C. H. SMITH.

NON-INTERFERING KEY.

APPLICATION FILED JUNE 19, 1913.

1,271,378.

Patented July 2, 1918.

3 SHEETS—SHEET 1.

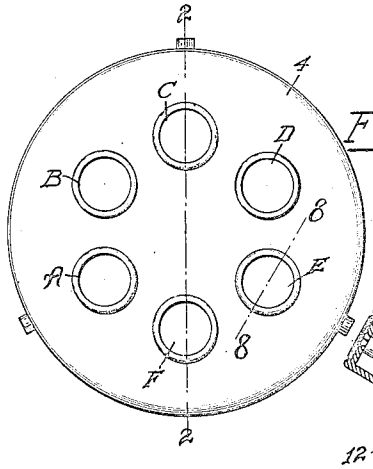


Fig. 1.

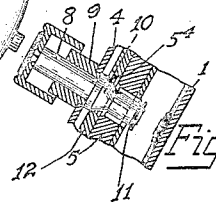


Fig. 8.

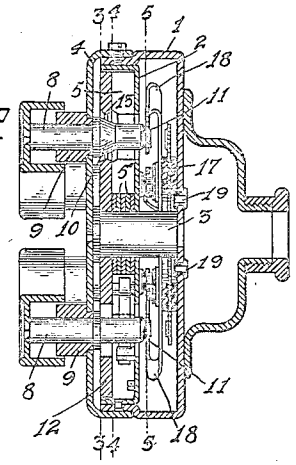


Fig. 2.

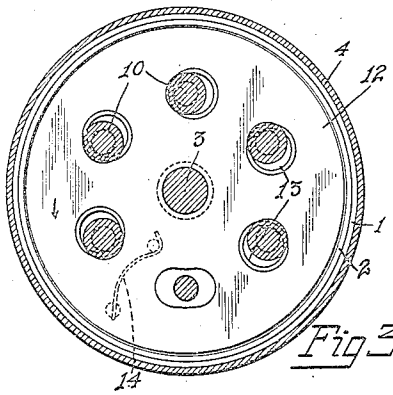


Fig. 3.

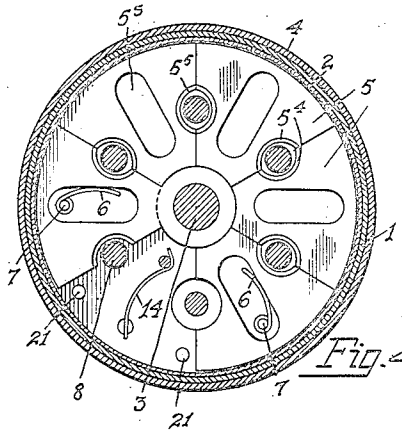


Fig. 4.

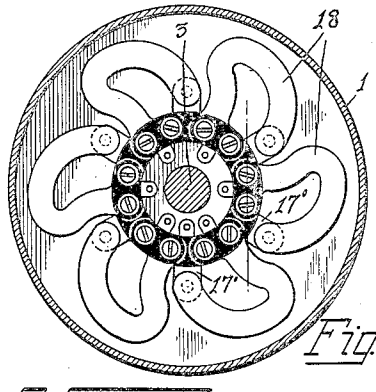


Fig. 5.

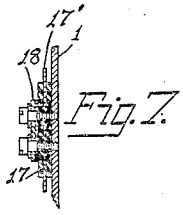


Fig. 7.

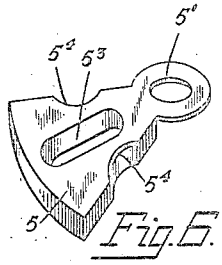


Fig. 6.

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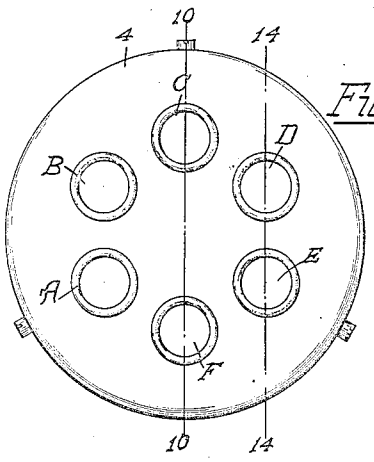


Fig. 9.

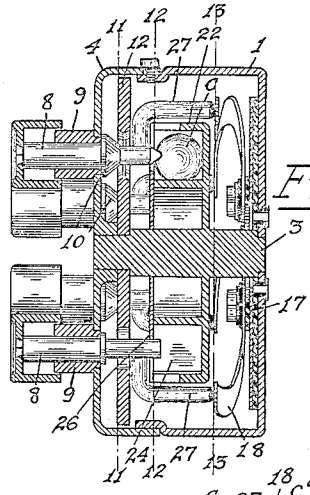


Fig. 10.

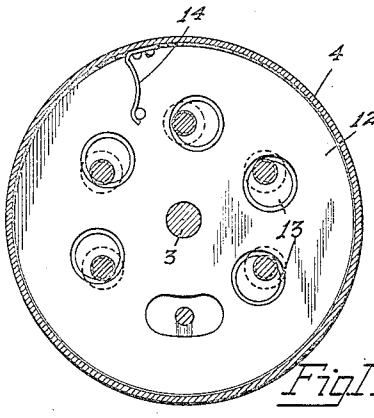


Fig. 11.

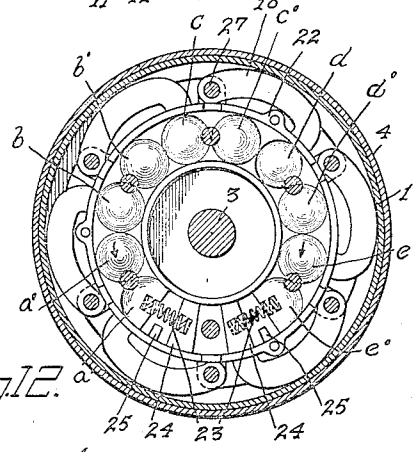


Fig. 12.

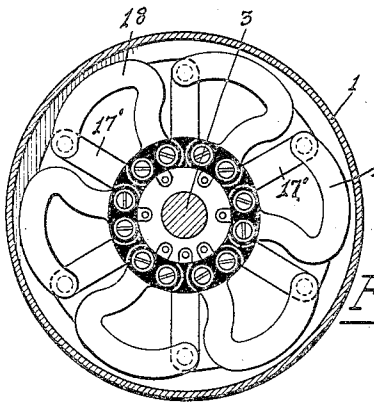


Fig. 13.

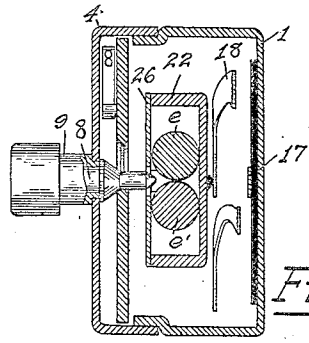


Fig. 14.

Witnesses:

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3 SHEETS—SHEET 3.

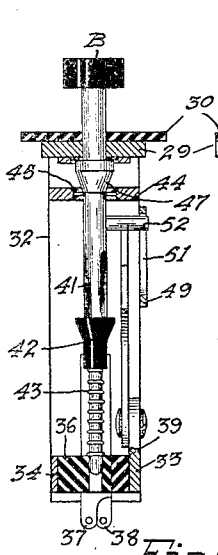


Fig. 16.

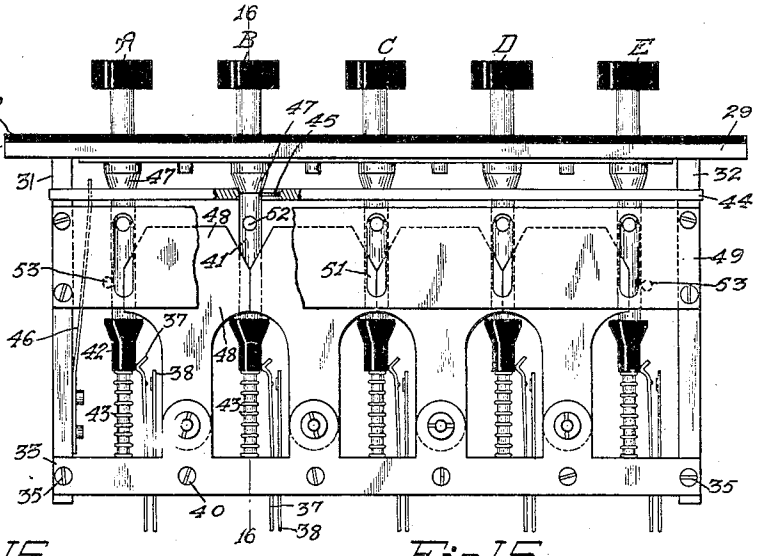


Fig. 15.

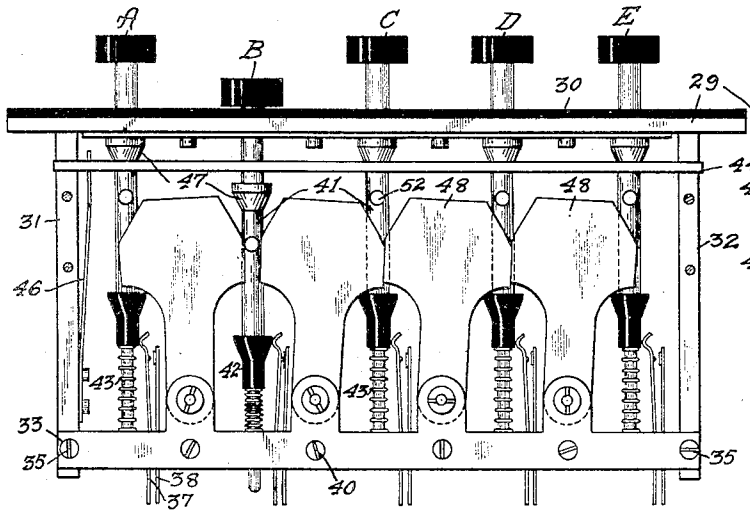


Fig. 17.

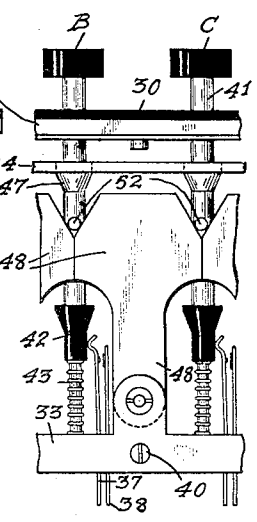


Fig. 18.

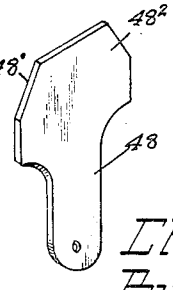


Fig. 19.

Witnesses:

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Inventor

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UNITED STATES PATENT OFFICE.

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NON-INTERFERING KEY.

1,271,378. Specification of Letters Patent. Patented July 2, 1918.

Application filed June 19, 1913. Serial No. 774,536.

To all whom it may concern:

Be it known that I, CHARLES H. SMITH, a citizen of the United States, residing in Chicago, county of Cook, State of Illinois, have invented certain new and useful Improvements in Non-Interfering Keys, of which the following is a specification.

My invention relates to switching devices and has to do more particularly with devices in which a plurality of switch actuating members are associated into a unitary structure. An object of my invention is to provide an efficient structure providing automatic means to prevent more than one switch actuating member being effectively actuated at one time.

While I have in the drawings indicated electrical switches to be operated, my invention is plainly not limited thereto, but may be used for any switching purpose, to control a valve system for example, or any other where indicating and non-interfering features are desired and accordingly in the appended claims I do not limit myself to electrical or any particular switching method.

Figure 1 is a plan view of one embodiment of my invention.

Fig. 2 is a sectional view on the line 2, 2, of Fig. 1.

Fig. 3 is a sectional view on the line 3, 3, of Fig. 2.

Fig. 4 is a sectional view on the line 4, 4, of Fig. 2.

Fig. 5 is a sectional view along the line 5, 5 of Fig. 2.

Fig. 6 is a perspective view of one of the locking strips.

Fig. 7 is a sectional view on line 7, 7, of Fig. 5, showing method of fastening springs.

Fig. 8 is a sectional view on line 8, 8 of Fig. 1, showing position of actuating member in relation with the release plate and locking strip.

Fig. 9 is a plan view of another embodiment of my invention.

Fig. 10 is a sectional view on the line 10, 10 of Fig. 9.

Fig. 11 is a sectional view on the line 11, 11 of Fig. 10.

Fig. 12 is a sectional view on the line 12, 12 of Fig. 10.

Fig. 13 is a sectional view on the line 13, 13 of Fig. 10.

Fig. 14 is a sectional view on line 14, 14 of Fig. 9, showing the portion of the actuating member in relation with the non-interfering means.

Fig. 15 is a side elevation of another embodiment of my invention.

Fig. 16 is a sectional view along line 16, 16 of Fig. 15.

Fig. 17 shows the key of Fig. 15 with one of its actuating members moved to an effective position.

Fig. 18 shows two actuating members of the device of Fig. 15 simultaneously depressed but without effective operation.

Fig. 19 is a perspective view of one of the locking members as embodied in Fig. 15.

Referring now to my invention as illustrated in Figs. 1 to 8, casing 1 has a cup-shaped member 2 fastened to it in any suitable manner. A central shaft 3 extends through cup 2, its lower end fastened to the casing 1 and its upper end to the cover 4. The locking strips 5 are radially disposed in the cup 2 as shown in Fig. 4. A locking strip 5, Fig. 6, is triangular having an extension 5^1, and each extension 5^1 is differently located on its respective strip 5 to enable all the strips to lie side by side in the cup 2, when extensions 5^1 are slipped over shaft 3. The shaft 3 acts as a pivot around which the locking strips rotate in their limited movement. The oblong openings 5^3 in strips 5 serve as bearing surfaces for the restoring springs 6, the other ends of the springs 6 being fastened to pins 7 driven into the cup 2. The concave indentations 5^4 in strips 5 are so positioned that when the locking strips are radially disposed in the cup member 2, said concave indentations 5^4 on adjacent strips 5, match and form elliptical openings.

A number of actuating members A, B, C, D, E, and F are provided, comprising each a plunger rod 8 which passes through a bearing 9, said bearing acting as a guide. A plunger rod 8 has an integral cam 10 adapted to be forced down into its associated elliptical opening 5^5 formed by locking strips 5. Rod 8 has an insulating button 11 resting against its individual spring contact 18. The actuating member F is in the form of a plunger rod but the rod has no cam integral with it. This actuating member may be depressed, but when the pressure is released the key plunger is restored to normal by

spring 18. No locking plate is connected with it, and when the plunger is depressed, said plunger does not operate the release plate.

A common circular release plate 12 fits into cup 2 and rests on the locking strips 5. The release plate 12 rotates about the shaft 3 in its limited movement and has a plurality of chamfered holes 13, one for each key plunger, and they rest against the cams 10 of the shafts 8. The restoring spring 14 for plate 12 is provided as shown.

The spring contact set associated with each key plunger 8 is located in the bottom of the casing 1. A common circular contact 17 has projections 17^1 for the individual contacts 18. The latter are suitably insulated electrically and act as restoring springs for the key plungers with which they are respectively associated. The terminals of the common contact and of the individual contacts extend inwardly and the wiring is brought through holes 19 in the bottom of casing 1. The pins 21 are driven into the bottom of the cup-shaped member 2 and limit the movement of the locking strips 5.

Having described in detail the construction of the form of my invention as illustrated in Figs. 1 to 8, the operation of the same will now be described.

Assuming now that all of the plungers are at normal, the plunger C may be depressed and upon the starting of the downward movement its cam 10 moves the common release plate 12 in the direction of the arrow against the tension of the restoring spring 14. When the upper or locking surface of the cam comes below the release plate 12, the said plate is moved back by the spring 14 to its locking position. As the plunger is depressed the cam 10 is moved into the elliptical opening formed by two of the locking strips 5 forcing them apart against the tension of the springs 6 and thereafter the plunger 6 operates its spring contact 18 to close an electrical circuit.

Assume now that another key, say D, is depressed, while C is down, the starting of the downward movement of the cam 10 of the plunger rod of D moves the release plate 12 in the direction of the arrow and when the locking surface of the cam is positioned in the chamfered hole of the release plate of the plunger of C that was in locking position is in such position that the cam 10 of C passes through its chamfered hole of the release plate and the plunger of C is restored to normal by means of the individual contact spring 18, while the plunger of D is further depressed, is locked down and actuates its spring.

Now assume that two key plungers are simultaneously depressed, their two cams 10 move downwardly into their respective elliptical openings formed by the locking strips 5 and tend to force the strips apart to the right and left. The movement of the strips 5 is limited by the stops 21 and not enough play is provided to accommodate two cams 10 at once, so the cams bear against the elliptical indentations and jam thus preventing an effective operation of the keys, inasmuch as while the plungers come down a little way the spacing of the parts is such that they cannot under the circumstances indicated descend far enough to actuate the contact springs.

Figs. 9 to 14.

Referring now to Figs. 9 to 14, inclusive, the parts thereof corresponding to parts of the first form of my invention are indicated by like reference characters. In the device as illustrated in Figs. 9 to 14, inclusive, the actuating members A, B, C, D, E and F of Fig. 9 are similar to those shown in Fig. 1, but the non-interfering feature is controlled by balls resting in a circular channel shaped member. The device includes a casing 1 and a central shaft 3 having its lower end fastened to the casing 1 and its upper end in the cover 4. The circular channel 22 is integral with the shaft 3 and I employ a plurality of balls a, a^1, b, b^1, c, c^1, d, d^1 and e, e^1 disposed in the circular channel as shown in Fig. 12. The actuating members A, B, C, D and E are non-interfering but the member F is not, as the said member can be depressed to operate its spring contacts and when the pressure is released restores to normal as no locking balls are associated with its plunger. Balls a, a^1 are associated with the actuating member A, b and b^1 are associated with B, etc. The locking balls a and e are hemispherical in shape and may have rectangular extensions fitting slidingly into the circular channel to maintain their proper positions. Their flat ends have holes to receive springs 23, the other ends of the springs fitting into blocks 24, held in place in any suitable manner. The spring 23 restores the balls when a key is released. The stops 25 limit the movement of the balls to the right or left. A cover 26 keeps the balls in the channel. The actuating members A, B, C, D, and E are provided with plunger rods 8, which pass through the bearing 9. The plunger rods 8 have cams 10 which operate in connection with the common release plate 12. Each plunger rod also carries its angular extension 27 extending beyond the circular channel and downwardly toward the contact springs to be actuated. The plunger rod proper has its lower end tapered and extends down through the cover of the circular channel. This tapered end is forced down in between the two locking balls when the plunger is depressed. A common release plate 12 like that before described is pro-

vided with chamfered holes and a restoring spring 14. The contact springs are similar in construction to the ones described in Figs. 1 to 8.

Having described in detail the construction of the form of my invention illustrated in Figs. 9 to 14, the operation of the same will now be described.

Assume that all of the plungers are in their normal positions. The plunger C is depressed and its cam 10 moves the common release plate in the direction of the arrow against the tension of the spring 14 and when the upper surface of the cam 10 comes below the release plate, said plate is moved back by the spring 14 to locking position. As the plunger is depressed the tapered end of the plunger rod is forced between the balls c, c^1, moving them apart against the tension of springs 23. The angular extension moves downwardly with the plunger rod and at the proper time operates the spring contacts to close an electrical circuit.

Assuming now that another key D is depressed, the starting of the downward movement of the cam 10 of the plunger rod moves the release plate 12 as before and when the cam is in the chamfered hole of the release plate the plunger of C which was in locking position passes up through its hole of the release plate and is restored to normal by its spring 18. Now assume instead that two key plungers B and D are depressed simultaneously. They are moved downwardly between the two balls with which each key is associated, the plunger D forces the balls d, e^1, e in the direction of the arrow indicated and the plunger B forces the balls b, a^1 and a in the direction of the arrow indicated thereon. The tapered end of the plunger rod of the key B contacts with the surface of the ball b^2 and the plunger rod of the key D contacts with the surface of the ball d^1, thus it may be seen that any further pressure upon the two keys B and D will not produce an effective operation of the two keys, because they will jam and the parts are so related that when this occurs, the circuit springs are not actuated.

Figs. 15 to 19.

Referring now to the form of my invention as illustrated in Figs. 15 to 19, inclusive, a frame having a top plate 29 is covered by an escutcheon plate 30. The plate 29 is connected by side plates 31 and 32, the latter being connected by plates 33, 34 fastened by screws 35. A block of insulating material 36 is slotted to receive the sets of contact springs 37, 38 and an insulating strip 39 is placed between the insulating block 36 and the connecting strip 33, the clamping screws 40 extending through strip 33 and the insulation strips 39 and 36 securely holding the springs 37 and 38 in place. A plurality of actuating members A, B, C, D, E, are provided in the form of plunger rods 41. An insulating sleeve 42 on the plunger rod 41, actuates the contact springs 37 and 38 when the plunger rod is fully depressed. Restoring spring 43 normally rests compressed between the sleeve 42 and the insulation block 36. A common release strip 44 is slidingly supported at its ends in the plates 31, 32 and has a plurality of chamfered holes 45, whose edges rest against plunger rod 41. The restoring spring 46 is arranged so that when a plunger is depressed the cam 47 integral with the plunger rod 41 moves the release strip against the tension of the spring 43 until the upper or locking surface of the cam 47 passes below the release strip and said spring forces the plate back into a locking position to hold the plunger actuated. The movement of the release strip caused by the actuation of a plunger, also releases, in an obvious manner, any plunger which is being held down by the release strip. The means to prevent simultaneous effective operations of two or more plungers includes a plurality of locking plates 48 pivoted to an extension of the strip 33 permitting said plates to be locked to the right or left. A plate 49 fastened to end plates 31, 32 has guiding slots 51 through which the guiding pins 52 extend. The locking plates 48 have the angular cam surfaces 48^1, 48^2 adapted to be engaged by a pin 52 when a plunger is depressed, each plunger pin 52 coöperating with two locking plates. The movement of the locking plates to the right or left is limited by the pins 53, which are driven into the guiding plate 49.

Having described in detail the construction of the form of my invention as illustrated in Figs. 15 to 19, the operation of same will now be described.

Assume now that all of the plungers are in their normal position and the plunger B is depressed. Upon the starting of the downward movement the cam 47 moves the common release plate 12 against the tension of the restoring spring 46. When the upper or locking surface of the cam 47 reaches a position below the release strip 44, the said plate is moved back by the spring to its locking position, holding the plunger in an indicating position. To operate the contact springs 37 and 38 further pressure of the actuating member B is required, and as further pressure is applied the contact spring 37 rides upon the angular cam surface of the sleeve 42 closing the contact springs 37 and 38. As the plunger moves downward to operate the contact springs, the pin 52 rides upon the angular cam surfaces 48^2 and 48^1 of the two locking plates it is associated with, and when the key is fully

actuated it forces the locking strip to the left against the stop and also moves the three other locking strips to the right against the other stop. Thus it will be seen that if another plunger is depressed the pin will engage the angular cam surface and no effective operation will be obtained. As the pressure is released the actuating member is forced back by the spring 43, the upper or locking surface of the cam 47 resting against the bottom of the release strip 44 in an indicating position.

Assuming now that another key is depressed the starting of the downward movement of the cam 47 of the plunger rod moves the release plate 44 and when the locking surface of the cam 47 is positioned in the chamfered hole of the release strip the cam 47 of the other plunger passes through the chamfered hole of the release plate that is associated with it and the said plunger is restored to normal by its spring 43. If two key plungers are simultaneously depressed the pins 52 are moved downwardly and engage the cam surfaces 48^1, 48^2 of the locking plate 48 shown in Fig. 18 and further pressure will not cause the plungers to actuate their respective circuit springs 37—38 since stops 53—53 are so spaced as not to admit of two pins 52 simultaneously descending between their respective locking plates.

As before stated, I do not limit my claims to electrical switching means, as my invention resides rather in the correlation of a plurality of movable devices with their associated indicating and interference preventing mechanisms.

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

1. A switching device including a plurality of circularly disposed plungers, supporting mechanism for said plungers whereby they may be manually reciprocated, a contact spring controlled by each of said plungers, said contact springs forming means for restoring said plungers, a pivotally secured circular plate provided with orifices adapted to receive said plungers, said plate being adapted to hold an actuated one of said plungers and to release a previously depressed plunger, and a plurality of pivoted sectors circumposed about their pivoted point and lying in a plane at right angles to the line of movement of said plungers for coöperation with said plungers to prevent a simultaneous operation of more than one of said plungers at one time.

2. A switching device of the character described including a supporting frame, a plurality of circularly disposed reciprocatable plungers carried by said frame, contact springs for said plungers for closing electrical circuits and for restoring said plungers, a pivotally secured circular plate provided with orifices adapted to receive enlarged portions of said plungers, said plate being adapted to hold an actuated one of said plungers in its indicating position and to release a previously depressed plunger, a spring for retaining said circular plate in its normal position to thereby hold the actuated plunger in its indicating position, a plurality of pivoted sectors circumposed about their pivoted point and lying in a plane at right angles to the line of movement of said plungers for coöperation with the enlarged portions of said plungers to prevent a simultaneous operation of more than one of said plungers effective upon their contacts, and springs for maintaining said sectors in their normal positions.

3. A switching device of the class described including a supporting member, a plurality of circularly disposed reciprocatable plungers carried by said supporting member, switch contacts controllable by said plungers for making electrical contact and for returning said plungers to normal position, a pivotally secured circular oscillatory locking plate coöperative with said plungers whereby when one of said plungers is actuated it will be locked by said plate and permit the restoration of any other actuated plunger, a spring for moving said plate into a position to lock said operated plunger, a plurality of related pivotally secured oscillatory sectors provided with orifices to receive said plungers and lying in a plane intersecting the line of movement of said plungers and adapted to prevent a simultaneous reciprocation of more than one of said plungers effective upon their contacts, and a plurality of springs for maintaining said sectors in normal position.

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

CHARLES H. SMITH.

Witnesses:
G. E. MUELLER,
B. O'BRIEN.