



## Repairing moving-coil loudspeakers

Considering that their construction includes a fragile material like paper, moving coil speakers are remarkably durable. But faults and damage can occur, and this month we will discuss some of these and how you can deal with them. Please note though, that I do NOT recommend attempting repairs to expensive high quality speakers. These require skilled treatment, and their repair should be left to specialists.

It is an interesting exercise to study the changes in speaker construction methods over the years. In most cases, the older the speaker, the more readily it can be dismantled. Early models, typified by the Kolster Brandes unit in Fig.1, were assembled with nuts and bolts. As time went by, and especially after the demise of the electromagnetic speaker, more and more of the assembly was pressed, glued and welded — until with today's speakers, anything but simple cone repairing is practically impossible.

Many receivers were fitted with speakers from well known international firms such as Rola, Magnavox and Celestion. Frequently though, radio manufacturers, especially the larger ones, made their own speakers, or used unbranded models. Even here, however, it is often possible to find a replacement.

It is very desirable to have the original

speaker in a receiver, or at least a similar model, but it is not uncommon for a receiver at some time to have had a substitute fitted in place of its original speaker. Sometimes this is all too evident. To find a modern permanent magnet speaker, perhaps with the original output transformer screwed to the side of the cabinet is, even to a beginner, an obvious anachronism. However, a contemporary replacement may have been made many years previously.

There was only a degree of standardisation of sizes and specifications, and it is often difficult to be completely certain about originality. Furthermore, set makers often changed speaker brands with changes in models, or had more than one source.

Sorting out speaker authenticity is typical of the research that can make the radio historian's life so interesting. Comparing notes with other collectors may well answer some questions. Some detective work, using clues like brand names and field resistance compared with the original, can be used as a check. If the replacement has the same specifications as the original and is of a similar age, a substitution is not too disastrous.

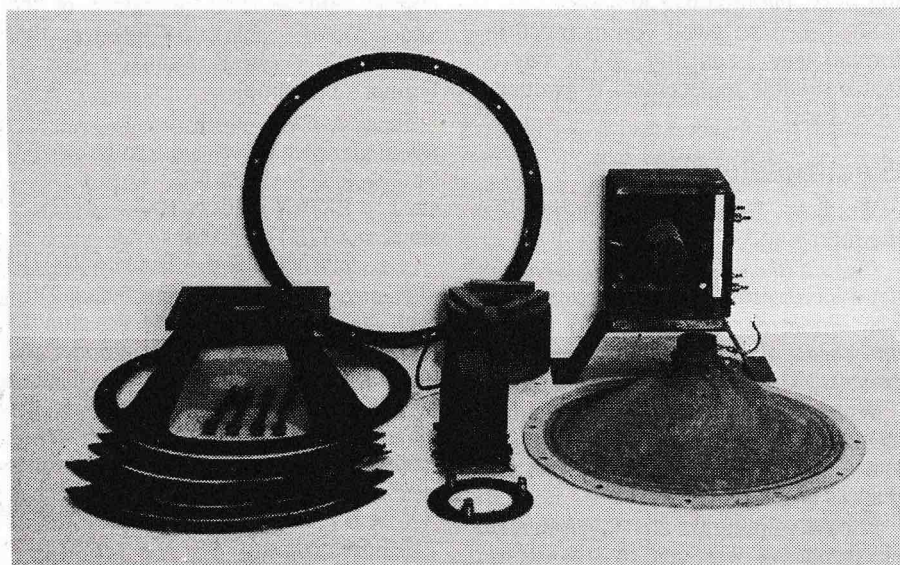
### Careful handling

A speaker undisturbed and in a dry clean environment can remain in good condition almost indefinitely, but damage and deterioration can occur in various ways. Most vulnerable is the cone, and a common source of damage is careless handling. Using one hand to pick up a speaker by the rim has resulted in the tearing of many cones. The heavy magnet causes the speaker to tilt, and then fingers go through the edge of the cone. Always make it a rule to pick up a speaker by the magnet, or use two hands...

It is also easy to damage a cone with a misplaced screwdriver being used on mounting screws. This is especially so with older permanent magnet speakers with large external fields, which can provide considerable force to drag a screwdriver in an unexpected direction.

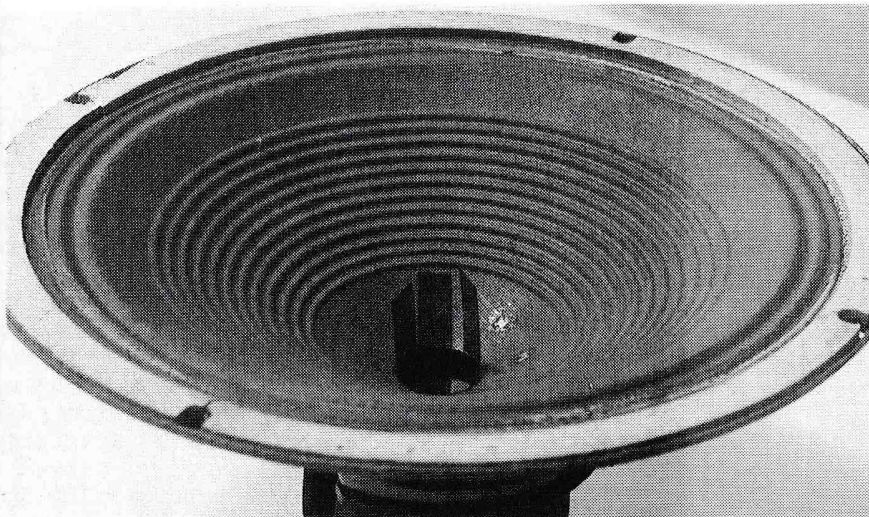
Speaker cones sometimes attract undesirable attention from children, with pencils and nails being poked through grill openings. Generally such damage does not effect performance significantly, but it does little for the cone's appearance.

All too often, a fine old receiver will be found to have hosted a colony of mice. For some reason, rodents find radios irresistible locations for setting up house, causing considerable damage from corrosion and gnawing, and there seems to be a premium on shredded speaker cones as nesting material.



**Fig.1: The component parts of a 1930 Kolster Brandes speaker. The construction is typical of early models, which are easily taken apart for repairs — unlike more modern models. This model has no hum-bucking coil or shading ring.**





**Fig.2: Centring of the voice coil is assisted by using three shims in the gap. Thin card can be used, but strips of photographic film are better. Missing sections of corrugated cones like this example can be difficult to patch.**

## Cone repairs

At one time, some receiver manufacturers stocked spare cones. Some of the major speaker makers, Rola being one, even provided a reconing service. For a modest fee, a new cone with voice coil could be factory fitted to many models, and the speaker returned as good as new. Today we have no option but to attempt our own repairs, for even if speakers are still made locally, to provide such a service would be quite uneconomic.

Simple tears and holes can be repaired without dismantling the speaker. Provided that all the pieces of the cone are still present, the edges can be reglued — but the adhesive should be flexible.

Cellulose cement was used traditionally for fixing the cone and gasket to the speaker frame and can still be used for this purpose. It also used to be recommended for cone repairs, but as it becomes very brittle it can cause buzzing noises. The rubber-based contact adhesives available today are ideal. A thin line of glue along the torn edges will usually suffice, but small patches of thin paper for reinforcement may sometimes be necessary.

Although its convenience may be tempting, *never* use cellulose tape! The adhesive eventually hardens and separates from the tape, leaving an unsightly mark and a failed repair. Incidentally, it should also never be used to repair old books or magazines, for the same reason.

Occasionally, there will be small radial tears at the edge of the cone and in the surround. These can occur naturally, and as they don't normally affect the speaker's performance, they can generally be ignored.

A cone that has a large section missing obviously cannot be repaired simply by gluing the remnants together. In this case patches of paper of a similar texture can be used. Artists' black paper is often suitable. However some cones are moulded with a series of corrugations, as in Fig.2, and these are very difficult to patch.

Cones are traditionally black in colour, although there have been other shades. If the speaker has had prolonged exposure to strong light, the cone colour will often have faded and the paper may have become brittle. One way of sprucing it up, and to disguise repairs is to paint on a light coating of automotive tyre black. This is thin enough to penetrate the pores of a cone, and it also seems to have a small content of a rubbery compound which provides a useful degree of revitalisation of brittle fibres.

Corrugated surrounds can be difficult to repair if damage is extensive. Some early speakers had thin leather or fabric surrounds, which are much easier to repair or renew. If there is significant damage, or perishing, the best approach is to first dismantle the speaker and separate the surround from the cone, after saturating the junction with lacquer thinners to soften the cement. Then, with the new surround cut out and lying flat on the table, it can be glued to the cone.

## Voice coil problems

A common problem with voice coils is 'poling', or rubbing against a pole piece. Clearances are very small and there is little tolerance for the coil being off-centre. In the case of modern speakers, with permanently fixed spiders, there is little that can be done. However many older

speakers have adjustable spiders, and recentring can be straightforward. Speakers with front spiders are the easiest of all to deal with.

The method used for both types is shown in Fig.2. With the spider adjustment screws loosened off, three equally spaced shims are inserted between the voice coil and the centre pole of the magnet. Heavy paper is usually about the right thickness and is often used for shim material, but a better material is photographic film cut into strips about 5mm wide. With the shims in position, retighten the spider adjusting screws.

Sometimes there will be a small dome at the centre of the cone to keep dust out, which will have to be removed first. A careful application of lacquer thinners may help in loosening any cement, but care must be taken not to loosen or detach the voice coil in the process.

If recentring the cone does not cure the voice coil rubbing, the coil former may be distorted, there may be iron filings in the gap or a knock may have shifted the centre pole piece off centre. To proceed further, the cone will have to be removed.

In the case of very old speakers, as in Fig.1, it is fastened to the rim by a clamping ring. In later speakers, the surround will be cemented under a cardboard or felt gasket. The cement may well be easily loosened, but otherwise lacquer thinners should be applied and left for a few minutes. Disconnect the flexible voice coil leads and the spider mounting and carefully lift the cone out.

If the pole pieces require repositioning or reassembling after dismantling, adjustment is simplified by the method shown in Fig.3. After loosening the appropriate screw(s), three nails — or better still, twist drills — of the correct diameter are positioned in the gap and the bolts tightened up again.

A warning: **NEVER SEPARATE THE MAGNET AND POLE PIECES OF A PERMANENT MAGNET SPEAKER.** Normally, it is unnecessary and to do so may cause serious demagnetisation. If filings or dirt have strayed into the gap, a steel knife blade or blue tack is useful in their removal.

With the very tight gap clearances, a voice coil needs only to be slightly distorted to rub on the pole pieces. The usual method of reshaping is to gently push in a cork of the right diameter, and then apply a thin coating of polyurethane lacquer.

An annoying fuzziness or buzzing, especially noticeable at low sound levels, may come from loose turns on the voice coil. Again, a thin coating of lacquer



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should be applied. This fault is sufficiently common that it is a good precaution to give this treatment automatically to any speaker that has been dismantled.

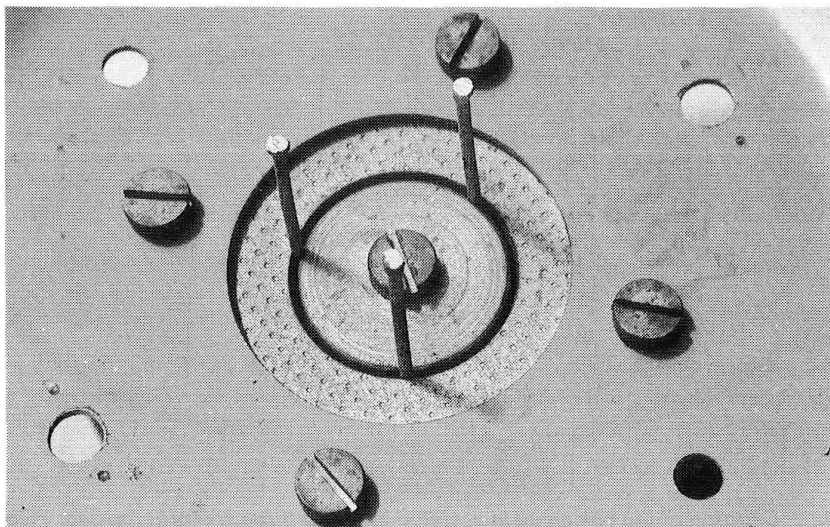
Another voice coil fault can create puzzling symptoms. The speaker seems to be 'dead', with the voice coil apparently open circuited. In some instances, some momentary life can be restored by flexing the cone.

This problem is caused by poor soldering at the eyelets where the voice coil wire is terminated, but considerable care is needed to correct the problem. The connection will have been coated with lacquer or cement, and it is very easy to overheat the eyelets with the soldering iron and burn a hole in the cone. The best method is to carefully scrape the metal as clean as possible and then resolder with a low wattage iron, as quickly as possible.

### Field windings

An essential part of an EM speaker is the field winding. One problem to always be on the lookout for is the possibility of a replacement speaker having a field of the wrong resistance. Too low a resistance and the high tension voltage applied to the valves will be too high, and it follows that with a higher than normal resistance, the reverse can apply.

Field windings are — fortunately — reasonably trouble free, but they can become open circuited. This is invariably due to the same 'green spotting' that afflicts audio transformers, and the cause is the same: acid in the paper bobbin attacking the copper wire.



**Fig.3: When re-assembling a speaker electromagnet, it's essential that the gap be accurately centred. Three nails of the right size can be used to hold the assembly in position while the bolts are tightened.**

If a field winding is found to have no continuity, it is worthwhile attempting a repair. Dismantle the speaker and carefully remove the field winding, noting the position of the hum-bucking coil. The winding may be a tight fit on the pole piece. If so, heating the assembly by leaving it on an oil-filled radiator for a while may help.

Most field winding bobbins are made of quite thin card and it is usually possible to gently peel them back sufficiently to look for green spots. These may be no bigger than a pinhead, and sometimes will leave a tell-tale mark on the bobbin. The wire ends can often be rejoined, soldered and insulated from the rest of the winding with a thin piece of tape. It is a good idea to saturate the bobbin cheeks and core with thin varnish or shellac, as a precaution against further trouble.

If the break cannot be found, or the bobbin is solid, the wire can of course be unwound until the break is found. In this case it's best to completely unwind the wire and immerse the bobbin in hot paraffin wax...

About 10 years ago, I did this with a 1930 Majestic G3 speaker that had been unused for many years, and it turned out to be a memorable task. Using a lathe I unwound the 7km of wire, to find no less than 15 breaks! After soaking the bobbin in hot wax, the field was rewound, and at last report, the speaker was still performing well. I might add that most fields do not have such daunting lengths of wire, although I would hesitate rewinding without some sort of winding aid.

When reassembling the speaker, remember to get the hum-bucking coil round the right way, or the effect will be

to add to the hum. If this happens, rather than dismantling the speaker, simply reverse the connections to the hum-bucking coil.

Apart from physical damage, usually from dropping, or corrosion, speaker chassis do not give much trouble. Be cautious, though. If the mounting screws are not tightened up carefully, it is possible to create chassis distortion, putting the voice coil out of alignment. Always tighten the screws in diagonal sequence, a turn at a time.

### Societies: a reminder

Lately I have received a number of requests for data on specific items of equipment; but unfortunately, I have not always been able to help. I would remind readers that advice, and sharing of information, circuits and data is one of the major aims and functions of the two vintage radio societies operating in Australia and New Zealand.

Of course there are other benefits of joining these societies, such as receiving their magazines, published quarterly. As well as having interesting articles on all manner of topics, these also feature buy, sell and swap columns. The annual membership fee of each society is only \$15. In high membership areas, both have local branches meeting regularly.

The Membership Secretary for the Historical Radio Society of Australia is J.R. Wales, of PO Box 283, Mount Waverley, Victoria 3149. Similarly membership applications to the New Zealand Vintage Radio Society should be made to Bryan Marsh, 20 Rimu Road, Mangere Bridge, Auckland 1701. Why not join one — or even both. ♦

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