

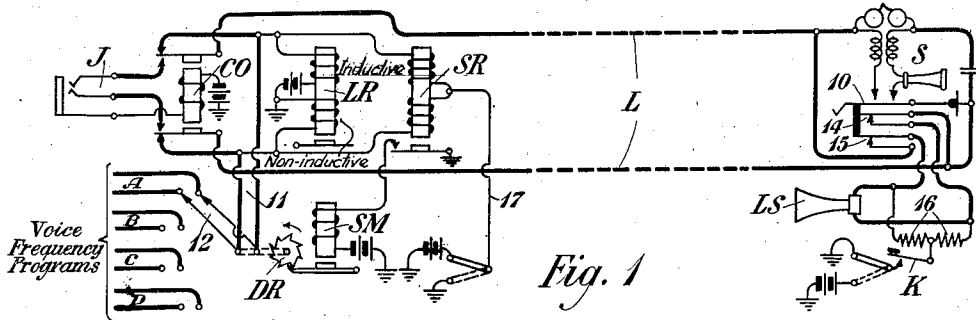
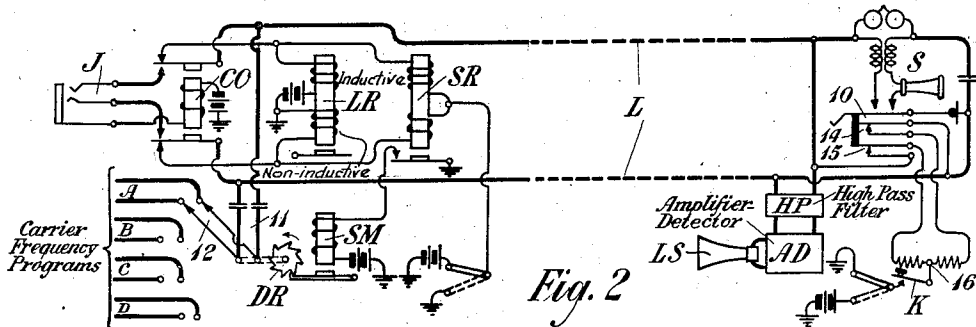
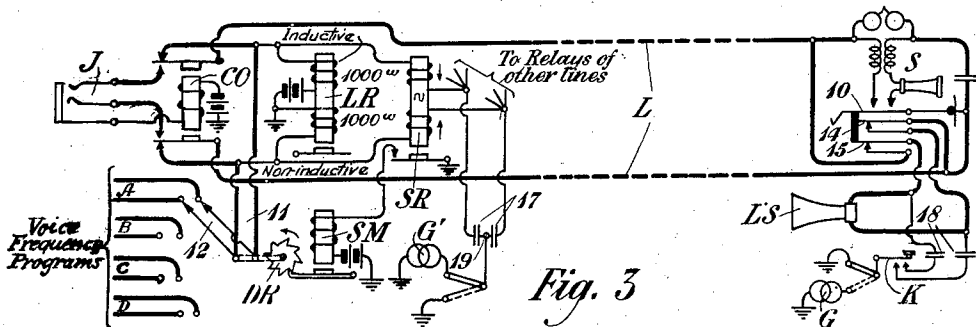
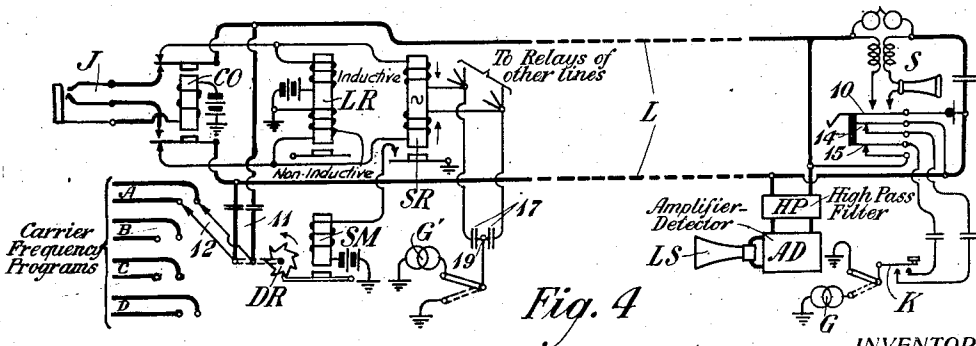
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M. E. STRIEBY

PROGRAM SELECTING CIRCUITS

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UNITED STATES PATENT OFFICE.

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PROGRAM-SELECTING CIRCUITS.

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This invention relates to transmission systems for transmitting programs over wires, and more particularly to arrangements for the selection of programs for such systems.

Where wire lines, such as ordinary telephone lines, for example, are used for the transmission of programs, such as news, lectures, concerts and the like, it is desirable that some arrangement be provided whereby the subscriber may automatically select the particular program which he desires to hear. In accordance with the present invention, it is proposed to accomplish this result by providing a selective switch at the central office which may be directly controlled by the subscriber to connect the terminals of the subscriber's line to the terminals of any one of a number of trunks each leading to a different program.

By the use of a directly controlled selective switch for selecting a program, it becomes immaterial whether the program be transmitted at voice frequencies or carrier frequencies, and it also becomes immaterial whether the several programs be transmitted at the same frequency or whether different carrier frequencies are used for different programs. The directive switch may be controlled by impulses of either direct or alternating current and the source of current for operating the switches may be located either at the sending station or at the subscriber's station. Preferably, the directive switch, in accordance with the present invention, will be operated by an impulse sender at the subscriber's station over the two sides of the line in parallel.

The invention will now be more fully understood from the following description, when read in connection with the accompanying drawing, Figure 1 of which illustrates how a direct current operated directive switch may be used to select a program transmitted at ordinary telephonic frequencies; Fig. 2 of which shows how a similar switch may be used to select carrier frequency programs; Fig. 3 of which shows how a directive switch operated by alternating current may be used to select voice frequency programs, and Fig. 4 of which shows how a similar directive switch may be used to select carrier frequency programs.

Referring to Fig. 1, L designates an ordi-

nary telephone transmission line terminating in the usual subscriber's set S at one end and terminating at the central office in the usual switching jack J. Normally the telephone line L is connected over the contacts of a cut-off relay CO to the windings of the line relay LR. The line relay, as is usual, may comprise two windings, the upper of which is associated with the tip side of the line and is inductive. The lower winding is associated with the ring side of the line and is non-inductive, and consequently, does not magnetize the core of the relay when current flows through said winding. The cut-off relay CO is so arranged that when it is operated the line relay LR is disconnected from the line L and the line is connected directly to the tip and ring terminals of the jack J.

In order that the line may be used for program purposes during such time as it is not being used for ordinary telephone purposes, a program receiver such as the loud speaker LS is provided at the subscriber's station. This receiver is bridged across the line through the back contacts 14 and 15 of the subscriber's switchhook. When the subscriber set S is used for ordinary telephonic purposes, the removal of the receiver from the switchhook opens the circuit of the loud speaker LS so that it may not be then used for receiving programs. At the central office a pair of conductors 11 are connected from the back contacts of the cut-off relay CO to the wipers 12 of the directive switch DR. The switch DR may be stepped by means of the stepping magnet SM into connection with any one of a number of trunks A, B, C or D, leading to different voice frequency programs.

In order to operate the stepping magnet SM, a switching device such as a dial or key K is provided at the subscriber's station for sending impulses of current over the two sides of the line in parallel to operate the differential stepping relay SR, the relay SR being bridged across the conductors leading from the back contacts of the cut-off relay in parallel with the windings of the line relay LR. The circuit of the key K is connected to the midpoint of the bridged impedance 16, this impedance being bridged across the conductors leading to the loud

speaking receiver LS. The impedance 16 is shown in Fig. 1 as a pure resistance. It may, however, also contain inductance thereby causing a smaller loss to the voice frequency currents in the circuit across which it is bridged. Consequently, when the receiver is removed from the switchhook, the impedance of the bridge 16 is disconnected from the line. The impulses transmitted over the two sides of the line to operate the stepping relay SR are direct current impulses and may be supplied from a direct current source located either at the central office or at the subscriber's station as indicated.

The operation is as follows: When the line L is not in use for telephone purposes and the subscriber desires to hear a program, such as the program C, for example, the subscriber will merely actuate the dial or key K, thereby sending impulses from ground, through said key, thence in parallel through the bridge 16, over the contacts 14 and 15 of the switchhook 10, over the two sides of the line L, over the upper and lower back contacts of the cut-off relay CO, and through the upper and lower windings of the differential stepping relay SR, at which point the parallel circuit merges and passes over conductor 17 to battery. It will be observed that a path is established from ground, over the key K, through the left-hand half of the bridge 16, then over the tip conductor of the line L, upper back contact of the cut-off relay CO, and through the upper winding of the line relay LR to battery. The resistance of the element 16 is so great, however, that the line relay is not operated over this circuit. The current flowing through the two windings of the differential relay SR, however, operates said relay so that the impulses sent by the key K are transmitted by the relay SR to the stepping magnet SM. Accordingly, the directive switch DR is operated step-by-step by the mechanism conventionally indicated to advance the wipers 12 to the terminals of the trunk leading to the program C. The currents for this program are now transmitted over the wipers 12 and conductors 11, over the back contacts of the cut-off relay CO and over the line L to the loud speaker LS.

If, while the circuit is being used for program purposes, the subscriber desires to make a telephone call, he merely removes the receiver from the switchhook 10 in the usual manner. The loud speaker LS is disconnected at the back contacts 14 and 15 of the switchhook so that the program ceases. At the same time, a low resistance circuit is established through the substation set from battery, through the upper winding of the line relay LR, over the back contact of the cut-off relay CO, over the tip side of the line L, over the switchhook 10, back

over the ring side of the line L, back contact of the cut-off relay CO, and thence through the non-inductive winding of the relay LR to ground. No energizing circuit is established for the relay SR because of the differential relation of its windings. The current through the upper winding of the relay LR causes the line relay to operate the line lamp (not shown) in the usual manner.

The operator, upon observing this signal, will insert the plug of the cord circuit into the jack J, thereby actuating the cut-off relay CO. The cut-off relay connects the line L at its front contacts to the tip and ring terminals of the jack J, and at the same time disconnects the line L from the relay LR and the differential relay SR, as well as the broadcasting connections 11 leading to the switch DR. The call is then completed in the usual manner. At the end of the conversation, the subscriber hangs up his receiver and the operator withdraws the plug from the jack J, thereby releasing the cut-off relay CO. This at once connects the line L to the program connections 11 and the subscriber may continue to hear the program being transmitted.

If, while the program is being received, a telephone call should come in for line L, the operator will insert the plug of her cord into the jack J, thereby operating the cut-off relay as before. The line L will now be disconnected from the program and will be connected over the front contacts of the cut-off relay to the terminals of the jack J. In answer to the ringing signal, the subscriber will remove his receiver from the switchhook and disconnect the loud speaker LS and the bridge 16. It will be observed that if the line is being used for telephonic purposes, it is impossible to set the directive switch DR, for the key K and the bridge 16 are disconnected at the subscriber's station as soon as the subscriber removes his receiver from the switchhook and the differential selecting relay SR is disconnected at the central station as soon as the cut-off relay CO is operated.

The same arrangements may be used for selecting any one of a number of carrier programs, as illustrated in Fig. 2. In this case, where the programs are transmitted at carrier frequencies, it is to be observed that the line may be used simultaneously for receiving program transmission and for ordinary telephonic purposes. Consequently, the connections 11 extending to the wipers 12 of the directive switch are extended to the tip and ring sides of the line L adjacent the armature connections of the cut-off relay, so that the operation of the cut-off relay will not disconnect the program connections 11 from the line L, the cut-off relay in this instance merely serving to disconnect the line relay LR and the stepping relay SR.

At the subscriber's station the loud speaker LS is bridged across the line independently of the switchhook 10, so that the removal of the receiver from the switchhook does not disconnect the loud speaker. The selecting key K is, however, connected through the bridge 16 to the two sides of the line in parallel over the contacts 14 and 15 of the switchhook as before. The program cannot, therefore, be changed during the time that the telephone set is in use, it being undesirable to permit change of program at this time because the subscriber would hear the noise due to the pulses transmitted by the key K.

The carrier frequency programs may be transmitted each at a different frequency, but by the use of the directive selective switch it is possible to use the same carrier frequency for all of the programs, since but one program will be transmitted over a line at a time. At the subscriber's station it will, of course, be necessary to provide suitable amplifying and detecting apparatus conventionally indicated at AD in order to translate the carrier program into voice frequency currents for operating the loud speaker. No selecting apparatus is necessary at the subscriber's station even in the case of carrier transmission, except a single high pass filter conventionally indicated at HP, this filter being provided to prevent the voice frequency currents transmitted over the line from actuating the loud speaker. The high pass filter will, of course, pass the carrier frequencies used for broadcasting, regardless of whether the same carrier frequency is used for all of the programs or whether a different carrier frequency is used for each program.

Instead of employing direct current for operating the selective switch, pulses of alternating current may be employed as indicated in Fig. 3. In this figure the circuit is arranged for the selection of voice frequency programs. Consequently, the connection of the loud speaker LS to the line and the connection of the conductors 11 to the line will be the same as in Fig. 1. The relay SR, however, will be a differential alternating current relay instead of a direct current relay. The windings of the relay SR will be connected to the generator G' or ground, as the case may be, through condensers 17 provided for the purpose of keeping the direct current out of the ground connection. These condensers may be included in conductors common to a large number of relays, such as LR, associated with the different lines. At the subscriber's station the connections through the key K to the two sides of the line will be made through a pair of condensers 18, said condensers being arranged to bridge across the loud speaker LS when the switching key K is depressed.

The source of alternating current for operating the directive switch DR may be either at the central station or at the subscriber's station. As indicated in the figure, the switch 16 may be thrown to its upper position, thereby connecting the alternating current source G' to the windings of the relay SR. A similar switch 16' at the subscriber's station, when thrown to its upper position, will connect the circuit of the key K to ground. By reversing the connections of the two switches, the key K will be connected to ground through an alternating current source G' at the subscriber's station, while the windings of the relay SR will be connected directly to ground at the central station.

The alternating current used for operating the directive switch DR may have any desired frequency but it will usually be expedient to use currents supplied from the power mains of a lighting circuit. This frequency usually is about 60 cycles but as the ringer of the subscriber's set is usually tuned to a frequency of about 20 cycles, the ringer will not respond to the transmission of the alternating current for operating the directive switch.

In order to select a desired program, the subscriber manipulates the key K, thereby completing a circuit (assuming the switches are in their upper position) from ground, to the midpoint of the condensers 18, thence in parallel through said condensers, over the back contacts 14 and 15 of the switchhook 10, over the two sides of the line L in parallel, over the back contacts of the cut-off relay CO, through the upper and lower windings of the stepping relay SR, through the two condensers 17 to the point 19, and thence to ground through the source G'. Each time the key K is closed, the alternating current relay SR is energized to transmit a pulse so that the directive switch is actuated step-by-step until its wipers rest upon the terminals of the trunk leading to the desired program. The line relay LR will, of course, not be actuated by the alternating current, partly because its lower winding, through which the alternating current flows, is non-inductive, and partly because its circuit is not tuned to the frequency of the alternating current. The remaining features of the operation are as already described in connection with Fig. 1.

The alternating current arrangement may be employed for selecting carrier frequency programs as illustrated in Fig. 4. As in the case of Fig. 2 the program connections 11 are made directly to the terminals of the line L so that the operation of the cut-off relay does not disconnect the broadcasting circuit. The tuned circuits including the key K at the subscriber's station and the differential alternating current relay SR at the

central office are connected to the two line conductors in the same manner as in Fig. 2, so that the impulses will be transmitted over the line conductors in parallel and so that the selection of programs may take place while the line is being used for telephonic purposes. The loud speaking receiver LS, together with the amplifying detector AD and the high pass filter HP, will, as in Fig. 2, be bridged across the line L directly, independently of the switchhook. Consequently, a program already selected may continue to be received by the subscriber through his loud speaker while a conversation is taking place, although the subscriber will not be able to change the program. The operation of the circuit in detail will be clear from the previously described operation of Figs. 2 and 3 and need not be further discussed.

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 following claims.

What is claimed is:

1. In a program transmitting system, a subscriber's telephone line terminating in a subscriber's telephone apparatus at the subscriber's station, switching means at the central office whereby a connection may be established between said subscriber's line and another subscriber's line, a plurality of trunks at the central office upon which programs may be impressed, a directly operated switch independent of said first mentioned switching means at the central office for establishing connections between said line and any desired trunk to exclusion of other trunks, and means at the subscriber's station for controlling the operation of said switch over the two sides of the line in parallel with the receiver on the switch hook.

2. In a program transmitting system, a subscriber's telephone line terminating in a subscriber's telephone apparatus at the subscriber's station, switching means at the central office whereby a connection may be established between said subscriber's line and another subscriber's line, a plurality of trunks at the central office upon which programs may be impressed, a step-by-step switch independent of said first mentioned switching means at the central office for establishing connections between said line and any desired trunk to exclusion of other trunks, and means at the subscriber's station for operating said switch over the two sides of the line in parallel with the receiver on the switch hook.

3. In a program transmitting system, a subscriber's telephone line terminating in a subscriber's telephone apparatus at the subscriber's station, switching means at the cen-

tral office whereby a connection may be established between said subscriber's line and another subscriber's line, a plurality of trunks at the central office upon which programs may be impressed, an impulse-operated switch independent of said first mentioned switching means at the central office for establishing connections between said line and any desired trunk to exclusion of other trunks, an impulse sender at the subscriber's station, and means whereby said sender may transmit impulses over the two sides of the line in parallel to operate said switch with the receiver on the switch hook.

4. In a program transmitting system, a subscriber's telephone line terminating in a subscriber's telephone apparatus at the subscriber's station, switching means at the central office for establishing connections between said line and other lines so that telephone conversations may take place at ordinary telephonic frequencies, a plurality of trunks at the central office upon which different programs may be impressed at carrier frequencies, a directly operated switch independent of said first mentioned switching means at the central office for switching said subscriber's line to the trunk upon which a desired carrier program is impressed to exclusion of other trunks, and means at the subscriber's station to control the operation of said switch over the two sides of the line in parallel with the receiver on the switch hook.

5. In a program transmitting system, a subscriber's telephone line terminating in a subscriber's telephone apparatus at the subscriber's station, switching mean at the central office for establishing connections between said line and other lines so that telephone conversations may take place at ordinary telephonic frequencies, a plurality of trunks at the central office upon which different programs may be impressed at carrier frequencies, a step-by-step switch independent of said first mentioned switching means at the central office for switching said subscriber's line to the trunk upon which the desired carrier program is impressed to exclusion of other trunks, and means at the subscriber's station for controlling the operation of said switch over the two sides of the line in parallel with the receiver on the switch hook.

6. In a program transmitting system, a subscriber's telephone line terminating in a subscriber's telephone apparatus at the subscriber's station, switching means at the central office for establishing connections between said line and other lines so that telephone conversations may take place at ordinary telephonic frequencies, a plurality of trunks at the central office upon which different programs may be impressed at carrier frequencies, an impulse-operated switch in-

dependent of said first mentioned switching means at the central office for switching said subscriber's line to the trunk upon which a desired carrier program is impressed to exclusion of other trunks, an impulse sender at the subscriber's station, and means for transmitting impulses from said sender to said switch over the two sides of the line in parallel with the receiver on the switch hook. 10

In testimony whereof, I have signed my name to this specification this 7th day of December, 1923.

MAURICE E. STRIEBY.