Dec. 9, 1930. P. H. GEIGER ET AL 1,784,004

ELECTRICAL FILTERING APPARATUS

Filed Oct. 7, 1925

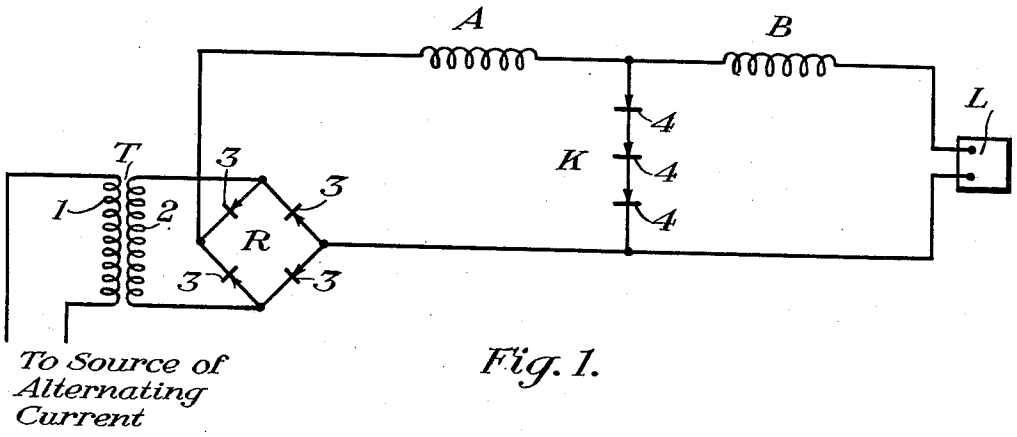


Fig. 1.

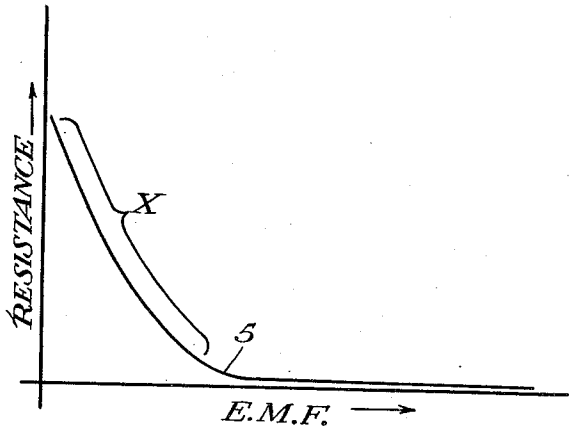


Fig. 2.

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Patented Dec. 9, 1930

1,784,004

UNITED STATES PATENT OFFICE

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ELECTRICAL FILTERING APPARATUS

Application filed October 7, 1925. Serial No. 61,013.

Our invention relates to electrical filtering apparatus, and particularly to apparatus interposed between a source of pulsating current and a load for reducing the pulsations in the current supplied to the load.

We will describe one form of filtering apparatus embodying our invention, and will then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a diagrammatic view illustrating one form of filtering apparatus embodying our invention. Fig. 2 is a diagram showing, graphically, one characteristic of a portion of the apparatus illustrated in Fig. 1.

Referring first to Fig. 1, the apparatus comprises a source of pulsating current here shown as a rectifier R supplied with energy from the secondary 2 of a transformer T. The primary 1 of the transformer is supplied with alternating current from a source not shown in the drawing. The rectifier R may be of any suitable form, and as here shown it is made up of four rectifying elements 3, each of which, may comprise a metal having a compound formed thereon. One form of element is composed of copper having cuprous oxide formed thereon, and has the property of offering a very much higher resistance to current flow from the copper to the oxide, than from the oxide to the copper. Rectifier elements of this type are shown and described in an application for Letters Patent of United States by Lars O. Grondahl, Serial #1,111, filed Jan. 7, 1925, for Uni-directional current carrying devices.

The energy supplied by the transformer T is changed by the rectifier R into pulsating current which is supplied to a load indicated diagrammatically at L.

Two reactors A and B are connected in series with the load L, and a resistor K is connected across the rectifier R and the reactor A. This resistor K comprises one or more elements 4, each similar to the elements 3 of rectifier R, and connected in series so that current flowing through the shunt path including reactor A and resistor K traverses each of the elements 4 in its low resistance direction.

We have discovered that uni-directional current carrying devices of the type disclosed in the patent application mentioned above have the characteristic of varying their electrical resistance in response to changes in the electromotive force applied thereto. Referring now to Fig. 2, the curve 5 represents the values of the resistance of one of the elements 4 in the low resistance direction for different values of applied electromotive force. It will be seen that for a limited range of applied electromotive force, represented by the portion of the curve 5 indicated at X, small increases in the electromotive force applied to the element cause comparatively large decreases in the resistance of the element. The resistor K is made up of such a number of elements 4 connected in series that the electromotive force across each unit is within this limited range.

Although experiment has shown that devices similar to those described in the Grondahl application referred to above are most suitable for use as elements 4, other substances having similar properties such as galena or crystalline selenium may be substituted.

In explaining the operation of the apparatus we will first assume that the pulsating electromotive force delivered by the rectifier R is at its maximum value. The electromotive force applied to the terminals of resistor K is therefore at its maximum and the resistance of the elements 4 is comparatively low. A considerable current therefore flows through resistor K and causes a large voltage drop in the reactor A. As a result the electromotive force actually applied to the load L is less than would be applied thereto if resistor K were omitted from the circuit. As the electromotive force delivered by the rectifier decreases, due to the pulsating character of the output of the rectifier, the electromotive force applied to resistor K decreases correspondingly. The resistance of the elements 4 therefore increases and the resulting decrease in the current through the resistor K is greater than would be the case if the resistor were of usual resistance material. Due to the lower

value of the current through the reactor A, the voltage drop through this reactor decreases and the electromotive force applied to the load increases.

When the current through reactor B is increasing, energy is stored in the field sursounding this reactor, and when the current tends to decrease this energy is returned to the circuit and tends to maintain constant the current through the reactor, and hence the current through the load L.

It will therefore be seen that the reactors A and B and the resistor K comprise filtering apparatus which tends to smooth out the pulsations in the current supplied to the load L and to maintain this current at a steady value.

One advantage of our invention is that because of the variations in the resistance of the elements 4 in response to changes in applied electromotive force, the power consumed in the branch circuit through the resistor K is but a small fraction of the power which would be wasted by an ordinary resistor. That is to say, with apparatus embodying our invention, much more effective filtering can be accomplished, for a given amount of wasted power, than with filtering apparatus hitherto known.

Although we have herein shown and described only one form of filtering apparatus embodying our invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of our invention.

Having thus described our invention, what we claim is:

1. A filter for use with a source of pulsating current and a load, comprising a plurality of elements connected in series across the source in parallel with the load, each such element exhibiting a considerable variation in resistance in response to a comparatively small change in the electromotive force applied thereto over a limited range of such electromotive force, and the number of such elements being such that the electromotive force across each such element is within said limited range.

2. A filter for use with a source of pulsating current and a load comprising a plurality of elements connected in series across the source in parallel with the load, each such element exhibiting a considerable variation in resistance in response to a comparatively small change in the electromotive force applied thereto over a limited range of such electromotive force, and the number of such elements being such that the electromotive force across each such element is within said limited range, and a reactor interposed between the source and the load.

3. A filter for use with a source of pulsating current and a load comprising a plurality of elements connected in series across the source in parallel with the load, each such element exhibiting a considerable variation in resistance in response to a comparatively small change in the electromotive force applied thereto over a limited range of such electromotive force, and the number of such elements being such that the electromotive force across each such element is within said limited range, a reactor interposed between the source and one terminal of said elements, and a second reactor interposed between said one terminal of said elements and the load.

In testimony whereof we affix our signatures.

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