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CARRIER TELEGRAPH REPEATER CIRCUITS

Filed Oct. 24, 1925

2 Sheets-Sheet 1

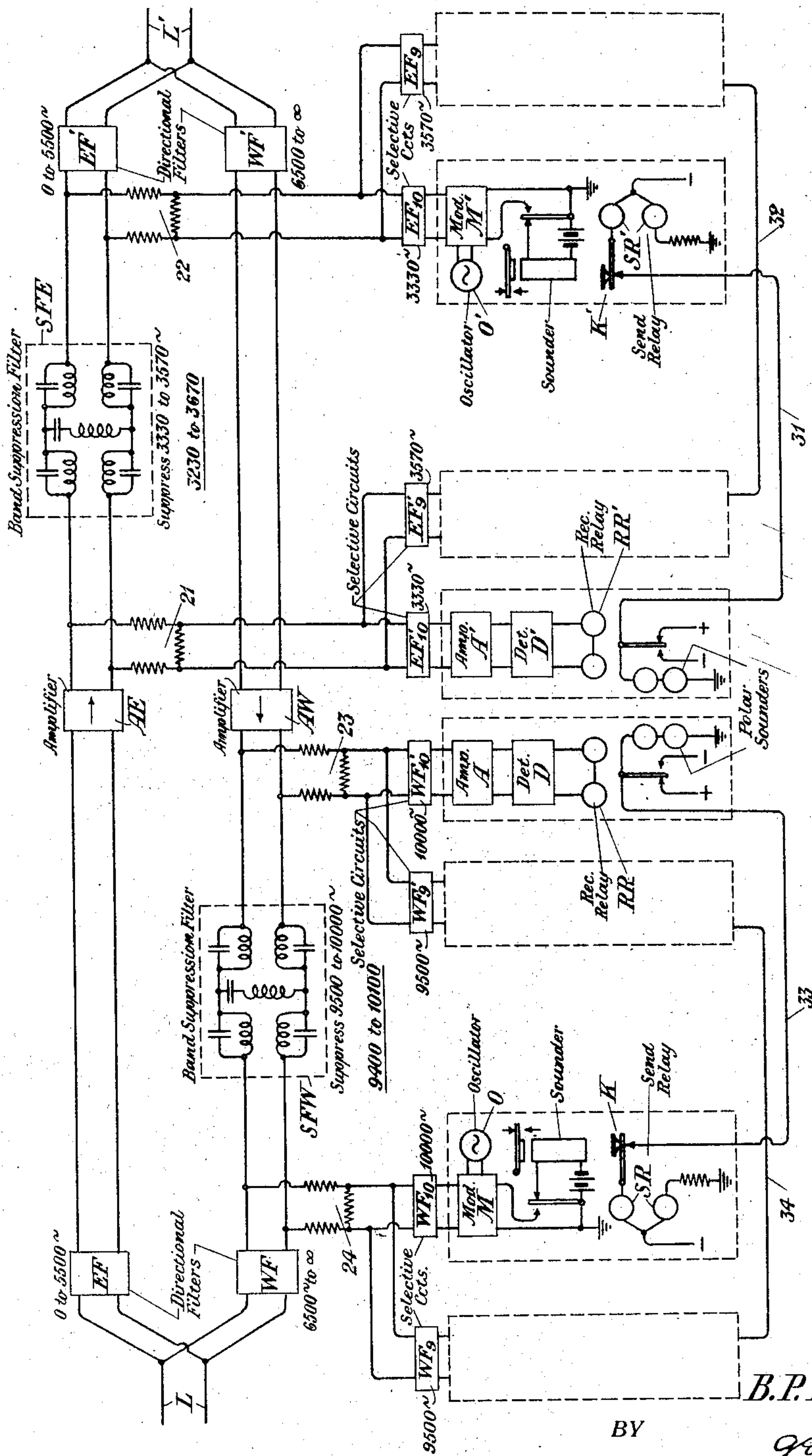


Fig. 1

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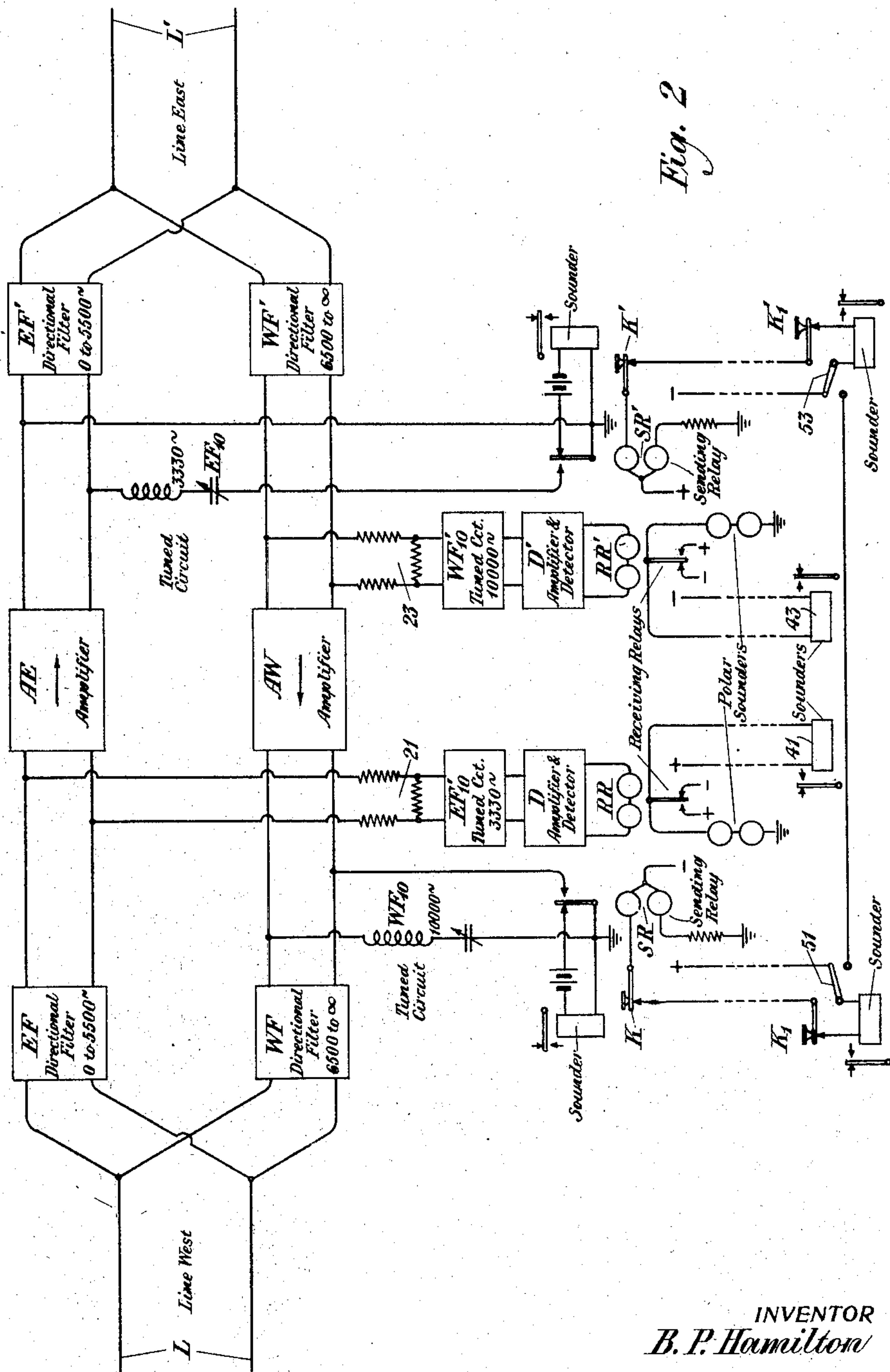


Fig. 2

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CARRIER-TELEGRAPH REPEATER CIRCUITS.

Application filed October 24, 1925. Serial No. 64,685.

This invention relates to repeater stations for multiplex signaling systems employing carrier currents, and more particularly to arrangements whereby intermediate subscribers' drops may be obtained at such repeater stations.

Two types of repeater equipment have heretofore been used for carrier telegraph systems. In the one type, individual repeating devices are provided for each channel of the system. In the other type, a single repeater circuit is used for amplifying all of the channels transmitting in a given direction. In a repeater arrangement of the first type, intermediate subscribers' drops may be readily provided for in connection with the repeater equipment, since each channel has its own individual repeater equipment. Amplifying equipment common to a plurality of channels would involve certain economies and would ordinarily be used where there is no necessity for separating the carrier channels one from the other. There are occasions, however, where it is desirable to provide local subscribers' drops at the repeater station for one or more of the channels without disturbing the effectiveness of the common repeater for amplifying all of the channels.

One of the objects of the present invention is to provide an arrangement whereby intermediate subscribers' drops may be obtained for one or more of the channels of a multiplex carrier system at a repeater station of the type in which the amplifying equipment is common to all of the channels transmitting in a given direction. Other and further objects of the invention will be clear from the following description when read in connection with the accompanying drawing, the figures of which illustrate certain diagrams embodying two modifications of the invention.

Referring to Figure 1, L and L' represent carrier transmission line sections over which a plurality of carrier currents of a multiplex telegraph system may be transmitted. The lines are shown interconnected through a carrier repeater involving an amplifier unit AE for amplifying the carrier currents of all of the channels transmitting from west to east, a similar amplifier AW being provided for amplifying the carrier currents of all of the channels transmitting from east to west. Each amplifier is in-

cluded in a separate transmission path at the repeater station, each path being used for transmission in one direction only. In systems of this type, the carrier frequencies used for transmitting in one direction are all included within one range of frequencies, and all of the carrier frequencies used for transmitting in the opposite direction are included within another range of frequencies. For example, the system may involve ten channels transmitting from west to east on carrier frequencies ranging from 3330 cycles per second to 5500 cycles per second, and ten similar channels transmitting from east to west on carrier frequencies ranging from 6500 cycles to 10,000 cycles. Low pass filters EF and EF' inserted on either side of the amplifier AE will enable the first group of carrier frequencies above mentioned to be transmitted through the amplifier AE while preventing the second group from being transmitted by said amplifier. Similarly, high pass filters WF and WF' included on either side of the amplifier AW will insure that only the carrier frequencies of the second group will be transmitted through said amplifier AW.

The filters above referred to are known as directional filters by reason of the fact that they separate the carrier frequencies of the channels at the repeater station according to the direction of transmission. It will be noted, however, that no provision is made for separating the carrier frequencies as between individual channels. In order that intermediate subscribers' drops may be provided in connection with any given transmission channel, some arrangement must be provided for segregating the particular frequency corresponding to that channel from all other frequencies at the subscribers' station. The apparatus shown in Fig. 1 is arranged to segregate two or more carrier frequencies from each directional band for the purpose of obtaining intermediate subscribers' drops for those channels. For this purpose a band suppression filter SFE of a well-known type is inserted on the output side of the amplifier AE to prevent the direct transmission of the carrier frequencies and side band frequencies corresponding to 3330 and 3570 cycles, for example, from the amplifier to the transmission line section L'. A resistance bridge 21 is connected across the output of the amplifier, and the two

carrier frequencies just referred to are transmitted through the bridge to suitable selective circuits EF'_{10} and EF'_9 . These frequencies are thus selected and impressed upon terminal receiving equipment of the ordinary type involving in the case of the frequency of 3330 cycles an amplifier A' and a detector D' , and a receiving relay RR' conventionally indicated in the drawing. Similar receiving equipment is provided in connection with the selective circuit EF'_9 . This receiving equipment will enable the local operator to receive signals on the channels corresponding to the two frequencies just referred to.

In order to enable the local operator to transmit at frequencies corresponding to the suppressed channels, a similar resistance bridge 22 is connected across the opposite side of the suppression filter SFE , and conductors from said bridge lead to similar selective circuits such, for example, as tuned circuits EF_9 and EF_{10} . Carrier transmitting equipment of the usual terminal type is associated with each of these selecting devices, for example, the transmitting equipment associated with the selective device EF_{10} comprises a sending relay SR' arranged to short-circuit the input of the modulator M' in accordance with the dots and dashes of the code, the modulator M' being supplied with a carrier frequency of 3330 cycles from a suitable local oscillator.

Arrangements are also provided whereby the signals corresponding to each of the suppressed channels may be transmitted through the local subscribers' drops from the line L to the line L' . For this purpose, the receiving relay RR' controls, by its armature, not only the usual polar sounder, but the polarity of current applied to a local subscriber's loop 31 which is connected through a key K' to the second relay SR' . Thus, in the normal operation of the circuit, the carrier frequency of 3330 cycles, which is suppressed by the filter SFE , is selected by the filter EF'_{10} so that the signals superposed thereon may be detected by the detector D_1 to operate the receiving relay RR' . The latter relay then transmits the signals through the local relay 31 in a well-known manner to operate the sending relay SR' which in turn causes an interruption of the carrier frequencies of 3330 cycles from the local oscillator O' , so that the carrier signals are then transmitted through the selective circuit EF_{10} and filter EF' to the line L' . The local operator may receive the signals by means of the polar sounder associated with the relay RR' , and when signals are not being received from the line L , may operate the key K' to transmit signals over the line L' . In a like manner, the receiving equipment corresponding to the channel requiring a carrier frequency of 3570 cycles and conventionally

indicated in the drawing, may be connected by another subscriber's loop 32 to permit a similar operation at the local repeater station.

In order to provide intermediate subscribers' drops in connection with the corresponding channels transmitting from east to west, a suppression filter SFW of a well-known type is included in the output circuit of the amplifier AW to suppress the carrier frequencies and side band frequencies of say 9500 cycles and 10,000 cycles. These particular frequencies are led through a resistance bridge 23 to receiving equipment similar to that already described, except that selective devices WF'_9 and WF'_{10} are arranged to select respectively the frequencies of 9500 cycles and 10,000 cycles. Likewise, on the opposite side of the suppression filter SFW , another resistance bridge 24 is provided, and this bridge is connected to transmitting equipment similar to that already described, except that the selective devices in this case will be selective of 9500 cycles and 10,000 cycles, respectively, and the local oscillators will be arranged to generate these two frequencies. Local subscribers' loops 33 and 34 connect the two groups of sending and receiving equipment so that by means of the key K , for example, the operator may signal at the frequency of 10,000 cycles to the line L when no signals are being received at that frequency from the line L' . If signals are being transmitted at the carrier frequency of 10,000 cycles over the line L' , such signals may be received by the local operator through the control exercised by the receiving relay RR over the usual polar sounder. The relay RR at the same time transmits the detected signals over the loop 33 so that the sending relay SR is actuated to relay the signals through the modulator M , filter WF_{10} and filter WF to the line L .

Fig. 2 shows a modified arrangement which is particularly adapted for use where only one carrier channel in each direction is to be used for operating an intermediate subscribers' drop. In this case, the arrangement of the repeater apparatus is identical with that described in connection with Fig. 1, except that the suppression filters SFE and SFW are omitted. A resistance bridge 21 is connected across the input side of the amplifier AE and leads to a selective circuit EF'_{10} for selecting the carrier frequency of 3330 cycles used for transmitting from west to east. The usual receiving equipment comprising amplifier and detector D , and a receiving relay RR is associated with the tuned circuit. In this instance, the carrier frequency just referred to is not suppressed from the repeater path, but is transmitted through the amplifier, and a circuit EF_{10} tuned to the frequency of 3330 cycles is arranged to be bridged across the output side

of the repeater under the control of the sending relay SR'. When no signals are being transmitted through the repeater at this frequency, the carrier frequency is steadily maintained upon the circuit, and when the tuned circuit EF'₁₀ is closed, the carrier frequency will be suppressed and prevented from being transmitted to the line section L'. Accordingly, this carrier frequency may be suppressed in accordance with the code by operating the sending relay SR' by means of a key K' or a key K'₁ included in a local subscriber's loop. The receiving relay RR' controls, in addition to the usual polar sounder, another loop leading to a local sounder 41. By means of said sounder, the local operator may receive signals transmitted from the line L at the carrier frequency of 3330 cycles. As already stated, signals may be transmitted to the line section L' at this frequency by operating the key K' or K'₁ to open and close the tuned circuit EF'₁₀. This, of course, would only be done when no signals are being transmitted at this frequency over the line L. When signals are transmitted over the line L at this frequency, they will pass through and be amplified by the amplifier AE and thus transmitted directly to the line L' in the usual manner.

For the corresponding channel transmitting from east to west, for example, the channel employing the carrier frequency of 10,000 cycles, a similar receiving equipment is connected with the bridge 23 associated with the input side of the amplifier AW. Likewise, similar transmitting equipment is connected to and controls the tuned circuit WF'₁₀ so that said tuned circuit may be bridged across the output side of the amplifier AW. When no signals at the carrier frequency of 10,000 cycles are being transmitted over the line L', the operator may employ either key K or K₁ to transmit signals at the carrier frequency of 10,000 cycles to the line L. When signals are being transmitted at this carrier frequency over the line L', they will be received by means of the receiving apparatus associated with the bridge 23, thereby causing the receiving relay RR' to operate the sounder 43 as well as the usual polar sounder. At the same time, the carrier frequency upon which the signals are superposed will be transmitted through the amplifier AW in the usual manner for transmission over the line L to a distant station.

Should the operator desire to simultaneously transmit to both the line L and the line L', switches 51 and 53 will be thrown to their alternative positions, thereby connecting the loops associated with the sending relays SR and SR' together in series. When so connected, the operation of any of the keys K, K₁, K'₁ and K' will result in oper-

ating both relays SR and SR', thereby transmitting signals at the carrier frequency 3330 cycles to the line L' and at the carrier frequency 10,000 cycles to the line L.

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

What is claimed is:

1. In a signaling system, a pair of transmission lines interconnected through a common amplifier, so that a plurality of carrier frequencies transmitted from one line to the other in the same direction are amplified by said common amplifier, means for obtaining an intermediate subscriber's drop at the repeater station comprising a bridged circuit associated with the amplifier path, a selective device connected with said circuit for selecting from said amplifier path a carrier frequency incoming from one of said lines without interfering with the transmission of other carrier frequencies over the amplifier path to the other line, and carrier receiving equipment associated with said selective device, said carrier receiving equipment including a receiving relay for operating local Morse receiving equipment.

2. In a signaling system, a pair of transmission lines interconnected through a common amplifier, so that a plurality of carrier frequencies transmitted from one line to the other in the same direction are amplified by said common amplifier, means for obtaining an intermediate subscriber's drop at the repeater station comprising a bridged circuit associated with the amplifier path, a selective device connected with said circuit for selecting from said amplifier path a carrier frequency incoming from one of said lines without interfering with the transmission of other carrier frequencies over the amplifier path to the other line, carrier receiving equipment associated with said selective device, said carrier receiving equipment including a receiving relay for operating local Morse receiving equipment, and means controlled by local Morse sending apparatus for transmitting signals to said last mentioned line upon a carrier frequency corresponding to the frequency selected into said receiving equipment.

3. In a signaling system in which a common amplifier is employed for amplifying all of the carrier frequencies transmitting in one direction, and another common amplifier is employed for amplifying all of the carrier frequencies transmitting in the opposite direction, means for obtaining intermediate subscribers' drops comprising a bridged circuit associated with each amplifier, a selective device connected to each bridged circuit, one of said selective devices

being selective of a frequency used for transmitting in one direction, and the other selective device being selective of one of the frequencies used for transmitting in the opposite direction, and carrier receiving equipment associated with each selective circuit, said carrier receiving equipment including means for operating local Morse receiving apparatus.

4. In a signaling system in which a common amplifier is employed for amplifying all of the carrier frequencies transmitting in one direction, and another common amplifier is employed for amplifying all of the carrier frequencies transmitting in the opposite direction, means for obtaining intermediate subscribers' drops comprising a bridged circuit associated with each amplifier, a selective device connected to each bridged circuit, one of said selective devices being selective of a frequency used for transmitting in one direction, and the other selective device being selective of one of the frequencies used for transmitting in the opposite direction, carrier receiving equipment associated with each selective circuit, said carrier receiving equipment including means for operating local Morse receiving apparatus, and means comprising local Morse sending equipment for controlling the transmission of signals at carrier frequencies corresponding to each of the carrier frequencies selected.

5. In a signaling system in which the carrier frequencies corresponding to a plurality of channels transmitting in the same direction are amplified by a common amplifier, means for obtaining intermediate subscribers' loops comprising a bridged circuit associated with the path of said amplifier, a selective device associated with said bridged circuit and selective of one of the carrier frequencies to be transmitted through the amplifier, carrier receiving equipment associated with said selective circuit, a second bridged circuit associated with the amplifier path, said second circuit including a selective device selective of a frequency corresponding to the frequency selected by said first mentioned selective device, carrier transmitting equipment for controlling the transmission of said frequency through said second selective circuit, a Morse sender for controlling said carrier transmitting equipment and a Morse receiver controlled by said carrier receiving equipment.

6. In a signaling system in which the carrier frequencies corresponding to a plurality of channels transmitting in the same direction are amplified by a common amplifier, means for obtaining intermediate subscribers' loops comprising a bridged circuit associated with the path of said amplifier, a selective device associated with said bridged circuit and selective of one of the carrier frequencies to be transmitted through the am-

plifier, carrier receiving equipment associated with said selective circuit, a second bridged circuit associated with the amplifier path, said second circuit including a selective device selective of a frequency corresponding to the frequency selected by said first mentioned selective device, carrier transmitting equipment for controlling the transmission of said frequency through said second selective circuit, a Morse sender for controlling said carrier transmitting equipment, a Morse receiver controlled by said carrier receiving equipment, and a local loop interconnecting said Morse receiver and Morse sender for relaying the signals superposed on a selected carrier frequency.

7. In a signaling system in which a common amplifier is employed for amplifying all carrier frequencies transmitted from west to east and a similar common amplifier is employed for amplifying all carrier frequencies transmitted from east to west, means for providing intermediate subscribers' drops, said means comprising a bridged circuit associated with each of said amplifiers, a selective device associated with each bridged circuit, one of said selective devices being selective of a carrier frequency transmitted from west to east, and the other selective device being selective of the carrier frequency transmitted from east to west, carrier receiving equipment associated with each of said selective devices, a second bridged circuit being associated with the path of each of said amplifiers, a selective device associated with each of said second bridged circuits and selective of frequencies corresponding to the frequency of the selective device associated with the other bridged circuit of the same amplifier, carrier transmitting equipment for controlling the transmission of the corresponding carrier frequency through each of said second selective devices, a Morse transmitter for controlling each carrier transmitting equipment, and a Morse receiver associated with each carrier receiving equipment.

8. In a signaling system in which a common amplifier is employed for amplifying all carrier frequencies transmitted from west to east and a similar common amplifier is employed for amplifying all carrier frequencies transmitted from east to west, means for providing intermediate subscribers' drops, said means comprising a bridged circuit associated with each of said amplifiers, a selective device associated with each bridged circuit, one of said selective devices being selective of a carrier frequency transmitted from west to east, and the other selective device being selective of the carrier frequency transmitted from east to west, carrier receiving equipment associated with each of said selective devices, a second bridged circuit being associated with the

path of each of said amplifiers, a selective device associated with each of said second bridged circuits and selective of frequencies corresponding to the frequency of the selective device associated with the other bridged circuit of the same amplifier, carrier transmitting equipment for controlling the transmission of the corresponding carrier frequency through each of said second selective devices, a Morse transmitter for controlling each carrier transmitting equipment, a Morse receiver associated with each carrier receiving equipment, and local subscribers' loops interconnecting each Morse receiving equipment with the corresponding Morse sending equipment, so that the signals carried by the selected carrier frequency transmitted from west to east will be relayed through the local loop, and the signals carried by the selected carrier frequency transmitting from east to west will be relayed through a local loop.

9. In a signaling system in which a common amplifier is provided in a repeater path interconnecting two line sections for amplifying all of the carrier frequencies transmitted from one line section through the repeater path to the other line section in a given direction, means for providing intermediate subscribers' drops, said means comprising a filter included in said repeater path for suppressing at least one of the carrier frequencies transmitted in a given direction, a bridged circuit connected to each side of said suppression filter, a selective device associated with each bridged circuit and selective of the carrier frequency suppressed by said suppression filter, a carrier receiving equipment associated with one of said selective devices, carrier transmitting equipment associated with the other selective device, a Morse receiver controlled by said carrier receiving equipment, a Morse sender for controlling said carrier transmitting equipment, and a local subscriber's loop for relaying signals from the Morse receiver to the Morse sender.

by said suppression filter, a carrier receiving equipment associated with one of said selective devices, carrier transmitting equipment associated with the other selective device, a Morse receiver controlled by said carrier receiving equipment and a Morse sender for controlling said carrier transmitting equipment.

10. In a signaling system in which a common amplifier is provided in a repeater path interconnecting two line sections for amplifying all of the carrier frequencies transmitted from one line section through the repeater path to the other line section in a given direction, means for providing intermediate subscribers' drops, said means comprising a filter included in said repeater path for suppressing at least one of the carrier frequencies transmitted in a given direction, a bridged circuit connected to each side of said suppression filter, a selective device associated with each bridged circuit and selective of the carrier frequency suppressed by said suppression filter, a carrier receiving equipment associated with one of said selective devices, carrier transmitting equipment associated with the other selective device, a Morse receiver controlled by said carrier receiving equipment, a Morse sender for controlling said carrier transmitting equipment, and a local subscriber's loop for relaying signals from the Morse receiver to the Morse sender.

In testimony whereof, I have signed my name to this specification this 22nd day of October, 1925.

BAXTER P. HAMILTON.