



TECHNICAL SHORTS'

by Gerry O'Hara, G8GUH

'TECHNICAL SHORTS' is a series of (fairly) short articles prepared for the Eddystone User Group (EUG) website, each focussing on a technical issue of relevance in repairing, restoring or using Eddystone valve radios. However, much of the content is also applicable to non-Eddystone valve receivers. The articles are the author's personal opinion, based on his experience and are meant to be of interest or help to the novice or hobbyist – they are not meant to be a definitive or exhaustive treatise on the topic under discussion.... References are provided for those wishing to explore the subjects discussed in more depth. The author encourages feedback and discussion on any topic covered through the EUG forum.

The Lonely Receiver

Woe Is Me...

It was the night before Christmas and in a dirty skip behind the boatyard something whimpered quietly to itself... Eddy remembered the days long ago when he had sat proudly on a shelf in a small crew cabin on a coastal 'packet steamer' plying the west coast of the USA and Canada, calling in at places up and down the coast from Anchorage to San Diego – Eddy liked those days, entertaining all the different crew that he sailed with on the ship for over 20 years: boy, could he tell some tales. Thinking back further he remembered the 'Bath Tub' in Birmingham UK, being switched on for the first time, aligned, being boxed-up and then waking up in a ships chandlers in Vancouver with his soon-to-be owner agreeing to pay for him... The packet steamer had been scrapped long-ago, and during its final re-fit in the late-1970's, again in Vancouver, the little Eddystone S.870A had been ripped out and replaced with a transistor set made in the far East. However, the folks in the boatyard figured that Eddy would make a good radio for their lunch room, and that is where he spent the next 20 years or so, playing all the local Vancouver AM stations while the boatyard folks ate their 'subs', smoked like chimneys and drank strong coffee. Then something fateful happened, Eddy developed a fault: a crackle and then silence - intermittent at first and 'Big Jim' used to thump him smartly and he would work again for a few weeks, then only for a few days, then not at all. "For heavens sake" shouted Sam, "lets get another radio – that thing is so old it has tubes in it!". And so Eddy was taken off his shelf and placed by Big Jim into the bottom of his locker, just in case it was needed sometime... but really, Jim liked the cute looks of Eddy and did not have the heart to throw him out. Eddy spent the next few years gathering dust in the bottom of Big Jim's locker, forgotten and wondering what was going to happen next.



The worst happened, Big Jim left for a better job and the boatyard hit bad times... after many months of lying dormant, the receivers moved in (no pun intended) and anything thought to be of value was sold – unfortunately the old locker units were classed as ‘scrap metal’ value only and thrown, Eddy and all, into the skip. Snow was now falling and Eddy started to cry, tears streaming down his dial glass, his mains lead dangling in amongst the scrap metal – he was lonely and cold: a long time had past since he had felt the warmth of his ballast resistor glowing on his side and the touch of a hand on his knobs - he started to worry that the next time he felt any warmth it might be that of a metal smelter...

Times Are A Changing...



Meanwhile, in a land far away in the East, some magic was happening... the Eddystone User Group (EUG) had been formed by the Three Wise Men, who's wisdom had been sparked by Ted's vision of a need to provide assistance to the legacy of the Bath Tub and any poor unfortunate Eddystone sets that had come on hard times, as well as the loving but oft' frustrated owners of such superlative sets worldwide. They produced fine Newsletters for 16 years and helped many a set and its owner. But not known by many was the supernatural powers held by their collaborative intellect and dedication of the three to the 'marque of marques', where 'scrap' sets, 'parts' sets and 'butchered' sets could be detected from afar by a bright shining star when the atmospheric conditions were just right...

And So...

Eddy suddenly felt some warmth: he looked up and saw he was still in the skip “phew” he thought “at least its not the smelter just yet”. He could hear voices – a group of young guys had started a bonfire next to the skip and were fooling about. Eddy sobbed some more, feeling lonelier than ever and his tears, salty from the residue of all those years at sea, dripped onto pieces of scrap metal of all types, copper, zinc, aluminium and steel – then by some miracle, perhaps the heat of the bonfire, Eddy's salty tears and the touching of different metals caused electrolytic action to start a DC current flowing in his AC/DC circuitry - the voltage generated being enough to cause a stir in his LO, setting off an alarm in the EUG Emergency Room near Birmingham all those miles away. The Three Wise Men dispatched an emissary to Vancouver in search of the plaintiff signals of a lonely and scared S.870A... hours later the skip was opened, the poor set retrieved and Eddy was in the hands of an appreciative new owner.



Happier Times...

That was the best Christmas morning Eddy could remember – his new owner had polished his case and dial glass, cleaned his chassis, had identified the intermittent fault

as a dry joint on his first audio stage and had fixed it. Eddy was sitting on his own table resplendent with Christmas decorations playing carols and in awe at the miracle that the EUG had bestowed on a lonely cabin set from the 1950's. Eddy could not believe his luck and he and his owner lived happily ever after...

The above is based on a true story of an S.830/7 recovered from a skip in the UK, recounted to the author by its new owner (thanks James!). Only the set type, locations, facts, physics and names have been changed to protect the guilty and the innocent. The actor playing the part of Eddy is an S.870A that lives in the well cared-for comfort of a home in the Vancouver area, BC, Canada, owned and cared for by a friend of the author.



Eddy has designs on becoming an S.840C some day, but in the meantime is content to play sweetly for his owner whenever he can.

Postscript – More on ‘Eddy’

Eddy was also featured in the AC/DC ‘Tech Shorts’ article on the EUG site. At that time only fully-clothed poses were available. Since then his agent has allowed some more revealing photos to be published. These are presented below with some technical details

Santa E‘Stone, North Pole, December, 2006



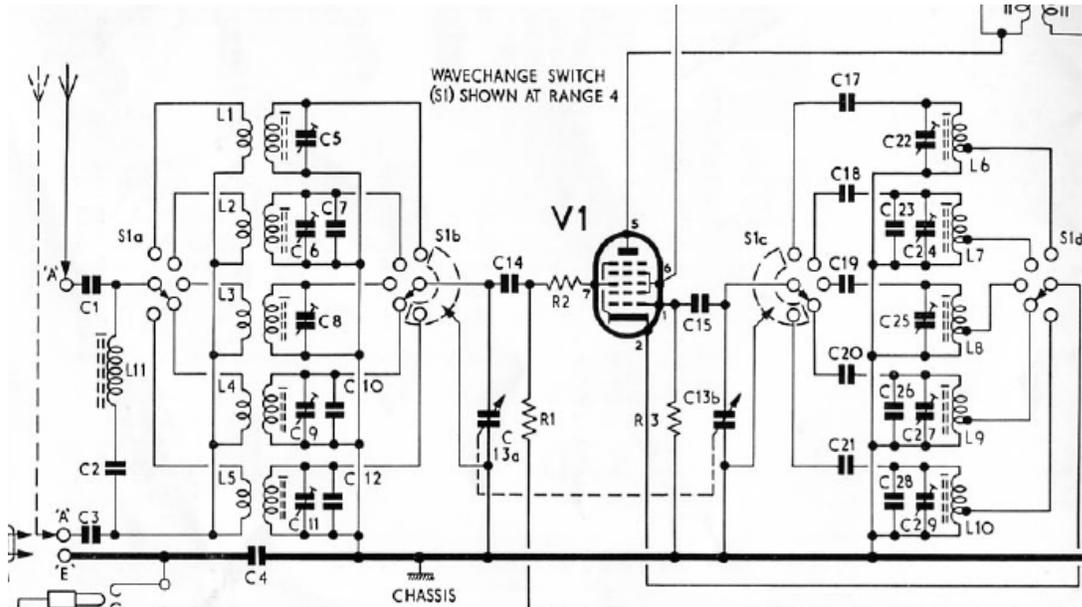
The Technical Bit

The circuit of the S.870A set was outlined in the AC/DC ‘Tech Shorts’ article and the full

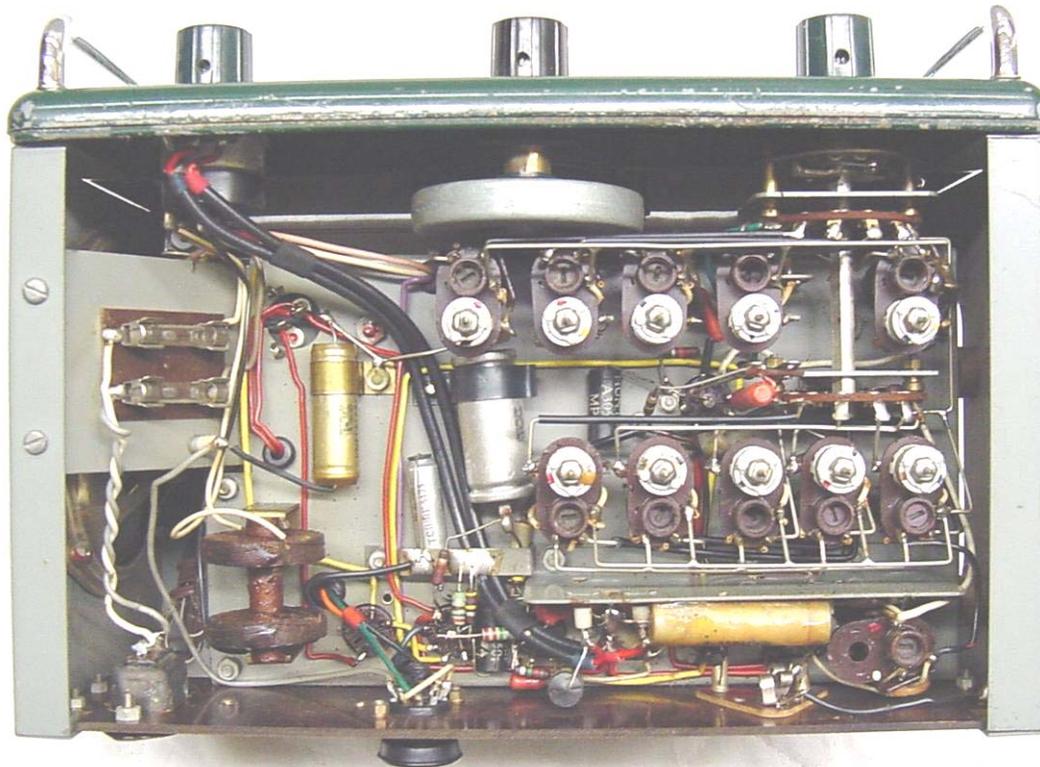


Owners Manual is appended to the end of this article. What wasn't included, due to that article already bloating to some 30 pages, were photos illustrating the set's construction. So, included below is the same information, expanded a bit, but this time fully illustrated. The set comprises:

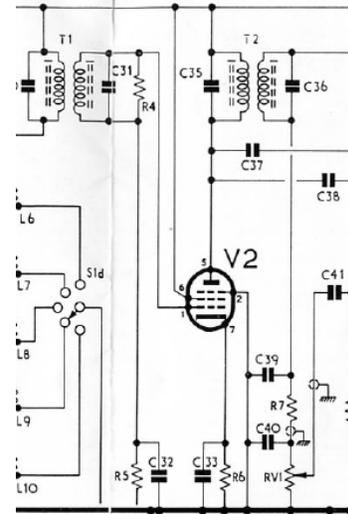
- A 12BE6 (V1) mixer-oscillator front end: nothing too extraordinary in the circuit design here – an electron-coupled oscillator circuit ; the



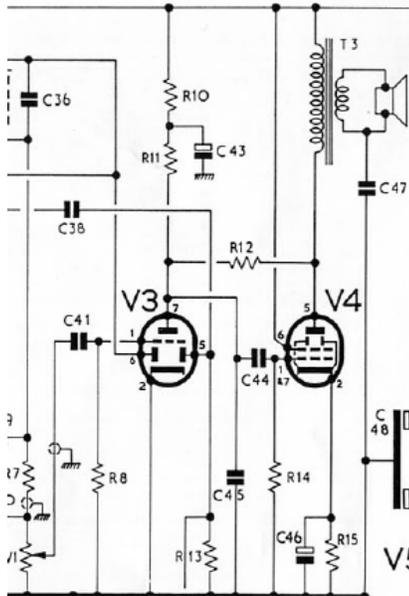
aerial and oscillator tuned circuits are switchable for the number of frequency ranges covered by S1 (in this case five) and a wave trap is present (C2, L11), designed to reject IF frequencies that may be picked up by the aerial system. However, the main thing that sets it apart from the cheaper AC/DC sets is the quality of the parts used in its construction and its careful layout, designed to allow useful and reliable operation on short waves up to 25MHz (see underside of chassis photo, below);



- A 12BA6 IF amplifier, V2 (figure, right): again, nothing extraordinary at all (except for the superior quality of the IF transformers);
- A 12AT6 AM detector, AGC and 1st audio amplifier, V3 (figure, below): separate diodes are used for detection and AGC circuits (many low-cost sets used a single diode for these functions);



- A 19AQ5 audio output stage (V4) of conventional design (figure, left) – though the 19AQ5 valve choice is a bit odd – see article in Lighthouse Issue 92, pp36 for an

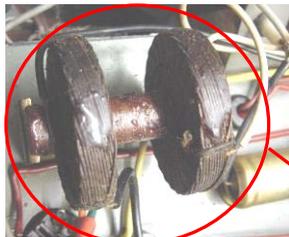


explanation; and

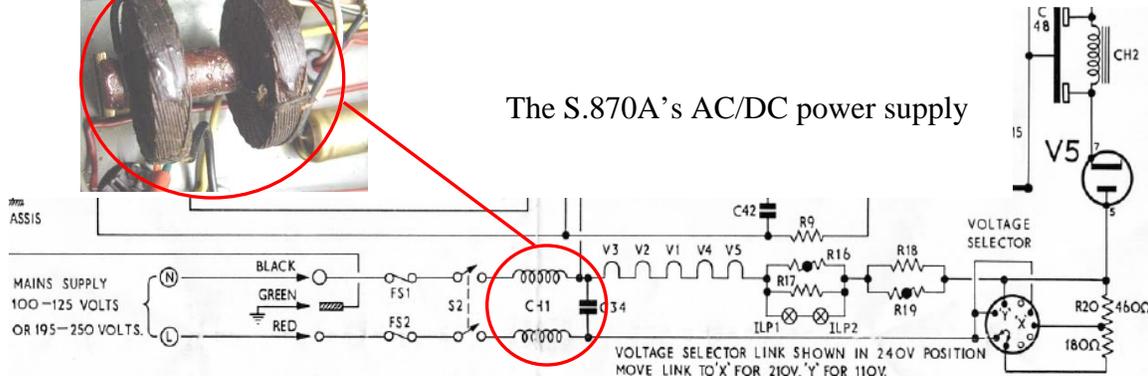
- A 35W4 half-wave rectifier (V5) in the power supply



circuit (figure, below): the main improvements over a standard domestic AC/DC set's supply being the installation of an effective supply-line noise filter and two thermistors, the latter providing both surge protection and a degree of HT stabilization to the set, this being



The S.870A's AC/DC power supply



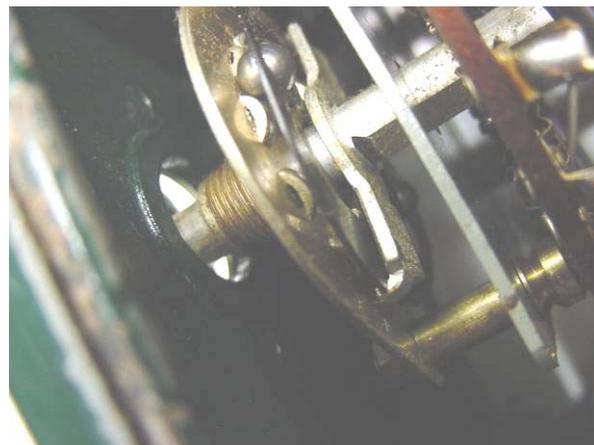
desirable for improved oscillator stability when the set was used on its higher frequency ranges (up to 25MHz).

- The set designers went to length to ensure that the chassis was electrically isolated from the case for safety reasons. This was done by:

- Installing a Paxolin rear panel. On this are mounted the power socket, voltage selector and the aerial/ground connections (photo, below);
- Placing a strip of Paxolin under the metal plate supporting the fuseholders



- to one side of the chassis (photo, right);
- Installing two Paxolin insulating washers on the opposite side of the chassis (photo, below left); and
- Ensuring that the control knob shafts did not contact the front panel, the shafts being insulated from the owners fingers by the control knobs (photo, below right).





Although housed in a 'miniature' case, the quality of the tuning mechanism, chassis, front panel, outer case and other components used in this and other Eddystone AC/DC models were of the usual Eddystone high standard (photo, above). Thus many of these sets are still in use today and some have become very 'collectible' (especially if rescued from skips).

Some Useful References

- The S.870A manual downloaded from the EUG web site and various articles in Lighthouse (listed in the AC/DC 'Tech Short').



The mains dropper (ballast), R20, switched into the power supply circuit on 210v and 240v supply positions



EDDYSTONE
MODEL "870A" RECEIVER





EDDYSTONE

MODEL "870A" RECEIVER

Introduction

The EDDYSTONE Model 870A is a high performance receiver designed primarily for personal use in situations calling for compactness and wide coverage. The receiver tunes the long, medium and short wave bands, has an internal loudspeaker and may be operated from any standard AC or DC mains supply. Ease of tuning is assured by the gear driven drive mechanism which is provided with a vernier bandspread device for accurate station logging. Troublesome mains borne interference is reduced to a minimum by an extremely efficient internal filter circuit not normally found in receivers of this type.

The receiver may be used in all areas regardless of climatic conditions and this feature together with the small size of the unit makes it particularly suited for cabin use aboard ship.

The five frequency ranges are as follows :—

| | | | |
|---------|----|-------------------------|--------------------------|
| Range 1 | .. | 7.5 Mc/s. to 24 Mc/s. | (40 to 12.5 metres). |
| Range 2 | .. | 3.2 Mc/s. to 7.5 Mc/s. | (93.9 to 40 metres). |
| Range 3 | .. | 1.3 Mc/s. to 3.5 Mc/s. | (230.7 to 85.7 metres). |
| Range 4 | .. | 510 kc/s. to 1400 kc/s. | (588.2 to 214.3 metres). |
| Range 5 | .. | 150 kc/s. to 380 kc/s. | (2000 to 789.4 metres). |

INSTALLATION

MAINS VOLTAGE ADJUSTMENT. The Model 870A may be operated equally well from either AC or DC mains supplies, but before making connection to the supply it is important to check that the voltage selector at the rear of the unit is adjusted to suit the mains voltage.

When despatched from the factory, the selector is placed in the 240 volt position which is correct for operation from AC or DC supplies in the range 230 to 250 volts. If the local mains voltage is in the range 200/230 volts, the selector (which is a captive plug) should be pulled forward and then rotated until the "210" marking is opposite the dot on the backplate. Pushing home the selector will now link the appropriate socket connections. The "110" position is suitable for supplies in the range 100 to 125 volts.

EARTHING. The method of earthing the receiver will depend on whether the unit is supplied from a two-pin or a three-pin mains socket. In the case of the latter, the earth is made by means of the green wire connected to the thick pin of the mains plug. If a two-pin connector is used, a good reliable earth must be connected to the earth plug which mates with the socket "E" at the rear of the receiver.

NOTE : When earthing is via a three-pin plug, the earth plug ("E") must be in position even though there will be no lead connected to it. This is necessary to complete the internal chassis earth.

CONNECTION TO THE MAINS. In order to simplify installation of the Model 870A, the mains input is taken to a small socket at the rear, so that should the lead provided prove too short, a longer length may be fitted without the need for jointing or making connections within the receiver itself. In most cases the normal lead will be of adequate length, its free end being left so that the user may fit a plug of a type suitable for connection to the local mains supply. When it is necessary to fit a two-pin plug in lieu of the more usual three-pin type, the green lead should be cut off short and then pushed back into the sleeving of the cable. With three-pin plugs the green lead should be connected to the thick pin.

Assuming that the wiring of the **supply socket** is correct, then the red lead should be connected to the plug pin that engages with the right-hand socket of the wall fitting. If the latter is wired incorrectly (as is occasionally the case) it may be necessary to reverse the red and black leads when the receiver is first tested. On DC mains supplies for example, the receiver will not function if these leads are the wrong way round. When an AC supply is used the receiver will function with the leads either way round, but one method of connection may result in a hum appearing in the output. If this is the case, reversal of the connections will clear the trouble.

THE AERIAL. Although numerous signals can be received with but a short length of wire "draped round the picture rail," far better results will be obtained if some thought is given to the installation of a more ambitious aerial.

Any length up to some 30 feet or so will be suitable and this should be erected well clear of obstructions taking care to keep the lead-in portion reasonably short. If it is not possible to attain a height exceeding 15 feet, the length may be increased (possibly to 50 feet) to compensate for the lowness of the aerial. Height rather than length however, is the main objective if really good results are to be obtained.

When the installation is on board ship any metalwork will have a marked effect on the performance of the aerial and every endeavour should be made to keep clear of rails, deckhouses, ventilators, etc.

Single wire aerials are connected to the socket marked "A" by means of the plug provided. The shorting plug must be in position when using unbalanced aerials of this type.

In installations suffering from direct pick-up of local interference, the simplest solution is

to use a dipole aerial which is of "T" formation and has a twin lead-in. The advantages of this type of aerial are that the lead-in does not act as a pick-up source, can be of any length and may be run close to obstructions without affecting the performance of the aerial proper. This means that the aerial itself (the top portion of the "T") can be placed clear of obstructions and noise sources so giving a definite improvement in reception. A disadvantage of the dipole is that its length determines the frequency band over which optimum results will be obtained.

To connect a dipole aerial to the Model 870A, merely remove the shorting plug and connect the two feeder wires to the two sockets marked "A."

The Model 870A is an extremely sensitive receiver and it is inadvisable to use too long an aerial or trouble may be experienced with overloading especially from strong local medium and long wave stations.

OPERATION

The receiver is switched on by rotating the volume control (left-hand side of panel) in a clockwise direction. A short period of time will elapse during which the dial lamps will illuminate the scale and then the receiver will become fully operative.

The right-hand knob selects the appropriate waveband as indicated by the figures at the left-hand end of the tuning scales. Tuning is by means of the centre knob. This control has a fine balance and the smoothness of tuning will be found a valuable asset when selecting stations on the short wave bands.

Volume is controlled by the knob at the left-hand side of the panel and adequate volume is available for listening in a normal sized room.

The mechanical bandspread scale in the centre of the main scale is read in conjunction with the lowest straight line scale to provide scale readings of great accuracy for station logging.

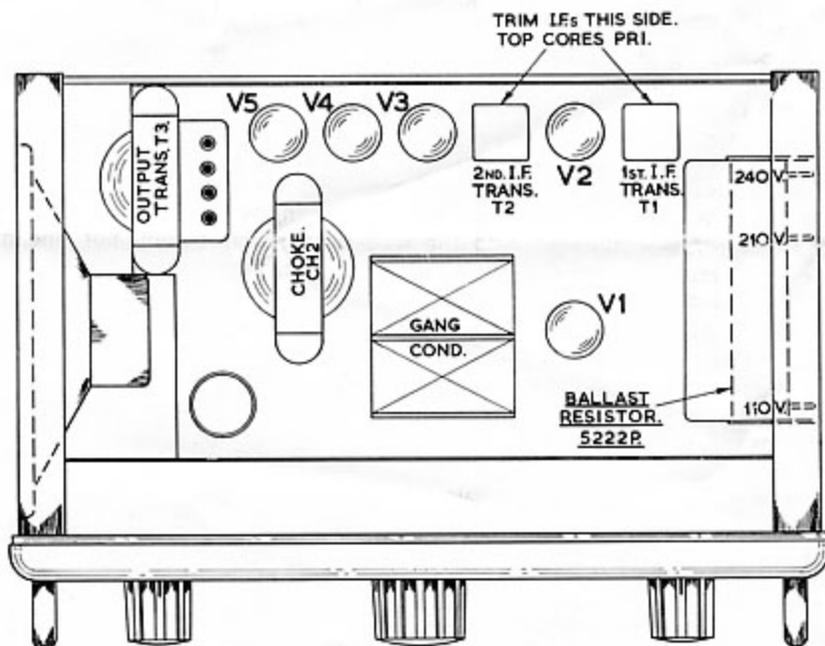


Fig. 1. Plan view of the "870A" receiver showing location of valves and major components.

SERVICING INSTRUCTIONS

Caution. The Model 870A is a Universal type and great care should be exercised when carrying out tests with the cabinet removed. When running from AC supplies it is advisable to ensure that the chassis is connected to the neutral pole of the supply. Alternatively, an isolation transformer may be used to feed the receiver.

Should the receiver fail in operation, first check that all external connections are correctly made and also that mains voltage is available at the supply point. Next check the fuses. These are fitted internally, but the cabinet is easily removed after taking out the four screws at the rear. Any slight difficulty experienced in freeing the cabinet from the panel can be overcome by applying leverage to the slots on the underside.

The two fuses are located beneath the chassis on a small insulated panel adjacent to the volume control and are standard $\frac{1}{2}$ Amp. cartridge type. Visual inspection will reveal whether or not they have failed.

Assuming a blown fuse is changed and the replacement burns out immediately, it is an indication that some component has broken down. In this case the receiver should be taken to the nearest EDDYSTONE agent who will rectify the trouble at a reasonable charge.

Should it be necessary to take the receiver to an engineer who is not familiar with EDDYSTONE equipment, take this instruction sheet with the set. It contains information that will be of value to the engineer and may enable him to clear the fault more rapidly than would otherwise be the case.

CIRCUIT DESCRIPTION.

The Model 870A is a superhet receiver employing modern miniature type valves. Size has been kept to a minimum by omitting an RF Stage, but the performance is maintained at a high level by means of the carefully designed coil unit associated with the Frequency Changer. The Local Oscillator is of the electron coupled type and the Mixer is followed by a single stage of IF amplification at 465 kc/s. Detection is provided by one diode of V3 while the other diode functions as the AGC Rectifier, this being fed direct from the anode of V2 via the coupling capacitor C38. The triode portion of V3 is fed from the volume control (RV1) and functions as the Audio Amplifier driving the Audio Output Stage V4.

The power supply is quite conventional, thermistors being included to protect the series connected valve heaters from the surge at switch-on and also to maintain the correct heater current in the event of the dial lamps going open-circuit.

OSCILLATOR TRACKING FREQUENCIES AND ADJUSTMENTS.

| Range | Trimming Frequency | Trimmer | Padding Frequency | Core |
|-------|--------------------|---------|-------------------|------|
| 1 | 22 Mc/s. | C22 | 8 Mc/s. | L6 |
| 2 | 7.5 Mc/s. | C24 | 3.3 Mc/s. | L7 |
| 3 | 3.5 Mc/s. | C25 | 1.35 Mc/s. | L8 |
| 4 | 1350 kc/s. | C27 | 550 kc/s. | L9 |
| 5 | 350 kc/s. | C29 | 160 kc/s. | L10 |

NOTE : The oscillator tracks on the "high" side of the signal. On Ranges 1 and 2 it may be possible to find two tuning points with trimmer and core. That occurring with minimum C or L is the correct one.

Once the dial calibration has been checked, it is in order to proceed with alignment of the aerial input circuits.

The signal generator should be connected to the Aerial/Earth sockets via a suitable dummy aerial, or, where this is not available, via a 400 ohm, non-inductive resistor. Isolation capacitors should be connected in series with both generator leads, a 1 Megohm resistor being wired directly across the Aerial/Earth sockets.

Tune to the frequencies given in the Table below and adjust the appropriate trimmers and cores for maximum reading in the output meter.

AERIAL INPUT ALIGNMENT FREQUENCIES AND ADJUSTMENTS.

| Range | Trimming Frequency | Trimmer | Padding Frequency | Core |
|-------|--------------------|---------|-------------------|------|
| 1 | 22 Mc/s. | C5 | 8 Mc/s. | L1 |
| 2 | 7.5 Mc/s. | C6 | 3.3 Mc/s. | L2 |
| 3 | 3.5 Mc/s. | C8 | 1.35 Mc/s. | L3 |
| 4 | 1350 kc/s. | C9 | 550 kc/s. | L4 |
| 5 | 350 kc/s. | C11 | 160 kc/s. | L5 |

IF REJECTOR CIRCUIT.

An IF Rejector circuit is placed across the input circuit to minimise breakthrough at the intermediate frequency. To check, a modulated signal at 465 kc/s. is applied from the signal generator across the Aerial/Earth sockets and the core in L11 is then adjusted until the output meter reading is at a **minimum**.

RE-ALIGNMENT : GENERAL.

Close tolerance capacitors and precision wound coils are employed in the IF and Oscillator Stages so that the initial factory alignment will hold good for a long period of time. Trimming adjustments should not be tampered with unless the symptoms clearly indicate that re-alignment is in fact required.

The instructions given below are for initial alignment and are given in full for the convenience of the service engineer. In most cases only minor adjustments will be necessary to compensate for ageing of components.

RE-ALIGNMENT OF THE IF TRANSFORMERS.

First disable the local oscillator by shorting out the forward section of the tuning gang. Set the range switch to 5, volume at maximum and connect the signal generator output across the rear section of the gang. Adequately rated blocking capacitors (0.01 mfd. capacity) should be connected in series with each lead from the generator. Disconnect the internal speaker and connect an output meter (matched to 2.5 ohms.) to the secondary of the output transformer T3.

After allowing a ten minute warming up period, tune the generator to 465 kc/s. with modulation at a depth of 30% (400 c/s.). Adjust the attenuator for a convenient output reading and then peak the cores of T1 and T2 for maximum reading in the meter. An insulated trimming tool should be used and the EDDYSTONE Cat. No. 122T will be found eminently suitable. Increase the attenuation as the alignment proceeds and ensure that on completion a sensitivity of less than 90 microvolts for a 50 milliwatt output is obtained. If it is not possible to achieve this figure, replacement of V2 may effect some improvement.

Having completed the IF alignment, disconnect the test equipment from the receiver, remove the short from the gang and reconnect the internal speaker.

RF ALIGNMENT.

The first step in the alignment of the RF Section of the receiver is a check on the accuracy of the dial calibration to ascertain whether or not any adjustments are required in the oscillator stage. Such a check is best carried out by using a modulated crystal controlled harmonic generator since the calibration accuracy of the average signal generator—being of the order 1%—2%— is inferior to the accuracy required. At least three spot frequencies should be checked on each range, the oscillator tracking being corrected if necessary as detailed below.

With the standard signal introduced at the Aerial/Earth sockets and an output meter connected across the speaker to give a visual indication of the correct tuning point, set the receiver dial to the trimming frequency applicable to the range in use (see Table at head of next column). Tune in the standard by means of the appropriate trimmer and then alter the receiver dial to the padding frequency. Tune in the standard by means of the oscillator core and re-check the trimming frequency, making any readjustments that may be necessary due to interaction between the trimmer and core.

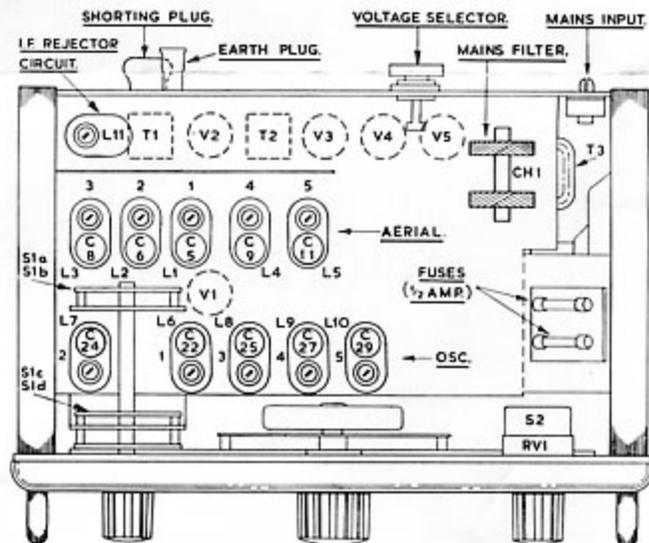


Fig. 2. Location of trimming adjustments and major components on the underside of the B70A receiver.

VALVE TYPES

| | | | | | | |
|----|----|----|----|----|----|-------|
| V1 | .. | .. | .. | .. | .. | 12BE6 |
| V2 | .. | .. | .. | .. | .. | 12BA6 |
| V3 | .. | .. | .. | .. | .. | 12AT6 |
| V4 | .. | .. | .. | .. | .. | 19AQ5 |
| V5 | .. | .. | .. | .. | .. | 35W4 |

TABLE OF VOLTAGE VALUES.

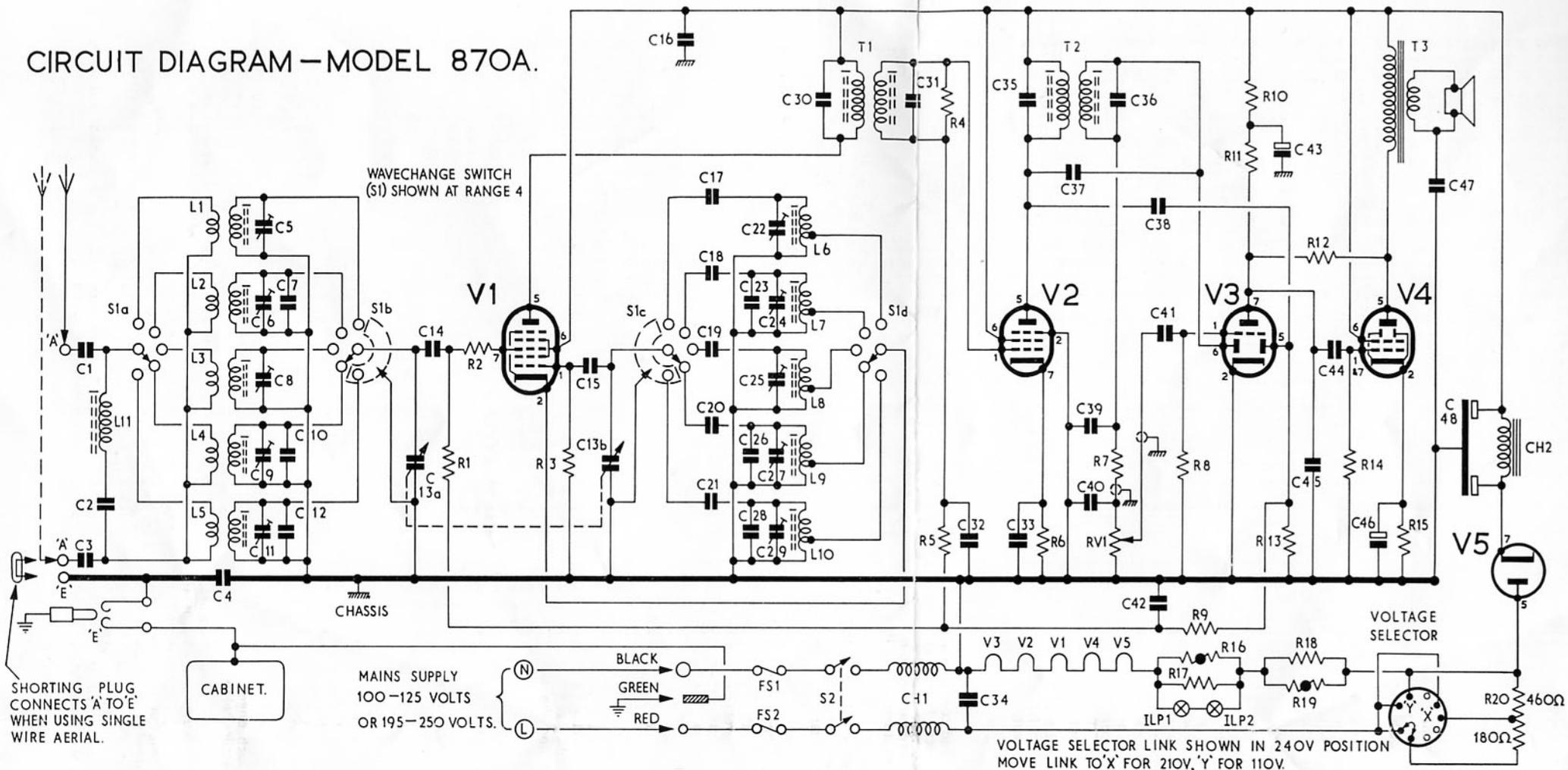
| Valve | Anode | Screen | Cathode |
|-------|----------|--------|----------|
| V1 | 100/93 | 101/94 | — |
| V2 | 100/93 | 101/94 | 0.65/0.5 |
| V3 | 43/30 | — | — |
| V4 | 98/95 | 101/94 | 4/3.7 |
| V5 | 115/110* | — | 105/98 |

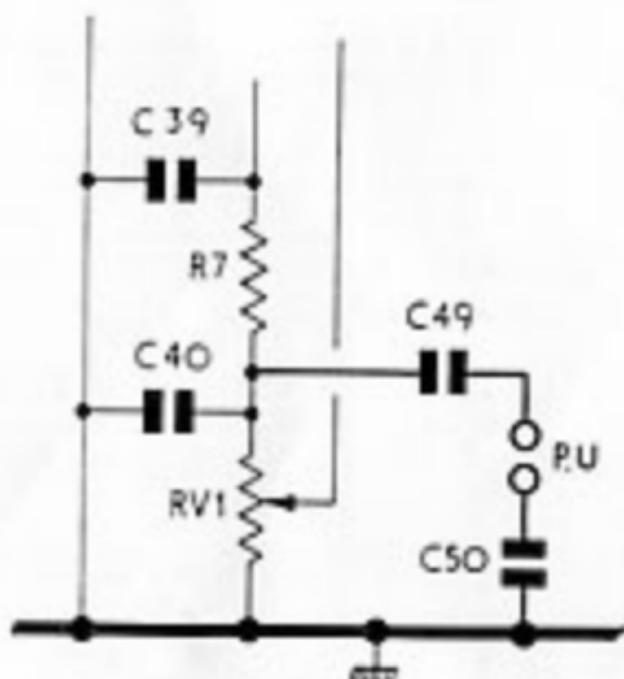
*AC. All other readings are DC and are taken between the point indicated and chassis. Readings are substantially correct for any applied mains voltage.

In each case, the first reading is that obtained using a meter of 20,000 ohms. per volt; the second 600 ohms. per volt. A variation of $\pm 5\%$ should be allowed.

Readings taken on Range 5 with volume at maximum and aerial input earthed, i.e. no signal conditions.

CIRCUIT DIAGRAM—MODEL 870A.





This receiver is now provided with "Pick-up" sockets which allow it to be used as an amplifier in conjunction with a standard high impedance gramophone unit.

The diagram shows the circuit addition involved and the values of the extra capacitors are as follows :

C49 0.01 mfd Ceramic
 $\pm 25\%$ 500V DC wkg.

C50 0.02 mfd Ceramic
 $\pm 25\%$ 500V DC wkg.

External connections should be made with screened cable terminated in suitable plugs. The screening should be connected to the left-hand socket.

DIAL LAMPS

The dial lamps are 5V M. E. S. types rated at 0.15 Amps. Stratton Part No. is 6484P.

TRANSFORMERS.

T1 ... 1st IF Transformer.
 T2 ... 2nd IF Transformer.
 T3 ... Output Transformer 5267P.

CHOKES.

CH1 ... Mains Filter. D2024.
 CH2 ... Smoothing. 5268P.

INDUCTANCES.

| | | | |
|-----|-----|--------------------------|--------|
| L1 | ... | Aerial coil Range 1. | D2453. |
| L2 | ... | " " " 2. | D2455. |
| L3 | ... | " " " 3. | D2457. |
| L4 | ... | " " " 4. | D2459. |
| L5 | ... | " " " 5. | D2264. |
| L6 | ... | Oscillator coil Range 1. | D2454. |
| L7 | ... | " " " 2. | D2456. |
| L8 | ... | " " " 3. | D2458. |
| L9 | ... | " " " 4. | D2460. |
| L10 | ... | " " " 5. | D2265. |
| L11 | ... | IF Rejector coil. | D2266. |

SALES AND SERVICE DEPOTS FOR EDDYSTONE "870A" RECEIVERS

Port of London :

WEBB'S RADIO
14, Soho Street, London, W.1.
Telephone : Gerrard 2089

Tilbury Area :

G. T. WILSON
12 Queen Street, Gravesend
Telephone : 4194

North Eastern Ports :

WILLINGS & Co.
73, Church Street, West Hartlepool
Telephone : Hartlepool 2668

A. L. WILLINGS & Co.
14, Marton Road, Middlesbrough
Telephone : 46205

Southampton Area :

SOUTHERN MARINE RADIO
Town Quay, Southampton
Telephone : Southampton 22721

Clydeside :

CAMPBELL & ISHERWOOD LTD.
1039/1041, Argyll Street, Glasgow, C.3
Telephone : Central 5455

Merseyside Area :

JAMES MCKENZIE LTD.
25, Oxton Road, Birkenhead
Telephone : Claughton 4833

Cardiff :

PEMBERTON & DOTCHON LTD.
35, Mount Stuart Square
Telephone : Cardiff 6507

Falmouth :

G. R. ENNOR
The Moor, Falmouth
Telephone : 321

Grimsby :

THE GREAT GRIMSBY COAL, SALT
& TANNING Co. Ltd.
Fish Dock Road,
Telephone : 5346

Swansea :

LARS KNUTSEN & SONS Ltd.
5 & 6, The Strand, Swansea
Telephone : 52412/3

Aden :

SAID AHMED O. BAZARA & BROS.
Section "A", Streets Nos. 3 & 15, Aden Camp
Telephone : 246 Cables : "Aletihad"

Australia :

R. H. CUNNINGHAM PTY. Ltd.
2-8 Bromham Place, Richmond, Melbourne, E.1
Telephone : 42 1614 Cables : "Cunnig"

29, Gibbes Street, Chatswood, Sydney
Telephone : 40 0218

43, Bowen Street, Brisbane
Telephone : 2 3755

205, Seacombe Road, Brighton, Adelaide
Telephone : 96 8755

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130, Great King Street, Dunedin P.O. Box 841

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Sweden :

AKTIEBOLAGET TRAKO
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Cables : "Trako"

LUNDEVALL ELECTRONIK

Husargatan 35, Gothenburg

Tanganyika :

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

Cables : "STRATNOID" Birmingham Telex : 33708 Telephone : PRlory 2231-2-3-4