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SELECTIVE SIGNALING SYSTEM

Filed May 26, 1934

2 Sheets-Sheet 1

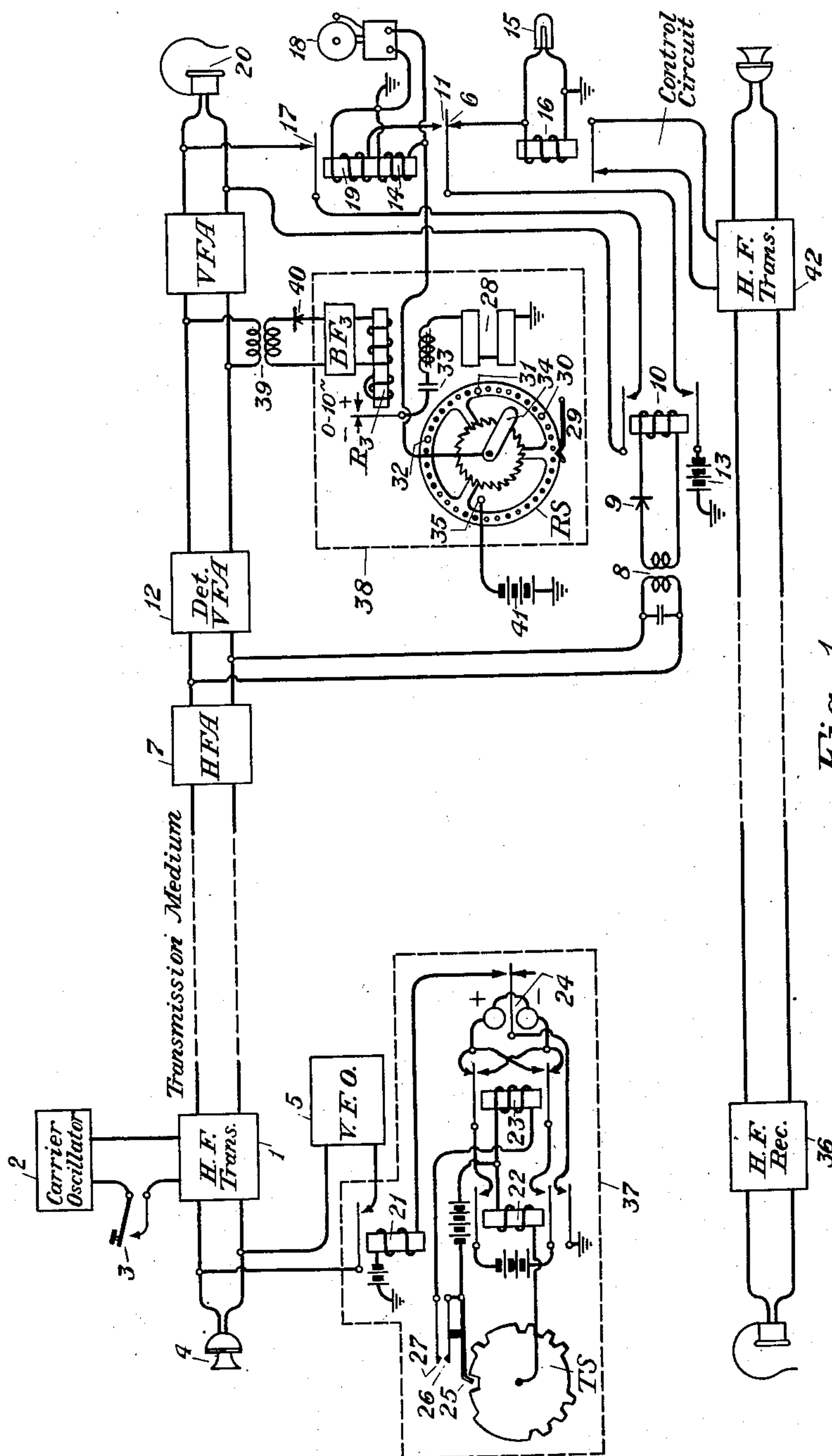


Fig. 1

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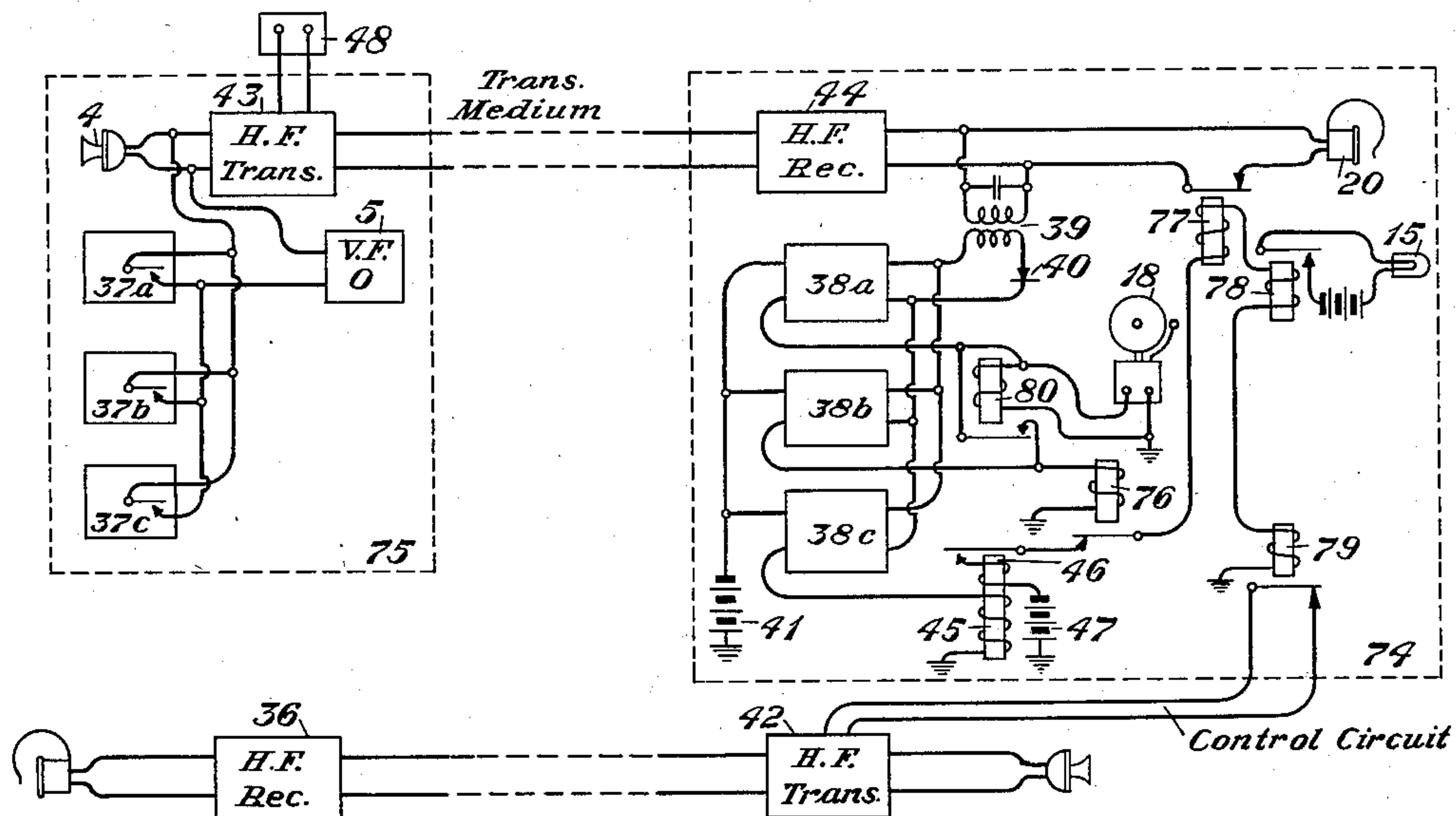


Fig. 2

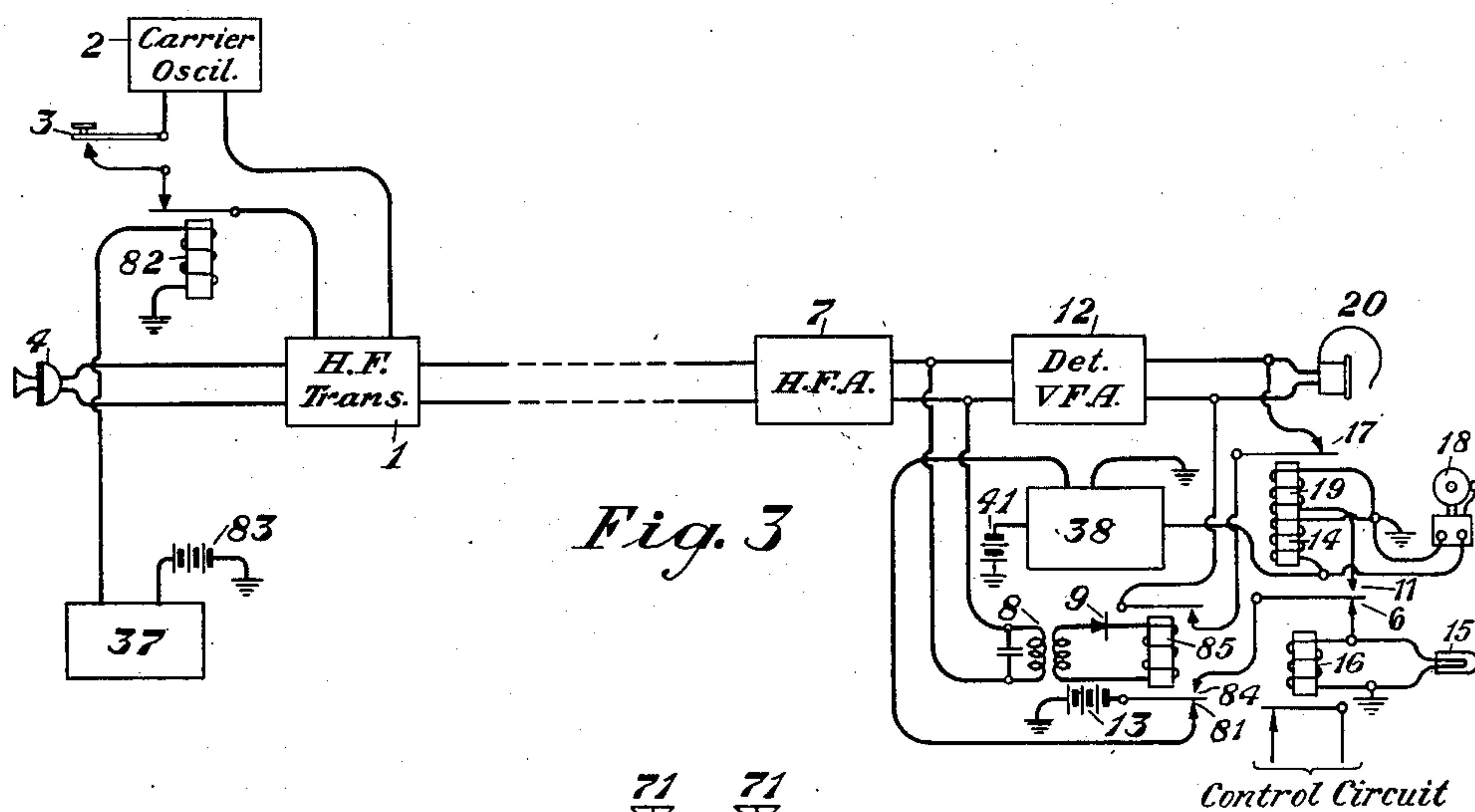


Fig. 3

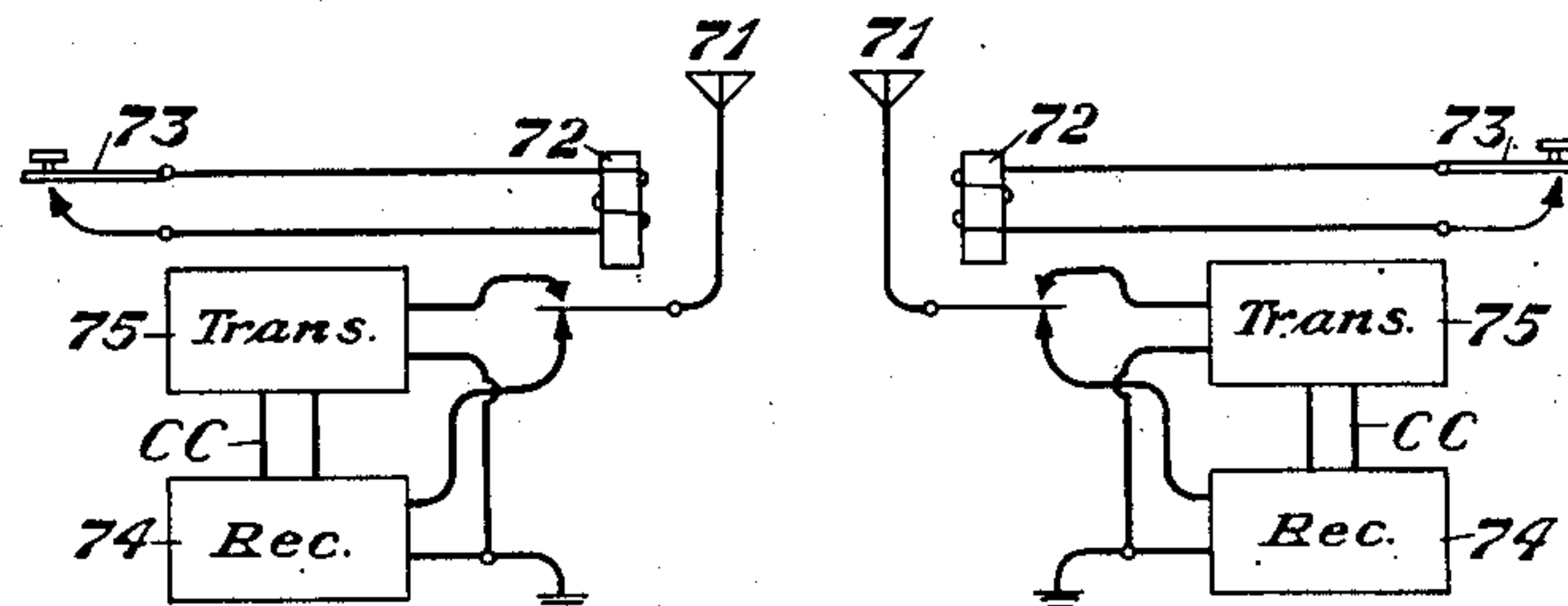


Fig. 4

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SELECTIVE SIGNALING SYSTEM

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13 Claims. (Cl. 179—84)

This invention relates to high-frequency transmission systems employing radiated waves or waves directed by wave guides and to the control of apparatus by pulses or selective signals sent from one station to another in such systems. More particularly it relates to arrangements for selectively calling one or more stations from a control station while holding all other stations inoperative.

In high-frequency communication systems characterized by groups of stations intercommunicating by a common medium or by frequencies used in common, the communication of one station to another station may be heard at all stations, and any station may break into the communication by operating its transmitter. One object of the present invention is to provide means whereby such overhearing or interruption may be prevented.

In accordance with this invention, circuit arrangements are provided whereby the carrier frequency and/or code signals superimposed thereon, emanating from one station, may operate a call signal at a desired station or stations, leaving apparatus at such stations in operative condition, and may render the apparatus at all other stations incapable of operation until released by still further carrier or superimposed code signals.

The invention may be more fully understood from the following description when read in connection with the accompanying drawings which are:

Figure 1 showing a simple form of the invention employing carrier and code signals for disabling and operating a busy signal and releasing and calling.

Fig. 2 showing a modified form of the invention wherein code signaling is employed for disabling, signaling and releasing.

Fig. 3 showing another form of the invention wherein another way of transmitting code signals is illustrated.

Fig. 4 illustrating application of the invention to a network of stations.

In Figs. 1, 2, and 3 the left portion of the figures illustrates a control station adapted to control and communicate with a number of secondary or controlled stations, of which for simplicity but one is illustrated at the right hand of the figures.

Referring to Fig. 1, the high-frequency transmitter 1, which may be a radio transmitter and which may be associated with a receiver 36 for two-way communication, is supplied with carrier frequency from an oscillator 2, through a

switch 3. This carrier may be modulated in the transmitter by voice currents emanating from the telephone instrument 4 or by tone current from the oscillator 5, the tone being emitted in pulses determined by the operation of the code sender shown in the box 37.

When switch 3 is closed, carrier passes from the output of the transmitter to the transmitting medium which may be free space as in radio, or may be some form of guiding agency, for example, a pair of wires, as in carrier transmission, or a coaxial conductor system. At the receivers of the controlled stations, of which but one is illustrated in Fig. 1, the incoming signals pass through the high-frequency amplifier 7. Across the output of this amplifier is bridged the tuned transformer 8 which selects the carrier frequency, which is thereupon rectified to unidirectional current by the rectifier 9 and operates the relay 10. Operating the upper contact of this relay causes a short circuit through contacts 17 across the input terminals of the telephone receiver 20. Operating the lower contact of relay 10 connects battery 13 through contact 6 of relay 14 to busy signal lamp 15 and thence by ground return back to battery 13, thereby lighting the busy signal and advising the operator that the control station is transmitting. At the same time the relay 16, in parallel with the signal lamp, is operated, whereby the relay contacts, which are in series with a transmitter control circuit, are operated and the transmitter rendered inoperative. This control circuit may be of any desired type, for example, it may be the power supply circuit. It is evident then that whenever the carrier from the control station is sent out by the closing of switch 3, all stations within its jurisdiction are thereby rendered inoperative for both transmitting and receiving of messages.

To release one of these stations for communication and to call its operator is the function of the code sender 37, the selector 38, and the apparatus operated thereby as will be described. The code sender 37 and selector 38 are identical with those illustrated in Figs. 1 and 2, respectively, of Patent 1,464,565 to Espenschied et al., and function in identically the same manner. Since a detailed understanding of the operation of this apparatus is not essential to an understanding of the present invention, reference is made to the above mentioned patent for a complete description.

In the code sender disc, TS is toothed in accordance with a code. When rotated it operates contacts 26 and 27 and thereby, through relays 22,

23, and 24, as described in the patent referred to, causes the contacts of relay 21 to open and close in accordance with the code represented on the toothed disc. Such operation of these contacts permits pulses of voice-frequency tone current from oscillator 5 to enter the transmitter 1 and be transmitted from its output as modulation of the carrier. The code sent from a particular disc is characteristic of a particular station among the group which may be called. Thus there may be a large number of code senders associated with the oscillator 5 and the transmitter 1 if it be desired to call any one of a considerable number of stations. Let it be assumed that the code sent by sender 37 is that to which selector 38 is responsive.

The carrier modulated with the voice-frequency tone pulses passes through the transmission medium which may be either wire or radio transmission or some form of wave guide, is amplified by the high-frequency amplifier 7, detected by the detector 12 and as voice-frequency pulses passes through the transformer 39 which may be any desired known type such, for example, as a transformer tuned to select the tone frequency. Rectified by rectifier 40 to pulsating direct current the code signals pass into the selector 38; through low-pass filter BF₃ they operate relay R3 and, as described in above mentioned Espenschied patent, act to turn selector wheel RS until contacts 34 and 35 come together, thereby closing the circuit from battery 41 through call bell 18 and the operating winding of relay 14. After this contact interval the selector wheel falls back to its waiting position ready to respond again if code wheel TS is again operated. The selector 38 is so arranged that contacts 34 and 35 will close only when the code peculiar to that selector is received. Thus bell 18 and relay 14 are not operated at other stations than the called station.

Operation of relay 14 opens upper contacts 17 removing the short circuit which had been caused by operation of relay 10 as described above, thereby permitting the receiving of messages in the telephone receiver 20. Operation of relay 14 also opens contacts 6 which cuts off signal lamp 15 and releases relay 16, thereby permitting operation of the transmitter 42 so that it may be used for sending messages. Current flows from battery 13 through lower contact of relay 10 and thence through contact 11, closed by operation of relay 14, to the winding 19, thereby locking the relay 14 in closed position. When selector wheel RS falls back, opening contacts 34 and 35, bell 18 ceases to ring but relay 14 remains operated by virtue of winding 19 as explained above. Communication, both transmitting and receiving, may now be carried on at the station or stations whose code signal has been emitted by the control station, as long as the carrier is present. If the carrier is shut off by opening switch 3, the relay 10 restores which in turn causes relay 14 to restore and the called stations go back to their original condition. Other stations not called are also restored to normal waiting condition by the release of relay 10 since thereby battery is removed from lamp 15 and relay 16.

If it is desired to originate a call from a controlled station, the following procedure takes place. The operator at the controlled station waits, if necessary, until his busy lamp 15 is extinguished, indicating that the control station is idle. He then operates his transmitter 42 and calls the control station through its receiver 36 either by code calling or by voice, depending on

the facilities provided by this channel, and announces his designation to the control station. In order to answer the call the control station operator must close his switch 3, which permits carrier to go out, thereby rendering the calling station inoperative, as above described. The control station operator has, however, by listening or through the agency of a code receiver if this be provided, been advised of the designation of the calling station and he sends the code signal for it, thereby restoring it to operative condition but holding silenced all other stations as described above.

If the called station operator does not answer, the called station may be restored to normal waiting condition by opening switch 3 which permits relay 10 to release, thereby unlocking and restoring relay 14.

Fig. 2 shows an arrangement whereby the principles of this invention may be applied, utilizing only code signals for the control functions. In fact this form of invention may be utilized in a system wherein the single sideband carrier suppression type of transmission is employed.

The high-frequency transmitter 43 with its control circuit, closed by switch 48, the transmitting medium and the high-frequency receiver 44 furnish a means of any desired known kind whereby voice-frequency signals may be transported to a distant station. Code pulses originating from the oscillator 5 through the senders 37a, 37b, and 37c may be sent as in the case of Fig. 1 already described. Each of the three code senders is identical with sender 37 of Fig. 1, but the three have different code discs sending different codes.

At each receiving station are three code selectors 38a, 38b, and 38c, each identical with code selector 38 of Fig. 1 except as follows: All selectors 38c are responsive only to code sender 37c. Likewise, all selectors 38b are responsive only to code senders 37b. Code selector 38a is individual to each station in that no two will operate on the same code signal except as may be required for selective group calling in which it is desired to call several stations with the same code. While but one sender 37a is illustrated, it will be understood that one will be required for each station or group to be called to the exclusion of others. As in Fig. 1, code pulses of tone are transmitted to the receiver, rectified by rectifier 40 and impressed upon the inputs of the code selectors, in this case there being three in parallel. The output contacts of these selectors are connected on one side in parallel through battery 41 to ground and on the other side individually to other apparatus as will now be described.

Let it be assumed that the station on the left desires to call the particular station illustrated at the right. Sender 37c is first operated. In response to the code thus sent the contacts of selector 38c are closed and battery 41 thereby connected to the operating winding of relay 45. Closure of this relay permits current from battery 47 to flow through locking winding 46, over contacts of relays 45 and 76, and via relays 77, 78, and 79 to ground. Thus relay 45 remains operated when selector 38c drops back to its waiting position. Relay 77 being operated by current from battery 47, opens the circuit to telephone receiver 20 thus disabling for receiving messages. Operation of relay 78 causes the lighting of busy signal lamp 15 and operation of relay 79 disables the transmitter 42 by opening its control circuit,

which may, for instance, be the power supply circuit. All controlled stations are now unable to transmit or receive.

Sender 37a is now operated to call a particular station, causing operation of selector 38a at that station. This connects battery 41 to call bell 18, causing it to ring, and to relay 80, the contacts of which being closed connect the battery 41 also to the winding of relay 76. When relay 76 operates it opens the circuit from battery 41, thereby releasing relays 45, 77, 78, and 79. These releases permit utilization of the transmitter and receiver and put out the busy lamp. When selector 38a drops back to waiting position, relay 80 and, in turn, relay 76 drop back also, but relay 45 is now open, no current flows from battery 41 and relays 77, 78 and 79 remain unoperated.

The called station is now able to communicate with the calling station; meanwhile all other stations remain disabled since their selectors 38a were not responsive to the code call sent to the called station.

When the communication is finished, sender 37b is operated, thereby operating selectors 38b at all stations. This connects battery 41 to relay 76 whose operation produces results already detailed above. All stations are thus restored to waiting condition.

An operator at a secondary station desiring to originate a call waits until the channel is free as indicated by the extinguishment of his busy signal 15, whereupon he operates his transmitter 42 to call the control station. When the control station answers, communication may proceed between the two stations if desired without any operation of senders or selectors, provided it is not desired to exclude other secondary stations from listening to or interrupting the conversation. If it be desired to exclude others this may be accomplished by operating senders 37c and 37a, as described above for calling a particular station, the particular station to be signaled being in this case the station originating the call.

It will be evident that, since operation of signaling and lockout features is in no way dependent upon the continuity or presence of the carrier, this system is applicable to a wide variety of types of transmission.

In the arrangement just described the code signals, while modulated as a voice-frequency tone on a carrier, may, in the case of single sideband transmission with carrier suppression, appear in the transmission medium as pulses of a single frequency. The signal is the same as it would be if a carrier itself had been keyed or modulated directly by the code sender and sent. Fig. 3 illustrates a system in which certain features of the systems of Figs. 1 and 2 are combined and the code signals are sent as interruptions of the carrier itself.

In Fig. 3 the transmitter 1, carrier oscillator 2 and switch 3 are the same as the corresponding elements in Fig. 1. In fact many other elements have similar correspondence and similar numbering. In series with key 3 are the contacts of relay 82 whose winding is connected through the contacts of code sender 37 to battery 83. Closing of the sender contacts will cause opening of the contacts of relay 82.

At the receiving end signals received through amplifier 7 pass through detector-amplifier 12 to telephone receiver 20 unless prevented by short circuit through contacts 17 and the upper contacts of relay 85. Received carrier passing through tuned transformer 8 and rectifier 9 op-

erates relay 85. Through the lower back contact 81 of this relay current from battery 13 may be caused to flow to the input of code receiver 38. In other respects the apparatus illustrated is the same as in Fig. 1 and its operation will now be described.

To call a station among a controlled group the operator of the control station closes his switch 3 which causes carrier to be transmitted continuously from high-frequency transmitter 1. This carrier received through amplifier 17 at controlled stations causes operation of relay 85 as just described. Closure of the upper contacts of relay 85 completes a short circuit through contacts 17 across telephone receiver 20 thus preventing receipt of messages. Closure of contact 84 of relay 85 connects battery 13 through contacts 6 of relay 14 to busy signal lamp 15 and relay 16 which, being operated thereby, opens the transmitter control circuit and disables transmitter 42. Thus by closure of switch 3 all stations receiving the carrier are disabled for receiving or transmitting messages. Opening of contacts 81 removes battery 13 from connection to the code signal receiver 38 which is then in a position to receive code signal pulses.

Now let the code sender 37 be operated to call a particular station. Closure of the contacts of the sender connects battery 83 to relay 82 which in turn opens the circuit from carrier oscillator 2 to transmitter 1. The pulses of the code signal are thus sent as interruptions or gaps in the carrier. These gaps in the carrier allow relay 85 at controlled stations to restore momentarily for each gap, making contact 81 and sending a pulse of direct current from battery 13 into code receiver 38. The selector responsive to the particular code signal sent from sender 37 has its contacts closed to connect battery 41 to relay 14 and to call bell 18. As soon as the sender key has ceased to send pulses its contacts remain open and relay 82 remains unoperated. In this condition continuous carrier is again sent out from transmitter 1 and all stations except the particular one called are held in a disabled state. The operation of relay 14 at the called station in combination with the reclosing and holding of relay 85 by the continued presence of steady carrier results in the same sequence of operations as has already been detailed in the description of Fig. 1, viz., contact 6 is broken, lamp 15 extinguished and relay 16 released. Contact 11 is made, putting battery 13 on locking winding 19. Contact 17 is opened, releasing telephone receiver 20 for receiving messages. When the code receiver 38 restores itself after a few moments, bell 18 ceases to ring but relay 14 remains locked and the station may communicate with the control station.

All stations are restored to waiting condition by opening of switch 3 which releases relays 85. Originating a call from a control station is done as with the apparatus of Fig. 1. That is, the controlled station operator calls with transmitter 42 (not shown), gives the designation of his station and states his desire to call. Then the control station operator silences all stations by closing switch 3 and calls the petitioning station by the proper code to release it as described.

In the above detailed description of this invention it has been assumed for the sake of simplicity that but a single master station is equipped for control. It will be evident from the following that the invention need not be limited in any such way but is applicable to each of a number of

stations in an intercommunicating group to the end that any one may control all the others. Referring to Fig. 4, for simplicity but two stations of an unlimited group are shown. In each station the transmitters 75 may be like those shown in the dotted enclosure 75 in Fig. 2, while the receivers 74 may be like corresponding receiver shown in dotted enclosure 74 in Fig. 2. A transmitter control circuit between them is shown by the lines C. C. In Fig. 4 it is assumed that communication between stations is all on one frequency, the antennae 71 being switched in a well-known manner from the transmitter output to the receiver input by relay 72 in response to the operation of switch 73 by the operator. The normal rest or waiting position of the relay 72 connects the receiver to the antenna.

When all stations in the group are quiescent or waiting, any one may originate a call to any other in the following manner. The calling station operator closes his switch 73 to connect his transmitter to his antenna. Thereupon he may function as a control station as described above in connection with Fig. 2, and all other stations, remaining in the receiving or waiting condition, become controlled stations. He may call one or more of them having silenced all others as already described. The intermittent transmission of carrier resultant from the disconnection of the transmitter from the antenna while receiving does not cause any difficulty because maintenance of the lockout of unwanted stations is not dependent upon the carrier in this form of the invention. When the communication is finished and the calling station operator has restored all stations to waiting condition by the procedure already described, the system is free and any other station may originate a call and temporarily become a control station. The use of the control system is in this arrangement entirely optional with the operators. If the control keys are not operated at any station, free intercommunication between any or all stations may be carried on.

It will be evident from the above that the invention may be applied to any high-frequency communication system involving a common transmission medium whether radio, wire or one involving a wave guide such, for example, as a concentric conductor system.

It will also be evident that, while the invention has been described above in connection with two-way communication systems, it is not limited to this use but may be applied to one-way communication systems such as broadcasting systems. For example, if transmitter 42 with its control circuit, and receiver 36 are eliminated from Figs. 1, 2, and 3, the illustrations then delineate one-way communication systems in which a central control transmitting station is able to select from time to time the receivers which it will permit to listen. Such an arrangement might be employed to deliver different program items to different receiving stations in accordance with a prearranged scheme.

The system is adapted to telegraph transmission simply by replacing telephone transmitter 14 with a suitable form of voice-frequency tone telegraph transmitter and replacing telephone receiver 20 with a corresponding telegraph receiver. These could, for example, be printing telegraph instruments arranged as described in a paper entitled "Application of printing telegraph to long wave radio circuits", by Austin Bailey and T. A.

McCann, published in Vol. X, pp. 601-615 of the Bell System Technical Journal.

It will be disclosed 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 carrier current electric wave signaling system a transmitter, means for controlling the carrier current signals sent out from said transmitter, said means including a source of selective code signals, a transmission medium, a receiver having in association therewith means responsive to carrier current from the transmitter to disable the message output of said receiver, and means responsive to selective code signals superposed on said carrier current to re-enable said output.

2. An electric wave transmitter and associated therewith a controllable source of carrier frequency and a code signal transmitter, a transmitting medium, and electric wave receiver having associated therewith means responsive to receipt of said carrier frequency to disable an output of said receiver, a code signal selector and means responsive thereto to re-enable said receiver output.

3. An electric wave transmitter, associated therewith a plurality of code senders, a transmitting medium, an electric wave receiver, associated therewith a first code selector and means responsive thereto to disable the message output of said receiver, a second code selector and means responsive thereto to re-enable the output of said receiver.

4. A carrier current electric wave transmitter, associated therewith means for controlling carrier current signals sent out from said transmitter said means including a source of selective code signals, a transmitting medium, a plurality of electric wave receivers and in association therewith means responsive to carrier current from the transmitter to disable the message outputs of all receivers and at each station means responsive to selective code signals superposed on said carrier current to re-enable the output of the associated receiver.

5. An electric wave transmitter, associated therewith a controllable source of carrier frequency and code signal transmitting means whereby code signals may be transmitted as modulations of the carrier wave, a transmitting medium, a plurality of electric wave receivers adapted to receive said modulated carrier, means associated with said receivers and responsive to the receipt of said carrier frequency to disable the message output of said receivers, associated with each receiver a code selector, and means responsive thereto to re-enable the output of the associated receiver.

6. An electric wave transmitting station adapted to send a carrier frequency and modulated thereon selective code signals characteristic of any receiving station, a transmitting medium, a plurality of receiving stations including at each a code selector adapted to receive a particular selective code signal from said transmitting station, means at each receiving station responsive to the carrier signal to suppress the message output of the station and means responsive to said code selector to release said output.

7. An electric wave communication station comprising a transmitter and associated there-

with means for supplying selective code signals to the input of said transmitter, a receiver and associated therewith code signal receiving means, means responsive to received signals to disable said transmitter and means actuated by said code signal receiving means to re-enable said transmitter.

8. In a high-frequency signaling and control system, a high frequency transmitter, means for controlling the signals sent out from the transmitter, said means including a source of selective code signals, a transmission medium, a receiver and in association therewith a transmitter, means responsive to signals from the first mentioned transmitter to disable said second mentioned transmitter and the message output of said receiver and means responsive to selective code signals to re-enable said second mentioned transmitter and said receiver output.

9. In a high-frequency signaling and control system, a high-frequency transmitter, means for applying a carrier frequency thereto, means for modulating said carrier with code signals, a transmitting medium, a receiver and associated therewith a transmitter, means responsive to the presence of received carrier to disable said second mentioned transmitter and the message output of said receiver, selective code signal receiving means responsive to certain of said code signals to enable said receiver output and said second mentioned transmitter.

10. In a signaling and control system a source of carrier, means for generating selective code signals, means for modulating said carrier by said signals, means for transmitting said modulated carrier, a receiver and a transmitter associated therewith, means responsive to the unmodulated carrier component to disable said second mentioned transmitter and an output of said receiver, a selective code signal receiver and means responsive thereto to re-enable said disabled transmitter and said receiver output.

11. A transmitter capable of sending carrier, a transmission medium, a second transmitter and associated therewith a receiver for receiving said carrier, means responsive to the receipt of said carrier to disable said second transmitter and the message output of said receiver and means to re-enable said second transmitter and the message output of said receiver.

12. A plurality of stations adapted to intercommunicate by electric waves, each comprising an electric wave transmitter and an electric wave receiver, means associated with each transmitter to send therethrough selective code signals, a transmitting medium, means associated with each receiver to receive and utilize selective code signals, said means comprising a first selector and responsive thereto means for suppressing the output of the associated receiver and disabling the associated transmitter, a second selector and responsive thereto means to release said output and re-enable said receiver, a third selector and means responsive thereto to operate a call signal and to release said receiver and re-enable said transmitter.

13. A plurality of stations adapted to intercommunicate by electric waves each station including a transmitter and a receiver, means associated with each transmitter to send code signals, a transmitting medium, code selector means at all receiving stations adapted to operate in response to a common code signal, and means responsive thereto to disable all transmitters and the message receiving portion of all receivers, code selector means at each station adapted to operate in response to a code signal characteristic of that station and responsive thereto means to re-enable the associated transmitter and receiver, code selector means at all stations adapted to operate in response to another common code signal, and means responsive thereto to enable all transmitters and receivers.

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