April 26, 1932. T. H. LONG 1,855,750

COIL CLAMP

Filed Oct. 20, 1930

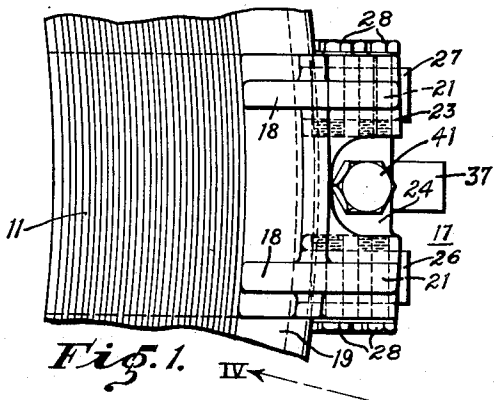


Fig. 1.

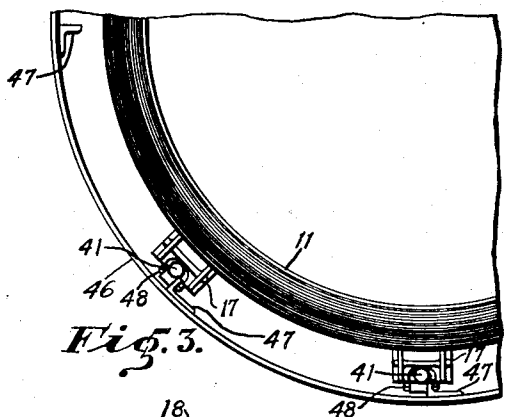


Fig. 3.

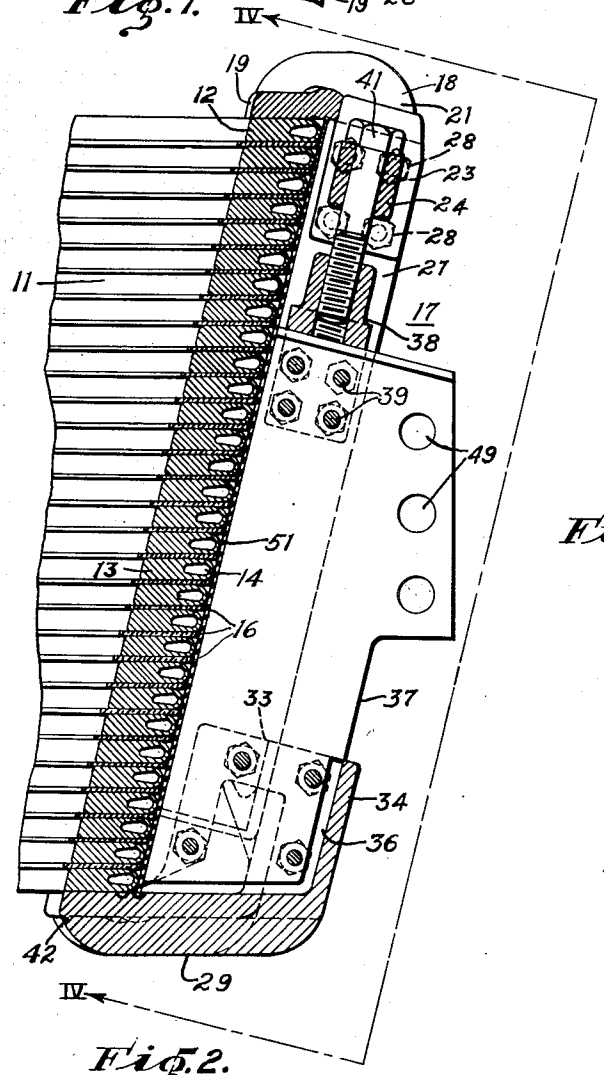


Fig. 2.

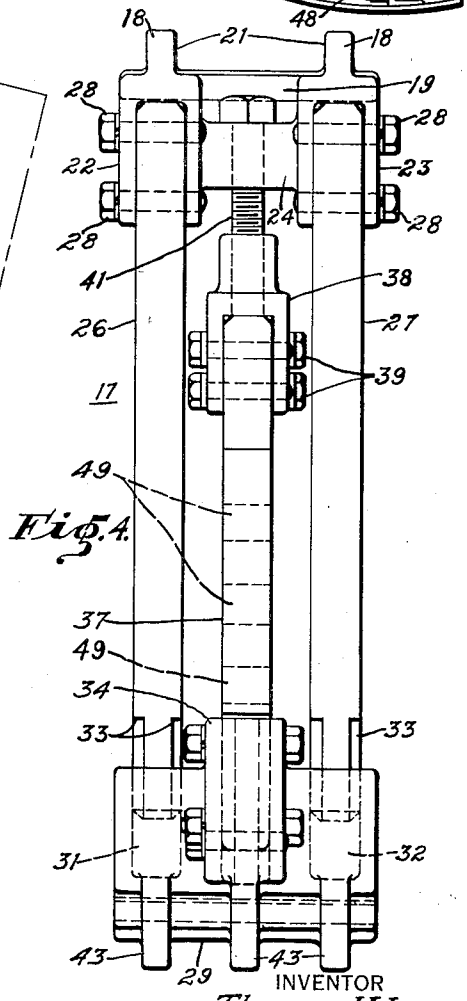


Fig. 4.

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UNITED STATES PATENT OFFICE

THOMAS H. LONG, OF IRWIN, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

COIL CLAMP

Application filed October 20, 1930. Serial No. 489,852.

My invention relates to electric furnaces and particularly to electric induction furnaces.

An object of my invention is to provide a relatively simple and highly efficient clamping and supporting means for the energizing coil of an induction furnace.

In practicing my invention, I provide a pair of clamps located in close operative relation to the top and the bottom turns of an energizing coil, a plurality of guide bars extending between the top and the bottom clamps, and a tension bar also extending therebetween, to permit of drawing the clamps toward each other. The clamps are made of metal, and the tension and guide bars are made of electric-insulating material.

In the single sheet of drawings,

Figure 1 is a top plan view of a portion only of an energizing coil and a single clamping structure associated therewith,

Fig. 2 is a fragmentary view, in vertical section, through a coil and clamping structure embodying my invention,

Fig. 3 is a partial top plan view illustrating the supporting means; and,

Fig. 4 is a view, in side elevation, of the clamping structure shown in Fig. 2, the view being taken on the line IV—IV of Fig. 2.

The clamping and coil-supporting structure, embodying my invention, is particularly applicable for use with energizing coils embodied in relatively large induction furnaces and has been designed with particular reference to an energizing coil in which the diameter of the uppermost turns is greater than the diameter of the lower turns.

Referring to Figs. 1 and 2 of the drawings, I have illustrated an energizing coil 11 as embodying a plurality of turns of a composite conductor 12, which may be made of copper, and includes an inner solid current-conducting portion 13 and an outer tubular portion 14, unitary with the portion 13 and adapted to be traversed by a suitable cooling fluid. No terminal portions are shown, as these constitute no part of my present invention. Strips 16, of electric-insulating material and of substantially annular shape, may be located between the several turns of conductors 12 and may be made of any suitable or desired material, such as mica or its equivalent.

A plurality of clamping structures 17 are provided, one of which is shown in Figs. 1, 2 and 4, in clearer detail. Each clamping structure includes an upper clamp 18 which is of substantially L-shape in lateral section and has a plate portion 19 operatively engaging the upper surface of the uppermost turn, and is preferably brazed to the conductor 12 in order to provide a path therebetween of relatively high heat conductivity. Radially extending rib portions 21 are provided in order to strengthen the clamp, and the lower portion of this clamp includes two lugs 22 and 23 and a cross bar 24 extending therebetween. The lugs 22 and 23 are hollow in order to receive two guide bars 26 and 27 of a suitable electric-insulating material, the upper ends of the guide bars being bolted to the hollow lugs 22 and 23 by bolts 28.

The lower clamp 29 of each clamping structure is made slightly greater in radial dimension than is the upper clamp 18 but is otherwise of substantially the same construction. Sockets 31 and 32 are provided in member 29 and are spaced a suitable distance apart to receive the lower ends of guide bars 26 and 27. The guide bars 26 and 27 may be of substantially rectangular shape in lateral section and may have the corners, at the lower end, beveled, as indicated at 33, to avoid the use of sharp corners where the guide bars fit into the sockets 31 and 32.

A central portion 34 is provided, having a socket 36 therein to receive the lower end of a tension bar 37, also of electric-insulating material, which extends upwardly between the guide bars 26 and 27. A metal yoke 38 is bolted to the upper end of the tension member 37 by bolts 39, the upper end of which has a screw-threaded aperture therein for receiving the tension bolt 41 which extends through cross bar 24 of the upper clamp. By turning the bolt 41, the lower clamp may be drawn upwardly toward the upper clamp, the guide bars 26 and 27 maintaining the proper relation of the lower clamps 29 to the upper clamp 18 and also supporting the coil

12 radially thereof. It is obvious that the lower portion of member 37 may also be made of metal, thus leaving only the intermediate portion of the member 37 to be made of electric-insulating material.

The inner end portion 42 of lower clamp 29 is brazed to the outer surface of the lowermost turn of the energizing coil 12 in order to be in good heat-conducting relation thereto. Radially extending ribs 43 are provided on the lower clamp member in order to strengthen the same.

Fig. 3 illustrates the method of supporting the energizing coil having a plurality of clamping structures associated therewith, as hereinbefore described, in a metal tank 46. A plurality of lugs 47, each of substantially L shape, may have one portion welded or otherwise secured to the inside of tank 46, at a suitable height, the other leg or portion being provided with a plurality of holes therethrough to receive a plurality of bolts 48 which extend through openings 49 in a portion of the members 37. By proper location of the lugs 47, the clamping structure may be secured thereto by the bolts 48 to support the coil within the casing of the tank 46.

The clamping structure hereinbefore described provides a means for tightly clamping the turns of the energizing coil, the individual clamps being brazed or soldered to the end turns of the energizing coil so that any heat, whether generated therein by electric inductive action or radiated or conducted thereto, may be, to a great extent, carried away by the cooling fluid traversing the tubular portion of the conductor. It is obvious that the clamp 18, particularly, is located in a position of relatively high temperature, and the cooling means provided for the coil will be effective also to reduce the temperature rise in the clamps.

Since the electric-insulating material, comprising the parts 26, 27 and 37, will not, in general, be such as will be able to withstand the relatively high temperatures existing at the top of the coil, a heat screen is provided between the material being heated or heat-treated and the said parts. By heat screen, I refer to the set of tubular portions 14 of the coil 11 which are traversed by a cooling fluid and which will, therefore, reduce greatly the transmission of heat from the heated material within the coil 11 to the parts 26, 27 and 37. In order to insulate the coil 11 from yoke 38, I provide a layer 51 of electric and heat-insulating material, such as mica or a high grade of asbestos, between the outer faces of the tubular portions 14 and the member 38 and extend this along the entire axial length of the coil.

The device embodying my invention thus provides a relatively simple clamping structure in which its members which are subjected to high temperatures are fluid cooled, these members being connected by electric-insulating parts of suitable shape, one of which is available to support the entire coil structure in a metal tank or casing.

Since various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof, I desire that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claims.

I claim as my invention:

1. In an electric furnace having an energizing coil, a coil-clamping structure including top and bottom clamps, a guide bar operatively engaging the outer surface of the coil to support the same and extending between the clamps to hold the clamps in alined positions at the ends of the coil, and means for drawing the clamps toward each other.

2. In an electric furnace having an energizing coil, a coil-clamping structure including top and bottom clamps, a guide bar having one end secured to one clamp and having its other end slidable in the other clamp, and means secured to the two clamps for drawing them toward each other.

3. In an electric furnace having an energizing coil and an enclosing casing, a coil-clamping-and-supporting structure including top and bottom clamps, guide bars, each having one end secured to one clamp and the other end slidable in the other clamp, an adjustable tension bar connecting the two clamps to draw them toward each other, and means on said tension bar to cooperate with the casing to support the coil therefrom.

4. In an electric furnace having an enclosing casing and an energizing coil therein, a coil-clamping-and-supporting structure including clamps at each end of the coil, guide bars extending between the clamps, each guide bar having one end rigidly secured to one clamp and its other end slidable in the other clamp, an adjustable tension member having its ends connected to the clamps to effect compression of the coil thereby, and means on the casing cooperating with the tension member to support the coil.

5. In an electric induction heater, a coil having a plurality of turns of a fluid-cooled conductor, a coil-clamping structure including top and bottom clamps in intimate heat-exchanging relation to the respective end turns of the coil, bars of electric-insulating material extending between the clamps and providing a radial support for the coil.

6. In an electric induction heater, a coil having a plurality of turns of a fluid-cooled conductor, a coil-clamping structure including top and bottom clamps in intimate heat exchanging relation to the respective end turns of the coil, and an adjustable tension device operatively associated with the clamps

for drawing them together to compress the coil.

7. In an electric induction heater having a plural-turn energizing coil, a coil-clamping structure including metal top and bottom clamps, means for securing said clamps in intimate mechanical relation to the top and to the bottom turn of said coil, and means closely and operatively associated with at least the top and the bottom turns of the coil for effecting cooling of the clamps and of the end turns of the coil.

8. An electric induction heater having an energizing coil and a coil-clamping structure including a fluid-cooled clamp at one end of the coil.

9. In an electric induction furnace having a plural-turn energizing coil, a coil-clamping structure including top and bottom clamps engaging the respective end turns of the coil, adjustable tension means between the clamps to draw the same together, electric-insulating means operatively associated with the adjustable tension means, and fluid-cooling means closely operatively associated with the energizing coil for reducing the temperature of the electric-insulating means.

10. In an electric induction heater having a plural-turn energizing coil, a coil-clamping-and-supporting structure including a plurality of pairs of clamps located, respectively, at opposite ends of the coil, a plurality of bars of electric-insulating material extending between the clamps of each pair, and means on one of said bars for attaching said coil to a suitable support.

In testimony whereof, I have hereunto subscribed my name this first day of October, 1930.

THOMAS H. LONG.