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PROGRAM SELECTING CIRCUITS

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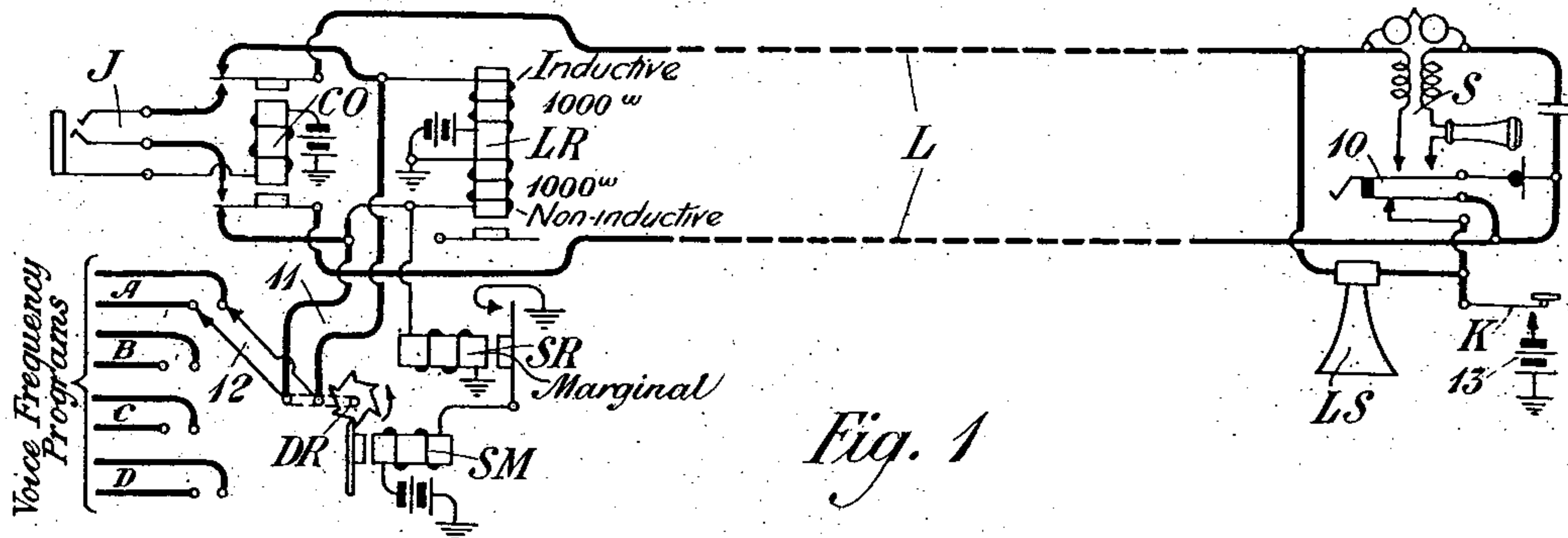


Fig. 1

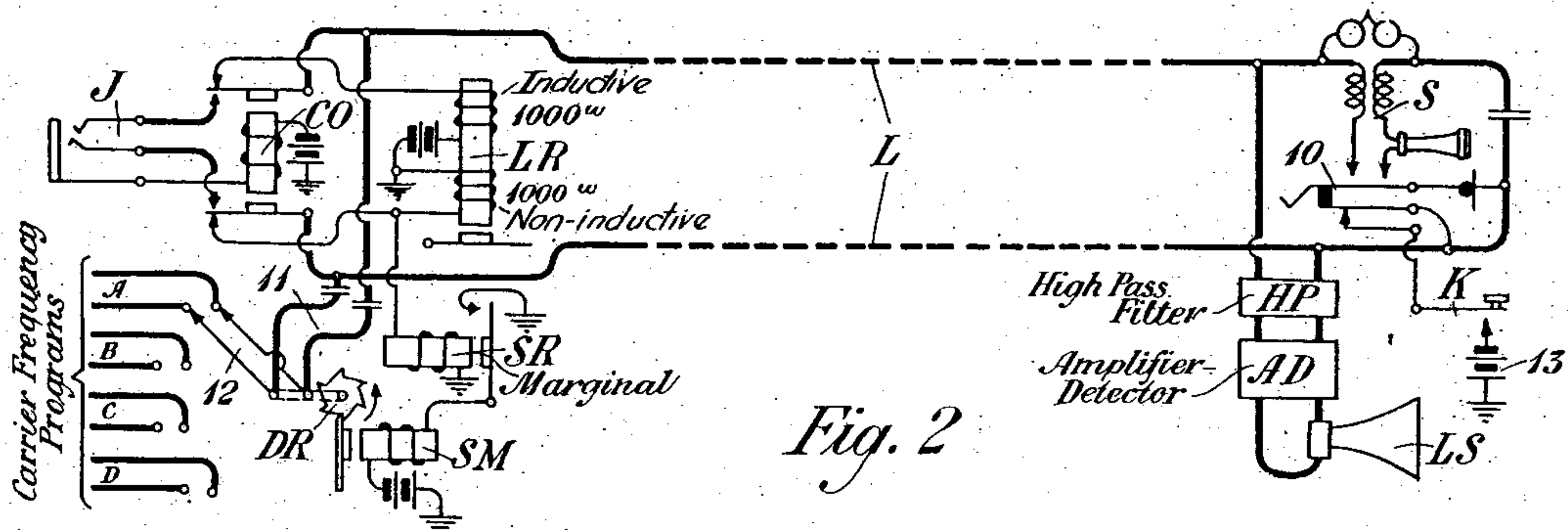


Fig. 2

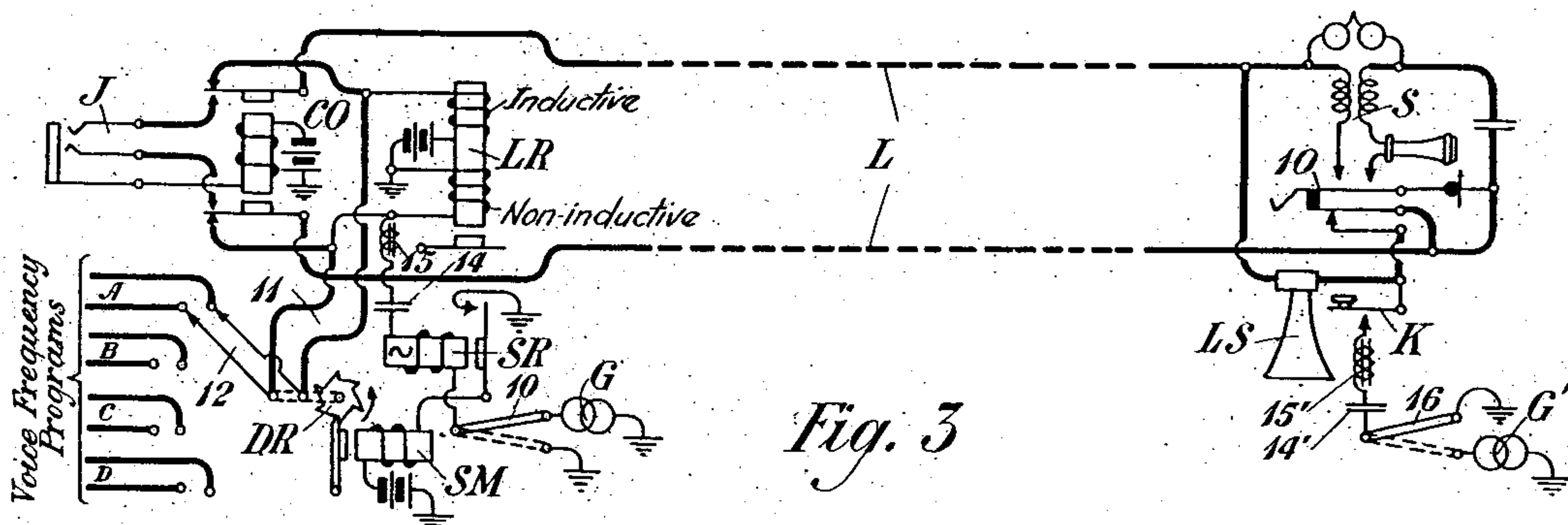


Fig. 3

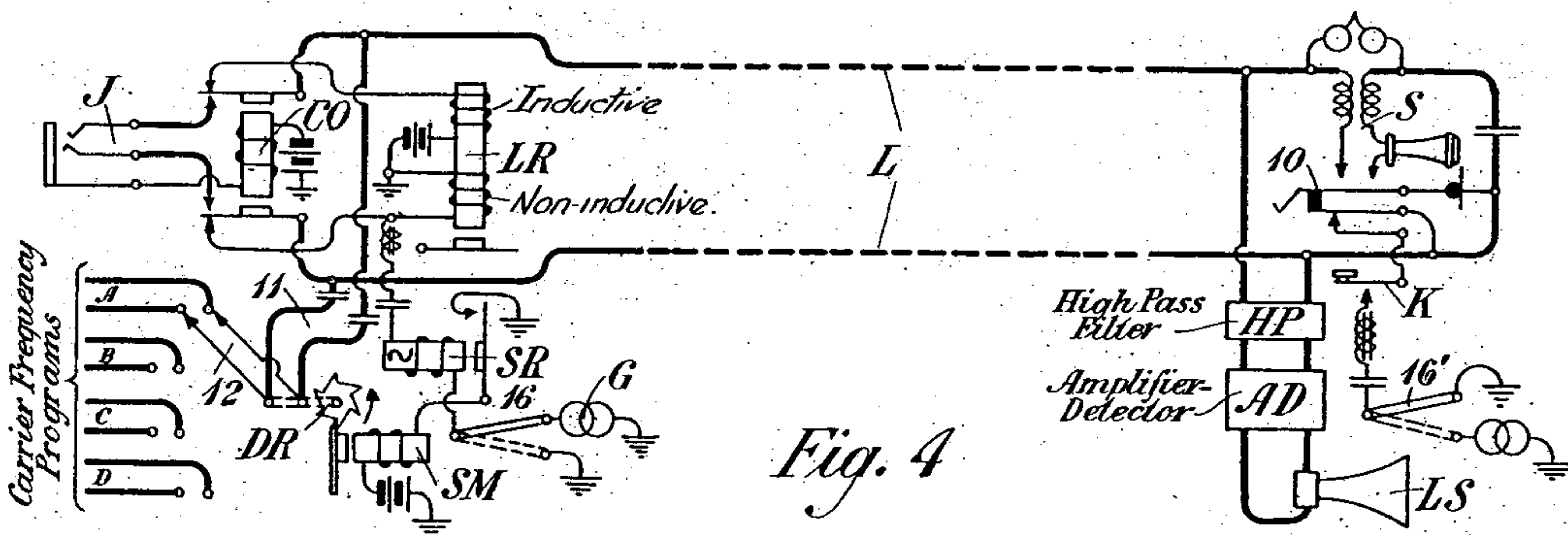


Fig. 4

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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.

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 programs 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 ordinary 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, each of about 1000 ohms. The upper winding is associated with the tip side of the line and is inductive. The lower winding is associated with the ring side of the line but 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, said receiving device being bridged across the line through the back contact of the switchhook 10. When the substation 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 a 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 battery current from one side of the line to energize the marginal stepping relay SR.

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 to send impulses over the ring side of the line L. These impulses pass from battery 13, over the contact of the key K, back contact of the switchhook 10, over the ring side of the line L, lower back contact of cut-off relay CO, and thence in parallel through the winding of the marginal stepping relay SR and the lower non-inductive winding of the relay LR. The current flowing in the latter winding is without

effect and the current flowing in the winding of the relay SR energizes 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 in the usual manner. The loud speaker LS is disconnected at the back contact of the switchhook so that the broadcast 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 in parallel through the non-inductive winding of the relay LR and through the winding of the marginal relay SR. The current flowing through the marginal relay SR over the two sides of the line L in series is not sufficient to actuate this relay but the current through the upper winding of the relay LR causes the line relay to attract its armature and 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 line relay LR, 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, 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 connections 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. 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 is disconnected as soon as the subscriber removes his receiver from the switchhook and the selecting relay SR at the central station is disconnected 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 to the tip side of the line over the back contact 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 program transmission, 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 an alternating current relay instead of a marginal relay and will be connected to the ring side of the line L through a circuit tuned by means of the capacity 14 and inductance 15. Similarly, at the subscriber's station, the connection through the key K will be tuned by means of the capacity 14' and inductance 15'.

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, a switch 16 may be thrown to its upper position at the central station, thereby connecting the alternating current relay SR through the alternating current source G to ground. 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 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 switches 16 and 16' are in their upper position) from ground, through the tuning elements 14' and 15', over the key K, back contact of switch 10, lower back contact of cut-off relay CO, through the tuning elements 15 and 14, and thence through the winding of the alternating current relay SR to ground through the alternating current 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 program circuit. The tuned circuits including the key K at the subscriber's station and the alternating current relay SR at the central station are connected to the ring side of the line, the former over the back contact of the switchhook and the latter over the back contact of the cut-off relay. Consequently, the selection of programs cannot take place while the line is being used for telephonic purposes. A program already selected, however, may continue to be received by the subscriber through his loud speaker even while a conversation is taking place. 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 subscriber's telephone apparatus comprising the usual transmitter, receiver and switch hook 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 directive switch independent of said first mentioned switching means at the central office, said directive switch being controlled by means at the subscriber's station when the receiver is on the switch hook for establishing a connection between said line and any desired trunk to the exclusion of other trunks.

2. In a program transmitting system, a subscriber's telephone line terminating in subscriber's telephone apparatus comprising the usual transmitter, receiver and switch hook 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, an impulse-operated switch independent of said first mentioned switching means at the central office, and means for transmitting impulses from the subscriber's station when the receiver is on the switch hook to operate said switch to establish a connection between said line and any one of said trunks to the exclusion of other trunks.

3. In a program transmitting system, a subscriber's telephone line terminating in subscriber's telephone apparatus comprising the usual transmitter, receiver and switch hook 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, an impulse-operated selecting switch independent of said first mentioned switching means at the central office, an impulse sender at the subscriber's station, and means to transmit impulses from said impulse sender to said switch when the receiver is on the switch hook to operate the same to establish a connection between said subscriber's line and any desired trunk to the exclusion of other trunks.

4. In a program transmitting system, a subscriber's telephone line terminating in subscriber's telephone apparatus comprising the usual transmitter, receiver and switch hook 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, an impulse-operated selective switch independent of said first mentioned switching means at the central office, said switch being connected to operate over one side of said line, an impulse sender at the subscriber's station, and means whereby the impulses may be transmitted from said sender over one side of the line when the receiver is on the switch hook to operate said switch at the central station, said switch, when operated, establishing a connection between said subscriber's line and a desired trunk to the exclusion of other trunks.

5. In a program transmitting system, an ordinary telephone subscriber's line terminating in subscriber's telephone apparatus comprising the usual transmitter, receiver and switch hook 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, and

a directly operated switch independent of said first mentioned switching means at the central office, said switch being controllable by means at the subscriber's station when the receiver is on the switch hook for switching said subscriber's line to the trunk upon which a desired carrier program is impressed to the exclusion of other trunks.

6. In a program transmitting system, an ordinary telephone subscriber's line terminating in subscriber's telephone apparatus comprising the usual transmitter, receiver and switch hook 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 step-by-step switch independent of said first mentioned switching means at the central office, said switching being operated by means at the subscriber's station when the receiver is on the switch hook to switch said subscriber's line to a trunk upon which a desired carrier program is impressed to the exclusion of other trunks.

7. In a program transmitting system, an ordinary telephone subscriber's line terminating in subscriber's telephone apparatus comprising the usual transmitter, receiver and switch hook 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 independent of said first mentioned switching means at the central office, an impulse sender at the subscriber's station, and means for transmitting impulses from said sender to said switch when the receiver is on the switch hook to switch said subscriber's line into connection with the trunk upon which the desired carrier program is impressed to the exclusion of other trunks.

8. In a program transmitting system, an ordinary telephone subscriber's line terminating in a subscriber's telephone set comprising the usual transmitter, receiver and switch hook at the subscriber's station, switching means at the central office for establishing a telephone connection between said line and another subscriber's line so that conversations may take place at ordinary telephonic frequencies, a plurality of trunks at said central office upon which different programs may be impressed at carrier frequencies, a subscriber's program receiving equipment at the subscriber's station including means for translating carrier

frequencies into ordinary telephonic frequencies, means for preventing ordinary telephonic frequencies transmitted over the line from actuating said receiving equipment, and a directly operated switch independent of said first mentioned switching means at the central office, said switch being controlled by means at said subscriber's station when the receiver is on the switch hook for connecting said subscriber's line to any desired trunk to the exclusion of other trunks.

9. In a program transmitting system, an ordinary telephone subscriber's line terminating in a subscriber's telephone set comprising the usual transmitter, receiver and switch hook at the subscriber's station, switching means at the central office for establishing a telephone connection between said line and another subscriber's line so that conversations may take place at ordinary telephonic frequencies, a plurality of trunks at said central office upon which different programs may be impressed at carrier frequencies, a subscriber's program receiving equipment at the subscriber's station including means for translating carrier frequencies into ordinary telephonic frequencies, means for preventing ordinary telephonic frequencies transmitted over the line from actuating said receiving equipment, a step-by-step switch independent of said first mentioned switching means at the central office, and means for controlling said switch from the subscriber's station when the receiver is on the switch hook to establish a connection between a subscriber's line and

any desired trunk to the exclusion of other trunks.

10. In a program transmitting system, an ordinary telephone subscriber's line terminating in a subscriber's telephone set comprising the usual transmitter, receiver and switch hook at the subscriber's station, switching means at the central office for establishing a telephone connection between said line and another subscriber's line so that conversations may take place at ordinary telephonic frequencies, a plurality of trunks at said central office upon which different programs may be impressed at carrier frequencies, a subscriber's program receiving equipment at the subscriber's station including means for translating carrier frequencies into ordinary telephonic frequencies, means for preventing ordinary telephonic frequencies transmitted over the line from actuating said receiving equipment, an impulse-operated switch independent of said first mentioned switching means at the central office, an impulse sender at the subscriber's station, and means whereby said impulse sender may transmit impulses to said switch when the receiver is on the switch hook to actuate said switch to establish a connection between the subscriber's line and any desired trunk to the exclusion of other trunks.

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

CHARLES H. FETTER.