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H. A. STRICKLAND, JR

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INDUCTION HEATING APPARATUS

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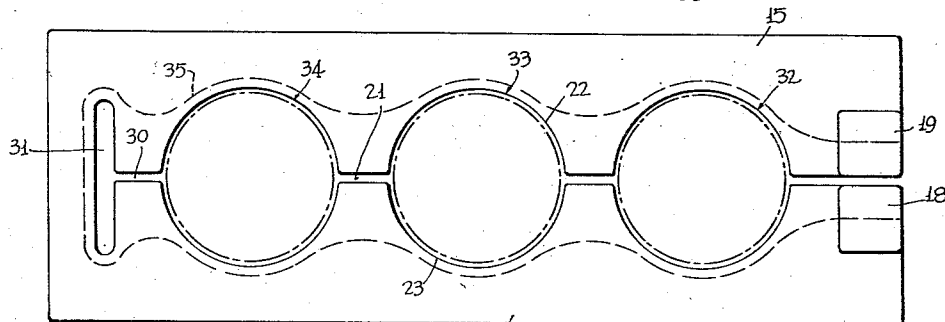
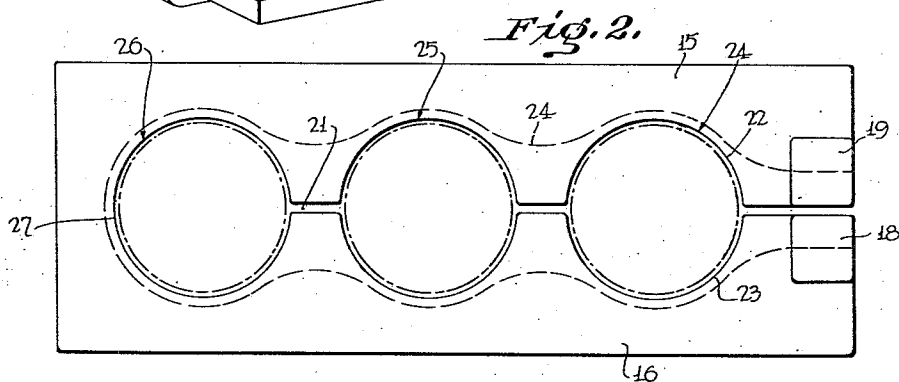
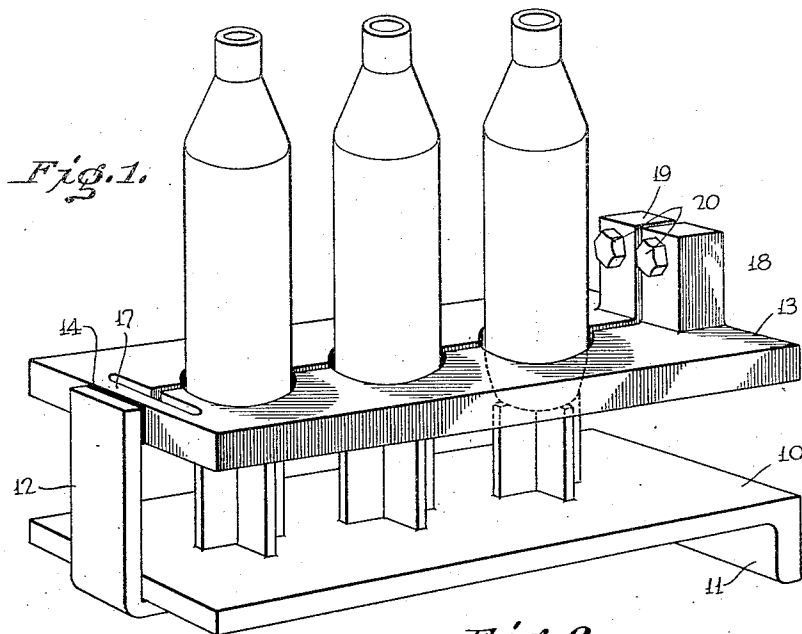


Fig. 3.

INVENTOR
Harold A. Strickland, Jr.

BY *John P. Farbox*
ATTORNEY

UNITED STATES PATENT OFFICE

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INDUCTION HEATING APPARATUS

Harold A. Strickland, Jr., Detroit, Mich., assignor, by mesne assignments, to Budd Wheel Company, a corporation of Pennsylvania

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5 Claims. (Cl. 219-13)

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This invention relates to an apparatus for heating various articles by electro-magnetic induction and has particular references to the heating of a number of articles uniformly at the same time.

In the prior art of inductive heating it is common practice to subject simultaneously a plurality of articles to the inductive effect of a secondary circuit in a transformer connected to a relatively high frequency alternating current source. A difficulty appearing in apparatus of this type has been inability to obtain a uniform degree of heating for each of the various articles and as a consequence some of the articles after the completion of the heating process would be unsatisfactory and further treatment would be required or the article discarded. It is an important object of the present invention to provide a type of inductive apparatus which when applied to a series of similar articles will produce heating effects in each substantially the same. Other objects contemplated are the provision of means for reducing rejections due to improper heating and the provision of induction heating means which may be applied without extensive modification in associated apparatus.

Referring to the drawing wherein is disclosed a form of the invention which may be preferred.

Figure 1 is a view in perspective of the induction heating apparatus as applied to a series of shells;

Figure 2 is a view of a heating secondary of known type; and

Figure 3 is a plan view of a secondary designed to secure uniform heat treatment for all of the heated articles.

In order to illustrate the use of the invention the same is applied to shells for military uses in which it is desirable to silver braze the cap piece, the same being normally screw threaded to the cylindrical body of the shell. In such assemblies it is desirable that the joint be gas proof and accordingly after assembly with flux and a ring of silver solder placed at the threaded joint, localized heat is applied inductively to fuse the solder causing it to seal the joint. Figure 1 illustrates an inductive apparatus for this form of heat treatment there being shown a base plate 10 which at one end has a flange 11 for attachment to a wall surface or other support. Positioned above this plate and spaced therefrom by means of angle strap 12 is the secondary 13, the same being insulated from the strap 12 by an insulation strip 14. The secondary 13 is roughly U shaped in that it consists of

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two parallel arms 15 and 16 joined by a cross strip 17 at one end, the free ends of the arms terminating in upstanding terminal blocks 18 and 19, the latter serving also as supporting means, by aid of the bolts 20, in attachment to a wall surface. As clearly shown in the figures the adjoining edges of the arms 15 and 16 are relatively closely spaced as indicated at 21 and at spaced points a series of semi-circular recesses 22, 23 are formed in these edges so that the recesses of adjoining edges together form circular areas spaced along the adjoining surfaces. The size of these circular areas is such as to receive workpieces such as the various shells hereinbefore mentioned, the diameter of the circular areas being greater than that of the workpieces so as to permit insertion thereof without establishment of an electrical contact between the secondary and workpiece.

Supports for the shells are indicated in Figure 1, in the form of flat plates centrally notched and interconnected to form a four wall stand. This stand is placed directly between the circular aperture, the shell being centered thereon by a continuation of the stand inside the shell or by other appropriate means.

Referring to the prior art of Figure 2, it is pointed out that the two circular areas 24 and 25 next to secondary terminals are identical in form whereas the third and outermost circular area 26 differs in that the end edge 27 is solid instead of slotted. As a result of this difference in construction the high frequency secondary current moving in the arms 15 and 16 of the secondary follows an average path roughly similar to that indicated by the dotted line 28. It therefore appears that whereas in the case of circular areas 24 and 25 the current follows an approximately identical curved path adjacent the area edges, in the case of the outermost area 26 the current follows a path completely enclosing the outermost section of the area with the result that work in this area receives a markedly increased amount of heat through this increased coupling of the current flow. This result obviously prevents uniformity in the heating among the stations.

To overcome the difficulty as above described in the prior art method and apparatus, applicant extends from the third or outermost circular area a cleavage 30 in the end plate or strip of the secondary as shown in Figure 3, the end of this cleavage terminating in a transverse slot 31 extending on either side to a point approximately in line with the common tangent of the

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circular areas 32, 33, and 34. The result of this construction appears when utilized for heating purposes in a rearrangement of an average flow of secondary current as indicated by the dotted line 35 in Figure 3. It is apparent by inspection that through the introduction of this transverse slot each of the circular areas including the outermost area is subjected to approximately the same pattern of heating current this resulting in the development of approximately the same amount of heat in each of the enclosed workpieces.

While I have shown a transverse slot to secure the desired uniformity of current flow about the circular aperture it is apparent that other forms of openings may be utilized, the essential requirement being that the open area 34 by virtue of the use of the end opening 31 receive an approximately equal distribution of heating current. Modifications may also be made in the shape of the particular work receiving aperture or openings and in the distance between the edges of the arms 15 and 16 and in other details and consequently no limitation is intended by the specific embodiment of the invention as shown other than is imposed by the scope of the claims hereunto appended.

What is claimed is:

1. A transformer unit for inductive heating of work-pieces which comprises an electrically conducting plate having a row of workpiece apertures formed therein of uniform lateral diameter, form and alignment, a terminal aperture formed at one end of said row, slots between said apertures and between the workpiece aperture at the end of said row opposite to said terminal aperture and the adjacent plate edge, said plate area lying between and extending outwardly beyond each of said apertures.

2. A transformer unit for inductive heating of workpieces which comprises an electrically conducting plate having a row of uniformly dimensioned workpiece apertures formed therein with plate metal extending between and outwardly from said apertures, slots between the apertures

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and between the aperture at one end of said row and the adjacent plate edge and means for establishing a uniform flow of current about each of said apertures.

3. A transformer unit for inductive heating of workpieces which comprises an electrically conducting plate having a row of uniformly dimensioned workpiece apertures formed along a common axis therein with plate metal extending between and outwardly beyond said apertures, slots between said apertures and between the aperture at one end of said row and the adjacent plate edge and means for establishing a uniform flow of current about each of said apertures, said means comprising a plate section extending axially from the edge of the terminal workpiece aperture opposite to the slotted plate edge having a laterally extending opening therein, diverse from said workpiece receiving apertures but of the same lateral diameter, and a slot connecting the terminal workpiece aperture and said laterally extending opening.

4. A transverse unit for inductive heating of workpieces each comprising an electrically conducting plate having a row of apertures formed therein along a common axis, uniform slots connecting said apertures along the axis thereof, a slot dividing the plate from a terminal aperture and the plate edge to form connector terminals, all said apertures having the same diameter transverse to said axis and all said apertures having the same form except the end aperture opposite to the connector terminals, the plate area lying between and extending laterally beyond each of said apertures.

5. Apparatus for heating a plurality of articles by electric currents comprising a metal plate conductor formed with a series of uniform work receiving apertures, terminal connectors at one end of said series of apertures, means for directing current flow between said connectors on opposite sides of the series of apertures, and means for establishing uniformity in current flow about each aperture.

HAROLD A. STRICKLAND, JR.