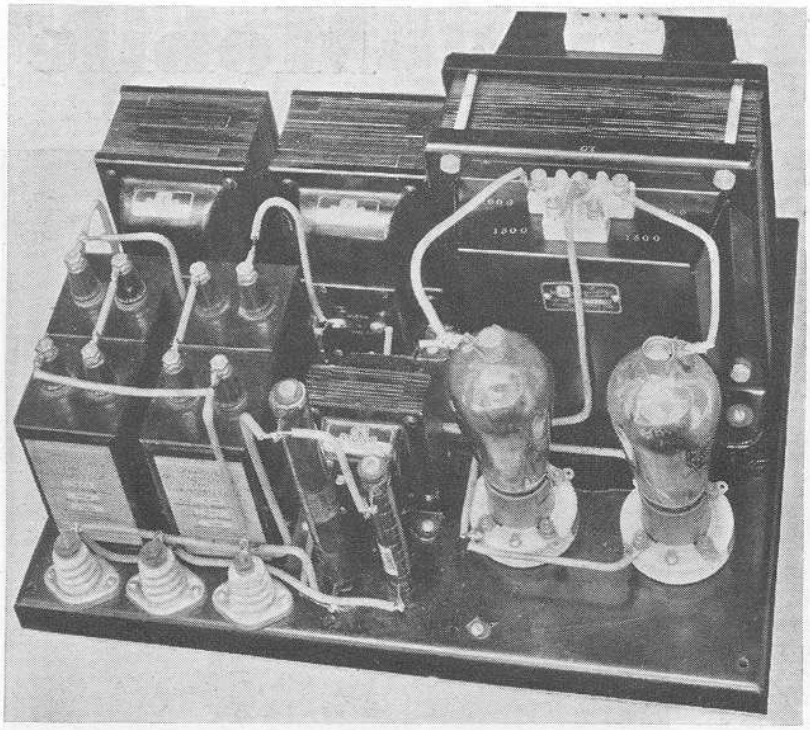


In building this power supply the leads were all kept above the chassis for greater safety and for servicing.

High Voltage Power Supplies

by LOUIS J. GAMACHE, W9RGL
Development Engineer
Standard Transformer Corp.
Chicago, Illinois

A ripple-free high voltage supply can be built by following the author's article.

THE proper design factors of a high voltage power supply, in the majority of cases, are often sadly neglected. It is common to find that the constructor of a power supply is left to a haphazard guess as to what is needed. Consequently, the entire operation and performance of the transmitter, or associated apparatus, does not always live up to the expectations of the builder.

In this day and age, where economy is of paramount importance, the *bargain price* transformers and chokes appear to be very attractive. However, in the manufacture of transformers and chokes, the copper and iron used cost the various manufacturers approximately the same amount in dollars and cents. Therefore, it stands to reason that the *economical* transformers and chokes are either very skimpy on iron or copper, or both, and these units, although specifications indicate that they will operate satisfactorily on CW, are not recommended for phone, or where the apparatus is left on for any period of time.

Another disadvantage of the above units, is that their regulation and IR drop (that is the resistance of the copper) is such that even on CW, the note may be chirpy. Another thing worth mentioning is that on the *economical* transformers, the voltage is rated as (a.c. voltage), which does not take into account the d.c. resistance of the transformer or the voltage drop of the rectifier and chokes. This would lead one to interpret and expect erroneously higher voltages from such a transformer.

In constructing a power supply, it is advisable to consider that in the future, changes are bound to occur in transmitting tubes and transmitter design and the yearning for higher power must always be satisfied. Therefore, the design of a power supply should be conservative.

The calculation of a power unit to supply energy to only one stage is rather simple. The factors necessary are: the d.c. voltage desired for that stage, the IR drop in the choke, tube, and transformer combination; and the current required for the bleeder to improve regulation. The bleeder serves a two-fold purpose by automatically discharging the condensers when the unit is turned off and preventing high peak voltage to the condenser when the load is removed.

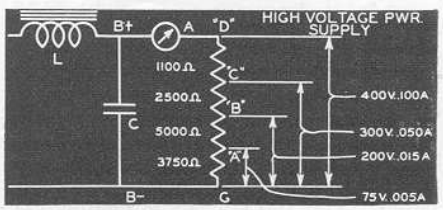
It may also be used in conjunction with a milliameter to indicate the voltage across that circuit (voltmeters are current meters with series resistors; a 0-25 milliameter with a 10,000 ohm resistor becomes a 0-250 volt voltmeter. Other values of current and resistor may be used for different ranges). With the new Ham regulations now in effect, the amateur wants to know the plate voltage to the final stage, which is advisable.

The design of a power pack to supply energy to more than one stage is a little more complicated, but well within the scope of the average amateur, experimenter and serviceman. The first step in calculating such a supply is to find the following: the current which will flow in the bottom part of the voltage divider or "bleeder current," and the current of circuits A, B, C, and D.

Using the following values in a hypothetical case, .020 amperes the bleeder current, .005 amperes the current desired from A, .015 amperes the current desired from B, .050 amperes the current desired from C, and .100 amperes the current desired from D, making a total of .190 amperes. Using the formula $R = \frac{E}{I}$ it is found that the resistance from A to G is 3750 ohms, capable of carrying .020 amperes continuous. The current flowing through the resistor A to B is .020 plus .005, or .025 amperes, and the voltage drop is 125 volts. Therefore, the resistance is 5000 ohms. The current flowing to the resistor C to B is .020 plus .005 plus .015, or .040 amperes, making a total of .090 amperes, and the voltage drop is 100 volts. Therefore, the resistance of this unit is 1100 ohms.

This voltage divider would then be a 15,000 ohm resistor capable of carrying .1 ampere. It will be more economical to use two individual voltage dividers, one of 5000 ohms capable of carrying 100 milliamperes, and the other of 10,000 ohms capable of carrying 50 milliamperes. Other power supplies may be figured by following the above procedure.

(*More data on page* 50)



Voltage divider circuit diagram.

It willy never do you any harm and may do you much good.

It is used in the automotive field. Facsimile is being used to make records of operations in the clock industry. There is no limit to the application of the various devices now being offered to the radio serviceman in fields far removed from radio. There is every justification for assimilating as much data as possible concerning present developments. Not that we dream of one service organization taking care of all types of service work, but that an organization is prepared to go into various fields and perhaps find a spot better suited to the individual or to the organization. And it is not an impossibility that a good radio service organization located in a mill town or factory town cannot build up a perfectly good clientele among the factories for the servicing and possibly, even installation of radio equipment in industry.

Town and Country

WE got a letter the other day from a serviceman who has an establishment here in New York and in the course of this letter he made a statement that set us to thinking. The gist of his statement was that he made it a practice to take in small receivers for servicing in the hopes that eventually he would be called in to service the large receivers he almost always saw in the homes where they had the little four-tube jobs. Furthermore, he admitted that in most cases he took a financial licking or at the best broke even on the majority of such jobs.

As I see it that serviceman has a problem. Here he is operating in a city with an unstable population and by that we mean that a good fat percentage of the inhabitants of Father Knickerbocker's town think it absolutely imperative that they move from one apartment to another every couple of years. It's true they may move only a block or two, but in a city of this size that's sometimes the equivalent of moving to a different town in other parts of the country. As soon as they move, they are besieged with advertisements for a new milkman, a new butcher, and, of course, a new radio serviceman. And being as susceptible to the written blandishments as the average New Yorker is, the chances are that when his receiver goes bad, he picks up the phone and calls in the new serviceman, totally forgetting the fellow who fixed up his little job last year. It's tough, but it's true.

On the other hand, the same procedure in suburban districts or in the country might be considered good business practice. In the first place most people in small towns own their homes, they do not even think about selling them every year or two. Therefore the serviceman who just breaks even on fixing up a so-called "secondary" receiver has a right to expect that he will be called upon to repair the large set if it needs attention. Business in small towns is conducted differently than it is in cities—everyone knows everybody else and if a serviceman does a good job once for a family, he is their serviceman for then on. Suburban folk have their tradespeople and it just never enters their heads to change except for a mighty good reason. . . . We could quote you case after case where people in small towns have done business for twenty, thirty and even more years with the same merchants. Once confidence is established, that's all there is to it.

No, we do not think that the serviceman in a large city whose clientele who lives in apartments and hotels should take a licking at random in the hope of future business. It's too much of a risk. Where a loss is inevitable, it must be taken, but as a business-getter, it just isn't worthwhile. —30—

High Voltage Power Supplies

(*Continued from page* 21)

The next step in designing a power supply is to determine the percentage of ripple permissible in the various circuits. Assuming that a ripple of 2 per cent is permissible in all of the various stages to which the supply furnishes energy, and consulting the manufacturer's ratings, a pair of suitable chokes are selected. For the voltage divider network calculated, it is found that chokes with a current carrying capacity of 200 milliamperes will have a d.c. resistance of approximately 70 ohms. The inductance of the filter chokes is to be approximately 20 henrys, and the swinging choke to swing from 8 to 35 henrys.

In calculating ripple, the lowest value of inductance in the swinging chokes is used. The percentage of ripple obtainable is calculated by using the formula $\frac{1}{C_1 L_1 C_2 L_2}$. Knowing the values of inductance, the values of condensers necessary are obtained by substitution until the proper percentage of ripple reduction is made.

The next operation in order is to determine the voltage drop in the rectifier. This may be obtained by referring to the tube manufacturer's data on the particular tube suitable for this application. With the figures obtained by adding the voltage from the output of the power supply, and the voltage drop in the rectifier tube, it is then necessary to refer to the manufacturer's catalog of transformers to select the proper transformer as described in a previous article. If, however, it is found that manufacturers do not have transformers giving the exact specifications required, it is always safer to select a transformer having a higher voltage and current rating than that required.

In the construction of a power supply, it is well to caution the builder that high voltage power supplies are *lethal machines* and all precautions must be taken to prevent contact with living beings. —30—