In response to many requests from readers, Smithy the Serviceman once more takes over "In your Workshop"

WHEN DICK WANDERED INTO SMITHY'S workshop, the serviceman was bending over the chassis of a 13-channel turret-tuned television receiver which was lying on its side on the bench. As he heard Dick enter he glanced over his shoulder and grunted a welcome. He was preoccupied with what he was doing, and Dick, knowing his habits, sat down quietly at the bench beside him.

After a few minutes Smithy turned round.

"Could you plug this co-ax lead into the signal-genny over there for me? I've got both hands full just now."

"Certainly," said Dick, picking up the lead and taking it to the signal generator Smithy had indicated. Suddenly Dick gave a snort of disgust.

"What's up?" asked Smithy.

"I can't plug it in," replied Dick. "It's the same old story: the lead has got an ordinary coaxial plug and the generator has a Pye socket. Why don't the manufacturers standardise on these things?"

"Not to worry," remarked Smithy, "There's an adaptor in the drawer. That'll do the job."

Dick found the adaptor, examined it with some interest, and fitted it to the signal generator. Smithy grunted a little more and made a few final checks with the signal generator. Finally, he straightened up and lit a cigarette.

A.F. Distortion

"Job finished?" asked Dick.

"Yes," said Smithy, with a look of satisfaction. "It was easy enough, but just rather fiddling. This is quite a new set, but it still had several things wrong with it.

"The first thing," he continued, "was quite routine—distorted sound. The fault, incidentally, was a leaky coupling condenser to the grid of the audio output valve. You know, you don't normally get that sort of thing very often in a new receiver these days—when paper condensers go leaky it's usually only after a period of several years service—but it's bound to happen every now and again, of course."

"How did you find it?" asked Dick.

"Well, there are several ways of tackling a distorted a.f. amplifier, assuming that it's of the simple type you get in most television sets. Whenever I get distortion I always go straight to any coupling condensers which are connected between an h.t. point and a grid, because these are the components most likely to cause trouble. The nature of the distortion sometimes gives you a clue, incidentally, although this is rather a matter of practice."

He took out a pencil and scribbled a circuit on a piece of paper.

"Look," he said, "here's the circuit of the audio output stage used in this set (Fig. 1). As you can see, there's nothing at all out of the ordinary in it. To start off with, let us assume that the grid coupling condenser (C_1) has developed a *low* resistance leak. If this happened, the grid of the output valve would carry quite a considerable positive potential with respect to chassis. Indeed, it is quite possible that the anode of the output valve would become red-hot in consequence, whereupon you would see the trouble straight away. If you measured the voltage between chassis and grid with a normal voltmeter, you would get a marked positive voltage reading and the fault would be easy to identify. Mind you, there would also be a possibility that the valve itself had an internal short-circuit, but this isn't a very frequent occurrence. Nevertheless, it might be worth while changing the valve for a known good one before isolating the grid condenser itself for a final test, if you felt it worth while. The snag with these sets is that it isn't advisable just to pull the valve out to see if the positive voltage on its grid clears, because you would then break the series heater chain."

"In other words," remarked Dick, "it's really a toss-up as to which way you isolate the fault. You either change the valve or disconnect the condenser."

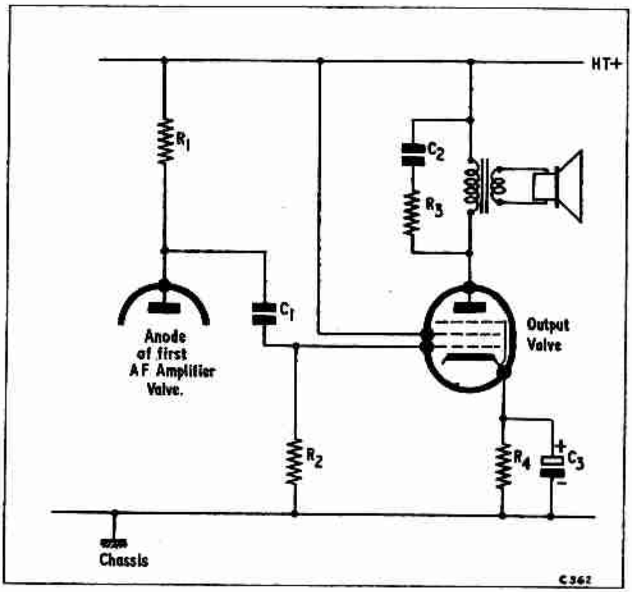

Fig. 1. The televisor a.f. output stage referred to in the text

"That's pretty well the case," agreed Smithy. "But, in any event, coupling condensers with low resistance leaks are usually easy to find. It becomes more difficult when the leak in the coupling condenser has a high value of resistance. However, such condensers can still cause trouble. If, for instance, the anode to which a leaky condenser is connected had a voltage, say, of 150, and the following grid leak a value of 500kΩ, just under one-twentieth of 150 volts would be applied to the grid even when the leak in the condenser was as high as 10MΩ. That would be approximately 7½ volts positive; quite enough to make any ordinary a.f. valve give a distorted output. If you tried to measure the positive voltage at the grid with the average low-resistance testmeter you would get very little deflection because of the high series resistance in the condenser.

"Whenever I am checking for distortion in a simple a.f. amplifier, and don't get a definite positive reading on the output grid, I usually make doubly certain that nothing is wrong with the coupling condenser by turning the volume back to minimum and short-circuiting the grid leak. Nearly always this can be done very quickly by simply shorting the grid down to chassis with a screwdriver. If the coupling condenser is not leaky the grid will already be at chassis potential via the grid leak, whereupon the short circuit provided by the screwdriver causes no change in circuit potentials. The short circuit, will therefore, cause no crackles in the loud speaker. Should the grid *not* be at chassis potential, due to a leaky coupling condenser, I would hear a definite crackle in the speaker as I shorted the grid to chassis. For this check the screwdriver should be in contact with the chassis before it touched the grid, of course.

"And that's all there is to it. If you hear a crackle something is wrong! It needs a little time to explain it, but the test takes only a moment to carry out. You have to keep an eye open to see that the output grid leak *is* returned to chassis, of course, before you start applying the screwdriver. And, also, you need to keep the screwdriver well clear of the anode and screen-grid!"

"Well, that's interesting," commented Dick. "And something more I've learnt as well. You said just now that you can often make a guess at the cause of distortion by its nature. How do you do that?"

"Well," said Smithy, a little guardedly, "this isn't a thing where I would like to lay down the law with any certainty. Nevertheless, after a little practice you can sometimes guess fairly accurately whether the trouble is in the speaker or is a particular type of distortion caused by the amplifier itself. If the speaker is faulty, the distortion occasionally has a "mechanical" sound. A torn cone, for instance, often causes distortion of a "buzzing" nature, frequently set off by one particular frequency. Speaker distortion is, in any case, easy to locate. All you have to do is to connect another speaker in place of the suspected unit.

"Distortion in the amplifier itself may be due to non-linear amplification in one of the stages and, normally, all frequencies and volume levels are distorted. Distortion *could* be caused by supersonic oscillation, but this is rare in two-stage amplifiers of the type we are discussing now. In the case of oscillation you sometimes find that a.f. below a certain volume level is distorted, but that it becomes clear above that level. However, as I said, I certainly would not like to be at all dogmatic on these points."

Oscillator Tuning

"What was the other fault in the set?" asked Dick.

"Ah, that was fairly easy also," said Smithy. "All that had happened was that the set had gone off-tune on Band III. As you know, Band III is rather a new thing for us in this district, but the snags you run into aren't very different from the sort of things we had with Band I. In this case, the oscillator had gone a wee bit off frequency and you could only get a picture right at one end of the fine tuner's travel. A properly defined picture was outside its range.

"Now, this is the sort of snag where the serviceman has to think for his customer as well as for himself. He could, for instance, take the stand that, if the oscillator had gone off-tune by the 3 Mc/s or so indicated by the performance of the fine tuner, there would be a fair possibility that the r.f. circuits had drifted off by as much also. Theoretically, therefore, he should re-align the whole turret on the channel concerned with a wobbulator and 'scope. But this would take time and would mean a bigger bill for the customer. Would it be worth while charging him that much extra if the improvement in the picture caused by the re-alignment was hardly noticeable? It's just one of those little problems that servicemen have to solve for their customers without the customer knowing!

"Anyway, this time I decided to re-align the oscillator coil only and see what happened. There didn't, incidentally, appear to be any need to change the triode-pentode frequency changer, which *might* have caused the trouble, since the gain of the set as a whole was quite adequate.

"This particular receiver was one of those in which you can't get at the oscillator coil slug when that coil is switched into circuit in the turret. You can't retune the oscillator whilst watching the picture, therefore, and you have to fall back on what I could best call a logical second-hand technique.

"The first thing to discover is the end of the fine tuner range at which the picture is obtained. The dielectric constants of the insulating materials employed for fine tuner vanes are, so far as I know, all greater than that of air. So, if you just get your picture when the fine tuner vane is all out of the fixed metal vanes, then this corresponds to the lowest capacity in the fine tuner. The oscillator, in consequence, is running at too low a frequency. In other words, the highest frequency given by the fine tuner is still not high enough to enable a picture to be resolved. The reverse holds true. If the vane has to be all in to obtain the picture, the oscillator is running at too high a frequency. All one has to do then is to take the requisite oscillator coil segment out of the turret tuner, give the oscillator coil slug a turn in the desired direction, put the segment back in the turret and check the result. After several attempts you should be able to get the oscillator core in just the right position, with optimum picture bang in the middle of the fine tuner's travel."

"Well, that doesn't sound too hard," remarked Dick. "But does it always work out as easily as that?"

"It does if you are careful about it," replied Smithy, "and care is definitely needed on a job like this. First of all, the set should be allowed to warm up for at least twenty minutes before you tackle the adjustment, just in case it has a tendency to drift. Secondly, any coil segments you take out of the turret should always be handled gingerly because they can sometimes be quite fragile. Some manufacturers apply their own patented 'Muckite' to the core to hold it in position after it has been aligned at the factory, so the core should always be adjusted *very* carefully at first. Give it a sharp wrench and you may find bits of coil former lying on the bench. Don't forget also that frequency goes *up* when you screw a brass core *into* a coil. Finally, and this is probably the most important point of all, never touch any core until you have positively identified that it is that of the oscillator coil. If you adjust cores experimentally without knowing which is which you will almost inevitably completely wreck the r.f. alignment of the turret; whereupon you *have* to use a wobbulator and 'scope to get things back to normal."

"Well, there are enough warnings there!" said Dick. "How do you identify the oscillator coil?"

"Preferably from the service manual," replied Smithy. "But if you have no information on the set a little circuit tracing may help. For instance, the oscillator coil is almost certain to be near the fine tuner, in order to keep the turret internal wiring short, and so on."

Coaxial Adaptor

Smithy glanced up at the clock.

"It's later than I thought," he commented. "Time I wasn't here!"

With Dick's help, Smithy commenced to clear up the work-bench and switch off his equipment. Just as they were about to leave, Dick gave an exclamation.

"I've just remembered a question I was going to ask you immediately after I got in!" he said.

"Oh, yes, what's that?"

"I just wanted to know where you got that neat little adaptor I used on the signal generator. You know, the one which allows ordinary coaxial plugs to be fitted to Pye sockets."

"Oh, that!" chuckled Smithy. "I made that one up myself. All you need is a Belling-Lee metal coaxial plug, type L.734P, and a Pye plug. You remove the clamping nut from the Belling-Lee plug, whereupon you should find that the threaded body just screws nicely into the threaded portion of the Pye plug. At any rate it does so with every Pye plug I have ever encountered myself! Add a wire to complete the centre connection, and the adaptor is complete (Fig. 2).

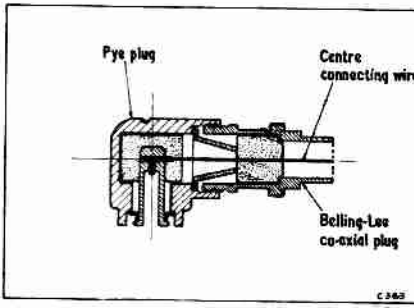

Fig. 2. Smithy's adaptor for coupling coaxial plugs to Pye sockets

"If you want a socket instead of a plug termination you can add an L.616 adaptor (two sockets back-to-back) to the plug. The whole thing forms one of those useful little gadgets which fill the proverbial long-felt want."

After which, Smithy gave one last look around, locked up the workshop, and gave Dick a glance which even that young man could only interpret as a definite "closing of the hangar doors" for the day.

New Labgear Dual-band Indoor T.V. Aerial

The illustration shows a new indoor t.v. aerial developed by Labgear (Cambridge) Ltd., Willow Place, Cambridge, for use on Bands I and III. It can be fitted directly to most televisors, so making the set transportable, and is suitable for use at ranges up to 10 miles from the transmitter, with either vertical or horizontal polarisation. It is priced at 39/6 retail; a suitable outlet box is available, if required, at 4/6. Both are obtainable from local dealers.