

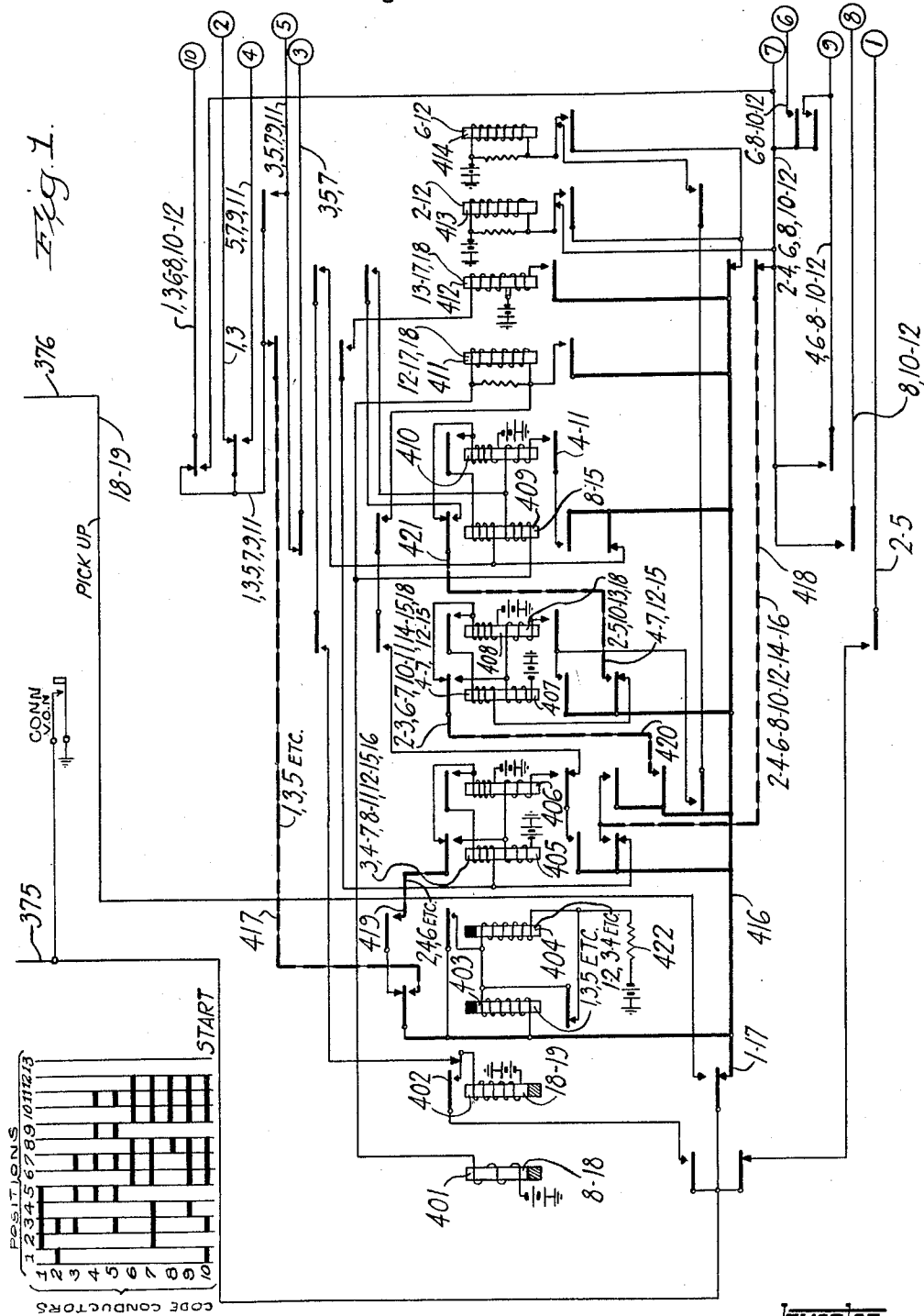
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CODE SIGNAL GENERATING DEVICE

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CODE SIGNAL GENERATING DEVICE

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6 Claims. (Cl. 177—380)

This invention relates to signalling apparatus in general, particularly to signalling apparatus for use in party-line telephone systems, and is concerned primarily with the apparatus for generating the signalling codes required in such systems.

This application is a division of my application Serial No. 153,791, filed December 10, 1926, upon which Patent No. 1,772,690 was granted August 12, 1930, and which discloses a party-line telephone system embodying the invention. Only the code generating apparatus is shown in the present application. In addition to operating with the switching apparatus disclosed in my prior application, the invention may be used in other known party-line telephone systems.

In automatic telephone systems, the party-line connectors and ring-back switches are ordinarily equipped with auxiliary ringing current selecting switches. The auxiliary switch is directly operated by a calling subscriber to select the particular code of ringing current required to signal the called station, the codes used ordinarily comprising various combinations of short and long ringing periods. The auxiliary switch completes a circuit from the ringing relay of the connector or ring-back switch to a code conductor which is grounded at certain predetermined intervals by a code generating device or interrupter. The ringing relay operates in response to each ground impulse and applies signalling current to the called line accordingly.

Code generating devices of the motor driven cam type and the rotary stepping switch type have been used extensively. Inasmuch as the code generator is required to operate more or less continuously during the exchange busy periods, there is considerable wear on the moving parts of such devices. This necessitates frequent adjustments and replacement of worn parts which is both troublesome and expensive. These difficulties are overcome in the present invention which has for its main object the provision of a novel and efficient code generating device consisting solely of relays.

The invention will be described with reference to the accompanying drawing comprising Fig. 1 and Fig. 2. Fig. 1 shows the code generating device. Fig. 2 indicates the codes applied to various signal conductors 1 to 0, inclusive.

Referring now to Fig. 1 of the drawing, it will be noted that a number of conductors terminate in circles designated 1—10, respectively, at the right-hand edge of the sheet. These numerals indicate the particular contact of the ringing

current selecting switch bank to which the associated code conductor is connected, i. e., conductor 1 is connected to the first contact of the bank, conductor 2 is connected to the second contact of the bank, etc. It is understood, of course, that corresponding contacts of the various switch banks are multiplied so that the code device is common to a number of connectors or ring back switches. Conductor 375, designated Start, is multiplied to the various switches having access to the code device. When a switch is used to extend a call ground is applied to this conductor until the call is answered. Conductor 376, designated Pick up, is also multiplied to the various connectors. This conductor is extended to the pick-up relay of the connector when a connection has been completed to an idle line and the ringing code has been selected. The pick-up relay of the connector connects up the ringing relay of that switch so that it will respond to the ground impulses applied to the particular code conductor selected to signal the called station.

Relays 403 and 404 of the code generating device may be designated as the prime-mover relays because they generate the impulses to operate the other relays. The remaining relays, especially relays 405—410, operate to count the impulses generated by relays 403 and 404, and the device as a whole is capable of assuming any one of nineteen positions, successively, the operation being repeated in cycles. The positions of the device in which the various relays are operated have been noted on the drawing. Also the positions of the device in which the principal conductors are grounded have been noted in order that the disclosure may be understood better.

When start conductor 375 is grounded upon the operation of the vertical off-normal springs of an associated connector, ground is extended through the lower armature of relay 402 to conductor 416, closing a circuit for relays 403 and 404, in series, through the resistance element 422. Relay 404 being short-circuited, relay 403 is the only one that responds immediately. When relay 403 operates, it places ground on conductor 417 at its upper armature, and removes the shunt from around relay 404 at its lower armature. Relay 404 operates and prepares to place ground on conductor 419, and at the same time shunts relay 403. Relay 403 falls back, and the device may be said to be in its second position. In the second position of the device, a circuit is closed through the upper armatures of relays 403 and 404 for the upper

winding of relay 406, including conductor 419 and the upper armature, normal, of relay 405. Relay 406 operates and closes a locking circuit for itself at its upper armature including the upper winding of relay 405, the lower armature of the said relay, and the grounded conductor 416.

With the device in position two, relay 404 is short-circuited at the lower armature of relay 403, and relay 404 shortly falls back, the device thereupon passing into position three. When relay 404 falls back, it removes ground from conductor 419, whereupon relay 405 operates in the locking circuit of relay 406, and at its upper armature prepares a circuit for shunting relay 406. It will be noted now that a new locking circuit is completed for relays 405 and 406 in series, and that the circuit of the upper windings of these relays is opened. The new circuit includes the lower windings of the relays in series and the inner lower armatures of the two relays.

When relay 404 falls back it removes the shunt from around relay 403 with the result that relay 403 operates again and removes the shunt from around relay 404. Relay 404 now reoperates and shunts relay 403. This operation of relays 403 and 404 continues, in the manner described, until it is terminated by the action of relay 402, as will be described hereinafter.

It will be noted, that relay 403 is labeled "1, 3, 5, etc." while relay 404 is labeled "1—2, 3—4, etc." These labels indicate that relay 403 is operated in positions 1, 3, 5, etc., and that relay 404 is operated in positions 1 and 2, is released momentarily, is operated again in positions 3 and 4, etc.

With the device in position 4, ground is again placed on conductor 419, short circuiting lower winding of relay 406. Relay 406 falls back when this takes place and opens the previously established locking circuit at its inner lower armature. Relay 405 remains operated over conductor 419.

When the device arrives in position 5, ground is removed from conductor 419, whereupon, relay 405 falls back.

The above described operation of relays 405 and 406 is repeated, beginning with position 6.

While relay 406 is operated in positions 2 and 3, ground from conductor 416 is held on impulse conductor 420, extending to the similar relays 407 and 408. The result is an operation of relays 407 and 408 similar to the above described operation of relays 405 and 406, but the time required for a complete operation is twice as long as that of relays 405 and 406, on account of the fact that only half as many impulses are delivered over conductor 420 as are delivered over conductor 419. It may be seen, therefore, that relay 408 is operated in positions 2—5, 10—13, and 18, and that relay 407 is operated in positions 4—7, and 12—15.

It will be noted, that ground from conductor 416 is placed on conductor 421 as long as relay 407 is operated. The result is that conductor 421 is grounded in the positions of the device in which relay 407 is operated, conductor 421 being the impulse conductor extending to the third pair of counting relays 409 and 410. It may be seen, therefore, that relay 410 is operated in positions 4—11, and that relay 409 is operated in positions 8—15.

When conductor 418 is grounded in position 2, a circuit is closed through the lower armature of relay 412 for relay 413. Relay 413 operates and locks itself through the middle lower

armature of relay 412 to conductor 16, and remains operated until relay 412 operates in position 13, as will be pointed out hereinafter.

When the device arrives in position 6, relay 414 is operated from the grounded conductor 416 through the inner lower armature of relay 407, lower armature of relay 406, and the lower armature of relay 413. Relay 414 operates and locks itself through the locking conductor of relay 413, with the result that relay 414 remains operated until ground is removed from this locking conductor at the beginning of position 13 when relay 412 operates.

When the device arrives in position 12, a circuit for relays 411 and 401 in series is completed from conductor 416 through the inner lower armature of relay 405, inner lower armature, normal, of relay 406, middle upper armature of relay 408, and the middle upper armature of relay 409. At its lower armature relay 411 locks itself and relay 401 to conductor 416. Relay 401 prepares a locking circuit for relay 402 at its inner armature.

When the device arrives in position 13, relay 405 falls back and closes at its lower armature a circuit through the inner upper armature of relay 411 for relay 412. Relay 412 operates and locks itself to conductor 416 until conductor 416 is ungrounded in position 18. At its middle lower armature, relay 412 opens the locking circuit of relays 413 and 414, whereupon these relays fall back.

When the device arrives in position 18, relay 408 is operated again, and it completes at its upper armature a circuit for relay 402 including the upper armature of relay 412 and the middle lower armature of relay 409. Relay 402, thereupon operates and locks itself to conductor 375 through the inner armature of relay 401, at the same time opening its initial circuit. At its lower armature, relay 402 removes ground from conductor 416 and places ground on pick-up conductor 376. The removal of ground from conductor 416 stops the operation of relays 403 and 404 and permits the operated relay 404 to fall back, and it opens the locking circuits of the relays 405—414, permitting such of these relays as are operated to fall back. Relay 401, which is in series with relay 411, is slow-acting and does not fall back right away when its circuit is opened upon the removal of ground from conductor 416.

When relay 401 falls back it opens the locking circuit of relay 402, the device is in position 19. A moment later relay 402 falls back and removes ground from pick-up conductor 376, reapplying it to conductor 416; then the device is in position 1 again.

The above described operation is repeated over and over as long as the ground potential remains on start conductor 375. The various impulse codes will be applied to the respective signal conductors during each cycle of operation as shown diagrammatically in Fig. 2 and described in succeeding paragraphs.

Considering now how the codes are placed on the various conductors, the conductor extending to terminal 1 is grounded through the lower armatures of relays 401 and 408 while the device is in positions 2—5; this code corresponds to one long ring.

The conductor extending to terminal 2 is grounded through the upper armatures of relays 403 and 411, and the middle armature of relay 410 while the device is in positions 1 and 3; this code corresponds to two short rings.

The conductor extending to terminal 3 is grounded in positions 3, 5, and 7 of the device through the upper armatures of relays 411, 413, and 409; this code corresponds to three short rings.

The conductor extending to terminal 4 is connected to the impulse conductor 417 through the upper armature of relay 411 and the middle upper armature of relay 410, and is grounded in positions 5, 7, 9, and 11; this code corresponds to four short rings.

In a similar way, the remaining code conductors are grounded in the positions indicated. The code placed on the conductor extending to terminal 5 corresponds to five short rings; the code placed on conductor 6 corresponds to two long rings; the code placed on conductor 7 corresponds to three long rings; the code placed on conductor 8 corresponds to a short ring and a long ring; the code placed on conductor 9 corresponds to a short ring and two long rings; and the code placed on conductor 10 corresponds to two short rings and two long rings.

What is claimed is:

1. In combination, a device for generating impulses, a relay group, means for operating certain relays of said group in response to said impulses through a certain cycle at a definite rate, means for operating certain other of said relays through a similar cycle of operations at a rate half that of the first mentioned relays, and auxiliary relays controlled by the first and second mentioned relays for operating the entire relay group in cycles, each of the latter cycles including a plurality of cycles of the first and second mentioned relays, circuit connections including code conductors and contacts controlled by said relays for generating a plurality of different code signals.

2. In combination, a device for generating uniform impulses at a definite rate, groups of relays, means for operating the first relay group in response to said impulses through a certain cycle of operations at a definite rate, means for operating the second relay group through a similar cycle of operations at one half the rate of the first relay group, means for operating the third relay group through a similar cycle of operations at one half the rate of the

second relay group, means controlled by said relay groups jointly for generating long and short impulses, and means for combining said long and short impulses into a plurality of different signal codes.

3. A code signal generating device comprising a plurality of signal conductors, a device for generating a series of uniform short impulses, a group of relays, circuit connections between said device and said relays for operating and releasing the relays to transform said short impulses into code signals comprising groups of long and short impulses, and contacts operated by said relays to impress said code signals upon said signal conductors.

4. A code signal generating device comprising a plurality of signal conductors, a plurality of relays, means for operating and releasing certain of said relays at a predetermined rate, means for operating and releasing certain other of said relays at a different predetermined rate, and means responsive to the operation and release of said relays for transmitting code signals over said signal conductors.

5. A code signal generating device comprising a plurality of pairs of relays, means for operating the first relay pair through cycles consisting of the successive actuation and successive release of the relays, means for operating the second relay pair through a similar cycle responsive to the operation of the first relay pair through two complete cycles, means controlled by said relay pairs for generating long and short impulses, and means controlled by said relay pairs for combining said impulses in a plurality of different combinations representing code signals.

6. A code signal generating device comprising a plurality of pairs of relays, means for operating the first relay pair at a definite rate through cycles consisting of the successive actuation and successive release of the relays, means for operating successive relay pairs through similar cycles at a rate one half that of the rate at which the relay pair immediately preceding is operated, a plurality of signal conductors, and means controlled by said relays for transmitting separate and distinct codes of impulses over the respective ones of said conductors.

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