

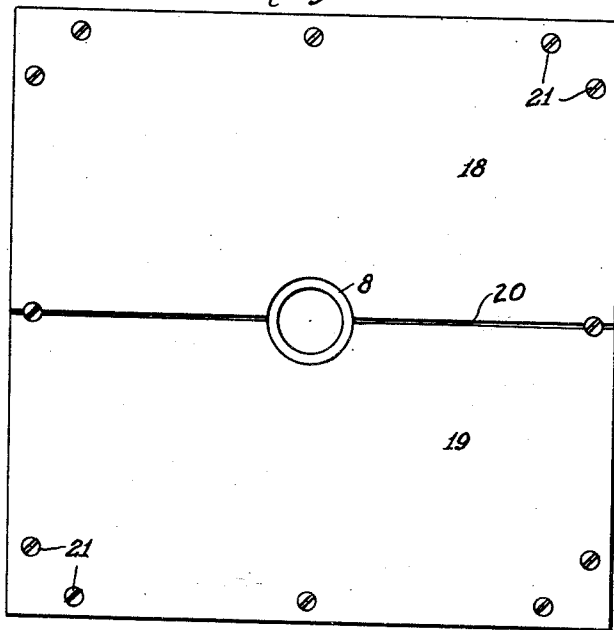
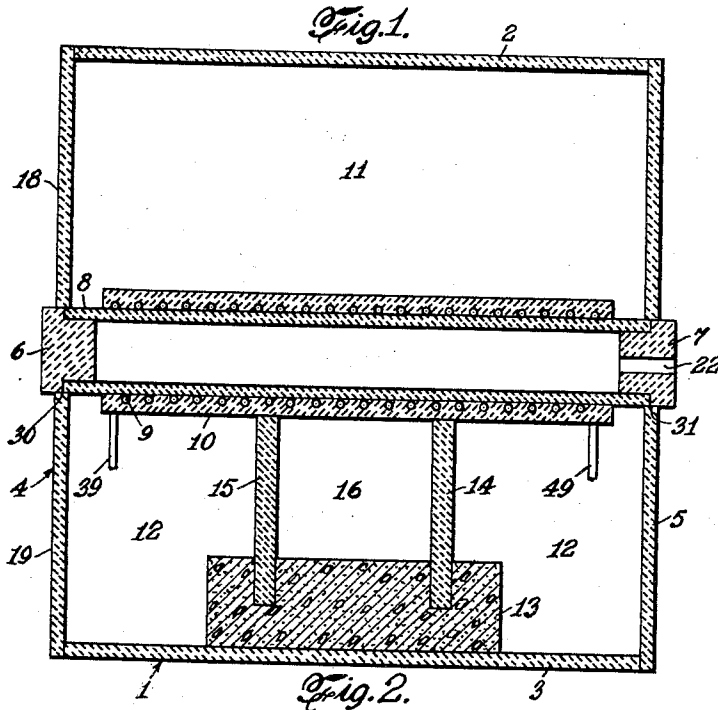
Dec. 1, 1953

A. J. LINCOLN ET AL

2,661,385

MUFFLE TYPE FURNACE

Filed Jan. 10, 1952



INVENTORS
ARNOLD J. LINCOLN AND
GEORGE D. COURTRIGHT
BY *George D. Courtright*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,661,385

MUFFLE TYPE FURNACE

Arnold J. Lincoln, Florham Park, and George D. Courtright, Newark, N. J., assignors to Baker & Co., Inc., Newark, N. J., a corporation of New Jersey

Application January 10, 1952, Serial No. 265,744

1 Claim. (Cl. 13—20)

1

This invention relates to electric resistance wound furnaces and specifically to an improved construction for muffle-type resistance furnaces.

In the operation of furnaces of the muffle type wherein a tubular heating chamber is provided in a box-type or shell housing, it has been found that after prolonged use at high temperatures, the furnace exhibits certain structural weaknesses. When operating at temperatures of 1400° C. or above, it has been observed that the muffle or tubular heating chamber sags at about its center. The extent of the sagging will depend on the length of the muffle between the end supports and the temperature reached.

Therefore, a support must be provided near the center of the muffle to prevent this sagging effect and resultant cracking of the muffle and its protective covering with consequent heat losses. Various types of supports have been used to prevent muffle sagging at high temperature but such supports have been found to present several drawbacks, e. g., a high rate of heat transfer from the central zone of the muffle resulting in uneven heat distribution; and the attack of the support material on the precious metal resistance winding.

In addition to the sagging effect noted above, it has also been observed that radial cracking occurs in the face pieces of the furnace around the ends of the muffle due to the presence of a high stress concentration area. Furthermore, when the muffle cracks due to the high temperature, it is then necessary to change the muffle and remove the face pieces. The presently constituted furnaces must thus be completely disassembled, every time a muffle is to be changed.

It is an object of this invention therefore to provide a high temperature furnace of the muffle type for especial use in heat treating operations. It is a further object of this invention to provide a high temperature furnace of the muffle type with a special support to prevent the sagging of the muffle when operating at high temperatures. A still further object is to provide a face piece construction in a high temperature muffle furnace that will structurally support the muffle ends and will withstand thermal shock without cracking.

Further advantages and objects of the invention will become readily apparent from the following description when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a cross-sectional view of a muffle type

2

furnace including the muffle supporting structure of the invention, and

Fig. 2 is a front view of an end plate of the muffle furnace providing structural support for the muffle tube.

According to the invention, the muffle is supported at its ends in a split face end panel or plate which facilitates mounting and demounting muffles from the furnace shell and eliminates any possibility of radial cracking at these points due to expansion and thermal shock. The muffle is supported at its center section by a mounting structure which reduces heat loss and prevents silica contamination of the precious metal windings.

In Figure 1 is shown a furnace shell 1, preferably of a cubical-like shape which has upper and lower partitions 2 and 3, respectively, and is also provided with a front panel 4 and a rear panel 5 and side panels. These partitions or panels are made of any combustion resistance structural material, but may also be of a refractory material, e. g., transite. The corners may be reinforced with angle iron, if desired. Centrally of each face piece or panel are openings 30, 31 for the reception of doors 6 and 7, respectively. These doors are made of a specially mixed refractory oxide cement, e. g., aluminum oxide cement, and at least one door will have an opening for the insertion of a suitable thermocouple instrument as at 22 (in door 7). The front and rear panels or at least those portions of these pieces adjacent the openings therein are made of a refractory material such as transite.

The muffle 8 is supported at its ends within the openings 30, 31 of the face pieces 4, 5. This muffle is usually cylindrically shaped, but may be made of any hollowed configuration and is fabricated of a refractory material such as aluminum oxide.

A resistance winding 9 is wound around muffle 8. This winding is of a precious metal, and for high temperature operations the winding is of platinum or a platinum alloy, e. g., 90% platinum-10% rhodium. A winding sequence is used which will produce the optimum conditions of heat distribution. These conditions can easily be brought about by winding the muffle on a lathe. The muffle 8 and the winding 9 are covered with a layer of a refractory oxide cement 10 for further protection and heat insulation. Leads 39 and 49 from the winding are connected to a suitably controlled power source, e. g., a variac.

3

Within the spaces 11, 12 and 16 a well compacted powdered refractory material such as magnesium oxide, diatomaceous earth, etc., is packed.

The muffle 8 and the layer 10 are composed of a material such as aluminum oxide because it will not attack the platinum windings within the temperature range 0° C. to 1650° C. within which the furnace will operate. However, most of the refractory oxides, including aluminum oxide, will soften and cause the muffle to sag in the center when the furnace is operated continuously at temperatures of 1400° C. and above and thus the winding is exposed which permits rapid disintegration due to volatilization. To prevent this sagging, we provide a support 14, 15 for the muffle which may consist of an auxiliary section of muffle tubing of a square or circular cross-section or alternately a pair of columnar supports may be used which can be so shaped at its upper end as to conform to the shape of the layer 10 and is of a similar material.

This support 14, 15, is embedded in a silica brick 13 which is appropriately recessed to receive the support column. The silica brick rests on the base partition 3 and the space 16 above the brick and between the portions 14, 15 of the support is filled with MgO or the like in powder form and arranged so that it fits underneath the muffle to be supported.

Generally, this type of support is appropriate where the muffle is 12 inches or longer in length. Where longer muffles are used (18 inches or more), two or more similar supports may be used.

The muffle 8 is thus in contact only with the fill of MgO and the Al₂O₃ support material and consequently any possibility of contamination and attack of the silica brick on the platinum winding is removed since it is spaced from the support. Furthermore, a low rate of thermal conductivity from the muffle is allowed which results in even heat distribution inside the muffle.

The muffle 8 is supported at its ends within the openings in the end panels. Consequently, the area of the panels immediately surrounding the muffle ends is subjected to continual expansion, contraction and thermal shock. As a result, radial cracking has been found to occur at this point. In order to prevent this occurrence, the end panels are split widthwise across the center as shown in Fig. 2 to form an upper 18 and a lower 19 panel portion. These panel portions are held onto angle iron corner braces by screws 21.

4

The space 20 left between the upper and lower panel portion serves to allow for the dissipation of heat radially away from the muffle and also to prevent cracking of the panel.

The invention hereinabove set forth is susceptible of various modifications without departing from the scope thereof. Having thus described our invention, what we claim and desire to secure by Letters Patent is:

In a resistance type high temperature furnace, a housing shell including a front and a rear panel, each of said panels consisting of at least two slightly spaced apart sections the spacing occurring centrally of the panel, a central opening in each panel, said spacing intersecting and including said central opening, a hollow muffle member fitting at its ends within the openings in the panels and extending through said housing, a resistance winding of a metal selected from the group consisting of the platinum metals and alloys thereof wound around said muffle member and having leads extending therefrom, a source of electrical power connected to said leads, a protective covering over said winding of a refractory oxide cement, at least one muffle supporting member located centrally of said muffle comprising a brick-like base member having a low coefficient of thermal conductivity resting on the bottom of said housing and a column-like member supported by said base member of a refractory material chemically inert to the material of the resistance winding, door members adapted to be inserted in and conforming to the openings in said panels to enclose the ends of said muffle member and provide a heating chamber, and a well compacted powdered refractory material completely filling the remainder of the space within said housing.

ARNOLD J. LINCOLN.

GEORGE D. COURTRIGHT.

References Cited in the file of this patent UNITED STATES PATENTS

Number	Name	Date
1,158,972	Boeck	Nov. 2, 1915
1,837,178	Benner et al.	Dec. 15, 1931
2,024,714	Woodson	Dec. 17, 1935
2,073,501	Stargardter	Mar. 9, 1937
2,145,324	Strauss et al.	Jan. 31, 1939
2,192,191	Hayes	Mar. 5, 1940