

Sept. 23, 1924.

1,509,758

H. J. H. HUBER

ELECTRIC SWITCH

Filed Aug. 30, 1920

2 Sheets-Sheet 1

Fig. 1.

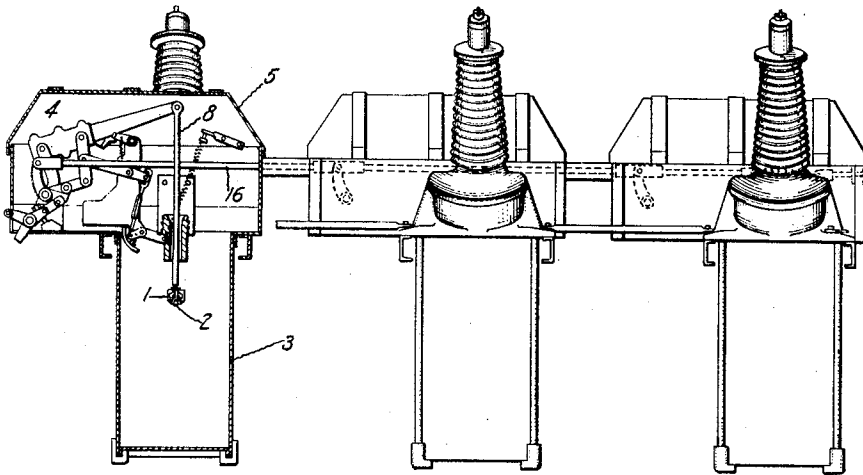
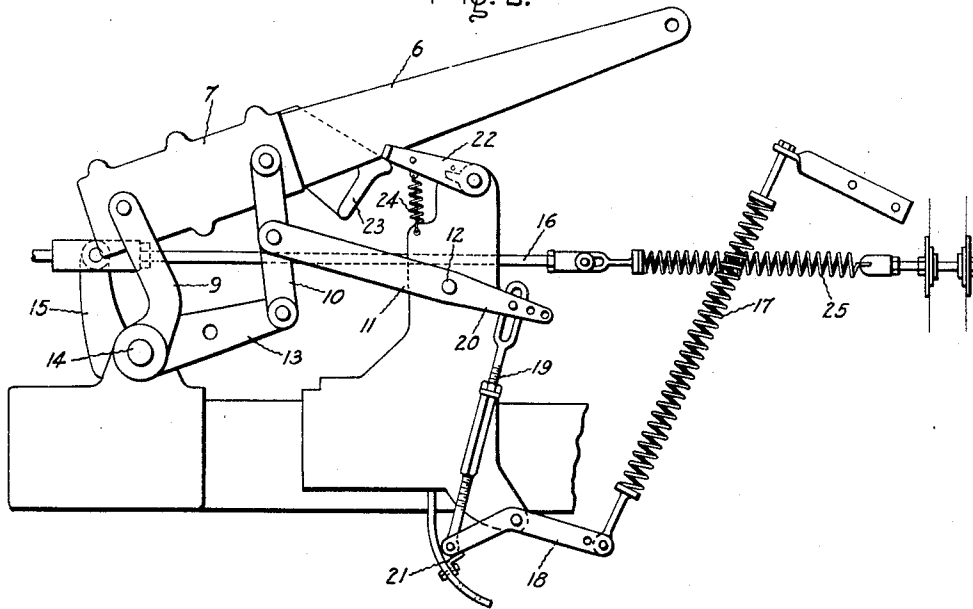


Fig. 2.



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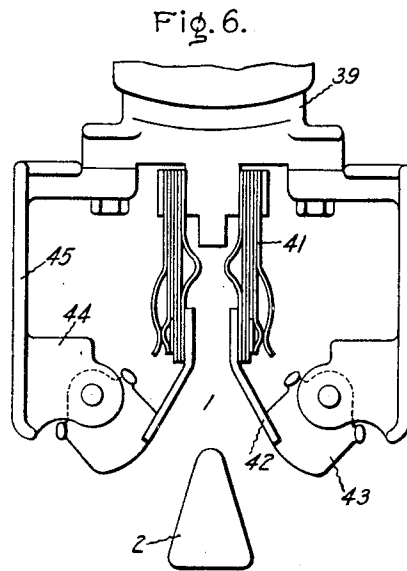
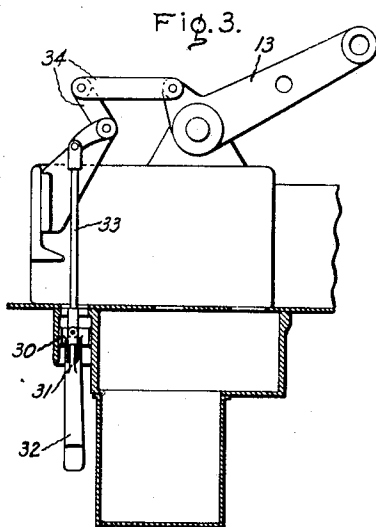
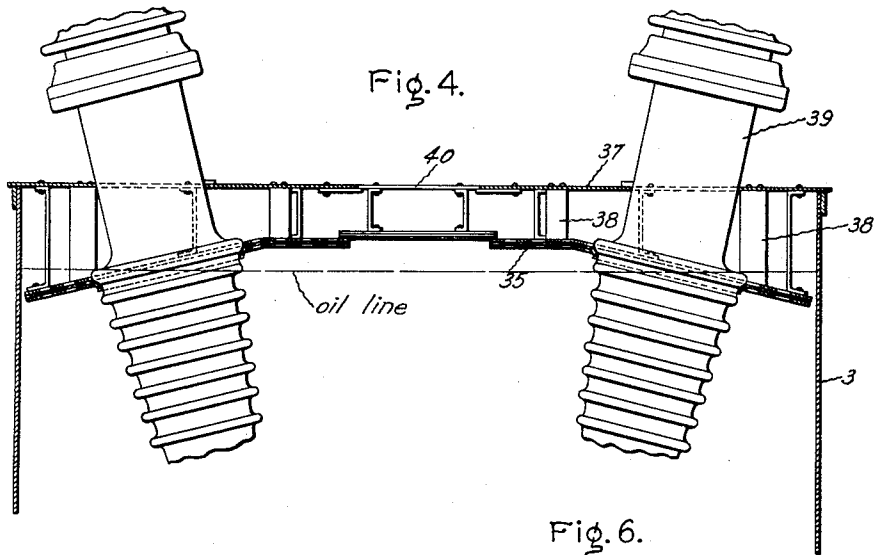
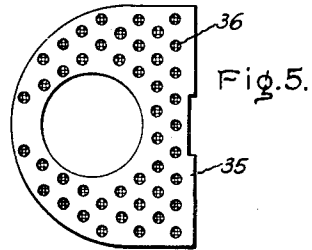
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ELECTRIC SWITCH

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

HERMAN J. H. HUBER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC SWITCH.

Application filed August 30, 1920. Serial No. 406,966.

To all whom it may concern:

Be it known that I, HERMAN J. H. HUBER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Electric Switches, of which the following is a specification.

My invention relates to electric switches, particularly to those switches having contacts separable in an insulating fluid and has for its object to provide an electric switch which is an improvement in many particulars, to be described more in detail hereinafter, in similar switches heretofore known in the art.

The novel features which I believe to be characteristic of my invention will be definitely indicated in the claims appended hereto, while the features of construction and mode of operation will be understood by reference to the following description taken in connection with the accompanying drawings which show the preferred embodiments of my invention and in which:

Fig. 1 is a side elevation of a triple pole switch embodying my invention; Fig. 2 shows the switch mechanism embodying my novel form of energy storing means; and Figs. 3, 4, 5 and 6 are views of detailed portions of the switch structure.

In Fig. 1 my invention is shown embodied in a triple pole or three unit switch, each unit comprising relatively movable cooperating contacts 1 and 2 separable beneath the surface of oil or similar insulating fluid contained in a vessel or tank 3. The contacts for each unit are controlled by mechanisms operative through a common mechanism 4. Enclosing the mechanisms for each unit is a cover structure 5 to which are secured the oil vessels 3.

The mechanism controlling the switch contacts for each unit comprises, as shown in Fig. 2, an actuating lever or arm 6, which is preferably of wood for purposes of lightness and insulation, secured in a clamp member 7. Attached to the end of member 6 is a reciprocating rod 8 carrying the movable contacts 2, as best shown in Fig. 1. For moving the end of arm 6 in a straight line, I provide a parallel motion mechanism comprising paralleling links 9 and 10 and a guide link 11 secured to paralleling link 10 and movable about the fixed point 12.

Links 9 and 10 are connected at one end to member 6 or clamp 7 and at the other end to a lever 13 which is movable about a fixed pivot 14. An arm 15 is also carried by pivot 14 and may be integral with lever 13. These arms 15 for each unit are connected by rods 16 whereby simultaneous movement of the mechanisms takes place. These separate mechanisms are controlled from a common operating mechanism 4 which may be of the solenoid operating type, as shown in Fig. 1, or may be of the hand operated type as desired. By a proper interchange of parts of mechanism 4, the stroke or extent of movement of the end of levers 6 can be varied over a wide range.

As the switch mechanism is necessarily rugged and heavy for switches of large rupturing capacity, I provide means facilitating the operation of the switch mechanism. As one portion of this means, I provide a means for counterbalancing the weight of the mechanism which consists of a resilient or energy storing member 17 secured at one end to a fixed support on the switch and connected at the other end to a bell-crank lever 18. The bell-crank is connected by means of an adjustable rod 19 to an extension 20 of guide link 11 through a lost motion connection. The mechanisms for each unit of the switch are provided with this balancing means, as shown in Fig. 2. With the movement of the switch to circuit opening position, the rod 19 is pulled up and bell crank 18 rotated clockwise to store energy in the spring 17. Due to the lost motion connection between rod 19 and extension 20, the switch mechanism moves freely during the first part of its opening movement and only functions to store energy in spring 17 during the last part of its opening movement. Cooperating with the end of bell crank 18 is an adjustable stop 21 adapted to limit the movement of bell crank 18 when the switch is moved to circuit closing position. In order that energy may be stored in the spring at the proper part of the switch opening movement, under varying lengths of stroke, I provide means for changing the point of connection between extension 20 and the end of rod 19 and also provide two or more points for the connection of spring 17 and bell crank 18. Stop 21 is made adjustable for this same purpose. It is thus apparent that de-

pendent on the extent of movement of the end of lever 6 or the stroke of the mechanism, this balancing means can be adjusted so that the spring 17 is tensioned at the proper part of the switch opening movement. The mechanism can also be adjusted so that sufficient energy is stored in spring 17 to exert a force in switch closing direction substantially equal to the weight of the mechanism. When the mechanism is, therefore, moved in circuit closing direction, the energy stored in spring 17 is delivered through bell crank 18 and rod 19 to link 11 and enables the mechanism to be moved with a minimum of effort. A comparatively small closing force is therefore sufficient to operate the switch. The lost motion connection between extension 20 and rod 19 is utilized as a means for cutting off the effect of spring 17 at a definite point in the switch closing movement.

If some provision is not made to prevent it, the energy stored in spring 17 will be exerted to effect a rebounding action when the switch mechanism reaches the end of its circuit opening movement. I overcome this effect by the use of the bell crank 18. In the closed position of the switch as indicated by Fig. 2, that arm of the bell crank which is attached to the rod 19 makes a sharp angle with the rod while the other arm is substantially perpendicular to the line of pull of the spring 17. The result is that as the switch is moved to open position and the bell crank is rocked in a clockwise direction, the effective length of the first mentioned arm increases while the effective length of the other arm decreases. The combined effect of these changes in effective lengths of the two lever arms of this bell crank is to substantially compensate for the increased tension of the spring 17 as it is stretched with the result that as the switch is moved to open circuit position the tension of rod 19 after the lost motion has been taken up remains substantially uniform. A further result is that when the switch has reached its open position the effective length of the one arm of the bell crank is approximately a maximum while the effective length of the other arm, the arm to which the spring is connected, is so short that the effect of the spring tension on the switch may be ignored and rebounding of the switch will be effectively prevented.

The second energy storing means which is a part of each mechanism is a means for preventing overtravel of the mechanism in circuit closing direction. The sudden cessation of movement of the mechanism must not cause an undue strain due to inertia and for this purpose I provide a lever 22 in the path of movement of buffer arm 23 carried by lever 6. The buffer arm acts in

response to the movement of the mechanism to circuit opening position, to engage an oil dash-pot or similar buffering means, not shown, to absorb the energy of the opening movement. In circuit closing direction, the buffer arm 23 is shaped to engage lever 22 near the end of its path of travel and move the lever about its pivot and against the tension exerted by a spring 24. This movement of lever 22 serves to retard the movement of the mechanism quickly and to prevent any overtravel with consequent strains on the mechanism.

The third energy storing means associated with my switch mechanism is a means for accelerating the opening movement of the mechanism. For this purpose, I provide an energy storing means in common to the whole switch mechanism, as best shown in Fig. 2. This means consists of the energy storing or spring member 25, which is connected at one end to the wall of the enclosure for the last unit or pole of the triple pole switch shown in Fig. 1, and is connected at the other end to the rod 16. The movement of the switch mechanism to circuit closing position operates rod 16 so that energy is stored in spring 25. This energy is delivered to the switch mechanism during its initial opening movement to accelerate the mechanism. A lost motion connection is provided between the spring 25 and rod 16 in order to provide a free initial movement of the mechanism in circuit closing direction before tension is exerted on spring 25.

In switches of the character described, it is often advantageous to give a visual indication of whether the switch is opened or closed, particularly in the form of switch shown in Fig. 1 in which the switch presents the same external appearance in both open and closed positions. For this purpose I use an indicating means of the semaphore type which consists, as shown in Fig. 3, of a pivotally supported signal member 30 having two projecting arms 31 and 32 substantially at right angles. Upon one arm is stamped the word "open" and upon the other arm the word "closed". The arms may also be appropriately painted to indicate at a distance whether the switch is open or closed. The member 30 is pivoted within the enclosure of the end unit of the switch and is operated from the link 13 of the parallel motion mechanism through the connecting rod 33 and links 34.

In Fig. 4 is shown another improved construction of my switch. In this figure, I have shown a means for cooling the arc gases formed as the contacts separate and preventing the ejection of heated particles into the air chamber above the oil. For this purpose I provide a baffling member 35 which is preferably made in sections for

convenience in assembling, three such sections being shown in Fig. 4. My baffling member comprises two plates provided with openings 36 in alignment and between the plates is mounted a wire mesh screen so that the openings 36 are screened. This structure is shown in Fig. 5 which is a plan view of one of the end sections.

The end sections of the member 35 are secured to a plate 37 at the top of the oil vessel 3 by struts 38 and are spaced apart from the plate 37 and inclined to correspond to the inclination of the terminal members 39. Openings are provided in the end sections through which the terminal members 39 extend and the sections of the baffling member are adapted to surround the terminal members at the ground sleeve thus acting in no way to cut down the striking distance for the arc. The central section of the baffling member is carried by a removable central plate 40 co-operating with the plates 37. This section is removable with the plate 40 to provide an opening through which a man can get into the oil vessel to align or properly investigate the contact structure. The baffling member 35 supported by the struts forms a rigid member. Having the end sections inclined, only the lower half of the sections are submerged in the oil, the upper half of each end section and the middle section being normally just above the level of the oil. When the contacts separate and arc gases are formed within the oil, the oil volume immediately expands and the oil level rises quickly, submerging the whole baffling member. The rise in level of the oil is in the nature of a "slap" which exerts considerable pressure. The baffling member is rigidly supported to withstand this "slap" of the oil, by the struts 38 and as the end sections are inclined, the oil pressure is progressively delivered as the oil level rises. The passage of gases through the openings 36 of baffling member 35 causes the gases to be broken up and cooled sufficiently so that they do not ignite the gaseous mixture in the space above the oil. Due to the wire screen, no highly heated particles can be ejected into the chamber. When the oil level subsides, the small space above the oil and beneath the baffle 35 is so rich in gases that it is non-inflammable, so that even should heated particles or hot gases come in contact with these gases, they will not explode. This baffling means for cooling the arc gases formed as the contacts separate and preventing the ejection of heated particles into the air chamber above the oil is claimed per se in my divisional application, Serial No. 551,265, filed April 10, 1922, for electric switches.

In Fig. 6 is shown the lower end of one of the terminal members 39 carrying the fixed

contacts 1 which in the form shown comprises a pair of laminated contact fingers 41 to which are secured the guide fingers 42. Co-operating with the fixed contact fingers 41 are the movable contact members 2 wedge-shaped in configuration and carried at one end of the reciprocating rod 8. As the movable contact members 2 are moved into and out of engagement with the fixed contacts, it often occurs that due to slight changes in adjustment the wedge-shaped member as it moves into contact engaging position will strike one of the guide fingers 42 bending it over and causing considerable damage making a poor contact and throwing the mechanism out of order. This condition is effectively overcome by providing means for guiding the movable contacts into proper engagement with the fixed contacts and protecting the guide fingers 42. For this purpose cam members 43 are pivotally supported by shoulders 44 rigidly carried by extensions 45 supported by the terminal members 39. These cam members 43 are so located relatively to the ends of guide fingers 42 and loosely pivoted to shoulders 44 that should the wedge-shaped movable contact 2 move out of alignment, it will strike one of the cam fingers 43 and be guided into its proper path without impairing the guide fingers 42.

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

1. In an electric switch, the combination with relatively movable cooperating contacts, of a mechanism controlling said contacts, means cooperating with said mechanism to prevent overtravel of said mechanism in circuit closing direction, means for accelerating the movement of said mechanism in switch opening direction, and means exerting a force on said mechanism in switch closing direction substantially equal to the weight of said mechanism.

2. In an electric switch, the combination with relatively movable cooperating contacts, of a mechanism for controlling said contacts, means for exerting a force on said mechanism in switch closing direction substantially equal to the weight of said mechanism comprising an energy storing device, a bell crank lever connected at one end to said device, and means for adjustably connecting the other end of said lever to said mechanism.

3. In an electric switch, the combination with relatively movable cooperating contacts, of a mechanism for controlling said contacts, a device in which energy is stored by the circuit opening movement of said mechanism, and means intermediate said device and said mechanism operative to prevent rebounding of said mechanism when reaching circuit opening position.

4. In an electric switch, the combination

with relatively movable cooperating contacts, of a mechanism for controlling said contacts, a spring adapted to be tensioned in response to the circuit opening movement of said mechanism, a bell crank lever connected to said mechanism and to said spring arranged to exert a uniform force on said spring during the circuit opening movement, and means whereby the tensioning of said spring can be adjusted to exert a force in circuit closing direction substantially equal to the weight of said mechanism.

5. In an electric switch, the combination with relatively movable cooperating contacts, of a mechanism for controlling said contacts adapted to operate with varying lengths of stroke, energy-storing means operative in response to the circuit opening movement of said mechanism to exert a force in the circuit closing direction substantially equal to the weight of said mechanism, means for preventing rebounding of said mechanism from the open circuit position, and means whereby the energy stored in said energy-storing means may be varied to correspond to the stroke of the mechanism.

6. In an electric switch, the combination with relatively movable cooperating contacts, of a mechanism for controlling said contacts, including an operating arm, an energy-absorbing means, and a member carried by said arm adapted to operatively engage said means to prevent overtravel of said arm when moving in the circuit closing direction, and a second means in which energy is stored during the latter part of the switch closing movement to accelerate the opening movement of the switch.

7. In an electric switch, the combination with relatively movable cooperating contacts, of a mechanism for moving said contacts in a straight line including a guide link, an extension to said link, an energy-storing device, and a bell-crank adjustably secured to said extension through a lost motion connection and connected to said energy-storing device operative in response to the final switch opening movement to store energy in said device and prevent rebounding of said contacts.

In witness whereof, I have hereunto set my hand this 20th day of August, 1920.

HERMAN J. H. HUBER.