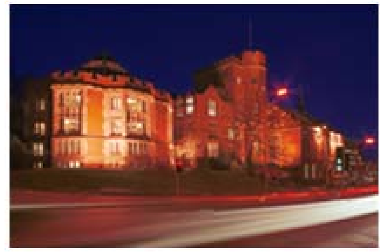
# Restoration of an Eddystone EC10 MkI Solid-State Receiver (Part 1) - by Gerry O'Hara, G8GUH/VE7GUH

## Background

In my Eddystone S.740 restoration article, I recounted that a long time ago (1971 or thereabouts I think) I owned a Murphy B40 ex-Admiralty communications receiver (available cheap on the surplus market at the time) bought out of my hard-earned wages working in the repair workshop of a local TV and radio store in Carlisle. At that time, one of my radio amateur friends, Gordon, G3MNL (now SK) owned an Eddystone S.640 and an S.770R and I was so impressed with those Eddystone receivers I decided to sell my B40 and buy the only Eddystone I could afford – a secondhand EC10 Mk1 for £40 or so ($80). There was also another consideration for me though - I was planning on going to university in Sheffield (photo, right) and there was no way the B40 could have gone with me – it weighed 1cwt!



Although I liked the quality construction and 'feel' of the EC10 – especially the smooth tuning - to be honest, I was a bit disappointed with its performance compared to the old (valve) B40. Also, it did not have a 'certain something' that Gordon's valved Eddystone sets had. So, in my youthful enthusiasm (and now with much regret and shame) I 'butchered' it – installing a Q-multiplier, crystal calibrator, S-meter, fine tuning, NBFM detector, squelch, product detector for SSB, 'hot' FET front-end, regulated psu, 2-meter converter, etc. Amazingly it still worked – and very well as I recall! I still have that EC10 – though it is residing far away in my mother-in-laws garage in the UK (I now live on the west coast of Canada). However, as noted in the S.740 article, one day I intend to rescue that EC10 and will try to undo the butchering…

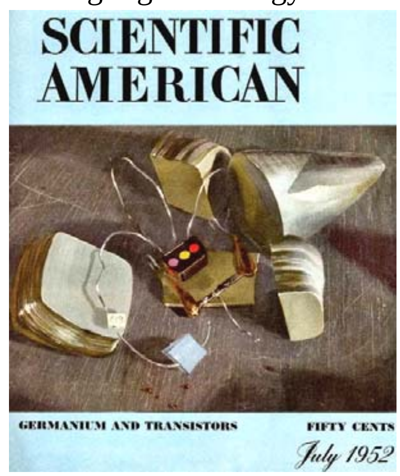
Well, I wrote the S.740 article back in June 2006 and almost 2 years later no rescue mission for that poor EC10 has been launched from the O'Hara QTH in Canada. Having 're-taken the plunge' into solid-state Eddystones with the purchase of an EC958/3 last fall from a radio amateur located in Winnipeg (an article will be written on that set sometime, though I have not even had its case off yet!), and not having bought an Eddystone receiver for some time, I was getting rather itchy for a 'fix' and a change from restoring domestic US & Canadian 'tube' radios. Back in February, 2008 I noticed an EC10 MkI in the 'For Sale' section of the EUG site – this one stood out in that it was located in Canada (much easier on the shipping costs for me). From the photos sent to me by the seller, it looked in generally sound condition, but had several cosmetic imperfections evident that suggested to me that it was likely in the 'suitable for restoration' class. Also, the seller reported that he had heard a hiss and 'a couple of

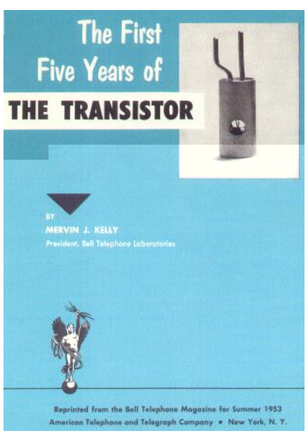
stations' on it when switched on, but that these were 'quite faint'. As the EC10 is a very popular set, I decided to go for it with a view of restoring the set and preparing an article for the EUG site that may be of some use to others, but also for a self-indulgent trip down memory lane. Some negotiation later I forked out a small 'fistful of dollars' and became the owner of my second EC10 MkI. This article details some aspects of my restoration of that set, but first I think a little context-setting would be useful – at least for the uninitiated in the land of radios containing three (or four)-legged semiconductor beasties.

**Context of the EC10 MkI**

'C'mon man, stop hogging that damn' microscope!'

Following the development of the first transistor devices in the late-1940's (when real engineers all wore ties - photo, left), the first commercial application of this fledgling technology were in hearing aid amplifiers around 1950. A short article from the December 1953 issue of *Radio-Electronics* is attached to provide some insight into this particular application. The first actual 'trannie' radio was reportedly developed by *Intermetall* in 1952, which they showed-off at the Dusseldorf Radio Show that year. This was followed by the first commercial transistor radio set in 1954, the 'Regency TR1', developed in the US as a joint project between the Regency Division of *Industrial Development Engineering Associates* and *Texas Instruments* (Texas Instruments manufactured the transistors and Regency designed and built the radio). This desirable gadget (bearing a remarkable likeness to the modern-day iPod) was marketed under the catchy slogan "*See it! Hear it! Get it!* – those that did get it though coughed up $49.95, around £200 ($400) in 2008 lucre. Meanwhile, over in Japan, the *Tokyo Tsushin Kogyo Company* (soon to be re-born under the moniker '*Sony*' for obvious reasons) followed close behind with their 'TR55' model, launched into the market in August 1955 (hey, that's when I was produced also! - though I was made in the UK). Speaking of which, the first UK-made portable trannie was the 'Pam 710', manufactured by *Pam (Radio & Television Ltd)* of Regent (not Regency) Street, London and launched in March, 1956 for about £33. The rest as the saying goes, even including the Sinclair matchbox radio, is history…

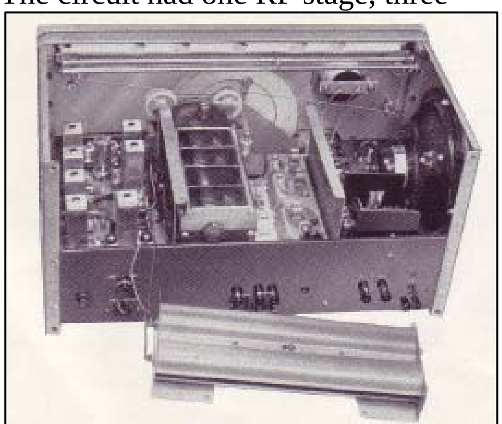



Eddystone first experimented with transistors around 1960 (see the *Cooke Report*, p18), and the first transistor set having an Eddystone pedigree was reportedly the 'Stratton Portable' produced in 1961. Graeme Wormald in the QRG notes this set to be an:

> *"…All-band transistor radio… strictly speaking this was not an "Eddystone", but* [it] *was developed in Stratton's Eddystone laboratory…*
>
> *The Laughton family, owners of Stratton and its Eddystone Radio division before the sale to Marconi in 1965, had family connections with the John Myers mail order company.*
>
> *Transistor Radios were new and it was thought that an opening might exist. The radio covered Long, Medium and Short waves up to 30MHz as well as VHF/FM* [quite impressive for its day]. *It was built into a diecast box with ferrite rod aerial in a plastic handle and rabbits' ears for HF/VHF.*
>
> *Needless to say, the build quality was far too good for the cut-throat competition of the mail order market. Three sets were constructed. They were raffled off amongst those involve with the development. You never know; one day… But it gave Eddystone's their first experience of solid state design."*


Building on this knowledge, and staying within their more traditional and familiar territory of communications receivers, Eddystone launched their first all-solid-state general coverage communications receiver in 1962. This set looked identical externally to an S.940, though with transistor circuitry replacing the traditional valves. The S.960 sported 12 germanium transistors and seven diodes, had six ranges covering 500kHz to 30MHz and was powered by an internal 12 volt battery pack. The circuit had one RF stage, three 465kHz IF stages, including a bandpass crystal filter. Its performance was apparently (and very believably) not on a par with the S.940 however, and the S.960 was dropped from the Eddystone range after the Bath Tub manufactured only 150 of the sets over 2 years. It is worth noting that the transistors used in the first experimental Eddystone solid-state sets cost the equivalent of around £50 ($100) *each*.


*Interior view of the "960" transistorised receiver. RF and oscillator section is in the centre, with the coils in a diecast housing; intermediate frequency stages on the left; and audio section on the right. The unit in the foreground is the battery container, normally fixed above the centre section.*


The next solid-state set out the Bath Tub was the famous EC10 – one of the companies biggest successes in terms of total sales (over 16,000 MkI and MkII series sets combined). This set was an instant success, receiving favourable radio press reviews and satisfying the need for a more 'modern' and compact communications receiver at a (fairly) reasonable price point. The EC10 was housed in a much smaller case (12" wide) than the S.960, while still retaining the famous Eddystone slide rule dial that made tuning the set a pleasure, as well as the hallmark Eddystone mechanical construction that made it *feel* like a quality piece of kit. The EC10 used an all-germanium PNP transistor line-up that shared many circuit design elements with the S.960 (its main features are described below), but was constructed on two 'Paxolin' printed circuit boards, with a zener-stabilized nominal 6.5 volt supply to the RF amplifier, Mixer, local oscillator (LO) stages and the beat frequency oscillator (BFO). The set could be powered from a removable battery pack using 6 'D' sized dry-cells to provide a 9.1 volts, positive earth supply (positive earth was the norm when using all-PNP transistor circuitry). A mains power supply (Type 924) could be substituted for the battery pack.

The MkI model was introduced in 1963 and was phased out in 1969, with the MkII model taking over from 1967 until production of the model finally ceased in 1977 (14 years is a pretty good production run for a radio!). The MkII circuitry was very similar to the MkI, retaining the simple all-germanium transistor design, which was a real anachronism by 1977 - compare this with the very sophisticated EC958 circuitry introduced by Eddystone in the late-1960's (ok, I admit, these sets were aimed at very different markets, however the early 1960's design and component complement of the EC10 was dated by any standards by 1977). The MkII added some minor refinements such as a fine tuning control effected by a varicap diode, standby switching and an S-meter, but was essentially a 'sheep in wolfs clothing' in terms of performance. Cosmetically, the MkII differed mainly by having a more trendy silver-coloured case and finger plate, black trim and more modern knobs. Interestingly, the MkII-style knobs were also used on some of the later MkI models. The EC10 MkI set described in this article (Serial Number 3086) has the older-style knobs, but was manufactured after the Marconi sale in 1965 (no mention of Stratton & Co. Ltd. on the identification plate on this one), so I date it around 1966-7.

The EC10 MkI that I bought in my teens (S/N KP0064) was manufactured in 1964 by Stratton & Co. Ltd. Both look very similar externally and internally.


EDDYSTONE

**"EC10" TRANSISTORISED COMMUNICATIONS RECEIVER**

A most efficient transistorised communications receiver of light weight, compact dimensions and capable of a really good performance. Five ranges give continuous coverage from 550 kc/s to 30 Mc/s (545 to 10 metres), and included are the medium wave broadcast band, the marine (coastal) band from 1500 to 3000 kc/s, and all the short-wave broadcast bands. Also available are the six major amateur bands and many services in between.

The "EC10" receiver accepts normal AM telephony and CW telegraphy, a special filter being provided to increase selectivity (and also reduce noise) in the CW mode, as is often desirable. Single sideband signals can be successfully resolved by appropriate setting of the BFO for carrier re-insertion. A total of 13 transistors and diodes is used, leading to high sensitivity and consistent results on all ranges.

The main scales occupy a length of nine inches and are clearly calibrated direct in frequency. The standard Eddystone precision slow-motion drive controls the tuning, and is exceptionally smooth and light to handle. An auxiliary logging scale permits dial settings of chosen stations to be recorded.

An internal speaker gives good aural quality and a comparatively high audio output is available — one can easily believe the set is mains operated. For personal listening, a telephone headset can be plugged in to the socket on the front panel, the speaker then being out of action.

Alternative aerial sockets are provided, for dipole, long wire or short rod or wire. Power is derived from six cells housed in a separate detachable compartment. Current consumption is related to audio output and, for long life, HP2 type heavy duty cells are recommended. The standard receiver can readily be converted to AC mains operation by the addition of a small mains power unit, of dimensions identical to those of the battery box.

The receiver is housed in a metal cabinet, and, with robust construction throughout, it will stand up to hard usage over a long period with a high degree of reliability. The finish is an attractive two-tone grey. The dimensions are width 12½"; height 6¾", depth 8"; Weight with batteries is 14 lbs.

LIST PRICE (in U.K.) : £48 0s. 0d.
Cat. No. 924 AC Mains Unit £5 0s. 0d.

Several EC10 variants also exist: the EC10A (1965) that had an IF of 720kHz, compared with the standard 465kHz of the other EC10 models - this was to allow this version to cover the 300-550kHz tuning range for the reception of non-directional beacons, and was produced for the Swedish Mercantile Marine; the EC10A2 (1966-77), having different frequency coverage on its lower ranges compared to the standard EC10, and which incorporated a crystal-controlled 'distress' channel on 2.182MHz (three different mounting versions were available, designated /1, /2 and /3); and the EC10M, badged and marketed by Marconi as the 'Seaguide'. Apart from the general public, EC10 customers included the Post Office, NATO, the Coastguard/coastal shipping services and even the Diplomatic Wireless Service (apparently only 10 'Diplomat' models were made that had 10 crystal-controlled channels in addition to the standard general coverage tuning – see Lighthouse Issue 75, p29). I even heard somewhere that Prince Charles had an EC10 fitted into his Scimitar sports car back in the 1960's - anyone have a photo of this for 'Eddystones in Famous Places'? – come on Charles you must have a snap in your family album we could have for the EUG website…

In Lighthouse Issue 90 (April 2005), Ted Moore reports he has no less than seven EC10 MkI's in his collection – why?... Ted explains:

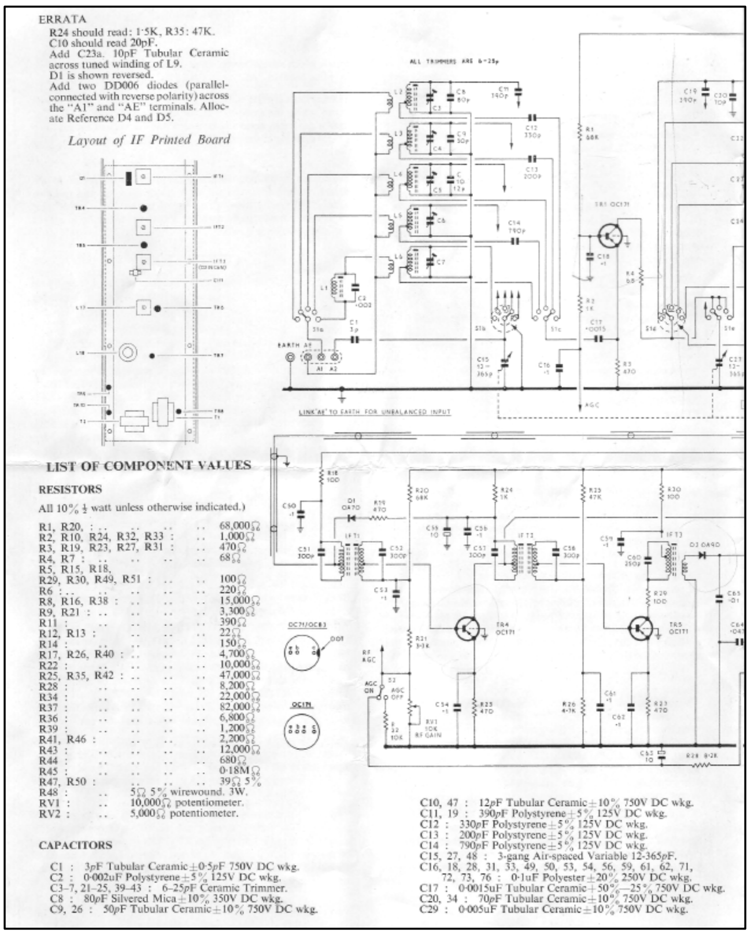
> *"…Well simply because they are all different in some way from each other. Honestly there are FOUR different styles of knobs – as original. There are THREE different styles of scale, thin or thick lettering, and even scale figures at slightly different positions on the scale plate.*

*There are also THREE different versions of PCB with some component placing differences. I even have one with ferrite beads fitted on the Base leg of all RF and IF trannies, as original! Colours? I have three different schemes…*

*Similarly with the MkII, TWO different PCB layouts. THREE colour schemes, and TWO different versions of scale plate… ".*

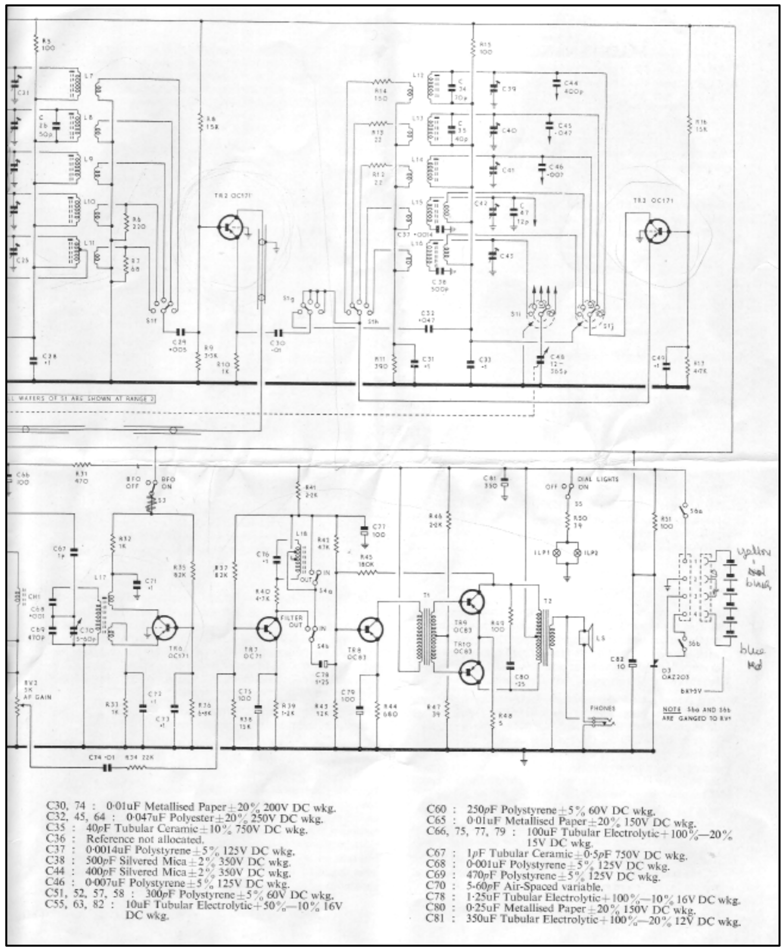
In other words, the EC10 has that typical Eddystone character built into its design, build quality and production history… it just happens not to be fitted with valves.

**A Quick Look at the EC10 MkI Circuit and Features**




As with the majority of Eddystone valve sets, the early Eddystone solid-state receivers were of generally conservative, almost textbook, design. In the case of the EC10, the manual (appended) includes a fairly detailed description of the circuit so only a brief summary is provided here.

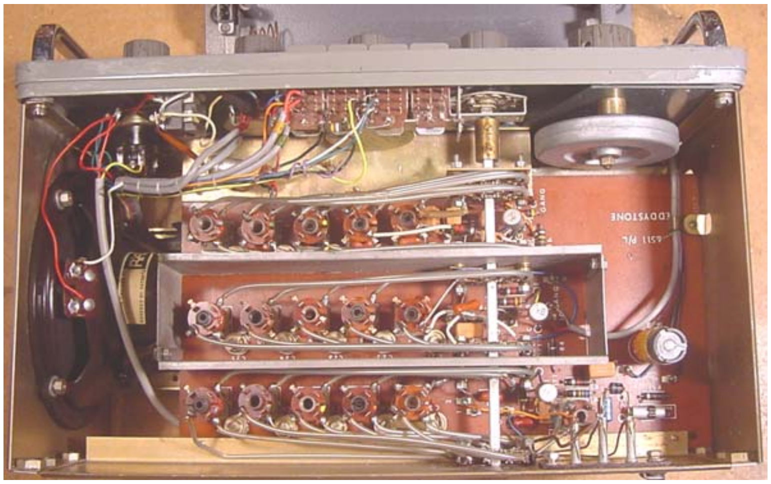
The front-end comprises a grounded-base OC171 RF amplifier, this being transformer-coupled to the base of an OC171 configured as the Mixer. The LO, tracking above the signal on all ranges, comprises another OC171 (why change when you are on a roll?) in a tuned-collector configuration, with the LO signal fed to the emitter of the Mixer transistor. Five tuning ranges are provided, selected by a multi-wafer Yaxley switch. Three stages of IF amplification are present at an IF frequency of 465kHz, comprising three more OC171's (what a roll!), each coupled by double-tuned transformers. Audio amplification is via an OC71 feeding an OC83D driver transistor to a pair of OC83's in transformer-coupled push-pull, as was the norm in the early 1960's. Yet a further OC171 acted as the BFO (feeding its signal to the primary of the second IF transformer), an OA90 diode as the detector, an OA70 as a diode switch (that introduced a damping resistor across the primary of the first IF transformer to assist the AGC circuit in preventing overloading in the presence of strong signals), and an OAZ203 6.5 volt zener diode providing a stabilized voltage supply to the RF amplifier, Mixer, LO and BFO stages to promote stability with varying battery supply voltage. The BFO was meant only for CW reception, so the injection level is quite low. A nominal 1kHz audio filter can be switched into the AF amplifier circuit to assist in receiving CW signals.



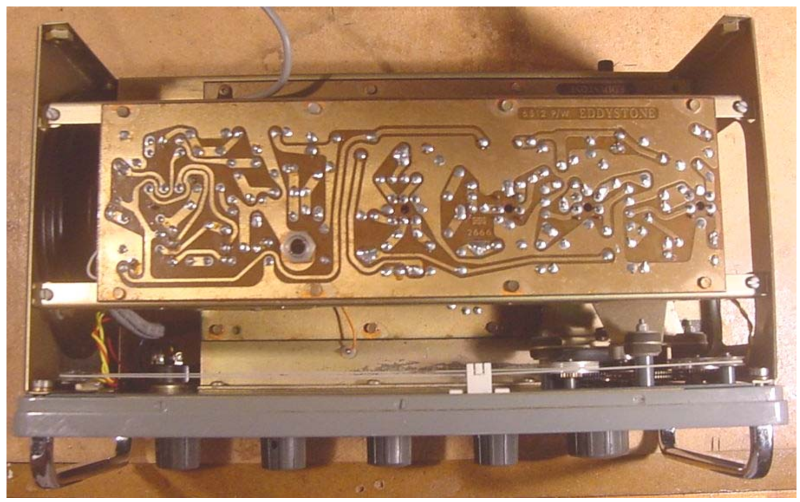

Given the fairly conventional circuitry in most Eddystone sets of the period, the main edge gained over their 'competition' was largely in the superlative mechanical build-quality, the excellent slide rule dial (with the famous silky-smooth feel when the tuning knob was spun), the high-quality inductors used in their tuned circuits, good factory set-up, solid and reliable performance and the prestigious Eddystone reputation. The EC10 range was no exception to this – hence the models' enduring popularity some 45 years after it was first introduced into the marketplace. The models' only real Achilles heel is the longevity and performance, or rather not, of the primitive germanium transistors used in the design, most notably the OC171 small-signal HF transistors used in the RF, Mixer, LO, IF stages and BFO (see sidebar on page 13 and the Preliminary Inspection and Electronic Checks section below) – but hey, that's about all that was available at the time the set was designed. Of course the passive components can also suffer deterioration with age – the most likely culprits being the electrolytic capacitors, though the resistors are not immune to drifting off or becoming noisy with the passing of time (a bit like me). The OC71 and OC83D/OC83 transistors used in the audio stages seem to be more reliable but can also become noisy. The zener also has a bit of a reputation for failing or going out of specification.

**Mechanical Construction**

Eddystone retained their 'trademark' diecast aluminium front panel and slide rule dial in the EC10 design. The RF circuit board is bolted to the side chassis member opposite the speaker end, to a bracket fitted to the rear of the dial assembly (see below) and to the rear chassis plate. The IF/AF circuit board is bolted to two angled side rails that in turn are



bolted to the upper side chassis members (photo, below). The latter arrangement allows the IF/AF strip to be unbolted, turned through 90 degrees and re-bolted in an upright position, thus allowing extremely good access for servicing and alignment. The RF board has a central metal box-channel fitted to its component side that acts as a screen between the RF, Mixer and LO stages (photo, above) – a functionally similar (but cheaper) format to the diecast structure found in contemporary Eddystone valve sets.




The one-piece steel outer case is held in place with four chrome-plated large-head 2BA bolts that secure into a return on each of the side chassis panels. Cut-outs are present in the rear of the case for the battery box (or the mains battery psu as a substitute), the usual Eddystone- style aerial/ground connections and the maker/serial number tag per the photo of the chassis rear, above. Perforated sections set into the sides of the case allow for ventilation and one serves as a speaker grill. Chrome carrying handles are fitted to the case front and the bolts for these also hold the front panel casting and dial mechanism mounting plate onto the steel side chassis members.

The slide rule dial is a modified Type 898 dial mechanism as found in the small valved Eddystone sets (eg, S.820, S.870 etc). However, here the tuning shaft, vernier scale and gearbox are all offset well over to one side rather than being located centrally. The tuning scale is printed in white lettering on the inside of the dial glass.

All-in-all, a very solid, well-built little set that is extremely easy to access and work on – a refreshing change from many solid-state receiver designs I have encountered.

**My Latest Acquisition Arrives…**

The vagaries of the Canadian postal service meant my 'new' set took almost two weeks to arrive (probably not helped by a massive dump of snow in northern Ontario that brought the place to a virtual standstill just as I sent my payment off). Anyway, it eventually did arrive and I must say it was very well packed in a box with a resilient foam moulding that could have been made for the set – compliments to the seller.

**Cosmetics**

The first thing I noticed on unpacking the set was that the case had a strange discolouration and dullness that could best be described as a 'bloom', along with several darker 'blotches' and many coffee mug stains that would not wipe off with soapy water or alcohol. It also had several deep scratches and scuffs – though mainly on the top surface. The paint finish was also not as I recall from my other EC10 or as present on MkII Eddystone valve sets – it was much less shiny and had a slight 'orange peel' finish. For now I decided to buff-up the paint finish with Brasso in an attempt to remove the coffee cup rings and blotches and to just touch up the scratches, though eventually I think I may have the case powder coated. The Brasso did indeed remove the coffee mug stains, darker blotches, some of the scuffs and imparted a shinier finish more in keeping of what I think it should be. I used a concoction of three different Humbrol enamel paint colours to touch-up the scratches and deeper scuff marks. When the paint had cured for several days, I buffed the case with more Brasso to better blend-in the touched-up areas – not a perfect finish, but good enough for now.


The front panel casting was going to be a tougher job though – looks like it will definitely need either a powder coat or spray job to get it looking as it should. It has several areas where the enamel paint has badly cracked and/or detached from the aluminium casting completely (circled red in the photo above) – as though the finish had not adhered to it correctly from new, or surface cracking had introduced moisture that had encouraged the enamel to part company with the aluminium, however, no corrosion was noted on the casting surface. Again, as a temporary fix, larger loose flakes were glued down and a concoction of Humbrol enamels was applied in several coats to build up the thickness of the original enamel finish on the bare areas before buffing-out with Brasso after curing.

The finger plate was bent in one corner (circled red in the photo, right) where I suspect that the set had been dropped onto one of its handles (aargh! – what is it with Eddystone sets I acquire? – this is the third set I have that has suffered from one of its previous owners testing its ruggedness by dropping from a great height) – at least the front panel casting seemed intact. The white lettering on the finger plate was worn off in parts – particularly around the bands change knob, but was otherwise it was ok.

When cleaning the knobs, I noticed that they were in extremely poor condition – they were all suffering from the dreaded cracking syndrome that I had first observed on my S.830/4 and as reported by others in 'Lighthouse'. It seems that the plastic surrounding the central brass insert in this knob design either shrinks with age and/or the different thermal characteristics of the brass and the plastic sets up stresses in the plastic that results in the cracks forming. The larger (tuning) knob only had one crack, but the

smaller ones had multiple cracks – to the point that they looked like 3-D jigsaw puzzles (see photo, left).

The dial glass/scale was in good condition – only a bit grubby – as was the tuning mechanism and dial pointer.  Some preliminary cleaning was undertaken, with the intent that the front panel would be removed later to clean the inside of the dial glass (scale) and to allow a more thorough mechanical servicing job undertaken at that time (see below).

The battery compartment was in generally good condition, apart from the paint flaking off in a couple of places (easily touched-up).  There was no corrosion present and the original paper battery polarity locator stickers were still in place.  The battery pack lead and the (awful) 4 way connector were also ok – but what were Eddystone thinking when they decided to use this silly little connector?  Its bad enough when using the 9 volt battery pack (as it can be forced in the wrong way around as noted in p20/21 of Lighthouse Issue 85), but when the mains power pack is used it also connect 240v AC through to the front panel on-off switch via very flimsy wires, with connectors right next to the 9v DC supply – not good at all from a safety point of view…

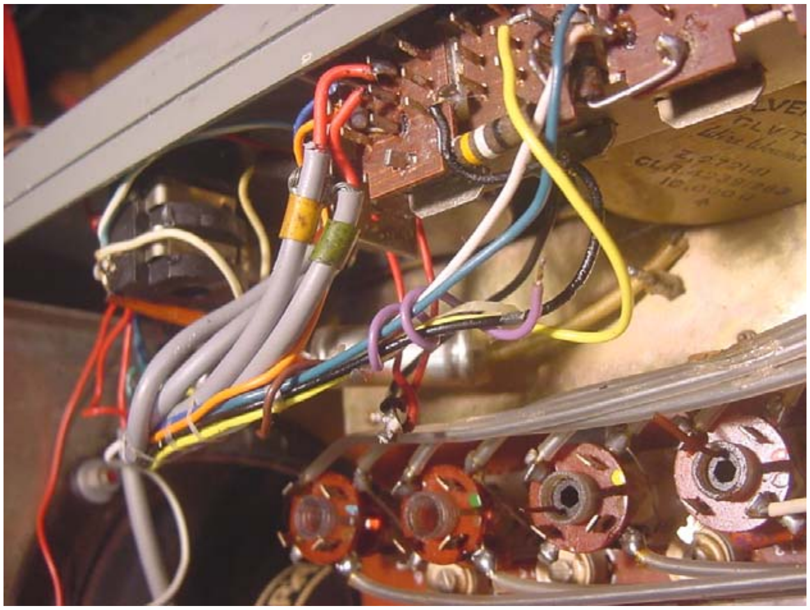
After some thought on the overall cosmetics, I contacted Ian Nutt and ordered a complete set of knobs and a new fingerplate.  At the time of writing I am awaiting their delivery.

**Preliminary Inspection and Electronic Checks**

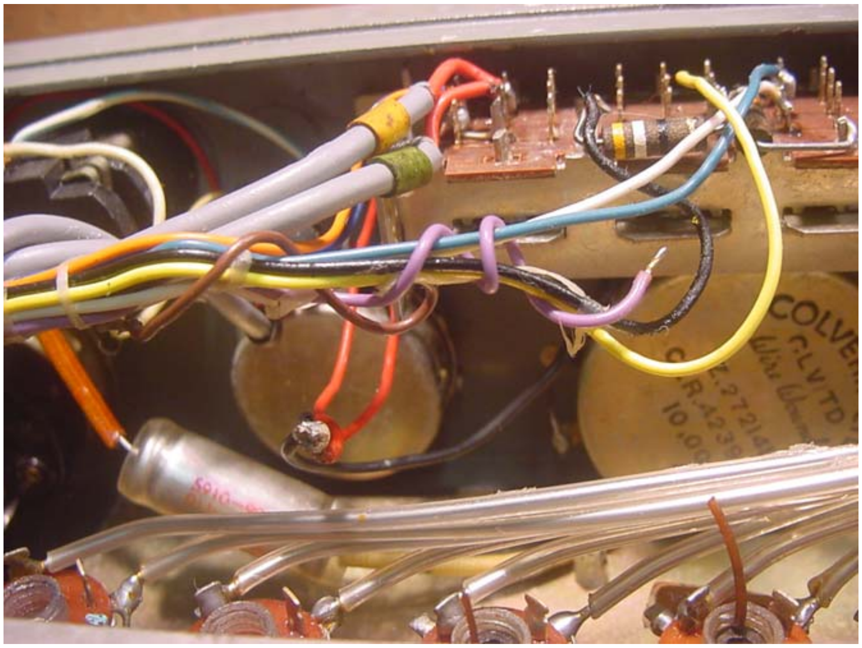
With the case removed, a quick inspection of both the IF/AF strip and RF circuit boards revealed some good news – both appeared completely 'Bath Tub fresh': no re-soldered joints or tell-tale flux residues and after close inspection I am pretty sure that all the components are the original fitment…. Phew.

The seller had reported the set to be working, albeit not very well, so after a quick check of the resistance across the B- to ground I decided to power it up from my bench psu.  Well, it did hiss quite a bit but no stations were heard.  Also, the RF and AF gain controls had no control over the hiss level whatsoever.  I tried injecting a modulated 465kHz IF signal into the 3$^{rd}$ IF transformer – nothing.  I then tried injecting an AF signal at the AF gain pot – again, nothing.  So I decided to take a closer look…

Looking carefully underneath of the receiver revealed a batch of not-so-good news:



- the variable capacitor for the BFO had been replaced by a (huge) Colvern 10k ohm wire-wound pot coupled to a 0.1uf capacitor, both of which looked like they were WWII surplus – photos, right and below right (at first I suspected that someone had modded the BFO circuit to use a varicap or had wired-in a varicap fine-tuning circuit as per the EC10 MkII – this proved not to be the case though). This pot was so large that it did not fit squarely in the space vacated by the BFO variable capacitor, with the consequence that the shaft passed through the front panel at a rather 'jaunty' angle – a superlative bodge job indeed, yes, full marks to whoever did that one (!);
- the wiring to the above mongrel components led to closer inspection of the wiring around the push switch bank and phones jack… oh dear more bad news;
- Some wires were observed to be hanging loose and not connected to anything;
- The dial lamp switch (the one that does not latch in order to conserve power when on battery power) was not wired to anything; and
- The wiring to the phones jack and speaker had been tampered with. Hmmmm…



Tracing the wires as they stood revealed that:

- the BFO on/off switch wiring was disconnected completely and was hanging loose;
- the wires to the BFO variable capacitor had been removed when the Colvern pot/capacitor

abomination had been installed;

- the Colvern pot/capacitor arrangement was wired as a crude tone control (treble-cut) across the AF gain pot;
- the AF gain pot now fed the phones socket and had been completely disconnected from the AF amplifier stages (the shielded cable to the AF stages had been disconnected and was hanging loose) – at least that explained why no audio apart from a hiss was present at the speaker when I fed an AF signal to the AF gain pot). Perhaps a previous owner had used the set as a tuner feeding an amplifier?;
- the dial lamp wiring, including the 39 ohm dropper resistor, had been removed from its correct switch and was now wired onto the (latching) BFO switch. I guess the guy that decided to do that mod had a sore finger from holding the spring-loaded off-biased (correct) dial-lamp switch in all the time and had an endless supply of batteries available.

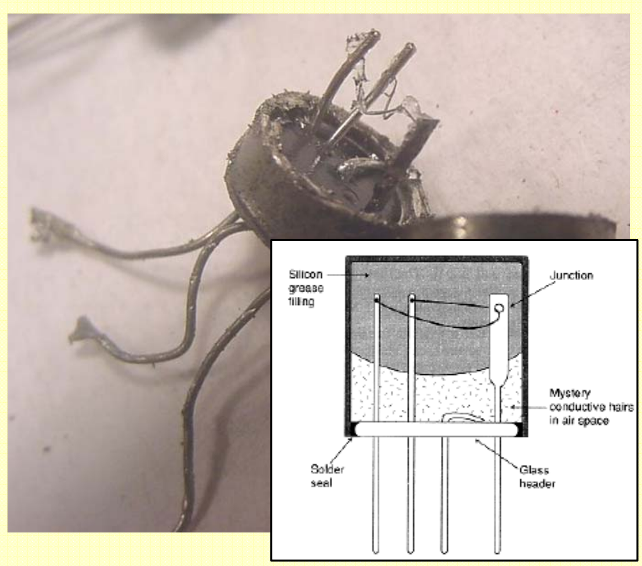
After figuring this lot out I removed the Colvern pot and capacitor and re-wired the switch bank, dial lamps, BFO, AF gain pot, speaker and phones socket all back to their original configurations – luckily the bodger had not shortened any of the wires. I switched the set on again - it was hissing just as before and there was still no control over the hiss volume with either gain control. I figured that there was likely a fault in the RF/IF stages and that the hiss was probably a

### Transistors with Whiskers…

The first transistors suitable for use in RF applications used the alloy-junction fabrication process. However, Mullard followed the US-led technology direction by adopting the alloy-drift fabrication technique. The first RF transistors manufactured by Mullard that were available commercially in quantity were the OC169, OC170 and OC171, introduced in 1959. This range was supplemented in 1961 with the AF117 to AF118 series. All these transistors were housed in a TO-7 case style that included, in addition to the base, collector and emitter connections, a fourth lead, connected internally to the transistors' aluminium case to act as a screen.

The internal construction of this transistor family is illustrated below. The collector lead acted as the support post for the semiconductor substrate, with fine wire connections from the emitter and base leads to the substrate. The upper part of the can was filled with a gob of silicon grease (presumably to protect the internal assembly from moisture ingress and possibly to add some resilience against shock). Beneath the silicon grease is a small air space – ok, a bit crude but functional, but here is the weird part…

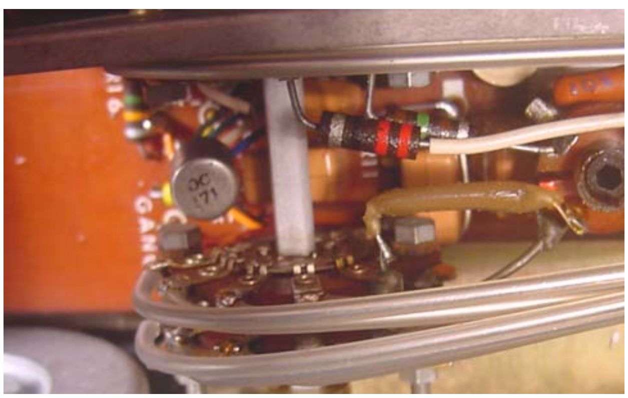
Over many years, microscopic metallic filaments develop inside this air space (these are reportedly only 0.008mm across). These filaments are noted as being 'tough, springy and electrically conductive'. Eventually one or more of these filaments contacts one or more of the leads inside the can, shorting it to the can – effectively 'killing' the transistor. This phenomenon (no explanation found) affects both used and new-old-stock (NOS) devices at random. A sharp tap on the transistor case can effect a temporary cure by dislodging the offending filament. Alternatively you can try cutting the screen lead.



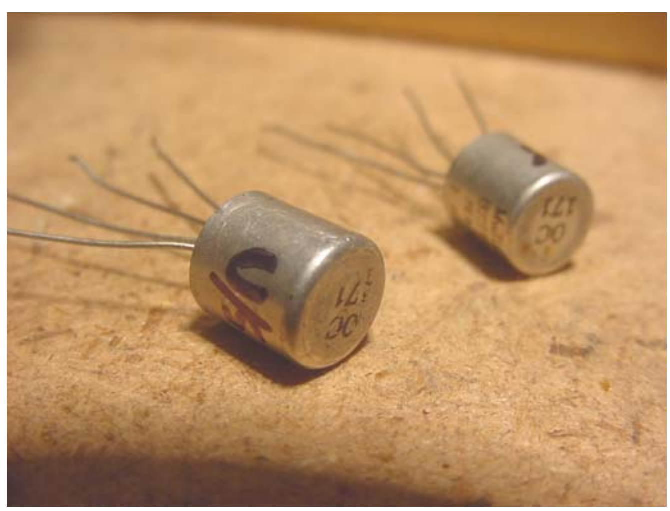
noisy resistor or transistor in the AF gain amplifier that I could fix later.

I re-tried injecting a modulated 465 kHz signal into the 3rd IF transformer – I could hear it this time, indicating the 3rd IF stage, AF stages and detector were functional. I then injected the 465kHz signal into the second IF transformer – a louder signal was heard. Good news so far, however, when injecting the signal into the collector or base of the Mixer stage transistor the signal was almost inaudible. Voltage checks around the OC171 Mixer transistor revealed that it was likely shorted between its base and emitter.

I had about ten OC171's in my junk box (see sidebar on the previous page) recovered many years ago from junk transistor sets (and, I think from my EC10 MkI in the UK when I 'upgraded' its solid-state complement to 'hotter' silicon devices in its RF and Mixer stages as I recall). I had tested all ten OC171's in advance and found that only five appeared to be still working ok (the rest either had a short to the screen, had very high leakage or had an open-circuit to one of the connections). I replaced the mixer OC171 with a tested good device, fitting the coloured insulation sleeves to retain original appearance (albeit the leads were slightly shorter). While the transistor was out of circuit I lifted the bias resistors and checked their values – these were found to be well within tolerance. I switched the set on again and voltage checks around the Mixer transistor looked much better. Now injecting the IF signal into the base of the Mixer transistor produced a very strong AF response.

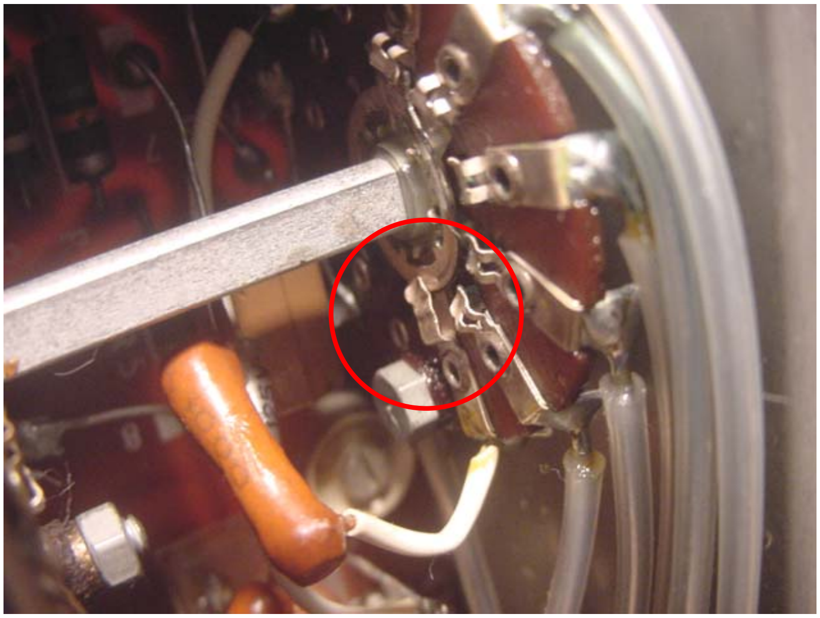


Still no on-air signals could be heard though, even with a long wire attached to the aerial socket. I decided to check if the LO was working (photo, left). Sniffing around the LO coil set with my trusty Millen GDO indicated that nothing was happening in the LO department on any of the ranges. I then did some voltage checks around the LO OC171 – this revealed that the emitter and base were both at ground potential. Ahah! – a case of the dreaded age-related 'whiskers' shorting the device out internally I suspected (see sidebar on previous page). I removed the LO OC171 and sure enough, the emitter and base were shorted to the screen connection (transistor case). I could have tried just cutting the screen lead as per Ted Moore's suggestion in Lighthouse, but I decided to replace it with a tested good device instead. Again with the transistor out of circuit I checked the bias resistors and they



were found to be within tolerance. Replacing the LO OC171 and switching on I immediately noticed an increase in noise accompanied by some fluorescent light 'buzz', and this was controllable by the RF gain control. Injecting an RF signal into the Mixer transistor base produced a strong signal when the EC10 was tuned to the same frequency. All bands seemed to be working ok when checked with the signal generator fed into the Mixer stage, however, there were still no signals to be heard with an aerial connected…

I suspected the RF stage transistor was probably faulty as well, however as I was preparing to check the voltages around the RF OC171, I noticed that there was some corrosion on the aerial wafers of the band switch and that the rotor contact on one of the switch wafers on the transformers between the RF amplifier and the Mixer stage looked 'loose' (had lost its 'spring') – circled red in photo, below. I cleaned up all the switch wafers using De-Oxit and Q-Tips and then when holding the loose spring connection firmly against the switch rotor the set burst into life – many stations coming in loud and clear on the broadcast band (medium wave) and several on the short wave bands too. I carefully adjusted the spring contact so it was making a firmer connection with the switch rotor and then did a quick check on all bands with my signal generator. The calibration was found to be not too far out - so I decided to leave alignment until I had undertaken some further electrical checks and mechanical servicing and clean-up of the dial mechanism (see below). At least it looked as though the RF stage OC171 was still functioning (for now at least – I guess its only a matter of time before it goes the same way as the others). I will probably have to do a more permanent fix on the switch wafer though – not a trivial job if I have to replace it, even if I can get an exact replacement wafer (three different types of Yaxley switch were reportedly used in the production run of the EC10).



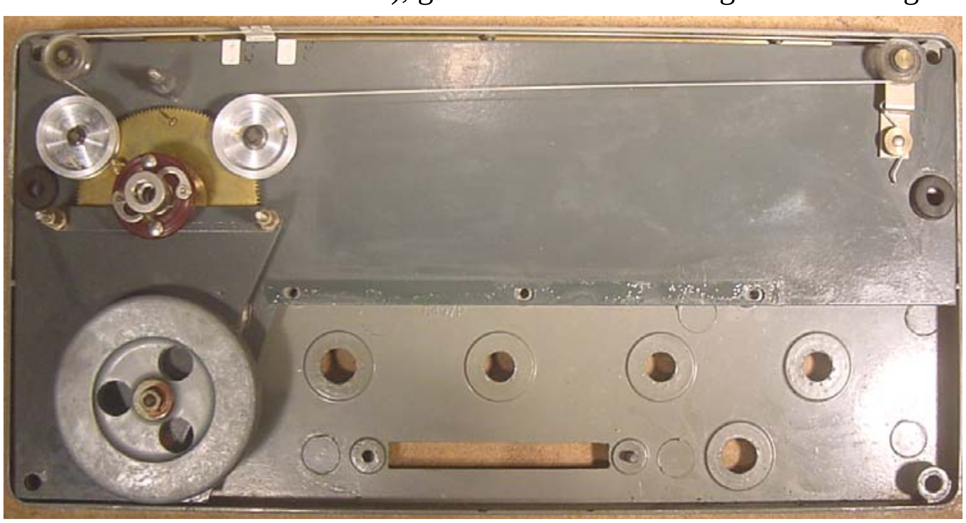
I then decided to see if the BFO was working. I connected a junk box NOS 5-70pf variable capacitor into the circuit where the original had been removed, switched it on and hey-presto, up came the BFO – almost bang on frequency as well.

The AGC circuitry was then tested and found to be working ok (and with it switched out strong signals were found to overload the set). The AF filter was also working, though I left checking the resonant frequency until I re-aligned the set at a later date. The restored dial lamp circuit was now working ok, though one of the bulbs was kaput. I made a mental note to investigate using less current-thirsty high-output LED's in place of the L.E.S. incandescents.

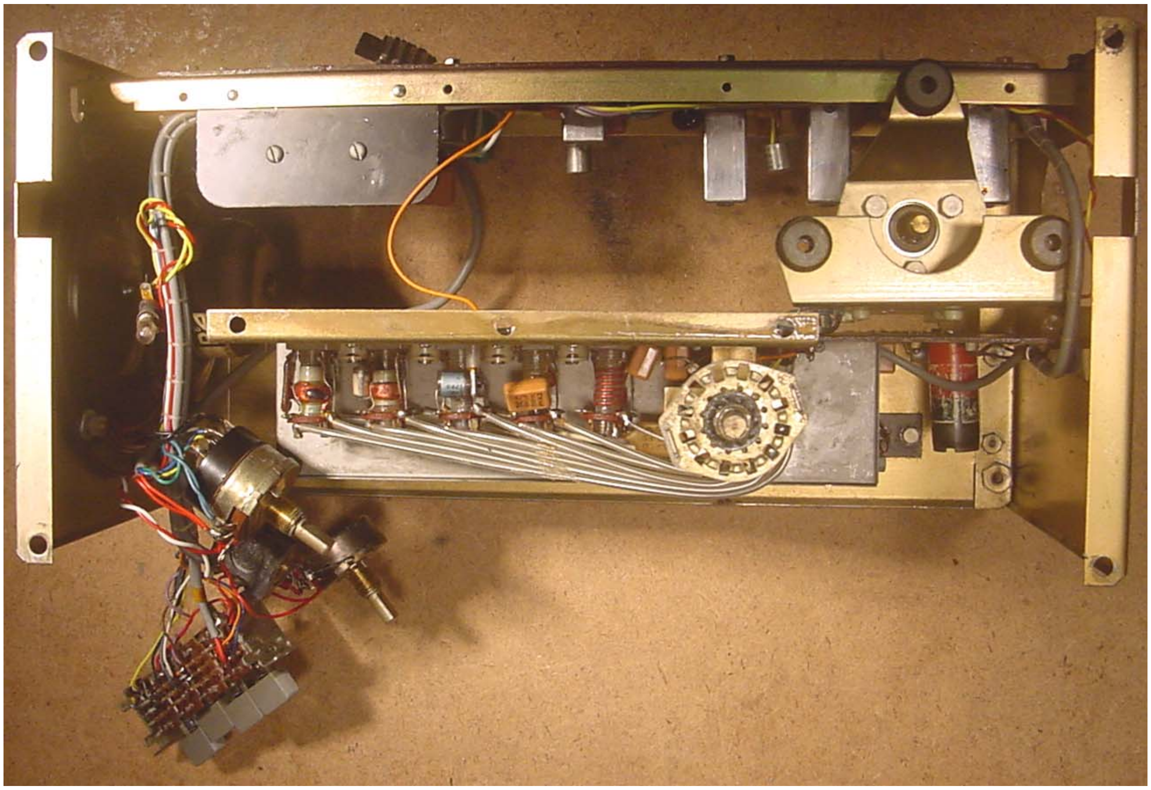
**Front Panel Removal/Replacement, Tuning Mechanism Servicing, Dial (Scale) Cleaning**


As noted above, the EC10 utilizes a modified Type 898 dial mechanism as found in the small valved Eddystone sets (eg, S.820, S.870 etc). For a fuller description of this mechanism please refer to my article on its use in an HBR13C homebrew receiver downloadable from the EUG website. In this adaptation, the tuning shaft, vernier scale and gearbox are all offset well over to one side rather than being located centrally. Also, the spool pulleys in the EC10 (this set at least) are turned from aluminium rather than brass as in the Type 898) and are slightly larger. Speaking of the Type 898 dial, I was recently given an unused one (thanks Ralph! much appreciated) – photos of the EC10 dial mechanism and the Type 898 are included at the end of this article for comparison.

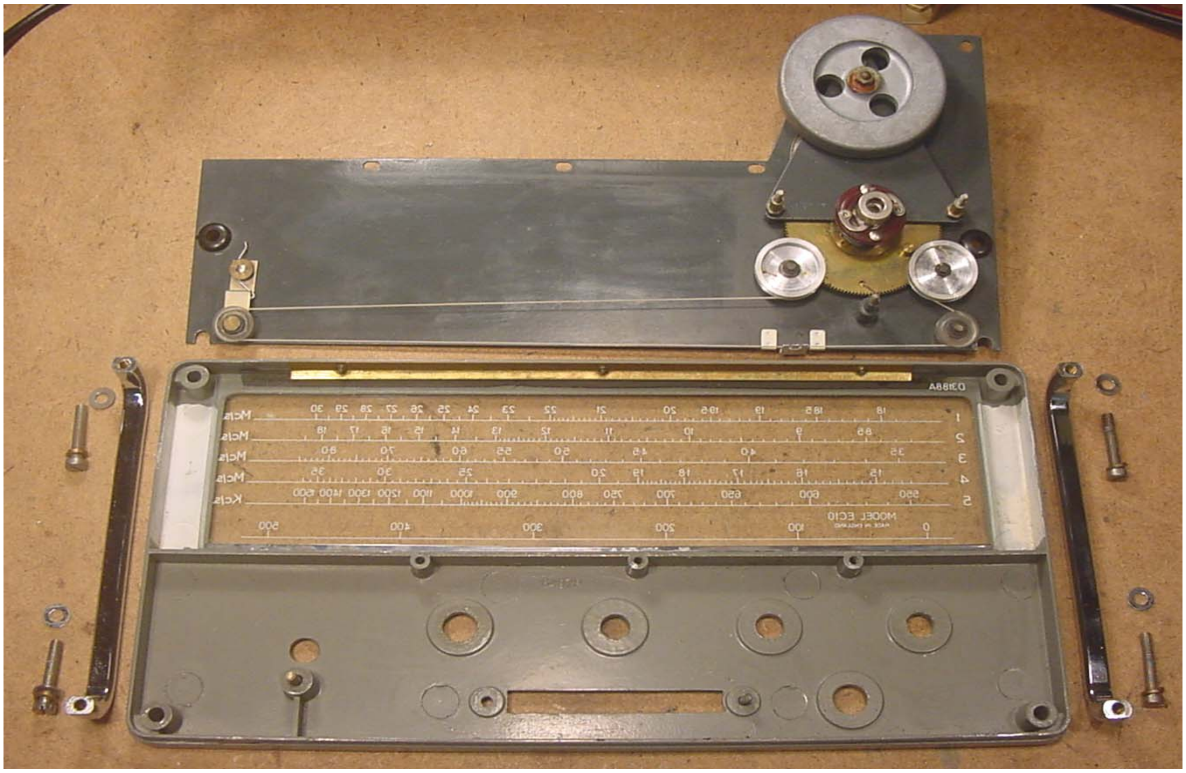
The metal pointer slider runs along the top edge of the sturdy grey-painted metal mounting plate that forms the support for the idler pulley wheels, gearbox (with cut-out for the circular vernier scale), grommets for the dial lights and an angle bracket that



supports the RF circuit board along its front edge. The front of this plate is visible behind the dial glass. This assembly is mounted onto the cast aluminium front panel, which is in



turn bolted to the two chassis side-plates. Removal of the front panel in this simplified form of 'traditional' Eddystone construction is fairly straightforward (though please study the photos very carefully before you start). Here is my recipe:



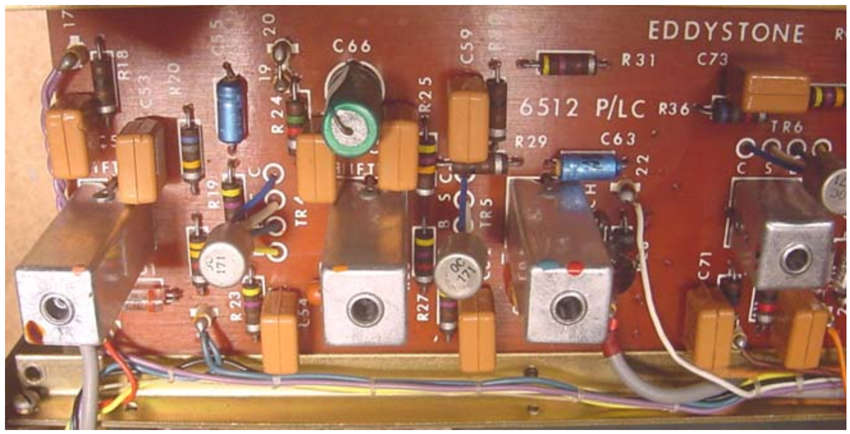
- Remove the four 2BA bolts securing the chassis side plates to the front panel (these are screwed into the carrying handles – watch out for the washers);
- Remove the retaining nuts from the front panel controls and phones jack. Take care doing this - use the correct nut-spinner if available and an over-size thick paper or Teflon washer to act as a guard to prevent scratching the fingerplate;
- Carefully remove the finger-plate (it will likely be stuck down with some double-sided adhesive tape), clean with soapy water and store safely;
- Remove two grub screws in the flexible coupler on the tuning gang shaft (preferably the ones on the tuning capacitor side);
- Remove the three 'Posidrive' self-tap screws holding the RF circuit board front mounting bracket to the drive assembly mounting plate;
- Pull out the two dial lamp holders from their grommets;
- Remove the three 6BA nuts securing the tuning capacitor rubber mounts to the gearbox and drive assembly mounting plate;
- Remove the two 4BA 'Posidrive' retaining screws holding the push switch bank onto the front panel; and
- Gently pull the front panel casting away from the chassis, with the tuning drive assembly attached;
- To separate the casting from the tuning drive mechanism, remove the single 4BA bolt that passes through the mounting plate just beneath the tuning shaft. This will have some locking compound applied to its nut, so may be difficult to loosen.

Take this opportunity to carefully clean the dial glass with luke-warm slightly soapy water and a cotton wool ball. The dial glass can be removed from the front panel casting to facilitate this by removing the three small screws holding its angled retaining strip

along its upper edge. This is also a good time to clean any hardened oil/grease from the gearbox bearings and gears, the friction drive spring (photo above) and to re-lubricate the gears and tuning shaft bearing with suitable grease (I used a very sparing amount of Moly-grease). Clean the friction clutch mechanism and ensure the outer edge of the drive plate and mating surface on the tuning shaft are grease-free.

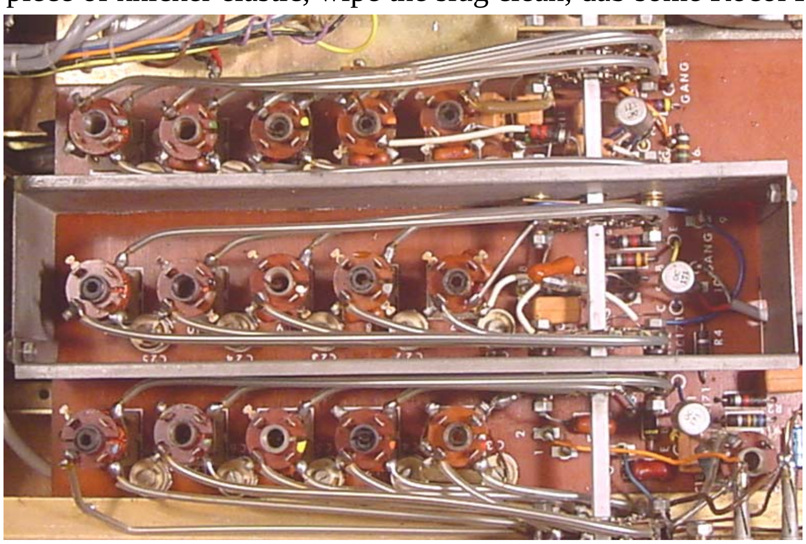
Re-assembly is simply a reversal of the above, but care is needed to ensure that when the dial pointer is at the '0' mark on the logging scale the circular vernier scale is also reading '0' and the tuning capacitor gang is almost fully meshed (maximum capacitance). You may need to adjust the position of the flywheel on the tuning shaft to get the correct amount of float such that the knob spins smoothly.

**Re-Alignment**




The alignment procedure for the EC10 is very straightforward and is detailed in the appended manual – so is not repeated here. However, you may find that a 'mad twiddler(s)' got there before you, so there may be some nasty surprises lurking in those coil formers – watch out for bits of snapped-off iron dust slug, cross threaded slugs and even damaged/loose wires to the coils.

Before aligning, I opted to carefully remove each slug, one at a time, clean the coil former threads with a pipe cleaner (yes, you can still buy them), discard the *de-rigueur* piece of knicker elastic, wipe the slug clean, dab some Rocol Kilopoise goop onto the slug and screw each one back into its former to approximately the same position as it was before being removed. Broken or jammed-in slugs must be coaxed out slowly with plenty of patience – those small coil formers can break all too easily. Any slugs that appear in any way cracked or damaged should preferable be replaced.



**Power Supply**

Not having a Type 924 mains power supply handy, I decided to improvise. I had several mains power 'blocks' from consumer electronic products that I had picked up over the years at thrift stores and fleamarkets (these power supplies are also known as 'wall warts'

– photo, right). This type of unit usually supplies an unregulated DC supply of whatever nominal voltage and current is indicated on the back of the 'wart'. However, when unloaded, the voltage output from the supply can be significantly in excess of that indicated, so some caution is advised (varies from 'wart' to 'wart'). I decided to use one of these gadgets to feed unregulated DC into the EC10, with a simple transistor/zener regulator fitted into the sets' battery compartment. I had a suitable 600mA unit in my junk box – plenty of 'oomph' for those 'thirsty' dial lights here (so maybe I won't replace their friendly glow with LED's after all…). A simple, cheap and very effective power supply solution with the benefit of no mods needed to the EC10.

**Conclusion**

The Eddystone EC10 MkI is a very popular little radio, and quite rightly so – although not in the same league in terms of performance as its contemporary Eddystone thermionic technology communications receiver siblings, it nevertheless filled an interesting spot in the marketplace at a reasonably affordable price point. Indeed, there was nothing quite like it around when it was introduced. It had the added advantage of being fairly compact (if not very lightweight) and battery-powered, hence suitable for use when travelling away from home, in a car, or on a boat. Interestingly, the Range 3 scale has an excellent tuning length from 4.00 MHz to 6.00MHz (actually about 25 turns of the tuning knob), ideal for pairing the set up with a 2-meter converter having this output frequency span – this was the popular way of receiving on 144 – 146MHz back then… I recall lugging my original EC10 with its trusty 'Burns Electronics' kit-built 2-meter converter bolted to the back of its case up many a hill in my youth. I guess that's the real reason for this second time around with an EC10 for me – pure nostalgia (and fun of course!).

Well, that's it for Part 1 of this article. I will live with the case and front panel in its cleaned and touched-up condition for a while but will most likely have them re-finished (probably powder-coated) at a later date. The replacement knobs and finger plate are on order from Ian Nutt – when they arrive and/or I have the powder coating done I will supplement this article with Part 2, providing updated photos and some additional details of the restoration work undertaken on this set. In the meantime I will keep the little guy on the desk in my office and compare its performance with my trusty S.750 (about sixteen years its senior and therefore of course predating any 'trannie' set in the world) – should be an interesting (if perhaps a little unfair) exercise. Stay tuned…

73's

© Gerry O'Hara, G8GUH/VE7GUH (gerryohara@telus.net), Vancouver, BC, Canada, March, 2008

**Some Useful References**

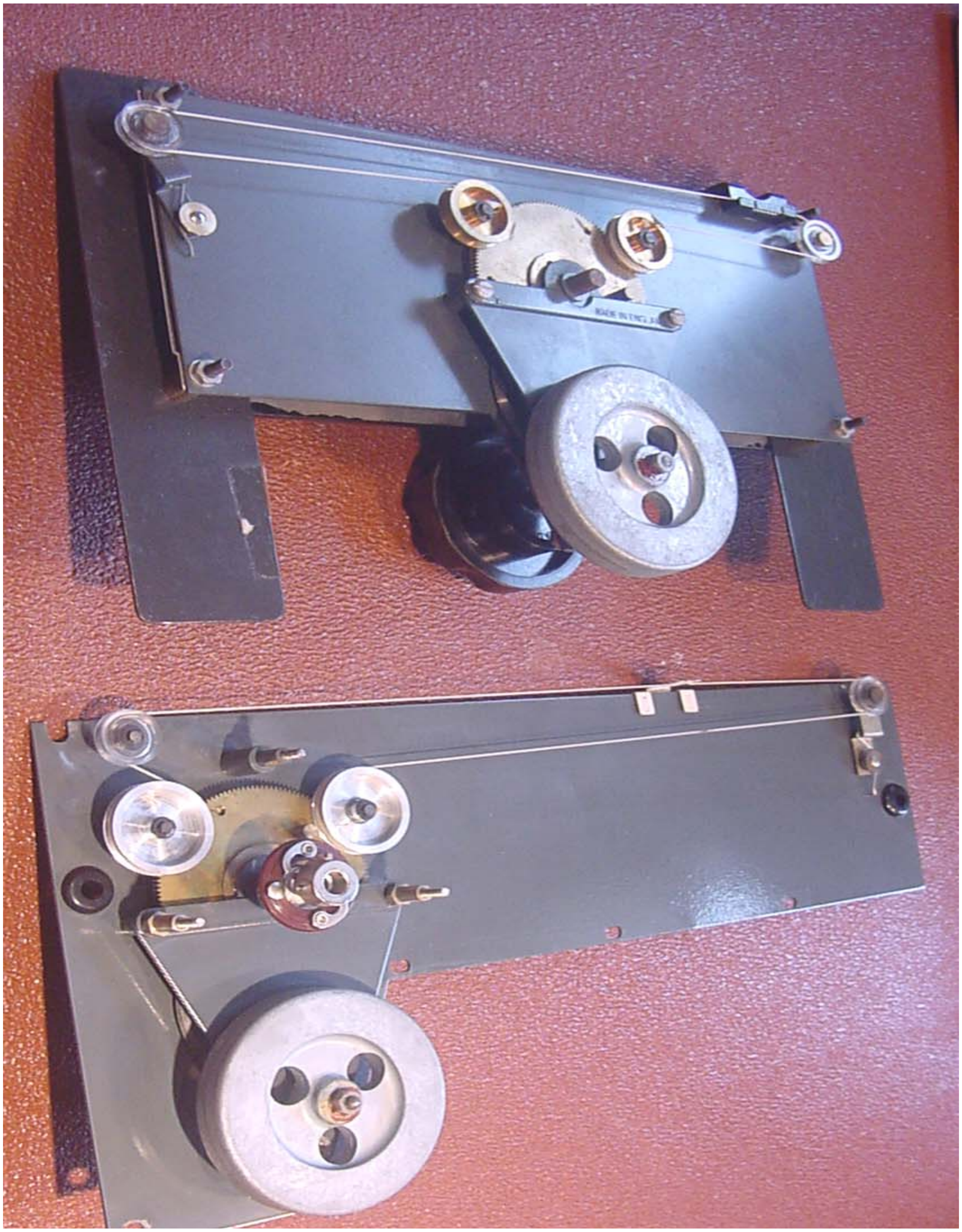

- Lemons, Wayne, Transistor Radio Servicing Course, 2nd Ed. 1977
- Patchett, GN, Radio Servicing VBol4 Fault Finding, 5th Ed. 1963
- King, Gordon, Radio and Audio Servicing Handbook, 2nd Ed. 1970
- Davidson, Homer, The Illustrated Home Electronics Fix-It Book, 2nd Ed.1988
- Hibberd, RG, Transistors: Principles and Applications, 1965
- Mullard Ltd. Transistor Audio and Radio Circuits, 1969
- Armstrong, DT, Miniature Hearing Aid, Radio-Electronics, Vol.24, No. 12, December, 1953
- Various documents downloaded from the EUG website, including:
    - The Ultimate Quick Reference Guide (QRG), 2nd Ed., 2005, Graham Wormald, G3GGL
    - The Cooke Report by Bill Cooke
    - EC10 MkI and MkII Manuals and promotional literature
    - S.960 Manual and promotional literature
    - O'Hara, Gerry, A Potted History of my 'Radio Life' and the Restoration of an Eddystone S.740, June, 2006
    - O'Hara, Gerry, Use of the Eddystone '898' Drive Unit in an HBR 13C Homebrew Receiver (under 'Technical Information'), January, 2008
    - EUG Newsletter/Lighthouse articles featuring the EC10 MkI and MkII, listed below for convenience (see also articles on other small Eddystone solid-state sets of this era, ie. EB35, EB36, EB37 and EY11):

**Article/Subject** **Issue** **Page**

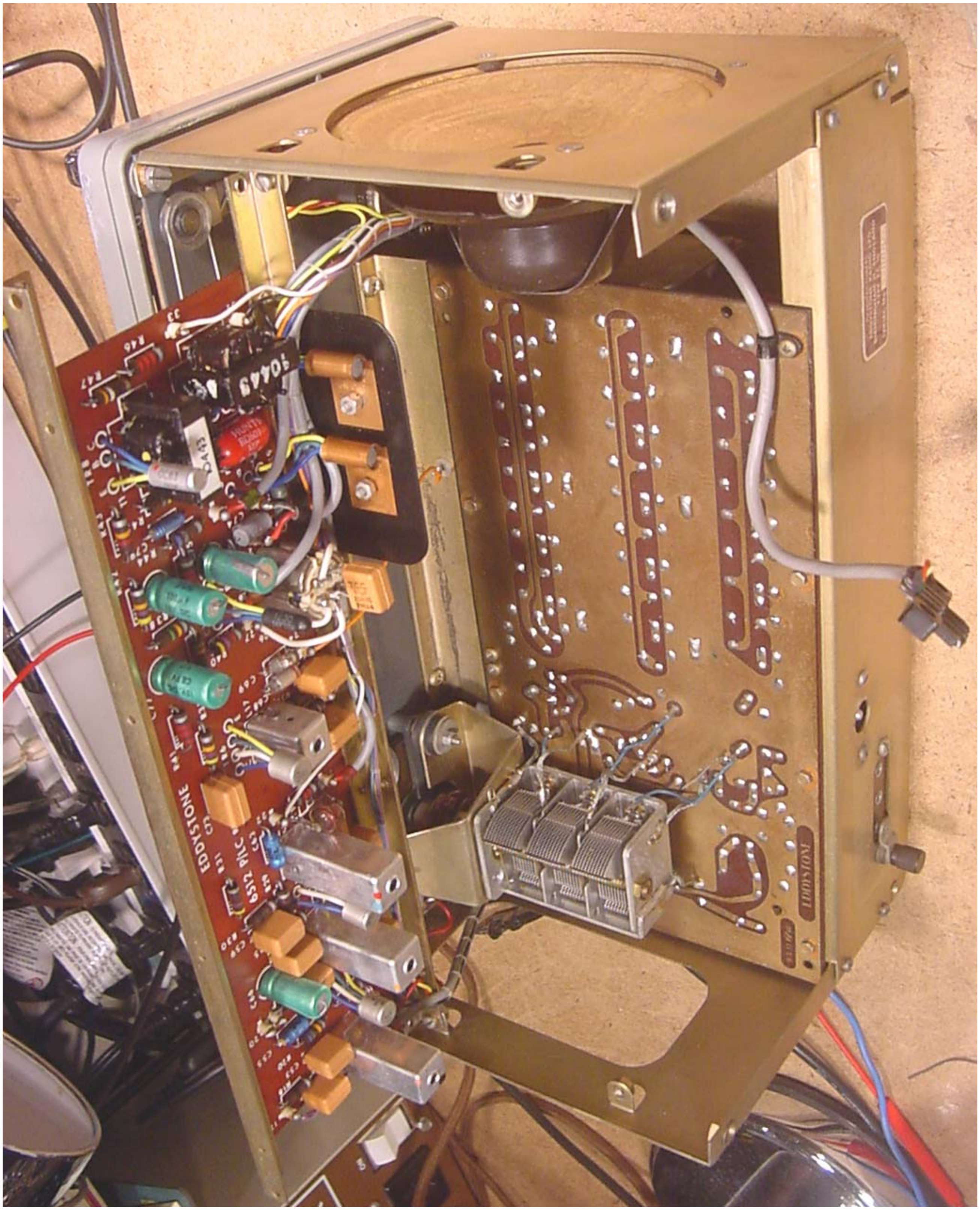
## Some Interesting 'Trannie' and Article-Related Websites:

- http://www.eddystoneusergroup.org.uk/):
- http://people.msoe.edu/~reyer/regency/
- http://www.pbs.org/transistor/background1/events/tradio.html
- http://history.sandiego.edu/GEN/recording/transistor.html
- http://www.geocities.com/aldoandr/transistor.html
- http://www.antiqueairwaves.com/regencytr-1.htm
- http://www.vintage-technology.info/pages/history/histpamtr.htm
- http://s206301103.websitehome.co.uk/tr.radio.history.htm
- http://www.qsl.net/vk3jeg/edd_ec10.html
- http://homepage.ntlworld.com/lapthorn/ec10.htm
- http://www.shopingathome.com/Eddystone%20EC10%20EC10%20Mk2.htm
- http://ourworld.compuserve.com/homepages/Andrew_Wylie/
- http://www.vintage-radio.com/repair-restore-information/transistor_transistor-faults.html
- http://www.vintage-radio.com/repair-restore-information/index.html
- http://users.arczip.com/rmcgarra2/index.html
- http://www.radio-workshop.co.uk/manuals.shtml
- http://www.transistor-repairs.com/print.html
- http://hometown.aol.co.uk/oldradioparts/semiconductors.htm

- http://www.ronmansfield.com/radiobooks.htm
- http://semiconductormuseum.com/Museum_Index.htm
- http://homepage.ntlworld.com/lapthorn/ec10.htm



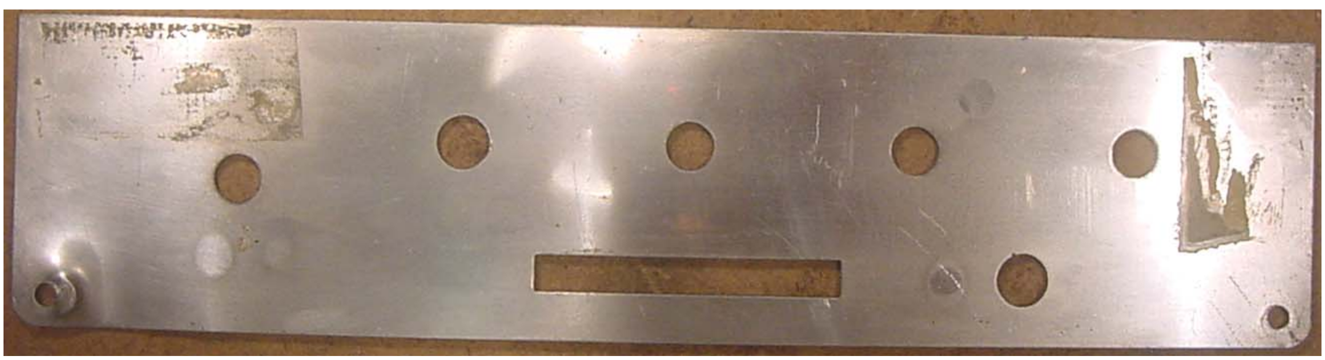
Above: Compare the Type 898 dial mechanism (top) with the EC10 dial mechanism (below) – a traditional Eddystone adaptation of a proven, robust design

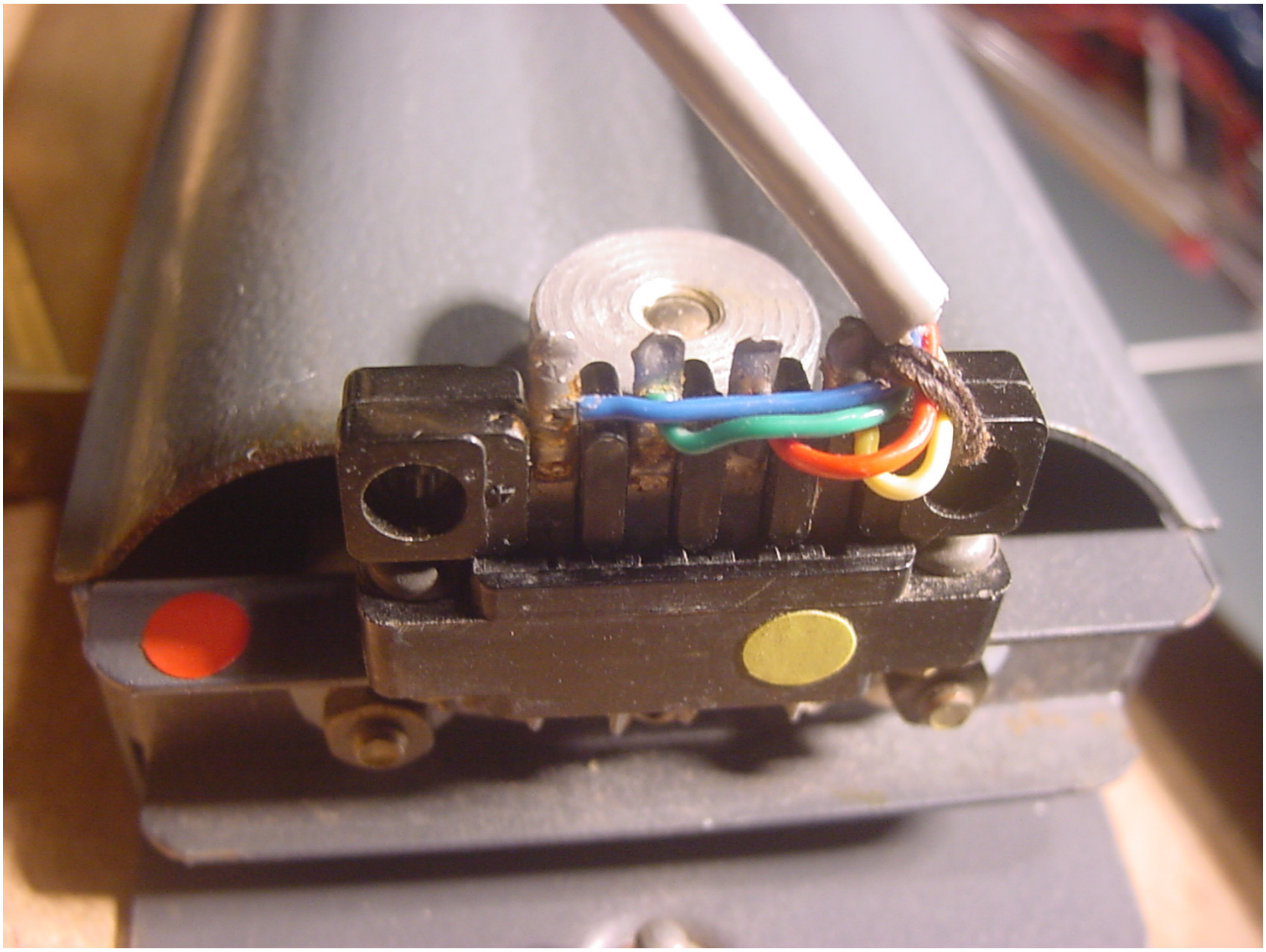



Above: Superb accessibility to all components as well as easy IF transformer/BFO coil adjustment is afforded by the EC10's clever design feature for rotating the IF/AF strip through 90 degrees while maintaining all connections. This also provides excellent access to the RF board printed circuit tracks – useful for replacing those pesky OC171s - Bill must have had a premonition…


Left: The front panel of the gearbox is formed by the mounting plate for the dial drive. The circular vernier scale is visible through a cut-out in the mounting plate above the tuning shaft

Below: The worn and damaged finger plate - looks like a bullet has passed through one of the holes that secure the handles in place (lower left of the photo of the rear of the finger plate shows this best) – ouch!



Above: Saving the worst till last, here is the dreadful power-supply connector. The yellow paper spot is the only indication of what end of the plug on the flying-lead goes to what end of the socket on the battery box (photo, below), or worse, on the Type 924 mains psu. The red paper spot in the photo above indicated the positive end of the batteries. Note the ease with which a short could occur in the wiring…