

March 9, 1926.

1,575,659

M. E. STRIEBY

FILTER ARRANGEMENT FOR WIRE PROGRAM DISTRIBUTION CIRCUITS

Filed Sept. 7, 1923

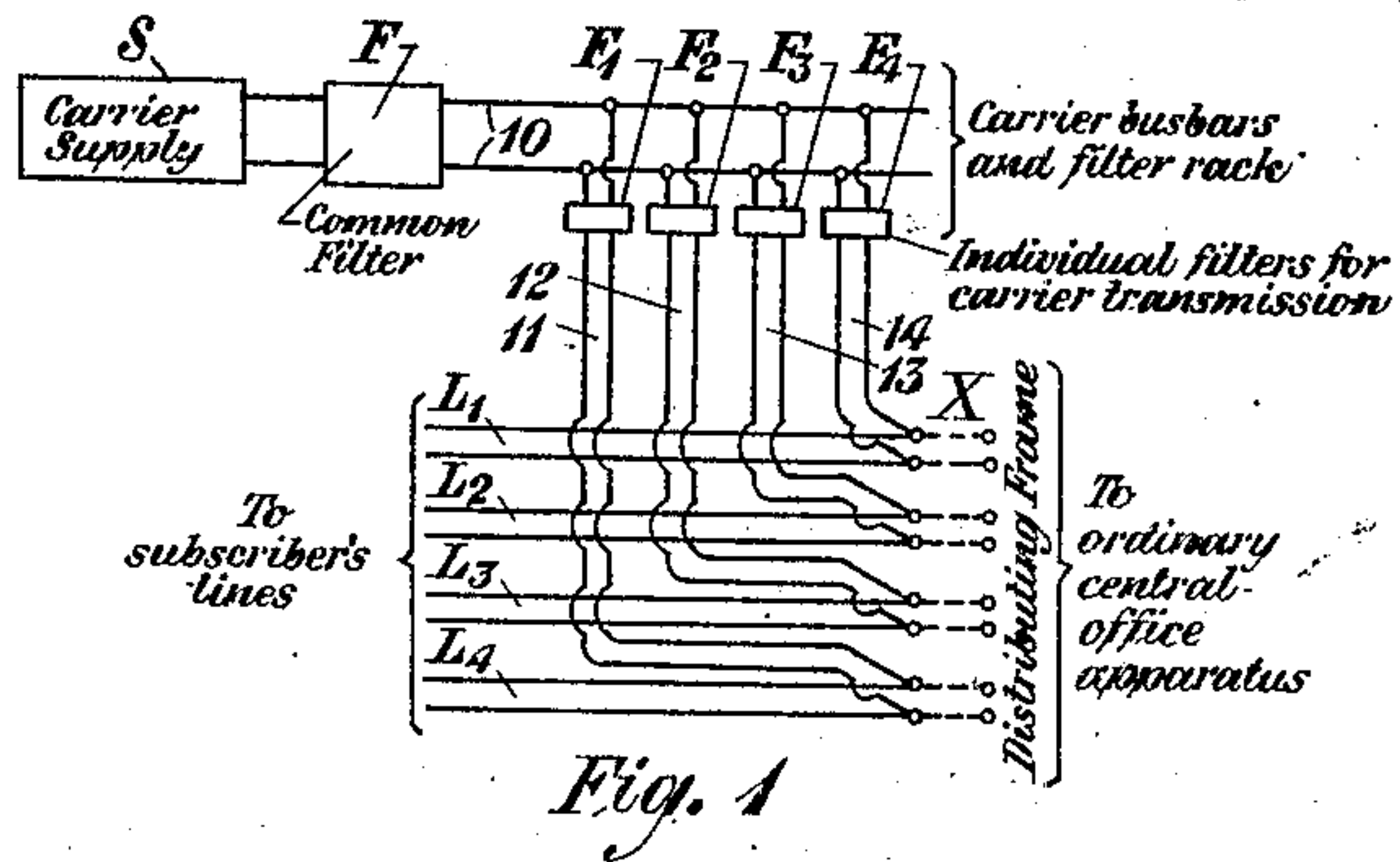


Fig. 1

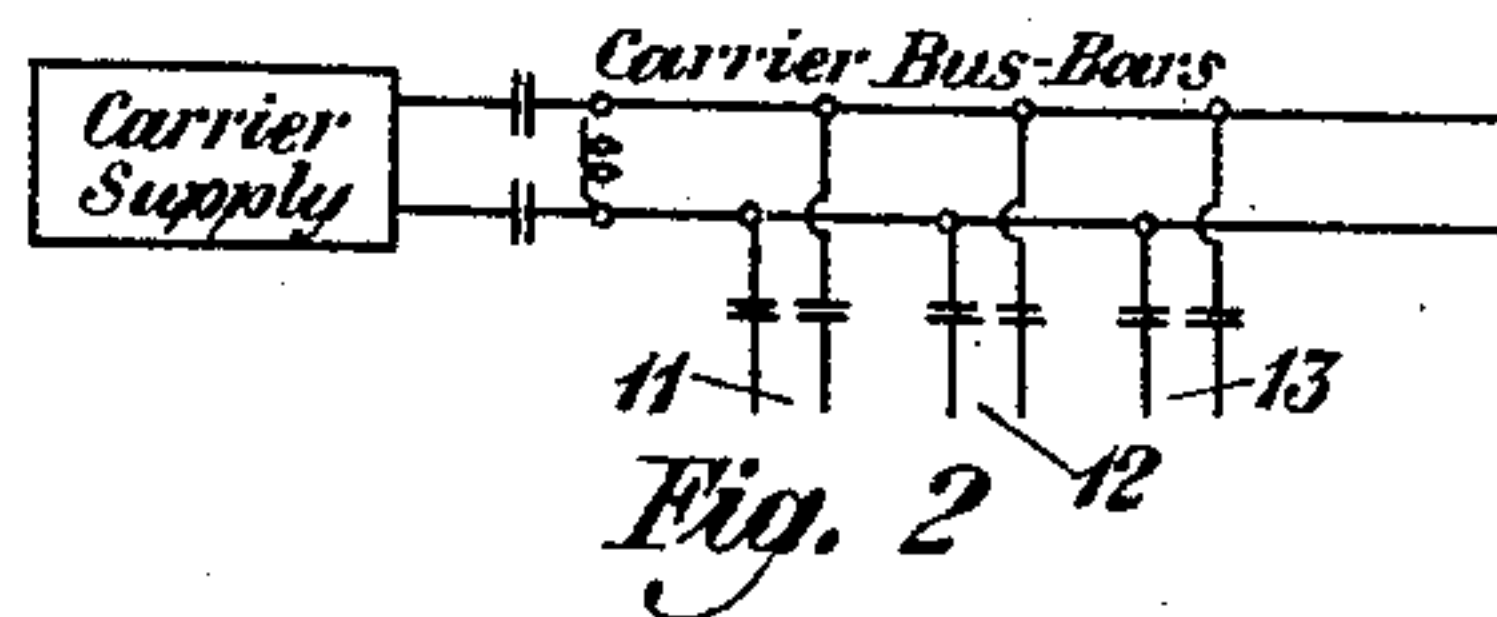


Fig. 2

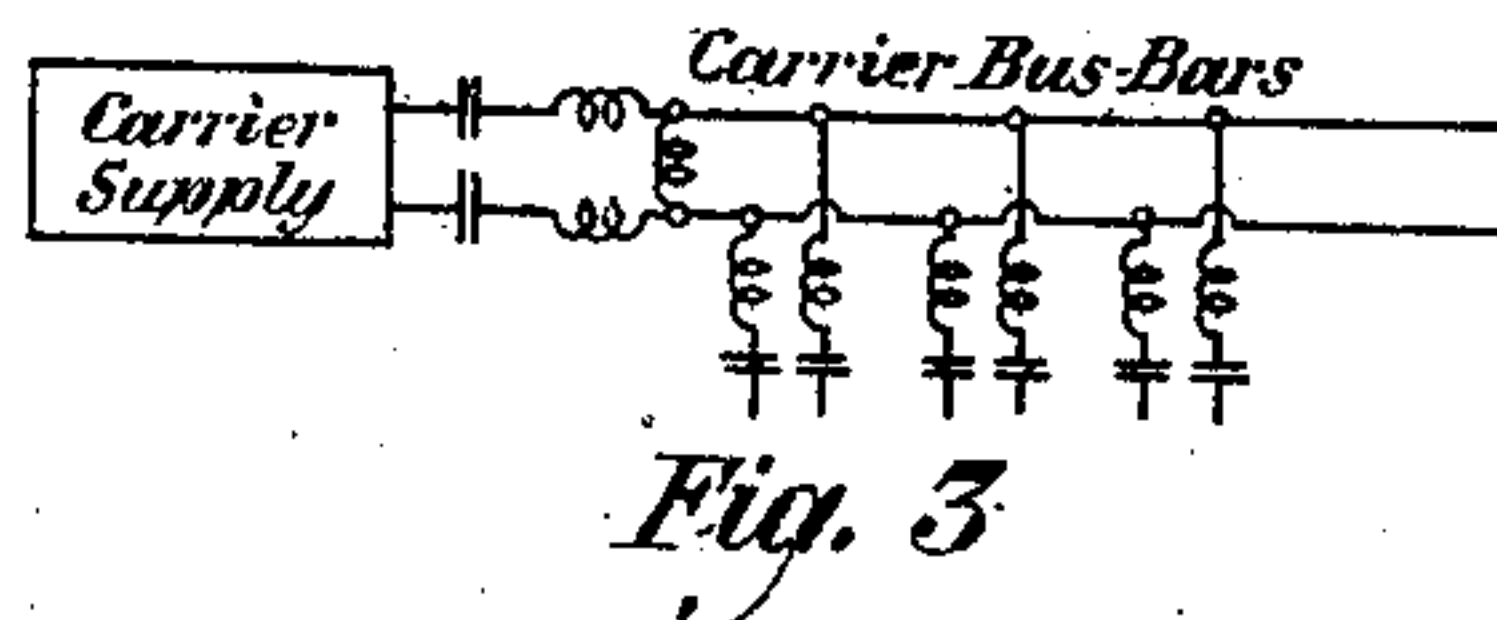


Fig. 3

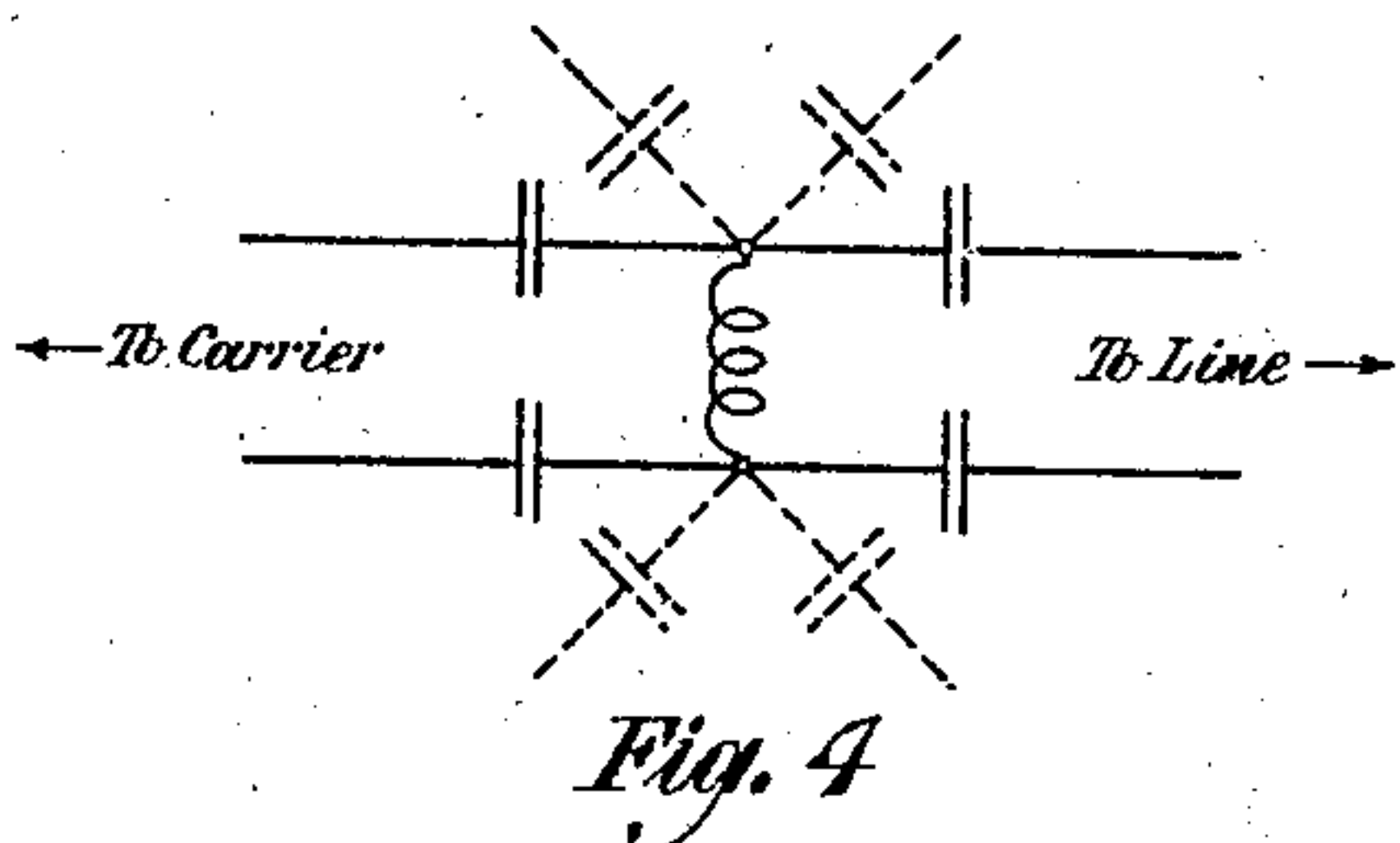


Fig. 4

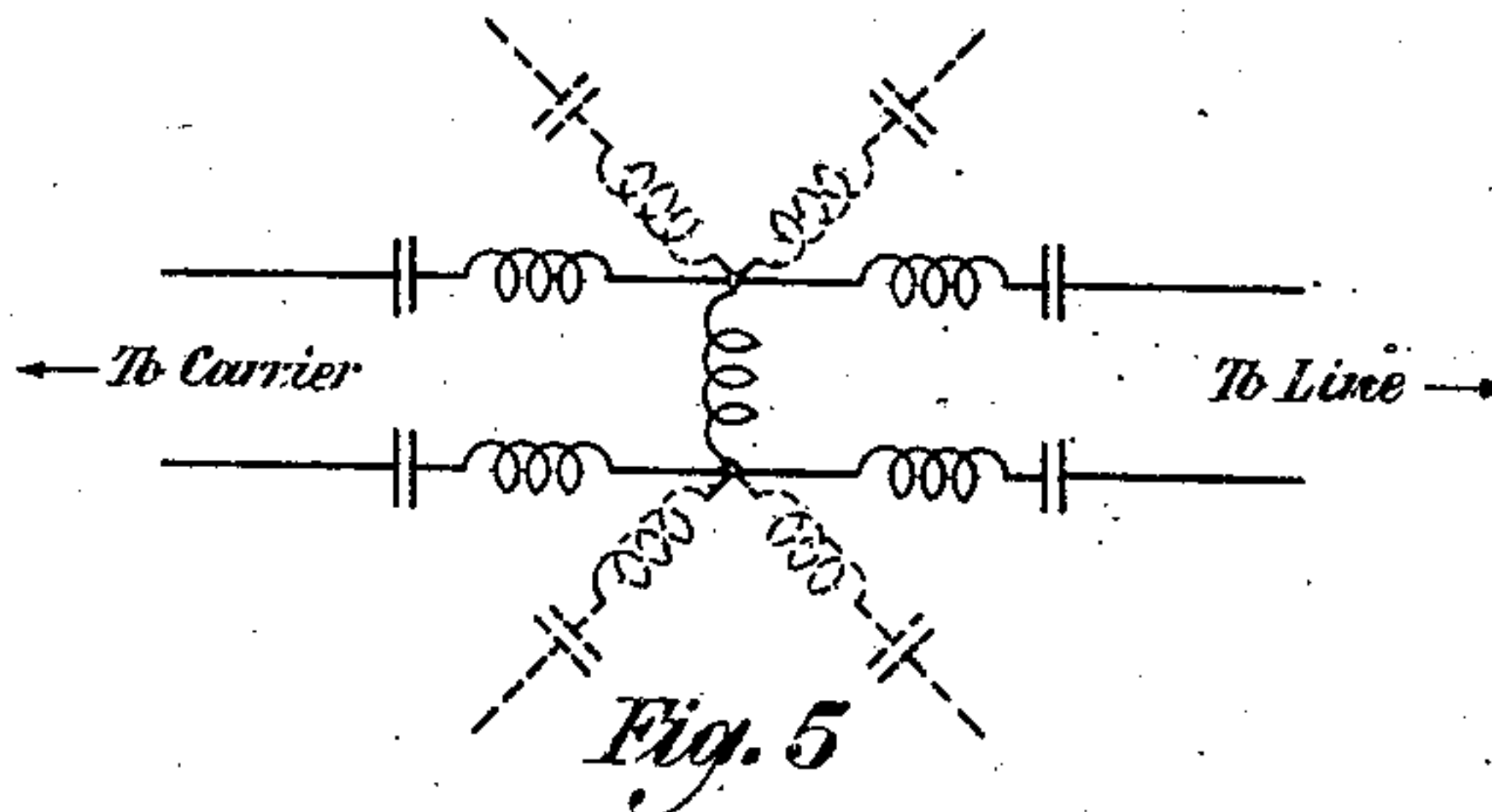


Fig. 5

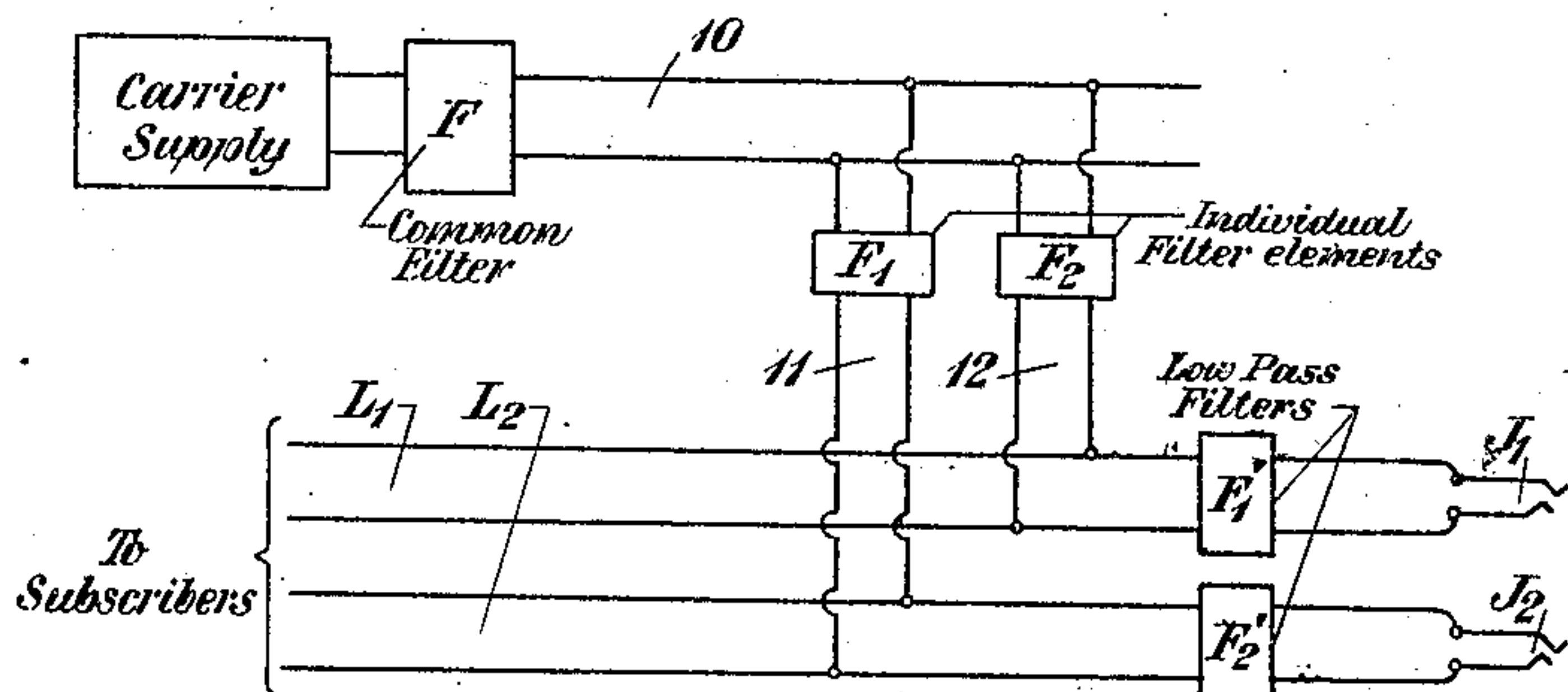


Fig. 6

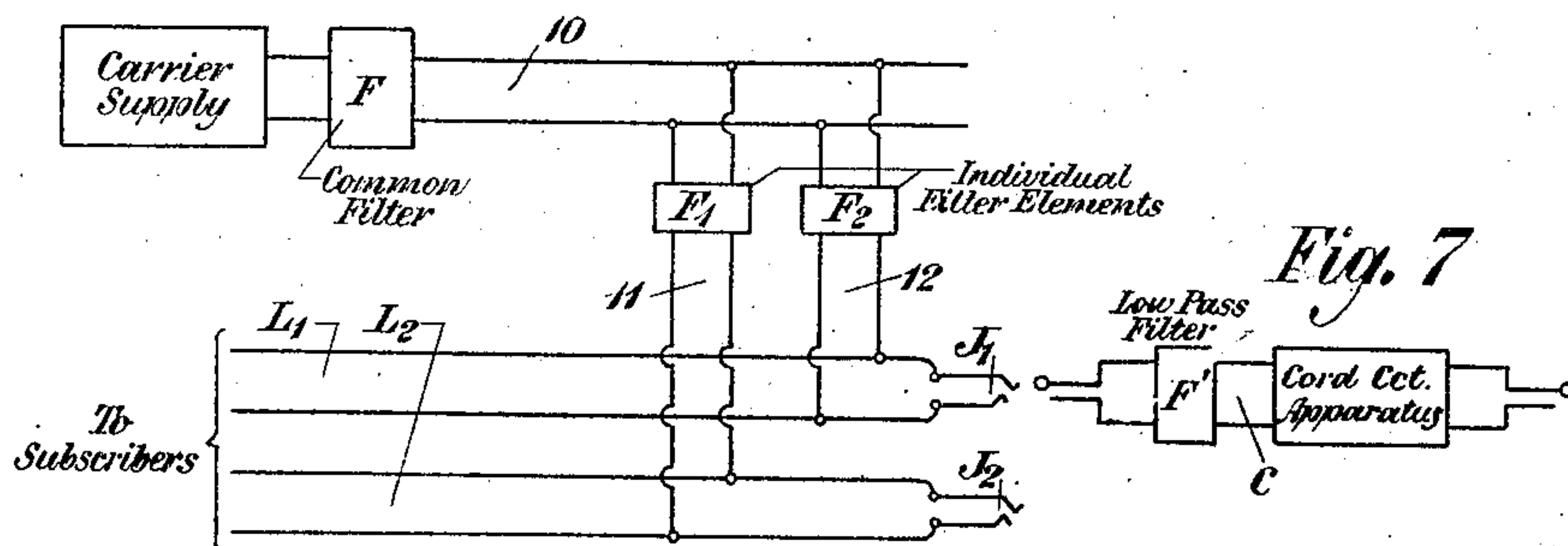


Fig. 7

INVENTOR

M. E. Strieby

BY

g4406

ATTORNEY

Patented Mar. 9, 1926.

1,575,659

UNITED STATES PATENT OFFICE.

MAURICE E. STRIEBY, OF MILLBURN, NEW JERSEY, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

FILTER ARRANGEMENT FOR WIRE PROGRAM-DISTRIBUTION CIRCUITS.

Application filed September 7, 1923. Serial No. 661,483.

To all whom it may concern:

Be it known that I, MAURICE E. STRIEBY, residing at Millburn, in the county of Essex and State of New Jersey, have invented certain Improvements in Filter Arrangements for Wire Program-Distribution Circuits, of which the following is a specification.

This invention relates to program distribution systems and more particularly to systems employing telephone subscribers' lines for transmitting the program currents.

In order to connect the common program source of a plurality of subscribers' lines at a telephone exchange where not all of the telephone subscribers are also subscribers to the program service it is necessary to provide some arrangement for preventing the program current from being applied to the other lines of the exchange. In accordance with the present invention it is proposed to accomplish this result by segregating the lines from each other where they are brought to the bus-bars leading to the program station by means of a cheap and economical filtering arrangement. In order to render the filtering arrangement inexpensive it is proposed to include only a part of each of the filters in the individual circuits associated with the subscribers' lines and substitute for the remainder of each of the filters a common filter element included in the bus-bar circuit, which common filter element will cooperate with the filter element in each subscriber's line to act as a complete filter for each line. Another object of the invention is to provide a circuit arrangement whereby when one subscriber's line provided with the program service is connected for telephonic purposes with another subscriber's line which is not provided with program service, the program currents will be prevented from being transmitted to said other subscriber's line.

The invention may now be more fully understood by reference to the following detailed description when read in connection with the accompanying drawing, Figure 1 of which shows schematically the arrangement of the filters for segregating the subscribers' lines, Figs. 2 and 3 of which show two forms of filter structure to be employed in connection with the circuit of Fig. 1, Figs. 4 and 5 of which are diagrams illustrating the principles of the filter arrange-

ment and Figs. 6 and 7 of which illustrate arrangements for preventing program transmission from being transmitted to a line not subscribing to the service when said line is connected telephonically with a line subscribing to the service.

Referring to Fig. 1, L_1 , L_2 , L_3 and L_4 designate ordinary telephone subscribers' lines terminating at the central office at a distributing frame X through which the lines may be connected to the ordinary central office apparatus whereby connections are made between different subscribers. In order that the lines may be provided with the program service connections are then made from the frame through circuits such as 11, 12, 13 and 14 to bus-bars 10 connected to a common source of carrier supply S. The connections 11, 12, 13 and 14 directly interconnect the lines so that normally the individual operation of the lines at voice frequencies would be interfered with. In order to prevent this filters may be included in the connections 11, 12, 13 and 14, these filters being arranged to suppress voice frequencies but to permit the carrier frequencies from the program source to pass to all of the lines.

As it would be expensive to provide a filter for each individual line sufficient to give the required degree of attenuation for voice frequencies it is proposed, in accordance with the present invention, to provide a common filter element F in the bus-bar circuit and individual filter elements, such as F_1 , F_2 , F_3 and F_4 in the circuits leading to each of the lines, the individual elements being so related to the common element that the latter cooperates with any given individual element to constitute a filter for the particular line circuit with which the individual element is associated. By this arrangement the filter apparatus individual to the line may be made much cheaper.

Fig. 2 shows one possible arrangement of the filters. In the bus-bar circuit series condensers are included and also a shunt inductance to complete the filter element. Series capacities should also be included on the other side of the inductance. These capacities are inserted in the conductors 11, 12, 13, etc., and are the only elements individual to the lines themselves. The series capacities in the bus-bars with the associated shunt inductance cooperate with the

series capacities in the individual line to act as a high pass filter, passing the program currents to the line but preventing voice frequencies from being transmitted from one line to another through the bus-bars.

The manner in which the common element and individual element of the filter cooperate to constitute a single filter will be clear from Fig. 4, which shows a circuit arrangement equivalent to that of Fig. 2. Here the shunt inductance and the condensers in the full lines to the left correspond to the common filter element of the carrier supply while the two condensers in the full lines to the right correspond to the condensers in the individual line. Considering this part of the circuit alone it is obvious that the arrangement, if properly proportioned, will act as a high pass filter. The connection of additional lines with series condensers to the bus-bars merely amounts to connecting one terminal of each of a number of condensers to the opposite terminals of the shunt inductance and it has been found that if the elements are properly proportioned the connection of additional condensers as indicated in dotted lines in Fig. 4 does not interfere with the operation of the arrangement shown in full lines as an ordinary high pass filter. Consequently, each of the subscribers' lines will be segregated from the other at voice frequencies by the arrangement shown.

A modified arrangement is shown in Fig. 3, in which the filter is provided with a series element comprising a condenser and inductance in series thus making a band pass filter. The common part of the filter, similarly, is made up of a shunt inductance and a series element of the type just described while another series element of the same type is included in each subscriber's lead. The fact that the common element will cooperate with any given individual element to constitute a band pass filter for that circuit will be obvious from the diagram of Fig. 5, which shows the common element and one individual element in heavy lines. These two elements corresponding to a well known type of Campbell band pass filter. The connection of other branches having inductances and capacities as shown in dotted lines, it has been demonstrated, does not interfere with the operation of the part shown in heavy lines as a filter.

A subscriber receiving program transmission in the above manner can use his telephone in the normal way without any interference. In case, however, the person with whom he is talking should at any time connect suitable receiving apparatus to his own telephone line he would be able also to receive the program transmission. If it is desired to avoid this it may be done by inserting a low pass filter or band elimination fil-

ter in each subscriber's line, as illustrated in Fig. 6 at F'_1 and F'_2 . Here, L_1 and L_2 designate the two subscribers' lines terminating at a central office in the usual jacks J_1 and J_2 . Connections 11 and 12 pass through the individual filter elements F_1 and F_2 to the bus-bars, which in turn have a common filter element F included therein, as in Fig. 1. The low pass filters F'_1 and F'_2 are connected in the individual subscribers' lines as shown between the connections 11 and 12 and the jacks J_1 and J_2 , thereby preventing the transmission of the program frequencies to other lines which may be connected telephonically to the lines L_1 and L_2 through the usual operator's cord circuit.

A more economical way of accomplishing the same result is to provide a common filter F' in the operator's cord circuit C , as shown in Fig. 7. By including the filter in the cord circuit which is common to a plurality of lines a very much smaller number of filters may be provided for accomplishing the same results as are attained by the arrangement of Fig. 6.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A transmission system comprising a common transmission path, a plurality of individual transmission paths associated therewith and means to segregate the individual paths from each other at certain frequencies comprising a common filter element in the common transmission path and individual filter elements in the individual paths, each individual element being so related to the common element that the two cooperate to form a band filter transmitting a band of frequencies through the individual path with substantially uniform attenuation while substantially suppressing the frequencies lying without the band.

2. A transmission system comprising a common transmission circuit, a plurality of individual transmission circuits associated therewith, a common filter element in the common circuit and individual filter elements in the individual circuits, each individual element being so related to the common element that the two function as a high pass filter for transmitting frequencies above a lower cut-off point while substantially suppressing frequencies lying below said point.

3. A transmission system comprising a common transmission circuit, a plurality of individual transmission circuits associated therewith, a filter element included in the common transmission circuit comprising a shunt impedance and a series impedance and individual filter elements in each of the indi-

vidual circuits comprising series impedances, the series impedance of each individual circuit being related to the series and shunt impedances of the common circuit so that they cooperate to constitute a band filter which passes with substantially uniform attenuation a band of frequencies while suppressing frequencies lying without the band.

4. A program distribution system comprising a program source, bus-bars connected thereto, a plurality of subscribers' lines leading to switching arrangements for interconnecting the lines telephonically, independent connections from subscribers' lines to said bus-bars, a common filter element in the bus-bars and individual filter elements in the connections of the subscribers' lines, each individual element cooperating with the common filter element to constitute a filter for passing a band of frequencies to the subscribers' lines and suppressing the frequencies lying without the band.

5. A program distribution system comprising a program source, bus-bars connected thereto, a plurality of subscribers' lines leading to switching arrangements for interconnecting the lines telephonically, independent connections from subscribers' lines to said bus-bars, a common filter element in the bus-bars and individual filter elements in the connections of the subscribers' lines, each individual element cooperating with the common filter element to constitute a high pass filter for transmitting program frequencies to the corresponding subscribers' line while preventing ordinary telephonic frequencies from being transmitted from one subscriber's line to another through the bus-bar connection.

6. A program distribution system comprising a program source, bus-bars connected thereto, a plurality of subscribers' lines terminating at an exchange and switching arrangements for interconnecting the lines for telephonic purposes, independent connections from the lines to the bus-bars, means in said connections to prevent telephonic transmission from one line to another through the

bus-bars while permitting the transmission of program currents from the bus-bars to the line and means to prevent the transmission of program currents from one line to another line which is interconnected therewith for ordinary telephone conversation.

7. A program distribution system comprising a program source, bus-bars connected thereto, a plurality of subscribers' lines terminating at an exchange and switching arrangements for interconnecting the lines for telephonic purposes, independent connections from the lines to the bus-bars, means in said connections to prevent telephonic transmission from one line to another through the bus-bars while permitting the transmission of program currents from the bus-bars to the line and means to prevent the transmission of program currents from one line to another line which is interconnected therewith for ordinary telephone conversation, said means comprising a filter associated with one of said lines beyond its connection to the bus-bars.

8. A program distribution system comprising a program source, bus-bars connected thereto, a plurality of subscribers' lines terminating at an exchange and switching arrangements for interconnecting the lines for telephonic purposes, independent connections from the lines to the bus-bars, means in said connections to prevent telephonic transmission from one line to another through the bus-bars while permitting the transmission of program currents from the bus-bars to the line and means to prevent the transmission of program currents from one line to another line which is interconnected therewith for ordinary telephone conversation, said means comprising a link circuit for effecting the ordinary telephonic connections and having a filter therein to suppress program currents.

In testimony, whereof, I have signed my name to this specification this 5th day of September, 1923.

MAURICE E. STRIEBY.