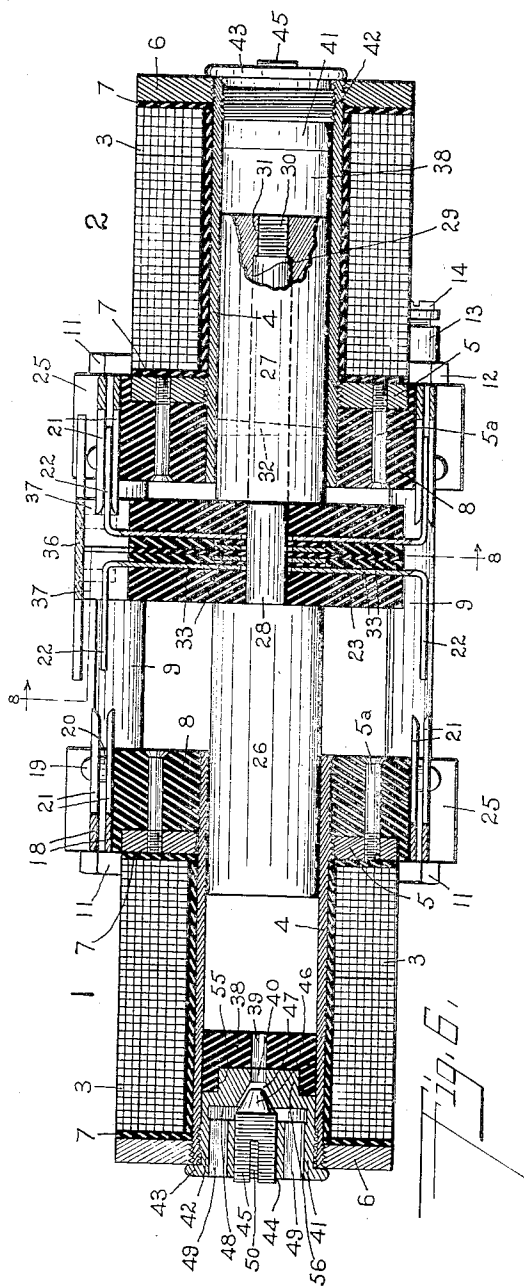
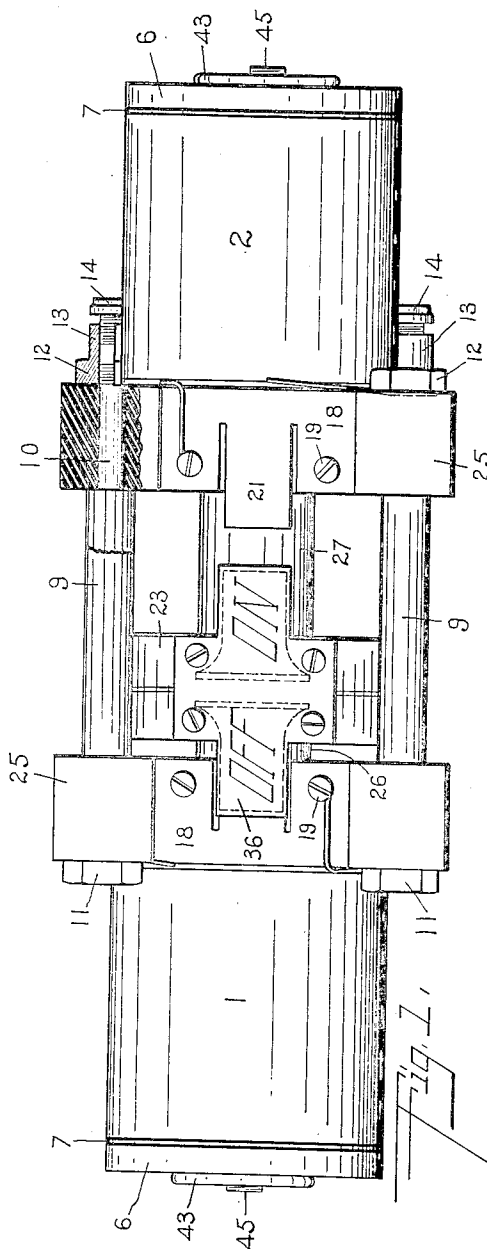


1,273,188.

W. R. SAVAGE.
ELECTRIC SWITCH.
APPLICATION FILED APR. 10, 1915.

Patented July 23, 1918.
3 SHEETS—SHEET 1.

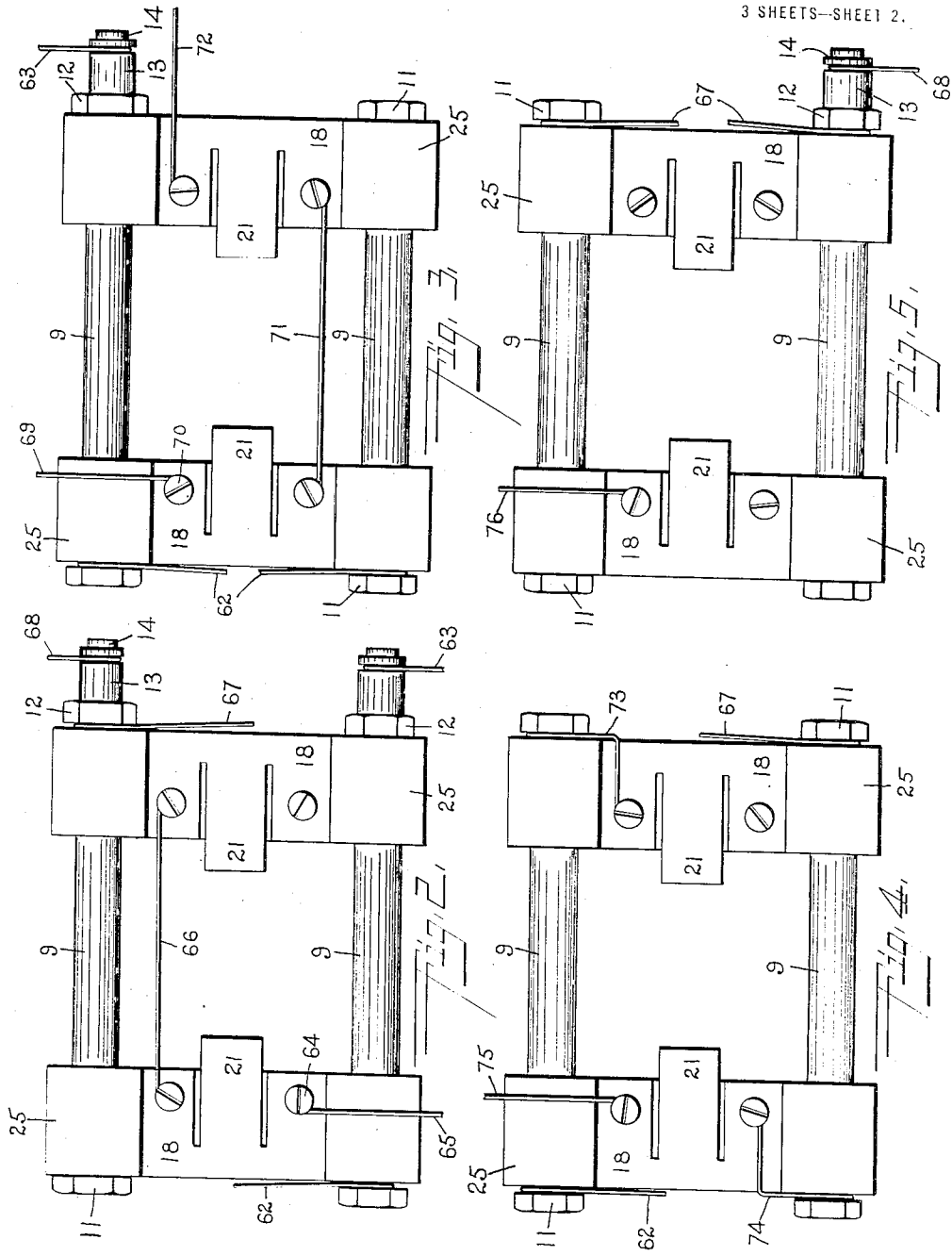


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3 SHEETS—SHEET 2.

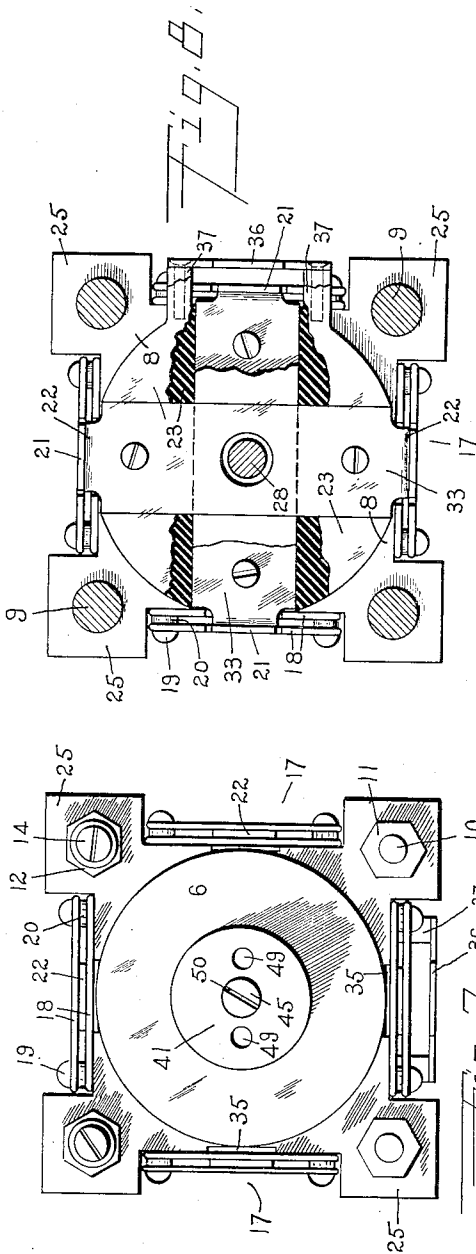
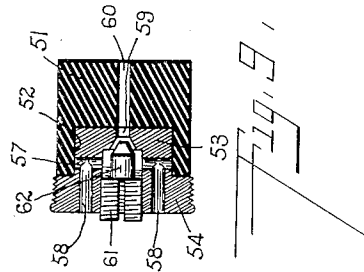
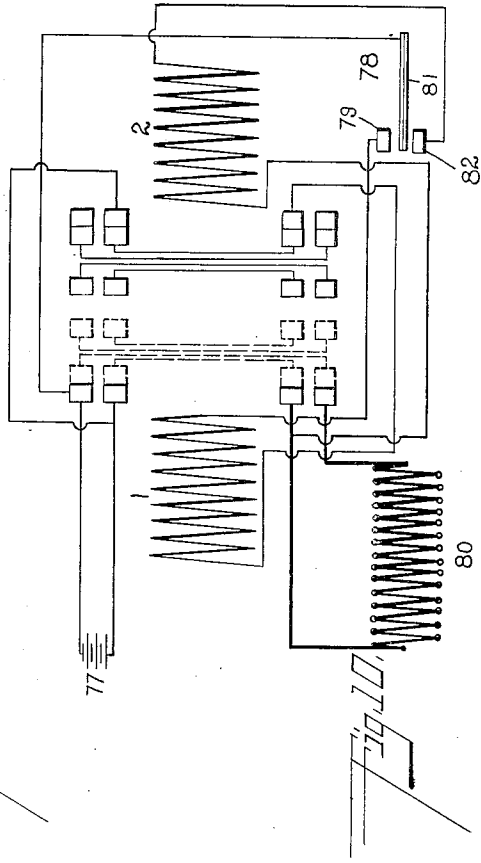


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UNITED STATES PATENT OFFICE.

WILL R. SAVAGE, OF OMAHA, NEBRASKA.

ELECTRIC SWITCH.

1,273,188.

Specification of Letters Patent.

Patented July 23, 1918.

Application filed April 10, 1915. Serial No. 20,562.

To all whom it may concern:

Be it known that I, WILL R. SAVAGE, a citizen of the United States, residing at Omaha, in the county of Douglas and State of Nebraska, have invented certain new and useful Improvements in Electric Switches, of which the following is a specification.

This invention relates to improvements in automatic electric switches.

10 The object of the present invention is to improve the construction of automatic electric switches and to provide a simple, practical and comparatively inexpensive automatic switch characterized by a solid construction and adapted to be operated by a direct or an alternating current and equipped with solenoids capable of exerting a heavy pull and arranged so as to be momentarily energized to prevent heating of the coils and to afford time by intermittent operation to dissipate any heat generated in the coils by each action before the next operation occurs.

25 Another object of the invention is to provide an automatic electric switch designed primarily for use in conjunction with an electrically heated radiator forming the subject matter of an application for patent filed August 21, 1913, Serial No. 785,970, but adapted for use wherever an automatic switch or remote control of operation is desired in making and breaking an electric circuit and equipped with pneumatic buffers adapted to render the operation of the switch practically noiseless.

35 The invention also has for its object to provide an automatic electric switch provided with electrical and mechanical contacts arranged to equalize the friction and pull of the solenoids and adapted to give a firm and elastic contact and at the same time afford a most compact construction.

40 With this and other objects in view, the invention consists in the construction and novel combination and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended, it being understood that changes may be made in the form, proportion, size and minor details without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

55 Figure 1 is a side elevation partly in section of an automatic electric switch constructed in accordance with this invention.

Figs. 2, 3, 4 and 5 are partial elevations of the central portion of the switch showing the respective sides thereof and illustrating the arrangement of the lead wires.

Fig. 6 is a central longitudinal sectional view of the electric switch.

Fig. 7 is an end elevation of the same.

Fig. 8 is a transverse sectional view on the line 8—8 of Fig. 6, and a detail view of the cross head.

Fig. 9 is a detail sectional view illustrating another form of pneumatic buffer.

Fig. 10 is a diagram of a circuit controlled by the automatic electric switch.

Like numerals of reference designate corresponding parts in all the figures of the drawings.

In the accompanying drawings in which is illustrated the preferred embodiment of the invention, 1 and 2 designate solenoids which are designed to be reduced to the smallest practical size and wound with a comparatively heavy gage wire to insure a strong pull during the period in which they are energized. The coil 3 of each solenoid is wound on a metal tube 4 constructed of brass, bronze or other suitable material and provided with inner and outer heads 5 and 6 of iron or steel, insulating fiber 7 or other suitable material being interposed between the coils and the metal tubes and heads. The metal heads are rigidly fastened by threading or other suitable means to the tubes 4 which extend beyond the inner heads 5 and receive insulating heads 8 of fiber or other suitable material and the said heads are also rigidly fastened on the tubes and secured to the inner metallic heads 5 and prevented from warping by screws 5^a spaced between the respective corners of the insulating heads. The fiber insulating heads of the solenoids are preferably rectangular in cross section and are rigidly connected and maintained in spaced relation by longitudinally disposed conductor rods 9 having reduced terminal portions 10 piercing the insulating heads 8 of the solenoids at the corners thereof and threaded for the reception of nuts 11 and 12. The longitudinally disposed rods 9, which are constructed of brass or other suitable conducting material to simplify the wiring, rigidly maintain the insulating heads and the solenoids in spaced relation and in proper alinement. The nuts 11, which are located at each end of two of the longitudinally disposed rods and at one end

of the other two rods 9, are of the ordinary construction, while the nuts 12 which are located at the remaining ends of the said rods 9, are provided with tubular extensions 13 which are interiorly threaded for the reception of binding screws 14 to which are connected the ends of the lead wires which extend to and are connected with the sides of a thermostat or analogous controlling means, as hereinafter fully described.

The insulating heads 8, in which the inner metallic heads are preferably embedded, are provided at their edges with recesses 17 and they are equipped at each of the said recesses 17 with double contact points 18 consisting of plates of bronze or other suitable material extending entirely across the recesses 17 and secured to the insulating heads 8 by screws 19 or other suitable fastening devices. The plates of the contact points are spaced apart by collars 20 or other suitable means and they are provided with inwardly projecting central enlargements or extensions and are slotted at opposite sides of the same to form resilient tongues 21 which coast with oppositely extending longitudinally projecting blades 22 carried by a cross head 23.

The recesses 17, which are provided for the purpose of arranging the double contact points 18 within the marginal edges of the insulating heads 8 leave projecting corner supporting portions 25, which form insulating supports and are adapted to rest against any supporting surface and keep the contact plates out of contact with the same.

The cross head 23, which is constructed of fiber or other insulating material is rounded at the corners and is firmly held between and is carried by cores or plungers 26 and 27, constructed of iron or steel and having their inner ends abutting against the side faces of the cross head 23 and firmly clamping the latter between them. The core 26 is provided with a reduced extension or stem 28 preferably formed integral with the core 26 and extending through the center of the cross head into a smooth longitudinal bore 29 in the core 27. The outer end 30 of the stem 28 is threaded to engage a threaded portion 31 of the bore 29, whereby the cores 26 and 27 are adjustably connected and are adapted to be screwed tightly against the cross head 23 and are firmly maintained in proper alinement. The cores are guided in their longitudinal sliding movement by the metal tubes of the solenoids and they are of sufficient length to enable them when at the limit of their outward movement to leave the inner end well within the magnetic field of the solenoid as clearly illustrated in Fig. 6 of the drawings. The stem 28 has a close fit in the smooth bore 29 and it constitutes a portion of the core 27. The cores and the cross head are locked together by means of a tapering pin

or key 32 disposed transversely of the core 27 and piercing the same and the stem 28.

The blades 22 which are arranged in pairs at each of the side edges of the cross head are connected with a blade at the opposite edge of the cross head by transverse connecting portions 33 insulated from one another and formed integral with the blades 22. The end edges 34 of the tongues of the contact points are bent outwardly slightly to form flaring entrances to the spaces between the slightly inwardly bent tongues 21 to permit the blades to enter readily between the tongues of the contact points. While four sets of contacts are shown on the insulating head of each solenoid, two of these sets on one solenoid have no electrical connection but are employed to equalize the friction and pull of the four sets of contacts on the insulating head of the other solenoid, which latter contacts are necessary for a double break or a two pole switch. For single pole switch or single break in a circuit two sets of contacts on each head would equalize each other and control the solenoids and the electric circuits. The friction is in the contact plates, which by being located at all four sides of the switch, or at two opposite sides thereof make the friction uniform or equal at opposite sides of the solenoid core and prevent any twisting or binding of the core, which twisting or binding might result if the contact plates were not arranged in pairs at opposite sides of the switch. The form of contacts on the insulating heads of the solenoids are designed to give an elastic and firm contact with the ends of the blades entering them and within the most compact space possible to attain these results. The insulating heads 8 are cut away at 35 at the recesses 17 to permit a slight spring of the tongues of the inner plates of the contacts.

Contact points 21 and blades 22 of sufficient length to engage each other from both sides with the cross head at the central position, prevent rotation of blades 22, insure alinement of contacts and blades and prevent any neutral position in the operation of the switch. The contact plates 21 and switch blades 22 are long enough to insure closure of the circuit through a sufficient length of travel of the core to store sufficient energy or momentum to carry the core to the end of its stroke.

Also the switch plates are always in contact with the contact plates at one or both ends of the switch and when in a central position are in contact with all of the contact plates and in no position are they out of contact with all of the contact plates, so that there is no neutral position of the switch plates. The cross head is equipped at one of its edges with an indicating plate 36 bearing the words "Off" and "On" and indicat-

ing at the center of the switch whether the current is off or on. The indicating plate 36 is secured to spaced supporting lugs 37 formed integral with the cross head and projecting beyond the adjacent blades as clearly shown in Fig. 8 of the drawings.

In order to render the operation of the switch noiseless each solenoid is equipped at its outer end with a bumper or buffer 38 of fiber or other material and of cylindrical form arranged within the metallic tube 4 and provided with a central aperture 39 registering with a central port 40 of a cylinder 41 threaded into the outer end of the metallic tube at 42 and provided at its outer end with an annular flange 43 which abuts against the outer metallic head 6 of the solenoid. With a switch like that of the present invention fiber has been found by actual experience to be an excellent material for a noise preventing buffer. The cylinder or body 41 which is constructed of suitable material is provided with a central threaded opening 44 receiving an adjusting screw 45 having a tapered or conical end 46 which extends into a tapered portion 47 of the port 40 to control the communication between the port 40 and transverse and longitudinal passages 48 and 49 and the ingress and egress of air through the same. The transverse passages 48 communicate at their inner ends with the port 40 and are connected at their outer ends with the longitudinal passages 49 which extend to the outer end of the cylinder or body and constitute wrench holes to enable the body to be screwed into and out of the tube 4. The screw 45 is provided with a slot 50 and the sides are sprung outwardly slightly and frictionally engage the walls of the threaded opening forming a resilient locking device for preventing accidental movement of the screw and alteration of the pneumatic control by any jar or vibration of the switch. The pneumatic cushioning devices control the rapidity of the ingress and egress of the air and cushion the stroke of the cores or plungers to a point at which the cores make practically a complete stroke and eliminate the knock and jar which would otherwise be an undesirable factor in the operation of the switch. The conical point of the screw makes it possible to obtain a finer degree of regulation than can be had with a screw seating against a flat surface.

In Fig. 9 of the drawings is illustrated a modification of the pneumatic cushioning device in which the buffer or bumper is provided in its outer end with a deep recess 52 which receives an inner reduced portion 53 of the cylinder or body 54 and fits over the same a greater distance than the buffer or bumper 38 in Fig. 6. The buffer or bumper 38 has a relatively shallow recess 55 to receive the reduced portion 56 of the cylinder

or body 41. In Fig. 9 the buffer or bumper 51 covers the outer ends of the transverse passages 57 which are drilled at right angles to the longitudinal passages 58 to connect the same with the port 59 and the central opening 60 of the buffer or bumper. The adjusting screw 61 has its inner portion 62 somewhat smaller than the outer portion to facilitate the connection between the port 59 and the transverse passages 57.

At the lower left hand side of Fig. 2 is shown one of the terminals 62 of the solenoid 1 connecting with the conductor and connecting rod 9 and the wire terminal 63 leading to one of the side contacts of the thermostat or other operating means. At 64 one line wire 65 of the dynamo or battery is connected to one of the contacts 18 which is connected with the corresponding contact of the opposite insulating head by a wire 66. One of the terminal wires 67 of the solenoid 2 is connected to the right hand end of the upper longitudinal conductor rod 9 with which is also connected the terminal 68 of the wire leading to the other side contact of the thermostat.

In Fig. 3 of the drawings the left hand end of the upper longitudinal rod 9 is connected with one of the terminals 62 of the solenoid 1 and the right hand end is connected with the terminal 63 of the wire leading to a side contact of the thermostat. The terminal 69 of the other dynamo wire is connected with the left hand contact 18 at 70. The left hand contact is connected by the wire 71 with the right hand contact plate from which extends the wire 72 leading to the middle contact of the thermostat. The other terminal 62 of the solenoid 1 is connected to the lower rod in Fig. 3. In Fig. 4 one terminal 62 of the solenoid 1 is connected to the upper rod 9 which is connected by the wire 73 with the contact at the right hand side of Fig. 4. The solenoid 2 has one of its wires 67 connected with the right hand end of the lower rod which is connected by wire 74 with the left hand contact from which extends one wire 75 to the heating coil or motor.

In Fig. 5 the solenoid 2 is connected with both longitudinal rods 9 and one of its terminals with the wire 68 leading to one of the side contacts of the thermostat. The other wire 76 of the controlled heating coil or motor is connected with the left hand contact plate 18.

In Fig. 11 is illustrated a diagram of the electric circuit in conjunction with the switch. 77 designates a source of electrical energy which may be a storage battery, dynamo or any other source of electric current generation. The blades at one side of the cross head are shown in electrical contact with the set of contacts of the insulating head of the solenoid 2 but connecting with

the solenoid 1 so that when the same is energized by the closing of the circuit by the thermostat 78 or other means at the side contact 79, the cross head will be moved to the dotted line position closing both sides of the heating coil 80, motor or other electric device and breaking the current with the solenoid 1 and closing the circuit with the solenoid 2 so that when the movable middle contact 81 of the thermostat 78 moves to the other side of the contact 82 the solenoid 2 is energized pulling the cross head back to the full line position breaking the circuit on both lines to the heating coil 80 and the circuit to the solenoid 2 and closing the circuit with the solenoid 1 ready for the next operation when the movable contact 81 passes to the contact 79. In each operation the contact 81 merely closes the circuit at the points 79 and 82, the circuit of the energized solenoid being automatically cut out following each momentary energization by the movement of the cross head and switch blades out of connection with the contacts through which they form the circuits of the solenoid that pulls them away from these contacts, preventing heating of the solenoids and consuming a minimum amount of current to operate the switch. While the solenoids are momentarily energized and immediately cut out the closure of the contacts by the heating coil 80 by the dotted line position of the diagram, Fig. 10, is left in constant service until the cross head and the switch blades are moved to the full line position which leaves the heating coil 80 out of action until the cross head is again moved to the dotted line position.

What I claim is:—

1. An electric switch including spaced solenoids having insulating heads, separate conductor rods connecting the heads and maintaining the solenoids in rigid spaced relation and forming conductors in the circuits in which the switch may be arranged, a cross head located between the insulating heads, cores carrying the cross head and arranged to be attracted by the solenoids, contacts mounted on the insulating heads and blades carried by the cross head and coacting with the contacts.

2. An electric switch including spaced solenoids provided at their inner ends with insulating heads, separate conductor rods connecting the insulating heads and electrically connected with the solenoids, a cross head located between the insulating heads, cores carrying the cross head arranged to be attracted by the solenoids, contacts mounted on the insulating heads, and blades carried by the cross head and coacting with the contacts, said contact plates and switch blades being located at opposite sides of the cores to equalize the friction of the plates and blades and prevent binding.

3. An electric switch including spaced solenoids having insulating heads, separate conductor rods secured to and rigidly connecting the insulating heads and constituting electrical conductors for the solenoids, a cross head located between the insulating heads, cores carrying the cross head and arranged to be attracted by the solenoids, contacts mounted on the insulating heads, and blades carried by the cross head and coacting with the contacts, said plates and blades being arranged in sets at opposite sides of each end of the switch to equalize the friction of the plates and blades and prevent binding of the same and the cores.

4. An electrical switch including spaced solenoids having insulating heads, separate connecting conductor rods piercing the insulating heads and having threaded terminals, nuts arranged on the threaded ends of the rods and rigidly securing the same to the insulating heads and forming attaching means for wire terminals, said rods being electrically connected with the solenoids, a cross head, cores carrying the cross head and arranged to be attracted by the solenoids, contacts mounted on the insulating heads, and blades carried by the cross head and coacting with the contacts.

5. An electrical switch including spaced solenoids having insulating heads, connecting conductor rods piercing the insulating heads and having threaded terminals, nuts arranged on the threaded ends of the rods and rigidly securing the same to the insulating heads and forming attaching means for wire terminals, some of the nuts being provided with tubular extensions, binding screws mounted in the said extensions for the attachment of other wire terminals, a cross head, cores carrying the cross head and arranged to be attracted by the solenoids, contacts mounted on the insulating heads, and blades carried by the cross head and coacting with the contacts.

6. An electric switch including spaced solenoids comprising coils, metal tubes extending through the coils, inner and outer metal heads secured to the tubes, and insulating heads mounted on the tubes, rods connecting the insulating heads and electrically connected with the solenoids and forming conductors for the same, a cross head located between the insulating heads, cores carrying the cross head and slidable in the said tubes, contacts mounted on the insulating heads, and blades carried by the cross head and coacting with the contacts.

7. An electric switch including spaced solenoids comprising coils, metal tubes through the coils, and inner and outer metal heads secured to the tubes, the latter being extended beyond the inner heads, insulating heads rigidly mounted on the extended ends of the tubes, rods connecting the insulating heads

and maintaining the solenoids in alinement, said rods being electrically connected with the solenoids and forming conductors for the same, a cross head located between the

insulating heads, cores carrying the cross head and slidable in the tubes, contacts mounted on the insulating head, and blades carried by the cross head and coacting with the contacts. to be attracted by the solenoids, electrical and mechanical contacts located on the insulating heads at opposite sides of the cores and consisting of plates arranged in pairs, and blades projecting in opposite directions from the cross head and arranged to extend between and frictionally engage the plates, said plates and blades being adapted to equalize the friction between them and prevent binding of the cores.

8. An electric switch including spaced solenoids provided with insulating heads having recesses at their marginal edges forming projecting portions or feet, contacts located in the recesses and supported by said projections or feet at an elevation out of contact with the supporting surface upon which the switch may be placed, a cross head arranged between the insulating heads, cores carrying the cross head and arranged to be attracted by the solenoids, and blades mounted on the cross head and coacting with the contacts.

13. An electric switch including spaced solenoids having insulating heads, a cross head located between the insulating heads, cores carrying the cross head and arranged to be attracted by the solenoids, contacts mounted on the insulating heads and consisting of plates arranged in pairs and having resilient tongues, and blades projecting from the cross head and being of a length to extend between and engage the tongues of the contacts of both insulating heads when in a central position, whereby a neutral position is prevented.

9. An electric switch including spaced solenoids having insulating heads provided with marginal recesses forming supporting portions or feet, rods connecting the solenoids and secured to the said supporting portions or feet, contacts located in the said recesses, a cross head arranged between the insulating heads, cores carrying the cross head and arranged to be attracted by the solenoids, and blades carried by the cross head and coacting with the contacts.

14. An electric switch including spaced solenoids having insulating heads, a cross head located between the insulating heads, cores carrying the cross head and arranged to be attracted by the solenoids, electrical and mechanical contacts mounted on the insulating heads and consisting of plates arranged in pairs and provided with extensions and split at opposite sides of the same to form resilient tongues, and blades projecting from the cross head and arranged to extend between the tongues, said contacts and blades being located at opposite sides of the cores to equalize the friction of the contacts and blades and prevent binding of the cores.

10. An electric switch including spaced solenoids having insulating heads, a cross head located between the insulating heads, cores carrying the cross heads and arranged to be attracted by the solenoids, electrical and mechanical contacts mounted in the insulating heads, and blades extending in opposite directions from the cross-head and coacting with the contacts, said electrical and mechanical contacts being located at opposite sides of the cores to equalize the friction of the contacts and blades and prevent binding of the cores.

15. An electric switch including spaced solenoids having insulating heads, a cross-head located between the insulating heads, cores carrying the cross-head and arranged to be attracted by the solenoids, electrical and mechanical contacts mounted on the insulating heads, and blades coacting with the contacts, said blades being located at opposite sides of the cross-head and having a connecting portion extending across the cross-head, said contacts and blades being arranged to equalize the friction at opposite sides of the cores to prevent the latter from binding.

11. An electric switch including spaced solenoids having insulating heads, a cross head located between the insulating heads, cores carrying the cross head and arranged to be attracted by the solenoids, electrical and mechanical contacts mounted on the insulating heads and consisting of plates arranged in pairs, and blades projecting in opposite directions from the cross head and arranged to extend between and frictionally engage the plates of the contacts, said electrical and mechanical contacts being arranged at opposite sides of the core to equalize the friction of the contacts and prevent binding of the cores.

16. An electrical switch including spaced solenoids having insulating heads, a cross-head located between the insulating heads, cores carrying the cross-head and arranged to be attracted by the solenoids, electrical and mechanical contacts mounted on the insulating heads, and blades coacting with the contacts, said blades being located at opposite sides of the cross-head and projecting in opposite directions and having connecting portions extending through the cross-head, said contacts being located op-

12. An electric switch including spaced solenoids having insulating heads, a cross head located between the insulating heads, cores carrying the cross head and arranged

posite each other at opposite sides of the cores to equalize the friction and prevent binding of the cores.

17. An electric switch including spaced
5 solenoids having insulating heads provided with contacts, a cross head located between the insulating heads and having blades co-acting with the contacts, and cores located

at opposite sides of the cross head, one of the cores having a stem extending through the cross head and provided with threads, and the other core having a bore to receive the stem and threaded to engage the same, said cores rigidly clamping the cross head. 10

In testimony whereof I affix my signature. 15

WILL R. SAVAGE.