

Transverse Current Microphone

Constructional Details of an Inexpensive Instrument Giving High-class Reproduction

By D. W. HEIGHTMAN

THE microphone described in this article is basically the same as that used largely for public address work, yet it is comparatively easy to build and will give very good reproduction.

THERE are many interesting and often amusing experiments possible with a good microphone joined to the pick-up terminals of the broadcast set, but whenever this ruse is adopted to derive some entertainment at the expense of visiting friends the quality of reproduction must be particularly good to be convincing. High-grade microphones are comparatively expensive, yet their construction is not beyond the scope of any home constructor having a reasonably well-equipped workshop. The difficulty does not lie so much with the actual making as finding a suitable design. The microphone described here can be relied on to give very good results, and it entails the outlay of a few shillings only for the materials.

Basically the microphone is similar to that used largely for public address work as it is a transverse current type, consequently the output is not large, being of the order of 0.1 volt across the secondary of the transformer. An output comparable to that from the average gramophone pick-up can be obtained by bringing the microphone fairly close to the speaker so that adequate volume for normal home requirements is possible with the LF amplifying portion of a broadcast receiver.

Good Response

Microphones of the transverse current type, if reasonably well designed, have a very good frequency response and are generally free from objectionable resonances, so the model must not be regarded as a toy and can justifiably be classified as a high-grade instrument suitable in every respect for serious experimental work and for amateur transmitter use.

The body of the microphone consists of a block of hard wood such as teak, mahogany, or any close-grained wood free

from resin, and preferably cut to the shape shown in the accompanying sketch. Care should be taken to plane the top face smooth and flat. Two slots are now cut in the planed face each $\frac{1}{2}$ in. deep and $\frac{1}{2}$ in. wide and 2 in. long. The simplest way is to drill a number of $\frac{1}{2}$ in. diameter holes along the space marked out for the grooves and remove the intervening wood with a sharp chisel. These grooves are spaced $2\frac{1}{2}$ in. apart, measuring from the inside edges.

A shallow trough must now be made between the two grooves for the carbon granules, and this could be formed by chiselling out the wood to a depth of $\frac{1}{16}$ in. and $1\frac{1}{2}$ in. wide. But a simpler method is to remove one layer from a piece of $\frac{3}{16}$ in. five-ply wood cut slightly larger than the main wooden block and with a sharp pen-knife cut out the centre to the dimensions given. This is then glued to the block with the long side grooves exactly coinciding with those below. When it has set hard the sides can then be filed or planed down to conform with the shape of the hard-wood block. In the meantime, attention can be given to the preparation of the remaining parts. One further spacing piece is wanted also cut from one layer of ply-wood as before. In its centre is a rectangular slot $2\frac{1}{2}$ in. long and $1\frac{1}{8}$ in. wide. This is shaped to conform with the hard wood block and can be put aside for the time being. Its purpose is that of a spacer between the thin mica diaphragm and the protecting wire gauze.

The front cover can now be prepared; this is cut from $\frac{3}{16}$ in. five-ply wood and in its centre is a $2\frac{1}{2}$ in. \times $1\frac{1}{8}$ in. rectangular slot. A narrow channel is cut out from the back of the cover plate to accommodate the gauze, so that when the whole is assembled the edges of the microphone present a smooth surface. This should

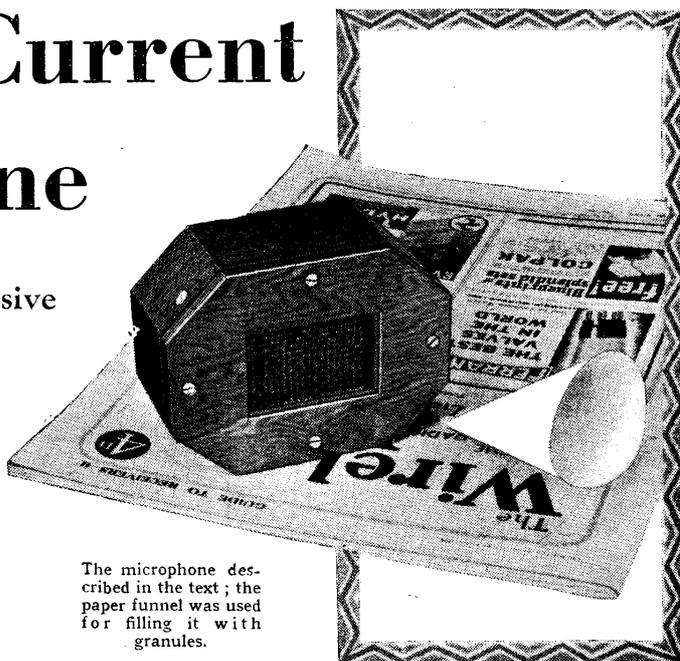
be slightly larger than the centre aperture and formed by removing the first layer of ply for $\frac{3}{16}$ in. round the edge of the aperture. A piece of fine mesh copper wire gauze is now cut just large enough to fit the space. These three pieces are marked E, F and G respectively in the drawing.

The hard-wood block and its glued-on piece should now be ready for handling, and the next process is to drill two $\frac{1}{2}$ in. holes in the chamfered side through to the two deep grooves in the block. Later these will be used to fill the microphone with granules.

Order of Assembly

Two rods of pure carbon $\frac{1}{2}$ in. or preferably $\frac{3}{16}$ in. in diameter cut $1\frac{1}{2}$ in. long are now prepared to fit into the side channels. These can be obtained from old torch batteries, and the best way to remove them is to first separate the cells, chip out the pitch, then grip the brass cap on top of the centre carbon tightly with a pair of pliers, twist once or twice, when the whole rod will slide out easily. When cut to size the top and bottom surfaces of the rods should have a flat filed along the full length. A hole to clear 6BA screwed rod is then drilled midway in each and one to correspond passed through the wood block from the side channels as shown in the drawings. These form the two terminals of the microphone.

Before attempting the final assembly the several pieces of wood spacers are fitted together and four holes drilled to pass $\frac{5}{16}$ in. No. 4 countersunk brass wood-screws. The clearance holes are carried down only through the outer cover and spacing piece. Brass screws are inclined to shear if screwed into hard wood without first drilling a small diameter hole, so when the four holes already mentioned have been drilled



The microphone described in the text; the paper funnel was used for filling it with granules.

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and their positions marked on the underneath block they should be continued for a distance, using a drill one size or so smaller.

A trial assembly can now be made so that the sides of the several pieces of wood may be trued up and sandpapered flush. A coat of varnish might even be applied to impart a presentable appearance.

When this has dried hard disassemble the front, remove the loose spacing piece, and the final assembly can be commenced.

First fit the carbon rods in position by cutting off two pieces of 6BA screwed brass rod sufficiently long to project about $\frac{1}{2}$ in. from the back of the wood block and $\frac{1}{16}$ in. above the top of the carbon rods. The carbon rods are then fixed in position by running 6BA nuts on each end of the brass rods and tightening. Care must be taken to see that the nuts are tight enough to hold the rods firmly in position but not so tight that it fractures them.

The diaphragm, which must be of clear ruby mica $2\frac{1}{2}$ in. long by $3\frac{1}{2}$ in. and 0.001 in. thick, is then glued in position, it must cover the centre trough and the two side channels and be securely fixed down all round. Seccotine, slightly warmed to make it flow easily by immersing the tube in warm water, is then thinly smeared on the face of the main block and the mica diaphragm placed carefully in position. Handle this very delicately as it is extremely fragile. An alternative to Seccotine that is suitable for this purpose is Rawlplug Durofix. As the diaphragms are not expensive several should be purchased in case of accidents. They cost 6d. a half-dozen and are obtainable from the British Mica Co., Ltd., Bedford. It is essential that the mica diaphragm be perfectly flat and not sag in the centre.

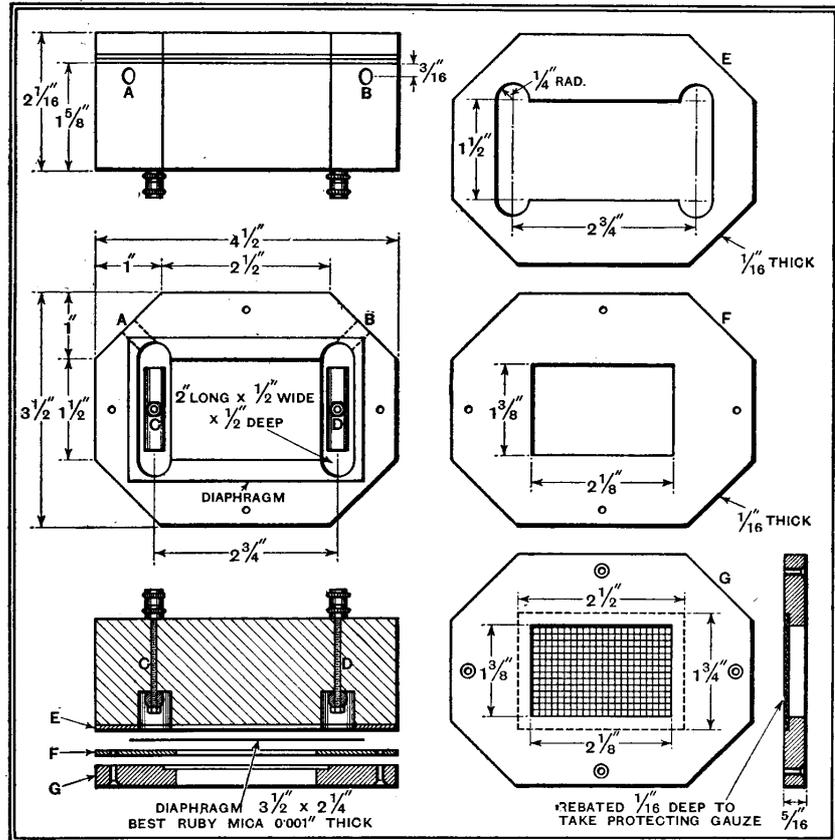
When the glue is hard the wood spacer may be placed carefully in position, the gauze grille fitted into the back of the front cover and the four wood screws replaced and tightened.

Filling

The next and final procedure is to pour in the carbon granules. These are very fine indeed, being more like carbon dust, and they are described as the No. 6 Quality T.G.1625N carbon granules, and obtainable from the Morgan Crucible Co., Ltd., Battersea Works, Church

Materials Required

- 1 block of hard wood $4\frac{1}{2}$ in. \times $3\frac{1}{2}$ in. \times 1 in. to $1\frac{1}{4}$ in. thick.
- 1 piece of $\frac{3}{8}$ in. 5-ply wood 12 in. \times 4 in.
- 1 length of 6BA rod, 6 in. long.
- 4 6BA locking nuts.
- 2 6BA terminal heads.
- 1 Mica diaphragm $3\frac{1}{2}$ in. \times $2\frac{1}{2}$ in. \times 0.001 in. thick.
- 1 piece of copper or zinc gauze fine mesh $3\frac{1}{2}$ in. \times $2\frac{1}{2}$ in.
- 2 small corks.
- $\frac{1}{2}$ oz. No. 6 quality T.G.1625N carbon granules.
- 4 $\frac{3}{8}$ in. No. 4 brass wood screws countersunk heads.

SCALE DRAWINGS OF THE MICROPHONE PARTS

Dimensional drawing of the various parts required for the construction of the microphone; the order of assembly is shown in the left-hand bottom corner. Holes A and B in the top left-hand elevation view are for filling the microphone with granules.

Road, London, S.W.11. They cost 5s. 6d. an oz. plus postage. If constructed according to the specification given the microphone will hold just about $\frac{1}{2}$ oz. of granules. They are poured in through the two holes A and B in the chamfered sides already mentioned, using a funnel fashioned from stout paper. As the granules are poured in the microphone is tilted and tapped gently to ensure that they find their way into the centre space. Fill to within about $\frac{1}{8}$ in. of the top and

see that the granules are perfectly dry before filling by keeping the bottle corked until required, as damp granules will pack and spoil the performance of the microphone. When the filling is complete plug the two holes with corks cut to shape and size with a razor blade.

This microphone needs between 6 and 8 volts for excitation and passes about 30 mA. It has an impedance of the order of 300 ohms and requires a transformer with a ratio of about 1 to 30.

MODERN BATTERY MANUFACTURE

EIGHTY complete dry-cell units, eighty-six connections, one hundred and seventy-two soldered joints, to say nothing of insulating separators, a container, sockets, etc. We have not checked all the figures, but that is roughly what one gets for 6s. in the new Ever Ready "Radio" 120-volt battery, which represents a triumph of modern manufacturing technique.

Reference to our files of ten years ago shows that Ever Ready batteries of the same voltage then cost 26s., and it is safe to say that the cells are now better in every respect.

Prices of other batteries in the "Radio" series are 3s. 6d. for 66 volts and 5s. for 100 volts.