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CARRIER CURRENT CHANNEL SEPARATION SYSTEM

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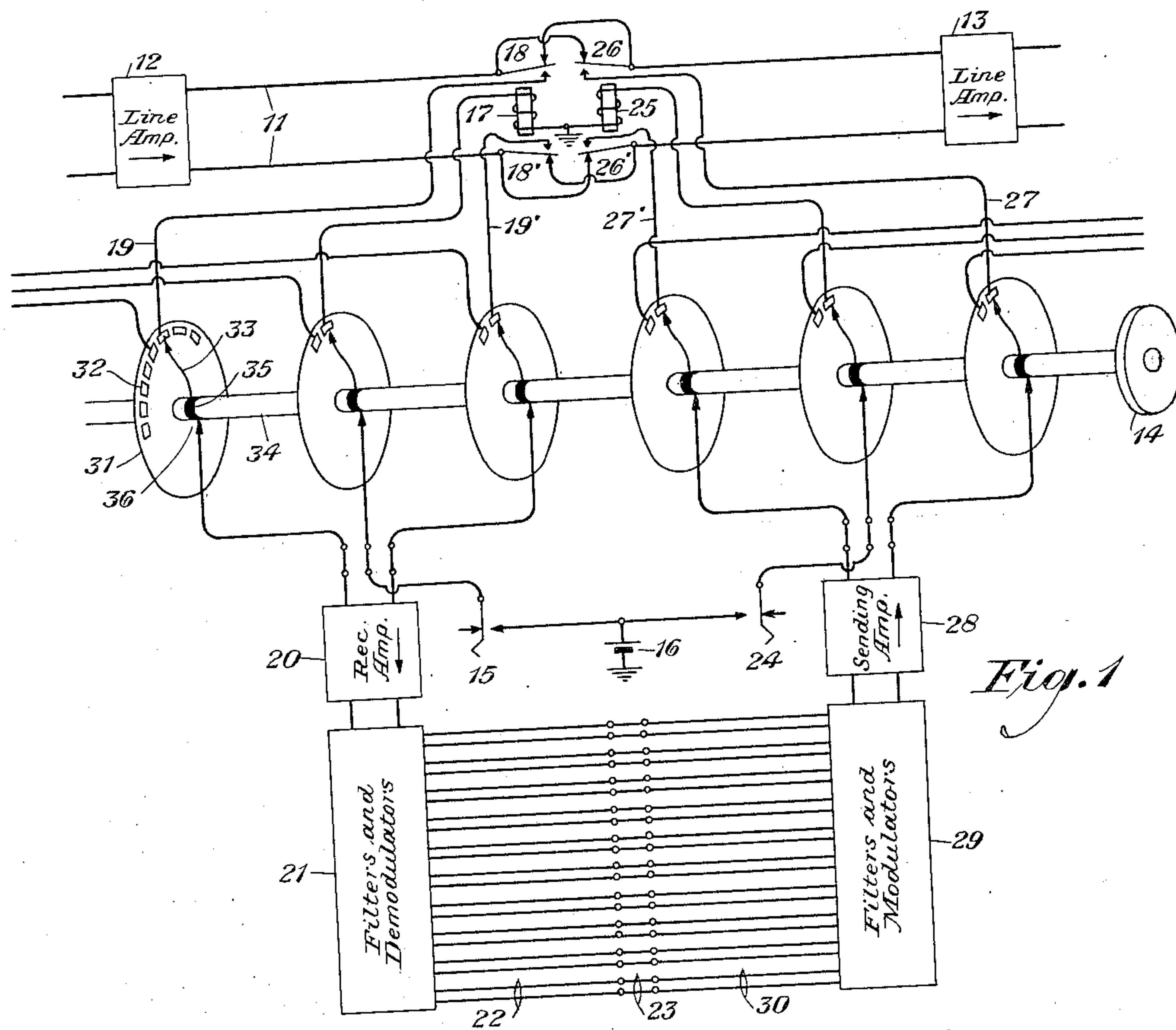


Fig. 1

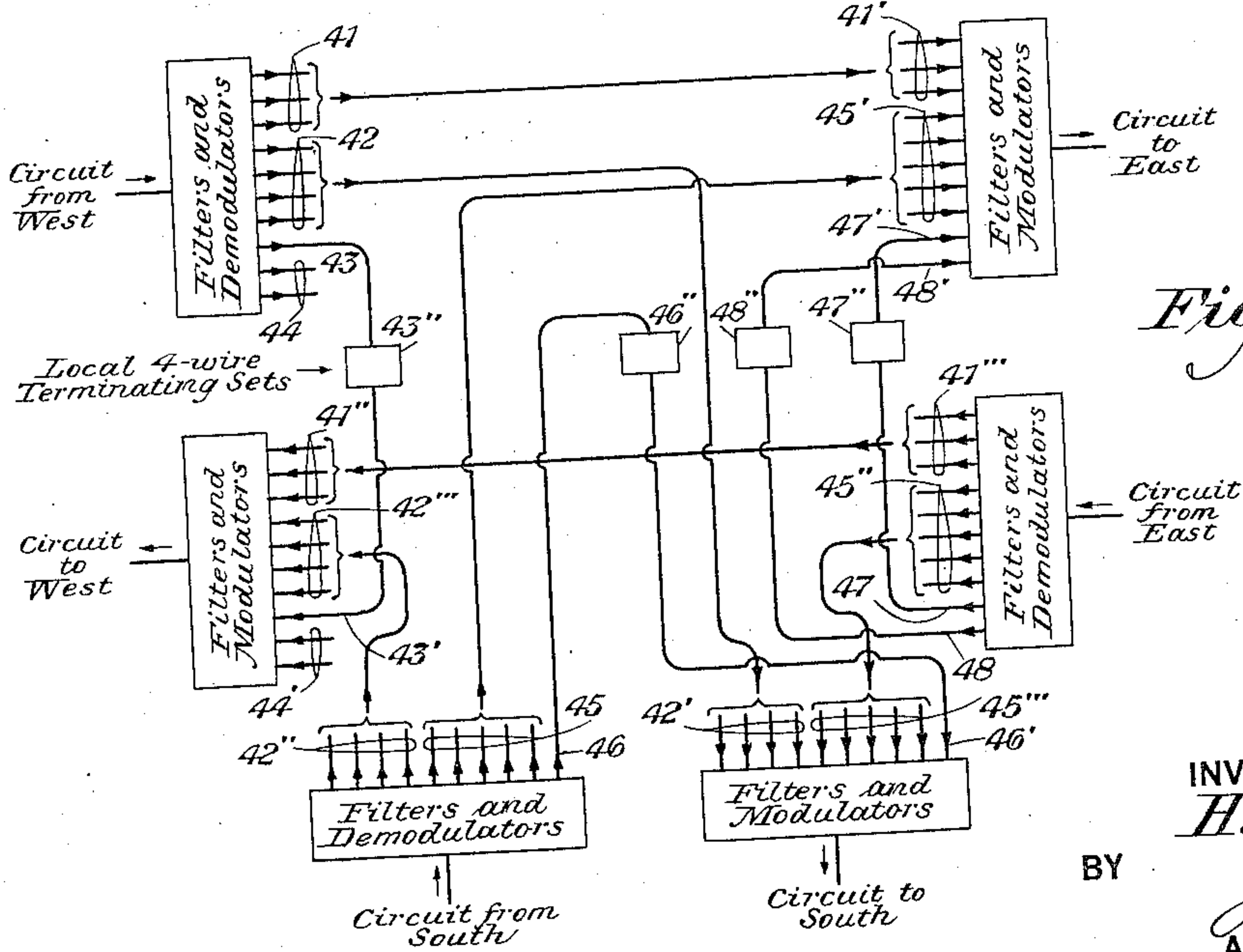


Fig. 2

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CARRIER CURRENT CHANNEL SEPARATION
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7 Claims. (Cl. 179—15)

It is among the objects of my invention to provide a new and improved system for interrupting a multi-channel carrier current signaling line at an intermediate point on the line either to listen on a particular channel or channels, or to talk into a particular channel or channels, or both; and also for the purpose of branching or reconnecting or terminating particular channels of the line. Another object of my invention is to provide for listening on such a line, or talking on such a line, or both, with only transient connection to the line for the purpose and with a minimum interference with normal through service on the line. Another object of my invention is to provide for such listening or talking, or both, on any one of a plurality of lines, with a single set of apparatus adapted for the purpose. All these objects, and various other objects and advantages of my invention will become apparent on consideration of a limited number of examples of practice according to the invention which I have chosen for disclosure in this specification. It will be understood that the following description relates principally to these particular examples of the invention, and that its scope will be indicated in the appended claims.

Referring to the drawing, Figure 1 is a diagram of apparatus adapted for transient connection at an intermediate point on any one of a plurality of carrier current lines, and Fig. 2 is apparatus adapted for interrupting carrier current lines at an intermediate point and reconnecting them locally to branch lines, or otherwise.

Referring to Fig. 1, there will be several conductor pairs of which 11 represents one such pair extending through the station. On this line 11 are two amplifiers 12 and 13. The line 11 is a carrier current conductor pair serving for signal transmission from west to east.

At this station there is a shaft 34 adapted to be turned by a milled head 14 for connection with any one of the pairs such as 11. The milled head 14 and the shaft 34 are now in the position for connection with the line 11. Further details of the structure in Fig. 1 will become apparent in connection with the following description of procedure in the use of the apparatus there shown.

If the operator wishes to monitor on any channel of the line 11, he operates the key 15, thus applying the battery 16 from ground to the magnet 17, which, in turn operates its armatures 18 and 18' to connect the conductors 19 and 19', respectively, to the sides of the line 11, but without interrupting the sides of the line 11. Following down on these conductors 19 and 19' they

lead through the receiving amplifier 20 to the set of band filters and demodulators represented at 21 from which the branch circuits 22 carry the respective channels at low frequency corresponding to the different carrier current channels on the line 11. At any point such as 23, the operator can listen on any channel that he pleases without interrupting through service at carrier frequency on each and all of the channels of line 11.

On the other hand, if the operator wishes to talk into a particular channel without listening, he operates the key 24 instead of 15, thus closing a circuit from ground, through battery 16, to relay 25. This relay operates the armatures 26 and 26', thus connecting the conductors 27 and 27', respectively, to the two sides of the line 11. Following down on these conductors 27 and 27', it will be seen that they lead from the sending amplifier 28, which in turn receives current from the set of band filters and modulators 29. Thus on any particular conductor pair 30 leading into the system 29, the operator can talk by means of apparatus connected at such a place as 23, and his talk will enter the line 11 on the one and only channel intended, without interrupting connections for through service at carrier frequency on each and all of the channels of line 11.

It will be noticed that in either of the cases discussed above, listening across the line 11, or talking across the line 11, there is no interruption of the continuity of the line 11. But if the operator wishes to listen and talk on a channel of the line 11, he operates both keys 15 and 24, thus shifting both pairs of armatures 18, 18' and 26, 26' and interrupting the line 11. It will be remembered that this is a one-way line. All the channels of talk or other signals coming in from the left now go down through the receiving amplifier 20 and are separated out to the respective channels in the respective conductor pairs 22; then these channels are again combined in the apparatus 29 and the line is continued out toward the east over the conductors 27, 27'. In this case the operator can connect in at any place such as 23, and can both listen and talk on a particular channel.

The line 11 at the top of Fig. 1 is only one of a plurality of such lines extending through the station; these may be conductor pairs in one and the same cable. The apparatus at the lower part of Fig. 1 is unitary; there is only one such set of apparatus at the station. By operating the milled head 14, shaft 34 can be rotated so as to make connection with any other line in the same way

that connection is now shown with line 11. This shaft 34 carries conducting rings 35 engaged by brushes 36. The disks 31 are stationary and carry conductor segments such as 32. Each conductor ring 35 carries a wiper arm 33 which sweeps over the segments 32. It will readily be seen how rotation of the milled head 14 enables the operator to connect his apparatus with any line that he pleases. It should be noticed that connection can be made in this way with lines from west to east, such as line 11, or equally readily, with lines from east to west.

Referring to Fig. 2, this shows how a carrier current circuit can be interrupted at an intermediate place and the channels separated and reconnected in various ways. In Fig. 2 the well known convention is employed by which each conductor pair is represented by a single line. Such a conductor pair or line comes in from the west to the filters and demodulators indicated at the upper left hand corner of Fig. 2, where the various channels are separated in respective voice frequency circuits such as 41, 42, etc. It is desired that the three channels 41 shall go directly on through to the east as if the line had not been interrupted, and this is indicated by the connection shown from 41 to 41'. The four channels 42 coming in from the west are to go out at 42' to the south, and the complementary channels 42'' coming in from the south are to go back to the west; hence, the connection to 42''' as shown in the drawing. On these four channels 42—42' one-way, and four channels 42''—42''' the opposite way, four two-way conversations may be carried on between west and south.

The one channel coming in from the west that is separated out in the line 43 is terminated at this place in the normal four-wire terminating set 43''. The complementary channel the opposite way is indicated at 43'.

The two channels 44 from the west and the complementary channels 44' to the west are left out of service.

At 45 there are five channels coming in from the south that are connected through at 45' to the east; the complementary channels from the east are shown at 45'' connected at 45''' to the south. Thus over these five channels, south and east can talk both ways.

One channel from the south at 46 is terminated at 46'', the complementary channel to the south being indicated at 46'.

Two other channels 47 and 48 from the east are terminated at this point in 47'' and 48'', the complementary channels to the east being designated 47' and 48'.

Thus by example it has been indicated in Fig. 2 how a pair of circuits from west to east and from east to west can be interrupted, their channels separated out in respective circuits, and these connected in a multitude of different ways for different demands of service.

In this Fig. 2 the circuits have been highly conventionalized, but it is to be understood that the details of the circuit and mechanism of Fig. 1 apply thereto as fully as may be desired. In particular, as in Fig. 1, only one line pair has been indicated as coming in at a given point, but a plurality of such line pairs and the accompanying switching mechanism would ordinarily be used.

I claim:

1. A station and a plurality of line conductor pairs extending therethrough, each line pair carrying a plurality of one way carrier current signal channels, separate local conductor pairs at

the station corresponding to the channels of one of the line pairs, switching means to select a desired line pair and additional switching means to connect said local pairs in multiple relation with the selected line pair, and a set of filters and modulating apparatus permanently connected with said local pairs and adapted to separate and shift the frequency ranges between said line pair and said local pairs.

2. A station and a plurality of line conductor pairs extending therethrough, each line pair carrying a plurality of one way carrier current signal channels, separate local conductor pairs at the station corresponding to the channels of one of the line pairs, connecting means to open any one line pair and interpose said local pairs in multiple relation with each other and in series relation in the line pair, frequency step-down and channel separating apparatus for connection in one direction and channel combining and frequency step-up apparatus for connection in the opposite direction.

3. A station and a plurality of one-way multiple channel carrier current line conductor pairs in and out of the station, separate local conductor pairs corresponding to the channels of any one of the first mentioned conductor pairs, means to listen and talk on the local pairs, filters and modulating apparatus permanently connected with said local pairs and means adapted alternatively for three different connections: first, to connect said local pairs in parallel through suitable filters and modulating apparatus for listening across any one of the line conductor pairs into the station; second, to connect said local pairs in parallel for talking across any one of the line conductor pairs out of the station; and third, to interpose said local pairs in parallel to each other and in series in relation to any one of said line conductor pairs for both listening and talking thereon.

4. A station and a plurality of line conductor pairs extending therethrough, each line pair carrying a plurality of one way carrier current signal channels, separate local conductor pairs at the station corresponding to the channels of one of the line pairs, a switch for connecting with any one of said line pairs, and a set of filters and modulating apparatus connected between said switch and said local pairs in multiple relation.

5. A station and a plurality of line conductor pairs extending therethrough, each line pair carrying a plurality of one way carrier current signal channels, separate local conductor pairs at the station corresponding to the channels of one of the line pairs, two switches alternatively for bridging connection across any one of said line pairs or simultaneously for interrupting such a line pair and connecting respectively to the ends of the line pair, and frequency step down and band separating apparatus between one switch and one set of ends of said local pairs and frequency step up and band combining apparatus between the other switch and the other set of ends of said local pairs.

6. A station and a plurality of multiple channel carrier current conductor pairs into the station and a like plurality of such pairs out, separate local conductor pairs at the station, means at the station to bring all the channels on one conductor pair into the station down to voice frequency on respective members of said separate local pairs, means also at the station to bring all the voice frequency currents on the local pairs up to respective channel frequencies out on

one carrier pair, and cross-connections among the local pairs in and out whereby the channels on the conductor pairs in are redistributed on the conductor pairs out.

and means associated with said connecting means to separate channels in such pair and monitor on any one of them or talk into any one of them or to interrupt them and interpose said connecting means both to monitor and talk.

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- 5 7. A station and a plurality of conductor pairs extending therethrough, connecting means adapted to bridge alternatively across any one pair,

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