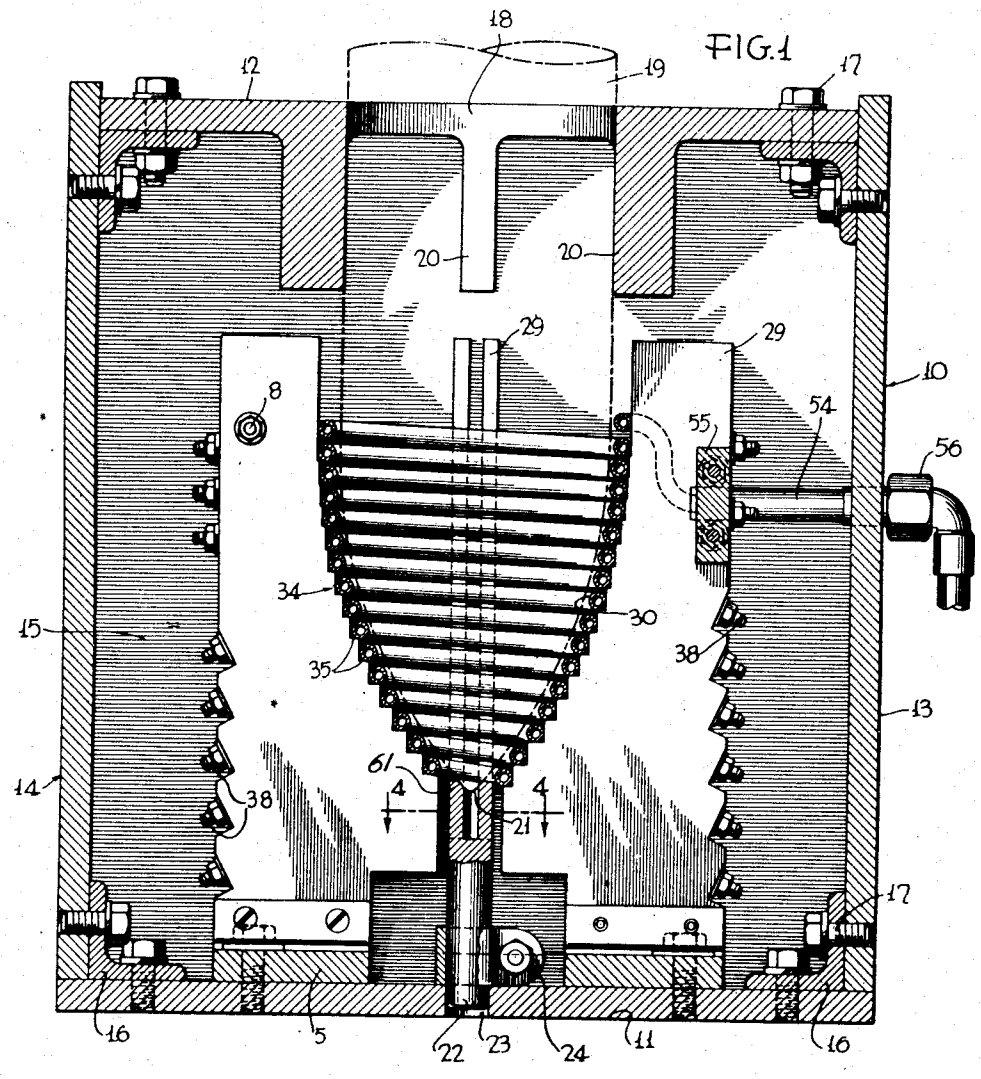
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SUPPORT FOR INDUCTION HEATING COILS

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FIG. 1



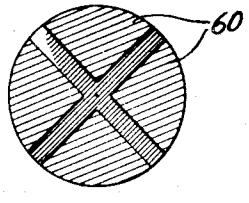


FIG. 4.

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FIG. 2

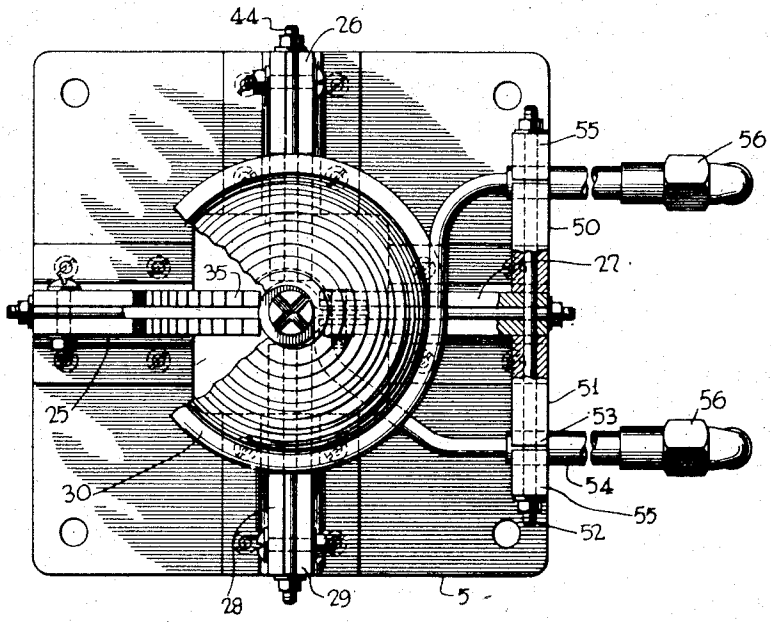
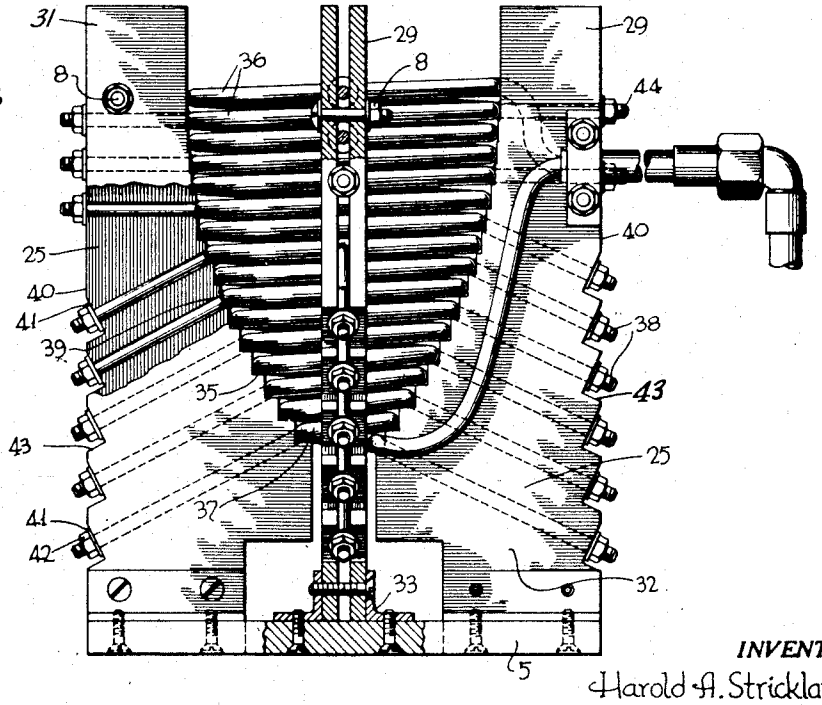


FIG. 3



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Patented June 24, 1947 2,423,054

UNITED STATES PATENT OFFICE

2,423,054

SUPPORT FOR INDUCTION HEATING COILS

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Application September 1, 1943, Serial No. 500,772

2 Claims. (Cl. 219—13)

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This invention relates to induction heating apparatus and more particularly to heating apparatus for workpieces of non-cylindrical or irregular shape.

In the heat treatment of cylindrical workpieces a cylindrically wound induction heating coil is conveniently and usually employed, the same having a horizontal axis and the workpiece being inserted at the side of the furnace into the coil for the heating operation. In the case of certain non-cylindrical shapes particularly where only a section of the workpiece is to be heated, the horizontal furnace is poorly adapted for proper placing and heating of the workpiece. Moreover in many cases it is undesirable to support the workpiece through the coils as this involves a complicated mechanical structure, as well as contributing to the distortion of the coil shape.

An important object of the present invention is to provide a furnace for inductive heating of a workpiece in which the support of the workpiece is entirely independent of the coil structure. Another object of the invention is to provide a support for a workpiece which will permit radial adjustment of the workpiece in relation to the induction heating coil for variation of the heating effect. An object of the invention also is to provide a simplified jig arrangement which may be readily modified to support a heating coil of any desired contour with particular adaptation for the supporting of a workpiece having curvilinear areas. An additional object is to provide positive holding means for the turns of the heating coil in relation to the coil jig. An object also is to provide a coil support in which the support area afforded the coil turns increases approximately as the weight of the coil. Other objects will appear on consideration of the following description of the form of the invention which may be preferred and of the accompanying drawings, in which:

Fig. 1 is an elevational view partly in section showing the heating apparatus;

Fig. 2 is a plan view of the heating coil with the furnace casing removed;

Fig. 3 is an elevation of the plan view of Fig. 2, and;

Fig. 4 is a section through the work support rod along lines 4—4 of Fig. 1.

Referring to Fig. 1 there is disclosed a furnace casing 10 of rectangular construction and having a base plate 11, a top plate 12 and side plates 13, 14 and 15, the front side plate not being illustrated. These plates are rigidly attached together by means of angle brackets 16 secured to the plates by screw bolts 17. The top plate 12 is

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illustrated as having an aperture 18 centrally located to receive the workpiece 19 shown in dash outline. At spaced points around the periphery of this aperture 18 are dependent guide bars 20 for preventing transverse displacement of the workpiece after insertion within the opening 18.

The weight supporting means for the workpiece which in the form illustrated is a shell having a conical nose 21, is a cylindrical member 22 movable through the aperture 23 formed in the center of the base plate 11 and adjustably held in vertical position within the casing by means of the rigid clamp 24. The supporting member 22 extends upwardly a short distance within the casing. The upper end of the member is preferably divided by axially formed openings into quadrants 60 and at the extreme top of the member, the central portion is cut-away to form a conical area 61 adapted to receive the nose tip 21 of the workpiece. It thus appears that when the nose of the workpiece rests in the conical support area 61 of the member 22, the entire weight of the workpiece is borne by this member and that by adjustment of clamp 24, the workpiece may move up or down in relation to the base to secure the desired position in relation to the heating coil.

The heating coil 30 in the partial showing of Fig. 1 is shaped to correspond with the contour of the nose of the shell 19 and consists of a number of turns 36 of a circular hollow conductor having a gradually decreasing diameter of turns proceeding toward the tip of the nose. The final nose turn 37 of the coil terminates rearwardly from the tip, so that the tip 21 is exposed through the end coil for engagement with the support member 22.

The specific jig arrangement for support of the heating coil comprises four pairs of vertically positioned plates 25, 26, 27 and 28, each pair being positioned an equal distance around the periphery of the coil, opposite pairs being in co-planar relationship. The support plate 29 of each pair is broadly triangular in shape with a narrow section 31 at the top and a broad section 32 adjacent the base. The base ends 32 of these plates rest upon the base plate 5 and are attached thereto by angle bars 33, the screws being inserted from the bottom side of the base plate and also through the vertical section of the angle bars to hold the plates rigidly in position. The inner edge 34 of each supporting plate is stepped beginning adjacent the top of the plate down to approximately the end of the shell nose. These steps 35 are of small width at the top but increase in width progressively toward the

base, so that the turns 36 of the coil which are adapted to seat in the notches formed by these steps 35 receive more of the width of the conductor toward the lower section of the stepped construction. Thus the lower steps of the supporting plates are adapted to receive more of the weight of the heating coil than the upper steps.

In order to insure a rigid holding of the turns 36 of the coil in the notched steps of the support, use is made of bolts 38. These bolts are placed between the adjoining support plates 25 of each pair with one end 39 silver soldered or otherwise attached to the conductor turn and the other extending beyond the outer edges of the support plates where they are attached by means of washers 41 overlying the two support plate edges and screw nuts 42 to bind the bolt in place. As more clearly shown in Fig. 3 in dashed outline, the bolts are applied to displaced sections of the coil and with the exception of the three upper bolts, are inclined downwardly toward the outer side of the support plates 25. Also the lower outer edges of the support plates are notched as at 43, so that the holding washers of the plates engage the edges at right angles to the bolt axis. This angular positioning of the lower bolts of the structure insures positive engagement of the turns of the coil in the various notches of the stepped edge. The holding bolts 44 adjacent the upper turns are horizontal, since in this section the turn weight is relatively small. There is thus provided, in quadrature, spaced supporting means for the coil which is of utmost simplicity and which may be readily and easily moved to suit the configuration of the coil as desired. The material of these supporting edges is of insulation stock such as an asbestos panel board, Transite, or similar compositions that are heat resistant and possess an adequate rigidity for the purpose intended. Cross bolts 8 are used to clamp the support plates 29 together.

The ends of the coil from the top and bottom thereof are led outwardly from the same through clamp supports 50 and 51. Each support consists of a bar of insulation material positioned adjacent the top of the support plates on either side thereof, these bars being axially apertured to receive a bolt 52 having screw threaded ends. The ends 53 of the bars are curved to receive couplings 54 for the conductors, and clamps 55, held in position by the nut ends of the bolt, normally hold the coupling and the associated conductor in fixed position. The coupling as shown in Fig. 1 extends beyond the support plates to appropriate supporting and water coupling means 56 external to the casing 10. Electrical connections by clamps or the like may be made on the couplings 54 or otherwise as desired.

It is now apparent that in the arrangement as described, the workpiece such as the shell may be inserted in the opening 18 with the support member 22 holding the weight of the same; that the coil 30 encloses the end of the shell with the exception of the extreme tip 21 and conforms in curvature thereto and while in close proximity to the shall does not contact with it at any point, thus permitting but not requiring freedom from insulation on the conductor turns; that the jig unit consisting of only four spaced members 29 rigidly fixed with reference to the workpiece, is provided with steps having widths designed to take care of increasing coil weight proceeding toward the base and is formed of a material easily workable to conform to any desired coil shape.

The independence of the coil with reference to the workpiece not only permits freedom from insulation of the turns and therefore increased simplicity but also a variation in the spacing of the workpiece and heating unit by means of the adjustable support member 22, so that the degree of heating application may be controlled to a considerable extent by variation in spacing between workpiece and coil. It is of importance to observe also that in the case of uninsulated or non-insulated conductors fixity of position of the conductor turns is most essential to prevent short circuiting; and that this fixity of positioning is obtained in the construction as shown by the notched steps and the angularly displaced bolts which hold the coil structure at the outer limits of the notches, these bolts being positioned along the entire length of the coil.

As shown in Fig. 1 of the drawing the conductor of the coil is hollow to receive coolant. The conductor shown is circular in cross section but as desired the conductor may be square in section or any other desired shape.

Modifications in the general or specific arrangement of the structure may of course be made and hence no limitation is implied by the illustrated embodiment, other than as required by the scope of the claims hereto appended.

What is claimed is:

1. In a heating apparatus, a base, a heating coil, right angled support plates extending radially from a common center on said base for supporting said coil, said plates being in pairs and having their inner edges stepped for the reception of the individual coil turns, and means for fixedly holding said turns in position in said steps, said holding means comprising bolts positioned between said plates and secured to individual coil turns at one end and to the outer edges of the pairs of supporting plates at the other end, the point of plate edge attachment for the most of the bolts being below the plane of the respective associated coil turn.

2. In a heating apparatus, a base, a heating coil, support plates extending lengthwise of the coil axis and perpendicularly from the plane of the base and radially from a common center on said base for supporting said coil, said plates being in pairs and having their inner edges stepped for the reception of the individual coil turns, and a means for fixedly holding said turns in position on said steps, said holding means comprising bolts extending outwardly and downwardly toward said base between said plates and having one end attached to a coil turn and the other end to the edge of said pair of plates.

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