

June 20, 1939.

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2,163,431

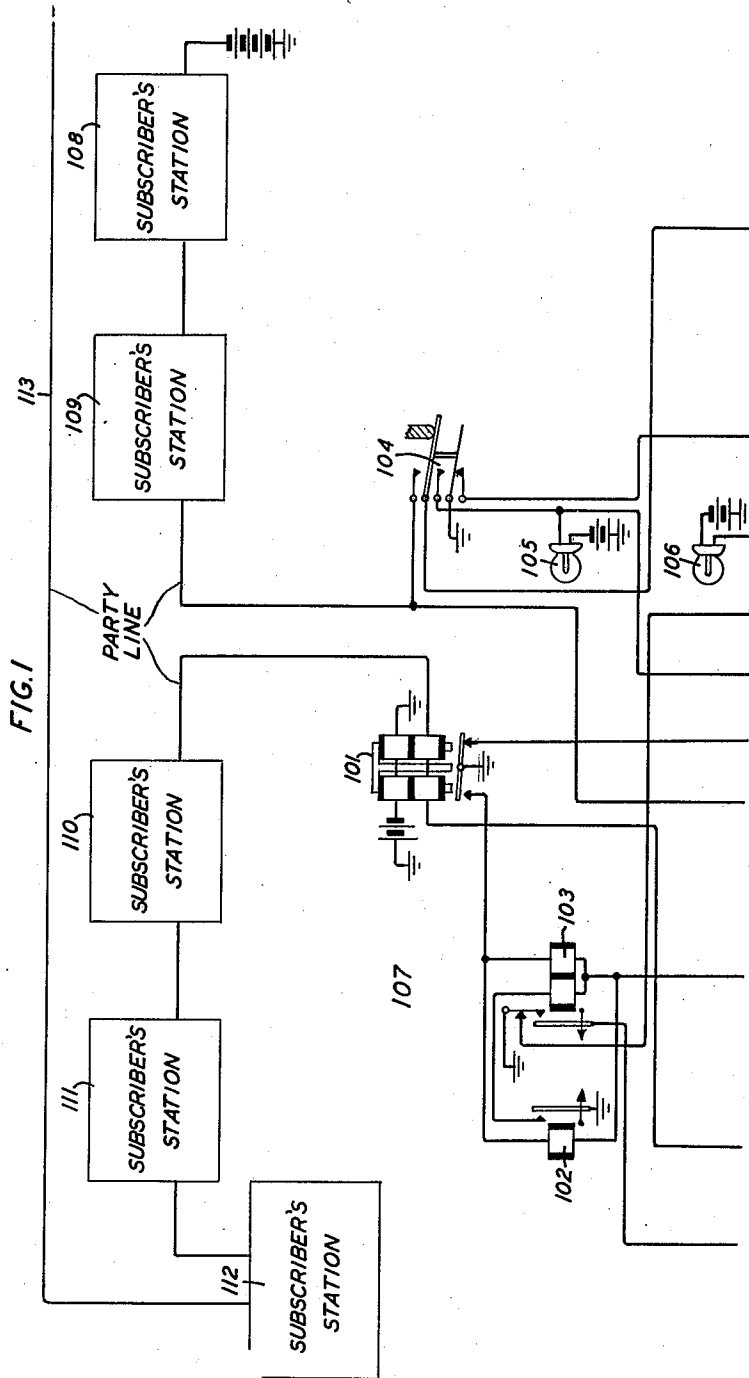
PRINTING TELEGRAPH EXCHANGE SYSTEM

Filed March 30, 1935

6 Sheets-Sheet 1

FIG. 7

FIG. 1	FIG. 3	FIG. 4	FIG. 5
FIG. 2		FIG. 6	



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PRINTING TELEGRAPH EXCHANGE SYSTEM

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6 Sheets-Sheet 2

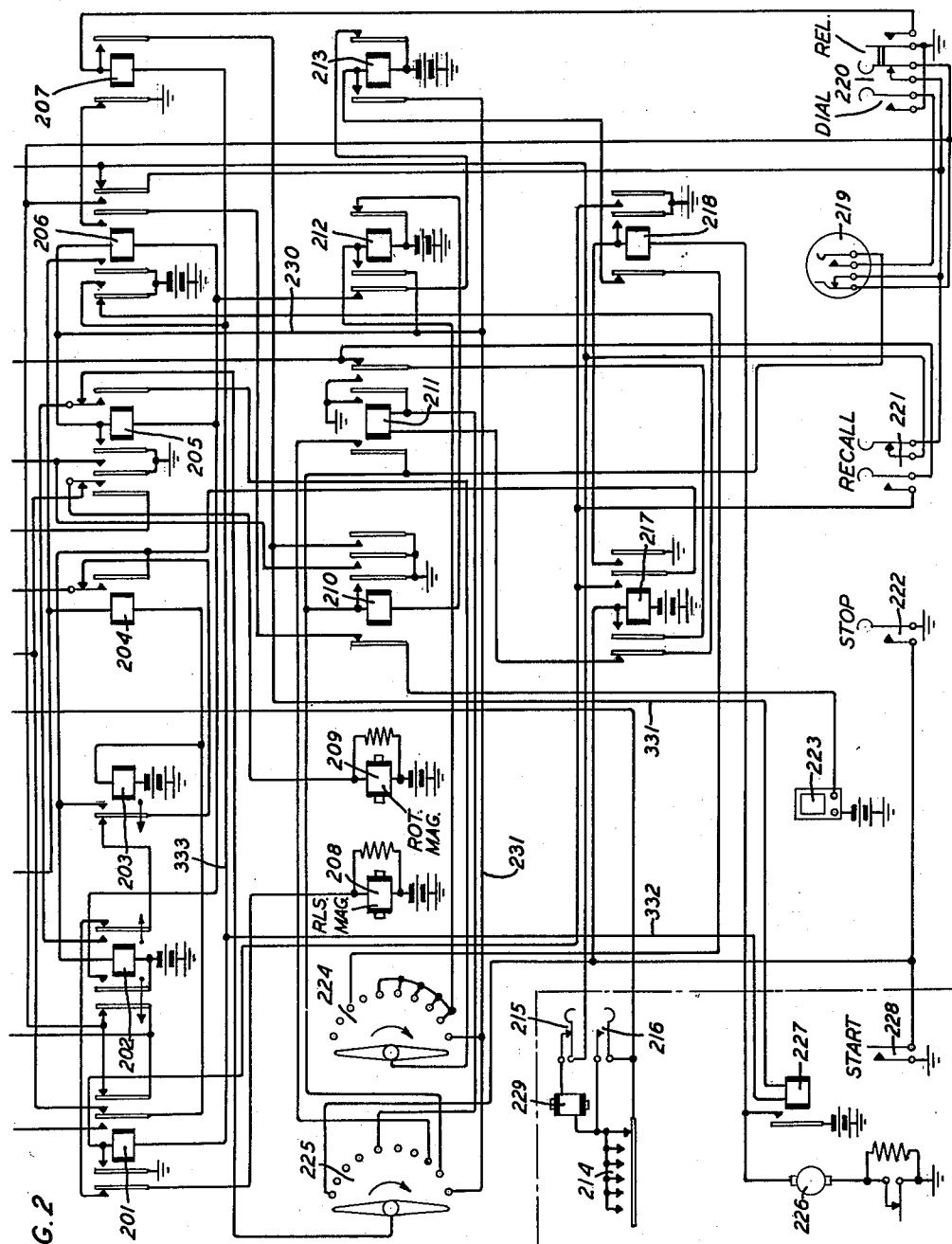


FIG. 2

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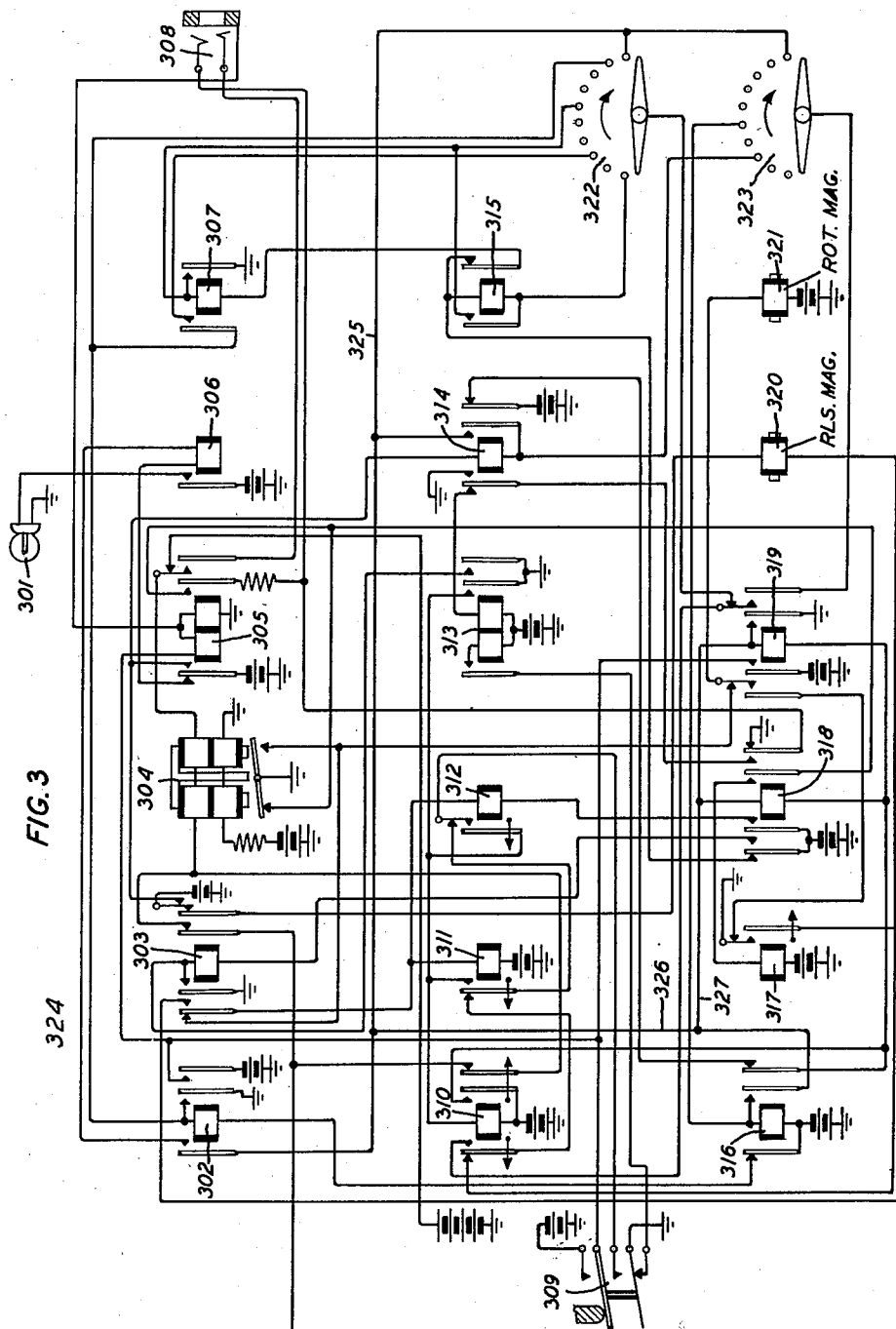
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PRINTING TELEGRAPH EXCHANGE SYSTEM

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6 Sheets-Sheet 3



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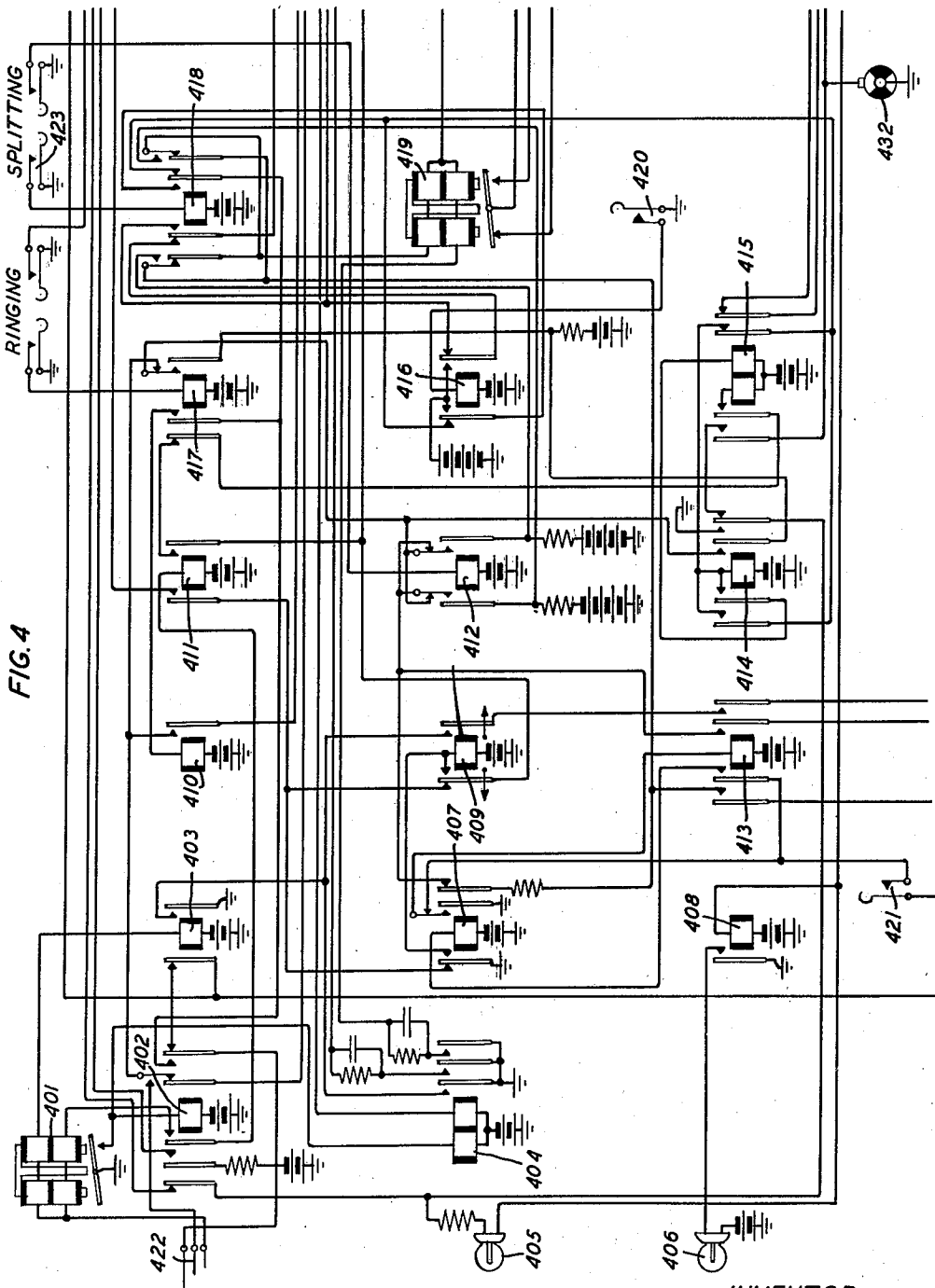
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PRINTING TELEGRAPH EXCHANGE SYSTEM

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6 Sheets-Sheet 4



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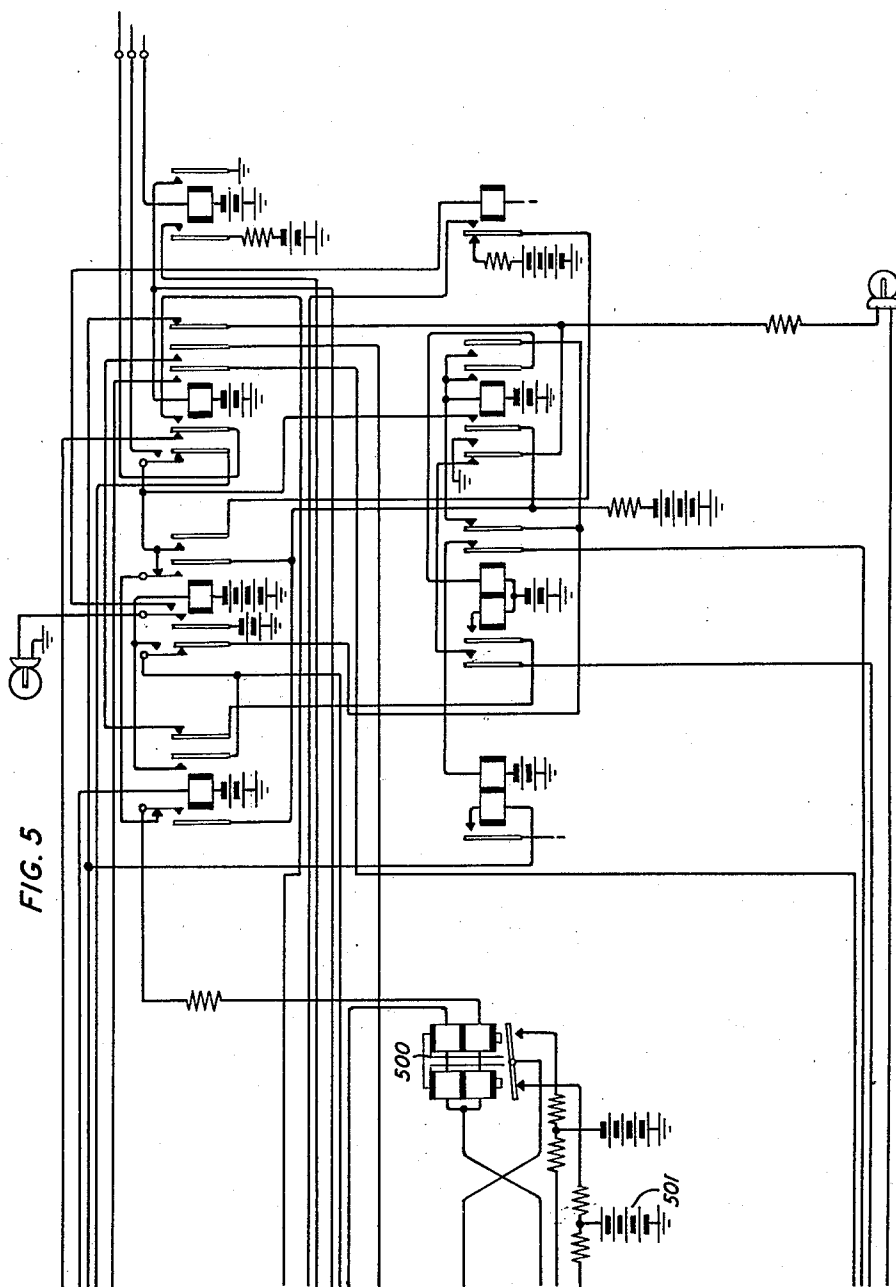
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PRINTING TELEGRAPH EXCHANGE SYSTEM

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6 Sheets-Sheet 5



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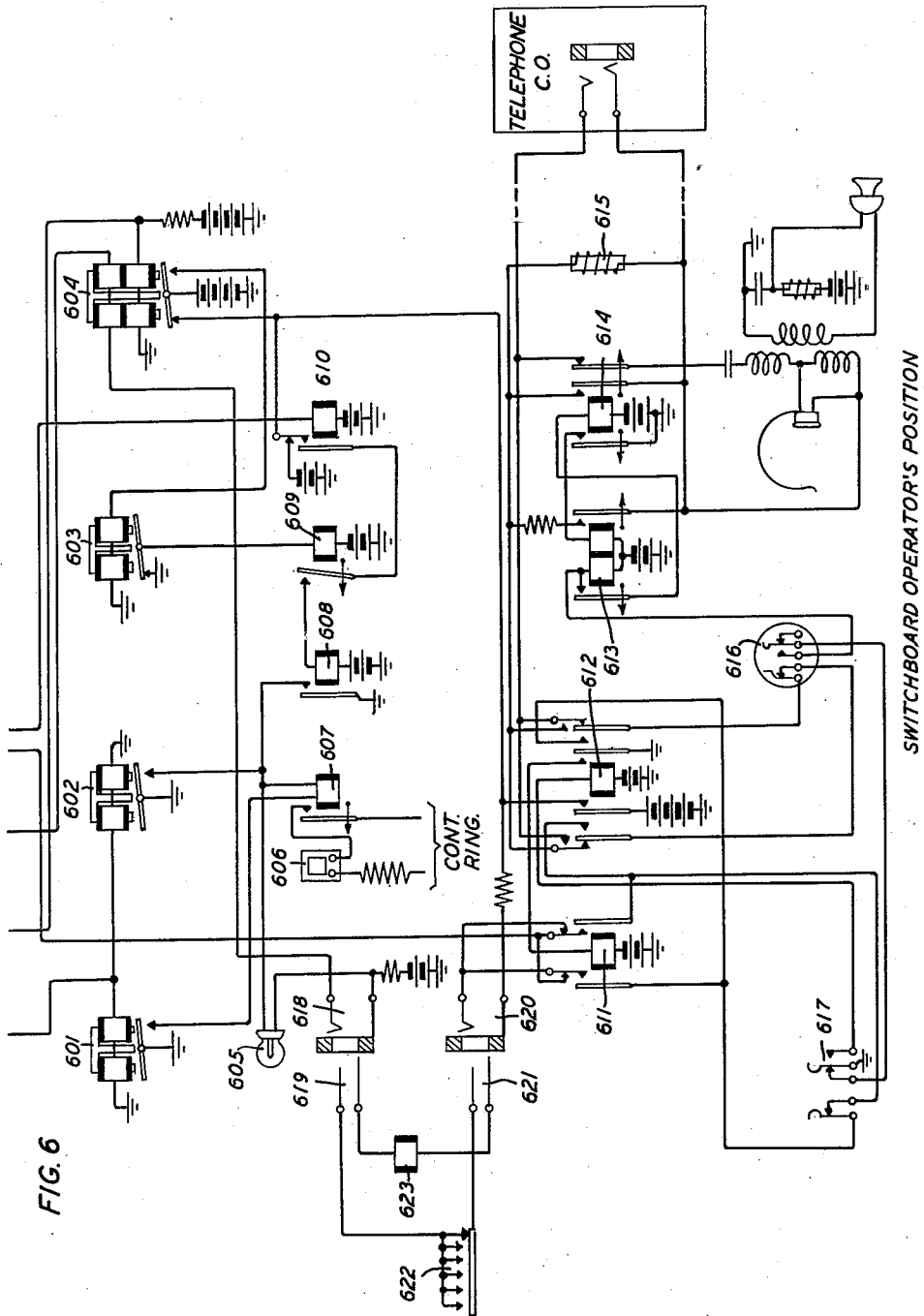
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Filed March 30, 1935

6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

2,163,431

PRINTING TELEGRAPH EXCHANGE SYSTEM

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Application March 30, 1935, Serial No. 13,859

13 Claims. (Cl. 178—2)

This invention relates to the art of telegraph communication and particularly to selective control circuits applicable principally to printing telegraph systems, whereby one or more telegraph stations associated with a given transmission circuit may be called by another substation for communication purposes.

An object of the invention is to adapt a party line transmission circuit comprising a plurality of teletypewriter stations for operation through a central office switchboard.

In Kinkad Patent 1,946,216, granted February 6, 1934, there is disclosed a system in which a plurality of printing telegraph stations are each equipped with code selecting switches and impulse sending devices so arranged that the operator at any station may selectively call any other station by sending a proper code consisting of successive series of impulses, each series causing a temporary setting of switches and recording of the series at the called station only, whereupon the switch is released in order to receive and record the next series of impulses of the code.

The system, according to the present invention, is an adaptation of the system disclosed in Patent 1,946,216 supra, for switchboard operation whereby a switchboard operator may establish a connection directed to any station on a party line, between stations on a party line, between a station on a party line and a station on a private, or individual, line, providing such private line terminates at the switchboard, and between stations on different party lines.

The invention will be more readily understood by reference to the drawings in which:

Figs. 1 and 2 show a party line circuit connecting party stations 107, 108, 109, 110, 111 and 112, the apparatus in party station 107 being shown in detail.

Fig. 3 shows a station line circuit appearing at a teletypewriter switchboard and

Figs. 4, 5 and 6 show an operator's cord and teletypewriter circuit arranged to complete calls from the party line to other lines in the exchange.

The system is arranged so that the operator at any party station may call one or more party stations on the same line without the assistance of the switchboard operator, or may call the switchboard operator who will complete the call to another subscriber in the same exchange. The switchboard operator is also provided with facilities so that she may call one or more parties on a party line. Busy lamps are provided at all stations to indicate a busy line condition.

Each party on the party line is assigned an individual code. Any one of the parties on the station line circuit may be called by dialing the assigned code followed by 0, a number of stations may be called by dialing their codes followed by 1, in each case, the whole group being followed

by 0, or all of the stations may be called by dialing the broadcast signal.

At each station called, the teletypewriter motors are started after receiving the 0 signal and an audible signal is given. The audible signal may be stopped by operating the dial and release key. In the case of the station line circuit, the signal appears as a line lamp in the teletypewriter switchboard.

Recall keys are provided so that additional stations may be called without redialing those originally connected. All of the stations are stopped by the operation of the stop key at any one station or by the transmission of the upper case H character.

If the call is to the central office, the operator inserts the answering plug of a cord circuit into the jack associated with the lighted line lamp, operates the teletypewriter key and obtains the desired number over the teletypewriter system in the usual manner. Completion of the call is effected by using the standard teletypewriter circuits.

The operation of the system will now be described in detail with reference to the drawings.

Individual station calls station line circuit

Figs. 1 and 2 disclose a party line circuit comprising individual stations, 107, 108, 109, 110, 111 and 112, of which the apparatus in station 107 is shown in detail. It will be assumed that the operator at station 107 desired to communicate with another station which may be reached through the teletypewriter switchboard. To call the teletypewriter switchboard operator, dial and release key 220 is operated and the code of the desired station line circuit (Fig. 3), which in this case is 63, followed by the digit 0 is dialed on dial 219. The operation of key 220 removes the short-circuit from the pulsing contacts of dial 219. When dial 219 is moved off-normal, relay 210 operates in a path traced from ground through the left contacts of key 220, off-normal springs of dial 219, the winding of relay 210 to battery through the right-hand contact and armature of relay 212. Relay 210 locks in a circuit traced from ground over its innermost right-hand armature and contact and winding to battery through the right-hand contact and armature of relay 212. Relay 210, operates, lights busy lamp 106 over its middle right-hand armature and contacts.

The line relays such as relay 101 in station 107, and relay 304 in station line circuit 324 are all in series in a circuit traced from negative battery through the line circuits of stations 108 and 109 in series, sending mechanism 214 of station 107, receiving printer magnet 229, the contacts of break key 215, right-hand contacts of recall key 221, the pulsing contacts of dial 219, outer left-

hand back contact and armature of relay 202, lower windings of relay 101, line circuits of stations 110, 111 and 112 in series, conductor 113, inner right-hand armature and back contact of relay 203 of station line circuit 224, upper windings of line relay 304, right-hand make-before-break contacts of relay 305 to positive battery. As the digit 6 is dialed on dial 219 all of the line relays such as relays 101 and 304 follow the pulses and connect ground to their respective right-hand contacts six times. In station line circuit 224, the release of relay 304 advances the switch shown as 322 and 323 to the sixth terminal. The circuit for this function is traced from ground on the armature and right-hand contact of relay 304, left-hand make-before-break contact of relay 319, to battery through the winding of rotary magnet 321. Since relay 304 in following the dial pulses makes its right-hand contact six times, rotary magnet 321 will be energized six times and the wipers associated with switch banks 322 and 323 will be advanced to the sixth terminals.

The release of relay 304 also operates relay 311 in a circuit traced from ground through the armature and right-hand contact of relay 304, back contact and outer left-hand armature of relay 303 to battery through the winding of relay 311. Relay 311 is of the slow to release type and does not release between dial pulses. The operation of relay 311 causes the operation of relay 310, as soon as the switch is advanced from its normal position in a circuit traced from ground through the lower spring and make contact of off-normal springs 309, make-before-break contacts of relay 312, armature and front contact of relay 311 to battery through the winding of relay 310. After the six pulses have been received relay 311 releases. Relay 310, however, is of the slow to release type and does not release immediately when its operating circuit is opened by the release of relay 311 and while it is operated and relay 311 is released, a circuit is closed from ground through the lower spring and make contact of off-normal springs 309, make-before-break contacts of relay 312, armature and back contact of relay 311, left-hand armature and front contact of relay 310, right-hand make-before-break contacts of relay 319, wiper and sixth terminal of bank 322, the winding of relay 307, right-hand armature and contact of relay 315, to battery over the back contact and outer left-hand armature of relay 318. Relay 307 operates in this circuit and locks in a circuit traced from ground through its right-hand armature and contact and winding, right-hand armature and contact of relay 315 to battery through the back contact and outer left-hand armature of relay 318. When relay 310 releases, a circuit is closed from ground through the lower spring and make contact of off-normal springs 309, make-before-break contacts of relay 312, armature and back contact of relay 311, left-hand armature and back contact of relay 310, the winding of release magnet 320 to battery through the outer right-hand armature and back contact of relay 303. Release magnet 320 operates in this circuit and restores the switch to its normal position, breaking the circuit just traced when the off-normal springs 309 return to their normal position.

On the dialing of digit 3, relay 304 releases three times operating relays 311 and 310 as before and advancing the switch to the third terminal. At the end of the train of pulses, relay 311 releases as before, and while relay 310 is still operated, a

circuit is closed from ground through the lower spring and make contact of off-normal springs 309, the make-before-break contacts of relay 312, armature and back contact of relay 311, left-hand armature and front contact of relay 310, right-hand make-before-break contacts of relay 319, wiper and third terminal of bank 322, front contact and left-hand armature of relay 307, the winding of relay 302 to battery through the contact and left-hand armature of relay 316. Relay 302 operates in this circuit and locks through its own inner right-hand armature and front contact. Relay 310 releases after an interval and operates release magnet 320, returning the switch to normal as before.

When 0 is dialed, relay 304 releases ten times and advances the switch to the tenth terminal and relays 311 and 310 are operated as in the previous selections. When relay 311 releases, after the completion of the dial impulse train and before relay 310 has released, a circuit is closed from ground through the lower spring and middle contact of off-normal springs 309, make-before-break contacts of relay 312, armature and back contact of relay 311, left armature and front contact of relay 310, right-hand make-before-break contacts of relay 319, wiper and tenth terminal of bank 322, conductors 225, 326 and 327, the windings of relays 318 and 319 in parallel, outer right-hand armature and back contacts of relay 316, to battery over the back contact and the outer right-hand armature of relay 314. Relays 318 and 319 operate in the circuit just traced and lock over the inner right-hand armature and front contact of relay 319.

The operation of relay 319 transfers the operating ground for relays 318 and 319 from the wiper of bank 322 to the wiper of bank 323 on a continuity basis, and as the tenth terminals of banks 322 and 323 are strapped together, no interruption in the operating paths of relays 318 and 319 is caused by this transfer. The operation of relay 319 causes the operation of relay 306 in a circuit traced from ground over the inner right-hand armature and front contact of relay 319, left-hand armature and contact of relay 302, the winding of relay 306 to battery through the back contact and left-hand armature of relay 305. Relay 306, operated, lights line lamp 301 as a signal to the central office operator. When relay 310 releases, release magnet 320 is operated and the switch is returned to the normal position as before.

At party station 107 relay 101 follows the pulses of dial 219 as previously explained. Assuming, however, that the code of station 107 is 58, relay 211 will not be operated when the switch is advanced on the dialing of the digits 6 and 3 but when 0 is dialed the wipers will be advanced to the tenth terminals on banks 225 and 224. The circuit for this operation is traced from ground over the armature and the right-hand contact of relay 101, left-hand make-before-break contacts of relay 205 to battery through the winding of rotary magnet 209. Relay 203 also operates in a circuit traced from ground over the right-hand contact of relay 101, back contact and the inner right-hand armature of relay 201 to battery through the winding of relay 203. Relay 203 is of the slow to release type and does not release between dial pulses. The operation of relay 203 causes the operation of relay 202 as soon as the switch leaves its normal position in a circuit traced from ground through the lower spring and middle contact of off-normal springs 104, make-

before-break contacts of relay 204, armature and front contact of relay 203 to battery through the winding of relay 202. When the train of pulses is finished relay 101 resumes its normal position, releasing relay 203. Relay 202, however, is of the slow to release type and does not release immediately when the release of relay 203 opens its operating circuit. While relay 203 is released but relay 202 is still operated a circuit is closed from ground through the lower spring and middle contact of off-normal springs 104, make-before-break contacts of relay 204, armature and back contact of relay 203, right-hand armature and front contact of relay 202, right-hand make-before-break contacts of relay 205, wiper and tenth terminal of bank 225, conductors 231 and 230, the windings of relays 205 and 206 in parallel, to battery over the back contact and the outer left-hand armature of relay 212 and the back contact and right-hand armature of relay 213. Relays 205 and 206 operate in this circuit and lock over the front contact and innermost left-hand armature of relay 205. Relay 207 now operates in a circuit traced from ground over the outermost right-hand spring and contact of key 220, through the winding of relay 207, to battery over the front contact and outer left-hand armature of relay 206. Relay 207 locks to ground over its front contact and outermost right-hand armature of relay 210. Relay 207, operated, opens the circuit to audible signal device 223 preventing it from operating. Relays 102 and 103 operate in a circuit traced from ground over the armature and left-hand contact of relay 101, through the winding of relay 102 and the right-hand winding of relay 103 in parallel, to battery over the front contact and inner left-hand armature of relay 206. The operation of relay 206 also causes the operation of motor control relay 227 in a circuit traced from ground over the outermost right-hand armature and contact of relay 210, conductor 331, through the winding of relay 227, to battery over conductors 332, and 333, the front contact and outer left-hand armature of relay 206. Relay 227, operated, connects battery to motor 226 causing it to rotate and condition the printer apparatus to transmit and receive printer signals.

The operator at the teletypewriter switchboard, noting the lighted line lamp 301 inserts the plug 422 of a cord circuit, shown schematically in Figs. 4 and 5, into jack 303 associated with line lamp 301. This closes a circuit from battery through the winding of relay 403, the upper windings of relay 401, the sleeve terminals of plug 422 and jack 303, to ground through the right-hand winding of relay 305. Relay 305 operates in this circuit and breaks the operating circuit of relay 306 releasing it and extinguishing lamp 301. The operation of relay 305 also extends the line circuit to jack 303 preparing the path for teletypewriter communication which will be described later.

Relays 401 and 403 also operate in the circuit traced above. Relay 401, operated, operates relay 402 by connecting ground to its winding terminal. Relay 402 operated connects the winding of relay 411 to the sleeve circuit through the innermost left-hand armature and contact of relay 402 and the lower windings of relay 401 thus holding the relay combination comprising relays 401, 402, 403 and 411 locked to the sleeve circuit. The sleeve circuit in this condition is traced from ground through the right-hand winding of relay 305, sleeve terminals of jack 303 and plug 422, to

battery through the upper winding of relay 401 and the winding of relay 403 in parallel with the lower winding of relay 401 and the winding of relay 411 through the contact and innermost left-hand armature of relay 402. Relay 401 also operates relay 404 by placing ground on its left-hand winding terminal and relay 404, operated, connects ground to the balancing network of the repeater relays 419 and 500.

The operator operates key 421 to associate her position circuit (Fig. 6) with the particular cord used. The operation of key 421 causes the operation of relay 413 in a circuit traced from battery through the winding of relay 413, make-before-break contacts of relay 407, the contacts of key 421 to ground through the lower winding of relay 604. The circuit just traced also energizes the lower or balancing winding of relay 604. Relay 413, operated, connects the line circuit of the cord to the teletypewriter in the operator's position and causes the operation of relay 407 in a circuit traced from ground through the lower windings of relay 604, the contacts of key 421, left-hand inner front contacts of relay 413 to battery through the winding of relay 407. Relay 407, operated, transfers the operating path of relay 413 to ground on the inner right-hand armature of relay 407 and causes the operation of relay 409 by connecting ground over the left-hand armature and front contact of relay 407 to the winding terminal of relay 409.

The party line station operator may now communicate by standard teletypewriter means with either or both the switchboard operator and the operator at the called station. The teletypewriter line circuit is traced from positive battery 501, over the normally closed left-hand contacts of relay 500, through the upper windings of relay 419, outer left-hand armature and back contact of relay 418, front contact and outer left-hand armature of relay 413, through the upper windings of relay 604, tip springs of jack 618 and plug 619, sending mechanism 622, tip springs of plug 621 and jack 620, left-hand make-before-break contacts of relay 611, inner right-hand armature and front contact of relay 413, right-hand make-before-break contacts of relay 412, make-before-break contacts of relay 417, make-before-break contacts of relay 402, ring springs of plug 422 and jack 303, outer right-hand armature and front contact of relay 305, through the upper windings of relay 304, back contact and inner right-hand armature of relay 303, line conductor 113, the line circuits of party stations 112, 111 and 110 in series, through the lower windings of line relay 101 of party station 107, outer left-hand armature and back contacts of relay 202, front contact and outer right-hand armature of relay 206, break contact and middle spring of key 220 which has been released, dialing being completed, the pulsing spring and contact of dial 219, right-hand contacts of key 221, the contacts of key 215, through the winding of printer receiving magnet 229, sending mechanism 214, the line circuits of party stations 109 and 108 in series to negative battery.

The further operation of the cord circuit, Figs. 4 and 5, and the operator's telephone circuit, Fig. 6 in completing a call to another subscriber in the same exchange is substantially the same as that contained in co-pending application of G. A. Locke and F. S. Kinkead Serial No. 459,684, filed June 7, 1930, to which reference is made for a complete description of this operation.

Stopping all stations

In order to stop all stations and clear all partial selections preparatory to the next call, key 222 at station 107 or a similar key at one of the other stations is operated. The operation of key 222 causes the operation of relay 217 by connecting ground to its winding terminal. Relay 217 locks in a circuit traced from ground through the lower spring and lowermost contact of off-normal springs 104, back contact and the outer right-hand, armature of relay 211 to battery through the inner left-hand armature, contact and winding of relay 217. Relay 217, operated, connects ground over its outer right-hand armature and contacts to one winding terminal of the winding of relay 218, the other terminal being connected to battery over the contact and armature of relay 227. Relay 218 operates in this circuit and locks through its inner right-hand armature and contact. The operation of relay 218 causes the operation of relay 201 in a circuit traced from ground through the outer right-hand armature and contact of relay 218, the winding of relay 201 to battery over conductor 333, front contact and outer left-hand armature of relay 206. Relay 201 locks through its inner left-hand armature and contact and opens the operating circuit of release magnet 208. Relays 203 and 204 now operate in a circuit traced from battery through the winding of relay 203 in parallel with battery through the inner left-hand armature and contact of relay 206 and winding of relay 204 to ground over the inner right-hand armature and front contact of relay 201 and the armature and front contact of relay 103. Relay 202 also operates in a circuit traced from ground through the outer right-hand armature and contact of relay 218, contact and inner right-hand armature of relay 217 to battery through the winding of relay 202. Relay 202, operated, opens the line circuit at its outer left-hand armature and contact thus releasing relay 101 which opens the circuit to relays 102 and 103 releasing these relays. The release of relay 103 opens the operating circuit of relays 203 and 204 releasing them. Ground is now connected through the make-before-break contacts of relay 103, the outer left-hand armature and contact of relay 205 to battery through the winding of rotary magnet 209 operating the latter and causing the switch to take one step. When the switch has stepped off its normal contacts, off-normal springs 104 operate, breaking the locking circuit of relay 217 which releases. The release of relay 217 opens the operating path of relay 202, releasing it. Relay 202, released, closes the line circuit and causes the reoperation of relay 101. Relay 101 operated causes the operation of relays 102 and 103 as before and relay 103, operated, removes ground from rotary magnet 209 allowing it to release and connects ground to relays 203 and 204 operating them as before. The operation of relay 204 causes the operation of relay 202 which opens the line circuit again, releasing relay 101 and causing the release a second time of the relay chain described above and advancing the switch another terminal. This slow speed pulsing circuit opens and closes the line at a definite frequency and advances the switch one terminal for each pulse. When the signal line has been opened and closed five consecutive times ground is connected through the lower spring and middle contacts of off-normal springs 104, make-before-break contacts of relay 204, armature and back contact of relay

203, right-hand armature and front contact of relay 202, front contact and right-hand armature of relay 205, wiper and fifth terminal of arc 224, to battery through the winding of relay 212, operating the latter relay. Relay 212 locks in a circuit traced from ground over the inner left-hand armature and contact of relay 205 to battery through the innermost left-hand armature, inner left armature and contact and winding of relay 212. Relay 212, operated, opens the circuit to the windings of relays 205 and 206 releasing these relays. Relays 205 and 206, released, open the circuit to all of the operated relays except line relay 101. With all the relays released but the switch off-normal a circuit is closed from ground through the lower spring and middle contact of off-normal springs 104, make-before-break contacts of relay 204, armature and back contact of relay 203, right-hand armature and back contact of relay 202, back contact and outer left-hand armature of relay 201 to battery through the winding of release magnet 208. Release magnet 208 operates in this circuit and returns the switch to normal in which position off-normal springs 104 release and open the operating circuit of release magnet 208. The station circuit is now in its original condition and in a position to receive a new call.

Relay 304 of the station line circuit (Fig. 3) is in the slow speed pulsing circuit described above and follows the slow speed pulses. Relay 317 is held operated on the left-hand contact and armature of relay 304 while the latter relay is operated. Relay 317 is somewhat slow to release and does not release when relay 304 follows printer pulses. When the five slow speed disconnect pulses are received, however, relay 317 is released and reoperated five times and causes the switch wipers to be advanced to the fifth terminals on the banks 322 and 323. The operating circuit for relay 317 is traced from ground through the left-hand contacts of relay 304, inner right-hand armature and contact of relay 318 to battery through the winding of relay 317. The circuit for operating rotary magnet 321 of the selector is traced from ground through the back contacts of relay 317, outer left-hand armature and front contacts of relay 319 to battery through the winding of rotary magnet 321. The open circuits of the line and the consequent releases of relay 304 also cause the operation of relays 311 and 312 in a circuit traced from ground through the armature and right-hand contact of relay 304, back contact and outer left-hand armature of relay 303 to battery through the winding of relay 311 in parallel with the winding of relay 312 and the contact and inner left-hand armature of relay 318. As soon as the switch has taken the first step and off-normal springs 309 have operated relay 310 operates in a circuit traced from ground through the lower spring and middle contact of off-normal springs 309, contact and armature of relay 312 to battery through the winding of relay 310.

When the wipers of the switch reach the fifth terminals on the banks 322 and 323 and relays 311 and 312 have released because relay 304 has resumed its normally operated position with its armature against its left contact, a circuit is closed from ground through the lower spring and middle contact of off-normal springs 309, make-before-break contact of relay 312, armature and back contact of relay 311, left-hand armature and front contact of relay 319, which because of its slow releasing characteristic remains operated for an interval after relays 311 and 312 have

opened its operating circuit, contact and outer right-hand armature of relay 319 wiper and fifth terminal of bank 323 to battery through the winding of relay 316. Relay 316 operates in this circuit and locks in a circuit traced from ground through the inner right-hand armature and contact of relay 319 to battery through the inner right-hand armature, contact and winding of relay 316. When relay 310 releases ground over the lower spring and middle contact of off-normal springs 309, through the make-before-break contacts of relay 312, left armature and their respective contacts of 311 and 310 is connected to battery through the winding of release magnet 320 and the outer right-hand armature and back contact of relay 303, thereby operating release magnet 320. Release magnet 320, operated, returns the switch to normal and breaks the circuit through its winding when off-normal springs 309 return to their normal position.

The operation of relay 316 opens the holding circuits of relays 318, 319 and 302 releasing them. Relay 318, released, connects ground through its outer right-hand armature and contact to the tip springs of jack 308 and plug 422 which causes supervisory lamp 405 to light in the usual manner. Relay 319 released opens the locking path of relay 316, releasing it. When the operator noting the lighted supervisory lamp withdraws the plug from the jack relay 305 releases, restoring the station line circuit to its normal condition.

All stations may also be stopped by the transmission from any one of them of a special character, such as upper case H. When this character is received by station 107, contacts 228 on the station teletypewriter instrument are closed. The closure of these contacts causes the operation of relay 217 which when operated causes the release of all apparatus and the signaling of the operator as previously described.

The operator may stop the stations which may be operating at the time by first operating keys 423 and 420 and then withdrawing plug 422 from jack 308. The operation of key 423 causes the operation of relay 418 and the operation of key 420 causes the operation of relay 416. These relays, operated, connect positive battery to the tip of the cord circuit and cause the operation of relay 313. This circuit is traced from positive battery over the front contact and the left-hand armature of relay 416, front contact and inner right-hand armature of relay 418, front contact and outer right-hand armature of relay 402, the tip conductors of plug 422 and jack 308, outer right-hand armature and front contact of relay 318, left hand armature and back contact of relay 314, to negative battery through the right-hand winding of relay 313. When plug 422 is removed from jack 308 the operating circuit of relay 305 is opened and relay 305 released. Relay 313 locks in a circuit traced from ground through the lower spring and lowermost contact of off-normal springs 309 to battery through the left-hand armature contact and left-hand winding of relay 313.

The operation of relay 313 causes the operation of relay 303 in a circuit traced from ground over the outer right-hand armature and contact of relay 313, through the winding of relay 303 to battery through the front contact and outer left-hand armature of relay 313. Relay 303 locks to ground through its inner left-hand armature. Relays 311 and 312 now operate in a circuit traced from ground through the front contacts of relay 317, which is operated at this time since

relay 304 is in its operated condition, front contact and outer left-hand armature of relay 303, to battery through the winding of relay 311 in parallel with the winding of relay 312 and the contact and inner left-hand of relay 318. The operation of relay 313 also causes the operation of relay 310 by connecting ground through the inner right-hand armature and contact of relay 313, to battery through the winding of relay 310. With both relays 303 and 310 operated the line circuit is opened and all the line relays including line relay 304 release. The release of relay 304 opens the operating circuit of relay 317 which releases, closing a circuit from ground through its make-before-break contacts, outer left-hand armature and contact of relay 319 to battery, through the winding of rotary magnet 321. Rotary magnet 321 operates, advances the wipers to the first terminals on the banks and operates off-normal springs 309. With off-normal springs in the operated position the holding path of relay 313 is opened and relay 313 is released but relay 310 is held operated in a circuit traced from ground through the lower spring and middle contacts of off-normal springs 309, front contact and armature of relay 312 to battery through the winding of relay 310. The release of relay 304 also opens the operating path of relays 311 and 312 which release after an interval due to their slow to release characteristics. With relays 311 and 312 released, the operating path of relay 310 is opened and relay 310 released. The release of relay 310 again closes the line circuit and causes the reoperation of line relay 304 which in turn reoperates relay 317 over the paths previously traced. Relay 317 operated operates relays 311 and 312 and breaks the circuit to rotary magnet 321 allowing it to release. The operation of relays 311 and 312 cause the operation of relay 310 in a circuit traced from ground through the lower spring and middle contact of off-normal springs 309, front contact and armature of relay 312 to battery through the winding of relay 310. Relay 310, operated, opens the line circuit again, releasing relays 304 and 317 and causing the wipers to be advanced another step.

The slow speed pulsing circuit described above opens the line circuit periodically and advances the switches in all of the stations which are in the operating condition at the time. When the switch at station line circuit 324 reaches the fifth terminal a circuit is closed from ground through the lower spring and middle contact of off-normal springs 309, back contacts of relays 312 and 311, left-hand armature and front contact of relay 310, front contact and outer right-hand armature of relay 319, wiper and fifth terminal of bank 323 to battery through the winding of relay 316. Relay 316 operates and locks to ground through its inner right-hand armature and contact and the inner right-hand armature and contacts of relay 319. Relay 316, operated, opens the operating circuits of relays 318, 319 and 302, releasing them and the release of relays 319 and 319 open the operating paths and release all the relays in the station line circuit 324 with the exception of line relay 304, thus restoring station line circuit 324 to its original condition.

Recall feature

Any of the stations which may be in operation at the time, can call in other stations without redialing the ones already connected. To accomplish this at a station such as station 107 the recall key 221 is operated. The operation of this

key starts the slow speed pulsing circuit described previously but does not operate relays 212 and 217 but opens the line circuit directly at the right-hand contacts of key 221. When the wipers of the switch reach the third terminals a circuit is closed from ground through the lower spring and middle contact of off-normal springs 104, make-before-break contacts of relays 254 and armature and back contact of relay 203, right-hand armature and front contact of relay 202, front contact and right-hand armature of relay 205, wiper and third terminal of bank 224, left-hand armature and contact of relay 210 to battery through the winding of relay 213. Relay 213 operates and locks in a circuit from ground through the inner left-hand armature and contact of relay 205 to battery through the left-hand armature contact and winding of relay 213. Relay 213, operated, opens the operating paths of relays 205 and 206 releasing them. With relays 205 and 206 released all the relays in the circuit with the exception of relays 210 and 101 are released and the switch is returned to normal as previously described. With key 221 in its normal position the dialing circuit is again closed and any other stations may be added by dialing their codes. When the desired stations have been dialed the digit 0 is dialed and as all the relays similar to relay 210, in both the old and newly dialed stations are now operated, the relays in these stations corresponding to relays 205 and 206 will operate and condition the circuits to receive printer signals as previously described.

At the operator's position the operation of keys 423 and 420 connects positive battery to the tip conductor of the line, operating relay 313 as before. In this case, however, the plug is not removed from the jack and relays 305 and 302 remain operated. This circuit now functions in a similar manner to that previously described and transmits three slow speed open circuit impulses and then conditions itself for the transmission of dial pulses. When the digit 0 is received relays 310 and 313 are operated and the circuit made ready to transmit printer signals.

Operator dials station

To dial a station the operator inserts plug 422 in jack 308 and operates position key 421 and dial key 617. Inserting the plug in the jack causes the operation of relays 305, 401, 402, 403, 404 and 411 as previously described. The operation of position key causes relays 413, 407 and 409 to operate as before. The operation of dial key 617 closes a circuit from ground through its right-hand spring and right contact to battery through the winding of relay 612 operating the latter relay. Relay 612, operated, operates relay 611 by connecting ground through the inner right-hand armature and contact of relay 612 to the winding terminal of relay 611. Relays 612 and 611, operated, extend the line circuit to dial 616. The short circuit of the pulsing contacts at the left-hand spring and contact of key 617 being opened by the operation of the key, the line circuit is now ready to receive dial pulses from dial 616. The line circuit for the dialing function is traced from negative battery through station circuits 108, 109, 107, 110, 111, 112 in series, conductor 113, the line circuit of station line 324, the ring springs of jack 308 and plug 422, make-before-break contacts of relay 402, make-before-break contacts of relay 417, left-hand make-before-break contacts of relay 412, inner right-hand armature and contact of relay 413, contact and right-hand armature of relay 611, front contact

and outer left-hand of relay 612, the pulsing contacts of dial 616, outer right-hand armature and front contact of relay 612, left-hand armature and contact of relay 611, tip springs of jack 620 and plug 621, sending mechanism 622, the tip springs of plug 619 and jack 618, through the upper windings of relay 604, outer left-hand armature and contact of relay 413, back contact and outer left-hand armature of relay 413, through the upper windings of relay 413 to positive battery 501 through the normally closed contacts of relay 500. After dialing is completed dial key 617 is returned to normal, releasing relays 612 and 611 and removing the dial from the circuit.

At the stations dialed an audible signal is given. At station 107 this signal is shown as buzzer 223 and is operated in a circuit traced from ground through the left-hand armature and contact of relay 207, contact and inner right-hand of relay 206, contact and left-hand armature of relay 210 to battery through buzzer 223. The audible signal may be silenced by the momentary operation of key 220 which operates relay 207 which locks and opens the circuit to the audible signal device.

Broadcast feature

The circuits are arranged so that if the digit 9 is dialed the relays at every station corresponding to relays 210 and 302 operate and lock and upon the dialing of the digit 0 the stations are connected to the line for the transmission of teletypewriter signals. For a complete description of this function reference is made to the patent to Kinkead #1,946,216.

Station to station call

A station to station call in this system is the same as that disclosed in the co-pending application of G. A. Locke et al., supra, to which reference is made for a complete description of this feature.

What is claimed is:

1. A telegraph exchange system comprising a plurality of stations, circuits extending from said stations, a switching station whereat said circuits terminate, a plurality of other stations connected in series in certain of said circuits, and means at said switching station for selectively interconnecting in response to code signals any one of said stations with any one of the other of said stations individually, said means being further arranged, in response to a particular code signal, to interconnect any one of said stations with two or more of the other of said stations for broadcast purposes.

2. A telegraph exchange system, according to claim 1, wherein means are provided for permitting any one of said other stations connected in series in said second circuit to be automatically connected to one or more of the other stations connected in the same circuit.

3. A telegraph exchange system, according to claim 1, wherein means are provided at the switching station for initiating a call to one or more stations connected in series in any one of said certain circuits.

4. A telegraph exchange system, according to claim 1, wherein means are provided at each of the stations connected in series for indicating when the line circuit of a station with which a connection is desired, is busy.

5. A telegraph exchange system, according to claim 1, wherein switches are respectively provided at the stations connected in series in said

certain circuits and are arranged to respond ineffectively to different incoming telegraphic codes followed by a special signal and effectively to an incoming telegraphic code individual to each of the stations connected in series provided said individual code is followed by said special signal, and wherein means are provided at each of said stations for transmitting said telegraphic codes and special signal.

6. A telegraph system, according to claim 1, wherein switches are respectively provided at the stations connected in series with each of said certain circuits and are arranged to respond ineffectively to different incoming telegraphic codes followed by a special signal and effectively to incoming telegraphic codes individual to each of the stations connected in series, provided said individual code is followed by said special signal, said switches being further arranged to respond effectively to establish for communication purposes a connection including a plurality of switches providing each individual telegraphic code of a group is followed by another special signal and the group is followed by the first mentioned special signal, and wherein means are provided at each of said stations for transmitting said telegraphic codes and special signals.

7. A telegraph exchange system comprising a plurality of stations, a central office, a switchboard at said central office, a plurality of jacks at said switchboard, a plurality of line circuits respectively extending from said stations to said central office and respectively terminating at said jacks, certain of said line circuits each including two or more other stations connected in series, and link circuits at said switchboard for connecting the line circuit of any one of said stations to the line circuit of any one, or the line circuits of more than one of said stations for the transmission of a message between two or more stations, impulse sending means at said switchboard for sending code signals over said link circuit, and switching means at said switchboard, arranged when operated, to cause said code signals to operatively connect two or more of said stations connected in series in one of said line circuits, to any other of said stations through one of said link circuits, for sending broadcast messages.

8. A telegraph exchange system, according to claim 1, wherein the link circuit is comprised of manually operated cord circuits and a repeater contained therein for connecting any one of said stations to any one of said two or more stations connected to a signal line circuit.

9. A teletypewriter exchange system comprising a central office, a multiparty line extending therefrom, a plurality of stations remote from said central office connected to said line and each provided with teletypewriter transmission and reception equipment, call responsive means at each of said stations and said central office, a device at said central office and each of said remote stations, a source of signal current at said central office controlled by any one of said devices for actuating said call responsive means at said central office and each of said remote stations simultaneously, a circuit arrangement in each of said call responsive means for effectively signaling said central office or any one of said stations, as desired, in response to a distinctive series of signals transmitted from said any one of said devices, each of said arrangements being controlled by a series of signals different from the series of signals for control-

ling the other of said arrangements, teletypewriter equipment at said central office connectable to said line whereby said central office may intercommunicate telegraphically with said signaling station, another station and a line therefor terminating at said central office, teletypewriter equipment at said other station, and a cord circuit at said central office for extending, in response to a request from said signaling station, said first-mentioned line as a telegraphic communication circuit to said other station.

10. In a system according to claim 9, a signal device at said central office individual to said multiparty line, and means for causing said signal device to indicate busy as a result of the initiation of selective operations to select said calling means.

11. In a telegraph system, in combination, a signal transmission circuit, a plurality of stations associated therewith, means at one or more of said stations for transmitting pulses to other stations, selective means at said other stations responsive to said pulses whereby one or more such stations may be called, means for rendering said selective means unresponsive to telegraph signals, means individual to any or all said stations whereby any said station may restore the selective means at the plurality of stations, means at one of said stations whereby said signal transmission circuit may be operatively extended for intercommunication with another signal transmission circuit.

12. In a telegraph system, in combination, a signal transmission circuit, a plurality of stations associated therewith, means at each of said stations for transmitting pulses to all said stations, selective means at each of said stations responsive to said pulses whereby one or more of said stations may be called, means for rendering said selective means unresponsive to telegraph signals, means at each of said stations whereby any of said stations may restore to normal the selective means at all said stations, another signal transmission circuit, a cord circuit at one of said stations whereby an operator thereat may extend said signal transmission circuit to said other signal transmission circuit for intercommunication between said transmission circuits, a disconnect signal at each of said stations, and means whereby any one of said stations after having been selected may energize said disconnect signal.

13. In a telegraph system, in combination, a signal transmission circuit, a plurality of stations associated therewith each equipped with a printing telegraph set, means at one or more of said stations for transmitting pulses to other of said stations, selective means at said other of said stations responsive to said pulses whereby one or more of said stations may be called and the printer set motors started thereat subsequent to said pulses, means for rendering said selective means unresponsive to telegraph signals after the desired stations are called, means individual to any or all said stations whereby any station may restore to normal the selective means at all said stations, another signal transmission circuit, and a link circuit at one of said stations whereby said signal transmission circuit may be connected to said other telegraph signal transmission circuit for telegraphic intercommunication between said signal transmission circuits.