July 31, 1923. 1,463,513

C. L. LEE

ELECTRIC FURNACE

Filed April 13, 1921 2 Sheets-Sheet 1

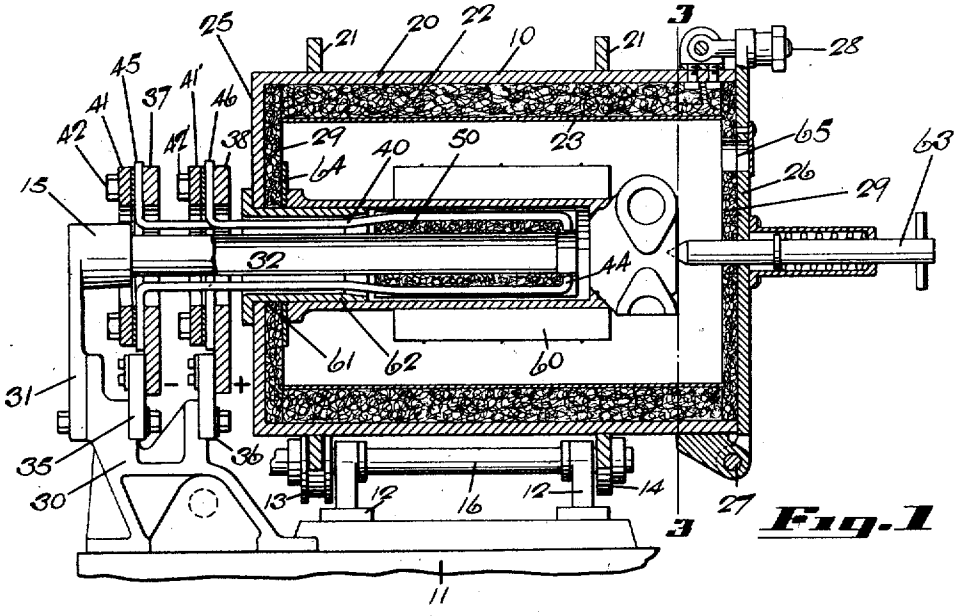

Fig. 1

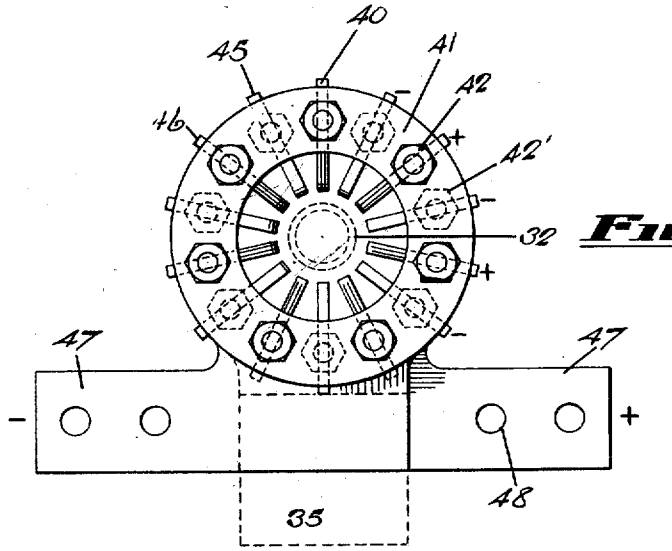

Fig. 2

Witnesses
L. H. Emrick
A. C. Lehman

By

Inventor
Charles L. Lee
Francis D. Hardesty
Attorney

July 31, 1923. 1,463,513

C. L. LEE

ELECTRIC FURNACE

Filed April 13, 1921 2 Sheets-Sheet 2

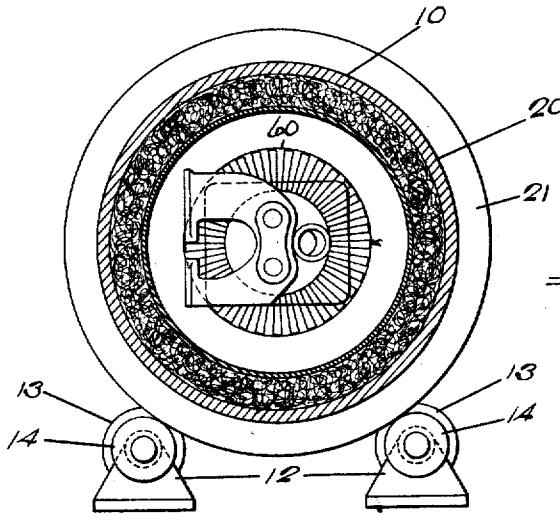

Fig. 3

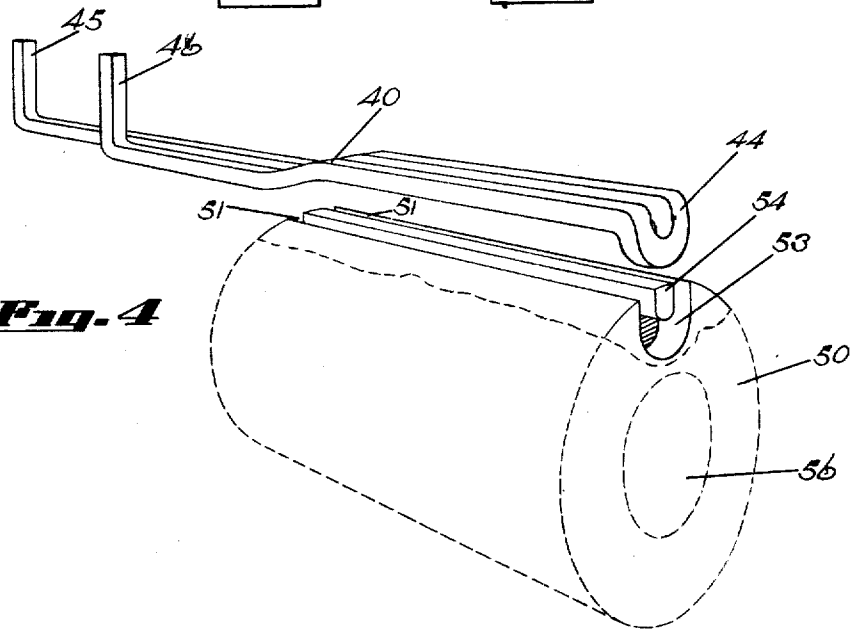

Fig. 4

Witnesses
L. H. Emrick
A. C. Lehman

By

Inventor
Charles L. Lee
Francis D. Hardesty
Attorney

Patented July 31, 1923. 1,463,513

UNITED STATES PATENT OFFICE.

CHARLES L. LEE, OF DAYTON, OHIO, ASSIGNOR TO GENERAL MOTORS RESEARCH CORPORATION, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

ELECTRIC FURNACE.

Application filed April 13, 1921. Serial No. 460,924.

To all whom it may concern:

Be it known that I, CHARLES L. LEE, a citizen of the United States of America, residing at Dayton, county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a full, clear, and exact description.

The present invention relates to electric furnaces and in its preferred form of embodiment, which has been chosen for the purposes of description and explanation, to electric furnaces for carrying out a process of attaching cooling ribs or fins to cylinders of internal combustion engines.

The process referred to, but forming no part of the present invention, is one in which after suitable machining operations, an assembly of an iron cylinder and cooling ribs or fins, preferably of sheet copper, is made by wrapping a set of the latter around the cylinder with an interposed sheet of brazing brass and with suitable fluxing. This assembly is then suitably heated to cause the fins to be brazed to the cylinder. This operation produces union between the metal of the cylinders and that of the cooling elements which is permanent and offers no substantial impediment to the passage of heat from one metal to the other.

It is among the objects of the present invention to provide a furnace for carrying out the above process.

Another object is to provide a furnace which is efficient, economical, and easily and exactly controlled.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of embodiment of the invention is clearly shown.

In the drawings:

Fig. 1 is a sectional view, with parts in elevation, of the furnace assembly with a cylinder in place.

Fig. 2 is a view in elevation of the collector rings for the resistors with the resistors attached.

Fig. 3 is an end view of the furnace along the line 3—3 of Fig. 1 with parts in section and parts in elevation.

Fig. 4 is a perspective view of a resistor and its holder showing clearly the adaptation of the holder for the resistor.

As is illustrated in the drawings the furnace assembly 10 is suitably mounted upon a base 11 having thereon supporting members 12 for rollers 13 and 14 which carry the furnace. Also mounted upon this base is the electric heating unit assembly designated as a whole by the numeral 15.

The furnace is adapted to be rotated about its longitudinal axis and is caused to revolve by means of the rollers 13 and 14 carried by a suitable drive shaft 16. In my prior application for patent, Serial No. 396,276, filed July 14, 1920, on "Furnaces", now Patent No. 1,445,220, dated February 13, 1923, there is described suitable means for driving a corresponding shaft in a similar furnace. In that application the means comprises a gear mounted on the end of the shaft which corresponds to shaft 16, which gear is driven by a worm carried by a shaft directly connected to a motor. For clearness and simplicity of illustration, this driving apparatus is omitted, and it should be understood that any suitable driving means may be used.

Referring more particularly to Fig. 1, the furnace consists of a casing 20, preferably cylindrical, which has bearing rings 21 around its periphery for the rollers 13 and 14. The casing is suitably heat insulated as at 22, preferably with transite or other composition containing asbestos, suitable means such as an inner cylindrical member 23 being provided for retaining the insulating material in place.

A closure plate 25 having a central opening is provided for one end of the furnace and is preferably integral with the casing. At the other end, however, the closure plate 26 is removable and preferably hinged at 27, as illustrated, and adapted to be secured in place in any suitable manner as indicated at 28. Both closure plates are provided at their inner faces with suitable heat insulating material 29 such as transite as mentioned above, which material at the plate 26 is preferably removable along with the plate itself.

The heating unit 15 comprises a supporting bracket 30 having attached rigidly thereto, an extended portion 31 for holding a tube 32 which extends through the opening in plate 25 centrally within the furnace and is adapted to support the heating elements hereinafter mentioned. Also sup-

ported by the bracket 30 are electric insulating plates 35 and 36 adapted to support the collector rings 37 and 38. Attached to these collector rings are a plurality of U-shaped electric resistors or heating elements 40, which are held against the rings by means of suitable clamping rings 41, 41', and bolts 42, 42'.

Referring to Fig. 4, it will be noted that the terminal ends of each resistor are bent substantially at right angles and at different distances from the closed end 44, as illustrated at 45 and 46, to permit the attachment of each resistor at its terminal ends to both collector rings. As shown in Fig. 2, each terminal end 45 may be attached to the outer collector ring 37, which corresponds electrically to the negative terminal of, the heating unit, and clamped in place by means of the clamping ring 41 and between the bolts 42. Similarly, each end 46 may be attached to the inner collector ring 38, corresponding to the positive terminal and clamped in place by the clamping ring 41' and between the bolts 42'. This manner of connecting the resistors to the collector rings results in the resistors being connected in electric parallel and as a whole offering little resistance to the flow of electric current. The collector rings have portions 47 adapted to permit connection to suitable sources of electric current by means of holes 48 for the installation of suitable terminals.

In Fig. 4, is shown, along with the type of resistor preferred, a holder 50 for supporting these resistors, only one resistor and the means for fitting and holding it in the holder being shown for convenience of illustration. Various metals may be found suitable for these resistors, but it is preferred to use nichrome since it has the quality of not oxidizing readily when heated to incandescence for a considerable length of time.

The holder 50 has a pair of grooves 51 for each resistor which grooves are arranged, as illustrated at 53, to form a hook 54. The closed or U-shaped end 44 of the resistor 40 is bent to fit into the grooved portion at 53 and is adapted to coact with the hook 54 to retain the resistor in place in the holder. This holder is made of some good heat and electrical insulating material preferably alundum cement and has a cylindrical hole 56 centrally located therein to permit its fitting over the tube 32.

The cylinder assembly 60 upon which the process is to be carried out is shown in Fig. 3. The cylinder is assembled, with the fin material as described in the above mentioned application, Serial No. 392,646 and as indicated in Fig. 3 by providing suitable flux therefor, placing the fin material around the cylinder with a sheet of brazing brass interposed and holding the assembly intact with wires. The end or closure plate 25 of the casing 20 is provided with a central opening 61 adapted to admit a sleeve 62 for supporting the cylinder assembly 60, as indicated in Fig. 1. The cylinder assembly is placed within the furnace over the sleeve 62 and held in place by means of a spring pressed plunger 63, or other suitable means adapted to locate and support this assembly, the plunger preferably being extended centrally through the plate 26. The heating unit 15 extends within the cylinder assembly and is substantially coaxial with the sleeve 62. In order to protect the heat insulating material 29 on closure 25 from abrasion by the end of the cylinder assembly, a plate 64 may be provided between the material and the latter, permitting the abutment of the cylinder against the plate as it is installed upon the supporting sleeve 62. The plate 26 may be provided with a peep-hole 65 for observing the condition of the cylinder assembly during the different stages of the heating operation.

With the cylinder assembly properly in place, the furnace is rotated and electric current is supplied to the heating elements, permitting the carrying out of the process hereinbefore referred to. It is evident that, when current is supplied to the resistors causing them to become less capable of retaining their form or place due to the influence of the heat generated in accordance with the well known Joule's law where $P=I^2R$, the resistors are retained in place by this holder and are prevented from coming in contact with the cylinder with possible injurious effects such as might result from short circuits.

Although the furnace may be operated with various voltages and currents depending upon the design thereof, it has been found that a relatively low voltage, for example around 8 to 10 volts, and heavy current operate very satisfactorily and adapt themselves very readily to commercial use.

It is obvious that, with various controls for the heating unit, very accurate reproduction of complete units may be obtained, assuring products that are satisfactory and unions between the metals of the cylinders and cooling elements which are permanent.

Further, while the structure herein shown and described constitutes a preferred form of embodiment of the present invention, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What I claim is as follows:

1. An electric furnace for heating cylinders comprising means for locating the cylinder within the furnace; a heating element; means for locating the heating element with-

in the cylinder; and means for connecting the said element within an electric circuit.

2. An electric furnace for heating cylinders comprising means for locating the cylinder within the furnace; a plurality of heating elements; means for locating the elements within the cylinder; and means for connecting the elements to a source of electric current.

3. An electric furnace for heating cylinders comprising means for locating the cylinder within the furnace; a plurality of heating elements; means adapted to insulate and support the elements within the cylinder; and means for connecting the heating elements to a source of electric current.

4. A rotatable electric furnace adapted to supply heat to a cylinder of an internal combustion engine during the process of attaching cooling elements thereto and having a heat insulated casing for the cylinder assembly comprising means for locating the cylinder assembly within the furnace; a resistance element; a holder therefor; means for locating the holder within the cylinder; and means for connecting the resistance element within an electric circuit.

5. A rotatable electric furnace adapted to supply heat to a cylinder of an internal-combustion engine during the process of attaching cooling elements thereto and having a heat insulated casing for the cylinder assembly comprising means for locating the cylinder assembly within the furnace; a plurality of electric resistors; a holder for the resistors; means for locating the holder within the cylinder; and means for connecting the resistors to a source of electric current.

6. A rotatable electric furnace adapted to supply heat to a cylinder of an air-cooled internal-combustion engine during the process of attaching cooling elements thereto and having a heat insulated casing for the cylinder assembly comprising means for locating the cylinder assembly within the furnace; a plurality of U-shaped electric resistors; means for locating the resistors at their closed ends within the cylinder; a holder for the portion of the resistors within the cylinder adapted to insulate and retain them in position; and means for connecting the resistors at their open ends to a source of electric current.

7. A rotatable electric furnace adapted to supply heat to a cylinder of an air-cooled internal-combustion engine for brazing cooling fins to the walls thereof and having a heat insulated casing for the cylinder assembly comprising means for locating the cylinder assembly within the furnace; a plurality of U-shaped electric resistors; an insulating holder having longitudinal grooves for resistor elements and adapted to coact with the closed ends of the resistors to retain them in place in the grooves; a support for the holder adapted to locate the holder centrally within the cylinder; and collector rings for those portions of the resistors external to the furnace casing adapted to connect the resistors in parallel to a source of electric current.

In testimony whereof I hereto affix my signature.

CHARLES L. LEE.

Witnesses:
R. K. LEE,
L. H. EMRICH.