April 3, 1928. 1,664,586

L. T. BARNES

SWITCHING APPARATUS

Filed Dec. 5, 1925 4 Sheets-Sheet 1

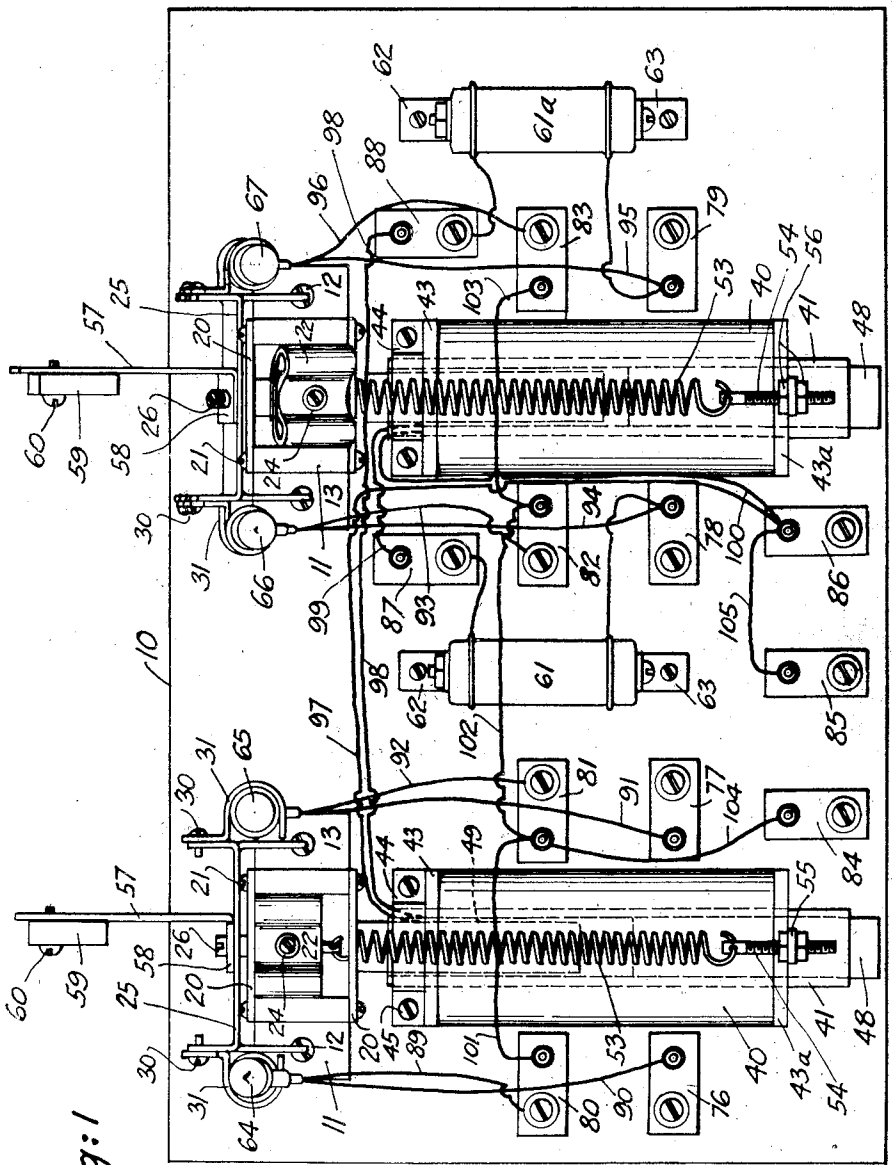


Fig: 1

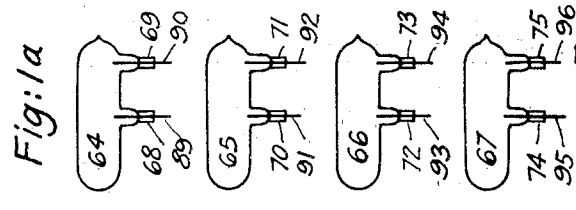


Fig: 1a

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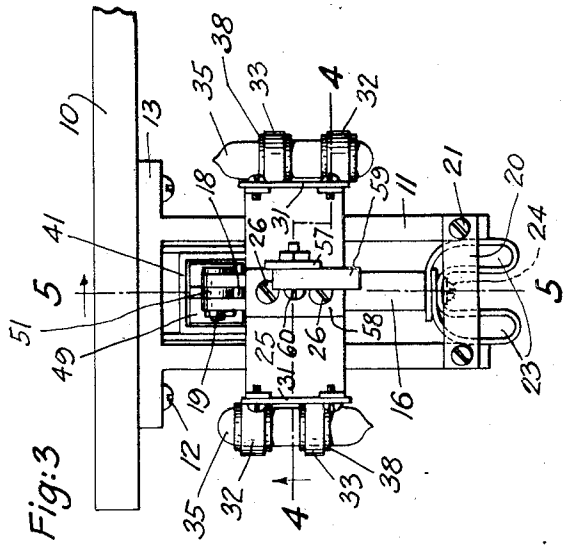


Fig: 3

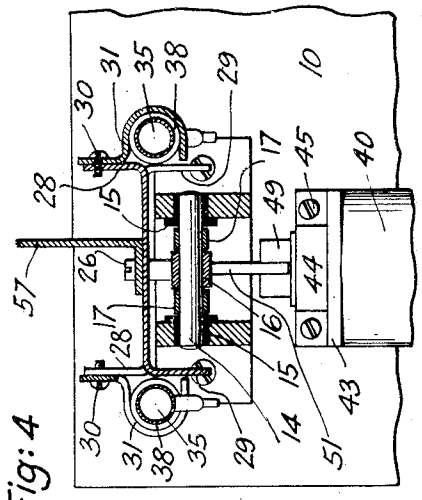


Fig: 4

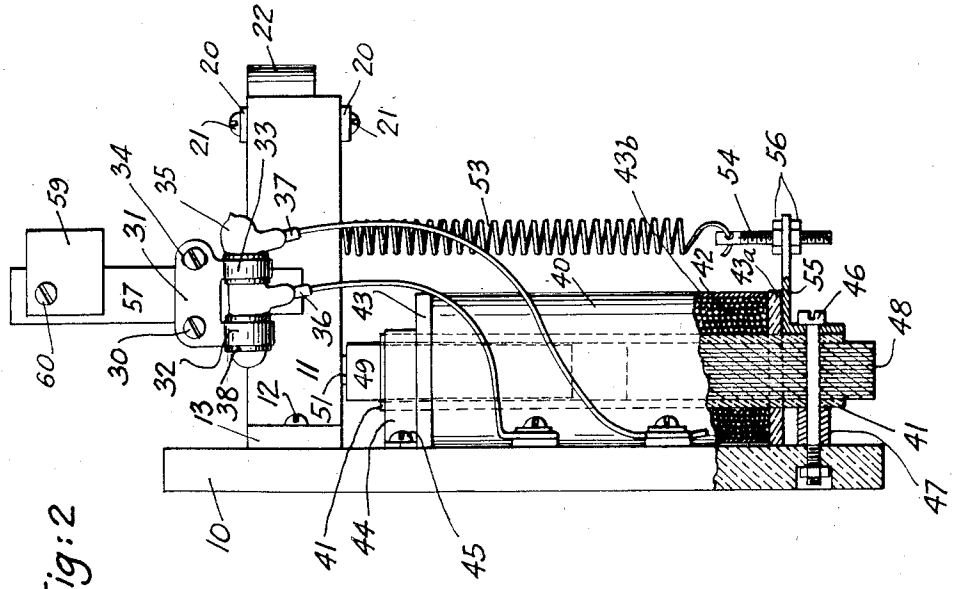


Fig: 2

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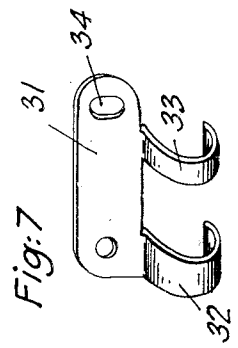


Fig: 7

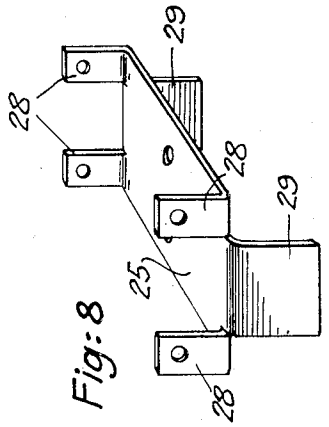


Fig: 8

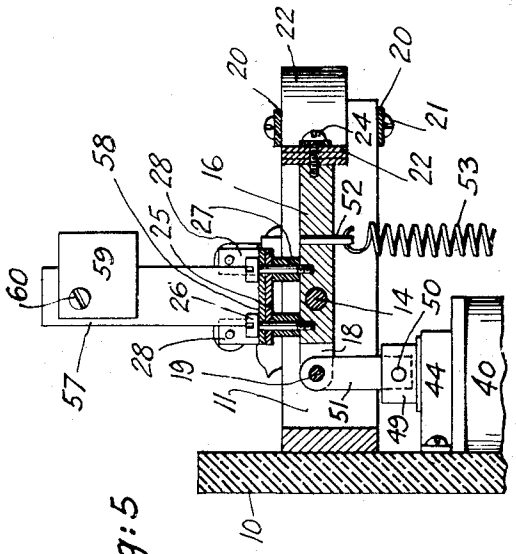


Fig: 5

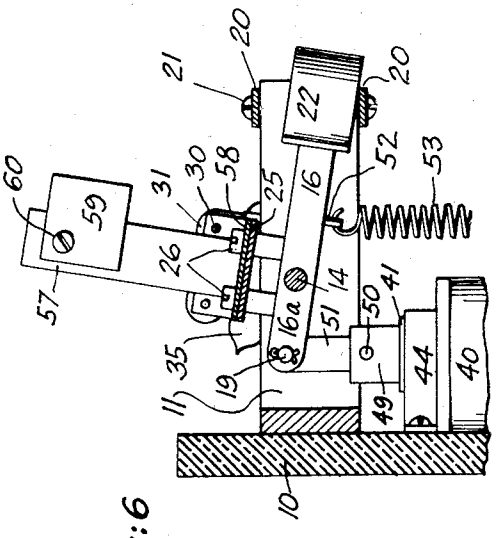


Fig: 6

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SWITCHING APPARATUS

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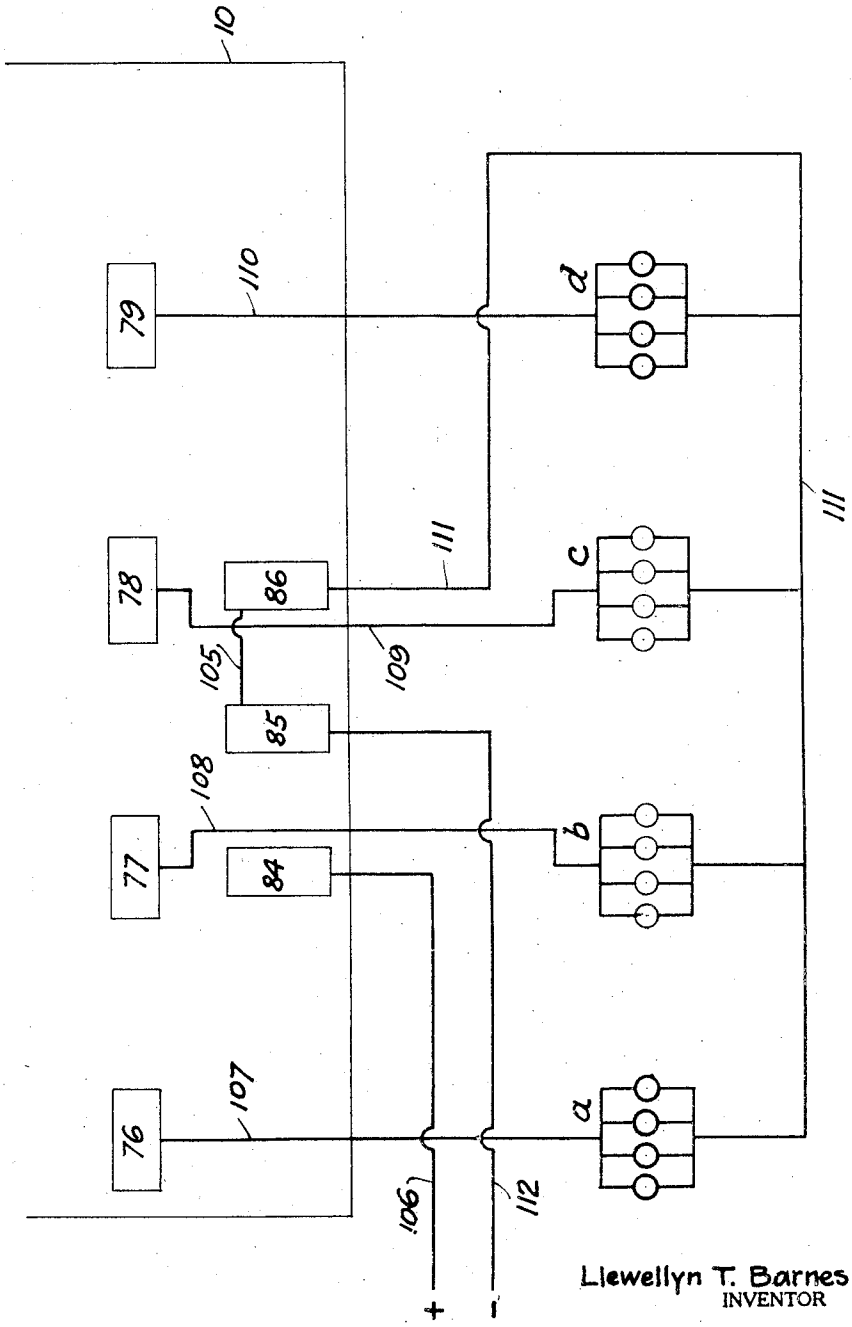


Fig. 9

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Patented Apr. 3, 1928. 1,664,586

UNITED STATES PATENT OFFICE.

LLEWELLYN T. BARNES, OF HEMPSTEAD, NEW YORK, ASSIGNOR TO THE GEM ENGINEERING CORPORATION, OF HEMPSTEAD, NEW YORK, A CORPORATION OF NEW YORK.

SWITCHING APPARATUS.

Application filed December 5, 1925. Serial No. 73,462.

This invention relates to switching apparatus and more particularly to devices adapted to intermittently render the working circuit or circuits operative and inoperative, and is especially applicable to flashing lamps or the like, for electrical signs, etc., although not necessarily limited to such applications.

It is one of the particular objects of the invention to make switching apparatuses of this kind especially suitable for synchronous operation of a plurality of circuits, and to adapt the invention to operate such circuits which are closed in sequence and at high speed, by means of a master control, to produce flashing effects, chasing borders, revolving wheels, and similar advertising signs.

Other objects are to make apparatuses of this character simpler in construction by the elimination of motors and reducing gears, to make them more silent in operation, to provide them with means to adjust their speeds, to effect ease of replacement of parts subject to wear, and to make possible their application to a greater number of electrical displays, as well as for signalling purposes, than heretofore.

Still further objects will become apparent in the following specification and the accompanying drawings, in which

Fig. 1 is a front elevational view of a preferred form of the switching apparatus, shown in connection with a four circuit system, the wiring connecting the various parts of the apparatus being indicated in the drawings diagrammatically;

Fig. 1ª is a series of side elevational views of switch tubes proper and their wire connections, shown diagrammatically only;

Fig. 2 is an end elevational view of the apparatus;

Fig. 3 is a fragmentary plan view with the wiring omitted;

Fig. 4 is a fragmentary sectional view along the plane of line 4—4, in Fig. 3;

Fig. 5 is a fragmentary sectional view along the plane of line 5—5, in Fig. 3;

Fig. 6 is a similar sectional view, partly in elevation, in another position;

Fig. 7 is a perspective view of the holder for a switch tube proper;

Fig. 8 is a perspective view of the connecting bracket supporting the switch tubes; and

Fig. 9 is a diagram showing the wiring connecting the apparatus with a number of lamp banks.

Like characters of reference denote similar parts throughout the several views and the following specification.

10 is a suitable insulating base upon which are fastened, preferably, two switch units of substantially identical construction.

Each unit consists of a bracket 11 of U shape, mounted upon the base 10 by means of screws 12 through outwardly extending lugs 13. Crosswise through both arms of the U-shaped bracket 11 is driven a fulcrum or axle 14, anchored within the bracket 11 in hard rubber bushings 15. 16 is an oscillating member or beam, pivotally mounted on fulcrum 14, and held in spaced relation to both arms of the bracket 11 by tubular washers 17. A rearwardly extending portion 16ª of the beam 16 is slotted at its end at 18 and is bored out transversely for a pin 19 which is provided with a shoulder at one end and a cotter at its other end, to hold it in place. The front ends of the arms of bracket 11 are connected at the top and at the bottom by cross bars 20, fastened to the arms by means of screws 21. 22 is a stop member, made preferably of felt and fastened to the front end of beam 16, so as to form two loops 23, by means of a screw 24, thereby extending the beam 16 between the top and bottom cross bars 20.

At the top of beam 16 is a switch bracket 25 of substantially rectangular shape, fastened to the beam by means of screws 26. The underside of the bracket is held sufficiently above the beam so as not to contact with bracket 11, by tubular washers 27 over the screws 26. Both sides of the bracket 25 are slotted and bent so as to form on each side two upwardly extending lugs 28 and a downwardly extending skirt 29 between them, as plainly shown in detail in Fig. 8. Fastened to lugs 28, at each side of the bracket 25, by means of two screws 30, is a switch holder 31, each of which is provided with straps 32 and 33. 34 is one of the holes for screws 30, made elongated in form, as shown in Fig. 7, for purposes of adjustment, as explained more in detail hereafter.

In Fig. 2 is shown a switch member proper 35 which consists of a glass tube arranged to receive a suitable conducting liquid, such as mercury, for instance. Each switch member has mounted therein two switch or working circuit contacts 36 and 37. These contacts extend into and are sealed in the tube. Straps 32 and 33 are bent around switch tubes 35 and hold each tightly against skirts 29 at both sides of bracket 25. 38 are asbestos rings around the tubes 35 to avoid contact with the tubes of straps 32 and 33, and thus avoid their breaking, due to uneven expansion, the straps being of metal. The position of the switch holders 31 and switch tubes 35 may be adjusted by loosening somewhat the screws 30 and pushing the holder 31 up or down the limit of its elongated slot 34, and when in the desired position, again tightening the screws.

40 is a solenoid which consists of a hollow square shaped bobbin 41, having a form wound coil 42 placed over it. Loose flanges 43 and 43ª, at both ends of the coil 42, and other suitable insulation 43ᵇ around it, serve as a covering for the coil 42. Bobbin 41 projects through flanges 43 and 43ª, and a bracket 44, fitted around three sides of the projecting end of the bobbin, is used to secure the top part of the solenoid to the base 10, by means of screws 45, and also retains the top flange 43 in position at the end of the coil. The lower end of the bobbin 41 is drilled for a screw 46 secured to the base 10. 47 is a tubular washer over the screw 46, between the base 10 and the bobbin 41, to hold the same in parallel spaced relation. Mounted within the bobbin 41 at its lower end is a magnet 48, customarily made of laminated metal sheets, which is rigidly held by the screw 46 which serves not only to secure the solenoid to the base, but also the magnet to the solenoid. Loosely mounted within the upper hollow part of the bobbin 41 and also made, preferably, of laminated metal sheets, is an armature 49 of square cross section, to which is fastened by means of a pin 50 an armature link 51. The other end of the link 51 is fastened to the beam 16 within its slot 18 by means of the pin 19.

At the lower side of beam 16, at a point intermediate its front end and fulcrum 14, is a downwardly extending pin 52 through a perforation of which is attached a retractile coiled spring 53. The other end of this spring is secured to a screw 54 passing through an L-shaped bracket 55 fastened also by screw 46 to the lower end of the bobbin 41, one of its legs being adjacent the lower flange 43ª and thereby hold this flange tightly against the coil of the solenoid. 56 are lock nuts for adjusting and retaining the position of screw 54 to regulate the tension of the spring 53.

At the top of bracket 25 is mounted a standard 57, having a base 58 at right angles thereto which is secured to the bracket by screws 26 which also secure it to the beam 16. To the upper end of the standard is screwed a rectangular block or pendulum 59 by means of a screw 60 for purposes set forth hereinafter.

61 and 61ª are high resistance coils, each suitably insulated and mounted upon the base 10 by brackets 62 and 63.

All parts of the switch units, so far described, are identical, and are mounted on the base 10 vertically and parallel to each other. The reference numbers of the various parts of both units are the same, but to aid now the explanation of the electrical features of the invention, I shall designate the switch tubes proper of the unit at the left side, as 64 and 65, respectively, and those of the unit at the right side as 66 and 67, as shown in Figs. 1 and 1ª, and the points where the wires are connected to the switch tubes as 68 and 69 for tube 64, as 70 and 71 for tube 65, as 72 and 73 for tube 66, and as 74 and 75 for tube 67. Fig. 1ª shows these tubes and their connections diagrammatically, tube 64 in elevation from the left side of the left hand solenoid, 65 in elevation from the right side of the left hand solenoid; tube 66 in elevation from the left side of the right hand solenoid, and tube 67 in elevation from the right side of the right hand solenoid.

Reference to Fig. 1 shows mounted on base 10 a set of four working circuit terminals namely 76, 77, 78 and 79, and similar terminals, numbered 80, 81, 82, 83, 84, 85, 86, 87 and 88. Connections between the contact points of the switch tubes and the terminals are made by flexible wires, customarily insulated by beads (not shown), as follows:

Switch tube 64, contact 68 with terminal 80 by wire 89, contact 69 with terminal 76 by wire 90; tube 65, contact 70 with terminal 77 by wire 91, contact 71 with terminal 81 by wire 92; tube 66, contact 72 with terminal 82 by wire 93, contact 73 with terminal 78 by wire 94; tube 67, contact 74 with terminal 79 by wire 95, contact 75 with terminal 83 by wire 96.

One end of the winding of the left hand solenoid 40 is connected by a wire 97 to terminal 86, the other end of the winding by a wire 98 to terminal 88. The winding of the right hand solenoid 40 is connected at one end by a wire 99 to terminal 87, and its other end by wire 100 to terminal 86.

Terminals 80 and 81 are connected together by a wire bridge 101; so are terminals 81 and 82 by a bridge 102, and terminals 82 and 83 by a bridge 103. Terminal 81 is also connected by a wire 104 with terminal 84, and terminals 85 and 86 by a wire 105.

Resistance coil 61 is interposed between and connected to terminals 78 and 87, and

resistance coil 61^a similarly to terminals 79 and 88, as shown in Fig. 1.

Inspection of Fig. 9 shows a positive line wire 106 connected to terminal 84. The positive sides of four lamp banks *a*, *b*, *c* and *d* are connected to the terminals 76, 77, 78 and 79, by load wires numbered, respectively, 107, 108, 109 and 110. The negative sides of the lamp banks *a*, *b*, *c* and *d* are all jointly connected by a negative load wire 11 to terminal 86, whence the current passes through bridge 105 and terminal 85 to a negative line wire 112, thereby completing the circuit.

The switching apparatus, when at rest, assumes in both units the position shown by the right hand solenoid in Fig. 1, that is switches 65 and 66 are closed or in circuit, while switches 64 and 67 are open.

To start the machine, current is admitted through line wire 106 to terminal 84, whence it is fed to terminals 80, 81, 82 and 83 by wire bridges 104, 101, 102 and 103. Current is thus passed through switches 65 and 66 from terminals 81 and 82 by wires 92 and 93, respectively. Through tube 66, being closed, current passes through the mercury contained therein into wire 94, terminal 78 through resistance coil 61 into terminal 87 by wire 99 into the solenoid 40 and thence through wire 100, terminal 86, bridge 105, terminal 85, into the negative line wire 112, thereby energizing the right hand solenoid. This causes the magnet 48 to draw downwardly the armature 49, from the position shown in Fig. 6, to assume the one illustrated in Fig. 5, thereby opening the switch 66 and closing switch 67. This in turn demagnetizes the right hand solenoid and admits the current from terminal 83 through wire 96, switch 67, wire 95 into terminal 79, and thence through resistance coil 61^a into terminal 88, wire 98 into the left hand solenoid 40, whence it passes through wire 97, terminal 86, bridge 105, terminal 85 into the negative line wire 112, thereby energizing the left hand solenoid. While this takes place, spring 53 draws down the forward end of the beam 16 of the right hand solenoid and returns the mechanism actuated by it to its starting position, and the cycle of operation is repeated.

While the current energizes the right hand solenoid through switch 66, lamp bank *c*, being in circuit with the same current by terminal 78 and load wire 109 connected thereto, is lit. Switch tube 65, being also closed in the starting position, and current being admitted through this tube from terminal 81 and wire 92 into wire 91, terminal 77 into the load wire 108, lights lamp bank *b* simultaneously.

Immediately after the right hand solenoid has been energized and the position of the switches 66 and 67 changed to open switch 66 and close switch 67, current passes from terminal 83, wire 96, through the tube 67, wire 95, terminal 79 into the load wire 110, when lamp bank *d* is lit. Simultaneously the left hand solenoid is energized and current admitted from terminal 80, wire 89, tube 64 (which is closed), wire 90, terminal 76 into the load wire 107, also lighting lamp bank *a*.

As soon as the device reaches its normal speed, the lamp banks *b* and *c* are not lit simultaneously, but *b* lags somewhat behind *c*, which lag can be varied by adjusting the position of the switches, the pendulum 59 and the spring 53. By this means, an alternate and successive lighting and darkening of each bank of lamps is obtained, causing a moving effect of the lights of which any desired number or combination may be connected to the switching apparatus.

It should be particularly noted that in actual practice the right hand solenoid is a self-contained unit, serving the function of a master control for devices, such for instance as illustrated as a preferred embodiment of the invention. In the apparatus described, the right hand solenoid operates entirely independently from the solenoid at the left side which latter may even be at a remote location. The right hand solenoid operates two banks of lamps alternately due to the position of its switches and other regulation, as explained above, and by connecting the left hand solenoid to one of the switches of the right hand solenoid, the left hand solenoid is energized in unison with one of the switches of the right hand solenoid, and this left hand solenoid, being preferably of a mechanical construction identical with that of the right hand solenoid, in turn alternately lights a set of two lamp banks, similar to the right hand solenoid. The operation of the right hand solenoid depends in no way upon the functioning of the left hand one.

While I have shown only two units mounted upon one base, any number of units may, of course, be connected to the right hand solenoid of the drawing, these additional units to operate either simultaneously or in series with each other to function one after the other.

The felt loops 22 are for the purpose of making the device quiet in operation. The pendulum 59 may be adjusted in such a way as to increase or decrease the speed of each unit, and by varying the same, as stated before, a time lag between the various units may be introduced which may also be regulated by adjustment of the spring 53 and the angular relation of the switch tubes to each other.

While I have shown the two switch tubes of each unit mounted each in opposite direction, so as to operate one after the other,

by mounting them in the same position, they may be made to operate simultaneously.

In the drawings has been illustrated the application of the principle of the invention to a four circuit system, used for the purpose of causing electrical flashing or chasing border effects. It is obvious that the construction may be varied to suit any plurality of circuits and made to adapt itself to many other purposes, not necessarily for electrical display, but may be used for signalling purposes, that is flashing a series of lamps, when the circuit is closed, or to many other applications.

It is understood that various changes of form, proportion and minor details may be resorted to without departing or sacrificing any of the advantages of the invention, as defined in the appended claims.

What I claim as new, is:

1. In a switching apparatus, a master control comprising a switch unit, adapted to operate similar units, having a pair of pivotally mounted mercury tube switches angularly disposed in relation to each other, so that one is closed, while the other is open, electrical means connected to the said closed switch to reverse the position of the said switches, and mechanical means to return the said switches to their original position to cause them to be opened and closed alternately.

2. In a switching apparatus, a master control comprising a switch unit, adapted to operate similar units, having a pair of pivotally mounted mercury tube switches angularly disposed in relation to each other, so that one is closed, while the other is open, a solenoid adapted to be energized through the said closed switch and reverse the position of the said switches, the solenoid being de-energized after the said switches are reversed, and mechanical means to return the said switches to their original position to cause them to be opened and closed alternately.

3. In a switching apparatus, a master control comprising a switch unit, adapted to operate similar units, consisting of a solenoid, a pair of pivotally mounted mercury tube switches in operable connection with the said solenoid, the said switches being angularly disposed in relation to each other, so that one is closed, while the other is open, means to energize the solenoid through the said closed switch to cause the position of the said switches to be reversed and the solenoid thereby de-energized, and mechanical means to again reverse the position of the said switches, while the said solenoid is de-energized, to continue this cycle of operation.

4. In a switching apparatus, a master control comprising a switch unit, adapted to operate similar units, consisting of a solenoid, an oscillating lever operably connected thereto, a pair of mercury tube switches adjustably secured to the lever, the said switches being angularly disposed in relation to each other, so that one is closed, while the other is open, means to admit current into the solenoid for energizing purposes through the said closed switch to cause the said lever to be tilted and the position of the said switches to be reversed, the opening of the said closed switch de-energizing the said solenoid, and a spring to tilt the said lever back to its original position, while the said solenoid is in a de-energized state, whereby the said solenoid is again energized and the sequence of operations repeated.

5. In a switching apparatus, a master control comprising a switch unit, adapted to operate similar units, consisting of a solenoid, a bracket having stop members, an oscillating lever fulcrumed within the bracket and operably connected to the said solenoid, a pair of mercury tube switches adjustably secured to the lever and angularly disposed in relation to each other, so that one is closed, while the other is open, the said oscillating lever having an extension of fabric adapted to limit its travel between the stop members of the said bracket, means to admit current into the solenoid for energizing purposes through the said closed switch to cause the said lever to be tilted and the position of the said switches to be reversed, the opening of the said closed switch de-energizing the said solenoid, and a spring to tilt the said lever back to its original position, while the said solenoid is in a de-energized state, whereby the said solenoid is again energized and the sequence of operations repeated.

6. In a switching apparatus, a master control comprising a switch unit, adapted to operate similar units, consisting of a solenoid, a bracket having stop members, an oscillating lever fulcrumed within the bracket and operably connected to the said solenoid, a support mounted on top of the said lever in spaced relation to the said bracket, a pair of switch holders adjustably fastened to the said support, a pair of mercury tube switches within the said holders, the said switches being angularly disposed in relation to each other, so that one is closed, while the other is open, the said oscillating lever having an extension of fabric adapted to limit its travel between the stop members of the said bracket, means to admit current into the solenoid for energizing purposes through the said closed switch to cause the said lever to be tilted and the position of the said switches to be reversed, the opening of the said closed switch de-energizing the said solenoid, and a spring to tilt the said lever back to its original position, while the said solenoid is in a de-energized state, whereby

the said solenoid is again energized and the sequence of operations repeated.

7. In a switching apparatus a master control comprising a switch unit, adapted to operate similar units, consisting of a solenoid, a bracket having stop members, an oscillating lever fulcrumed within the bracket and operably connected to the said solenoid, a support mounted on top of the said lever in spaced relation to the said bracket, a pair of switch holders adjustably fastened to the said support, a pair of mercury tube switches within the said holders, the said switches being angularly disposed in relation to each other, so that one is closed, while the other is open, a standard mounted upon the said support having a weight eccentrically secured to its top to vary the momentum of the said oscillating lever for purposes of adjusting its speed, the said oscillating lever having an extension of fabric adapted to limit its travel between the stop members of the said bracket, means to admit current into the solenoid for energizing purposes through the said closed switch to cause the said lever to be tilted and the position of the said switches to be reversed, the opening of the said closed switch de-energizing the said solenoid, and a spring to tilt the said lever back to its original position, while the said solenoid is in a de-energized state, whereby the said solenoid is again energized and the sequence of operations repeated.

In testimony whereof I have hereunto set my hand.

LLEWELLYN T. BARNES.