

Nov. 22, 1966

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3,287,530

ELECTRICAL SWITCH WITH IMPROVED PLUNGER RELEASE MECHANISM

Filed June 28, 1965

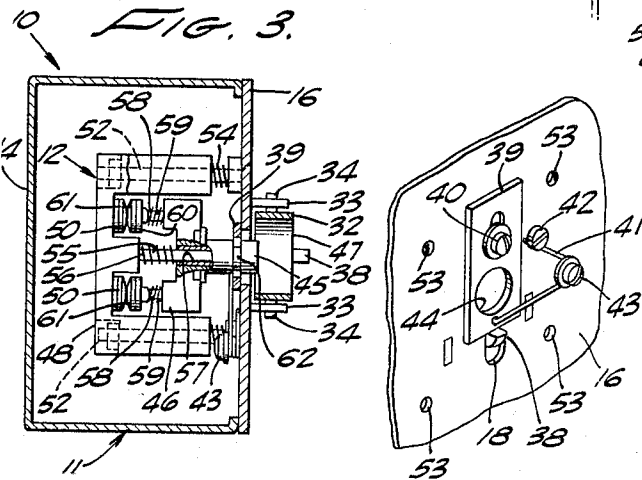
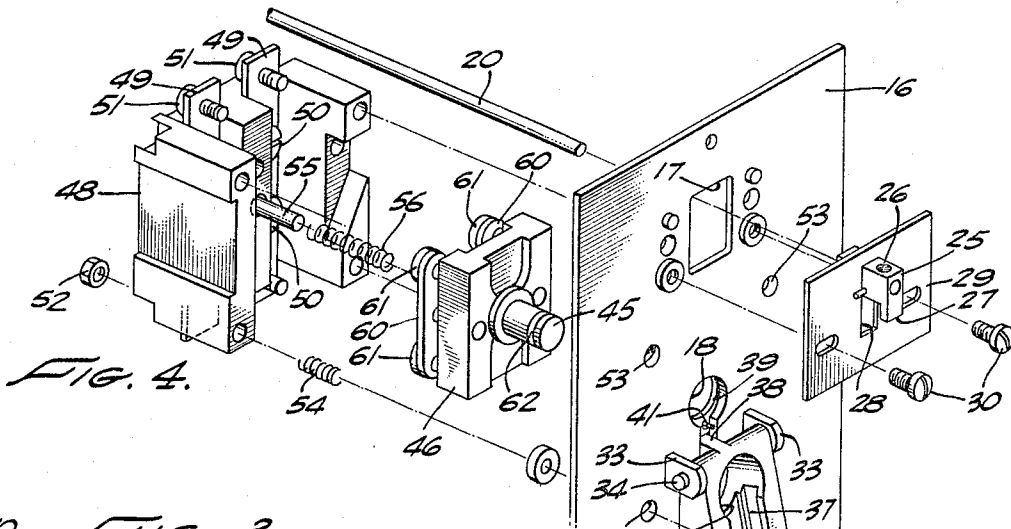
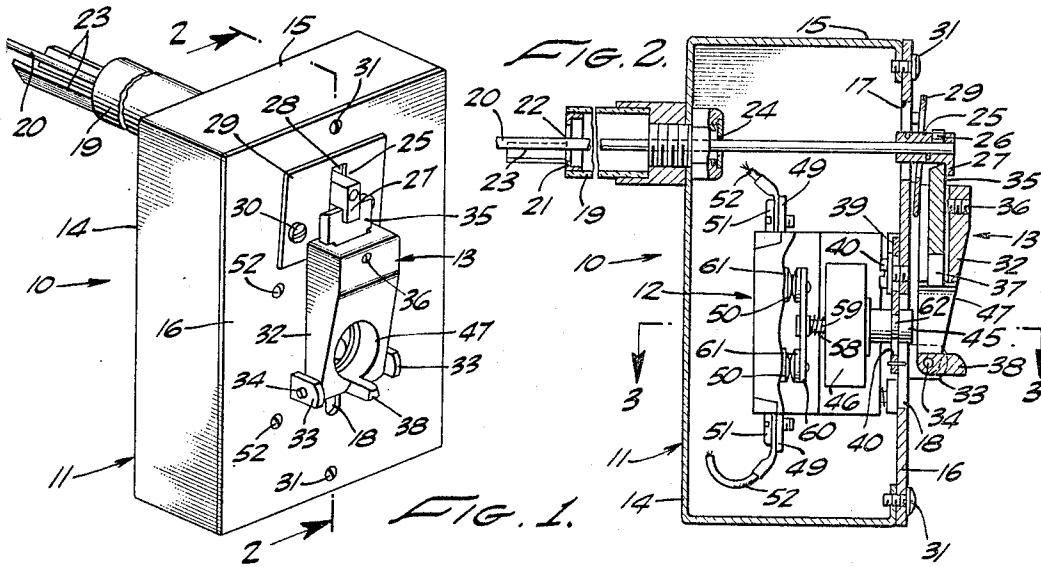


FIG. 5.

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ATTORNEYS

1

3,287,530

**ELECTRICAL SWITCH WITH IMPROVED  
PLUNGER RELEASE MECHANISM**

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Filed June 28, 1965, Ser. No. 467,364  
4 Claims. (Cl. 200-142)

This invention relates to electrical switches and more specifically to a switching device for interrupting and electrical circuit supplying power to a kiln.

Modern practice for operating a kiln involves the use of pyrometric cones to determine when the firing is complete. The operator may place such a cone in the kiln and observe the physical changes which will result over time at elevated temperatures. When the cone has become sufficiently softened, as indicated by its top turning downwardly in hairpin fashion, the firing is complete and power to the kiln is manually turned off.

Manual operation, however, is susceptible to errors attributable to the human element. Such errors can be drastically reduced by using the pyrometric cone with a device such as disclosed in my U.S. Patent No. 2,675,600 issued April 20, 1954. The present invention, which constitutes an improvement over this patent, virtually eliminates any error attributable to the human element. In brief, an actuating rod is supported by a pyrometric cone which, under prolonged elevated temperatures, sags causing a release claw fastened to the actuating rod to move out of engagement from a moveable weight. This weight in turn falls downwardly and a stud protruding therefrom releases a spring biased plunger having moveable conductor means or straps, thereby creating a circuit discontinuity and hence an interruption of power flow to the kiln. Freezing which may be due to excessive heat is prevented by allowing adequate play between the plunger and associated parts. In addition, a switching device constructed according to the invention can be easily and accurately calibrated and last minute adjustments can, if necessary, or desired, be quickly made, all without establishing circuit continuity to the kiln. In other words, after the pyrometric cone has been properly positioned in place with the trigger of the moveable weight engaging the release claw but before power is applied to fire the kiln, the operator depresses the plunger to establish circuit continuity which plunger when the firing is completed, is then automatically released to interrupt power flow and shut down the kiln.

It is therefore the primary objective and purpose of this invention to provide an improved switching device for controlling a kiln.

Another object of the invention is to provide an improved switching device of the type described for interrupting the flow of electrical power to a kiln.

Another object of the invention is to provide an improved switching device of the type described which operates freely without freezing of parts due to excessive heat from the kiln to interrupt the electrical circuit supplying power thereto.

A further object of the invention is to provide an improved switching device for controlling a kiln having provisions for establishing circuit continuity after the release mechanism is disposed in its operable position.

Other objects and advantages of the invention will appear and be brought out more fully in the following specification reference being had to the accompanying drawing wherein:

FIGURE 1 is a perspective view of a switching device in accordance with the invention showing the release mechanism disposed in its operable position;

FIGURE 2 is a cross-sectional view taken along a line 2-2 as shown in FIGURE 1;

2

FIGURE 3 is a cross-sectional view of the device according to the invention taken along a line 3-3 as shown in FIGURE 2;

FIGURE 4 is an exploded perspective view showing the various arrangement of the parts forming the switch and showing the release mechanism and disposed in its actuated position; and

FIGURE 5 is a partial perspective of a portion of the release mechanism and serves to facilitate the describing of the invention.

Referring more particularly to the drawing the numeral 10 indicates a switching device of the invention which device includes a housing 11, a switch 12 disposed in the housing 11, and a release mechanism 13. The housing 11 which preferably is rectangular in configuration includes a rear wall 14, a top wall 15 extending at right angles to the rear wall 14, and a removable front cover plate 16 having two openings 17 and 18 respectively. Extending outwardly from the rear wall 14 and partially there through into the housing 11 is a refractory tube 19 through which extends an actuating rod 20. An end plate 21 is provided for the outer end of the refractory tube 19 and includes a vertical slot for guiding the up and down movement of the actuating rod 20. The end plate 21 also includes two support elements 23 for supporting a pyrometric cone not shown which in turn supports the outer end of the actuating rod 20 under operating conditions. The actuating rod 20 may be pivotally mounted by a pin 24 extending transversely through the refractory tube 19 preferably at a piston within the housing 11. The actuating rod also extends to the opening 17 in the front cover plate 16 and has attached thereto a release claw 25 by means of a set screw 26. The release claw 25 includes a downwardly extending lip 27 and is guided in its up and down movement by a vertically positioned slot 28 disposed in a thin guide plate 29 which is mounted to the front cover plate 16 over the opening 17 by means of threaded fasteners 30. The front cover plate 16 is in turn mounted to the housing 11 by means of conventional threaded fasteners 31.

The release mechanism 13 which includes the actuating rod 20 and the release claw 25 having the downwardly extending lip 27 further includes a movable weight 32 pivotally mounted to the front cover plate 16 by means of a bracket assembly 33 positioned slightly below the opening 18 in the front cover plate 16. A shaft 34 extends horizontally through the bracket assembly 33 and the lower end of the movable weight 32 as seen in FIGURES 1, 2 and 3. The movable weight 32 includes a trigger 35 which as seen in FIGURES 1 and 2 engages the release claw 25 at its downwardly extending lip 27 to hold the movable weight 32 in its upright position. The trigger 35, which may have a bevelled outer edge as shown in FIGURE 2, may be adjustably positioned by means of a set screw 36 in a raceway 37 milled in the movable weight 32. An outwardly extending stud 38 is provided on the movable weight 32 adjacent to the shaft 34. The stud 38 as seen in FIGURE 2 is rotated clockwise and enters the opening 18 when the movable weight 32 falls downwardly from its upright position of FIGURE 2 to that position as shown in FIGURE 4. When the stud 38 enters the opening 18, a thin plate 39 loosely mounted on the back side of the front cover plate 16 by means of a threaded fastener 40 as seen in FIGURE 5, is engaged and moved slightly upwardly against the force of a hair spring assembly 41 mounted by means of fasteners 42 and 43 to the front cover plate 16. The thin plate 39 includes an opening 44 through which a cylindrical post 45 of a plunger 46 to be described extends; the movable weight 32 also includes an opening 47 from manually depressing the plunger when the movable weight 32 is disposed in its upright position as shown

in FIGURES 1 and 2.

The switch 12, as seen in FIGURES 2, 3 and 4, includes the plunger 46 and a ceramic body 48 having an E-type configuration in a plane parallel to the top wall 15. In each of the channels of the body 48, there are provided conductive inserts 49 having stationary contacts at their inner ends and threaded fasteners 51 at their outer ends for fastening electrical conductors 52 thereto. The ceramic body 48 is spring mounted to the front cover plate 16 by means of conventional threaded fasteners 52 extending through openings 53 and including springs 54. A guide pin 55 is provided on the ceramic body 48 and extends from mid center toward the front cover plate 16. A plunger return spring 56 is carried on the guide pin 55 which is received in a bore 57 extending partially through the post 45 of the plunger 46 as best seen in FIGURE 3.

The plunger 46 includes two thin rods 58 each carrying a compressible spring 59 and movable conductive members 60 each having two spaced apart contacts 61 for engaging the stationary contacts 50 when the plunger 46 is fully depressed. This arrangement permits the movable contact 61 to freely seat themselves on the stationary contacts 50 due to the action of the springs 59 as well as the plunger return spring 56. In addition, the springs 54 allow relative movement between the switch 12 and the other parts of the switching device 10.

The main portion of the plunger 46, that is the portion to which the thin rods 58 are attached and from which the post 45 extends, may be formed of ceramic material similar to that used for the ceramic body 48. The diameter of the post 45 should be slightly smaller than the opening 44 in the thin plate 39. In addition on the outer end of the post 45, as seen in FIGURE 4, there is provided an annular groove 62 into which the thin plate 39 falls under action of the spring assembly 41 when the plunger 46 is depressed as shown in FIGURE 2 after the movable weight 32 is disposed and held in its upright position by means of the release claw 25 engaging the trigger 35.

To calibrate the switching device 10, the actuating rod 20 is held stationary preferably in the center of its travel in the vertical slot 22 and the trigger 35 adjustably positioned in the raceway 37 by means of the set screw 36 so that the trigger 35 is just short of contacting the downwardly extending lip 27 of the release claw 25. When a pyrometric cone is placed upon the support elements 23 with the outer end of the actuating rod 20 resting on the pyrometric cone, the lip 27 extends over the trigger 35 substantially as shown in FIGURE 2. Under these conditions, the plunger 46 when depressed will be held in this depressed state by the action of the thin plate 39 falling into the groove 62. When the pyrometric cone sags sufficiently so that the release claw 25 moves upwardly around the pin 24 by a sufficient amount so that the trigger 35 passes under the lip 27, the movable weight 32 rotates clockwise around the shaft 34 causing the stud 38 to enter the opening 18 and engage the thin plate 39 to move it upwardly out of the groove 62 so that the energy stored in the plunger return spring 56 is released to move the plunger 46 out of its depressed state to open or interrupt the electrical circuit. It should be clear that the plunger 46 can only be locked in its on position when the movable weight 32 is disposed in its upright position as shown in FIGURE 2. When otherwise, the stud 38 prevents the thin plate 39 from falling downwardly into the groove 62.

While I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and methods.

What I claim is:

1. In a switching device having a release mechanism operable at elevated temperatures to interrupt an electrical circuit to a kiln in response to the displacement of an actuating rod coupled to said kiln, a switch comprising a ceramic body defining in a first plane an E-type configuration forming first and second spaced apart channels parallelly arranged and having a back surface defining a second plane intersecting said first plane at right angles; means for spring mounting said body to said switching device; conductive inserts disposed partially in said channels at each end thereof and including stationary contacts at one end by said back surface and terminal connectors at the other outwardly extending ends; a plunger formed of ceramic material and including a metallic post extending outwardly from the center of said plunger and two thin rods each having a head and extending outwardly in a direction opposite that of said post on either side thereof in said first plane at the center of corresponding first and second channels, said post including a bore extending partially therethrough from said plunger; moveable conductive members having contacts formed at each end and including an opening intermediate said ends having a diameter larger than that of said thin rods and smaller than that of said head for mounting one of said moveable conductive members on each of said thin rods; a compressible spring carried on each of said thin rods intermediate said corresponding moveable member and said plunger for urging said member against said head; a guide pin centrally positioned on said ceramic body and extending parallel to said first plane and at right angles to said second plane, said guide pin having a diameter slightly less than that of said bore; and a plunger return spring carried on said guide pin to store energy received when said plunger is depressed inwardly along said guide pin to engage said moveable spring biased contacts with said stationary contacts and to utilize the energy stored to move said plunger outwardly to interrupt said electrical circuit when said actuating rod actuates said release mechanism.

2. A switching device for interrupting an electrical circuit to a kiln in response to a predetermined distortion of a pyrometric cone disposed in said kiln comprising, in combination, a housing; a refractory tube extending into said kiln from the rear of said housing and including means for supporting said pyrometric cone at the ends thereof; an actuating rod extending through said refractory tube into said kiln and resting upon said pyrometric cone, said rod pivotably mounted in said refractory tube near said housing; a cover plate attached to the front of said housing and including a first opening in axial alignment with said refractory tube, a second opening spaced apart from said first opening and directly below in vertical alignment therewith, and a bracket assembly disposed below said second opening; a moveable weight having a trigger pivotably mounted on said bracket assembly and including an outwardly extending stud; a guide plate attached to said cover plate over said first opening and including a vertically positioned slot; a release claw disposed in said slot and mechanically coupled to said actuating rod, said release claw engaging said trigger to hold said moveable weight to an upright position to permit the completion of said electrical circuit; first and second pairs of stationary contacts having corresponding first and second pairs of terminals connected thereto carried on a ceramic body spring mounted to said cover plate adjacent said second opening, said ceramic body including a guide pin and a spring carried thereon; a moveable plunger slidably mounted on said guide pin in contact relation with said spring and including a cylindrical post extending through said second opening and separate spring mounted conductive members forming moveable contacts for engaging said stationary contacts to provide a conductive path between corresponding ones of said first and second pairs of terminals when said moveable plunger is disposed inwardly in a closed position, said

5

cylindrical post including an encircling groove recessed therein near the outer end thereof, said moveable plunger being urged outwardly in an opened position by said guide pin spring; a thin plate having an opening slightly larger in diameter relative to said cylindrical post and loosely carried on the back side of said cover plate, said cylindrical post extended through said thin plate opening; and a spring mounted to said cover plate for biasing said thin plate into contact engagement with said cylindrical post when said moveable weight is disposed in said upright position and for urging said thin plate into said encircling groove when said plunger is thereafter depressed to retain same in said closed position, said release claw moving upwardly in response to the distortion of said pyrometric cone during the operation of said kiln to release said moveable weight to drive said stud into engagement with said thin plate and out of said encircling groove to release said plunger and interrupt said electrical circuit.

3. The switch in accordance with claim 2 further charac-

6

terized in that said trigger is adjustably positioned in said moveable weight for varying the extent to which said release claw extends over said trigger to effect interruption of said electrical circuit by different predetermined distortions of said pyrometric cone.

4. The switch in accordance with claim 3 further characterized in that said moveable weight has an opening extending therethrough and in alignment with said second opening when said moveable weight is disposed in said upright position.

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