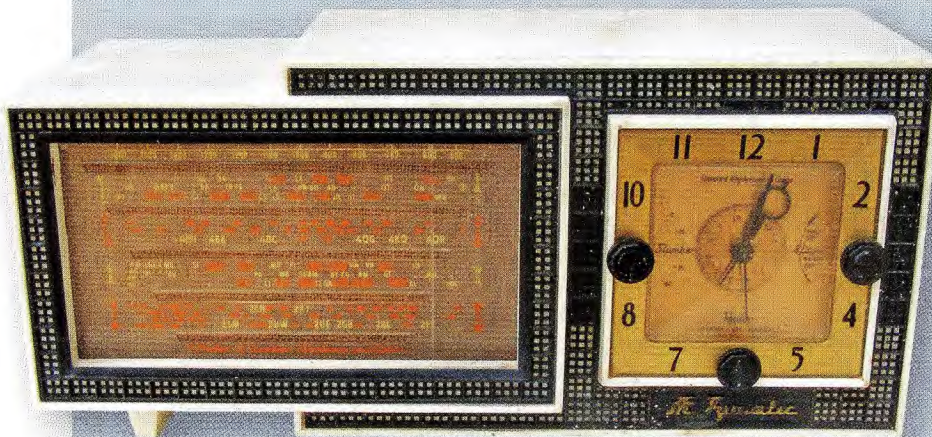


Vintage Radio

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The STC A5150 5-valve mantel clock radio



Clock-radio mantel receivers were all the rage in the 1950s. This month, we take a look at the STC (Standard Telephones & Cables) A5150 clock-radio which used a conventional 5-valve superhet circuit but was housed in a rather unusual cabinet.

MANTEL RECEIVERS for use in the kitchen had become quite popular by the late 1940s, with both economy 4-valve units and more up-market 5-valve units being sold. However, as that market became saturated, manufacturers looked at adding extra features to keep buyers interested. Electric clocks had by then been around for some time, so the manufacturers hit on the idea of incorporating them into mantel receivers.

One result of this was that such sets could now also be used as bedside receivers, since they invariably included an alarm system. So instead of the user being awoken by an alarm clock, they could instead be roused by the radio automatically switching on.

In addition, the clock typically switched a mains socket on the back of the chassis. A bedside lamp could then be plugged into this socket, the idea being that the lamp would switch on at the same time as the radio.

Another common feature was the “sleep” or “slumber” mode. This typically allowed the user to leave the radio on but to set it so that it would automatically turn off up to an hour later. Of course, this all worked as long as the mains power didn’t go off during the night!

The STC A5150 clock radio

STC’s A5150 clock radio was first produced in 1955. It is a typical 5-valve mantel/bedside receiver with

an in-built Smiths electric clock. As an aside, it’s worth noting that most manufacturers built two versions of their mantel receivers during this period – one with a clock and a cheaper version without a clock. As far as I can determine, the receiver-only version of this unit was designated the A5140, which came out in 1954.

A feature of the A5150 is its unusual but interesting plastic cabinet. In fact, it looks like two cabinets grafted together!

The lefthand end of the cabinet carries a large rectangular dial scale, while the tuning gang is on the chassis immediately behind the dial. The tuning control is at the righthand end of the cabinet and this drives a long brass shaft which runs right across the chassis and through a bracket mounted on one end of the gang (see photo). This shaft then drives the dial drum and the dial pointer via a dial cord assembly.

It’s an unusual arrangement but is still very effective.

The loudspeaker is located immediately behind the dial. This was a fairly common arrangement in mantel receivers as it saved quite a bit of space. The loudspeaker has an oval-shaped frame and is a permanent magnet type with a 3Ω voice coil.

The clock is mounted to the extreme right of the cabinet and it’s interesting to note that the same cabinet was used for the A5140, ie, the model without the clock. In fact, the A5140 has the speaker mounted where the clock goes in the A5150. This got it out from behind the dial and presumably resulted in slightly better sound quality. Only the front escutcheon differs between the two models; the rest of the cabinet is identical.

Inside, the chassis is quite tightly packed with components in some places, although access isn’t difficult. All the controls for the receiver come out at the righthand end of the cabinet. This frees up the front of the set for the

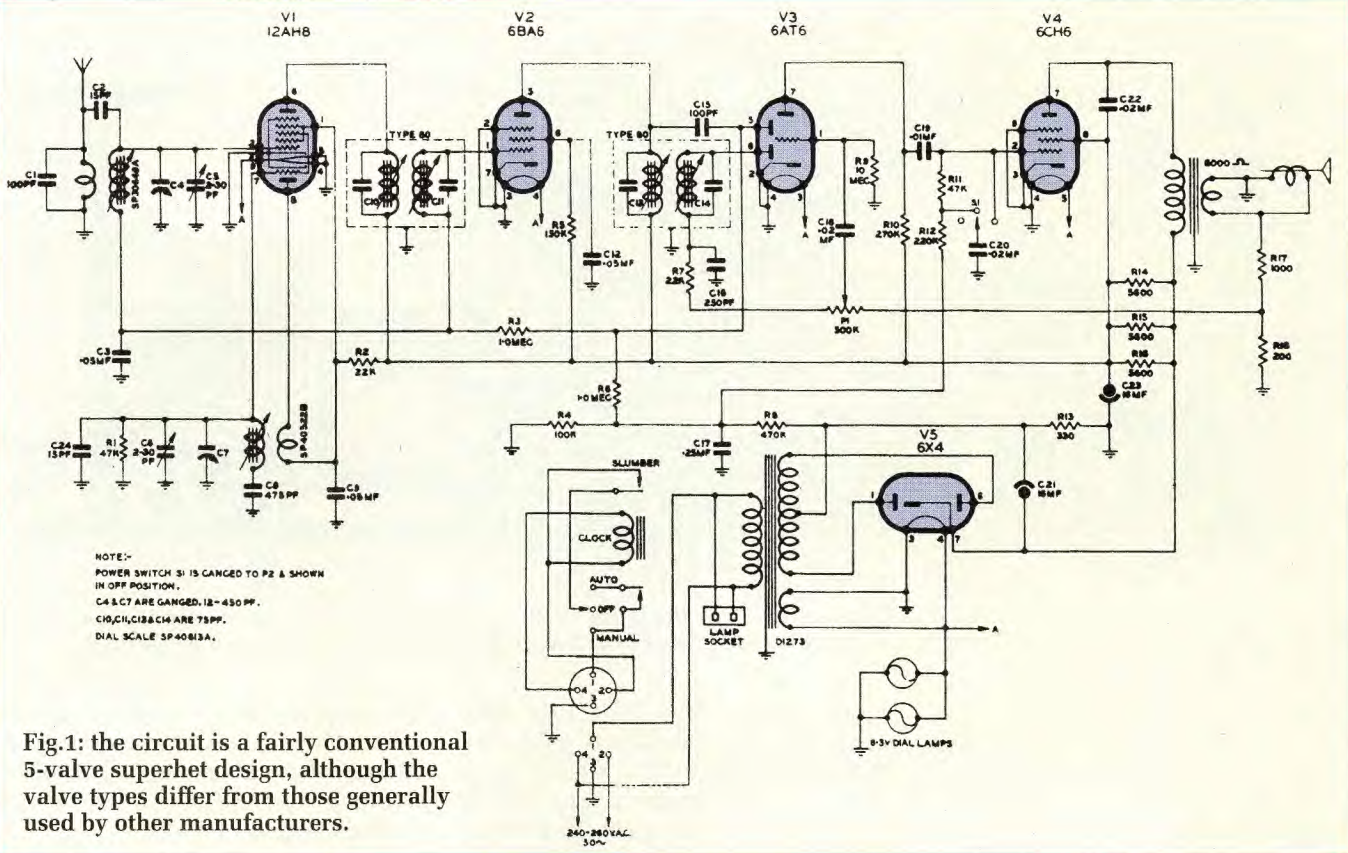


Fig.1: the circuit is a fairly conventional 5-valve superhet design, although the valve types differ from those generally used by other manufacturers.

dial scale and the clock and ensures that the controls are well spaced.

Circuit details

Let's take a look now at the circuit – see Fig.1. It's a 5-valve superhet design and is a typical STC radio circuit for the era. However, it's slightly different to the run-of-the-mill circuits from other manufacturers, the differences relating mainly to the valves used.

The antenna section employs two tuned circuits: (1) a fixed tuned circuit which includes the primary of the antenna coil; and (2) a variable broadcast-band tuning circuit which tunes from 530-1620kHz. The fixed tuned circuit is broadly tuned below the broadcast band and ensures good performance with the shorter antennas that were commonly used in the 1950s and 1960s.

These antennas usually consisted of a 7-metre length of wire that was run around the picture rail in the room.

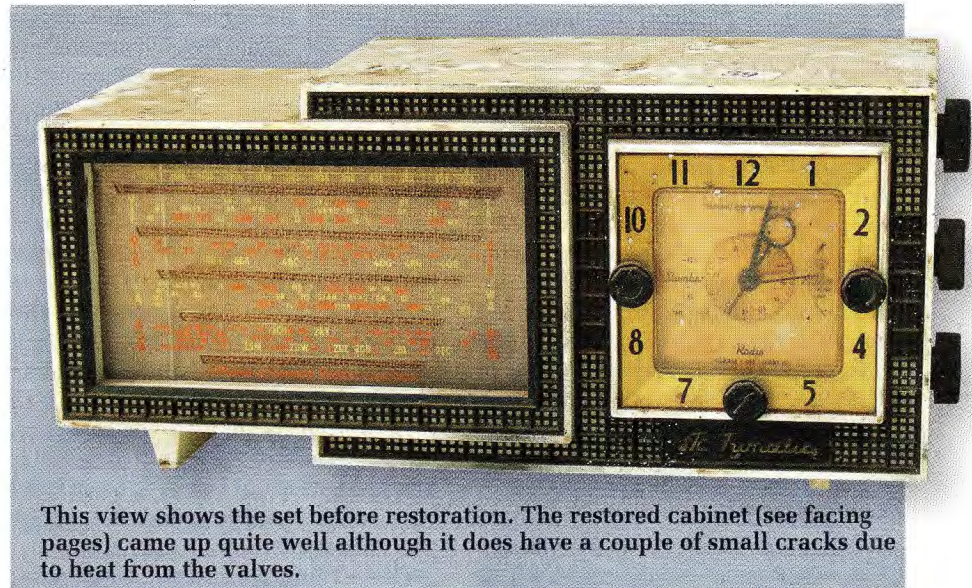
The oscillator circuit is quite conventional. However, unlike other circuits, it doesn't have an oscillator blocking capacitor as the tuning capacitors in this section do that job. The 47kΩ oscillator grid leak resistor is wired across the tuned circuit.

The converter valve (V1) is a 12AH8 and is rarely seen in sets other than STC models. It is similar to a 6AE8 or 6AN7 but also has a 12V centre-tapped heater which makes it more versatile, particularly for car radio work.

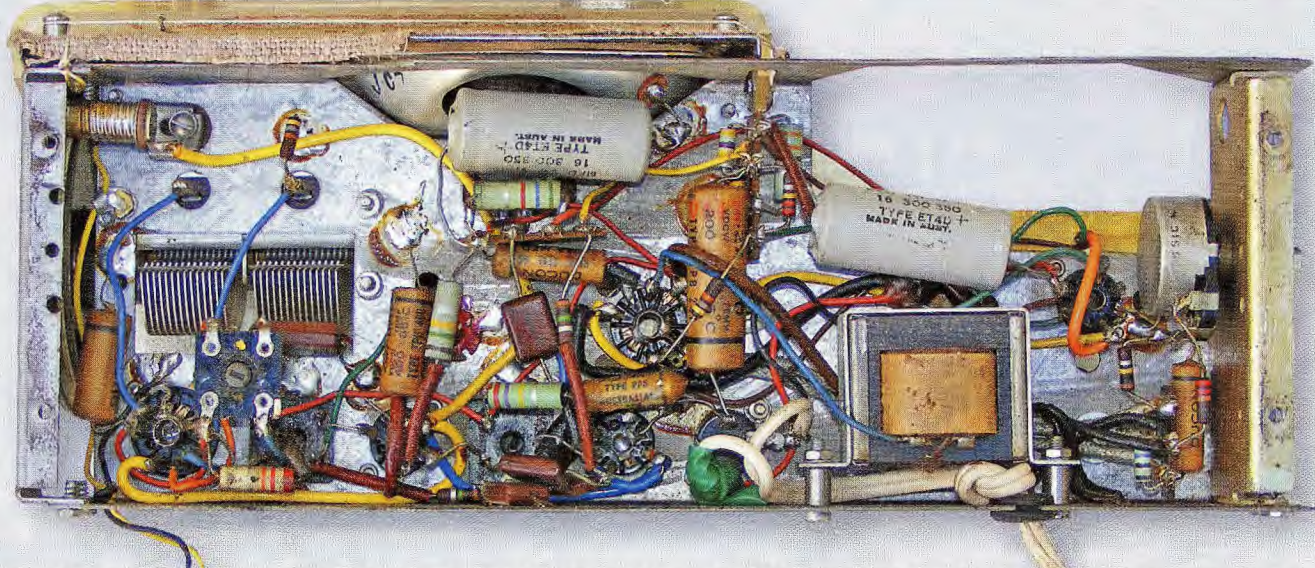
The 455kHz signal at the plate of the 12AH8 is fed to the first IF (intermediate frequency) transformer and then applied to V2, a 6BA6 IF amplifier stage. The amplified IF signal is then

applied to the second IF transformer and fed to a detector diode in V3. Valve V3 is shown on the circuit as a 6AT6, although the higher gain 6AV6 was also used in some chassis and is in fact fitted to this particular set.

The resulting audio signal from the detector is fed via resistor R7 (at the bottom of the second IF transformer) to volume control P1. It is then fed via a capacitor to the grid of V3 and



This view shows the set before restoration. The restored cabinet (see facing pages) came up quite well although it does have a couple of small cracks due to heat from the valves.



This is the underside of the chassis before restoration. Note the crude (and now unacceptable) method used to “anchor” the mains cord. The latter will be replaced with a correctly anchored 3-core flex so that the chassis can be earthed.

amplified. The amplified plate signal is then AC-coupled to the grid of V4 (a 6CH6), which is a high-gain pentode audio output valve.

V4 in turn drives a 6kΩ speaker transformer. Most speaker transformers have either a 5kΩ or 7kΩ plate impedance winding which suits valves such as the 6AQ5 and 6M5 respectively. The 6CH6 is slightly different in its characteristics and has higher gain as well.

The circuit shows a resistive divider across the speaker transformer's secondary which applies negative feedback to the grid of the 6AT6 (V3), ie, via the volume control and grid-coupling capacitor. In this set though, the negative feedback had been left disconnected (more on this later).

Delayed AGC

As with most similar sets of the era, the circuit has delayed automatic gain control (AGC). The AGC diode in the 6AT6 (ie, at pin 5) operates at a fixed bias and so this diode does not conduct until the applied IF signal rises above this level.

Note that the AGC diode is fed via a mica capacitor from the plate of the 6BA6 (V2), so that it receives a larger signal than is fed to the detector diode. This results in a simple but very effective delayed AGC system.

Power supply

The power supply is conventional for the era and is based on a 6X4 full-

wave rectifier (V5). Note that there are no filter chokes as by this time the latest (higher capacitance) electrolytic capacitors and cheap carbon resistors were more than adequate for filtering the high-tension (HT) line.

The back bias for the circuit is generated across resistor R13 (330Ω) and is between 14-16V. In addition, three parallel 5.6kΩ resistors (R14, R15 & R16) act as part of a decoupling circuit between the plate circuit of the 6CH6 and the HT rail to the rest of the receiver. Finally, a 2.5V bias voltage for V1, V2 & V4 is derived from a voltage divider across the back-bias resistor (R13).

Clock interface

The clock is plugged into the chassis via a 4-core lead. It is a synchronous clock, so its timing is locked to the mains frequency.

In operation, the receiver can be switched on or off using the “Auto-Off-Manual” switch. In the “Auto” position, the clock mechanism closes a set of contacts at the set time to switch the radio on. In addition, if a lamp is plugged into the outlet socket at the back of the radio, this will come on as well – or at least, that's what the circuit shows.

In this particular receiver, however, no lamp socket has been fitted. Either that, or all traces of it have been removed by a previous restorer or serviceman.

One advantage of a valve clock-radio

is that it comes up to volume much more gradually as the valves warm up than a solid-state device. This makes it much more pleasant to use as a bedside alarm.

Restoring the cabinet

Unfortunately, the set featured here had not had an easy life and its cabinet looked quite neglected. In particular, a previous owner had obviously used the set as entertainment while they did painting. As a result, numerous spots of blue and white paint adorned the cabinet and the clock face, along with several sticky tape tracks.

Before restoring the chassis, it was necessary to remove both the chassis and the clock mechanism. This is done by first pulling off the three control knobs, removing the cabinet back (it's held on by four screws) and unplugging the clock mechanism. The chassis can then be removed by undoing four screws from the cabinet bottom, after which the clock mechanism is removed by undoing four nuts (one at each corner of the mounting plate) and removing the three knobs on the front of the mechanism.

It might sound like a complicated disassembly procedure but it's quite straightforward in practice and is certainly much easier compared to many other clock-radios of the 1950s.

Once all the parts had been removed, the cabinet and all six knobs were washed in soapy water. A nail-brush was used to get most of the muck

off both the inside and outside of the cabinet and was also used to scrub the flutes of the knobs to rid them of years of accumulated grime. The cabinet and the knobs were then rinsed with clean water and set aside to dry.

The next job was to clean the paint spots and sticky tape remains off the cabinet. I used a small single-sided razor blade to scrape the worst of the muck off, at the same time taking care not to scratch the plastic. The cabinet itself is white on the outside while the inside had been painted black. However, it had not been masked properly when this was done and so I also spent some time scraping away several areas of overspray.

Once this had all been done, the cabinet looked quite reasonable despite two small cracks in the plastic on the top. These had obviously occurred due to heat from the output valve and the power transformer. Fortunately, they were not too obvious and were not worth fixing.

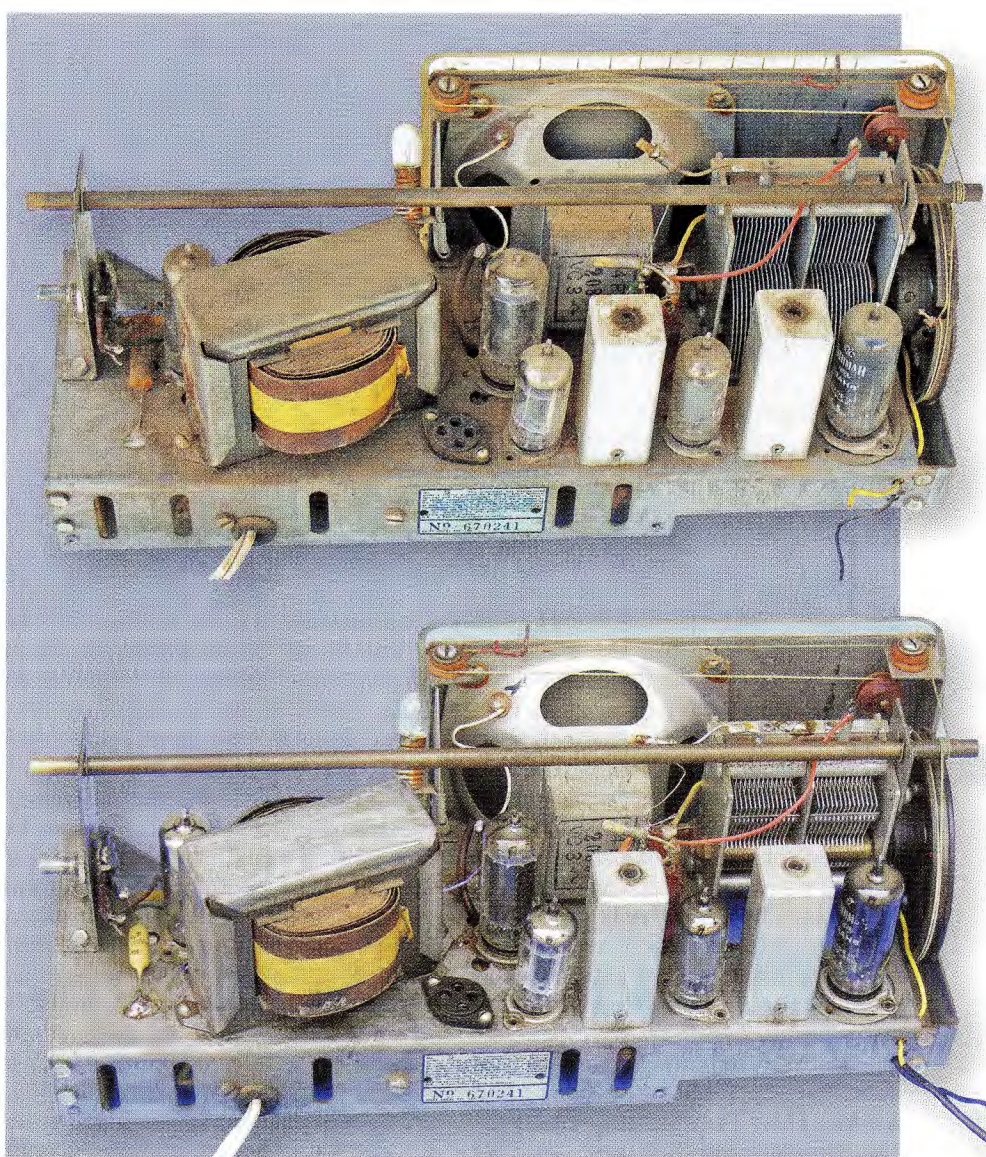
Cracks or distortions in the plastic due to heat from adjacent parts were common in many mantel receivers. In this set, STC had endeavoured to minimise the problem by gluing a couple of pieces of metallic foil to the top underside of the cabinet, the idea being to reflect the heat back and disperse it as much as possible. This technique was only partly successful, as the cracks indicate.

Finally, the cabinet restoration was completed by polishing it with automotive cut and polish compound. This brought up the lustre quite well but this particular cabinet is still not in pristine condition despite the restoration work. Heat damage is the main problem.

Chassis restoration

Unlike the cabinet, the chassis was in really good condition. There were no signs of rust but it did have a coating of accumulated dust and some wax on the top side.

After removing the valves, the chassis was dusted down using a small paintbrush. The wax spots were then lifted and scraped off using a flat-bladed screwdriver after which the chassis and most of the other above-chassis components were wiped with a kerosene-soaked rag to remove any remaining gunk. Once this had been done, the chassis looked quite respectable.



These two photos show the chassis before restoration (top) and after restoration (bottom). A kerosene-soaked rag is good for getting rid of the gunk.

Next, the valves were cleaned with soapy water. I don't dunk them in the water though; instead, I gently rub the valve envelopes with a soapy finger to remove any grime. The valve markings were left alone though, since they are all too easy to remove. Once the valves were clean, I rinsed them with clean water and stood them on their pins to let them dry.

Clean valves look great in a receiver and this one was no different. Note, however, that octal valves must be cleaned in a slightly different way, to ensure no muck gets down into the base.

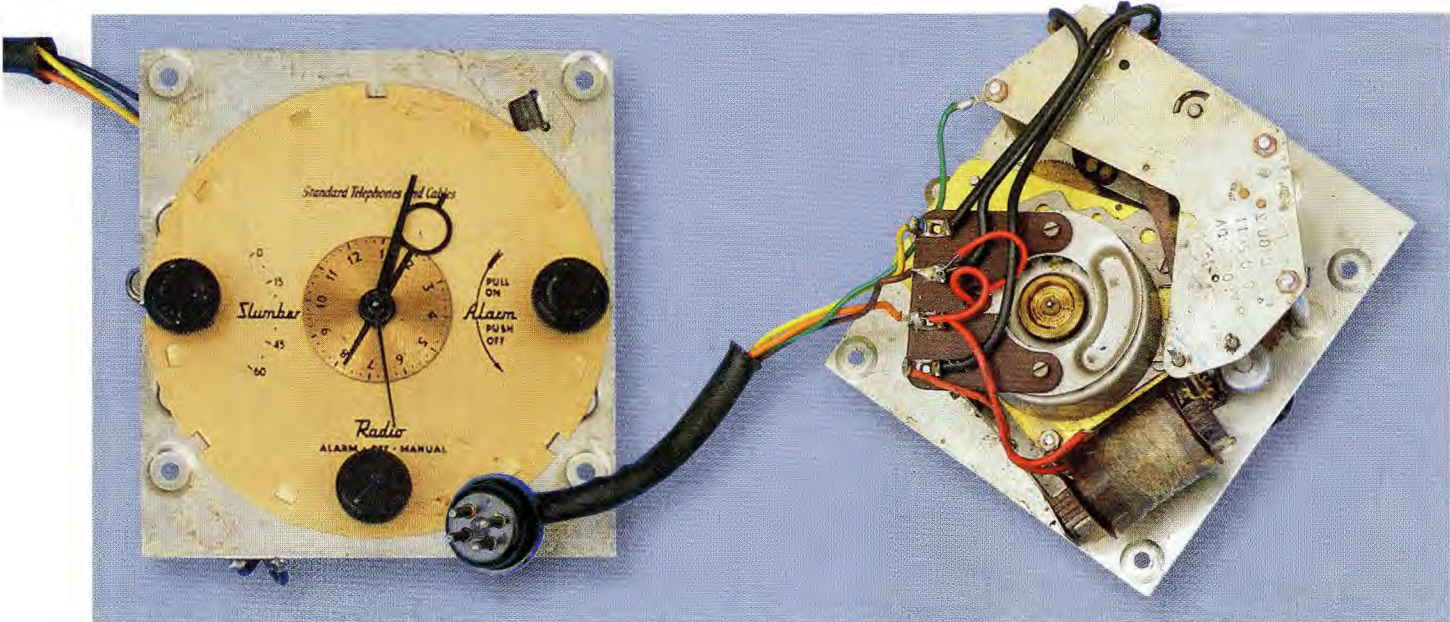
Now that everything was clean, the various pulleys and shafts were given a drop of oil to ensure they all operated smoothly. The tone control switch and all valve sockets were then sprayed

with Inox to lubricate them and clean any corrosion off the contacts.

Fixing the circuit

It was now time to work on the circuit. I began by replacing the AGC bypass capacitor (C3), along with C18, C19, C20 & C22 in the audio section, as leakage in any of these will cause problems. This turned out to be a wise move because they were all quite leaky, particularly C3 and C19, the most critical items. These paper capacitors were all replaced with polyester units with similar voltage ratings. The only paper capacitor left in the set is C17, the back bias filter.

Next, I checked the resistors to make sure that they were all close their marked values. These were all OK except for R5, the screen resistor to the



The clock mechanism plugs into the chassis via a 4-way socket adjacent to the power transformer. Unfortunately, it no longer works because the teeth are missing from one of the gears, just after the motor.

6BA6, which was open circuit and had to be replaced. My guess is that this resistor's failure was the reason the set had been taken out of service many years ago, its owner deciding that it simply wasn't worth fixing.

Further checking also revealed that the negative feedback line from the bottom of resistor R17 (on the speaker transformer secondary) to resistor R18 was missing. In fact, it was impossible to determine whether this wire was ever there or not. As a result, I fitted a wire so that I could easily join these two resistors together later on. That way, I would be able to quickly check the receiver's performance with and without the feedback.

The speaker transformer was in good order with both windings showing continuity. However, I was disappointed to discover that the clock is beyond repair. The teeth have worn off one of the gears, just after the motor, which means that the mechanism is unable to rotate.

I also encountered problems with the mains cord. **The original has been anchored by tying a knot in the lead just inside the chassis but that's completely unacceptable these days.** Unfortunately, it's impossible to fit a 3-core mains lead complete with cable clamp at its present entry point, as this will interfere with the speaker transformer.

One way around this would be to drill a hole in the chassis straight through the ARTS&P sticker and fit

a 3-core mains lead there. However, I don't want to do that as it would spoil the authenticity of the restoration.

At the time of writing, I've yet to solve this problem but I'll probably end up moving the speaker transformer so that I can install and secure the new mains cord in the current location. A 3-core lead will enable me to earth the chassis, in the interests of safety.

Leakage checks

My next step was to check the mains transformer. This was done by checking the isolation between its frame and the primary and secondary windings using a 1000V insulation tester. This revealed no signs of any insulation breakdown.

In fact, I've found the mains transformers in old radios to be remarkably reliable although the occasional one is defective. However, just because faulty mains transformers are rare, it doesn't mean that we can be complacent. They should all be tested using a high-voltage insulation meter before power is applied, as the consequences on not doing this could be fatal.

A resistance check between the HT line and the chassis also showed very little leakage. I then connected my electrolytic capacitor reformer to the HT line and set it to the 250V range. After a few minutes, the voltage on the HT line rose to about 250V, indicating that the electrolytic capacitors had reformed. By then turning the reformer

off and on a few times, I could see that the capacitors charged within a second or so, so they were probably OK.

Getting it going

Once all the above tests had been completed, the valves were reinstalled and the set switched on. The HT line and several other voltages were then monitored as the set warmed up and these all proved to be correct. What's more, there were no signs of any trouble with any of the valves, such as internal sparking.

Once the set had warmed up, there was a slight hum from the speaker and this indicated that the audio stages were probably working. However, I was unable to hear any stations, even after tuning right across the dial.

I fired up my signal tracer and this detected RF signals at IF and signal frequencies, so those sections seemed to be working correctly. It was then that I discovered that the 6AV6 wasn't lighting up, so I wriggled it in its socket and shortly afterwards was rewarded with noise from the speaker. Obviously the Inox hadn't quite cut through the corrosion on the valve sockets until I wriggled the valve.

I then tried tuning the set again and this time stations came in right across the dial.

It was now time to try the negative feedback circuit. I connected it and was immediately disappointed with the quality of the sound. I looked at the audio waveform from the signal

generator's detected RF signal on the oscilloscope and I could see that the resulting sine wave was much less distorted when the feedback was disconnected. What's more, there was no sign of any supersonic oscillations and the bias on the 6CH6 was normal.

In the end, I left the feedback disconnected in order to extract the best performance from the receiver.

Alignment

By now, the performance of the receiver was quite good. Even so, it was worth checking the alignment to ensure that the receiver was operating to its full potential.

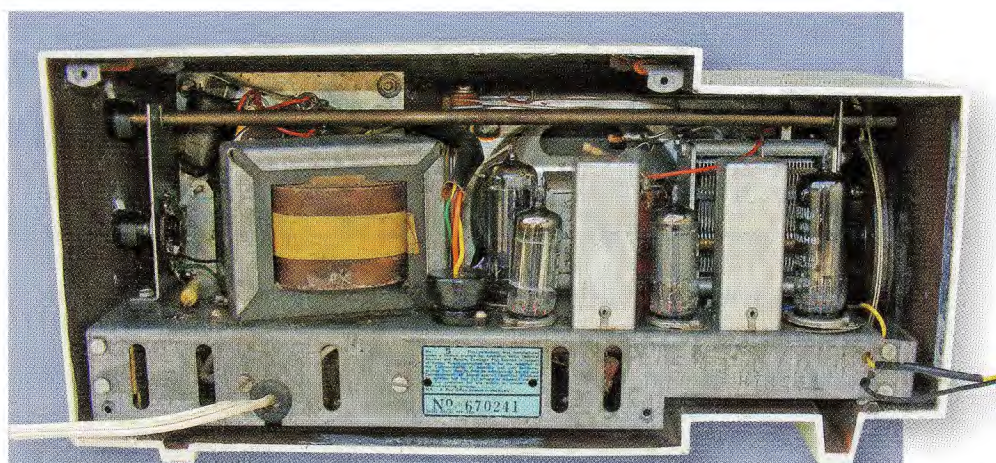
I began by connecting the output of my Leader LSG11 signal generator to the antenna terminal. The tuning gang was then closed and I tuned the signal generator across the likely IF frequency of 455kHz and adjusted its output level to get a reasonable signal through the receiver.

The set gave its best response at around 455kHz, so I adjusted all four IF transformer tuning cores with an insulated alignment tool (a modified plastic knitting needle can also be used for this job) to peak the response. As I did so, I kept reducing the generator's output so that the signal was a little noisy as each coil was peaked. This method ensures that the IF stage is correctly adjusted for peak performance on weak signals.

Having done this, the performance was quite good and it was time to align the receiver's front end. This alignment can be done with instruments connected to the audio output or to the detector. However, I find that I can accurately align receivers by listening for the best quality audio signal with the lowest input signal practical.

The front-end alignment was out a little so I fed in a 600kHz signal from the generator and adjusted the oscillator coil until this signal was heard at the 600kHz marking on the dial. I then tuned to the high-frequency end and found that a 1400kHz signal from the generator was heard slightly further along than its correct location on the dial. This was corrected by removing a couple of turns of wire from the wire-type trimmer capacitor.

The final step in the alignment was to adjust the antenna circuit. Tuning to the low-frequency end of the dial, I found that I needed to adjust the tuning slug considerably to get the



The chassis is a neat fit inside the plastic case. The case has cracked in a couple of places due to heat build up, despite the valves being some distance away from the sides and the top.

best sensitivity. I then tuned to the high-frequency end and found I had no adjustment available, as the trimmer capacitor was missing from the set!

As a result, I connected a trimmer that I had available but found that even with the trimmer adjusted to minimum, I couldn't peak the performance at that end of the dial. In the end, I found that I had to compromise with the low-frequency core adjustment by moving it slightly off peak performance. This then allowed me to adjust the trimmer for good performance at the high-frequency end of the dial.

I suspect that the problem is connected with the padder capacitor used in this set. This has a value of 475pF which is quite a bit higher than the usual value of about 425pF. However, if I were to change the value of the padder, many of the dial markings would be incorrect, so I left it alone.

Because of this, I had to accept that I couldn't tune the set for maximum output. However, it is still a good performer and the quoted sensitivity of 10 μ V means it is no slouch in this aspect.

Odds & ends

The previous owner had altered the mains input wiring by bypassing the on-off switch on the clock. However, even though the clock no longer worked, this switch could still do its job so I rewired it back in series with the mains supply.

Before plugging the set into the mains, I clipped my multimeter test leads to the switch contacts and checked its operation. To my surprise,

I found that it was quite intermittent.

My first thoughts were that the contacts must be dirty so I cleaned them with some fine wet and dry paper. Unfortunately though, that didn't fix the problem, the multimeter intermittently varying from zero ohms to open circuit when the switch contacts were closed.

I eventually tracked the problem down to a well-disguised dry joint on one of the switch terminals. This dry joint had obviously been there from the time the radio was made, although it may not have started giving problems until some years later. It also explains why the previous owner had bypassed the switch.

As a final check, I decided to measure the set's power consumption. The clock mechanism drew just 1.25W while the total power consumption with the receiver operating was 36W.

Summary

The circuit of the STC A5150 clock-radio is quite conventional and it works well, although there are some problems with the negative feedback network and the alignment of the antenna tuned circuit. Despite these problems, the sensitivity and the audio quality are both quite good. It's a shame that the clock has a worn out gear, although a friend has indicated that he has a clock that may suit the set.

As stated earlier, STC did things a little differently. The A5150 is certainly not the most awe-inspiring receiver around but it is still an interesting set that I am happy to have in my collection. **SC**