E. E. CLEMENT.

AUTOMATIC SWITCH.

APPLICATION FILED OCT. 26, 1907.

1,029,590.

Patented June 18, 1912.

5 SHEETS—SHEET 1.

Fig. 1.

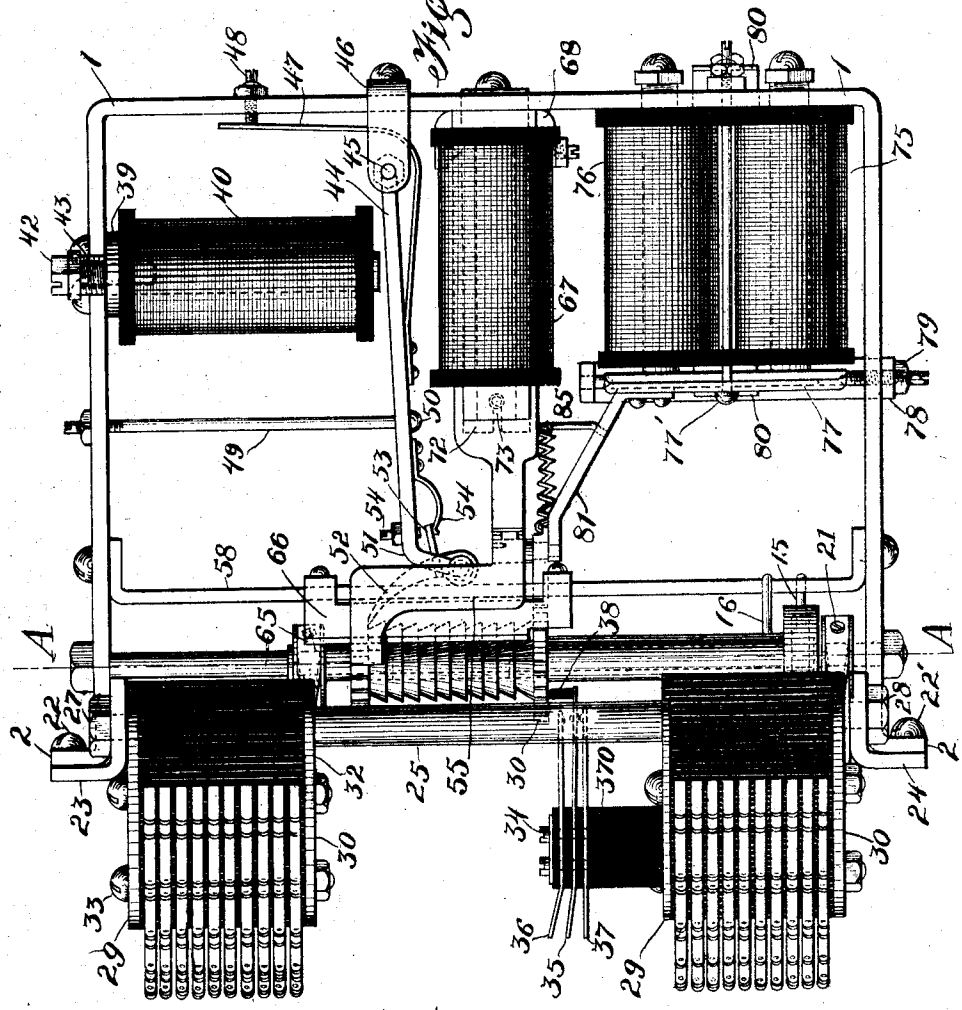
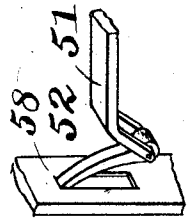


Fig. 1a.



Witnesses

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5 SHEETS—SHEET 2.

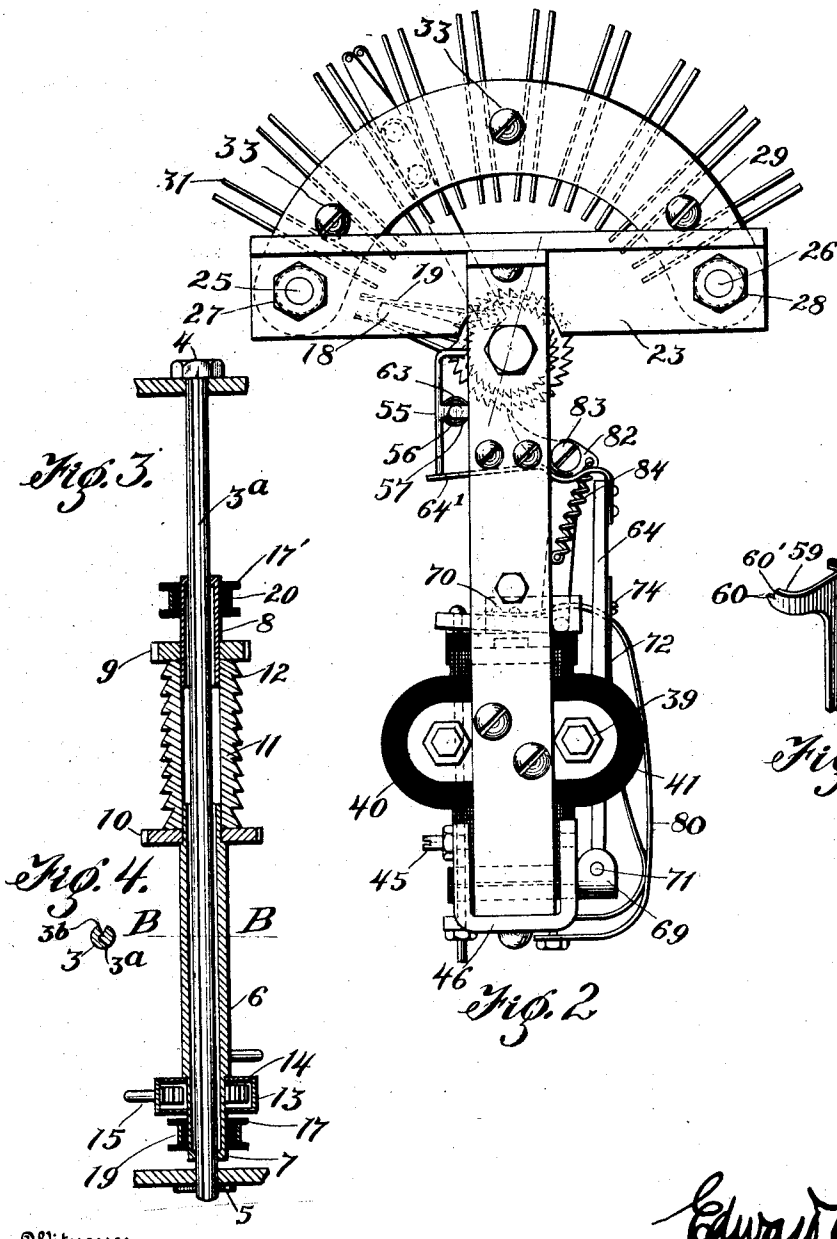

Fig. 3.

Fig. 4.

Fig. 2

Fig. 5.

Witnesses

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5 SHEETS—SHEET 3.

Fig. 6.

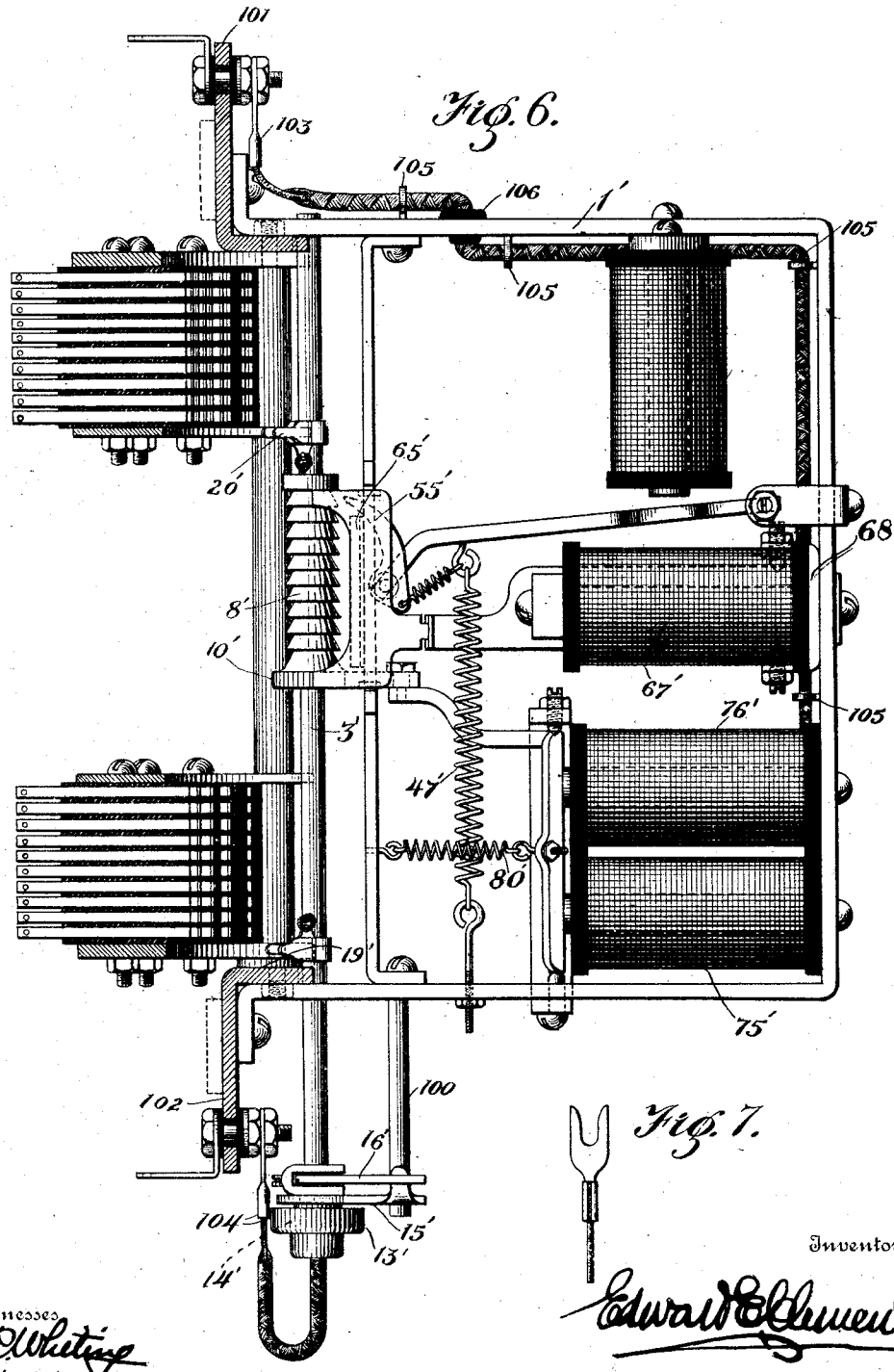

Fig. 7.

Witnesses

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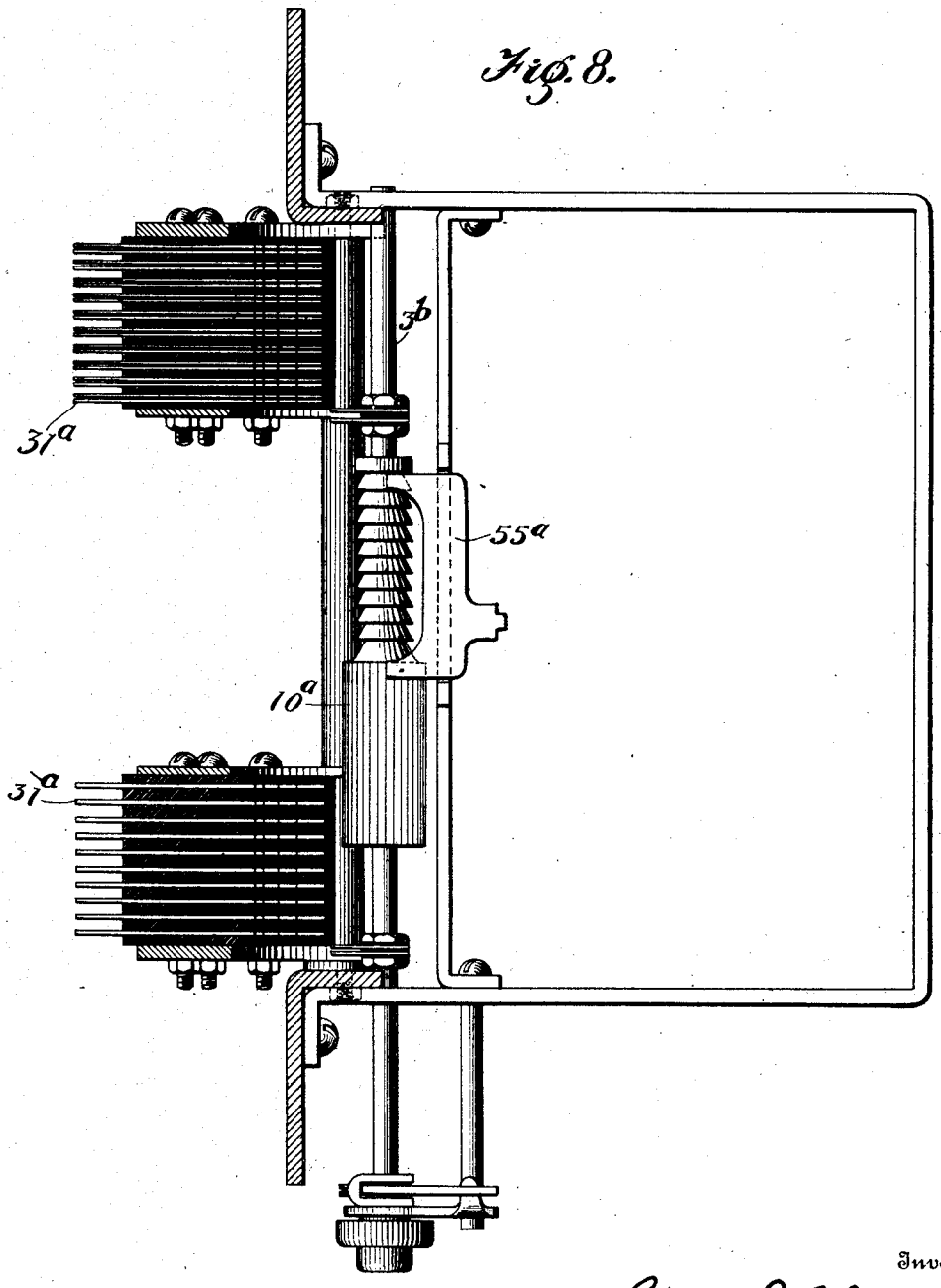
5 SHEETS—SHEET 4.

Fig. 8.



Witnesses

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AUTOMATIC SWITCH.

APPLICATION FILED OCT. 26, 1907.

1,029,590.

Patented June 18, 1912.

5 SHEETS—SHEET 5.

Fig. 9.

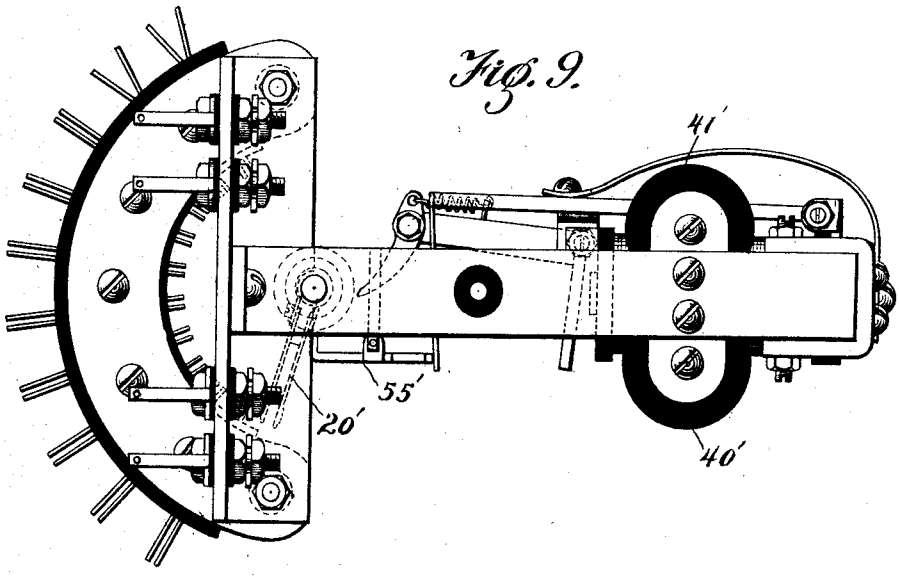
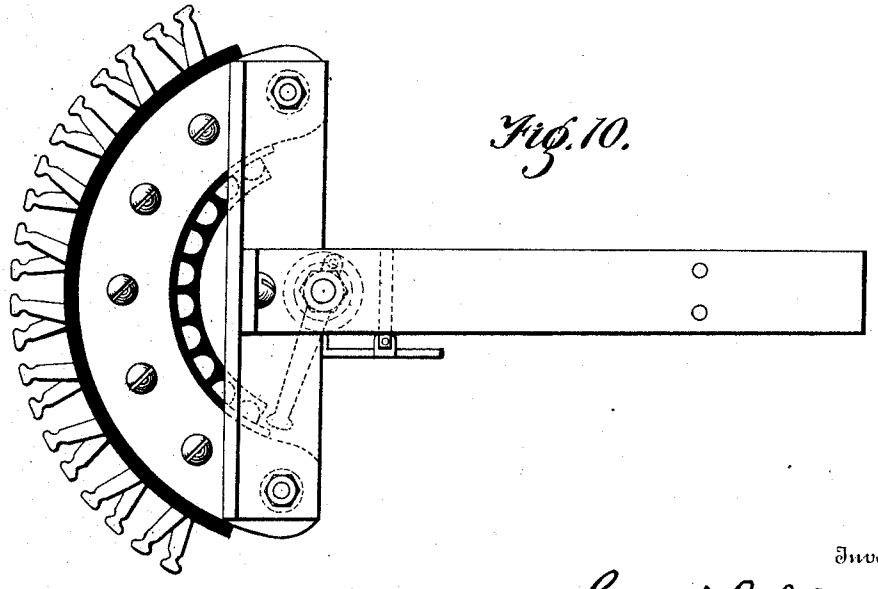


Fig. 10.



Witnesses

H. S. Whiting

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UNITED STATES PATENT OFFICE.

EDWARD E. CLEMENT, OF WASHINGTON, DISTRICT OF COLUMBIA.

AUTOMATIC SWITCH.

1,029,590. Specification of Letters Patent. Patented June 18, 1912.

Application filed October 26, 1907. Serial No. 399,284.

To all whom it may concern:

Be it known that I, EDWARD E. CLEMENT, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Automatic Switches, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to automatic switches and more particularly to those switches which are used in effecting connection of the talking circuits in telephone exchange systems. Switches of this type are generally operated by means of electrical impulses sent from the subscriber's station, as in the full automatic systems, or by means of a sending device manipulated by an operator, as in the semi-automatic systems.

An object of my invention is to provide a switch in which the working parts are closely assembled on a light supporting frame and in which the contact banks are also within said frame, thus providing a compact and self-contained structure.

A further object of my invention is to provide a switch which does away with the necessity for associated side switches for controlling the actuating magnets, the latter being controlled by ordinary relays separate from the switching device.

A further object of my invention is to provide means for effectively retaining the switch parts in their shifted position and for restoring them to their normal position. This I accomplish through the medium of a retaining dog which works in conjunction with a stationary stop member.

A further object of my invention is to provide a switch structure in which certain of the moving parts are less liable to damage since they are not projected beyond the frame in their shifted positions. To this end I have provided a sleeve, capable of longitudinal movement along a shaft, the latter being stationary and the former designed to carry wipers for engagement with the contacts in the contact banks.

Other objects and advantages will appear in the detailed description of the device.

My invention is illustrated in the accompanying drawings in which—

Figure 1 is a side elevation of my improved switch; Fig. 1ª is a fragmentary detail view showing the vertical pawl and guiding means. Fig. 2 is a plan view of the switch; Fig. 3 is a sectional view through the main shaft along the line A—A of Fig. 1; Fig. 4 is a sectional view of the shaft along the line B—B of Fig. 3; Fig. 5 is a perspective view of the retaining pawl; Fig. 6 is a side view of a modified form of switch; Fig. 7 is a detail view of a connector terminal; Fig. 8 is a view showing another modification of the switch; Fig. 9 is a plan view of the form shown in Fig. 6; Fig. 10 is a plan view of the form shown in Fig. 8.

Referring to Fig. 1, the frame of the switch is denoted in general by the numeral 1, and it consists of a flat bar of steel or iron bent into a U-shaped form and having outwardly turned flanges at the free ends. Disposed between the parallel sides of said U-shaped frame is a stationary spindle or shaft 3, one end of which is provided with a hexagonal head 4 and the other end of which is perforated to receive a cotter pin 5. In assembling the parts the spindle is passed through registering openings in the parallel sides of the frame and is secured to the latter by means of the cotter pin, although obviously other equally efficient means might be employed for securing the spindle. The spindle is provided with a V-shaped slot 3ª, thereby providing edges 3ᵇ which serve to cut or scrape the dust from the bearing surfaces and permit it to fall free from the shaft.

On the shaft 3 is disposed a metallic sleeve 6 having a reduced lower end 7 and connected with an upper sleeve 8 by means of a cylindrical member interposed between the two, the whole constituting a single sleeve having a bore somewhat larger than the diameter of the shaft except at the ends where the bore is reduced. This construction provides end bearings for the sleeve and considerably reduces the friction between the latter and the spindle along which the sleeve is adapted to slide. It also prevents binding due to any slight springing of the shaft.

Two ratchet wheels 9 and 10 are secured to the upper reduced portion of the sleeve, the axes of said wheels coinciding with that of the sleeve. The lower of said ratchet wheels has a slightly greater diameter than that of the upper one. Carried by said sleeve between the ratchet wheels 9 and 10 is a cylindrical rack 11 provided with downwardly inclined teeth 12.

A cylindrical casing 13 is loosely mounted on the lower reduced portion 7 of the sleeve. This casing provides a housing for a spiral spring 14, one end of which is secured to the sleeve and the other to the side of the casing itself. A stud or stop 15 is secured in the wall of the casing and a small stop 16, located at a slight distance above the casing, is carried by the sleeve 6.

Firmly secured to the upper and lower reduced ends 8 and 7 respectively of the sleeve are insulating spools 17 and 17′. The opposite surfaces of both of these spools are slotted to provide parallel sides to which the wipers 19 and 20 are fastened by means of the screws 21. These wipers are adapted to effect electrical connection with the rows of contacts in the contact banks in a manner hereinafter described. In order to prevent the wipers from coming in contact with each other an insulating stud 18 is provided as is shown in Fig. 2.

Secured to the outwardly turned flanges 2 of the U-shaped frame, by means of the screws 22 and 22′, are the transverse L-shaped members 23 and 24, connected by the bolts 25 and 26. These bolts have reduced ends adapted to pass through openings in the members 23 and 24. The nuts, 27 and 28, securely clamp the banks of assembled contacts between the members 23 and 24 and the shoulders on the shafts 25 and 26.

Two contact banks are shown in the drawing, although obviously more might be provided. Each contact bank comprises two arc-shaped retaining plates, 29 and 30, between which are held the contact pieces 31, the latter being arranged in vertical rows. The rows are grouped in pairs, those of each pair being parallel and arranged approximately on a radial line, with the axis of the spindle as a common center. The contacts also form a series of horizontal rows as may be readily seen from the figures, being spaced apart from one another both horizontally and vertically by suitable insulating material 32. The assembled contact springs, together with the insulation, are firmly clamped as before stated between the retaining plates 29 and 30 by means of the bolts 33. The individual contact members are composed of flat pieces of metal, each row of contacts being arranged with the flat sides of the contacts in a common, vertical, radial plane.

In the switch herein described the upper bank is provided with talking contacts and wipers, being designed to effect a double connection while the lower bank has contacts for testing purposes only. The arrangement of the contacts with their flat sides in vertical planes instead of horizontal planes eliminates all chance of the contacts becoming clogged up by accumulations of dust or dirt, the vertical reciprocatory movement of the wipers further serving to effectually remove whatever dust adheres to the sides of the contacts.

Secured to the plate 29 of the lower bank of contacts by means of the screws 34 is the spring contact 35 together with its upper and lower anvils 36 and 37 respectively, these springs being spaced apart and being supported by the insulating material 370. On the outer end of the spring contact 35 is an insulating stud 38 adapted to be engaged by the lower ratchet wheel 10 when the latter is in its normal position.

Secured to the upper part of the frame 1 is the transverse member 39 the latter forming part of the metallic circuit for the magnetic flux of two depending magnets 40 and 41. The cores of the magnets 40 and 41 are tapped at one end to receive the screws 42 which pass through threaded bushings 43 adapted to engage similar threads in openings in the transverse member 39. This construction permits a vertical adjustment of the magnets. The armature of these magnets consists of a bar of soft iron 44 pivoted at 45 to the arms of the U-shaped member 46 which is secured to the frame 1. A spring 47 is fastened to the under side of the armature 44, is then bent upwardly and passes between the arms 46 into engagement with a screw 48 carried by the frame 1 and designed to regulate the tension of the spring. An adjustable rod 49 passes through an opening in the armature 44 and is provided with a head 50 on its lower end, the latter limiting the downward movement of the armature. The free end of the armature is bent downwardly at 51 and a pawl 52 is pivoted thereon. The pawl is provided with a laterally projecting lug 53 adapted to be engaged by a spring 54 carried on the under side of the armature, while a regulating screw 54′, also carried by the armature and adapted to engage the lug 53, serves as an adjustable stop for the pawl.

The magnets 40 and 41, the armature 44 together with its associated pawl and springs constitute means by which the sleeve 6 may be raised vertically, each actuation of the magnets attracting the armature which forces the pawl into engagement with the cylindrical rack and raises the latter one step. On the retraction of the armature the sleeve would drop were it not for the dog 55,

a detailed view of which is shown in Fig. 5. This dog is pivoted on a shaft 56 which is carried by laterally projecting arms 57 on a vertical bar 58, the latter being firmly secured to the frame 1 and constituting in fact a part of said frame. The member 58 is provided with a rectangular opening through which the pawl 52 is adapted to pass, being guided by the lower edge of said opening in its movements toward and from the rack. The dog 55 is provided with an upper arm 59 bent laterally at its end and having a reduced, beveled extension 60 at its extremity, thereby providing a shoulder 60′. The oppositely extending lower arm 61 has a reduced end 62. The dog 55 is normally held in engagement with the upper ratchet wheel 9 by means of a spring 63. A perforated spring member 64′ carried by a pivoted bar 64 is adapted to engage the dog in a manner hereinafter described. At the first upward movement of the sleeve, the arm 59 leaves the upper ratchet wheel 9 and the sleeve is thereafter kept from rotation by means of the knife edge 65 on a vertically disposed bar 66 which is firmly secured to the bar 58, the said knife edge entering the space between two adjacent teeth of the lower ratchet wheel 10, as the dog 55 leaves the upper ratchet wheel 9, thereby preventing the rotation of the sleeve. The shoulder 60′ on the arm 59 serves as a stop for the downwardly inclined teeth of the cylindrical rack 11 against which the dog is held, the beveled edge of the latter permitting a free upward movement of the rack.

The release magnet 67 is secured to the frame 1, a metallic member 68, provided with integral ears 69 bent laterally at one end thereof, being firmly clamped between the frame 1 and said magnet and serving as part of the magnetic circuit of the latter. Secured to the opposite end of the pole piece of the magnet 67 is a rectangular extension 70. The bar 64 which is pivoted at 71 between the two ears 69 serves as the armature of the magnet and is attracted toward the rectangular extension 70 when the magnet is energized. A spring 72 provided with a slot 73 is secured to the frame by the same screw that holds the magnet and the member 68. This spring is bent laterally and is held in sliding engagement with the armature 64 by means of a headed screw 74 which is adapted to pass freely into the slot 73. When the release magnet is energized the armature 64 is attracted, the perforation in the spring 64′ is brought into registration with the extension 62 on the lower arm of the dog 55, the spring slipping over the extended part 62. When the magnet is deenergized the armature 64 is retracted by means of the spring 72 thereby pulling the dog out of engagement with the circular rack and allowing the sleeve to drop. The dog 55 is held by the spring away from the rack until released through the action of the rotary magnets described herein.

The rotary magnets 75 and 76 are secured to the frame in a similar manner described in connection with the vertical magnets 40 and 41. The armature 77 of the rotary magnets is pivoted between the arms of a U-shaped supporting member 78, the latter being secured to the lower arm of the frame 1 by means of the screw 79. The motion of this armature is limited, as in the case of the armature of the vertical magnet, by a similar adjustable stop 77′. A flat spring 80 is secured to the opposite end of the magnet, is bent laterally and fastened to the armature, serving to retract the latter when the magnet is deënergized. An upwardly inclined arm 81 is secured to the armature 77, said arm being bent laterally at its upper end to form a horizontal extension. A pawl 82 is pivotally secured on said extension by means of a pivot screw 83 and is adapted to be held normally in engagement with the lower ratchet 10 by means of a spring 84, having one end attached to the pawl on one side of said pivot and the other to a pin 85, carried by the upwardly inclined arm 81. On the energization of the rotary magnet, the armature, through the medium of the pawl and ratchet wheel, rotates the sleeve one step, as may be clearly seen from Fig. 2.

The operation of the device may be readily understood from the above description of the parts. As has been stated the device is designed to be used in telephone exchange systems either as a connector switch to connect with a desired line, in which case the switch is operated by a predetermined number of impulses from a sending device or as a selector switch to be controlled by relays. When the switch is to be used as a connector, the energizing current is generally produced by grounding one side or the other of the line by means of sending devices operated to furnish the desired number of impulses. Suppose for instance, it is desired to connect the wipers with the fifth pair of contacts in the eighth vertical row. In the normal position of the wipers as shown in Fig. 2 the latter are free of the contact banks. Eight electrical impulses are sent to the rotary magnets, each impulse causing the armature to actuate the pawl 82 and thereby turn the ratchet wheel 10 through one step against the tension of the spiral spring 14 in the casing 13, and carrying the wipers on the sleeve to the bottom of the eighth vertical row. Five impulses are now sent to the vertical magnets which operate in the manner already described to lift the sleeve through five steps thereby bringing the

wipers into engagement with the desired contacts. At each operation of the vertical magnets the rack is kept suspended by the dog 55 while the knife edge 65 prevents the sleeve from returning to its original position by its engagement with the teeth of the ratchet wheel 10 which has passed beyond the control of the pawl 82. It will be noted that on the first upward movement of the ratchet 10 the spring 35 which was held in engagement with the anvil 37 is now permitted to engage the upper anvil 36. The restoration of the switch to its normal condition is effected by the release magnet 67. For this purpose an impulse is sent to the magnet which draws up the armature 64 the perforation in the spring member 64′ carried by the armature hooking over the extension 62 on the dog 55. On the cessation of the magnetizing current the armature is retracted by the spring 72 and the dog 55 is moved out of engagement with the teeth of the cylindrical rack thereby allowing the sleeve and the wipers to drop. When the lower ratchet wheel 10 is clear of the knife edge 65 the sleeve is returned to its original position by the spring 14. The stop 16 which is carried by the sleeve limits the motion of the latter by its engagement with the bar 58. The stop 15 is in constant engagement with the bar 58 on the opposite side to prevent any movement of the casing. It will be noted that after the release of the switch the dog 55 is still held out of engagement with the rack by the spring member 64′. The restoration of the dog to the position shown in Fig. 2 is accomplished on the succeeding movement of the armature of the rotary magnets the pivot pin 83 being extended so as to move the spring 64′ thereby effecting the disengagement of said spring and the dog.

A modified form of my switch is shown in Fig. 6. In general the arrangement is the same as that shown in Figs. 1 and 2. In Fig. 6 however, in place of the reciprocating sleeve a hollow shaft 3′ is provided which is arranged for rotary and vertical movement in bearings in the U-shaped frame 1′. Secured to the shaft are the wipers 19′ and 20′ in the manner clearly indicated in Fig. 9. The cylindrical rack 8′ in this instance is secured to the shaft together with a ratchet wheel 10′. The lower end of the shaft is extended and the bottom thereof bears the casing 13′ attached thereto and inclosing the spiral spring, not shown, which is attached at one end to the casing and at the other to a sleeve loosely mounted on the shaft and having an arm 15′ provided with an upturned ear. A downwardly extended rod 100 passes through a perforation in the arm 15′ to keep the latter from turning. Secured to the shaft is a stop arm 16′.

The rotation of the shaft is effected by means of the rotary magnets 75′ and 76′ in a similar manner to that described in connection with Figs. 1 and 2 and the vertical movement of the shaft is effected likewise by the magnets 40′ and 41′. In place of the dog 55 I may use a dog 55′ of a U-shaped form, the lower arm serving to engage the teeth of the ratchet 10′ to prevent a backward movement of the shaft, and the upper arm serving to keep the shaft suspended as it is stepped up. The release of the dog 55′ is accomplished in a similar manner as that heretofore described. As in the preceding figures when the release magnet 67′ is actuated and the dog 55′ is withdrawn from engagement with the teeth of the cylindrical rack, the shaft 3′ together with the wipers first descends until the ratchet wheel 10′ has cleared the knife edge 65′ when the spiral spring in the casing 13′ turns the shaft until the stop arm 16′ comes in contact with the upturned ear on the arm 15′, this being the normal position of the switch. I have also shown in Fig. 6 certain additional members. Among these may be mentioned the L-shaped bars 101 and 102 which are held between the arms of the frame 1 and the retaining plates of the upper and lower contact banks respectively. These bars carry the binding screws to which the connections 103 and 104 are fastened. The latter are flexible cables composed of a plurality of wires provided with U-shaped terminals, a detailed view of which is shown in Fig. 7. The lower cable 104 forms an electrical connection between the wipers 20′ and 19′ and the binding screws on the lower supporting bar 102, the cable being passed through the hollow shaft and the individual wires passing through openings in the latter and being secured to ears on the wipers. I have also shown in this modification means for holding the cable containing the wires leading to the magnets, these means comprising the loops 105 fastened to the frame 1 and insulating bushings 106. Instead of the flat springs 47 and 80 which respectively hold the armatures of the vertical and rotary magnets in their retracted positions I make use of the spiral springs 47′ and 80′ as clearly shown in Fig. 6.

Fig. 8 shows another modification of my device, certain common features such as the magnets and the shaft-actuating devices being omitted. In this form of the device the shaft 3^b carries an elongated ratchet wheel 10^a. The dog 55^a prevents the shaft from dropping by the engagement of the upper U-shaped arm with the teeth of the cylindrical rack and it also prevents the shaft from returning to its original position after it has been rotated against the tension of the spring. The ratchet wheel 10^a con-

tinues in engagement with the dog through the entire upward movement of the shaft, the knife edge being omitted. It will be observed that the contacts of the two banks are arranged with their flat sides in horizontal planes instead of vertical planes as may be clearly seen from Figs. 8 and 10. The wipers carried by the shaft 3^a are also arranged in a similar manner. In the forms described heretofore, there is first a rotary movement of the shaft to bring the wipers to a desired vertical row and then a vertical movement of the shaft to bring the wipers to the desired contact of the row. In this form, however, there is first a vertical movement to bring the wipers to the desired horizontal row of contacts and then a rotary movement to effect connection with the proper contact of the horizontal row.

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

1. In an automatic switch, a frame, actuating magnets secured thereto, contact banks secured within said frame having the contacts arranged in parallel vertical rows each row consisting of horizontally opposed parallel vertical contacts, a movable member bearing a wiper, and means for rotating said member with the wiper out of engagement with any contact so as to bring said wiper into alinement with the desired row of contacts, together with means thereafter brought into operation to produce vertical linear motion of said member, so as to bring the wiper into engagement with the contacts of the selected row, and by continuing motion along the row to bring about the engagement of the wiper with any desired contact.

2. In an automatic switch, a frame, actuating magnets and contact banks secured within this frame, the contacts being arranged in vertical parallel rows, a movable member carrying a wiper adapted to be given both horizontal and vertical motion, and when moving vertically to engage with the row contacts in such manner as to prevent further horizontal motion, means controlled by an actuating magnet for first producing horizontal motion of the wiper to bring it into alinement with any desired row of contacts, means controlled by another actuating magnet for moving the wiper vertically into engagement with and along the selected row, means for retaining said wiper in engagement with any desired contact in the row, means for releasing the same, and means for restoring the wiper to its normal initial or zero position by reversing its previous movements.

3. In an automatic switch, a frame, actuating magnets and contact banks secured within said frame, the contacts being arranged in vertical, parallel rows, each row consisting of a plurality of pairs, and each pair composed of horizontally opposed projecting parallel vertical contacts, a movable member bearing wipers adapted to engage said contacts, means actuated by certain of said magnets for effecting rotation of said movable member, and other means for effecting a longitudinal movement of said movable member, thereby effecting the engagement of the wipers with the contacts in a vertical row successively.

4. In an automatic switch, a frame, actuating magnets and contact banks secured within said frame, the contacts being arranged in vertical, parallel rows, each row consisting of a plurality of pairs, and each pair composed of horizontally opposed projecting parallel vertical contacts, a movable member bearing wipers adapted to engage said contacts, means actuated by certain of said magnets for rotating said movable member, together with its wipers, other means for stepping up said movable member to effect the engagement of said wipers with the contacts of a vertical row successively, and means actuated by other magnets for restoring the movable member to its original position, thereby effecting the disengagement of the wipers and the contacts.

5. In an automatic switch, a frame consisting of a U-shaped bar, contact banks and actuating magnets secured within the arms of said frame, a spindle connecting the ends of said bar and having its ends secured thereto, a movable member bearing wipers mounted on said spindle, and means actuated by said magnets for effecting engagement of the wipers with any desired contact.

6. In an automatic switch, a U-shaped frame member, actuating magnets and contact banks secured within the arms of said U-shaped member, a spindle connecting the ends of said member and having its ends secured thereto, a movable sleeve bearing wipers mounted on said spindle, and means actuated by said magnets and engaging said sleeve for effecting the engagement of the wipers with any desired contact.

7. In an automatic switch, a U-shaped frame member, transverse members secured to the arms thereof, retaining bolts having reduced end portions connecting said transverse members, and upper and lower contact banks secured on said reduced end portions and held by said transverse members.

8. In an automatic switch, a U-shaped frame member, transverse members secured to the arms thereof, retaining bolts having reduced shouldered end portions receiving and holding said transverse members, contact banks carried on said retaining bolts, a movable member bearing wipers mount-

ed in said frame with actuating magnets supported on the frame, and means actuated by said magnets for effecting engagement of said wipers with any desired contact of the contact banks.

9. In an automatic switch, a U-shaped frame member, transverse members secured to the arms thereof, parallel retaining bolts having reduced or shouldered end portions receiving and holding said transverse members, contact banks mounted on said parallel bolts, a movable member bearing wipers mounted in said frame with operating magnets therefor carried on the frame, means actuated by certain of said magnets for effecting engagement of said wipers with any desired contact of the contact banks, and means actuated by other of said magnets for effecting the disengagement and the restoration of the wipers to their normal position.

10. In an automatic switch, a U-shaped frame member, actuating magents, contact banks and a shaft secured between the U-shaped arms of said frame, a sleeve loosely mounted on said shaft and capable of longitudinal and rotary motion thereon, wipers secured to said sleeve adapted to engage contacts in said banks, and means actuated by said magnets for effecting the engagement of the wipers with said contacts.

11. In an automatic switch, a U-shaped frame member, actuating magnets, contact banks and a shaft secured between the arms of said frame, a hollow sleeve having end bearings and capable of longitudinal and rotary movement on said shaft, wipers carried by said sleeve, and means actuated by said magnets for effecting the engagement of the wipers with the contacts.

12. In an automatic switch, a U-shaped frame member, actuating magnets, contact banks and a shaft having a longitudinal V-shaped slot on one side thereof, all secured within the arms of said frame, a hollow sleeve having end bearings and capable of rotary and longitudinal movement on said shaft, wipers carried by said sleeve, means actuated by certain magnets for effecting the engagement of the wipers with desired contacts, and means actuated by other magnets for effecting the disengagement of the wipers and their restoration to their normal position.

13. In an automatic switch, a frame, actuating magnets, contact banks and a shaft having a V-shaped slot on one side thereof all secured within said frame, a hollow sleeve provided with end bearings and adapted for rotary and longitudinal movement secured on said shaft, one portion of said sleeve constituting a cylindrical rack, and means actuated by certain magnets for effecting a longitudinal movement of the sleeve through the medium of said cylindrical rack.

14. In an automatic switch, a frame, actuating magnets and a shaft secured to said frame, a hollow sleeve capable of rotary and longitudinal movement disposed on said shaft, one part of said sleeve constituting a cylindrical rack and bearing ratchet wheels at the ends thereof, means actuated by certain of said magnets for engaging one of said ratchet wheels to effect a rotary movement of said sleeve, and means actuated by other of said magnets for engaging the teeth of said cylindrical rack to effect a longitudinal movement of said sleeve along said shaft.

15. In an automatic switch, a frame, actuating magnets, contact banks and a shaft all secured within said frame, a hollow sleeve disposed on said shaft and arranged for rotary and longitudinal movement thereon, one portion of said sleeve constituting a cylindrical rack and bearing ratchet wheels at each end thereof, means actuated by certain of said magnets and engaging the lower ratchet wheel for rotating said sleeve against the tension of a spring, means actuated by other of said magnets and engaging said cylindrical rack for stepping up said sleeve longitudinally, and means to engage the lower ratchet wheel to hold the sleeve in its rotated position after the first upward movement thereof.

16. In an automatic switch, a frame, actuating magnets, contact banks and a shaft secured within said frame, a sleeve arranged for rotary and longitudinal movement on said shaft, a portion of said sleeve constituting a cylindrical rack and having ratchet wheels at the ends thereof, wipers carried by said sleeve, a tension spring for the sleeve, means for rotating said sleeve against the tension of the spring, means for stepping up said sleeve for effecting an engagement of the wipers with the contacts, and a knife edge adapted to enter between the teeth of the lower ratchet wheel after the first upward movement of said sleeve to keep said sleeve in its rotated position.

17. In an automatic switch, a frame, actuating magnets, and a shaft secured within said frame, a sleeve arranged for rotary and longitudinal movement along said shaft, one portion of said sleeve constituting a cylindrical rack, upper and lower ratchet wheels secured to said sleeve, a tension spring for the sleeve, means actuated by certain magnets and engaging said lower ratchet wheel for causing a rotation of said sleeve against the tension of the spring, means engaging said cylindrical rack for steppi g up said sleeve vertically, and a single retaining dog adapted to retain said sleeve in its rotated position and after the first upward movement to thereafter retain the sleeve in its upper shifted position.

18. In an automatic switch, a frame, actu-

ating magnets and a shaft secured within said frame, a sleeve arranged for rotary and longitudinal movement disposed on said shaft, means actuated by the magnets for rotating said sleeve and for stepping up said sleeve vertically and a retaining dog adapted to engage said sleeve to initially hold the latter in its shifted, rotated position, and after the first upward movement to hold the sleeve in its shifted, upper position.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD E. CLEMENT.

Witnesses:
PEARL THWAITE,
E. EDMONSTON, Jr.