quartz iodine lamps. I have never fiddled with 3600W Xenons, and I don't think I would want to, either.

Anyway, thanks for your story, Reg. It's one of the most interesting contributions we've had for some time. I look forward to hearing from you again with more stories from the technical side of the movies.

Unstable Conn organ

Our next contributor is a true 'pioneer' serviceman. He began building crystal sets in the 1920s and retired from active servicing in the 70s. He has wide experience with radio and audio, and claims to have not become involved with TV only because of the mass of new test gear required. I guess if you were approaching retiring age, you would hesitate to spend good money on gear that would only serve you for a limited time. I know that's *my* excuse for not going deeply into digital technology!

But enough of that. Our contributor is Stan Allison, of Rosebud in Victoria, and he raises the general tone of the column by taking us into the realm of church music and PA systems. Here's what he has to say...

I serviced a 'Conn' church organ for some years. It was a very early solid state instrument and had no chips or master oscillators, just discrete transistors with a separate oscillator for each note. Most of the work involved tuning the oscillators, and this became more frequent as time passed. Eventually the organ needed retuning every couple of months, and I suspected that some of the oscillator transistors were unstable.

I found the particular transistor type listed in a catalog, but a note pointed out that the type included a range of six different characteristics, each identified by a coloured dot. I found a trade house that had about 100 of the old type left, so I bought the lot, for $10! But oddly, none of them had coloured dots.

I removed the transistors from six of the oscillators that had never needed tuning, and averaged their characteristics. I was then able to select about 30 of the new stock that closely matched the good ones.

Then, while playing each of the notes in turn, I hit the corresponding transistor with freezer spray. They all drifted a little as the spray took effect, but some changed very dramatically. These I exchanged for new transistors, and that was the end of the tuning troubles.

Later, after the organ had been playing faultlessly for months, it began to occasionally emit a very ribald 'raspberry'. It greatly amused the congregation, but ruined the decorum of the service!

I struggled for some months to nail down the fault, until one day the organist showed me that she could produce the noise at will, by playing together two particular notes. Since these were part of a chord that didn't often appear in her music, it accounted for the very intermittent nature of the fault.

Careful examination finally revealed that the output wire from one of the oscillators was fractured inside its insulation. When played on its own, that note worked perfectly. But when the second note was played at the same time, it produced the 'raspberry'. It seems that the fracture vibrated in tune with the second note while at all other times the broken ends of the wire sat quietly in contact.

In the same church, a PA amplifier developed the habit of going quiet without warning. No plops or clicks etc., and never when anyone was speaking into the system. Simply, when the fault appeared, someone would start to speak but the system would be dead. All four inputs behaved in the same manner.

I connected the amplifier to my system at home and left it running with the cover off. However, on testing, I had only to touch any of the knobs or put the meter probes on any part of the circuit to restore the sound. I reasoned that as there were no clicks or plops, the fault must lie in part of the circuit not carrying DC. This eventually proved to be where the four inputs were commoned to the master volume control pot.

There was no fault to be seen, so I removed the master volume pot and gave it a thorough testing. I could find no fault with it, but on restoring the pot, I noticed one connecting pad looked as though it had never been tinned properly. I scratched at what looked like the pad, only to find that I was scratching at the board surface itself.

There was no sign of the pad, but I knew it had been there before. I eventually found it stuck on the end of the solder wick I had used to clean up after removing the pot. It seems that the track had been fractured where it met the pad and when the fault was present, any testing or electrical disturbance was enough to restore the low level circuit.

I have often commented that most

faults in electronic equipment is caused by mechanical deficiencies, and Stan Allison's story here shows just how difficult they can be to find.

Wires broken inside the insulation can be the very devil to locate. First, they have to be suspected otherwise you could spend hours looking for something that isn't there. Then having suspected a break, there's the trouble of finding it.

Stan didn't say how he went about it, but I lift each suspect wire with a screwdriver then run the shaft along under the wire. If the conductor inside is broken, the insulation will tend to bend sharply as the break passes over the tool. By watching for this sudden kink, one can get a fair idea of the condition of the internal wire. (But I didn't say it was easy!)

Then Stan's problem with the broken PCB pad is just another of those trials that are sent to plague us. In this case, our contributor was lucky that the pad came adrift. If it had stayed in place, the break might never have been properly located and repaired.

Thanks for your contribution, Stan. I'm sure that we all feel better for that short visit to your local church.