VINTAGE RADIO

By JOHN HILL

Troubleshooting the transformers

Transformers are a fairly common component in electrical and electronic circuits and a number of different types are to be found in old valve radios. Here's a run down on the various types that you'll encounter.

A valve radio has several different transformers, all of which perform critical circuit functions. A typical 240-volt mains operated receiver will have a power transformer, a number of intermediate frequency (IF) transformers and a loudspeaker transformer. Very early radios of 1920s vintage will most likely have a few audio transformers, while battery operated vibrator radios will be fitted with a special vibrator transformer.

Vibrator transformers differ from power transformers in that they step up low tension voltages to high tension voltages.

Many of these old transformers have modern counterparts. A transistor radio can still have a power transformer and will still have IF transformers, but they are such a radical departure from the valve radio versions that one would not recognise them as being related.

Parts availability

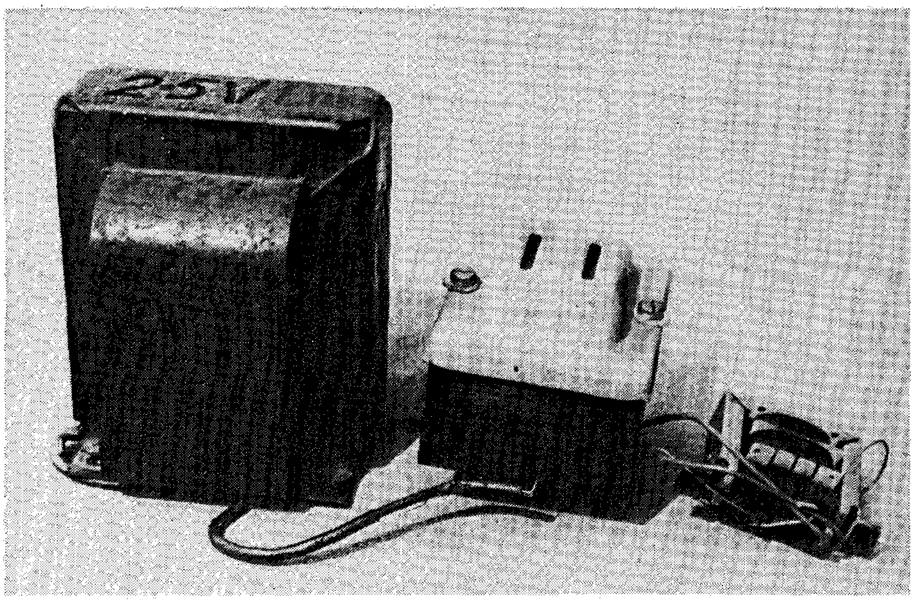
Many components in valve radios can be replaced with modern equivalents (eg, resistors and capacitors), but not so transformers. About the only components that can still be bought across the counter are speaker transformers (also known as audio line transformers). If you want other types of transformers for valve radios, the only alternative is to scrounge and use serviceable secondhand units.

In recent months I have read a number of suggestions implying that old power transformers can be dangerous and that they should be earthed as a safety precaution. In the past, valve radio power transformers were always wired with 2-core flex, not 3-core. However, it has been suggested that they should be earthed because the insulation breaks down with age.

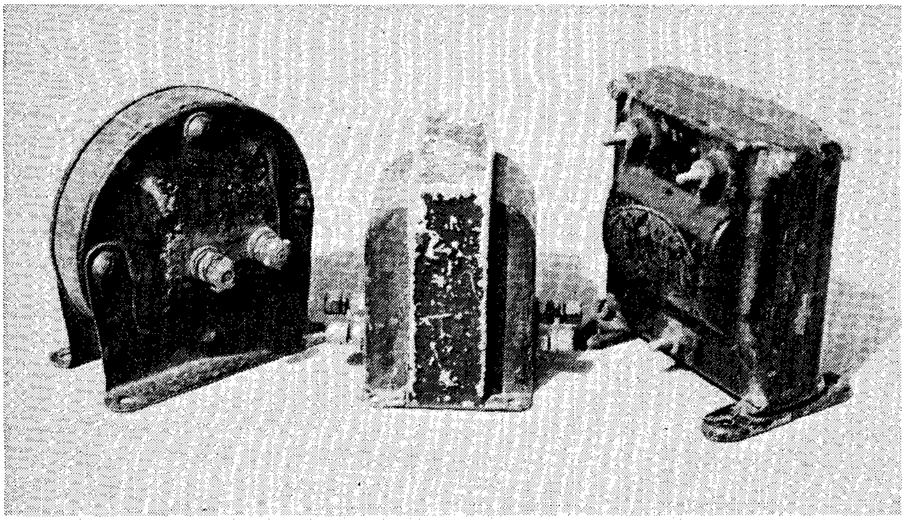
In my (admittedly limited) experience, I have never had much trouble with power transformers. I have replaced just one only to find out later that there was no need to replace it. The problem turned out to be a crook connection, not a crook tranny.

Power transformers give very little trouble and I have yet to encounter any type that has a real problem. I know that they can and do break down — but not often and rarely without cause.

A power transformer from a transistor radio differs greatly from its valve counterpart. It usually has a single secondary winding of 6, 9 or 12 volts. The low tension secondary current is then rectified to DC and the whole set works off that one voltage. These power transformers are quite small because a transistor radio rarely consumes more than 50 milliamps



This photo clearly shows the diminishing size of radio power transformers. From left: an old 2.5 volt transformer from the early 1930s; a 6.3V transformer from about 1950; and a transformer from a modern transistorised radio.



These ancient-looking components are audio frequency transformers from the 1920s. These transformers were used to couple the audio output stages. From left: Emmco, Viking and Ferranti.

at 6 volts — perhaps 150 milliamps if it's a cassette radio.

On the other hand, a valve radio power transformer is much larger and has a number of secondary windings for various purposes. Secondary voltages of 5, 6.3 and 285 volts are common. The 5V winding is for the rectifier filaments, while the 6.3V winding goes to the heaters of the other valves and to the dial lamps. The 285V secondary is rectified and filtered to give a high tension DC supply of 250 volts or thereabouts.

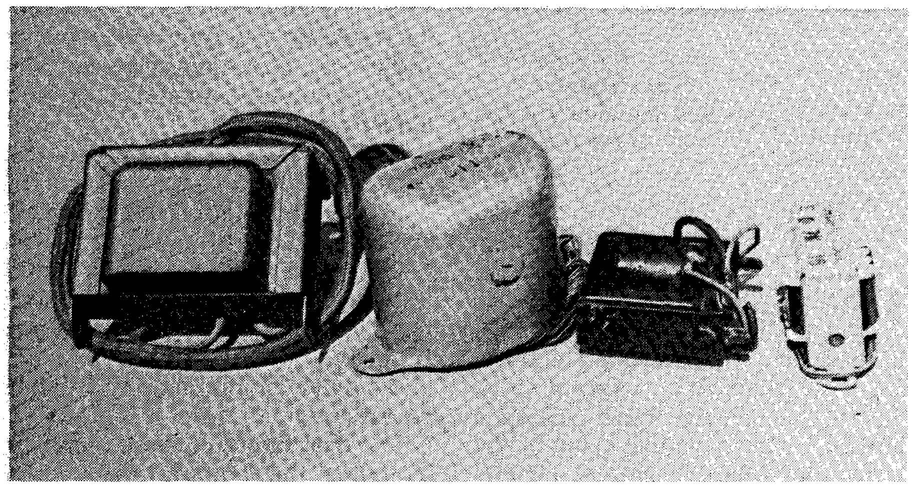
Electrical efficiency

An interesting comparison can be made at this stage between the efficiency of transistorised equipment and the inefficiency of valve equipment.

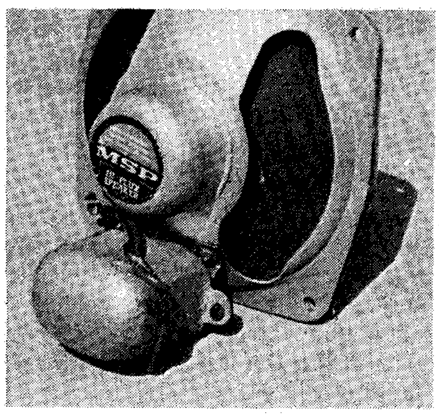
The filaments of a 5Y3 rectifier valve draw 2 amps at 5 volts. The other receiving valves will consume anything from 0.3 amps to 0.7 amps at 6.3 volts, while the dial lamps typically consume 0.3 amps each.

When plugged into 240-volt mains, the cost of running a valve radio is still pretty minimal (50-60 watts) but a transistor radio virtually costs nothing to run (about one watt). Just a single dial lamp on a valve radio consumes roughly 10 times more current than an average transistor radio. So if you read somewhere that valve equipment is inefficient, believe it!

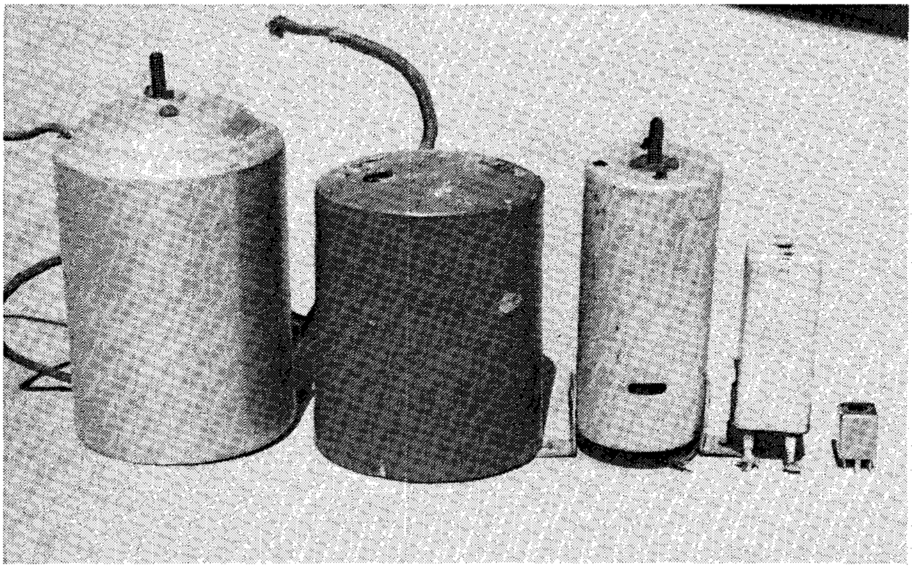
The high filament and heater consumption is the reason for the somewhat larger power transformers fitted to valve radios. Those old power transformers used lots of copper wire and iron and neither size nor weight was ever a serious consideration.

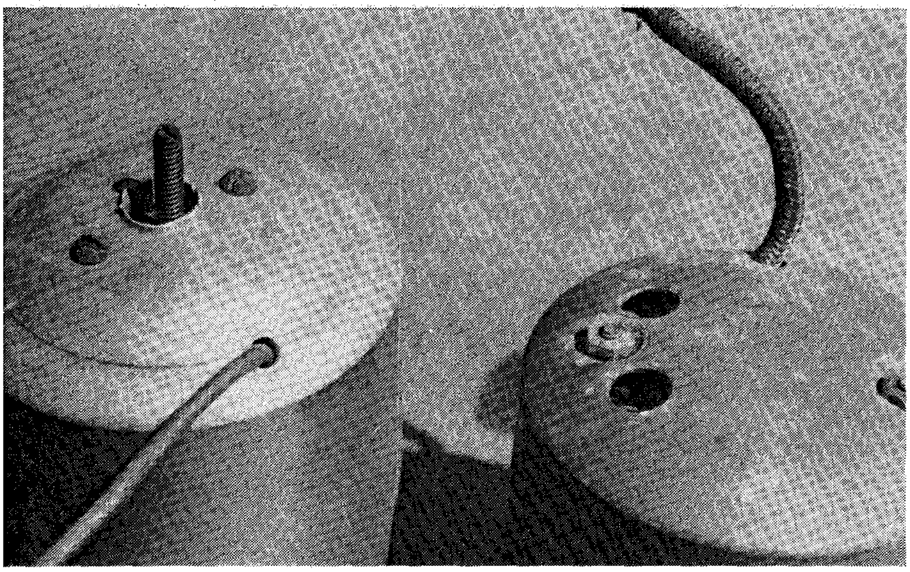


Loudspeaker transformers can be unreliable so it's always a good idea to have a good stock of spares. In particular, you should always save the speaker transformer if you junk a set, along with any other parts that might prove useful.



It was common practice to attach the speaker transformer to the frame of the loudspeaker but this won't always be the case. In some sets, you'll find the speaker transformer mounted on the chassis.


Intermediate frequency (IF) transformers became smaller as time progressed. You can easily check these units out by testing each of their two windings for continuity. Corrosion is often a problem with IF transformers, so they can give trouble.


IF transformers can be either slug tuned (left) or capacitor tuned (right). Always use an RF generator (usually set to 455kHz) when making adjustments. This will ensure that the IF transformers are tuned to the correct resonant frequency.

Some of the older valve radios even have two power transformers. A particular set in my collection has one transformer for the rectifier only, plus a second transformer for the heaters of the remaining valves.

The old 2.5V valves of the late 1920s and early 1930s required rather large power transformers to supply the high current needed. When those 2.5V valves were superseded by 6.3V types of lower amperage, there was a reduction in the size of power transformers.

IF transformers

Intermediate frequency transformers, as used in superhet valve radios, serve as tuned coupling stages between valves prior to the detector stage. There are usually two or occasionally three IF transformers in a superhet receiver, depending on the number of stages of IF amplification.

IF transformers are very simple units consisting of tuned primary and secondary windings. These windings are designed to resonate at a specific frequency (455kHz is a common intermediate frequency). The primary and secondary windings can be tuned with either a trimmer capacitor or an adjustable iron core.

One of the reasons a superhet receiver is so selective is because the IF transformers are tunable. However, it is advisable to use a radio frequency generator when tuning them so that they can be tuned to the correct frequency — but that's a story for some other time.

Early IF transformers of the capacitor-tune type can have their own particular problems when tuning. If a metal screwdriver is used for tuning (not the best instrument but often used), it's possible to short circuit the high tension between the trimmer screw and the shielding can which is earthed. The resulting high voltage discharge can not only give the operator a helluva fright but there is also the possibility of burning out one of the fine windings in the IF transformer.

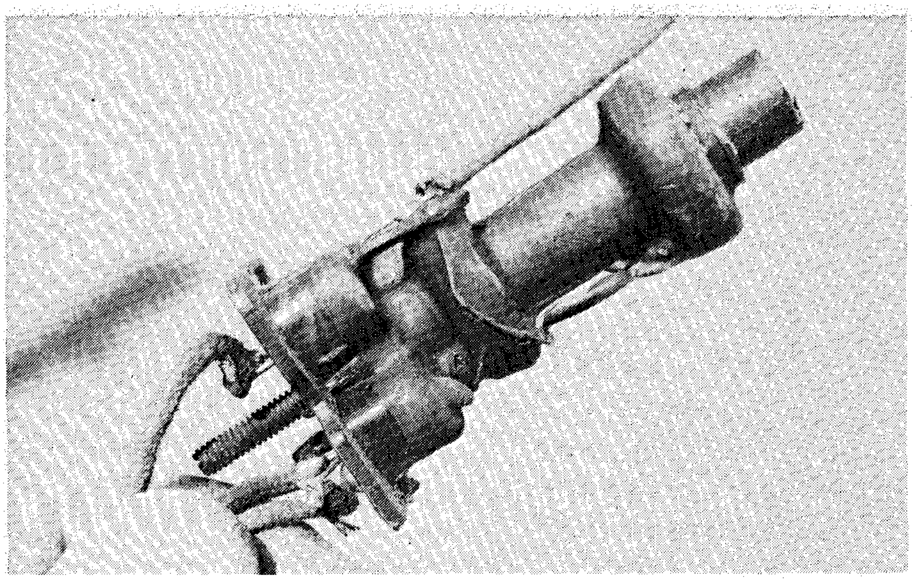
The amount of HT voltage and the size and condition of the electrolytics would have some bearing on this matter. The bigger the zap, the greater the likelihood of damaging the transformer.

Speaker transformers

Speaker transformers may seem to be a strange device to those accustomed to working with modern radios as most transistorised circuits connect directly to the loudspeaker.

With valve equipment, it's necessary to connect the output valve or valves to the speaker via a speaker transformer. These transformers are usually mounted on the speaker frame itself and more often than not carry markings such as: 5500/8, 7000/8, 5000/3.5, plus quite a number of other variations.

The first figure of these numbers indicates the output load of the valve (as stated in the valve manual), while the second figure represents the speaker voice coil impedance in ohms. Using the three



This is what an IF transformer looks like when it's removed from its metal can. The two windings are sealed in wax to prevent corrosion. Take care when handling the transformer as the winding leads are easily broken.

examples given, a 5000Ω speaker transformer primary matches with a 6V6 and a 6AQ5; 5500Ω matches a 6F6, 42 or 2A5; and 7000Ω works with an EL33 or a 6M5.

For best results, the loudspeaker should be correctly matched to the output valve(s) with the appropriate speaker transformer. In practice, mismatching is fairly common in old sets but this doesn't seem to cause any problems.

Audio transformers

Some mention should be given at this stage to the old audio transformers of the 1920s.

It was common practice in the early days of radio to have up to three stages of transformer-coupled audio amplification. For example, a mid-1920s model receiver could consist of one or two stages of radio frequency (RF) amplification (all with separate tuning capacitors and dials), a detector and two or three audio stages. Transformers were used to couple the low gain triode valves.

Common problems

Of all the transformers mentioned so far in this article, the speaker transformer is usually the most troublesome and the one most likely to burn out. A totally mute receiver is often the result of a burnt out primary winding in the speaker transformer.

This problem is easy to troubleshoot. You simply unsolder the primary connections and check for an open circuit with an ohmmeter. Such a problem will cause the screen grid of the output valve to glow red hot — a sure indication of a crook speaker transformer.

Continuity checks are also applicable when checking out IF transformers. An IF transformer has only two windings and four connections so it shouldn't be difficult to check for an open circuit in either winding. Corrosion is often a problem in IF transformers.

Power transformers can be checked in a similar manner and a conmtinuity check on the primary winding will soon indicate a problem. The HT secondary winding should produce the same voltage (or have the same resistance) either side of the centre tap.

But generally speaking, it is the finer primary winding of a transformer that gives trouble. This can be due to burn out or to an internal disconnection to one of the leads.

While most power transformers give no trouble, there are occasions when they do break down and need replacing. Of course, the ultimate repair is to rewind the defective winding. The easiest course is to simply substitute another transformer of similar size and specification.