May 1, 1945. R. U. VOLTERRA 2,375,154

ELECTRIC FURNACE

Filed Oct. 7, 1943

FIG. 1.

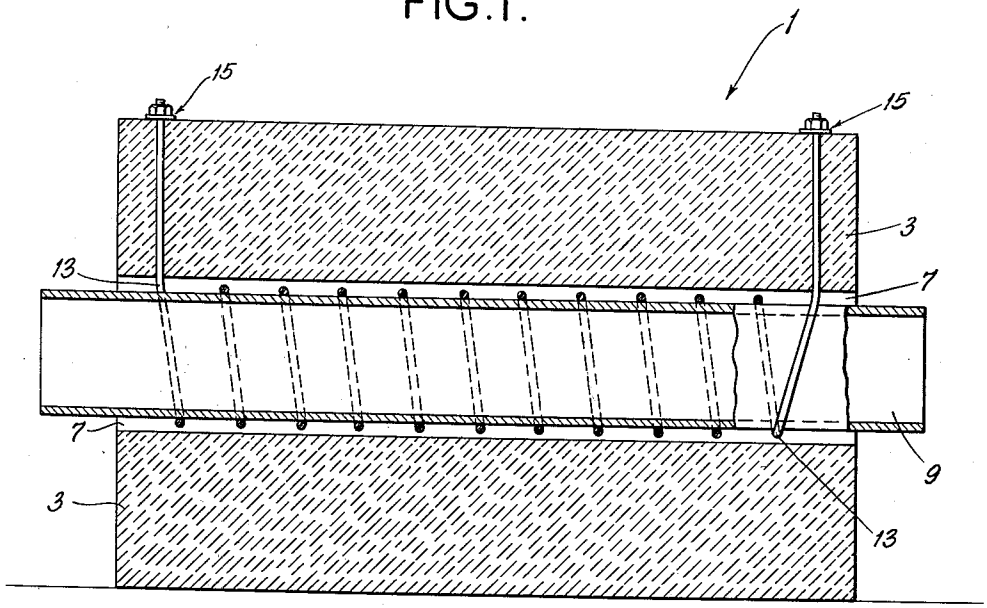


FIG. 2.

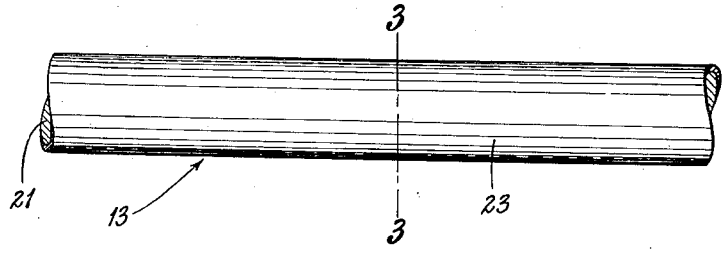
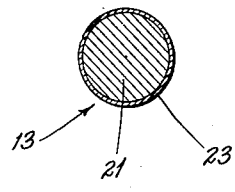


FIG. 3.



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ELECTRIC FURNACE

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6 Claims. (Cl. 201—76)

This invention relates to electric furnaces, and with regard to certain more specific features, to resistance-wound electric furnaces for high temperature heating.

Among the several objects of the invention may be noted the provision of a resistance-wound furnace which employs a minimum amount of the usually-used expensive platinum but which does not require a vacuum or hydrogen to prevent oxidation of a substitute for said platinum, and which therefore is cheaper and more safe to operate; the provision of the furnace of the class described which, because of the absence of hydrogen can safely be cooled immediately in air, thus saving operating time; the provision of a furnace in the class described which requires less resistance wire for a given heat output than was heretofore used and which is therefore also less costly. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a longitudinal diagrammatic section of a typical muffle furnace embodying the invention;

Fig. 2 is an enlarged side elevation showing a detail of the resistance wire used in the furnace; and,

Fig. 3 is a vertical section taken on line 3—3 of Fig. 2.

Similar reference characters indicate corresponding parts throughout the several views of the drawing.

High-temperature resistance heating furnaces have heretofore been made with all-platinum wire, but this is so inordinately expensive, that the furnaces are impracticable for industrial use and are quite expensive even for laboratory use. In order to overcome this disadvantage, furnaces have been proposed which use molybdenum resistance wire, but this solution of the problem introduces the problem of preventing oxidation and vaporization of the molybdenum at the high temperatures which prevail.

Thus in such molybdenum-wound furnaces, in order to prevent the molybdenum from oxidizing at the elevated temperatures it has been the practice to flow a continuous stream of hydrogen around it while hot. The use of hydrogen is expensive, and very dangerous for if air leaks occur the admixture of oxygen with the hydrogen at high temperatures may result in an explosion. It is for this reason that molybdenum wired furnaces have not come into general industrial use. They are almost exclusively confined to use in scientific laboratories.

Referring now more particularly to the drawing, numeral 1 shows a muffle furnace which consists of a shell 3 composed of a refractory or heat insulating material. In the chamber 7 of the furnace is the muffle 9 about which is placed the platinum-clad molybdenum wire 13. The wire is connected between terminals 15.

The wire 13 is composed of a relatively large molybdenum core 21 on the outside of which is a relatively thin platinum sheath 23. Since the molybdenum furnishes the primary electrical resistance for converting electrical into heat energy its cross section is primarily determined by the electrothermal conversion requirements. Molybdenum has a higher resistance coefficient than platinum and since the furnace has as its primary function the conversion of electrical into heat energy, the furnace is cheaper because of the shorter length of wire required. The platinum thickness needs only to be enough to cover the molybednum so as to prevent vaporization and oxidation of the molybdenum at the furnace temperatures desired. Its thickness may range from several thousandths of an inch down to several ten thousandths.

If desired, the molybdenum core 21 may be made hollow as a tube, provided the ends and inside are covered up with platinum so that contact of air does not occur anywhere on the inner molybdenum. The tube may then constitute a muffle by itself. Other cross sections may also be used.

The sheath of platinum 23 may be plated on the molybdenum core in order to obtain the thin coating desired, or any other suitable processes may be used for the purpose.

It is to be understood that although a muffle type of furnace is shown, the invention is applicable to other furnaces. For example, resistance elements may be hung on the walls of the furnace without the interposition of any other material between the resistance and the articles to be heated.

It is to be understood that, although molybdenum is shown for the core of the wire, other materials may be used which require protection

against oxidation at high temperatures, which are to be preferred to an all-platinum wire, such as for example tungsten. Molybdenum however is preferable.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In an electric resistance heating furnace, a resistance wire comprising a molybdenum core and a platinum sheath thereon.

2. In an electric resistance heating furnace, a resistance wire comprising a molybdenum core and a relatively thin platinum sheath thereon.

3. In an electric resistance heating furnace, a resistance wire comprising a molybdenum core of a cross section providing for substantially all of the heat transformation desired in view of the current value used and a relatively thin platinum sheath on said core, whereby said core is protected at operating temperatures which would bring about oxidation of the molybdenum.

4. In an electric resistance heating furnace, a resistance wire comprising a molybdenum core of a cross section providing for substantially all of the heat transformation desired in view of the current value used, and a platinum sheath on said core, whereby said core is protected at temperatures which would bring about oxidation of the molybdenum, said platinum sheath being of a thickness not over a few thousandths of an inch.

5. In an electric resistance heating furnace, a resistance wire comprising a molybdenum core of substantial cross section, and a platinum sheath thereon of a thickness not over the order of a few thousandths of an inch.

6. In an electric resistance heating furnace, a resistance wire comprising a metal core of a cross section providing for substantially all of the heat transformation desired in view of the current available, and a thin metal sheath on said core adapted to protect said core at temperatures which would otherwise bring about oxidation or vaporization of the core.

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