July 31, 1951 I. E. McCABE 2,562,626

MULTIPLE CONTACT SWITCH STRUCTURE

Filed March 28, 1947 2 Sheets-Sheet 1

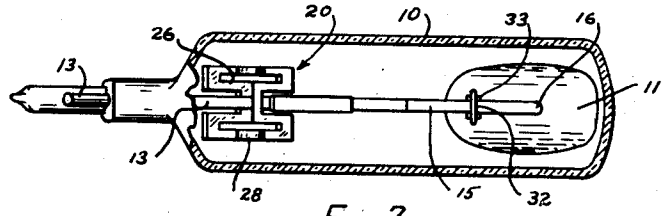


Fig. 2

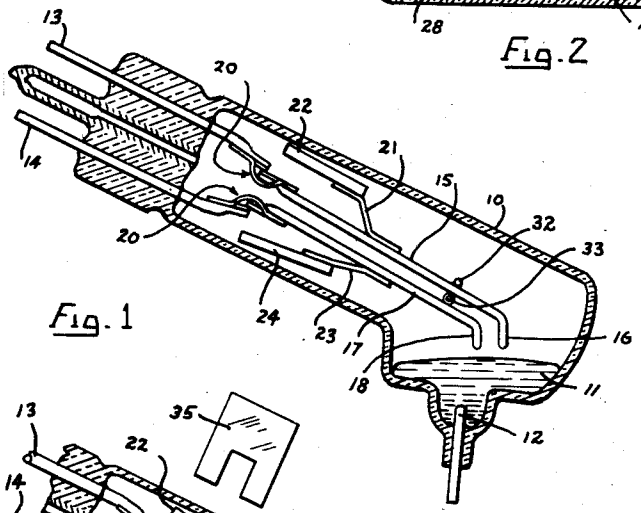


Fig. 1

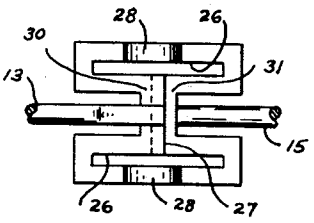


Fig. 3

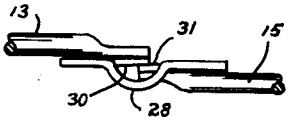


Fig. 4

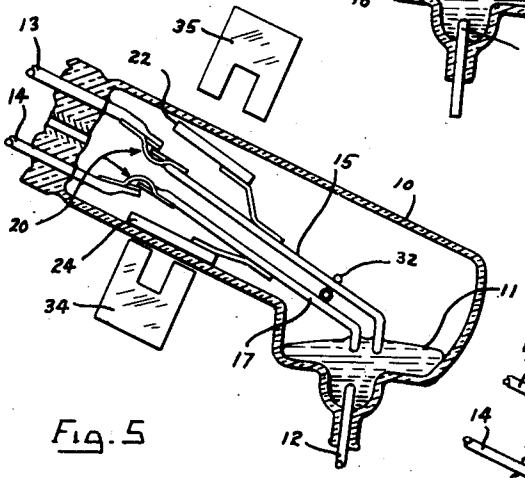


Fig. 5

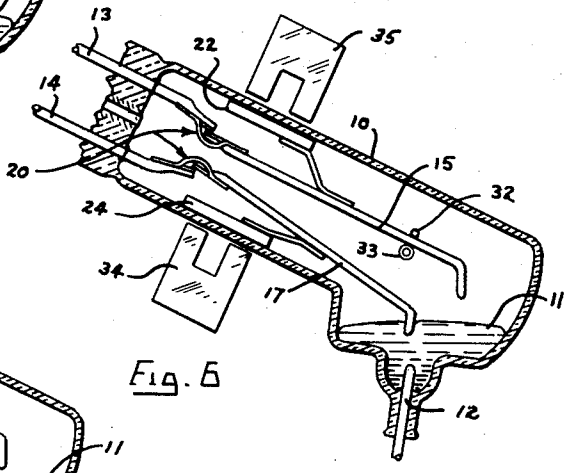


Fig. 6

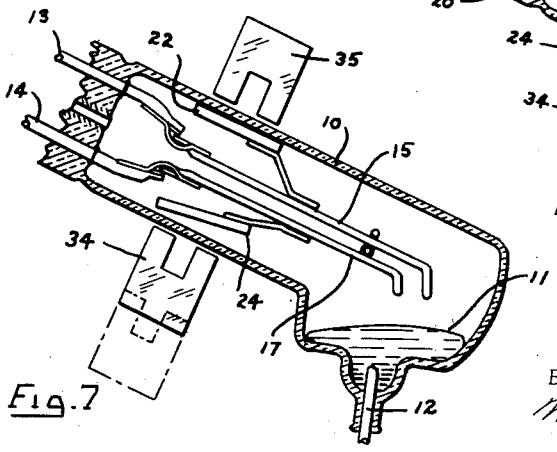


Fig. 7

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MULTIPLE CONTACT SWITCH STRUCTURE

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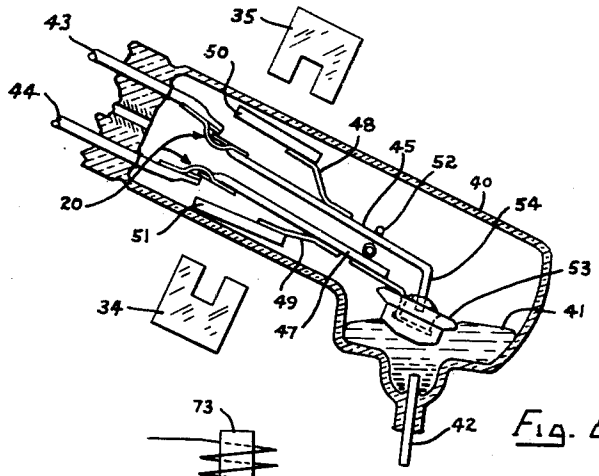


Fig. 8

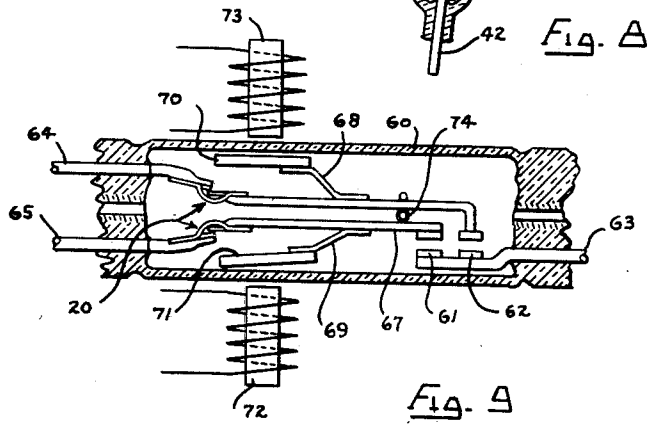


Fig. 9

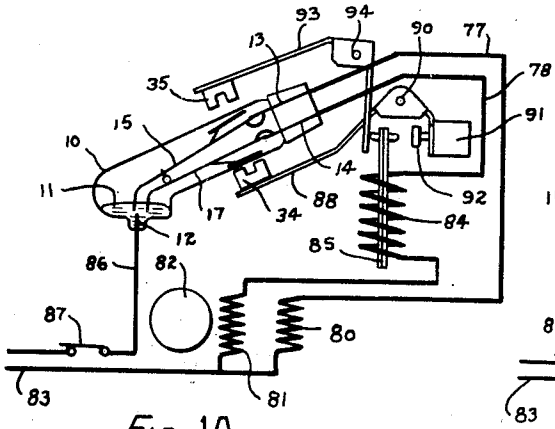


Fig. 10

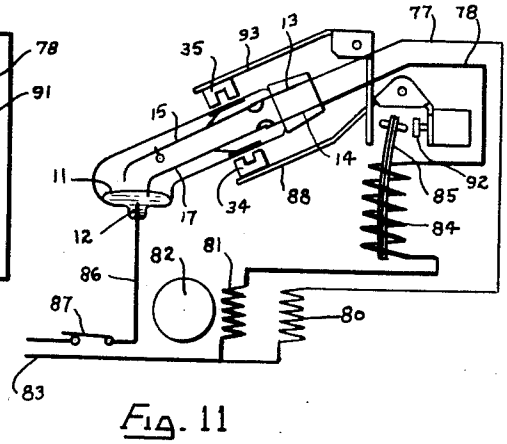


Fig. 11

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MULTIPLE CONTACT SWITCH STRUCTURE

Ira E. McCabe, Chicago, Ill.

Application March 28, 1947, Serial No. 737,903

6 Claims. (Cl. 200—152)

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The invention relates to electric switches, particularly to a multiple contact switch having flexible or movable contact members adapted to make and break electric circuits according to a predetermined sequence of operations, and has for an object to provide an improved multiple contact switch which will be simple in construction, responsive to magnetic means for its operation, and which will serve as a controller for motors and for similar uses in electrical apparatus.

A more specific object of the invention resides in the provision of an enclosed multiple contact switch preferably of the mercury type having a pair of flexible or movable contact members adapted to make and break their respective electrical circuit with respect to a common terminal and which movable contact members are resiliently biased so as to oppose each other whereby to normally maintain the members in open circuit position.

Another object is to provide an enclosed mercury switch having a pair of flexible contact members both of which are movable in the same direction to close electrical circuits respectively and wherein spring means yieldingly bias the contact members in opposite directions to oppose each other and which spring means are so adjusted that one contact member when urged by magnetic means will move into circuit closing position due only to the assistance of the spring tension of the other contact member and which may thereafter be maintained in circuit closing position by the magnetic attracting force to which it is responsive.

A more specific object of the invention is to provide a switch having a pair of movable electrodes adapted to make and break electrical circuits with respect to a common terminal which may comprise a body of mercury and wherein the movable electrodes may be actuated by magnetic means to move in the same direction and in unison to a circuit closing position and to move selectively from said circuit closing position to an open position.

Another object is to provide multiple contact switch structure of the character described which may have particular application as a control element for controlling the starting and running windings of an electric motor, and wherein said switch structure by its novel construction will cooperate with and be responsive to magnetic means actuated in response to certain conditions for providing energization of both starting and running windings of the motor, for effecting the

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interruption of the starting winding after the motor is up to speed, for interrupting the motor circuit in case the motor is stalled or overloaded, and preventing thereafter a restart of the motor until, after a delay, both starting and winding circuits are simultaneously closed.

A further object is to provide multiple contact switch structure which will have application to electrical circuits in addition to that as described above as, for example, in oil burner control apparatus for simplifying said apparatus in providing control of an oil burner motor and electric ignition means associated therewith. The improved switch may be advantageously used to provide burner motor and ignition energization with subsequent cut-off of the ignition means and may be functionally made operative to prevent operation of the burner motor without a closure of the ignition circuit when starting the burner after a period of idleness.

With these and other objects in view the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings which illustrate an embodiment of the invention and wherein like reference characters are used to designate like parts—

Figure 1 is a longitudinal sectional view through an enclosed mercury switch embodying the improvements of the present invention;

Figure 2 is a longitudinal sectional view through the glass container of the mercury switch of Figure 1 showing the switch elements in plan elevation;

Figure 3 is a plan view of the flexible hinge member for supporting and resiliently biasing the movable contact members of the switch;

Figure 4 is a side elevational view of the hinge member shown in Figure 3;

Figure 5 is a longitudinal sectional view of the switch such as shown in Figure 1 with the movable contact members in circuit closing position;

Figure 6 is another longitudinal sectional view showing one contact member in open position and the other contact member in circuit closing position;

Figure 7 is still another longitudinal sectional view of the present switch illustrating an open circuit position of the contact members when a certain member is under the influence of magnetic means;

Figure 8 is a longitudinal sectional view of a

modified form of enclosed mercury switch embodying the improvements of the present invention;

Figure 9 is another longitudinal sectional view illustrating a further modified form of multiple contact switch constructed in accordance with the invention and equipped with electromagnetic actuating means;

Figure 10 is a schematic wiring diagram illustrating an electric circuit employing the multiple contact switch of the invention as control means for the starting and running windings of an electric motor; and

Figure 11 is a diagram similar to Figure 10 but illustrating the position of the parts during normal running of the motor.

Referring to Figures 1 and 2, the switch selected for illustrating the present invention essentially consists of a cylindrical glass tube or container 10 closed at its lower end, which end receives and retains a small body of mercury or other electrical conducting fluid 11 which has electrical contact with terminal 12. The opposite end of the tube 10 is suitably closed, the said end having sealed therein one or more lead-in wires 13 and 14. The lead-in wires may have electrical connection with individual circuits and which circuits are selectively controlled with respect to the common terminal 12 by means of a plurality of movable electrodes or contact members provided by the present switch.

The movable electrode identified by numeral 15, is provided with a contact point 16 for making and breaking its respective electrical circuit with respect to the pool of mercury 11 which has electrical connection with the common terminal 12. The movable electrode 17 is likewise provided with a contact point 18 which also has coaction with the mercury pool for making and breaking the electrical circuit connecting therewith. The electrodes 15 and 17 are supported from the lead-in wires 13 and 14 respectively by flexible hinge members generally designated by numeral 20. Said hinge members are best shown in Figures 3 and 4 wherein it will be seen that the same consist of two relatively movable sections, one section being fixedly secured to a stationary support such as the lead-in wire 13, whereas the other section has fixedly secured thereto a movable electrode or contact member such as 15. A bracket 21 is fixed to the movable electrode 15 and said bracket carries at its free end an armature 22. In a similar manner bracket 23 is fixed to movable electrode 17 and the free end of said bracket carries the armature 24. Said armatures are adapted to be actuated by magnetic means whereby desired movement is imparted to the movable electrodes 15 and 17.

The form of hinge structure as shown in Figures 3 and 4 is described and claimed in my Patent No. 2,442,981, granted June 8, 1948, and entitled Electrical Switch Structure. Said member has substantially the shape of the letter H and the same is formed of relatively thin flat spring metal. The elongated spaced legs of the member are each slotted as at 26 and the connecting or transverse central section is cut from slot to slot, as, for example, at 27. Accordingly, the member consists of two sections which are relatively movable and which sections are joined by the outer strip of metal of each elongated leg. The hinge member is further processed to provide said outer strip of metal of each leg with a semi-circular depression 28, each depression or deformation taking such depth and breadth as will draw the severed edges of the connecting center portion toward each other so that the separated parts 30 and 31 of the center portion have lapping relation, thus providing a fulcrum for the flexing of one section of the hinge member on the other. It is preferable to so arrange the location of the depressions in each leg as to locate the edge of the underlapping part 31 substantially in alignment with the center of said depressions. As a result of this structure the fulcruming edge of the hinge member will have action substantially centrally of the member and also centrally of the said depressions. In the illustrated embodiment of the switch as shown in Figure 1 the hinge members 20 flexibly support the movable electrodes from the lead-in wires and the said hinge members are constructed and arranged to resiliently bias the electrodes in opposed directions. In other words, the top electrode 15 is supported and spring tensioned by the hinge member 20 in a direction downwardly, whereas, electrode 17 is supported by its hinge member 20 and is spring tensioned by the same to move upwardly. A U-shaped member 32 is carried by electrode 15, one leg of which is insulated at 33 and disposed between electrodes 15 and 17 to maintain said electrodes in spaced parallel relation and electrically insulated from each other when they are in open circuit position.

With the movable electrodes spring tensioned as above described the said electrodes normally assume an open position as shown in Figure 1, provided the armatures 22 and 24 are not under the influence of magnetic actuating means. In Figure 5 both movable electrodes have moved downwardly to close their electric circuits through mercury pool 11 with the common terminal 12. Said downward movement of the electrodes is effected by the permanent magnet 34 which is applied to the underside of the glass container 10 so as to influence armature 24 and to attract said armature downwardly, with the result that the movable electrode 17 also moves downwardly since its movement in this direction is assisted by the spring tension of the upper movable electrode 15. In accordance with the invention the spring tensioning of the electrodes 15 and 17 is such that movable electrode 17 will move downwardly when attracted by magnetic means having the strength of said magnet 34 only when it has the assistance of electrode 15. Thus with the lower electrode 17 being attracted downwardly by the permanent magnet and with the spring assistance of the upper electrode 15 both electrodes will move into a circuit closing position with mercury pool 11.

In Figure 6 a second permanent magnet 35 has been placed in associated relation with the top surface of tube 10 so as to attract armature 22 of electrode 15. The action of this permanent magnet is to lift said electrode 15, thus breaking its electrical circuit with respect to mercury pool 11. However, since the permanent magnet 34 remains in an operative position the lower armature 17 is retained in contact with said mercury so that the electric circuit as regards this electrode is maintained closed. The effect of the second permanent magnet 35 is to cause selective actuation of the electrodes since electrode 17 is maintained in circuit closing position by magnet 34 although said magnet will not alone move electrode 17 into contact with the mercury pool but requires the assistance of the spring tension of electrode 15.

Figure 7 illustrates how the present switch is non-

this electrode. However, electrode 67 will remain in circuit closing position as long as electromagnet 72 is energized. In the event said magnet 72 is deenergized electrode 67 will be released but said electrode will not move into circuit closing position even should magnet 72 be energized until the electromagnet 73 is deenergized.

The form of flexible hinge member as disclosed in my prior Patent No. 2,442,981 is preferred for the present multiple contact switch structure. However, it is to be understood that other forms of flexible hinge members may be employed to produce certain desired results or may be required for larger current carrying or controlling structures. It is further recognized that the novel cooperative spring action of the movable electrodes with the magnetic forces to which they are responsive may be carried further to switch structures employing additional movable members, whereby a simplified enclosed switch structure for multiple circuit control is provided. The actuating means for the magnetic means may take any form as available or practical in connection with the control system or apparatus being controlled such as temperature or pressure expanding and contracting elements, electro-thermal or bimetallic elements.

In Figure 10 the switch structure of the invention is shown in a schematic wiring diagram which illustrates the application of this improved form of switch to the control of an alternating current induction motor having starting and running windings. The lead-in wires 13 and 14 of the switch are electrically connected by means of conductors 77 and 78 with the starting and running windings 80 and 81 of the electric motor generally designated by numeral 82. The other ends of the windings are connected to conductor 83 having electrical connection with one terminal of the electric circuit. An electric resistance element 84 has a series circuit relation with running winding 81 so that the heat generated by said electric resistance element as a result of flow of current through the same will heat the electro-thermal actuator 85 having associated relation with said resistance element. The common terminal, namely 12 of the switch 10, which is in electrical contact with the mercury pool 11, has connection by means of the conductor 86 with switch 87 which in turn electrically connects with the other terminal of the electric circuit.

In Figure 10 the parts are shown in the position which they assume upon initial closing of switch 87. The permanent magnet 34 has attracted the armature of the bottom electrode 17 and said electrode and also the top electrode 15 has therefore moved downwardly into a circuit closing position with respect to mercury pool 11. The magnet 34 is suitably supported by arm 88 which is pivoted at 90, said arm extending beyond said pivot in a downward direction and which depending end carries the weight 91 and the stop 92. Whereas magnet 34 is operatively positioned by its arm 88 it will be observed that magnet 35 is inoperatively positioned. Said magnet 35 is supported by its arm 93 which is pivoted at 94, the said arm extending beyond the pivot in a downward direction and which depending portion is engaged by the actuator 85 when said actuator is vertical as a result of an idle condition of the motor, or, in other words, when the actuator is not under the influence of heat generated by resistance element 84. Since both circuits including conductors 77 and 78 are closed upon closing of switch 87 the motor 82 starts operation with both starting and running windings energized.

Figure 11 shows the action of the actuator as the motor attains running speed. As a result of the flow of current through the resistance element 84 heat is generated by this element which influences the actuator, causing the same to bend or curve in a direction toward the right. Movement of the actuator in this direction releases its engagement with the depending leg of arm 93 and thus the permanent magnet 35 is operatively positioned with respect to the switch to attract the armature of the top electrode 15 and opening the starting circuit. During normal running of the motor the current through the running winding 81 is decreased in value so as to maintain the electro-thermal actuator 85 in a neutral position which maintains the parts of the switch in the position as shown in said figure, and the motor continues to run as long as the main switch is closed.

In the event of an overload condition on the motor the value of the current flowing through the resistance element 84 will increase to such an extent as to cause movement of the actuator 85 to an extreme right hand position where it will engage the stop 92, actuating arm 88 and rendering magnet 34 inoperative. Electrode 17 therefore moves upwardly since it is spring tensioned in this direction, as previously described, and the circuit through the running winding of the motor is opened with the resulting stopping of the motor. Cooling of the resistance element 84 will thereupon take place and the actuator will move in a direction toward the left, releasing its engagement with stop 92 which renders magnet 34 operative again. Although magnet 34 is restored to operative position the motor circuits are not closed through the switch due to the fact that the necessary cooperative action of the top electrode 15 is lacking since said top electrode is under the influence of the upper magnet 35.

The actuator continues to move in a direction toward the left as resistance element 84 cools to normal temperature and eventually said actuator will engage the depending portion of arm 93 to render the upper magnet 35 inoperative, as shown in Figure 10. Upon this action taking place both electrodes move downwardly into a circuit closing position under the influence of the lower magnet 34, and a restarting of the motor is initiated with both starting and running windings of the motor being energized.

The foregoing motor control arrangement provides for a restart after a delay. Such an arrangement, particularly in connection with electric household refrigerators, is desirable since many of the causes of overload are self-corrective and delays between restarting generally provide a time element during which said overload causes may be removed, whereupon normal operation may be resumed. In any event, the motor control arrangement of the invention will not permit such overload causes as are not self or time-corrective to be injurious to the motor because of the short runs and subsequent idle periods of operation.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will of course be apparent to those skilled in the art without de-

operative to close in the event the upper magnet 35 is holding the upper electrode at the time the lower magnet 34 is moved toward the lower armature. Thus, as shown in Figure 6, if the lower magnet is withdrawn the switch contacts will assume the open circuit position of Figure 7 and subsequent return of said lower magnet 34 will fail to change the positions of the electrodes for the reason that the spring assistance of the upper contact is lacking. However, if magnets 34 and 35 are withdrawn the electrodes will assume the open position as shown in Figure 1 and by repeating the actuation of the magnets another cycle of operation of the electrodes may be effected.

In Figure 8 a modification of the invention is shown wherein one of the movable electrodes supports a cup of insulating material containing a quantity of mercury and which is movable into the pool of mercury for closing an electrical circuit by mercury to mercury contact. The glass tube or container 40 retains a small body of mercury in its closed right hand end which end seals the common terminal 42, the same having electrical contact with said pool of mercury. At the opposite end of the glass tube the lead-in wires 43 and 44 extend into the container and support movable electrodes 45 and 47 by means of hinge members 20 in a manner as previously described with respect to the switch of Figure 1. Also the movable electrodes each carry a bracket 48 and 49, to the outer end of which is secured an armature 50 and 51, respectively. Said armatures are adapted to be actuated by magnetic means in a manner as described with respect to Figure 1, and it is further understood that the hinge members 20 not only flexibly support the electrodes 45 and 47 for movement but said hinge members are so constructed and arranged as to tension the electrodes. The hinge member flexibly supporting electrode 45, spring tensions said electrode in a downward direction. The hinge member 20 flexibly supporting the lower electrode 47 spring tensions this electrode so as to bias the same in an upward direction. A U-shaped member 52 of insulating material is carried by electrode 45 and one leg of the insulating member is disposed between the electrodes to normally maintain them in separated relation.

In this modification the lower electrode 47 has suitably secured thereto at its outer end a cup 53 of insulating material which is adapted to contain a small quantity of mercury in electrical contact with the electrode. The top electrode 45 is provided with a contact point 54 which in certain positions of the electrode will contact the mercury in cup 53. With the parts positioned as shown in Figure 8 the insulating cup 53 floats upon the pool of mercury 41, which action is the result of the particular spring tensioning applied to the electrodes. The attraction of armature 51 by a magnet such as magnet 34, Figure 5, will produce downward movement of the insulating cup 53 and closing of the electrical circuits connecting with the electrodes through mercury pool 41. The magnet 34 in effecting this closing of the circuits is of course assisted by the spring tensioning of electrode 45. In the event armature 50 is attracted by a magnet such as 35 the upper electrode 45 will move into an open circuit position in a manner similar in all respects to the action of electrode 15 in Figure 6. The switch structure of Figure 8 makes possible the handling of larger currents for at least one electrical circuit by reason of the mercury to mercury make and break.

The switch structure of Figure 8 also finds application in safety devices wherein is utilized the closed circuit condition normally existing between electrodes 45, 47, as a result of the mercury in the cup when the cup floats upon the mercury 41. Such a use for the switch may incorporate said electrodes into a circuit comprising a starting control circuit which, when closed, may be caused to energize an electromagnet adapted to cause attraction thereto of armature 51, thus submerging the cup into the pool of mercury, and completing a circuit to some form of electrically operated device being controlled. As previously described, electrode 45 would follow the cup to remain in contact with the mercury. A time controlled device may be employed, acting after a predetermined interval, to cause magnetic means to attract armature 50 whereupon the starting control circuit, controlled by electrode 45, would be opened. A condition responsive device may be employed responsive to conditions produced by operation of the controlled device adapted, when a predetermined condition is produced, to establish a maintaining control circuit to the electromagnet prior to the interruption of the starting control circuit thereto by the time device whereby operation of the controlled device may continue until desired stopped by interruption of the electromagnet circuit. Failure of the condition responsive device to act before the time device interrupted the starting control circuit would result in demagnetization of armature 51, when the time device operated, and the cup would be removed from the mercury by action of the spring hinge 20 and the circuit to the controlled device opened.

In Figure 9 a modified form of switch is disclosed wherein solid metal to metal contacts are employed in the place of mercury. Also this modified form discloses electromagnetic means for actuating the armatures and thus the respective electrodes. The switch essentially consists of a glass tube 60 closed at both ends with the right hand end having contacts 61 and 62 provided by the common terminal 63, and which terminal is sealed in this end of the glass tube and extends exteriorly of the same. The opposite end of the glass tube seals the lead-in wires 64 and 65 which support at their inner ends within the tube the hinge members 20. The upper electrode 66 is supported for flexing movement by the hinge member 20 from lead-in wire 64 and the lower electrode 67 is similarly supported by a hinge member 20 from the lead-in wire 65. The electrodes 66 and 67 each have suitably secured thereto the brackets 68 and 69, respectively, which brackets at their free end carry armatures 70 and 71. The said armatures are actuated to effect movement of their respective electrodes by the electromagnets 72 and 73, it being understood that the hinge members spring tension the electrodes in a manner as described to yieldingly bias them to oppose each other. The insulating member 74 carried by electrode 66 normally maintains the electrodes in separated relation. The operation of this modified form of switch may be similar in all respects to that as described in connection with Figures 1 and 8. Upon energization of magnet 72 the armature 71 will be attracted to move downwardly and both electrodes will be caused to engage their respective contacts, namely, 61 and 62. Should electromagnet 73 be energized armature 70 will be attracted to produce upward movement of electrode 66, thus breaking the electrical circuit of

parting from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In a magnetically actuated electric switch, in combination, first and second movable electrodes, contact means with which both said electrodes are adapted to engage in one position of the electrodes to close electric circuits respectively, means spring tensioning said electrodes individually and in a manner whereby the electrodes normally assume an open circuit position with respect to the contact means and move simultaneously into circuit closing position upon movement of one of the electrodes to said position, first magnetic means associated with the first movable electrode for actuating the same, second magnetic means associated with the second movable electrode for actuating the same, the magnetic strength of said first magnetic means when operative being effective to actuate the first movable electrode into said circuit closing position only when the second magnetic means is inoperative, in which case both electrodes move simultaneously into circuit closing position as a result of their particular spring tensioning, and said first magnetic means as long as it is operative thereafter holding the first movable electrode in circuit closing position.

2. In a magnetically actuated electric switch, in combination, first and second movable electrodes, contact means with which both said electrodes are adapted to engage in one position of the electrodes to close electric circuits respectively, means spring tensioning the second electrode to resiliently bias it in a direction toward the contact means and against the spring tensioning of the first electrode, the spring tensioning of said first electrode being effective to normally locate both electrodes in an open circuit position, first magnetic means associated with the first movable electrode and operative under certain conditions for effecting actuation of both electrodes simultaneously into circuit closing position, second magnetic means associated with the second movable electrode and operative only for actuating said second movable electrode from closed circuit position to an open circuit position, the magnetic strength of the first magnetic means when operative being effective to move the first movable electrode into said circuit closing position only when said movement is assisted by the spring tensioning of the second movable electrode, in which case both electrodes move into circuit closing position simultaneously, and said first magnetic means as long as it is operative thereafter holding only the first movable electrode in circuit closing position in the event the second magnetic means is rendered operative.

3. In a magnetically actuated electric switch, in combination, first and second movable electrodes, means spring tensioning said electrodes individually and in a manner to resiliently bias them in a direction to oppose each other so that said movable electrodes normally assume a first circuit controlling position and which is spaced with respect to a second circuit controlling position, first magnetic means associated with said first movable electrode and effective under certain conditions for actuating both electrodes to cause simultaneous movement of the same from the first to the second circuit controlling position, second magnetic means associated with said second movable electrode for actuating said electrode and being independently and solely operative for effecting movement of said second electrode from the second to the first circuit controlling position, the magnetic strength of said first magnetic means when operative being effective to move the first movable electrode into said second circuit controlling position only when the movement is assisted by the spring tensioning of the second movable electrode, in which case both electrodes move simultaneously into said second circuit controlling position, and said first magnetic means as long as it is operative thereafter holding only the first movable electrode in said second circuit controlling position in the event the second magnetic means is rendered operative.

4. In a magnetically actuated electric switch, in combination, a first movable electrode and a second movable electrode, contact means with which said electrodes engage in a closed circuit position and with which said electrodes are out of engagement in an open circuit position, means spring tensioning the second movable electrode to resiliently bias the same toward a closed circuit position, means spring tensioning the first movable electrode to resiliently bias the same toward an open circuit position, insulating means located between the movable electrodes for engagement therewith, whereby the tension of one electrode is exerted through the insulating means against the tension of the other electrode to normally maintain both electrodes in an open circuit position and in spaced, insulated relation with each other, an armature fixed to each electrode and having positions in opposite relation to each other so that said electrodes may be actuated independently and in a selective manner, a first magnetic means for actuating the armature of said first movable electrode, second magnetic means for actuating the armature of the second movable electrode, the magnetic strength of said first magnetic means when operative being effective to actuate the first movable electrode into said circuit closing position only when said movement is assisted by the spring tensioning of the second movable electrode, in which case both electrodes move into circuit closing position simultaneously, and said first magnetic means as long as it is operative thereafter holding the first movable electrode in circuit closing position in the event the second magnetic means is rendered operative.

5. In an electric switch, in combination, a container, a pool of mercury therein, a pair of independently movable electrodes positioned one above the other in substantial vertical alignment, a contact member in electrical connection with the pool of mercury providing a common terminal for said electrodes and which have an open circuit and a closed circuit position therewith, a cup of insulating material carried by the bottom electrode and which dips into the mercury pool when the electrode is in circuit closing position, the top electrode having a contact point adapted to contact mercury within the cup in certain positions of said electrodes to electrically connect the electrodes, spring means supporting each electrode, the spring means for the bottom electrode spring tensioning said electrode in a direction to move the cup out of the mercury pool, the spring means for the top electrode spring tensioning the electrode in an opposing direction toward the mercury pool, insulating means interposed between the electrodes and carried by one electrode for maintaining them in spaced relation against said tensioning means, whereby as a result of said spring tensioning the electrodes are normally located in open circuit position with

the top electrode contacting the mercury in the cup and the cup being supported by the bottom electrode partly immersed but floating upon the mercury pool, first magnetic means associated with the bottom electrode for actuating the same, and second magnetic means associated with the top electrode for actuating the same, the magnetic strength of the first magnetic means when operative being effective to move the bottom electrode to immerse the cup in the mercury pool only when said movement is assisted by the spring tensioning of the top electrode, in which case both electrodes move into a closed circuit position with said contact member.

6. An electric switch as defined by claim 5, wherein the second magnetic means when operative will move the top electrode from a closed to an open circuit position, wherein the first magnetic means is additionally capable as long as it is operative to hold the bottom electrode in closed circuit position after it has moved into said position even though the second magnetic means may be rendered operative, and additionally including an armature carried by each electrode and so disposed as to cause said movement of its respective electrode when subjected to the magnetic force of its particular magnetic means.

IRA E. McCABE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,558,277	Phelan et al.	Oct. 20, 1925
1,971,199	Owens	Aug. 21, 1934
2,441,633	Horman	May 18, 1948

FOREIGN PATENTS

Number	Country	Date
293,837	Germany	Aug. 31, 1916