Microphone Pre-Amplifier

Cathode Follower Circuit Suitable for P.A. Work

By

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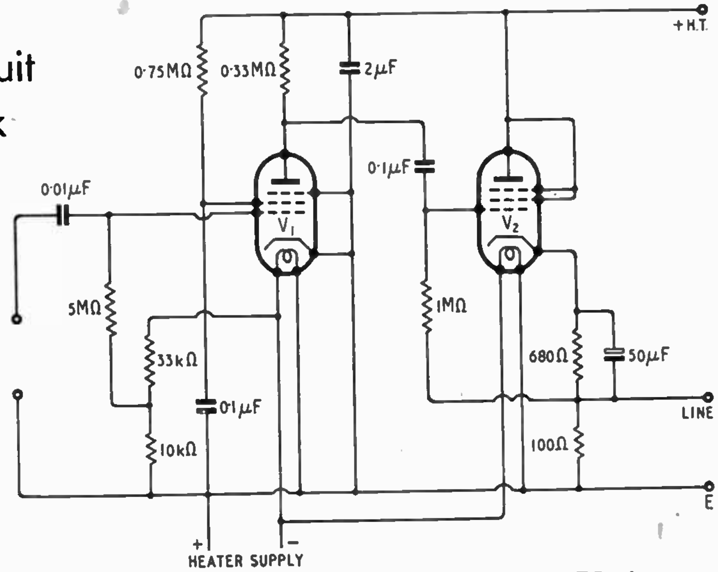

Fig. 1. Circuit diagram of amplifier. V_1 and V_2 are EF50's.

DURING the course of modernizing some general-purpose P.A. equipment, it was thought that the existing moving-coil microphones constituted a weak link in the chain of what was intended to be a high-fidelity amplifying system, and consideration was therefore given to the sound cell type of piezo crystal microphone.

The outstanding advantage of this type of microphone is the good frequency response, stated by the makers to extend almost level to about 10,000 c/s. Non-directional pickup, small size and weight, and absence of "blasting" when overloaded, are also useful features. On the other hand, the low voltage output (which cannot be stepped up by a transformer as in the case of moving coil microphones) and the high impedance present problems. The makers give the output as –66 db to a reference level of 1 volt per dyne per sq cm and the impedance as being similar to a capacity of 0.005 μF. In the absence of reliable figures for other types, it is difficult to make any accurate comparison, but in practice it may be said that additional voltage amplification of perhaps 35 to 40 db is required as against a sensitive moving-coil microphone and transformer. The high impedance, predominantly of a capacitive nature, implies that the microphone must work into a load of the order of 5 megohms if loss of bass is to be avoided, and that the self-capacity of the lead, which must be thoroughly screened, will cause a loss of voltage.

A preliminary attempt at incorporating an additional high-gain stage of amplification in an existing A.C. mains amplifier proved, as expected, to be unsatisfactory owing to hum and noise. Attention was therefore turned to the use of a separate pre-amplifier, using D.C. supply for valve heaters, and employing to advantage the characteristics of the cathode follower.

The main amplifying stage, V_1, is conventional, employing an R.F. pentode (EF50). This valve is very suitable for the purpose, since it has a very steep slope and is satisfactorily non-microphonic. Strictly speaking, the use of a variable-mu valve is to be deprecated, but in view of the extremely small grid swing to be handled it is not considered that any distortion is introduced. In spite of the use of a 5 megohm grid resistor no grid current can be detected. Bias is derived from a potential divider across the heater supply.

The output stage is a cathode follower, employing another EF50. The high input impedance enables maximum gain to be obtained from V_1 without loss of high frequencies, whilst the low output

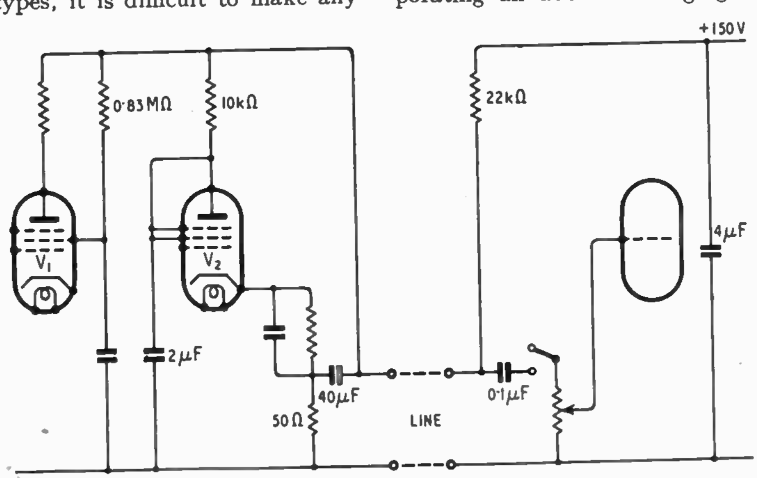

Fig. 2. Method of obtaining H.T. supply from main amplifier.

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Microphone Pre-amplifier—
impedance permits operation with an unscreened line to the main amplifier. This feature was considered essential, as screened cable, apart from expense, is less durable and much more awkward to handle and joint than ordinary T.R.S. flex.

There is, of course, a considerable loss in the output stage due to the use of the very low load resistance of 100 ohms, but the overall gain of the amplifier is sufficient for all ordinary purposes. If desired, higher values can easily be substituted by a switch, so that when conditions permit the operation of a higher impedance line a higher signal level can be maintained.

H.T. consumption is approximately 2 mA at 100 volts and can, therefore, be supplied easily from a dry battery. Alternatively it may be obtained from the main amplifier, either by a separate line, or by utilizing a species of phantom circuit on the existing signal line, as shown in Fig. 2. The latter method has proved entirely satisfactory. A switch has been fitted to disconnect the circuit for occasions when the main amplifier is being used alone, otherwise its input will be shunted by the comparatively low 22kΩ resistance.

It will be noted that the anode circuits of the pre-amplifier have been rearranged slightly in order to provide the necessary filtering between A.F. and D.C. as simply as possible. This also permits the use of a slightly higher H.T. voltage with a consequent substantial increase in gain, and it becomes possible to reduce the load resistance to a figure as low as 50 ohms. The blocking condenser should be as large as possible in order to keep the line impedance low at low frequencies. The writer has used 40μF but a value of the order of 100μF would be preferable, and is not difficult to arrange since the rated working voltage need not be more than about 150 volts.

The H.T. supply must be adequately decoupled and should be taken from a potential divider in preference to a series dropper, in order to prevent excessive rise of voltage on the line and on the electrolytic blocking condenser if the heaters of V_1 and V_2 are cold.

The use of this type of pre-amplifier is not, of course, confined to the sound cell microphone. With suitable alterations to the input constants, any other type of microphone may be used, and a pickup may be fed into the grid of V_2 or the suppressor of V_1. In fact it may easily be developed into a mixing unit of any desired complexity. The writer has incorporated a method of remotely controlling the main amplifier. The main virtue lies in the use of a cathode follower for matching to a low-impedance line, and in the writer's opinion represents a distinct advance on the conventional output stage with step-down line transformer.

Clip-on Test Prod

Made from Easily Obtained Materials

THE test prod described here, although it is not quite as simple in construction as the plain pencil type, combines the slenderness and adequate insulation of that type with a gripping device that enables it to be clipped on to a test point and left hanging there while both hands are free for work. Anybody who has once made and used one of these gadgets will wonder how he ever put up with the non-gripping type. It can be easily made in the most modest workshop.

Fig. 1 (a) shows the general appearance and dimensions. When the cross-bar in the handle is pulled back by the forefinger and thumb, the gripping jaws A and B at the business end are separated. Inside the handle, as shown in Fig. 1 (b), there is a spring that normally presses these jaws together, thus gripping the wire, terminal, etc., that form test points, when this cross-bar (which slides in a slot in the hollow handle) is released. The details will probably be obvious from the diagrams. The author has found it possible to construct these gripping test prods with quite simple and easily obtained materials such as a bicycle spoke for the inner rod, thin metal tubing, Terry springs, and ebonite tube for the handle part.

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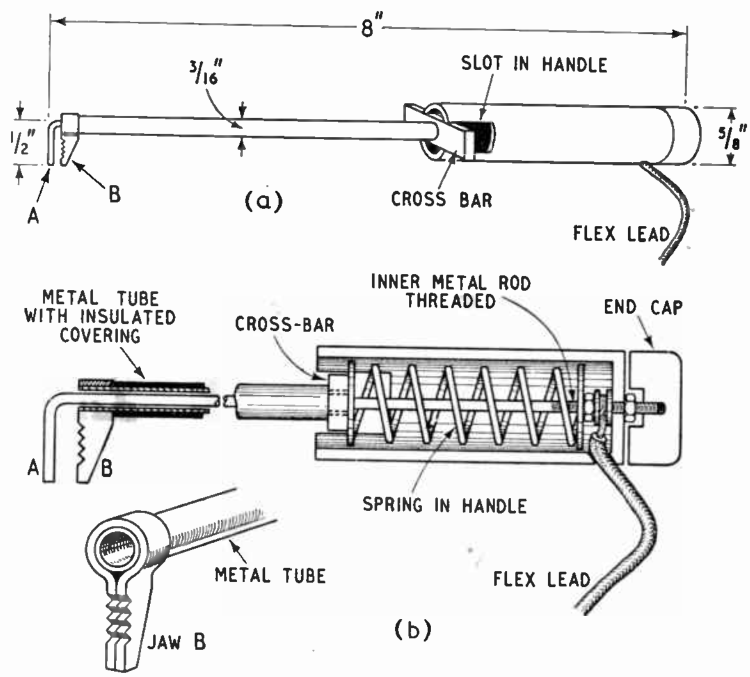

Fig. 1. Constructional details of the clip-on test prod. For general-purpose use the handle portion can be 3½ in long and the prod part 4½ in.