Sept. 5, 1933. S. C. GULICK 1,925,633

CONTROL SWITCH

Filed June 21, 1932

Fig. 1.

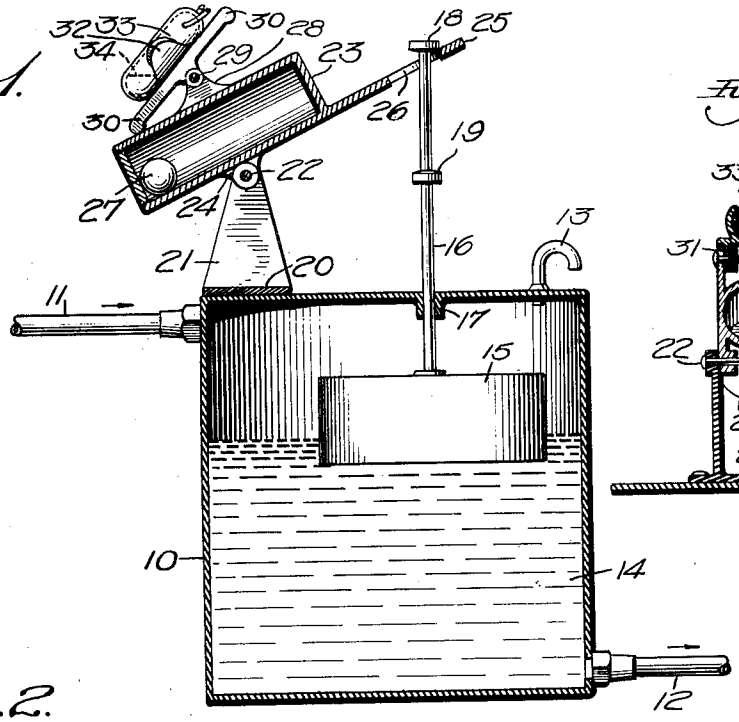


Fig. 4.

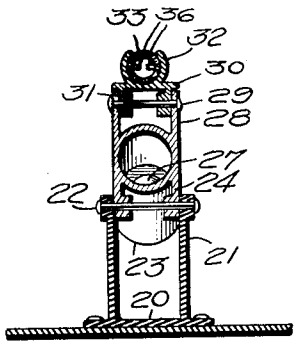
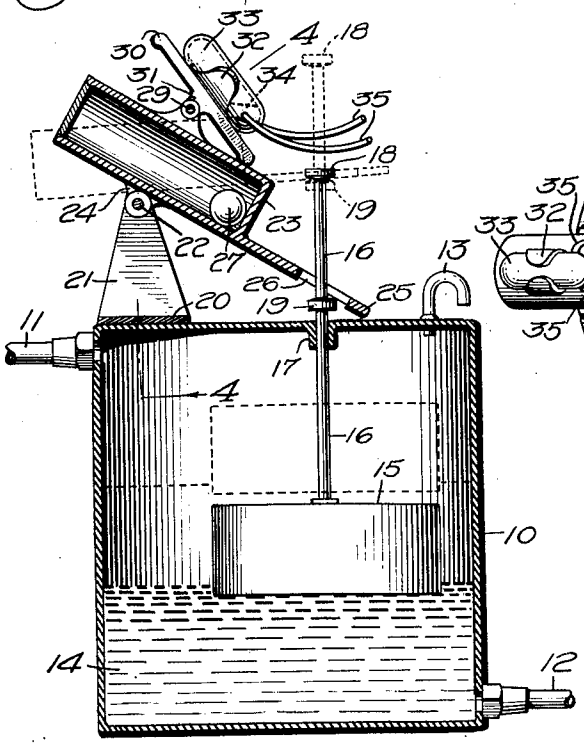


Fig. 2.



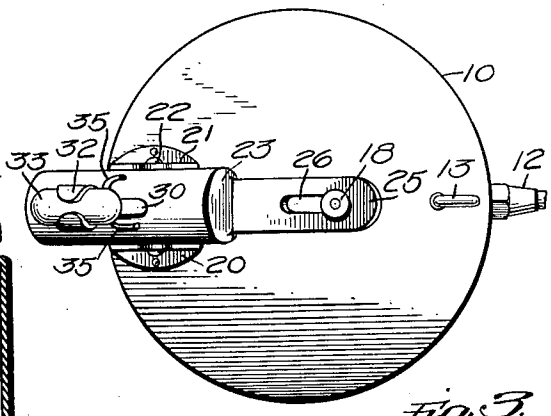


Fig. 3.

Inventor
SEELEY C. GULICK

C. L. Parker, Jr.
Attorney

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1,925,633

CONTROL SWITCH

Seeley C. Gulick, Champaign, Ill.

Application June 21, 1932. Serial No. 618,542

14 Claims. (Cl. 200—84)

This invention relates to control switches for intermittently operating electrical devices.

It has been the practice for a number of years to employ mercury switches in electrical installations wherein it is desired to operate an electrical device in accordance with varying conditions. For example, mercury switches have been used in the circuits of motors associated with domestic and commercial oil burner heating systems and the mercury switches have been thermostatically controlled to operate between predetermined minimum and maximum temperatures. Mercury switches usually are in the nature of tubes having embedded contacts in one end and containing a body of mercury adapted to shift back and forth to make and break the circuit across the contacts as the tube is tilted in accordance with temperature conditions.

Such devices have been found fully operative and practicable for use with various forms of apparatus wherein the supporting means for the mercury containing tube is stationary, but the device has been found to possess no utility when the support for the mercury tube is movable as in the cases of motor vehicles, boats, etc. In such uses, it will be apparent that as the mercury tube gradually alters its position in accordance with changing conditions, a point is reached wherein the tube is substantially balanced in a horizontal position, and under the influence of movement of the supporting means for the tube, the latter is caused to shift back and forth, thus rapidly and alternately opening and closing the circuit to no useful purpose and with possible damage to the parts.

For a number of years it was the common practice to supply fuel from the storage tank of a motor vehicle to the vehicle engine through the medium of an intermediate supply device commonly known as a "vacuum tank" which device was employed because of the fact that the storage tanks were arranged below the level of the engine carbureters. These devices were float controlled and operated to supply fuel from the main tank to the auxiliary tank periodically as the supply in the auxiliary tank would decrease. Such devices have been generally replaced in recent years by positively operated pumps, but such devices are caused to operate constantly because of the lack of intermediate storage means, and they are forced to pump at a rate in excess of the normal demands of the vehicle engine so as to positively maintain an adequate fuel supply under abnormal conditions. The use of a mercury switch for controlling the motors of the pumps in conjunction with an intermediate storage tank has been desirable since it would permit the operation of the motor to start when the level of the fuel drops to a predetermined point and to continue only until the level of the liquid reaches a higher predetermined point.

The use of mercury switches for this purpose, however, has been impossible for the reasons stated above, the various moving forces to which the device would be subjected making it impossible for it to operate in the desired manner.

An important object of the present invention is to provide a mercury switch which is applicable to any use to which the present types of mercury switches are put, and it may be employed in connection with movable supporting means without the danger of the mercury moving rapidly back and forth in the tube to open and close the circuit when a condition of equilibrium is reached.

A further object is to provide a device of the character referred to which is readily adapted for efficient operation on automobiles, boats, etc., and which may be readily employed for controlling electrical devices in accordance with varying conditions such as temperatures, pressures, etc.

A further object is to provide a mercury switch which is particularly adapted for use as circuit making and breaking means for a motor employed for pumping fuel from the supply tank of a motor vehicle to an auxiliary tank arranged above the carbureter of the vehicle.

A further object is to provide a device of the character referred to wherein a control device tiltable independently of the mercury tube is employed between the tube and a member which alters its position in accordance with varying conditions whereby sudden movement is transmitted to the mercury tube to tilt it before it has reached a position of equilibrium wherein it might accidentally swing back and forth under the influence of the motion of the vehicle or other apparatus to which the device is connected.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawing I have shown one embodiment of the invention. In this showing,

Figure 1 is a sectional view of an auxiliary fuel tank showing the control switch associated therewith,

Figure 2 is a similar view showing the parts in a second position,

Figure 3 is a plan view of the device, and,

Figure 4 is a detail section on line 4—4 of Figure 2.

As previously stated, the present device is applicable to a variety of uses, and may be responsive to variations in any desired conditions such as temperatures, pressures, liquid levels, etc., and has been illustrated in the present instance as being connected to a liquid fuel tank to be responsive to variations in the level of the fuel therein. Referring to Figure 1 the numeral 10 designates a fuel tank which, in the present instance, may be an auxiliary tank arranged beneath the hood of a motor vehicle to receive fuel pumped from the supply tank and to feed the fuel by gravity to the carbureter. For this purpose, the tank 10 is provided with an inlet pipe line 11 in which is connected a suitable electrically operated motor (not shown) which is adapted, when energized, to supply fuel from the main tank of the vehicle to the tank 10. An outlet pipe 12 is also provided and leads from the tank 10 to the float chamber of the carbureter. The tank 10 is preferably vented to the atmosphere as at 13 to permit the fuel to flow freely into and out of the tank.

In Figures 1 and 2, the tank 10 is illustrated as containing a body of liquid fuel 14, and a float 15 is buoyantly supported by the fuel and alters its position in accordance with the level thereof. The float 15 is provided with a vertically extending stem 16 operating in a guide 17 carried by the top of the tank 10. Spaced annular upper and lower flanges 18 and 19 are carried by the stem 16 for a purpose to be described.

A supporting bracket 20 is mounted upon the top of the tank 10 and carries upstanding ears 21 between which extend a pivot pin 22. An actuating member in the form of a tubular member 23 is arranged above the bracket 20 and is provided with depending ears 24 pivotally connected to the pin 22. One end of the actuating device is provided with an extension 25 having a slot 26 through which the upper end of the float stem 16 extends, and the flange 18 is preferably in the form of a cap or nut threaded on the stem 16 and removable to permit the insertion of the stem through the slot 26. The tube 23 is closed at its ends as shown in Figure 1 and a steel or similar relatively heavy ball 27 is arranged in the tube 23 for a purpose to be described.

The tube 23 is provided with a pair of upstanding ears 28 carrying a pivot pin 29. A tilting tube holder 30 is mounted above the ears 28 and is provided with depending ears 31 receiving the pivot pin 29. The holder 30 is provided with upstanding clips 32 receiving a sealed tubular member preferably in the form of a glass tube 33. This member contains a body of mercury 34, as indicated in dotted lines in Figure 1. Flexible lead-in wires 35 extend into one end of the tube 33 and terminate in contacts 36 adapted to be engaged by the mercury, when the tube is in the position indicated in Figure 2. The wires 35 are connected in the circuit of the motor previously referred to which operates to pump fuel from the main tank of the vehicle to the tank 10 through the pipe 11.

The operation of the device is as follows:

The position of the float 15 and stem 16 will vary in accordance with the level of the fuel in the tank 10, as will be apparent. Assuming that the parts are in the positions shown in Figure 1, the ball 27 will be arranged in the end of the tube 23 remote from the stem 16, while the mercury 34 will be arranged in the end of the tube 33 remote from the contacts 36. Under such conditions, the circuit through the motor will be broken, but fuel will flow by gravity from the tank 10 to the carbureter through the pipe 12. Thus it will be apparent that the level of the liquid in the tank 10 will gradually drop due to the consumption of fuel, and thus the float 15 and associated parts will move downwardly.

As the downward movement of the float progresses, the upper flange or button 18 will contact with the projection 25 thus gradually swinging the tube 23 about its pivot 22. When the tube 23 approaches a horizontal position it will be apparent that the tube 33 will still be arranged at a substantial angle, and accordingly the ordinary motions of a vehicle will not cause the mercury 34 to engage the contact 36. When the float and associated parts reach approximately the position shown in Figure 2, the tube 23 will have been moved past a horizontal position, and accordingly the ball 27 will roll downwardly to the other end of the tube, that is, to the end nearest the stem 16. Thus the tube 23 will assume the position shown in Figure 2, and when such position is reached, the holder 30 will then slightly pass a horizontal position, thus causing the mercury to flow toward the end of the tube 33 in which the contacts 36 are arranged, and the tube 33 will be overbalanced to turn to the position shown in Figure 2. The mercury will then bridge across the contacts 36 closing the circuit to the motor and causing fuel to be pumped into the tank through pipe 11.

As the fuel accumulates in the tank 10 the float 15 will move progressively upwardly, and the lower flange or button 19 will contact with the projection 25 thus moving the tube 23 until it again passes horizontal position, at which time the ball will return to the end of the tube remote from the stem 16, causing the tube 23 to swing to the position shown in Figure 1 with the projection 25 in engagement with the upper button 18. The tube 33 will be slightly overbalanced when the tube 23 reaches its limit of movement, and thus the tube will return to the position shown in Figure 1 due to the weight of the mercury flowing to the end of the tube 33 remote from the contacts 36. It will be apparent that the ends of the holder 30 engage the tube 23 to limit the turning movement of the holder 30 in either direction.

Accordingly it will be apparent that a very definite swinging movement of the tube 23 to either limit of movement is necessary before the tube 33 will be operated, and thus the mercury is either definitely in engagement with the contacts 36, or is definitely arranged in the other end of the tube 33. Accordingly it will be apparent that vibration and other motions of the vehicle will not cause a splattering action of the mercury to result in rapid opening and closing of the circuit across the contacts 36. Accordingly the device is particularly adapted for use where the supporting means for the mercury switch is subjected to movement, as in the case of installations in motor vehicles, boats, etc.

While the device has been specifically described as means for controlling a motor adapted for supplying fuel from the main fuel tank of a motor vehicle to the engine thereof, it will be apparent that it is not limited to such use, or to use with any liquid supply system. For example, the device is equally adapted for use in connection with steam boilers wherein pressure variations are utilized for moving the tube 23, and for use in connection with thermostats wherein thermostatic movement incident to temperature

variations is transmitted to the tube 23. Accordingly it will be understood that the stem 16 is only illustrative of some form of member responsive to varying conditions, and in the appended claims, it is understood that the expression "member movable between two positions in accordance with varying conditions" is intended to include any member of the type which is responsive to such varying conditions as liquid levels, fluid pressures, temperatures, etc.

In any of the uses of the device, the action of the mercury tube is positive and takes place only upon movement of the tube 23. The use of the tube 23 as an actuating device for the mercury tube permits the latter to be arranged at a relatively sharp angle at all times except at the instant when it is being overbalanced in one direction or the other, thus rendering the mercury switch positive in operation.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. An electrical switching device comprising a switching member pivotally supported to swing about a horizontal axis intermediate its ends to either of two positions, said member having electrical contacts in one end thereof, circuit closing means carried by said member and shiftable by gravity between the ends thereof to close the circuit across said contacts when said member is in one position and to open such circuit when the member is in the other position, an actuating device pivoted on a horizontal axis intermediate its ends to swing back and forth between two positions and having end portions contacting with end portions of said switching member to overbalance the latter as the actuating device reaches either of its two positions, and weight means carried by said actuating device and movable across the vertical plane of the pivot axis thereof as said device is tilted away from one of its two positions to cause it to be moved to its other position.

2. An electrical switching device comprising an actuating device pivoted on a horizontal axis intermediate its ends to swing back and forth between two positions, weight means shiftable by gravity to overbalance said actuating device to move it to one of its positions as it passes a position of balance while being moved from its other position, a member pivotally mounted adjacent the actuating device to swing about a horizontal axis intermediate its ends to either of two positions, said member having electrical contacts in one end thereof and having end portions contacting with said actuating device to be overbalanced thereby in either direction as the actuating device reaches either of its positions, and circuit closing means carried by said member and shiftable between the ends thereof to close the circuit across said contacts when said member is in one position and to open such circuit when the member is in the other position.

3. An electrical switching device comprising an actuating tube pivoted therebelow and intermediate its ends on a horizontal axis, a weight ball arranged in the tube to overbalance it as it passes a horizontal position moving in either direction, a member pivotally mounted adjacent the tube to swing about an axis below and intermediate the ends of the member and having end portions contacting with the tube to be overbalanced thereby as the tube swings a substantial distance on either side of a horizontal position, a pair of contacts carried by one end of said member, and shiftable circuit closing means carried by said member to close the circuit across said contacts when said member is in a position to one side of a horizontal position and to open such circuit when the member is in a position to the other side of a horizontal position.

4. An electrical switching device comprising an actuating device pivoted on a horizontal axis intermediate its ends to swing back and forth between two positions, weight means shiftable by gravity to overbalance said actuating device to move it to one of its positions as it passes a position of balance while being moved from its other position, a member pivotally mounted adjacent the actuating device to swing about a horizontal axis intermediate its ends to either of two positions, said member having a tubular portion provided with electrical contacts projecting thereinto adjacent one end thereof and being formed of insulating material, said member having end portions contacting with said actuating device to be overbalanced thereby in either direction as the actuating device reaches either of its positions, and a body of mercury in said tubular member shiftable between the ends thereof to close the circuit across said contacts when said member is in one position and to open such circuit when the member is in the other position.

5. An electrical switching device comprising an actuating tube pivoted therebelow and intermediate its ends on a horizontal axis, a weight ball arranged in the tube to overbalance it as it passes a position of balance moving in either direction, a member pivotally mounted adjacent the tube to swing about an axis below and intermediate the ends of the member and having end portions contacting with the tube to be overbalanced thereby when the tube swings a substantial distance from either side of a horizontal position, said member including a tubular portion having contacts extending into one end thereof, and a body of mercury in the tubular portion of said member engageable with the contacts to close a circuit thereacross when the member is in one position and adapted to open the circuit when the member is in the other position.

6. An electrical switching device comprising an actuating tube having depending ears centrally of its length, a supporting pivot pin passing through said ears, a weight ball arranged in the tube to overbalance it as it passes a position of balance moving in either direction, a mercury container arranged above said tube, a pivot member supporting said container therebelow and intermediate its ends, contacts extending into said container to one side of the pivot axis thereof, and a body of mercury arranged in said container, said container having portions on opposite sides of the pivot axis thereof contactible with said tube to move the container past balance in one direction as said tube moves in the same direction a substantial distance beyond its balancing point.

7. An electrical switching device comprising an actuating tube having depending ears centrally of its length, a supporting pivot pin passing through said ears, a weight ball arranged in the tube to overbalance it as it passes a position of balance moving in either direction, a mercury tube arranged adjacent said actuating tube and pivot-

ally supported to turn about a horizontal axis below and intermediate the ends of said mercury tube, said mercury tube being formed of insulating material and having a pair of contacts extending into one end thereof, and a body of mercury arranged in said mercury tube, said mercury tube having portions on opposite sides of the pivot axis thereof contactible with said actuating tube to move the mercury tube past balance in one direction as said actuating tube moves in the same direction a substantial distance beyond its balancing point.

8. The combination with a member movable between two positions in accordance with varying conditions, of a switching member pivotally supported to swing about a horizontal axis intermediate its ends to either of two positions, said member having electrical contacts in one end thereof, circuit closing means carried by said member and shiftable by gravity between the ends thereof to close the circuit across said contacts when said member is in one position and to open such circuit when the member is in the other position, an actuating device pivoted on a horizontal axis intermediate its ends to swing back and forth between two positions and having end portions contacting with end portions of said switching member to overbalance the latter as the actuating device reaches either of its two positions, said actuating device having a portion engageable with the movable member to be actuated thereby, and weight means carried by said actuating device and movable across the vertical plane of the pivot axis thereof as said device is tilted away from one of its two positions to cause it to be moved to its other position.

9. The combination with a member movable between two positions in accordance with varying conditions, of an actuating device pivoted on a horizontal axis intermediate its ends to swing back and forth between two positions and having a portion engageable with the movable member, weight means shiftable by gravity to overbalance said actuating device to move it to one of its positions as it passes a position of balance while being moved from its other position, a control member pivotally supported by the actuating device to swing about a horizontal axis intermediate its ends to either of two positions, said control member having electrical contacts in one end thereof and having end portions contacting with said actuating device to be overbalanced thereby in either direction as the actuating device reaches either of its positions, and circuit closing means carried by said control member and shiftable between the ends thereof to close the circuit across said contact when said control member is in one position and to open such circuit when the control member is in the other position.

10. The combination with a member movable between two positions in accordance with varying conditions, of an actuating tube pivoted on a horizontal axis intermediate its ends and below its center of gravity, a weight ball arranged in the tube to overbalance it as it passes a horizontal position moving in either direction, a control member pivotally supported adjacent the tube to swing about an axis below and intermediate the ends of the control member and having end portions contacting with the tube to be overbalanced thereby as the tube swings a substantial distance on either side of a horizontal position, said tube having a portion engageable with the movable member to be moved thereby about its pivot axis, a pair of contacts carried by one end of said control member, and shiftable circuit closing means carried by said control member to close the circuit across said contacts when said control member is in a position to one side of a horizontal position and to open such circuit when the control member is in a position to the other side of a horizontal position.

11. The combination with a member movable between two positions in accordance with varying conditions, of an actuating device pivoted on a horizontal axis intermediate its ends to swing back and forth between two positions, weight means shiftable by gravity to overbalance said actuating device to move it to one of its positions as it passes a position of balance while being moved from its other position, said actuating device having a portion engageable with and movable by the movable member, a control member pivotally supported adjacent the actuating device to swing about a horizontal axis intermediate its ends to either of two positions, said control member having a tubular portion provided with electrical contacts projecting into one end thereof and being formed of insulating material, said control member having portions on opposite sides of its pivot axis contacting with said actuating device to be overbalanced thereby in either direction as the actuating device reaches either of its positions, and a body of mercury in said tubular member shiftable between the ends thereof to close the circuit across said contacts when said control member is in one position and to open such circuit when the control member is in the other position.

12. The combination with a member movable between two positions in accordance with varying conditions, of an actuating tube pivoted intermediate its ends on a horizontal axis, a weight ball arranged in the tube to overbalance it as it passes a position of balance moving in either direction, said actuating device having a portion engageable with and movable by the movable member, a control member pivotally supported adjacent the tube to swing about a horizontal axis below and intermediate the ends of the control member and having end portions contacting with the tube to be overbalanced thereby when the tube swings a substantial distance to either side of a horizontal position, said control member including a tubular portion having contacts extending into one end thereof, and a body of mercury in the tubular portion of said control member engageable with the contacts to close a circuit thereacross when the control member is in one position and adapted to open the circuit when the control member is in the other position.

13. The combination with a member movable between two positions in accordance with varying conditions, of an actuating tube having depending ears centrally of its length, a supporting pivot pin passing through said ears, a weight ball arranged in the tube to overbalance it as it passes a position of balance moving in either direction said tube having a portion engageable with and movable by the movable member, a mercury container arranged above said tube, a horizontal pivot member supporting said container intermediate its ends and below its center of gravity, contacts extending into said container to one side of the pivot thereof, and a body of mercury arranged in said container, said container having portions on opposite sides of the pivot thereof engageable with said tube to move the container past balance in one direction as the tube passes

a substantial distance beyond its balancing point in the same direction.

14. The combination with a member movable between two positions in accordance with varying conditions, of an actuating tube having depending ears centrally of its length, a supporting pivot pin passing through said ears, a weight ball arranged in the tube to overbalance it as it passes a position of balance moving in either direction, said tube having a portion engageable with and movable by the movable member, a mercury tube arranged above said actuating device and pivoted on a horizontal axis in the vertical plane of the axis of the actuating tube, said mercury tube being formed of insulating material and having a pair of contacts extending into one end thereof, and a body of mercury arranged in said mercury tube, said mercury tube having portions on opposite sides of the pivot axis thereof engageable with said actuating tube to move the mercury tube past balance in one direction as said actuating tube moves in the same direction a substantial distance beyond its balancing point.

SEELEY C. GULICK.