THE EDDYSTONE 740 AND 750 RECEIVERS

NOTES ON CIRCUITRY, COVERAGE AND ALIGNMENT OF POPULAR VALVE DESIGNS

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DETAILS of particular receivers are generally of interest to the many who look to the second-hand market for modestly priced equipment. The Eddystone 740 and 750 are not often to be seen offered in large numbers—presumably on the grounds that those who have them wish to keep them. But they are obtainable fairly regularly, and the details here should go a long way towards clarifying what are their circuit features and other details.

S.740 External

This adopted the popular Eddystone design with semi-circular scales and the dimensions are approximately 16¾ x 10 x 8¾ inches high. The whole assembly is extremely rigid, as with all Eddystone receivers. The wrap-round cabinet can be released by four screws and taken off, leaving the panel and chassis with its attached side runners, so that it can be turned upside-down without damage. The cabinet has a lift-up lid. (*See* picture p.155.)

Four bands give continuous coverage from approximately 485 kc to 30·6 mc. The three higher frequency bands are calibrated in megacycles, as follows: 30·6-10·5; 10·6-3·7 ; and 3·8-1·4 mc. The lowest frequency band is calibrated in metres from 205m. to 620m.

Two large knobs provide band selection and tuning. The other controls are on/off-tone, RF gain, BFO pitch, and AF gain. Three toggle switches are for Noise Limiter, AVC/BFO, and send/receive (or standby with heaters on and HT on some stages). There is also a panel outlet for phones.

At the back are two octal sockets. One allows the use of an external power supply, to run from an accumulator. The other is for the usual Eddystone S-meter, or similar home-built accessory. There are two aerial sockets or terminals, and an earth terminal. Balanced feeders are taken to the two aerial sockets. For end-fed or other unbalanced systems, one aerial terminal is earthed. This gives good general results with all aerials. With some aerials a tuner or Z-match may increase signal strength on some frequencies, in the usual way.

The receiver operates from 110v., 200/230v. mains, *via* a mains transformer giving isolation of the chassis.

Valve Line-Up

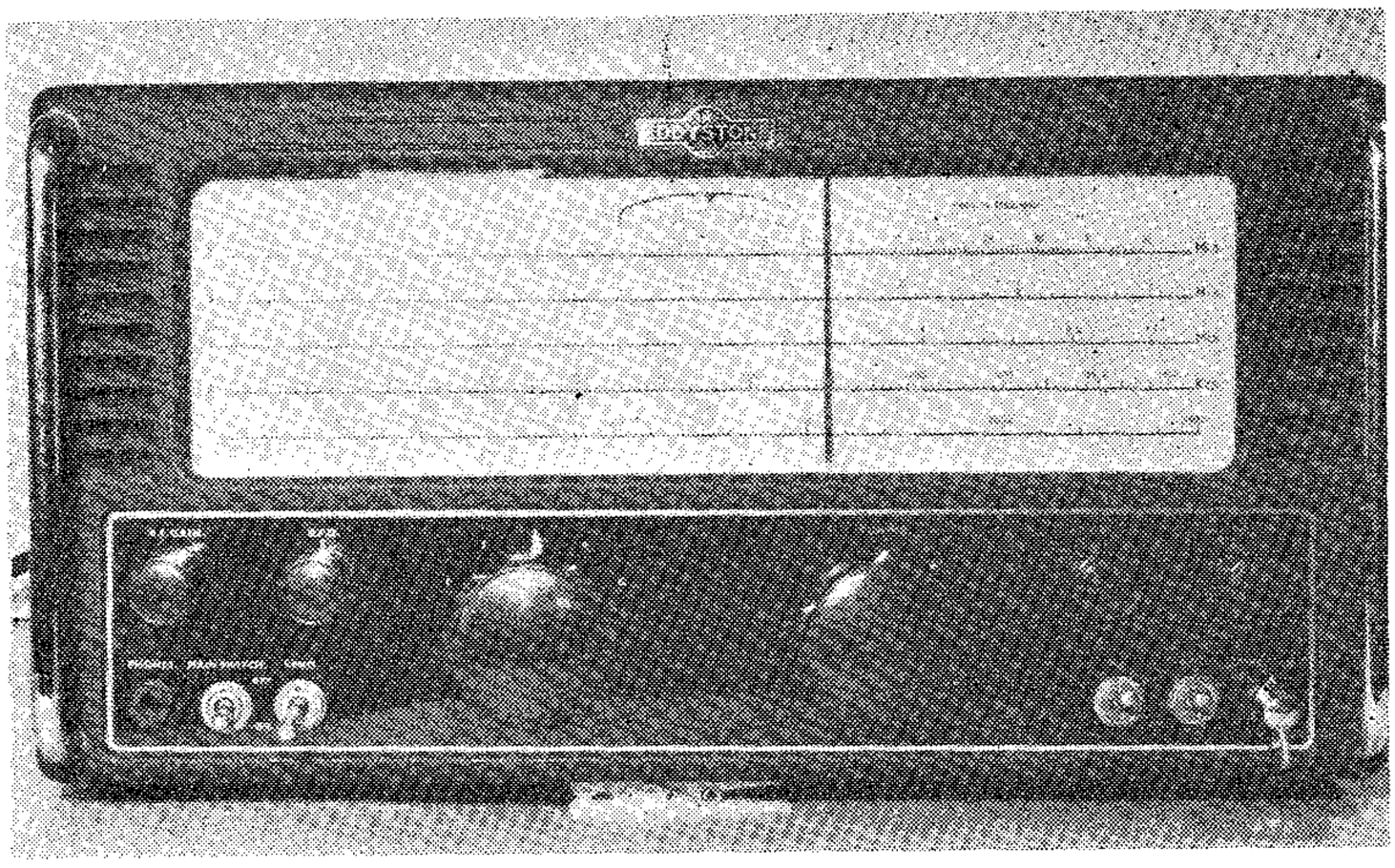
Valves are EAF42 RF amplifier, ECH42 oscillator/mixer, EAF42 IF amplifier, EAF42 pentode 1st AF stage, and EL42 output, diodes in IF and 1st AF stages being employed for detection and AVC bias. The BFO stage takes an EAF42, and a EB41 double diode is fitted for noise-limiter and S-meter circuit. The full-wave rectifier is an EZ40.

Fig. 1 is a block diagram of the circuit. Output is for a 2/3 ohm speaker. Inserting the phone plug mutes the speaker. (*See* p.152.)

Tuning Considerations

These are always very important. The actual tuning mechanism has a ratio of about 140:1, flywheel loaded, with sprung gears. The general-coverage type dial, with its four scales, cannot of course give frequency readings to fine limits within narrow limits, such as an amateur band. This is overcome to some extent by a " band-spread " scale driven through sprung gears and visible in a window to the right of the main scales. Readings

The Eddystone 750 Rx. The four horizontal scales are each about 12 inches long. A rotating dial appears in the central window and, for accurate logging, is read in conjunction with the lowest horizontal scale. With an S.750 in good order, very accurate calibration is possible and the re-setting accuracy is high.



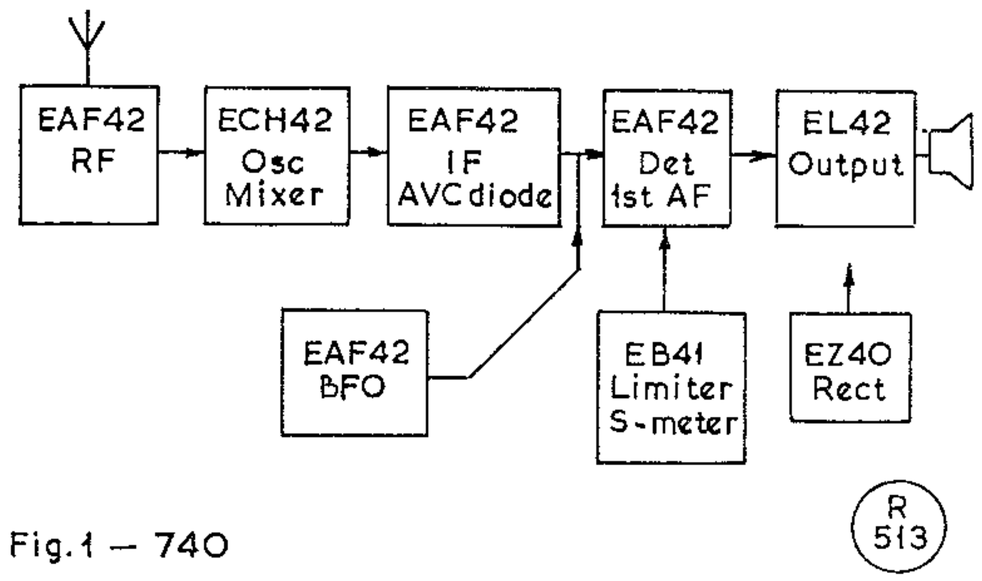


Fig. 1. Block schematic of the Eddystone S.740 receiver, which is discussed on p.151.

here are used in conjunction with an 0-9 scale on the dial, so that each of the four bands, or any sections of them, can be logged on a 0-900 basis.

With correct alignment, frequency readings on the four general coverage scales can be very accurate. This allows easy finding and tuning of any amateur band.

When frequencies are to be read to narrower limits on the receiver, the band-spread dial readings can be logged against the pips of a 100 kc crystal marker, in a similar manner to that described with the 750. This gives additional frequency resolution within any chosen bands. The actual band-spread scale degrees for the various amateur bands were found to be as follows: 1·8-2·0 mc, 94; 3·5-3·8 mc, 34; 7·0-7·1 mc, 12; 14·0-14·35 mc, 21; 21·0-21·45 mc, 25; 28·0-29·7 mc, 35.

Performance

Quoted sensitivity is better than 10 μV for a 15 dB signal-to-noise ratio, though a signal of 2 μV could be read with the actual receiver used. With a 450 kc IF and one RF stage, images begin to show up on the higher frequencies, as would be expected. The listed image ratio is 15 dB at 30 mc, and naturally improves with lower frequencies. In practice, this means that strong signals 2/IF away from the wanted frequency have virtually no practical effect on the 7, 3·5, and 1·8 mc bands, but can become troublesome on 14 mc from the broadcast 19-metre band. They also arise on 21 and 28 mc, of course. (The effect of this type of interference depends to some extent on the time of day.) Also, on 28 mc there are few transmissions to cause 2nd channel trouble, while 21 mc is at some times relatively free, for the same reason. A pre-amplifier for the HF bands (to put another tuned circuit ahead of the mixer) could be a worth-while addition for the enthusiast bent on improving results.

Selectivity is given as 30 dB at 10 kc. This, like the sensitivity and image rejection, agrees with that quoted for the more modern Eddystone 840. In practice, it means that operating the 740 side by side with a highly selective (and more costly) receiver, occasions show up when the need is felt for more selectivity. Yet despite this it can only be said that the 740 brings in most signals satisfactorily and has an excellent all-round performance.

The BFO switch and pitch controls operate in the usual way. SSB can be resolved by turning down the RF gain, and having AF gain at maximum. As with all non-SSB (straight detector) type receivers, this is something to be acquired by practice with the needful adjustments. BFO coupling was found to be extremely low, from a lead adjacent to the detector diode circuit. This can be increased by substituting a few turns of insulated wire round this lead, and is desirable for better SSB performance.

Modifications

Since these details are for a receiver in original condition, it is not proposed to go into possible modifications. An external RF pre-amplifier has been mentioned. An IF crystal filter would not prove too difficult to incorporate. An S-meter circuit can be used as for the 750. In a 740, actually used at this station for some time, the only modification made was to remove the small " 740 " plate filling an opening opposite the band-spread dial, and fit a tuning indicator. This was operated from the AVC line in the usual way.

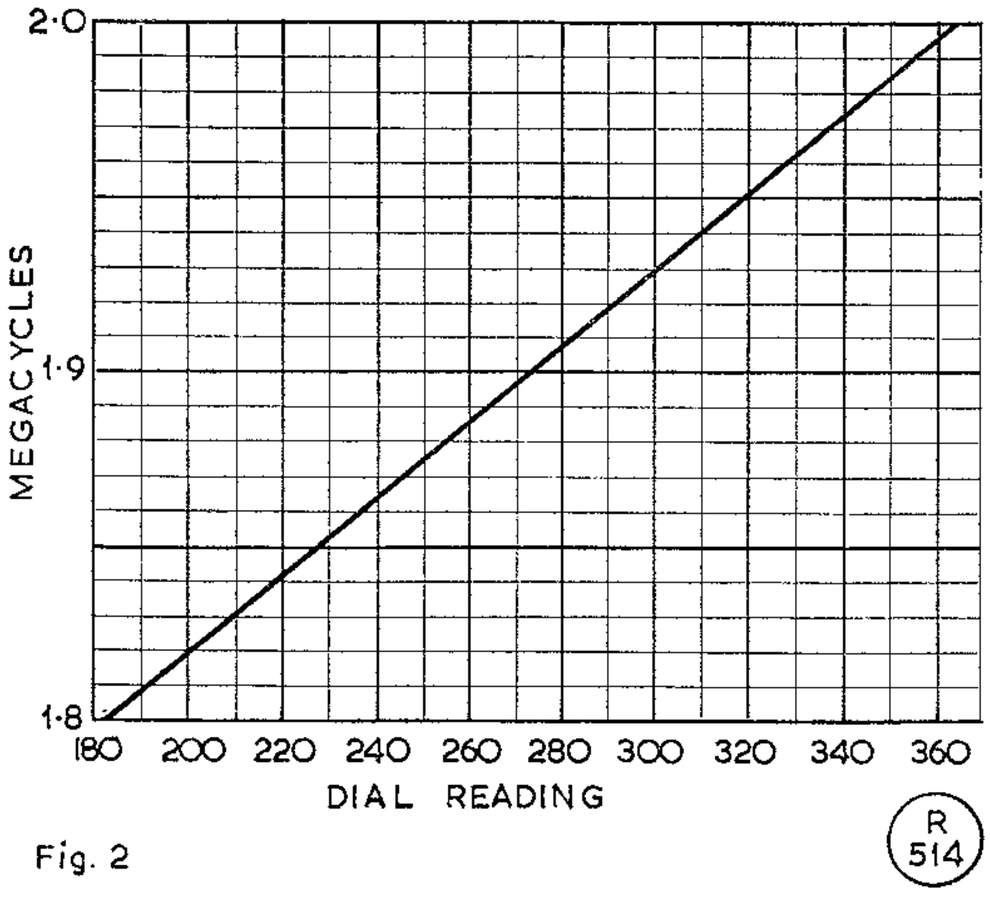


Fig. 2. How a calibration graph can be constructed—see text. This must of course be done for receivers individually, as explained on p.154.

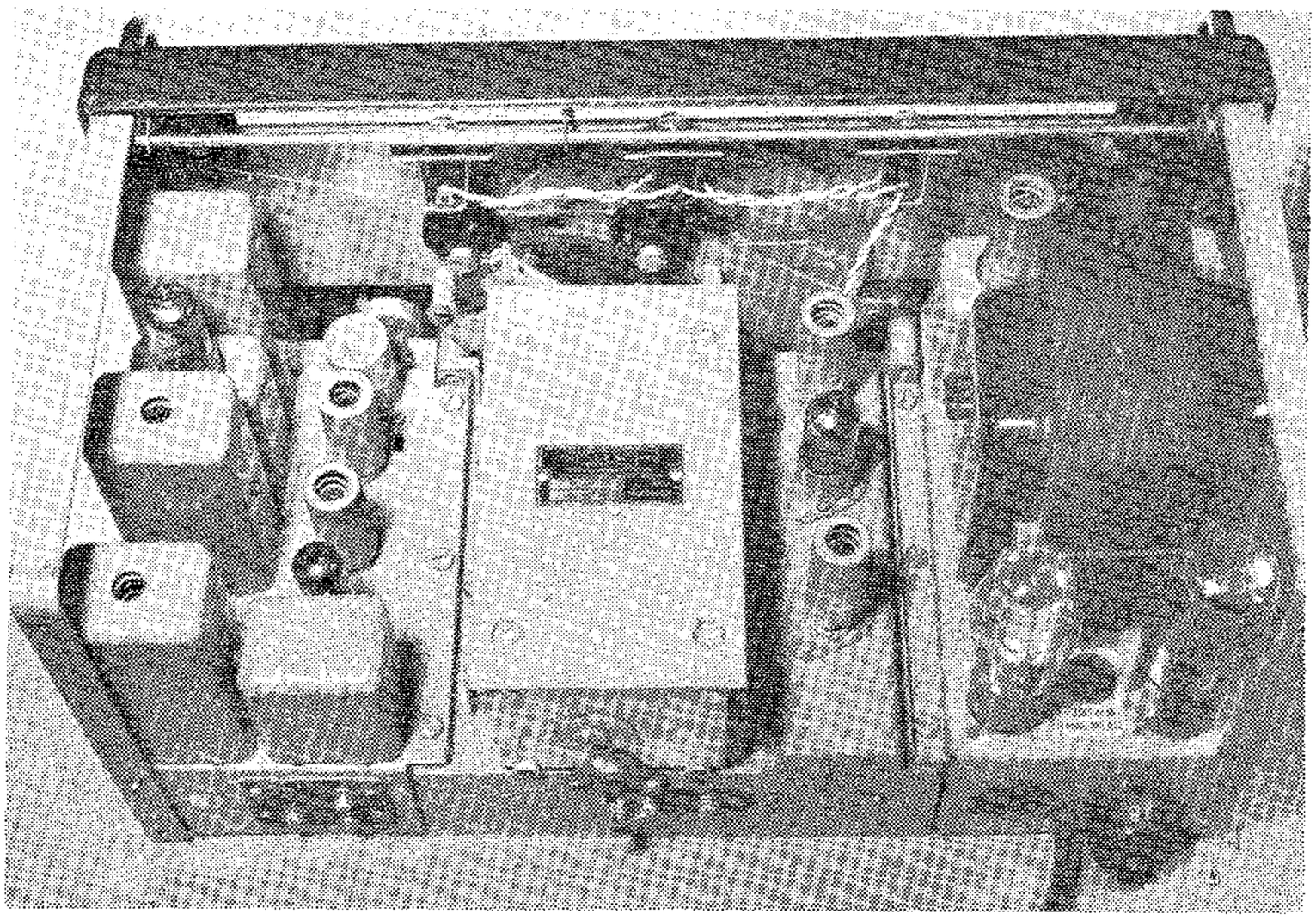
Alignment

In an old or second-hand model, this could need attention, both for best results and close agreement with the scale markings. The IF is 450 kc and not over 80 μV, 30% modulated input, should be required for 50 mW output into a 2·5 ohm load fed from the LS sockets. Should any valves be suspected, a meter test will show if they need replacing, perhaps due to lost emission.

Oscillator coils are at the front, mixer coils in the middle, and aerial coils at the back, and can be reached when the bottom cover plate is taken off. The HF ranges are nearest the switch.

If necessary, adjust the oscillator coil cores for correct dial readings on bands and frequencies as follows: (1) 12 mc; (2) 4 mc; (3) 1·5 mc; and (4) 550 kc or 545·5m. Similarly, adjust oscillator trimmers for: (1) 28 mc; (2) 9 mc; (3) 3·2 mc; and (4) 1200 kc or 250m. Repeat as required for best calibration.

Aerial and mixer cores are peaked at similar frequencies to those for the oscillator cores, and trimmers are adjusted on 28 mc for Band 1, 9 mc for Band 2, and



Inside the 750. Mains transformer, rectifier and voltage regulator are to lower right, with the BFO assembly (valve on can) towards the panel. RF, mixer and 1st oscillator valves are to the right of the gang tuning-pack (boxed). At extreme left, the cans are 1st IF (nearest panel), 2nd osc. with valve on top, 2nd IF, 3rd IF. Sockets on rear chassis drop are for PU, speaker, aerial, Ae/E, S-meter and external power supply, if required. The general assembly underside resembles that of the 740—as shown below.

so on. On the HF band, check that the oscillator is HF of the signal frequency, *e.g.*, the image arises when tuning the receiver 900 kc LF, or the generator 900 kc HF.

If alignment is nearly correct, it can be completed with the pips from a 1 mc/100 kc crystal marker. Or for amateur band purposes it may be convenient to use the transmitter VFO, or VFO/buffer stages, adjusting the cores at 14, 3·8 and 1·8 mc, and the trimmers at 28, 7 and 3·5 mc. Signal input to the receiver must be kept well down.

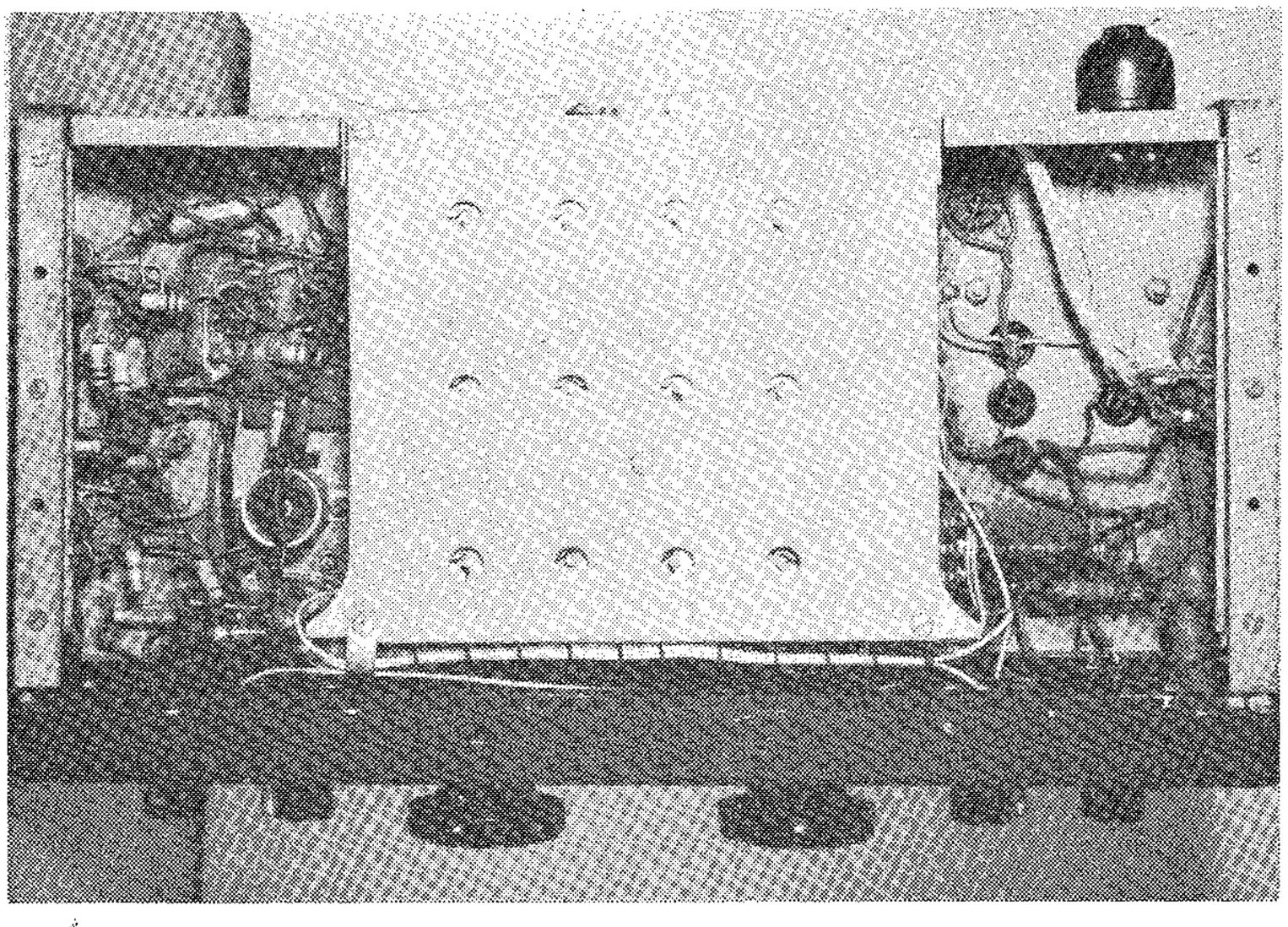
THE EDDYSTONE 750

Continuing with the 750, these notes should be of interest to owners of the 740 and 750 receivers, or to those who are thinking of purchasing such equipment in used condition. The 750 is a double-conversion superhet, with variable selectivity, and capable of an extremely good performance.

750, External

This design embodies the long horizontal scales used for many Eddystone receivers. Each scale is about 12in. long, and each of the four bands is directly calibrated in frequencies. Ranges are: 32-12 mc; 12-4·5 mc; 4·5-1·7 mc; and 1465-480 kc. This is continuous coverage except for the gap left around the 1st IF of 1620 kc, for which a trap is sometimes desirable.

Dimensions of the 750 are approximately $16\frac{3}{4}$ x 10 x $8\frac{3}{4}$ inches high. The cabinet has a hinged lid, and is removable in the same way as for the 740. Back sockets or terminals provide for connecting a balanced or end-fed or unbalanced aerial system, a 2/3 speaker, and a



Underneath the Eddystone S.740 Rx, showing die-cast coil box with twelve individual trimmers, for the aerial, mixer and oscillator circuits. The cover plate is removed by taking out five screws, to reach the adjustable coil cores—see text.

pick-up or other audio source for which amplification is required. Octal sockets on the back allow the use of an S-meter, or optional external power supplies such as an accumulator and HT unit.

Front controls are RF gain, BFO pitch, bandswitch, tuning, IF gain, AF gain, mains on/off, Noise Limiter, BFO and a "send" or standby switch leaving heaters on. There is also a variable selectivity control, and a socket for headphones. Inserting the phone plug silences the speaker.

The receiver normally operates from 110v., or 200/240v. mains, with its own power supply, and the internal mains transformer gives isolation of chassis from the mains circuit.

Tuning Arrangements

The tuning control has a flywheel, and the reduction ratio is about 150:1. Amateur bands and other frequencies are clearly marked on the appropriate horizontal scale.

More accurate determination of frequency within a narrow band is possible by using the mechanical band-spread dial. This is centrally placed, and operated through spring-loaded gears. In a 750 which has been used by the writer for some years the band-spread dial reads from 0-2500, in conjunction with a scale on the bottom of the horizontal dial plate. (However, different numbering appears on some of the maker's literature.)

To determine frequency in an amateur band, dial readings can be logged against the pips of a 100 kc crystal marker. Fig. 2 shows calibration at 1·8, 1·9 and 2·0 mc marks by this method, so that a graph can be drawn, from which other frequencies in the band can be read with reasonable accuracy. One such graph would be required for each amateur band. Naturally, the one in Fig. 2 would *not* be expected to be absolutely correct for another receiver.

A mechanical band-spread system of this kind is also useful during normal tuning and operating. The listed number of band-spread divisions for various bands are as follows: 1·8-2·0 mc, 182; 3·5-4·0 mc, 364; 7·0-7·3 mc, 91; 14·0-14·35 mc, 39; 21·0-21·45 mc, 45·5; and 28·0-29·7 mc, 208.

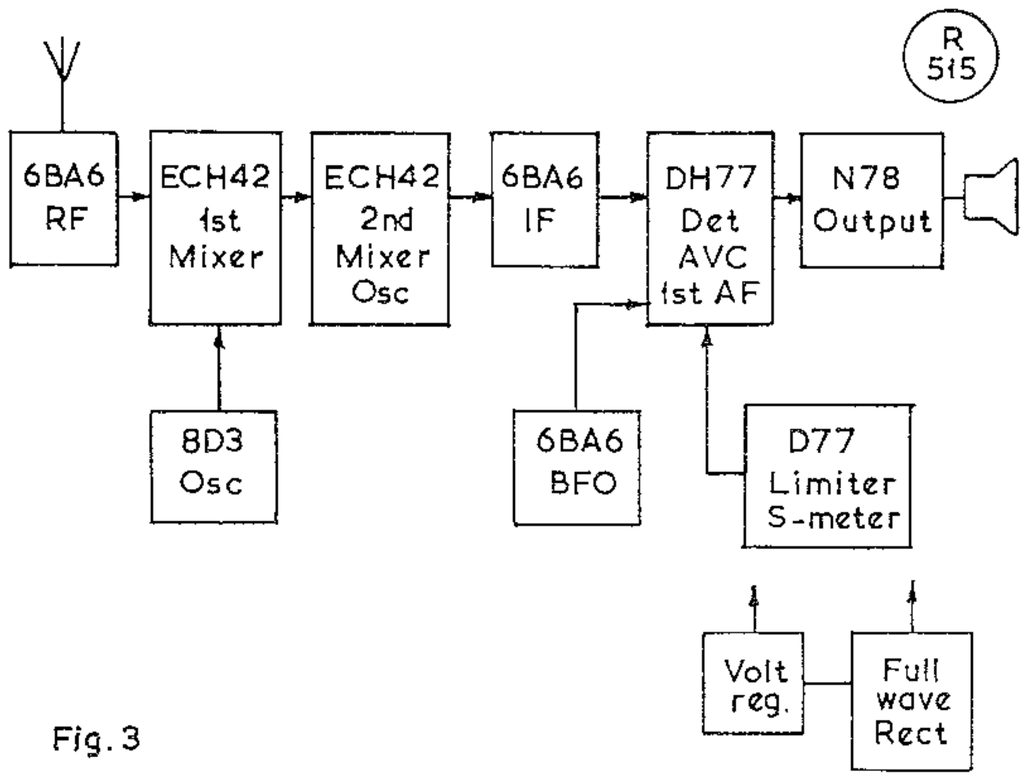
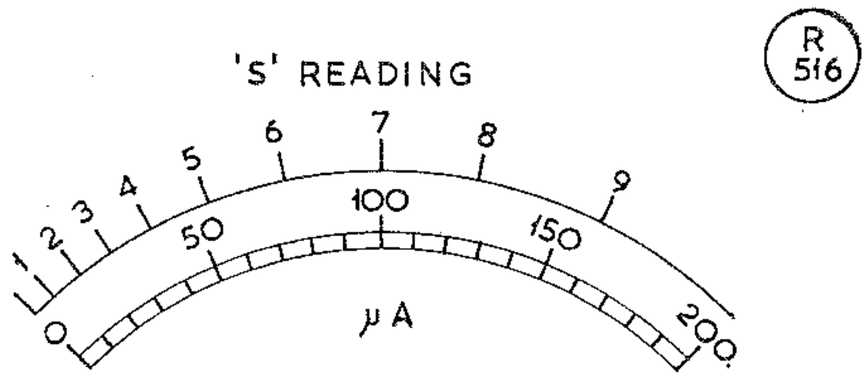


Fig. 3. Block diagram of the well-known Eddystone S.750, which for years has been a popular general-coverage receiver, capable of an excellent performance—see text.



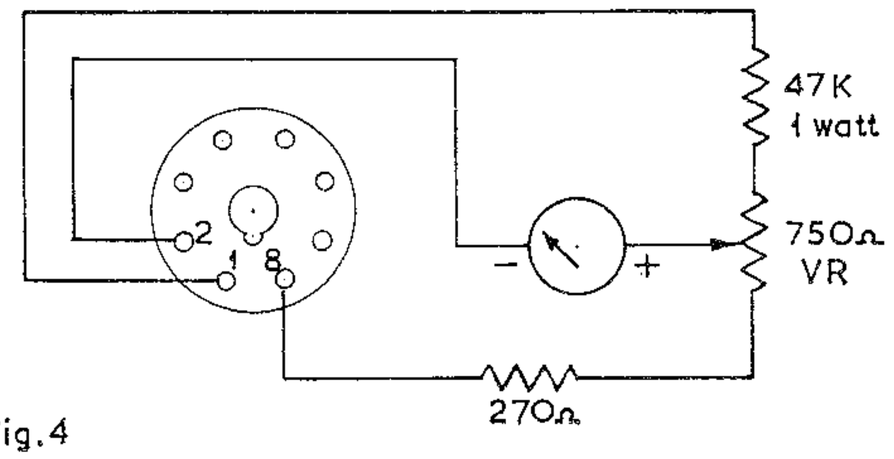


Fig. 4. Suggested circuitry and scaling for an S-meter suitable for post-war Eddystone valve receivers.

Valve Line-Up

The valves fitted, and their function, correspond to the following: 6BA6 RF amplifier; ECH42 1st mixer with 8D3 oscillator; ECH42 2nd mixer/oscillator; 6BA6 85 kc IF; DH77 for detection, AVC and 1st audio amplifier; N78 output stage; VR-150 regulator for oscillators and 1st mixer; 6BA6 BFO, D77 noise limiter and S-meter valve, with a 5Z4G full-wave rectifier.

Fig. 3 shows stages in the 750. This combination is capable of exceedingly good results.

Performance

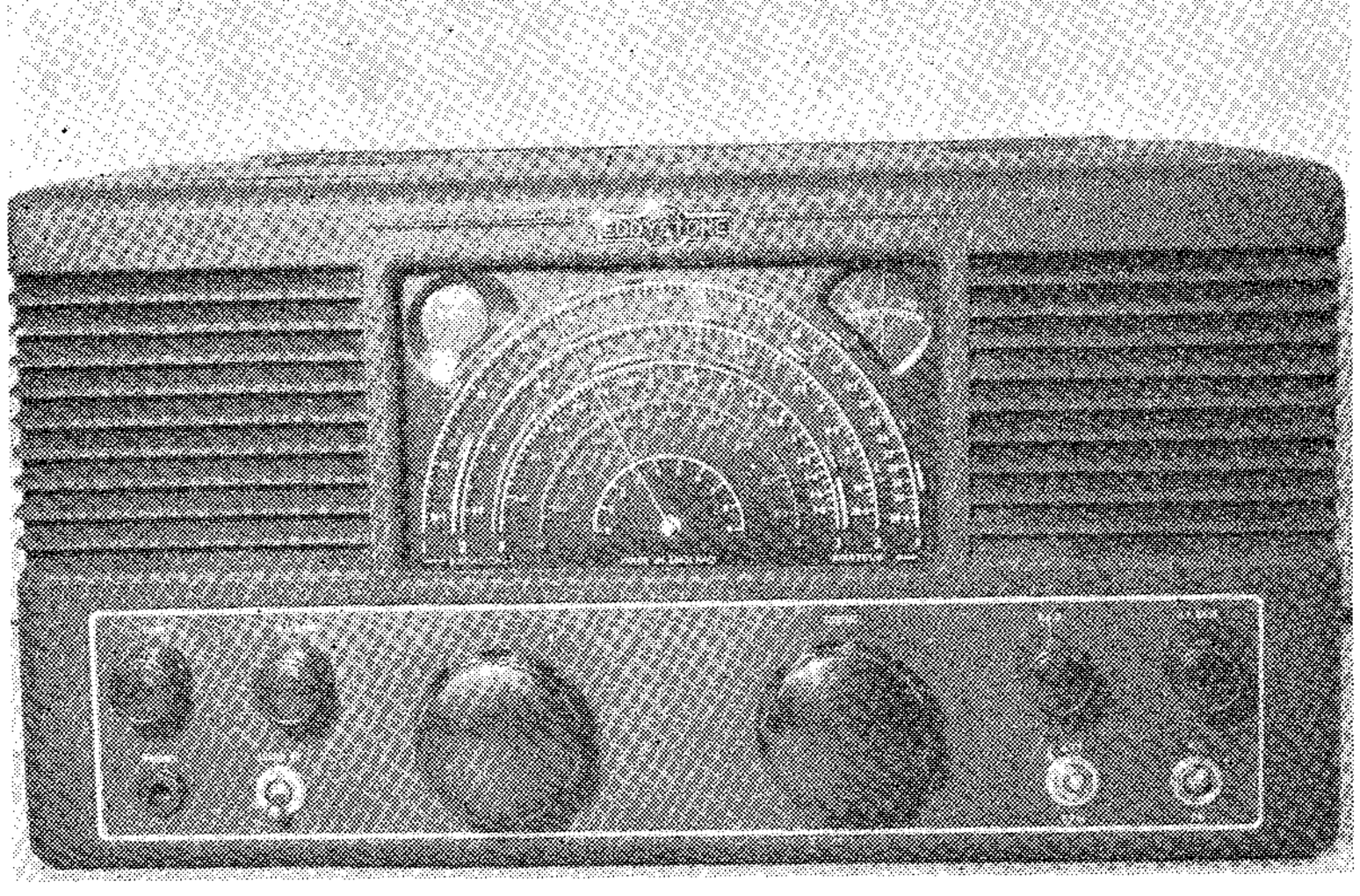
As the 1st IF is at 1·62 mc, 2nd channel or image interference seems in use to be totally absent. The quoted image rejection is 40 dB at 30 mc, and naturally even greater on lower frequencies. On 14 mc there is a notable freedom from interference from those 19m. band commercial transmissions which come in with many receivers having a 460 kc or similar IF. Sensitivity is quoted as better than 5 μV for a 20 dB signal-to-noise ratio. Actually, a 1 μV signal from a laboratory-type signal generator can be copied.

Selectivity is variable, by mechanical adjustment of the coupling in the two 85 kc IF transformers. Listed selectivity is variable from 30 dB to 60 dB, at 5 kc off tune. In operation, the effect of moving the selectivity control is very apparent.

SSB reception can be obtained in the usual way with pre-SSB receivers (that is, by turning back RF and IF gain controls), and the fact that the BFO has a regulated supply seems useful here. BFO injection is to the detection diode through a 20 $\mu\mu$F capacitor, and the receiver behaves in quite a practical manner for this mode of reception.

IF Alignment

Correct alignment naturally becomes very important with this type of circuit. It should be carried out with



Front panel appearance of the Eddystone 740 Rx. Tuning scales are on glass, back lit. The 0-100° mechanical bandspread dial is visible at upper right of scales; this, with a small 0-9° central scale, gives 0-900 degrees for logging. The receiver front panel, with all controls, is a permanent fit to the main chassis, and the cabinet draws off from behind. See p.153 for an underside view.

the selectivity control at maximum. (At minimum selectivity, a band-pass double hump will become apparent.) With injection of a 85 kc, 30% modulated, signal at the 2nd mixer grid, an input of 280 μV should give 50 mW output into a 2·5 ohm load substituting for the speaker. The 85 kc IFT's are those with the moving links.

A 1·62 mc signal can now be injected at the middle section of the tuning capacitor, with the bandswitch at G (gram). The 1st IF cores are then adjusted, and also the 2nd mixer oscillator coil core, if necessary. This is in the can under the ECH42. Output at the speaker terminals should be 50 mW with an input of 5-10 μV at 1·62 mc.

With correct adjustment, the S-meter reading of a stable signal should not fall off when moving the control from minimum to maximum selectivity, when originally tuned in accurately at maximum selectivity. There should be a notable reduction in noise or nearby signals, however. Lost sensitivity through slight errors in alignment are more likely to become apparent when selectivity is increased.

RF and Oscillator Side

If required, oscillator cores are adjusted at 13 mc for Band 1; 4·7 mc for Band 2; 2 mc for Band 3; and 550 kc for Band 4, for correct dial readings. Trimmers are set up for 30, 11 and 4·2 mc, and on 1350 kc. These should be repeated as necessary.

The aerial and mixer signal-frequency cores are then peaked at about the lower frequency for each band already mentioned, and the trimmers are adjusted at the higher frequencies given.

As mentioned for the 740, alignment signals can be taken from a crystal marker. There is also no objection to aligning specifically at amateur-band frequencies, if desired. These calibration points can be obtained from a crystal, or the transmitter VFO, signal strength being kept well down. As example, the core of Range 1 may be adjusted at 14 mc, and the trimmer at 29 mc. In a similar way, Range 3 can be trimmed at 3·8 mc, and the core adjusted at 2 mc.

Additions

Modifications or changes seem rather superfluous, except for an external S-meter (obtainable as a standard Eddystone accessory). Should sensitivity seem low after attending to the points mentioned, probably the best thing is to test each valve for emission, in or out of the receiver. Do not overlook the rectifier.

Fig. 4 is a circuit which allows the S-meter to be plugged into the brown back socket. (An octal plug must be present in the other optional power socket as some circuits are completed by strapped pins.) With a 200 μA meter, S1 to S9 may occupy the positions shown in Fig. 4. Because of the series diode, set the meter pointer mechanically a little below zero, then adjust the potentiometer VR until it reads zero with the aerial terminals shorted to chassis and IF gain at maximum. It was found that satisfactory results could be obtained from the small, popular "ready calibrated" type of 1 mA S-meter.

The 750 is a particularly good general-coverage receiver, and is much used as the IF/AF amplifier for VHF converters, for which its wide tuning scale provides accurate calibration. In this duty, its variable selectivity and adjustable IF gain are particularly useful.