

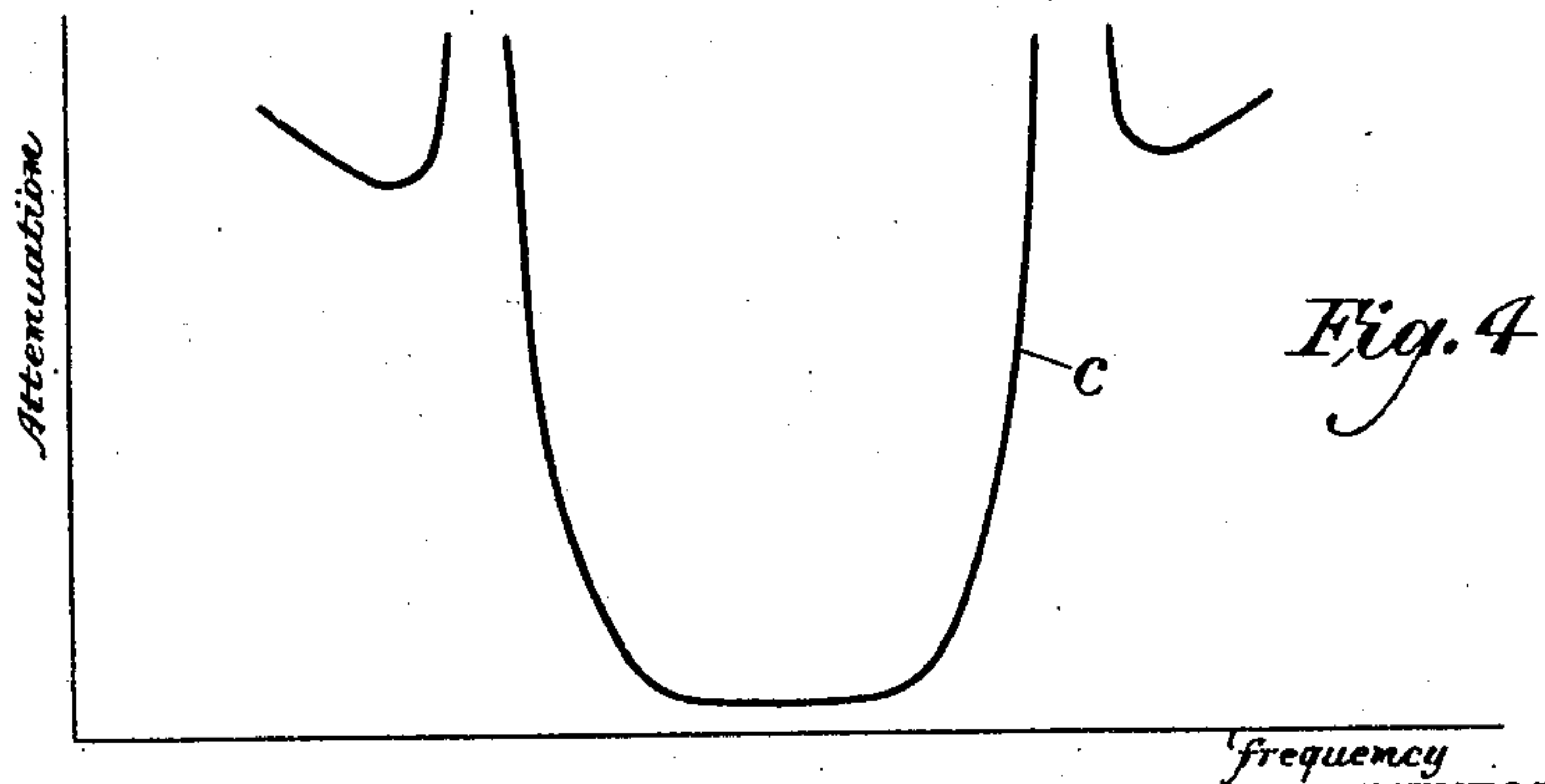
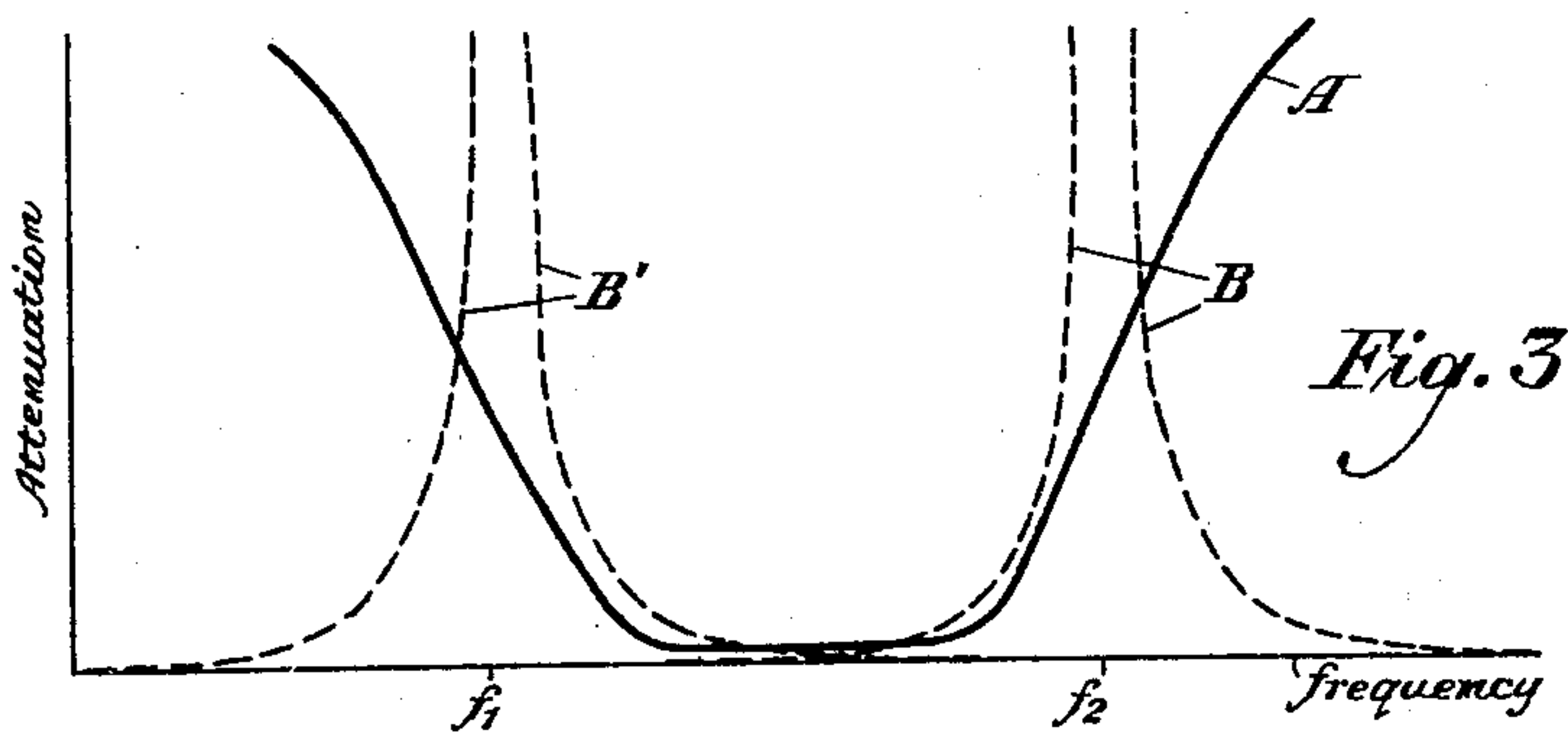
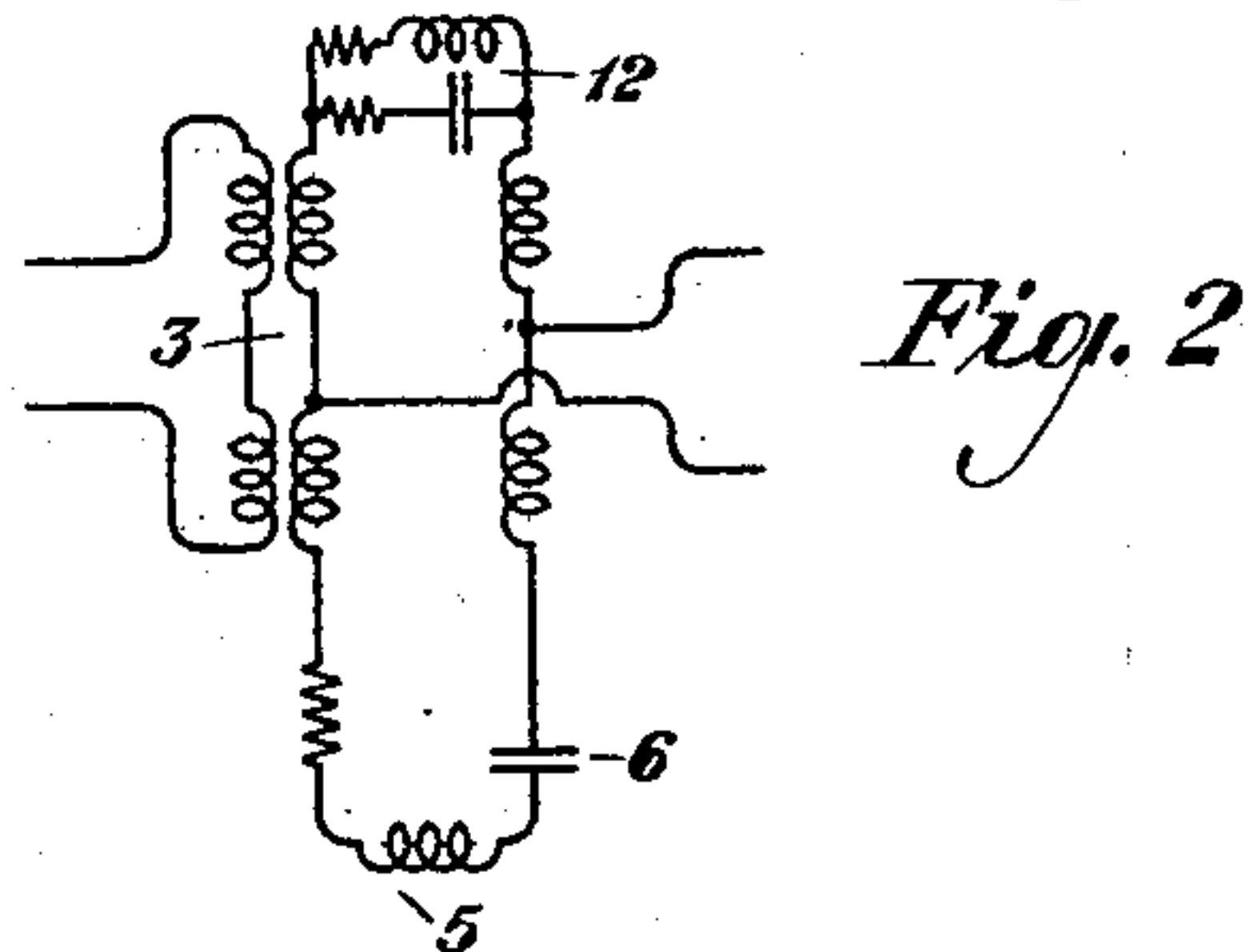
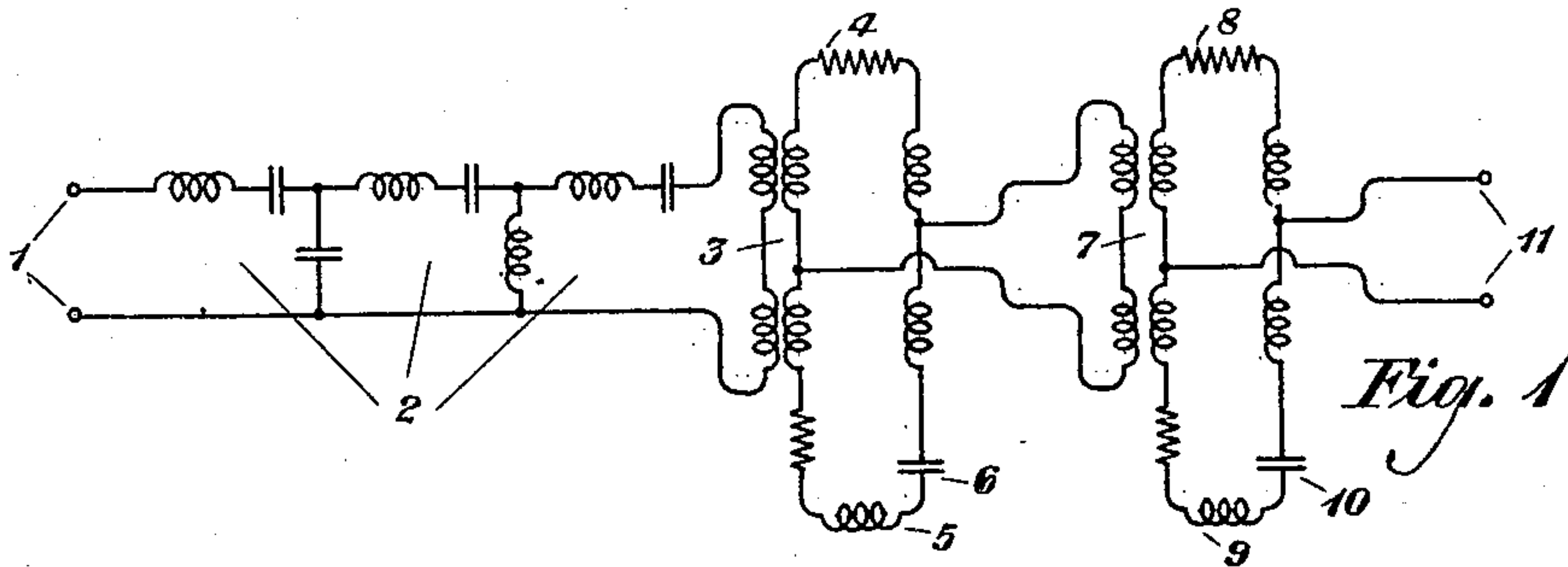
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SELECTIVE CIRCUIT ARRANGEMENT

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SELECTIVE CIRCUIT ARRANGEMENT

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This invention relates to selective circuits and more particularly to selective circuit arrangements for freely transmitting a band of frequencies while suppressing frequencies outside of the band.

One of the primary objects of the invention consists in providing a filter of the band pass type of economical design and having a sharp cut-off at the extremities of the frequency band to be transmitted. Accordingly, in the arrangements of the invention, there is combined in a circuit a band pass filter and two band suppression filters, each of the latter being designed to suppress bands of frequencies at the extremities of the frequency band which the band pass filter is designed to freely transmit.

In combination of selective circuits comprising this invention, the band pass filter utilized may be of the well known Campbell type, which is made up of sections comprising series and shunt impedance elements. Such a filter operates to discriminate between the band or bands of frequencies passed and the band or bands of frequencies suppressed by reason of the attenuation properties of the filter. The two band suppression filters differ from the Campbell type filter in that their selective functions do not depend upon the impedance looking into the filter. On the contrary, a band selecting action is obtained in this type of filter by taking advantage of the fact that the transmission through a four-member network whose members are balanced in pairs may be made extremely small at those frequencies for which the network is approximately in balance and the loss is comparatively small at frequencies for which the network is unbalanced. This is accomplished by connecting in tandem with an ordinary band pass filter, whose cut-off it is desired to make sharper, two balanced circuits. One of these balanced circuits is approximately in balance for a band of frequencies near the lower edge of the band which it is desired to transmit and the other in balance for a band near the upper edge. A Wheatstone bridge, one arm of which contains a resonant circuit, may be used. A more desirable arrange-

ment is that using the hybrid coil commonly employed in telephone repeater circuits.

A particular instance in which the use of the combination of selective circuits of this invention would be particularly desirable would be in connection with a voice frequency carrier telegraph system wherein it might be desirable to utilize higher carrier frequencies than heretofore. It has been the practice to utilize band pass filters of the Campbell type to provide selectivity with respect to the voice frequency carrier channels of such a system. However, as the frequencies of the carrier channels increase, it becomes exceedingly difficult and expensive to design the band pass filters of the Campbell type which are utilized. In fact, such filters become commercially impracticable with a given band width after a certain frequency limit has been passed. However, the combination of selective circuits of this invention is capable of commercial use up to a much higher frequency limit. Accordingly, with the arrangements of this invention, a great many more channels are commercially usable in such a system than heretofore. It is pointed out that the foregoing is an illustration of only one of the many utilizations that may be made of the combination of selective arrangements of the invention. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description, together with the accompanying drawings in the Figures 1, 2, 3, and 4 of which the invention is illustrated. Fig. 1 is a circuit diagram embodying a preferred form of the invention. Fig. 2 is a modification thereof. In Figs. 3 and 4 are shown curves illustrating the principles of operation of the arrangements of the invention. They illustrate in a general way, the arrangements shown in both Figs. 1 and 2, but apply more particularly to Fig. 2. Similar reference characters have been utilized to denote like parts in all of the figures.

In Fig. 1 is shown a transmission line comprising two line sections 1 and 11 intercon-

nected by the combination of selective arrangements of the invention. This combination comprises a band pass filter of the Campbell type and two band suppression filters, or hybrid coil suppressors, and the combination operates as a band pass filter with narrow band width and sharp cut-off. In line section 1 is shown a band pass filter 2 of the Campbell type comprising sections of series and shunt inductance and capacity. This band pass filter for commercial reasons might not have a sharp enough cut-off and accordingly it will be connected to a hybrid coil arrangement 3. The balancing windings of this hybrid coil arrangement may be connected to a resistance 4 and the line windings may be connected to a filter or resonant circuit comprising the inductance 5 and condenser 6. The resistance of the coil is indicated as a separate unit. At the resonant frequency the impedance of the resonant circuit and the impedance of the circuit including the resistance are equal and hence no energy is transferred through the hybrid coil. These impedances are unbalanced for frequencies above or below this resonant frequency, and hence the loss through the hybrid coil becomes increasingly less as the departure from the resonant frequency becomes greater. It might be desirable to introduce loss in a narrower band of frequencies than the above arrangement allows. This may be done by connecting a resonant circuit, such as circuit 12 of Fig. 2, to the balancing windings in place of the pure resistance 4. A second hybrid coil suppressor 7 would be connected in the circuit and would have connected to the line windings a resonant circuit comprising inductance 9 and condenser 10. The balancing windings of this arrangement would be connected to a resistance 8. Connected to the midpoints of this hybrid coil arrangement is the line section 11.

The two hybrid coil suppressors would be designed to suppress a band of frequencies at each edge of the free transmission band desired, such as the band passed by the filter 2. For purposes of illustration, let it be assumed that the arrangement was to be used in a voice frequency carrier telegraph system and that the carrier channel under consideration was 2465 cycles and with channels spaced 70 cycles apart. Under such conditions, one hybrid coil suppressor would be adjusted with its resonant frequency about 2550 to 2560 cycles and the other hybrid coil suppressor would be adjusted with its resonant frequency about 2370 to 2380 cycles.

In Fig. 3 is a curve A showing the attenuation frequency characteristics of a band pass filter, such as filter 2. The curves B and B' show the attenuation frequency characteristics of the hybrid coil suppressors, such as 3 and 7. If it is desired to narrow the band to be passed by filter 2 and to provide it with

a sharper cut-off, the hybrid coil suppressors 3 and 7 will be adjusted with their resonant frequencies at f_1 and f_2 , or in other words, at either edge of the frequency band passed by the filter 2. The resultant of the combination is shown by the attenuation frequency curve C of Fig. 4.

While the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many and other widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A combination of selective circuits comprising a band pass filter and two band suppression filters arranged in a common transmission path, one being designed to suppress a band of frequencies at one extremity of the band passed by said first mentioned filter, and the other being designed to suppress a band of frequencies at the other extremity of the band passed by said first mentioned filter, whereby the band passed over the common path will be sharply defined between the neighboring edges of the two suppression bands.
2. A transmission line comprising two line sections interconnected by a combination of selective circuits, said combination comprising a band pass filter and two band suppression filters of the balanced hybrid coil suppressor type arranged in a common path, one suppression filter being designed to suppress a band of frequencies at one extremity of the band passed by said first mentioned filter and the other suppression filter being designed to suppress a band of frequencies at the other extremity of the band passed by said first mentioned filter, whereby the band passed over the common path will be sharply defined between the neighboring edges of the suppression bands.
3. A transmission line comprising two line sections interconnected by a combination of selective circuits, said combination comprising a filter designed to pass an arbitrarily chosen band of frequencies and two band suppression filters of the hybrid coil suppressor type arranged in a common transmission path, one of said hybrid coil suppressor type filters being designed to suppress a band of frequencies at one extremity of said arbitrarily chosen band, and the other hybrid coil suppressor type filter being designed to suppress a band of frequencies at the other extremity of the band passed by said first mentioned filter, whereby the band passed over the common path will be sharply defined between the neighboring edges of the two suppression bands.
4. A transmission line comprising two line sections interconnected by a combination of selective circuits, said combination comprising

ing a filter designed to pass an arbitrarily chosen band of frequencies and two band suppression filters of the hybrid coil suppressor type arranged in a common transmission path, one of said hybrid coil suppressor type filters being designed to suppress a band of frequencies at one extremity of said arbitrarily chosen band, and the other of said hybrid coil suppressor type filters being designed to suppress a band of filters at the other extremity of the band passed by said first-mentioned filter, whereby the band passed over the common path will be sharply defined between the neighboring edges of the two suppression bands, and each suppression filter comprising a hybrid coil balancing circuit having a resonant circuit connected to the line terminals of said coil and an impedance element which is substantially constant with frequency connected to the balancing terminals of the hybrid coil.

5. A transmission line comprising two line sections interconnected by a combination of selective circuits, said combination comprising a filter designed to pass an arbitrarily chosen band of frequencies and two band suppression filters arranged in a common transmission path, each of said band suppression filters comprising a hybrid coil balancing circuit having a resonant circuit connected to the line terminals of said coil and an impedance element which is substantially constant with frequency connected to the balancing windings of said hybrid coil, one of said resonant circuits being designed for resonance at frequencies at one extremity of said arbitrarily chosen band of frequencies, and the other resonant circuit being designed for resonance at frequencies at the other extremity of said band, whereby the band passed over said common path will be sharply defined between frequencies near said resonant frequencies.

6. A transmission line comprising two line sections interconnected by a combination of selective circuits, said combination comprising a filter designed to pass an arbitrarily chosen band of frequencies and two band suppression filters of the hybrid coil suppressor type, the said hybrid coil suppressor type filters being designed to suppress bands of frequencies at the opposite extremities of the said arbitrarily chosen band, and each of said hybrid coil suppressor type filters comprising a circuit arrangement, a network associated with said circuit arrangement, said network having a definite impedance in one range of frequencies and a materially different impedance outside said range, and an impedance device associated with said circuit arrangement in balancing relation to said network, said impedance device having substantially the same impedance as said network in said first mentioned range of frequencies and a different impedance outside said range, whereby said circuit arrangement is balanced

to prevent transmission of said first mentioned range of frequencies therethrough but is unbalanced to permit transmission of frequencies outside of said range.

In testimony whereof, I have signed my name to this specification this 20th day of June 1929.

LELAND C. ROBERTS.

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