

No. 716,406.

Patented Dec. 23, 1902.

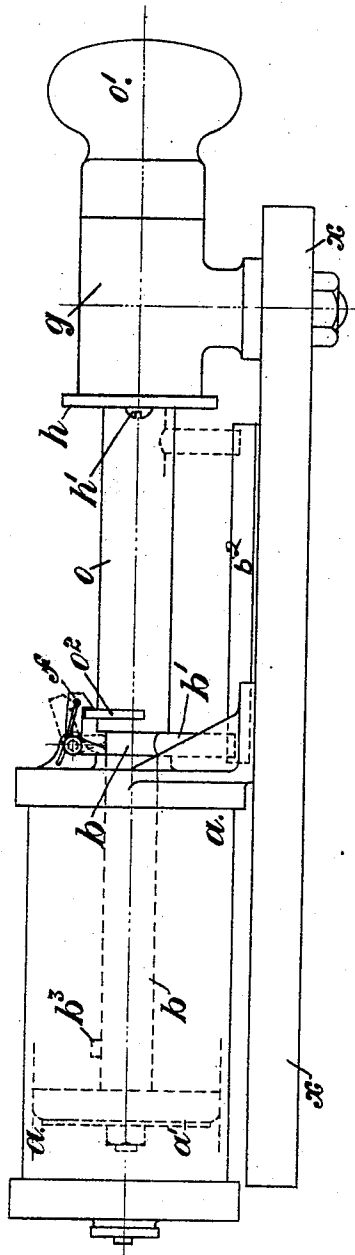
A. H. GIBBINGS.
ELECTRICAL SWITCH.

(Application filed Dec. 3, 1901.)

(No Model.)

4 Sheets—Sheet 1.

Fig. 1.



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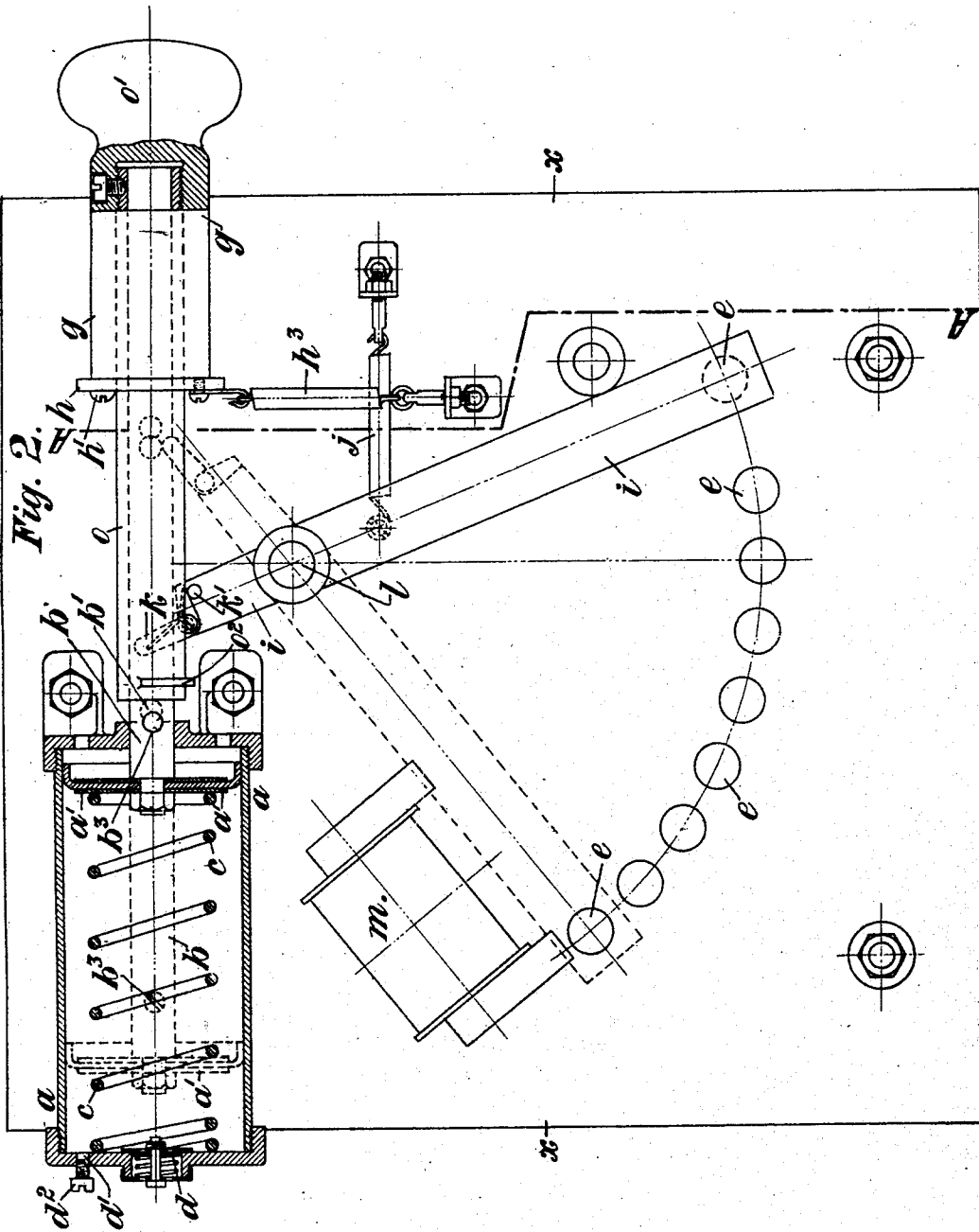
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4 Sheets—Sheet 2.



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Fig. 3.

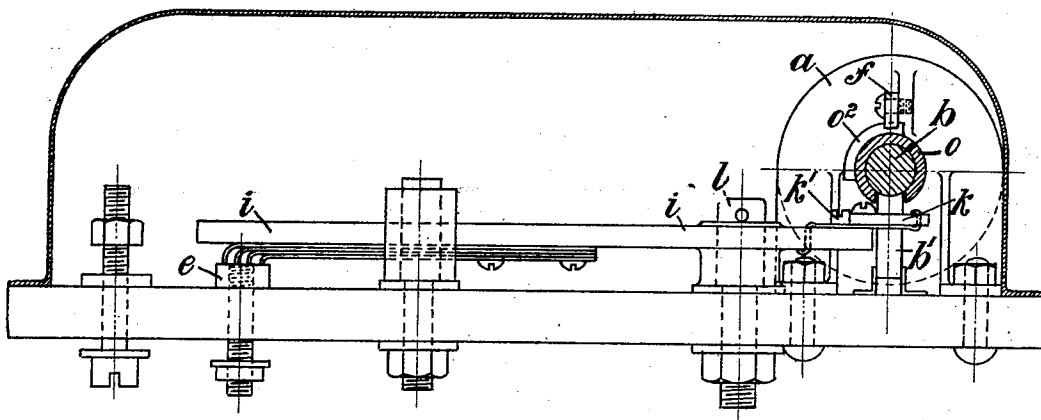
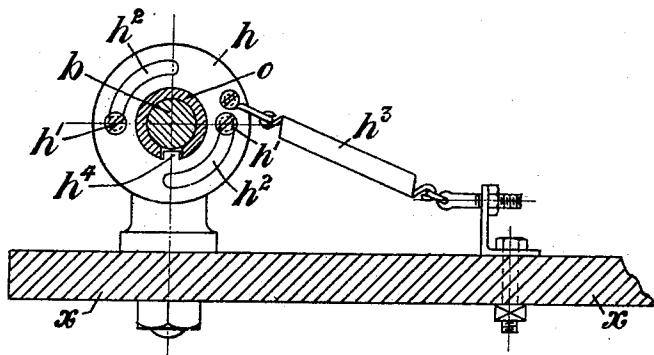


Fig. 4.



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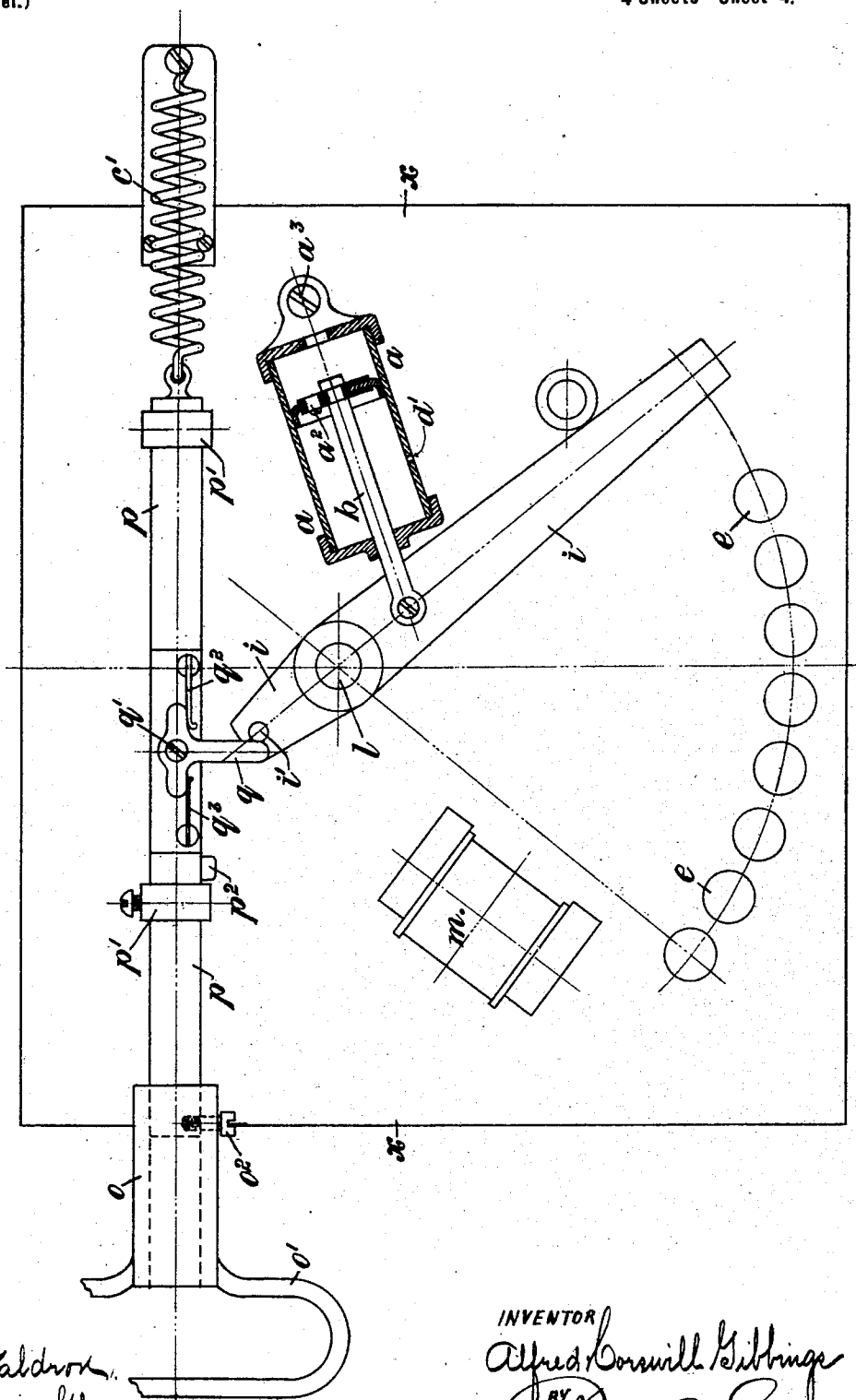
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4 Sheets—Sheet 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

ALFRED HORSWILL GIBBINGS, OF LIVERPOOL, ENGLAND.

ELECTRICAL SWITCH.

SPECIFICATION forming part of Letters Patent No. 716,406, dated December 23, 1902.

Application filed December 3, 1901. Serial No. 84,551. (No model.)

To all whom it may concern:

Be it known that I, ALFRED HORSWILL GIBBINGS, engineer, a subject of the King of England, and a resident of Liverpool, in the county of Lancaster, England, have invented certain new and useful Improvements in Electrical Switches, of which the following is a specification.

This invention has reference to electrical switches used for controlling the supply of electrical current to motors and other electrical installations, more particularly those where such current has to be more or less frequently supplied to the motor or place of use and cut off—as, for instance, in the controlling of current to the motors of electrically-driven vehicles or locomotives, in which application it may be adopted with very considerable advantage.

The invention has for its objects and effects, among others, to provide improvements in connection with switches of the character herein referred to by which the actions required are effected practically without liability of derangement or breakdown of the apparatus, and at the same time their action shall be uniform and certain, and, further, to provide a mechanism which at once accomplishes these effects and is simple and easily operated.

According to this invention, in connection with a plurality of contact bars or pieces as commonly employed, connected with the several resistances and motor or device of electrical consumption or use, I employ a movable piece forming a terminal through which the current is conveyed and a spring or pneumatic or equivalent mechanism operated in one direction by the attendant and operating automatically in the opposite direction, the spring, pneumatic, or like device being so adapted that in its return action after operation by the attendant it will operate or control the operation of the movable terminal contact-piece across the switch-plate from one end to the other and at a governed or controlled and uniform rate of speed. This piece will under normal conditions be held in the position to which it has been moved by an electromagnet energized by the current of the circuit, and this condition of things will exist until the circuit is opened, when the moving contact

part will be automatically moved back to the starting position beyond the first resistance-bar by a spring.

The invention, the general characteristics of which are above specified, is illustrated in the annexed drawings, which show two arrangements and combinations of parts of modified forms of apparatus under it.

Figure 1 is a side elevation, and Fig. 2 is a plan, partly in section, showing one form of the apparatus; and Figs. 3 and 4 are cross-sections taken at the line A A looking to the left and right, respectively. Fig. 5 is a plan, partly in section, showing the modified or second arrangement of apparatus.

Referring to the drawings, *a* generally designates a fluid-flow or escapement-timing device and motor device combined, the fluid used in connection with it being the atmospheric air.

e represents a plurality of contact-pieces connected with the several resistances and motor or other electrical appliances, and *i* is the movable terminal contact piece or bar through which the current is conveyed to the contacts *e*.

The pneumatic device *a* comprises a cylinder having a piston *a'* within it, and in connection with the piston-rod *b* of this piston there is a projecting pin *b'*, which is acted upon by the actuating part *o*, which is a tube fitting over the rod *b* and having an actuating-handle *o'* on its outer end, while the pin *b'* itself acts upon and operates the movable terminal contact-bar *i*.

Within the cylinder of the pneumatic device *a* there is a spring *c*, which acts as the motor of the apparatus after the manual part of the actuation has been performed. This spring normally presses the piston *a'* outward toward the handle *o'*, and it has at one end an air-escape valve *d'* of considerable area to admit free and rapid escape of air outward and an aperture *d'* of relatively small area, controlled by a regulating-screw *d²*, for admitting air comparatively slowly or restricting the inlet of air, so that a considerable minus pressure will exist in the cylinder when the piston is being pressed outward by the spring *c*.

The tube *o* has a slot in it (see Fig. 3) to permit of longitudinal movement of the pin *b'* along it, and it has a projecting rib *o²* at its

outer end, in connection with which a hinged catch f operates, this catch being normally pressed down by a spring and adapted to be lifted out of connection with o^2 by a projection b^3 on the piston-rod b , which strikes the vertical arm of the bell-crank catch when the piston reaches the end of its outstroke. The tube o is mounted in the guide or bearing g , fixed on the switch-plate x , and on the inner face of this guide there is a disk h , held by pins h' , which pass through curved slots h^2 in it. These slots admit of the disk being revolved about the tube o , and it is normally pulled to and held in the position shown in Fig. 4 by a spring h^3 , connected at one end with it and fastened at the other to the switch-plate x . This disk has an inwardly-directed projection or tongue h^4 on the inner edge, which is disposed within the slot of the tube o . By this tongue or projection h^4 and the spring h^3 the slot in the tube o is normally pressed and held down, so as to take the position shown in Fig. 4—that is, the position in line with the pin b' ; but by means of the slots h^2 and the handle o' it is capable of receiving circular motion about its axis, as and for the purposes hereinafter described.

The pin b' in its strokes is guided by the guide-bars b^2 on the switchboard x .

On the end of the lever i there is a hinged bell-crank lever k , the outer arm of which is normally held in line with the lever by the pin-stop k' on i , it being normally pressed thereon by a spring, while it is free to be moved backward about its hinge in the opposite direction. This lever k is operated upon by the pin b' , as hereinafter described, and moves the movable contact-lever i about its pivot l in the circuit-closing stroke, and this lever is normally pressed into the position shown in full lines by the spring j —that is, the position in which the circuit is open.

An electromagnet m (called a “no-load” magnet) is energized by the circuit-current when closed by the movement of the switch terminal lever i toward it and is adapted to move the lever i for the last stage of this stroke by its attraction, which is not effected by the pin b' .

As regards the mode of use and the action of the switch after the circuit controlled by the switch has been closed by the apparatus and then subsequently opened by opening the main switch on it and stopping the current through the magnet m the terminal lever i is released by it and is pulled over by the spring j to the position shown in full line. The piston a' will also be in the position shown in the drawings—that is, at the outer end of its stroke. Then to close the circuit again after the main switch has been closed the piston a' has to be moved inward by the actuating-handle o' and the spring c compressed, and then this piston has to return, so that its pin b' shall engage with the crank k and move the contact-lever i over the contacts e to the position shown in dotted lines. To do this,

before the piston a' can be pressed inward the tube o has to engage with the pin b' , and this is effected, first, by pulling out the handle o' , (which is then freed by the catch f), and when out, with its inner end beyond the pin b' , by then turning it around axially, so that the slot of the tube is out of the path or line of the pin b' , and then finally by pressing in the handle o' . The result is that by the tube o pressing on the pin b' the piston-rod and piston of the governing device a are pressed inward, compressing the spring c in the end of the cylinder. In this action the pin b' will strike the bell-crank trigger-lever k , revolve it about its hinge, and pass it, whereupon the trigger flies back to its normal position by its return action-spring, with its inner end resting on the stop k' . Thus the stroke of the pin b' is greater than that of the bell-crank k , and this pin should be pressed “home”—i. e., so far that the projection o^2 on it is caught under the catch f on the cylinder. After the pin is home the return stroke of the piston cannot take place until the slot in the tube o comes opposite the pin b' , and this takes place as soon as the handle o' is let go, the action being effected by the spring h^3 pulling it around through the projection h^4 of the disk h , which is within the slot. Directly this takes place the slot in o is in line with b' and the spring c instantly presses the piston a' outward at a practically uniform regulated speed, (which is governed by the area of the air-inlet aperture d'), the pin b' entering and moving along the slot in o . When the pin b' has entered the slot a small distance, it comes in contact with the bell-crank k and moves the contact terminal lever i over the contacts e , and as the pin b' when near the outer end of its stroke leaves the bell-crank k the lever i will be near the magnet m , and it will be moved by this magnet alone onto the magnet-poles. By this latter portion of the stroke of the pin b' , wherein it moves clear of the bell-crank k , this bell-crank and lever can be moved back by the spring j , when the magnet m is deenergized and the lever i is freed. During the outstroke of the piston and pin b' the handle o' and tube o cannot be pulled out, as they are held by the catch f , and it is only freed by the projection b^3 at the end of the stroke. By the action thus far described the closing of the circuit is completed, and as long as the circuit is closed the lever i will be held by the magnet m and is independent of the other parts of the apparatus, and whatever may be done with the handle o' so long as the contact terminal lever i is so held it has no action on it (lever i) whatever.

If the handle o' be pushed in or operated while the current is passing and the motor in the case of power installation is in operation, it has no action upon the switch; and, again, if the handle be pushed in before the main circuit-switch, or the opposite pole-

switch, or the double-pole switch, as the case may be, is closed then the switch will not be operated, as the contact-lever i will be moved back to its normal position by the spring j , and this lever cannot remain in the "on" position or in any intermediate position when the circuit is open. Further, the operator has no control over the rate at which the switch operates and the motor is started or current is supplied, and its action is practically independent of him after the actuating part is pressed in.

In the absence of wilful damage no tying up, holding, or tampering with this switch is possible. Further, the apparatus can be applied to any form of resistance and also be fitted with overload attachment or any other form of protective device, and it may be used in connection with multiphase electrical machinery and also for operating time-switches—that is, electrical switches in which time is a controlling or governing feature.

In the modification shown in Fig. 5 the switch-lever operating and timing or escapement device a is directly connected with the switch-lever i and the hand-operated parts o o' and the part which it acts on directly are separate from the device. The part in this modified arrangement which is acted upon and works in connection with the tube o consists of a rod p , working in guides p' and normally pulled or pressed in the direction which would move the lever i to the on position by the motor-spring c , which is equivalent to the spring in the former arrangement. The rod p carries a T-crank lever on trigger q , fulcrumed on q' , one end of the T of which is held by a strong spring q^2 , while the other is pressed upon in the same direction by a weaker spring q^3 . p^2 is a stop on the rod p , which limits the movement of this rod p when it is pulled out by the handle o' . The timing or rate of movement of the piston a' of the device a is governed by a hole d' , through which the air previously drawn into the cylinder in the instroke of the piston is discharged, this aperture being regulated in size, while the inlet of air to the outer end of the cylinder enters through a valve a^2 of any suitable area, so as to give free admission of air. The back end of the cylinder a is in this case hinged at a^3 to the switch-plate x and the piston b is directly connected to the lever i . In action to close the circuit the rod having been moved to the position shown in the drawings by the spring c' of the handle o' is moved toward the magnet m by the T-crank q acting on the pin i' on i , and it is held from moving about its hinge by the strong spring q^2 . When near the outer end of the stroke the lever i reaches the magnet m and the lever i is stopped, the spring c' pulls the T-lever q past the pin i' , being greater in strength than the spring q^2 , so that the lever i is free to move back automatically, when the circuit is again broken and it is released by the magnet m . In this

action the rate of movement of the lever i is governed by the air-exit aperture d' in the escapement pneumatic device a . When the rod p has been pulled out to the position shown in the drawings, a pin o^2 in the end of this rod and projecting through a slot in the tube o will be at the end of such slot and bearing on the metal of the tube, and in this position this rod p cannot be pressed in by the handle o' or tube o , as by moving the handle inward it merely slides loosely on the rod p up to the stop-guide p' , as through the slot in the tube o the tube does not act on the pin o^2 . In other words, the handle and tube o are adapted so that the rod p can be pulled out by them, but cannot be pressed in by them, in which latter movement the regulated and uniform rate of speed of the switch-arm i is controlled by the pneumatic device as required. In the pulling-out action the T-lever q comes against the pin i' and is moved about its hinge q' , and so gets behind this pin, and then is pressed out to the normal position by the spring q^3 . In this respect and general characteristic this arrangement shown in Fig. 5 is similar to that set forth with reference to Figs. 1 to 4.

What is claimed in respect of the herein-described invention is—

1. In an electrical switch, the combination of a moving contact part, a contact over which said part moves in supplying current and closing the circuit, a spring, a piston acted upon by the spring to operate said moving contact part, a cylinder in which said spring and piston operate, a hand-actuated part adapted to actuate and store energy in a spring when moved in one direction when inoperative thereon, and on the apparatus when moved in the other, and a fluid-flow-controlling device in connection with the cylinder for governing the rate of movement of moving contact part, actuated by said spring, substantially as set forth.

2. In an electrical switch, a contact; a moving contact part operating in connection with said contact; a spring for moving said moving part in the circuit-closing operation; a rod and tube working in connection with each other; and an actuating-handle connected with one of said parts, adapted to operate said rod when moved in one direction, and to be inoperative thereon when moved in the other, and said bar being adapted to operate the moving contact part, and put a spring under strain when moved by said hand actuating part; substantially as set forth.

3. In an electrical switch, the combination of a contact; a moving contact part working in connection with same; a pneumatic cylinder, and a piston therein for regulating the rate of movement of the moving contact part in the circuit-closing action; a spring adapted to operate the parts after being hand-actuated; a rod operating in connection with the moving contact part, a tube connected with the actuating-handle fitting over said rod,

and having a limited free movement thereon longitudinally; and a hinged spring-controlled part forming a connection between the hand operating means of said moving contact part 5 and said rod; substantially as described.

4. In an electrical switch, the combination of a contact; a moving contact part working in connection with same; a pneumatic cylinder, and a piston therein for regulating the 10 rate of movement of the moving contact part in the circuit-closing action; a spring adapted to operate the parts after being hand-actuated; a rod operating in connection with the moving contact part; a tube connected with

the actuating-handle fitting over said rod, 15 and having a limited free movement thereon longitudinally; a hinged spring-controlled part forming a connection between the hand operating means of said moving contact part and said rod; and a holding-magnet in the 20 circuit for holding the moving contact part; substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ALFRED HORSWILL GIBBINGS.

Witnesses:

CAROL D. ROSE,
IDA P. WALLACE.