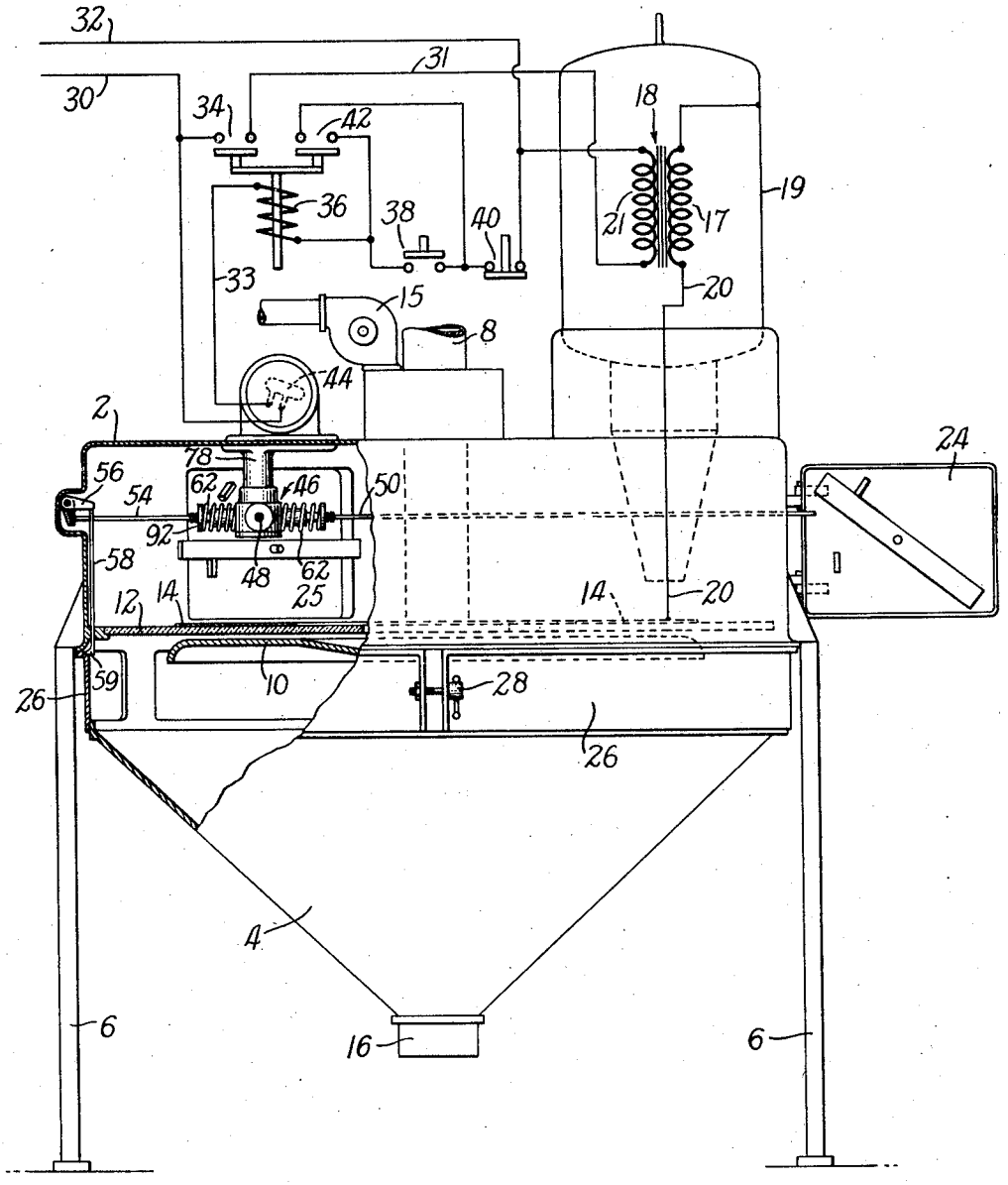
Feb. 27, 1940. K. H. CONLEY 2,191,816

ELECTRICAL CONTROL APPARATUS

Filed Oct. 29, 1937 3 Sheets-Sheet 1

Fig. 1.



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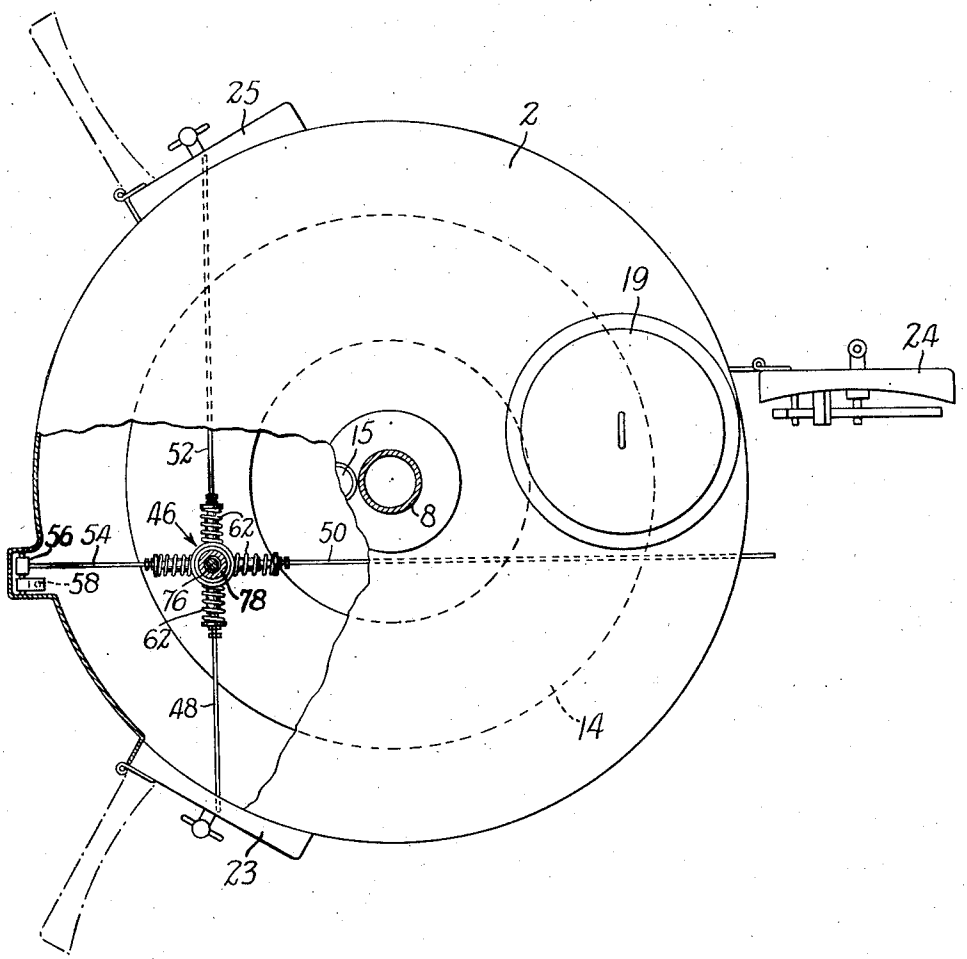
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Fig. 2.



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ELECTRICAL CONTROL APPARATUS

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Fig. 3.

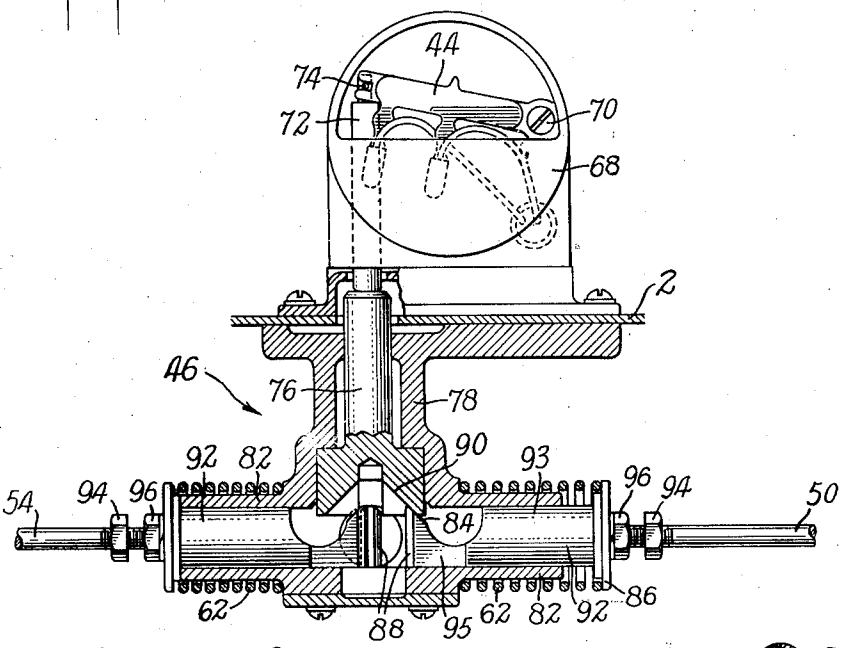


Fig. 4.

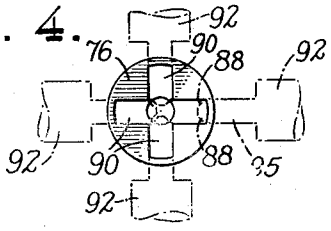


Fig. 5.

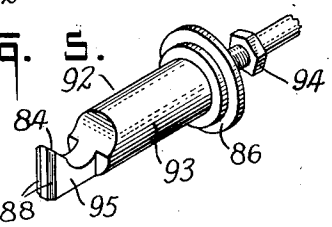
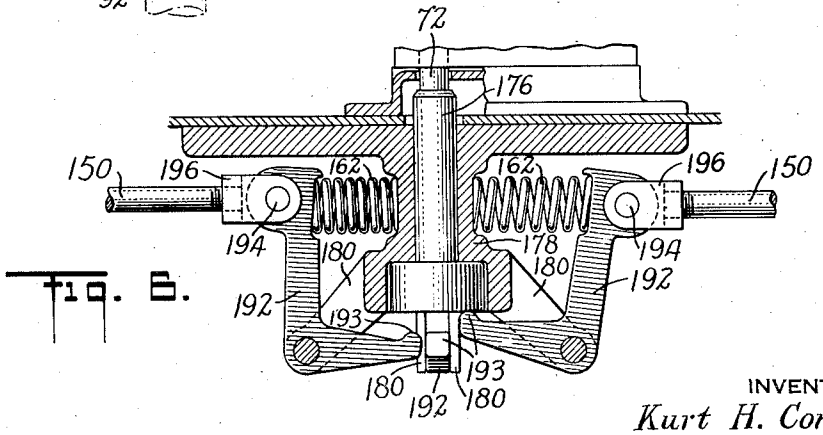


Fig. 6.



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Patented Feb. 27, 1940 2,191,816

UNITED STATES PATENT OFFICE

2,191,816

ELECTRICAL CONTROL APPARATUS

Kurt H. Conley, Bridgeport, Conn., assignor, by mesne assignments, to Entoleter Company, Inc., a corporation of New Jersey

Application October 29, 1937, Serial No. 171,650

12 Claims. (Cl. 21—102)

This invention relates to electrical apparatus and more particularly to a safety mechanism to be used with apparatus for sterilizing products such as food or the like.

An object of this invention is to provide a highly efficient and dependable mechanism of the above nature for controlling the operating circuit of such apparatus. A further object is to provide such a safety mechanism compact and sturdy in construction, and dependable and efficient in operation. Another object is to provide a mechanism capable of preventing the operation of such apparatus until it is in proper condition for operation. Another object is to provide a mechanism of the above character which prevents operation of such apparatus as long as the dangerous parts thereof are accessible.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the drawings:

Figure 1 is a diagrammatic representation of the electrical circuit and certain of the mechanical parts of electrical sterilizing apparatus showing one embodiment of this invention;

Figure 2 is a plan view of a portion of the apparatus shown in Figure 1, certain of the parts thereof being broken away;

Figure 3 is an elevation partly in section showing certain details of construction of the switching mechanism shown in Figures 1 and 2;

Figure 4 is a bottom plan view of the vertical plunger and associated parts, for operating the safety switch;

Figure 5 is a perspective view of one of the horizontally positioned cam plungers; and

Figure 6 is a view similar to Figure 3 showing a modification of the switching mechanism.

Reference is here made to the copending application of Franklin S. Smith, Serial No. 150,522, filed June 26, 1937, disclosing one type of apparatus for treating materials by means of an electrical discharge. The present application relates to safety and control mechanism for use with apparatus of the character shown in that application.

The particular embodiment of electrical apparatus shown in Figures 1 and 2 is a bulk material sterilizer which is used in the treatment of products such as grain. The apparatus is mounted in a casing 2, having a cylindrical upper portion, with a funnel-like hopper 4 at the bottom mounted upon suitable frame structure including a plurality of legs 6. Material being treated enters the casing from the top through a conduit 8, moves downwardly to the center portion of a rotatable lower electrode 10 and moves outwardly due to centrifugal force through the treatment zone beneath an annular plate 12 formed of material such as quartz or high power factor glass.

An annular upper electrode 14 is positioned upon the upper surface of dielectric plate 12 and during the movement of the material, a high potential is impressed across electrodes 10 and 14 so as to cause discharges within the treatment zone. After passing through the treatment zone, the material falls into hopper 4 and leaves the machine through outlet conduit 16.

The product is treated in the presence of air, and ionization products, such as ozone and oxides of nitrogen, are formed during operation of the apparatus. These ionization products are removed by a blower 15 mounted upon the top of casing 2 and air is normally drawn into the casing through grain outlet 16 and through any other openings in the apparatus. However, it is important that a substantially sealed casing be provided and that the treating apparatus be ineffective except when this sealed condition exists. Also the interior of the apparatus is dangerous during operation and it is therefore desirable to prohibit any access to the apparatus while operating.

The high potential which is impressed across electrodes 10 and 14 is delivered in the form of a low potential to the primary winding 21 of a transformer 18 having a casing 19 supported on the top of casing 2. The upper electrode 14 is connected through a high potential lead 20 extending up through casing 19 to one side of the secondary winding 17 of transformer 18. The other side of winding 17 and the lower electrode 10 are both grounded to the casing structure, thus completing a high potential circuit which is totally contained within casings 2 and 19.

The upper portion of casing 2 is provided with three doors 23, 24 and 25, preferably equally spaced thereabout, as shown in Figure 2, which may be opened to provide access to the upper portion of the treating apparatus. Access may be had to the lower portion of the treating apparatus by removing a band 26 covering a space between casing 2 and hopper 4. Band 26 is

tightly held in place by a screw-clamp 28 which draws it tightly about the frame of the apparatus. Accordingly, band 26 forms an effective seal between casing 2 and hopper 4.

Electrical power is delivered to the low potential primary winding 21 of transformer 18 through a lead 32 and a lead 31 which is connected to a lead 30 by a switch 34. Thus the high potential discharges across electrodes 14 and 10 are controlled by this switch 34 in the low potential circuit. Switch 34 is biased toward open position, but is closed by energizing a solenoid 36. One side of solenoid 36 is connected to a mercury switch 44 through a lead 33, and the other side of the mercury switch is connected to lead 30. The other side of solenoid 36 is connected through a push button starting switch 38 and a push button stop switch 40 to lead 32; switch 38 is by-passed by a holding switch 42 mounted to close with switch 34. Switches 38 and 42 are biased to open position while stop switch 40 and mercury switch 44 are biased to closed position.

Thus with switches 40 and 44 closed, if starting switch 38 is closed, solenoid 36 is energized so as to close switches 34 and 42. Upon release of switch 38, solenoid 36 remains energized due to the connection through switch 42. When stop switch 40 is pushed, solenoid 36 is de-energized and switches 34 and 42 open.

However, switch 44 which is biased to the closed position is in the circuit of solenoid 36 and a switch-operating mechanism, generally indicated by the numeral 46, is provided for moving switch 44 to open position when any of doors 23, 24 and 25 are open or when band 26 is out of place.

As best shown in Figure 3, switch 44 is rockably mounted upon a base frame 68 by a pivot shaft 70 and is moved to the open position (shown in the drawings) from its normal closed position by an operating pin 72. Operating pin 72 is connected to switch 44 by a pin-and-slot connection 74 and is lifted, in a manner to be fully pointed out below, by upward movement of a vertical plunger 76. This switch-operating mechanism also includes three horizontal push rods 48, 50 and 52 (see Figure 2) which extend outwardly to the side walls of the casing so as to be engaged and displaced by three doors 23, 24 and 25 when the doors are in closed position.

A fourth horizontal push rod 54 extends to the left (see also Figure 1) where it is engaged by a crank arm 56 which is operated in turn by a vertical push rod 58. When band 26 is in the sealing position, as shown, its upper edge contacts an extension 59 on the lower end of the vertical push rod 58 so as to hold push rod 58, the crank arm 56 and push rod 54 in the positions shown. Now, when push rods 48, 50 and 52 are moved inwardly to the position of rod 54 by the closing of doors 23, 24 and 25, the end of each engages a cam plunger 92 (see Figure 3) carried in a horizontal sleeve 82 of mounting frame 78. Cam plungers 92 are biased outwardly by springs 62 fitting about sleeves 82 and resting against flanges 86 on the plungers. However, when push rods 48, 50, 52 and 54 are pushed inwardly, due to the closing of doors 23, 24 and 25 and the proper positioning of band 26, plungers 92 all assume the position of the plunger shown at the left of Figure 3.

Referring to Figure 5, each of cams 92 includes a cylindrical body portion 93 and a toe portion 95 having a cam surface 84 (see also Figure 3). When all of plungers 92 are pushed inwardly, their toe portions interfit in the manner shown in broken lines in Figure 4, each toe portion being bevelled along its vertical edges at 88.

Slidably mounted directly above these toe portions, is a vertical plunger 76 having an enlarged lower end with four radial recesses or cam-ways 90. Cam-ways 90 receives the four toe portions of plungers 92, with cam surfaces 84 engaging the cam surfaces of cam-ways 90. When the four plungers 92 are pushed inwardly with their toes interfitting, vertical plunger 76 moves downwardly, but when one of plungers 92 moves outwardly to the position shown in the right of Figure 3, its cam surface 84 engages its cooperating cam surface and moves vertical plunger 76 upwardly.

The engagement between each of the horizontal push rods 48, 50, 52 and 54 and its cam plunger 92 is through a stud bolt 94. Stud bolts 94 are adjustably mounted in the ends of cam plungers 92 and are locked in place by means of lock nuts 96.

An alternative form of safety switch-operating mechanism is shown in Figure 6 where a vertical plunger 176 is slidably mounted to move switch operating pin 72. Mounting frame 178 is provided with downwardly and outwardly extending brackets 180 which carry four equally spaced crank arms 192 (only three of which are shown). Each of crank arms 192 is provided at its lower end with a cam portion 193, which engages the lower end of vertical plunger 176. These crank arms are biased by springs 162 so that they tend to assume the positions shown at the right of Figure 6; thus holding vertical plunger 176 in its upper position.

Each crank arm 192 is pivotally connected through a pin 194 and a forked bracket 196 to a horizontal push rod 150. Horizontal push rods 150 correspond to push rods 48, 50, 52 and 54, and may be operated to move horizontally in the same manner.

When push rods 150 are pushed inwardly, as by closing doors 23, 24 and 25 (Figure 2) and by properly positioning band 26 (Figure 1), crank arms 192 (Figure 6) are rocked against the tension of springs 162, thus moving the cam portions 193 downwardly to the position shown at the left of Figure 6. When this occurs, vertical plunger 176 moves downwardly and switch-operating pin 72 drops to close a switch such as switch 44.

When one of the horizontal push rods moves outwardly, its crank arm 192 is rocked by its spring 162 to cause its cam 193 to lift vertical plunger 176 to the position shown. Thus, if all of the push rods 150 are moved inwardly, switch-operating pin 72 is permitted to drop, but whenever one of the push rods is not in its inward position, pin 72 is held in its upper position.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawing, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In control apparatus, the combination of, a switch, a plunger means which may be moved to operate said switch, said switch and said plunger means being biased toward their normal positions, said plunger means having a plurality

of cam faces thereon, a plurality of cam members each having a cam face which is adapted to cooperate with one of said cam faces to displace said plunger means, and means to independently operate said cam members so as to move them into a position to permit said plunger means and switch to assume their normal positions.

2. In control apparatus, the combination of, a switch, an operating pin operatively associated with said switch, said switch and said operating pin being normally biased toward switch-closing position, a vertical plunger having its upper end engaging said operating pin and having an enlarged lower end, said lower end being cut away to form a plurality of recesses and cam surfaces, a plurality of cam plungers horizontally mounted and extending radially from said vertical plunger, each of said cam plungers having a toe portion with a cam surface cooperating with one of the cam surfaces on said vertical plunger, spring biasing means associated with said cam plungers to bias each of them in a direction away from said vertical plunger, said vertical plunger and said cam plungers being so related that when said cam plungers are displaced toward said vertical plunger against the biasing action of said spring means said vertical plunger will fall to its lowest position with the toe portions of said cam plungers positioned in the recesses of said vertical plunger, but if said cam plungers are all in this position and one of said cam plungers is permitted to move away from said vertical plunger its cam surface will cooperate with the corresponding cam surface of said vertical plunger and said vertical plunger will be raised to move said operating pin and operate said switch.

3. In switch-operating mechanism, the combination of, a plunger means having a recess therein which comprises a central hole and a plurality of radially extending portions, each of said radially extending portions having a cam surface which extends from near the extremity of said hole to one surface of said plunger means, and a plurality of cam plunger members one of which is associated with each of said radial portions of said recess, each of said cam plungers having a toe portion which has a cam surface to cooperate with the corresponding cam surface of said plunger means, said toe portions being so shaped and so interrelated that when they are moved toward the axial center of said plunger means they will fit within said recess.

4. In a switch-operating mechanism, the combination of, a mounting frame having an axial bore therein with an enlargement at one end, said mounting frame also having a plurality of radially extending bores adjacent the enlargement in said axial bore, an axial plunger member snugly fitting within said axial bore and having an enlarged portion with a plurality of cam surfaces thereon, a plurality of radial plungers one of which is snugly fitted within each of said radial bores, each of said radial plungers having a portion with a cam surface thereon which cooperates with a corresponding cam surface upon said axial plunger member, and spring biasing means tending to move said radial plungers radially.

5. In switch-operating mechanism, the combination of, a mounting frame having an axial bore therein with an enlargement at one end, said mounting frame also having a plurality of radially extending bores adjacent the enlargement in said axial bore, an axial plunger member snugly fitting within said axial bore and having an enlarged portion with a plurality of cam surfaces thereon, a plurality of radial plungers one of which is snugly fitted within each of said radial bores, each of said radial plungers having a portion with a cam surface thereon which cooperates with a corresponding cam surface upon said axial plunger member, said axial plunger member and said radial plungers being so related that when said radial plungers are moved toward each other said axial plunger member may move axially, and spring biasing means tending to impart individual radial movement to said radial plungers.

6. In apparatus of the class described, the combination of, a mercury switch rockably mounted so as to move between its open and closed positions and being biased toward its closed position, and means to rock said switch to its open position including, an actuating member having a plurality of cam surfaces thereon, a plurality of operating elements each having a cam surface which is adapted to operatively engage a cam surface on said actuating member, and a plurality of spring members one of which is associated with each of said operating elements to tend to move its operating element in a direction to cause the cam surface thereof to operatively engage the corresponding cam surface on said actuating member.

7. In apparatus of the class described, the combination of, a mercury switch rockably mounted so as to move between its open and closed position, tions and being biased toward its closed position, and means to rock said switch to its open position including, an actuating member having a plurality of cam surfaces thereon, a plurality of operating elements each having a cam surface which is adapted to operatively engage a cam surface on said actuating member, a plurality of spring members one of which is associated with each of said operating elements to tend to move its operating element in a direction to cause the cam surface thereof to operatively engage the corresponding cam surface on said actuating member, and operating means to individually engage said operating elements to move said elements axially against the tension of their respective spring members.

8. In apparatus for operating a switch which is normally biased toward one of its positions, the combination of, a mounting frame having a vertical bore therein with an enlarged portion at its lower end, a switch-operating plunger snugly fitting within said bore and having an enlarged portion which limits its upward movement within said bore, a plurality of cam elements each having a cam portion which is adapted to engage the enlarged portion of said plunger member to move said plunger member to its extreme upper position, and a plurality of spring members one of which is associated with each of said cam elements to tend to move its cam element into engagement with said plunger member.

9. In apparatus for operating a switch which is normally biased toward one of its positions, the combination of, a mounting frame having a vertical bore therein with an enlarged portion at its lower end, a switch-operating plunger snugly fitting within said bore and having an enlarged portion which limits its upward movement within said bore, a plurality of cam elements each having a cam portion which is adapted to engage the enlarged portion of said plunger member to move said plunger member to its extreme upper position, a plurality of spring members one of which

is associated with each of said cam elements to tend to move its cam element into engagement with said plunger member, and means operative to move said cam elements against the tension of their spring members, said cam elements being so positioned that when they are all moved against the tension of their spring members their cam portions will cooperate to limit the downward movement of said plunger member.

10. In apparatus of the class described, the combination of, a mounting frame having a vertical bore therein with an enlargement at one end, a plunger member snugly received within said bore and adapted to move axially, a plurality of crank arms rockably mounted upon said mounting frame, each of said crank arms having a cam portion which is adapted to engage said plunger member, and spring means tending to rock said crank arms individually so as to hold their respective cam portions into engagement with said plunger member.

11. In apparatus of the class described, the combination of, a mounting frame having a vertical bore therein with an enlargement at one end, a plunger member snugly received within said bore and adapted to move axially, a plurality of crank arms rockably mounted upon said mounting frame, each of said crank arms having a cam portion which is adapted to engage said plunger member, spring means tending to rock said crank arms individually so as to hold their respective cam portions into engagement with said plunger member, and means to move each of said crank arms against the tension of said spring means.

12. In control apparatus, the combination of, a switch, a plunger means which may be moved to operate said switch, said switch and said plunger means being biased toward their normal positions, a plurality of crank arms rockably mounted adjacent said plunger means, each of said crank arms having a cam portion operatively engaging said plunger means, means biasing each of said crank arms so as to tend to move said plunger means and said switch from their normal positions, and means associated with each of said crank arms to move said crank arms against the action of said biasing means.

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