Nov. 4, 1924. 1,513,890

H. BRYAN ET AL

ELECTRIC FURNACE OF THE RESISTOR TYPE

Filed Oct. 24, 1923

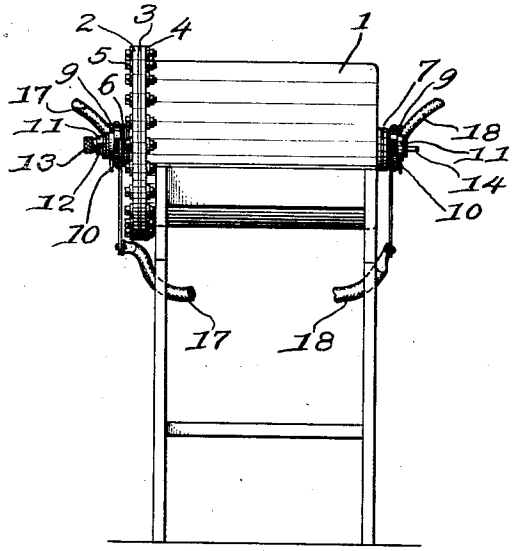


Fig. 1.

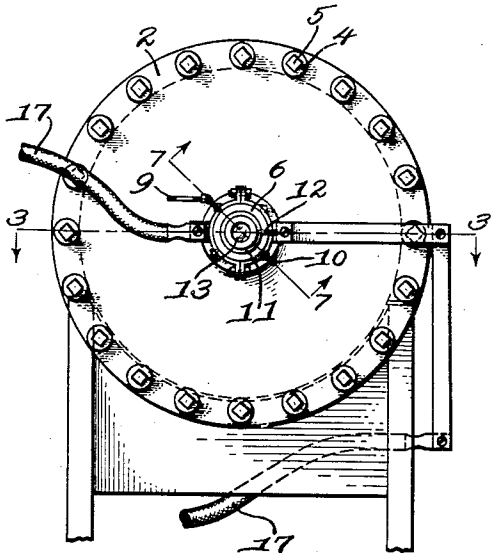


Fig. 2.

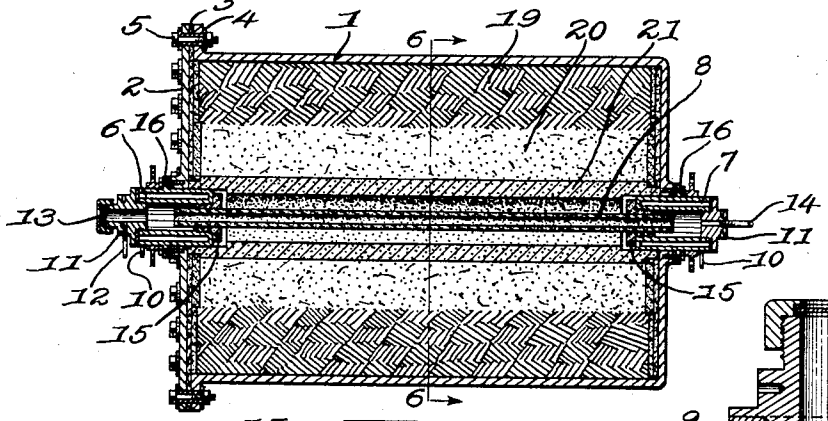


Fig. 3.

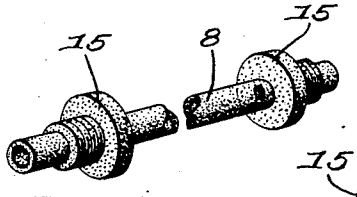


Fig. 4.

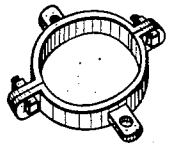


Fig. 5.

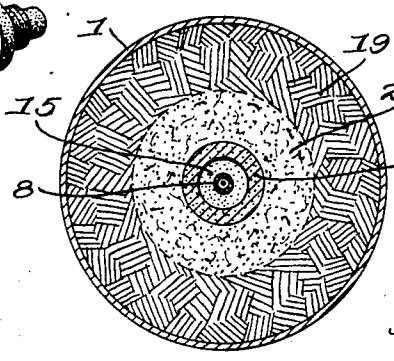


Fig. 6.

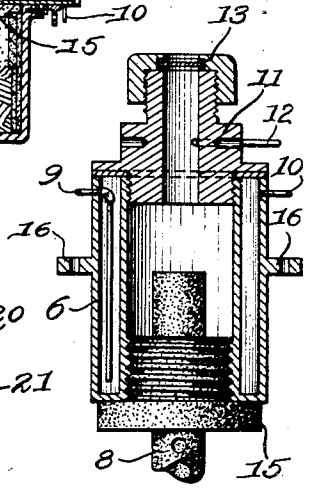


Fig. 7.

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Patented Nov. 4, 1924. 1,513,890

UNITED STATES PATENT OFFICE.

HARRY BRYAN, ARNON L. MEHRING, AND WILLIAM H. ROSS, OF WASHINGTON, DISTRICT OF COLUMBIA, DEDICATED, BY MESNE ASSIGNMENTS, TO THE CITIZENS OF THE UNITED STATES OF AMERICA.

ELECTRIC FURNACE OF THE RESISTOR TYPE.

Application filed October 24, 1923. Serial No. 670,546.

(FILED UNDER THE ACT OF MARCH 3, 1883, 22 STAT. L., 625.)

To all whom it may concern:

Be it known that we, HARRY BRYAN, ARNON L. MEHRING, and WILLIAM H. ROSS, citizens of the United States of America, and employees of the Department of Agriculture of the United States of America, residing at Washington, D. C., have invented certain new and useful Improvements in Electric Furnaces of the Resistor Type; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

This application is made under the act of March 3, 1883, chapter 143 (22 Stat., 625) and the invention herein described and claimed may be used by the Government of the United States or any of its officers or employees in the prosecution of work for the Government and any person in the United States without the payment to us of any royalty thereon.

This invention relates to an electric furnace of the resistor type and has for its object to provide a furnace which is capable of ready temperature control and of developing a higher temperature than is possible to maintain in furnaces of the muffle type with alloy resistance elements.

A further object of the invention is to provide a furnace which can be quickly charged or recharged and which admits of having the resistor element easily replaced as desired.

A still further object of the invention is to provide a means for the collection of any gases or fumes which may be evolved from the charge in the furnace during its operation.

With the foregoing and other objects in view this invention consists in such novel features of construction, combination and arrangement of parts as will be hereinafter more fully described and illustrated in the accompanying drawings and claims.

In describing the invention in detail reference will be had to the accompanying drawings wherein like characters designate like and corresponding parts throughout the several views and in which:

Fig. 1 is a side elevation of the improved furnace.

Fig. 2 is an enlarged front elevation of the furnace.

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

Fig. 4 is a perspective view of the resistor element of the furnace which is constructed of graphite or other high melting point material.

Fig. 5 is a perspective view of one of the clamps for connecting the circuit leads with the terminals of the resistor.

Fig. 6 is a vertical cross section of the furnace taken on the line 6—6 of Fig. 3.

Fig. 7 is a horizontal cross section of one of the terminals of the resistor taken at the line 7—7 of Fig. 2.

Referring more particularly to the drawings, 1 designates the exterior casing of the furnace which is preferably cylindrical in shape and constructed of such material as ¼ inch sheet iron. The casing is flanged at the front face to make a gas-tight joint with the sheet iron plate 2 which serves as the front end of the furnace. The latter is insulated from the furnace casing by means of asbestos packing 3 and fibre bushings 4 which surround the connecting bolts 5. The flanged head and rear face of the furnace casing serve to support the water-cooled terminals 6 and 7 of the graphite resistor 8. Terminal 6 as represented in Fig. 7 is machined from a cylinder of brass or similar material and is provided with a water-inlet 9 and outlet 10. It is also provided with a flanged head 11 which can be screwed into the terminal to make a gas-tight connection. The flanged head is in turn provided with a gas inlet 12 and a replaceable window 13 which enables the charge in the furnace to be in plain view of the operator and through which readings may be made with an optical pyrometer of the temperature within the furnace. Terminal 7 is of the same construction as terminal 6 excepting that the flanged head with which it is provided carries a gas outlet 14 and the use of a window is unnecessary. Each terminal is also provided with a threaded graphite bushing 15 with which it makes close contact as represented in Fig. 7, and which is constructed of the same material as the resistor. The bore of each bushing is of proper diameter to make good

electrical contact with the graphite resistor and at the same time permit of free motion of the resistor through the bushing. The terminals are supported in place and make an air-tight connection with the casing of the furnace by means of screw bolts through the terminal flanges 16. The circuit leads 17 and 18 make contact with the resistor terminals by means of clamps as represented in Fig. 5. For heat insulation there may be used such materials as powdered silocel 19 and carborundum 20. A carbon cylinder 21 serves as a partition to protect the graphite resistor from the insulating material.

In the operation of the furnace water is first allowed to flow through the terminals and the air in the furnace evacuated by means of any ordinary type of exhaust pump. The furnace is then filled with a non-oxidizing gas such as nitrogen or carbon monoxide and the electric current finally applied through the circuit leads 17 and 18. Variations of temperature within the furnace are most conveniently controlled in the ordinary way by means of a transformer and switch board which are capable of giving a suitable range of voltage in one volt steps. The sliding contacts between the resistor and graphite bushings take up any expansion or contraction of the casing due to differences of temperature in the furnace without imparting any appreciable strain on the resistor.

The addition of a charge to the furnace or its withdrawal may be quickly made by unscrewing the flanged head of either terminal. In the same way by removing the flanged head from both terminals a worn out resistor may be easily and quickly removed and a new one inserted in its place. Any fume or other volatile material which is evolved in the operation of the furnace may be easily collected through the outlet of the rear terminal.

We are aware that the Arsem furnace as now placed on the market is also a furnace of the graphite resistor type, but the resistor in this furnace is constructed in the form of a helix and being very fragile is necessarily suspended vertically. The opening and closing of this furnace as well as the replacement of the helix takes a much longer time than that required for the furnace embodied in this invention. The Arsem furnace moreover operates under a high vacuum and the recovery of corrosive fumes, such as those evolved in the experimental study of the volatilization of phosphoric acid from phosphate rock is impractical.

While the use of a resistor of the helix type is much more fragile and expensive than the cylindrical form, and the use of the latter is, therefore, to be preferred it is nevertheless possible when desired to substitute the helix type of resistor in our invention without otherwise modifying the form of the apparatus.

It will be understood that the invention is not limited to the specific embodiment shown and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What we claim is:

1. An electric furnace comprising a cylindrical graphite resistor supported by graphite bushings which make sliding contact with said resistor, water-cooled cylindrical terminals for supporting said graphite bushings, and a sheet iron furnace casing making air-tight connection with the said water-cooled cylindrical terminals.

2. An electric furnace comprising a cylindrical graphite resistor, graphite bushings supported in water-cooled cylindrical terminals and making sliding contact with said graphite resistor, and a sheet iron furnace casing making air-tight connection with the said water-cooled cylindrical terminals.

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