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H. S. MARSH ET AL
THERMOELECTRIC PYROMETER

Filed Sept. 24, 1925

FIG. I.

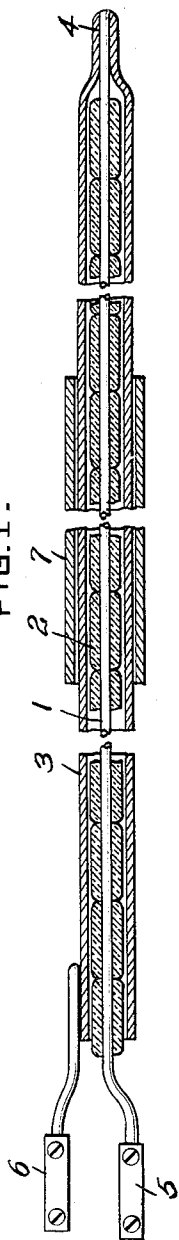


FIG. III.

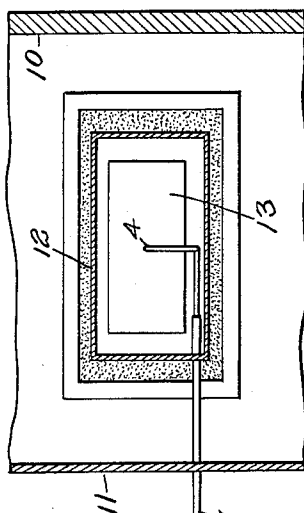
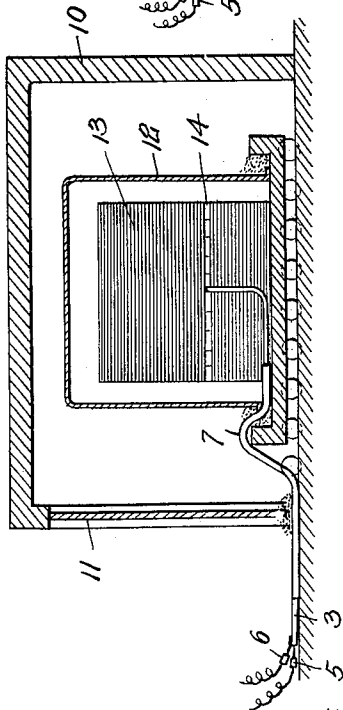


FIG. II.



WITNESSES

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UNITED STATES PATENT OFFICE.

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THERMOELECTRIC PYROMETER.

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Our invention relates to the structure of thermo-electric pyrometers, and consists in features of structures which render such instruments more durable under service conditions.

A thermo-electric pyrometer of our invention is shown somewhat diagrammatically and in longitudinal section in Fig. I of the accompanying drawings. Fig. II is a view in vertical section and Fig. III in horizontal section through an annealing furnace for steel sheets and they show the pyrometer of our invention in one typical application. Figs. II and III are drawn to much smaller scale than Fig. I.

The pyrometer of our invention involves the use of a thermo-couple, that is to say, two lengths of dissimilar metals united at one end and otherwise insulated one from the other. A circuit including a galvanometer or other measuring instrument is completed between the otherwise free ends of the two lengths of metal, and the united ends are subjected to the temperature condition, whose value is to be determined.

The Leeds and Northrup potentiometer system includes a thermo-couple whose components are formed of base metals. Two wires are employed, one of iron, the other of constantan. Constantan is an alloy of copper and nickel. We preferably employ like materials, and our invention lies in structure.

For the particular use to be indicated below we take an eighth-inch constantan wire eighteen feet long, indicated at 1, Fig. I. Upon this wire we string a succession of clay beads 2, to serve as insulators. These beads are of suitable diameter to slip within a three-eighths inch pipe, and may be an inch long. Instead of an iron wire (the Leeds and Northrup system employs iron) we provide a steel pipe 3 of three-eighths inch diameter and seventeen feet long. Into it we draw the beaded constantan wire. The end of the wire projects somewhat beyond the final bead. The end of the pipe is hammered flat upon the end of the end of the included constantan wire, and the two metal bodies are welded at this point 4, to form the hot end of the thermo-couple. Brass electrical couplings 5 and 6 are attached, one to the free end of the constantan wire 1, the other to the free end of the steel pipe 3. Leads of constantan and of iron wire may manifestly be secured to these

couplings, to complete a circuit through a galvanometer or other measuring instrument.

Turning to Figs. II and III, 10 indicates the wall and 11 a door of an annealing furnace. 12 is an annealing box within the furnace, and 13 a pile of sheets within the annealing box. At about one third of the distance from the base a layer 14 of one-inch bars is introduced in the pile, and between the bars of this layer the hot end of the pyrometer is introduced. The pyrometer is proportioned and shaped to occupy the position clearly illustrated in Figs. II and III. From the hot end which, as has been said, extends into the interior of the pile 13, the pyrometer extends externally of the pile to the base of the box; thence beneath the rim and through the luting which seals the box upon its base; thence across the furnace space, and out beneath the furnace door, and through the luting, if any, found at that point. The free ends of the couple, externally of the furnace, are connected as has been said.

It is that portion of the couple particularly which extends from beneath the annealing box, across the furnace chamber to exit beneath the furnace door which particularly is subject to destruction. The hot furnace gases which at this point sweep over the introduced instrument tend to destroy it rapidly.

By forming our couple as a wire within a tube, we protect one element of the couple by the other, and, as we have explained, we make the more costly and more perishable member the inner member. We also have a construction in which one envelope of insulation suffices; otherwise, two are necessary, one surrounding each element of the couple.

Additionally, we provide an extra heavy, three-quarter inch steel sleeve 7 and surround with it so much of the couple as in service extends through the furnace space. When the couple has been formed and the sleeve 7 has been brought to place, the assembly is bent hot to the shape required for service. The assembly of the one-eighth inch constantan wire within the three-eighths inch steel pipe, may be bent by hand; accordingly beyond the sleeve 7 and toward its inner or hot end, the couple is easily shaped, to fit boxes of different sizes.

But for our invention, such a pyrometer

made of wires and wrapped for protection with asbestos, is dependable for accuracy for only one heat; built according to our invention, the pyrometer lasts perfectly
5 from twenty to forty heats. We have found that so far as temperature detection is concerned, a steel pipe is equally efficacious with an iron one, and obviously is cheaper to provide. Other base metals than those particu-
10 larly named may, of course, be employed.

The pyrometer as we have designed and built it is peculiarly suited to the rough usage which such an instrument must endure in a steel mill.

15 We have illustrated and particularly described one application of the pyrometer of our invention; manifestly it is applicable generally, and particularly where the temperature of an object is to be measured,

which is situated within a box or under a
20 cover, and to which there is no approach but across a zone of oxidizing flame; to carbonizing boxes, for example.

We claim as our invention:

1. A thermo-couple in which beads of in-
25 sulation are strung upon one member while the other member in tubular form envelops the assembly.

2. A thermo-couple of which one member in the form of a steel tube encircles the other
30 member in the form of a wire of dissimilar metal, a succession of clay beads being threaded on the wire within the tube.

In testimony whereof we have hereunto set our hands.

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