Aug. 19, 1930. J. K. ELDERKIN 1,773,304

FILTER SYSTEM

Filed June 15, 1925

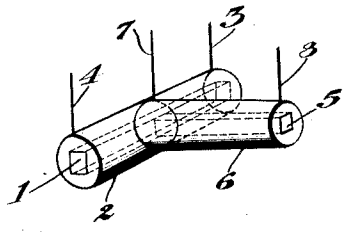


Fig. 1

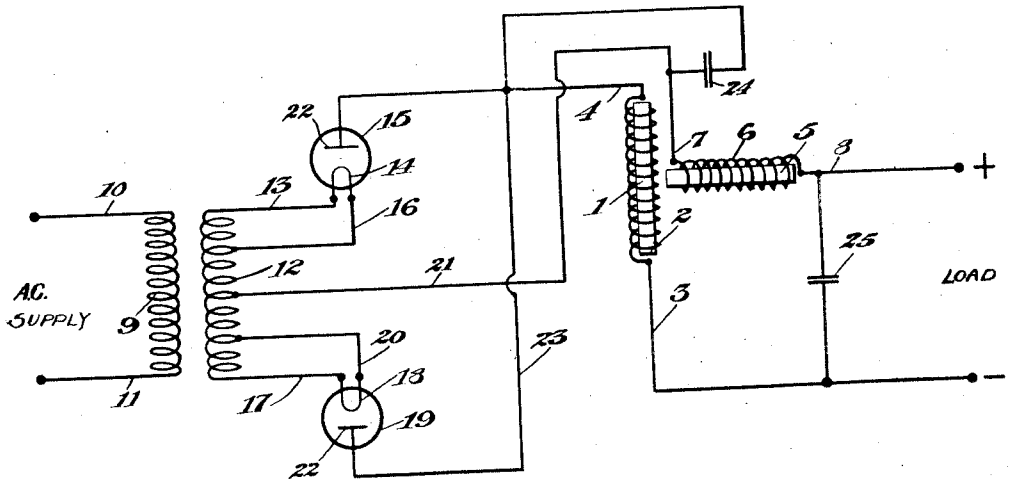


Fig. 2

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UNITED STATES PATENT OFFICE

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FILTER SYSTEM

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This invention relates to improvements in choke coils primarily for filter circuit as are used in filtering or smoothing out rectified alternating current, and particularly when current is used as a source of power for radio sets.

In such systems it has been the practice to connect choke coils into the circuit, with the choke coils spaced apart as far as possible to prevent any interaction between them. It has been experienced that it is necessary to build the coils as when disposed with the cores or axes parallel to one another with a complete magnetic circuit and then separate them as far as possible in order to make them operate in any way effectively. In a filter system designed for radio service it is very desirable to confine the filter as compactly as possible, especially in receiving outfit so as to be portable and capable of being installed in reduced sizes of cabinet, and also to condense the weight to as low a limit as possible.

It is therefore an object of the invention to arrange a pair of choke coils in structural unity for compactness free from any deleterious interaction and offering a reduction in material employed in their construction with increased efficiency and obtaining a higher value of impedance with a minimum weight.

Another object of the invention is to reduce the number of turns of the coil windings decreasing the size of the coils.

Another object of the invention is to relatively dispose a pair of choke coils having straight cores so that the core of one winding is in the neutral field of the second winding, and in a preferred configuration in resemblance of a T.

Other objects and advantages will be more fully set forth in the description of the accompanying drawings forming a part of this specification, in which:

Figure 1 is a diagrammatic view of a pair of choke coils disposed with their cores at an angle to one another preferably at right angles in the arrangement of a T.

Figure 2 is a diagrammatic view illustrating a filter circuit of a rectified alternating current including a pair of choke coils in the leads in the related order as shown in Fig. 1.

The use of choke coils in radio circuits either transmitting or receiving to smooth out variations in the current is of recognized value, and likewise in an alternating current rectifier circuit, they have been employed as a part of a filter arrangement for eliminating the alternating current ripples in which an inductance is inserted in each of the leads of the rectified output current when used as a source of power for a radio set. The present invention provides for a relative arrangement of a pair of choke coils for compactness, increased efficiency and a reduction in material over standard coils of equal value.

Referring to the drawings, 1 indicates a core of a choke coil 2 having leads 3 and 4 from the opposite ends of the windings, thereof. 5 indicates a core of a second choke coil 6 having leads 7 and 8 leading from the opposite ends of the windings thereof. One of the choke coils is disposed transversely to the axis of the second, and as illustrated the choke coil 5 has one of its ends abutting the choke coil 2 centrally thereof in representation of a T or cross. The two cores however can be made integral or a single unit, so that the two cores are directly together with the winding or one coil divided so that one half the choke is on each side of the butt connection of the core of the second choke. The result of the two forms is practically the same, one form being the equivalent of the other.

In Figure 2 one form of a rectified filter circuit with the improved arrangement of choke coils included is illustrated and comprises a suitable alternating current transformer having its primary windings 9 connected to the alternating current supply (not shown) through the leads 10, 11. The secondary winding 12 has one of its leads 13 connected to one end of the filament or hot cathode 14 of a thermionic tube 15. A second lead 16 connects with the secondary windings and the opposite end of the filament 14 of the tube 15 for supplying suitable secondary voltage to said filament. An opposite end lead 17 of the secondary windings connects with one end of the filament 18 of a second thermionic tube 19 and a second lead 20 con-

nects with the opposite end of the filament 18 of the tube 19 and secondary winding 12 to supply current to said filament. The secondary winding is also provided with a central lead connection 21 connecting with the winding of the choke coil 6 at the input end, with the output end of said coil connected to the positive pole of the load. The two thermionic rectifier tubes 15 and 19 each have an anode 22 connected together by a wire 23 to which the branch or lead 4 of the choke coil 2 connects. The opposite end or lead 3 connects to or furnishes the negative pole or line of the load. A condenser 24 is connected across the circuit in front of both choke coils 2 and 6 by connecting with the wires 21 and 23 and a second condenser 25 is connected across the circuit on the other side of the chokes by connecting with the wires 3 and 8. Condenser connection across the circuit may be otherwise made as for instance as disclosed in a prior application filed by me on December 31st, 1924, Serial No. 759,124, as a means of eliminating the alternating current ripple from the rectified alternating current.

The operation of the transformer and two tube thermionic rectifier is well known and therefore the passage of the current is only briefly traced.

An impulse passes from the transformer over wire 21 and lead 7 to the winding of choke coil 6 and its lead 8 to the positive terminal of a utility device which may be the filament of a radio tube or any other device utilizing a direct current, thence over the negative lead 3 through the winding of choke coil 2 and its lead 4 to the anode of one of the two thermionic tubes 15, 19, depending upon which half cycle of the alternating current is being rectified at that instant. The second half cycle passes through the circuit in the same manner and returns through the transformer through the thermionic tube not used during the previous or first half cycle.

By placing the chokes in the relation illustrated that is, the employment of straight cores with the core of one winding in the neutral field of the second, the alternating current ripple or hum is greatly reduced due to the core of one choke being placed at the neutral point of the second choke thereby allowing fewer turns of wire in the chokes and a much smaller iron core to accomplish the desired result than could possibly be obtained by the use of chokes disposed so that their different magnetic fields are brought together with their directions parallel, it being recognized that if the lines of magnetic flux are in the same direction, the two fields mutually repel one another, or set up an induced current in one or the other, or otherwise affect the individuality of the coils detrimental to the purpose for which they are intended. Under the parallel disposition in practice it was found necessary to separate the coils as far as possible, which destroys the advantage of compactness and unity highly desirable for radio receiving outfits irrespective of any electrical value.

In the assembled arrangement it is not necessary to have a closed or partially closed core, the straight core being sufficient, thereby greatly decreasing the weight of the choke.

It is apparent that any type of rectifying means may be used and the condenser of the filter circuit placed in other relations than shown, or may be omitted, and therefore no restriction to any particular filter circuit or rectifying circuit is contemplated by the disclosure of the chokes in a particular circuit exemplified herein.

Having described my invention, I claim:

A filter for a rectified alternating current from a plural tube thermionic rectifier, comprising, a pair of choke coils each having its coil winding inserted in one of the rectified current circuit leads, the coils having their cores relatively disposed at right angles to one another, and with the end of one core centrally of the length of the other.

In witness whereof, I hereunto subscribe my name.

JAMES K. ELDERKIN.