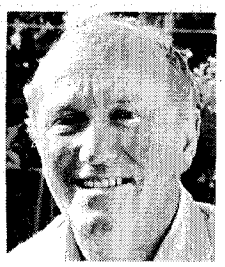
VINTAGE RADIO

By JOHN HILL



Paper capacitors cause lots of trouble

Paper capacitors cause lots of problems in old valve radio receivers. Often, the best approach it to simply replace the lot with modern equivalents.

A fellow collector came to see me recently, asking if I would repair his late 1940s mantle model Radiola. He had not been collecting old radios for long and did not know how do his own repairs.

There was a specific and most unusual request regarding this repair. I was not to replace any of the capacitors because the owner wanted the set to look completely original both inside and out.

Readers who are familiar with Radiolas of that era will know that that's an impossible task. How can one repair a Radiola of that vintage without replacing capacitors?

I questioned the owner for a reason. It appeared that the guy he bought the set from had told him that it only needed a valve but the owner didn't know which one should be replaced. We've all heard the old "it only needs a valve" story before, haven't we?

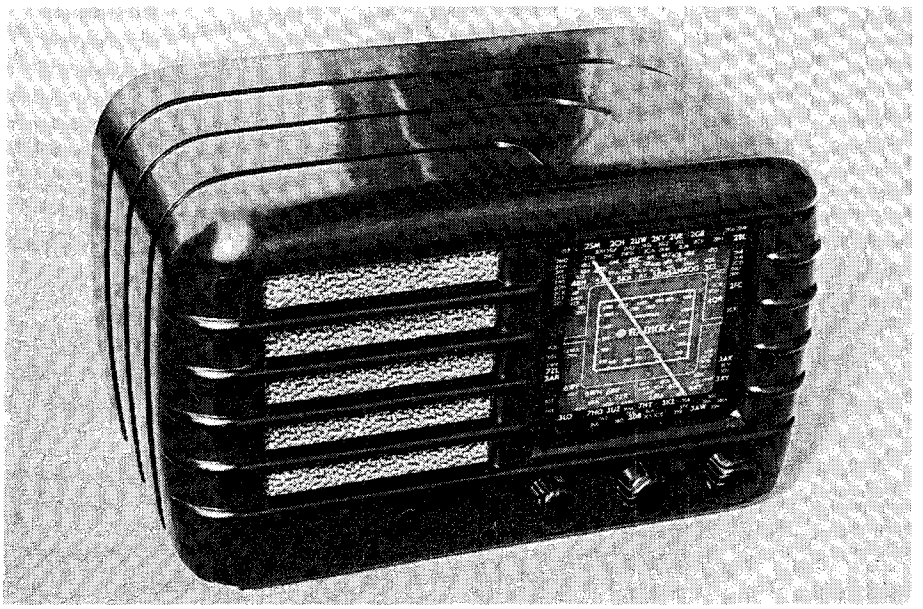
Original condition

The control knobs and chassis-mounting bolts were removed and the chassis slid out of its cabinet. It was then up-ended on the workbench and a quick glance indicated that the set was still in its original condition.

However, there were signs of capacitor problems everywhere. As was typical of AWA sets of that era, the capacitors were black moulded types carrying the MSP (Manufacturer's Special Products) brand. Many of them were showing that characteristic bulge near the ends where separation had taken place inside. It is simply amazing that some of these receivers continue to function (not very well, I admit) when almost every paper capacitor has become faulty or ineffective.

I took hold of one of the smaller capacitors and broke off one end of it with a "snap". The owner looked stunned and uttered not a word. I then cracked off the other end and gave him the centre section of the capacitor to view more closely, pointing out the dull appearance of the foil where it had been separated from the ends for many years.

By the time the owner left, I had permission to replace all the original paper capacitors. Suddenly, originality no longer seemed important and I had won another convert to my way of thinking.

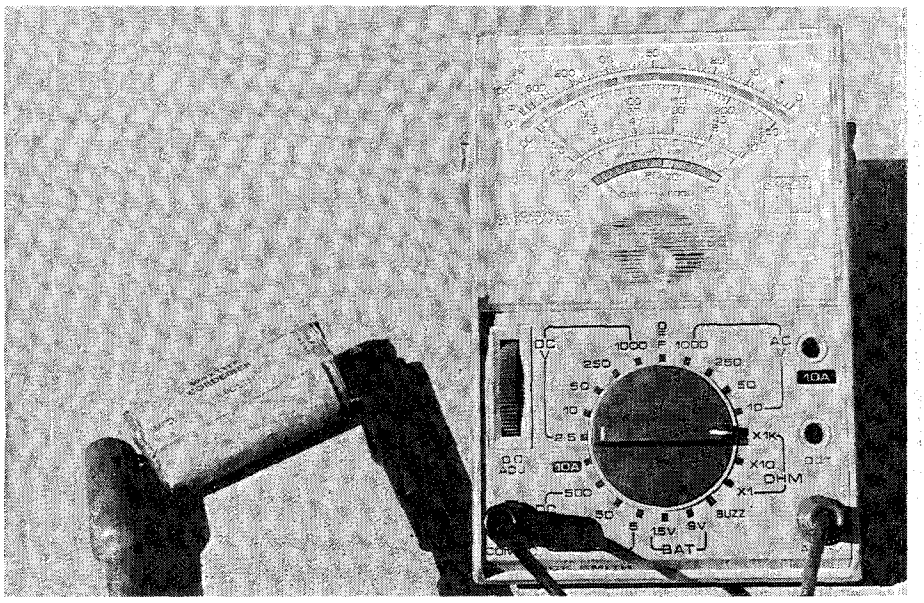


It's impossible to repair a late 1940s 5-valve Radiola like this unit while leaving all of the original paper capacitors intact. Paper capacitors cause a multitude of problems & should all be replaced with modern polyester units.

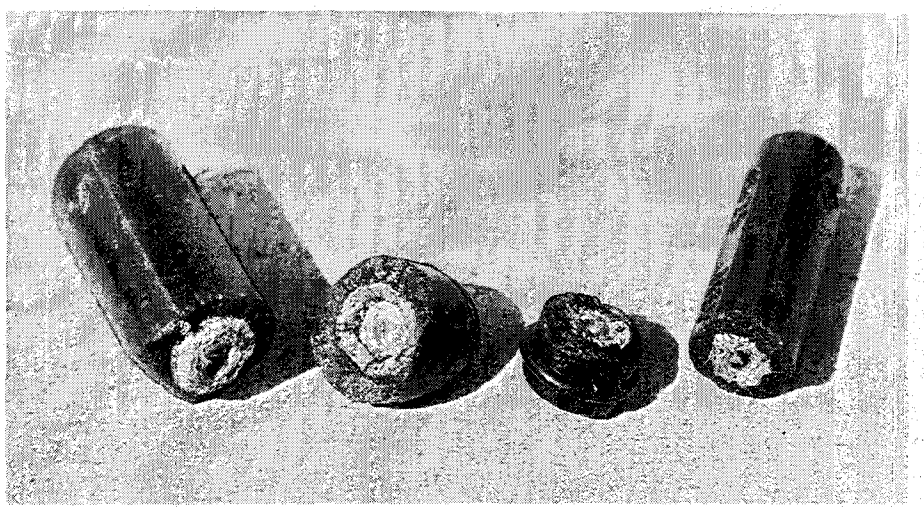
New wine, old bottle

When discussing this problem with a colleague, he reminded me of a trick which I mentioned in these notes some years ago. Where original appearance is important, the trick is to carefully open the capacitor at one end, saving any wax involved, extract the "innards", and replace them with a modern capacitor of similar value. The end is then sealed with the salvaged wax.

Most modern capacitors are significantly smaller than their older counterparts and this trick works well



This old paper capacitor behaves more like a 1MΩ resistor than a capacitor. A receiver full of such defective components has little chance of working efficiently, if at all.



The ends of these old MSP moulded capacitors have completely separated. Old paper capacitors can be easily described in one word – trouble!

with most cardboard tube type assemblies.

But the black moulded MSP types used in AWA sets are not candidates for this trick. This material is extremely brittle and is almost impossible to work with. There is little option but to replace these.

About the only thing in favour of these black moulded capacitors is that they are well-labelled and their capacitance value is easily identified. Today, some 40-50 years after they were made, they are no longer capable of doing the job and must all be replaced. No doubt, many other brands of paper capacitors are just as bad but, when they are encased in a cardboard tube, at least the ends don't drop off.

Leakage problems

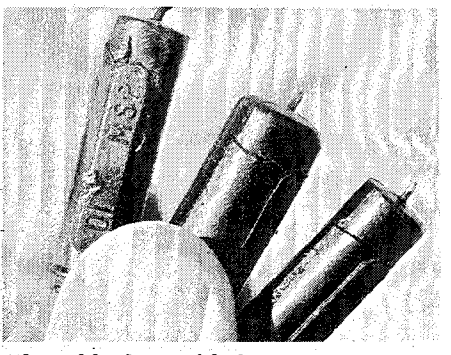
Paper capacitors are aptly named - they have a waxed paper dielectric between the foil layers and that's all there is to insulate the two capacitor plates. Age, moisture, and chemical impurities in the paper combine forces and eventually the dielectric breaks down. This situation is further aggravated by the voltage applied to the two plates, which encourages the chemical action.

As a result, the capacitor develops an electrical leakage problem. And the higher the voltage and the more the set is used, the sooner this happens. Many end up behaving more like resistors than capacitors.

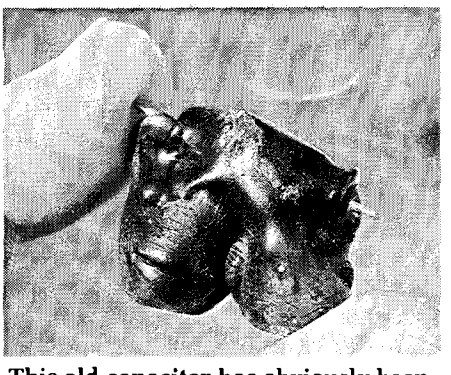
That said, one should not be overcritical of paper capacitors. They were originally developed at a time when paper was about the only practical and economical material that could be used in their manufacture. What's more, some of them still work OK despite all the uncomplimentary things I have said about them.

Modern high voltage capacitors use a thin film of polyester to separate the layers. These polyester capacitors are also better sealed and their epoxy coating is completely moisture-proof. If a well-made paper capacitor can last up to 50 years and still work OK, then a polyester capacitor should last a hundred years or longer.

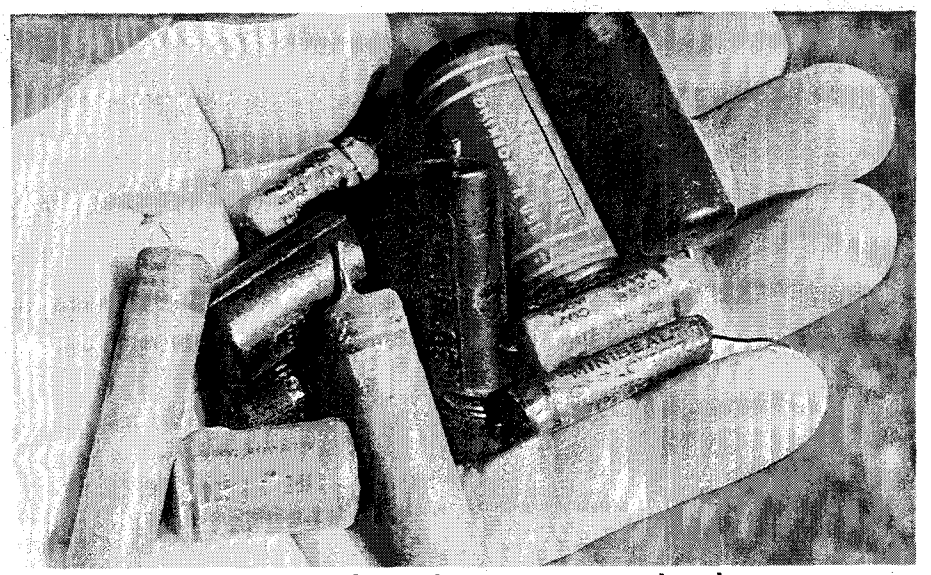
I have always been an advocate of the "clean sweep" technique whereby all paper capacitors are replaced with



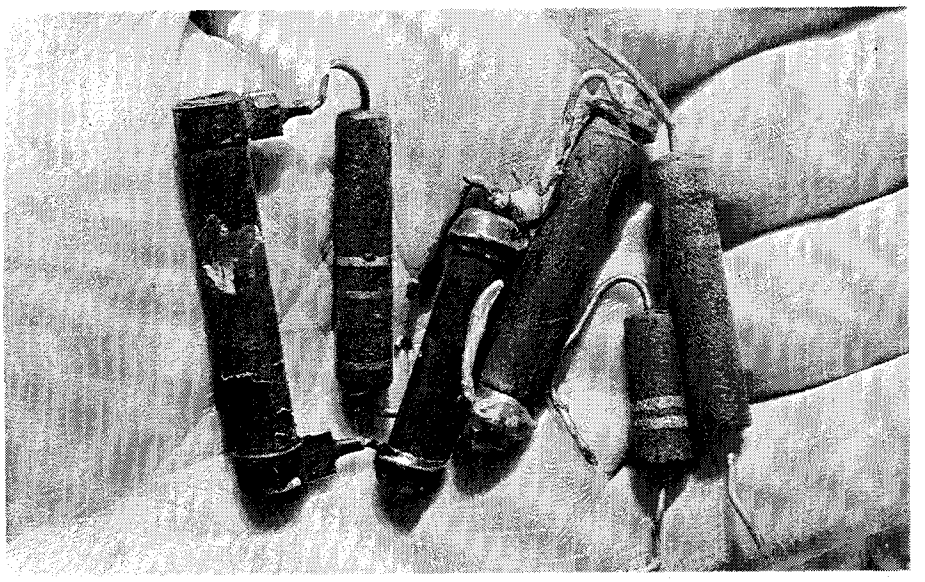
These black moulded paper capacitors were used in AWA receivers from the mid 1930s to the mid 1950s. They were and still are a common source of trouble and are usually found with their ends either split, bulging or completely separated. Replacement is the only solution.



This old capacitor has obviously been running much hotter than its maker originally intended. If a leaky capacitor passes enough current, overheating soon becomes a problem.



Successful restorations depend on a clean-sweep approach to the paper capacitor problem. Replacing all of a receiver's paper capacitors will often solve many otherwise difficult to locate faults.



A handful of burnt-out resistors. While a resistor can break down under normal working conditions, an overload caused by a faulty capacitor is usually the cause. Replacing the resistor is pointless unless the real culprit (the leaky capacitor) is also replaced.

modern counterparts. Readers may think that such a move is not totally necessary and that some of the old originals will still work, but I do like to do things properly. Replacing all the paper capacitors will not only solve a few hard to locate problems but also prevents future problems from occurring.

Now I know that I have mentioned these things before. It's a very important aspect of vintage radio repairs and that's why I keep reminding readers of the troubles that old capacitors can create. What I haven't mentioned in the past is what specific problems a particular capacitor fault can cause. Let's take a look at some.

Coupling capacitor

One of the most troublesome paper capacitors in a valve radio is the coupling capacitor between the plate of the driver valve and the control grid of the output valve. This capacitor has a high positive (plate) voltage at one end and a negative (grid bias) voltage at the other end. If it develops a leakage problem, lots of nasty things happen.

Leakage in this capacitor will allow the plate voltage to override the negative grid bias and apply a positive bias to the grid. This has two immediate effects: gross distortion of the audio signal and excessive plate current drawn by the output valve. Running a receiver for a long period while in this state will shorten the life of the output valve. But the problems do not end there.

If the output valve is drawing excessive current, then the rectifier valve will endeavour to supply it. Accordingly, the rectifier may also be overloaded and its life reduced if the set continues to work under these conditions. And there are other components which can be effected by this one leaky capacitor.

The excessive current also flows through the output transformer primary and the loudspeaker field coil, or high tension choke. A hot field coil or choke is a good indication of excess high tension current flow. Field coils and high tension chokes should not run any hotter than moderately warm.

No, we haven't finished yet! Any component breakdown that causes excessive high tension current can also overload the power transformer, which may also overheat.

Replacing the faulty coupling capacitor with a modern high voltage equivalent will most likely mean that this problem will never happen again for as long as the set is in existence. This is just one reason that I am so enthusiastic about replacing old paper capacitors with superior modern types.

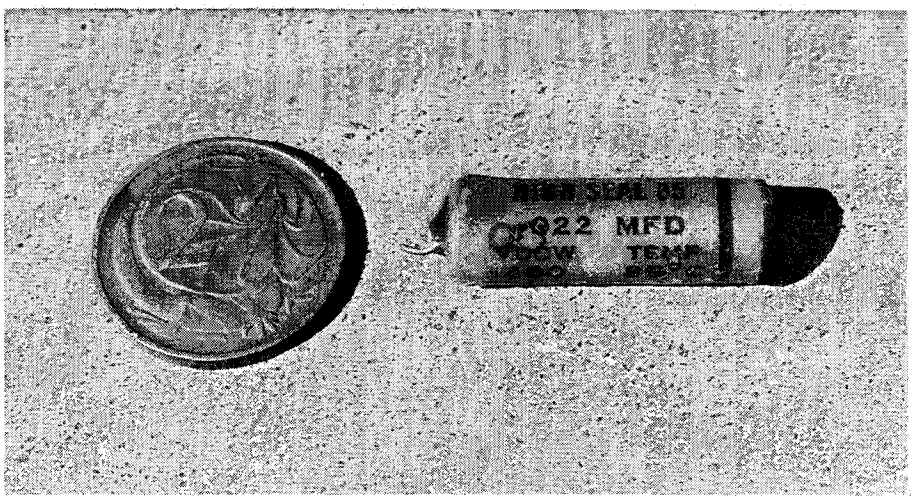
Overloaded resistors

A leakage problem or an internal short in any high tension capacitor may cause similar overload problems. However, the problem may be more localised, involving simply an overloaded resistor.

If a faulty screen bypass capacitor is allowing current to flow from the screen to chassis, then the resistor that feeds the screen grid must bear the overload. Often it can't, becomes open circuit, and the receiver stops working. In such a case, it is pointless replacing the burnt-out resistor without also replacing the faulty capacitor that caused the overload in the first place.

So, a burnt-out screen resistor is a

Paper capacitors come in all shapes and sizes. The larger ones are "block capacitors", a metal cased variety that were used for high tension filtering & cathode bypassing before the advent of electrolytics.



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pretty sure sign of a faulty capacitor. A couple of milliamps screen current doesn't usually cause a resistor much concern and its failure is reasonable evidence of an overload problem. Of course, there's such a thing as a faulty resistor but there are a lot more faulty capacitors.

While on the subject of resistors, I always make a "finger check" to test for overheating. This is done with the receiver switched off after it has been operating for half and hour or so.

If there are any hot resistors, it's important to find out why. There are often some that work quite warm but if they run really hot, it's advisable to do some checking. If the current is around normal, there may be a problem with that particular resistor.

Often, a few simple checks like this can prevent a future and possibly expensive breakdown. This is most important when doing repairs for others; if a set stops working soon after it has supposedly been fixed, it becomes a reflection on the repairer. The fact that he is expected to guarantee dozens of 50-year old parts to work forever is another matter.

Not all of the capacitors in a valve radio work under high voltage conditions and may have little or no voltage across them. Even so, these capacitors can still become leaky and cause all sorts of problems.

For example, leaky capacitors in the AGC (automatic gain control) line can cause trouble and reduce the effectiveness of the system since they behave like resistors!

I remember trying to repair my first dual-wave receiver many years ago. The broadcast band was working reasonably well but the shortwave section was really "short"; in fact, it was so "short" that there was nothing there at all.

In desperation, I eventually went to see our village expert on such matters. "Get rid of all those useless old capacitors", was his first comment, "and any resistors in there that have gone high too"!

That was the best piece of vintage radio advice I have ever received. After replacing the paper capacitors and two resistors in the frequency converter circuit, the shortwave section sprang into life.

Without that timely advice, I would probably still be floundering around in the dark. **SC**