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A. HUND

1,822,929

FILTER CIRCUIT

Filed May 12, 1927

FIG. 1

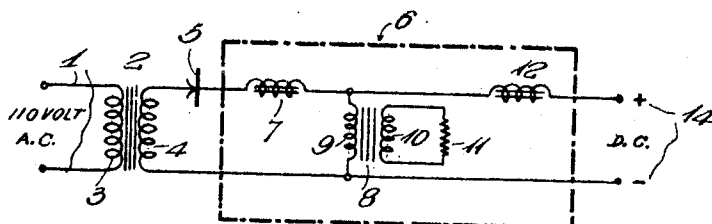


FIG. 2

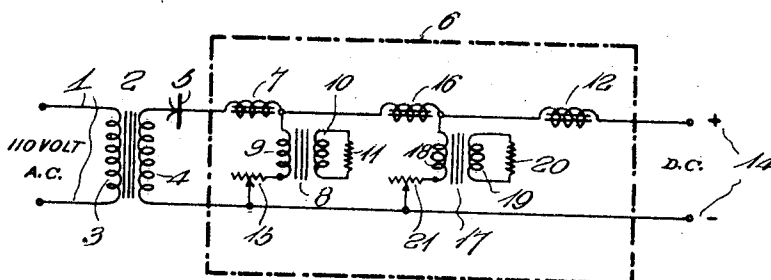


FIG. 3

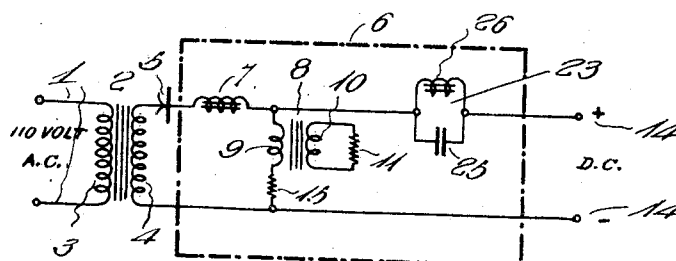


FIG. 4

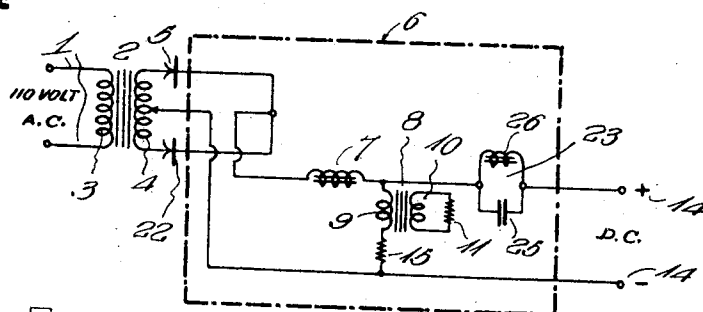
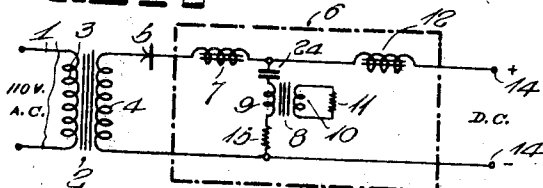


FIG. 5



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AUGUST HUND, OF BETHESDA, MARYLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
FEDERAL TELEGRAPH COMPANY, A CORPORATION OF CALIFORNIA

FILTER CIRCUIT

Application filed May 12, 1927. Serial No. 190,883.

My invention relates broadly to power supply circuits for electron tubes and more particularly to a filter system for rectified alternating current.

5 The object of my invention is to provide a simplified filter system for rectified alternating current eliminating the necessity of large size chokes and condensers and thereby reducing the inherent cost of manufacture and assembly of rectifier and filter systems.

Another object of my invention is to provide an inexpensive construction of filter circuit for interposition between a rectifier and the power circuits of electron tube systems for energizing the electron tube circuits from an alternating power supply system, while eliminating the effects of the cyclic changes in the supply source.

20 Other and further objects of my invention reside in the arrangement of parts in a filter circuit as more fully disclosed in the specification hereinafter following by reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a filter circuit for rectifier systems embodying the principles of my invention; Fig. 2 illustrates a circuit arrangement for a filter system constructed in accordance with my invention in which a plurality of sections are provided for smoothing out the rectified current; Fig. 3 illustrates a modified wiring arrangement for a filter embodying the principles of my invention; Fig. 4 illustrates the filter circuit of my invention as applied to a double wave rectifier system; and Fig. 5 illustrates a further modified circuit arrangement for the filter of my invention.

40 In rectifier systems for the supply of power to electron tube circuits from an alternating current lighting line, it has heretofore been necessary to employ large size chokes and large capacity condensers in order to carry the current required in the plate circuits of power tubes.

It is essential that the rectified current supplied to the circuits of electron tubes be smoothed to a degree which will avoid reproduction of noises in the circuits of sensitive

electron tubes. The filter circuit arrangement of my invention effects such smoothing of the rectified current by dissipative action with respect to the alternating current components, the dissipative means 55 which I provide for the alternating current components existent in the filter circuit enabling the direct current to be supplied to the electron tube circuits.

Referring to the drawings in more detail 60 reference character 1 designates the supply line which is usually 110 volts A. C. A transformer 2 is provided having a primary winding 3 connected with the supply line and a secondary winding 4 coupled thereto for conveying the alternating voltage to a suitable 65 rectifier indicated at 5 to the filter system of my invention. The filter system is illustrated as included within the dot and dash line 6. Choke coils 7 and 12 are connected 70 in series in one side of the line extending from the rectifier 5, and across the line I provide a dissipative filter system in the form of a transformer 8. The transformer 8 has its primary winding 9 connected across the line 75 and its secondary winding 10 short-circuited or partially short-circuited by closing the winding through a suitable resistance 11. The transformer system 8 segregates the 80 alternating current components from the rectifier circuit and dissipates the alternating current components for reducing their effects when properly adjusted. The rectifier 5 may be of the half-wave type as illustrated in Figs. 1, 2, 3 and 5 or of the full 85 wave type as illustrated in Fig. 4. In the full wave rectifier the fundamental frequency corresponds to an alternating current of double the frequency of the applied voltage. In the single wave rectifier the fundamental 90 current in the rectified branch circuit has the same frequency as that of the applied voltage taken from the alternating current network.

In Fig. 2 I have illustrated a filter system 95 embodying my invention with a pair of dissipative branches. The dissipative branch which includes primary winding 9 has resistance 15 connected in series therein. The second dissipative branch is connected across the 100

line and constitutes a transformer 17 having primary winding 18 and secondary winding 19. The primary winding 18 is connected in series with resistance 21 which is disposed
 5 across the line. A choke 16 is added to the line circuit between dissipative branches. The secondary winding 19 of the transformer 17 is connected across the resistance element 20 for dissipation of alternating current components which may be transferred thereto.
 10 Shunting the secondary windings 10 and 19 by means of resistances 11 and 20 respectively is equivalent to reducing the effective inductance across the line to a small value.
 15 The resistance 15 and the resistance of the primary winding 9 determine the direct current loss across the line. For that reason the resistance values are chosen such that they give the proper voltage drop due to the
 20 direct current without appreciable energy dissipation. The alternating current components become effective across the primary winding and are absorbed by the secondary winding for dissipation through a resistance.
 25 Increasing the number of stages as represented in Fig. 2 has the effect of more effectively eliminating the alternating current components.

In Fig. 3 I have shown a further modified form of filter circuit embodying my invention wherein a tuned circuit 23 is interposed in series in one side of the circuit leading from the rectifier. The tuned circuit 23 includes inductance 26 shunted by condenser 25
 35 and may be adjusted to the 120 cycle frequency where full wave rectification is employed or to 60 cycles where half wave rectification is employed.

In Fig. 4 I have illustrated the full wave rectifier constituted by the individual rectifier devices 5 and 22 as applied to the filter circuit system of my invention.

In order to positively prevent any effect upon the direct current components in the filter system of my invention I may interpose a condenser 24 in series with the primary winding 9 as represented in Fig. 5. The alternating current components freely pass through condenser 24 and are absorbed in
 50 the transformer system 8 thereby eliminating from the filter system the undesirable alternating current components.

It will be observed that while condensers 24 and 25 have been represented as constituting a part of the filter system these condensers are not large in size and are not comparable with the type of condensers heretofore employed in filter circuits. The reduction in number and size of condensers required in the filter circuit for effectively
 60 eliminating the undesired disturbances is such as to clearly decrease the manufacturing costs of the apparatus.

While I have described my invention in certain of its preferred embodiments, I de-

sire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A filter system for separating alternating and direct components of current obtained from a source of rectified alternating
 75 current comprising a transformer having one winding connected in parallel through a condenser with said source of rectified alternating current and another winding of said transformer connected in parallel with a resistance unit the last mentioned winding and resistance unit forming a dissipating circuit for all of the alternating current components from said source.

2. A filter system for separating alternating and direct components of current obtained from a source of rectified alternating current comprising in combination a transformer having one of its windings connected in series with a condenser and the series combination connected across said source of rectifying alternating current and another winding of said transformer connected in parallel with a resistance unit comprising a dissipating circuit for all of the alternating current components from said source.

3. In combination, a source of rectified alternating current having both alternating and direct current components, and inductance connected in series with said source, and a shunt circuit connected across said source and said inductance, said shunt circuit comprising a condenser, the primary winding of a transformer and a resistance connected in series, and a secondary winding of said transformer inductively coupled to said primary winding and having a resistance connected in parallel therewith, the resonant frequency of said shunt circuit being widely different from the frequency of any of the alternating current components from said source.

In testimony whereof I affix my signature.
 AUGUST HUND.

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