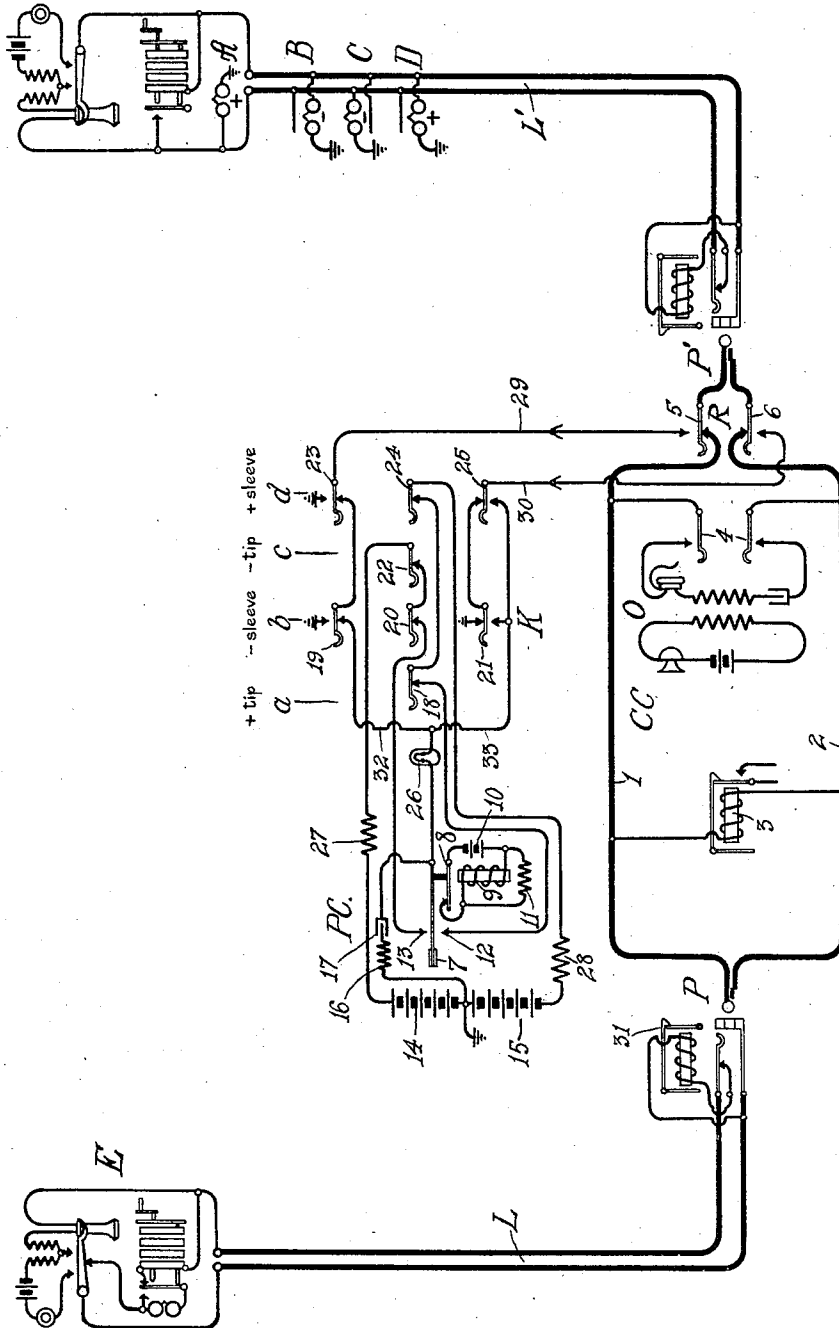


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SIGNALING SYSTEM.
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SIGNALING SYSTEM.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES A. LARSON, a citizen of the United States, residing in Highland Park, county of Lake, State of Illinois, have invented certain new and useful Improvements in Signaling Systems, of which the following is a specification.

My invention relates to signaling systems for telephone exchanges and more particularly to signaling systems which are adapted for selectively signaling any one of a plurality of substations connected to a telephone line, and is directed to systems of the above character in which a pole-changer is provided for furnishing positive and negative pulsating currents, and also alternating currents, an object being to provide such a system which is more simple of construction, efficient in operation, and in which a single vibrating contact is adapted, by cooperation with two stationary contacts in combination with a master-key, to supply such currents of the above character.

Other features of my invention will be more particularly pointed out in the appended claims.

Referring now to the accompanying drawing which illustrates the preferred arrangement of my invention, the system illustrated comprises two telephone lines L and L', terminating at the exchange in jacks and drops. Line L is connected to substation E which may be any regular form of local battery telephone, the one illustrated comprising the usual transmitter, induction coil, receiver, call bell, generator and switch-hook. Line L' is connected to substation A which has equipment similar to substation E, but which is connected as illustrated at A. Three other substations B, C and D are also connected to line L', the said line L' thus being equipped as a four-party line. The substations B, C and D are not illustrated but the call bell of each said substation is shown connected to one of the line conductors. The call-bell of A is connected from the tip line conductor to ground and is adapted to respond to positive pulsations, any form of bell of such character being used. Substation B has its call-bell connected from sleeve conductor to ground and is adapted to respond to negative pulsations. The bell of substation C is connected to the tip conductor of the line and is adapted to respond to negative pulsations, while the bell

of substation D is connected from the sleeve conductor to ground and is adapted to respond to positive pulsations of current. Thus with an arrangement as outlined, when positive pulsations are applied to the tip conductor, the bell of substation A only will respond, while with negative pulsations applied to the sleeve strand, substation B will be selectively called, with negative pulsations applied to the tip strand the bell of substation C will be selectively operated and with positive pulsations applied to the sleeve strand, the call bell of substation D only will be rung.

Cord circuit CC comprises the usual answering and calling plugs P and P' respectively, which are adapted for insertion into the jack terminals of the lines in a well known manner. The said cord circuit also includes the connecting strands 1 and 2 having a drop 3 connected in bridge thereof. An operator's telephone O is also provided being adapted to be connected to the cord circuit strands by means of the listening key contacts 4. A ringing key R of any well known type is provided for each cord circuit CC, and includes contacts 5 and 6.

The pole changer PC which is adapted to transmit positive or negative pulsating current, or alternating current, is of the usual construction and includes a vibrating contact-carrying reed 7 carrying an armature 8 adapted to be attracted by electromagnet 9. The said magnet 9 has its winding in circuit with a battery 10 and the closed contact of armature 8, a spark-killing non-inductive resistance 11 being connected in multiple with the winding of magnet 9. Thus when electromagnet 9 attracts its armature 8, reed 7 closes contact with contact 12 and upon the opening of normal contact 8, magnet 9 releases its armature thus allowing reed 7 to return and close contact with contact 13, contact 8 thereby again closing and causing another energization of magnet 9, this action continuing and causing a vibration of the reed 7 in a well known manner. The battery 14—15 which feeds the current to the pole-changer contacts, is grounded at a central point as illustrated, this point also being connected to the reed 7 through non-inductive resistance 16 and condenser 17, these being provided to eliminate the sparking of contacts 12 and 13 as will be more fully described and which action is well known.

A master-key K is provided, one for each operator's position, or such a key K may be provided for each cord circuit as desired. Master-key K may be of any well known type in which the actuating plungers are locked when depressed, and includes four keys or sets of contacts *a*, *b*, *c* and *d*. Key *a* includes the contacts 18, key *b* contacts 19, 20 and 21, key *c* contact 22 and key *d* the contacts 23, 24 and 25, all of the contacts of the individual keys being shown in their normal position. When key *a* is operated its contact 18 is opened, while upon operation of key *b* its contacts 19, 20 and 21 are moved to their alternate position, keys *c* and *d* operating the same as *a* and *b* respectively. The vibrating reed or contact 7 is normally connected through the lamp 26 to contacts of master-key K, while the positive and negative poles of battery 14—15 are connected through protective resistances 27 and 28 to contacts of master-key K.

When the contacts *a* are operated, positive pulsations are adapted to be applied to the tip strand to ring selectively the call-bell of substation A; upon operation of contact *b* negative pulsations are adapted to be connected to the sleeve strand operating only the call-bell of substation B which it will be noted is connected to the sleeve strand of line L'; upon operation of springs *c* negative pulsations are adapted to be connected to the sleeve strand to selectively ring the call-bell of substation C, while contact springs of key *d* are adapted when operated to connect positive pulsations to the sleeve strand to ring the call-bell of substation D. With the master-key K in its normal position which is illustrated, alternating current is supplied from pole-changer PC to conductor 29.

To provide a pulsating current to ring the call-bell of any substation A, B, C or D, the operator first actuates the proper individual keys *a*, *b*, *c* or *d* and thereafter operates ringing key R, and if the operator desires to ring the bell of a sub-station such as E by alternating current, a current of this character being normally connected to strand 29 as previously referred to, ringing key R only is operated.

Operation: Having described in general the apparatus as illustrated in the drawing, the operation of the system will now be described. Assuming the subscriber at E desires to communicate with another subscriber, he will operate his generator thus throwing the drop 31 at the central office in a well known manner. The operator then inserts plug P in the jack of the calling line L, thereby disconnecting the winding of drop 31 and connecting the cord circuit strands to the line conductors L. The operator then actuates listening key 4 and ascertains the number of the wanted sub-

station and assuming that substation A is the desired one, plug P' is inserted in the jack of line L'. As previously stated the call-bell of substation A is adjusted to respond to positive pulsations of current and is connected to the tip conductor of line L', therefore the operator presses the plunger *a* opening normal contacts 18 of master key K and thereafter actuates the ringing key R, thus connecting positive pulsations from battery 14 to the tip strand in the following manner: from the ungrounded positive pole of battery 14, non-inductive resistance 27, contacts 22—20, contacts 13—7, each time they are closed by the swing of vibrating contact 7, lamp 26, conductor 32, normal contacts 19, 23, conductor 29, alternate contact 5, tip contacts of plug and jack, tip conductor of line L' through the call bell of substation A to ground, returning by way of earth to the grounded pole of battery 14, thus ringing the call-bell of substation A. It will be noted that normal contacts 21 and 25 of master-key K connect ground to the sleeve strand of line L' when ringing key R is actuated, thus preventing the operation of the bell of substation D, which is adjusted to respond to positive pulsations, should the subscriber at A remove his receiver during a ringing interval, this ground connection from the said contact springs 21, 25 to the sleeve conductor being effective to short circuit or shunt the bell of said substation D. Upon the response of the called subscriber by the removal of his receiver from its switchhook, the substations E and A are connected for conversation. After finishing conversation they restore their receivers to their respective switchhooks giving a ring-off operation to their hand generators, thereby operating drop 3 of the cord circuit CC whereupon the operator withdraws plugs P and P' from the respective connected spring jacks. As before referred to, alternating current is being normally applied to conductor 29 leading from master-key K, but when key A is operated, the negative pulsations are interrupted or excluded and only the positive pulsations are effective, while when key *c* is actuated the opposite effect is produced.

Referring now to the non-inductive resistance 16 and condenser 17 of pole-changer PC, it will be noted that while the reed 7 is vibrating and while ringing current is being applied to the called line, the said resistance 16 and condenser 17 are connected in multiple with the substation bell which is being rung, but they are so proportioned that they do not interfere with the proper operation of the called substation bell. Due to this multiple connection of the elements 16, 17 each time contacts 12 or 13 are interrupted; depending on whether positive or negative pulsations are being applied to the

called line, these elements 16, 17 are adapted to eliminate the sparking of these contacts to a great extent by taking the discharge due to the rise of potential across the said contacts each time they are interrupted. Now
 5 for instance should the operator desire to ring the bell of substation B which is adapted to respond to negative pulsations, after inserting plug P' in the jack of line L', she
 10 will actuate the plunger of key *b* thus moving the contacts 19, 20 and 21 to their alternate position and thereafter operate ringing key R, thereby connecting negative pulsations of current to the sleeve strand in the
 15 following manner: from the ungrounded negative pole of battery 14—15, non-inductive resistance 28, normal contacts 24—18, contacts 12—7, each time vibrating contact 7 connects with contact 12, lamp 26,
 20 conductor 33, the alternate contact 21, normal contact 25, conductor 30, alternate contact 6, sleeve contacts of the plug and jack, sleeve line conductor, call-bell of substation B to ground, returning over earth to the
 25 grounded positive pole of battery 14—15, thus operating the bell of said substation B. Due to the closing of alternate contact 19 of key *b*, the tip conductor of line L' is grounded, thus preventing the operation of
 30 the call-bell of substation C through the switchhook contacts of substation B, should the subscriber at B remove his receiver during a ringing period. It will be noted that when ringing key *b* is operated contacts 20
 35 are interrupted, thus preventing application of the positive pulsations to the terminals of the called line.

As previously stated, the circuit arrangements of pole-changer PC and master-key K are such that normally alternating current or in other words, positive and negative pulsations are being alternately applied to conductor 29 which leads to the tip strand of the cord circuit, so that to apply positive
 40 pulsations to the tip strand the circuit arrangements are such that when key *a* is actuated the negative pulsations are excluded allowing only the application of positive pulsations to the tip strand, while if it is
 45 desired to apply negative pulsations to the tip strand, key *c* is operated thereby disconnecting the positive pulsations due to the opening of contacts 22, and thus allowing only the application of negative pulsations to
 50 the tip strand. To apply negative or positive pulsations to the sleeve strand, keys *b* or *d* respectively are operated, these keys while their contacts not only disconnect either
 55 positive or negative pulsations as the case may be, but also apply the desired pulsation to the sleeve strand instead of to the tip strand as is done when the keys *a* or *c* are actuated.

While I have preferably described the
 65 key springs R as being separate from mas-

ter-key K, they may be arranged as common to the master-key contacts, in such a manner that they are actuated each time a set of contacts *a*, *b*, *c* or *d* are operated, such an arrangement being well known in the art and therefore no further description is
 70 deemed necessary.

While I have illustrated my invention in a preferred form, it is to be understood many changes and modifications thereof
 75 may be made and therefore I do not desire to be limited to the exact structure as shown, but aim to cover all those changes and modifications as come within the spirit and scope of the appended claims.

What I claim and desire to secure by Letters Patent is:

1. A signaling system comprising a source of current, a master-key having a plurality of actuating members and contacts therefor,
 85 a pole-changer, connections extending from each pole of said source through certain of said key contacts to contacts of said pole-changer, other connections from the pole-changer contacts to said master-key contacts,
 90 signaling conductors extending from said master-key contacts, said members and contacts when actuated causing the application of pulsations of current from either pole of said source to said conductors.

2. A signaling system comprising a source of current, a master-key having a plurality of sets of contacts, a pole-changer, connections extending from each pole of said source through contacts of said master-key
 100 to contacts of the pole-changer, other connections from said pole-changer to said master-key, signaling conductors extending from said master-key, and means whereby said master-key contacts are operated and
 105 pulsations of current from either pole of said source thereby connected to any one of said signaling conductors.

3. A signaling system including a source of current, a plurality of sets of contacts, a
 110 pole-changer, connections extending from each pole of said source through certain of said contacts to said pole changer, other connections from said pole-changer to said sets of contacts, signaling conductors extending
 115 from said sets of contacts and means for actuating said sets of contacts to cause the application of pulsations of current from either pole of said source to one of said conductors.

4. A signaling system comprising a central source of current, a master-key, a pole-changer, signaling conductors extending from contacts of said master-key, connections extending from each pole of said
 125 source through contacts of said master-key to contacts of said pole changer, other connections from said pole-changer contacts to said master-key whereby alternating current is normally impressed upon said conductors,
 130

said master-key being adapted when actuated to exclude alternating current and apply positive or negative pulsations to said conductors.

5 5. A signaling system comprising a source of current, a master-key having sets of contacts, a pole changer, signaling conductors extending from said master-key contacts, connections extending from each pole of
10 said source through contacts of said master-key to contacts of the pole-changer, other connections from said pole-changer contacts to said master-key whereby pulsations of current from each pole of said source is
15 normally applied to said conductors, said master-key when actuated excluding pulsations of either polarity from said conductors according to its operation.

6. A signaling system comprising a party
20 telephone line, a link circuit connected thereto, a source of current, a master-key having ringing contacts for each telephone on said line, a pole-changer, connections extending from each pole of said source
25 through contacts of said master-key to said pole-changer's contacts, other connections from the pole-changer to said master-key, and means whereby pulsations of current from either pole of said source may be connected
30 to either strand of the link circuit to selectively signal any of said telephones by operation of the master-key.

7. A signaling system comprising a source of current, a master-key, a pole-changer, connections extending from each
35 pole of said source through contacts of said master-key to said pole changer, other connections from said pole-changer to said master key, a link circuit, signaling conductors extending from said master-key to
40 said link circuit, a telephone line having a plurality of signaling bells connected to the talking conductors of said line, a return conductor from said signaling bells to
45 a middle point of said central source of cur-

rent, said master-key being adapted when actuated to apply positive or negative pulsations of current from said source to either talking conductor of said line, to selectively
ring any of said call-bells. 50

8. A signaling system comprising a central source of direct current, a pole-changer, a master-key, a telephone line having a plurality of substations, signaling conductors
55 from said master-key to said telephone line, and circuit connections extending from said central source of current through said master-key and said pole-changer, whereby positive or negative pulsations of current from
60 said central source may be applied to either line conductor to selectively ring the bell of a desired substation.

9. A signaling system comprising a central source of direct current, a pole changer, a master key, a pair of signaling conductors, and circuit connections extending from said
65 central source of current through said master key and pole-changer whereby positive or negative pulsations of current from said source may be connected to either conductor
70 by operation of the master key.

10. A signaling system comprising a central source of direct current, a pole changer, a master key having four actuating members, a pair of signaling conductors, and circuit connections extending from said central
75 source of current through said master key and pole changer whereby positive or negative pulsations of current from said source may be connected to either conductor according to the selection of the actuating member.

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

CHARLES A. LARSON.

Witnesses:

GEORGE E. MUELLER,

CARRIE E. ANDERSON.