

July 26, 1938.

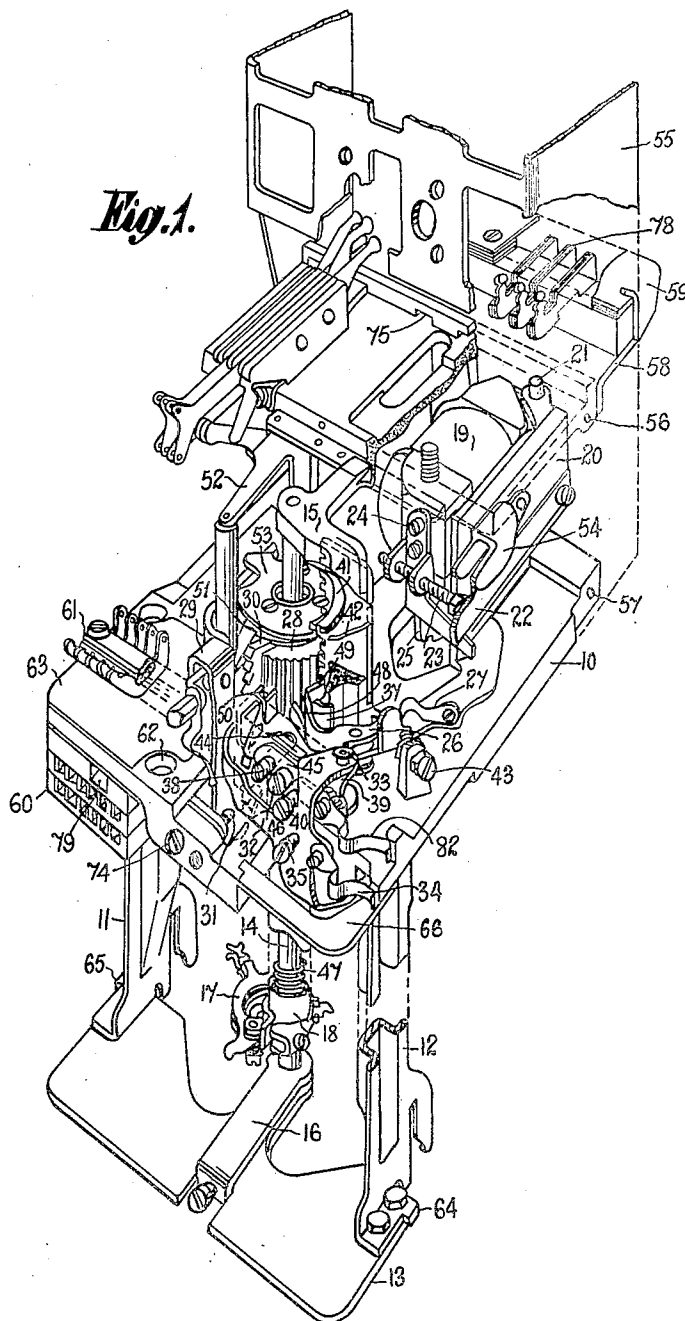
R. N. SAXBY

2,124,750

AUTOMATIC SWITCH FOR USE IN TELEPHONE OR LIKE SYSTEMS

Filed Dec. 13, 1935

4 Sheets-Sheet 1



INVENTOR

ROBERT NORMAN SAXBY

Chas. H. Candy

ATTY.

July 26, 1938.

R. N. SAXBY

2,124,750

AUTOMATIC SWITCH FOR USE IN TELEPHONE OR LIKE SYSTEMS

Filed Dec. 13, 1935

4 Sheets-Sheet 2

Fig. 2.

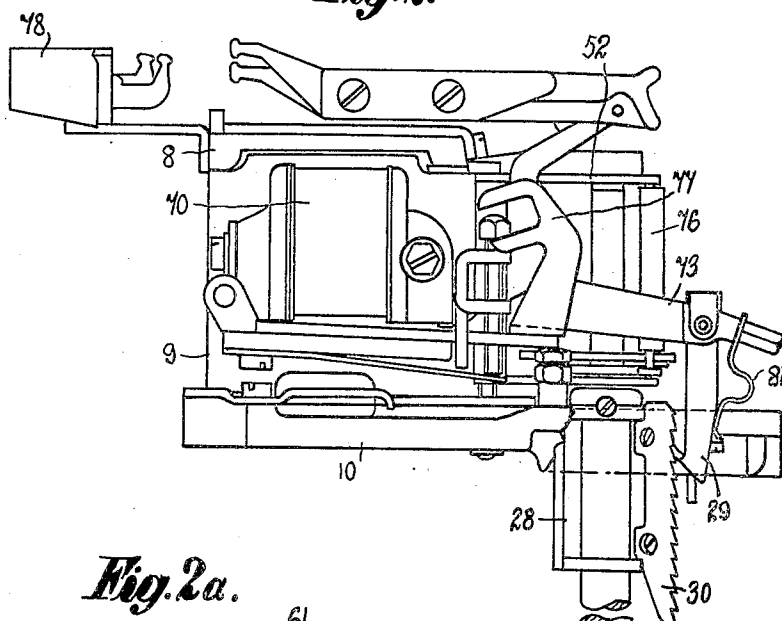
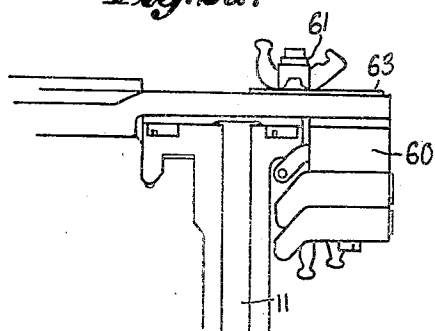
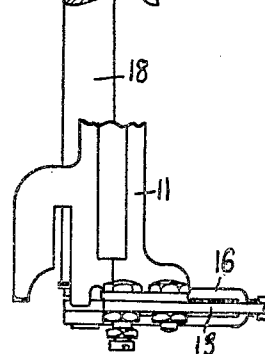


Fig. 2a.



INVENTOR

ROBERT NORMAN SAXBY

Chas. E. Candy

ATTY.

July 26, 1938.

R. N. SAXBY

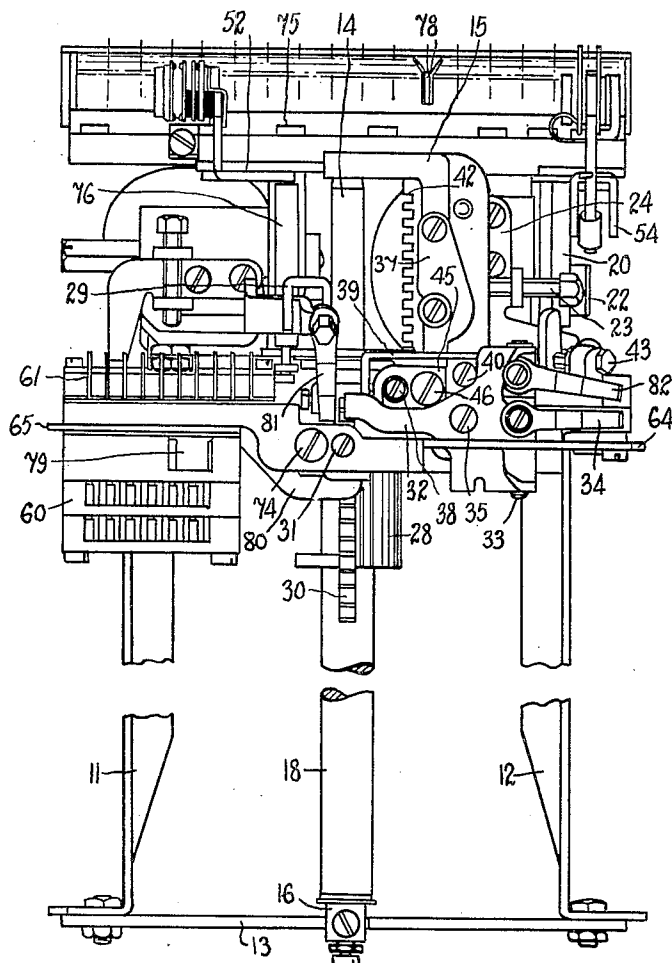
2,124,750

AUTOMATIC SWITCH FOR USE IN TELEPHONE OR LIKE SYSTEMS

Filed Dec. 13, 1935

4 Sheets-Sheet 3

Fig. 3.



INVENTOR

ROBERT NORMAN SAXBY

Chas. H. Canty

ATTY.

July 26, 1938.

R. N. SAXBY

2,124,750

AUTOMATIC SWITCH FOR USE IN TELEPHONE OR LIKE SYSTEMS

Filed Dec. 13, 1935

4 Sheets-Sheet 4

Fig. 4.

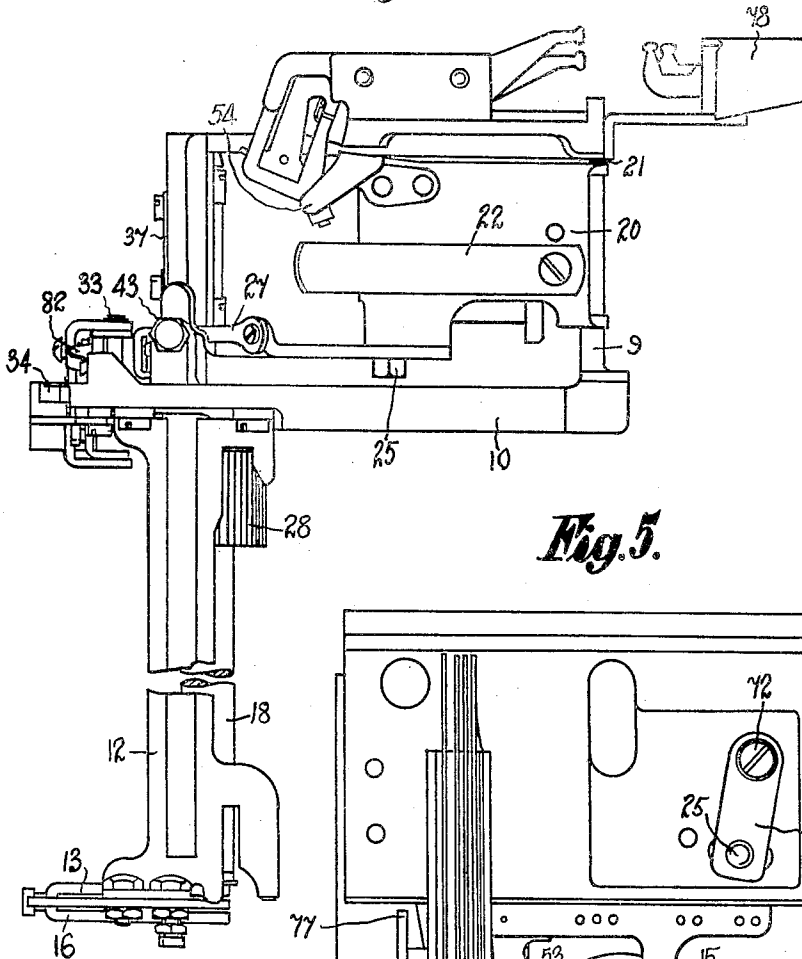
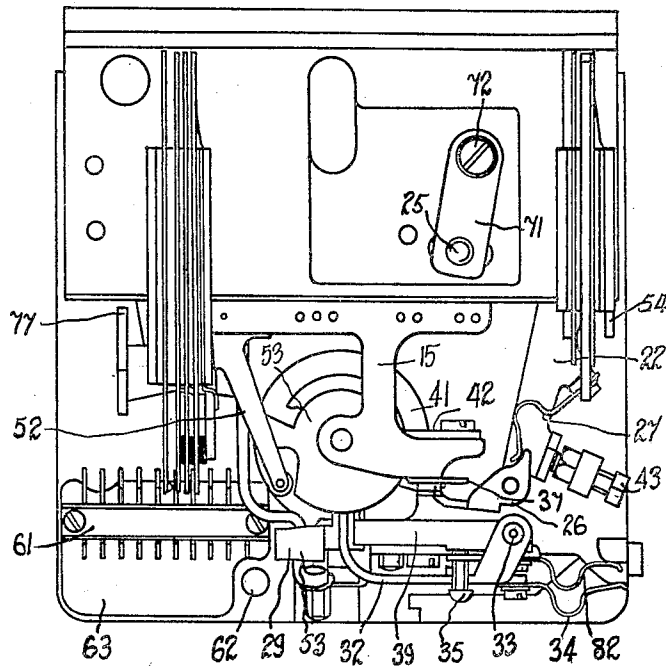


Fig. 5.



INVENTOR

ROBERT NORMAN SAXBY

Chas. L. Condy

ATTY.

UNITED STATES PATENT OFFICE

2,124,750

AUTOMATIC SWITCH FOR USE IN TELEPHONE OR LIKE SYSTEMS

Robert Norman Saxby, Liverpool, England, assignor to Associated Telephone & Telegraph Company, Chicago, Ill., a corporation of Delaware

Application December 13, 1935, Serial No. 54,287
In Great Britain January 8, 1935

8 Claims. (Cl. 179—27.52)

The present invention relates to improvements in automatic switches of the type used in telephone or like systems and is more particularly concerned with switches of the two-directional type arranged to have longitudinal and rotary movement. The invention moreover represents a development of the switch disclosed in the patent of Robert N. Saxby, No. 2,028,689, granted January 21, 1936.

10 The general object of the invention is to provide an improved two-directional switch of the type disclosed in this specification particularly as regards ease of adjustment and accessibility of components.

15 According to one feature of the invention locking means are provided for preventing rotary movement of the switch from the normal position.

The invention will be better understood from the following description of a preferred form of construction, reference being had to the accompanying drawings. Of these Fig. 1 is a perspective view with certain parts broken away to enable the construction to be more readily appreciated. Fig. 2 is a left-hand side elevation with a portion broken away shown separately in Fig. 2a. Fig. 3 is a front elevation, Fig. 4 is a right-hand side elevation and Fig. 5 is a plan.

Referring now to the drawings, it will be seen that the switch is of the same general construction as that described in the specification above referred to, only in this case the die-cast frame on which the various components are assembled is roughly H-shaped, having an upper platform 8 and a lower platform 10 joined together by a substantially central wall 9. Fastened to the underside of the lower platform 10 are two channel members 11 and 12, bridged at the bottom by a plate 13 which serves as a support for the lower end of the switch shaft 14. The upper end of the switch shaft is tapered and accommodated as a push fit in the bracket 15 forming part of the cast frame, while the lower end is rigidly clamped to the plate 13 by the U-shaped clip 16. This arrangement enables the shaft and wiper carriage it supports to be readily removable from the switch and this is effected by uncoupling the plate 13 from the channel members after which the shaft and carriage can be withdrawn downwards away from the switch. Only one set of wipers 17 is shown and these are clamped to the tubular carriage member 18 adapted to slide and rotate on the fixed shaft 14 and carrying at its upper end the vertical and rotary ratchet member.

Magnet assemblies of similar construction drive the tubular carriage member and are mounted side by side in the recesses of the cast frame thus making their assembly and removal very simple. Only the rotary magnet assembly has been shown in Fig. 1 but the vertical magnet assembly 70 is clearly shown in Fig. 2. As will be seen the rotary magnet assembly comprises a coil 19 bridging the pole pieces on which is mounted an armature 20 rotatable about the pivot 21 and arranged to be attracted against the pressure of the flat spring 22 the tension of which is adjustable by means of the screw 23. No locking nut is provided for the screw 23 the necessary locking effect being obtained by arranging that the lugs of the bracket 24 into which the screw is threaded are bent slightly out of parallel and the frictional force exerted on the screw by drawing them into line produces a satisfactory locking effect. This method of locking simplifies adjustment and eliminates the possibility of disturbing the adjustment when tightening a locking nut.

The complete magnet assembly is fastened to the upper plate of the frame by a bolt 25, passing through the forward pole piece and engaging in a plate 71 shown in Fig. 5, while location of the assembly is effected by means of the end of the armature pivot pin 21 which enters a hole in the frame. To permit lateral adjustment the hole in the frame which accommodates the fastening bolt 25 is slotted and the plate 71 is rotatable about the screw 72 so that the complete magnet assembly can be pivoted about the armature pivot pin into the desired position. It should be mentioned that the magnet core and rectangular pole pieces are of cast iron and are formed as a single casting having roughly the form of an H. To the extended arm of the armature is pivoted a pawl 26 which is spring-loaded by means of the spring 27 and adapted to co-operate with the rotary ratchet member 28 fastened to the tubular carriage. In respect of the vertical magnet assembly which is of substantially identical construction, only the operating pawl 29 is shown in Fig. 1 and this is pivoted to the extended arm of the armature 73 and co-operates with the vertical ratchet member 30.

Considering now the detailed mechanical operations involved, when the vertical magnet is energized the pawl 29 which is loaded by the spring 81 runs up the lower guide member 80 seen in Fig. 3 so as to engage with the vertical ratchet member 30 which is lifted until the pawl becomes locked against the upper pawl stop 31

in which position the tubular carriage and wipers will have been raised to the first level. Actually in Fig. 1 the carriage is shown as raised to the fifth level and rotated one step so that the vertical ratchet 30 has left the detent and the wipers are set to contact 1.

During the vertical stepping the carriage is retained in its operated position by means of the detent 32 situated above the vertical pawl and pivoted on a pin 33 which passes through the frame and is locked thereto by a screw, not shown. A spring 34 similar to spring 81 provided for the pawl holds the vertical detent in engagement with the ratchet member and the extent of this inward movement is limited by the adjusting screw 35 which is threaded through the detent so as to bear against the front edge of the cast frame. No lock nut is provided for this screw but the required effect is obtained in the manner already described by means of a lug bent up into the form of a U behind the detent.

Rotary motion of the carriage is effected from the other magnet 19 which is provided with a different shaped pawl 26 arranged when operated to be guided along the edge of the adjusting plate 37 so that it plunges into the correct tooth of the rotary ratchet 28 which is rotated until the pawl becomes locked against the pawl stop 38. At each rotary step the carriage is held in its operated position by means of a detent member 39 pivoted on the same pin as the vertical detent and loaded by means of spring 82 so as to engage with the ratchet teeth and adjustable as regards its resting position by means of the screw 40 which is threaded through a turned-over lug of the detent proper so as to bear against a projection on the frame.

On the first rotary step the arcuate plate 41 fastened above the ratchet members on the tubular carriage is arranged to enter a tooth on the comb member 42 fastened to the cast frame, in order that the carriage and wipers may be supported when the vertical ratchet member rides out of engagement with the holding detent 32.

As regards the adjustment of the rotary magnet it will be seen that the resting position of the armature is regulated by the adjusting screw 43 while the angle of the pawl is set by swinging the adjusting plate 37. The pawl front stop 38 is not provided with the usual locking nut but the required effect is obtained in substantially the manner already described. In this case, however, it has not been possible to employ a turned over lug and this is replaced by a separate plate 44 into which the stop screw 38 is threaded as well as through the projection 45 on the cast frame. A further screw 46 passing through a clearance hole in the frame is threaded into the plate 44 and by tightening this screw the required locking effect is obtained on the stop screw. Similar locking arrangements are provided for the vertical pawl stop 31 by means of the locking screw 74.

Restoration of the carriage and wipers is effected in both directions of motion by a single helical spring 47 which encircles the fixed shaft and is contained in the tubular wiper carriage. The spring is secured at one end to the shaft and at the other end to the wiper carriage so that during the setting operation of the switch it is both compressed and twisted, or alternatively stretched and twisted depending upon the manner in which it is secured, in order to store up energy necessary for the restoring movement in both directions.

When the switch is to be restored, the circuit is arranged so that the wipers continue their rotation into an extreme position out of engagement with the bank, whereupon the arcuate plate 41 leaves the comb member 42 and the tubular carriage is then restored by the spring 47 to its normal position as regards the vertical movement. In this position the rotary ratchet 28 is lowered clear of the retaining detent 39 and the wipers are then rotated to the normal position below the banks, where the vertical ratchet member 30 re-engages with its holding detent 32 and also comes up against a fixed stop (not shown in the drawings) which is secured to the underside of the cast frame member.

During release the rotary pawl enters a deep slot in the rotary ratchet and the projection 48 carried by the pawl comes up against a locking stop 49 before the interrupter springs open, thereby mechanically preventing the self-interruption of the magnet after the wipers have left the bank. Furthermore when the wiper carriage reaches its fully-restored position a stepped projection 50 on the rotary detent latches behind the extended end 51 of the arcuate plate 41 as shown in Fig. 1 thereby preventing the rotation of the wipers by hand from their normal position. Though the shape of the plate 41 is hidden by the plate 53 lying above it, it will be understood that from the extended end 51 to the slot which engages with the comb member 42 the plate 41 has a profiled edge so that during the restoring movement the rotary detent 39 is gradually forced outwards until it drops over the end 51. Without this arrangement there is the danger that the wipers may stick in some off-normal position if moved by hand because for ordinary release purposes the restoring spring 47 is only sufficiently tensioned to bring them back without undue shock when they move from the extreme position.

All mechanically-operated spring sets are mounted side by side across the upper platform of the frame and are bodily removable by withdrawing the associated bracket fixing screws. Only one fixing screw is provided for each set while the opposite end of the bracket is tapered and accommodated in a slot such as 75 in the cast frame so as to line up the spring set in its proper position. For convenience in the drawings only one set of springs is shown in Fig. 1, namely, the rotary off normal springs and these are operated from the lever 52 which is pivoted between the upper and lower platforms of the frame and actuated on the first rotary step of the wiper carriage by the arcuate plate 53 through roller 76. The various other spring sets, namely, the off normal springs, cam springs and normal post springs, not shown, are operated from levers pivoted in a similar manner to that described for the normal rotary springs, and the details of operation are fully described in relation to Fig. 5 of the above mentioned specification.

As shown in Figs. 3, 4 and 5, rotary interrupter springs are mounted on the right-hand side of the upper platform and vertical interrupter springs though not shown are assumed to be similarly mounted on the left-hand side. These spring assemblies are conveniently of the type operating on the toggle principle so as to have two positions of equilibrium and a certain amount of lost motion between the operating arm carried by the armature and the contact-spring-operating member which it engages. Both sets of springs are operated directly from 75

the magnet armatures and those associated with the rotary magnet are controlled by the forked member 54 attached to the magnet armature. As may be seen from Fig. 2 the forked bracket 77 attached to the vertical magnet armature is of somewhat different construction and conveniently the operating arm of the lost motion spring set is turned through an angle of 90° in order to convert the vertical movement of the magnet armature into a horizontal movement of the spring set.

If the switch is to be used in circumstances where the absorption of one or more of the setting digits is desirable, direct vertical release can be achieved by the use of a small auxiliary magnet adapted on operation to disengage the vertical detent from the vertical ratchet so that the carriage and wipers immediately fall to the normal position. Furthermore, should it be desired to restore the wipers in the rotary and vertical direction along the path over which they were set, this can be achieved by the use of a hinged vertical ratchet.

The mounting plate 55 for the control relays is of the well-known tray-shaped construction rigidly fastened to the cast frame by four screws, two at each side, which enter the tapped holes 56 and 57.

Vertical wipers and banks may be provided in the manner shown in the patent of Robert N. Saxby, No. 2,067,246, granted January 12, 1937, according to which the wipers are mounted on a hinge so that they may be swung out of engagement with the bank to facilitate removal of the switch from its mounted position when desired.

Mounting of the switch on the shelf is also described in this specification, the arrangement being that each switch is seated in a separate cradle member fastened to the shelf and supporting also the contact banks. Locating means are included in this mounting which function as a pivot on which the switch may be swung into its mounted position, thereby ensuring accurate engagement of the switch and shelf connecting jacks. An angle bracket 58 extending rearwardly from the frame supports the switch jack 78 which is the well-known construction and is protected from above by a metal guard 53.

For test purposes certain of the connecting wires forming part of the electrical circuit are lead out to the test jack 60 fastened to the left of the cast frame, at the front of the switch. The jack comprises essentially three rectangular blocks of insulating material provided with a number of parallel slots in which are laid the contact springs after which the blocks are assembled together to form a complete unit. As shown in the drawings the top cavity 79 will accommodate a supervisory lamp, while the two rows of lower cavities present 12 connection points which may be interconnected as desired either by short-circuiting U links or any other means. Preferably each contact spring is bowed to provide a good electrical contact and is formed with a small tongue which projects into a hole in the base of the slot to lock the spring in position.

Immediately above the test jack is mounted a terminal block 61 for terminating the flexible cords from the wipers which rise through the hole 62 in the cast frame. In construction it follows somewhat the lines of the testjack in that the terminals are accommodated in slots in a block of insulating material and are clamped

to a plate of insulating material 63 lying on the frame.

The whole of the switch including the relays, mechanism and wipers is enclosed in a dust-proof cover comprising a rectangular metal box open at the back and the bottom. A lip at the top of the box clips behind the relay mounting plate, while at the bottom, slots on each side register with the projections 64 and 65 on the side members to trap the cover in its mounted position. A plate 66 which acts as a guard for the vertical and rotary detent mechanisms serves to guide the cover into its mounted position and also completes the symmetrical appearance of the switch frame.

It will be seen that with the improved switch construction according to the invention all the various adjustments required in practice may be made from the front of the switch and the majority of them may be effected by the use of a screw driver only.

I claim:—

1. An automatic step-by-step switch having wipers, magnets for first stepping the wipers in a vertical direction and then in a rotary direction, armatures for said magnets having pawl and ratchet mechanisms for controlling the stepping movement, adjusting devices for adjusting the stroke and limits of said mechanisms, all of said adjustments accessible from the front side of the switch.

2. An automatic switch having wipers, magnets for moving the wipers in two directions, armatures and pawl and ratchet mechanisms therefor controlled by the magnets to move the wipers, adjusting devices for regulating the movement and stroke of said mechanisms, said devices all accessible from the front of said switch consisting of slotted screws when facing the front of the switch, and hexagonal headed screws when facing transversely across the switch.

3. An automatic switch having wipers and ratchet and pawl means for stepping the wipers in a vertical and rotary movement, a rotary detent for holding the wipers in each rotary position when advanced thereto, a cam member attached to the wiper carriage, said cam member and said detent cooperating to prevent any rotary movement of the wipers before they are moved in a vertical direction.

4. An automatic switch having wipers and magnets for moving the wipers with a plurality of electric circuits in the switch, a test jack assembly mounted on the switch for testing said circuits, said jack comprising a plurality of blocks of insulating material each containing a plurality of slots, a series of loosely mounted bowed metal contacts one in each slot connected to the different circuits of the switch, and a tongue on each contact engaging a hole in its slot to hold it in position.

5. An automatic switch having a shaft carrying wipers, and a bank of contacts, magnets for moving the shaft to bring the wipers into engagement with certain of said contacts, said shaft having its upper end detachably mounted, a bracket for securing the lower end of the shaft below the contact bank, said bracket removable to permit removal of the assembly including said bracket said wiper shaft and wipers from the switch assembly.

6. In an automatic switch having a shaft carrying wipers that have access to bank contacts, a vertical magnet for stepping said shaft in a vertical direction to position the wipers opposite a desired row of contacts, a rotary magnet for step-

- ping said shaft in a rotary direction over the selected row of contacts to select one of the contacts in the row, pawl and ratchet mechanisms for each of said magnets for controlling the stepping of said shaft by said magnets, adjusting means accessible from the front of said switch for adjusting the stroke of said mechanisms, and means cooperating with said rotary magnet for stepping said shaft in the same rotary direction to restore the shaft to normal position.
7. In a switch as claimed in claim 6, in which a cam shaped member attached to the shaft prevents the rotary magnet from controlling the shaft after it has restored to normal.
8. In an automatic switch having a wiper shaft

movable in vertical and rotary directions, a vertical magnet and armature therefor cooperating with a pawl and ratchet mechanism to raise the wiper shaft step by step, a rotary magnet and armature therefor cooperating with a pawl and ratchet mechanism to rotate the wiper shaft step by step after the shaft has been raised from normal, means accessible from the front of the switch for adjusting the air gap between the magnets and their associated armatures to control the stroke of the associated pawl, and means also accessible from the front of the switch for adjusting the position of the pawls in respect to the position of the associated ratchets.

ROBERT NORMAN SAXBY. 15