valve after valve to a receiver, the absolute sensitivity can be increased but whether any worth while improvement in actual reception of signals takes place depends on how much the noise level increases. Which leads do a point about specifying sensitivity. Most well designed communications receiver will render audible signals having a strength of one microvolt or possibly less, but the information is really useful only when a figure is quoted in comparison with noise. In the '750' the *minimum* sensitivity is quoted as 5 microvolts for a 20 db signal-to-noise ratio - which is an extremely good figure. It simply means that a comparatively weak signal is audible against a very quiet background and this is one of the most noticeable and most appreciated features which immediately claim attention when one comes to use the '750'.

It is normal for the sensitivity to vary to some degree over each range of a receiver. Sometimes, the variation is great but in the '750' the interstage couplings have been adjusted so that the variation is small. Maintenance of accurate tracking of the ganged condenser also assists considerably in this respect.

Valves.

Of recent years much research has taken place in the development of improved valves and the modern

miniature types have many advantages over older types. One is the short lead-out wires, resulting in low inductance, another the lowe anode/gris capacity, achieved by reason of better internal screening—two factors which materially assist in improving the high frequency performance. In the '750', nine miniature valves are employed, plus a rectifier and a neon stabiliser, the two latter being of the octal type.

Circuit Line-Up.

By reason of careful design and the use of a high slope 6B4 6 valve, the RF stage gives amplification of a high order. The gain is more than sufficient for all normal purposes and the addition of a second stage is not justified.

Then follows the first frequency changer, in which position an ECH42 triode-hexode valve is used. The anode of the triode portion is earthed and the oscillator voltage, developed by a separate valve (a 6AM6) is injected into the grid. An increased degree of frequency stability is thereby secured.

The output at 1620 Kc/s from the IF transformer in the anode circuit of the ECH42 is fed direct to the second frequency changer, another ECH42. Now some may question the absence of an intermediate amplifying stage, so a few words on this will not be out of place. Whether or not an amplifying stage will be of benefit depends on the signal voltage required at the grid of the second frenquency-changer to ensure a high signal-to-noise ratio. In the '750', the high gain given by the RF stage, the good conversion efficiency of the first frequency-changer, and the high "Q" of the voltage magnification given by the 1620 Kc/s IF transformer result in the voltage at the grid of the second frequency changer being adequate without further amplification.

The oscillator section of the second ECH42 operates at a fixed frequency of 1535 Kc/s and the resulting output at 85

Kc/s is fed to a high "Q" transformer and amplified by the 6BA6 high slope valve. As mentioned earlier, the coupling between the windings in both transformers are continuously variable by a mechanical leakage controlled by a butterfly knob on the front panel.

There follows a double diode triode. the diode being employed one for signal detection, the other for AGC, the triode section amplifying the audio signal before it is passed on to the high slope N78 output valve. The latter is a new type of Osram manufacture and is capable of giving in excess of 3.5 watts output at a low level of distortion.

One diode of a type 6AL5 valve is used as a series noise limiter, and, as a result of the careful attention given to the design, this limiter is strikingly effective and is a great boon in situations where automobile ignition and similar interference is prevalent. The noise limiter has only a slight effect on the general audio level.

The second diode is connected in series with the external "S" Meter (when used). By its normal rectifier action, it prevents the flow of current in a reverse direction, and thus prevent possibility of damage to the 200 microampere movement fitted to the "S" Meter.

The BFO is a completely screened unit, utilising a 6BA6 valve and designed for high stability.

The VR150/30 stabiliser valve regulates the HT voltage to the anodes of the oscillator valves, to the screen of the first frequency changer valve and also to the resistor network associated with the "S" Meter when the latter is used. Finally, there is a 5Z4G rectifier valve.

Special Points about the '750'.

Attention has already been drawn to the high selectivity and sensitivity possessed by the '750' receiver and there are a number of other features which deserve mention.

The heater circuits are balanced, the centre tap of the transformer winding being earthed. Heater by-pass condensers are used where necessary and tray couplings through the heater wiring minimised. As a result, there is a complete absence of modulation hum right up to the highest frequency — signals with a T9 note are heard as T9. The smoothing in the HT lines is fully adequate and no hum is heard from this source.

Special attention has been given to the noise limiter circuit, not only to make it fully effective, but also to prevent the introduction of hum due to heater cathode leakage. A separate centre tapped winding is employed for the noise limiter valve and a bias system is arranged to ensure that the cathode is positive to the heater.

The transformer fitted to the '750' is of generous size and is capable of providing more power than the '750' actually uses. The transformer therefore runs cool under any conditions. All components are finished for tropical use, the metal has been specially treated to resist corrosion and reliability of a high order is assured even when the receiver is operated in areas of high ambient temperature and humidity.

Tuning Mechanism.

The train of spring-loaded gears forming the tuning mechanism is a fine piece of small engineering. The control knob spindle is flywheel loaded and the movement is smooth and positive. The mean reduction ratio between control knob and gang condenser spindle is approximately 150 to 1, which makes possible very fine tuning. The scale is directly calibrated, a noticeable feature being the linear spacing of the markings. The dial is large, occupying the major portion of the front panel and it is edge-illuminated by three small lamps fitted along the top.

Band-Spread.

Driven from the main gears is a rotating scale, the gradation on which (0—100 divisions) are read off in the

opening at the top of the main scale. For every complete revolution of the auxiliary scale, the main pointer moves the length of one major division printed at the bottom of the main scale. In all, the band-spread scale covers 2,500 divisions over each wave range, equivalent to a length of about 32 feet. It follows that ample band-spread is available on each of the amateur bands, the actual figures being given below. These are based on the allocations made at the Atlantic City Conference.

Band Width.	Tuning Coverage On Vernier Scale.	Vernier Divisions of Band-Spread.	Kilo-cycles in Band.
29.7 Mc/s to 28 Mc/s	34 375"	208	1700
21.45 Mc/s to 21 Mc/s	7.5"	45.5	450
14.35 Mc/s to 14 Mc/s	6.45"	39	350
7.3 Mc/s to 7 Mc/s	15"	91	300
4.0 Mc/s to 3.5 Mc/s	61"	364	500
2.0 Mc/s to 1.8 Mc/s	30"	182	200

Use other than on Amateur Bands.

The total coverage of the '750' Receiver is from 32 Mc/s (below 10 metres) to 480 Kc/s, continuous except for a small gap which must necessarily be allowed on each side of the first intermediate frequency of 1620 Kc/s. It will be appreciated therefore that the '750' is suitable for the reception of short wave broadcast stations on all internationally allocated frequencies, for reception of commercial and ship stations (telegraphy or telephony) and for medium wave reception, in areas where stations operate on medium waves. Provided the loud speaker employed is capable of good reception, excellent quality is obtained from the '750' Receiver with the selectivity switch at "minimum", whilst at the same time, interference from stations on adjacent channels is much reduced, if found at all, because the inherent selectivity of the '750' is considerably greater than the average domestic broadcast receiver.

Absence of Crystal Filter.

The selectivity given by the '750' Receiver with the control at maximum is so great that it is practically impossible to make effective use of any greater degree. It is therefore not necessary to go to the expense of adding a crsytal filter, with the attendant complications.

Operation on Telephony.

With its high sensitivity and low noise level, the '750' Receiver is the ideal for those whose interests lie in the reception of weak telephony, either from amateur stations or from far distant broadcast stations. The intelligibility of such transmission can be enhanced by careful adjustment of the selectivity control, which should be at minimum with strong stations and in cases where interference is not present. Unfortunately, under present day conditions, interference is a major problem and occurs only too often. Moving the selectivity control towards maximum will gradually cut it out and only in extreme cases will it be necessary to use the highest possible selectivity.

Automatic gain control in the '750' is most effective and the audio output from a given signal is held within close limits despite severe fading.

CW Operation.

Some experience is necessary with any receiver if maximum results are to be secured and the '750' is no exception to this rule. When the BFO is switched on, AGC is cut out (otherwise the sensitivity would suffer). With minimum selectivity, the IF transformer couplings are optimum and there is rather more IF gain available than is desirable under normal circumstances. Hence IF gain should be reduced manually.

In the majority of cases, it will be advantegeous to use a high degree of selectivity, and, with the transformer

couplings below optimum, the IF gain control should be advanced.

The BFO pitch control gives a variation of 3 Kc/s each side of zero beat. Because of the very steep slope of the selectivity curve, it will be found that a signal peaks up, on the side to which the BFO pitch is set. When interference is present, it can often be reduced or removed by moving the BFO pitch to the other side of zero beat and then slightly returning. In effect, single signal reception is possible.

Standby Switch.

The standby switch is fitted with a long "dolly" (operating lever) so that there is no mistaking it from the other switches The method used for muting the receiver is to increase the bias on the IF amplifier valve, with the HT remaining on all stages. Two benefits result - the oscillator valves operate under constant conditions thereby maintaining good frequency stability and the receiver is available to monitor the out going signal from the associated transmitter.

Pick-Up Terminals.

Provision is made for the use of a standard type crystal or magnetic pick-up and, as the audio section of the '750' receiver has a practically linear frequency response from 50 10 10,000 c p.s., the quality of reproduction from gramophone records is excellent,

The pick-up terminals serve another useful purpose— a signal from a separate monitor (CW or telephony) can be fed in and will become audible on the telephone or loudspeaker, thereby rendering unnecessary an external switch.

"S" Meter.

Some operators like to have available an "S" Meter, which instrument can be very useful for comparative

reports of telephony transmissions and as a tuning indicator. Other operators, and particularly those whose main interest is CW, do not require an "S" Meter and the latter is therefore made an optional extra. It takes the form of a diecast housing finished to match the receiver and fitted with an octal plug which only has to be inserted in the socket at the rear of the receiver to bring the "S" Meter into use.

Power Requirements.

The '750' Receiver is designed for operation normally from AC mains, 40/60 cycles, a voltage selector panel enabling voltage of 110, 200/220 and 230/250 to be chosen. The consumption from the mains is approximately 70 watts. The transformer is of more than adequate size and runs cool over an extended period. Very generous smoothing is included, with a consequent absence of hum.

On occasions, it may be desired to operate the receiver from a battery supply and a special vibrator unit is available to meet this requirement. Listed under Cat. No. 687/1, this unit is contained in a small cabinet which matches the receiver, and is fitted with plugs for connection to the receiver. The consumption from a 6 volt accumulator is in the region of amperes.

Very special attention has been paid to the problem of eliminating the interference-producing "hash" developed by the vibrator itself, provided the instructions supplied with the unit are followed, no difficulty will be experienced from this source.

Construction.

The mechanical construction is most substantial and follows the usual Eddystone standard, with which many readers will probably be acquainted. The front panel is an alluminium diecasting, securely attached to the diecast coil-box. These two units form a solid foundation for the

receiver. The very thorough screening conferred by the thick metal coil-box is one reason why Eddystone receivers possess a performance well above average.

The exterior of the receiver is finished a fine ripple black, the steel cabinet first being specially treated to resist corrosion. The workmanship throughout is first-class, and this high standard is maintained equally in all sections. As the illustration shows, the finished product possesses a most presentable appearance.

Conclusion.

Although the foregoing description of the new Eddystone receiver is fairly lengthy, it still does not cover the subject completely nor do justice to the inherent "know-how" which has gone into the design of the receiver. But enough has been said to enable the reader to judge for himself the suitability of the '750' for use in amateur and professional communications and for broadcast reception on high and medium frequencies.

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