Aug. 28, 1934. A. W. KRIEGER 1,971,614

CIRCUIT CONTROLLING DEVICE

Filed Oct. 26, 1933 2 Sheets-Sheet 1

Fig. 1

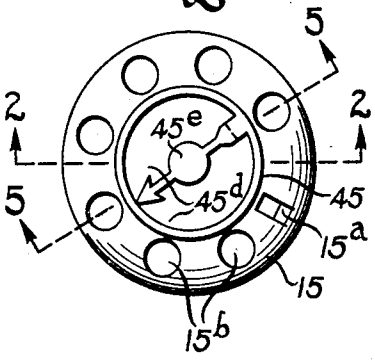


Fig. 4

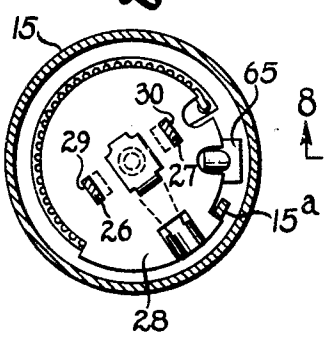


Fig. 7

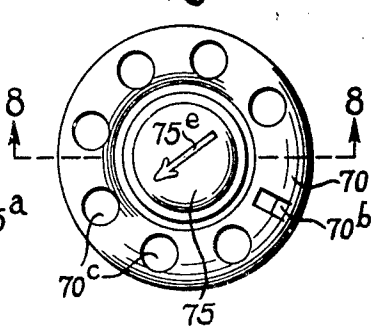


Fig. 2

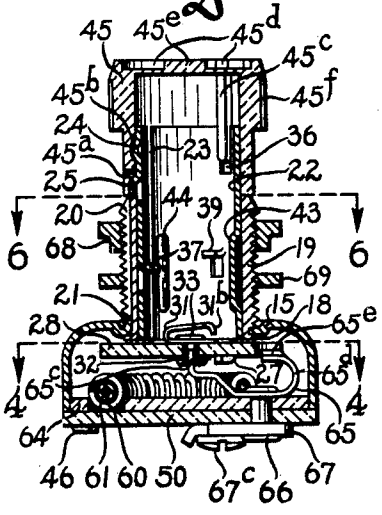


Fig. 5

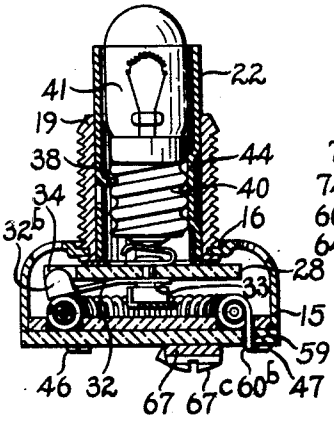


Fig. 8

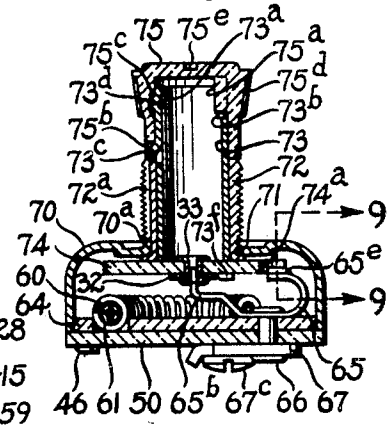


Fig. 9

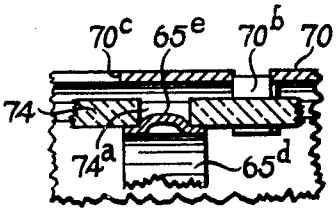


Fig. 3

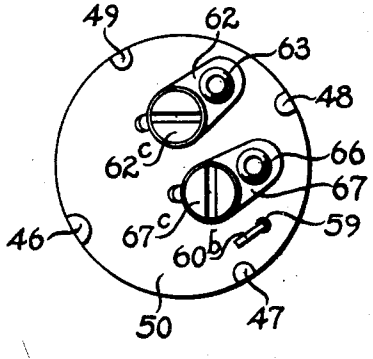
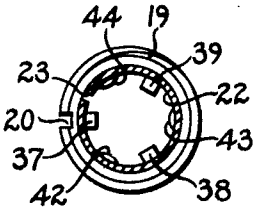


Fig. 6



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CIRCUIT CONTROLLING DEVICE

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Fig. 10

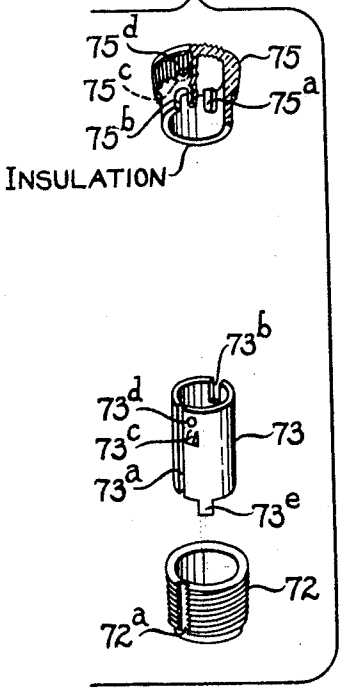


Fig. 11

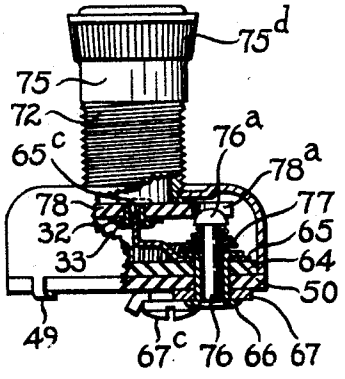
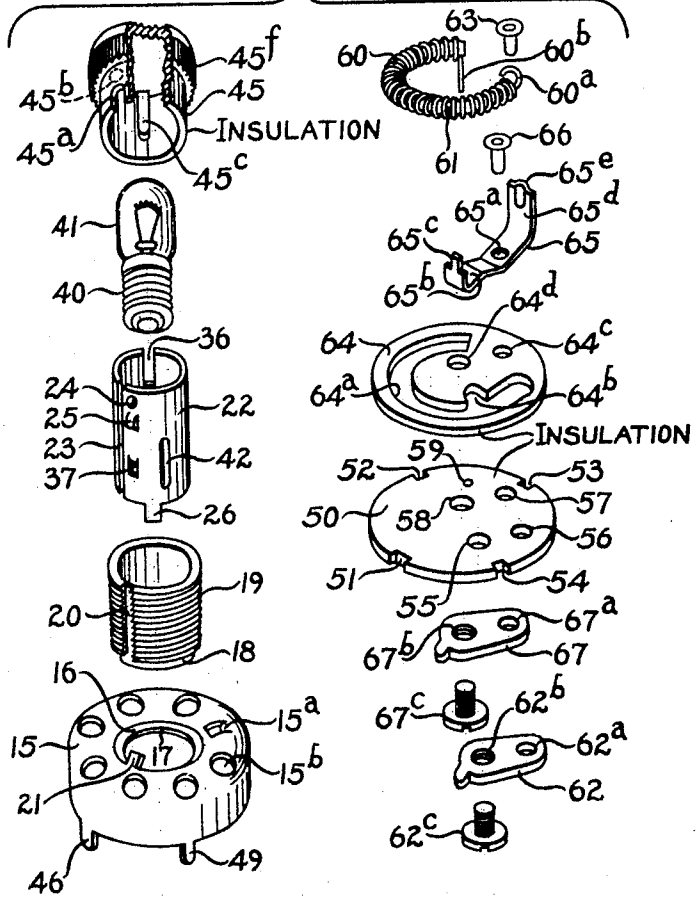


Fig. 12



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UNITED STATES PATENT OFFICE

1,971,614

CIRCUIT CONTROLLING DEVICE

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Application October 26, 1933, Serial No. 695,336

20 Claims. (Cl. 201—56)

This invention relates to improvements in circuit controlling devices, and more particularly to improvements in rheostats for control of relatively low voltage circuits.

An object of the invention is to generally improve and simplify the details of construction and assembly of the parts of devices of the aforementioned character.

Another object is to improve the operating characteristics of such devices.

Another object is to provide a novel form of actuating shaft for the movable contactor of the device.

Another object is to provide an improved form of insulating operating knob for cooperation with an actuating shaft of the character aforementioned.

Another object is to provide improved means for supporting and cooling the rheostat resistor.

Another object is to provide an improved form of combined rheostat and indicating light.

Another object is to provide a novel arrangement of the indicating light supporting elements with respect to the rheostat parts.

Another object is to standardize a maximum number of the parts employed in constructing rheostats both with and without associated indicating lights.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate certain embodiments of the invention which will now be described, it being understood that the embodiments illustrated are susceptible of modification in certain details thereof without departing from the scope of the appended claims.

In the drawings, Figure 1 is a top plan view of a rheostat with an indicating light, as constructed in accordance with my invention,—the clamping nuts of Fig. 2 being omitted for purposes of illustration.

Fig. 2 is a vertical sectional view on the line 2—2 of Fig. 1,—the electric lamp being omitted.

Fig. 3 is a bottom plan view of the device illustrated in Figs. 1 and 2.

Fig. 4 is a horizontal sectional view on the line 4—4 of Fig. 2.

Fig. 5 is a vertical sectional view on the line 5—5 of Fig. 1,—the lamp being shown in position, the operating knob and clamping nuts being omitted, and the actuating shaft having been rotated clockwise through an angle of approximately 120 degrees from the position thereof shown in Figs. 1 and 2.

Fig. 6 is a horizontal sectional view on the line 6—6 of Fig. 2,—the bushing and the actuating shaft only being illustrated.

Fig. 7 is a top plan view of a form of rheostat without an indicating light, as constructed in accordance with my invention,—the usual clamping nuts being omitted for clarity of illustration.

Fig. 8 is a vertical sectional view on the line 8—8 of Fig. 7.

Fig. 9 is an enlarged fragmentary sectional view on the line 9—9 of Fig. 8.

Fig. 10 is a perspective view, in separated relation, of certain of the parts shown in Figs. 7 and 8,—a portion of the operating knob being broken away.

Fig. 11 is a side elevational view of a rheostat like that shown in Fig. 8,—a portion of the rheostat being shown in vertical section to illustrate a modified form of device for indicating to the touch the circuit making and circuit breaking positions of the contactor, and

Fig. 12 is a perspective view, in separated relation of the parts of the device illustrated in Figs. 1 to 6,—the clamping nuts of Fig. 2 being omitted.

In all figures of the drawings, except Fig. 9, a scale of one and one-half times normal size is employed,—Fig. 9 being drawn to a scale of approximately three times normal size.

Referring first to Figs. 1 to 6 and 12, the numeral 15 designates a housing formed of a single piece of sheet metal, said housing being of inverted cup-shape. The upper end of said housing is slightly depressed to provide a flat portion 16 of circular contour, said flat portion 16 being provided with a substantially circular opening 17 within which the reduced lower end 18 of an externally threaded hollow metal bushing 19 is adapted to fit,—said end 18 being upset over the inner surface of the housing (as shown in Figs. 2 and 5) to rigidly and permanently secure the latter and said bushing to each other.

Bushing 19 is provided with the usual vertical groove 20 to accommodate the key or lug formed upon a suitable dial or indicating plate (not shown). For purposes of my invention it is necessary to insure securement of the bushing 19 and housing 15 in a given rotary relationship to each other, and accordingly the housing 15 is provided with an integral lug 21 which is adapted to fit into the aforementioned groove 20, as best illustrated in Fig. 2. While upsetting of the lower end 18 of the bushing is normally sufficient to prevent relative rotation thereof with respect to housing 15, the engagement of lug 21 with the walls of groove 20 will additionally and positively insure against relative movement of said parts.

The actuating shaft 22 of the rheostat is of split tubular form,—the same preferably consisting of a punched and stamped sheet metal plate which is bent to the shape best illustrated in Fig. 12. Shaft 22 is provided adjacent to the upper edge thereof and adjacent to the split 23 with an integral boss or projection 24 of the form illustrated in Figs. 2 and 12. In a predetermined plane below the plane of boss 24, and preferably in vertical alinement with the latter, is a lug 25 sheared at the bottom and sides thereof from shaft 22 and bent outwardly with respect thereto, whereby upon downward insertion of said shaft into bushing 19 the lower edge of lug 25 will engage the upper end of the bushing to insure exposure of a given portion of the upper end of the shaft.

The arrangement is preferably such that the main body of the lower end of shaft 22 is located substantially flush with the lower end of said bushing, said shaft being provided with a pair of diametrically opposed integral lugs 26 and 27 which extend below said bushing. I provide a flat punched plate 28 of insulation, said plate having openings 29 and 30 through which the respective lugs 26 and 27 are adapted to extend, said lugs being bent inwardly toward each other over the lower surface of said plate, as shown at 27 in Fig. 2 and as indicated in dotted lines in Fig. 4.

Plate 28 is provided on its upper face with a center lamp contact 31 and on its lower face with a rheostat contactor 32, said contact and said contactor being formed of a resilient or springy metal, and the same being mechanically connected to plate 28 and electrically connected with each other as by means of an eyelet 33 (see Fig. 12). After attachment of said parts to plate 28 the free end of contact 31 is bent or reflexed along the dotted line 31^a (Fig. 12), said contact end having an angularly extending lug or nib 31^b to prevent excessive bending thereof by the center contact of a lamp as best illustrated in Figs. 2 and 5. The free end of contactor 32 is angled downwardly with respect to plate 28, and the same is provided with a pair of substantially parallel ears 32^a, 32^b which extend upwardly into the plane of plate 28,—the latter being provided with a notch or cut-away portion 34 to provide clearance therefor. Upsetting of eyelet 33 will ordinarily prevent rotary movement of plate 28 relatively to contactor 32, and as best illustrated in Fig. 5 the walls of notch 34 will cooperate with said ears 32^a, 32^b to further insure against such relative movement.

In order to insure a proper electrical connection between shaft 22 and bushing 19 I prefer to interpose between plate 28 and the lower end of said bushing a metal ring or washer 35 of the form best illustrated in Fig. 12, said ring having notches 35^a, 35^b to accommodate with a snug fit the aforementioned lugs 26 and 27, and the latter when bent in the manner aforedescribed being adapted to draw said ring fairly tightly against the lower end of shaft 22 and into frictional or sliding engagement with the lower end of bushing 19. Other means might be employed to insure proper electrical engagement between shaft 22 and bushing 19, as by extending outwardly from the former one or more lugs or bosses to resiliently engage the inner surface of the latter.

As shown in Figs. 2 and 12 the shaft 22 is provided at the upper end thereof with a vertical notch 36. Shaft 22 is provided with a plurality of lugs partially sheared therefrom and bent inwardly, as indicated at 37, 38 and 39, said lugs being angularly and vertically spaced relatively to each other to cooperatively engage the thread upon the screw shell contact 40 of a suitable electric lamp the major portion of the bulb 41 of which is adapted to be positioned within the shaft 22. In the particular form of the device as illustrated the diameter of the screw shell contact 40 is substantially less than the internal diameter of shaft 22, and accordingly I prefer to provide the latter with a plurality of inwardly pressed beads or ridges 42, 43 and 44, whereby the lamp will be properly centered with respect to said shaft.

The operating knob of the device preferably comprises a hollow molded insulating member 45 which is adapted to telescope onto the upper end of shaft 22, said knob having a notch 45^a in the lower edge thereof for cooperation with the boss 24 and lug 25 aforementioned to insure assembly in only one rotary relation of said parts. Due to the presence of the slit 23 in shaft 22 the latter is rendered compressible to an extent sufficient to permit the inner wall of member 45 to pass downwardly over boss 24, said inner wall being provided with a depression or undercut 45^a into which said boss is adapted to snap to releasably restrain member 45 and shaft 22 against separation. The inner wall of member 45 is further provided with an integral flat-sided rib 45^c which fits into the notch 36 in the upper end of said shaft to positively restrain the latter and said member 45 against rotary movement relatively to each other.

The recess in member 45 is sufficiently large to provide clearance for the projecting upper end of lamp bulb 41. Inasmuch as the lamp bulb is entirely enclosed by the shaft 22 and member 45 I mold the latter from insulating material of translucent character. Electrical insulating molding compositions having the aforementioned characteristics are well known in the art and need not be described in detail herein. In carrying out my invention, however, I prefer to mold the member 45 with an upper end wall at least certain portions or areas 45^d of which are relatively thin to permit ready passage of light rays from the lamp when the latter is illuminated. Also I prefer to provide in said upper end wall a relatively thick portion or portions 45^e,—said thick portion preferably being in the form of a suitable outline or indicator which is thrown into accentuated relief with respect to the relatively thin portion when the lamp is lit. The periphery of knob 45 is preferably grooved or otherwise roughened as indicated at 45^f to facilitate manual operation thereof.

The housing 15 is preferably provided with a plurality of integral lugs 46, 47, 48 and 49,—one of said lugs 46 being of a width or size different from that of the other lugs. I also employ a flat punched insulating plate 50 which is provided with peripheral notches 51, 52, 53 and 54 to register respectively with the lugs 46 to 49 aforementioned,—said lugs being bent inwardly over the lower surface of said plate to retain the latter in assembled relation to the housing. Plate 50 is provided with four openings 55, 56, 57 and 58 of substantially identical size, and a relatively smaller opening 59.

The resistor of the rheostat preferably comprises a wire composed of an alloy of nickel and chromium, said wire being wound into the form of a helix as illustrated. I prefer to locate within the helix a core 61 comprising a suitable

length of multiple-strand copper wire having a covering of asbestos fibers. Said core will assist in supporting the individual turns of the helix, and the same also acts to increase the rate of dissipation of the heat generated in the resistor. The helix 60 is bent to arcuate form as illustrated, and a coil at one end thereof is bent to provide an attaching loop 60^a which lies in the plane of the lower surface of the helix. Said helix is positioned upon the upper surface of plate 50 with loop 60^a in registry with the aforementioned opening 56, and a terminal plate 62 is positioned upon the lower surface of plate 50 with its opening 62^a (Fig. 12) in registry with said opening 56. An eyelet 63 is then passed through loop 60^a and openings 56 and 62^a and then upset to secure said terminal plate and one end of helix 60 to plate 50 and to electrically connect the same with each other. Plate 62 is provided with a tapped opening 62^b to receive the usual binding screw 62^c,—the opening 55 in plate 50 providing clearance for the shank of said screw.

Helix 60 is provided at the other end thereof with an uncoiled portion 60^b which is inserted downwardly through opening 59, said end being bent over the lower face of plate 50 and then cut by means of a suitable tool to the length thereof shown in Fig. 3. To insure against distortion of helix 60 from the arcuate form thereof illustrated I prefer to employ an additional flat punched plate 64 of insulation,—the same being superimposed upon plate 50 and having an arcuate slot 64^a to accommodate the helix and to restrain the latter against substantial movement in a horizontal plane. Plate 64 is notched as indicated at 64^b to provide clearance for the shank of screw 62^c, and said plate is further provided with a pair of openings 64^c and 64^d to register with the aforementioned openings 57 and 58.

Superimposed upon plate 64 is a resilient metal member 65, the same having a horizontal portion provided with an opening 65^a. An eyelet 66 is adapted to penetrate the openings 65^a, 64^c and 57 and an opening 67^a in a terminal plate 67 located upon the lower surface of plate 50, said eyelet having one end thereof upset to retain all of said parts in assembled relation. Terminal plate 67 is provided with a tapped opening 67^b to receive the usual binding screw 67^c,—the openings 58 and 64^d in plates 50 and 64 respectively affording clearance for the shank of said screw. Member 65 is provided with an arm 65^b offset upwardly from base 50 and said arm comprises a vertical portion having a reduced and shouldered upper end 65^c,—the reduced end of which is adapted to fit into the opening in eyelet 33 and the shoulders of which are adapted to bear against the lower end of said eyelet (see Fig. 2) to provide an electrical connection between the terminal plate 67 and the rheostat contactor 32 and center lamp contact 31.

Member 65 is provided with a second arm 65^d which is reflexed to extend upwardly and then inwardly into frictional engagement with the lower surface of plate 28 (see Fig. 2). The end of reflexed arm 65^d is provided with an upwardly extending boss or projection 65^e which is adapted to snap into and fit snugly between the walls of the respective notches 28^a and 28^b. The arrangement is such that when knob 45 is moved in a counter-clockwise direction to the position thereof indicated in Fig. 1 said boss 65^e will snap into engagement with the walls of notch 28^a in plate 28 to indicate to the touch that the rheostat contactor has been moved entirely out of engagement with the rheostat resistor 60 whereby the circuit of the controlled motor and the circuit of lamp 41 are interrupted. Upon a slight movement of knob 45 in a clockwise direction from the position thereof last mentioned the boss 65^e will snap into engagement with the walls of notch 28^b to indicate to the touch that the rheostat contactor 32 is engaged with resistor 60 at a point closely adjacent to the point of connection of the latter to terminal plate 62, whereby substantially full voltage is applied to the motor terminals to insure starting thereof. After the motor (not shown) has been started the speed thereof may be reduced gradually by continued movement of knob 45 in a clockwise direction to increase the amount of the resistance of resistor 60 included in the motor circuit.

In order to positively limit the degree of rotation of knob 45 and its associated parts in each direction, I prefer to provide upon plate 28 a pair of integral radial shoulders 28^c and 28^d arranged in spaced relation to each other on opposite sides of the aforementioned notch 34,—the shoulder 28^c being adapted to engage a lug 15^a (sheared and struck downwardly from the upper end of housing 15) when the parts are in the circuit breaking position thereof, and the shoulder 28^d being adapted to engage said lug 15^a when the parts are rotated to their opposite extreme position wherein substantially all of the resistance of resistor 60 is included in the controlled circuit. Housing 15 is provided with a multiplicity of openings 15^b to afford ventilation and cooling of the rheostat resistor.

In practice one terminal of the controlled motor is connected with terminal plate 67, and one terminal of the battery is connected with terminal plate 62,—the other terminals of the motor and battery and the metal bushing 19 being grounded in the usual manner. The device herein disclosed is particularly applicable to the control of fractional horse-power motors such as are employed for driving the fans of hot-water-type heaters for automobiles. To install the device a single hole may be provided in the dashboard of an automobile, and after attaching the proper circuit wires to the terminal plates 62 and 67 the knob 45 and one of the clamping nuts 68 are removed,—the nut 69 being properly adjusted to correspond with the thickness of the dashboard. After insertion of the bushing 19 through the hole from the rear toward the front of the dashboard the nut 68 is applied to clamp the device in position and the knob 45 is then applied to the outer end of the shaft 22 by a straight-line telescoping movement.

In the device illustrated in Figs. 7 and 8 the insulating plates 50 and 64 and the parts carried thereby are identical with those aforedescribed and the same have been given corresponding characters of reference. The housing 70 may be formed from a metal blank identical with that employed for formation of housing 15. However, the opening 71 in housing 70 is made relatively small to accommodate the reduced lower end of the externally threaded hollow metal bushing 72,—said bushing having a vertical groove 72^a and housing 70 having a lug 70^a to cooperatively engage the same. The relatively small tubular shaft 73 is provided with a vertical slit 73^a, a notch 73^b in the upper edge thereof, and an outwardly extending lug 73^c and boss 73^d corresponding to the lug 25 and boss 24 aforedescribed. Shaft 73 is provided at its lower end with a pair of diametrically opposed lugs 73^e (Fig. 10) and 73^f (Fig. 8).

As will be understood the lugs 73e, 73f of shaft 73 are less widely spaced than the aforementioned lugs 26, 27 of shaft 22,—and the flat punched insulating plate 74 is provided with openings (not shown) to register with lugs 73e, 73f. Said lugs are bent away from each other over the lower face of plate 74, as indicated at 73f in Fig. 8, to provide clearance between the same and the rheostat contactor 32. An eyelet 33 like that aforedescribed may be employed to secure contactor 32 to plate 74. Plate 74 is otherwise identical with the plate 28 aforedescribed, the same having a peripheral notch 74a (corresponding with notch 28a) to receive the boss 65e of arm 65d of member 65 in the circuit breaking position of the parts, and said plate being provided with a notch to receive the upwardly extending ears of contactor 32, a notch corresponding with notch 28b aforedescribed, and shoulders corresponding with the shoulders 28c, 28d of plate 28. Housing 70 is provided with a sheared and downwardly struck lug 70b to cooperate with the shoulders on plate 74. Housing 70 is provided with lugs corresponding in size and function with the lugs 46 to 49 aforedescribed (see 46, Fig. 8, and 49, Fig. 11).

The knob 75 need not be composed of translucent insulating material, and accordingly I prefer to mold the same from a phenol formaldehyde condensation product. Knob 75 is recessed to accommodate the upper end of shaft 73,—the same having a projection 75a to enter the notch 73b, a notch 75b and depression 75c to accommodate the lug 73c and boss 73d respectively, and a grooved or roughened periphery 75d to facilitate manipulation thereof. The upper surface of knob 75 may have a depression, of the character indicated at 75e formed therein, said depression being preferably filled or coated with white enamel or other material having a distinguishing color as compared with the color of said knob 75. Ventilating openings 70c may be provided in the housing 70. The manner in which the boss 65e snaps into engagement with the notch 74a, for instance, is shown in enlarged detail in Fig. 9.

In the modification shown in Fig. 11 most of the parts are substantially like those shown in Figs. 7 to 10 and have been given corresponding numerals of reference. In Fig. 11, however, the member 65 is not provided with the reflexed arm 65d aforementioned; but instead thereof a bolt 76 has its shank slidable within the opening in eyelet 66,—the rounded upper end 76a of said bolt being biased by a coiled compression spring 77 into engagement with the walls of a notch 78a provided in the flat punched insulating plate 78,—said notch 78a (corresponding with the off position of the rheostat) and the other notch (corresponding with the initial circuit making position of the rheostat) extending radially inwardly to a slightly greater extent than the notches 74a (Fig. 8) and 28a, 28b (Fig. 12) aforedescribed. The spring 77 is of substantially conical shape as illustrated to provide for employment of a wire of the required size in formation thereof while permitting compression of the helix without interference between the respective turns thereof. Moreover the enlarged lower end of spring 77 permits the same to surround the flange at the upper end of eyelet 66 whereby employment of a spring having the desired vertical dimension when compressed is permitted.

What I claim as new and desire to secure by Letters Patent is:

1. In a rheostat, in combination, an inverted cup-shaped sheet metal housing, a flat punched plate of insulating material against which the lower edge of said housing is adapted to seat, said plate having a plurality of peripheral notches, one of said notches being of greater width than other of the same, said housing having a corresponding number of lugs so shaped as to provide for a fit thereof within said notches in only one rotary relation of said parts, said lugs being bent inwardly over the lower face of said plate to retain the same in assembled relation to said housing, a helical resistor wire arcuately arranged upon and secured to the upper face of said plate, a pair of wiring terminal members positioned upon the lower face of said plate, one of said terminal members being electrically connected with one end of said resistor wire, an externally threaded hollow metal bushing secured to the upper end of said housing, a hollow shaft penetrating said bushing and having portions thereof projecting from each end of the latter, a flat punched plate of insulating material to which the lower end portion of said shaft is permanently connected to provide for driving of the former by the latter, a contactor biased into the plane of said resistor wire, an eyelet penetrating said contactor and said last mentioned plate to secure the same against rotary movement relatively to each other, a metal member having a reduced end portion resiliently engaging the walls of said eyelet and means for electrically and mechanically connecting said metal member with the other of said terminal members.

2. In a rheostat, in combination, an inverted cup-shaped sheet metal housing, a flat punched plate of insulating material against which the lower edge of said housing is adapted to seat, said plate having a plurality of peripheral notches, one of said notches being of greater width than other of the same, said housing having a corresponding number of lugs so shaped as to provide for a fit thereof within said notches in only one rotary relation of said parts, said lugs being bent inwardly over the lower face of said plate to retain the same in assembled relation to said housing, a helical resistor wire arcuately arranged upon and secured to the upper face of said plate, a pair of wiring terminal members positioned upon the lower face of said plate, one of said terminal members being electrically connected with one end of said resistor wire, an externally threaded hollow metal bushing secured to the upper end of said housing, a hollow shaft penetrating said bushing and having portions thereof projecting from each end of the latter, a flat punched plate of insulating material to which the lower end portion of said shaft is permanently connected to provide for driving of the former by the latter, a contactor biased into the plane of said resistor wire, an eyelet penetrating said contactor and said last mentioned plate to secure the same against rotary movement relatively to each other, a metal member having a reduced end portion resiliently engaging the walls of said eyelet, means for electrically and mechanically connecting said metal member with the other of said terminal members, means providing for resiliency of the upper end of said shaft, a molded hollow insulating knob, said knob and said shaft being formed to provide a snap catch therebetween upon telescoping thereof, and means formed integrally with said knob and said shaft to positively insure against rotation thereof relatively to each other.

3. In a device of the character described, in

combination, an inverted cup-shaped sheet metal housing, an externally threaded hollow metal bushing rigidly and permanently secured to the upper end of said housing, a cylindrical hollow shaft formed of resilient metal, said shaft having a vertical slit extending throughout the length thereof, said shaft being insertable downwardly through said bushing and having a lug struck outwardly therefrom to engage the upper end of said bushing, said shaft having a plurality of lugs formed integrally therewith and adapted to project beyond the lower end of said bushing, a flat punched plate of insulating material having openings to accommodate said last mentioned lugs and over the lower face of which the latter are bent to retain said parts in assembled relation, a metal member secured to said plate and having a resilient arm extending radially of the latter to provide a contactor, a helically wound resistor wire with which said contactor is adapted to engage, an insulating base upon which the helical resistor is supported in arcuate formation, a pair of wiring terminal elements exposed upon the lower surface of said base, one of said terminal elements being electrically connected with one end of said resistor, and means providing an electrical connection between the other of said terminal elements and said contactor.

4. In a device of the character described, in combination, an inverted cup-shaped sheet metal housing, an externally threaded hollow metal bushing rigidly and permanently secured to the upper end of said housing, a cylindrical hollow shaft formed of resilient metal, said shaft having a vertical slit extending throughout the length thereof, said shaft being insertable downwardly through said bushing and having a lug struck outwardly therefrom to engage the upper end of said bushing, said shaft having a plurality of lugs formed integrally therewith and adapted to project beyond the lower end of said bushing, a flat punched plate of insulating material having openings to accommodate said last mentioned lugs and over the lower face of which the latter are bent to retain said parts in assembled relation, a metal member rigidly secured centrally of said plate and having a resilient arm extending radially of the latter to provide a contactor, a helically wound resistor wire with which said contactor is adapted to engage, an insulating base upon which the helical resistor is supported in arcuate formation, a pair of wiring terminal elements exposed upon the lower surface of said base, one of said terminal elements being electrically connected with one end of said resistor, means providing an electrical connection between the other of said terminal elements and said contactor, a molded insulating knob having a substantially cylindrical recess to accommodate the upper end of said shaft, and said upper end of said shaft and the walls of said recess being cooperatively formed to provide for telescopic engagement thereof with a snap action in only one rotary relation of said parts and to restrain said parts against rotation relatively to each other.

5. In a device of the character described, in combination, an inverted cup-shaped sheet metal housing, an externally threaded hollow metal bushing rigidly and permanently secured to the upper end of said housing, a cylindrical hollow shaft formed of resilient metal, said shaft having a vertical slit extending throughout the length thereof, said shaft being insertable downwardly through said bushing and having a lug struck outwardly therefrom to engage the upper end of said bushing, said shaft having a plurality of lugs formed integrally therewith and adapted to project beyond the lower end of said bushing, a flat punched plate of insulating material having openings to accommodate said last mentioned lugs and over the lower face of which the latter are bent to retain said parts in assembled relation, a metal member rigidly secured centrally of said plate and having a resilient arm extending radially of the latter to provide a contactor, a helically wound resistor wire with which said contactor is adapted to engage, an insulating base upon which the helical resistor is supported in arcuate formation, a pair of wiring terminal elements exposed upon the lower surface of said base, one of said terminal elements being electrically connected with one end of said resistor, means providing an electrical connection between the other of said terminal elements and said contactor, a molded insulating knob having a substantially cylindrical recess to accommodate the upper end of said shaft, said upper end of said shaft being provided with a boss and a notch and the walls of said recess being provided with a depression and a projection to respectively cooperate with said boss and said notch to provide for telescopic engagement of said knob and said shaft with a snap action in only one rotary relation of said parts and to restrain said parts against rotation relatively to each other, said knob having an indicating element formed upon the upper surface thereof and arranged in a given rotary relation to said depression and said projection.

6. In a rheostat, in combination, a flat punched plate of insulation, a pair of wiring terminal elements positioned upon the lower face of said plate, a helically wound resistor wire arranged in arcuate formation upon the upper face of said plate and having the ends thereof secured to said plate, one of said ends being electrically connected with one of said terminal elements, a relatively smaller flat punched plate of insulation superimposed upon said first mentioned plate and having an arcuate slot to accommodate said helix, the walls of said slot cooperating with said helix to prevent substantial displacement thereof relatively to said first mentioned plate, a metal member positioned upon the upper face of said second mentioned plate, said member having a portion thereof bent upwardly at an angle to said second mentioned plate to provide a resilient arm, said arm having a reduced and shouldered end portion located substantially centrally of said plate and extending upwardly at substantially a right angle thereto, and an eyelet penetrating said member, said plates and the other of said terminal elements to secure said parts in assembled relation to each other.

7. In combination, a resistor consisting of a wire composed of an alloy of nickel and chromium, said wire being wound into the form of a helix having the turns thereof slightly spaced from each other, an insulating base upon which said helix is arranged in arcuate formation and to which the ends thereof are attached, and a core located within said helix and supported by the latter, said core acting to resist endwise movement of the respective turns of said helix relatively to each other and to assist in dissipating the heat generated by said helix, said core comprising a multiple-strand copper wire having a flexible fireproof insulating covering formed thereon.

8. In combination, a resistor consisting of a wire composed of an alloy of nickel and chromium, said wire being wound into the form of a helix having the turns thereof slightly spaced from each other, an insulating base upon which said helix is arranged and to which the ends of said helix are attached, a core located within said helix and supported by the latter, said core acting to resist endwise movement of the respective turns of said relix relatively to each other and to assist in dissipating the heat generated by said helix, said core comprising a multiple-strand copper wire having an asbestos covering formed thereon, a pair of wiring terminal elements located upon the lower surface of said base, one of said wiring terminal elements being mechanically and electrically connected to one end of said helix, a single-arm contactor cooperable with said helix and supported independently of said base, and means comprising a resilient conductor adapted to provide an electrical connection between said contactor and the other of said terminal elements.

9. In a rheostat for control of relatively low voltage circuits, in combination, an inverted cup-shaped sheet metal housing, said housing having in the top thereof a relatively large central opening and a multiplicity of relatively smaller openings surrounding said central opening, an externally threaded hollow metal bushing, said bushing having a reduced lower end portion inserted into said opening and upset over the inner surface of said housing, said bushing having a vertical groove and said housing having a lug positioned within said groove to positively restrain said parts against relative rotation, a punched and stamped sheet metal plate, said plate being bent to provide a longitudinally split shaft of substantially cylindrical form, said shaft having a lug struck outwardly therefrom adjacent to said split and engageable with the upper end of said bushing to insure exposure of a given length of the upper end portion of said shaft, said shaft having a boss formed thereon in a plane above the aforementioned lug and a notch extending downwardly from the upper edge thereof, a molded insulating knob having a recess to accommodate the upper end of said shaft, said knob having a notch in the lower edge thereof for cooperation with said lug to guide said parts into proper telescopic engagement with each other, the wall of said recess having a depression formed therein to accommodate said boss whereby said parts are engaged with a snap action, and the wall of said recess also having a projection formed integrally therewith for cooperation with the notch in said shaft, whereby said knob and said shaft are positively restrained against rotation relatively to each other.

10. In a rheostat for control of relatively low voltage circuits, in combination, an inverted cup-shaped sheet metal housing, said housing having in the top thereof a relatively large central opening and a multiplicity of relatively smaller openings surrounding said central opening, an externally threaded hollow metal bushing, said bushing having a reduced lower end portion inserted into said opening and upset over the inner surface of said housing, said bushing having a vertical groove and said housing having a lug positioned within said groove to positively restrain said parts against relative rotation, a punched and stamped sheet metal plate, said plate being bent to provide a longitudinally split shaft of substantially cylindrical form, said shaft having a lug struck outwardly therefrom adjacent to said split and engageable with the upper end of said bushing to insure exposure of a given length of the upper end portion of said shaft, said shaft having a boss formed thereon in a plane above the aforementioned lug and a notch extending downwardly from the upper edge thereof, a molded insulating knob having a recess to accommodate the upper end of said shaft, said knob having a notch in the lower edge thereof for cooperation with said lug to guide said parts into proper telescopic engagement with each other, the wall of said recess having a depression formed therein to accommodate said boss whereby said parts are engaged with a snap action, the wall of said recess also having a projection formed integrally therewith for cooperation with the notch in said shaft, whereby said knob and said shaft are positively restrained against rotation relatively to each other, said shaft having a pair of lugs formed integrally with the lower end thereof and adapted to extend below said bushing, and a flat punched plate of insulation having openings to accommodate said lugs and over the lower surface of which said lugs are bent to positively restrain said shaft and said bushing against substantial movement longitudinally of each other.

11. In a rheostat for control of relatively low voltage circuits, in combination, an inverted cup-shaped sheet metal housing, said housing having in the top thereof a relatively large central opening and a multiplicity of relatively smaller openings surrounding said central opening, an externally threaded hollow metal bushing, said bushing having a reduced lower end portion inserted into said opening and upset over the inner surface of said housing, said bushing having a vertical groove and said housing having a lug positioned within said groove to positively restrain said parts against relative rotation, a punched and stamped sheet metal plate, said plate being bent to provide a longitudinally split shaft of substantially cylindrical form, said shaft having a lug struck outwardly therefrom adjacent to said split and engageable with the upper end of said bushing to insure exposure of a given length of the upper end portion of said shaft, said shaft having a boss formed thereon in a plane above the aforementioned lug and a notch extending downwardly from the upper edge thereof, a molded insulating knob having a recess to accommodate the upper end of said shaft, said knob having a notch in the lower edge thereof for cooperation with said lug to guide said parts into proper telescopic engagement with each other, the wall of said recess having a depression formed therein to accommodate said boss whereby said parts are engaged with a snap action, the wall of said recess also having a projection formed integrally therewith for cooperation with the notch in said shaft, whereby said knob and said shaft are positively restrained against rotation relatively to each other, said shaft having a pair of lugs formed integrally with the lower end thereof and adapted to extend below said bushing, a flat punched plate of insulation having openings to accommodate said lugs and over the lower surface of which said lugs are bent to positively restrain said shaft and said bushing against substantial movement longitudinally of each other, a resilient contactor located upon the lower surface of said plate having an end portion thereof secured to said plate

substantially centrally of the latter, the free end of said contactor being bent downwardly from said plate and having a pair of upwardly extending substantially parallel ears, and said plate having a notch to accommodate said ears.

12. In a rheostat for control of relatively low voltage circuits, in combination, an inverted cup-shaped sheet metal housing, an externally threaded metal bushing secured to the upper end of said housing and having a passage communicating with the interior of the latter, a longitudinally split tubular shaft formed of stamped sheet metal, said shaft being insertable downwardly into said bushing and having a projection engageable with the upper end of the latter to insure exposure of a given portion of the upper end of said shaft, a hollow molded insulating knob telescopically engaged with the upper end of said shaft and positively interlocked therewith against rotation relatively thereto, said knob and said shaft having parts formed integrally therewith to provide a snap catch therebetween upon telescoping thereof, said shaft having a plurality of lugs formed integrally with the lower end thereof, a flat punched plate of insulation having openings through which said lugs extend, said lugs being bent over the lower surface of said plate to rigidly secure the same and said shaft and bushing in assembled relation to each other, a flat metal ring interposed between said plate and the lower end of said bushing, said ring having notches formed therein and with the walls of which said lugs are adapted to engage to insure a proper electrical connection between said shaft and said bushing, and said shaft being formed interiorly to provide for cooperative engagement therewith of the screw shell contact of an electric lamp.

13. In a rheostat for control of relatively low voltage circuits, in combination, an inverted cup-shaped sheet metal housing, an externally threaded metal bushing secured to the upper end of said housing and having a passage communicating with the interior of the latter, a longitudinally split tubular shaft formed of stamped sheet metal, said shaft being insertable downwardly into said bushing and having a projection engageable with the upper end of the latter to insure exposure of a given portion of the upper end of said shaft, a hollow molded insulating knob telescopically engaged with the upper end of said shaft and positively interlocked therewith against rotation relatively thereto, said knob and said shaft having parts formed integrally therewith to provide a snap catch therebetween upon telescoping thereof, said shaft having a plurality of lugs formed integrally with the lower end thereof, a flat punched plate of insulation having openings through which said lugs extend, said lugs being bent over the lower surface of said plate to rigidly secure the same and said shaft and bushing in assembled relation to each other, said shaft having lugs struck inwardly therefrom in vertically and angularly spaced relationship to each other, an electric lamp the screw shell contact of which is adapted for cooperative engagement with said lugs, the major portion of the length of the lamp bulb being positioned within the upper end of said shaft, the diameter of said screw shell lamp contact being substantially less than the diameter of said lamp bulb, and said shaft having a plurality of angularly spaced ribs formed on the inner surface thereof adjacent to said screw shell contact to positively insure substantial centering of the latter.

14. In a rheostat for control of relatively low voltage circuits, in combination, an inverted cup-shaped sheet metal housing, an externally threaded metal bushing secured to the upper end of said housing and having a passage communicating with the interior of the latter, a longitudinally split tubular shaft formed of stamped sheet metal, said shaft being insertable downwardly into said bushing and having a projection engageable with the upper end of the latter to insure exposure of a given portion of the upper end of said shaft, a hollow molded insulating knob telescopically engaged with the upper end of said shaft and positively interlocked therewith against rotation relatively thereto, said knob and said shaft having parts formed integrally therewith to provide a snap catch therebetween upon telescoping thereof, said shaft having a plurality of lugs formed integrally with the lower end thereof, a flat punched plate of insulation having openings through which said lugs extend, said lugs being bent over the lower surface of said plate to rigidly secure the same and said shaft and bushing in assembled relation to each other, said shaft having lugs struck inwardly therefrom in vertically and angularly spaced relationship to each other, an electric lamp the screw shell contact of which is adapted for cooperative engagement with said lugs, the major portion of the length of the lamp bulb being positioned within the upper end of said shaft, the inside diameter of said shaft being substantially greater than the diameter of said screw shell lamp contact and said shaft having a plurality of angularly spaced ribs formed on the inner surface thereof adjacent to said screw shell contact to positively insure substantial centering of the latter, a resilient center lamp contact and a rheostat contactor respectively positioned upon the upper and lower surfaces of said plate and an eyelet forming an electrical and mechanical connection therebetween, an insulating base secured to said housing, a helically wound resistor interposed between said base and said contactor, and a wiring terminal element exposed upon the lower surface of said base and electrically connected to one end of said resistor, said contactor being movable selectively into and out of engagement with said resistor at the aforementioned end of the latter.

15. In a rheostat for control of relatively low voltage circuits, in combination, an inverted cup-shaped sheet metal housing, an externally threaded metal bushing secured to the upper end of said housing and having a passage communicating with the interior of the latter, a longitudinally split tubular shaft formed of stamped sheet metal, said shaft being insertable downwardly into said bushing and having a projection engageable with the upper end of the latter to insure exposure of a given portion of the upper end of said shaft, a hollow molded insulating knob telescopically engaged with the upper end of said shaft and positively interlocked therewith against rotation relatively thereto, said knob and said shaft having parts formed integrally therewith to provide a snap catch therebetween upon telescoping thereof, said shaft having a plurality of lugs formed integrally with the lower end thereof, a flat punched plate of insulation having openings through which said lugs extend, said lugs being bent over the lower surface of said plate to rigidly secure the same and said shaft and bushing in assembled relation to each other, said shaft having lugs struck inwardly therefrom in vertically and angularly spaced re-

lationship to each other, an electric lamp the screw shell contact of which is adapted for cooperative engagement with said lugs, the major portion of the length of the lamp bulb being positioned within the upper end of said shaft, the inside diameter of said shaft being substantially greater than the diameter of said screw shell lamp contact and said shaft having a plurality of angularly spaced ribs formed on the inner surface thereof adjacent to said screw shell contact to positively insure substantial centering of the latter, a resilient center lamp contact and a rheostat contactor respectively positioned upon the upper and lower surfaces of said plate and an eyelet forming an electrical and mechanical connection therebetween, an insulating base secured to said housing, a helically wound resistor interposed between said base and said contactor, a wiring terminal element exposed upon the lower surface of said base and electrically connected to one end of said resistor, said contactor being movable selectively into and out of engagement with said resistor at the aforementioned end of the latter, a second wiring terminal element exposed upon the lower surface of said base, means comprising a resilient metallic member electrically connected with said second terminal element and interposed between said base and said plate, said member having one arm thereof biased into engagement with said eyelet, said member also having another arm thereof reflexed and biased into the plane of said plate, said last mentioned arm having a boss, and said plate having a pair of adjacent peripheral notches to be releasably engaged by said boss, said notches and said boss being utilized to indicate to the touch the circuit making and circuit breaking positions respectively of said contactor.

16. In a rheostat for controlling relatively low voltage circuits, in combination, an inverted substantially cup-shaped sheet metal shell, an externally threaded hollow metal bushing secured to the upper end of said shell, a longitudinally split substantially cylindrical shaft formed of sheet metal, said shaft being insertable downwardly into said bushing and having a projection engaging the upper end of the latter, a hollow molded insulating knob telescopically engaged with the upper end of said shaft, said knob and said shaft having parts formed integrally therewith to provide a releasable snap connection therebetween and to positively restrain the same against rotary movement relatively to each other, a flat plate of insulation rigidly connected to the lower end of said shaft to positively restrain the latter against separation from said bushing, an insulating base adapted to seat against the lower end of said shell, said shell having lugs bent inwardly over the lower surface of said base to secure said parts to each other, a helically wound resistor wire arranged arcuately upon the upper surface of said base and having the ends thereof secured to the latter, a wiring terminal element exposed upon the lower surface of said base and electrically connected to one end of said resistor, a contactor secured to said plate and biased into the plane of said resistor, said contactor being movable respectively into and out of engagement with said resistor at a point adjacent to the point of connection of the aforementioned end thereof to said terminal element, a second terminal element exposed upon the lower surface of said base, means including a resilient arm associated with said last mentioned terminal element for continuously electrically connecting the latter with said contactor, said plate having a pair of notches formed therein adjacent to each other, and means also associated with said last mentioned terminal element and biased into engagement with said plate, said means cooperating with the walls of said notches to indicate to the touch the movement of said contactor into and/or out of engagement with said resistor.

17. In a device of the character described, in combination, a contactor actuating metal shaft of hollow substantially cylindrical form, the interior of said shaft being formed to provide a screw socket for the screw shell contact of a lamp, a lamp having the screw shell contact thereof mechanically engaged with and electrically connected to said shaft, the major portion of the lamp bulb being located within said shaft, a hollow molded insulating knob adapted to telescopically engage the upper end of said shaft, said knob and said shaft having parts formed integrally therewith to provide a snap catch therebetween upon telescoping thereof and to positively restrain the same against rotation relatively to each other, said knob being composed entirely of relatively translucent material, and at least a portion of the upper end wall thereof having a relatively small dimension in vertical section, whereby the lighted or unlighted condition of said lamp is rendered apparent notwithstanding complete enclosure of the latter.

18. In combination, a tubular metal actuating shaft for rheostats and the like, an electric lamp insertable into the upper end of said shaft and having a portion of the bulb projecting upwardly beyond and exposed with respect to the latter, a hollow molded insulating knob removably attached to the upper end of said shaft and adapted to provide a manual operating element for the latter, said knob being composed entirely of relatively translucent material, and the upper end wall of said knob having adjacent areas of relatively thick and relatively thin cross section respectively, said area of relatively thick cross section being adapted to embody a suitable design which is thrown into accentuated relief with respect to said relatively thin area under the influence of light generated in said lamp.

19. In a device of the character described, in combination, an inverted cup-shaped sheet metal housing, an externally threaded metal bushing secured to the upper end of said housing and having a passage communicating with the interior of the latter, a tubular metal shaft insertable downwardly into said bushing and having an integral projection engageable with the upper end of the later to insure exposure of a given portion of the upper end of said shaft, said shaft having a pair of diametrically opposed vertical lugs formed integrally with the lower end thereof, a flat punched plate of insulation of greater diameter than the lower end of said bushing, said plate having a pair of openings formed therein and through which said lugs extend, said lugs being bent over the lower surface of said plate to rigidly secure the same and said shaft and bushing in assembled relation to each other, a contactor rigidly and permanently attached to said plate for support and rotation thereby, said plate having a pair of radial shoulders formed in the periphery thereof at opposite sides respectively of said contactor, and said housing having a lug formed integrally therewith and extending downwardly into the path of said shoulders to limit said plate to rotation through an angle of

substantially less than three hundred and sixty degrees.

20. In a device of the character described, in combination, an inverted cup-shaped sheet metal housing, an externally threaded metal bushing secured to the upper end of said housing and having a passage communicating with the interior of the latter, a longitudinally split tubular shaft formed of stamped sheet metal, said shaft being insertable downwardly into said bushing and having a projection engageable with the upper end of the latter to insure exposure of a given portion of the upper end of said shaft, a hollow molded insulating knob, said knob and said shaft having parts formed integrally therewith to provide a releasable snap connection therebetween upon telescoping thereof and to positively restrain the same against rotation relatively to each other, said shaft having a pair of diametrically opposed lugs formed integrally with the lower end thereof, a flat punched plate of insulation of greater diameter than the lower end of said bushing, said plate having openings formed therein and through which said lugs extend, said lugs being bent over the lower surface of said plate to rigidly secure the same and said shaft and bushing in assembled relation to each other, a resilient contactor rigidly attached to said plate for support and rotation thereby, said plate having a pair of radial shoulders formed in the periphery thereof at opposite sides respectively of said contactor, and said housing having an integral lug extending downwardly into the path of each of said shoulders to positively limit said plate to rotation through an angle of substantially less than three hundred and sixty degrees.

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