W. KAISLING.

AUTOMATIC SWITCH FOR TELEPHONE SYSTEMS.

APPLICATION FILED JAN. 3, 1911.

Patented Mar. 9, 1915.

1,131,140.

2 SHEETS—SHEET 1.

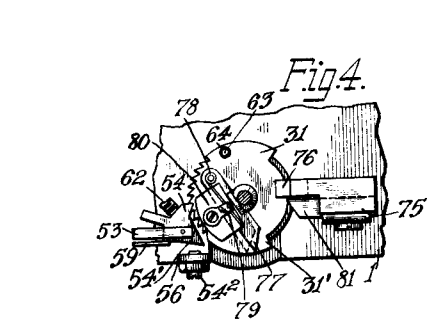

Fig. 4.

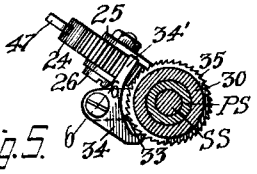

Fig. 5.

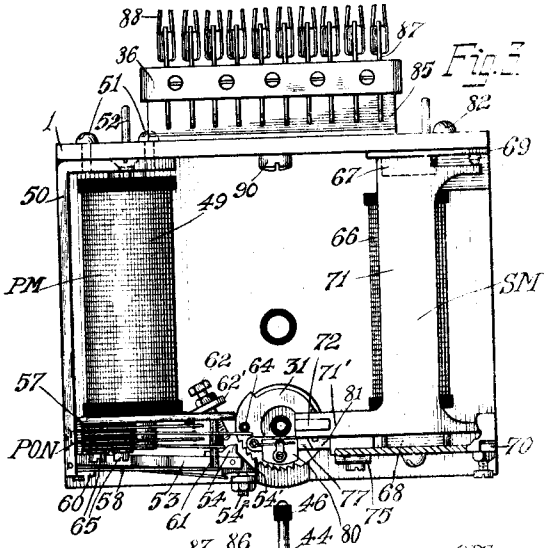

Fig. 3.

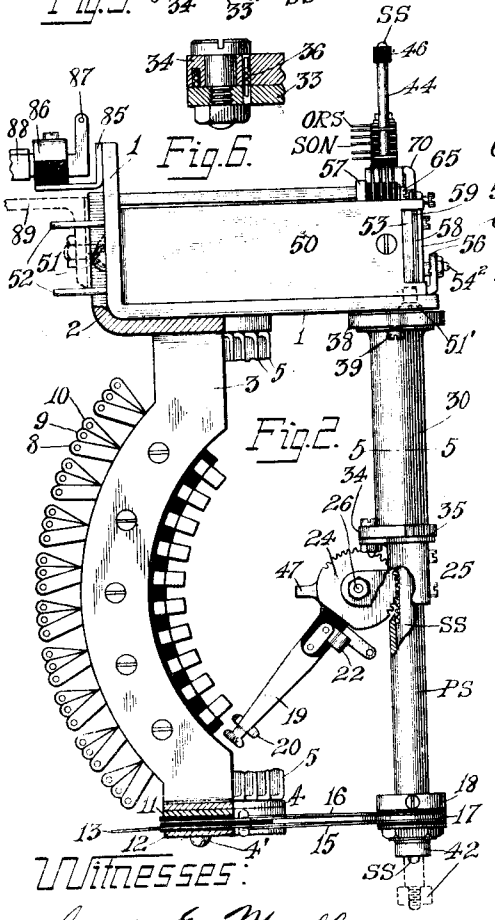

Fig. 2.

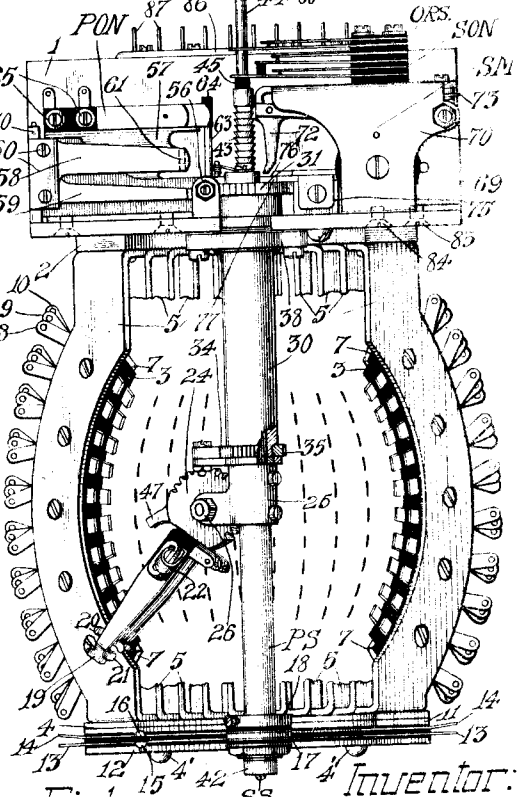

Fig. 1.

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2 SHEETS—SHEET 2.

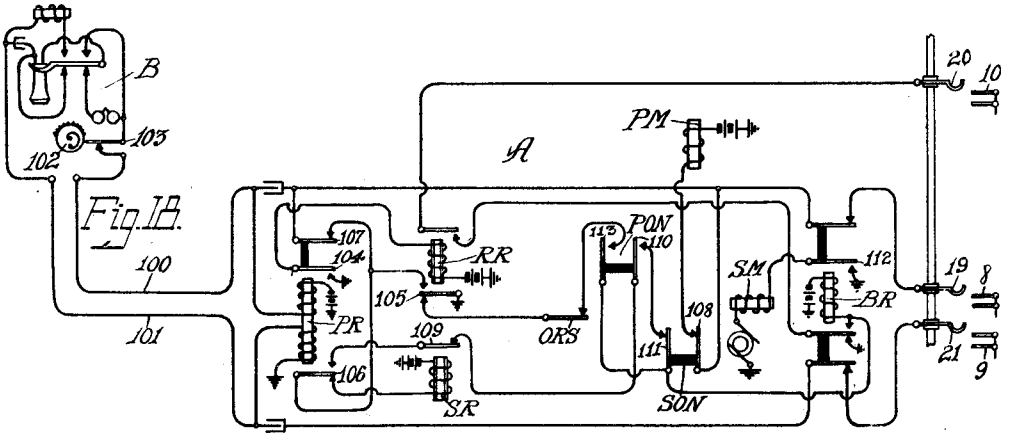

Fig. 18.

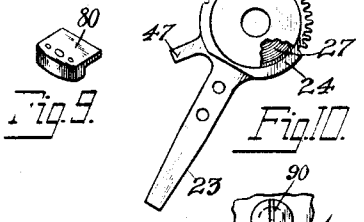

Fig. 9.

Fig. 10.

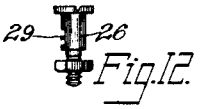

Fig. 12.

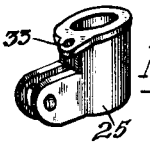

Fig. 11.

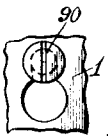

Fig. 17.

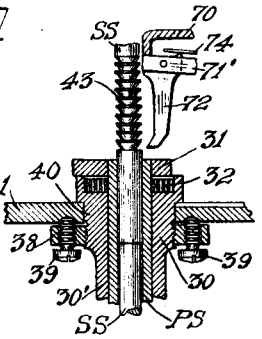

Fig. 7.

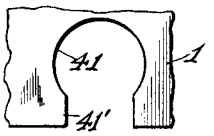

Fig. 8.

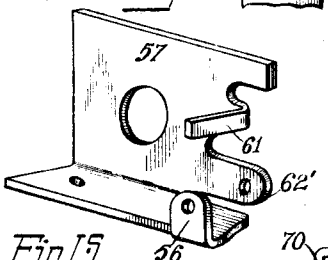

Fig. 15.

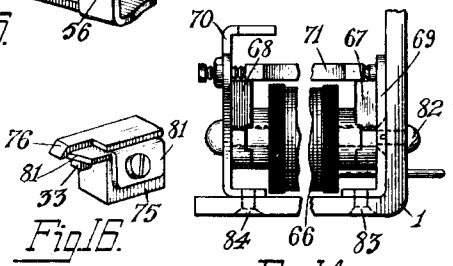

Fig. 14.

Fig. 16.

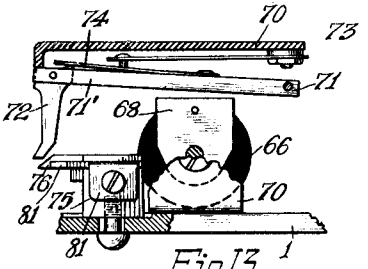

Fig. 13.

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UNITED STATES PATENT OFFICE.

WILLIAM KAISLING, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC SWITCH FOR TELEPHONE SYSTEMS.

1,131,140. Specification of Letters Patent. Patented Mar. 9, 1915.

Application filed January 3, 1911. Serial No. 600,664.

To all whom it may concern:

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

My invention relates to automatic switches for telephone systems and in particular to switches of the type in which bank contacts are arranged in groups and in which movable wipers are given a primary movement to a group of bank contacts and thereafter are given a secondary movement to connect with a contact in a group.

Prior to this, switches having the above characteristics, usually employ an extra release magnet to be operated to allow the wipers to be restored, or where no release magnet is employed, the wipers are aided by gravity in their restoration.

An object of my invention is to provide a switch in which no extra release magnet is employed, and in which the wipers are restored by spring tension, and do not depend upon gravity, thus providing a switch which is more positive in operation.

Another feature of my invention, is in constructing a switch in units, so that the magnets, wiper shafts and other units, as will be more particularly pointed out in the specification, may be readily replaced without disturbing the adjustment of other parts of the structure.

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

My invention may be more fully understood by reference to the accompanying drawings in which,

Figure 1 is a front elevation of a switch structure embodying my invention. Fig. 2 is a left side elevation of the structure illustrated in Fig. 1 but with the wipers moved opposite the fifth contact bank. Fig. 3 is a plan view of Fig. 1. Fig. 4 is an enlarged view of a portion of the switch with the primary wiper shaft moved off normal. Fig. 5 is a sectional view along the line 5—5 of Fig. 1. Fig. 6 is an enlarged sectional view along line 6—6 of Fig. 5 showing more particularly the tension spring for holding the retaining pawl in engagement with its associated ratchet. Fig. 7 is a sectional view of a portion of the upper end of the wiper shafts and their bearing which is supported by the frame of the switch. Fig. 8 illustrates a portion of the horizontal part of the switch frame showing particularly the opening in which the shaft bearing is secured and the slot through which it is removed. Fig. 9 is an enlarged perspective view of the supporting block mounted on the primary or rotary ratchet as illustrated in Figs. 3 and 4. Fig. 10 is a detailed view of the wiper carrying arm and its supporting spring drum and gear. Fig. 11 illustrates in perspective the clamping collar which mounts the wiper carrying arm and gear. Fig. 12 is a view of the bolt or shaft which secures the wiper arm and gear to the clamping collar of Fig. 10. Fig. 13 is an enlarged front view of a portion of the secondary magnet SM showing more particularly the armature and actuating pawl spring arrangement. Fig. 14 is a right side view of the secondary magnet SM showing particularly the method of securing the pole pieces to the spool core. Fig. 15 is a perspective view of the front frame of the secondary magnet. Fig. 16 is a perspective view of the block which serves as a stop for the secondary actuating pawl, a stop for the wiper shaft and is also adapted to coöperate with the secondary shaft retaining pawl. Fig. 17 shows an arrangement for removably securing the movable-part-supporting frame to the contact bank frame. Fig. 18 is a diagrammatic illustration of a circuit arrangement adapted to be used in connection with the switch of my invention.

Referring now to the structure of the switch of my invention, the same comprises a frame 1, on which are mounted all of the movable parts for operating the wipers. The contact bank mounting frame 2 is so formed as to fit against the outer vertical and horizontal surfaces of frame 1, said frame 1 being removably secured to frame 2 by means of screw 90. Suitably fastened to the said frame 2 are ten contact banks 3, which are also suitably secured at their lower ends to the plate 4 preferably by screws. Each contact bank 3 comprises a mounting plate 5 and clamping plate 7, between which are insulatingly held ten sets of contacts 8, 9 and 10. In Fig. 1 the two outer banks 3 are shown in full, while of the other eight banks, only the upper and lower

ends of the mounting plates 5 are shown. In this Fig. 1 the eight intermediate banks are represented by dotted lines, they having been shown in this manner so as not to complicate the drawing to too great an extent. In Fig. 1 of the drawing, the extreme right and left banks 5 are shown and in each case the middle and outside bank contacts only are shown as the inside contact (contact 10 of the left bank and contact 8 of the right bank) are hidden back of the insulation strip 3. In Fig. 2 the contact 8 is shown and it is to be understood that contact 10 is similar to contact 8 but on the other side of the insulating strip 3. To the lower surface of the plate 4 is secured by means of screws 4', a contact bank having an upper mounting plate 11, and a lower plate 12 between which are insulatingly clamped ten bank contacts 13, there being one such contact 13 for each contact bank 3, the said contacts 13 being preferably disposed at a point below their associated contact bank 3. A common plate 14 is arranged above the contacts 13 having an exposed contacting surface extending beyond the plate 11. The said contacts 13 and common plate 14 are adapted to be engaged respectively by wipers 15 and 16, the said wipers being electrically connected through the stiffening plate 17 and insulatingly mounted on the removable hub 18. Thus it will be seen that when the wipers 15 and 16 are engaging respectively a contact 13 and plate 14, that the said plate 14 and the engaged contact 13 are adapted to be electrically connected through said wipers 15, 16 obviating the use of a connecting wire to the wipers.

Adapted to coöperate with the contacts 8, 9 and 10, are the wipers 19, 20, and 21. The said wipers are mounted on the arm 23, being suitably insulated therefrom, and have terminals as illustrated most clearly in Fig. 1. Mounted alongside of the said wipers is the wiper cord bracket 22, which is adapted to be fastened to the wiper cords which are usually soldered to the terminals of the said wipers, thus relieving the strain which is usually placed upon the soldered connections between the said wiper cords and the wiper terminals. In using this cord bracket 22, the cords are passed through the large opening in the curled end, and then soldered to the wiper terminals. The said cords may then be fastened to the said bracket 22 in any suitable manner, either by placing a twine around the cords and fastening them to the bracket or by squeezing the curled end of the bracket 22 around the wiper cords.

The arm 23 is carried by the drum or gear 24 which is pivotally secured to the clamping collar 25 by means of the shaft or bolt 26. This drum 24 has gear teeth cut in the periphery thereof which are in mesh with teeth in the secondary saft SS so that when the said shaft SS is reciprocated longitudinally, the transferred motion due to the engagement between the teeth of gear 24 and shaft SS, rotates the said gear 24 about the pivot 26, thereby moving wipers 19, 20 and 21 along a row of bank contacts 8, 9 and 10. The said gear drum 24 is hollow and has a clock spring 27 which fits snugly therein and has a plate 28 pressed into the said hollow so as to hold the spring 27 therein. The outer end of spring 27 is suitably pinned to drum 24, while the inner end is adapted to hook over the pin 29 in shaft 26. This spring 27 is so arranged that the tension thereof exerted upon the drum 24 tends to pull the wipers 19, 20 and 21 downward but which is normally prevented due to stop 42 of shaft SS engaging the lower end of shaft PS. The clamping collar 25 is secured to primary shaft PS and said shaft is adapted to partake of rotary motion only. The said shaft PS extends through the sleeve bearing 30 shown in the section in Fig. 7.

Secured to the upper end of primary shaft PS is the primary or rotary ratchet wheel 31 bearing against the uppermost end of sleeve 30 while the clamping collar 25 bears against the lower end of the sleeve 30. The upper end of sleeve 30 is hollowed out as shown in Fig. 7 and contains a clock spring 32 having its outer end secured to the said sleeve 30 and its inner end secured to the primary shaft. The spring 32 is so arranged that due to its tension, it has a tendency to hold the stop 31' of primary ratchet 31 against the stop 33 of the block 75 Fig. 16.

The clamping collar 25 which is secured to primary shaft PS has an ear 33, to which is secured a primary detent or retaining pawl 34. Said detent 34 is held in engagement with the teeth of ratchet wheel 35 by means of the spring 36 shown in Fig. 6. The said ratchet wheel 35 is rigidly secured to sleeve 30, being preferably driven on to the end of the said sleeve as shown in the broken away portion in Fig. 1, so that the said ratchet 35 has no movement being supported by sleeve 30 which is also held rigid. When the primary shaft PS is rotated, carrying the wipers and collar 25 therewith, the detent 34 by engaging the teeth of ratchet wheel 35, prevents back movement of the primary shaft PS until the said detent 34 is moved out of engagement with the teeth of ratchet 35. The said sleeve bearing 30 has a clamping ring 38 threaded on to its upper end as shown in Fig. 7, the said ring 38 having two screws 39 threaded therein and adapted to engage frame 1. The upper or drum portion of sleeve 30 is slightly larger than the next

portion 40, thus forming a shoulder which rests upon frame 1, the said portion 40 fitting snugly into the opening 41 of the said frame. By means of clamping ring 38 and screws 39 the said sleeve 30 is rigidly held in an adjusted position in the said frame.

The secondary shaft SS extends through the hollow primary shaft PS, having a stop 42 secured to its lower end, the said stop 42 engaging the lower end of primary shaft PS, thus serving as a stop for the said shaft SS when it is restored. The said shaft SS has a slight clearance in several places, preferably above and below the part of the shaft SS having the gear teeth cut therein, thus the said shaft SS bears only at its ends and in a middle part. At the upper end of shaft SS are the ratchet teeth 43 which are adapted to be acted upon to move the shaft SS downward and thereby rotate the wipers 19, 20 and 21 vertically along contacts 8, 9 and 10 of a contact bank 3. The upper extension 44 of secondary shaft SS has rubber buffers 45 and 46 secured thereto, so that on the first downward step of the shaft SS the buffer 45 is adapted to move away from the lower secondary off normal spring SON, allowing the off normal switch SON to assume an alternate position. The buffer 46 is adapted when the secondary shaft SS is moved to its extreme downward position, and after the wipers 19, 20 and 21 have moved beyond the last contacts 8, 9 and 10, to act upon the over run switch ORS opening the contacts thereof. The extension 44 of shaft SS passes through slotted openings of the said switch springs. the said slots being large enough to keep part 44 clear of electrical contact with the said switch springs. When the secondary shaft SS is moved to this over run position whereby the wipers 19, 20 and 21 are one step beyond the last row of bank contacts 8, 9 and 10, the finger 47 carried by the gear 24, engages arm 34′ of primary detent 34 rotating the said detent on its pivot and disengaging it from the ratchet 35. When this occurs the wipers and the primary shaft are rotated back in a horizontal direction, by spring 32, until the stop 31′ of the primary ratchet 31 engages the stop 33 of block 75.

The primary magnet PM which is adapted to move the wipers 19, 20 and 21 in a primary or horizontal direction, comprises the usual electromagnet spool 49 and heel iron or pole piece 50. The rear end of the core of magnet 49 is suitably secured to pole piece 50 as shown by the dotted screw in Fig. 3, the said pole piece being rigidly fastened to the vertical portion of frame 1 by means of screws 51. The terminals 52 of magnet 49 extend through openings of pole piece 50 and frame 1, being insulated therefrom. Pivoted to the forward end of pole piece 50 is the armature 53, carrying the pivoted pawl 54. The said pawl 54 has an extending portion 54′, which serves as a stop for armature 53 upon its retraction, by engagement with the screw stop 54^2, which is threaded into an ear 56 of the frame 57. The armature 53 is held at normal under tension of spring 58, while the spring 59 acts upon pawl 54, the said springs 58 and 59 being fastened to armature 53 by means of screws and clamping plate 60. The spring 58 has its free end resting against the extension 61 of frame 57, so that when armature 53 is attracted, it moves against the tension of the said spring, the said spring then serving to restore the armature upon the deënergization of the primary magnet. The adjustable stop 62 which is threaded into an ear 62′ of frame 57, serves as a locking stop for the pawl 54, upon attraction of armature 53, as illustrated more clearly in Fig. 4. In the operation of primary magnet PM the armature 53 is attracted moving away from stop 54^2, and during this movement the spring 59 acts upon pawl 54, rotating the said pawl about its pivot and into engagement with a tooth of primary ratchet 31, and the armature continuing in its movement, rotates said ratchet wheel 31 until pawl 54 engages the stop 62 and assumes the position shown in Fig. 4. The stops 62 and 54^2 are so adjusted that upon each operation of the primary magnet PM, the primary ratchet 31 is advanced one step or one tooth and the wipers are horizontally rotated from one bank 3 to the next.

Rigidly secured to the primary ratchet wheel 31 is an off normal stud 63 having an insulated sleeve 64 suitably secured to its upper end. This insulated sleeve 64 normally rests in engagement with a primary off normal spring PON, thus holding the primary off normal switch PON in its normal position as shown in Fig. 3. Upon the first primary step of the switch, which of course means the first step of primary ratchet 31, the insulated sleeve 64 moves away from the primary off normal switch springs and they assume an alternate position. The said switch springs PON are insulatingly mounted on frame 57 by means of screws 65.

The secondary magnet SM comprises the usual electromagnet 66, having the pole pieces 67 and 68 secured to the ends of its core by screws. The core of magnet SM has its ends shaped to fit into transverse slots in the pole pieces so that when the secondary magnet unit is removed from the frame 1, the parts are rigidly held together. Fastened to the pole piece 67 is the rear frame 69, while the front frame 70 is suitably fastened to the pole piece 68. Pivoted between the said frames 69 and 70 is the arma-

ture 71 over-lying the said pole pieces 67 and 68, and adapted to be attracted by them when the magnet is energized. The arm 71' of armature 71 carries the secondary actuating pawl 72 which is pivoted to the outer end of said arm 71' as shown in Fig. 13. Fig. 13 which illustrates most clearly some of the parts of the secondary magnet shows a portion of the frame 70 broken away to illustrate the manner in which the tension springs act upon armature 71. The tension spring 73 fastened to the lower surface of the upper part of frame 70, has its free end engaging a pin which is secured to the armature 71, so that when the armature 71 is attracted by its electromagnet the said spring 73 restores the armature after the magnet is deënergized. The spring 74 has one end riveted to armature 71 and has its free end bearing upon a projecting portion of pawl 72. The upper left edge of pawl 72 as illustrated in Fig. 13 rests normally in engagement with the downwardly extending portion of frame 70, this downwardly extending portion acting as a stop for armature 71 and also acting as a stop for pawl 72, so that when armature 71 is restoring after it has been attracted, the said pawl 72 engages this stop and is thrown out of engagement with ratchet teeth 43 of shaft SS. In Fig. 3, the frame 70 of secondary magnet SM is broken away to expose the armature 71 more clearly.

The block 75 is adjustably secured to the frame 1, 75 being slidably mounted in a slot in said frame 1 as illustrated in Fig. 13. The inclined end 76 of block 75 serves as a locking top for pawl 72, so that when armature 71 of the secondary magnet SM is attracted, the said stop 76 limits the downward movement of the pawl 72 and also is adapted to lock the said pawl and its engaged tooth of ratchet 43 in such a manner that any over run of the secondary shaft SS due to the momentum received from its actuation, is prevented.

The secondary detent or retaining pawl 77 is pivoted to the primary ratchet wheel 31 and has a spring 78, having one end held by the clip 79 while the other end engages the detent 77 in such a manner that the spring tends to rotate the said detent 77 against the ratchet teeth 43 of secondary shaft SS. The block 80 has a projecting portion over-lying the said detent 77, being so fitted that the said detent is free to rotate on its pivot but is held by means of the said block 80 against the upper surface of ratchet wheel 31. When the switch is in its normal position the beveled end of detent 77 rests in engagement with the beveled end of the adjustable stop 81, thereby being held out of engagement with the ratchet teeth 43 of shaft SS as illustrated in Fig. 3. In Fig. 4 the ratchet wheel 31 and primary shaft PS are shown moved several steps off normal, and in this figure the detent 77 is shown engaging a tooth of ratchet 43, while the dotted lines in said Fig. 4 indicate its normal position when thrown out of engagement with the shaft SS.

In the operation of the switch the primary shaft PS is first actuated, thus moving the detent 77 away from its stop 81 so that it may act upon the ratchet teeth 43 of shaft SS. Then when the secondary shaft SS is stepped downward the detent 77 is adapted to sucessively engage the teeth 43, as the shaft SS is stepped downward moving one notch for each actuation of the secondary magnet SM. Each step of the shaft SS downward advances the wipers 19, 20 and 21 from one set of contacts 8, 9 and 10 to the next set of contacts.

In the release of the switch after the wipers 19, 20 and 21 have been moved to engage a set of bank contacts 8, 9 and 10, the secondary magnet SM is actuated, stepping shaft SS downward until the wipers 19, 20 and 21 have advanced one step beyond the last or uppermost set of contacts 8, 9 and 10. As the said wipers advance to this position, the finger 47, which is carried by the gear 24, engages the arm 34' of primary detent 34, moving the said detent out of engagement with ratchet wheel 35, and thus it will be seen that the spring 32 which acts upon primary shaft PS, restores the said shaft PS by rotating it until the stop 31' of primary ratchet 31 engages the stop 33 of block 75, the wipers 19, 20 and 21 of course also being carried along. As the primary ratchet 31 advances to its normal position as just described, the beveled end of detent 77 engages the beveled end of stop 81 and the said detent 77 is thereby thrown out of engagement with secondary shaft SS, allowing the said shaft SS and the wipers 19, 20 and 21 to be restored by the spring 27 which is in the spring drum 24. Upon the restoration of the primary shaft PS to normal the stud 63 engages and restores the primary off normal switch PON, while upon the restoration of the secondary shaft SS the insulated buffer 45 engages and restores the secondary off normal switch SON to normal. At the beginning of the restoring movement of shaft SS the rubber buffer 46 moves upward away from over run switch ORS restoring the said switch to normal.

Rigidly secured to the vertical part of frame 1, is the angular bracket 85, on which is mounted a rubber block and clamping member 86, carrying a number of terminals 87. These terminals are adapted to be inserted between jack springs 88 in a well known manner. The switch as a whole may be mounted on any suitable frame, and in Fig. 2 I show an angular mounting strip 89 by means of dotted lines, the said mounting strip 89 also being adapted to suitably support the jack springs 88. The contact bank

mounting 2 may be fastened to mounting strip 89 in any suitable manner, one method of fastening the same being by means of a screw and nut as shown in dotted lines on Fig. 2. In wiring up the switch, the different outgoing connections from terminals of the magnets and contact springs are connected to terminals 87. The connections leading from the switch are then wired to the jack springs 88, thus affording connection to the different magnets and contacts through the jack springs 88 and terminal springs 87. Thus, to move the frame 1 and its parts, the screw 90 more clearly shown in Fig. 17, is loosened and the frame 1 moved upward until the large opening is directly back of the head of screw 90, and the frame 1 may then be moved forward away from the bank frame 2 and replaced by another frame.

The switch as illustrated, is made up of certain units which are each detachably secured to the frame 1. For instance, the primary magnet PM including all the parts carried thereby, is a unit which may be removed from frame 1, by taking out the screws 51 and 51'.

To remove the unit which comprises secondary magnet and the parts carried thereby, the screws 82, 83 and 84 are removed, and it may be removed as a whole and be replaced by another one. To remove the sleeve 30 and the wipers, shafts, and other parts carried thereby, the screws 39 are first loosened, then the clamping ring 38 is removed from the threaded portion of sleeve 30, and then by removing the block 75 and pressing pawl 72 back toward the frame of magnet SM, the sleeve 30 may be moved upward until the portion 30' is in the hole 41 and it may then be moved forward through the slot 41', and thus is free of the frame 1.

It will thus be seen from the foregoing description that should either of the magnets or any of the parts carried thereby, be in need of repair, they may be readily replaced by other units without disturbing other parts of the switch, and as to the wiper carrying unit, which includes the two actuating shafts, this may be moved by disturbing only the block 75, or if desired the frame 1 if in need of repair, may be removed and replaced by another one and then any of the units replaced.

Fig. 18: In describing the operation of the switch I believe it is an advantage to refer to a circuit arrangement, therefore I have included the circuit arrangement illustrated in Fig. 18 that the operation of the switch may be more fully understood, but it is to be understood that the circuit arrangement illustrated is no part of my invention, and that the switch structure is capable of many other uses than in connection with said Fig. 18. In the said Fig. 18 I have illustrated a circuit arrangement "A," which may be used as a selector switch circuit, connected to a sub-station "B" by means of line conductors 100 and 101. The sub-station "B" is a well known telephone circuit arrangement and includes a dial 102 adapted to operate impulse springs 103. The selector circuit "A" includes a primary magnet PM, secondary magnet SM, a primary off normal switch PON, a secondary off normal switch SON, and an over run switch ORS. The operation of the switch is under the control of a primary relay PR, a secondary relay SR, a release relay RR and a busy relay BR. The apparatus of circuit "A" which corresponds to parts of the switch structure illustrated in Figs. 1 to 17 have correspondence reference characters.

The operation of the switch when using the circuit of Fig. 18 is as follows: The receiver is first removed from the switch hook at sub-station "B," and a circuit through primary relay PR is closed from ground through the lower winding of said relay PR, line conductor 101, sub-station "B," line conductor 100, and through the upper winding of relay PR to battery, energizing the said relay and closing a circuit through release relay RR from ground at alternate contact 104, thereby energizing the said relay RR. Dial 102 is now operated until a required number of teeth on the periphery thereof have passed springs 103, say five of them if connection is desired to the fifth group of contacts, and the dial is then released, being restored by the spring shown thereon, opening and closing contact springs 103 and interrupting the circuit through primary relay PR five times. Responsive to said operations of relay PR the circuit through release relay RR is interrupted five times, but the said relay being a slow releasing relay, does not retract its armature while its circuit is being rapidly interrupted. Upon the first deënergization of relay PR, secondary relay SR is energized, from ground through alternate contact 105, normal contact 106 and the winding of relay SR to battery. The said relay SR being also a slow releasing relay maintains its armature attracted, while the primary relay PR is vibrating, due to the impulses over the circuit just traced. Also responsive to the energization of relay PR, five impulses of current are transmitted through primary magnet PM, traced from ground through alternate contact 105, normal contact 107, normal contact 108, and winding of magnet PM to battery. Responsive to the resulting five operations of magnet PM, its actuating pawl 54 engages the teeth of primary ratchet 31, rotating primary shaft PS and stepping the wipers 19, 20 and 21 to a point below the fifth contact bank 3. Upon the first step of primary shaft PS the primary off normal switch PON moves to its alternate position

as previously described, and the secondary retaining pawl 77 moves into engagement with shaft SS, so as to be in a position to engage the teeth 43 when the shaft SS is stepped downward. After the last impulse has been transmitted from relay PR, it remains energized over the line circuit and the circuit through secondary relay SR is interrupted at normal contact 106 long enough for said relay SR to deënergize. Responsive to the said deënergization, an energizing circuit for busy relay BR is established from ground through alternate contact 105, alternate contact 106, normal contact 109, alternate contact 110 of switch PON, which is now closed, normal contact 111, winding of said relay BR to battery, energizing the said relay. Responsive to the said energization of relay BR a circuit for secondary magnet SM is established from ground through alternate contact 112 and the winding of said magnet SM to the alternating current generator, and the said magnet SM is thereupon energized and its pawl 72 engages a tooth 43 of shaft SS, moving the said shaft downward one step and thereby moving wipers 19, 20 and 21 into engagement with the first set of contacts 8, 9 and 10 of the selected contact bank. Upon the first downward step of shaft SS, secondary off normal switch SON is moved to its alternate position as previously described, thereby opening the initial energizing circuit for busy relay BR at contact 111. Assuming that one of the multiple sets of the said first set of contacts 8, 9 and 10 have already been engaged by another switch, in a manner which is well known in the art, there will be a ground upon private contact 10 and a locking circuit for relay BR will be established from the said ground, and secondary magnet SM continues to step the wipers 19, 20 and 21 until an idle set of contacts 8, 9 and 10 are engaged, thereby opening the locking circuit for relay BR which deënergizes and interrupts the circuit through secondary magnet SM preventing any further actuation thereof. To release the switch to restore it to normal, the receiver is again replaced upon its switch hook interrupting the circuit through primary relay PR, thereby interrupting the circuit through release relay RR and allowing said relay RR to deënergize and retract its armature. Responsive to the said deënergization of relay RR a circuit for relay BR is established from ground at normal contact 105, over run switch ORS, alternate contact 113 and the winding of said relay BR to battery. Relay BR is thereupon energized, closing a circuit through magnet SM from ground at alternate contact 112, and the said magnet SM now steps shaft SS downward, thereby moving wipers 19, 20 and 21 upward along the contacts 8, 9 and 10 until they have stepped above the uppermost contact set, when the finger 47 carried by gear 24, engages the arms 34′ of detent 34 moving the said detent out of engagement with ratchet 35. When the shaft SS has been moved to this position the rubber buffer 46 opens the contact springs of over run switch ORS, thereby interrupting the circuit through relay BR which now deënergizes, interrupting the circuit through magnet SM and preventing any further actuation thereof. As soon as detent 34 is moved out of engagement with ratchet 35, it will be seen that the shaft PS is restored by the spring 32 thus restoring wipers 19, 20 and 21 horizontally, above the uppermost sets of contacts 8, 9 and 10, as previously described. While the shaft PS is restoring to normal, and just before it reaches its normal position, the detent 77 engages the stop 81 and is thrown out of engagement with the teeth 43 of shaft SS. When the said detent 77 is disengaged from teeth 43 of shaft SS, it will be seen that the spring 27 is free to act, and it now restores wipers 19, 20 and 21 downward to their normal position, and the gear 24 being in mesh with the rack of shaft SS, the said shaft is restored upward until the stop 42 at its lower end engages the end of shaft PS.

From the foregoing description it will be seen that in the operation of the switch, the wipers 19, 20 and 21 are first rotated horizontally to a contact bank 3 and are then rotated vertically to a contact in the selected bank. In releasing the switch the vertical rotary motion of the wipers is continued until they reach a point above the uppermost contact sets 8, 9 and 10 whereby the shaft PS is automatically released, restoring the wipers in a horizontal rotary direction until the secondary shaft SS is automatically released, whereby the wipers are restored downward until they assume the position shown in Fig. 1.

In Fig. 18 I have not shown connections for the rotary wipers 15 and 16, but in using the switch of my invention as a line selector, of which it is also capable of being used, these wipers 15 and 16 may be used in controlling the selection of a contact bank 3, although it should be understood that they may be used for other purposes and are not limited to any particular use.

It will be understood that I do not wish to limit myself to the details of construction above described. I have worked out my invention in commercial form, but many other embodiments thereof might be designed and many changes in the construction shown, might be made, without departing in any way from the spirit of my invention, and I contemplate in the appended claims all such modifications. The principle of my invention is one that is highly useful and I have shown herein only the preferred

form embodying that principle in a commercial switch, but I desire to cover all such forms as come within the scope of that principle.

I claim:

1. An automatic switch, comprising bank contacts arranged in groups, wipers adapted to coöperate with said contacts, a primary magnet adapted upon operation to move said wipers to a group, a spring member adapted to act upon said wipers to retard said primary movement, a secondary magnet adapted upon operation to move the wipers to a contact in the selected group, a second spring member adapted to act upon said wipers to retard said secondary movement, said secondary magnet being adapted to advance said wipers to a position beyond the last contact in the selected group, means actuated upon said wipers assuming such position whereby said wipers are restored by said spring members.

2. In an automatic switch, passive contacts arranged in rows, movable arms having contact ends adapted to engage said contacts, an electromagnet and apparatus controlled thereby for rotating said contact ends to select a row, elastic means for retarding the movement of said contact ends, a second electromagnet and apparatus controlled thereby for rotating said contact ends in an intersecting plane to select a contact of a row, elastic means for retarding said latter rotation, said second electromagnet also being adapted to rotate said contact ends to a position beyond the last contact in the row, whereby said elastic means are adapted to automatically restore said contact ends.

3. In an automatic switch, passive contacts arranged in rows, movable arms having contact ends adapted to engage said contacts, an electromagnet and apparatus controlled thereby for rotating said contact ends to select a row, a second electromagnet and apparatus controlled thereby for rotating said contact ends in an intersecting plane to select a contact of a row, said second electromagnet also being adapted to rotate said contact ends to a position beyond the last contact in the row, whereby said contact ends are automatically restored.

4. An automatic switch including passive contacts arranged in rows, movable contact ends adapted to engage said passive contacts, a spring retarded shaft for moving said contact ends to select a row, a primary magnet for actuating said shaft, a second spring retarded shaft for moving said contact ends to select a contact in a row, a secondary magnet for actuating said second shaft, said secondary magnet being adapted to actuate said second shaft to move said contact ends to a position beyond the last contact of the row, and means actuated upon movement of the contact ends to such position whereby said contact ends and said shafts are automatically restored.

5. An automatic switch including passive contacts arranged in rows, movable contact ends adapted to engage said passive contacts, a rotatable shaft for rotating said contact ends to select a row, an electromagnet for rotating said shaft, a longitudinally movable shaft and connecting mechanism for rotating said contact ends in an intersecting plane to connect with a contact in a row, a second electromagnet for moving said second shaft, said second electromagnet being adapted to continue the movement of said second shaft to advance said contact ends in a position beyond the last contact of the row, and means thereupon actuated whereby said shafts and contact ends are automatically restored.

6. An automatic switch including a frame, bank contacts divided into groups, a unit detachably supported by said frame comprising wipers, primary and secondary actuating shafts and suitable connecting mechanism between said shafts and the wipers, each of said shafts also having an actuating ratchet, a pair of electromagnets and actuating pawls, one for each shaft, each said electromagnet and its associated pawl forming a unit detachably supported by said frame.

7. An automatic switch including a frame, bank contacts divided into groups, a unit comprising wipers, primary and secondary wiper actuating shafts and suitable connecting mechanism between said shafts and wipers, said unit being detachably supported by said frame, and a pair of actuating electromagnets, one for each shaft.

8. In an automatic switch, a detachable unit therefor including wipers adapted to be moved primarily and secondarily in intersecting planes, primary and secondary actuating shafts, and suitable connecting mechanism between said shafts and wipers.

9. An automatic switch comprising a bank of passive contacts, a coöperating active contact, means for moving said active contact into engagement with one of said passive contacts, and then moving said active contact beyond said bank, and mechanism thereupon effective for restoring said active contact to normal position.

10. An automatic switch comprising a bank of passive contacts, a coöperating active contact, means for moving said active contact against the action of two retarding springs into engagement with one of said passive contacts, and means for continuing the movement of said active contact beyond said bank, said springs being thereupon effective to restore said active contact to normal position.

11. An automatic switch comprising a bank of passive contacts, a coöperating ac-

tive contact, means for moving said active contact against the action of a retarding spring into engagement with one of said passive contacts, means for thereafter continuing the movement of said active contact beyond said bank, and means for thereupon releasing said spring to restore said active contact to normal position without retracing its movement.

12. An automatic switch comprising a bank of passive contacts, a coöperating active contact, means for moving said active contact against the action of a retarding spring into engagement with one of said passive contacts, means for thereafter continuing the movement of said active contact beyond said bank, and means whereby said spring thereupon moves said active contact in a forward direction to its normal position.

13. An automatic switch comprising a bank of passive contacts, a coöperating active contact, means for moving said active contact to one of said passive contacts, means for retarding said movement, and means for moving said active contact beyond said bank, whereby it is restored to normal position by said retarding means.

14. An automatic switch comprising a bank of passive contacts, a suitable coöperating active contact, means for moving said active contact in two different directions to engage one of said passive contacts, a retarding device therefor effective in each direction of movement, said retarding device becoming active when said active contact is moved beyond said bank to restore it to normal position.

15. An automatic switch comprising a bank of passive contacts and an associated active contact, of suitable means for primarily driving said active contact against spring pressure to a group of passive contacts, means for secondarily driving said active contact against spring pressure to engage one of said passive contacts, means for thereafter driving said active contact beyond said bank, whereby said active member is restored to normal position by said spring pressure.

16. An automatic switch comprising a bank of passive contacts, of a suitable active contact therefor, electromagnetic means for driving said active contact in two directions to engage with one of said passive contacts, and suitable driving means for moving said active contact in two directions over a different path, to restore it to normal position.

17. An automatic switch comprising a bank of passive contacts of a suitable coöperating active contact, electromagnetic means for driving said active contact in two directions to engage one of said passive contacts, electromagnetic means for thereafter moving said active contact beyond said bank, and suitable driving means for moving said active contact in two directions over a different path, to restore it to normal position.

18. A selector switch comprising contacts arranged in groups, mechanism for driving the wipers of the contacts against opposing spring tension to a group and then against opposing spring tension to a contact in the group, and means whereby said mechanism restores the wipers.

19. A connector switch comprising arcuate radially disposed groups of contacts, mechanism for driving the wipers of the contacts to a group and then to a contact in a selected group, and means whereby said mechanism restores the wipers.

20. A step by step selector switch comprising arcuate radially disposed groups of contacts, mechanism for driving the wipers of the contacts step by step to a group and then step by step to a contact in the selected group, and means whereby said mechanism effects the restoration of the wipers.

21. A selector switch comprising arcuate radially disposed groups of contacts, mechanism for rotating the wipers of the contacts to a group and then rotating the wipers to a contact in the selected group, and means whereby the second driving means effects the restoration of the wipers.

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

WILLIAM KAISLING.

Witnesses:
GEORGE E. MUELLER,
WILLIAM BERGHAHN.