Oct. 26, 1943. E. L. ERWIN 2,332,966

CODE CALL SYSTEM

Filed Feb. 25, 1942 5 Sheets-Sheet 1

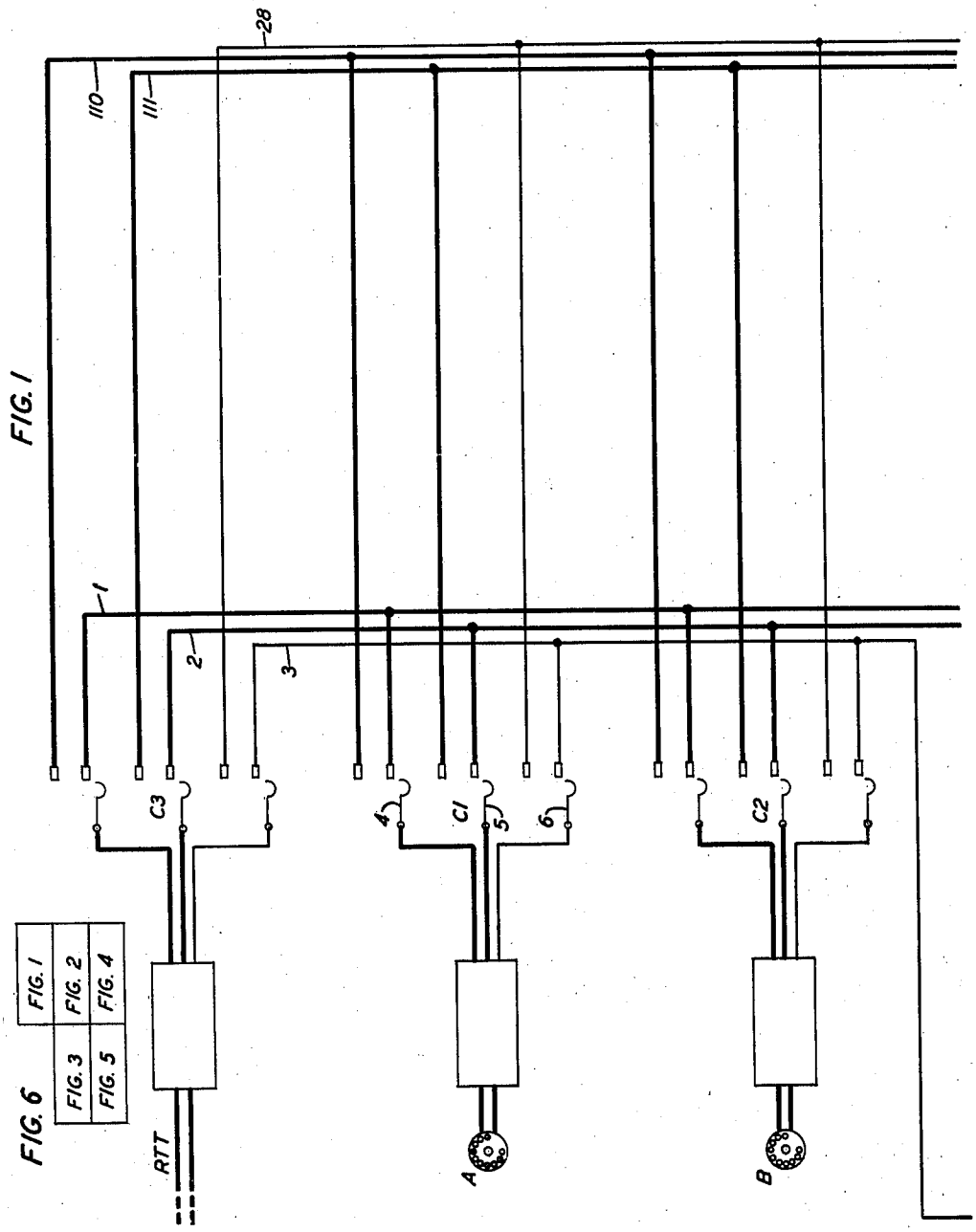

FIG. 1

FIG. 6

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

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CODE CALL SYSTEM

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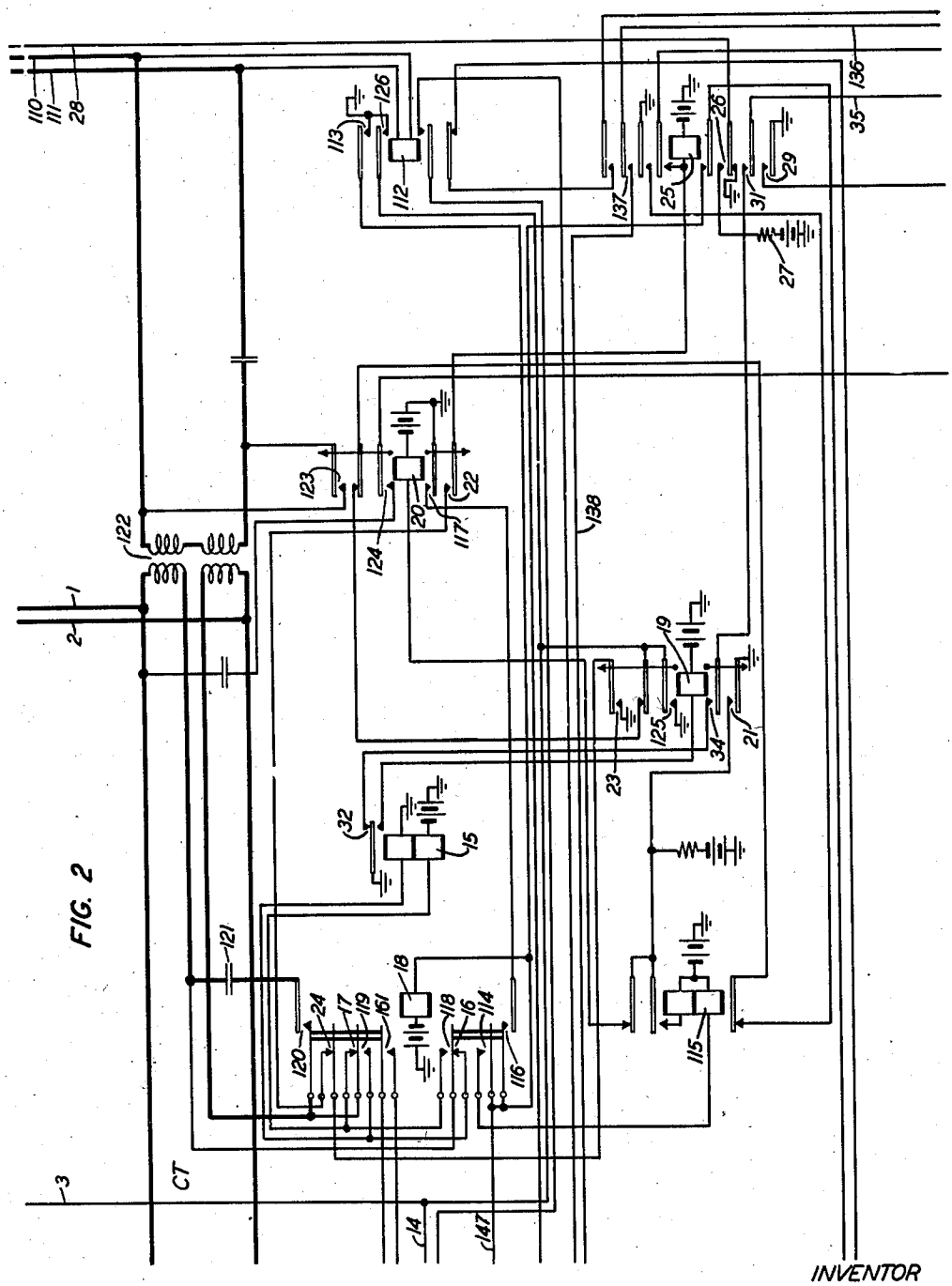

FIG. 2

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CODE CALL SYSTEM

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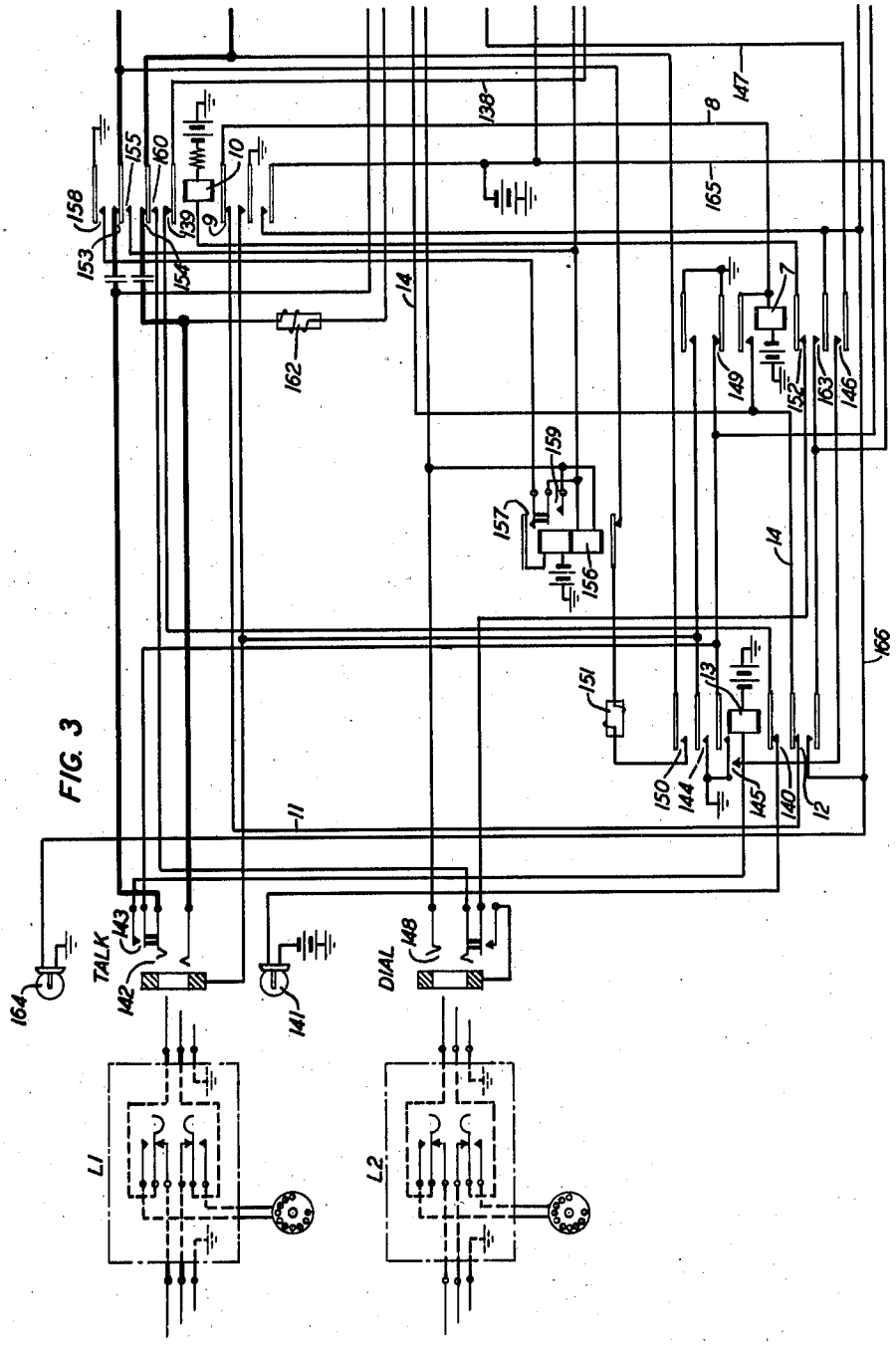

FIG. 3

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CODE CALL SYSTEM

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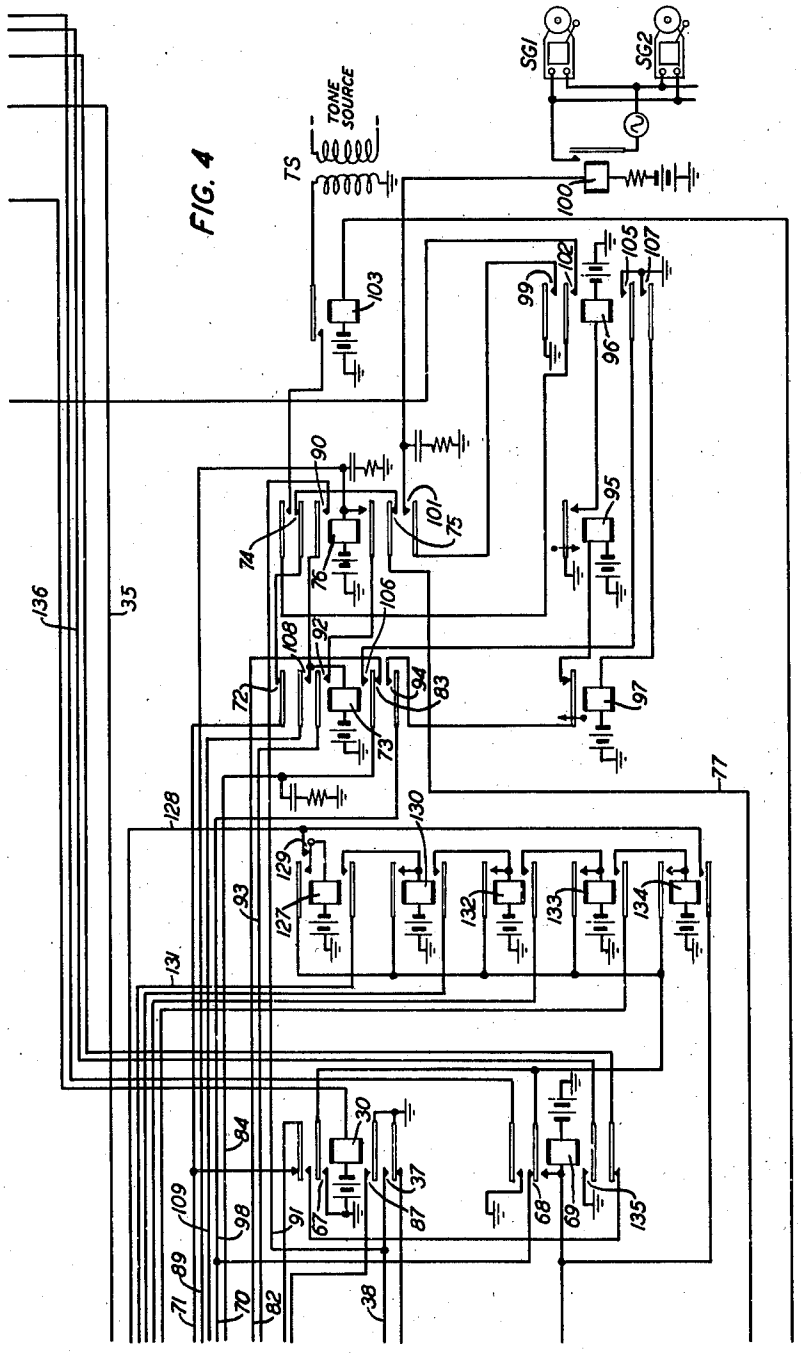
FIG. 4



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CODE CALL SYSTEM

Filed Feb. 25, 1942 5 Sheets-Sheet 5

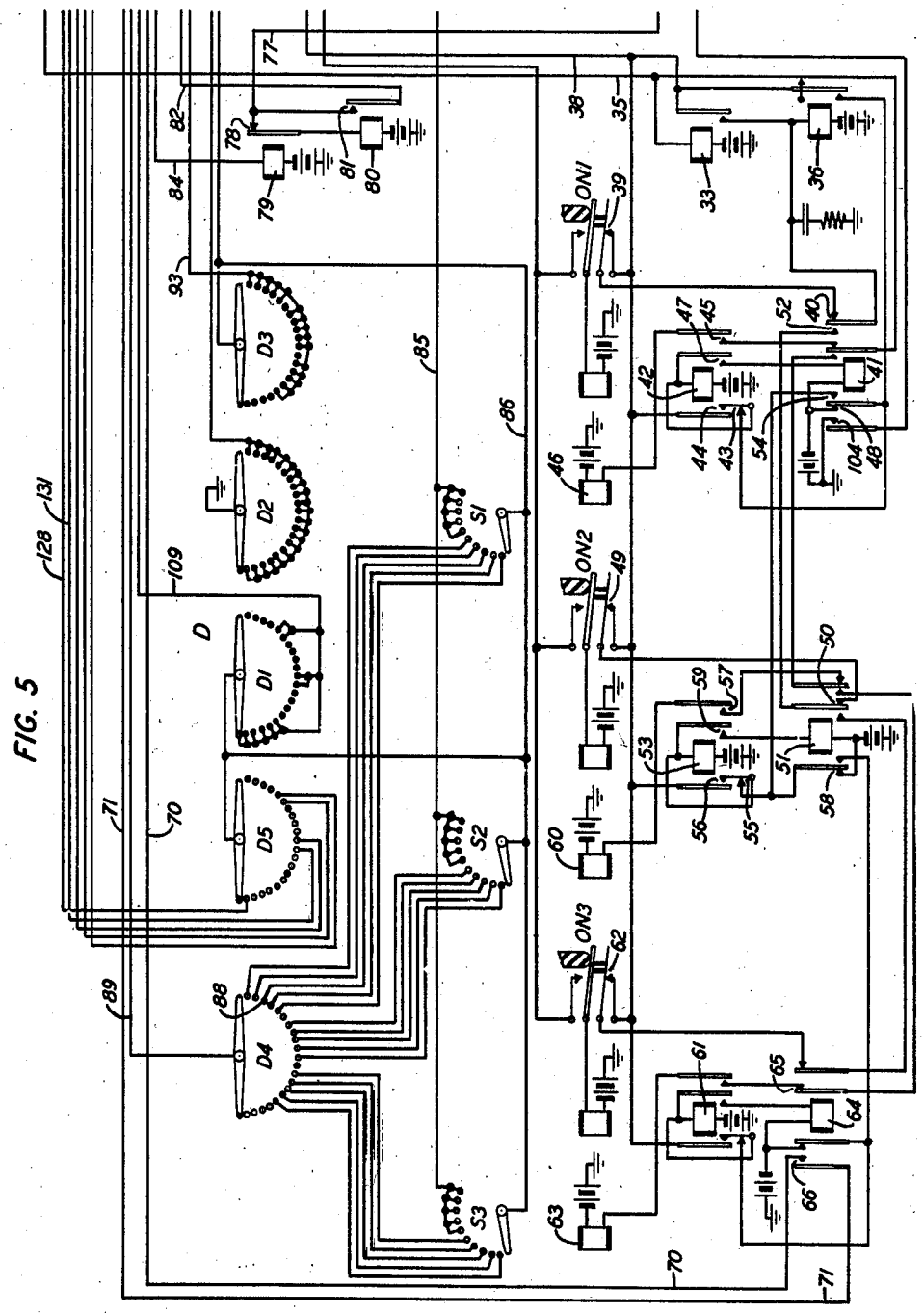

FIG. 5

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2,332,966

UNITED STATES PATENT OFFICE

2,332,966

CODE CALL SYSTEM

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Application February 25, 1942, Serial No. 432,273

5 Claims. (Cl. 179—18)

This invention relates to automatic private branch exchange systems and more particularly to code signaling arrangements for such exchanges of the character described, for example, in the Reissue Patent 17,006, M. L. Nelson, dated June 9, 1928, which system provides facilities whereby certain persons may be called when they are absent from their office and in some other department or location in the factory, store or other establishment served by the private branch exchange.

An object of the present invention is to improve systems of the above character whereby greater flexibility of operation is obtained and additional service features are provided.

One feature of the invention resides in means for limiting the number of times a transmitted code is repeated to operate the bells, or other code signal devices.

A related feature resides in means, operated at the termination of a predetermined number of code signal repetitions, initiated by a subscriber, to signal the exchange attendant if the called party has not answered in the meantime.

Another feature resides in means for enabling the attendant to connect to and directly control the code signaling equipment from her position independent of the automatic switching equipment, and also to connect thereto central office or tie trunks, incoming to and terminating at her position whereby the code signaling equipment may be controlled over said trunks independent of both the automatic switching equipment and the attendant.

Another feature resides in means whereby when the called party, in responding to his code, obtains a connection to the calling party through the code signaling equipment, a battery reversal toward the calling party is effected which reversal is required in some cases when certain types of trunks are connected to and control the code signaling equipment.

Still another feature resides in means for separating the digits of a dialed code by substantially the same interval of time regardless of the number of pulses forming the individual digits, for example, the time intervals between the digits in the code 1—1—1 will be substantially the same as between the digits 5—5—5, and further the time interval between successive repetitions of the code dialed will be the same regardless of the number of impulses forming the first and last digits of the code, for example the interval between successive repetitions of the code 1—1—1 will be substantially the same as the interval between successive repetitions of the code 5—5—5.

Other features of the invention will appear from the following description and appended claims.

An understanding of the invention will be obtained from the following description when read in connection with the accompanying drawings, the figures of which, when arranged in accordance with Fig. 6, show a complete system in accordance therewith, Fig. 1 showing in schematic form an automatic private branch exchange with two subscribers' lines and an incoming trunk from a central office, or another private branch exchange, having access to the automatic equipment; Fig. 3 shows a manual switchboard position associated with the private branch exchange, and Figs. 2, 4 and 5 show the arrangement of the code signaling equipment, containing the novel features of the invention, which is arranged to receive and translate three-digit dial pulses into code signals of the same number of digits.

A description of the system and its operation follows: Referring to the drawings it will be first assumed that the subscriber A, Fig. 1, has called a certain other subscriber X, not shown, by dialing his station in the usual manner and, having received no response, has released the connection and decided to attempt to reach the wanted party by sending out his preassigned code to operate a plurality of bells or other signal devices S1, S2, etc., located throughout the factory, store or other establishment served by the private branch exchange. It will be further assumed that the preassigned code of subscriber X is 323.

When the receiver is removed from the hook at station A, the line finder (not shown) will hunt for and seize the calling line after which it will be extended to a trunk terminating in an idle selector-connector C1 in the usual manner after which the subscriber dials a predetermined code to cause this final switch to seize a trunk CT terminating in the code switching apparatus shown on Figs. 2, 4 and 5, which trunk we will assume appears in the No. 1 contacts of the first level of connector C1 over conductors 1, 2 and 3. It will be further understood that the second and all succeeding terminals of the first level are made permanently busy.

When the brushes 4, 5 and 6 of switch C1 are raised to the first level and rotate to the first terminal under control of the subscriber's dial, if the code switching apparatus is idle, the circuit of the rotary magnet will be opened in the usual manner and the switch will stop thereon. If the

code switching equipment is busy the rotary magnet will continue to step the brushes around past all the succeeding permanently busy contacts into the busy position to give the subscriber a busy signal all of which is well-known practice and needs no further explanation. If the switch stops on the first set of contacts due to battery on the sleeve conductor 3 which can be traced from relay 7, conductor 8, contacts 9 of relay 10, conductor 11, contacts 12 of relay 13, and conductor 14 to the sleeve conductor 3, relay 7 will operate due to ground from the preceding switch applied through brush 6 of connector C1. Closure of contacts 163 of relay 7 connects battery to light the busy lamp 164 at the attendant's switchboard position in a circuit which can be traced from battery, conductor 165, contacts 163 of relay 7, and conductor 166 to ground, through the busy lamp 164 thus indicating to the attendant that the code call circuit is busy. The calling subscriber's line will also be cut through to relay 15 which operates in series therewith over contacts 16 and 17 of relay 18. Operation of relay 15 operates relay 19 in an obvious circuit which latter relay at its contacts operates slow-to-release relay 20. Relay 20 closes its contacts 22 thereby completing a circuit to operate relay 25 from ground, contacts 23 of relay 19, contacts 24 of relay 18, contacts 22 of relay 20, and winding of relay 25 to battery. Relay 25 in operating closes its contacts 26 to connect battery in series with resistance 27 to the sleeve conductor 28 which is connected in multiple to the first terminal in the second level of switches C1, C2 and C3 for a purpose to be hereinafter referred to. Relay 25 in operating closes at its contacts 29 an obvious circuit to operate relay 30 (Fig. 4). Relay 25 also closes its contacts 31 to connect the back or pulsing contacts 32 of relay 15 to the winding of relay 33 (Fig. 5), the circuit for which includes contacts 34 of relay 19 and conductor 35.

Relay 30 in operating operates relay 36, the circuit for which can be traced from ground, contacts 37 of relay 30, conductor 38, contacts 39 of the off-normal switch ON1 associated with selector S1 and contacts 40 of relay 41 to battery through the winding of relay 36. Relay 36 in operating closes its contacts thereby completing a circuit to operate relay 42 which can be traced from ground, contacts 37 of relay 30, conductor 38, front contact of relay 36, contacts 43 and winding of relay 42 to battery. Relay 42 in operating closes its contacts 44 to lock itself operated to ground on conductor 38 supplied at contacts 37 of relay 30, and at its contacts 45 connects the rotary magnet 46 to conductor 35 which extends to the pulsing contacts 32 of relay 15.

When the subscriber releases the dial for the first digit (3) of the assumed code, relay 15 follows the pulses and alternately operates relay 33 and the rotary magnet 46 which magnet steps the brush of selector S1 ahead to the third contact. When the selector S1 moves off-normal, it opens contacts 39 of the off-normal switch OF1 which interrupts the original operating circuit of relay 36, but this relay (36) is slow to release and holds operated due to the intermittent operation of relay 33 in step with magnet 46. When the first digit is finished relays 33 and 36 release. Relay 36 opens its contacts thereby removing a short circuit from the winding of relay 41 which was connected when relays 36 and 42 operated. This short circuit can be traced from the right-hand terminal of the winding of relay 41, contacts 47 and 44 of relay 42, front contacts of relay 36 and contacts 48 of relay 41 to the left-hand terminal of its winding.

When relay 36 releases this short circuit is removed and relay 41 now operates in a circuit from battery, winding of relay 41, contacts 47 and 44 of relay 42 and conductors 38 to ground at contacts 37 of relay 30. When relay 41 operates, relay 36 reoperates in a circuit from ground on conductor 38, contacts 50 of relay 51, contacts 52 of relay 41 and winding of relay 36 to battery. Reoperation of relay 36 now operates relay 53 in a circuit which can be traced from ground on conductor 38, front contacts of relay 36, contacts 54 of relay 41, contacts 55 and winding of relay 53 to battery. Relay 53 in operating locks at its contacts 56 to ground on conductor 38 and closes its contacts 57 to connect the rotary magnet 60 for selector S2 to the pulsing lead 35. Operation of relays 36 and 53 completes a short circuit around the winding of relay 51 which can be traced from the lower terminal of its winding and its contacts 58, contacts 54 of relay 41, front contacts of relay 36 and contacts 56 and 59 of relay 53 to the upper terminal of the winding of relay 51.

Dialing of the second digit of the code (2) causes relay 33 and magnet 60 to follow the pulses. Magnet 60 steps the brush of selector S2 ahead to the second terminal. When the selector S2 moves off-normal it opens the contacts 49 of the off-normal switch ON2 which interrupts the operating circuit of relay 36 but this relay, as before, holds operated due to the operation of relay 33 in step with the pulses. When the second digit is finished relays 33 and 36 again release and the release of relay 36 opens the previously traced short circuit for relay 51 which now operates in the following circuit: battery, winding of relay 51, contacts 59 and 56 of relay 53, to ground on conductor 38.

In a like manner, as previously described, operation of relay 51 causes relay 36 to again operate which causes relay 61 to operate, lock, and connect the rotary magnet of selector S3 to the pulsing lead 35. Relay 64 is also short-circuited.

Dialing of the third and last digit (3) of the code steps the switch S3 ahead to the third terminal and at the end of the pulsing, relays 33 and 36 again release thereby removing the short circuit from relay 64 which thereupon operates to open its contacts 65 thereby preventing further dialing from moving switch S3.

When relay 64 operates at the end of the code impulses, it closes at its contacts 66, a circuit to initiate a self-interrupted stepping of switch D which circuit can be traced from ground, contacts 67 of relay 30 (Fig. 4), contacts 68 of relay 69, conductor 70, contacts 66 of relay 64, conductor 71, contacts 72 of relay 73, contacts 74 and 75 of relay 76, conductor 77, contacts 78 of stepping magnet 79 and winding of relay 80 to battery, Relay 80 operates and closes its contacts 81 to complete a circuit to energize magnet 79 which can be traced from ground on conductor 77, contacts 81 of relay 80, conductor 82, contacts 83 of relay 73, conductor 84 and winding of magnet 79 to battery. Energization of magnet 79 steps the brushes of switch D ahead and opens its contacts 78 thereby causing relay 80 to release and open its contacts 81 whereupon magnet 79 is deenergized and releases and closes its contacts 78 which recloses the circuit

of relay 80 which operates and closes its contacts 81 which in turn reenergize magnet 79 to move switch D ahead a second step. This stepping continues to advance the brushes of switch D at a very rapid rate.

Selector switches S1, S2 and S3 serve as registers for the digits of the code dialed which in the present case was 323, and therefore the brush of switch S1 is standing on the third terminal, the brush of S2 on the second terminal and the brush of S3 on the third terminal, which terminals are grounded due to the fact that the brushes are connected in multiple to ground on conductor 85 applied at contacts 87 of relay 30, Fig. 4. Further, the terminals of the switches S1, S2, S3 are connected to different terminals in the arc D4 of the selector switch D. At this point it may be mentioned that for practical reasons codes having individual digits greater than the digit 5 are not desirable and therefore the system disclosed is so arranged and consequently the switches S1, S2 and S3 which serve to register the digit pulses have their first five terminals only connected to terminals of the arc D4 and the remaining terminals of each of the switches S1, S2 and S3 are connected in multiple to a conductor 85 for a purpose hereinafter described.

When the brush corresponding to arc D4 engages terminal 88, which is grounded by the setting of switch S1, a circuit is completed to operate relay 76 (Fig. 4) which includes conductor 89. When relay 76 operates, it opens its contacts 75 thereby interrupting the previously traced circuit for stepping magnet 79 whereupon the switch D stops. Relay 76 also closes its contacts 90 to operate relay 73, the circuit of which can be traced from ground at contacts 37 of relay 30, conductor 91, contacts 90 of relay 76 and winding of relay 73 to battery. Relay 73 closes its contacts 92 to lock relay 76 operated in a circuit including conductor 93, the third terminal and brush of arc D3, and contacts 87 of relay 30 to ground. Relay 73 also closes its contacts 94 to initiate sequential operation of interrupter relays 95, 96 and 97 which function as follows: closure of contacts 94 of relay 73 completes a circuit to operate relay 95 which can be traced from ground, contacts 67 of relay 30, contacts 68 of relay 69, conductor 98, contacts 94 of relay 73 and the back contacts of relay 97 to the winding of relay 95. Relay 95 operates in this circuit and closes an obvious circuit to operate relay 96 which performs several functions, i. e., at its contacts 99, it closes a circuit to operate relay 100 which can be traced from ground, contacts 99 of relay 96, contacts 101 of relay 76 and winding of relay 100 to battery. Relay 100 in operating closes a circuit to energize the signal bells SG1, SG2 and any others that may be connected in multiple therewith. Closure of contacts 102 completes a circuit to connect tone source TS to the trunk CT as an indication to the calling subscriber that the code signals are operating. The circuit for this tone connection can be traced from the source TS, closed contacts of relay 103, which relay was operated when relay 41 closed its contacts 104 at the conclusion of the pulses representing the first digit. The closure of contacts 105 of relay 96 completes a circuit to reenergize stepping magnet 79, independently of relay 80, which can be traced from ground, contacts 105 of relay 96, contacts 106 of relay 73, conductor 84, and winding of magnet 79 to battery. Magnet 79 moves switch D ahead another step in connection with the fourth terminal. Operation of relay 96 also closes its lowermost contacts 107 thereby operating relay 97 which opens its upper back contacts to release relay 95 which, in turn, opens the circuit of relay 96 which also releases thereby opening its contacts 99, 102, 105 and 107 to release relay 100 and open the circuit for the signals SG1, etc., to disconnect tone from the trunk CT, to release the stepping magnet of switch D, and to release relay 97. Relay 97 is slow to release but when it recloses its back contacts, the preceding cycle of operation is repeated whereupon the signals SG1, etc., are again operated, tone is again transmitted to the calling subscriber and switch D moves ahead another step to the fifth terminal and relay 97 is operated to again release relay 95 which, in turn, releases relay 97 to recondition the chain of relays 95, 96 and 97 for a third cycle of operation which again functions as previously described, including driving the switch D ahead to the sixth terminal. As will be noted, the sixth terminal of arc D3 is dry, i. e., is disconnected from conductor 93 which, in turn, is connected through relay 76 to battery and therefore when the brush steps off the fifth terminal and engages the sixth terminal, relay 76 releases which disables the signal devices SG1, etc., and the tone circuit to the calling subscriber. At this point it should be mentioned that when the switch D moves into its fifth position, a holding circuit was established for relay 73 independent of relay 76 which can be traced from battery, winding and contacts 108 of relay 73, conductor 109, the fifth terminal and brush of arc D1 and conductor 86 to ground at contacts 87 of relay 30. And, therefore, when relay 76 releases, as above mentioned, relay 73 remains operated thereby holding the circuit prepared to again operate relay 95 when relay 97 releases and therefore another cycle of operation of relays 95, 96 and 97 takes place to energize magnet 79 and move the switch D ahead to the seventh position whereupon the brush of arc D1 moves off the sixth terminal which opens the previously described locking circuit for relay 73 which now releases. This pause at the end of the digit while switch D moves over terminal 6 without operating the signal bells SG1, etc., and without transmitting a tone pulse to the calling subscriber is for the purpose of introducing the space between the first and second digits of the code sounded which will be referred to later.

When relay 73 releases it recloses a circuit to cause stepping magnet 79 to operate under control of relay 80 and to advance the switch D until the brush of arc D4 engages the tenth terminal which is grounded from the selector switch S2, the brush of which is standing on its second terminal at which time relays 76 and 73 operate in succession and cause relays 95, 96 and 97 to function to again sound the signals SG1, etc., and transmit a tone to the calling subscriber.

The brush of arc D3 advances from the tenth to the twelfth terminal as before described under control of relay 96 thereby sounding the signal devices twice after which relay 76 releases due to the brush of arc D3 moving off the eleventh terminal thereby opening the circuit to the signal devices and the tone circuit. The switch D, however, takes another step due to the relay 73 being held by the brush of arc D1 while the switch moves through its eleventh and twelfth positions thereby introducing a pause between the second

and third digit signals. When the brush of arc D1 moves off its twelfth terminal relay 73 releases thereby reclosing the self-interrupting circuit for stepping magnet 79 which advances switch D until the brush of arc D4 engages its fifteenth terminal which is grounded by switch S3 which is standing on its third terminal whereupon, as before, relays 76 and 73 operate to initiate operation of relays 95, 96 and 97.

The first three times relay 96 operates, the signal devices SG are sounded, tone is connected to the calling subscriber and the magnet 79 is energized to drive the switch D ahead one step. When the brush of arc D3 moves off its seventeenth terminal, relay 76 releases but the brush of arc D1 closed in its seventeenth position a holding circuit for relay 73 which held the circuit closed to continue the sequential operation of relays 95, 96 and 97. Due to the fact that the remaining terminals of arc D1 are strapped together relay 73 will remain operated and relays 95, 96 and 97 will continue to function to drive the switch D around until it passes off its last terminal whereupon the relay 73 releases. This stepping of the switch D over terminals 18, 19, 20, 21 and 22 of arc D1 provides a suitable pause between the third digit of the first code cycle and the first digit of the second code cycle.

When relay 73 releases the switch D, which now stands in its first position, again continues to advance under control of relay 30 and magnet 79 until the brush of arc D4 again reaches its first grounded terminal whereupon the circuit functions in the manner previously described to send out a second, third, fourth, and fifth cycle of code signals provided the called subscriber has not answered in the meantime.

Called party answers

When the called party hears his code signal and wishes to answer, he goes to any convenient nearby telephone of the private branch exchange, station B for example, and dials a certain predetermined code to cause a connector C2 to seize terminals connected to the trunk CT over conductors 110, 111 and 26. The sleeve brush of the connector C2 finds battery through resistance 27 and conductor 28 on the sleeve terminals and stops whereupon ringing current will be applied to the tip and ring conductors in the usual manner. Tripping relay 112 is connected in bridge of these conductors which trips the ringing and operates either on ringing current, the silent interval battery, or on the talking battery. In operating, relay 112 closes, at is contacts 113, an obvious circuit to operate relay 18 which latter relay closes its contacts 114 to operate relay 115 from ground at contacts 113 of relay 112. Relay 18 also locks at its contacts 116 to ground at contacts 117 of relay 20. By opening contacts 16 and 17 and closing its contacts 118 and 119, the battery supplied through relay 32 to trunk CT is reversed in polarity which, in the present example, performs no essential function, but is effective in case an incoming repeating tie trunk RTT, Fig. 1, has seized the code trunk CT through connector C3 to cause the incoming trunk to cut through into the talking condition. Relay 18 in operating also closes its contacts to connect a condenser across the midpoint of the left-hand winding of the transformer 122. Relay 18 also opens at its contacts 24 the operating circuit for relay 25 which relay, however, is held locked to ground supplied by the brush of arc D2 until the code circuit finishes the code cycle being transmitted. When the switch D reaches its last position of the cycle, relay 25 releases thereby opening its contacts 29 to release relay 30 and prevent further operation of switch D and further signaling.

Relay 115 in operating locks over its upper winding to ground at contacts 21 of relay 19 and releases relay 20 which opens its contacts 123 to remove the short circuit from the right-hand winding of repeating coil 122, opens the tone lead at its contacts 124, and opens at its contacts 117 the locking circuit for relay 18 which releases. The sleeve conductor 3 of the calling party is grounded at contacts 125 of relay 19 and also at contacts 126 of relay 112 so that the trunk CT will not be reseized by another connector until both the calling and called stations have disconnected. The calling and called subscribers are now connected in a conversational circuit.

Called party fails to answer

If the called party fails to answer before five complete rounds of the code have been sounded, the code signalling circuit is disabled and the attendant (Fig. 3) is signaled to come in on the trunk CT to talk to the calling party.

It will be noted that when switch D made its first revolution thereby sending out the first round of the code, relay 127 operated when the brush of arc D5 engaged the next to the last terminal of the arc thereby completing a circuit to operate relay 127 which can be traced from ground at contacts 87 of relay 30, conductor 86, brush of arc D5, conductor 128, contacts 129 and winding of relay 127 to battery. Relay 127 locks up to ground at contacts 87 of relay 30 and closes its lower contacts to connect relay 130 to conductor 131 which is connected to the twelfth terminal of arc D5 and therefore when the switch D makes a second revolution and the brush of arc D5 engages this terminal, relay 130 operates to lock in multiple with relay 127 and prepares a circuit for relay 132 which is closed when switch D makes a third revolution and the brush of arc D5 engages its eleventh terminal. In a like manner relays 133 and 134 operate in succession as the switch D makes successive revolutions and the brush of arc D5 engages its terminals 6 and 5. When relay 134 operates, it closes its lower contacts thereby connecting relay 69 to conductor 128 which terminates on the next to the last terminal 21 of the arc D5 and therefore when the switch D arrives in that position, ground is connected, as before, to this conductor and relay 69 operates thereby opening its contacts 68 to disable the stepping of switch D and causing its brushes to remain in position 21. Relay 69 also closes its contacts 135 thereby connecting ground to conductor 136 which extends over contacts 137 of relay 25, conductor 138, contacts 139 of relay 10 (Fig. 3), contacts 140 of relay 13, to battery through lamp 141 at the private branch exchange attendant's position.

Upon noting lighted lamp 141 the attendant plugs into the talk jack 142 with one of her cord circuits thereby operating relay 13 over the auxilary contacts 143 of the talk jack. Relay 13 opens at its contacts 140, the circuit for the lamp 141, grounds the sleeve of jack 142 by closing contacts 144 and by closing its contacts 145 operates relay 18 in a circuit including contacts 146 of relay 7 and conductor 147.

Relay 18 in operating opens its contacts 24 to release relay 25 and closes its contacts 114 to operate relay 115 which relay locks up to relay

19. Relay 15 opens its uppermost contacts to release relay 20. The release of relay 25 opens its contacts 29 thereby releasing relay 30 and preventing further operation of switch D. Relay 18 remains operated under control of contacts 143 of jack 142 which are closed as long as the cord circuit is connected to the trunk. The operator now talks with the calling subscriber. When both calling subscriber and operator have disconnected, relays 7, 13, 15, 19 and 115 release and the circuit restores to normal.

Non-existent code

If the subscriber calls a number containing a digit higher than the limits for which the system is set, which in the present example is 5, all the terminals above 5 of switches S1, S2 and S3 are connected together and to relay 69 whereby if a number containing the digit 6, for example, is dialed as soon as the particular switch S1, S2 or S3 passes out of its fifth position, relay 69 will operate to prevent the operation of the signals SG and to call in the attendant as previously described.

Code call originated by attendant

The attendant may initiate a code call by plugging one of her cord circuits, L1 for example, into the talk jack 142, and the calling end of another pair of cords L2 equipped with a dial, into the dial jack 148.

When the cord L1 is plugged into jack 142, relay 13 operates in the following circuit, battery, winding of relay 13 and contacts 143 of the jack to ground at contacts 149 of relay 7. Relay 13 grounds the sleeve of the jack and cord and closes at its contacts 150 a bridge including impedance coil 151 across the trunk to operate the line relay 15 in the code signaling equipment. When a plug of another cord circuit L2 is connected to jack 143, relay 10 operates from the sleeve of the plug over the auxiliary contacts of the jack and contacts 152 of relay 7. Relay 10 in operating disconnects, at its contacts 153 and 154, the tip and ring of the jack 142 from the trunk CT and closes its contacts 155 and 160 to operate relay 156 if the dial key of the cord circuit is operated in a circuit from ground, upper winding of relay 15, contacts 16 of relay 18, upper left winding of transformer 122 and the tip conductor of the trunk CT, contacts 155 of relay 10, lower winding of relay 156, tip spring of jack 148, through the closed contacts of the dial, back over the ring of the jack, contacts 160 of relay 10, ring conductor of the trunk, lower left winding of transformer 122, contacts 17 of relay 18, and lower winding of relay 15 to battery. Relay 156 locks up over its upper winding and contacts 157 to ground at contacts 158 of relay 10 and by closing its contacts 159 short circuits its lower winding thereby removing the resistance of this relay winding from the pulsing circuit which includes relay 15. Relay 156 in operating also opens at its lower contacts the bridge including impedance coil 151 connected across the trunk when relay 13 operated. This, however, does not release relay 15 as that relay is now held operated under control of the dial contacts of the cord L2.

The attendant now operates her dial to transmit the desired code pulses and when the dialing is completed and the called party answers to operate relay 112, relay 18 operates, to connect, at its contacts 161, the impedance coil 162 across the tip and ring of the jack 142 to extinguish the supervisory lamp in the cord circuit L1. Removal of both cords L and L2 from their respective jacks permits the circuit to restore to normal.

Emergency interception by attendant

If the attendant wishes to use the code call circuit in an emergency which is indicated busy by the lighted condition of the busy lamp 164, she may plug into the jack 142 with a cord circuit and talk to the parties in conversation requesting them to disconnect. The attendant then withdraws the plug of her cord circuit and waits for the busy lamp 164 to be extinguished which indicates that the code call circuit is now idle after which she may originate a code call in the manner previously described.

Time interval between digits of the code sounded and between successive repetitions of the code

It will be noted that the movement of switch D is very rapid while driven by the operation and release of relay 80 and at a relatively much slower rate by the sequential operation of relays 95, 96 and 97 and therefore the pause between digits of the code and also between successive repetitions of the code is determined by the movement of the brush of arc D1 over the bridged terminals 6, 12 and 18 to 22 and substantially independent of the time consumed in the rapid movement of switch D under self-interruption, i. e., by the operation and release of relay 80.

What is claimed is:

1. In a telephone system, automatic switches, a code selecting switch accessible to said automatic switches, signal devices, means for controlling said code switch from said automatic switches to repeatedly operate said signal devices in accordance with a predetermined code and to disable said code switch when said signals have repeated said code a predetermined number of times.

2. In a telephone system, automatic switches, an operator's position, a code selecting switch accessible to said automatic switches and position, a signal device at said position, other signal devices, means for controlling said code switch from either said automatic switches or operator's position to repeatedly operate said other signal devices in accordance with a predetermined code, and means for disabling said code switch when said code has been repeated a predetermined number of times and to actuate said position signal when an automatic switch has control of said code switch.

3. In a code calling system, automatic switches, a plurality of code register switches accessible to said automatic switches, pulse transmitting means for controlling said automatic switches and seize control of said register switches and to thereafter sequently set said register switches in accordance with a predetermined code, a selector switch, signal devices controlled thereby, means responsive to the setting of the last register switch to cause said selector switch to cyclically operate said signal devices in accordance with the code pulses registered, and means for introducing a substantially uniform time delay between the digit operations of said devices regardless of the number of operations representing each digit and other means for introducing a different uniform delay between each operation cycle regardless of the number of operations representing the last digit of one cycle and the

number of operations representing its first digit of the succeeding cycle.

4. In a telephone system, automatic switches, an operator's position, a code sending switch accessible to both said automatic switches and to said operator's position, signal devices, means for controlling said code switch from said automatic switches to repeatedly operate said signal devices in accordance with a predetermined code, and means for controlling said code switch from said operator's position to operate said signals independent of said automatic switches.

5. In a telephone system, automatic switches, an operator's position, a code sending switch accessible to both said automatic switches and said operator's position, first signal devices, means for controlling said code switch from said automatic switches and repeatedly operate said first signal devices in accordance with a predetermined code, means for controlling said code switch from said operator's position to operate said signal devices independent of said automatic switches, a visual signal device located at said operator's position, and means responsive to seizure of said code switch by said automatic switches to display said visual signal.

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