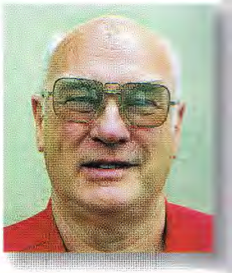
VINTAGE RADIO



By RODNEY CHAMPNESS, VK3UG

The AWA PF 11B-6V car radio and the Ferris "Tranimate"

We often think that transistorised radios are a fairly recent innovation. However, solid-state equipment has been around in reasonable quantities since the late 1950s or almost half a century! As a result, many transistorised receivers now fall into the "vintage" category.

The two items described in this article certainly fall into that category. For example, the AWA PF 11B-6V car radio was a mid-1960s all-transistor receiver, that was available in two models: a "standard" model with a single-ended audio output and an up-market unit with a push-pull audio output stage.

The other unit to be described is the Ferris "Tranimate" which, to the best of my knowledge, was a unique Australian innovation. In the 1960s, dedicated car radios were expensive "add ons" and this little device was intended to allow an ordinary household transistor portable to function as a cheap but effective car radio. A car radio antenna was installed on the car, with its coaxial lead plugged into the Tranimate. The output from the Tranimate was then coupled to the portable radio and bingo – you had a cheap car radio.

AWA VW-1200 car radio

There are lots of people involved in restoring old cars, often to "as-new" condition – and in many cases, better than new. And of course, they want the radio that's installed to look and work just as it did many years ago.

As a result, I've recently been involved in restoring several car radios for vintage car enthusiasts. The jobs are not always straightforward though, since car radios are usually a bit more of a challenge to restore than "bog-standard" 5-valve AC mantel radios. That's mainly because car radios are more compact and so are harder to access than domestic receivers. They have also invariably had a rougher life and are usually better performers than metal receivers, which means that you have to know how to get the most out of them.

Still, it's always interesting to restore these old radios and it helps me recoup some of the outlay for my hobby.

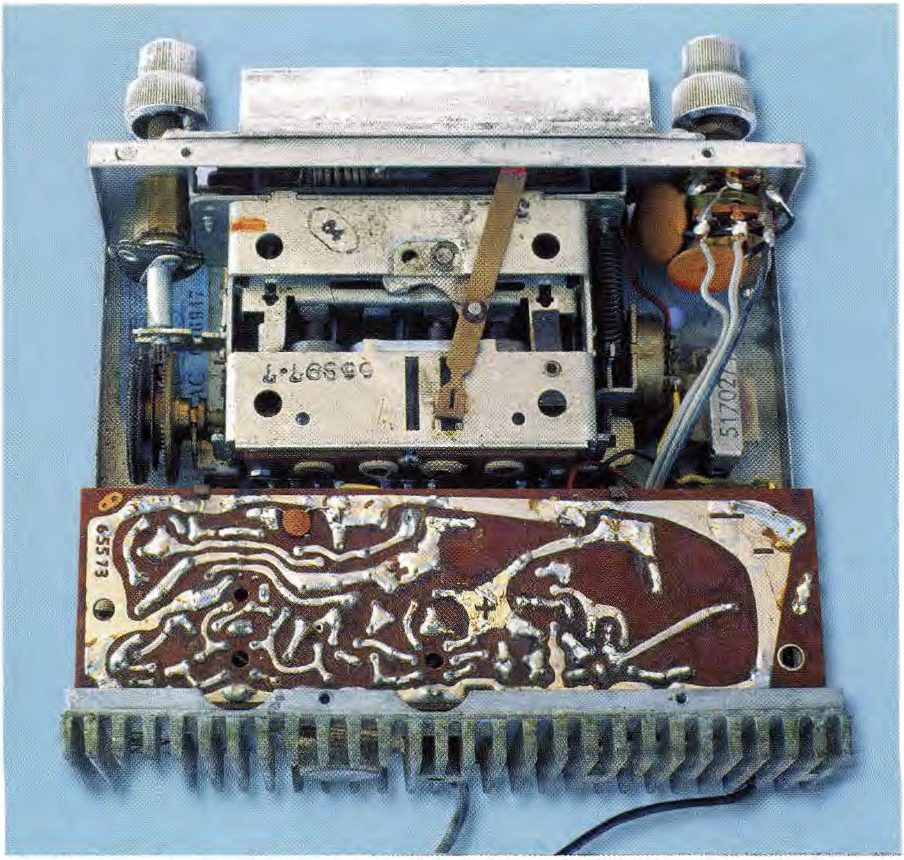
I'm not too sure how the Volkswagen driver found me – he simply turned up one day and asked me if I could get his 6V AWA car radio going properly. It was operating but only just – the stations that could be picked up were very weak and the set had quite a bit of noise in it.

Well, it looked like an interesting project and as luck would have it, I already had a circuit for the 12V version of the set (it's very similar to the 6V version). I don't like tackling a restoration job without a circuit diagram if at all possible, since the job is always so much quicker and easier if you have the circuit details.

This old AWA car radio receiver cleaned up quite well and will certainly look the part inside the restored Volkswagen. Note the press button tuning.

Opening up the receiver

The first step was to remove the cover (shield) from the set and this is



The PC board is mounted upside down inside the chassis but is quite easy to detach and "swivel" away from the finned heatsink. Note the large preset tuning mechanism.

done by removing 12 screws around the top of the case and lifting it clear (car radios are shielded to minimise external interference). This reveals a sheet on the inside of this cover, showing the locations of the various transistors and the alignment points on the PC board. This sort of information is always very useful when it comes to servicing the set.

As shown in the above photo, the PC board is mounted upside down inside the case with its track side facing upwards. In order to gain access to the component side, it is necessary to first "spring" a couple of clips along the front edge of the PC board. That done, the front edge of the board can be lifted up and moved forwards slightly. This disengages the board from slots in the heatsink and its back edge can then be swivelled up.

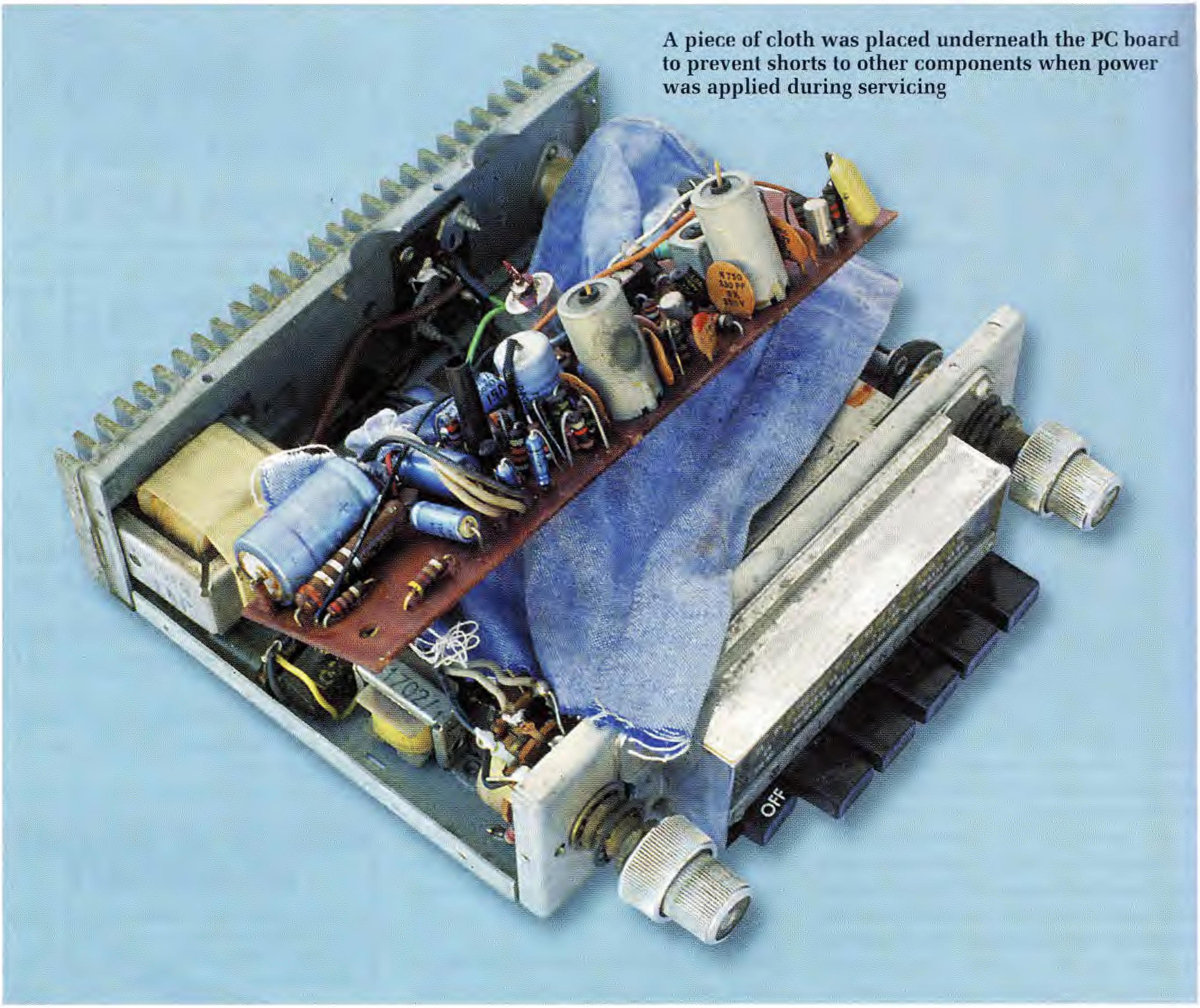
Once it's out, it would be quite easy to short parts of the board to the earthed metal clips that hold the board in place. As a result, I placed a layer of thick cloth between the board and the clips to prevent this from happening. I than took a look at the various stages inside the set but could see nothing that was obviously wrong – ie, no broken wires, overheated components or the like.

Audio stage troubleshooting

My next step was to connect the receiver to a 6V DC regulated supply capable of delivering up to 3A.This coped quite easily, as the receiver's drain is just 1.2A maximum. I then connected an antenna to the set and plugged in a 16-ohm loudspeaker.

When it was turned on, it behaved just as it did in the car. The reception was so noisy receiver that it was a struggle to pick out any of the stations. However, this noise was still there when the volume control was turned down, so that part of the problem certainly didn't involve the RF section.

Next, I installed a 1000µF electrolytic capacitor across the base to emitter junction of the 2N408 transistor in the audio output amplifier and the noise disappeared. Because the audio amplifier is direct coupled, I reasoned, incorrectly as it turned out, that the 2N408 was noisy (this can be a problem with germanium transistors). I didn't have



A piece of cloth was placed underneath the PC board to prevent shorts to other components when power was applied during servicing

any 2N408 germanium transistors, so I fitted a BC558 silicon transistor instead. The transistor worked OK but the noise was still there.

It was then that I spotted an electrolytic capacitor that was starting to bulge at one end. This too was replaced but rather surprisingly, it made no difference.

What next to try? First, resistor R20 needed to be replaced with a lower value, so that the BC558 I had substituted (and the other stages) would be biased correctly. The original resistor was 15kΩ (remember this is the 6V version of this receiver), so I replaced it with a 10kΩ resistor. And would you believe it? – the noise disappeared.

So I had jumped to the wrong conclusion that the old germanium transistor was noisy. In fact, I should have woken up to this when I first tried the electrolytic capacitor across the base-emitter junction. The audio stage now performed as it should, with quite good gain and just a slight background hiss, so I was half-way through fault finding.

RF stage repairs

Checking the front end wasn't quite as easy, not that direct-coupled audio stages are always a joy to work on. The set couldn't receive any stations, so I decided to begin by checking the intermediate frequency (IF) stage.

To do this, I first connected a 10nF ceramic capacitor in series with the output of an RF signal generator. The RF generator was then set to 455kHz and its output fed, in turn, to various points of the IF amplifier. However, the output levels varied according to where the probe was placed, due to the capacitive voltage divider and the heavy loading I was placing on the tuned circuits with the crude probe I was using. As a result, there was no clear-cut indication of the performance of the IF amplifier.

Next, I fed the RF generator's signal into the base of the converter (VT2) and carefully aligned the IF amplifier stages. This noticeably improved the performance of this stage but the receiver was still having trouble picking up stations.

By now, I was beginning to think that the converter wasn't converting the signal frequency to the IF (intermediate frequency). To test this theory, I tuned the set to the low-frequency end of the dial and then tuned another receiver to 1200kHz and placed its antenna lead adjacent to the car set's converter stage. I then tuned the car radio upwards from 530kHz and was greeted by noise quietening as the car radio's oscillator went past 1200kHz.

So the oscillator was working and hence the converter probably was too. But there was still no sign of stations!

I then did some measurements around the RF stage and found that there was 6V on the collector of this transistor instead of 0V. The cause wasn't hard to find – RF choke L2 was open circuit! A quick hunt around my workshop soon turned up some small Dai-1Chi 5mH RF chokes that I had and I fitted one into the receiver. And that was it – the collector voltage on the RF transistor dropped to 0V and the set burst forth into glorious sound.

Now that the set was operating properly, all that remained was to align the front end and give it a good clean up. The oscillator alignment was already correct but trimmer capacitor C7, which peaks the RF stage at the high frequency end of the tuning range, had been adjusted for maximum capacitance and was difficult to move. In fact, it appeared that the trimmer didn't have enough range to peak the alignment of this stage. This problem was solved by connecting a 10pF NPO ceramic capacitor in parallel with the trimmer (under the board), after which I was able to peak the RF stage alignment.

Final peaking of the RF and oscillator stages is carried through a hole in the base of the set once the metal cover is back in place. In particular, the antenna circuit cannot be peaked until the receiver is in the vehicle and attached to the fully extended antenna. To do this, the set is tuned to a weak station at around 1500kHz and the flat knob on the underside of the set is rotated until the best performance is achieved.

Cleaning up

Having got the set working correctly, I then proceeded to clean up the case as much as practical. The knobs were washed in the laundry sink in soapy water and I used a small nail brush to remove the dirt from between the ridges in the knobs. In addition, the two smaller knobs had peeling black paint in their centres so I put a small amount of flat black enamel paint on them to make them look original.

The case itself had a couple of pieces of masking tape and other bits of muck stuck to it which I scraped off. I then used a eucalyptus-soaked rag to clean the case and the front panel. A kitchen scourer was then used to remove some of the more stubborn marks although this was done rather gently because I didn't want to destroy any of the wanted markings on the case.

In the end, both the case and the front panel looked quite good, although they still weren't exactly in pristine condition.

Brief circuit details

OK, let's now take a brief look at the circuit details of this AWA car radio receiver – see Fig.1. As shown, the antenna input is a typical car radio input circuit, where the capacitance of the coaxial cable from the antenna forms part of the tuned circuit. That's why the antenna circuit cannot be peaked for best performance until the set is installed in the car. Note that the actual tuning of this and the following stages is done by a variable inductance tuner.

Transistor VT1 amplifies and applies the signal through another inductance tuned circuit to an autodyne mixer/converter stage based on transistor VT2. This stage converts the

Photo Gallery: Peter Pan Model BKJ 5-Valve Receiver

Housed in a stylish wooden cabinet, the Peter Pan BKJ was a 5-valve dual-wave mantel receiver which covered the medium-wave (broadcast) and the 5.88-18.75MHz shortwave bands. It was manufactured around 1946 by Eclipse Radio Pty Ltd (Melbourne) and used the following valves: 6J8-G frequency changer; 6U7-G IF amplifier; 6B6-G detector, AVC detector and first audio amplifier; 6V6-G audio output; and 5Y3-G rectifier. (Photo courtesy Historical Radio Society Of Australia (Inc.).

A Note On IF Alignment

The December 2002, January 2003 and February 2003 issues covered the subject of receiver alignment. As a follow-up to this, John Breden from New Zealand advocates doing the IF alignment with the tuning gang in the fully unmeshed position, as this obviates the possibility of tuning the IF to the bottom of the broadcast band when the gang is closed.

This can and has happened when the IF alignment is done without using a signal generator.

It is rare but does happen when over-enthusiastic people alter the alignment adjustments without knowing what they are doing. Using a signal generator ensures that the IF is aligned to the correct frequency. So if you do align the IF without using a signal generator, just be careful you don't fall into this trap.

The Ferris "Tranimate"

Ferris Radio (Australia) were renowned for making many innovative devices and the "Tranimate" was one of them. "What's the Tranimate?", you may well ask. Well, the Tranimate was a 2-transistor tuned amplifier designed to accept a signal from a car radio antenna and output it to a domestic portable transistor radio.

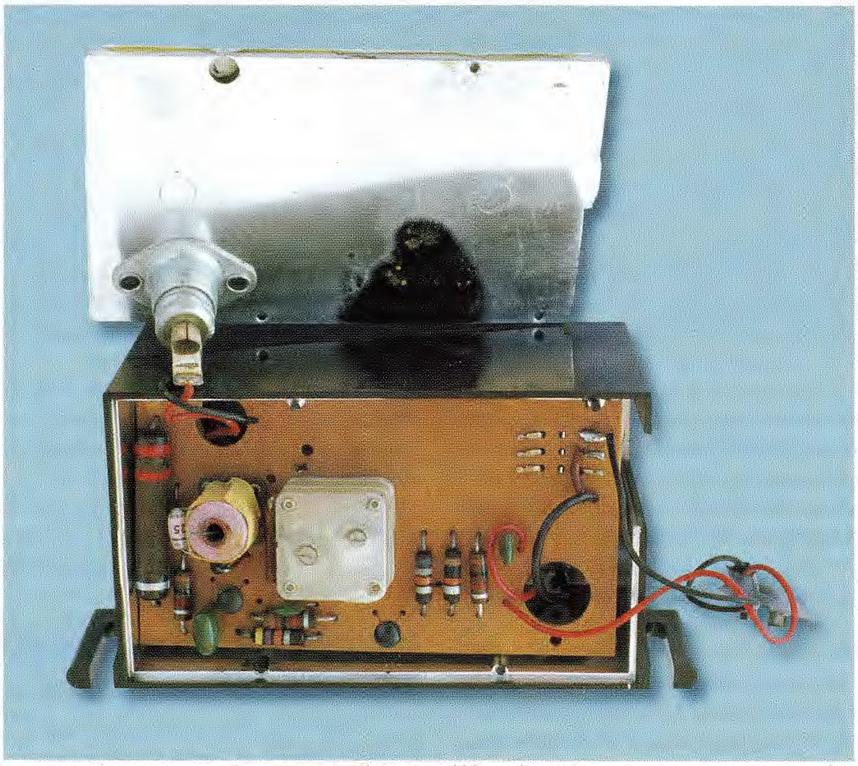
It worked like this: a car radio antenna was installed on the car, complete with its coaxial cable lead. This lead was then plugged into the Tranimate which was screw-mounted to the underside of the dash panel of the car (remember, you could do those things in 1960s cars).

The Tranimate had an input tuned circuit and this was manually tuned by a small tuning gang. The dial was calibrated with some stations but being so small, only a few representative stations were marked.

The tuned signal was first amplified by a transistor operating in common emitter configuration and then fed to a second transistor wired as an emitter follower. From there, the resulting RF output was then fed down a thin coaxial cable to a ferrite-cored coil which was clipped to the transistor radio so that it was in line with the portable's loopstick antenna. As a result, the signal in the Tranimate's coil was induced into the loopstick antenna and so the portable received a clear signal.

Of course, a portable radio will work in a car without a "signal booster" such as the Tranimate. However, the signals tend to be weak and the vehicle's electrical equipment, particularly the ignition system, interferes severely with reception. Hence the reason for the Tranimate – it picked up a relatively noise-free signal in a good signal environment and amplified it so that the noise from the vehicle's ignition became insignificant.

The Tranimate was powered by a 216 battery slipped into the case at one end. The circuitry inside the plastic case is shielded from interference within the vehicle by metallic plating of the inside of the case. The tuning dial on the front is peaked up for best reception of the station being received.



The top view shows the Ferris "Tranimate", complete with its coupling coil and connecting coaxial cable, while immediately above is the view inside the case. The complete unit is around the size of a packet of cigarettes.

So that was it – a simple little device that filled a small niche market for the many people who could not afford both a transistor portable and a car radio at the time. I doubt that it proved to be a winner and I obtained mine at a clearance price. Still, it's a desirable item to have in a vintage radio collection, because they are so rare and innovative for their era.

input signal to 455kHz and feeds it to the IF stage.

The IF stage is based on VT3. It amplifies the signal and because of the high gain of this stage, it is neutralised using capacitor C18. AGC is developed from the signal at VT3's collector via C17 and diode MR1. This AGC is only applied to VT1 in the RF stage but, although it's only applied to this one stage, is still quite effective.

Detector

Diode MR2 at the output of IF transformer TR3 functions as the detector. It feeds the detected audio signal to the volume and tone controls, and thence to the audio amplifier stage which is based on transistors VT4-VT6. Direct-coupled audio amplifiers are quite common and in operation, each stage interacts with the others. This can make fault-finding difficult if there is a DC fault.

Because some of the transistors are germanium types, it is necessary to stabilise the audio amplifier against thermal runaway with increased temperature. This is done using thermistor TH1 which acts to stabilise the current drawn by the audio amplifier with increased temperature.

VT5 is the only NPN transistor and it has a small heatsink attached to it. VT6, a 2N301, is mounted on the rear heatsink and only gets slightly warm, even after the set has been running for some time. An auto transformer (L7) couples the audio signal on VT6's collector to the loudspeaker.

Summary

This AWA car radio is a good example of germanium transistor design. The circuit is relatively simple and by altering just a few components, the basic design can be adapted to either 6V or 12V DC operation. It is also quite a good performer for a car radio from the 1960s.

This particular set was not difficult to restore and it showed only moderate signs of wear and tear. The press-button station selector still works well and in general, it's a receiver I would be happy to have in my collection.

The only real criticism I have is that the PC boards of the era are hard to work on. The leads coming through the board are usually bent over along the copper tracks, making it difficult to remove a component for testing. It's also necessary to be careful when soldering to ensure that the tracks aren't heated excessively, otherwise they will separate from the board or damage one of the leads.

Finally, I find that the circuits on these phenolic boards are difficult to trace at times! And the draughtsman who drew the circuit diagram omitted the earth/chassis connection on the 0V rail. **SC**

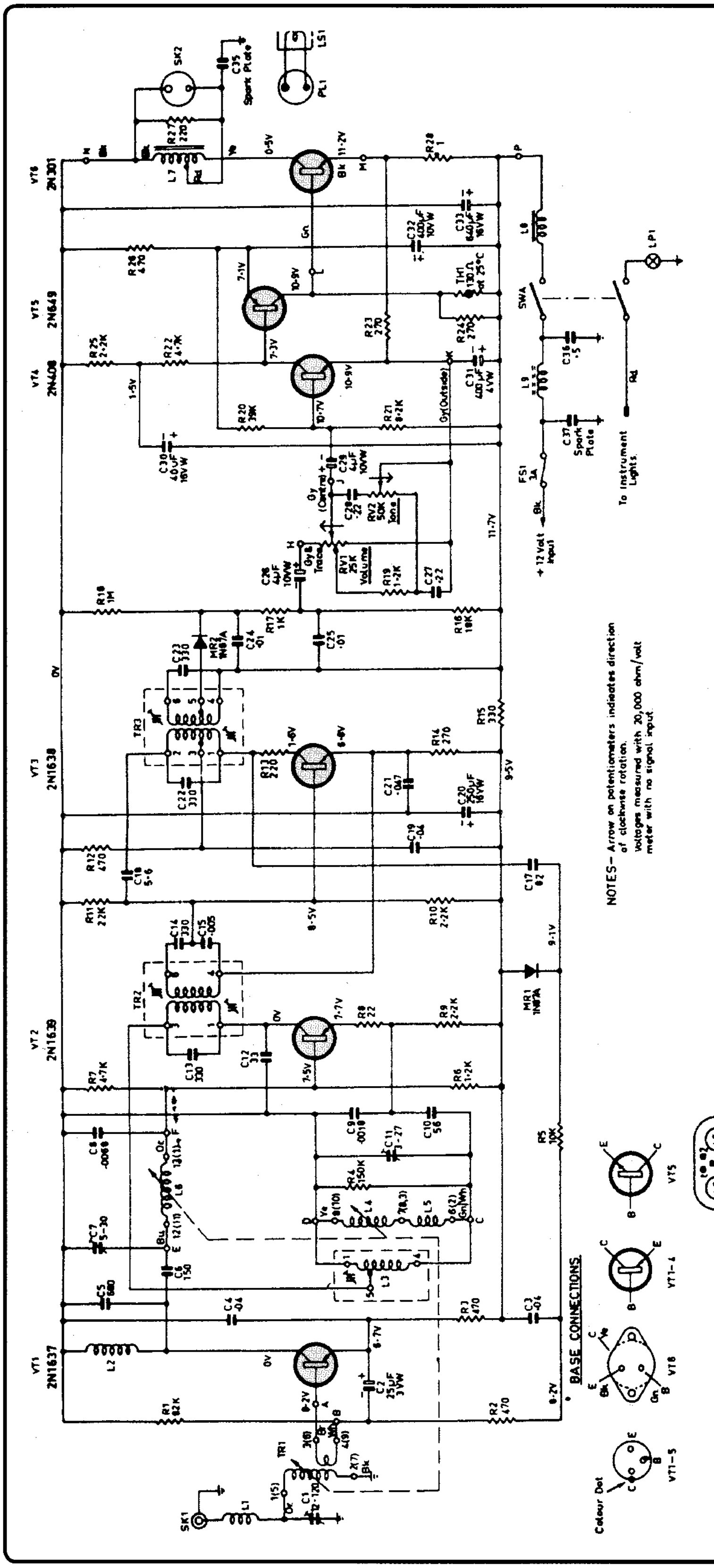


Fig.1: the circuit is a fairly conventional 6-transistor superhet design. Transistor VT1 provides RF gain, while VT2 and VT3 function as the converter and IF gain stages respectively. Diode MR2 is the detector and this feeds a direct-coupled audio amplifier based on transistors VT4-VT6.