

## THE SERVICEMAN

### Fixing a 'pinny'

Our contributor's story this month comes from Raffaele (Raff) Lerro, from Southport in Queensland. Raff offers a tale about reconditioning something we haven't seen in these pages before — pinball machines.

At one time these machines were entirely electro-mechanical and therefore would not have rated a comment in these pages. However, from the early 1970's onward, electronics took over more and more of the logic functions, until, as you will see from Raff's story, they became almost completely electronic.

Here's what our contributor has to say...

*My very high interest in all things with a power cord attached promotes a healthy underhouse collection of electronic paraphernalia, ranging from*

*ancient bakelite radio receivers to a Honeywell minicomputer, a total of six pinball machines and a locally designed and built video jukebox, using a multi standard VHS VCR as a playback device controlled by (of all things) a humble Commodore VIC20.*

*The story that follows relates to one of the pinball machines, a 1979 model called 'Howzat!' built by an Australian company named Hankin.*

*It all started early one Saturday morning with a telephone call from a neighbour from years past. It seemed he had a mate who had been given an old pinball machine, and as it seemed 'brain dead' he wanted to see if I could fix it for him so that he could sell it. This particular neighbour knew all too well my strange love affair with those marvellous machines, and knew I couldn't knock back the opportunity to play with yet another one.*

*So it duly arrived in the back of an old van, and after much grunting and sweating the beastie was in my shed. Later that afternoon, I decided to have a look at this new device and plugged it in for a smoke test. So far so good, with no smoke leaking out — but not much action either. A few lights on the playing field lit up, but nothing else happened.*

*As this machine was of an early microprocessor controlled variety, it has a self test button located within the front door, so I pressed it to see what would happen. Some different lights came on, but that was it. I opened the front door and removed the playing field glass so that I could prop up the playing field for a look around.*

*Here I found a most pleasant surprise — a manual! This is a somewhat rare thing to find in a machine as old as this one, and with circuit diagrams too! This was beginning to look decidedly hopeful. Firstly I had a flip through the manual to familiarise myself with the workings. This manual was one of the best I have seen, with block diagrams of all of the circuitry and detailed schematics.*

*After studying the block diagrams and looking over the circuit boards in the machine's head, I saw a couple of legs poking out of one of the boards but with no component attached. I figured that this was as good a place to start as any, so I looked in the manual to see what should be there.*

*It turned out to be a hefty six-amp diode, that must have got so hot in the past that it simply melted its way off the board leaving its legs behind. I replaced*

it with a couple of paralleled diodes from the junk box and switched on.

I now had several game solenoids buzzing uncontrollably on the playing field. It seemed that there were at least two shorted SCRs on the lamp and solenoid driver board, and so these were also replaced with bits from the junk box.

I then had all of the bumpers going and the flippers worked too, but still no score displays or sounds. I needed the displays to work next, as the machine's diagnostics use these to communicate the results of tests etc.

Firstly, as I was taught so many years ago, I checked all of the power supply rails for correct voltage — and found no problems there. Next, I studied the circuit to see how the displays are driven. It seems that all five displays (one for the number of credits and ball in play, plus one each for four players) are the same and wired in parallel, except for a latch enable line to select which display the UPC is addressing.

So I figured that as all of the displays were dead, there must be a common problem and that there was probably nothing wrong with the individual display units. It was time for the heavy duty fault-finding equipment, so out came the CRO. I went looking for data going to the display units from the UPC.

This looked fine, just nice square-edged data on all of the segment data lines. I replaced a 4502 IC that is in the display latch enable lines, but this produced no joy. It was about this time that I noticed a line from the MPU board marked 'display blanking', so I checked it with the scope and found just low level hash.

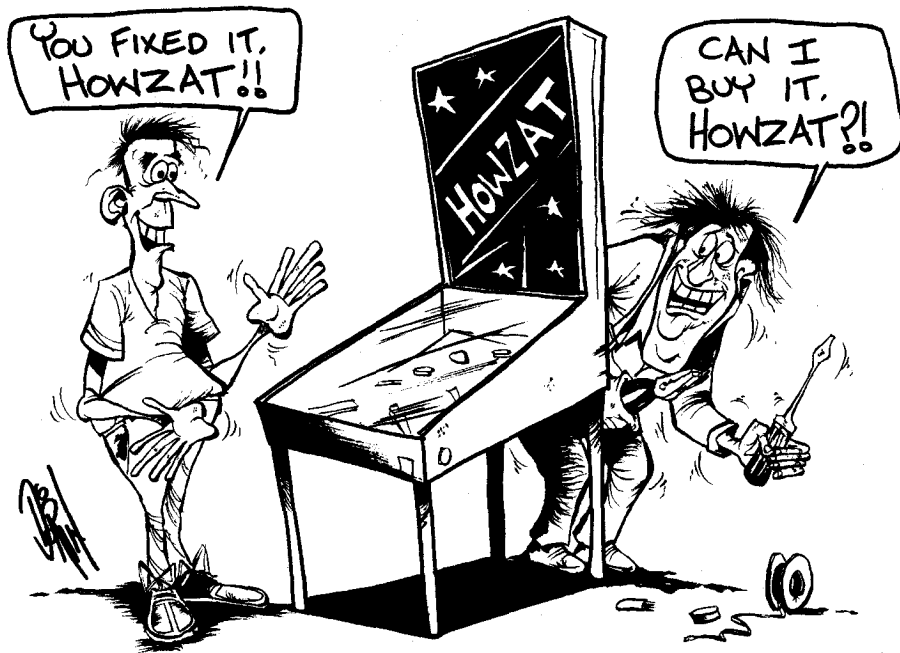
I back tracked past a couple of gates looking for good data. There is a 47nF ceramic capacitor in part of this circuit that proved to be acting more like a resistor than a capacitor, so I replaced it with a green cap from the junk box.

I then had the displays operating, so things were looking up! But I wanted sound too, so it was on into sound board territory to investigate...

I noticed that this machine had two 6802 UPCs, one for the game proper and one for the sound. So after consulting a data book to see just what a 6802 was (and did), I swapped the two and fired up.

But now I had no action at all and wondered could the sound board's UPC be faulty? There was only one way to be sure. So I was off to the local electronics shop for a 6802 — where my friend behind the counter thought it was very amusing that I would want such a 'useless' part as this old 8-bit UPC.

When I told him what it was for, he



became quite excited about the whole idea and wished me luck with the machine's restoration. I rushed home and plugged the new UPC into its socket, switched on, and no sound!

Firstly, I swapped the new UPC into the MPU board to check its operation. My friend at the electronics shop thought that the 6802 was a masked-ROM type or one that needed programming in order to function correctly, like a micro-controller, but all was well here as the new UPC performed exactly as the old one in the MPU board.

Being suspicious of the ceramic capacitors used in this part of the circuit, I probed about with my multimeter and found several more which had an identity crisis and thought that they were resistors. So after replacing them all, I now had glorious sound.

Driven by my success so far, I set about replacing all of the globes that needed attention and spraying a shot of CRC 2-26 on all of the contacts that I could find. CRC seems to agree with these old pinballs and helps the old electro-mechanical ones no end.

I also found several contacts on the power supply board were very badly corroded due to long term overheating, and corrected this by soldering the wires from the wiring loom straight to the board.

After polishing the play area with non abrasive car polish, and cleaning the machine generally, it looked fantastic. I played this thing day and night — I just couldn't help myself. It is a good game to play and very fast, but it still had one very annoying habit of calling 'TILT' randomly and ending the ball in play.

It seems that this fault had been the cause of someone else's frustration in

the past, as the entire tilt mechanism, (which is a plumb bob type of pendulum suspended in a ring which forms the second contact) had been removed and left lying on the inside of the machine.

I looked at the tilt mechanism left bolted to the inside of the case for clues, and there noticed another one of those wretched ceramic caps across the contacts. So after removing it, the machine now plays fair...

As an ending to this story, it might come as no surprise to some that I have fallen in love with this machine and don't really want to part with it. And as the owner only wanted it repaired for sale and has no other interest in pinball machines, I think that I may just have to be the buyer!

So how about that? Or should I say 'HOWZAT'?

Thanks for that story, Raff. As I said earlier, we haven't had any mention of these machines in the past, and yet they are just as electronic as any other appliance.

I appreciate your comments about ceramic capacitors, too. During the 1970s a lot of new component types were put on the market, yet so many of them turned out to be unreliable in the long run. I can think of tantalum capacitors and ceramic coated, flame proof resistors as just two of these products that began with great promise, but eventually became so unreliable as to bring general condemnation on the entire range of products.

Thanks for your story Raff, and we'll look forward to more yarns about your fascinating 'underhouse' collection.

And that's all for this month. I'll be back next month with more service stories, if the fates are willing. ♦