VINTAGE RADIO

By JOHN HILL

How to deal with block capacitors

As a young lad, I saw quite a few radio sets come and go from my bedroom. Each one was the ultimate receiver – that is, until something better replaced it.

My first sets were a couple of crystal sets which served me well for many years. Following these were the regenerative receivers: several 1-valvers, a 2-valver and even a 2-valve short-wave set with plug-in coils. I spent a fair amount of my time building receivers and listening to them. There is nothing quite like the satisfaction of making something that actually works. Looking back, I have very fond memories of those bygone days.

After the home-made battery sets had run their course, I spent up big and bought a mains-powered set – my first big purchase. It was only half a set really, just a chassis and speaker that I bought from a kid at school for 30 shillings. Unfortunately, my memory is not good enough to recall all of the details and I wish now that I could remember them more clearly.

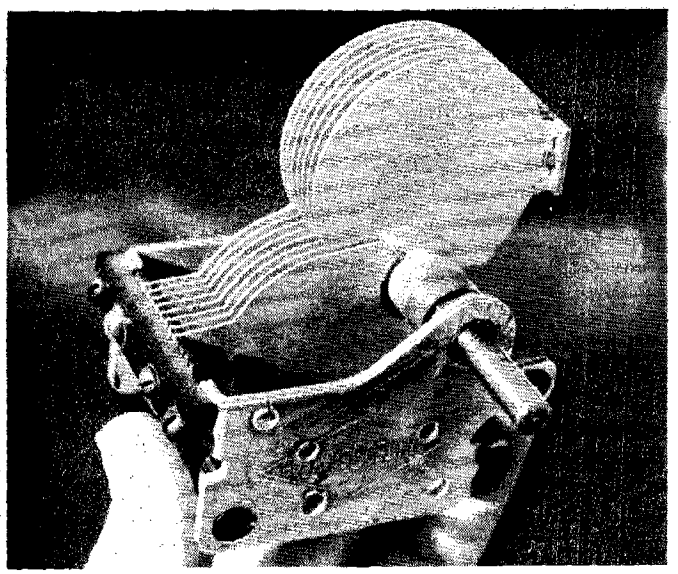
The set involved was a 4-valve regenerative detector type receiver. I still have the single gang tuning capacitor, so that aspect of it is fairly clear in my mind. There was no dial, just a knob fitted to the tuner shaft. It took a steady hand to tune it to stations at the high frequency end of the dial.

I distinctly remember that one of the valves was very large, blue in colour and extremely hot when it was working. I would just about bet a week's wages that it was an E406. A couple of other valves were silvery looking 5-pin triodes and there must have been an old 280 rectifier or the like in the line-up as well.

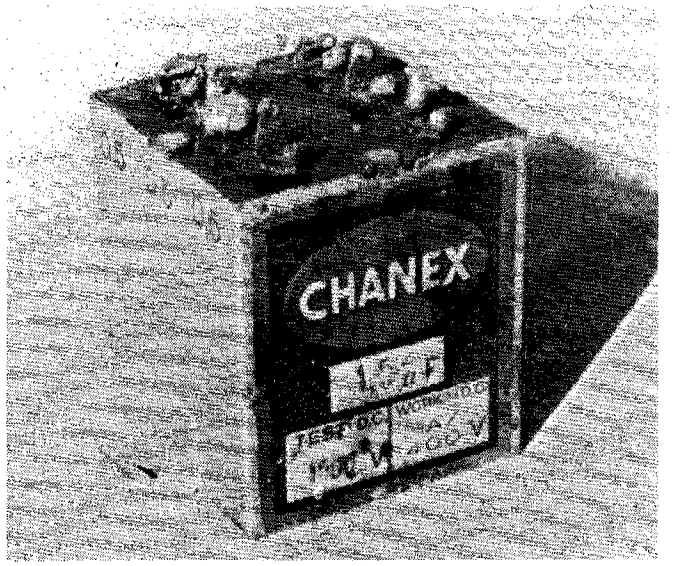
The chassis was a metallic bronze colour which seemed to be pretty classy at the time. No doubt, it was just one of those cheapies that were made in the early depression years.

Block capacitors

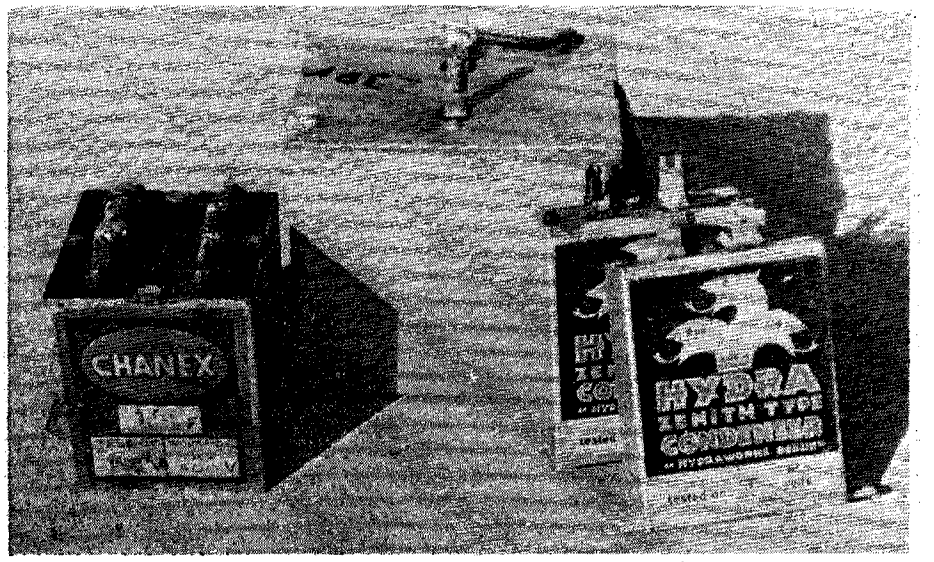
This old AC receiver had two volume controls (one being the reaction control), a feature that was not uncommon in those days. It also had two large pressed steel covers mounted on top of the chassis and these housed the power transformer and block capacitors. It was that can full of capacitors that finally caused the demise of my pride and joy and the set was eventually cannibalised for spare parts.



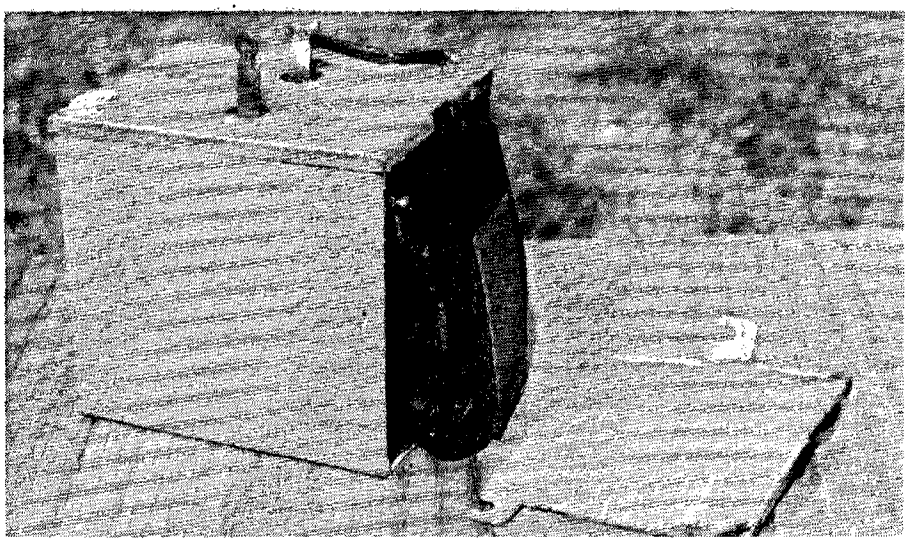
This tuning capacitor is all that remains of the author's first mains-powered receiver. The set used large block capacitors for smoothing the high tension rail – common practice prior to the advent of the electrolytic capacitor.



This block capacitor contains three separate 0.5µF capacitors & their capacitance is clearly marked on the side. In this instance, each capacitor is separate & none is connected internally to the case.



Block capacitors were usually housed in large metal cans. The "Chanex" can at left houses three 0.5μF capacitors, while to its right are a 4μF capacitor (middle) and two 1μF capacitors. Chanex capacitors were made in Australia.



This old block capacitor has suffered a terminal internal disorder. No doubt something like this happened to many block capacitors when the paper dielectric broke down and allowed them to short circuit.

Many early sets used block capacitors. These units were nothing more than paper capacitors in metal cans instead of the cardboard tubes that were to become the norm in later years.

Although the term "block capacitor" strictly refers to metal-cased paper capacitors of quite large size, the comments made in this article include all metal-cased paper capacitors, even the smaller sizes.

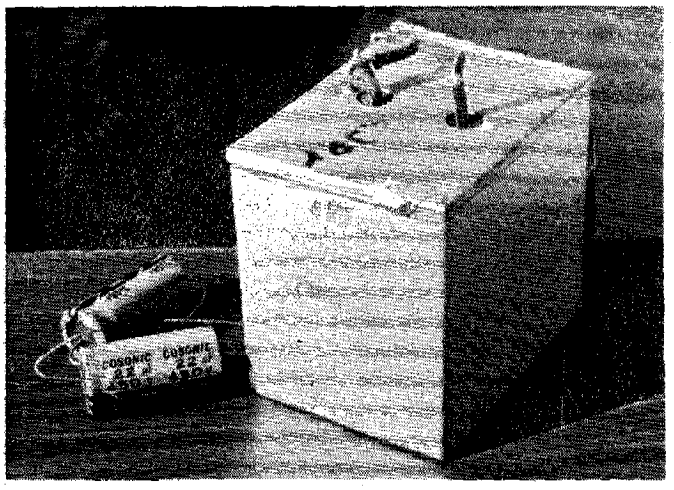
AC-operated receivers required much larger capacitors than any battery set had needed up until that time. Mica capacitors of relatively small sizes were adequate for battery sets but this situation changed with the advent of mains-powered radios.

Initially, paper capacitors were used in the high tension filter instead of the electrolytics that were to become common a few years later. A pair of 4μF paper capacitors did a reasonable job of smoothing out the mains hum when used in conjunction with a loudspeaker field coil (the latter acting as a choke).

Unfortunately a pair of 4μF paper capacitors take up a sizable amount of space. It was common practice at this stage of receiver development to place all the big bulky capacitors in a large pressed steel can instead of having them situated throughout the circuit as would be the case a few years down the track.

When hot wax, smoke and ominous rumbling sounds poured forth

This view shows the contents of a typical block capacitor. This one contained five individual units which could only be connected as a single unit into the circuit. The can formed a common chassis connection for all five capacitors.



The difference in size between a 4µF block capacitor and a couple of modern 22µF 450V electrolytics is illustrated by this photograph. Fitting modern capacitors into an old can is easy as far as space is concerned but getting the cans apart without wrecking them can be another matter.

from my old regenerative's capacitor box, it appeared as though the end had come. Knowing what I know now, I guess it wouldn't have been a difficult problem to repair but as a 14-year old, it seemed like the end of the world. What a terrible feeling to see 30 shillings self-destruct before your eyes.

At a rough guess, I would say that the input capacitor on the high tension filter developed a short circuit. This is not an unknown happening, even with electrolytics, and a sure sign of this problem is the rectifier anodes glowing red.

Block capacitors are no different to any other old paper capacitor and require exactly the same treatment. That's right! Discard them completely and replace with modern equivalents whether they be polyester or electrolytic. There is no room in any of my receivers for leaky, troublesome 60-year old paper capacitors.

Early paper capacitors were made in two types: inductive and non-inductive. The inductive type was suitable only for some applications and could not be used if the capacitor was required to pass RF signals.

Rolled foil capacitors were made non-inductive by a very simple trick. The metal foils were made slightly wider than the paper dielectric and offset slightly relative to each other, so that each protruded from one end of the roll. A connection was then made to each foil by means of a rivet which connected all the turns of the foil together.

Block capacitors vary greatly in size. Some are relatively small in size and capacity while others, as previously discussed, are quite large. Many of the larger capacitors are not singular in construction but have multiple units inside them. In fact, they can have as many as four or five separate capacitors in the one casing.

Some electrolytic capacitors were also built into metal cans, usually in pairs. In other instances, they were packaged in cardboard containers.

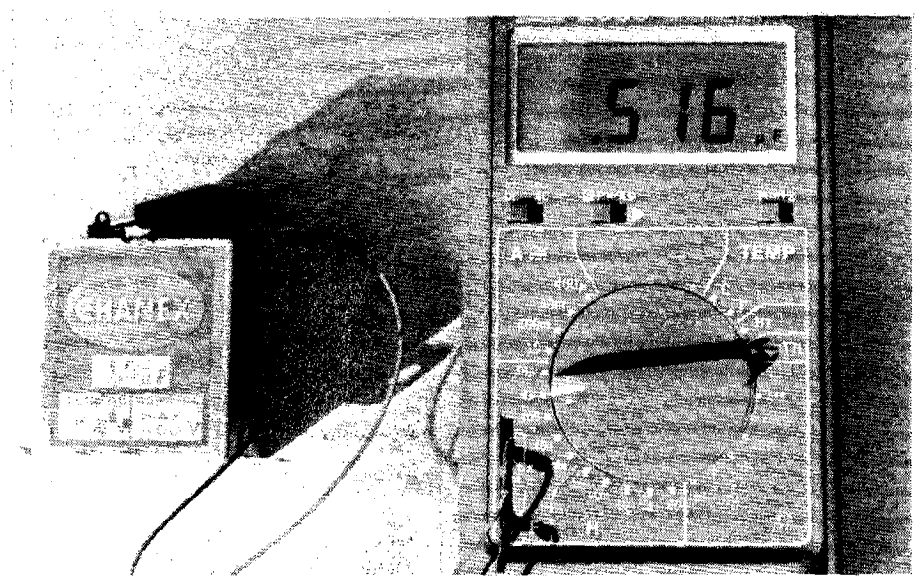
Common problems

There is a reasonable possibility of encountering block capacitors in any mains-powered radio from the late 1920s to the end of the 1930s. A 1939 German SABA receiver I worked on recently used quite a large block capacitor.

One problem frequently encountered when replacing block capacitors is that, in some instances, there are no identifying markings on the can to indicate the capacity or the voltage rating of the capacitor. Some are clearly marked but others are not. This can be a problem at times but usually a solution can be found.

Often, particularly where quite large capacitances are involved, it doesn't make a great deal of difference if the replacement capacitor is half or double that of the original value.

I have cut 0.5µF capacitors out of circuit while a receiver is working



Despite its age (at least 60 years), this capacitor still registers it true capacitance on the meter. How it would perform with 250V across it is quite another matter.

only to find that their removal makes no apparent difference to the set's operation. In this case, virtually any size replacement capacitor would work OK. On the other hand, capacitors from some parts of the circuit need to be of a particular capacitance or fairly close to it.

Usually however, the capacitance is not critical and a ballpark value will work just as well. A substitution box can be a great help when replacing capacitors of unknown value.

One way out of the unknown value dilemma is to measure the old capacitor with a capacitance meter. Although an ancient paper capacitor may be leaky, it will usually register its value with reasonable accuracy on a capacitance meter. A capacitance meter tests a capacitor at a potential of only a few volts and any leakage at those levels is usually only slight. It can behave quite differently when 250V is applied to it, however.

If a capacitor fails the meter test, its value can often be guesstimated by its physical size.

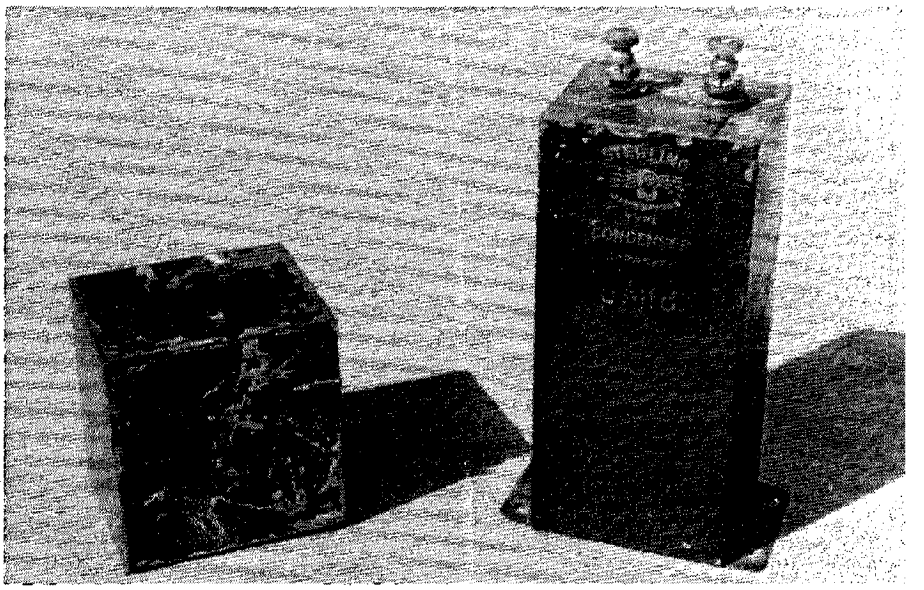
The capacitance meter can also be very handy when replacing those larger blocks which contain four or five separate capacitors. If the capacitance value of each unit can be determined, then their substitution is much easier.

Multiple block capacitors come in two types: some have a number of different leads coming from them, while others have connection lugs at the top. With the first type, each wire connects to one contact of an internal capacitor, while all the other contacts share a common connection to the inside of the can. In other words, bolting the can to the chassis effectively grounds one side of all the capacitors.

Thus, if there are four wires coming from the can, then there are four capacitors in the block and the can is the chassis connection.

The other type does not have an internal common connection to the can and individual units can be connected singularly or in parallel as required; eg, the 1.5µF block capacitor shown in one of the photographs can be wired into the circuit as a single 1.5µF capacitor, as three 0.5µF capacitors, or as two capacitors with values of 1µF and 0.5µF.

When replacing block capacitors, there is no reason why the new capacitors cannot be placed inside the old can if so desired. Sometimes, however, this is easier said than done because the can may prove difficult to open without wrecking it.



These two block capacitors have values of 4µF (left) & 6µF. Block capacitors were very large by today's standards & they took up a considerable amount of space.

Many early tubular paper capacitors carried the inscription "non inductive" to distinguish them from earlier inductive types. They used an extended foil construction similar to that used for modern paper & polyester capacitors.

In my old 3-valve Seyon, the 280 rectifier originally teamed up with two 1µF paper capacitors which were used in the high tension filter. Unfortunately, such a small amount of capacitance does not do the job particularly well and the hum level is quite objectionable.

When restoring the set, the original Philips capacitors showed considerable leakage when tested and they were replaced with modern 1µF 350V electrolytics. Being relatively inexperienced in valve radio repairs at the time, it never occurred to me to increase the capacitance. There was plenty of room inside the cans to accommodate larger units which would have greatly reduced the mains hum.

In summary then, block capacitors should not present any real problems for vintage radio repairers. They are simply paper capacitors that should be replaced if a restoration is to be effective and reliable. Whether or not the original can is used to house the replacement capacitors is entirely up to each individual restorer. **SC**