March 18, 1941. W. HAGEN 2,235,018

ELECTRIC FILTER ARRANGEMENT

Filed Sept. 1, 1938

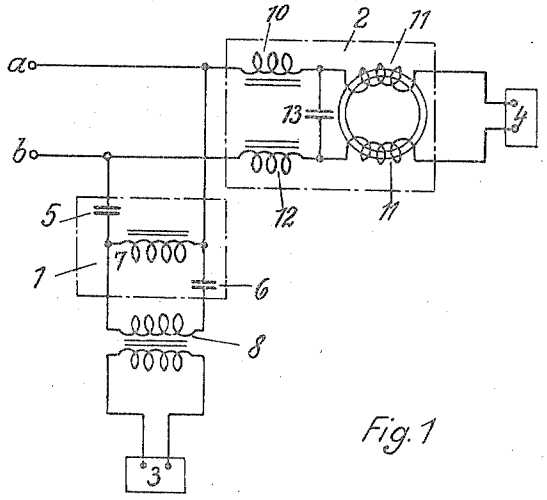


Fig. 1

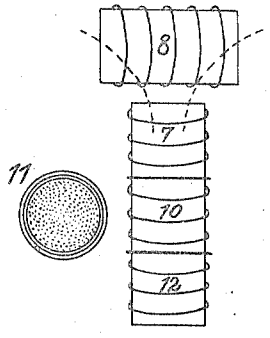


Fig. 2

Inventor:
Wolfgang Hagen
by E. D. Phinney Att'y

Patented Mar. 18, 1941

2,235,018

UNITED STATES PATENT OFFICE

2,235,018

ELECTRIC FILTER ARRANGEMENT

Wolfgang Hagen, Berlin, Germany, assignor to C. Lorenz Aktiengesellschaft, Berlin-Tempelhof, Germany, a company

Application September 1, 1938, Serial No. 227,911
In Germany September 3, 1937

4 Claims. (Cl. 178—44)

It is well known to transfer broadcast programmes, alarm signals and the like over wire networks, such as telephone network, by means of high frequency carrier currents. In systems of this kind electric filter circuits must be provided in order to separate the currents of different frequencies. For instance, the low frequency telephone talking currents are to be separated in this way from the high frequency wire radio currents.

The usual electric filter circuits comprise a high-pass filter and a low-pass filter. The high-pass filter is to be of the least possible attenuation in relation to the high frequency currents while being of very great attenuation as regards low frequency talking currents, in order, for instance, to preclude that the telephone conversations can be listened to on the lines of the high frequency receiving apparatus. The low-pass filter on the contrary is to avoid the high frequency currents arriving in the telephone apparatus in which they would be modulated with the talking currents, thus becoming audible in the high frequency receiver. Also, both filters must be of a construction symmetric to earth in order that no disturbing voltages shall be received.

Furthermore it is necessary that the number of the constructional elements employed in the filters and hence the space requirements be as low as possible.

The invention relates to a filter circuit that shall fulfill all these requirements. The high pass filter here comprises two asymmetric parts which are arranged in mutual opposition in the lines to which the high frequency apparatus is connected.

In accordance with another feature of the invention the output transformer to which the high frequency apparatus is joined is so dimensioned that its inductivity corresponds to the final inductivity of the high-pass filter.

Furthermore the invention relates to constructional features of filter arrangements as provided by the invention, the object being to obtain attenuation values that comply with the aforesaid requirements to the greatest possible extent.

The invention will be understood from the following description, reference being had to the accompanying drawing in which—

Fig. 1 shows the circuit arrangement of one embodiment of the invention, while Fig. 2 is a partially diagrammatic view representing constructional features of this embodiment.

a, b, Fig. 1, denote the supply lines which may be a telephone subscriber's lines, for instance. The electric filter arrangement joined to these lines comprises a high-pass filter 1 and a low-pass filter 2. To filter 1 a broadcast receiver or wire radio receiver 3, for example, is connected. A telephone set 4 of the customary type is joined to filter 2. Filter 1 comprises two asymmetric links, which are constituted by condensers 5, 6, an inductance 7 and the inductance of an output transformer 8. Filter 1 is thus formed of two serially connected monominal parts which are in mutual opposition arranged in the two wires connected to receiver 3. In the customary high-pass filters, composed of two symmetric parts, four condensers are necessary which are double the size of those forming the asymmetric circuit. In the case of asymmetric links, however, there is likewise symmetry to earth, as the condensers 5, 6 are practically of the same size, thus having the same capacity to earth. Transformer 8 is so dimensioned that its inductivity corresponds to the final inductivity of filter 1, that is to say, is calculated to form a part of this filter. In addition, transformer 8 is so dimensioned that the ohmic impedance at the receiver terminals, measured with low frequency, is very low in order to preclude the low frequency conversations being influenced from the high frequency side. Filter 2 consists of three inductances or coils 10, 11, 12, arranged in the lines *a, b*, and also comprises a condenser 13, connected in bridge of these lines. Inductance 11 has two windings disposed on the same core.

It is in general necessary to comprise the individual parts of filter arrangements of this kind in the smallest possible space, so that such parts will be easily influenced by electrostatic or magnetic fields. Such electrostatic influence may be obviated by means of earthed screens while in accordance with the invention the magnetic influence is suppressed by providing for a suitable mutual position of the parts.

As shown in Fig. 2, transformer 8 is so arranged that it shall be cut by the stray lines of force at right angles and symmetrically. The coils 7, 10, 12 are disposed in coaxial relation to each other and their axis is normal to the centre of the axis of transformer 8 so that the voltages produced in this transformer by the stray lines of force shall annul each other. This arrangement acts to prevent stray couplings from transferring the low frequency energy to high-pass filter 1, this filter being given by this means a very high attenuation.

In order that the high frequency attenuation

of the low-pass filter shall be as great as possible it is necessary that the coils 8, 7, 10, 12 traversed by the high frequency currents, do not influence the coils 11. The coils 11 are therefore positioned at right angles to the axes of the coils 8, 7, 10, 12 so as to be in symmetric relation to the stray fields of all these other coils, distubing voltages produced in the coils 11 therefore annulling each other. If in this way the coils 7, 10, 12 are positioned at right angles to the middle of transformer 8, and if this transformer and the coils 7, 10, 12 are located at right angles to the middle of the coils 11, then the best attenuation is attained.

The inductances employed in the described arrangement are preferably fitted with cores of finely divided ferromagnetic material.

What is claimed is:

1. An electric filter arrangement, particularly for use in the transmission of intelligence by high frequency energy on a two conductor telephone line which simultaneously are used for ordinary low frequency telephone traffic, characterized in that the filter arrangement includes a high pass filter comprising, a pair of conductors connected to respective ones of the conductors of said line, a condenser disposed in each of the conductors of said pair, an inductance bridged between the conductors of said pairs to interconnect oppositely poled terminals of said condensers, and a transformer bridged across the terminals of said conductor pair.

2. An electric filter arrangement according to claim 1, wherein the inductance of said transformer corresponds with the final inductance of said high pass filter.

3. An electric filter arrangement according to claim 1, wherein said transformer is of a low ohmic impedance for low frequency energy.

4. A unitary electric filter arrangement for use in a circuit comprising lines for connection to a low frequency apparatus, other lines joined to said first named lines for connection to high frequency apparatus, a low pass filter including two inductances in said lines first mentioned, a high pass filter in said other lines including condensers arranged in respective ones of said other lines, an inductance bridged across said other lines to interconnect oppositely poled terminals of said condensers, and a transformer bridged across the terminals of said second conductors, said two inductances of the lower pass filter and the said inductance of said high pass filter being disposed in coaxial relation to each other, with their axis normal to the center of the axis of the output transformer, whereby the several elements may be arranged in a small space without deleterious stray coupling therebetween.

WOLFGANG HAGEN.