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METHOD AND MEANS FOR SIMULTANEOUSLY SIGNALING ALL SUBSCRIBERS OF CARRIER TELEGRAPH SYSTEMS

Filed Sept. 21, 1926 2 Sheets-Sheet 1

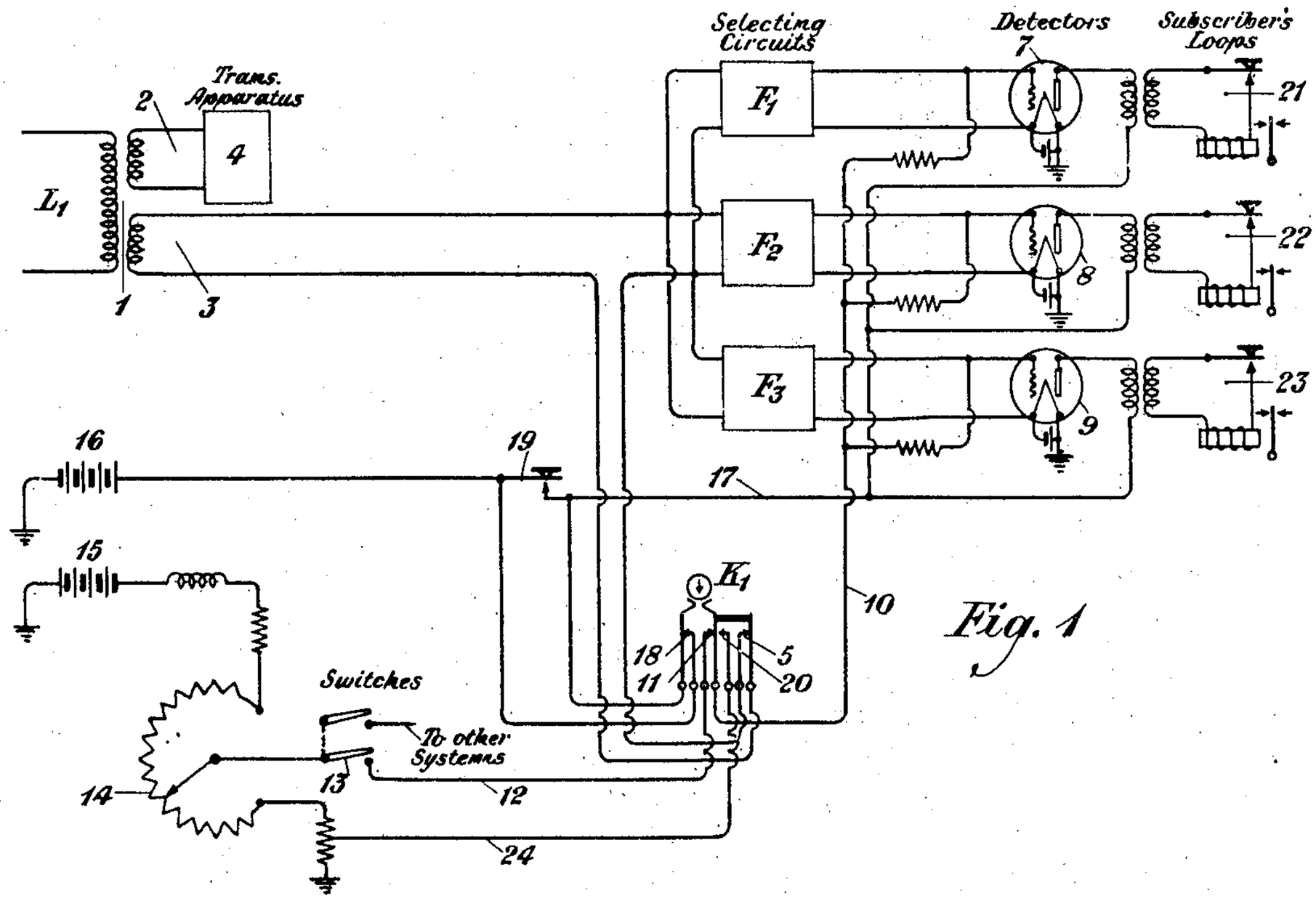

Fig. 1

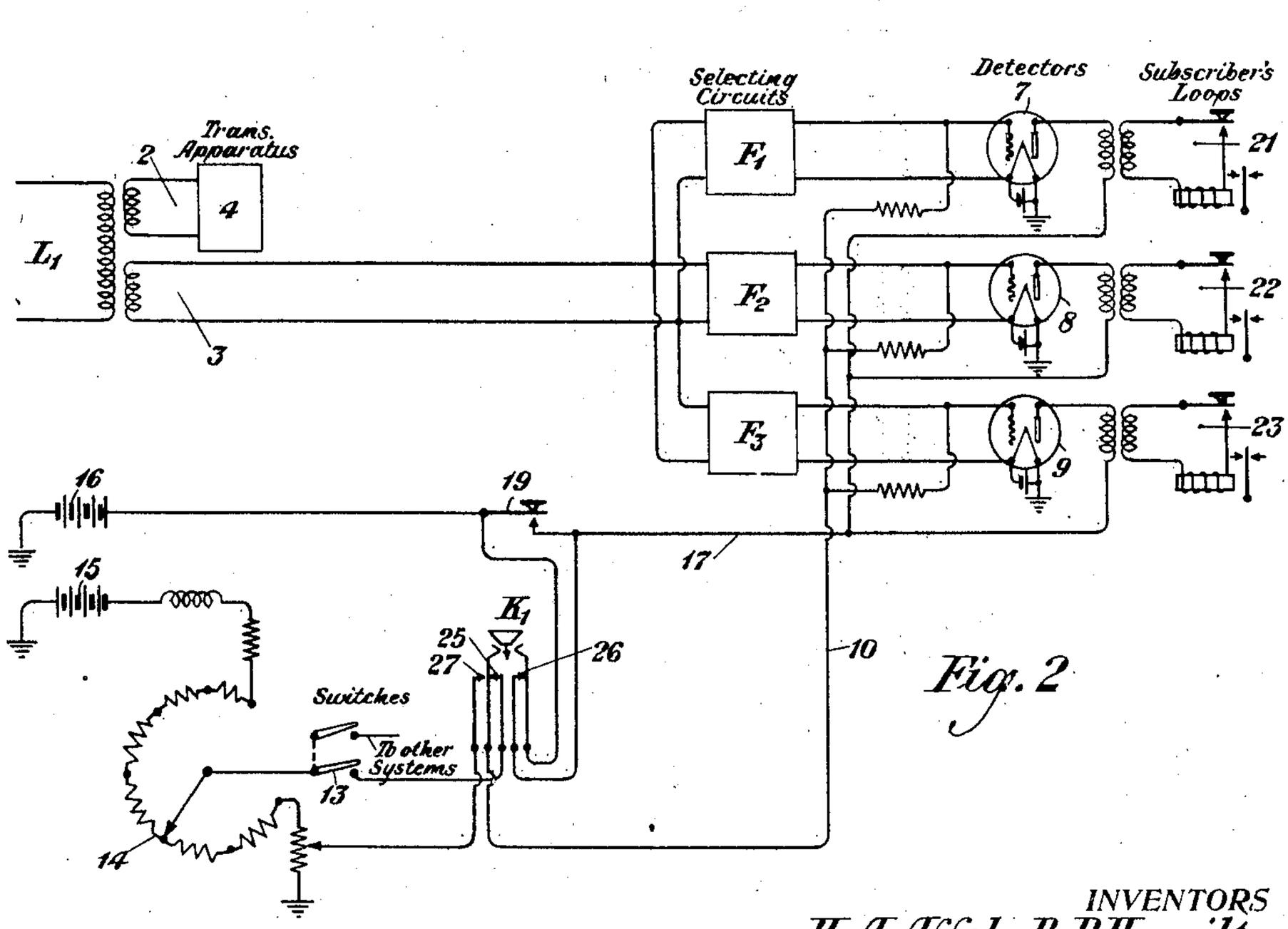

Fig. 2

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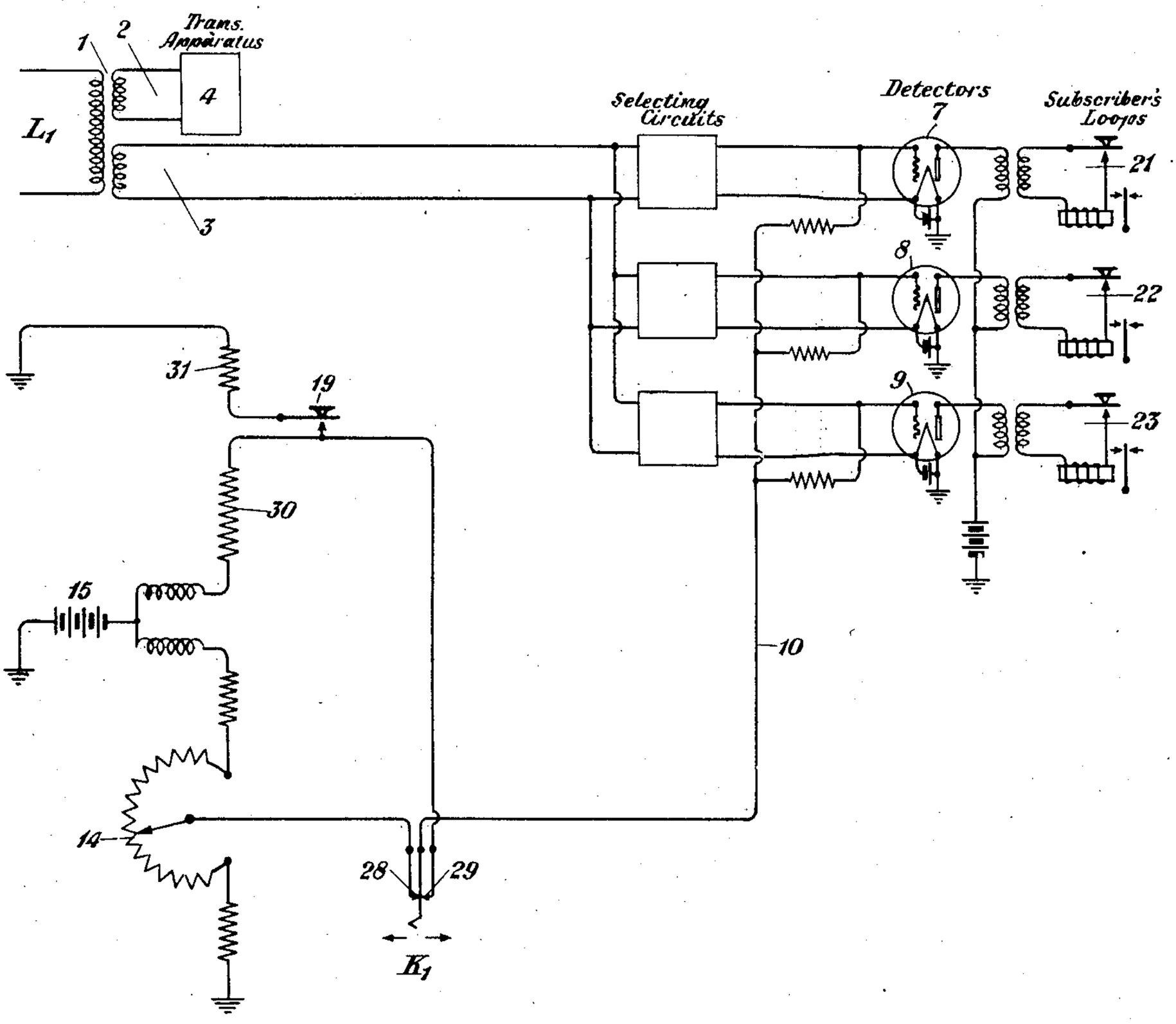

Fig. 3

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UNITED STATES PATENT OFFICE.

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METHOD AND MEANS FOR SIMULTANEOUSLY SIGNALING ALL SUBSCRIBERS OF CARRIER TELEGRAPH SYSTEMS.

Application filed September 21, 1926. Serial No. 136,842.

This invention relates to carrier telegraph signaling systems, and particularly to means for simultaneously calling all of the subscribers connected with the channels transmitted over such a system.

In the operation of carrier telegraph systems in which a plurality of channels are established over a single line circuit, each of which channels serves to connect two or more telegraph subscribers, it is frequently desirable to call all of the subscribers simultaneously in order to give to them information in which all are interested. For example, line trouble may interfere with all of the channels operating over the line and consequently information regarding the nature and probable duration of such trouble is of interest to all subscribers. Heretofore it has been customary to call each subscriber affected by such trouble and advise him regarding the interruption of the service. Obviously much time can be saved if the attendant at the carrier terminal station is able to notify all of the subscribers simultaneously.

This invention resides in methods and means to enable the attendant at a terminal station to signal simultaneously all of the subscribers connected with the channels operating over a particular circuit.

Other objects of this invention will be apparent from the following description when read in connection with the attached drawing, of which Figure 1 shows schematically a form of embodiment of the invention which involves opening the line circuit when the attendant signals the subscribers; Fig. 2 is effectively a modification of Fig. 1; and Fig. 3 shows an arrangement by which the signaling of the subscribers is effected by variations of the grid voltage of the rectifiers without opening the line.

In Fig. 1, L_1 represents a wire line over which carrier signals may be transmitted in both directions. These signals may be both telephone and telegraph, and in addition the line may also transmit any signals outside the carrier telegraph range. Since the invention relates to carrier telegraph systems, only the apparatus pertinent thereto has been shown. The line L_1 is connected by the transformer 1 with a transmitting circuit 2 and a receiving circuit 3. The transmitting circuit has connected therewith transmitting apparatus 4 which may be of any well-known type capable of transmitting one or more channels of carrier telegraph signals over the line L_1 for reception at the distant end. The distant end of the line L_1 would also be equipped with transmitting apparatus, and the telegraph signals transmitted from the distant end would be impressed upon the receiving circuit 3, selected according to frequency and rectified, and the resultant direct current impulses would be sent to the subscribers connected with the branch circuits.

The receiving circuit 3, which is normally closed through the contact 5 of the key K_1, is connected with a plurality of branch circuits having therein suitable selecting circuits, such as the filters F_1, F_2 and F_3. Each filter is capable of transmitting a frequency or a band of frequencies representing a particular telegraph channel. The voltage of the wave transmitted by the filter F_1 is impressed upon the grid of the vacuum tube rectifier 7. This grid is connected by a circuit that includes the conductor 10, contact 11 of key K_1, conductor 12, and switch 13 with the arm of the potentiometer 14 by means of which a portion of the negative voltage of the battery 15 may be applied to the grid of the tube. It is desirable to point out that not only is the normal negative biasing voltage applied by the conductor 10 to the grid of the tube 7, but also to the grids of tubes 8 and 9 which are connected with other channels operating over the line L_1. It will accordingly be seen that any operation affecting conductor 10, such as the actuation of the key K_1, produces a similar effect upon the grids of all the rectifier tubes. The plate of tube 7 is connected with the plate battery 16 by a circuit including the conductor 17, and contact 18 of key K_1, which contact is shunted by the telegraph key 19. The key K_1 is arranged to connect the grids of the tubes with a small negative potential whenever, upon the operation of the key, contact 11 is opened and contact 20 is closed. The purpose of this will be clear from subsequent description. The output circuit of the rectifier 7 is connected with the loop circuit 21, and similarly

the output circuits of the other rectifiers are connected with the loop circuits 22 and 23.

The manner in which the invention operates to effect the desired result will probably be rendered clearer by a brief description of the manner in which an alternating current telegraph system normally operates. In such a system the rectifier tube is normally supplied with sufficient grid biasing voltage to make its plate current substantially zero when no current is being received from the line. This plate current of the rectifier tube controls the receiving relay so that zero plate current represents a spacing signal at the subscriber's station. When the plate current increases to a predetermined value the relay will operate and a marking signal will be produced at the subscriber's station. In like manner the transmission of marks and spaces may be effected directly by variations of the plate current itself. It will therefore be apparent that the attendant, by varying the grid or plate voltage can transmit signals to a subscriber. It is furthermore apparent that since all of the rectifier circuits are supplied by a common source of grid voltage and of plate voltage, variations of either of these by the attendant will produce signals at all of the subscribers' stations simultaneously.

In the arrangement shown in Fig. 1, the switch 13 is closed and the potentiometer 14 is normally adjusted to impress upon the grid of each rectifier tube a voltage such that, when signals are not being impressed by the line L_1 upon the circuit 3, plate current will not flow in the output circuits of the rectifiers. When signals are impressed upon the receiving circuit 3, the grid voltage will be rendered less negative so as to increase the plate current to such extent as to operate the relays connected with the loop circuits. If trouble exists upon the line L_1 which affects the transmission of the channels over the line, the attendant signals all of the subscribers simultaneously in the following manner: By operating key K_1, the receiving circuit 3 is opened at contact 5, thereby preventing interference between line currents and the signals that the attendant is sending to the subscribers. In certain forms of service interruptions, the trouble alternately disappears and returns. During the instant when the trouble disappears, the signaling currents will be transmitted over the line and when impressed upon the circuit 3 they will interfere with the attendant's signals unless suitable precautions are taken, such as opening the receiving circuit. The operation of key K_1 also opens the circuit of the plate voltage supply at contact 18, and likewise changes the voltage applied to the grids by disconnecting conductor 10 from conductor 12 and connecting it with conductor 24 which has a smaller negative voltage than conductor 12. The decrease in the negative grid voltage on all of the tubes tends, of course, to permit a greater plate current to flow through the tubes and, of course, through the relays connected with the plate circuits. This plate current will, however, flow only when the telegraph key 19 is closed. Therefore, by closing and opening this key, marking impulses and spacing impulses, respectively, may be transmitted by the attendant to all subscribers simultaneously without interference from line signals.

The arrangement shown in Fig. 2 differs from that shown in Fig. 1, in that it is unnecessary in Fig. 2 to open the line circuit to prevent interference from line currents during the signaling of the subscribers by the attendant, because the signals sent by the attendant are so much stronger than line signals that the former are not affected by the latter. In Fig. 2, in which the same reference symbols have been employed as in Fig. 1 to represent the same parts, the grids of the tubes are connected with the voltage source 15 by a circuit including conductor 10, contact 25 of key K_1, switch 13, and the arm and the resistance of the potentiometer 14. The potential applied to the grids depends upon the setting of the potentiometer. The plates of the tubes are connected by conductor 17 with the source of voltage 16, the connection including the contact 26 of key K_1 which is shunted by the telegraph key 19. The manner in which this circuit is employed is as follows: When the attendant desires to call all of the subscribers, he operates key K_1, which removes from the grids of the tubes the voltage represented by the setting of the potentiometer 14, and applies a smaller negative voltage by the closing of contact 27. This voltage will be such as to permit the flow of a relatively large plate current. This current will, however, not flow unless key 19 is closed, because the plate circuits of the tubes are opened at contact 26 of the key K_1. These circuits, however, may be closed and opened by the key 19 which effects the transmission of marking and spacing impulses over the loop circuits to the subscribers. The arrangement shown in Fig. 2 differs structurally from that shown in Fig. 1 only in the absence from Fig. 2 of means for opening the receiving circuit 3. The invention covered by Fig. 2 resides more in the method of operation which consists in making the negative grid voltage relatively small so that the plate current will be so high that the impulses representing the attendant's signaling will be large in comparison with those resulting from intermittent signals coming from the defective line circuit. This insures the proper receipt of the attendant's signals at the subscribers' stations.

The arrangement shown in Fig. 3 is similar to that shown in Fig. 2 in that it avoids the opening of the receiving circuit but it oper-

ates upon a different principle. In this arrangement the grids of the rectifiers are connected to a common source of negative potential 15 by a circuit that includes conductor 10, contact 9 of key K_1, and the arm of the potentiometer 14. The voltage which depends upon the setting of the potentiometer is adjusted so that when line signals are not being received, the current in the plate circuits of the tubes is reduced to zero. When key K_1 is operated, contact 28 is opened and contact 29 is closed which connects the common grid circuit of the tubes with the source 15, the connection including a very high resistance 30 of the order of 20,000 ohms. The battery 15 and the filaments of the tubes are grounded. Since the resistance 30 is extremely high, substantially the full voltage of the battery 15, which is of the order of 120 volts, will be impressed upon the grids of the tubes. This voltage is higher than that represented by the setting of the potentiometer 14 to produce the normal biasing voltage. It will be seen that a telegraph key 19 is connected through a relatively low resistance 31 of the order of 4,000 ohms to ground. Whenever the key is open, the full battery voltage is applied to the grids, but with the key closed the grid filament circuit is shunted by the low resistance 31 which materially reduces the negative voltage applied to the grids. Accordingly, when the attendant desires to transmit a marking signal, he closes key 19, which decreases the negative grid voltage and increases the plate currents of the tubes. To transmit the spacing impulse he opens the key, thereby increasing the negative voltage to such extent as to prevent the flow of plate current even though signals may be intermittently impressed by the line L_1 upon the branch 3. The effect of this is to eliminate interference between intermittent line signals and the signals being transmitted by the attendant to the subscribers. The manner in which this result is obtained will be apparent when it is remembered that the negative voltage upon the grids necessary for the proper operation of the tubes for normal line signaling voltage is materially less than the full voltage of the battery 15. The normal grid voltage is represented by the setting of the potentiometer 14, which, of course, represents but a portion of the drop to ground of the voltage from the said source. It will be seen, therefore, that the arrangement shown in Fig. 3 enables the attendant to signal all subscribers simultaneously without opening the receiving circuit.

While this invention has been disclosed as applied to a wire carrier system, it is of course obvious that it is of broader scope and may be applied to systems operating through or over other media. By the term "carrier system" is meant any system in which high frequency oscillations serve as the means for propagating signals over or through any media and therefore covers radio as well as wire directed transmission. Furthermore, the arrangements shown are purely schematic and the invention may be embodied in other forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a carrier telegraph system in which the source of grid voltage and the source of plate voltage are common to all of the rectifiers of the system, the method of signaling all of the subscribers simultaneously which consists in opening the line circuit, reducing the grid voltage to the point where the plate current of each rectifier tube is normal, and simultaneously transmitting signals to all subscribers by opening and closing the plate circuits of the said tubes.

2. In a carrier telegraph system in which the source of grid voltage and the source of plate voltage are common to all of the rectifiers of the system, the method of signaling all of the subscribers simultaneously which consists in reducing the grid voltage to increase the plate current of all rectifier tubes above normal, and simultaneously transmitting signals to all subscribers by opening and closing the plate circuits of the said tubes.

3. In a carrier telegraph system the combination with a line circuit carrying a plurality of carrier telegraph channels of a receiving circuit having a plurality of branches connected therewith, each branch having means to select a particular channel and a vacuum tube to rectify the signal superposed thereon, a source of grid voltage common to the rectifiers of all channels, a source of plate voltage common to all rectifiers, means to disconnect the normal grid voltage from the said rectifiers, and means to connect therewith a voltage greater than normal for the transmission of spaces and less than normal for the transmission of marks.

4. In a carrier telegraph system the combination with a line circuit transmitting a plurality of carrier telegraph channels of a plurality of branch circuits connected therewith, each having means to select a particular channel and a vacuum tube to rectify the signals superposed thereon, a source of grid voltage common to the rectifiers of all channels, a source of plate voltage common to all rectifiers, means to disconnect the normal grid voltage from the said rectifiers and means to apply a high negative voltage to each rectifier, said means including a source of potential in series with a large resistance, and means to reduce the grid potential to a value less than normal by shunting the grid by a relatively low resistance.

5. In a carrier telegraph system in which the source of grid voltage and the source of plate voltage are common to all of the rectifiers of the system, the method of signaling all of the subscribers simultaneously which

consists in varying either of said common sources to produce signals in all channels at the same time.

6. In a carrier telegraph system in which the source of grid voltage and the source of plate voltage are common to all of the rectifiers of the system, the method of signaling all of the subscribers simultaneously which consists in opening and closing the circuit of either of said common sources for the transmission of telegraph signals over all channels at the same time.

7. The method of signaling simultaneously all of the subscribers in a carrier telegraph system, in which the source of grid voltage and the source of plate voltage are common to all of the rectifiers of the system, which consists in removing from the said rectifiers the normal grid biasing voltage common thereto and applying a negative biasing voltage greater than normal to the said rectifiers for the transmission of spaces and less than normal for the transmission of marks.

8. The method of signaling simultaneously all of the subscribers in a carrier telegraph system, in which the source of grid voltage and the source of plate voltage are common to all of the rectifiers of the system, which consists in increasing beyond normal the common negative grid voltage applied to the grids of all rectifiers for the transmission of spaces and in decreasing the negative voltage below normal for the transmisison of marks.

In testimony whereof, we have signed our names to this specification this 20th day of September, 1926.

HERMAN A. AFFEL.
BAXTER P. HAMILTON.
VAUGHN P. THORP.
ROBERT H. CLAPP.