April 15, 1924. 1,490,408

T. VAN ALLER

PROTECTIVE MEANS FOR ELECTRIC FURNACES

Filed April 26, 1922

Fig. 1.

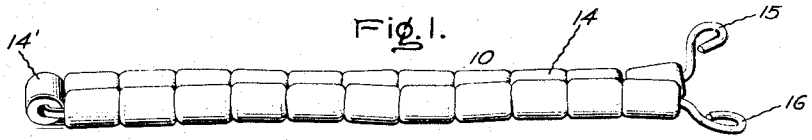


Fig. 2.

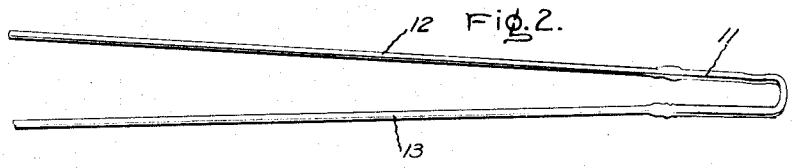
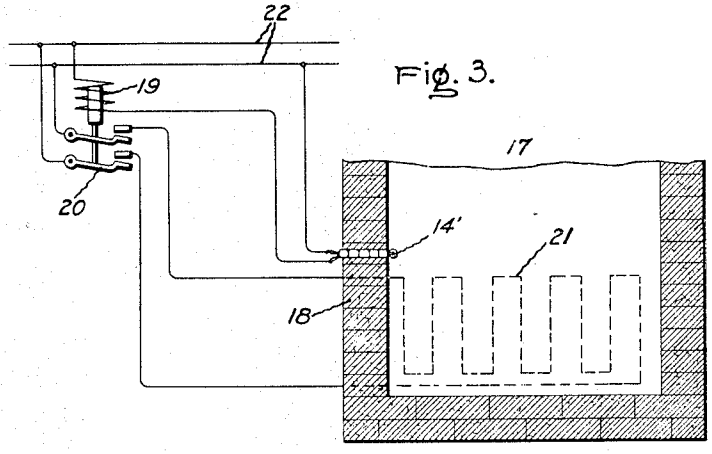


Fig. 3.



Inventor:
Tycho Van Aller,
by Albert G. Davis
His Attorney

Patented Apr. 15, 1924. 1,490,408

UNITED STATES PATENT OFFICE.

TYCHO VAN ALLER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PROTECTIVE MEANS FOR ELECTRIC FURNACES.

Application filed April 26, 1922. Serial No. 556,782.

To all whom it may concern:

Be it known that I, TYCHO VAN ALLER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Protective Means for Electric Furnaces, of which the following is a specification.

My invention relates to protective means for electric furnaces and has for its object the provision of means for opening the heating circuit of the furnace upon the occurrence of a predetermined maximum temperature therin.

More specifically my invention relates to high temperature electric furnaces such as are used, for example, in the heat treatment of metals for the purpose of annealing, hardening, etc. Such furnaces are commonly heated by a resistance heater which is designed to safely withstand a certain maximum temperature. This maximum safe temperature is often only slightly higher than the maximum working temperature (approximately 900° C.) required in the furnace, and consequently care must be taken in the operation of such a furnace, particularly when operating at the maximum working temperature, to prevent overheating and destruction of the heating element. Such overheating may also result in damage to the furnace walls and the charge being heated.

It is therefore imperative in prolonging the useful life of the furnace that some means be provided to protect furnaces of this type against accidental overheating through carelessness of the operator, or from any other cause. I have found that a fuse made of silver provides a simple, reliable and efficient means for protecting furnaces of this type. I preferably mount the silver element in the interior of the furnace where it is exposed to the temperature of the furnace and arrange the element so that it will open the heating circuit of the furnace when subjected to a temperature sufficient to fuse it. I have found that silver, while possessing the property of resisting oxidation essential in a fuse, has also the characteristic of fusing at a temperature making it suitable for the protection of high temperature electric furnaces, particularly high temperature resistance furnaces. Where a somewhat higher maximum safe temperature is either permissible or desirable, gold lends itself as a suitable fuse metal.

For a better understanding of my invention, reference should be had to the accompanying drawing in which Fig. 1 is a perspective view of a fuse embodying my invention; Fig. 2 is a view of the fusible element and leads before the insulating beads are applied; while Fig. 3 is a diagrammatic view showing an electric furnace equipped with a protective means embodying my invention.

Referring to the drawing, the fuse 10 in one form of my invention comprises a short strip or link 11 of silver, forming a fusible element, which is electrically connected at its ends to two short heat refractory, electrically conducting leads 12 and 13. The leads may be formed, for example, of nickel chromium alloy resistance material. The fusible element 11 may be welded or otherwise connected to the leads after which insulating beads 14 are slipped on the leads and fusible element and the fusible element bent intermediate its ends to form the whole in the shape of a hair pin, the leads 12 and 13 being substantially parallel and insulated by beads 14. One of the beads 14′ is positioned on the fusible element across the end of the fuse. The free ends of the leads 12 and 13 are then bent, as shown in Fig. 1, to form eyelets 15 and 16 whereby the fuse may be conveniently connected in an electric circuit. This also secures the beads in place on the leads.

As shown in Fig. 3, the fuse is mounted in the high temperature resistance furnace 17 with the leads 12 and 13 extending through the wall 18, and the fusible element 11 with the bead 14′ located in the interior of the furnace so as to be exposed to the temperature therein. The fuse may be connected, as shown in the drawing, in circuit with the operating coil 19 of a contact or switch 20 which effects the connection of the resistance heater 21 of the furnace to a suitable source of supply 22. Operating coil 19 is also energized from supply source 22. When the operating coil is energized the contactor is held in closed position and the resistance heater 21 thus connected to the supply source 22.

In a high temperature furnace of the resistance type the maximum possible safe temperature is limited by the heat refractory

characteristics of the resistance heating element. With the usual heating resistance material, for example, nickel chromium alloy, this maximum temperature is, approximately from 1000 to 1100 degrees C. A temperature of 800 to 900 degrees C. has been found to be ample for the heat treatment of metals, such as in annealing, hardening, etc. This, however, leaves a small margin between the maximum working temperature required and the maximum safe working temperature of the furnace. As a protective device to prevent overheating in the furnace silver, by reason of its melting point at 961 degrees C. is therefore particularly adapted.

The fusible element may be heated somewhat by the passage through it of the exciting current for the operating coil 19 and consequently may fuse upon the occurrence of a furnace temperature somewhat lower than the melting point of silver. Under normal conditions of operation the operating coil circuit will be maintained closed through the fuse 10. Upon the occurrence of a temperature in the furnace approaching its maximum safe temperature the fusible element will melt opening the circuit of operating coil 19, whereupon the contactor will drop out disconnecting the resistance heater. The opening of the control circuit is made more positive and excessive arcing prevented by the bead 14′ which immediately falls upon the fusing of the element 11.

By using the heat refractory leads 12 and 13 the amount of the fusible metal necessary may be limited to only that portion of the fuse which is exposed directly to the temperature of the furnace, whereby the cost of the fuse is greatly reduced. The conductors 12 and 13 extend through the furnace walls and serve as a means for connecting the fusible element in a suitable electric circuit.

In case a somewhat higher maximum temperature limit is desired the fusible element may be made of gold.

While I have described my invention as embodied in concrete form and as operating in a specific manner in accordance with the provisions of the patent statutes, it should be understood that I do not limit my invention thereto, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

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

1. The combination with a high temperature electric furnace, of a fuse of non-oxidizable metal subjected to the temperature in said furnace and adapted to control the heating circuit of said furnace upon the occurrence of a predetermined temperature therein.

2. The combination with a high temperature electric resistance furnace, of a fuse of silver subjected to the temperature in the furnace and adapted to control the heating circuit of said furnace upon the occurrence of a predetermined temperature therein.

3. A protective device for electric furnaces comprising insulated heat refractory electrical conductors extending through the wall of said furnace, and a link of non-oxidizable fusible metal in said furnace connecting the inner ends of said conductors and adapted to open a circuit therethrough to control the heating circuit of said furnace upon the occurrence of a predetermined temperature therein.

4. A protective device for electric furnaces comprising insulated heat refractory electrical conductors extending through the wall of said furnace, and a link of silver in said furnace connecting the inner ends of said conductors and adapted to control a circuit therethrough to open the heating circuit of said furnace upon the occurrence of a predetermined temperature therein.

In witness whereof, I have hereunto set my hand this 25th day of April, 1922.

TYCHO VAN ALLER.