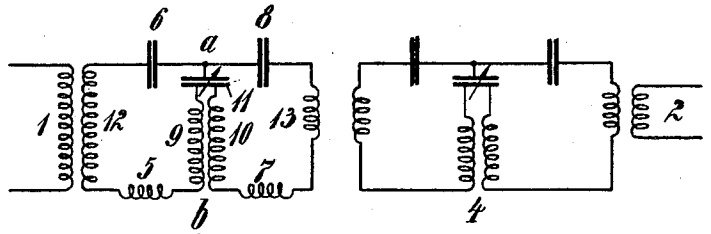
Oct. 19, 1926. 1,603,805

H. RIEGGER

FILTER CIRCUITS

Filed August 8, 1922

Fig. 1



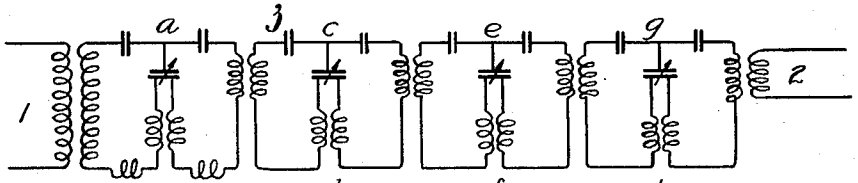
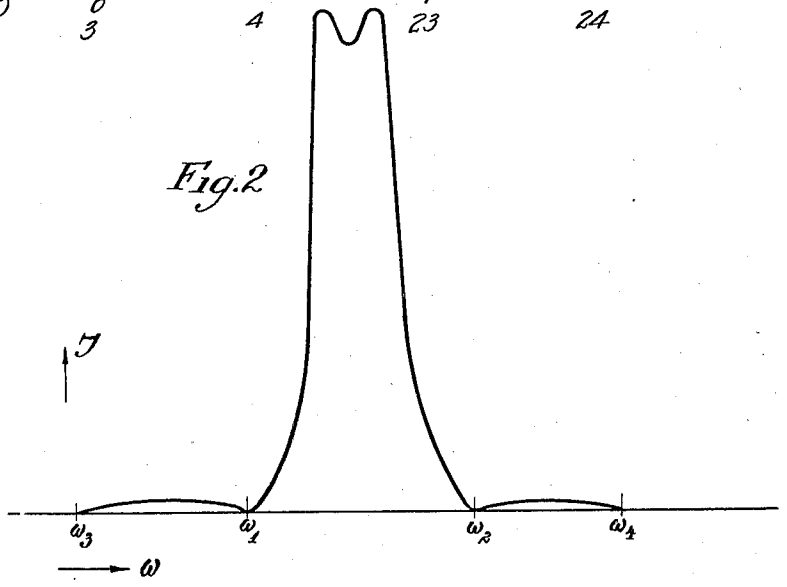


Fig. 3

b 3 d 4 f 23 h 24

Fig. 2



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UNITED STATES PATENT OFFICE.

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FILTER CIRCUITS.

Application filed August 8, 1922, Serial No. 580,469, and in Germany August 17, 1921.

It is known to use for the transmission of electric oscillations a chain of filter circuits which permit the passage of oscillations within a determined frequency range, but which suppress the oscillatory currents outside of said range.

The present invention relates to a chain of filter circuits, in which at least at two points between the individual circuits inductive as well as capacitative coupling exists, the self-induction and capacity at the points of coupling being so selected that at the limits of the filter range the coupling becomes zero.

A chain of filter circuits of this type has the advantage that at the above-mentioned limits practically no oscillations are transmitted whereby the admittance of the chain beyond these limits is generally quite small while all frequencies located within these limits are well transmitted.

An embodiment of the present invention is shown by way of example on the accompanying drawing, in which:

Figure 1 is a diagrammatical illustration of the filter circuit chain, while

Figure 2 shows the efficiency curve, and

Figure 3 shows a modification of the circuits shown in Figure 1.

The windings 1 at one end of the chain, being suitably excited, transmit the oscillations through the chain of filter circuits to windings 2 at the other end of the chain, by which latter windings they may be transmitted to any desired receiving element. The chain consists of two members 3 and 4. Both members are of almost similar construction. The member 3, for instance, consists of two elementary oscillatory circuits of which one comprises the self-induction 5 and the capacity 6, while the other comprises the self-induction 7 and the capacity 8. These two elementary circuits are coupled with each other inductively by the transformer windings 9 and 10 and capacitatively by the condenser 11, and each of these elementary circuits is tuned to a frequency to be transmitted to produce a well known two peak resonance curve. The windings 12 serve as a medium for coupling this chain member to the energy supply coil 1, and the windings 13 serve as a coupling medium with the second chain member 4. If the self-induction produced by 9 and 10 and the capacity 11 form for themselves a combination in resonance with the transmitted electric oscillations, the capacitative reactance is equal but opposite to the inductive reactance so that their sum substantially equals zero. Consequently the potential difference between points a and b will be zero provided the ohmic resistance be negligible. In this case, no transmission of the oscillations from the oscillatory circuit 5, 6 into the oscillatory circuit 7, 8 will take place. The values of the self-induction 9, 10 and of the capacity 11 are selected so that resonance occurs at one of the two limits of the desired frequency range, beyond which oscillatory currents should not be allowed to pass. In the second chain member 4, on the other hand, the corresponding parts are so dimensioned that the resonance occurs at the other limit of the range. In this manner, an efficiency is produced as is illustrated by the curve shown in Figure 2.

The electromotive force in the supply windings 1 (Figure 1) may be maintained constant, the frequency of oscillations being however variable. If in this case the frequencies are plotted as abscissæ while the currents that are produced in the receiving windings 2 are plotted as ordinates, the curve shown in Figure 2 will be produced. It is assumed in this case that the two systems are suitably coupled so as to slightly broaden the resonance curve within a very narrow band of frequencies, which is desirable in practice. For this reason the resonance curve shown in Figure 2 has been shown with well known two peaks closely located together, which represents for all practical purposes a resonance curve with a slightly broadened average peak having substantially the same maximum value between the frequencies ω_1 and ω_2. At the frequency ω_1 resonance occurs at the coupling points a, b in chain member 3, and at the frequency ω_2 resonance occurs in the chain member 4 at the corresponding points. Consequently, no currents flow in the windings 2 at the frequency ω_1 or ω_2. Within the frequency range between ω_1 and ω_2 the oscillatory currents will be allowed to pass through the chain as in the diagram shown in Figure 2.

In order to prevent a perceptible rise of the curve below the frequency ω_1 and above the frequency ω_2, further chain members with electrostatic and electromagnetic coupling can be provided, which, as indicated in Figure 2, produce resonance for instance at

the frequencies ω_3 and ω_4. The resonance curve must also at these frequencies touch the abscissæ line and it will, therefore, not considerably ascend between ω_1 and ω_3 on the one hand and between ω_2 and ω_4 on the other hand.

Such a modification is shown in Figure 3. Aside from the coupled members 3 and 4, such as are shown in Figure 1, the chain further contains the coupled members 23 and 24. The couplings between the points *a* and *b* in the member 3 becomes substantially zero value at the frequency ω_1 (Figure 2), between the points *c* and *d* in member 4 it becomes zero at the frequency ω_2, both similar to the manner explained with reference to Figure 1. The coupling between *e* and *f* in member 23 becomes zero at the frequency ω_3, and between the points *g* and *h* in member 24 at the frequency ω_4, as is also indicated in Figure 2.

I claim:—

1. An improved chain of electric filter circuits, comprising a plurality of members, each member consisting of a plurality of elementary oscillating circuits electromagnetically and electrostatically coupled with each other, the self-induction and the capacity at the coupling points being suitably selected to reduce the degree of coupling at a predetermined frequency to substantially zero value.

2. An improved chain of electric filter circuits, comprising a plurality of members each member consisting of a plurality of elementary oscillating circuits electromagnetically and electrostatically coupled with each other, the self-induction and the capacity at the coupling points being suitably selected to reduce the degree of coupling at a predetermined frequency to substantially zero value, one member of the chain having said zero value at the lower limit, and another member having said zero value at the upper limit of a predetermined range of frequencies.

In testimony whereof I affix my signature.

HANS RIEGGER.