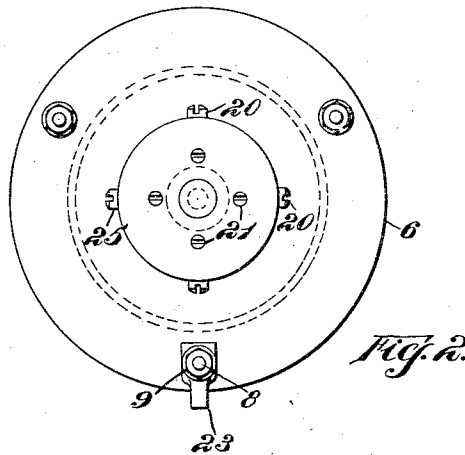
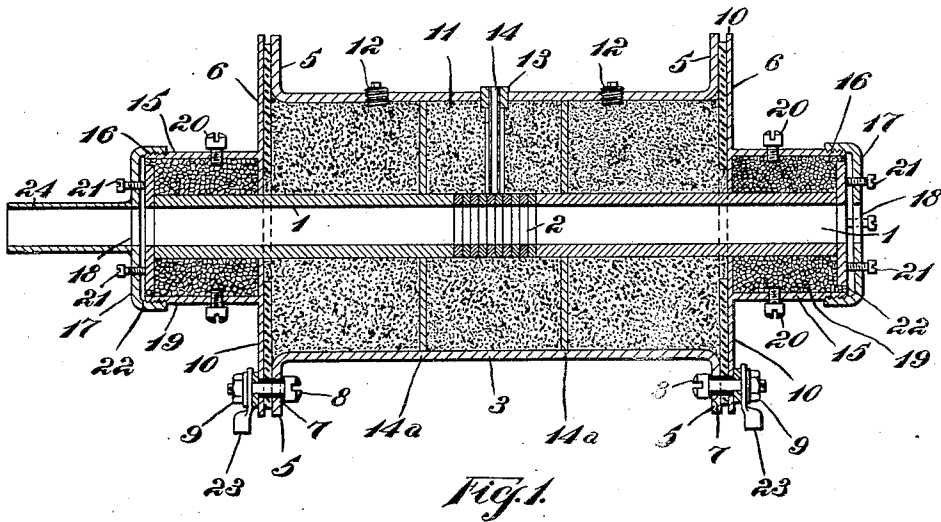


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G. M. LITTLE.
ELECTRIC RESISTANCE TUBULAR FURNACE.
FILED MAR. 23, 1921.



WITNESSES:

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ELECTRIC-RESISTANCE TUBULAR FURNACE.

Application filed March 23, 1921. Serial No. 454,777.

To all whom it may concern:

Be it known that I, GEORGE M. LITTLE, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful improvement in Electric-Resistance Tubular Furnaces, of which the following is a specification:

My invention relates to electrical furnaces and more particularly to furnaces of the type employed to give green resistance rods an initial baking.

To construct a furnace that will efficiently bake resistance rods has always been difficult. It has been found that the best way to obtain a uniform product is to subject all rods to the same cycle of treatment. To accomplish this, I have devised a furnace in which the rods may enter at one end and be pushed through and out at the other end so that all of the rods receive the same treatment.

Since furnaces of the type indicated are subject to disintegration, it is necessary not only to provide a furnace which gives a continuous and steady heat but also one in which all parts are easy of access, to enable broken or worn parts to be replaced.

My invention comprises an inner heater tube of resistance material the central portion of which is composed of a plurality of annular sections. Surrounding the heater tube is an outer shell packed with a resistance material capable of retaining heat, such as lampblack.

Located near the ends of the heater tube are thin elastic metallic end plates which are firmly clamped to the outer shell and serve to support metallic packing containers around the tube ends, and also to maintain a substantially constant pressure on the heat retaining material. The packing containers are filled with some crushed conductive substance, such as graphite, so that terminals of the current main applied to the end plates will cause electricity to flow to and from the heater tube. The end plates and the outer shell are insulated from each other and are held together by insulated clamps. I provide also means carried by the packing containers for compressing the heater tube to hold the sections in alignment.

An object of my invention is to construct an electric furnace in which the parts may

be easily taken down and in which any part subject to wear or disintegration may be quickly and easily repaired.

Another object of my invention is to construct a simple and durable electric furnace in which the greatest heat is at the center of the furnace where the loss by radiation or conduction is least.

With these and other objects in view, which may be incident to the improvements, my invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising my invention may be varied in their proportions and arrangement without departing from the scope of the appended claims.

In order to make my invention more clearly understood, I have shown, in the accompanying drawings, means for carrying the same into practical effect without limiting the improvements in their useful applications to the particular constructions, which for the purpose of explanation, have been made the subject of illustration.

In the drawings, Figure 1 illustrates a longitudinal section through my furnace.

Fig. 2 illustrates an end view of the furnace.

Referring to the drawings, a heater tube 1 is shown composed of graphite or other suitable resistance material, a considerable portion intermediate its ends being composed of annular sections 2 in order to increase the electrical resistance of this portion and thus ensure the production of the highest temperature therein. The annular sections 2 are held in place by pressing the ends of the tube toward the center, as will be hereinafter described. The heater tube 1 is mounted within a cylinder 3 which may be an iron pipe if suitable, insulating members are employed in connection therewith, or asbestos board may be employed, thereby rendering other insulating materials unnecessary. The cylinder 3 is provided with annular flanges 5 at its ends and is closed at each end by thin elastic end plates 6. A plurality of co-operating openings 7 is provided in each of the flanges 5 and the end plates 6 to permit of locating therein insulated bolts 8 provided with nuts 9 to secure the plates 6 against the flanges 5.

To insure that there shall be no passage

of current between the cylinder and the end plates, I provide two non-conducting rings 10 between the said plates and the annular flanges 5. The rings 10 may be formed of any suitable heat-resisting, non-conducting material and their function is to positively prevent any passage of current between end plates 6 and the cylinder 3.

Between heater tube 1 and the outer shell 3, is placed finely ground lampblack, as indicated by numeral 11, this lampblack being compressed about the heater tube by means of screws 12. By removing the screws 12 openings are provided in the cylinder 3 to permit of introducing additional quantities of lampblack, should this become necessary, by reason of the wasting away of the original mass. Screwed into the center of the outer shell 3 is a sight cap 13 having a downwardly projecting sight tube 14. The cap permits the observer to ascertain roughly the degree of heat at the center of my furnace by noting the color of the heater tube 1.

As the lampblack may become electrically conductive when heated by the action of the resistor and cause current to be shunted therefrom, a plurality of insulating barriers 14a, which may be made of asbestos, may be located at suitable places in the mass of lampblack. They are of such internal and external dimensions as to fit closely around the tube 1 and inside of the cylinder 3.

The elastic end plates 6 are provided with packing containers 15 consisting of horizontally projecting annular flanges, preferably formed integrally with the end plates. The packing containers 15 are adapted to fit around the ends of the heater tube 1, and are provided with screw threads 16 upon which are screwed caps 17, having apertures 18 through their centers. The diameters of the apertures 18 are approximately equal to the diameter of the interior of the heater tube 1. The packing containers 15 are filled with broken graphite 19, and screws 20 serve to adjust the pressure of that material upon the heater tube 1. By adjusting the position of the screws 20 any desired degree of pressure of the broken graphite 19 upon the heater tube 1 may be obtained, thereby insuring the proper conduction of the electric current to and from the heater tube without waste. Through the caps 17 pass screws 21 that bear, at their inner ends, on washers 22, that, in turn, bear against the ends of the heater tube 1. By suitably tightening the screws 21, any desired degree of compression may be brought to bear upon the center of the heater tube 1, whereby the annular sections 2 of that tube are held in engagement. The elasticity of the end plates aid in keeping this pressure constant.

To conduct the current through the tube, conductors 23, are suitably attached to the end plates 6.

One of the caps 17 located at the leaving end of the furnace, is provided with an extension 24 of suitable length to permit of the rods cooling therein and to prevent oxidation of the rods while passing there-through. By the time the rods have passed through the extension 24 they will be cooled sufficiently to be safe from further oxidation.

In use, electricity is conducted from the conductors 23, through the end plates 6 and the broken graphite 19 in the packing containers 15, to the ends of the heater tube 1. The annular sections 2 of the heater tube cause the central portion of the tube to have the highest temperature, and the degree of temperature may be ascertained through sight cap 13 by inspecting the color of the heater tube. The furnace, having once been started, will maintain an even degree of heat for a long time, because the lampblack 11 is closely packed about the heater tube and acts as an efficient heat insulator. Green unbaked rods are slowly pushed through this furnace at such rate of speed that they are thoroughly baked by the time they have passed the length of the heater tube.

All parts of my furnace are quickly accessible for repair. The central portion of the heater tube may be removed in a few minutes by removing the clamping bolts 8, new annular sections 2 put in place, and the furnace be again put in operation in a short space of time.

While I have shown but one embodiment of my invention, it is to be understood that modifications may be made therein without departing from the spirit thereof, and I desire therefore, that my invention shall be limited only as set forth in the appended claims or by the showing of the prior art.

I claim as my invention:

1. An electric furnace comprising a heater tube of resistance material divided into sections, a heat-storing means around the tube, compression means to hold the sections together, and means for conducting an electrical current to and from the heater tube.

2. An electrical furnace comprising a heater tube of resistance material, divided into sections, an outer shell, heat-storing material between the heater tube and outer shell, end plates, and means co-operating with the end plates to keep the heater tube under pressure.

3. An electrical furnace comprising a heater tube of resistance material, conductive end plates, a packing container on each end plate, and conductive packing material in the packing containers to conduct current to and from the heater tube.

4. An electrical furnace comprising a heating means, a packing container at each end of the heater means, and conductive packing material in the containers to conduct current to and from the heater means.

5. An electrical furnace comprising a heating means, a packing container at each end of the heater means, conductive packing material in the containers to conduct the current to and from the heater means, and means for maintaining the conductive packing material under pressure.

6. An electrical furnace comprising a heating means, a packing container at each end of the heater means, caps for the packing containers, conductive packing material in the containers, and compression screws to keep the conductive material under pressure.

7. An electrical furnace comprising a heater tube of resistance material, an outer shell surrounding the heater tube, heat-storing material between the heater tube and the outer shell, end plates insulated from the outer shell, means for keeping the heat-storing material under pressure, and means for conducting current to and from the heater tube.

8. An electrical furnace comprising a heater tube of resistance material, an outer shell surrounding the heater tube, heat-storing material between the heater tube and the outer shell, end plates insulated from the outer shell, packing containers on the end plates, conductive packing material in the containers, caps for the packing containers, and compression screws for keeping the conductive material under pressure.

9. An electrical furnace comprising a heater tube of resistance material divided into sections, an outer shell surrounding the heater tube, heat-storing material between the heater tube and outer shell, end plates insulated from the outer shell and means co-operating with the end plates to hold the sections of the heater tube compressed.

10. An electrical furnace comprising a heater tube of resistance material divided

into sections, a packing container at each end of the heater tube, conductive packing material in the containers, caps for the packing containers, and means co-operating with the caps to hold the sections of the heater tube together.

11. An electrical furnace comprising a heater tube of resistance material divided into sections, a packing container at each end of the heater tube, conductive packing material in the containers, caps for the packing containers, washers within the containers adapted to fit against the ends of the heater tube, and bolts passing through the caps and bearing against the washers to press the sections of the heater tube together.

12. An electrical furnace comprising a heater tube of resistance material divided into sections, an outer shell surrounding the heater tube, heat-storing material between the heater tube and the outer shell, end plates insulated from the outer shell, compression screws for maintaining the heat-storing material under pressure and for permitting the addition of new heat-storing material, and means for conducting current through the heater tube.

13. An electrical furnace comprising a heater tube of resistance material divided into sections, an outer shell surrounding the heater tube, heat-storing material between the heater tube and the outer shell, end plates insulated from the outer shell, compression screws for maintaining the heat-storing material under pressure and for permitting the addition of new material, packing containers on the end plates, conductive packing material in the containers, caps for the packing containers, washers adapted to fit against the ends of the heater tube, and bolts passing through the caps and bearing against the washers to compress the sections of the heater tube together.

In testimony whereof, I have hereunto subscribed my name this 15th day of March, 1921.

GEORGE M. LITTLE.