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3,249,674

KILN SHUT-OFF DEVICE

Filed July 9, 1963

2 Sheets-Sheet 1

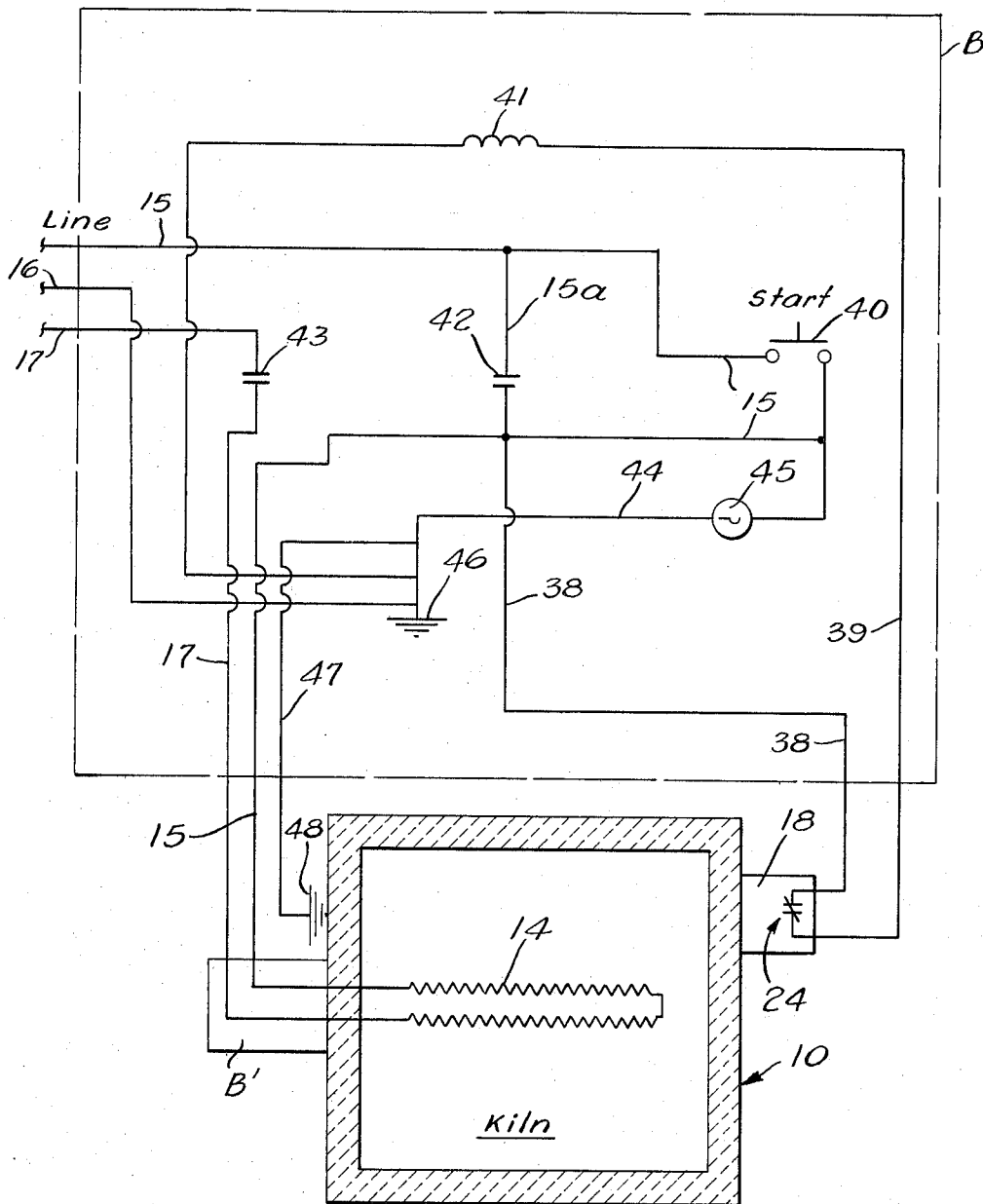


FIG. 1

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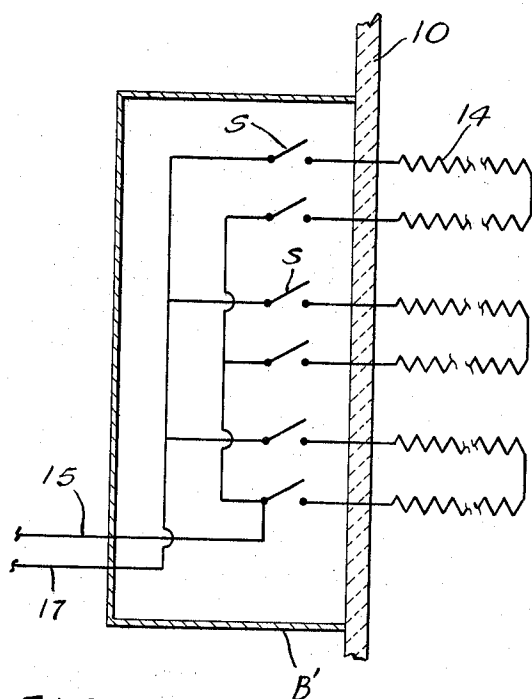


FIG. 4

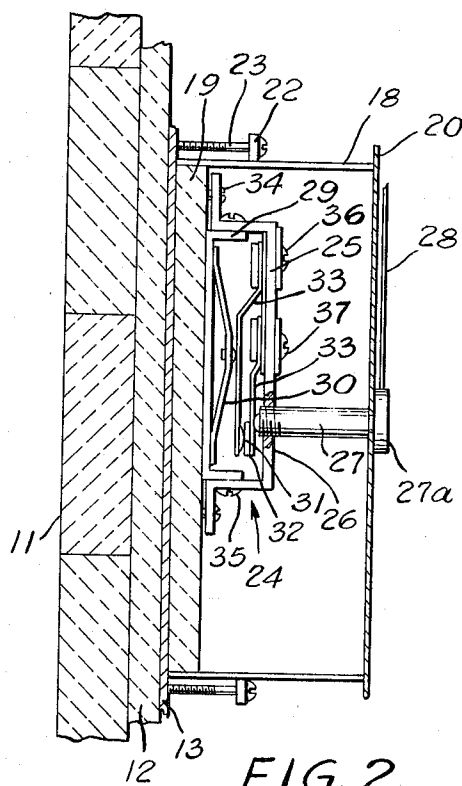


FIG. 2

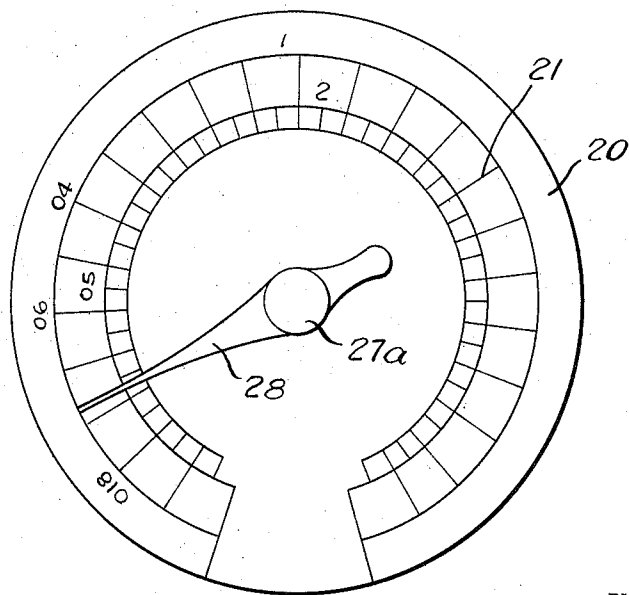


FIG. 3

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KILN SHUT-OFF DEVICE

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9 Claims. (Cl. 13—24)

This invention relates to ceramic kilns and the like, and more particularly to electrical shut-off devices for automatically shutting off the heating elements used to heat the kiln when a predetermined temperature has been reached.

One of the prime objects of the invention is to provide a shut-off device of simple and economic construction which operates automatically so that the kiln operator need not be present to turn off the heating elements when the desired temperature is reached in the kiln. Most ceramic kilns in use today use pyrometric cones which tip over when a predetermined temperature is obtained within the kiln. It is necessary that the operator in charge of firing the kiln be present and be looking through a peephole to determine when the cone which is inside the kiln tips over, so that he can at that time shut off the electric heating elements or the like which are firing the kiln. As is well known, kiln temperatures are usually of a critical nature because it is necessary that the wares be fired at proper temperatures.

Another object of the present invention is to provide a shut-off device which does not take up space within a kiln and does not have to be constructed in an expensive manner to withstand the high temperatures reached within the kiln.

Another object of the invention is to provide a shut-off device of extremely reliable nature which can be readily calibrated, using commercially available elements, which in most instances the kiln operators already possess.

A further object of the invention is to design a shut-off device which can be mounted on the exterior of the kiln and can then be readily calibrated to the particular kiln, there being no necessity of providing special shut-off systems for kilns having walls of different character, for instance.

Still a further object of the invention is to provide a shut-off device which eliminates the necessity for drilling holes through the kiln walls and obviates the necessity of providing thermocouple wires or tubes.

Other objects and advantages of the invention will be pointed out specifically or will become apparent from the following description when it is considered in conjunction with the appended claims and the accompanying drawings, in which:

FIGURE 1 is a schematic view illustrating the electrical circuits which comprise the invention, and showing the various elements which make up the system;

FIGURE 2 is a greatly enlarged, elevational, sectional view showing a thermostat assembly in operative association with the pointer of the shut-off device;

FIGURE 3 is an enlarged, front elevational view showing the indicia which are placed on the face of the dial once the device is calibrated to the particular kiln; and

FIGURE 4 is an enlarged, sectional plan view illustrating the manually operable switches which are presently used with the electric heating coils in a kiln.

Referring now more particularly to the accompanying drawings, in which a preferred embodiment of the invention only has been depicted, a numeral 10 (see FIGURE 1) generally indicates a ceramic kiln, which conventionally may be formed of a suitable firebrick, as shown particularly in FIGURE 2. Such kilns are constructed with firebrick walls 11 and may be covered with exterior insulating board or the like 12 having a metal skin 13

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which, for example, may be 22 gauge steel. The insulation 12 may be a conventional asbestos insulating board such as Transite.

Provided within the kiln to heat the interior thereof to a firing temperature are electric heating coils 14 as shown. Usually a series of three coils 14 are employed in a kiln, but for the sake of convenience only one is shown in FIGURE 1. To supply electric current to the heating coil 14 in a manner which will be described, power lines 15, 16 and 17 can be connected with a source of single phase 220 volt alternating current.

Mounted on the side wall of the kiln is a box comprising an outer housing 18 having an inner wall 19 (see FIGURE 2), formed of a Transite insulating board, and an outer wall 20 upon which indicia 21 are provided, as shown, to constitute a dial. Ears 22 provided on the housing permit the device to be secured in position with screws 23. It will be noted that the firebrick wall 11, the insulation board wall 12, the metal skin 13 and the wall 19 forming the inner wall of the housing 18 are all in heat transfer engagement.

Mounted within the housing 18 is a thermostat, generally designated 24, which comprises a U-shaped mounting strap 25 which is threaded as at 26 to receive an adjusting shaft 27, the adjusting shaft 27 including an exterior knob portion 27a provided with a pointer 28. A base plate comprising a heat sensitive element 29 with a high coefficient of expansion is provided within the strap 25 in full-area conduction contact with the insulation wall board 19 and mounts a thermal spring 30 which has a low coefficient of expansion, the spring 30 being welded at its ends to the base plate 29. It will be seen that the strap 25 also mounts a pair of fine silver contacts 31 and 32 welded on nickel alloy springs 33 which are secured to the strap 25. The strap 25 is secured to the Transite plate 19 by screws 34, and screws 35 connect the base plate 29 with the strap 25. Insulated terminal screws 36 are provided on the strap 25 for the wires 38 and 39 (FIGURE 1) which connect to the springs 33 and contacts 31 and 32. The contacts 31 and 32, which are normally closed, are opened and closed by expansion and contraction of the base plate 29 and resulting inward and outward movement of the low expansion thermal spring 30. The axial position of the adjusting shaft 27 determines how much expansion of base 29 is necessary to move spring 30 inwardly sufficiently so that the normally closed contacts 31 and 32 can open.

It will be seen that a push button 40 is provided in the line 15 which leads to the heating element 14 to energize the coil 41 of a relay (such as an Arrow-Hart and Hegeman relay type O) momentarily and close the normally open contacts 42 and 43 of the relay. The contacts 42 are in a line 15a which parallels the start push button 40 so that current is supplied to the coil 41 through the line 38 and normally closed thermostat contacts when the start button 40 is returned to its open position at the time the operator releases it. Provided in parallel with line 15 is a line 44 having a lamp 45 which lights when the contacts 42 are closed, the line 44 connecting to a grounding terminal 46, as shown. The wire 47, also connected to the terminal 46, is grounded to the kiln, as at 48. The push button 40, relay, and lamp 45 are preferably housed in a control box (indicated schematically in FIGURE 1 at B) which is mounted near the kiln.

A typical dial is shown in FIGURE 3 and it will be seen that various calibrations, such as 04 and 06, are provided thereon, the line 04 corresponding to a temperature of 1905° F. and the 06 line to a temperature of 1851° F., for instance. In practice, to calibrate the dial to a particular kiln so that a particular temperature setting can be marked on the dial 20, the pointer 28 is first

swung clockwise to a position far to the right and the start button 40 is pushed. Turning of the pointer 28 to the right moves the adjusting shaft 27 inwardly to force contacts 32 and 31 inwardly to a position in which they will remain normally closed even when considerable temperatures are reached inside the kiln. Prior to pushing button 40, an 06 cone, for instance, is placed in the kiln and observed after the button is pushed, as the kiln heats up. When the push button 40 is pushed, the coil 41 is energized immediately as current flows through lines 15 and 38 and the closed thermostat contacts, and contacts 42 and 43 are immediately closed. With the closing of contacts 42 and 43, the circuit to the heating element 14 is made through the lines 15a, 15 and 17. At the same time, current is furnished to the lamp 45 via the lines 15a, 15 and 44. When the kiln heats up to a temperature which causes the 06 cone in the kiln to tip over, the dial pointer 28 is turned counterclockwise to the point where the lamp 45 goes off, and this will be the 06 setting which is marked on the dial 20. In turning counterclockwise, the adjusting shaft 27 moves outwardly relative to the contact springs 33 and permits them to return to a position in which the expansion of base plate 29 has moved low expansion spring 30 inwardly sufficiently so that the spring 33 of contact 31 can move contact 31 away from contact 32, and open the thermostat 24. When the thermostat 24 contacts 31 and 32 are opened, the coil 41 is deenergized and contacts 42 and 43 are opened, so that no power is supplied to heating coil 14 or lamp 45. The 04 and other settings which correspond to other temperatures can be similarly marked on the dial 20 in the same manner.

Thereafter, in the operation of the kiln, the operator will, when the kiln is cold and he wishes to create an 06 temperature in it, simply move the pointer 28 to the 06 setting, for instance. When he pushes the push button 40, power is immediately supplied to the lamp 45 and heating coil 14. When the temperature in the kiln reaches the temperature corresponding to the 06 setting, the thermostat contacts 31 and 32 automatically are opened. When the temperature within the kiln 10 drops below the 06 temperature, the contraction of the base plate 29 will permit the spring 30 to once again close contacts 31 and 32. However, coil 41 will not be energized and the heating element 14 will not again be activated to overfire the kiln and deleteriously affect the ware.

It should be apparent that I have provided a simple and reliable kiln shut-off device which can be readily furnished to kiln operators to attach to existing kilns or which, of course, could be furnished with new kilns as original equipment. In some kilns the insulation wall 12 is much thicker than in most kilns. Where the wall 12 is particularly thick a light, heat conducting probe can be attached to the element 29 or at least placed in heat conductive engagement with it. This probe would extend from the element 29 through the wall 12 and into engagement with the outer surface of the brick 11.

In FIGURE 4 I have shown how the connection is made in a kiln in which a plurality of heating elements 14 are employed. The present manually operated switches S which are enclosed in a box B' are simply moved to closed position and remain closed, thus permitting the automatic shut-off device which I have described to operate the kiln. While resistance heating coils 14 are shown for heating the kiln, it is anticipated that the device will also be useful when other electrically controlled heating elements are employed.

It is to be understood that the drawings and descriptive matter are in all cases to be interpreted as merely illustrative of the principles of the invention, rather than as limiting the same in any way, since it is contemplated that various changes may be made in the various elements to achieve like results without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a ceramic kiln or the like; a kiln housing; electrically controlled heating means within said housing; an electric circuit for said electrically controlled heating means; thermostat means connected therein including an actuating element in heat transfer engagement with an outer wall surface of said kiln housing operative to shut off said heating means when a predetermined temperature is reached in said kiln; an assembly, including scale markings and indicator means, outside said housing and connected with said thermostat means for controlling the operation of said thermostat means so that it is actuated when the indicator means is set at a particular scale marking and the temperature corresponding to the marking is reached in the kiln; and signal means signaling when said thermostat element is actuated to indicate that the predetermined temperature has been reached.

2. The combination defined in claim 1 in which said signal means comprises a lamp and said thermostat means has normally closed contacts which are opened when said predetermined temperature is reached.

3. The combination defined in claim 1 in which said actuating element of the thermostat means is in heat conductive engagement with a heat insulating board which is in heat conductive engagement with the exterior surface of a wall of said kiln.

4. In a ceramic kiln or the like; a kiln housing formed of a heat insulating material; electric heating means within said kiln; a power source; a first circuit line connecting said power source and electric heating means; thermostat means having normally closed contacts; an actuating element for said thermostat means; a second circuit line connecting said power source and the contacts of said thermostat means; a heat insulating backer plate in facial engagement with an exterior wall of said kiln housing and in heat conductive engagement with the actuating element of said thermostat means; said actuating element being expansible under the influence of a temperature rise to disengage the contacts of said thermostat means; a relay, having a coil in series with said contacts of the thermostat means, and normally open contacts in said circuit line connecting said power source and electric heating means, said relay also having normally open contacts in said line connecting said power source and contacts of said thermostat means; lamp means in parallel with said second circuit line; and push button means in said first circuit line for energizing the coil and lamp and closing said normally open contacts.

5. The combination defined in claim 4 in which said first and second circuit lines are in parallel.

6. In a ceramic kiln or the like; a kiln housing formed of a heat insulating material; electric heating means within said kiln; a power source; a first circuit line connecting said power source and electric heating means; thermostat means having normally closed contacts; an actuating element for said thermostat means; a second circuit line connecting said power source and the contacts of said thermostat means; a heat insulating backer plate in facial engagement with an exterior wall of said kiln housing and in heat conductive engagement with the actuating element of said thermostat means; said actuating element being expansible under the influence of a temperature rise to disengage the contacts of said thermostat means; a dial having markings thereon corresponding to known temperatures; a threaded operating shaft with a pointer thereon adjustable axially to vary the set of said thermostat means actuating element to open said thermostat contacts when a predetermined temperature is reached in said kiln; a relay, having a coil in series with said contacts of the thermostat means, and normally open contacts in said circuit line connecting said power source and electric heating means, said relay also having normally open contacts in said line connecting said power source and contacts of said thermostat means; lamp means in parallel with said second circuit line; and push button means in

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said first circuit line for energizing the coil and lamp and closing said normally open contacts.

7. The combination defined in claim 4 in which said thermostat actuating element closes said contacts of the thermostat means to energize said coil when the temperature drops below the predetermined temperature.

8. In a ceramic kiln; a kiln housing; electrically controlled heating means within said housing; an electric circuit; thermostat means connected therein including an actuating element in heat conductive engagement with an outer wall surface of said kiln operative to shut off said heating means; a dial having markings thereon corresponding to known temperatures; and an indicator for said dial; one of said indicator and dial having a shaft engaging and controlling the operation of said thermostat means so that said thermostat means is actuated when the indicator is set at a particular marking and the temperature corresponding to the marking is reached in said kiln.

9. In a ceramic kiln; a kiln housing; electrically controlled heating means within said housing; an electric circuit; temperature responsive means connected therein including an actuating element in heat conductive engagement with an outer wall surface of said kiln operative to shut off said heating means; a scale having markings thereon corresponding to known temperatures; and an indicator for said scale; one of said indicator and scale

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having means controlling the operation of said temperature responsive means so that said temperature responsive means is actuated when the indicator is set at a particular marking and the temperature corresponding to the marking is reached in said kiln.

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