Dec. 4, 1923. 1,476,003

DE LOSS K. MARTIN

RADIOSIGNALING CALL SYSTEM

Filed Aug. 18, 1922 2 Sheets-Sheet 1

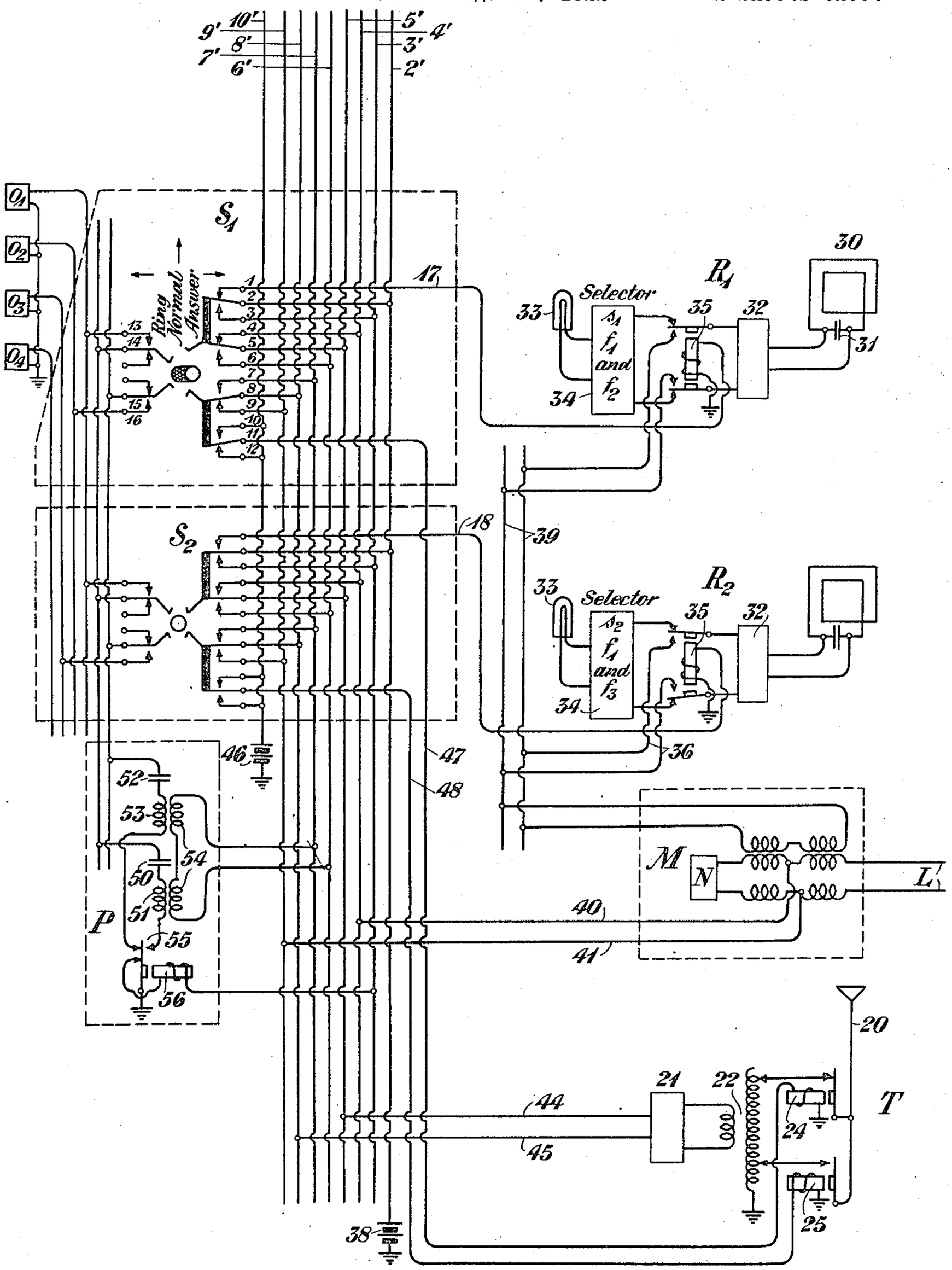

Fig. 1

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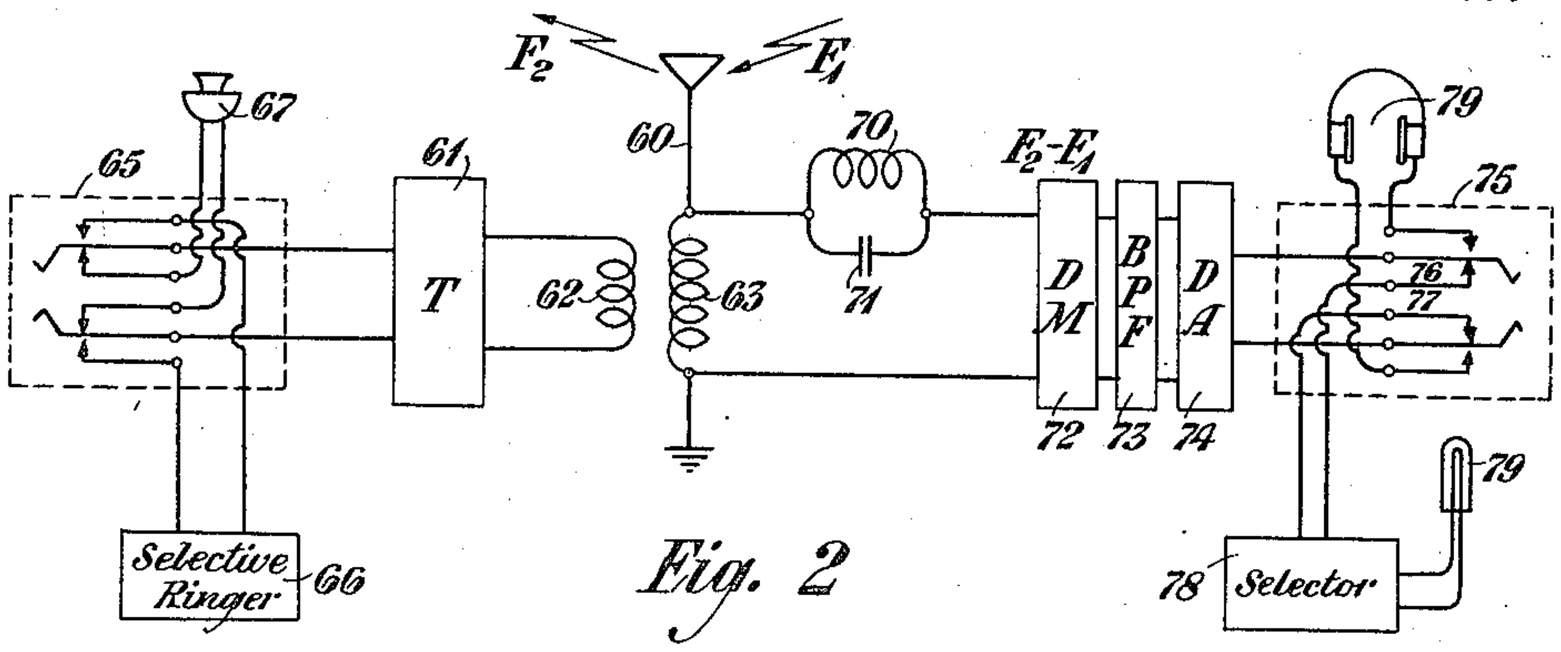

Fig. 2

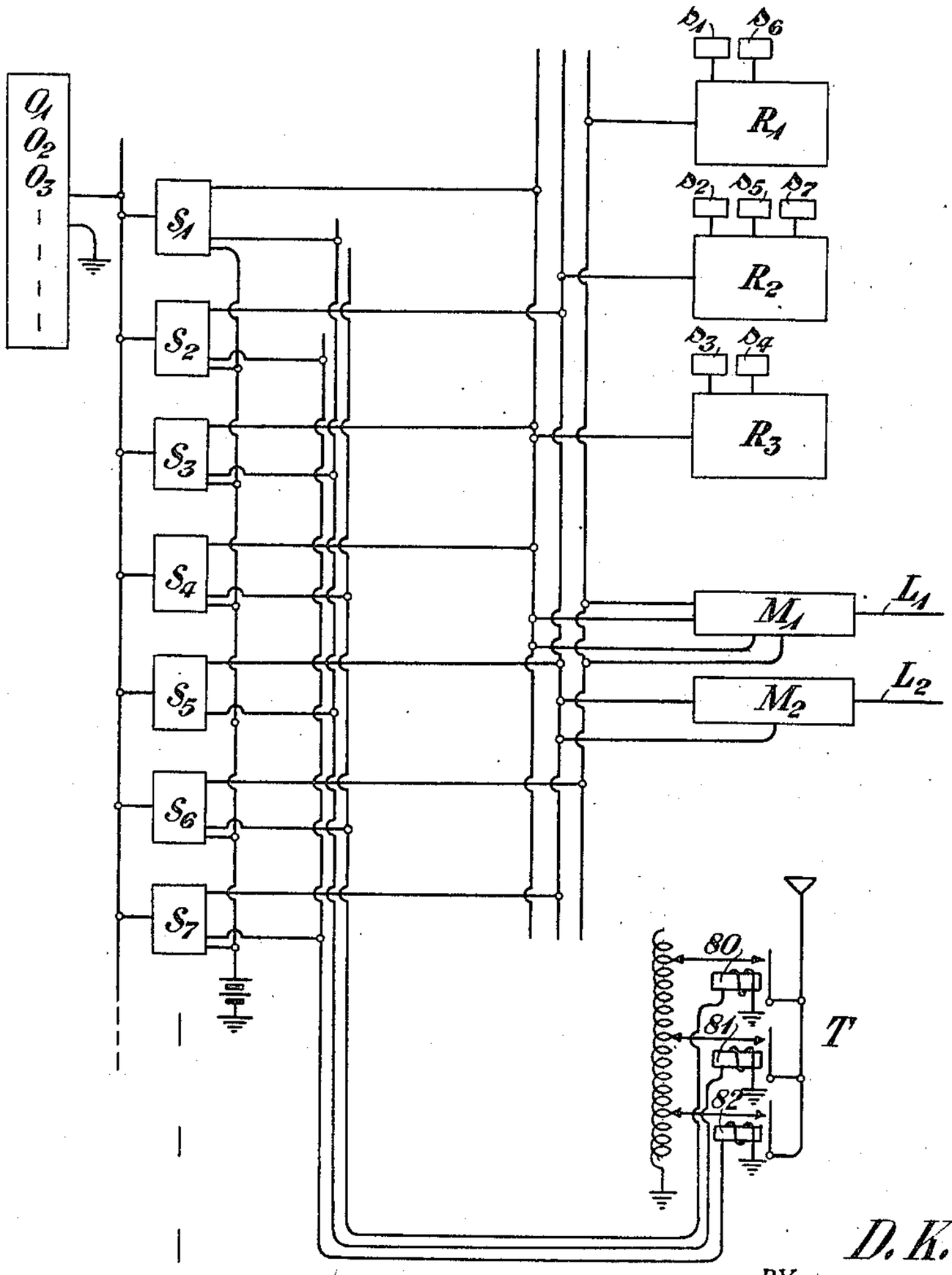

Fig. 3

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Patented Dec. 4, 1923. 1,476,003

UNITED STATES PATENT OFFICE.

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RADIOSIGNALING CALL SYSTEM.

Application filed August 18, 1922. Serial No. 582,729.

To all whom it may concern:

Be it known that I, DE LOSS K. MARTIN, residing at Orange, in the county of Essex and State of New Jersey, have invented certain Improvements in Radiosignaling Call Systems, of which the following is a specification.

This invention relates to a radio signal call system and more particularly to the association of a central radio station with a number of remote stations. Its object is to provide circuits to facilitate calling any one of the remote stations and to permit such stations to call the central station, giving information at the same time as to which remote station is calling. A further object is to make provision for communication with a very large number of outlying stations by a simple calling arrangement. To this latter end I use certain ringing frequencies, preferably voice frequencies, impressed on the carrier, and by various combinations of these frequencies a comparatively few ringers, with suitable selective devices, will make provision for a relatively large number of calls.

Still a further object of my invention is to provide a circuit which, by its symmetry, will permit an indefinite expansion of the system to provide for additional remote stations.

The system will find particular application in such signaling as between harbor tubs, river-craft and a shore station, or from airplanes to an aid-field station, or from point to point over land. For such service the distances over which operation will take place will normally be relatively short and therefore it will probably be desirable to use the higher range of radio frequencies, which will naturally allow a greater number of communications to be established. It may be that the stations of one interest, as represented by one central station, may communicate with its various outlying stations on one radio carrier, using, however, different combinations of voice or other frequencies for selective signaling. On the other hand, it may be that one central station will use a plurality of carrier frequencies, one for each outlying station, or one for each group of outlying stations. In this manner a wide latitude of variation is possible, as will appear later. The system, as will also appear later, is somewhat analogous to a wire telephone system centering in an exchange in which there is a plurality of channels corresponding to each pair of outgoing wires and in which each pair of wires may be a party line, the correct party being obtained by means of selective ringing.

The invention will be better understood by reference to the accompanying drawing, in which Figure 1 shows a circuit arrangement comprising my invention and adapted, for the sake of simplicity, to accommodate a few stations only. Fig. 2 shows a form of circuit arrangement which may be used at one of the remote stations, and Fig. 3 shows schematically an amplification of the circuit of Fig. 1, indicating how that circuit may be expanded to accommodate a larger number of remote stations.

Referring particularly to Fig. 1, there are shown two receiving circuits, R_1 and R_2, and a transmitting station T. With the receiving station R_1 is associated a switching mechanism S_1, comprising a plurality of contact points which may be operated to produce one effect or another. A similar switching mechanism S_2 is associated with the receiver R_2. At the same time these switching mechanisms are associated with the transmitter T, with a talking circuit L and a ringing control circuit P.

While the switches S_1 and S_2, which are shown as identical in structure, may take on a variety of forms, in the drawing they are shown as possessing on the one side 12 contacts or terminals represented by the numerals 1 to 12 respectively and having on the other side a switch with four contacts or terminals represented by the numerals 13 to 16 respectively. Associated with this second side of the switches are a plurality of oscillators, O_1, O_2, O_3 and O_4, which may be of any suitable type, such as vacuum tube oscillators or mechanical vibrators. These oscillators are preferably of voice frequency and, taken in various combinations, are used as calling signals.

The transmitting station comprises an antenna 20 and a local circuit 21, this latter comprising a generator of carrier oscillations and suitable apparatus associated therewith, whereby these carrier oscillations may be modulated by a signal impressed thereon. The apparatus may be associated with the antenna 20 through a transformer 22, one coil of which is shown as the induc-

tance of the antenna. Two relays 24 and 25 are provided, upon the operation of which a greater or smaller amount of inductance may be included in the antenna circuit, thus changing the frequency to which this antenna is tuned.

The receiving circuit R_1 comprises an antenna, which is here shown, as the loop antenna 30 with an associated condenser 31. Across this antenna is connected suitable receiving mechanism 32, comprising in general a detector and such amplifiers as may be necessary. The output of this circuit 32, as shown in the receiver R_2, is normally connected with a selector circuit 34, which upon receipt of a proper combination of impulses, will operate an indicating means such as a lamp 33. Contacts from the circuit 32 to the selector 34 are controlled by a relay 35. upon operation of which connection with the selector 34 is broken and contact is made through conductors 36 to a line L, over which a message is to be rendered. The connection to the line L is preferably through a connection M comprising a hybrid coil and a balancing network N, in order that speech coming from the line L shall not enter into the receivers but may be taken off for transmission over the transmitter T, as will appear later.

The invention will be best understood by pointing out the connections to the various points of the switches along with the explanation of the operation and for the sake of simplicity and symmetry, I have shown the various contacts 2 to 10 of the switches S_1 and S_2 connected to corresponding leads, indicated by 2′ to 10′. If a remote station, corresponding to the receiver R_1, sends in a call consisting of a radio carrier corresponding to the loop antenna 30 and modulated with respect to certain voice frequencies f_1 and f_2, the receipt and detection of such a calling signal will operate the lamp 33 through the selector mechanism s_1. When the operator observes this signal he throws the lever of the switch S_1 to the answering position. A circuit will then be closed through the battery 38, conductor 2′, contacts 2 and 1 and relay 35 to ground. This will disconnect the selector s_1 and connect the receiver circuit 32 through the conductors 39 to one pair of terminals of the hybrid coil M, whence the message goes to the telephone receiver of the operator or subscriber. The same operation of the switch S_1 by closing the contacts 4 and 5 and the contacts 8 and 9 connects the conjugate points of the hybrid coil M to the transmitter in the following manner for the purpose of enabling duplex conversation: line L, conductor 40, lead 4′, contacts 4 and 5, lead 5′, conductor 44, transmitting apparatus 21, conductor 45, lead 8′, contacts 8 and 9, lead 9′, conductor 41 and line L. At the same time the operation of the switch makes connection between contacts 11 and 12, thus closing circuit through battery 46, conductor 10′, contacts 12 and 11, conductor 47 and relay 24 to ground. The closing of this circuit, attracting the armature of 24, connects the antenna 20 through a portion of the inductance of the transformer 22, whereby the antenna is tuned for that frequency which corresponds to the station from whence a message came to the receiver R_1. A complete talking channel between the two stations is thus established and upon the completion of the conversation the switch S_1 is returned to its normal position, the various contacts then being related as shown in S_2.

In case a message from a station corresponding to the receiver R_2 were to arrive there would be impressed on the incoming carrier signaling impulses corresponding to frequencies f_1 and f_3, which would operate on the selector s_2 to give an indication at 33. The switch S_2 would then be brought to its answering position and circuits would be closed again in a similar manner to establish a talking channel In this case, the relay 25 through the conductor 48 would be operated to tune the antenna 20 to the corresponding frequency for this channel.

In case a call is to be initiated from the central station, use is made of the oscillators O_1, O_2, etc., to modulate the transmitted waves accordingly. If, for example, the station corresponding to the receiver R_1 is to be called the lever of the switch S_1 is turned to the left or ringing position. In this event the spring leads of the contacts 14 and 15 are separated to make connection with the contacts 13 and 16. At the same time the spring members on the other side of the switch are brought together so that the spring members 2, 5, 8 and 11 make connection respectively with the contacts 3, 6, 7 and 10. By this operation, circuit is closed from the ground through the oscillator O_1, contacts 13 and 14 and through the condenser 50 and the inductance 51, which latter is adapted to be connected to ground by a vibrating contact 55 of a relay 56. Also, contact is made from ground through the oscillator O_2, contacts 16 and 15, to a circuit comprising capacity 52 and inductance 53, which is also adapted for connection to ground through the vibrating element 55. Associated with the inductances 51 and 53 are inductances 54. The bringing together of the spring members on the right-hand side of the switch S_1 has brought about the following conditions: circuit is closed through battery 38, lead 2′, contacts 2 and 3, lead 3′, relay 56 and ground. This latter causes the vibrator 55 to alternately connect the inductances 51 and 53 to ground so that there is impressed on the coil 54 alternately alternating currents f_1, corresponding to the oscillator O_1, and f_2, corresponding to the

oscillator O_2. Circuit has at the same time been closed from the transmitter circuit 21, through conductor 44, lead 5′, contacts 5 and 6, lead 6′, coil 54, lead 7′, contacts 7 and 8, lead 8′ and conductor 45 to the transmitter circuit 21. Circuit has also been closed through battery 46, lead 10′, contacts 10 and 11, conductor 47, relay 24 and ground, whereby the transmitter antenna 20 is tuned to the proper frequency. By this operation, then, oscillators O_1 and O_2 are connected to impress their corresponding frequencies on the coil 54, which is connected to the transmitter 21 to modulate the carrier frequency in accordance with the calling signal for that station which corresponds with the receiver R_1. In the meantime, all connections with the talking circuit L and with the receiver R_1 have been interrupted.

Upon receipt of the message at the remote station, an answering calling signal is sent out, which operates the indicator 33 at the station R_1 and the lever of the switch S_1 is then brought to answering position, whereupon a telephone channel would be established between the line L and the remote station as explained heretofore.

While the circuit at the remote station may take on a variety of forms, I have shown in Fig. 2 one circuit arrangement which would be especially well adapted to cooperate with the circuit arrangement thus far described in connection with the central station. Referring to said Fig. 2, there is shown the antenna 60, which may be used both for transmission and reception. The transmitting apparatus 61 is associated with the antenna by means of the coils 62 and 63, the transmitting apparatus 61 comprising a generator of oscillations and a suitable modulator therefor. With this circuit 61 is associated a switch 65, by means of which either a selective ringer 66 or microphone 67 may be connected to control the modulator of the transmitter 61. In sending out a call, the spring members of the switch 65 would be separated to connect in the selective ringer, which selective ringer might comprise suitable mechanical vibrators. Upon establishment of the talking channel, the switch may then be operated to disconnect the ringer 66 and connect the microphone 67. For purposes of receiving there is shown associated with the antenna 60 an inductance 70 and condenser 71 arranged in parallel and preferably tuned to a frequency equal to the transmitted frequency, and constituting thereby an anti-resonant circuit. The circuit also includes a demodulating device 72, a filter 73 and a detector amplifier 74. Incoming signals of carrier frequency F_1 readily pass through the anti-resonant circuit into the demodulator 72. At the same time the anti-resonant circuit suppresses almost wholly the transmitting carrier frequency F_2, permitting, however, a small portion to enter into the demodulator 72. As a result there is produced an intermediate frequency $F_2—F_1$, this intermediate frequency being, of course, modulated with whatever signals were impressed upon the carrier F_1. The band filter 73 may be inserted to pass the frequency $F_2—F_1$, with its modulated side bands. The detector amplifier 74 will then yield the desired signal. There is associated with the detector amplifier 74 a switch 75, which normally closes, by contacts 76 and 77, a circuit through the selector 78. Upon receipt of the proper signaling impulses this selector will cause an indication at 79. By operation of the switch 75, this selector is then cut out and the receiver 79 inserted in its place.

While I have shown and described in Fig. 1, mechanism for two remote stations, it is apparent from the symmetry of the circuit arrangement that a larger number of remote stations may be accommodated. This is illustrated by skeleton circuit drawing in Fig. 3, in which there are shown switches S_1 to S_7 of the form described above and corresponding to seven remote stations and the indication that there may be other switches. Each of these would be connected to a corresponding receiving circuit, although it is not necessary that there should be a separate receiving antenna for each remote station. In the figure, I have shown but three such receiving circuits. Of these, R_1 is shown as connected to the switching mechanism S_1 and S_6. R_2 is connected to the switches S_2, S_5 and S_7. R_3 is connected to the switches S_3 and S_4. In case one receiving circuit is to be used for two or more remote stations, there should be suitable selective mechanism to indicate which remote station is calling. R_1 is therefore shown as having associated with it selectors s_1 and s_6 and so with the other receivers. The transmitter T is shown as being adapted for three carrier frequencies by means of relays as described in connection with Fig. 1. Each relay may be associated with a suitable number of the switches S. In this case, for example, I have shown the switches S_4 and S_6 as connected to one relay 80, the switches S_1, S_3 and S_5 as connected with the relay 81 and the switches S_2 and S_7 as connected to the relay 82. It will be observed that the grouping of the switches with the receivers R_1, R_2 and R_3 is not the same as that for the relays 80, 81 and 82, nor is this in general desirable, for it may frequently occur that the relationship of the frequencies received and transmitted at any one remote station shall be different from that at other stations. The system

which I have described, therefore, provides full freedom in this respect. A suitable number of oscillations O_1, O_2, etc., would be provided to give the necessary number of combinations of ringing impulses to accommodate the remote stations.

It may be that at the central station it will be desirable to have more than one operator and for this purpose a plurality of talking lines L should be provided. Fig. 3 shows two such lines, L_1 and L_2, with their corresponding hybrid coils and networks M_1 and M_2, these being associated with the receivers and the switching mechanism in the manner indicated in connection with Fig. 1. The figure shows the coil M_1 connected to receivers R_1 and R_3 and the coil M_2 connected to the receivers R_2 but any other grouping may be used.

The connections between the switches, the oscillators and the receivers, the transmitter and the talking lines are in skeleton form only, it being understood that in general the circuit arrangement for each switch is identical to that of Fig. 1, and that by virtue of the symmetry, the circuit of Fig. 3 may be expanded indefinitely.

What is claimed is:

1. In a radio signaling system, a station adapted for communication with a plurality of remote stations, and comprising a receiving circuit for each station with which communication is to be held, and a telephone and calling means for each such receiving circuit selectively responsive to a call from a corresponding station only.

2. In a radio signaling system, a station adapted for communication with a plurality of remote stations, and comprising a receiving circuit for each station with which communication is to be held, calling means for the receiving circuits each selectively responsive to a call from a corresponding station only, and switching mechanism associated with the first named station whereby a communication channel may be established with the calling station.

3. In a radio signaling system, a station adapted for communication with a plurality of remote stations, and comprising a receiving circuit for each station with which communication is to be held, a telephone and calling means for the receiving circuits each selectively responsive to a call from a corresponding station only, and switching mechanism associated with said receiving circuits for disconnecting the calling means of the responding receiver and connecting the telephone thereto.

4. In a radio signaling system, a central station comprising a transmitting circuit and a plurality of receiving circuits adapted for communication with a plurality of remote stations, calling means for selectively calling any remote station, switching mechanism at the central station for controlling the calling means and for connecting in the corresponding receiving circuit.

5. In a radio signaling system, a central station comprising a transmitting circuit and a plurality of receiving circuits adapted for communication with a plurality of remote stations, calling means for each receiving circuit selectively responsive to a call from a corresponding remote station only, calling means for selectively calling any remote station and switching mechanism at the central station for controlling said last calling means and for connecting in the corresponding receiving circuit.

6. In a radio signaling system, a plurality of stations arranged for intercommunication, calling means for establishing channels between one station and any other station, comprising apparatus responsive to a plurality of different combinations of voice frequencies on a given carrier frequency.

7. In a radio signaling system, a plurality of stations arranged for intercommunication, calling means for establishing channels between one station and any other, comprising a given combination of voice frequencies on a plurality of different carrier frequencies.

8. In a radio signaling system, a plurality of stations arranged for intercommunication, calling means for establishing channels between one station and any other, comprising apparatus responsive to a plurality of different combinations of voice frequencies on a given carrier frequency and a given combination of voice frequencies on a plurality of different carrier frequencies.

In testimony whereof, I have signed my name to this specification this 14th day of August 1922.

DE LOSS K. MARTIN.