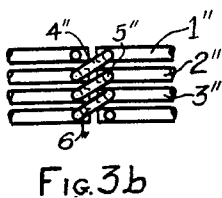
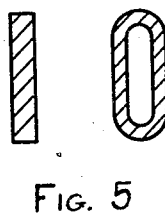
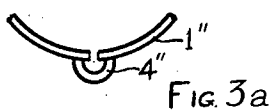
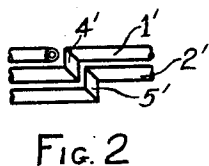
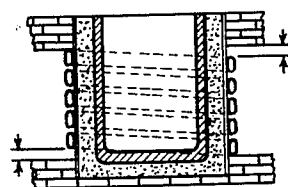
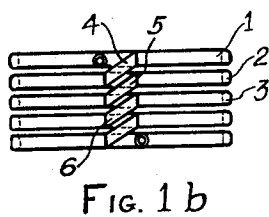
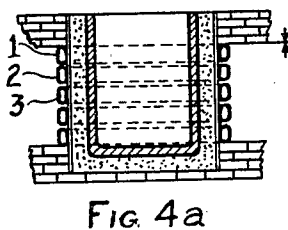
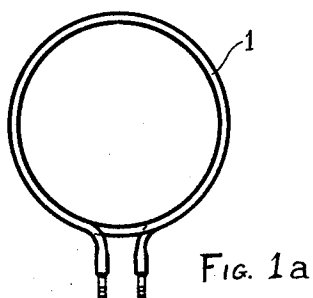


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E. F. NORTHRUP
INDUCTION ELECTRIC FURNACE

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UNITED STATES PATENT OFFICE

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INDUCTION ELECTRIC FURNACE

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11 Claims. (Cl. 219—47)

This invention relates to a new type of inductor coil for induction electric furnaces.

The purpose of the invention is to facilitate the winding of coils to be made up of large and cumbersome copper straps or tubing.

Another purpose of the invention is to leave a substantially smaller section of the furnace coil open where the top and bottom turns leave the main coil.

A further purpose is to provide adequate backing for any material used within the coil to back up a melting crucible or charge.

A further purpose is to eliminate the necessity of welding fins onto the top turns of a coil to offer backing for material placed within the coil, thereby eliminating some of the loss due to eddy currents in such fins.

Further purposes will appear in the specification and in the claims.

I have chosen to illustrate my invention by five figures.

Figs. 1a and 1b are top and elevation views of a furnace coil showing one method of forming a coil according to my invention.

Fig. 2 is a fragmentary view of Fig. 1b except that the connecting pieces from coil turn to coil turn are placed at a much greater angle.

Figs. 3a and 3b are fragmentary top and elevation views of Fig. 1b showing that the coil rings may be connected by a formed jumper connection.

Fig. 4a shows how a coil according to my invention gives complete lateral support for a furnace crucible and refractory while Fig. 4b shows the inadequate support offered by the old method.

Fig. 5 is a fragmentary view showing sample cross-sections of conductors which may be used to form the furnace inductor.

In the drawing similar numerals indicate like parts.

When winding the coils for induction electric furnaces of small size, it was found that the inductor coils giving the best results were composed of a comparatively large number of turns and that the distance from turn to turn or from the top turn to the next lower turn was very little. In these smaller size furnaces no attempt was made to fill out the space left on the ends.

As furnaces became larger in size and as power supplied to the furnace coils became greater, it was found that fewer turns were required; that the turns instead of being wound of edgewise flattened tubing, should be wound of round or even flatwise wound tubing. This meant that large spaces were left at the ends, where the turns

were taken away from the coil proper as shown in Fig. 4b. This situation was met by welding a copper fin onto the top turn so that the effective coil cylinder was complete without empty spaces at the ends. The copper fin was difficult to make. It had to be heavy enough to stand the mechanical stresses of use and to taper from the full coil width where the end turn left the coil to zero width on the other side of the coil. It had to be adapted with saw cuts at regular intervals to break up the eddy current paths.

In addition to leaving spaces at the coil ends the heavier flatwise wound tubing is more difficult to wind and to twist into the necessary helix.

In my invention, I propose to form the coil of a number of circular rings, 1, 2, 3, etc., each ring to be formed and placed in a plane surface, split at one point and connected to the adjacent ring by a short connector, 4, 5, 6, etc., cut and welded to fit, or by offsetting the tubing by bending it mechanically to give the same effect. The coil may be tubular or solid as in Fig. 5, without defeating my purpose. The connecting strap or tube may make a small angle with the plane of the ring, as shown in Fig. 1b; it may drop abruptly as shown in Fig. 2, or it may extend outside the surface of the coil cylinder as in Figs. 3a and 3b. In all cases the space left at the coil ends is small or negligible and no addition of foreign parts or fins is necessary.

In addition the coils have been made more easy to wind and the construction as a whole made applicable to any size furnace.

Having thus described my invention so that others skilled in the art may be enabled to practice the same, what I desire to secure by Letters Patent is defined in what is claimed.

1. The method of forming a single layer tubular furnace inductor coil which comprises making the turns of plane surface rings, cutting said rings and connecting them in series by short connecting pieces.

2. The method of constructing an inductor coil which comprises forming a number of plane surface rings of substantially equal diameter, spacing said rings in position to form a cylinder, cutting a segment out of each ring, preparing connectors and welding them to the ends of adjacent rings to effect a continuous single layer helical coil.

3. The method of constructing an inductor coil of hollow tubing and providing for water cooling through the turns comprising said coil which consists in forming a number of plane surface rings of substantially equal diameter out of hollow tub-

- ing, spacing said rings in position to form a cylinder, cutting a segment out of each ring, preparing hollow tubular connectors and welding them in position to connect the ends of adjacent rings in series to form a continuous tubular helical coil of a single layer.
4. The method of forming a single layer tubular furnace inductor coil which comprises making the turns of plane surface rings, cutting said rings, deforming their ends to abut the ends of adjacent rings and connecting them in series.
5. The method of forming a single layer tubular furnace inductor coil which comprises making the turns of plane surface rings, cutting said rings, offsetting one end of each ring to contact the corresponding opposite end of the adjacent ring and connecting them in series.
6. The method of forming a single layer tubular furnace inductor coil which comprises making turns of plane surface rings, cutting said rings, offsetting a section on each ring the distance of the winding pitch and connecting the rings in series to form a continuous helical type coil.
7. The method of forming a single layer furnace inductor coil which comprises winding the coil substantially in the form of a helix, deforming each turn as wound with an offset equal to the winding pitch so that the turns on the completed coil will lie substantially in planes perpendicular to the axis of the coil.
8. A single layer tubular helical type inductor coil each turn of which lies substantially in a plane surface and each turn of which is connected in series with the adjacent turn by a short offset section.
9. A single layer tubular helical type inductor coil each turn of which is offset at one point the distance of the winding pitch so that the windings lie in planes substantially perpendicular to the axis of the coil.
10. A single layer tubular helical type inductor coil comprising turns lying in plane surfaces substantially perpendicular to the axis of the coil each turn being offset at one point the distance of the pitch of the winding and connected to the adjacent turn.
11. A single layer tubular helical type inductor coil comprising turns lying in plane surfaces substantially perpendicular to the axis of the coil, each turn being offset at one point in its circumference a distance equal to the pitch of the winding and connected to the adjacent turn at another point in its circumference.
- EDWIN FITCH NORTHROP.