Sept. 25, 1934. C. HOTCHKISS 1,974,960

SIGN FLASHER

Filed April 17, 1926 3 Sheets-Sheet 1

Fig. 1.

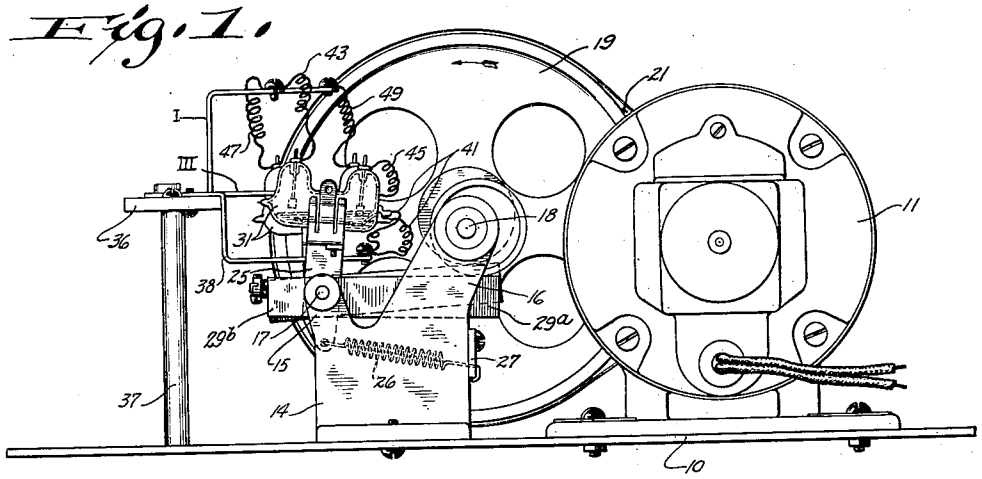
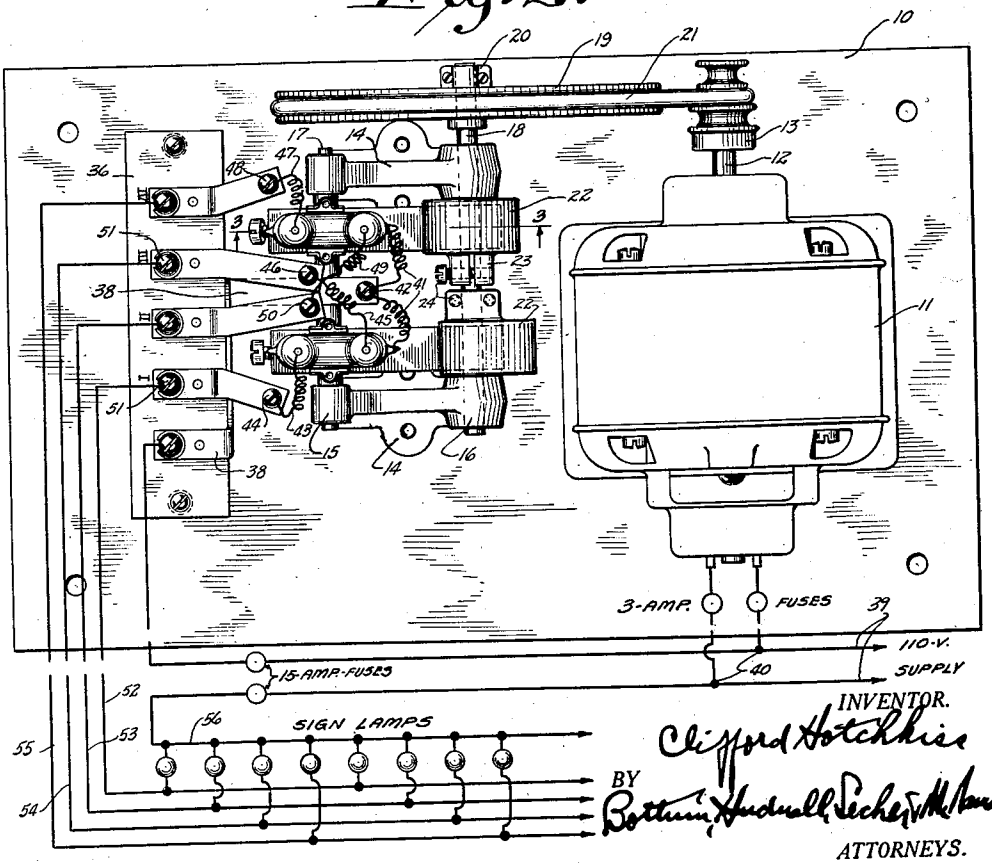


Fig. 2.



INVENTOR.
Clifford Hotchkiss
BY
Bottum, Hudnall, Secker & Mercer
ATTORNEYS.

Sept. 25, 1934. C. HOTCHKISS 1,974,960

SIGN FLASHER

Filed April 17, 1926 3 Sheets-Sheet 2

Fig. 3.

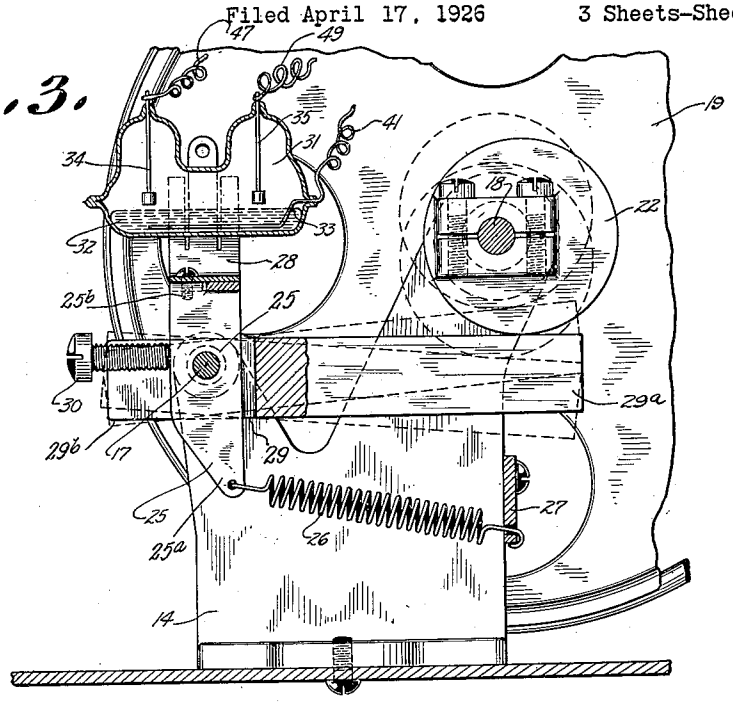


Fig. 4.

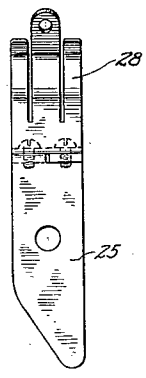
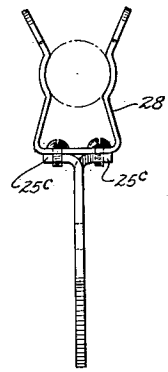


Fig. 5.



INVENTOR.
Clifford Hotchkiss
BY
Bottum, Hudnall, Seiche & Mauer
ATTORNEYS.

Sept. 25, 1934. C. HOTCHKISS 1,974,960

SIGN FLASHER

Filed April 17, 1926 3 Sheets-Sheet 3

Fig. 6.

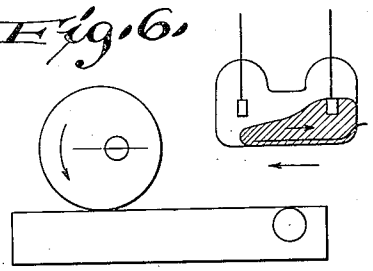


Fig. 9.

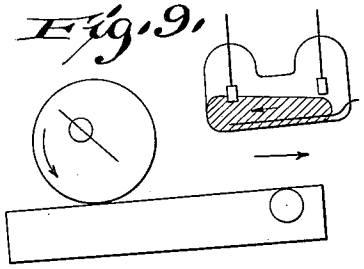


Fig. 7.

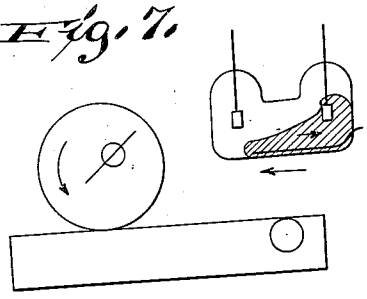


Fig. 10.

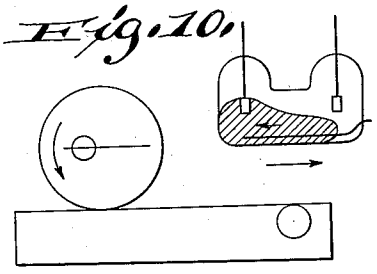


Fig. 8.

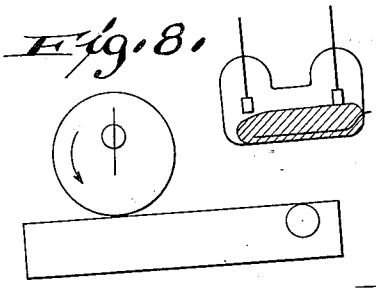


Fig. 11.

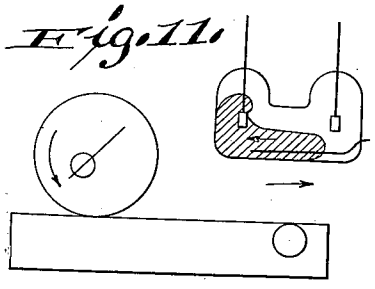


Fig. 12.

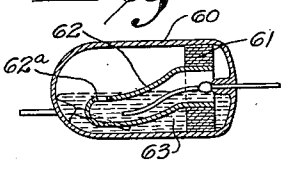
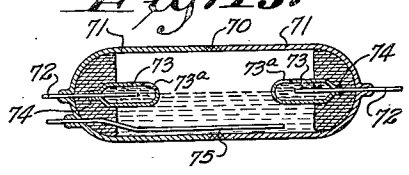


Fig. 13.



INVENTOR
Clifford Hotchkiss

BY
Bottum, Hudnall, Secher & McNamara
ATTORNEYS

Patented Sept. 25, 1934 1,974,960

UNITED STATES PATENT OFFICE

1,974,960

SIGN FLASHER

Clifford Hotchkiss, Milwaukee, Wis., assignor, by mesne assignments, to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware

Application April 17, 1926, Serial No. 102,628

4 Claims. (Cl. 200—32)

This invention relates to improvements in apparatus for intermittently making and breaking a plurality of electrical circuits in predetermined order, and more particularly to apparatus of the type commonly known as sign flashers.

One object of the invention is to provide sign flashing apparatus which shall be positive and quiet in its operation, economical to manufacture, simple and efficient in construction and operation and readily adjustable to meet the various requirements encountered in actual use.

Another object resides in the provision of apparatus of the character described which shall be especially designed for the utilization of mercury switches for the circuit controlling or making and breaking functions, instead of commutators such as have been commonly employed in the past.

A further object is to provide a new and improved method of operating switches of the mercury tube type for controlling electric circuits whereby such tubes may be employed for rapid positive control ranging, for instance, from 100 to 500 alternate making and breaking operations per minute.

Other objects and advantages of the invention will be apparent from the following specification taken in connection with the accompanying drawings wherein one form of the invention is illustrated.

In the drawings:

Figure 1 is a side elevation of a sign flasher constructed in accordance with the present invention;

Fig. 2 is a top plan view thereof, the electrical circuits being shown diagrammatically;

Fig. 3 is an enlarged sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged side elevation of one of the mercury switch supporting clips or brackets;

Fig. 5 is a front view thereof;

Figs. 6 to 11, inclusive, are diagrammatic views illustrating the operation of one of the mercury switches according to the improved method which forms a part of the present invention; and

Figs. 12 and 13 are cross-sectional views illustrating other types of mercury switches which may be employed in the apparatus.

Referring more in detail to the drawings, the apparatus which is shown mounted on a suitable panel or base plate 10 comprises an electric motor 11, the armature shaft 12 of which is provided with a plural grooved pulley 13. Mounted on the plate 10 in advance of the motor are a plurality of upstanding brackets 14, each provided with outwardly diverging apertured arms 15 and 16. These brackets 14 are mounted on the plate 10 in spaced apart relation and support two parallel shafts 17 and 18, these shafts also being parallel to the motor armature shaft 12. The shaft 17 is journaled in the arms 15 of brackets 14 and the shaft 18 is journaled in the arms 16 of said brackets. Fixed to the outer end of shaft 18 is a large sized grooved wheel 19 which may be adjusted longitudinally of the shaft through the provision of the split releasable clamping device 20. In this manner the wheel 19 may be aligned with any one of the three grooves in pulley 13 on the motor armature shaft, thus providing three different speeds for shaft 18. A driving belt 21 of any suitable material, rubber, leather or the like, connects pulleys 13 and 19.

A plurality of cams 22 are adjustably fixed on shaft 18 intermediate brackets 14, each of these cams being provided on one side thereof with a split collar 23, set screws or the like 24 cooperating with the split sections of said collars serving to clamp the cams securely in their adjusted positions. Pivotally mounted on shaft 17 and in respective alignment with the cams 22 are a plurality of vertically disposed switch supporting levers 25. Each lever 25 has a lower arm 25^a connected by a coiled spring 26 or the like to a transverse anchoring bar 27 secured across the front edges of brackets 14 slightly above the base plate 10. Each lever 25 also has an upper arm 25^b which is split and flanged outwardly in opposite directions as to 25^c to provide a support for the spring clips 28 which are attached to said flanges 25^c by means of screws or other suitable fasteners. Also pivoted on shaft 17 in respective alignment with cams 22 are a plurality of operating levers 29 which, if desired, may be of wood for the purpose of quieting the operation. Each lever 29 has an arm 29^a which engages with the cam 22 so that upon rotation of shaft 18 the arm 29^a is oscillated up and down. Each lever 29 also has an arm 29^b which is bifurcated or slit longitudinally so as to receive the switch supporting lever 25 substantially as shown. A set screw is provided in the arm 29^b of each lever 29 to engage inwardly against the edge of arm 25^b of lever 25 for purposes of adjusting the timing of the circuit making and breaking operations of the switches. The downward motion of arm 29^a of the lever 29 as effected by the rotation of the corresponding cam 22 is transmitted by the arm 29^b through the set screw to arm 25^a of lever 25, while the coiled spring 26 acting through the arm 25^a and thence the arm 25^b of lever 25 effects by

means of the set screw and arm 29b of lever 29 an upward motion of the arm 29a as the cam 22, by rotation, admits thereof. Thus the oscillation up and down of the arm 29a results in a back and forth motion through a short arc of the arm 25b of the switch supporting lever 25a.

The mercury switches bear reference character 31, one of these switches being mounted in each of the clips 28 and in such wise that the longitudinal axis of each lies substantially parallel to the corresponding axis of its operating lever 29. These switches are each of the so-called plural circuit control type, and to this end include, in addition to the mercury 32, an electrode 33 common to both circuits controlled by the switch and two other electrodes 34 and 35 individual to the two controlled circuits, respectively. The amount of mercury in each of the switch tubes is such that in one position of the tube, such as shown in Fig. 3, for instance, wherein the switch supporting lever 25 is substantially in its vertical position, electrodes 34 and 35 are both out of contact with said mercury and the controlled circuits therefore both broken. Upon movement of operating levers 29 to either of their extreme positions, however, the mercury in the tubes moves towards one end or the other thereof in the manner hereinafter described so as to complete the circuit controlled by the particular electrode into contact with which the mercury is moved.

In Figures 6 to 11, inclusive, the operation of one of the mercury switches according to the improved method forming part of the present invention is diagrammatically illustrated. Heretofore mercury switches, according to known methods of operation, have not been at all suitable for sign control of the rapid or quick changing types. According to the present invention, it is proposed to effect a positive engagement between the mercury and the electrodes, first at one end of the tube and then at the other through imparting a rapid back and forth endwise movement to the tube in such wise as to cause the mercury and the tube to move in relatively opposite directions so that the circuits in each tube are alternately made or completed in reverse order with respect to the direction of travel of the tube. This operation is illustrated in Figures 6 to 11, inclusive, just referred to. In Figure 6 the tube is shown travelling in the direction of the arrow, the mercury moving in the opposite direction and beginning to accumulate in the right-hand end, the same having already made substantial contact with the corresponding electrode. In Figure 7 the tube is illustrated as having travelled farther in the same direction, resulting in further accumulation of the mercury in the same end of the tube, the relative movement of the tube and mercury in opposite directions producing at this point in the cycle of operation a slight wave in the surface of the mercury adjacent the electrode. In Figure 8 the tube has reached its limit of travel and is about to be moved in the opposite direction. In this position the mercury has almost assumed its normal position, contact with the right-hand electrode being just about broken while contact with the other electrode is just about to be completed. In Figure 9 the tube is shown travelling to the right, the contact between the mercury and the right-hand electrode having now been broken and contact between said mercury and the other electrode having been completed. In Figures 10 and 11 the action of the mercury upon further movement of the tube in the same direction is illustrated, these figures showing substantially the same result as illustrated in Figs. 6 and 7, save of course that the tube is travelling in the opposite direction. It has been found in actual practice that tubes constructed as herein described and illustrated and operated according to the foregoing, that is, moved rapidly back and forth endwise, that the circuits may be very accurately controlled by the speeds of from 100 to 500 oscillations of the tube per minute, a result which, so far as applicant is aware, has never heretofore been attained in the use of mercury switches. In the drawings, the tubes or mercury switches are shown mounted for oscillation about a center quite a bit offset with respect to the tubes. This has been found very satisfactory in actual practice, but it is not desired to limit the invention in this respect, for it has also been demonstrated that a straight back and forth endwise movement imparted to the tubes may be utilized in an equally satisfactory manner.

During operation of the apparatus, the shaft 18 being continuously driven at a fairly good rate of speed, the mercury switches are caused to move to and fro fairly rapidly, this operation being so timed with relation to the construction of the switches and relative arrangement of their parts as to bring about a substantially simultaneous making of one circuit with the breaking of the other in each of the tubes. Furthermore, the cams 22 are preferably arranged in staggered relation, one being set substantially a quarter of a revolution in advance of the other, so that the four circuits are successively completed, the second simultaneously with the breaking of the first, the third simultaneously with the breaking of the second, the fourth simultaneously with the breaking of the third, and the first simultaneously with the breaking of the fourth, this order being preserved throughout the operation of the apparatus, which functions continuously all the time the motor is on.

In advance of the switch mechanism supported on the brackets 14, a panel 36 is supported above the base plate 10 on a plurality of legs 37. Secured to this panel are a plurality of connecting strips, the one for the line bearing reference character 38, while the others, which are adapted for connection with the four circuits to be controlled, are designated I, II, III and IV. The supply line is shown diagrammatically at 39, the motor 11 being connected directly across the line as at 40, one terminal of the line thereafter connecting directly with the connecting strip 38. To the other end of this strip 38 the two common electrodes 33 of the mercury switches are connected by conductors 41 and binding post 42. Electrode 34 of the inner mercury switch, as viewed in Fig. 2, connects with the free end of connecting strip I through conductor 43 and binding post 44. Electrode 35 of this same switch connects with the free end of connecting strip III through conductor 45 and binding post 46. The electrode 34 of the other switch is connected with the free end of connecting strip IV through conductor 47 and binding post 48, while the other electrode of said switch is connected with the free end of connecting strip II through conductor 49 and binding post 50. The ends of the connecting strips I, II, III and IV, which are secured to the panel 36, are provided with binding posts 51, conductors 52, 53, 54 and 55 being connected, respectively, with these binding posts 51 of strips I, II,

III and IV, these conductors each being individual to the four circuits to be controlled, the sign lamps of each circuit being connected in parallel between these conductors, respectively, and the other conductor or terminal 56 of the main supply line, as shown diagrammatically in Figure 2. Thus, it will be observed that upon operation of the apparatus, the several banks of sign lamps connected in the various circuits will be successively flashed on and off in predetermined order.

As will be observed, set screws 30 provide for very accurate adjustment of the switch supporting levers 25, while cams 22 may also be adjusted, both of these adjustments serving to provide for very accurate timing of the operation. Should it be desired to change the order in which the sign lamps are flashed on and off, the connections at binding posts 51 may be rearranged as desired. For instance, the connections between conductors 52 and 55 and their respective connecting strips II and IV may be reversed or, if desired, the motor may be reversely driven, the general wiring arrangement also permitting of other changes to bring about different lighting effects in the sign.

In Fig. 12 a single circuit mercury switch of a different type is illustrated, switches such as this having also been found suitable for use in the sign flashing machine operating in accordance with the method of operation above described in connection with the tubes illustrated in the other figures of the drawings. In operation this tube may either be oscillated as in the apparatus shown in Figs. 1, 2 and 3 of the drawings, or it may be operated shuttle fashion, that is, with a straight back and forth movement parallel to its longitudinal axis. This tube comprises the usual envelope 60 which may be made of soft glass. A partition wall 61 of fibrous material or the like is mounted within the envelope near one end thereof and supports an inner tube 62 preferably of hard glass such as Pyrex or the like, this tube being provided with an opening 62ª adjacent its forward end. The compartments of the tube on either side of the partition 61 communicate only through the aperture 62ª, one electrode extending into the tube 62, while the other extends into the envelope along the lower wall thereof intermediate the tube and said wall. The mercury bears reference character 63. Upon oscillation of this tube, as in the machine shown in Figs. 1, 2 and 3, or upon reciprocation in straight back and forth directions, the mercury is alternately separated and flows together at the opening 62ª to control or make and break the circuit. Upon operation of this tube, the mercury and the envelope move in relatively opposite directions, as in the tube previously described, to provide a positive quick action. In Fig. 13, a plural circuit control mercury switch is shown, which has also been found suitable for use in the sign flasher, a mercury to mercury make and break being obtained in the operation of said tube as in the tube shown in Fig. 12 and just previously described. The tube of this switch is made up of two like parts welded together, as shown at 70. Each part comprises a half envelope section 71 and electrode 72 sealed through one end thereof and carrying at its inner end a short tubular section 73 which is pinched about the electrode at 74 so as to be supported thereby. The inner end of the tube is provided with an opening 73ª and a suitable cement is preferably placed in the end of the envelope section in sufficient quantity to partly cover the inner end of the tube so as to provide a better support and seal for the latter. In addition, one of the sections is provided with a second electrode 75, which when the sections are joined together as at 70, extends along the lower wall of the envelope so as to serve as the common electrode of the switch. Upon operation of this tube, either by oscillating the same or by imparting a rapid reciprocatory movement thereto, the mercury and envelope are moved in opposite directions resulting in the bridging of first one of the electrodes 74 with the common electrode 75 and then the other electrode 74 with said electrode 75, the make and break occurring at the openings 73ª.

The mercury switches shown in Figs. 12 and 13 have been incorporated to illustrate certain other types of tubes which have been found entirely suitable in carrying out the method of operation contemplated by the invention. There are also many other tubes or switches which might be devised for utilization in this respect and, accordingly, it is not desired to in any way restrict or limit the invention to any special type or types.

While only two plural circuit switches and associated mechanism have been illustrated in Figs. 1, 2 and 3 of the drawings, it will be readily appreciated that in this respect the invention is not limited. On the other hand, as many switches may be used as may be desired, additional switches merely necessitating the further separation of brackets 14 and the use, possibly, of longer shafts corresponding to those bearing numbers 17 and 18, so as to accommodate the additional cams, operating levers, switch supporting levers and related parts. It is also desired to have it understood that the invention contemplates also the use of but a single tube in cases where only one or two circuits are to be controlled.

It will be further appreciated that the invention is susceptible of various changes and modifications without departing from the spirit thereof and it is not, therefore, desired to limit or restrict the same except where limitations appear in the appended claims.

The invention claimed is:

1. In combination, a mercury switch comprising, a tube, mercury therein, a plurality of electrodes suspended above said mercury and an electrode within said mercury and means for imparting endwise motion to said tube and said electrodes alternatingly in opposite directions and simultaneously alternatingly raising and lowering the ends of the tube, all at a speed such that a wave alternatingly rises in said mercury and contacts said suspended electrodes.

2. In combination, a mercury switch, comprising a tube, mercury therein, a plurality of electrodes suspended out of electrical contact with said mercury in the repose form assumed by it when said tube is horizontal and an electrode continuously in electrical contact with said mercury, means for moving said tube and electrodes with a to-and-fro motion and simultaneously tilting said tube at such a speed that the combined effects of the inertia and surface tension of said mercury cause alternatingly occuring waves to form on its surface and come into electrical contact with the first named electrodes.

3. In an apparatus of the class described, a shaft, a plurality of directly interconnected levers pivoted thereon, said levers having a plurality of arms, a mercury switch carried on one arm of one of said levers, means engaging another arm of said last mentioned lever for moving said levers in one direction, means coacting with an arm of

another of said levers for moving said levers in the opposite direction, said levers being relatively adjustable, and means for adjusting the same.

4. In an apparatus of the class described, a shaft, a plurality of directly interconnected levers pivoted thereon, said levers having a plurality of arms, a mercury switch carried on one arm of one of said levers, means engaging another arm of said last mentioned lever for moving said levers in one direction, means coacting with an arm of another of said levers for moving said levers in the opposite direction, said levers being relatively adjustable, and means for adjusting the same, said last named means being carried by another arm of said last named lever.

CLIFFORD HOTCHKISS.