

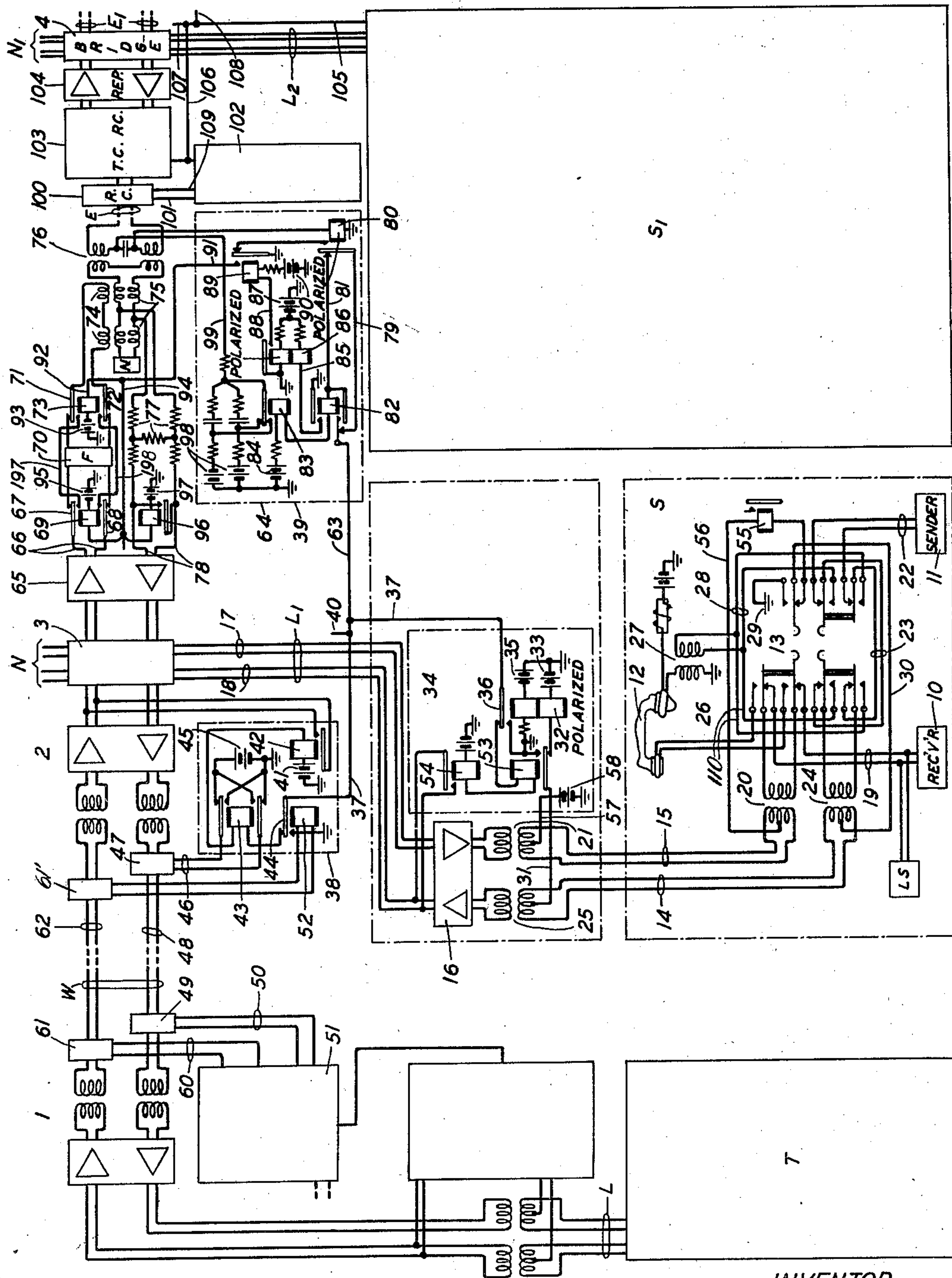
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COMMUNICATION SYSTEM

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COMMUNICATION SYSTEM

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The present invention relates to communication systems and more particularly to a line network over which communications of different characters may be transmitted.

5 The invention has special reference to the case where a series of lines, each having one or more communicating stations connected thereto, are connected together to constitute a network which is turned over to a customer to be controlled and operated by him.

10 An object of the invention is to provide means at each station for conditioning the network to accommodate the different types of communications being transmitted from time to time.

15 In one aspect the invention is concerned with means for conditioning a network, normally designed for the transmission of signals of a special character from any one station to any number or all stations of the system, to permit signals of a different character from that of the special type to be transmitted one way from one station to a selected group or all stations, or to permit two-way transmission of signals of the last mentioned type between stations.

20 As a practical embodiment, there will be hereinafter described in detail, a network, primarily designed for telephotographic or picture transmission, including at each station a three-position switching means which either connects a loud-speaking receiver to the incoming path of a station terminal circuit, a telephone transmitter and telephone receiver simultaneously to the respective outgoing and incoming paths of the terminal circuit, or which serves to control the operation of auxiliary apparatus associated with the lines of the network for conditioning the latter to permit speech to be broadcast thereover and operates simultaneously therewith to connect the telephone transmitter to the outgoing path of the terminal circuit.

40 A detail description of the invention follows and is illustrated in the attached drawing, the single figure of which shows portions of the network respectively comprising four-wire lines and two-wire lines each having associated therewith certain apparatus units shown in detail.

While a portion only of the network is shown and will be hereinafter described in detail, such portion includes various apparatus units that are employed in the system and hence a description of their mode of operation and of that of the auxiliary apparatus associated with them will serve to disclose the principles of the invention.

55 In the drawing T is a customer's terminal station connected by a four-wire terminal loop L to

a central office 1 from which extends a four-wire line W to a second central office 2, including a bridge circuit arrangement 3 for interconnecting line W with other lines N and E and a terminal loop L₁ leading to a customer's station S, and a second bridge arrangement 4 for interconnecting line E with other lines N₁ and E₁ and with a second customer's station S₁. Line E₁ represents an extension of the network, with which other lines may be connected by means of additional bridge arrangements, or customers' stations may be directly connected thereto, each over a terminal loop. In addition, bridge arrangements may be used for interconnecting the lines shown with similar lines extending in any direction therefrom, and bridge arrangements may be used for interconnecting a group of lines to any or all of the added lines. In this manner a network of lines, adapted to serve customers' stations in all parts of the country, may be built up.

The following description relates to customer's station S which has been selected for detail description, because it is representative of all stations connected intermediate the network. However, except for minor details, the description applies to the circuits used for connecting stations to the terminating lines of the network.

Referring now to station S, 10 represents a picture receiving machine, 11 a picture sending machine, 12 a telephone handset and 13 a key for controlling the connection of the picture apparatus or the telephone set to the outgoing and incoming paths 14 and 15, respectively, of the station loop circuit L₁. This circuit which extends to a central office, includes an alternating current repeater 16 having input and output paths connected by circuits 17 and 18, respectively, to bridge arrangement 3.

The bridge arrangements 3 and 4 are designed to provide a simple and direct apparatus which permits several four-wire lines to be associated in such manner that each transmitting line may transmit into all the other receiving lines except its own receiving line and, as to that, it is practically conjugate. For a more complete disclosure of these bridges and their method of operation, reference may be made to U. S. Patent 2,019,603 of C. W. Green, issued Nov. 5, 1935.

With the key 13 in normal position, i. e., non-operated, the picture receiving machine 10 and a loud-speaking receiver are connected via conductors 19 to the two upper left-hand normal and lever contacts of key 13, the upper repeating coil 20, conductors 15, right-hand repeating coil

21 and conductors 17 to bridge 3, and the picture sending machine 11 is connected to this bridge by conductors 22, the lower right-hand normal and lever contacts of key 13, conductors 23, lower left-hand normal and lever contacts of key 13, repeating coil 24, conductors 14, repeating coil 25, left-hand transmitting path of repeater 16 and conductors 18 to bridge 3. However, as will appear hereinafter, when the picture sending machine is connected to the network and a picture is being sent from a station, the line circuit connected to the incoming path of the station loop is short-circuited and hence the receiving machine can not be used to receive a picture, and when a picture is being received, the circuit connected to the outgoing path of the station loop is short-circuited and hence a picture can not be transmitted from the station to the network.

When the attendant at station S desires to send a picture he throws key 13 to the left, thereby disconnecting its right-hand key levers from the normal contacts and engaging them with the alternate contacts. The picture sending machine is thereby disconnected from the outgoing path and microphone 26 of the handset is connected thereto, via the repeating coil 27, conductors 28, two right-hand lower alternate and lever contacts of key 13, conductors 23, two left-hand lower normal contacts and levers of key 13, through repeating coil 24 and thence to the bridge 3 through the connection described above for the picture sending machine.

Throwing key 13 to the left completes a circuit from ground 29, upper right-hand alternate and lever contacts of key 13, conductor 30, the secondary winding of coil 24, conductors 14, primary winding of coil 25, conductor 31, lower winding of relay 32, battery 33, at the loop direct current repeater 34, and through ground to 29. Relay 32 is polarized by the flow of current, from ground, battery 35, upper winding of this relay, a resistance and through ground to battery 35.

Current flow from battery 33 through the lower winding of relay 32 causes this relay to pull up its armature 36 and thereby apply ground to conductor 37, which leads to the direct current repeaters 38 and 39 and via conductor 40 to a similar direct current repeater associated with line N.

Grounding conductor 37 causes current to flow over the following circuit, beginning at direct current repeater 38, battery 41, winding of relay 42, winding of relay 43, armature 44, conductor 37, armature 36 at the loop direct current repeater, and through ground to battery 41.

Relay 42 pulls up its armature to apply a short circuit across the upper output path of repeater 2 thereby preventing picture or other signal currents from being received over line W and noise currents, picked up by the line W, from affecting the transmission of signal currents from bridge 3 over the east lines comprising the network. Relay 43 pulls up its armatures to reverse the connection of battery 45, via its upper and lower armatures, conductors 46 and composite set 47 to the two lower line conductors 48 of line W to station T. This composite set, as well as the other similar sets include the usual choke coils, condensers, etc., associated with the lines as shown. These sets terminate in conductive paths over which direct current signals may be transmitted over conductor 48 in the usual way.

Under normal, or non-operating, conditions, battery 45 supplies current over conductors 48 in one direction to polarize relays, included in direct current repeaters associated with alternat-

ing current repeaters included in the section of line W which connects station S with the next right-hand or western station T. When current flow through conductors 48 is reversed by the operation of relay 43 the line relays operate to effect certain control functions at the line repeaters, since this feature has no direct bearing on the present invention these line repeaters and the control circuit therefor are not shown and need not be further described.

The reverse current supplied by the battery 45 over conductors 48 flows through the composite connection 49 and conductors 50 and through a polarized relay included in direct current repeater 51 of the terminal loop associated with station T. Repeater 51 is identical with direct current repeater 38, except that its relay 43 does not short-circuit the output or upper path of the alternating current repeater at central office 1. This is unnecessary, since the upper outward path of the alternating current repeater comprises only loop terminal circuits which are thoroughly isolated to prevent the pickup of noise currents, and hence there is no danger of such currents effecting the signal currents received over the lower path of the alternating current repeater at central office 1.

For the purpose of disclosing the operation of a central office direct current repeater, let it be assumed that keys 13 at all stations are in normal position and that the control key at terminal station T has been thrown to the left to activate its right-hand key levers to effect the controls described above in connection with station S. In this case, the relay corresponding to 43 will have applied reverse current through leads 60, composite connection 61, upper conductors 62 of line W, composite connection 61' and polarized relay 52 of direct current repeater 38, thereby applying ground via its armature 44 to conductor 37 connected to the direct current repeater associated with loop L₁, conductor 40 of a direct current repeater associated with line N and conductor 63 of direct current repeater 39 associated with line E. A control circuit is thereby established from ground, armature 44, conductors 37 to repeater 34 and over the following path at this repeater: armature 36, relays 53 and 54, battery and through ground to the lead connected to armature 44. Current flow through this circuit energized relay 53, the armature of which is pulled up to connect conductor 31 to ground. A circuit is thereby established from ground, armature of 53, conductor 31, primary of coil 25, conductors 14, secondary of repeating coil 24, conductor 30, upper key lever and normal contact of key 13, which is in its normal or not operated position, relay 55, conductor 56, secondary winding of repeating coil 20, conductors 15 and 57, battery 58 and through ground to the armature of relay 53.

Relay 55 will be thereby operated to effect the desired controls with respect to the picture receiving machine which require no further description, since they are not a feature of this invention.

At the same time relay 54 will operate to apply a short circuit to the outgoing path of loop L₁.

Applying ground to conductor 40 will cause like apparatus units of the direct current repeater associated with line N to operate to short-circuit the two conductors of this line and to supply reverse current over its two other conductors.

Conductor 63 leads to a direct current repeater 39 associated with a terminating circuit for con-

necting the four-wire output circuit of repeater 65 with a two-wire line E. The output leads 66 of repeater 65 are normally connected by armatures 67 and 68 of relay 69, filter 70, armatures 71 and 72 of relay 73 to the upper winding 74 of a three-winding transformer, the other windings 75 of which have their respective terminals connected to a balancing network N and through a repeating coil and composite set 76 to line E, and the mid-tap leads of winding 75 are connected through a resistance pad 77 to the input leads 78 of the repeater 65.

Applying ground to conductor 63 completes the following circuit: from ground at armature 44 (direct current repeater of line W) conductors 37, 63 and 79, armature of relay 80, conductor 81, relays 82 and 83, battery 84 and through ground to armature 44. Current flow through this circuit causes relays 82 and 83 to pull up their armatures.

Lower armature of relay 82 operates to complete a lock-up circuit for these relays via conductor 63, the lower armature, windings of relays 82 and 83, battery 84 and through ground to armature 44, and then open-circuits the path through conductor 79 and armature of a relay 80, which is adapted to be energized by control currents incoming over line E, as will be explained below.

The upper armature of relay 82 will complete a circuit from ground through this armature, conductor 85, the lower winding of relay 86, battery 87 and through ground to the upper armature of relay 82. Relay 86 is polarized by current flow from battery 87, upper winding of this relay and through ground to the other terminal of battery 87. Current flow through the lower winding of relay 86 causes it to pull up its armature and thereby complete the following circuit: from ground, armature of 86, conductor 88, windings of relay 89, battery 90 and through ground to the point of beginning. Relay 89 operates to pull up its armature and thereby disconnects it from its outer (right-hand) contact and connects it with its inner (left-hand) contact to complete the following circuit: from ground, armature of 89, conductor 91 and through three branch circuits, the first via conductor 92, winding of relay 73, battery 93 and through ground to the armature of relay 89, the second via conductor 94, winding of relay 69, battery 95 and through ground to the armature of relay 89, and the third through the winding of relay 96, battery 97 and through ground to the armature of relay 89. Relays 69 and 73 are thereby energized to pull up their upper and lower armatures to extend the upper output path of repeater 65 via conductors 197 and 198, respectively, to the upper winding 74 of the three-winding transformer included in the four-wire two-wire terminating circuit and thereby disconnect filter 70 from the output path of the repeater, and relay 96 pulls up its armature to short-circuit the input path 78 of the repeater 65. At the same time, armature of relay 83 operates to disconnect lower battery 98 from conductor 99 and to connect upper battery 98 to conductor 99 and hence to the upper conductor of line E via a composite set associated with repeating coil 76.

Lower battery 98 supplies current of one sign to the upper conductor of line E and upper battery 98 supplies current of opposite sign to this same conductor when relay 83 operates. The purpose of this current reversal is to control polarized relays in the line (not shown) at mid-sta-

tion repeater points, as described above with respect to the four-wire west line. This feature has no bearing upon the operation of the present invention and hence will not be described in detail.

Reverse current incoming over the upper conductor of the east line flows through a composite set at repeating coil 100 and conductor 101 to a direct current repeater 102 associated with the apparatus unit comprising a repeating coil 100 and the two-wire four-wire terminal circuit 103, which unit is similar to that comprising the repeating coil 76 and the terminal circuit just described. Its composite set is associated with the lefthand winding of the repeating coil 100, i. e., the winding physically included in line E, and the terminal circuit is reversed, i. e., is used to connect a two-wire line to a four-wire line, the latter being connected by a two-way alternating current repeater 104 to a bridge 4, through which connections may be extended to a line N₁ and over a terminal loop L₂ to a station S₁, identical with station S, and through line E₁ to other portions of the network.

Should the attendant at station S₁ desire to condition the network for broadcasting thereover, he would throw his key 13 to the left and thereby control the circuit of the direct current repeater associated with his terminal loop, in the manner described above, to apply ground to conductors 105 and 106 extending to the direct current repeater 102, conductor 107 extending to the direct current repeater associated with line N₁ and lead 108 to a direct current repeater associated with line E₁.

Grounding conductor 106 causes repeater 102 to supply reverse current, as described above for repeater 39, over conductor 109 and the lower conductor of the east line to polarized relay 80 at repeater 39. This relay will operate to pull up its armature and thereby complete the following circuit: from ground, the armature of relay 89, armature of relay 80, conductors 79 and 63, 40 and 37 to relays 53 and 54 of the terminal repeater of loop L₁, relays 43 and 42 of repeater 33 and similar relays of the N line direct current repeater. These repeaters will operate as described above and as a result of the operation of relay 43, reversed control current will be transmitted via conductors 48 to repeater 51, associated with the terminal loop of station T.

Let it be assumed that the attendant at station T desires to transmit a picture. He first throws his talking key 13 to the broadcast position and thereby conditions the network via the successive station direct current repeaters to control all alternating repeaters so that current can only be transmitted through them in one direction. He then broadcasts the necessary information over the conditioned network and this information is heard by the attendant at the various stations by means of the loud-speakers LS permanently connected to the incoming path of each station terminal loop. He then throws his key 13 to the right-hand or talking position. As the key passes through its normal position, ground is removed from conductor 30 with the result that the different direct current repeaters and the various apparatus units of the network controlled thereby are restored to normal, that is as shown in the drawing, and hence the network may be used for two-way telephone conversations between the attendants at all stations. The attendants at the other stations also throw

their keys 13 to talking position and thereby operate the left-hand levers of the respective keys 13, each to connect the microphone of the telephone set over repeating coil 27, conductors 110, the two lower left-hand alternate contacts and levers of key 13 to repeating coil 24 and the output path of the terminal loop, and the telephone receiver via the two upper alternate contacts and levers of key 13 through repeating coil 20 to the input path of the terminal loop.

Having completed the telephone conversation, the attendants at all stations restore their keys 13 to normal, whereby the telephones are disconnected from the network and the pictures sending and receiving machines 11 and 10 are connected to the respective paths of the terminal loop.

For picture transmission from any station, key 13 is in normal position and a starting key associated with the sending machine is operated to apply ground to conductor 30 and thereby control the direct current repeaters at the respective central offices and station loops to condition the network in the same manner as it is conditioned when the key 13 is thrown to the left for speech broadcasting. Further description of this feature appears unnecessary, since it is not essential to the present invention, but a complete disclosure with respect thereto is given in an application of E. M. Staples, Serial No. 734,180, filed July 7, 1934.

The present invention therefore provides a simple key arrangement, which, in normal position connects the loud-speaker to the station receiving path, in the left-hand position connects the telephone microphone for speech broadcasting over the network and at the same time controls apparatus units associated with the lines to condition the network for one-way transmission, and, in the right-hand position, connects the microphone and telephone receiver to the incoming and outgoing path of the station loop, whereby two-way telephone conversations may be carried on between stations.

What is claimed is:

1. In a communication system, a network comprising a series of lines, means for connecting said lines together to permit signal transmission from any line to other lines, stations associated with each said lines, said stations each comprising signal sending and receiving devices, means for simultaneously connecting said signal devices to said network, and means for conditioning line elements for conditioning said network for one-way transmission thereover and for simultaneously connecting one of said signal devices to said network.

2. In a communication system, a network com-

prising a series of lines, means for connecting said lines together to permit signal transmission from any line to other lines, stations local to each said lines, said local stations each comprising signal transmitting and receiving devices, means for simultaneously connecting said signal devices via its line to the network, and means controlling devices for conditioning the lines for one-way transmission over said network and for simultaneously connecting said signal transmitting device to said network.

3. In a communication system, a network comprising a series of lines, telephone transmitting and receiving apparatus associated with each line, means for simultaneously connecting said telephone apparatus via its line for two-way transmission over the network, and means controlling devices associated with said lines for conditioning said network for one-way transmission thereover and for simultaneously connecting said telephone transmitter to said network.

4. A communication system comprising a series of lines constituting a network over which signals may be transmitted from any line to other lines, stations local to each said lines, said local stations each comprising telephone transmitting and receiving apparatus, a loud-speaker and a three position switch for respectively connecting said loud-speaker to said network, connecting said telephone apparatus for two-way transmission over said network and controlling devices associated with said lines to condition said network for one-way transmission thereover and for simultaneously connecting said telephone transmitting apparatus to said network.

5. A communication system comprising at each of a plurality of stations telephone transmitting and receiving apparatus and a loud-speaking receiver, a transmission path connecting a local station with a distant station, a three-position switching means at said local station for conditioning the system for either loud-speaker reception, two-way telephone communication with or one-way telephone transmission to a distant station.

6. A communication system comprising at each of a plurality of stations telephone transmitting and receiving apparatus and a loud-speaking receiver, a transmission path connecting a local station with a distant station, a three-position switching means at said local station for conditioning the system for either loud-speaker reception from any of said stations, two-way telephone communication with a plurality of said stations, or one-way telephone broadcasting to at least a plurality of said stations.

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