The Serviceman

No fault is simple — when it's three layers down!

When is an appliance too old to service? This is something like asking how long is a piece of string — and nearly as hard to answer. While most of us develop some kind of instinct about such things there is always an element of chance involved and it is still possible to get caught, as this month's story reveals.

As recently as the November 1979 issue I discussed this subject, as an afterthought to my experience with a TV set in a holiday cottage. First aid to produce a (just) watchable picture was one thing, but getting the set back into first class operation would have been quite uneconomic.

Nor would it have taken a genius to work this out; with just about every function in the set in need of attention it would have been a major overhaul in every sense of the term. By comparison, the tape recorder which is the subject of this month's story should have been a push-over.

Granted, it was at least 15-years-old, and a valve device, but there any comparison with the TV set finished. It had, according to the owner, only one fault (failure to record properly) which I mentally registered as being most likely due to a sick bias/erase oscillator valve. This, coupled with the fact that the owner had the original manual and circuit, persuaded me to tackle the job.

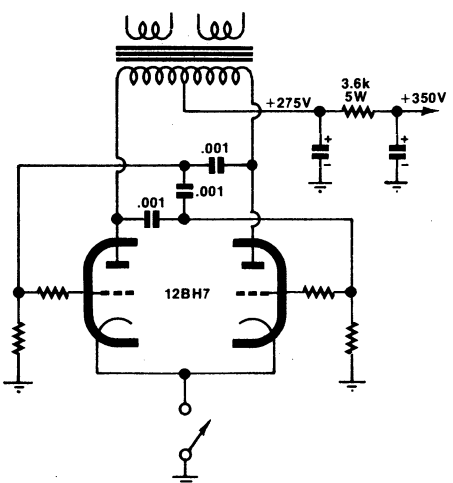
It was a Sony recorder, model TC-500A, stereo, mains powered, all built into a substantial carrying case with two speakers fitted as a two-piece detachable lid. It was built like a battleship and weighed 25kg — or close to half a hundredweight by pre-metric standards. I was glad I didn't have to carry it any further than from the counter to the workshop.

A few preliminary tests confirmed the owner's description of the fault; while the VU meters responded to signals into the microphone, thereby absolving it and its associated amplifier, the system would not record these signals or, indeed, erase the previous recording. This latter point alone clearly suggested partial or total failure of the bias oscillator system.

I removed the head cover, identified the erase head, and used the CRO to check for oscillator voltage across the head. There wasn't a sign of anything, thereby confirming the general nature of the fault.

The oscillator valve was a 12BH7 twin triode, in a cross-coupled multivibrator circuit, with a centre tapped transformer coupling one plate to the other. The valve itself seemed the most likely suspect, particularly as, according to the owner, all the valves were original.

So much for the theory; locating the valve and changing it wasn't quite so simple. Just getting the chassis out of its wooden case was a major operation, after which I realised just how tightly everything had been packed in. The electronics had been stacked around the motor, with a large portion of it (mainly the record and replay sections) in a shielded section.



It seems only yesterday that circuits like the above were normal and commonplace — a tape recorder bias oscillator using a twin triode valve and three high voltage mica capacitors in the grid and anode circuitry. Valves? Mica capacitors?

Fortunately, the erase oscillator, along with the power supply, was one section outside the shield, but it still wasn't the most accessible arrangement I have seen. Changing the valve was reasonably easy, but achieved virtually nothing. The system still would not record.

Closer inspection revealed a couple of clues. There was some gunk in the vicinity of the main power electrolytics, suggesting that they had been overheated in some way. This led to the second clue; a five watt resistor in close proximity which had obviously been badly overheated. This was all the more obvious because, for some reason best known to the makers, they had enclosed the resistor in shrink plastic tubing!

The next thing was to try to get at the 12BH7 socket and measure some voltages, but this was easier said than done. The whole erase oscillator circuit was tucked in behind the power transformer, and I had to partially dismantle this part of the chassis before I could even juggle a pair of test prods into position to make a few voltage measurements.

According to the circuit, the main HT supply was 350V in the record mode, and this was applied to the plates of the 12BH7 via a 3.6k decoupling resistor (the one which had overheated) and the centre tap of the coupling transformer. The HT voltage was close enough, but that on the 12BH7 plates was another matter.

According to the circuit it should have been 275V in the record mode but, in fact, it was only a little over 70V. No wonder the poor old 3.6k resistor was getting hot, it would have been dissipating over 20W! (At the same time, I calculated that it would normally dissipate only about 1.5W, which would make the plastic tubing more acceptable, even if the reason for it is not obvious.)

Looking at the circuit it appeared that the only other components, apart from the valve, which might be suspect were three .001uF capacitors in the grid cir-

cuits of the valve. But confirming this was another matter. It was virtually impossible to get at the capacitor leads with the meter prods without a lot more dismantling.

I gained the impression that this section of the recorder was the first to be wired, so that everything else had been built around or on top of it. There were also numerous harnesses connecting the various sections together so that to dismantle the set any further would have been a massive, and costly, operation.

The only other possibility seemed to be to cut the capacitors loose, one by one, until I found the faulty one — and hope that Murphy was on holidays! Even this wasn't easy but, selecting the most accessible one, I managed to get a small pair of cutters in and clip the first pigtail, bend the capacitor out of the way, and then clip the second one.

And that proved to be about the only bright spot of the whole operation because, believe it or not, that was the faulty one — a dead short. I couldn't be sure which one it was, but it was most likely one of the two which couple to the grids. If so, it would have applied the full HT voltage to one grid, effectively preventing oscillation and causing that valve to draw several times its normal current.

But my troubles were far from over. I now had to replace the capacitor, and this presented two problems; finding a suitable replacement, and getting it in there. The capacitor was one of the old mica type, which were often rated as high as 1000V, and I had not idea where I could put my hands on anything with an equivalent rating in this age of low voltage circuits and components.

Finally a colleague came to the rescue with a 1600V polycarbonate type which was also physically compatible. But then I had to fit it and this was obviously going to be even harder than getting the faulty one out. There was no way that I could hold the pigtail in position while I applied solder and heat; it was hard enough just getting a small soldering iron in there.

In the end I carefully trimmed the pigtails to the right length, tinned them, and loaded the end of each with a generous blob of solder. Then, working by feel as much as by sight, I managed to mate the pigtail and its terminal and coax the iron onto the junction. As far as I could tell, it made a solid joint.

With the first pigtail anchored, soldering the second one was a little easier, although still tricky enough. That done, I switched the recorder on and it worked. Voltages now matched the figures on the circuit and, more important, it would erase and record.

I was a little worried about the 3.6k resistor, and the electrolytics which had been heated by its overload. Ideally, both should have been replaced but, again, it would have been a massive undertaking. I was able to measure the resistor from other points in the circuit,

"Your take-up reel seems to be acting rather funny, Ed!"

and it was spot on, while I could detect no trace of hum in any of the operating modes.

In the circumstances I decided that any further work would be hard to justify.

But something more was necessary. Having cured the recording problem I suddenly realised that only one of the two channels was working on playback and a quick changeover of the speakers showed that it was in one speaker. An ohmmeter check then narrowed it down to the cable.

It was a shielded cable and I was surprised to discover that both the active and the shield were open circuit. Closer examination showed that it had apparently been pinched, probably in a doorway, about half way along its length, but even this did not explain how both conductors had been broken.

It seems most likely that, when the cable was caught in the doorway, somebody had tried to free it with a hefty pull, without bothering to find out why it wouldn't move. Anyway, that problem was soon fixed, and the machine returned to the owner.

Naturally, he was happy to have it fixed, and seemed not unduly perturbed by the bill which, while not insignificant, was not exorbitant either. But he had no idea how lucky he had been. Had the fault involved one of the less accessible components the labour cost would have been considerably higher. Either that, or he may have elected not to have the job done, leaving me out of pocket for the work already done.

The simple fact is that, in the 15 years since that device came on the market, labour costs have risen so much that a few hours work now represent a significant proportion of the original purchase price. Which isn't a good place to start from anyway, but when we add a tricky layout and the need for hard-to-get components, the situation can easily get quite out of hand.

So keep that in mind the next time you are tempted to tackle an old appliance because the fault looks easy.