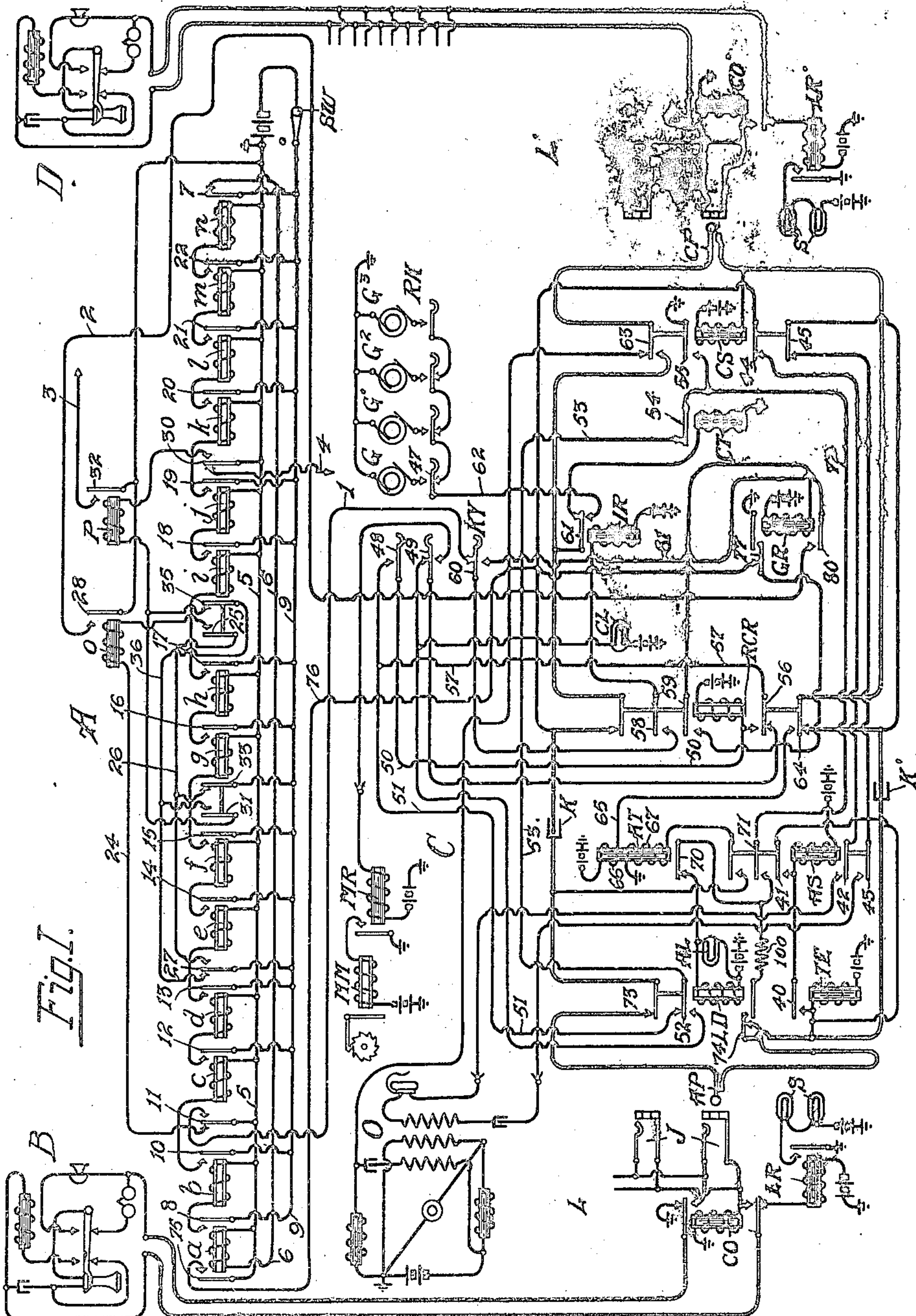


Jan. 2, 1923.

1,440,365

R. W. AUGUSTINE.
TELEPHONE SYSTEM.
FILED JULY 31, 1916.

2 SHEETS-SHEET 1



WITNESSES:
G. A. Janochowski.
W. Berghahn.

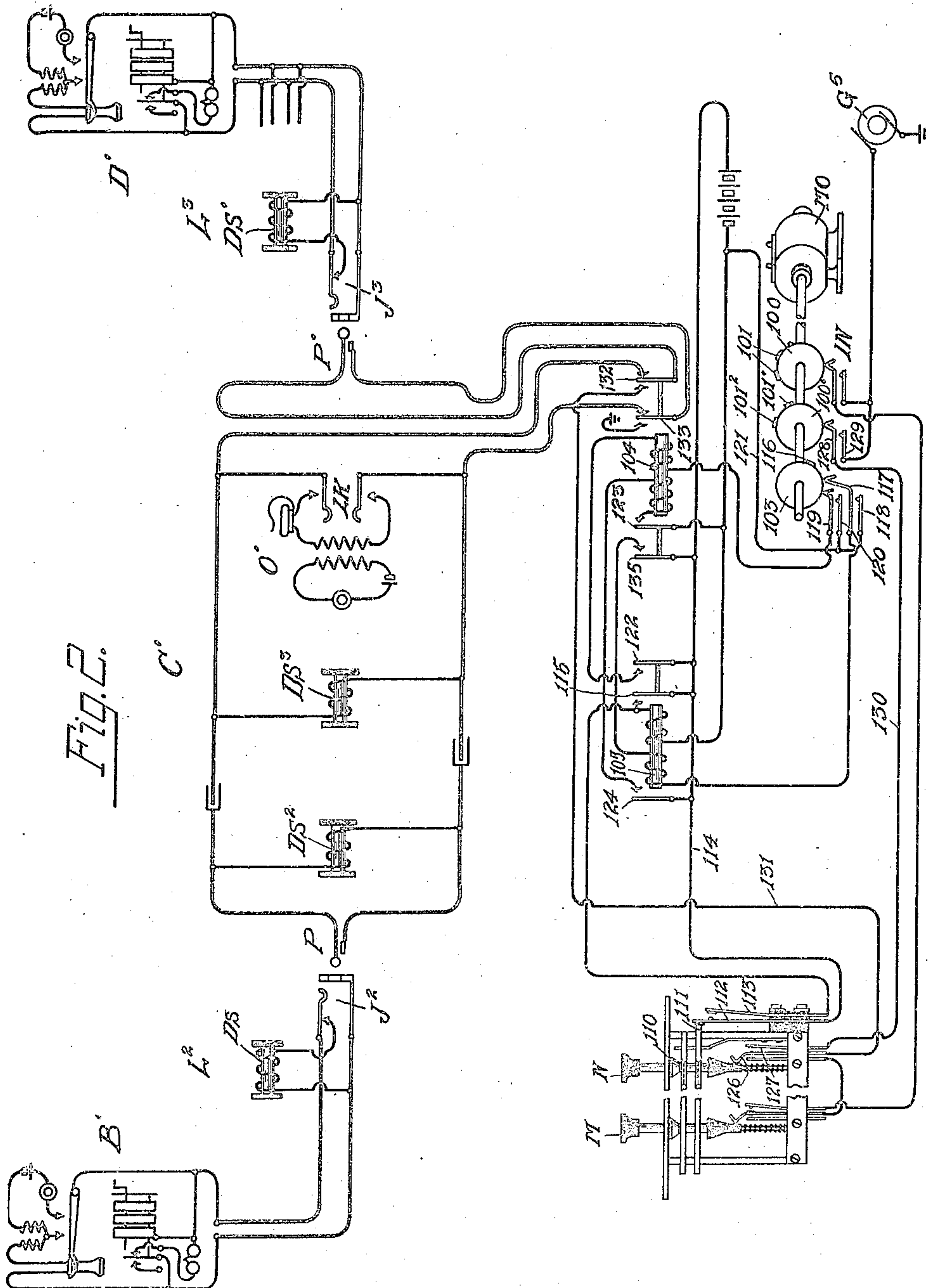
Inventor:
Roy W. Augustine.
By Curtis B. Camp.
Attorney

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2 SHEETS-SHEET 2



Witnesses:
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Inventor:
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By Curtis B. Camp
Attorney.

UNITED STATES PATENT OFFICE.

ROY W. AUGUSTINE, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

Application filed July 31, 1916. Serial No. 112,242.

To all whom it may concern:

Be it known that I, ROY W. AUGUSTINE, a citizen of the United States of America, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to code ringing apparatus such as is used in connection with telephone systems to code ring the different stations upon a polystation line.

In telephone systems wherein so-called code ringing apparatus is used, it has been customary to manually code ring the substation upon the polystation lines, but this method is slow and inaccurate as the different operators differently transmit the same code ring. To overcome this inaccuracy, I have arranged a device to automatically transmit the code rings with no other duty necessary on the part of the operator than to select the required code. I have arranged a mechanically operated device to perform the above-mentioned function where the exchange is of a size to provide a constantly operating device, and I have also arranged an electromagnetically operated device for use in exchanges where it is found desirable to use the same.

The principal object of my invention is to provide a simple, compact and comparatively inexpensive device to automatically code ring the substations upon a polystation telephone line. It is a further object of my invention to provide means for insuring that the signaled substation will receive the full code ring, no matter in what position the sending apparatus may be in at the time that the operator selects the desired code. These and other objects of my invention will appear in the ensuing specification and will be more particularly out in the appended claims.

For a more complete understanding of my invention, reference may be had to the accompanying drawings in which—

Fig. 1 illustrates a relay interrupter for code ringing operating in connection with a common battery cord circuit and

Fig. 2 illustrates a modified device, in-

cluding a mechanically controlled device for automatic code ringing, and adapted to be used in connection with magneto lines.

Referring now in general to my invention as illustrated, and referring particularly to Fig. 1, I show an interrupter circuit A in its unactuated position and it comprises 16 relays, *a* to *p* inclusive. The relays *a* to *n* are slow-acting relays, that is, slow to release their armatures upon de-energization, while relays *o* and *p* are quick-acting relays. I also show interrupter leads 1, 2, 3 and 4 connected with these relays, and with this arrangement it is possible to install eight parties on one subscriber's line and have them rung selectively, that is, by using four current generators of different frequencies four parties will be given one ring selectively and four parties will be given two rings selectively. The operation of the interrupter device will be more particularly pointed out in the ensuing specification.

To further illustrate my invention, I have shown a cord circuit C for interconnecting two subscribers' lines B and D which terminate respectively in line circuits L and L'. The line circuit L comprises the usual line relay LR, cut-off relay CO, multiply connected jacks J, and a line signal S for each jack. The jacks J are distributed among the different operators' positions so that when a call is initiated over any line the line signals S are lighted, and any one of a plurality of operators may seize the call to the exclusion of the other operators. The line circuit L' is similar to that of L bearing the same reference characters, but with the suffix prime added.

The cord circuit C comprises the usual answering plug AP and the calling plug CP, the two plugs being connected by the heavily marked tip and sleeve conductors which have the condensers K and K' interposed. At the answering end of the cord circuit, I provide a comparatively high resistance test relay TR which is connected to the sleeve strand and energized when the answering plug AP is inserted into an answering jack, thereby connecting the answering sleeve supervisory relay AS to the sleeve conductor.

With this arrangement the first operator to answer a call seizes it to the exclusion of any subsequent operator, that is, when the first plug AP is connected to a calling line the sleeve relay AS associated therewith is connected to the sleeve strand and should a second operator attempt to seize this call, the high resistance test relay TE of the second cord circuit cannot operate, and this prevents the second operator from connecting to this line. An answering tip supervisory relay AT is also associated with the answering end of the cord and is connected to the tip strand. The said relays AS and AT control the answering supervisory signal AL. I also provide an instantaneous disconnect and recall arrangement including a link disconnect LD so that should a calling subscriber desire to recall, as soon as his receiver has been replaced and prior to the disconnection of the operator's cord C from his line, the replacing of his receiver energizes the link disconnect relay LD thereby disconnecting relays AT and AS so that the removal of his receiver will again operate his line lamp S and the recall may be seized by the same or a different operator.

Associated with the calling end of the cord circuit C, I provide a calling sleeve relay CS and a calling tip supervisory relay CT which are operated in a well-known manner, the two relays controlling the calling supervisory signal CL. Automatic party line ringing is also provided, and to this end I have provided a party line key RK together with ringing generators G, G¹, G² and G³ and a ringing control relay RCR which is energized when a plunger of the ringing key RK is actuated. An interrupter relay IR is also provided for alternately connecting ringing generator and the calling tip relay CT to the called line. A call register is also provided comprising a meter relay MR and a meter magnet MM which are controlled through the common contacts of the ringing key RK. Automatic listening and disconnect of the operator's set O is also provided, the operator's set being connected to the cord conductors by the answering sleeve relay AS when connection is made to a calling line and again disconnected by the operation of the calling sleeve relay CS when connection is extended to a called line.

For the purpose of describing my invention, it will be assumed that the interrupter circuit A is associated with a twelve-position switchboard equipped with cord circuits as C. The interrupter A has four interrupter leads, 1, 2, 3 and 4 controlled by the operation of different connecting relays in the interrupter circuit, and are multiply connected to different positions of the switchboard preferably as follows: The lead 1 is common to the cord circuits C of the first, third, fifth, seventh, ninth and eleventh

positions, and lead 2 is also common to the first, third, fifth, seventh, ninth and eleventh positions. Lead 3 is common to the second, fourth, sixth, eighth, tenth and twelfth positions, and lead 4 to the second, fourth, etc., positions. I distribute the leads as above described to equalize and evenly distribute the load. It is to be understood, however, that my invention is not limited to this exact method of grouping but that it is broader in scope and the interrupter leads may be associated with the link circuits in any desirable manner.

The interrupter circuit A is constantly operating but may be shut off by the switch SW in the battery lead. I will now describe one complete cycle of operation of the interrupter circuit A. Assuming that the apparatus is in normal position, as illustrated, a circuit for the relay *a* is established, when the switch SW is closed, traced from ground over the conductor 5, through winding of relay *a*, conductor 6, and through normal contact 7 of relay *a* to battery. The energization of the relay *a* closes a circuit for the relay *b*, traced from ground over the conductor 5, through winding of relay *b*, alternate contact 8 of relay *a*, and conductor 9 to the other side of battery. The energization of the relay *b* establishes an energizing circuit for relay *c* traced from ground over conductor 5, through winding of relay *a*, alternate contact 10 of relay *b*, and conductor 9 to the other side of battery. The closing of alternate contact 11 of relay *c* connects interrupter lead 1 in operative relation with the ringing apparatus of its associated cord circuits. The closure of alternate contact 12 of relay *c* establishes a circuit for relay *d*, traced from ground over conductor 5, through winding of relay *d*, alternate contact 12 of relay *c*, and conductor 9 to the other side of battery. The energization of relay *d* establishes an energizing circuit for relay *e* traced from ground over conductor 5, through winding of relay *e*, alternate contact 13 of relay *d*, and conductor 9 to the other side of battery. The energization of relay *e* establishes an energizing circuit for relay *f* traced from ground over conductor 5, through winding of relay *f*, alternate contact 14 of relay *e*, and over conductor 9 to other side of battery. The energization of relay *f* establishes an energizing circuit for relay *g* traced from ground, over conductor 5, through winding of relay *g*, alternate contact 15 of relay *f*, and over conductor 9 to the other side of battery. The energization of relay *g* establishes an energizing circuit for relay *h* traced from ground over conductor 5, through winding of relay *h*, alternate contact 16 of relay *g* and conductor 9 to the other side of battery. The energization of relay *h* establishes a circuit for relay *i* traced from

ground over conductor 5, through winding of relay *i*, alternate contact 17 of relay *k*, and over conductor 9 to the other side of battery. The energization of relay *i* establishes an energizing circuit for relay *j* traced from ground over conductor 5, through winding of relay *j*, alternate contact 18 of relay *i*, and over conductor 9 to the other side of battery. The energization of relay *j* establishes an energizing circuit for the relay *k*, traced from ground over conductor 5, through winding of relay *k*, alternate contact 19 of relay *j*, and over conductor 9 to the other side of battery. The energization of relay *k* establishes an energizing circuit for relay *l* traced from ground over conductor 5, through winding of relay *l*, alternate contact 20 of relay *k*, and over conductor 9 to the other side of battery. The energization of relay *l* establishes an energizing circuit for relay *m*, traced from ground over conductor 5, through winding of relay *m*, alternate contact 21 of relay *l*, and over conductor 9 to the other side of battery. The energization of the relay *m* establishes an energizing circuit for the relay *n* traced from ground over conductor 5, through winding of relay *n*, alternate contact 22 of relay *m*, and over conductor 9 to the other side of battery. Thus all of the relays *a* to *n* are energized having come up successively, but, of course, in the fraction of a second. The energization of the relay *n* brings about the opening of normal contact 7 and the opening of the said contact 7 interrupts the circuit of the relay *a* which slowly restores to normal. The relay *a* restoring, opens its alternate contact 8, opening the energizing circuit of relay *b* and the restoration of relay *b* brings about the opening of its alternate contact 10 which opens the circuit of the relay *c*. The relay *c*, upon restoration, opens its alternate contact 11 disconnecting the interrupter lead 1, interrupter lead 1 having been in operative relation with its associated cord circuits, while relays *c* to *n* were being energized and while relays *a*, *b* and *c* are de-energizing. The closing of normal contact 11 upon the restoration of relay *c*, establishes an energizing circuit for relay *o* traced from ground over conductor 5, through normal contact 11 of relay *c*, conductor 24, winding of relay *o*, alternate contact 25 of relay *i*, conductor 26 to alternate contact 27 of relay *e*, and conductor 9 to the other side of battery. Relay *o* energizing closes its alternate contact 28 thereby placing interrupter lead 2 in operative relation with its associated cord circuits. The opening of alternate contact 12, upon de-energization of relay *c*, brings about the restoration of the relay *d* and the opening of alternate contact 13 of relay *d* brings about the restoration of the relay *e*. The opening of alternate contact 27 of relay *e*

brings about the de-energization of relay *o*, and relay *o* restoring to normal, opens its alternate contact 28 to disconnect interrupter lead 2 from its associated cord circuits. The closing of normal contact 27 of relay *e* establishes an energizing circuit for relay *p* traced from ground over conductor 5, through alternate contact 30 of relay *k*, winding of relay *p*, alternate contact 31 of relay *g*, conductor 26, normal contact 27 of relay *e*, and conductor 9 to the other side of battery. The closing of alternate contact 32 of relay *p* connects interrupter lead 3 with its associated cord circuits. The opening of alternate contact 14 of relay *e*, upon its de-energization, brings about the restoration of the relay *f* and the opening of alternate contact 15, upon restoration of relay *f*, brings about the de-energization of relay *g*. The opening of alternate contact 31 of relay *g* interrupts the energizing circuit of relay *p* bringing about its de-energization and the opening of alternate contact 32, thereby disconnecting the interrupter lead 3. The closing of normal contact 33 of relay *g*, upon its de-energization, again establishes an energizing circuit for relay *o* traced from ground over conductor 5, normal contact 11 of relay *c*, conductor 24, winding of relay *o*, alternate contact 25 of relay *i*, conductor 26, normal contact 33 of relay *g*, and conductor 9 to the other side of battery.

The closing of alternate contact 28 of relay *o* again connects the interrupter lead 2 with its associated cord circuits. The opening of alternate contact 16, upon restoration of relay *g*, brings about the restoration of the relay *h*, and the opening of its alternate contact 17 brings about the restoration of the relay *i*. The opening of alternate contact 25, upon restoration of relay *i* brings about the restoration of the relay *o* and the opening of alternate contact 28 of relay *o*, again disconnects interrupter lead 2. The closing of normal contact 35, upon restoration of relay *i*, establishes an energizing circuit for relay *p* traced from ground over conductor 5, through alternate contact 30 of relay *k*, coil of relay *p*, back contact 35 of relay *i*, conductor 36, normal contact 27 of relay *e*, and conductor 9 to the other side of battery. The closing of alternate contact 32 of relay *p* again connects interrupter lead 3 with its associated cord circuits. The opening of alternate contact 18, upon de-energization of relay *i*, brings about the de-energization of the relay *j* and the opening of alternate contact 19 of relay *j* brings about the restoration of the relay *k*. The opening of normal contact 30 of relay *k* again interrupts the circuit of relay *p* and the opening of alternate contact 32 of relay *p*, when it de-energizes, disconnects the interrupter lead 3 from its associated cord circuits. The closing of normal contact 30

of relay k connects the interrupter lead 4 with its associated cord circuits. The opening of alternate contact 20 of relay k upon its de-energization, brings about the de-energization of the relay l and the opening of alternate contact 21 of relay l brings about the de-energization of the relay m , and the opening of alternate contact 22 of relay m brings about the de-energization of the relay n . The relay n , upon restoring to normal, again closes its normal contact 7 to again bring about another cycle of operation of the interrupter A. The interrupter lead 4 remains in operative relation with its associated cord circuits while relays k to n inclusive restore to normal and relays a to k inclusive again operate. Upon the operation of the relay k its normal contact 30 is opened to disconnect the interrupter lead 4 from its associated cord circuits. The relays continue to perform the above cycle of operation and maintain an automatic sequential energization and de-energization thereof at predetermined intervals.

I will now describe the interrupter circuit A operating in connection with the cord circuit C which I will assume is one of the plurality of cord circuits of the first position with which the interrupter leads 1 and 2 are common. Assuming now that a call is initiated at substation B by the removal of the receiver thereat, line relay LR is energized over the calling line effecting the operation of the line signals S. An operator upon noting the glowing of the signals inserts an answering plug AP into a jack J of the calling line thereby connecting relays TE and CO in series and causing the energization of TE but not that of CO. Relay TE, upon energizing connects the sleeve relay AS to the sleeve conductor of the cord circuit C through alternate contact 40 of relay TE, causing the energization of relay AS and CO in series followed by the energization of the tip relay AT over the calling line. Relay AS upon energizing, closes its alternate contact 41 effecting a locking circuit for itself through the sleeve conductor independent of the alternate contact 40. The closing of alternate contacts 42 and 43 of the relay AS connects the operator's set O in circuit with the cord circuit C through alternate contacts 44 and 45 of the calling sleeve relay CS.

Before proceeding further with the description of the connection, we will refer briefly to the arrangement for excluding operators who may subsequently connect to this same line. Assuming that a second operator inserts a plug AP into another jack J of this calling line after the insertion of the first plug, this second operator's telephone will not be connected to this calling line due to the fact that the test relay TE

of the second cord will not become energized because of the circuit established through the comparatively low resistance relay AS of the cord. Therefore, the sleeve relay AS of the second cord does not energize and the second operator receiving no reply knows that the call has been seized.

Again taking up the first connection above referred to, the first operator to seize the call inquires the wants of the calling subscriber A and assuming that it is the substation D which is wanted, the operator of the cord circuit C tests a multiple jack of the called line D, as to its idle or busy condition. Should the line be busy the operator receives the customary busy click in her head receiver. Assuming that the line of the called substation D is idle, the operator inserts the calling plug CP into a multiple jack J of the wanted line, bringing about a series energizing circuit for the sleeve supervisory relay CS and the cut-off relay CO¹ of the line circuit L¹ traced from battery through the winding of the relay CS, the sleeve contacts of the connected plug and jack, and through the winding of the relay CO to ground. The opening of normal contacts 44 and 45 disconnects the operator's set O from the cord circuit C.

A key KY is provided which is used when a subscriber on a party line is rung selectively by two rings. If a subscriber on the party line is rung selectively by one ring, the key KY is not actuated by the operator but remains normal as illustrated. Should the called subscriber on a party line be rung selectively by two rings, the key is moved to its alternate position for purposes as will be more fully described in another part of the specification. The operator now fully depresses the proper ringing plunger of the party line ringing key RK and assuming that it is the plunger 47 which is depressed, the end springs 48 and 49 immediately assume their alternate positions, the spring 48 closing an energizing circuit for the ringing control relay RCR, traced from battery through the winding of the said relay, conductor 50, alternate contact 48 of the end spring, conductor 51, normal contact 52 of the relay LD, conductor 53, and normal contact 54 of the calling tip supervisory relay CT to ground at alternate contact 55 of relay CS. Although the circuit of the relay RCR is interrupted at contact 48 when the operator removed pressure from the actuated plunger, the relay RCR remains locked up over a circuit extending from battery, through alternate contact 56 of relay RCR, conductor 57, conductor 51, normal contact 52, conductor 53, and normal contact 54 of relay CT to ground at alternate contact 55 of relay CS. Upon the energization of the relay RCR, the alternate contact 58 is closed which connects

the interrupter lead 1 of the interrupter circuit A with the interrupter relay IR of the cord circuit C. The closing of alternate contact 59 of relay RCR brings about the energization of the guard relay GR, but the operation of this relay is only incidental when a subscriber of the called line is rung selectively with one ring as will be more fully hereinafter described.

Assuming that the relay α of the interrupter circuit A is in its energized position, as previously described, and its alternate contact 11 closed, an energizing circuit for the relay IR is established. It is to be noted that the conductor 1 is connected with the same side of the exchange battery as is interrupter relay IR and the circuit of the said relay is traced from ground through the alternate contact 11 of relay α , the interrupter lead 1, the normal contact 60 of the key KY, alternate contact 58 of relay RCR, and through the winding of the interrupter relay IR to battery. Upon the energization of relay IR, its alternate contact 61 is closed which connects ringing current to the called line from the ungrounded pole of the generator G, through the alternate contact 47 of the springs of the depressed ringing plunger, the ringing lead 62, alternate contact 61 of relay IR, alternate contact 63 of relay CS, tip contacts of the connected plug and jack, alternate contact of the cut-off relay CO through the condenser and call bell of the called substation D, the alternate contact of the relay CO, sleeve contacts of the connected plug and jack, alternate contact 64 of relay RCR, conductor 65, and through the winding 66 of relay AT to battery. The winding 66 of relay AT is of few turns and of low resistance, and the ringing current passing through this winding induces current into the winding 67 of the relay AT, thus giving an audible signal to the calling subscriber at substation B notifying him that the party wanted is being rung. The relay IR is energized each time the interrupter lead 1 is connected to ground through alternate contact 11 of the relay α , thus connecting ringing current to the wanted line for substantially one second of time, and allowing a silent interval of about three and two thirds seconds time. When the called subscriber answers, an energizing circuit for the relay CT is established over the line, thereby causing said relay to energize and open its normal contact 54, which interrupts the locking circuit of the relay RCR allowing the said relay to de-energize and open the circuit of the relay IR at the alternate contact 58. The opening of alternate contact 58 disconnects the lead 1 from relay IR and prevents it from again operating. The subscriber at the substation B and the subscriber at substation D

are now in conversational circuit, the talking circuit being traced over the heavily marked conductors. When conversation has been completed and the receivers have been replaced on their respective switch-hooks, the relays CT and AT de-energize to bring about the lighting of the supervisory signals AL and CL whereupon the operator withdraws plugs AP and CP from the jacks J and J', restoring the apparatus of the cord and line circuits to normal.

Should the subscriber at the substation B wish to recall before disconnection has taken place, the replacement of the receiver thereat brings about the energization of the link disconnect relay LD, its circuit being traced from battery through the winding of the said relay, normal contact 70 of the now normal answering tip supervisory relay AT, the alternate contact 71 of relay AS, and conductor 72 to ground at alternate contact 55 of relay CS. The series circuit of answering supervisory relay AS and cut off relay CO is opened upon the energization of relay LD, but due to the make before break contact 74 of relay LD a substitute circuit is established for relay AS traced from battery, through the winding of relay AS, alternate contact 74 of relay LD, resistance 100, alternate contact 71 of relay AS, conductor 72 to ground at alternate contact 55 of relay CS. The relay AS being of one hundred ohm resistance, the substitute circuit which includes the resistance 100 prevents an excess battery flow through the relay AS. Upon the energization of the relay LD, the contacts 73 and 74 of said relay assume their alternate positions opening the cord conductors, allowing the relay CO to restore; the relay CO restoring to normal places the relay LR of the line circuit L in operative relation with the subscriber's line and the removal of the receiver at the substation B for a recall brings about the energization of the said relay LR, which energization lights the line signals S. The recall may then be seized by the same operator or by another operator.

Assuming now that a called subscriber as D is one that requires a code ring of two rings, the operation of the circuit of the cord circuit C is the same as previously described, up to and including the actuation of the relay RCR. The relay GR is actuated each time the interrupter circuit A starts a cycle of operation due to the closure of alternate contact 75 of relay α , the circuit for relay GR being traced from ground through alternate contact 75 of said relay α , conductor 76, normal contact 77 of relay GR, alternate contact 59 of relay RCR, and through the winding of the relay GR to battery. The relay GR, upon energizing, closes a locking circuit for itself traced from battery through the winding of the

said relay, the alternate contact 59 of relay RCR, and the alternate contact 77 of relay GR to ground. The operator now actuates the key KY to close its alternate contact 60 and assuming that the operator has actuated the said key KY at the beginning of a cycle of operation, the interrupter lead 2 will be connected and disconnected twice as previously described in connection with the interrupter circuit A. The first energizing circuit for the relay IR extends from ground through alternate contact 28 of relay *o*, the interrupter lead 2, the alternate contact 80 of relay GR, conductor 81, alternate contact 60 of key KY, alternate contact 58 of relay RCR, and through the interrupter relay IR to battery. The first period of energization of the relay IR connects the ringing lead 62 through alternate contact 61 of relay IR to ring the call bell of the called subscriber at substation F, as described in the previous connection. The second period of energization of the relay IR is brought about upon the energization of the relay *o* of the interrupter circuit A when the relay *c* of said interrupter circuit A is restored to normal. Interrupter relay IR is again energized over the circuit previously traced to connect the ringing lead 62 to the called line, to operate the call bell of the called subscriber D a second time. Now should the operator depress the key after the interrupter lead 2 has been operatively associated with the cord circuit C once, no actuation of the interrupter relay IR will be brought about, due to the fact that the interrupter lead 2 is connected to the cord circuit C after the first relay *a* of the series has de-energized, and therefore no energizing circuit for the relay GR of the cord circuit C can be established. It is thus readily apparent that the code ring cannot be transmitted until the apparatus is in a position to transmit a full code signal.

I have found by experiment that by timing the relays *a* to *n* of interrupter circuit A so that one cycle of the operation occurs in about four and two-thirds seconds very satisfactory results can be obtained. This places the lead 1 in operative relation with its associated cord circuits, during the period relays *d* to *n* are energized and relays *a*, *b* and *c* are de-energizing due to the energization of relay *n* which energization opens its normal contact 7. This places the interrupter lead 1 in operative relation with its associated cord circuits for a period of one second of time, and off for three and two-thirds seconds until a new cycle is again completed as is well understood. The interrupter lead 2 is placed in operative relation with its associated cord circuits for its first period by the de-energization of relay *c* which de-energization operates relay *o*, the said relay *o* remaining energized while relays *c* and *e* are de-energizing, thus placing the lead 2 in operative relation for its first period for two-thirds of a second of time. The de-energization of the relay *e* brings about the energization of relay *p* which places lead 3 in operative relation with its associated cord circuits for the first period while relays *f* and *g* are de-energized which places lead 3 in operative relation for its first period of two-thirds of a second of time. The de-energization of relay *g* again causes the operation of relay *o* to place the lead 2 in operative relation with its associated cord circuits for a second period while relays *h* and *i* are de-energized thus placing lead 2 in operative relation for its second period for two-thirds of a second of time. The lead 2 will thus be connected for two-thirds seconds for its first period and off for two-thirds seconds, while lead 3 is connected for two-thirds of a second for its first period. The lead 2 is again connected for two-thirds seconds while lead 3 is disconnected for two-thirds seconds of time. Thus interrupter lead 2 is disconnected for two and two-thirds seconds of time until another cycle of operation for said interrupter lead 2 is started. Upon the de-energization of relay *i*, another operation of the relay *p* is brought about to place the lead 3 in operative relation with its associated cord circuits for its second period, while relays *j* and *k* are de-energized thus placing lead 3 in operative relation for a second period of two-thirds of a second. The lead 3 will thus be connected for two-thirds seconds, then disconnected for two-thirds seconds for its second period, again connected for two-thirds seconds and then disconnected for two and two-thirds seconds of time, until another cycle for the interrupter lead 3 is started. The de-energization of relay *k* places lead 4 in operative relation with its associated cord circuits while relays *l*, *m* and *n* restored and relays *a* to *k* again operate during the next cycle thus placing the lead 4 in operative relation for about one second of time and disconnecting it for about three and two-thirds seconds. From the foregoing, it is apparent that I may arrange the apparatus to transmit various codes containing any desired combination and of any duration of time.

Referring now to Fig. 2, I show a mechanical interrupter arrangement operating in connection with magneto lines. Each magneto line of an exchange is generally equipped with a plurality of subscribers' substations and code ringing is used as is well known in the art, such as one ring, two rings, one long and one short ring, etc. My invention is most particularly directed to code ringing as just described and I provide at the exchange a plurality of keys M, N,

etc., individual to each cord circuit of the exchange, there being as many keys as there are codes to be rung. The keys have a normal, indicating and fully depressed position, and a key which has been fully depressed is restored to its indicating position as is readily apparent from the inspection of the drawing. I also provide an interrupter device IN which is common to the exchange, said device IN being provided with a plurality of disks 100, each of these disks being provided with a different number or combination of projections 101 to control the different code rings, as will hereinafter be more particularly pointed out. The disks 100 are suitably mounted on a shaft, the said shaft being constantly driven by a suitable motor MO. The projections 101 on the different disks 100 in their rotation engage suitable springs, said springs being normally open but when engaged, by the projections, the spring contacts are closed to transmit code ringing current to the called subscriber's substation bell. The character of the code is dependent upon which key, M, N, etc., is depressed. A disk 103 is provided which presents the splitting up of a code ring should a key be depressed after a code has been started, that is, after a projection 101 on a disk 100 has passed its associated spring, thus preventing false code rings from being transmitted to the called substation. My invention, of course, is not limited to the number of code disks or the character of the code, as it is readily apparent that any number of code disks of any desired character may be used. I also provide two relays 104 and 105, the relays being individual to the cord circuit. The operation of the relays will hereafter be more fully described.

To further illustrate my invention, I have shown a magneto cord circuit C¹ for interconnecting magneto subscribers' lines as B¹ and D¹ which terminate respectively in the line circuits L² and L³. The line circuit L² comprises a combined jack J² and visual signal or drop DS. Line circuit L³ is similar to that of L² and comprises the usual combined jack J³ and drop signal DS¹. Magneto cord circuit C¹ comprises the answering and calling plugs P and P¹ and the usual clearing-out drops DS² and DS³. I also show a listening key LK which, when actuated connects the operator's set O¹ to the cord conductors so that she may inquire the wants of the calling subscriber.

Having described in general the apparatus of Fig. 2, I will now describe the operation of the circuit more in detail. The subscriber at the substation B¹ desiring a connection, operates the hand generator at the substation to throw the drop signal DS at the exchange which drop in actuating signals the operator. The operator associated with the cord circuit C¹ noting the actuated drop, in-

serts plug P into jack J² of the calling line and then throws her listening key LK to connect the operator's set O¹ to inquire the wants of the calling subscriber. The insertion of the plug P into the jack J² restores the drop signal DS and disconnects it from the line conductors.

Assuming that it is the subscriber at D¹ that is wanted, the operator inserts the calling plug P¹ into the jack J³ of the wanted line, and assuming further that the character of the code ring to signal substation D¹ is two long rings, the operator depresses the key N to its fully depressed position, which act causes the cam 110 of the key plunger to move the cam plate 111 to momentarily close the end springs 112 and 113. The momentary closure of these two contacts establishes an energizing circuit for relay 105, its circuit being traced from battery through the right hand winding of the relay 105, momentarily closed contacts 112 and 113, and conductor 114 to the other side of battery. The relay 105 then closes a locking circuit for itself traced from battery through right hand winding of relay 105, its alternate contact 115, and conductor 114 to the other side of battery. Assuming that the interrupter IN which is constantly rotating and is in the position illustrated when the key N is depressed, the disk 103 in rotating causes the projection 116 on said disk 103 to move spring 117 to engage spring 118, but this engagement of springs 117 and 118 is only incidental as the relay 104 is still at normal. Projection 116 after passing spring 117 engages spring 119 causing spring 119 to engage spring 120 bringing about an energizing circuit for relay 104 traced from battery, through conductor 121, closed spring contacts 119 and 120, right hand winding of relay 104, alternate contact 122 of relay 105, and conductor 114 to the other side of battery. Relay 104, upon energizing, closes a locking circuit for itself traced from battery through its now closed contact 123, left hand winding of said relay 104, alternate contact 124 of relay 105, and conductor 114 to the other side of battery. After pressure has been released from the depressed key plunger of the key N, said key assumes its indicating position as is readily apparent, and in this position springs 126, 127 of the key N are closed. Generator current is now transmitted to the called substation D¹ over a circuit traced from generator G¹, through the closed contacts 128, 129, (said contacts being closed when the first projection 101¹ of the disk 100¹ engages the said spring 128) over conductor 130, closed contacts 126, 127 of the key N, conductor 131, alternate contact 132 of the relay 104, tip conductor of the cord circuit C¹, tip contacts of the connected plug and jack through the call bell of the called substation D¹, sleeve contact of the connected

plug and jack, and sleeve conductor of the cord circuit C¹ to ground at alternate contact 133 of relay 104. When the first projection 101¹ of the disk 100¹ disengages the spring 128, said springs 128 and 129 assume their normal position interrupting the path of the ringing current. When the second projection engages spring 128, said contacts 128 and 129 are again closed to transmit an impulse of ringing current to the call bell of the called subscriber at substation D¹. Thus the two long rings, which we have assumed are the code ring of the called substation D¹, are transmitted to the substation D¹. Just before the completion of one complete revolution of the shaft upon which the disks 100 and 103 are mounted, the projection 116 upon the disk 103 engages the spring 117 causing it to momentarily engage contact 118. This closes a circuit through left hand winding of relay 105, over a circuit traced from battery through the closed contacts 117, and 118 through left hand winding of said relay 105, alternate contact 135 of the relay 104, and conductor 114 to the other side of battery. Since the relay 105 is differentially wound, the circuit through the left hand winding of relay 105 brings about its de-energization, and the opening of contact 124 of relay 105 opens the locking circuit of said relay 104, which relay restores to normal and interrupts alternate contacts 132, 133 bringing about disconnection of ringing current. Thus a particular code is rung once; then the ringing is automatically stopped. The operator to again ring the called substation D¹, again depresses the key N to its fully depressed position again momentarily closing the contacts 112 and 113 to bring about the operation of the relay 105 to again complete a cycle of operation as just described.

The disk 103 with its projection 116 acts as a guard against splitting up of the different code rings. Assuming that the operator has depressed a key after the projection 116 of disk 103 has passed the springs 119 and 117, no energization of relay 104 is brought about as the energization of said relay is controlled by the contacts 119 and 120. The contacts 132 and 133 of relay 104 remain at normal and no ringing current is transmitted until the disk has completed a revolution, when the projection 116 engages the contact 119 and brings about the closing of contact 120 with that of 119 to energize relay 104.

This automatic code ringing is non-interfering and automatic in its action so that a plurality of keys in different cord circuits may be depressed simultaneously without interfering with each other.

While I have shown and described my invention in connection with certain forms of link circuits, it is apparent that my invention is of broader scope and may be used in

connection with any form of link circuit and that many modifications and changes may be made in my apparatus without departing from the spirit and scope of the same.

Having described my invention, what I claim as new and desire to secure by United States Letters Patent, is:

1. A signalling system of the character described including a poly-station telephone line, a manual link circuit for connection to said line, code ringing apparatus associated with said link circuit, a plurality of switches controllable by a central office operator for connecting the said code ringing apparatus to said telephone line to automatically code ring the substations thereon, and substation controlled means for operatively disconnecting said code ringing apparatus from said telephone line.

2. A signalling system of the character described including a poly-station telephone line, a manual link circuit for connection to said line, code ringing apparatus associated with said link circuit, a plurality of switches controllable by a central office operator for connecting the said code ringing apparatus to said telephone line to automatically code ring the substations thereon, means for insuring that any substation upon said line will receive its full code ring, and substation controlled means for operatively disconnecting said code ringing apparatus from said telephone line.

3. A telephone system including a calling and a called telephone line, a plurality of substations connected to said called telephone line, a link circuit provided with a pair of normally connected terminal plugs for connecting said lines in conversational circuit, code ringing apparatus associated with said link circuit, and an operator's key for connecting said ringing apparatus with said called telephone line to automatically code ring the desired substation upon said line and for disconnecting one of said plugs from the other of said pair of plugs.

4. A telephone system including poly-station telephone lines, a plurality of connecting links for interconnecting said telephone lines, code ringing apparatus common to said link circuits, switch keys for individually associating the different codes with the said link circuits, and means responsive to an operation of one of said keys to connect the desired code with a called one of said lines to automatically code ring the substations thereon and for disconnecting said called line from the associated connecting link.

5. In a telephone system, the combination with a manual link circuit connected to a called telephone line, of code ringing apparatus for selectively signalling the substations upon said called line, operator controlled means for operating said code ringing apparatus to selectively automatically

signal the desired one of said substations, and means controlled over said called telephone line for disassociating said code ringing apparatus from said called line.

5 6. In a telephone system, the combination with a plug-ended link circuit connected to a poly-station telephone line, of code ringing apparatus associated with said link circuit, a plurality of switch keys for selecting the
10 code to signal a desired substation upon said line, and means controlled by one of said keys to connect the desired code at predetermined intervals to signal the desired substation upon said line and for disconnecting said
15 link circuit from said telephone line.

7. A telephone system including a poly-station telephone line, a link circuit for extending a call to said line, code ringing apparatus for selectively signalling the sub-
20 stations upon said line, a selective device controllable by a central office operator for selecting the desired code, a relay controllable by said selective device to associate the code ringing apparatus with the said line
25 to automatically signal the desired substation thereon, and automatically controlled means for de-energizing said relay to disassociate said code ringing apparatus from said line.

30 8. A telephone system comprising subscribers' poly-station telephone lines, a plurality of link circuits for interconnecting said lines in conversational circuits, code ringing apparatus associated with said link
35 circuits, operator controlled switches for selecting codes, a relay for connecting the selected codes to called lines to automatically signal the desired substations thereon, said relay being controlled by said operators'
40 switches and subscriber controlled means for deenergizing said relay.

9. A signalling system of the character described, including a plug-ended link circuit connected to a poly-station telephone
45 line, code ringing apparatus associated with said link circuit, an operator controlled device for connecting said code ringing apparatus to said telephone line, means for automatically operating said signalling apparatus to insure that a full code ring will
50 be applied to signal the desired substation, and automatic means for operatively disconnecting said code ringing apparatus from said telephone line.

55 10. A telephone system including a called subscriber's line provided with a plurality of substations, a plurality of sources of ringing current located at the central exchange, the number of substations connected to said
60 line being a multiple of the number of sources of ringing current, and code ringing apparatus for connecting said sources of ringing current to said line to signal the desired substations thereon.

65 11. A telephone system including a called

subscriber's line provided with a plurality of substations, a plurality of sources of ringing current located at the central exchange, the number of substations connected to said line being a multiple of the number of
70 sources of ringing current, code ringing mechanism, and operator controlled means for connecting said ringing current to said line via said ringing mechanism to signal desired substations upon said line. 75

12. A telephone system including a called subscriber's line provided with a plurality of substations, a plurality of sources of ringing current located at the central exchange, the number of substations connected
80 to said line being a multiple of the number of sources of ringing current, an operator's link circuit for extending a connection to said line, code ringing interrupter mechanism, and operator controlled means for connecting said ringing current to said line via
85 said code ringing mechanism.

13. A telephone system including a called subscriber's line provided with a plurality of substations, a plurality of sources of ringing current located at the central exchange, the number of substations connected to said line being a multiple of the
90 number of sources of ringing current, an operator's link circuit for extending a connection to said line, code ringing interrupter mechanism, operator controlled means for connecting said ringing current to said line via said code ringing mechanism, and auto-
95 matic means for disconnecting said code ringing apparatus and said ringing current from said telephone line. 100

14. A telephone system including a calling subscriber's line and a poly-station called subscriber's line, an operator's link circuit
105 for connecting said lines, code ringing apparatus associated with said link circuit, switchboard operator-controlled means for connecting said code ringing apparatus to said called line and for insuring that a full
110 code ring will be applied to signal the desired substation upon said line, and automatic means for disconnecting said code ringing apparatus from said called line.

15. A telephone system including a calling
115 and a called telephone line, a plurality of substations connected to said called telephone line, an operator's link circuit for connecting said lines in conversational circuit, code ringing apparatus associated with said
120 link circuit and common to a plurality of telephone lines, switchboard operator controlled means for connecting said code ringing apparatus with said called telephone line to automatically code ring the desired sub-
125 station upon said line, and means for insuring that a full code ring will be applied to said called line.

16. A telephone system including a calling subscriber's telephone line and a called
130

subscriber's poly-station telephone line, a manual link circuit for connecting said lines in conversational circuit, a ringing current generator, a relay for connecting said ringing current generator to said called line, code ringing apparatus for differently energizing said relay according to the desired substation to be called upon said line, and means for preventing further energization of said relay controlled over said called line.

17. A telephone system including a calling subscriber's telephone line and a called subscriber's poly-station telephone line, a manual link circuit for connecting said lines in conversational circuit, a ringing current generator, a relay for connecting said ringing current generator to said called line, code ringing apparatus for differently energizing said relay according to the desired substation to be called upon said line, and substation controlled means for disconnecting said relay from said code ringing apparatus to prevent further operations of said relay.

18. A telephone system including subscriber's poly-station telephone lines, a manual link circuit for connection to one of said lines, code ringing apparatus associated with said link circuit and common to said lines, switchboard operator controlled means for connecting said code ringing apparatus with said telephone line to automatically code ring the desired substation upon said line, means for insuring that a full code ring will be applied to said called line and means controlled by the called subscriber for disconnecting said code ringing apparatus from said telephone line.

19. A telephone system including subscribers' poly-station telephone lines, a link circuit for connecting said lines, a plurality of sources of signaling current, code ringing apparatus, means for operatively associating said code ringing apparatus with said link circuit, whereby said code ringing apparatus connects one of said sources of current to the called one of said lines to automatically code ring the desired substation upon said line.

20. A telephone system including subscribers' poly-station telephone lines, a link circuit for connecting said lines, a plurality of sources of signaling current, code ringing apparatus, means for operatively associating said code ringing apparatus with said link circuit, whereby said code ringing apparatus connects one of said sources of current to the called one of said lines to automatically code ring the desired substation upon said line, and automatic means for insuring that a full code ring will be applied to said called line.

21. A telephone system including subscribers' poly-station telephone lines, a link circuit for connecting said lines, a plurality of

sources of signaling current, code ringing apparatus, means for operatively associating said code ringing apparatus with said link circuit, whereby said code ringing apparatus connects one of said sources of current to the called one of said lines to automatically code ring the desired substation upon said line, and automatic means for disassociating said code ringing means and said sources of current from said called line.

22. A telephone system including a calling subscriber's line, a poly-substation called subscriber's line, a manual link circuit for connecting said lines, a plurality of sources of signaling current and code signaling apparatus associated with said link circuit, and means for controlling said code ringing apparatus to cause the same to apply one of said sources of signaling current to said called line to automatically code ring the desired substation upon said line.

23. A telephone system including a calling subscriber's line, a poly-substation called subscriber's line, a manual link circuit for connecting said lines, a plurality of sources of signaling current and code signaling apparatus associated with said link circuit, means for controlling said code ringing apparatus to cause the same to apply one of said sources of signaling current to said called line to automatically code ring the desired substation upon said line, and subscriber-controlled means for disassociating said code apparatus from said called line.

24. In a telephone system, the combination of a signaling circuit including a plurality of signals, each signal constructed to respond to a particular one of a plurality of currents of different character, means for producing a number of currents of different character, means for determining which character of current shall be connected in said circuit and mechanism for modifying the current thus connected into the circuit according to a particular code.

25. In a telephone system, the combination of a signaling circuit, a plurality of tuned ringers connected in said circuit, a plurality of sources of current of different frequency adapted to be connected in said circuit, said sources producing current of a frequency to which said ringers are responsive, means for selecting each of said sources and connecting each in said circuit, and mechanism for breaking the current from said sources up into periods according to a certain code.

26. In a telephone system, the combination of a signaling circuit including a plurality of signals, a plurality of sources of signaling current for selectively operating said signals, mechanism for selecting and connecting said sources in said circuit, a plurality of devices for modifying the effect of the current from said sources on said sig-

nals, and means for selectively causing said devices, each independently of the other, to modify the effect of the current from each source upon said signals.

5 27. In a telephone system, the combination of a signaling circuit including a plurality of tuned ringers, a plurality of sources of current for operating said ringers, each source adapted to produce a current of a certain frequency calculated to operate a plurality of said signals, apparatus to selectively connect each of said sources in said circuit, a plurality of commutators differently arranged, and means to cause
10 each of said commutators to interrupt the current in said circuit from each of said sources.

28. In a telephone system, the combination of a signaling circuit, a plurality of signals in said circuit, a plurality of sources of signaling current each adapted to produce current of a character to which a plurality of said signals are responsive, mechanism to connect any of said sources of current in said circuit, a plurality of devices having differently arranged contacts, and means for causing either of said devices to interrupt the current in said circuit from either of said sources.

30 29. In a telephone system, the combination of a signaling circuit including a plurality of signals, a plurality of sources of current each adapted to produce current capable of operating a plurality of said signals, means for selecting and connecting said sources in said circuit, a plurality of devices each adapted to interrupt the current from said sources according to a predetermined code, and a single key mechanism for determining which of said devices
35 40

should act upon the current in the ringing circuit.

30. In a telephone system, the combination of a calling line and a called line, a signal on the called line, a cord circuit for connecting the lines together, an answering switch for connecting the cord to the calling line, a calling switch for connecting the cord to the called line, a ringing circuit including a portion of the cord circuit and the called line, a source of signal operating current adapted to be connected in said circuit, a relay controlling the connection of said source in said circuit, a circuit for said relay, a second relay controlling said circuit, and a circuit for the second relay controlled by the answering switch.

31. In a telephone system, the combination of a calling telephone line, substation apparatus thereon, a called telephone line, a signal on said line, a main station, link conductors at the main station for connecting the telephone lines together, a switching device for connecting the link conductors to the called line, a signaling generator at the main station, means to connect said generator to said signal, including said called telephone line, a signaling key including key contacts controlling the connecting means and mechanism, operable independently of said switching device and substation apparatus for relieving such key contacts from the control of said connecting means.

Signed by me at Chicago, county of Cook and State of Illinois, in the presence of two witnesses.

ROY W. AUGUSTINE.

Witnesses:

G. A. YANOCHOWSKI,
WM. BERGHAIN.