

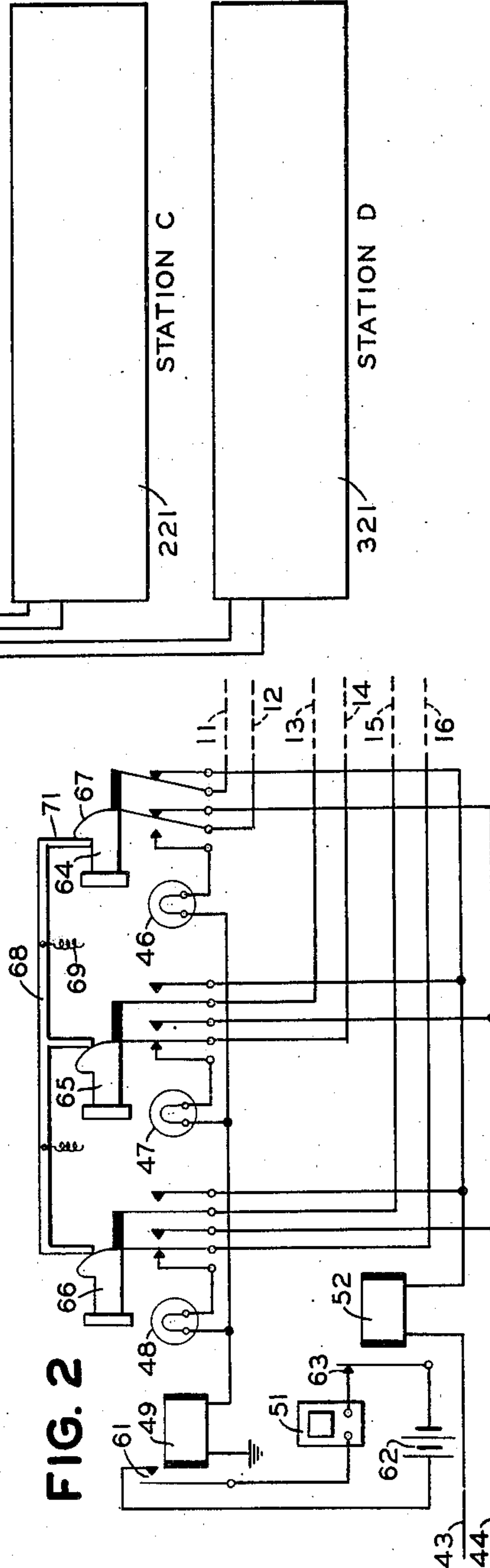
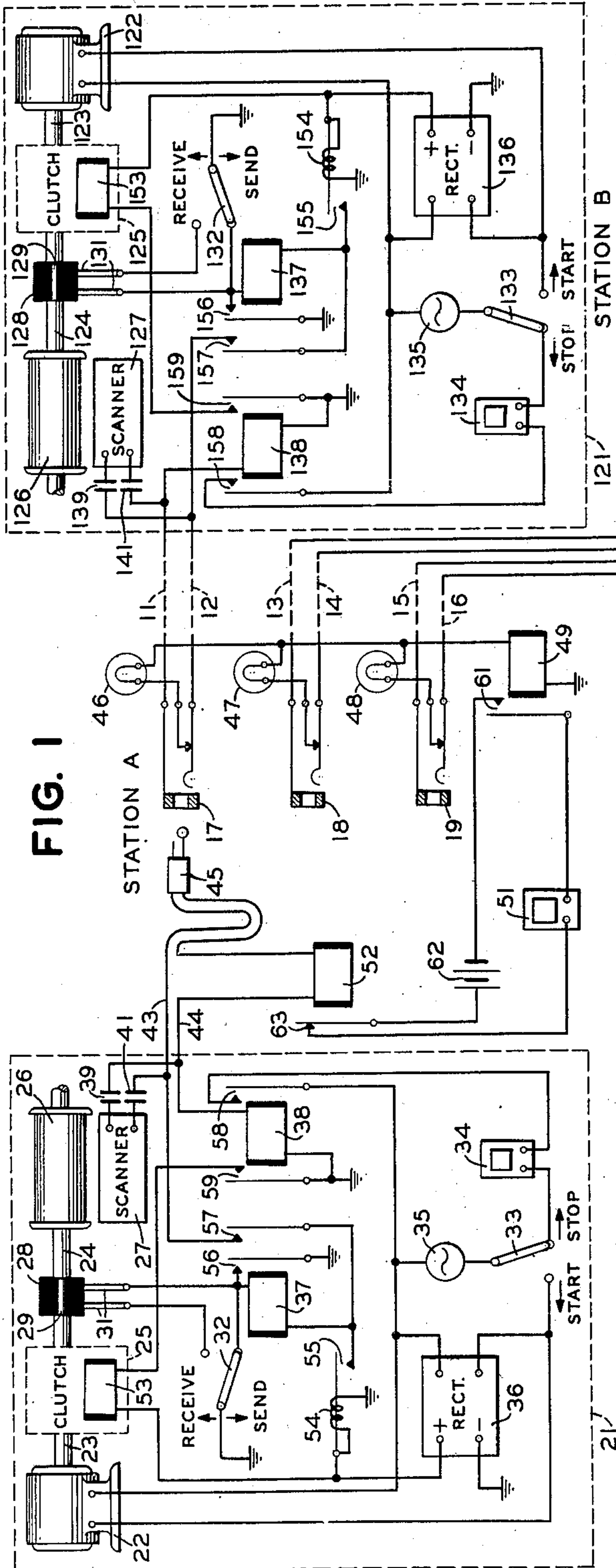
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FACSIMILE SWITCHING SYSTEM

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FACSIMILE SWITCHING SYSTEM

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This invention relates to facsimile systems and has particular reference to systems wherein facsimile transmitting and recording apparatus may be selectively interconnected for communication.

An object of the instant invention is to provide an improved switching system of greater flexibility for use in interconnecting combination transmitter-recorders for communication.

Another object of the invention is to provide a switching arrangement whereby the lines to a plurality of branch stations each having combination transmitter-recorders may be selectively connected to a combination transmitter-recorder at a central station.

Still another object of the invention is to provide a switching system whereby a central station combination transmitter-recorder may be connected to any one of a plurality of lines terminating respectively in branch stations, at each of which is a combination transmitter-recorder, the switching operation being the same whether the central station initiates or answers a call.

A better understanding of the invention may be obtained from the following description which is taken in conjunction with the accompanying drawing, of which:

Fig. 1 illustrates schematically an embodiment of the invention utilizing a plug and jack switchboard; and

Fig. 2 shows a modification of the switching apparatus in which push button switches are employed.

In Fig. 1 there is shown a central station A and three branch stations B, C and D. The branch stations B, C and D are connected to the central station by line conductors 11—12, 13—14 and 15—16, respectively, and each pair of conductors terminates at the central station A in jacks 17, 18 and 19, respectively.

The central station and each of the branch stations are each provided with combination facsimile transmitters and recorders. The combination transmitter-recorder 21 at the central station is similar to the facsimile apparatus located at each of the branch stations. This apparatus and the combination transmitter-recorder 121, station B, are shown diagrammatically, while the combination transmitter-recorders 221 and 321 of stations C and D, respectively, are indicated in block diagram form. Inasmuch as the apparatus at the various stations is similar, only that at station A will be described in detail. For the purpose of identifying corresponding apparatus at station B, the same characters of reference will be used to designate such apparatus. In order to avoid confusion in the description of the system, the reference characters employed in connection with the apparatus of station B will be preceded by the numeral 1.

The combination transmitter-recorder 21 is of

the type disclosed in detail in an application of Wise et al., Serial No. 293,188, filed September 8, 1939, now Patent No. 2,315,361, granted March 30, 1943. Since such apparatus forms no part of the instant invention, there is disclosed herein diagrammatically only enough thereof to afford an understanding of the illustrative embodiment of the invention. The facsimile apparatus utilizes a synchronous motor 22 to drive the shaft 23 and also a shaft 24 upon the engagement of a clutch 25. The apparatus disclosed in the Wise et al. case is modified for use in the present system by the introduction of a clutch between the shafts 23 and 24. A cylinder 26 is secured to the shaft 24 for rotation thereby and serves to support a sheet for cooperation with a facsimile scanner 27. When the machine is used as a transmitter, the sheet bearing the subject matter for transmission is mounted upon the cylinder 26, and the scanner includes apparatus for generating facsimile signals in accordance with the tonal densities of the subject matter in any well-known manner. Also, when the apparatus is used as a recorder, a blank recording sheet is placed upon the cylinder 26 to receive marks placed thereon by means of the scanner 27, which in this case utilizes any well-known recording mechanism such as an electrical stylus, or a source of light where the recording is to be done by a photographic process. A commutator 28 is also attached to the shaft 24 so that upon rotation the single conducting segment 29 bridges a pair of brushes 31 for a phasing or framing purpose to be described.

The combination transmitter-recorder 21 is also provided with a send-receive switch 32, by means of which the apparatus is arranged either as a transmitter or a recorder. Such a switch will preferably include additional contacts in order to switch into operation the appropriate type of scanning apparatus. The transmitter-recorder 21 also includes a start-stop switch 33 which, in its stop position, prepares an operating circuit for a buzzer 34 or other suitable alarm and, in its start position, connects a source of alternating current 35 to the driving motor 22 and to a rectifier 36. A relay 37 is also provided to transmit a direct current signal over one of the line conductors. A relay 38 is connected to be responsive to a direct current signal received over the other line conductor for a control purpose to be described.

The scanner 27 is connected through a pair of direct current blocking condensers 39 and 41 to conductors 43 and 44 which terminate respectively in the sleeve and tip elements of a switchboard plug 45. The plug 45 may be inserted in any of the jacks 17, 18 and 19 whereby conductors 43 and 44 are connected to a pair of line conductors extending to one of the branch stations.

Associated with each of the line jacks 17, 18 and 19 through normal contacts thereof are signal lights 46, 47 and 48. Thus, one terminal of each of the signal lights is normally connected respectively to one of the line conductors extending to each of the branch stations B, C and D. The other terminals of the signal lights are connected through the winding of a relay 49, which is energized whenever one or more of the signal lights is energized, to close a circuit for the operation of an alarm such as a buzzer 51. The operating circuit for the buzzer 51 includes break contacts of a relay 52, the winding of which is inserted in one of the conductors, in this case conductor 44, connecting the combination transmitter-recorder 21 with the plug 45.

For a description of the operation of this system, assume that it is desired to transmit by facsimile from the central station A to one of the branch stations, for example, station B. The send-receive switch 32 is operated to its send position; the plug 45 is inserted in the jack 17, and the start-stop switch 33 is operated to its start position. Immediately the motor 22 is operated to drive the shaft 23. Since at this time the clutch magnet 53 is deenergized, the shaft 24 and the apparatus connected thereto is held stationary in a predetermined position. The rectifier 36 is also energized by the operation of the start-stop switch and, when it becomes completely operative, a circuit is completed from the positive terminal thereof through the winding of a thermal relay 54 to ground. The negative terminal of the rectifier being grounded, the thermal relay becomes energized. After this relay has been sufficiently heated, its contact 55 is closed to extend the circuit from the positive terminal of the rectifier through the winding of relay 37 and the send-receive switch 32 to ground. This relay is operated and locked through its contact 56. Also, by reason of the closing of contact 57 of relay 37, the positive terminal of the rectifier 36 is connected over conductor 43, the sleeve connections of the plug 45 and jack 17, over line conductor 11, through the winding of relay 138, to ground.

This relay operates and closes a circuit which includes the source of alternating current potential 135, the start-stop switch 133, in its stop position, the buzzer 134 and contact 158 of the relay. The attendant at station B, in response to the sounding of the buzzer 134 which indicates that there is a communication to be recorded at this station, places the send-receive switch 132 in its receive position and operates the start-stop switch to its start position. The latter operation silences the buzzer by opening the operating circuit therefor and connects the alternating current source 135 to energize the rectifier 136 and the motor 122. In this case, as soon as the rectifier becomes operatively conditioned, a circuit is completed from the positive terminal thereof through the clutch magnet 153 and the make contact 159 of relay 138 to ground, thereby engaging the clutch to rotate the shaft 124 and the apparatus connected thereto including the commutator 128. When the contact 155 of the thermal relay 154 is closed, the positive terminal of the rectifier is connected to one terminal of the winding of relay 137, which does not necessarily operate immediately because of the rotation of the commutator 128. Upon the engagement of the brushes 131 with the conducting segment 129, following the closure of the thermal relay contact, a circuit is completed through the

winding of relay 137 and the send-receive switch 132, in its receive position, thereby operating the relay, which locks through its contact 156 and connects positive direct current potential through its contact 157 to line conductor 12.

At the central station A, the positive direct current potential on conductor 12 is communicated through the tip elements of the jack 17 and the plug 45 and is extended through the winding of relay 52 and over conductor 44 to the winding of relay 38. The latter relay operates and, by means of its contact 59, completes a circuit through the clutch magnet 53. The clutch 25 is thus engaged to initiate rotation of shaft 24 and the apparatus connected thereto so that accurate framing between the transmitting cylinder 26 and the receiving cylinder 126 is effected.

The facsimile signals generated by the scanner 27 are transmitted through the switching apparatus to station B where they are employed to operate the recording scanner 127 in a well-known manner.

When it is desired to transmit by facsimile from one of the branch stations to the central station, the attendant at the branch station, such as station B, operates the send-receive switch 132 to its send position and the start-stop switch 133 to its start position. As in the previously described case, the motor 122 immediately starts, but in this case it rotates only the shaft 123, since the clutch 125 is disengaged by reason of the incomplete operating circuit therefor at the contact 159 of relay 138. Following the closure of the contact 155 of the thermal relay 154 and the closure of contact 157 of relay 137, positive direct current potential is impressed upon the line conductor 12.

At the central station A this positive potential is extended through the normal contact of jack 17 through the lamp 46 and the winding of relay 49, thereby operating the lamp and the relay. The closure of contact 61 of relay 49 completes a circuit including a source of energy 62 and the break contact 63 of relay 52 to sound the buzzer 51. The attendant at this station, responding to the call thus initiated, inserts the plug 45 in jack 17 in accordance with the indication given by the lamp 46 and operates the send-receive switch 32 of the combination transmitter-recorder 21 to its receive position and the start-stop switch 33 to its start position. The extension of the line conductor 12 through the tip elements of the jack 17 and the plug 45 impresses the direct current potential upon the windings of relays 52 and 38, thereby causing the operation of these relays. The insertion of the plug 45 in the jack 17 opens the normal contact of the latter, thereby extinguishing the light 46 and deenergizing the relay 49, the latter operation resulting in the silencing of the buzzer 51. The opening of contact 63 of relay 52 conditions the operating circuit of the buzzer 51 so that any incoming calls while the transmitter-recorder 21 is busy will operate one of the signal lights 47 or 48 and also the relay 49, but the latter operation will not sound the buzzer. It will be noted that the buzzer is prevented from operating while the central station transmitter-recorder 21 is busy irrespective of whether it is used as a transmitter or a recorder for the reason that in either case there is connected to conductor 44 a direct current potential during the operative condition of the facsimile apparatus to cause the operation of relay 52. The transmitter-recorder 21 arranged as a re-

corder operates in the same manner as the previously described operation of the transmitter-recorder 121 at station B when arranged as a recorder. Relay 37 is operated under the control of the commutator 28 at a predetermined point in a revolution of the cylinder 26 to connect positive direct current potential by means of its contact 57, conductor 43, the sleeve elements of the plug 45 and the jack 17 and line conductor 11 to relay 138 at station B. The closure of contact 159 of this relay energizes the clutch magnet 153 to effect the engagement of the clutch 125 and to initiate rotation of the cylinder 126 in a manner similar to that previously described.

Instead of the plug and jack switchboard apparatus for selectively connecting the central station facsimile apparatus to that of any of the branch stations, Fig. 2 illustrates an arrangement using push button controlled contacts for this purpose. Contacts controlled respectively by push buttons 64, 65 and 66 are used to selectively connect line conductors 11—12, 13—14 and 15—16 to conductors 43 and 44 extending to the combination transmitter-recorder 21. These push buttons are of the type which, when operated, are locked in such position and are released by unlocking upon the operation of another push button. Each of the push buttons such as 64 is provided with a cam surface 67 which, upon operation of the push button, moves a bail member 68 against a restraining member such as a spring 69 so that a flange 71 of the bail member is moved to permit the lobe of the push button cam to be moved beyond the flange. The flange 71 is then moved under the influence of the spring 69 to engage a portion of the cam lobe whereby the push button is held in its operated position. The push button is held in such position until one of the other push buttons such as 65 is similarly operated to again move the bail member 68 sufficiently to allow the cam lobe of the push button 64 to become disengaged from the flange 71. The newly operated push button 65 is then locked in its operated position in a manner similar to that in which push button 64 is locked. Such a structure or an equivalent thereof is conventional and is shown herein as embodying a bail member having a plurality of flanges such as 71 for ease of illustration. Preferably, the push buttons should be arranged in a horizontal row whereby the cam lobes thereof would be aligned, thereby making it possible to use a bail member having but a single flange extending along the aligned push button cam lobes.

Whether for the purpose of initiating a call from the central station A or for answering a call from one of the branch stations B, C or D, the push button associated with the line extending to the branch station is operated for the purpose of connecting the line conductors to the conductors 43 and 44 extending to the central station transmitter-recorder 21. For example, line conductors 11 and 12 extending to the branch station B are connected by means of make contacts associated with the push button 64 to the conductors 43 and 44 in an obvious manner. Also, in response to the initiation of a call from one of the branch stations such as station C, for example, direct current potential is impressed upon line conductor 14 and through a normal contact associated with the push button 65 is extended through the lamp 47 and the winding of relay 49, thereby indicating the call to be answered. In this case, the call is answered by operating

push button 65, thereby extinguishing the light 47 and deenergizing the relay 49 and connecting line conductors 13 and 14 to conductors 43 and 44.

It will be noted that in this embodiment of the invention the relay 52 is connected in series with the line conductor 43 to illustrate that the particular conductor 43 or 44 with which this relay is associated is immaterial, since, as previously indicated, both conductors have impressed thereon direct current potentials during operative conditions of the transmitter-recorder 21.

Since any push button remains locked in its operated position until another push button is operated, the line conductors associated with an operated push button are left connected to the central station transmitter-recorder 21 after this apparatus and the branch station apparatus connected to the line conductors have been placed in their idle conditions. For example, when push button 64 is operated, the transmitter-recorder 121 of branch station B is connected to the transmitter-recorder 21 of the central station A. After the exchange of communication between these two stations, the respective apparatus thereat is stopped by placing the respective start-stop switches 33 and 133 in their stop positions. If, while these conditions exist, branch station C desires to transmit to the central station A, the call is effected over line conductor 14 to operate the lamp 47 and energize the relay 49. Since the central station transmitter-recorder 21 is idle, there are no direct current potentials connected to conductors 43 and 44 so that relay 52 is deenergized and thereby permits the operation of the buzzer 51 in response to the operation of relay 49. The usual indications of the call from branch station C are therefore given, and the call is answered by the operation of push button 65.

However, if while push button 64 is operated during an idle period branch station B desires to transmit to the central station A, the connection of direct current potential to line conductor 12 will not operate the lamp 46 or the relay 49, but by reason of the extension of the line conductor 12 through the operated contacts associated with the push button 64 over line conductor 44, relay 38 is operated at the transmitter-recorder 21. The closure of contact 58 of this relay energizes the buzzer 34 associated with the facsimile apparatus and thereby indicates to the attendant at station A that the branch station already connected to the facsimile apparatus at the central station desires to transmit. The attendant then places the send-receive switch 32 in its receive position and operates the start-stop switch 33 to its start position, and the apparatus functions in the usual manner.

The nature of the invention may be ascertained from the foregoing description of two illustrative embodiments, it being understood that changes in the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

What is claimed is:

1. In a facsimile system, a central station, a plurality of branch stations, similar combined transmitter-recorders at all of said stations each of said transmitter-recorders comprising a common copy holder and driving mechanism therefor, individual communication circuits connecting each of said branch stations with said central station, and switching means at said central station to connect selectively said central station

transmitter-recorder for either transmitting or recording communication with the transmitter-recorder at any one of said branch stations.

2. In a facsimile system, a central station, a plurality of branch stations, similar combined transmitter-recorders at all of said stations each of said transmitter-recorders comprising a common copy holder and driving mechanism therefor, individual communication circuits connecting each of said branch stations with said central station, and switching means for connecting selectively any of said communication circuits to said central station transmitter-recorder for communication either to or from said central station.

3. In a facsimile system, a central station, a plurality of branch stations, similar combined transmitter-recorders at all of said stations each of said transmitter-recorders comprising a common copy holder and driving mechanism therefor, individual communication circuits connecting each of said branch stations with said central station, switching means for connecting selectively said central station transmitter-recorder to any of said communication circuits, and means employing said selective connection for transmitting to the branch station associated with the connected one of said circuits when said central station transmitter-recorder is arranged for transmission and for receiving from the connected branch station when said central station transmitter-recorder is arranged for receiving.

4. In a facsimile system, a central station, a plurality of branch stations, similar combined transmitter-recorders at all of said stations, individual communication circuits connecting each of said branch stations with said central station, means at said central station for connecting selectively said central station transmitter-recorder to any one of said communication circuits, means utilizing direct current potentials on corresponding conductors of said communication circuits for placing calls for connections to the respective ones of said circuits, indicating means at said central station individually associated with each of said communication circuits and each responsive to said direct current calling signal, and means including said connecting means and utilizing a direct current potential on the other conductor of the calling communication circuit for synchronizing the facsimile apparatus at the connected stations.

5. In a facsimile system, a central station, a plurality of branch stations, similar combined transmitter-recorders at all of said stations, individual communication circuits connecting each of said branch stations with said central station, connecting means at said central station for placing said central station transmitter-recorder in communication with the transmitter-recorder at one of said branch stations, individual indicating devices normally responsive to direct current potentials applied to corresponding conductors of each of said communication circuits for calling purposes, a signal responsive device commonly associated with all of said indicating devices and normally responsive to a calling direct current signal received over any of said communication circuits, means including said connecting means operable in answering a call for releasing the individual indicating device associated with the

calling circuit and also said common signal responsive device, and means controlled by a direct current potential applied to one of the conductors of said connected communication circuit for disabling said common signal responsive device for the duration of the communication.

6. In a facsimile system, a central station, a plurality of branch stations, similar combined transmitter-recorders at all of said stations, individual communication circuits connecting each of said branch stations with said central station, connecting means at said central station for placing said central station transmitter-recorder in communication with the transmitter-recorder at any one of said branch stations, individual indicating devices normally responsive to direct current potentials applied to corresponding conductors of each of said communication circuits for calling purposes, a signal responsive device commonly associated with all of said indicating devices and normally responsive to a calling direct current signal received over any of said communication circuits, means including said connecting means operable in response to a call for releasing the individual indicating device associated with the calling circuit and also said common signal responsive device, and means also including said connecting means for disabling said common signal responsive device.

7. In a facsimile system, a central station, a plurality of branch stations, similar combined transmitter-recorders at all of said stations, individual communication circuits each comprising a pair of conductors connecting each of said branch stations with said central station, means at said central station for extending any pair of conductors to said central station transmitter-recorder, individual indicating devices normally associated with corresponding conductors of each of said communication circuits and responsive to direct current potentials applied to said conductors for calling purposes, a signal responsive device commonly associated with all of said indicating devices and normally responsive to a calling signal received over any of said communication circuits, means including said conductor extension means for disabling the indicating means associated with the extended pair of conductors for the duration of said extension, and means also including said conductor extension means for disabling said common signal responsive device for the duration of the communication.

8. The invention defined in claim 7 further characterized by, means including the indicating device associated with a non-extended pair of conductors for indicating during the extension of another pair of conductors the receipt of a call from the branch station connected to said non-extended pair of conductors.

9. The invention defined in claim 7 further characterized by, a signal responsive device associated with said central station transmitter-recorder, and means including said transmitter-recorder signal responsive device for indicating during the extension of a pair of conductors to said central station transmitter-recorder the receipt of a call from the branch station connected to said extended pair of conductors.

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