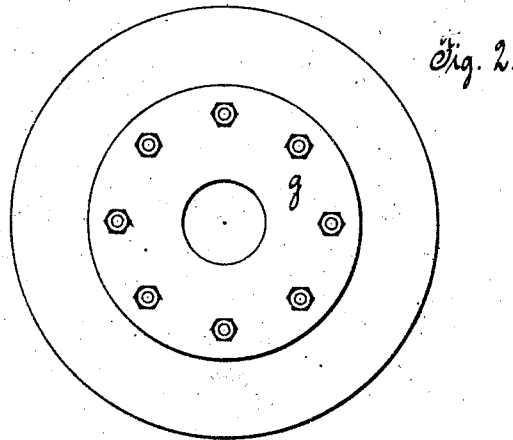
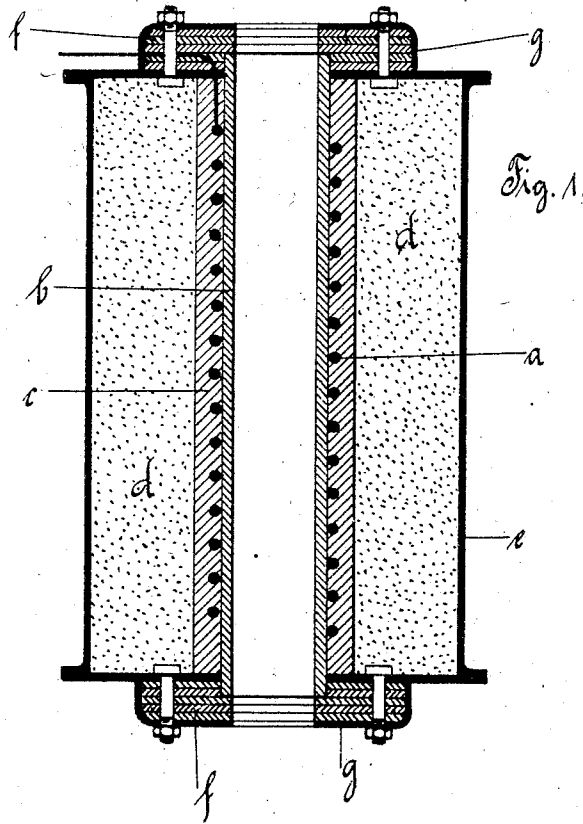


L. UBBELOHDE.
ELECTRIC RESISTANCE FURNACE.
APPLICATION FILED DEC. 22, 1911.

1,060,868.

Patented May 6, 1913.

2 SHEETS—SHEET 1.



Witnesses—
Stanley Wood
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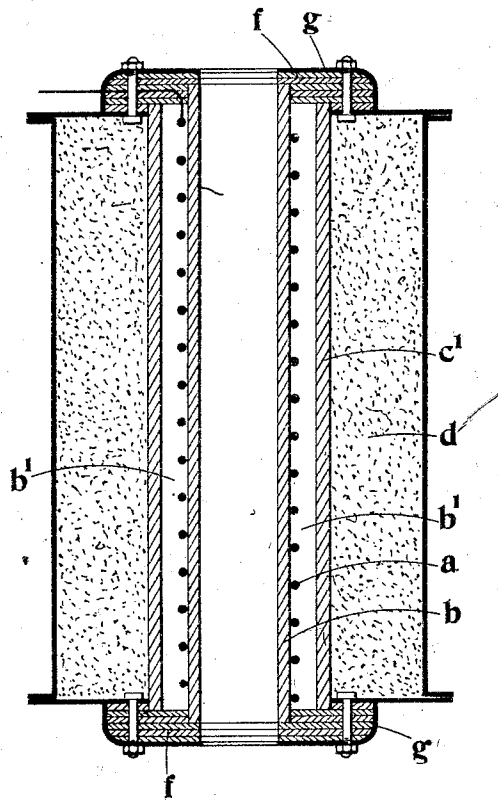


Fig. 3 .

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UNITED STATES PATENT OFFICE.

LEO UBBELOHDE, OF KARLSRUHE, GERMANY.

ELECTRIC-RESISTANCE FURNACE.

1,060,868.

Specification of Letters Patent.

Patented May 6, 1913.

Application filed December 22, 1911. Serial No. 687,358.

To all whom it may concern:

Be it known that I, LEO UBBELOHDE, a subject of the German Emperor, residing at 41 Bismarckstrasse, Karlsruhe, Baden, Germany, have invented a certain new and useful Electric-Resistance Furnace, of which the following is a specification.

This invention relates to an electric resistance furnace of the type in which metals which oxidize in air, are employed as the resistance. To prevent the injurious action of oxidation, it has been proposed, to exclude the oxygen of the air by surrounding the resistance body by an air-tight substance, or to prevent oxidation by allowing free access to reducing gases, such as hydrogen.

According to the present invention, the oxidation is avoided by surrounding the metal, which is liable to oxidation by a porous electric insulator and then, in the known manner, by a layer of carbon. A similar arrangement is already known, but it is for quite a different purpose to that of this invention.

In the prior case the carbon does not act as a protecting agent but the oxidation of the electric resistance is avoided by the admission of a reducing gas, while the porous layer surrounding the resistance serves as a heat insulator and is adapted to prevent the carbonization of the resistance body. The invention is thus clearly seen in view of the difference of purpose for which it is to be employed.

In the drawings are diagrammatically illustrated two constructional forms of the invention.

Figure 1 is a longitudinal section of one constructional form. Fig. 2 is a plan corresponding thereto and Fig. 3 is a longitudinal section of a modification.

The resistance wire *a* which consists of a metal liable to oxidation, is wound in spiral windings around a heating tube *b* composed for example of porcelain, glass or the like, and is also embedded in a covering *c* of a porous electric insulator, which latter is surrounded by a carbon layer *d* adapted to prevent oxidation. The whole is then inclosed in a metal casing *e* and the ends of the metal casing are closed by asbestos sheets *f*, which are screwed into position, and connected together by the electrical insulating material, for the purpose of preventing access of air. The sheets of asbestos are retained in position by a metal cap *g*. As

electric insulators such substances are employed which do not volatilize when exposed to the air or to high temperatures.

A mixture of pulverized kaolin and alumina, fibrous asbestos and water-glass, which mixture can be made plastic by the addition of small quantities of sodium carbonate, is very suitable for the purpose and offers the advantage that it will not burst. The insulating intermediate layer is adapted for the purpose of preventing direct contact between the carbon and the resistance wire. The carbon in this instance is charcoal, which as is known, possesses the property that when in a pulverized condition it will not commence to conduct until a high temperature has been reached. It has been proved that at about 600° the pulverized charcoal becomes such a good conductor that a short circuit is formed and the wire burnt out at any point. In consequence of the porosity of the insulating layer, the protecting action of the carbon is not affected. If, for example, there is any air between the carbon, this is burnt with the carbon, and forms carbonic acid and carbonic oxid corresponding to the relative value of the carbonic acid. This gas mixture forces its way through the pores of the insulating layer, and retains the resistance wire continually in a reduced condition.

In order to insulate the electrical resistance wire from the carbon and simultaneously to protect it against the oxidizing action of the air, it is possible to employ a solid tube *c*¹ of clay surrounded by carbon or a tube of carbon *d*¹ secured to the metal casing, the tube *c*¹ of clay being of a somewhat larger internal diameter than the wire winding *a* so that a free space *b*¹ remains between the heating tube *b* and the tube *c*¹ of clay.

As the metals, such as platinum, which are employed for this purpose possess a high temperature co-efficient of electrical conductivity, it is impossible to heat up the furnaces generally employed by means of a metal winding at the normal working potential.

A platinum furnace for example, which at 1000 degrees consumes about 25 amperes, would at the moment of heating up require about 170 amperes. For such strengths of current, the usual laboratory conductors are insufficient, without having regard to the fact, that at such strength of current, the

thin resistance wires fuse in the furnace, in consequence of being over heated at certain parts. It is consequently necessary when commencing the heating up to employ high steadying resistances which as soon as a high temperature has been obtained are no longer necessary for controlling this and retaining it constant. The steadying resistances are not only very expensive but consume electrical energy. This disadvantage is avoided if alloys having a low temperature coefficient, for example, an iron alloy containing about 25% nickel, is employed as the resistance wire, which at 1000° has only a resistance of about 46% higher than at 20° so that it is possible to start heating up the furnace at the full working potential thus avoiding all losses in energy.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In an electric furnace, the combination of a central tubular member said member consisting of a non-conducting substance, a spiral wire around said member, a layer of carbon surrounding the wire and the tubular member a non-conducting member disposed between the tubular member and the layer of carbon, and a metal casing surrounding the layer of carbon.

2. In an electric furnace the combination of a central tubular member said member consisting of a non-conducting substance, a spiral wire around said member, a layer of carbon surrounding the wire and the tubular member, a porous insulator between the

said wire and the layer of carbon, the spiral wire being embedded in said porous insulator, and a metal casing surrounding the layer of carbon.

3. In an electric furnace, the combination of a central tubular member, said member consisting of a non-conducting substance, of spiral wire around said member, a layer of carbon surrounding the wire and the tubular member, and a metal casing surrounding the layer of carbon, a porous insulator between the tubular member and the layer of carbon, the spiral wire being embedded in said porous insulator, and means for protecting the resistance wire and the porous insulator and tubular member from the action of the atmospheric air.

4. In an electric furnace the combination of a central tubular non-conducting member, spiral wire around said member, a layer of carbon surrounding the wire and the tubular member, a porous insulating member disposed between the central tubular member, and the carbon layer consisting of a mixture of asbestos, kaolin, alumina, and water-glass, and a metal casing, surrounding the layer of carbon.

In testimony whereof I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

LEO UBBELOHDE.

Witnesses:

LOUISE OFFENBURGER,
A. VOLDERAUER.