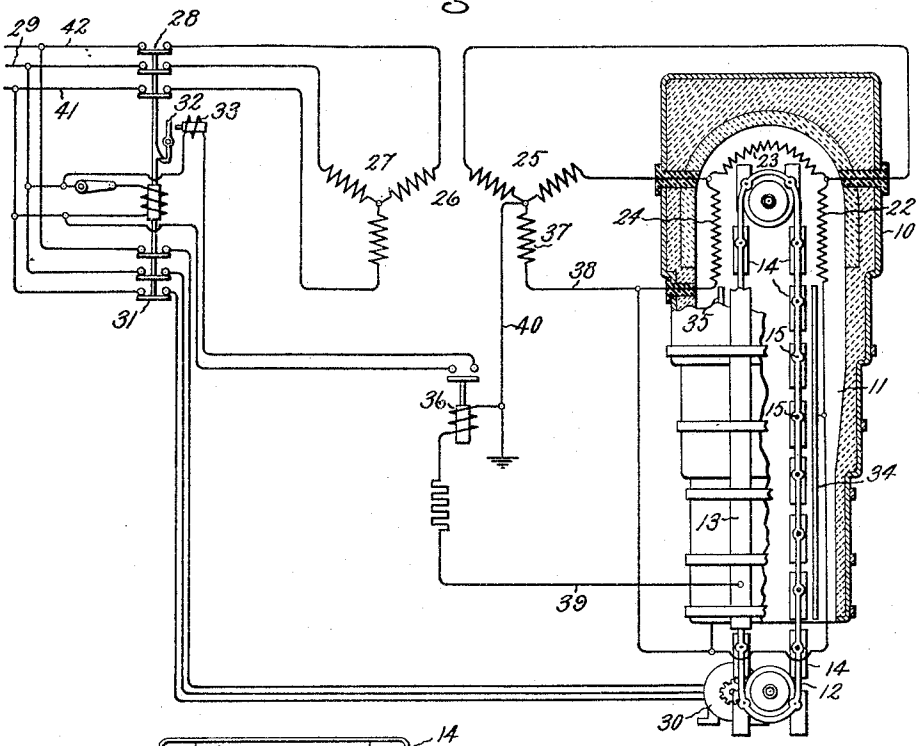
April 18, 1933. R. D. VAN NORDSTRAND 1,904,580

PROTECTIVE CIRCUIT FOR ENAMELING FURNACES

Filed July 24, 1931

Fig. 1.



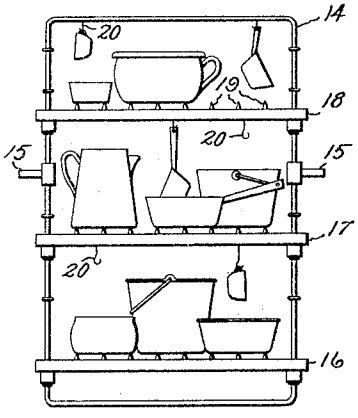


Fig. 2.

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UNITED STATES PATENT OFFICE

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PROTECTIVE CIRCUIT FOR ENAMELING FURNACES

Application filed July 24, 1931. Serial No. 553,016.

My invention relates to furnaces of the conveyor type and more particularly to protective means therefor and has for an object the provision of a simple and reliable means for deenergizing the furnace and stopping the convevor on the occurrence of an abnormal condition, such as the dislodgement of the work from the conveyor cradles or the undue oscillation of the cradles.

In continuous vitreous enameling furnaces the furnace is usually constructed with a relatively long approach chamber, and an endless conveyor mounted on a suitable track carries the work through the approach chamber to and from the furnace, baking the enamel on the work.

In order to maintain the coating of enamel relatively intact, the work to be enameled is usually supported on each conveyor cradle by sharp pointed pins or it may be suspended from the cradle by suitable hooks. Inasmuch as each cradle is pivotally carried by the conveyor, any jerkiness in the travel of the conveyor will cause the cradles to oscillate about their pivots often dislodging the work from its relatively unstable support. The oscillations may be great enough at times to cause the cradle to strike the walls of the approach chamber or the heating units within the furnace. Upon the occurrence of either condition, a jam may be formed, causing considerable damage.

In carrying out my invention in one form, I provide a relay for controlling the deenergization of the furnace and of the conveyor driving motor on the occurrence of an abnormal oscillation of a conveyor cradle. The relay is operated by the completion of its energizing circuit by a cradle oscillating sufficiently for the work carried thereon or for the cradle itself to strike a conductor extending along the conveyor and in juxtaposition therewith. It will thus be observed that if either the cradle or the work carried by the cradle comes into contact with the conductor the relay operates to deenergize the furnace and the conveyor motor. Ordinarily, of course, the enamel is a good insulator but I have found that in its heated condition it is sufficiently conductive to operate the relay.

It is to be understood that my invention is not limited to the conductor arrangement described as other means will now suggest themselves which will respond to the oscillation of the cradles caused by the jerky motion of the conveyor.

For a more complete understanding of my invention reference should now be had to the drawing in which Figure 1 is an elevation partly in section of a furnace and the protective circuit therefor embodying my invention, and Figure 2 is an elevation of one of the cradles of the conveyor loaded with work to be enameled.

Referring to the drawing, I have shown my invention in one form as applied to a vertical vitreous enameling furnace 10 having a relatively long approach chamber 11 within which is suitably mounted a motor driven overhead endless conveyor 12 as by the conveyor track 13 secured to the walls of the furnace. Cradles 14 are pivotally carried by the conveyor 12 and are free to oscillate about their pivots 15, which are substantially horizontal. Each cradle as is shown in Figure 2 has a plurality of shelves as indicated by the reference numerals 16, 17 and 18 and extending upwardly from each shelf there are provided a plurality of sharp pointed pins 19 for supporting the work. It will, of course, be understood that the sharp pointed pins 19 provide a minimum supporting area for each article to be enameled. There is also provided on each cradle suitable hooks 20 from which work to be enameled such as cups or small utensils may be suspended.

In the operation of the conveyor 12, I have found that the cradles are subjected to oscillations which oscillations are primarily due to a jerky motion of the conveyor arising from irregularities in the track 13, or from the inherent variable friction usually encountered with relatively long conveyors. At times the oscillations may be great enough to dislodge the work or to cause a cradle 14 to strike the walls of the approach chamber or of the heating coils provided within the working chamber of the furnace 10. Whenever a cradle does strike the wall of the furnace the sudden stopping of the oscillation

in nearly all cases dislodges the work from its relatively unstable support. And it will at once be seen that if work being enameled, such as a bucket or the like, falls from one of the upper cradles the probability of its striking other cradles as it falls and dislodging more work being enameled is very great. The result is generally a jam formed by the piling up of the utensils or articles within the furnace. The conveyor 12 not only should be immediately stopped but also the heating means for the furnace 10 should be immediately rendered ineffective in order to minimize the scorching or burning of the work on the cradles which work would otherwise be ruined.

In the form of my invention shown the heat for the furnace is generated by the heating resistors 22, 23 and 24, which resistors are directly connected across the secondary 25 of a Y-connected transformer 26, the primary 27 of which is connected through an electromagnetically operated switch 28 shown in its closed position to a suitable source of supply indicated by the reference numeral 29. The energization of the motor 30 driving the conveyor 12 is controlled by a switch 31 operated with the switch 28. A suitable trip 32 is arranged to open the switches 28 and 31 whenever the trip operating coil 33 is energized, which coil 33 is arranged to be energized whenever the abnormal oscillation of a cradle occurs, thus deenergizing the furnace heating resistors 22, 23 and 24 and the conveyor motor 30.

This is accomplished by providing protective conductors 34 and 35, arranged in juxtaposition with the conveyor 12 in the approach chamber so that if a cradle in the approach chamber oscillates more than a predetermined amount either the cradle or the work carried thereon will strike conductor 34 or conductor 35, before striking the wall of the approach chamber, thereby energizing a relay 36 which completes the circuit to the trip coil 33. In the furnace proper or in the working chamber the heating resistors 22, 23 and 24 serve not only to generate the heat for the furnace but also to perform the function of the protective conductors 34 and 35.

It will now be assumed that the upper right hand cradle on the conveyor has been oscillated until it strikes the heating resistor 23. The conveyor is immediately stopped and the furnace deenergized as above described by the completion of the circuit of the relay 36 which circuit may be traced from a transformer coil 37 by conductor 38 to the resistor 24, resistor 23, the cradle in contact with resistor 23, the conveyor track 13, by conductor 39, the operating coil of the relay 36, by conductor 40 to the neutral point of the secondary 25 of transformer 26. The relay 36 now closes, establishing an energizing circuit for the trip coil 33 which circuit may be traced from the supply line 41, relay 36, trip coil 33, and to the other supply line 29. The trip 32 for switches 28 and 31 is thereupon operated, the said switches immediately opening to deenergize both the conveyor motor 30 and the heating resistors 22, 23 and 24.

Also if one of the articles being enameled strikes either the protective conductors 34, 35, or the heating resistors 22, 23, 24, the circuits are completed as above described to deenergize the furnace and the conveyor motor 30, inasmuch as the enamel becomes conductive when hot.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In a protective system for furnaces, the combination of heating means for said furnace, motor driven means for conducting work through said furnace along a restricted path, and means responsive to a predetermined departure of said motor driven means from said restricted path at any point thereof for rendering said heating means ineffective and for stopping said motor driven means.

2. The combination in a furnace of heating means for said furnace, a conveyor extending within said furnace and having work carrying cradles pivotally mounted on said conveyor, driving means for said conveyor, and means responsive to undue oscillations of any one of said cradles within said furnace for rendering said heating means ineffective and for stopping said driving means.

3. In a protective system for vitreous enameling furnaces having an approach chamber, the combination of heating resistors for said furnace, a conveyor extending within said furnace, work carrying cradles pivotally mounted on said conveyor, a driving motor for said conveyor, deenergizing means for said resistors and said driving motor, and conductive means responsive to undue oscillations of any one of said cradles about their pivots and in juxtaposition with said conveyor for operating said deenergizing means whereby said heating resistors and said motor are deenergized on the occurrence of more than a predetermined oscillation of any one of said cradles.

4. In a protective system for vitreous enameling furnaces having an approach chamber, the combination with heating resistors for said furnace, a conveyor, a plurality of work carrying cradles pivotally mounted thereon, a motor for driving said

conveyor, a relay arranged to deenergize said resistors and said motor, a conductor between said conveyor and said furnace wall arranged to be engaged by said cradles when unduly oscillating about their pivots, and means responsive to the engagement of a cradle with said conductor for energizing said relay whereby said resistors and said motors are deenergized.

5. Protective means for vitreous enameling furnaces having an approach and a working chamber, a conveyor having work carrying cradles pivotally mounted thereon, a motor for driving said conveyor, a relay arranged to deenergize said motor, an energizing circuit therefor, and means responsive to undue oscillations of any one of said cradles in either said approach chamber or said working chamber for completing said circuit whereby said motor is deenergized.

6. In a protective system for furnaces the combination of heating resistors for said furnace, a conveyor for said furnace having cradles pivotally mounted thereon, a motor for driving said conveyor, means responsive to the contact of any one of said cradles with said resistors for deenergizing said resistors and said motor.

7. In a protective system for a furnace, the combination of a driven conveyor extending therein, a driving motor for said conveyor, work carrying means carried by said conveyor, means for stopping said driving motor, and means interposed between said conveyor and extending along the entire length of said furnace wall adjacent said conveyor to effectuate operation of said motor stopping means whenever said work carrying means or work carried thereby strikes said interposed means.

8. In a protective system for furnaces having walls arranged to form a working chamber and an approach chamber, the combination with heating resistors mounted in spaced relation with the walls of said working chamber, an endless conveyor extending through said approach chamber and into said working chamber, a plurality of charge supporting cradles pivotally mounted on said conveyor, a motor for driving said conveyor, a relay for controlling the deenergization of said resistors and said motor, elongated conductors connected to said resistors and supported between said conveyor and said walls and in juxtaposition with said conveyor, an energizing circuit for said relay completed by engagement of any one of said cradles with any portion of said conductors or resistors.

In witness whereof, I have hereunto set my hand.

ROBERT D. VAN NORDSTRAND.