Oct. 9, 1923. 1,469,794

L. D. KELLOGG

TELEPHONE SYSTEM

Filed Feb. 17, 1919 4 Sheets-Sheet 1

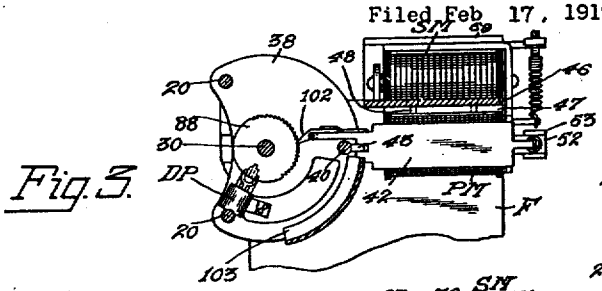

Fig. 3.

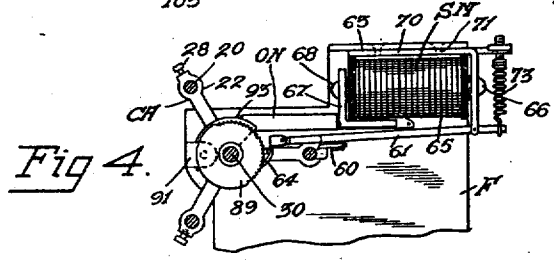

Fig 4.

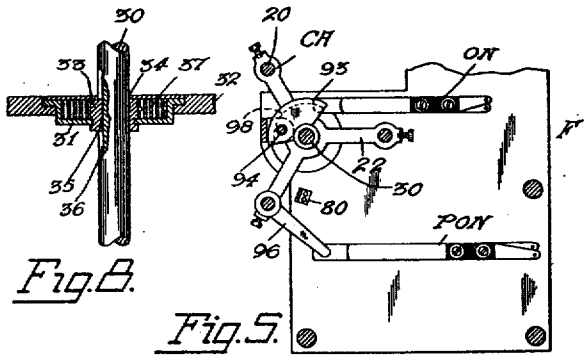

Fig. 8.

Fig. 5.

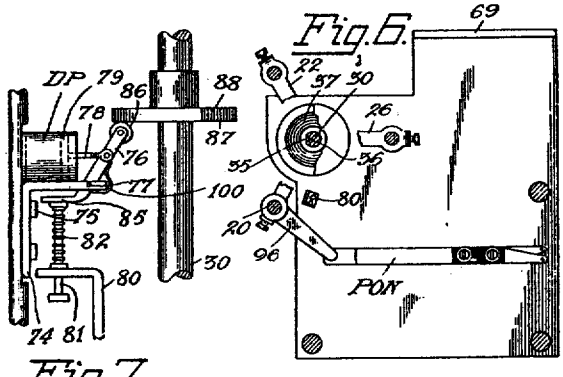

Fig. 7

Fig. 6.

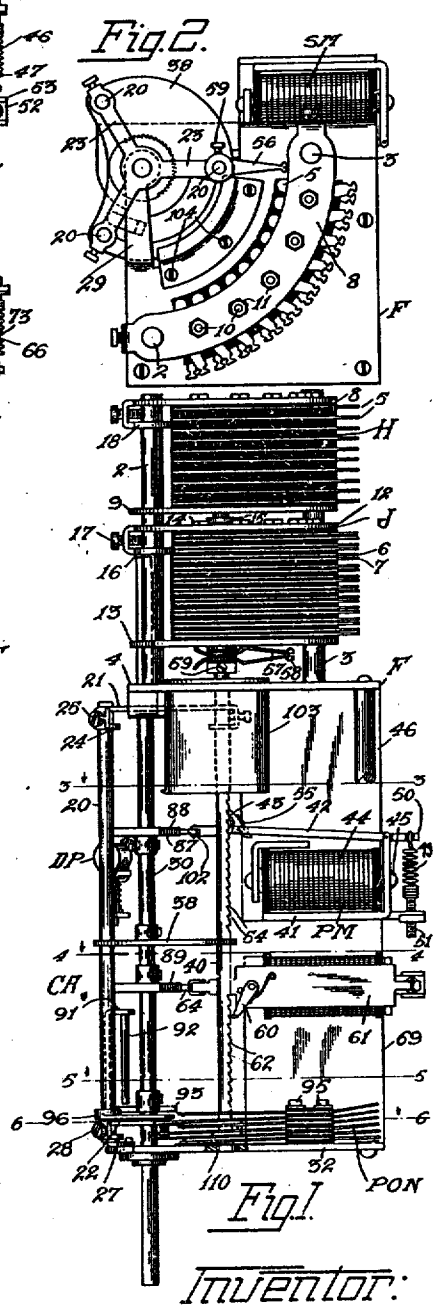

Fig. 1.

Fig. 2.

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TELEPHONE SYSTEM

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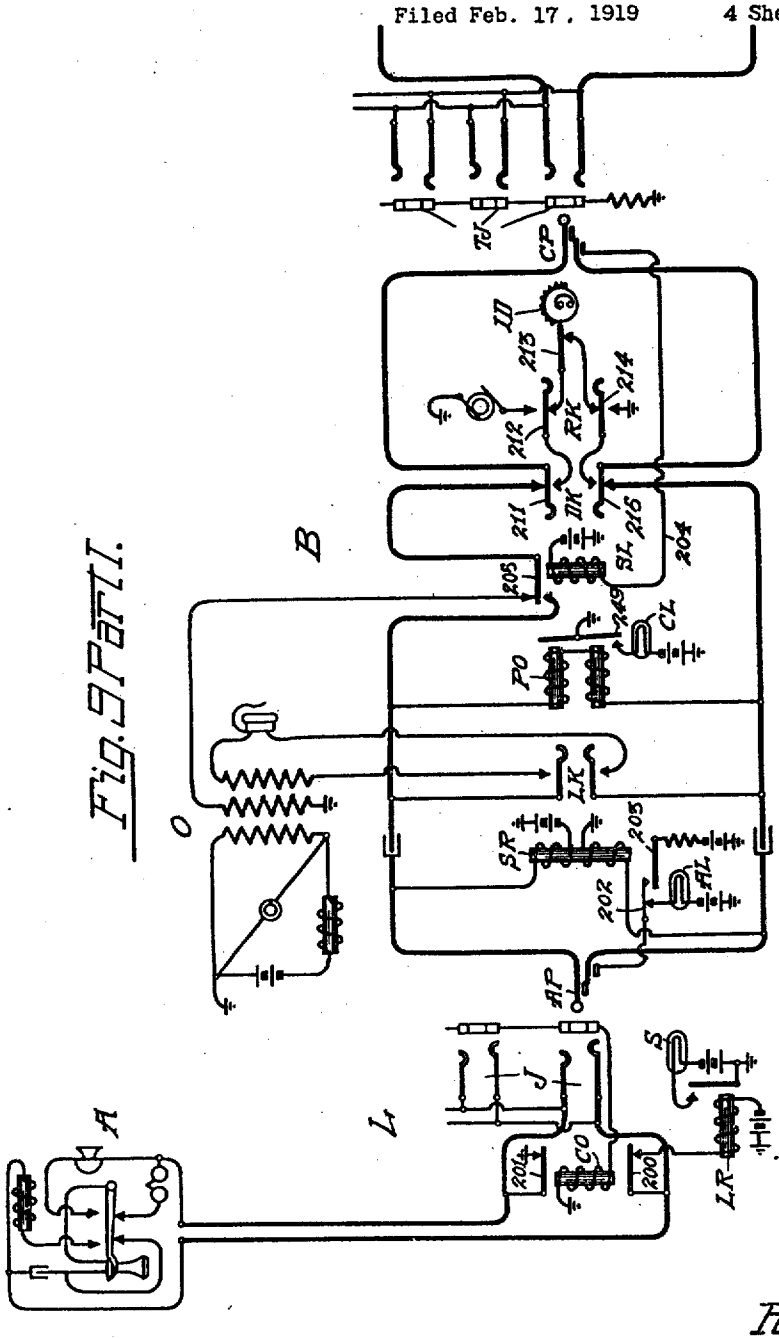

Fig. 9 Part I.

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TELEPHONE SYSTEM

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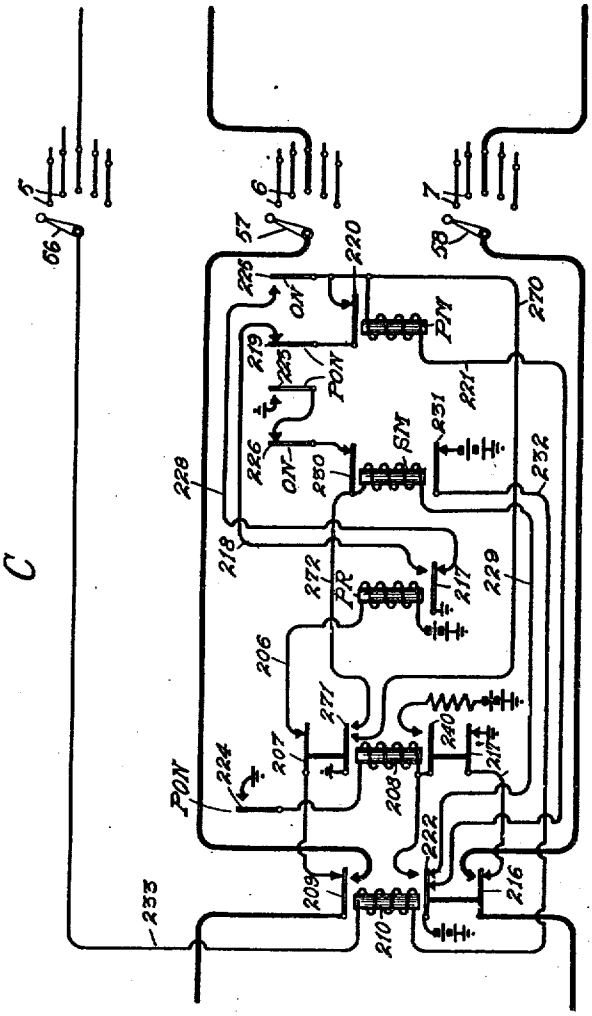

Fig. 9, Part 2.

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TELEPHONE SYSTEM

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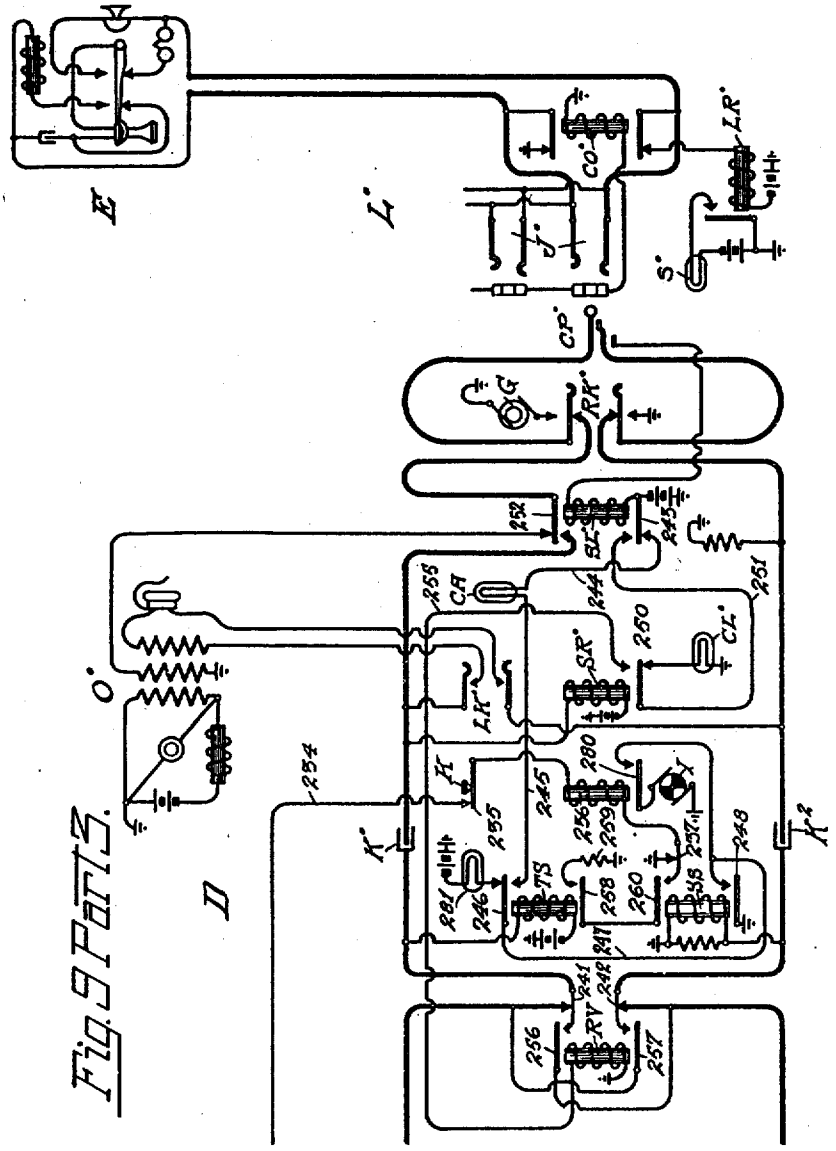

Fig. 9 Parts.

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Patented Oct. 9, 1923. 1,469,794

UNITED STATES PATENT OFFICE.

LEROY D. KELLOGG, OF DEERFIELD, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

Application filed February 17, 1919. Serial No. 277,437.

To all whom it may concern:

Be it known that I, LEROY D. KELLOGG, a citizen of the United States of America, residing in Deerfield, county of Lake, 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 telephone systems in which automatic switches are employed for completing connections, and more particularly to systems of the type in which the switches are adapted to receive a primary adjustment to select a group of contacts and thereafter a secondary adjustment to select a contact in the selected group.

An object of my invention is the production of a switch structure which is provided with a novel arrangement in which the switch carriage and shaft are both stepped in a primary direction, and when so adjusted the shaft restores to normal to be stepped in a secondary direction, as is also the carriage, for the contact selecting operation.

Another object of my invention is the provision of novel release means in which the stepping magnets, which adjust the switch wipers in their primary and secondary directions, are also utilized for release purposes, and another feature is the interlocking means that I provide for the switch to hold it in its advanced position.

A further object of my invention is to provide an improved switch structure and cooperating circuits which embody desirable features and advantages all in a simple, efficient and economical manner, which is most efficient and economical in its operation, and which has its parts so constructed and combined as to make them readily accessible for repair and adjustment.

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

For a more complete understanding of my invention, reference may be had to the accompanying drawings in which like reference characters in the different views denote like parts, and in which:

Fig. 1 is a front elevation of the switch structure of my invention;

Fig. 2 is a plan view of Fig. 1;

Fig. 3 is a sectional view along the line 3—3 of Fig. 1 looking in the direction of the arrow;

Fig. 4 is a view along the line 4—4 of Fig. 1 looking in the direction of the arrow;

Fig. 5 is a view along the line 5—5 of Fig. 1 looking in the direction of the arrow;

Fig. 6 is a view along the line 6—6 of Fig. 1 looking in the direction of the arrow;

Fig. 7 is an enlarged fragmentary view of the dash pot control of the switch shaft;

Fig. 8 is an enlarged sectional view of the motor spring showing its relation with the shaft of the switch, and

Fig. 9, which comprises Parts 1, 2 and 3, is a diagrammatic illustration of a circuit adapted to be used in connection with the switch structure of my invention.

Referring now more in detail to the switch structure as illustrated, in Figs. 1 to 8, inclusive, it comprises in general a frame F, which frame F suitably supports the contact banks H and J, the operating magnets and its associated movable parts and the carriage CA and the shaft 30.

Referring now more in detail to the switch structure as illustrated, it comprises a frame F, and to support the contact banks H and J, I provide posts 2 and 3 which are suitably secured to the portion 4 of the frame F, and to which the bank of contacts H and J are adjustably secured, as will presently be described. The upper bank of contacts H comprises the private bank contacts, as they are commonly known in the art, which include one hundred contacts 5 arranged in ten horizontal rows of ten contacts each. The lower bank of contacts J is also adjustably secured to the posts 2 and 3 and comprises the two sets of line contacts, namely, the vertical and rotary contacts 6 and 7, as they are commonly known in the art. There are one hundred pairs of contacts as 6 and 7 arranged in ten horizontal rows, there being ten pairs of contacts 6 and 7 to each row. The private bank contacts 5 are securely clamped between clamping plates 8 and 9 and suitably insulated from each other and also from the plates 8 and 9. Bolts 10 and nuts 11 are provided and form the clamping means for securing the rows of contacts 5 together as a whole to form the bank of contacts H.

The vertical and rotary contacts 6 and 7 are securely clamped between the clamping

plates 12 and 13 and are suitably insulated from each other, and bolts 14 and nuts 15 form the clamping means for securing the rows of contacts comprising vertical and rotary contacts 6 and 7 together, as a whole, to form the bank of contacts J. To secure the bank of contacts J, as a whole, to the supporting posts 2 and 3, I provide the upper clamping plate 12 with a pair of ears 16, preferably formed integral with the said plate 12, the said ears 16 being bent over parallel to the plane of the said plate 12 proper. The plates 12 and 13 and ears 16 are provided with suitable openings of a size to receive the posts 2 and 3. The bank J, as a whole, is slipped over the posts 2 and 3 and when the bank of contacts J is in a desired position, the screws 17, which screws have screw-threaded engagement with the ear portions 16, are tightened to maintain the bank in this position. The bank H, which comprises the private contacts 5, is provided with ears 18 and which serve the purpose as above described, and a further description as to the means for supporting the bank H is not deemed necessary.

A carriage CA which is adapted for a primary movement in an upward direction and for movement in a secondary rotary direction is in the form of a triangular shaped frame work composed of a rod 40 and rods 20, which rods 20 and 40 are connected by the spiders 21 and 22 to form the said frame, which comprises the carriage CA. The spider 21 is provided with radially disposed arms 23, which arms are provided with ears 24 which are bent parallel with the plane of the arms. The arms 23 and ears 24 are provided with suitable openings through which the rods 20 and 40 pass, and when the spider is in a desired position, screws 25 which are provided are tightened. The spider 22 is also provided with arms 26 and ears 27 which have suitable openings through which the rods 20 and 40 pass, and screws 28 are provided which are tightened when the spider 22 is in a desired position. The rods 20 and 40 are thus held in definite relation with each other by means of the spiders 21 and 22 forming a triangular frame work, which we will term a carriage CA. The carriage CA as illustrated is in its normal position, and when in this position the spider 21 rests against an arm 29 integrally formed with the frame F. A shaft 30 is provided centrally located with relation to the carriage CA, and adapted to impart the rotary motion to the carriage CA. The spiders 21 and 22 and arm 29 are provided with suitable openings through which the shaft 30 passes, the said arm forming the top bearing for the shaft 30. The lower end of the shaft 30 passes through a spring barrel 31, which barrel 31 is suitably secured in an orifice in the angular portion 32 of the frame F. A sleeve 33 is rotatably secured to the spring barrel 31 in any suitable manner, and is provided with a central opening 34 through which the shaft 30 passes. The sleeve 33 has a key 35 cut in its central opening 34, and the shaft 30 has a keyway 36 cut in it into which the key 35 rests. This arrangement permits the shaft 30 to be moved vertically in either direction, but when the shaft 30 is rotated to transmit the rotary motion to the carriage CA, the sleeve 33 is also rotated due to the relation established by the key 35 and keyway 36 between the sleeve 33 and shaft 30. The normal tension of the spring 37 in the spring barrel 31 is such so as to hold the said shaft 30 in its normal position as one end of the said spring 37 is secured to the sleeve 33 and its other end to the barrel 31, and when the shaft is rotated, the spring 37 is wound up for restoring purposes, as will be more fully hereinafter described. The shaft 30 is operatively connected with the carriage CA by means of a plate 38 which is suitably secured to the shaft 30, and which plate 38 is provided with suitable openings through which the rods 20 pass, so that any rotary motion of shaft 30 is also transmitted to the carriage CA for purposes as will be more fully hereinafter described. The post 40 of the carriage CA when in its normal position, rests in a suitable opening 110 in the angular portion 32 of the frame F to keep the switch and its associated parts in their normal position. A primary magnet PM which is adapted to move the carriage CA in a primary upward direction includes a heel iron 41, an armature 42, a driving pawl 43 and an electromagnet 44. The electromagnet 44 is secured to the heel iron 41 by means of a screw 45, which screw 45 has screw-threaded engagement with the core of the magnet 44. The mounting frame F is provided with an angular extension 46 which serves as mounting means for the primary magnet PM. The heel iron 41 is provided with an angular portion 47 which has suitable tapped orifices and the screws 48, which have screw-threaded engagement with the said tapped openings, secure the said magnet PM as a whole to the extension 46 of the frame F. The armature 42 is pivotally supported by the heel iron 41, and a coil spring 49 for holding the armature 42 in its normal position has its one end fastened to an arm 50 which is integrally formed with the armature 42 and its other end is fastened to an adjustable screw 51, which screw passes through a suitable opening in an arm 52, which arm is integral with the heel iron 41, the said screw 51 having screw-threaded engagement with a saddle member 53. The post 40 is provided with a plurality of teeth 54 which are successively engaged by the

pawl 43 to move the carriage CA in a primary upward direction. The pawl 43 is pivotally secured to the armature 42 and is spring pressed into engagement with a tooth 54 of the post 40 by means of a leaf spring 55. The post 40 of the carriage CA carries the wipers 56, 57 and 58, which wipers are adapted to co-operate with the contacts 5, 6 and 7, the said wipers being suitably insulated from the post 40 and secured thereto by means of the screws 59. The wiper 56 which is known in the art as the private wiper, is operatively associated with the private bank contacts 5 and the wipers 57 and 58, which are known in the art as the line wipers, are operatively associated with the vertical and rotary bank contacts 6 and 7. The wipers 56, 57 and 58 are normally two steps distant from the first row of bank contacts so that upon the first energization of the primary magnet PM, which is a preliminary energization, its armature 42 is attracted causing the pawl 43 to engage the next tooth 54 on the post 40, and upon its de-energization, the carriage CA and shaft 30, as a whole, are lifted up one step. The succeeding energization and de-energizations of the primary magnet PM, due to impulses of current transmitted thereto, cause the pawl 43 to engage successive teeth 54 on the post 40 and move the carriage CA and shaft 30 as a whole to place the wipers 56, 57 and 58 opposite the desired row of contacts 5, 6 and 7. To retain the carriage in its advanced position, I provide a retaining pawl 60 pivotally secured to the armature 61 of the secondary magnet SM, the said pawl being operatively associated with a plurality of teeth 62 on the post 40, and said pawl 60 engages successive teeth 62 to hold the carriage in its advanced position, as will be more fully hereinafter described.

A secondary magnet SM, which is adapted to move the wipers 56, 57 and 58 in a rotary secondary direction over the selected group of contacts to seek an idle set of contacts in the selected group, includes a heel iron 63, an armature 61, a driving pawl 64 and an electromagnet 65, the said electromagnet 65 being secured to the heel iron 63 by means of screw 66. A pole piece 67 is also provided and is secured to the core of the magnet 65 by means of the screw 68. The frame F is provided with an angular extension 69 which serves as a mounting means for the secondary magnet SM. The heel iron 63 is provided with an angular extension 70 which has suitable tapped openings which the screws 71 have screw-threaded engagement with to secure the magnet SM as a whole to the extension 69 of the frame F. The armature 61 is pivotally supported by the iron heel 63 and a coil spring 73 for holding the armature 61 in its normal position is also provided and is similar to that described in connection with magnet PM, and a further description is not deemed necessary.

A dash pot DP is provided and is secured to a bracket 74 in any suitable manner, the said bracket 74 being in turn secured to the post 20 of the carriage CA by means of the screws 75. An arm 76 is pivotally secured to the bracket 74 by means of the pivot pin 77 which is provided, and a link 78 pivotally secured to the arm 76 connects the dash pot piston 79 with the arm 76. A bracket 80 suitably secured to the angular portion 32 of the frame F supports a stud 81 which stud has a coiled spring 82 around it, and its tension is such that it holds the stud 81 into engagement with the angular portion 85 of the arm 76. The arm 76 carries a roller 86 at its free end, the said roller 86 engaging the bottom face 87 of the retaining ratchet 88, which is secured to the shaft 30 in any suitable manner. A rotary ratchet 89 is secured to the shaft 30 in any suitable manner and is provided with a plurality of teeth which are adapted to be engaged by the pawl 64 of the secondary magnet SM to step the wipers 56, 67 and 58 in a secondary direction. A bracket 91 secured to the angular extension 32 of the frame F carries a rod 92 which is operatively associated with an arcuate plate 93 secured to the shaft 30 for purposes as will be more fully hereinafter described.

In the operation of the switch, the primary magnet PM is alternately energized and de-energized, causing the pawl 43 to engage successive teeth 54 on the rod 40 to step the carriage CA in a primary upward direction from one group of contacts 5, 6 and 7 to the next. Upon the first de-energization of the magnet PM, the pawl 43 engages a tooth 54 of the ratchet to lift the carriage up one step, and as the wipers are normally two steps from the first group of contacts 5, 6 and 7, this preliminary step places the wipers one step from the first said group of contacts. The dash pot DP is secured to the post 20 of the carriage CA, and as the roller 86 engages the retaining ratchet 88, this motion is also transmitted to the shaft 30 also raising the said shaft 30 one step. The spring 82 causes the stud 81 to follow the distance of one step and as the stud 81 is still in engagement with the angular portion 85 of the arm 76, the said arm is held in position with the roller 86 engaging the face 87 of the retaining ratchet 88. The plate 93 is provided with a suitable opening 94 and upon this first step of the shaft 30 and carriage CA as a whole, the rod 92 enters the opening 94 to prevent any lateral movement of the car-

riage CA during its primary adjustment. A set of primary off-normal contacts PON is provided and is secured to the angular portion 32 of the frame F by means of the insulated screws 95. An arm 96, secured to a rod 20 of the carriage CA in any suitable manner, is provided with an insulation buffer which buffer engages the primary off-normal contacts PON and holds them in their normal position when the switch is in its normal position. Upon the first step of the carriage CA off normal, in a primary upward direction, the buffer on the arm 96 disengages the primary off-normal springs PON and allows them to assume their alternate position. The key 35 and keyway 36 in the sleeve 33 and shaft 30 permits the said shaft 30 to move in a primary upward direction with the carriage CA. The plate 93 which is secured to the shaft 30 is associated with a set of off-normal contacts ON, which contacts ON are insulatingly mounted upon the angular extension 32 of the frame F, and which contacts ON when the switch is in its normal position are thus engaged by an arcuate buffer 98 to hold the said contacts in their normal position. Upon the first step of the carriage CA in a primary upward direction, the buffer 98 disengages the spring set ON allowing the same to assume its alternate position. The retaining pawl 60 engages a tooth 62 on the rod 40 and holds the carriage CA in its advanced position. Now, as the primary magnet PM is alternately energized and de-energized, due to impulses being received by it, the carriage CA and shaft 30, as a whole, are stepped in a primary upward direction, and the wipers 56, 57 and 58, which are also carried by the rod 40 of the carriage CA, are carried from a position opposite one row of contacts 5, 6 and 7 to the next. Upon the second step of the carriage CA, the angular portion 85 of the arm 76 disengages the stud 81, but as the carriage is stepped upward, this upward movement of the carriage CA in conjunction with the properly adjusted weight of the shaft 30 and its parts which are being lifted by roller 86 as the carriage CA is stepped upward, does not allow spring 100 to operate the dash pot sufficiently for roller 86 to disengage the face 87, since each stroke of pawl 43 has the effect of causing supporting roller 86 to move slightly inwardly on surface 87 to compensate any partial outward movement caused by spring 100 between impulses. Piston 79 has the usual means to allow relatively free outward movement and a slower compression movement. When the carriage CA has been stepped so as to place the wipers 56, 57 and 58 opposite the proper levels of contacts 5, 6 and 7, the carriage CA and its wipers 56, 57 and 58 come to rest and are held in their advanced positions by means of the retaining pawl 60 engaging a tooth 62 of the rack on the rod 40, and the spring 100 forces the piston 79 inward and the link 78 which connects the piston 79 and arm 76 causes the said arm 76 to rock about its pivot until the roller 86 disengages the retaining ratchet, and as the shaft 30 is free, it restores to normal due to gravity again placing the rotary ratchet 89 in operative relation with the actuating pawl 64 of the secondary magnet SM. The buffer 98 on plate 93 again engages the off-normal springs ON and restores them to normal and the rod 92 is again free of the orifice 94 in the plate 93. The armature 42 of the primary magnet PM is provided with a rotary retaining pawl 102 which engages a tooth of the retaining ratchet 88 when the shaft 30 restores. The secondary magnet SM is now alternately energized and de-energized, causing the pawl 64 to engage successive teeth of the rotary ratchet 89 to step the shaft 30 in a rotary direction. The plate 38 which is secured to the shaft 30 transmits this rotary motion to the carriage CA, due to the rods 20 of carriage CA passing through suitable openings in the plate 38. The wipers 56, 57 and 58 are now moved in a rotary direction, causing them to engage successive contacts 5, 6 and 7 of the selected group to seek an idle set of said contacts 5, 6 and 7. I provide a locking plate 103 which is secured to the frame F in any suitable manner, as by means of the screws 104, and upon the first rotary step of the carriage CA, a tooth 54 on the rod 40 engages the locking plate 103 holding the said carriage CA in its upward advanced position. The locking plate 103 is provided as the retaining pawl 60 is attached to the armature 61 of the secondary magnet SM, and upon each actuation of the armature 61 the pawl 60 disengages the tooth 62 on the rod 40, and I, therefore, provide this locking plate 103 to hold the carriage CA in its advanced position and still allow the carriage CA to be rotated in its secondary direction. The buffer 98 of the plate 93 engages the contacts ON during the rotary secondary motion of the shaft 30 to hold them in their normal position. When an idle set of contacts 5, 6 and 7 is seized by the wipers 56, 57 and 58, the magnet SM remains inert, and the pawl 102 engaging a tooth of the retaining ratchet 88 holding the carriage CA and shaft 30 in their advanced secondary position, thus holds the wipers 56, 57 and 58 in engagement with the selected set of contacts 5, 6 and 7.

Now, to release the switch restoring the apparatus to normal, the primary magnet PM and secondary magnet SM are simultaneously energized and the attraction of ar-

mature 42 of primary magnet PM causes the retaining pawl 102 to be withdrawn from engagement with a tooth of the retaining ratchet 88, allowing the carriage CA and shaft 30 to be rotated back due to the spring 37, and when the wipers 56, 57 and 58 disengage contacts 5, 6 and 7, the locking plate 103 disengages a tooth 54 on the post 40, and as the secondary magnet SM is also energized, the retaining pawl 60 is free of the teeth 62 on the post 40 and allows the carriage CA to restore to normal by gravity, the lower end of the post 40 again entering the opening 110. The buffer on arm 96 again engages the primary off-numeral springs PON and restores them to their normal position, thus placing the switch at normal so as to permit another operation when selected.

In Fig. 9, which comprises Parts 1, 2 and 3, I show the necessary apparatus for establishing a connection between a calling subscriber at substation A and a called subscribed at substation E. In Fig. 9, Part 1, I show a calling substation A, together with its line circuit equipment L located at the central office, an operator's cord circuit B, together with an operator's telephone set O, and a set of multiple jacks TJ connected to a trunk circuit leading to a selector switch C, as shown in Fig. 9, Part 2. The selector switch C, as illustrated, has its different levels or groups of contacts extending to different exchanges and after an exchange has been selected by the switch C, it operates to select an idle trunk in the exchange selected. The trunk terminates at an operator's cord D as shown in Fig. 9, Part 3, so that the operator can extend the connection to the called substation E, shown at the right of Fig. 9, Part 3, together with its line equipment L'.

The substation A and the substation E are of the ordinary Kellogg common battery type, while the line circuit equipments L and L' contain the usual line relays and cut-off relays, together with multiple jacks J and J', respectively. The cord circuit B is provided with the necessary supervisory apparatus, together with an operator's impulse or calling device ID, which is diagrammatically illustrated. The cord B may also be used for establishing local connections, and I show a ringing key RK for this purpose. The selector switch C, shown in Fig. 9, Part 2, comprises the necessary line relays, motor magnets, wipers, etc. to permit them to operate successfully with the switch structure, as illustrated in Figs. 1 to 8, inclusive. The cord circuit D, shown in Fig. 9, Part 3, comprises the necessary apparatus for establishing a connection with a called substation as E.

Referring now more in detail to Fig. 9, when the subscriber at the calling substation A initiates a call, the removal of the receiver establishes an energizing circuit for the line relay LR, and line relay LR upon energization closes its alternate contact to establish a circuit for the line signal S, which causes the said signal S to glow. The operator noting the lighted signal S inserts the answering plug AP of the cord circuit B in the answering jack J of the calling line, establishing an energizing circuit for the cut-off relay CO, traced from ground through the winding of relay CO, sleeve contacts of the connected plug AP and jack J, normal contact 202 of supervisory relay SR, through the supervisory lamp AL to battery and ground. The relay CO upon energization opens its normal contacts 200 and 201, interrupting the circuit of the line relay LR which relay LR restores to efface the signal S. The insertion of the plug AP also establishes an energizing circuit for the supervisory relay SR, traced from battery through the upper winding of relay SR, tip contacts of the connected plug AP and jack J, through the substation A, through ring contacts of the connected jack J and plug AP to ground, through the lower winding of relay SR. Relay SR upon energization closes its alternate contact 203 closing a substitute circuit for cut-off relay CO, traced from batery through alternate contact 203, sleeve contacts of the connected plug and jack AP and J to ground through the winding of the cut-off relay CO. The operator after inserting the plug AP into the jack J actuates her listening key LK to connect her operator's set O to the cord conductors and inquires the wants of the calling subscriber. Assuming that it is the subscriber at the substation E of a distant exchange that is wanted, the operator now tests one of the trunk jacks TJ as to its idle or busy condition by placing the tip of the calling plug CP to the sleeve of the trunk jack TJ and if the trunk jack leads to a busy selector switch C, the sleeve of the jack TJ will have a battery potential upon it, and the operator will receive the usual click in her head receiver. Assuming that the trunk jack leads to an idle selector C, the operator inserts the calling plug CP into the trunk jack TJ and this insertion establishes an energizing circuit for the sleeve relay SL, traced from battery, through the winding of the relay SL, conductor 204, sleeve contacts of the connected plug CP and jack TJ to ground, and the relay SL upon energization closes its alternate contact 205, completing the continuity of the tip conductor.

There are a plurality of these selector switches C operatively associated with an operator, and having seized an idle one of them, the next act of the operator is to select the exchange in which the called substation E is located. Assuming that the

called substation E is in the exchange represented by the fifth level of the switch C, the operator now actuates her dial key DK to connect her impulse device ID to the calling end of the cord conductors. The actuation of the dial key DK after the insertion of the calling plug CP into a trunk jack TJ closes an energizing circuit for the primary relay PR of the selector switch C, traced from battery, through the winding of the relay PR, conductor 206, normal contact 207 of relay 208, normal contact 209 of relay 210, tip contacts of the connected plug and jack CP and TJ, alternate contact 211 of the dial key DK, normal contact 212 of the ringing key RK, normal contact 213 of the impulse device ID, normal contact 214 of the key RK, alternate contact 215 of key DK, ring contacts of the plug CP and jack TJ, normal contact 216 of relay 210 to ground at normal contact 217' of relay 208. Primary relay PR upon energization closes its alternate contact 217, establishing an energizing circuit for the primary magnet PM, traced from ground at alternate contact 217, conductor 218, normal contact 219 of primary off-normal contacts PON, normal contact 220 of magnet PM, through the winding of magnet PM, conductor 221 to battery and ground at normal contact 222 of relay 210. The primary magnet PM is energized and de-energized, causing the carriage CA and shaft 30 to be stepped in a primary upward direction one step, placing the wipers 56, 57, and 58 one step distant from their associated first level of contacts 5, 6 and 7. Due to the dash pot arrangement between the carriage CA and the shaft 30, the shaft 30 is also moved up one step as already described. Upon this step of the carriage off-normal contacts 219, 223 and 224 of primary off-normal contacts PON assume their alternate position due to the buffer on arm 96 disengaging the primary off-normal contacts PON. The buffer on plate 93 also disengages the off-normal contacts 225 and 226, allowing them to assume their alternate positions. The operator now actuates her impulse dial ID to send five impulses of current which will step the selector C to the fifth level of contacts, which we assumed was the level assigned to an exchange in which the called subscriber at substation E is located. The impulse device ID opens and closes the circuit and de-energizes the primary relay PR five times which energizes and de-energizes the primary magnet five times. Upon the first de-energization of the relay PR it closes its normal contact 217, establishing an energizing circuit for the primary magnet PM traced from battery to normal contact 222, conductor 221, through the winding of magnet PM, alternate contact 225 of contacts ON, conductor 228 to ground at normal contact 217. The four remaining impulses from the impulse device ID cause the primary magnet PM to be energized and de-energized four more times, the pawl 43 engaging successive teeth 54 of the post 40, causing the wipers 56, 57 and 58 to be stepped in an upward primary direction to the fifth level of contacts which are the contacts of trunks leading to the exchange in which the called substation E is located. The relation between the carriage CA and shaft 30 and the dash pot DP serves to also step the shaft 30 in an upward direction, but when the carriage CA remains in its advanced position, the dash pot DP operates, releasing the shaft 30 and allowing it to restore to normal, causing the buffer of plate 93, to again close the off-normal contacts 226 which we remember assumed their alternate position on the first step of the carriage CA off normal. The closing of normal contact 226 of springs ON now establishes an energizing circuit for secondary magnet SM, traced from battery at normal contact 222, conductor 229, through the winding of magnet SM, its normal contact 230, the normal contact 226 of ON to ground at alternate contact 223 of primary off-normal contacts PON. The secondary magnet SM is energized and de-energized causing the driving pawl 64 to engage a tooth of the rotary ratchet 89, stepping the wipers 56, 57 and 58 into engagement with the first set of contacts 5, 6 and 7 in search of an idle trunk leading to an idle operator in the exchange in which the called subscriber at substation E is located. As long as the wipers 56, 57 and 58 are passing over busy contacts 5, 6 and 7, the private contacts 5 are open so that as long as wiper 56 engages contacts 5 that are busy, the secondary magnet SM is energized and de-energized to step the wipers 56, 57 and 58 from one set of contacts 5, 6 and 7 to the next, and when an idle contact 5 is encountered by the wiper 56, the said idle contact 5 will be grounded, closing an energizing circuit for relay 210, traced from battery at normal contact 231 of magnet SM when it is in one of its de-energized conditions, conductor 232, through the winding of relay 210, conductor 233, wiper 56, contact 5, conductor 234, contact 235 of key K, through the winding of relay 236 to ground at normal contact 237 of supervisory relay SS. The relays 236 and 210 are energized in series and the opening of normal contact 222 of relay 210 opens the circuit of secondary magnet SM, preventing further actuation of the magnet SM and allowing the wipers 56, 57 and 58 to rest in engagement with the idle set of contacts 5, 6 and 7. The closing of alternate contacts 209 and 216 establishes the continuity of the talking conductors and the closing of alternate contact 222 establishes an energizing circuit for re-

lay 208, traced from battery through the winding of relay 208 to ground at alternate contact 224 of primary off-normal contacts PON. The relay 208 upon energization establishes a locking circuit for itself traced from from round at alternate contact 224, through the winding of relay 208, its alternate contact 240, to battery and ground.

The closing of alternate contacts 209 and 216 of relay 210 establishes an energizing circuit for the tip and sleeve supervisory relays TS and SS, traced from battery through the winding of relay TS, normal contact 241 of the reversing relay RV, contact 6, wiper 57, alternate contact 209, tip contacts of the connected plug CP and jack TJ, normal contact 211 of key DK, which key DK was restored to normal after the impulses were sent, alternate contact 205 of relay SL, through the windings of polarized relay PO, normal contact 215, ring contacts of the connected plug CP and jack TJ, alternate contact 216, wiper 58, contact 7, normal contact 242 of relay RV, through the winding of SS to ground. The relays TS and SS upon energization close an energizing circuit for the call lamp CA, traced from battery at normal contact 243, conductor 244, through the lamp CA, conductor 245, alternate contact 246 of relay TS, conductor 247 to ground at alternate contact 248 of relay SS.

The closing of alternate contact 258 of relay TS connects a substitute ground for the circuit of relays 236 and 210, and the ground at normal contact 237 of relay SS is disconnected, the circuit of relays 236 and 210 now extending from ground through the resistance 259, alternate contact 258, alternate contact 260, through the winding of the relay 236 and over the previously described path through relay 210 to battery at contact 231. The resistance 259 and the construction of relays 210 and 236 are such as to permit the continued energization of relays 210 and 236, but are such that should another switch seeking an idle operator in the exchange engage this already engaged contact, the resistance and construction would prevent the relay 210 of the other switch from operating and the switch would step ahead in search of an idle contact as already described.

The battery flow through the polarized relay PO over the previously described path is in such a direction that the armature is attracted to close its alternate contact 249 to light the supervisory lamp CL, notifying the operator at the cord circuit B that the operator at the distant exchange has been seized. The operator of the cord D noting the lighted signal CA connects her operator's set O′ to the cord conductors so that she may converse with the operator at the originating exchange or with the calling subscriber at substation A. Having assumed that it is the subscriber at the substation E that is wanted, she places the tip of the calling plug CP′ of the cord circuit D to the sleeve of the jack J′ of the called line and tests it as to its idle or busy condition. If the line is busy, she receives the usual busy click in her head receiver. Assuming that the line is idle, she inserts the plug CP′ into the jack J′ of the called line and this insertion establishes an energizing circuit for the sleeve relay SL′ traced from battery through the winding of the relay SL′, sleeve contacts of the connected plug CP′ and jack J′ and through the winding of the relay CO′ to ground. The energization of relay CO′ of line circuit L′ removes the substation control of the line circuits L′ and the energization of the sleeve relay SL′ opens its normal contact 243, effacing the call signal CA. The signal CA is not affected by the interrupter I upon the energization of relays TS and SS as the interrupter is shunted at the grounded alternate contact 248. The closing of alternate contact 243 of relay SL′ closes a circuit for the calling supervisory signal CL′ from ground through the signal CL′, normal contact 250 of supervisory relay SR′, conductor 251 to battery and ground at alternate contact 243 of relay SL′, the said lamp remaining lighted until the called subscriber at substation E answers. The operator now actuates the ringing key RK to connect the generator G to the cord conductor to signal the called subscriber at substation E, the said ringing current being traced from the ungrounded pole of the generator G, tip contacts of the connected plug and jack CP′ and J′, through the condenser and call bell of the substation E, back through the ring contacts of the jack J′ and plug CP′ to ground. When the subscriber at called substation E answers, an energizing circuit is established for the supervisory relay SR′, traced from battery through the winding of relay SR′, alternate contact 252 of relay SL′, tip contacts of the connected plug and jack CP′ and J′, the now closed contacts of the substation switch hook, back through the ring contacts of the plug CP′ and jack J′ to ground. The opening of normal contact 250 of relay SR′ effaces the signal CL′ and notifies the operator at the cord circuit D that the called subscriber has answered. The closing of alternate contact 250 of relay SR′ closes an energizing circuit for the reversing relay RV, traced from battery at alternate contact 243 of relay SL′, conductor 251, alternate contact 250, conductor 255, through the winding of relay RV, to ground. The relay RV upon energization closes its alternate contacts 256 and 257, reversing the

battery flow through the polarized relay PO of cord circuit B at the originating exchange so that its armature is attracted to open its closed contact 249 thus effacing the signal CL and notifying the operator at the originating exchange that the called subscriber has answered. The subscribers are now in conversational circuit, which may be traced over the heavily marked conductors, the said conductors having the condensers K′ and K² interposed.

The subscribers having finished conversation, replace their receivers, and the replacing of the receiver at the called substation E opens the energizing circuit for the supervisory relay SR′ which relay de-energizes and again closes a circuit for the supervisory lamp CL′ which is caused to glow, notifying the operator of the cord D that the subscriber at E has replaced his receiver. The opening of alternate contact 250 opens the energizing circuit for the reversing relay RV, and the opening of its contacts 256 and 257 changes the direction of flow of battery through relay PO to cause it to again close its contact 249 to cause the lamp CL to glow. The subscriber at the calling substation A replacing his receiver opens the circuit of the supervisory relay SR which relay de-energizes to close a circuit for the supervisory lamp AL. The operator at D noting the lighted signal CL′ now withdraws the plug CP′ from the jack J′ and this removal opens the circuit of sleeve relay SL′, which relay de-energizes and opens the circuit of lamp CL′, which lamp is effaced. The operator at the originating exchange noting the two lighted signals AL and CL withdraws the plugs AP and CP from jacks J and TJ, and the removal of the plug CP from the jack TJ opens the energizing circuit for the supervisory relays TS and SS of the cord circuit D at the distant exchange, and the relays restoring, their alternate contacts 258 and 260 are opened, opening the energizing circuit for relays 236 and 210. The relay 210 restoring, closes its normal contact 222 which simultaneously energizes the primary and secondary magnets PM and SM, the circuit of magnet PM being traced from battery at normal contact 222, conductor 221, the winding of magnet PM, conductor 270, to ground at alternate contact 271 of relay 208, which relay 208 as previously described was locked up through its alternate contact 240 upon the energization of relay 210. The circuit of magnet SM is traced from battery at normal contact 222, conductor 229, through the winding of magnet SM, conductor 272 to ground at alternate contact 271 of relay 208. The magnets PM and SM attract their armatures and withdraw their respective retaining pawls 60 and 102 from engagement with their respective retaining ratchets 62 and 88, allowing the switch C to restore to normal by spring tension and gravity, and when the switch has restored, the primary off-normal contacts PON assume their normal positions and the opening of primary off-normal contact 224 opens the locking circuit of the relay 208, and the relay 208 restoring, opens its alternate contact 271 allowing the magnets PM and SM to restore. The withdrawal of the plug CP from the jack TJ allows the polarized relay PO to restore and efface the signal CL. The withdrawal of the answering plug AP from the jack J effaces the answering supervisory lamp AL. The apparatus used in establishing the connection above outlined is now at normal and available for establishing other connections.

Assuming now that a call has been extended to a switch as C and that the switch is operating to select an idle trunk in the exchange group, and assuming further that before the idle trunk has been selected the operator at the cord circuit B removes the plug CP from the trunk jack TJ, the selection of the switch continues, as previously described, until the wiper 56 has seized an idle contact 5 leading to an idle operator as D. A circuit is now established for the relays 210 and 236 as described, and relay 208 operates and is locked up as before. In this instance no circuit is established for the supervisory relays TS and SS, as the plug CP is not in the trunk jack TJ. The relays TS and SS remain at normal and the closing of alternate contact 280 closes a circuit for the lamp 281, traced from battery, through the said lamp, normal contact 246 of relay TS, conductor 247, alternate contact 280 of relay 236, through the interrupter I to ground. The circuit through the interrupter I causes the lamp 281 to flash and notifies the operator at D of the incompleted call. The operator now depresses the key K, opening the circuit of relays 210 and 236 at the key contact 235. This allows the relay 210 to restore to close a circuit for the magnets PM and SM, which magnets are simultaneously energized to allow the switch C to restore as previously described. The relay 236 also restores, opening the flashing circuit of lamp 281. The apparatus is now at normal and available for establishing other connections.

While I have illustrated one embodiment of my invention, it is apparent that it may be applied in various ways, and also that modifications and changes will readily suggest themselves to those skilled in the art.

I, therefore, am not limited to the structure shown, but what I do claim is:

1. A two dimension automatic switch provided with a switch shaft and wipers

adapted to be moved in a lineal direction and then rotated, a magnet for stepping said shaft and wipers in a lineal direction, a second magnet for adjusting said shaft and wipers in a rotary direction, said second magnet remaining inert during the stepping operation of said first magnet, and release mechanism operative by the simultaneous actuation of said magnets to first return said switch from its rotary position by spring tension and then from its lineal position by gravity.

2. A two dimension automatic switch for an automatic exchange provided with switch wipers adapted to be moved in a lineal direction and also rotated, a magnet for stepping the wipers in a lineal direction, a second magnet for adjusting the wipers in a rotary direction, and restoring means therefor operative in response to the simultaneous energization of said magnets to first permit the restoration of said switch from its rotated position and then from its lineal position.

3. A two dimension switch for an automatic exchange including a shaft and wipers adapted to be rotated and moved in a lineal direction, a magnet provided with an armature for moving the shaft and wipers in a lineal direction, a second magnet for moving the shaft and wipers in a rotary direction, means for energizing both of said magnets, and mechanical holding means released by the simultaneous energization of said magnets to permit restoration of said switch first from its rotary direction by spring tension and then from its lineal direction by gravity.

4. A two dimension switch for automatic exchanges, including a primary adjusting magnet and a secondary adjusting magnet, said primary magnet serving as means for stepping said switch in a vertical direction and said second magnet serving as means for stepping said switch in a rotary direction, and retaining devices controlled by the armatures of said magnets to hold the switch against return movement during primary adjustment, said armatures serving to withdraw said devices at time of release.

5. A two dimension switch for automatic exchanges, including a primary adjusting magnet and a secondary adjusting magnet, said primary magnet serving as means for stepping said switch in a vertical direction and said second magnet serving as means for stepping said switch in a rotary direction, a retaining device controlled by the armature of said first magnet to hold the switch against return movement during secondary adjustment, a second retaining device controlled by the armature of said second magnet to hold the switch against return movement during primary adjustment, said armatures serving to withdraw said devices at time of release.

6. A two dimension switch for automatic exchanges, including a primary adjusting magnet and a secondary adjusting magnet, a retaining device controlled by the first magnet holding the switch against return movement while being adjusted by the second magnet, a retaining device controlled by the said second magnet holding the switch against return movement while being adjusted by the first magnet, and means controlled by the simultaneous energization of said magnets adapted to actuate said respective devices to free said switch for release.

7. A selective switch for automatic exchanges, including contacts arranged in groups, a magnet to adjust said switch to select a group, another magnet to adjust the switch to select a contact of a selected group, and mechanical connections under conjoint control of said magnets and operable by their simultaneous actuation to restore the switch first from said selected contact and then from said selected group to normal.

8. A selective switch for automatic exchanges, including contacts arranged in groups, a magnet to adjust said switch to select a group, a second magnet to adjust said switch to select contacts of a selected group, a holding device for said second magnet to restrain said switch from return movement from its group adjusted position, a second holding device for said first magnet to restrain said switch from return movement from its contact adjusted position, and armatures on said magnets adapted to withdraw the holding devices by the simultaneous energization of said magnets.

9. A selective switch for automatic exchanges, including contacts arranged in groups, a magnet to adjust said switch to select a group, a second magnet to adjust said switch to select contacts of a group, a holding device for said first magnet to restrain said switch from return movement from its contact adjusted position, a second holding device for said second magnet to restrain said switch from return movement from its adjusted position, and armatures for the said magnets adapted to withdraw the holding devices.

10. A reciprocating switch for automatic exchanges, including a rotary ratchet and magnet, a longitudinal ratchet and magnet, a holding pawl for the rotary ratchet controlled by the longitudinal magnet and a holding pawl for the longitudinal ratchet controlled by the rotary magnet.

11. A selective switch for automatic exchanges, adapted for primary and for secondary adjustment, including a magnet to

adjust the switch in one direction, and a second magnet for adjusting the switch in the other direction, said first magnet having an armature carrying a detent for holding the switch against return movement when adjusted in the other direction by said second magnet.

12. A selecting switch for automatic exchanges, including a primary ratchet and a secondary ratchet, said ratchets, being independently adjustable respectively, means for restoring one ratchet, means for restoring the other ratchet at the end of conversation, said first and second means operating simultaneously to restore said ratchets, and off normal switches controlled by said ratchets respectively.

13. A two directional selecting switch including a pair of off normal contacts, means for restoring the one contact at conclusion of the switch's travel in a particular direction, and means for restoring the other at the end of conversation.

14. A two direction backward release selecting switch including advance controlling magnets, one for each direction, a release mechanism for said switch solely controlled by the simultaneous joint action of said magnets for first restoring said switch from its last moved position, and then from its first moved position.

15. Backward release switch mechanism including advance controlling magnets, one controlling group selection, and the other contact selection from a group, and release means for said mechanism solely controlled by the simultaneous action of said magnets to first release said switch from a selected contact in a selected group and then from said selected group.

16. In a selecting switch having two directions of travel, an advancing magnet for the one direction, and a holding device against back movement from an advanced position in the other direction, said holding device being attached to the armature of and controlled by said magnet.

17. An advancing selecting switch adapted for adjustment in a primary direction and then in a secondary direction, a primary magnet for stepping said switch in a primary direction, a secondary adjusting ratchet and a secondary magnet pawl for operating the same, means for destroying the operative adjustment between said ratchet and pawl at each step of a primary magnet during the primary advance, and means for restoring the operative adjustment between said ratchet and pawl after the primary advance.

18. A selecting switch circuit including a primary relay having a front contact and a back contact, a primary magnet and circuit connections from said magnet's winding to said contacts respectively, a normally closed off normal contact in one connection, and a normally open off normal contact in the other, and a switch contact of said magnet in one connection.

19. A selector for automatic exchanges, including back release mechanism, a primary advance controlling magnet and a secondary advance controlling magnet simultaneously energized to render said mechanism effective for release, a relay controlling said magnets, and means for operating said relay to energize said magnets when disconnection is desired.

20. A progressive switch for automatic exchanges, including a group selection controlling magnet, a relay controlling said magnet in its group selecting operation, means for employing said magnet to restore said switch, a second relay to control said magnet in its restoring operation, and automatic means to switch said magnet from control of said first relay to control of the second.

21. Selecting switch mechanism including driving magnets for adjustment to select a contact group, and to select contacts out of a selected group, independent circuit connections controlling said magnets in their selecting operations, a single circuit controlling device to control both magnets, and release means for said switch operative by the simultaneous energization of said magnets under control by said device.

22. In a selecting mechanism for automatic exchanges, a plurality of private multiple contacts with normal low resistance battery connections respectively, means for inserting resistance in said connections to render said contacts busy, a test relay for connection to said contacts to test the same, a test circuit including the winding of said test relay, and means for opening the circuit of said test relay when it connects to a busy contact.

23. In a selecting mechanism for automatic exchanges arranged for group selection, and rotary selection of contacts from a group, a contact selection magnet and a relay controlling it, a group selecting magnet, automatic means to place it under control of said relay at a particular point in the operation of said mechanism whereby said relay controls both said magnets, and release apparatus for said mechanism operable by said magnets on operation of said means.

24. In selecting mechanism for automatic exchanges arranged for group selection, and selection of contacts from a group, a combined contact-testing and release relay, a group selection magnet and a contact selection magnet and automatic means whereby both are temporarily controllable by said relay after a particular point in the opera-

tion of said mechanism is reached, and release mechanism thereon controlled by said magnets.

25. In a selecting mechanism for automatic exchanges, arranged for group selection, and rotary selection of contacts from a group, a magnet controlling groupwise adjustment of said mechanism, a second magnet controlling adjustment of said mechanism from contact to contact of the selected group, a relay for testing the idle or busy condition of an engaged contact and for controlling the release of said mechanism, and automatic means for placing the energization and de-energization of said first magnet under control of said relay at a particular point in the operation of said mechanism.

26. In a selecting mechanism for automatic exchanges, a selector having a pair of normally open talking wires and a test wire, a magnet to adjust said mechanism groupwise, a relay adapted to complete the continuity of said talking wires at a particular point in the operation of said mechanism, and automatic means for switching said magnet under control of said relay, said magnet serving as a release magnet when so controlled.

27. A selecting mechanism for automatic exchanges, having wipers adapted to be moved for group adjusting and rotated for contact adjusting, a magnet for groupwise adjusting said mechanism, a relay controlling automatic selection of individual contacts out of a group, and automatic means whereby at a particular point in the operation of said mechanism, said relay seizes the control of said magnet. said relay when operated preventing the release of said mechanism.

28. In a selecting mechanism for automatic exchanges, a magnet for groupwise adjusting said mechanism, a relay controlling automatic selection of individual contacts out of a group, a second relay operated by the first to place said magnet under control of said first relay, a locking circuit for said second relay including an off normal contact, and release mechanism controlled by said magnet.

29. A selector having a switch shaft and wipers for vertical and rotary adjustment and also including a vertical magnet and a rotary magnet, and means for said selector to restore it first from its rotary adjustment and then from its vertical adjustment when said magnets are simultaneously energized.

30. A telephone system including an operator's circuit, automatic switches operable in a vertical and a rotary direction for selecting said operator's circuit, a signal for said operator's circuit, and switchboard operator controlled means for intermittently operating said signal when an unstandard call is extended to said operator's circuit.

31. A telephone system including subscribers' lines, an operator's circuit, automatic switches for connecting said subscribers' lines and said operator's circuit, a signal for said operator's circuit, and means for intermittently operating said signal when a connection is effected to the operation of one of said switches and said connection is discontinued before connection is effected with said operator's circuit.

32. A telephone system including subscribers' lines, an operator's circuit, automatic switches for connecting said subscribers' lines and said operator's circuit, a signal for said operator's circuit, means for intermittently operating said signal when a connection is effected to the operation of one of said switches and said connection is discontinued before connection is effected with said operator's circuit, and operator-controlled means for releasing said switch.

33. A telephone system including an operator's circuit, automatic switches operable in a vertical and a rotary direction for selecting said operator's circuit, a call answering signal for said circuit, a supervisory signal for said circuit, and a third signal for said circuit for visualizing unstandard connections.

34. A telephone system including a numerical automatic switch, an impulse-controlled primary magnet for said switch, an interrupter-controlled secondary magnet for said switch, a release relay for said switch adapted to be held energized during conversation, and circuits for said magnets adapted to be closed by the de-energization of said release relay to effect a release of said switch.

35. A telephone system including a numerically controlled automatic switch, an impulse-controlled primary magnet for said switch, an interrupter-controlled secondary magnet for said switch, a release relay for said switch adapted to be held energized during the time the said switch is held in use for conversational purposes, circuits for said magnets controlled by said release relay, and release mechanism brought into operation by the actuation of said magnets.

36. An automatic switch of the character described including a bank of passive contacts and active contacts for cooperation therewith, an electromagnetically controlled member carrying said active contacts, an auxiliary electromagnetically controlled member mechanically linked to said first electromagnetically controlled member, a driving magnet for moving said first electromagnetically controlled member and said second electromagnetically controlled member, time-controlled mechanism for disconnecting said auxiliary electromagnetically

controlled member from said first electromagnetically controlled member, and a second driving magnet for rotating said auxiliary electromagnetically controlled member and said first electromagnetically controlled member.

37. A device of the character described including a switch shaft carrying wipers, an auxiliary switch shaft, a primary magnet for moving said switch shafts in one direction, a time-controlled device for releasing said auxiliary shaft from said first-mentioned shaft, a secondary magnet for operating said auxiliary switch shaft, and a mechanical link connecting said switch shafts whereby the operation of the auxiliary switch shaft causes an operation of said wiper-carrying switch shaft.

38. A device of the character described including a wiper-carrying switch shaft and an auxiliary switch shaft, a primary magnet for moving said switch shafts in one direction, means for permitting the restoration of one of said switch shafts without restoring the other switch shaft, and a secondary magnet for then rotating said switch shafts.

39. A device of the character described including a wiper-carrying switch shaft and an auxiliary switch shaft, a primary magnet for moving said switch shafts in one direction, means for returning one of said switch shafts to normal, a secondary magnet for then operating said last switch shaft, and a link between said switch shafts causing both of said switch shafts to be operated when the last said switch shaft is operated.

40. A device of the character described including a switch shaft carrying wipers, an auxiliary switch shaft, a primary magnet for moving said switch shafts in one direction, a time-controlled device for releasing said auxiliary shaft from said first-mentioned shaft, a secondary magnet for operating said auxiliary switch shaft, a mechanical link connecting said switch shafts whereby the operation of the auxiliary switch shaft causes an operation of said wiper-carrying switch shaft, and releasing means for permitting the restoration of said switch shafts to normal, said releasing means being controlled by said magnets.

41. A device of the character described including a wiper-carrying switch shaft and an auxiliary switch shaft, a primary magnet for moving said switch shafts in one direction, means for permitting the restoration of one of said switch shafts without restoring the other switch shaft, a secondary magnet for then rotating said switch shafts, and releasing means for permitting the restoration of said switch shafts to normal, said releasing means being controlled by said magnets.

42. A device of the character described including a wiper-carrying switch shaft and an auxiliary switch shaft, a primary magnet for moving said switch shafts in one direction, means for returning one of said switch shafts to normal, a secondary magnet for then operating said last switch shaft, a link between said switch shafts, causing both of said switch shafts to be operated when the last of said switch shafts is operated, and releasing means for permitting the restoration of said switch shafts to normal, said releasing means being controlled by said magnets.

43. An automatic switch of the character described including a switch shaft, a primary magnet and a secondary magnet for said switch, armatures and driving pawls for said magnets, a retaining detent connected to the armature of said secondary magnet for retaining the said switch shaft in an operated position when moved thereto by the primary magnet, and a retaining detent connected to the armature of the primary magnet for retaining said switch shaft in operated position when moved thereto by the secondary magnet.

44. An automatic switch of the character described including a switch shaft, a primary magnet provided with an armature and a driving pawl, a secondary magnet provided with an armature and a driving pawl, a detent connected to the armature of said secondary magnet for preventing the return of said switch shaft to normal in one direction when moved to an operated position by the primary magnet, and a detent connected to the armature of the primary magnet for preventing return of the switch shaft to normal in another direction when moved to an operated position by the secondary magnet.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 12 day of February, 1919.

L. D. KELLOGG.