

Nov. 29, 1927.

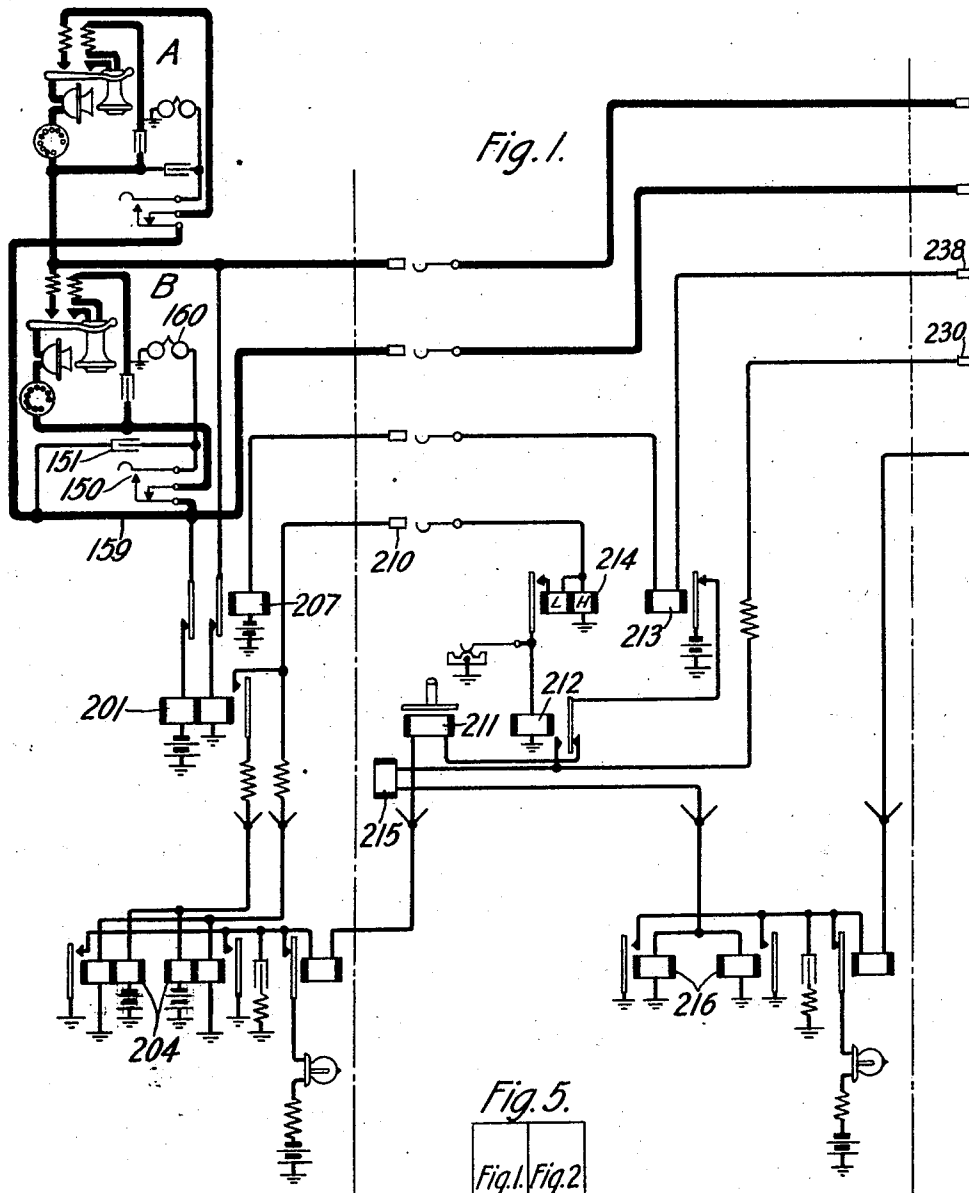
G. DEAKIN

1,651,017

PARTY LINE REVERTIBLE RINGING SYSTEM

Filed Feb. 25, 1926

4 Sheets-Sheet 1



Inventor:
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by *E. W. Adams* Att'y

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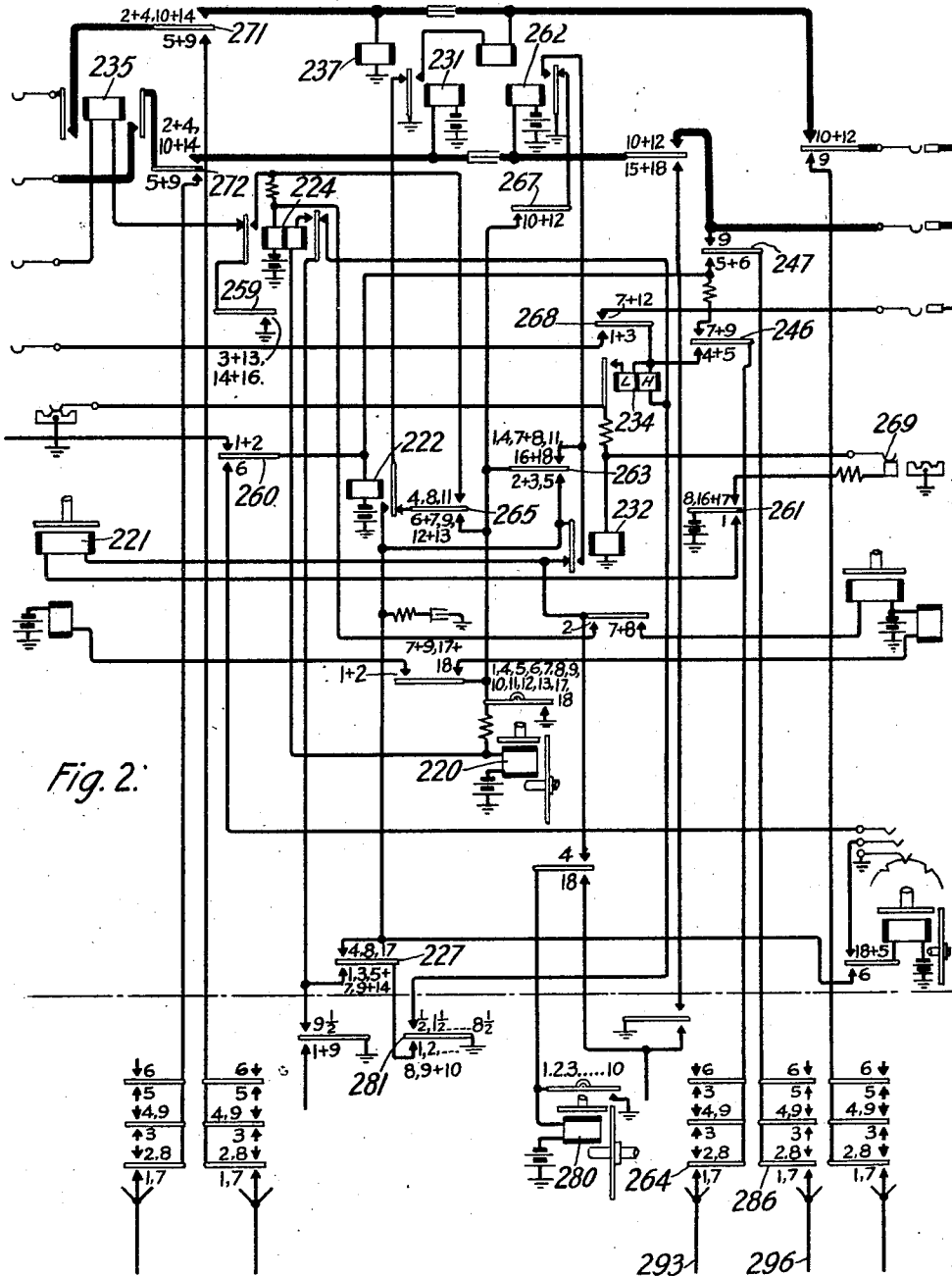
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4 Sheets-Sheet 2



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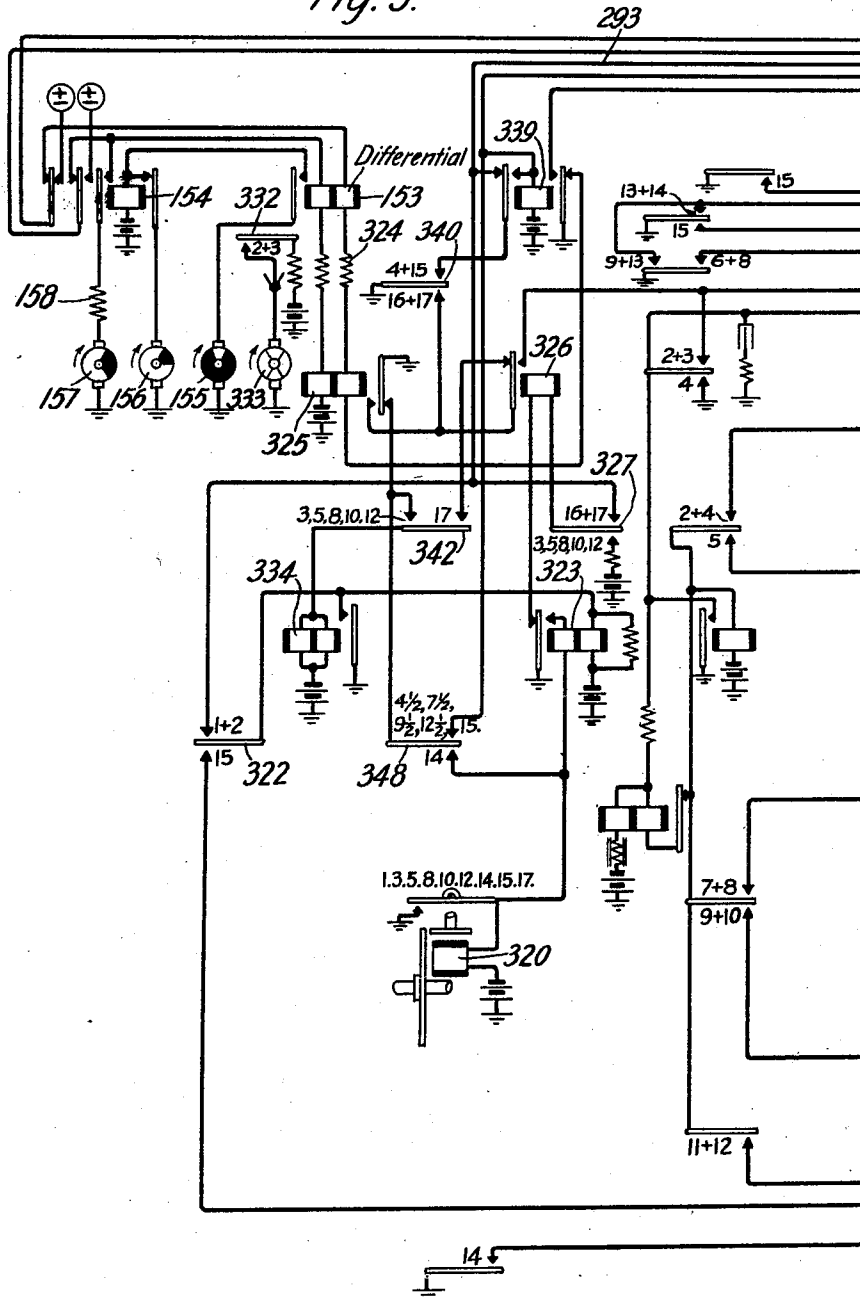
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Fig. 3.



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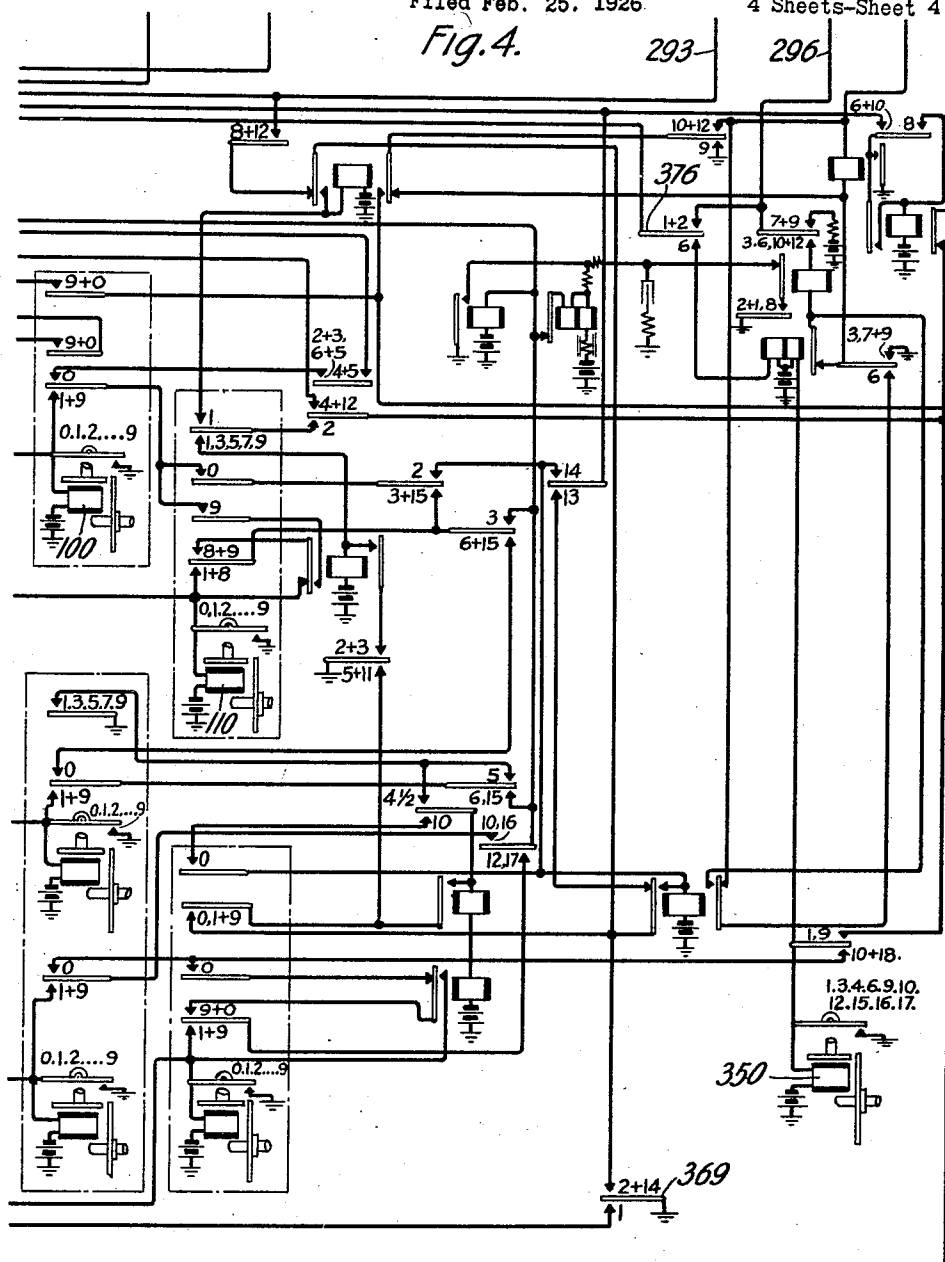
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4 Sheets-Sheet 4

Fig. 4.



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1,651,017

UNITED STATES PATENT OFFICE.

GERALD DEAKIN, OF ANTWERP, BELGIUM, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PARTY-LINE REVERTIBLE RINGING SYSTEM.

Application filed February 25, 1926, Serial No. 90,459, and in Great Britain February 26, 1925.

This invention relates to telephone exchange systems and more particularly to party line arrangements in automatic and semi-automatic telephone systems.

5 An object of the invention is to provide a simple arrangement for making revertive calls over a two party line.

A feature of the invention lies in the provision and means for signaling the other party on a two party line without dialing.

10 A further feature of the invention lies in the provision of a key for causing the application of ringing current to the party line.

These features will become more clearly apparent from a consideration of the following description, drawings and appended claims.

15 In the drawings, Fig. 1 shows a two party subscriber's line circuit, together with a primary line finder.

20 Fig. 2 shows a secondary line finder and selector switch for extending calls. It also shows a sender selector in the space below the broken line.

25 Figs. 3 and 4 show a register sender for recording the digits corresponding to the wanted line and for controlling selections.

30 Fig. 5 shows the manner in which the Figs. 1 to 4 should be arranged to disclose this invention.

35 The present invention is particularly applicable to a system such as that disclosed in U. S. Patent 1,479,554 granted January 1, 1924 to L. Polinkowsky et al. and has been disclosed in such a manner that Figs. 1 to 4 of the present invention can be substituted for Figs. 1 to 4 of the Polinkowsky patent.

40 In accordance with the general features of this invention, a party line subscriber such as the subscriber at substation B, wishing to call the second party on his line, will remove the receiver from the hook and, upon receiving the dial tone which informs him that the apparatus is ready to receive dialing, will depress his non-locking key 150 and hold it depressed until his bell rings. He may thereupon release key 150. The bells of both stations are rung simultaneously for a predetermined period of time after which the ringing ceases.

50 Should the wanted station fail to answer in response to this ringing the calling subscriber must hang up and recall in the above manner.

55 When the called subscriber answers the

current for conversation is supplied from the connecting circuit shown in Fig. 2, the sender being disconnected automatically.

A comparison of the drawings of the present application with those of the above identified patent to Polinkowsky et al. will show that the only additional equipment at the subscriber's substation is the key 150 and condenser 151 in each substation circuit. At the central office the additional equipment consists of a differential relay 153, a second relay 154 and interrupters 155, 156 and 157 and resistance 158.

The detailed operation of the circuits may be described as follows:

70 When the subscriber at one of the substations, say B, initiates a call, it causes the energization of line relay 201 which in turn causes the energization of the common start relays 204 and connects battery through these relays to terminal 210 marking the line in the banks of the primary line finders. The operation of the start relays 204 closes a circuit for energizing the power magnets 211 of the free first line finders in the group serving the calling line. The brush carriages of the free first line finders rotate. When one of these reaches terminal 210 it completes a circuit from battery through the windings of the start relays 204, terminal 210, the right high resistance winding of testing relay 214 to ground. The operation of relay 214 connects ground through the left low resistance winding and through the winding of relay 212 in parallel to terminal 210 making the terminal non-selectable to other first line finders. The operation of relay 212 opens the circuit of the power magnet and closes the circuit of the holding magnet 215 and of the start relays 216 of the secondary line finders. It also connects battery over the back contact of relay 213, front contact of relay 212 to terminal 230 to identify this primary line finder as calling.

100 The secondary line finders are divided into pairs and when the connecting circuits are free the corresponding sequence switches 220 are held either in position 18 or position 1. Only the line finder of a connecting circuit of which the sequence switch 220 is in position 1 is able to search for a calling first line finder. The operation of start relays 216 causes the energization of relay 222 in such a connecting circuit over the upper contact of cam 260. Relay 222 operates in this cir- 110

cuit and closes a circuit for energizing the the power magnet 221 in a circuit over the lower contact of cam 261, back contact of relay 232, front contact of relay 222, back contact of relay 231 to ground. The brush carriage of the secondary line finder rotates under the control of power magnet 221. On reaching terminal 230, test relay 234 is energized in a circuit from battery on terminal 230, lower contact of cam 268, right high resistance winding of relay 234, right back contact of relay 224, lower contact of cam 227, lower contact of cam 281 to ground. Relay 234 attracts its armature and connects its left hand low resistance winding in series with the winding of relay 232 to ground, marking terminal 230 busy. Relay 232 when energized causes the energization of sequence switch 220 in a circuit extending over the upper contact of cam 263, front contact of relay 232, front contact of relay 222, back contact of relay 231 to ground. Sequence switch 220 moves out of position 1 and into position 4.

When sequence switch 220 passes position 2 the high resistance winding of relay 234 is disconnected at the bottom contact of cam 227, and relay 234 is maintained energized over its low resistance winding and the winding of relay 232. In position 3 of switch 220 a circuit is established from ground over cam 259, back contact of relay 224, winding of relay 235, terminal 238, winding of relay 213, winding of cut-off relay 207 to battery. The energization of cut-off relay 207 deenergizes relay 201 and brings the brush carriages of any primary or secondary line finders which are still hunting to rest. Relay 231 and retardation coil 237 are connected to the calling line at this time. The advance of sequence switch 220 to position 4 opens the holding circuit of relay 234.

In position 4 of sequence switch 220, the sequence switch 280 of the connector circuit is energized to hunt for an idle register sender. The register sender of Figs. 3 and 4 is connected to the connecting circuit when sequence switch 280 is in position 1 or position 7. Assuming this register sender to be idle, as soon as sequence switch 280 reaches position $\frac{1}{2}$ or position $6\frac{1}{2}$ a circuit is closed from battery through the right winding of relay 323, upper contact of cam 322, conductor 293, lower contact of cam 264, lower contact of cam 246, right winding of relay 234, upper contact of cam 281 to ground. The cuttings of cam 264 are made wide enough to complete this circuit at the time that the upper cuttings in the half positions of cam 281 are closed, so that relay 234 operates and closes its holding circuit over its front contact and the winding of relay 232 to ground. The operation of relay 232 opens the circuit of sequence switch 280 to

bring that sequence switch to rest when it reaches position 1 or 7.

Sequence switch 220 is thereupon advanced to position 5 in a circuit through the winding of sequence switch 220, upper contact of cam 263, contact of relay 232, upper contact of cam 227, lower contact of cam 281 to ground. With sequence switch 220 in position 5 the calling subscriber's line is connected over the front contacts of relay 235, lower contacts of cams 271 and 272, the back contacts of relay 154, windings of differential relay 153, secondary windings of dial tone coil 324 and the windings of stepping relay 325 of the register sender. Relay 325 operates in this circuit but relay 153 being differential does not.

The operation of relay 323 in the previously traced circuit closes a circuit from ground over its front contact and left winding, through the winding of sequence switch magnet 320 to battery advancing that sequence switch to position 3. With sequence switch 320 in positions 2 and 3 the primary circuit of dial tone coil 324 is closed over the lower contact of cam 332 and interrupter 333. A tone is thereupon induced in the dialing circuit of the subscriber and a tone is produced in the receiver at substation B. In the case of a call to a subscriber on some other line, the subscriber at substation B would now operate his dial and under the control of sequence switch 320 would set the registers 100, 110 etc. of Fig. 4. Since this is a call to another party on the same line the subscriber now depresses the key 150. The operation of key 150 opens the loop circuit at a substation and connects ground to conductor 159 through the substation ringer 160. This holds relay 325 operated and unbalances the circuit through relay 153 and that relay also operates. Relay 154 and interrupters 155, 156 and 157 control the reveritive calling.

Interrupter 155 closes a circuit to ground for about one tenth of a second once every four seconds or any other interval which may be desirable for a ringing period. This circuit is extended over the front contact of relay 153, through the winding of relay 154. Interrupter 156 is arranged to close its conducting segment at the same time that interrupter 155 closes but it does not open its contact until a tenth of a second before interrupter 155 again closes its contact. Interrupter 157 is also arranged to close its conducting segment at the same time as interrupters 155 and 156 but it opens its conducting segment two-tenths of a second before interrupter 155 recloses its contact.

Therefore the operation of relay 154, due to the closure of interrupter 155, completes a locking circuit for itself through interrupter 156. The operation of relay 154 also connects ringing current over its outer left

front contacts to the two sides of the calling line thus ringing the bells of substations A and B simultaneously. A holding circuit for relays 325 and 153 is also completed through the left windings of these relays and the inner left front contact of relay 154 to ground through interrupter 157 thus preventing the premature release of the register sender. As soon as ringing starts, key 150 may be released since the ringing is now under the control of relay 154. As the potential applied to the two sides of the line is the same, no appreciable current will pass through the transmitter even though it is connected to the line.

As the interrupters approach the end of their cycle, interrupter 157 will open its contact and release relays 153 and 325. A tenth of a second later interrupter 156 will open and release relay 154. Since relay 153 is already released the closure of the contact of interrupter 155 is ineffective at this time.

In the meantime the advance of sequence switch 320 from position 2 opens the circuit of relay 323 and that relay releases. When relay 325 released as above described a circuit was closed from battery through the winding of relay 334, left contact of cam 342 to ground at the back contact of relay 325. Relay 334 in operating closes a circuit from battery through the right winding of relay 323, front contact of relay 334 to ground. Relay 323 closes a circuit for advancing sequence switch 320 out of position 3. In passing through position 4½ with relay 325 released, a circuit is closed from battery through the winding of relay 339, upper contact of cam 348, to ground at the back contact of relay 325. Relay 339 locks over its left front contact and the upper contact of cam 340. A circuit is then closed from battery through the winding of relay 222, lower contact of cam 247, lower contact of cam 286, conductor 296, upper contact of cam 376, right front contact of relay 339 to ground. Relay 222 operates in this circuit and closes a circuit from battery through the winding of magnet 220, lower contact of cam 263, back contact of relay 232, front contact of relay 222, back contact of relay 231 to ground. Sequence switch 220 is advanced to position 6 in this circuit.

The operation of relay 339 prevents the reoperation of relay 325 at this time and relays 334 and 323 are reoperated in position 5 of sequence switch 320 to advance that sequence switch to position 8. This operation is repeated in positions 8, 10 and 12 advancing sequence switch 320 to position 14. It is advanced out of position 14 by means of a circuit over the lower contact of cam 348 and back contact of relay 325.

With sequence switch 350 still in position 1 relay 323 is operated in position 15 of switch 320 over the lower contact of cam 322

and lower contact of cam 369, advancing sequence switch 320 to position 17. Relay 334 is reoperated in position 17 over the right contact of cam 342, back contact of relay 326, lower contact of cam 340 in turn reoperating relay 323 and advancing sequence switch 320 to position 1. When sequence switch 320 leaves position 15 the locking circuit of relay 339 is opened and that relay releases opening the circuit of relay 222. Sequence switch 220 is then advanced to position 8 in a circuit over the lower contact of cam 265, back contact of relay 222, back contact of relay 231 to ground.

Since the selector switch has not been operated a local circuit is closed in position 8 of sequence switch 220 from battery over the upper contact of cam 261, over normal contact 269 of the selector through the winding of relay 232. Relay 232 operates and closes a circuit from battery through the winding of sequence switch magnet 220, upper contact of cam 263, front contact of relay 232, upper contact of cam 227, lower contact of cam 281 to ground, advancing sequence switch 220 to position 9. In position 9 the previously traced circuit over the back contacts of relays 222 and 231 is again closed sequence switch 220 advanced to position 10. With sequence switch 220 in position 10 the calling subscriber's line is connected through relay 231 to battery and through retardation coil 237 to ground. The subscriber receives talking current through relay 231 and the operation of that relay prevents the release of the connecting circuit until both subscribers have hung up. Since no outgoing connection has been established over the connector switch, relay 262 is not operated and a circuit is closed from battery through the winding of sequence switch magnet 220, contact of cam 267 to ground at the back contact of relay 262 advancing sequence switch 220 to position 13.

Sequence switch 220 remains in this position until relay 231 is released by the disconnection of the two subscribers. The further release of the apparatus is as described in the above identified patent to L. Polinkowsky et al.

What is claimed is:

1. In a telephone exchange system, a telephone exchange, a subscriber's line extending to said exchange, a pair of substations on said line, an auxiliary calling device at each substation and means at said exchange responsive to the operation of said auxiliary calling device at one station to signal both substations on said line.

2. In a telephone exchange system, a telephone exchange, a subscriber's line extending to said exchange, a pair of substations on said line, an auxiliary calling device at each substation, signaling means at said exchange, and means at the exchange responsive to

the operation of said auxiliary calling device to close a signaling circuit for both substations on said line for a predetermined time only.

3. In a telephone system, a telephone exchange, subscribers' lines connected with said exchange, a pair of substations being connected to certain of said lines, means at said exchange for establishing connections between subscribers' lines, control apparatus for directing the establishment of such connections, an auxiliary calling device at the substations of lines to which a pair of substations are connected, means in said control device responsive to the operation of said auxiliary calling device to signal the substations on said line and means for disconnecting said control device.

4. In a telephone exchange system, subscribers' lines, including party lines, automatic switches for extending connections from said lines, a common sending device including a plurality of registering devices for controlling the operation of said switches, substation means to variably position said registering devices, means in said sending device for applying ringing current to calling party lines, and substation means for rendering said latter means effective independently of said registering devices.

5. In a telephone exchange system, subscribers' lines, including party lines, automatic switches for extending connections from said lines, a common sending device including a plurality of registering devices for controlling the operation of said switches, substation means to variably position said registering devices, means in said sending device for applying ringing current to calling party lines, and means operable independent to said register positioning means to render said ringing current applying means effective.

6. In a telephone exchange system, subscribers' lines, including party lines, automatic switches for extending connections from said lines, a common sending device including a plurality of registering devices for controlling the operation of said switches, substation means to variably position said registering devices, means in said sending device for applying ringing current to calling party lines, means operable independent of said registering devices to render said ringing current applying means effective, and means for thereupon disconnecting said sending device.

7. In a telephone exchange system, subscribers' lines, including party lines, automatic switches for extending connections from said lines, a common sending device including a plurality of registering devices for controlling the operation of said switches,

substation means to variably position said registering devices, means in said sending device for applying ringing current to calling party lines, means operable independent of said registering devices to render said ringing current applying means effective, means for thereupon disconnecting said sending device, and means for supplying talking current to a calling line.

8. In a telephone exchange system, subscribers' lines, including party lines, a link circuit, means for extending a calling line to said link circuit, automatic switches for further extending connections from said lines, a common sending device including a plurality of registering devices for controlling the operation of said switches, substation means to variably position said registering devices, means in said sending device for applying ringing current to calling party lines, means operable independent of said registering devices for rendering said ringing current applying means effective, means for thereupon disconnecting said sending device, and means for supplying talking current from said link circuit to said calling line.

9. In a telephone exchange system, subscribers' lines, including party lines, automatic switches for extending connections from said lines, a common sending device including registering devices for controlling the operation of said switches, a pulsing circuit for associating said registering devices with a calling line, substation means for controlling said pulsing circuit to variably position said registering devices, means in said sending device for applying ringing current to calling lines, a differential relay in said pulsing circuit and substation means for operating said relay to render said current applying means effective.

10. In a telephone exchange system, subscribers' lines, including party lines, automatic switches for extending connections from said lines, a common sending device including registering devices for controlling the operation of said switches, a pulsing circuit for associating said registering devices with a calling line, a pulsing relay and a differential relay in said circuit, substation means for controlling said pulsing relay to variably position said registering devices, means in said sending device for applying ringing current to calling lines, and substation means for operating said differential relay to render said current applying means effective without positioning said registering devices to control said switches.

In witness whereof, I hereunto subscribe my name this 2 day of February, A. D., 1926.

GERALD DEAKIN.