TECHNICAL TOPICS

RADIO HANDBOOK

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Cathode Follower Circuits

The principles of the cathode follower have already been discussed, and by way of demonstrating a practical application of the principle, a complete amplifier system will now be described. In this, 6L6 valves are used as triodes to obtain an output of 12 watts at very good quality.

To promise good quality with only an ordinary power transformer as an output transformer may lead to a "raising of the eyebrows," but this is quite possible. The output impedance of a cathode follower is low, and as a result the output transformer does not require as large an inductance as it would for the conventional arrangement. It is this high inductance which adds to the cost of a good quality output transformer. Whereas the conventional arrangement of 6L6's in push-pull requires a load impedance of 10,000 ohms, the arrangement shown in the circuit has a load impedance of approximately 500 ohms.

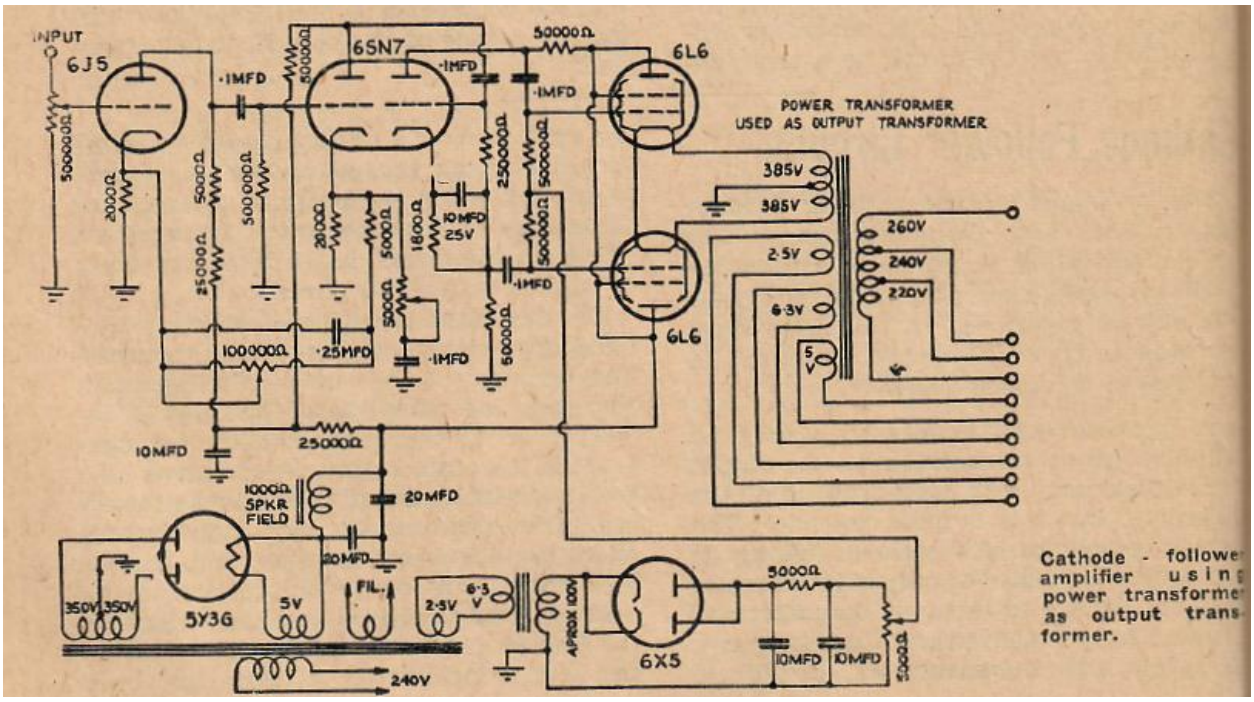
In the standard cathode-follower circuit, input voltage appears across the cathode resistance as the cathode swings with the grid, and since the output also is developed across this resistance, the arrangement is therefore highly degenerative, as a result of which distortion will be extremely low. Other features are high input impedance, low input capacitance and, as has been shown, low output impedance.

These characteristics are important to the builder of a high-fidelity amplifier. In the past, considerable thought has been necessary on the matter of suitable quality push-pull input and output transformers. A phase inverter could be used in lieu of the input transformer, but there is no substitute for a good-quality output transformer. In the conventional arrangement, good filtering and power supply regulation are essentials, and these points alone often resulted in a compromise between efficiency and cost.

Having decided to use a push-pull cathode follower in the output stage of the amplifier, it is feasible to use a phase inverter to feed the output valves, since cathode followers have high input impedance and low input capacity. This allows the designer to use large values of plate resistance in the inverter to get large swings. Also, due to the mode of operation of the output stage, it is not necessary to deliver power to the grids of the final valves, voltage swings are more important, so that an input transformer with a low secondary resistance is unnecessary. Finally, the low output impedance of the cathode follower stage permits an output transformer of simple design to be used with satisfactory results.

Several novel features will be noticed on reference to the circuit diagram. An ordinary receiving type power transformer is used as the output transformer. The 2.5, 5, and 6.3 volt windings offer a host of output impedances used either singly or in series aiding for matching speaker voice coils or low impedance lines. The normal 240 volt input primary winding comes in handy for feeding a 500 ohms line, and the voltage tappings 220 or 260 allow adjustment.

The bias supply is another interesting feature. The output valves, when operated as cathode followers, require a fixed bias supply. The usual method of obtaining this supply is to use a specially-designed power transformer with taps from which the bias supply is taken off and rectified. Such transformers, though not terrifically expensive, are almost impossible to obtain, and the arrangement shown in the circuit overcomes the problem in a very simple manner. A 6.3-volt filament transformer is operated backwards, with the 240-volt winding connected to the 6X5GT rectifier. The 6.3-volt winding is connected to a 2.5-volt winding on the main power transformer. As a result of this connection, approximately 100 volts is available for the bias rectifier. The rectified voltage is passed on to the bias voltage divider, and 20 volts is taken off for biassing the 6L6 valves. Note that the electrolytic capacitors are connected opposite to the usual power supply connection. This is necessary because the negative is isolated from earth, and the positive side is earthed instead. The bias should be adjusted to 20 volts by varying resistor R with the 6L6 valves out of their sockets.



Cathode - follower amplifier using power transformer as output transformer.

Some technicians may prefer to use a permag. speaker, in which case the field coil can be replaced by a 10 henry 150 mA choke. There is no need to feel concerned over the filtering, since there is only slight gain in the cathode follower stage and it is possible to use less output stage supply filtering than normally would be necessary. Adequate smoothing for the early stages is provided by an additional resistance-capacitance filter section.

If more output than 12 watts is required, additional 6L6 valves may be added in parallel. Negative feedback is applied between the first and second stages to provide bass and high boost.

For maximum performance, a bass reflex enclosure should be used for the large speaker. This is essential if the low-frequency reproduction capabilities of the system are to be fully used.

Though 6L6 valves are shown, it would be quite possible to obtain equally good results, but with lower output, using smaller valves, such as 6V6's, 6F6's, 2A3's and 6A3's, or higher output using 807's or similar valves, but larger size power transformers will be required for use as an output transformer if the power delivered is greater than about 45 to 50 watts.