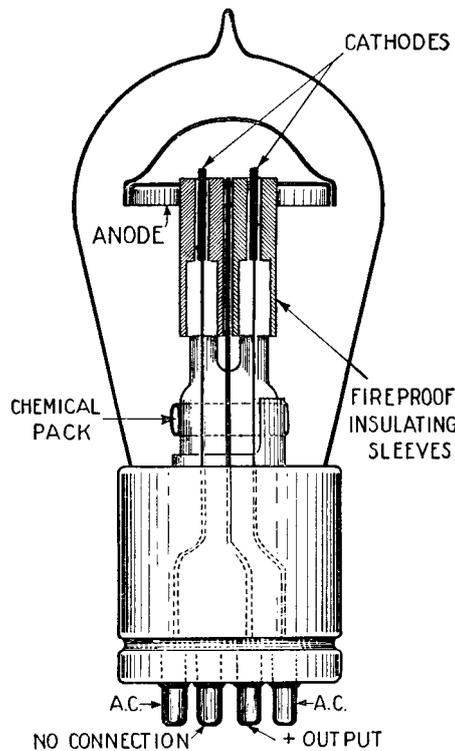


A New Rectifier Tube for "A-B-C" Power Units

Here is described another step forward in radio—a rectifier tube which will pass sufficient current to supply the power needs of every filament, plate and grid-bias in a receiver employing 199-type tubes.

THE development of a new type rectifier tube, termed the "BH," now makes it possible, for the first time, satisfactorily to obtain "A," "B," and "C" voltages from the A.C. light socket. The radio experimenter and set builder have long awaited the opportunity to obtain a rectifier which would have sufficient current and voltage capacity to light the filaments of 199-type radio tubes, *in series*, and at the same time supply sufficient plate voltage to operate a power amplifier.

The new type fulfills these requirements in a particularly satisfactory manner; and there still remains a reserve of power from which the radio set may draw at momentary overloads, without fear of burning out the tube or impairing the quality of reproduction.



The arrangement of the elements in the new rectifier tube may be clearly seen from this sketch. The anode is connected by the center rod to the output prong; and the chemical pack to the glass stem.

Fig. 1 is a schematic drawing of an "A-B-C" power unit with the "BH" tube. The power transformer is built to supply 350 volts, on each side of the high-voltage secondary winding, at no load. The current-carrying capacity of this winding should be equal at least to 85 milliamperes; and in order to insure good regulation in keeping with that already determined by the tube, the regulation of the power transformer should be not more than 10 per cent. The power transformer has also a filament-supply winding which delivers five volts at .5 amperes for the filament of a 112 or a 171 power-amplifier tube.

FILTERING THE OUTPUT

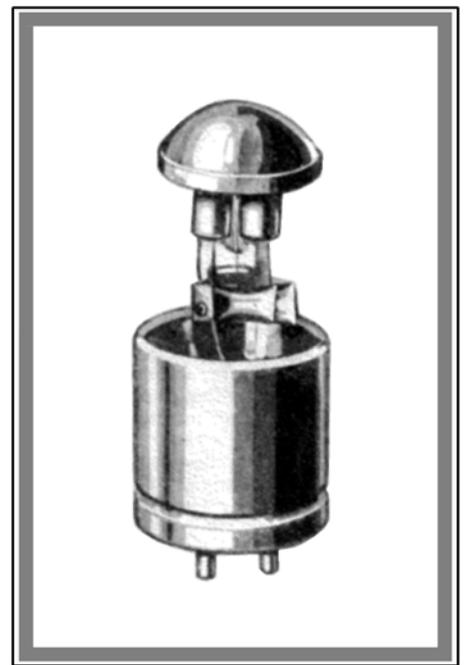
The usual condensers of 0.1- μ f. capacity, C_1 and C_2 , are placed across each half of the transformer secondary as shown in Fig. 1. The filter circuit consists of two choke coils, L, L, capable of carrying at least 85 milliamperes D.C. and having an inductance of at least 25 henries per choke when passing this amount of D.C. Several manufacturers are now supplying such choke coils. The filter condensers are arranged as shown in Fig. 1: The first, C_3 has a 4- μ f. capacity, C_4 has 4- μ f. and C_5 has 6- μ f.

The resistance-control unit, which is used to determine the various "B" voltages for the receiver and to drop the "B+" maximum voltage to the value required by the filaments in series, presented quite a problem in its development, because practically no manufacturers of resistance units had conceived the demand for the types required particularly in the case of variable resistors. The great difficulty was to find resistors of sufficient current-carrying capacity and a wide-enough range of resistances to be of value.

The ideal unit for this service would be a variable resistor of at least 60-milliamperes current-carrying capacity with a resistance range of from 2500 to 5000 ohms. One arrangement which was used to achieve the degree of control required was a combination of a fixed 3000-ohm resistance, R_3 , in series with another fixed resistance, R_1 , of 5000 ohms, around which was shunted a third resistance, R_2 , which has a variable resistance of 2,000 ohms, maximum value.

Several potentiometers on the market will fill this requirement; although there are none yet which have been specifically designed for the circuit. The value of the remaining resistances of Fig. 1 are shown in the diagram, and are the customary "B" power-supply specifications.

The filament of the power-amplifier tube, being supplied with raw A.C. has a 400-ohm potentiometer, R_8 , connected across its terminals. The variable tap of this potentiometer is connected to "B—", and is set at such a position as to give minimum A.C. hum. The "C" voltage for the power amplifier is obtained from a variable resistor, R_7 ,



This illustration shows the elements of the new rectifier tube. The parts may be identified from the sketch at the left.

Photos by courtesy of Raytheon Mfg. Co.

connected as shown. In order to obtain 45 volts "C" from this source, it would be necessary that R_7 have a maximum resistance of at least 600 ohms.

ADDITIONAL VOLTAGE AVAILABLE

The performance of the "A-B-C" power unit is to a very great degree dependent upon characteristics of the new tube, which are of an extremely technical nature, and can best be appreciated from a comparison with other rectifiers designed for "B" power service.

For example, if a "B" power supply which has hitherto been equipped with a type "B" tube is now equipped with one of the new "BH" tubes, there will be an average increase in output from the power supply unit of 30 volts for any given radio set.

When adjustment of the radio-frequency and detector voltages is made, reducing them to their previous values, there will be a further increase in the voltage output of the power supply unit, of from five to fifteen volts. This high voltage is of course available and extremely desirable for use in connection with the power amplifier; and for this reason makes the new tube more valuable as a rectifier.

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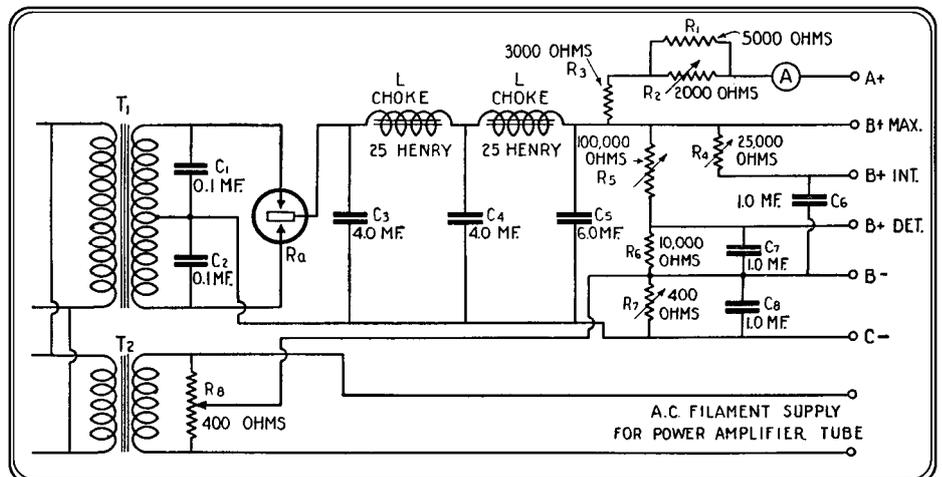


Fig. 1. The circuit diagram of an eliminator supplying "A, B and C" current to the receiving set. This is rectified by the new tube, shown above, from the 110-volt A.C. house circuit.

A New Rectifier Tube

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BETTER REGULATION

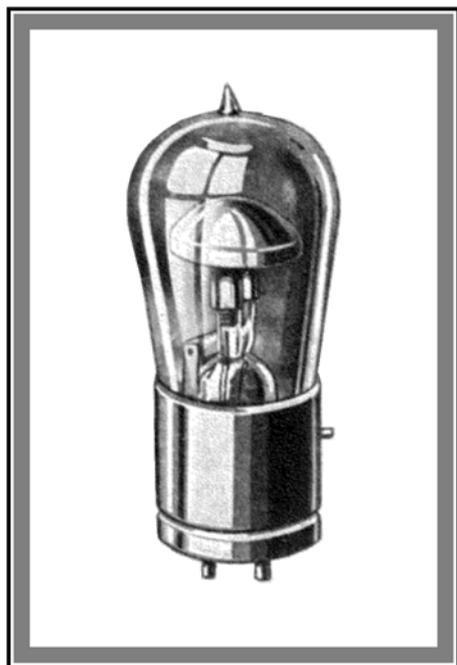
Another feature of the new rectifier, which is of great importance in connection with the "A-B-C" power supply unit, is the improved regulation of the tube itself. Actual measurements have shown that the new tube has a constant voltage drop from a very low current up to 85 milliamperes. If the output from the rectifier is never less than 10 milliamperes, as will be the case if a suitable system is adopted, the only regulation of the power supply needed will be that of the transformer and filter circuit. There will be no loss of voltage due to changing characteristics of the tube. This feature is really remarkable and one which has never before been available in power-supply rectifiers.

In order to take advantage of this characteristic, the constructor of the unit may well pay attention to the proper design of its power transformer and filter circuit, with regard to loss of voltage which might be caused by poor regulation.

An opportunity to improve the regulation of the filter circuit may be found in condenser C_3 of Fig. 1. By increasing this capacity from 2- to 4- μ f., at 85 milliamperes, an increase in D.C. output of approximately 15 volts may be secured.

MARGIN OF RESERVE POWER

Still another feature of the new tube which is of considerable importance in obtaining high-quality reproduction is the reserve power available for momentary overloads without damage to the rectifier. Extreme bursts of volume from the speaker demand proportionate amounts of energy from the power-supply unit. If this energy is not available at a constant voltage, there is certain to be distortion and a considerable loss of quality. If the power-supply unit is properly designed with regard to regulation, and if the rectifier is capable of delivering these peaks of energy without loss of voltage, good reproduction is insured at all times.



The size of this rectifier tube is approximately the same as that of the ordinary vacuum tube. The position of the elements may be easily seen.

Photos courtesy Raytheon Mfg. Co.