

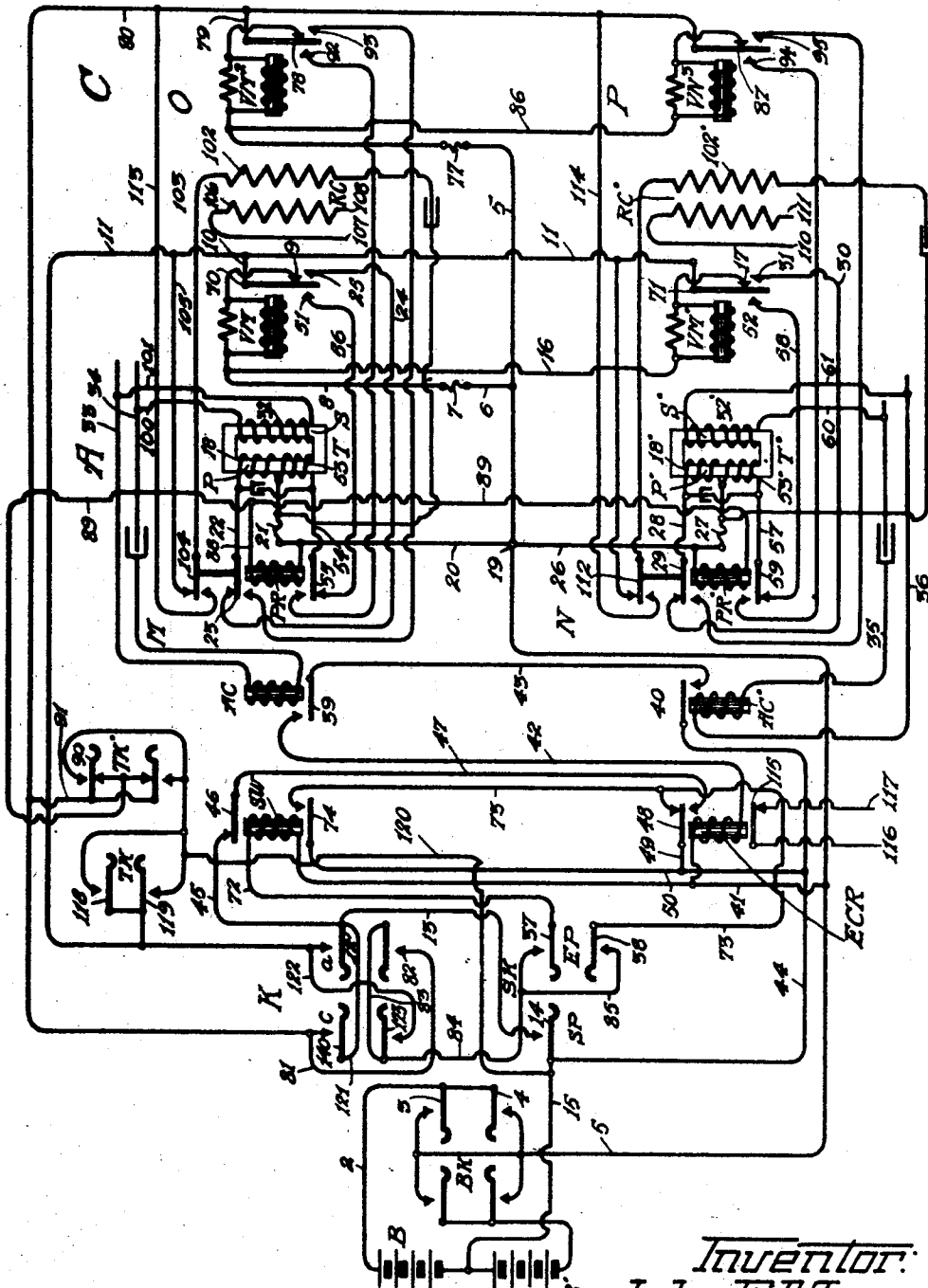
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J. F. MEYERS

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POLE CHANGER SWITCHING CIRCUIT

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UNITED STATES PATENT OFFICE.

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POLE-CHANGER SWITCHING CIRCUIT.

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To all whom it may concern:

Be it known that I, JOHN F. MEYERS, 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 Pole-Changer Switching Circuits, of which the following is a specification.

My invention relates to switching circuits and has to do more particularly with circuits in which duplicate sets of apparatus are employed and in which means are provided for automatically switching from one set of apparatus to another. In telephone systems of the class in which pole changers are used for delivering ringing current, duplicate pole changer sets are employed, one of which may be termed the primary pole changer and the other pole changer may be termed the emergency pole changer. It sometimes happens that the primary pole changer becomes disabled and stops for various reasons such as mechanical trouble, or circuit trouble thus making it necessary to employ the emergency pole changer. In order to connect this emergency pole changer, the operator presses a button which is located on the switchboard and under her control, or a switch which is located on the powerboard. This means of connecting and disconnecting the pole changers is objectional because of loss of time and the interruption of ringing current, it being done manually. To overcome these objectional features, I provide a switching circuit which automatically switches from one pole changer to the other.

A feature of my invention is the provision of a key which when moved to one position, places the primary pole changer in operative circuit and when moved to its other position the primary pole changer is cut off and places the emergency pole changer in operative circuit so that the primary pole changer may be used for a period of time and when desirable this primary pole changer may be shut off by opening its associated key contacts, and the moving of the key to its other position will connect the emergency pole changer in operative circuit for any desired length of time.

Another feature of my invention is the provision of means whereby should the primary pole changer which is connected in

circuit by means of its associated key contacts stop for various reasons, such as the opening of a fuse, or mechanical trouble, the said means will function automatically to switch from the primary pole changer to the emergency pole changer without the manipulation of any keys or buttons.

Another feature of my invention is the provision of one set of transformers for the primary and emergency pole changers and automatic means which control the switching of the transformers from one pole changer to the other when the switching means operates to switch from one pole changer to the other.

Referring now in general to my invention as illustrated in the accompanying drawing, I shown a primary pole changer A comprising units M and N. The units M and N comprise vibrator magnets VM and VM' and their associated vibrator contacts. The pole changer C which I term the emergency pole changer comprises the units O and P which consist of the vibrator magnets VM² and VM³ and their associated vibrator contacts. I show a transformer T which is common to the units M and O of the pole changers A and C and a transformer T' which is common to the units N and P of the pole changers A and C. Retardation coils RC and RC' are also provided, retardation coil RC being common to units M and O of the pole changers A and C and retardation coil RC' being common to units N and P of pole changers A and C. The retardation coils are used for the usual tone purposes. I also provide a pole changer switching relay PR which is associated with the units M and O of the pole changers A and C and when operated switches the transformer T from the unit M of the pole changer A to the unit O of the pole changer C and also switches the retardation coil RC from unit M to unit O. A pole changer switching relay PR' associated with the units N and P of the pole changers A and C when operated switches the transformer T' from the unit N of pole changer A to unit P of the pole changer C. I also show alternating current relays AC and AC', the relay AC being common to units M and O of pole changers A and C and relay AC' being common to units N and P of the pole changers A and C. An emergency control relay ECR is provided and in association with the relays AC and AC' the

said relays automatically control the switching from the pole changer A to C or vice versa.

I provide a switching key K which is of the usual cam type, and has two positions *a* and *c*. When the key is moved to its *a* position the pole changer A is the pole changer that will be operated when the starting key SK is moved to its starting position SP and when the key K is moved to its *c* position the pole changer C will be the pole changer that is operated when the starting key is moved to its starting position SP. The starting key SK is also of the usual cam type and has a starting position SP and an emergency position EP to which it is moved from its starting position SP when starting the pole changer A or C as the case may be for purposes as will be more fully hereinafter described. I provide a battery switching key BK of the usual cam type to connect either the battery B or B' for current supply purposes.

I also provide a testing key TK associated with the pole changer A for testing the pole changer A and a testing key TK' for testing the pole changer C.

Having described in general the apparatus comprising my invention, I will now describe in detail the operation of the switching circuit of my invention.

Assuming that the primary pole changer A is the pole changer being used, its associated key switch K is moved to its position *a* and further assuming that the battery B is being used, its associated battery switching key BK will be in its actuated position. To start the pole changer A, starting key switch SK is moved to its starting position SP to close a circuit for the vibrator magnets VM and VM' of the units M and N of the pole changer A, the circuit of vibrator magnet VM being traced from battery B, over conductor 2, closed contacts 3 and 4 of the battery key BK, conductors 5 and 6, the fuse 7, conductor 8 through the winding of the vibrator magnet VM, its interrupter contact 9, conductors 10 and 11, closed contact 12 of the key switch *a* associated with the pole changer A, conductor 13, closed contact 14 of the key switch SK, conductor 15 to the other side of the battery B. The circuit for vibrator magnet VM' of the unit N of pole changer A may be traced from battery B over the path just described to the branch over conductor 16, through the winding of the magnet VM', its interrupter contact 17, armature 71 conductor 11 to the other side of the battery B over the previous described path.

The vibrator magnets VM and VM' of units M and N of the pole changer A are energized over the circuits just described and due to their interrupter contacts 9 and 17 the armatures 70 and 71 of the said mag-

nets VM and VM' are vibrated. The alternate closing of vibratory contacts 25 and 51 of the vibrator magnet VM permits impulses of current to flow through the windings 18 and 53 of the primary P of the transformer T, the circuit through the winding 18 of the transformer T being traced from battery B over conductor 2, closed contacts 3 and 4 of the battery switching key BK, conductor 5 to the point 19, and extending from the point 19 over conductor 20, fuse 21, winding 18 of the primary P of the transformer T, conductor 22, contact 23 of the pole changer switching relay PR, conductor 24, closed contact 25 and armature 70 of the vibrator magnet VM conductors 10 and 11, closed contact 12 of the switching key K, conductor 13 and closed contact 14 of the starting key SK, conductor 15 to the other side of battery.

The circuit through the winding 53 of the primary P of the transformer T when contact 51 is closed may be traced from battery B, conductor 2, closed contacts 3 and 4 of battery switching key BK, conductors 5 and 20, fuse 21, winding 53, conductor 54, normal contact 55 of relay PR, conductor 56, closed contact 51 and armature 70 of magnet VM, conductors 10 and 11 to the other side of battery B over the path described in connection with the circuit of winding 18. The impulses of current through the windings 18 and 53 of the primary P of the transformer T which are induced into the secondary winding 32 of the secondary S of the transformer T pass over conductors 100 and 101 to conductors 33 and 34, through the winding of the alternating current relay AC, associated with the transformer T. The retardation coil RC is provided for tone purposes and has its primary winding 102 cut across the armature 70 and contact 9 of the vibrator magnet VM thus placing it in parallel connection with the said magnet VM. One terminal of the primary 102 is connected over conductor 103 through normal contact 104 of relay PR, conductor 105 to the armature 70 which is connected to one side of battery B. The other side of the primary 102 is connected to the other side of battery B at contact 9 so that when magnet VM vibrates the opening and closing of contact 9 and armature 70 will cause surges of current to flow through the primary 102 which are induced into the secondary winding 106 which produce a tone which is delivered over conductors 107 and 108 to the switchboard with which pole changer A is associated, the tone being used for various purposes as is known in the art.

The vibrator magnet VM' of the unit N of the pole changer A is vibrated by reason of its energizing circuit just described and the alternate closing of its vibratory contacts 52 and 31 permits impulses of current

to flow through the windings 18' and 53' of the primary P' of the transformer T'. The circuit through winding 18' being traced from battery B to the point 19 and
 5 over conductor 26, fuse 27, winding 18', conductor 28, normal contact 29 of relay PR' conductor 30, closed contact 31 and armature 71 of the vibrator magnet VM', conductor 11 to the other side of battery B
 10 over the path traced in connection with winding 18 of transformer T. The circuit through the winding 53' of the primary P' of transformer T' of the unit N of pole changer A when contact 52 is closed is traced from battery B, to the point 19 and
 15 over conductor 26, fuse 27 winding 53', conductor 57, normal contact 59 of relay PR' conductor 58, closed contact 52 and armature 71 of magnet VM', conductor 11
 20 to the other side of battery B. The impulses of current through the windings 18' and 53' of the primary P' of the transformer T' are induced into the secondary winding 32' of the secondary S' of the
 25 transformer T' and pass over conductors 60 and 61 to conductors 35 and 36, through the winding of alternating current relay AC' associated with the transformer T'. The retardation coil RC' associated with the
 30 pole changer unit N has its primary 102' also connected in parallel with the magnet VM' across armature 71 and contact 17 operates in a manner similar to RC to deliver a tone to the switchboard over conductors
 35 110 and 111. Current over conductors 35 and 36 also passes through the alternating current relay AC' associated with the unit N of the pole changer A.

The starting key switch SK is of the well
 40 known cam key type and when moved to its starting position SP to start the operation of the pole changer A, it is immediately moved to the right into its emergency position EP to close the spring contacts 37 and
 45 38 for purposes as will presently be described.

Relays AC and AC' upon energizing close their alternate contacts 39 and 40 to establish an energizing circuit for the emergency
 50 control relay ECR traced from battery B, conductor 2, closed contacts 3 and 4 of the battery switching key BK, conductors 5 and 41 through the winding of the relay ECR, conductor 42, alternate contact 39 of
 55 the alternating current relay AC, conductor 43, alternate contact 40 of the alternating current relay AC, conductors 44 and 15 to the other side of battery. The initial energizing circuits of the vibrator magnet VM
 60 and VM' of the pole changer A were opened when starting key SK was moved from its starting position SP to its emergency position EP but a substitute circuit is now established for the vibrator magnets VM and
 65 VM', the circuit of magnet VM being traced

from battery B, conductor 2, closed contacts 3 and 4 of the battery key BK, conductors 5 and 6, fuse 7, conductor 8, through the winding of the magnet VM, its interrupter contact 9, conductors 10 and 11, closed contact
 70 12 of the key switch a, associated with the pole changer A, conductor 45, normal contact 46 of the switching relay SW, conductor 47, alternate contact 48 of the relay ECR, conductors 49, 50, 44 and 15 to the
 75 other side of battery B. The circuit for the vibrator magnet VM' of the pole changer a extends over conductor 16 through the winding of the magnet VM', normal contact 17, conductor 11 to the other side of bat-
 80 tery B over the path just described in connection with the vibrator magnet VM. The windings 18, 53 and 18', 53' of the primary windings P and P' of the transformers T and T' receive current from battery B over
 85 conductors 20 and 26 normal contacts 23 and 55 of relay PR and normal contacts 29 and 59 of relays PR', conductors 22 and 54, 28 and 57, contacts 25 and 51 of magnet VM, contacts 31 and 52 of magnet VM', conductor
 90 11 to the other side of battery B over the return path just traced in connection with the magnets VM and VM'.

The current from the winding 32 of the secondary S of the transformer T passes
 95 over conductors 100 and 101 to conductors 33 and 34 which lead to the switchboard with which the pole changer A is associated. The current passing over conductors 33 and 34 delivers a pre-determined cycle of ring-
 100 ing current to the switchboard. This current also flows through the alternating current AC and holds said relay energized as long as the unit N of the pole changer A is operated. The current from the winding
 105 32' of the secondary S' of the transformer T' which passes over conductors 60 and 61 to the conductors 35 and 36 which conductors lead to the switchboard with which the pole changer A is associated to deliver a pre-
 110 determined cycle of ringing current thereto. The current also passes through the winding of the alternate current relay AC', associated with the unit N of the pole changer A and said relay AC' remaining energized
 115 as long as the unit N is operated.

Assuming that the primary pole changer A fails in its operation for the reason that the fuse 7 opens the vibrator magnets VM and VM' of the pole changer, units M and
 120 N will receive no battery current from the battery B. The vibrator magnets VM and VM' of units M and N of the pole changer A remain inert and the armatures 70 and 71
 125 of the vibrator magnets VM and VM' come to rest and the contacts 25 and 51 of the magnet VM, contacts 31 and 52 of the magnet VM' are open. The windings 18 and 53 of the primary P of the transformer T and windings 18' and 53' of the primary P'
 130

of the transformer T' receive no current and therefore the alternating current relays AC and AC' de-energize and restore to normal. The opening of alternate contacts 39 and 40 of the relays AC and AC' open the energizing circuit of the relay ECR and the said relay ECR upon de-energization permits its normal contact 48 to close to establish an energizing circuit for the switching relay SW, traced from battery B, conductor 2, closed contacts 3 and 4 of the battery BK, conductor 5, conductor 41 through the winding of the relay SW, conductor 72, closed contacts 37 and 38 of the starting key SK (it will be remembered that the starting key SK was moved to its emergency position to close the contacts 37 and 38 conductor 73, normal contact 48 of the relay ECR, conductors 49, 50, 44 and 15 to the other side of battery B). The switching relay SW upon energization, establishes a locking circuit for itself traced from battery B, conductor 2, closed contacts 3 and 4 of the key BK, conductors 5 and 41 through the winding of the relay SW, conductor 72, closed contacts 37 and 38 of the key SK, conductor 73, alternate contact 74 of the switching relay SW, conductors 50, 44 and 15 to the other side of battery B. The switching relay SW is now held energized independent of the contact 48 of the relay ECR. When the switching key SK was moved to its emergency position EP to close its contacts 37 and 38, one portion of the energizing circuit of the vibrator magnets VM² and VM³ of the units O and P of the emergency pole changer C is closed, but due to the fact that normal contact 48 is open due to the fact that the relay ECR is in an energized condition while the pole changer A is in operation the energizing circuits of the vibrator magnets VM² and VM³ are held open, but upon its de-energization, the relays ECR closes its contact 48, establishing an energizing circuit for the vibrator magnets VM² and VM³ of the units O and P of the pole changer C which may be traced from battery B, conductor 2, close contacts 3 and 4 of the battery BK, conductor 5, fuse 77 through the winding of the vibrator magnet VM² of the unit O of the pole changer C, interrupter contact 78 of the magnet VM², conductors 79 and 80, conductor 81, closed contact 82 of the key switch a, conductors 83, 84 and 85, closed contact 38 of the switching key SK, conductor 73, normal contact 48 of the relay ECR, conductors 49, 50, 44 and 15 to the other side of battery B. The circuit of the vibrator magnet VM³ of the unit P of the pole changer C is traced from battery B, conductor 2, closed contacts 3 and 4 of key SK, conductor 5, fuse 77, conductor 86 through the winding of the vibrator magnet VM³, its interrupter contact 87, conductor 80 to the other side of battery B over the path described in connection with the vibrator VM². The closure of normal contact 48 of relay ECR also establishes an energizing circuit for the pole changer switching relays PR and PR', the circuit of the relay PR being traced from battery B, conductor 2, closed contacts 3 and 4 of the key BK, conductor 5, conductor 20, through the winding of the relay PR, conductors 88 and 89, normal contact 90 of the test key TK' conductors 91, 80 and 81, closed contact 82 of the key switch a, conductors 83, 84, and 85, closed contact 38 of the key SK, conductor 73, normal contact 48 of relay ECR, conductors 49, 50, 44 and 15 to the other side of battery B. The circuit of the pole changer switching relay PR' may be traced from the point 19 over conductor 26 through the winding of the relay PR' and over conductor 89 to the other side of battery B as described in connection with the relay PR. The relay PR upon energization closes its alternate contacts 23 and 55 to switch the windings 18 and 53 of the primary P of the transformer T from contacts 25 and 51 of the vibrator magnet VM of the pole changer A to the vibratory contacts 92 and 93 of the vibrator magnet VM² of the unit O of the pole changer C, so that the vibrator VM² which is now in vibratory circuit due to the opening and closing of its interrupter contact 78, passes current through the windings 18 and 53 of the primary P of the transformer T. The relay PR' upon energization closes its alternate contacts 29 and 59 to disconnect windings 18' and 53' of the primary P' of the transformer T' from the contacts 31 and 52 of the vibrator magnet VM' of unit M, of the pole changer A to the vibratory contacts 94 and 95 of the vibrator magnet VM³ of the unit P' of the pole changer C so that the windings 18' and 53' of the primary P' of the transformer T' may receive current. The induced current from the primary P of the transformer T and the primary P' of the transformer T' into the respective secondary windings 32 and 32' of the transformers T and T' again permits alternating current at predetermined cycles to pass over conductors 33, 34 and 35, 36 to the switchboard with which the pole changer C is associated. The closure of alternate contacts 104 and 112 of relays PR and PR' switches the primaries 102 and 102' of the retardation coils RC and RC' over conductor 113 and 114 in parallel with magnets VM² and VM³ to permit a tone to be generated for delivery to the switchboard when pole changer C is in use. Current also passes through the alternating current relays AC and AC' to again bring about their energization and the closing of their alternate contacts 39 and 40 again establishes an

energizing circuit for the relay ECR and relay ECR upon energization opens its normal contact 48 but the opening 48 has no effect upon the energizing circuits of the primary relays PR and PR' and the vibrator magnets VM² and VM³ of pole changer C as switching relay SW is locked in its energized condition through its alternate contact 74 and this alternate contact 74 also holds, as previously mentioned, relays PR and PR' and magnets VM² and VM³ energized.

Referring again to relay ECR which was de-energized when the relays AC and AC' restore to normal, relay ECR upon de-energization closes its normal contact 115, and the conductors 116 and 117 which are connected to the contact 115 have associated therewith, a suitable alarm signal which operates when the pole changer A stops operating to notify the attendant at the exchange so that the pole changer may be repaired. For testing the pole changers A and C, I provide test keys TK and TK', the test key TK being associated with the pole changer A and the test key TK' being associated with the pole changer C in the description. Having assumed that the pole changer C has been automatically connected, should the attendant wish to test the pole changer A, after having taken care of the needed repair thereof, the test key TK may be operated to close an energizing circuit for the vibrator magnets VM and VM' of the units M and N of the pole changer A, the circuit being traced from battery B, conductor 2, closed contacts 3 and 4, conductors 5 and 6, fuse 7 through the winding of the magnet VM, interrupter contact 9, conductors 10 and 11, closed contacts 118 and 119 of the test key TK, conductors 120 and 15 to the other side of battery. The circuit of the vibrator VM' is traced over conductor 16 through the winding of the magnet VM', its interrupter contact 17, conductor 11 to the other side of battery, and vibrator magnets VM and VM' now operate over this circuit.

Assuming that the fuse 21 or 27 opens, this will open the battery circuit through either the windings 18 and 53 of the primary P and transformer T, or the windings 18' and 53' of the primary P' of the transformer T', and as no further current passes through either of the windings P or P', as the case may be, the relay AC or the relay AC' will be de-energized and the opening of either alternate contact 39 or 40 will bring about the operation of the circuit as already described in connection with the opening of the fuse 7.

I also provide a switching position *c* for the key K which position is associated with the operative circuit of the pole changer C and assuming that neither pole

changer is operating and one desires to connect the pole changer C, the key K is moved to its position *c* to close contacts 140 and 123 and operates starting key SK to close its starting contact 14, key SK is moved to its starting position SP to close the initial energizing circuit of the vibrator magnets VM² and VM³ from battery B conductor 2 closed contacts 3 and 4, conductor 5, fuse 77, winding of the magnet VM², interrupter contact 78 of the magnet VM² conductors 79 and 80, closed contact 140 of conductor 121, conductor 13, closed contact 14 of key SK, conductor 15, to the other side of battery B. The circuit of the vibrator magnet VM³ extends over conductor 86 through the winding of VM³, interrupter contact 87, conductor 80 to the other side of battery. Energizing circuits for pole changer switching relays PR and PR' are also established the circuit of PR being traced from battery B, conductor 2, closed contacts 3 and 4, conductors 5 and 20, winding PR, conductors 88 and 89, normal contact 90 of key TK', conductor 80, closed contact 140, conductors 121 and 13, closed contact 14, of key SK, conductor 15, to the other side of battery B. Relays PR and PR' close their alternate contacts 23 and 55, and 29 and 59 to connect the primary windings P and P' of the transformers T and T' in connection with the contacts 92 and 93 of the vibrator magnet VM² and contacts 94 and 95 of the vibrator magnet VM³. Ringing current is now delivered to conductors 33 and 34 from transformer T at a predetermined cycle to the switchboard and to conductors 35 and 36 from the transformer T' at a predetermined cycle to the switchboard. Relays AC and AC' and ECR are operated as previously described. The key SK is now moved from its starting position SP to its emergency position EP, and closed contact 14 of the key SK is opened and substitute circuits for the magnets VM² and VM³ and relays PR and PR' are now closed and extend over conductors 121 and 45, normal contact 46, of relay SW conductor 47, alternate contact 48 of relay ECR, conductors 49, 50, 44 and 15 to the other side of battery B, and the operation of the apparatus when pole changer C is operating from this point is readily apparent from the previous description.

Should pole changer C stop due to the opening of the fuse 77, the circuits of the vibrator magnets VM² and VM³ would reopen and the alternating current relays AC and AC' and relay ECR will be de-energized and the closure of normal contact 48 of the relay ECR will establish an energizing circuit for the vibrator and magnets VM and VM' of the pole changer A over a circuit traced from battery B, conductor 2, closed contacts 3 and 4 conductors 5 and

6, fuse 7, through the windings of vibrator magnets VM and VM' the interrupter contacts 9 and 17 of the magnets VM and VM', over conductor 11, conductor 122, alternate contact 123 of the key K, conductor 84, conductor 85, alternate contact 38, conductor 73, normal contact 48, conductors 49, 50, 44 and 15 to the other side of battery B.

The closure of normal contact 48 of the relay ECR establishes an energizing circuit for the switching relay SW over a circuit as previously described, and the opening of its normal contact 46 opens the circuits of the pole changer switching relays PR and PR'. The closure alternate contact 74 of the relay SW established a locking circuit for itself, as already described. The vibrator magnets VM and VM' now operate and current through the primary windings P and P' of the transformers T and T' again delivering a pre-determined cycle of current to the conductors 34 and 35 connected to the transformer T, and conductors 34 and 35 which are connected to the transformer T'. Relays AC and AC' are again energized as is also the relay ECR and the opening of normal contact 48 of relay ECR opens the initial energizing circuits of the magnets VM and VM', but as alternate contact 74 of relay SW is closed, the magnets VM and VM' are energized through this contact independent of the contact 48.

With the switching system of my invention it is readily apparent that either pole changer A or C may be used by simply moving the key K to either its *a* or *c* position and that should either pole changer stop functioning for any reason depending on which one is operating at the time automatic means are provided for instantly switching to the idle pole changer without any manipulation of keys or buttons thus eliminating an interruption of the ringing current to the switchboard with which the pole changers are associated.

While I have illustrated and described a preferred embodiment of my invention, I do not wish to be limited to this particular application of my invention as it may be used for a number of purposes.

What I claim as new and desire to secure by United States Letters Patent, is as follows:—

1. A switching system of the character described including a pair of pole changers, each of which comprises two units, a key for manually controlling the connection of either pole changer, a switch for starting the operation of said pole changer and control means conditioned by said switch and operating automatically to switch from one pole changer to the other.

2. A switching system of the character described including a pair of pole changers

each of which comprises two units, a key for manually controlling the connection of either pole changer, a switch common to said pole changers for starting the pole changer connected by said key, said switch having an emergency position to which emergency position it is moved from its starting position and control means conditioned by the movement of said switch to said emergency position to automatically switch from the pole changer in use to the other pole changer.

3. A switching system of the character described comprising a pair of pole changers, a key for manually controlling the connection of either pole changer, a switch having a starting position and an emergency position, starting means for said pole changer connected by said key when said switch is moved to starting position, and conditioning means controlled by said switch when moved from said starting position to said emergency position to switch from one pole changer to the other pole changer when the pole changer in use is disabled.

4. A switching system of the character described including a pair of pole changers each comprising two units, a key for connecting either pole changer in circuit, a switch for starting said pole changer connected by said key, an emergency position for said switch to which it is moved from starting position, a pair of transformers common to said pole changers, and means controlled by said switch when in emergency position to switch the transformers from one pole changer to the other.

5. A switching system of the character described including a pair of pole changers, a key for manually connecting either pole changer in circuit, a switch having a starting position for starting said pole changer connected by said key, an emergency position for said switch to which it is moved from its starting position, a pair of transformers common to said pole changers, a pair of relays common to said transformers, and means controlled by said switch when in emergency position to cause the operation of said relays when the pole changer in use is disabled to automatically switch said transformers from the said pole changer to the other pole changer.

6. A switching system of the character described including a pair of pole changers, a key for manually connecting either pole changer in circuit, a switch having a starting position for starting said pole changer connected by said key, an emergency position for said switch to which it is moved from its starting position, a pair of transformers common to said pole changers, a pair of relays common to said transformers energized by current from transformers

when the pole changer in use is operating, and means controlled by said relays for automatically switching the transformers from the pole changer in use to the second pole changer in case the first said pole changer is disabled.

7. A switching system of the character described including a pair of pole changers, a key for manually connecting either pole changer, a switch for starting said pole changer connected by said key, an emergency position for said switch to which it is moved from its starting position, a pair of transformers common to said pole changers, a pair of relays common to said transformers energized by current from said transformers, a pair of relays common to said pole changers, and means controlled by said first pair of relays and the switch in emergency position to operate said second pair of relays to switch said transformers from the pole changer in use to the second pole changer.

8. A switching system of the character described including a pair of pole changers, a key for manually connecting either pole changer, a switch for starting said pole

changer connected by said key, an emergency position for said switch to which it is moved from its starting position, a pair of transformers common to said pole changers, a pair of relays common to said transformers and energized by current from said transformers, a pair of relays common to said pole changers, a relay controlled by said first pair of relays, switching means controlled by said first pair of relays when the pole changer in use is disabled to effect said relay to operate said second pair of relays to switch said transformers from the disabled transformer to the second transformer.

9. A system including a pair of ringing current supply devices, a key for connecting either of said current supply devices, a supply circuit, and a switch for conditioning automatic means for disassociating one of said devices in use from said supply circuit and for connecting the other one thereto.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 28 day of Sept., 1923.

JOHN F. MEYERS.