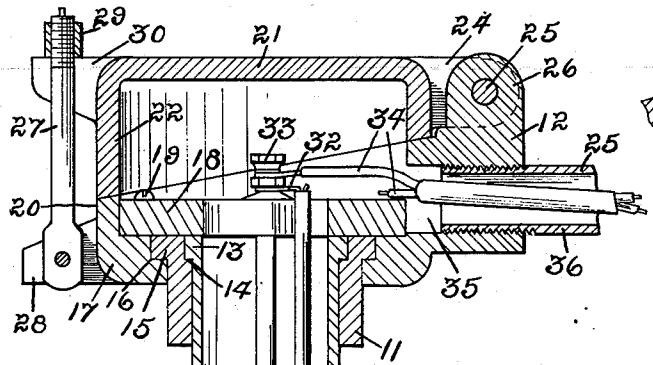
July 26, 1932. J. A. JEFFERY ET AL 1,869,151

PYROMETER TUBE

Filed May 17, 1926



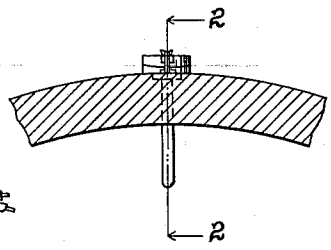




Fig. 1.

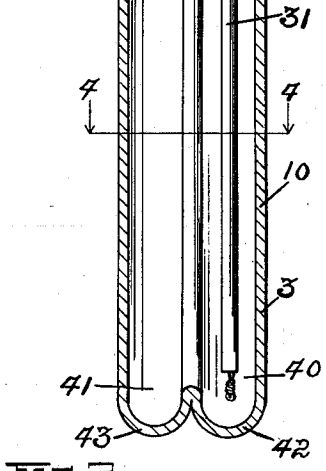



Fig. 2.

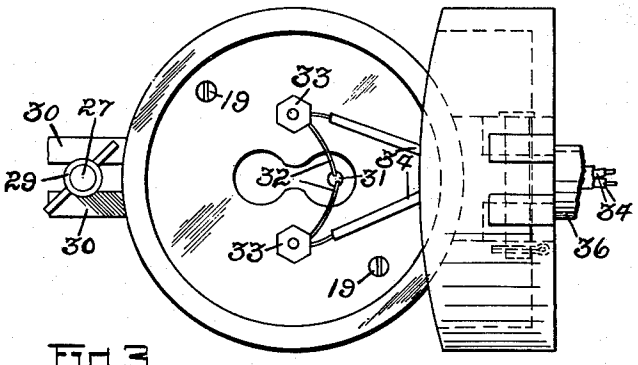



Fig. 3.

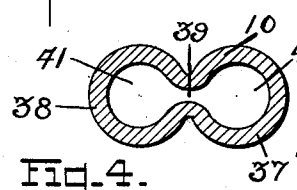



Fig. 4.

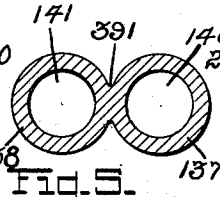



Fig. 5.

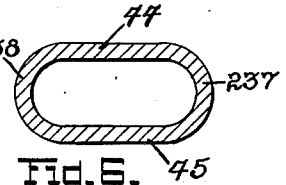



Fig. 6.

Inventor

Joseph A. Jeffery.

Frank H. Riddle.

By Owen + Owen

Attorneys.

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# UNITED STATES PATENT OFFICE

JOSEPH A. JEFFERY AND FRANK H. RIDDLE, OF DETROIT, MICHIGAN, ASSIGNORS TO CHAMPION PORCELAIN COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN

## PYROMETER TUBE

Application filed May 17, 1926. Serial No. 109,473.

Our invention relates to pyrometer tubes, and more particularly to tubes modified for convenience in checking the accuracy of the thermocouples. The purpose of our invention is to provide a tube which may be substituted for tubes now commonly in use and which will provide improved facilities for checking the thermo-couple and the pyrometer as a whole.

Thermo-couples which are used to measure temperatures of furnaces, and where they are used in other positions in which there are likely to be gases or vapors deleterious to thermo-couples, are usually supported in gas tight tubes. The usual material for such tubes is porcelain.

Usually, one end of a pyrometer tube projects into the furnace or other location, the temperature of which is to be tested, and its other end connects with a head having binding posts and leads for making electrical connections between the thermocouple and an indicating device.

It has been customary to remove a thermocouple from the place in which it is being used, and take it to the laboratory for calibration. This method has several disadvantages, particularly if the set up is in an extremely warm or rather inaccessible position. If the thermo-couple is removed from the tube, there is considerable difficulty, and a possibility of breaking the platinum wires, also in reconnecting there is a possibility of not getting the set up quite the same as before, or the same as the set up in laboratory during testing. Where the tube is taken out with the thermocouple, there is considerable danger of breaking the tube during handling, also the possibility of letting dirt through the port into the furnace, or into the outer protection tube, if there be one. Putting the cool tube back into the hot furnace is likely to break it and contaminate the couple.

The removal and reinstallation of the set up must be done by a skilled operator, and the operation is very unpleasant, and the incident breathing of partially combusted gases quite often results seriously. The time consumed in removing the couple, calibrating or testing, and replacing is considerable, and during this time the equipment must be run without the aid of a pyrometer or else a substitute couple must be employed, with the resultant necessity of making two removals and reinstallations, instead of one.

Sometimes a furnace has been provided with an additional opening in which the tube of a standardized pyrometer could be placed for testing purposes; but this requires a special construction of the furnace, which is expensive and of no utility except when tests are needed, and exposes the tube of the standard pyrometer to danger of breakage during handling. The heat conditions in a furnace are seldom uniform, and the pyrometer tubes are frequently protected by encasing blocks, which may vary in conductivity, so that it is impossible to eliminate the doubt as to whether any discrepancy in the reading of the standard instrument and the regular equipment is due to a difference in the pyrometer or to a difference in the heat conditions to which their thermocouples are subjected.

We avoid the above and other difficulties by our invention, which will be described in connection with the accompanying drawing, forming a part of this specification.

In the drawing, Figure 1 is a section of a portion of a furnace wall, showing a pyrometer tube and connections which may be used in carrying out our invention; Fig. 2 is an enlarged section on the line 2—2, Fig. 1; Fig. 3 is a plan view of the end closure with its lid open; Fig. 4 is a section on the line 4—4, Fig. 2; Figs. 5 and 6 are sections similar to Fig. 4 of alternative forms of tubes.

In the form of device shown, a tube 10 is mounted in a bushing 11 adapted to be inserted in a suitable opening in the wall of an enclosure, the temperature of which is to be measured. The bushing is mounted, in turn within an enclosure 12.

We prefer to form the tube with a flange 13 adapted to fit in a groove 14 in the bushing, and the bushing with a flange 15 adapted to fit in a groove 16 in the base plate 17 of enclosure 12. A plate 18 is removably fastened to the base plate by screws 19, or

other suitable means, and holds both bushing and tube in proper position.

Enclosure 12 is formed by base plate 17 having an upstanding flange 20, and a lid 21 having a flange 22 adapted to abut flange 20. The lid has outstanding lugs 24 which are pivoted at 25 to an upstanding lug 26 on flange 20. A clamping bolt 27 is pivoted to lugs 28 on the base plate and has a clamping nut 29 adapted to bear on lugs 30 on the lid and so hold the lid clamped against the base plate.

A thermo-couple 31 is mounted within the tube, and is connected by leads 32 to binding posts 33 and 33 suitably mounted on plate 18. From these binding posts leads 34 pass out through an opening 35 in flange 20, and through conduit 36 to an electrical indicator, not shown, adapted to indicate the temperature to which the thermo-couple is subjected.

It is desirable to surround, or substantially surround, the thermo-couple with a tube which is of substantially even thickness and heat transmitting power, and which is approximately equi-distant at all points from the thermo-couple, so that heat from various directions is transmitted to the thermo-couple in a substantially uniform manner.

A uniform cylindrical tube answers these requirements, and is a customary form of tube. Our preferred form of tube is shown in Figs. 2 and 4. The cross section of this tube is shaped like a figure 8. It is formed of two substantially cylindrical members 37 and 38 arranged so closely side by side that they overlap, and as a result there is a small slit 39 connecting the two channels 40 and 41 of the tube. The end of the tube is formed of two substantially hemispherical portions 42 and 43. Such a tube heats a thermo-couple in either of its channels substantially the same as a cylindrical tube, and both channels are heated substantially the same. The channels act as guides, so that a thermo-couple may be inserted in or withdrawn from one channel without danger of injurious contact with a thermo-couple in the other channel.

When the thermo-couple 31 in channel 40 of our pyrometer is to be tested, the thermo-couple of a standard pyrometer is inserted in channel 41. It will be seen that the regular equipment does not need to be disturbed in order to test it, that no additional tube is needed for the standard pyrometer, and that the thermo-couple will be affected in substantially the same way by heat around the tube.

In Fig. 5 a tube is shown differing from that shown in Figs. 2 and 4 by having the cylindrical walls of portions 137 and 138 completed, so that there is a dividing wall 391 between the two channels 140 and 141. This has the advantage of surrounding each thermo-couple by a wall equi-distant therefrom at all points, but does not allow the interchange of gases between the channels.

In Fig. 6 there is shown a cross section of a tube having two semi-cylindrical portions 237, 238 connected by straight side walls 44 and 45. This tube has the wall equi-distant from the thermo-couple through only 180°, and does not furnish a guiding groove to aid in positioning a thermo-couple, but has the advantage of free interchange of gases between the portions surrounding two thermo-couples located along the axes of the respective portions 237 and 238.

Although the lower ends of the tubes shown in Figs. 5 and 6 are not shown, it will be readily understood that the lower end of the tube shown in Fig. 5 is formed of two semi-spherical portions, as in Fig. 1, while the bottom of the tube shown in Fig. 6 is formed of two quadra-spherical portions at the ends of portions 237 and 238, and a semi-cylindrical portion unites the ends of sides 44 and 45.

It will be readily seen that our invention provides a pyrometer tube which may be substituted for the simple tubes in use, without any necessity for changing the structure of the furnace or other inclosure with which the pyrometer is associated, and allows the testing of the thermo-couple or entire pyrometer in such an accurate and expeditious manner that it renders practicable the frequent testing which is necessary to avoid trouble from false heat indications.

Various changes may be made in the form of device shown, and while we prefer, and claim as especially useful, a tube having a shape in cross section substantially like a figure 8, the invention is not confined to the exact shape of the tube except where this is made a part of the appended claims. Some of the benefits of our invention may be attained with tubes of shapes other than those shown, and various other changes may be made, in the device illustrated, without departing from the scope of the appended claims.

In the appended claims the expression "portable pyrometer tube" is intended to cover a tube capable of being inserted in place of the usual pyrometer tube, and to distinguish from a block which forms a permanent part of a furnace wall.

What we claim is:

1. A pyrometer tube having walls of substantially equal thickness throughout, and having therein two substantially cylindrical parallel channels communicating with each other on their adjacent sides.

2. A portable pyrometer tube, adapted to be substituted for a pyrometer tube having an interior hollow space for a single thermo-couple, and having an interior hollow space, the shape of said tube and space providing

two similarly located axes longitudinally of the space, and a casing within which the head of the tube is removably mounted, said casing being provided with means for mounting a thermo-couple along each of said axes.

3. In combination, a portable pyrometer tube having a hollow space providing two parallel longitudinal axes, said tube being closed at one end and open at the other and having a flange about its open end, a plate within which said flange is removably seated and means providing a housing over the open end of the tube and means within said housing for mounting a thermo-couple along each of the axes of said tube.

4. An integral portable pyrometer tube oblong in cross section and having two parallel axes, one adjacent each end of said oblong section, the side portions forming the ends of said oblong sections being equi-distant from the respective axes, and the walls of the tube being of substantially uniform thickness and being equally and similarly spaced from the respective axes, and one end of said tube being closed by walls similarly located with respect to the two axes.

5. An integral portable pyrometer tube oblong in cross section and having a single longitudinal channel therein closed at one end and open at the other end, the walls of the tube being of substantially uniform thickness throughout except for a flange around the open end, and the walls of the tube and the opening therein being formed with two longitudinal parallel axes with the walls on opposite sides of said axes constituting semi-cylindrical portions about said axes.

In testimony whereof, we have hereunto signed our names to this specification.

JOSEPH A. JEFFERY.
FRANK H. RIDDLE.