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Pot Cores and Kippered (Smoked) Rigs!

In this month's *In The Shop* column, Harry Leeming G3LLL discusses dodgy pot cores, safety problems, tobacco damage, awkward relays and switching faults.

Welcome to *In The Shop* (*ITS*)! Some time ago I received the following interesting E-mail from Derek Beales G3MWO (Sufolk), who wrote: *"Last year my Icom IC-761 continued functioning normally except that the output power was significantly lower than usual. I tested just about everything I could think of without success as all voltages seemed normal. Finally, a friend came to the rescue by lending me his IC-765 which is a very similar rig. I found that the drive r.f. levels much lower in mine than in his. Then I noticed that one of the driver tuned circuits had a small pot core on a coil in his rig, whereas in my '761 there was none.*

"Oddly enough the adjustable core would bring the drive to a peak without the enclosing pot core. Further investigation revealed that my pot core was on the floor on a dark surface where it was not easily seen. Clearly – as all this was after a spell of very hot weather – the core had fallen off the coil as the securing wax had melted, and laid inside the steel screen cover. in the IC-761 this particular coil pack lies upside down in normal use so gravity had taken over! Replacing the core brought the drive and output back to normal.

"The coil had peaked to resonance at some other (higher) unwanted frequency without the pot core – which is what fooled me. The pot must have fallen to the floor when I removed the outer screen cover without me noticing it. Without the help of my good friend ***David Johnson G3MPN*** *and his IC-765 for comparison, I would probably still be pondering!"*

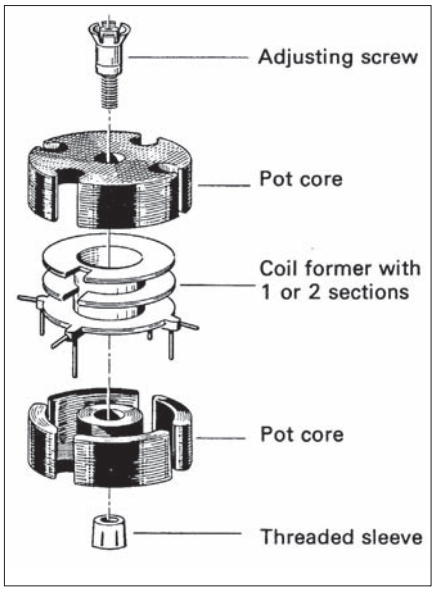

Fig. 1: The type of pot core that Derek G3MWO had trouble with.

Many thanks for that Derek, this fault could occur on any equipment fitted with this kind of coil, **Fig. 1** and so it is well worth passing on.

Another Look At The FT-102

Despite the fact that I have been retired for over 10 years, I seem to be getting more and more requests to look at these Yaesu rigs. I can – however – only do this for locals, so I'll make the position clear.

If you are thinking of buying an FT-102, my advice would be to only do so if you or a friend is competent to carry out repairs, and don't even think about buying one if you (or the present owner) are tobacco smokers!

The FT-102 is an excellent rig when it's working properly, but it does tend to suffer from intermittent faults. Because of this it's impossible for any repairer to be absolutely sure that every trouble has been definitely 'nailed'. And (whoever you get to repair one) you should be prepared to collect it, test it for a few weeks and then (if necessary) make a return visit if there's still a problem.

Sending the rig by carriers, or making round trips of several hundred miles is just not a good idea! So, having got that off my chest, let's have a look at some of the problems.

Safety warning: Please note the warnings about working on live equipment! Next - please remember that the FT-102 has been known to hold the charge on the 900V high tension (h.t.) rail for over a week after it's been disconnected from the mains. And there are several points under the chassis where you can accidently touch this high votage line.

I was working on an FT-102, having disconnected it from the mains, and then went on holiday. In fact, I remember when I came back from one holiday, that I found out **the hard way** that the 900V supply was still charged up. Since then, when working on the FT-102 I always, disconnect it from the mains, wait five minutes and then short the 900V line to chassis.

Small relays (such as the unsealed ones in the 211 series) can be a problem with any rig. The FT-101ZD for instance has only one, but the FT-102 has six relays, and it does not take a genius to work out that this considerably increases the chance of one of them causing trouble.

The Main Culprits

The main culprits are the five relays on the r.f. board, shown in **Fig. 2**. You can see two original relays with transparent covers, and two blue Omron ones that have been used as replacements. (The 'extra' blue one is a reflection in a screening cover!).

The yellow-bodied pen points at the fifth relay, which is located underneath the band switch spindle. (Just to make replacement or cleaning difficult!).

The fan at the rear draws air right

across these five relays and as the original items were not air tight any pollution in the atmosphere soon has an effect. Strangely, the rig doesn't just become intermittent, instead the receive gain, and sometimes also the transmit drive, fall off as the contact resistance increases with age. The best cure, of course, is to replace the relays, but as these are becoming difficult to get hold of I have recently resorted to cleaning the originals.

The first difficulty when trying to clean the relays is removing the transparent plastic covers because the relays are mounted very close together. To help, I've adapted a small screwdriver as per **Fig. 3**. I use this to lever the tops off the four relays that it's possible to get at.

Note: Before levering the tops off – it's important to mark the covers clearly to show as to which way round they fit! refitting the covers is difficult enough as it is in the cramped space, but if you don't know which way round they are supposed to go, you stand a very good chance of damaging a relay during the refitting operation.

Once you have removed the relay covers you'll need some switch cleaner that **does not** contain a lubricant, such as ' Aero Klene 50' from Maplin. (Don't use anything that leaves a residue, or which damages plastic). You'll also need a set of sparking plug feeler gauges with the '4 thousandth' of an inch blade cut down as per **Fig. 4**. With care you will find that you can pass the feeler gauge between the contacts, apply the switch cleaner, and then work it back and forth cleaning the contacts.

The fifth relay at the front is another story! First try cleaning it. If you put the rig on its side it is possible using the tool shown in Fig. 3, to force open the plastic case slightly. Once you have done this, flood it with the cleaning fluid, then fire up the rig (watch where you put your fingers!) and operate the push to talk (p.t.t.) and the pre-amplifier button quickly. Do this many times until the cleaning fluid starts to dry and then repeat the operation a few times.

With a bit of luck (sometime before your thumb drops off!) the rig will start to perform perfectly. If however, it's still somewhat intermittent gently poke at all the relays one by one. By doing this it's usually possible to identify the one that is still causing trouble. Once you've identified it, try re-cleaning it, and then if all else fails look on the internet for a replacement. The FT Club (also known as the 'Fox-Tango' Club) in the USA have a few – **but I'm sorry – I can't help**.

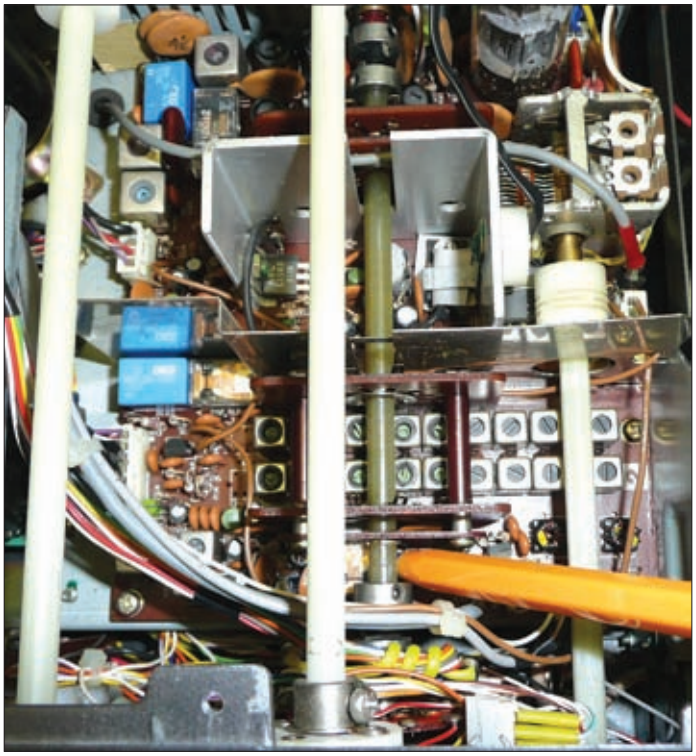

Fig. 2: The r.f. board from the FT-102. Note that there's a reflection of the lower blue relay on the metal screening wall. Once you've removed the relay covers you will need some switch cleaner that does not contain a lubricant.

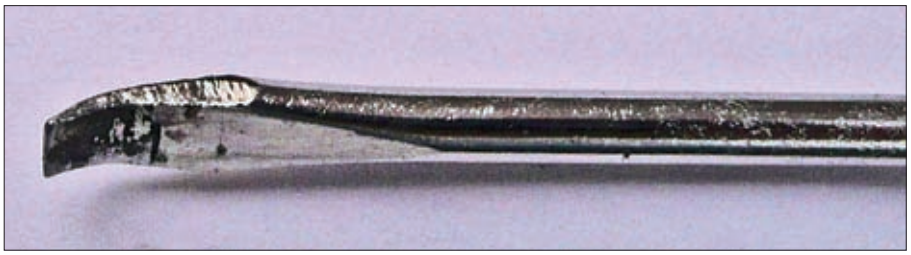

Fig. 3: A modified screwdriver can make the job of removing the relay much easier.

The front relay can be replaced with difficulty and patience. Cut the contact pins under the p.c.b. as short as possible and then use normal unsoldering techniques. It is just about possible to tease it out from under the band change switch, without getting involved with the mammoth task of removing the whole r.f. board, or the switch (if it's really necessary to do this, then carefully 'smash' the relay cover).

To fit the new relay similarly cut the pins short, and using sticky tape slide it in place. It's best to leave the cover on, but if necessary leave the cover off. If you have difficulty lining up the pins with the mounting holes, temporally hold the relay in place on the underside of the board to make sure that all the solder holes are clear.

The Band Change Switch

If you look at Fig. 2 you'll see that the band change switch incorporates three separate switches coupled together with spindle couplers. One coupler is at the front near the yellow pen, and the other coupler is near to the power amplifier (p.a.) valves at the rear. The spring loaded indexing ball is on the front section, and it is this section that determines as to what band is indicated by the display, and as to

Fig. 4: Feeler gauges can make an ideal relay contact cleaning tool.

The FT-102 is a great rig, but perhaps not if you are (or a previous owner was) a heavy smoker!

what frequencies are generated by the synthesiser.

A common fault with the FT-102 is that one of spindle couplers slips. If the one at the front moves only a fraction the rig will become intermittent, while if it moves more than a few degrees you end up with the synthesiser switched to one band and the receiver on another!

The result is that the receiver's reception becomes very weak; on some bands nothing is heard, but on others non-Amateur stations appear. If the rear section slips, the receiver will be okay, you will have loads of p.a. current, but a p.a. circuit which refuses to load or tune. The cure is obvious – align the switch correctly – but this is rather easier said than done!

If only the front coupler (and not the knob) has slipped, the display and the control knob will indicate as to which band the front section of the switch is set to. (At this point re-read the safety paragraph, before removing the p.a. stage covers) and then short the p.a. valve's top caps to chassis). It should then be possible to trace the wiring from the p.a. switch to the coil, and by referring to the circuit diagram determine when the switch is on (Let's say 1.8MHz).

Next, all you **should** have to do is to loosen the spindle coupler at the front, and rotate the front section of the band change switch, until this also indicates 1.8MHz. If only it were so simple!

On some rigs it seems that the three separate switches weren't purchased from the same supplier, as the indexing doesn't line up perfectly. There's some play in the spindle couplers. Because of this, on the FT-102 it's recommend that you always change band by rotating the switch in a clockwise direction. If you do this it's then possible to set the spindle couplers so that a reasonable compromise can be achieved, and that the switches all make contact on every band.

I did once have a rig where it seemed impossible to get the contacts on the rear ceramic switches to line up with the other switches on all bands. If I got them right on let's say 1.8MHz – they were hardly making contact on 14MHz!

If you have this problem it's possible to melt the solder and 'glue' on the out of line ceramic fixed switch contacts with an iron, and then to rotate them on their mounting rivet slightly. This help to obtain a better match with the slider.

Monitoring PA Current

The p.a. current on the FT-102 need monitoring! Although I don't like repeating myself too often, as I mentioned in the February 2007 issue, it's essential to keep a watchful eye on the p.a. current when operating the FT-102. Due to the three p.a. valves being very close together they do tend to warm each other up.

The close proximity can make the rig go into thermal run away. If you don't notice that the p.a. current indicated by the I/C meter is gradually creeping up, it can result in considerable damage. My recommendation is to set the p.a. current at about 60mA, (not 75mA as suggested in the manual) when the rig is cold and then always leave the rig's 'Meter Select' switch in the I/C position.

Watch the I/C reading whilst you are transmitting, and if the resting current starts creeping up to more than say 90mA, make your excuses quickly, and go back to receive while things cool. If this problem occurs frequently you may have to fit three new valves and improve the ventilation, or modify the bias on the p.a. stage. (More details about this next month).

Cooling Fans!

Excessive heat results in unreliability, and so small compact high power 13.5V power supply units (p.s.u.s) need powerful fans to keep them cool. If however, the p.s.u. is over-rated for the task in hand (if let's say a 40A unit is used to drive a 100W rig in the s.s.b. mode, the fan can safely be run at a lower speed and this will vastly reduce the noise.

The obvious answer way of achieving a lower speed is to connect a resistor in series with the fan. Unfortunately, as more current is required to start a motor than run it, this method will sometimes result in the fan not starting. The simple answer is to connect a filament type lamp in series with the motor. A normal 12 100mA pilot lamp must,(from Ohms Law R= E/I,) have a resistance of 120Ω when it's operating.

If you care to check a lamp with an Ohmmeter however, you will find that it has a resistance of about a tenth of this when cold. By trial and error you should be able to find a lamp that will slow the fan down the required amount, but which will still 'kick start' it. I usually start experimenting by trying lamps of the same voltage as the motor, with various wattages.

As an example a 25W mains voltage lamp, fitted in series with our bathroom fan very much reduces the noise while still enabling the fan to work efficiently. But please don't do the silencing and then end up 'cooking' your equipment! See you next time! ●

Problems

I like to hear about problems with older equipment, particularly pre 1990 Yaesu rigs. Please E-mail me, (add some radio related term in the subject heading, to differentiate against spam), or write and enclose a stamped addressed envelope. Remember that electricity is dangerous, if you aren't familiar with safety precautions you must never work on your equipment whilst it is plugged into the mains. (Switching off at the wall socket does not necessarily make equipment safe).