Jan. 5, 1954

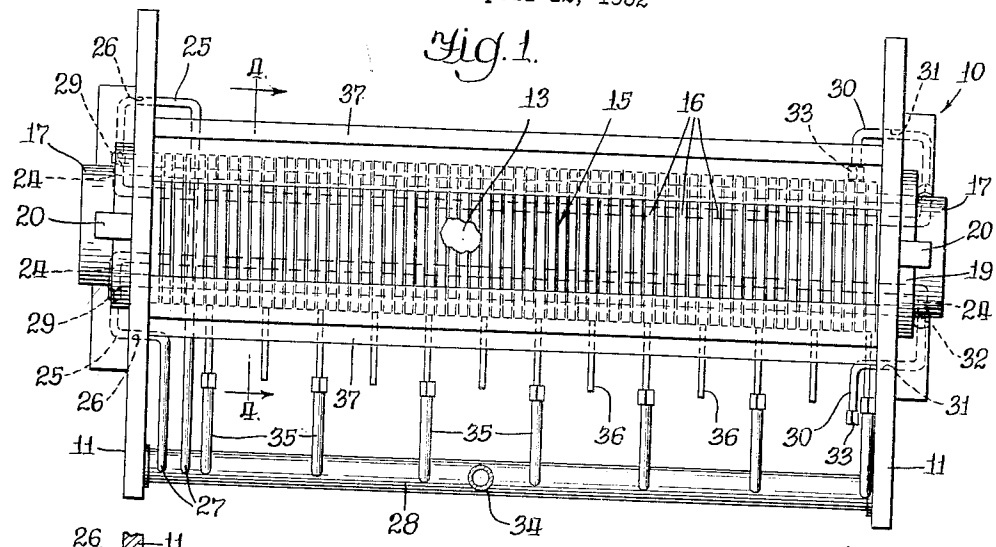
N. J. CUTLIFF ET AL

2,665,368

INDUCTION HEATING UNIT

Filed April 12, 1952

Fig. 1.



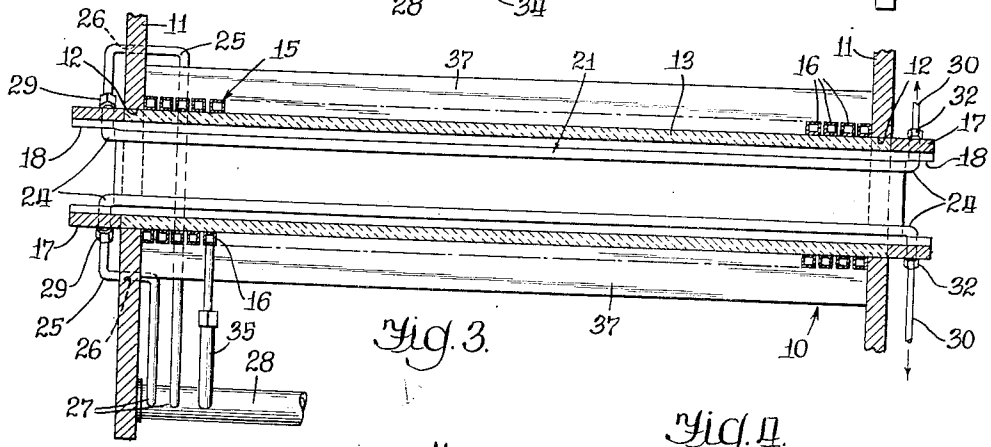
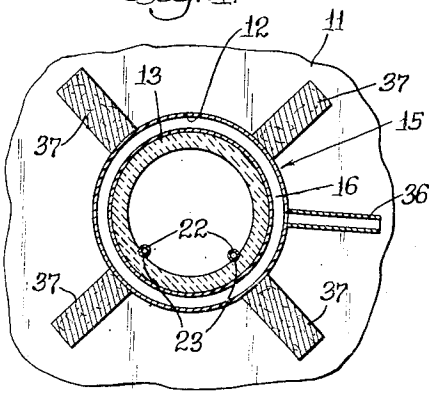


Fig. 3.

Fig. 4.



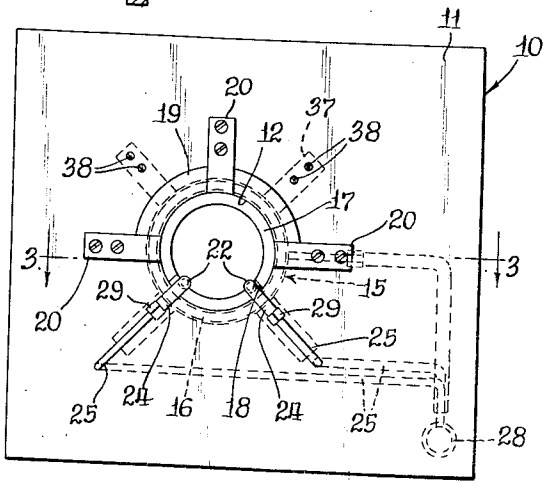


Fig. 2.

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INDUCTION HEATING UNIT

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9 Claims. (Cl. 219—47)

1

This invention relates to an induction heating unit and more particularly to an improvement in an induction coil. More specifically the invention relates to an improved induction heating coil particularly adaptable for heating billets and the like employed in forging operations.

An induction heating furnace of the type to which the present improvement applies is disclosed in the patent to Strickland, Number 2,408,350 patented September 24, 1946. The type of heating unit shown in this patent is utilized in the heating of billets or the like and the heating unit comprises essentially a tubular refractory element around which the coil-turns of an induction coil are disposed. The refractory tube serves to support the billets during their travel through the furnace and also serves to heat insulate the coils of the induction unit. In this patent the refractory tubular member consists of a plurality of individual segments or pieces which are suitably cemented together to form a cohesive structure. In induction coils of this type it is desirable to provide a plurality of tracks within the refractory, these tracks serving to guide and to support the metal billets as they travel through the furnace. In the above mentioned application guide rails of this type are employed, the guide rails being tubular in construction so that proper cooling of the rails may be effected during their operation. The rails or tracks of the Strickland patent are embedded within the refractory tube and this embedding takes place during the assembling or construction of the furnace, the tubes being held in position by the mortar which is disposed between the individual segments of the refractory. Portions of a hardened material are connected to the tubular embedded members and these hardened portions serve to act as guide elements or tracks for the billets during their travel through the induction furnace.

In practice with the use of furnaces of the type above indicated it has been found that the tracks will frequently have to be replaced and that this is quite a costly procedure since the coil has to be completely broken down. This breaking down of the coil takes place during the removal of the tracks since they are embedded in between the individual segments or sections of the tubular refractory. A tubular refractory which is made up of individual bricks or segments also in practice has been found to be expensive from the standpoint of maintenance since individual portions or bricks would become loose during use or sagging of the tubular refractory as a unit would take place. It can be appreciated that any breakdown of the refractory might occasion improper operation since scale forming on the heated billets will very likely travel through the broken portions of the refractory and become engaged with portions of the induction coil whereupon the coil will short-out and cause improper operation. It is a prime object of this invention therefore to provide an improved construction in induction furnaces or induction coils the induction unit being inexpensive in construction and in maintenance.

2

A still further object is to provide an improved induction coil having a pair of longitudinally extending liquid cooled tracks, the tracks being readily removable from the induction coil for replacement purposes without damage or deterioration of the refractory tube which is constructed within the induction coil.

Another object is to provide an improved induction coil comprising a pair of longitudinally spaced supports positioned to support an integral or one piece refractory tube which is surrounded or encircled by means of an induction coil, the refractory having contained therein a pair of longitudinally extending water cooled tracks the tracks being connected to the coil for ready removal and replacement.

A still further object is to provide an improved induction coil having a pair of longitudinally spaced supports the supports including center openings in longitudinal alignment for supporing a one piece refractory tube, the refractory tube being arranged to support an induction coil which encircles said tube, the unit further including a pair of water cooled tubular tracks which rest upon and project from the inner smooth surface of the refractory tube, the tubular tracks being removably connected to inlet and outlet conduits in a manner wherein cooling of the tracks is facilitated and quick removal of the tracks may be accomplished.

A still further object is to provide an improved induction heating unit comprising a pair of longitudinally spaced supports having a one piece refractory tube supported thereon, the tube including a plurality of tubular tracks which are supported on the smooth inner surface of the refractory tube and which project therefrom, the tubular tracks being removably connected to inlet and outlet conduits which provide for the inflow and outflow of a cooling liquid from said tubes, the inlet tubes also being connected to a longitudinally extending manifold which is disposed between the longitudinally spaced supports,

the manifold also including tubular connections which are connected to the induction coil for supplying a liquid coolant to said coil.

These and further objects will become more readily apparent from a reading of the specification when examined in connection with the accompanying sheets of drawings.

In the drawings:

Figure 1 is a plan view of an induction heating unit embodying the features of the invention;

Figure 2 is a front view in elevation of an induction heating unit.

Figure 3 is a sectional view through an induction heating unit taken substantially along the line 3—3 of Figure 2; and

Figure 4 is a sectional view through an induction coil taken along the line 4—4 of Figure 1.

Referring now to the drawing, an induction heating unit is generally designated by the reference character 10. The induction heating unit 10 comprises a pair of longitudinally spaced supports provided with center openings 12 which are in alignment. The spaced supports are preferably constructed of a non-conducting material such as wood, fibre, etc. A tube or hollow member 13 has its end portions suitably supported in the center openings 12 of the supports 11. The tube 13 is constructed of a refractory material, the tube being in one piece or integral such as might be formed by a casting or extruding process. An induction coil 15 is carried by the refractory tube 13. The induction coil 15 comprises a plurality of interconnected coil-turns or coil sections 16 which as indicated in the present disclosure encircle the refractory tube 13 in a spiral fashion.

A collar 17 is connected to the outer face of each of the longitudinally spaced supports 11. Each collar 17 is constructed of silica carbide material which is very hard and heat resistant. The collars 17 include cut-outs 18 and flanges 19. Suitable brackets 20 engage the flanges 19 for securing them against the outer surfaces of the spaced supports 11. In certain induction furnaces several of these induction units may be utilized and the collars 17, which project from the outer faces of the supports 11 may be placed in contiguous relation to form a bridge between the induction units to support the billets which may be passing through said units.

A track generally designated 21 is provided within the refractory tube 13. The track 21 consists of a pair of longitudinally extending track sections or tubes 22 which are supported in longitudinally extending recesses 23 provided in the inner cylindrical surface of the refractory tube 13 as best indicated in Figure 4. Each track section or longitudinally extending tube 22 is provided at its ends with laterally extending tubular end portions 24. Inlet conduits 25 extend through openings 26 in one of the supports 11, the inlet conduits being connected as indicated at 27 to a longitudinally extending manifold or conduit 28 which is supported on the longitudinally spaced supports 11. The inlet conduits 25 project outwardly from one of the supports 11 and are bent in a suitable manner to register with the tubular end portions 24. At one end of the tubes 22 threaded screw type inlet fittings 29 suitably connect the inlet conduits 25 and the tubular end portions 24.

Outlet conduits 30 are supported on the other spaced support 11, the outlet conduits 30 extending through openings 31 in the support 11. The outlet conduits 30 are suitably bent to register with the tubular end portions 24 and are connected thereto by threaded outlet fittings 32. The outlet conduits 30 are also provided with suitable threaded fittings 33 at their other ends for connection to drain conduits (not shown).

The manifold 28 is provided with a suitable inlet 34, the said manifold 28 being in communication with the tubular coil section 16 by means of a plurality of inlet conduits 35. Cooling liquid from the manifold 28 is thus delivered to the coil sections 16 through the conduits 35. Likewise cooling liquid to the track sections 22 is supplied from the manifold 28 through the inlet conduits 25. The cooling liquid leaves the track sections 22 by means of the outlet conduits 30 to a suitable drain. Likewise the outlets 35 provide for the discharge of the cooling liquid.

The operation of the induction coil 15 is conventional, since it is suitably connected to a source of high frequency power (not shown). The travel of cooling liquid from the manifold to the induction coil and to the longitudinally extending tracks also has been described. The structure is rigidly held in assembly by means of a plurality of longitudinally extending bars 37 which are circumferentially spaced about the induction coil 15. The bars 37 are constructed of a non-conducting material preferably such as wood, fibre, etc. The ends of the bars 37 are suitably connected to the spaced supports 11 as indicated in Figure 2 at 38.

The track sections 22 are made from a hard and high heat resistance steel, since the billets travel on the track sections 22 from one end of the induction unit to the other. In view of the extreme heat, it is found frequently necessary to replace the track sections and this can readily be accomplished by simply unscrewing the inlet and outlet fittings 29 and 32 whereupon each track section 22 can readily be removed from the one piece refractory tube 13. Thus change-over and maintenance of the track sections 22 is a simple matter. The refractory tube which is manufactured in one piece can be used for a long period of time without any break-downs, this feature being of prime importance when considered in comparison with the maintenance problems presented by the built up or brick and segmental types of tubes discussed in the above mentioned patent. The novel arrangement of the manifold and its connecting parts with the coil and the tubular track are also believed to be of significance in the arrangement indicated since an inexpensive rigid and durable induction coil is provided.

It can now be seen that the objects of the invention have been fully achieved and it must be understood that changes and modifications may be made which do not depart from the spirit of the invention as disclosed nor from the scope thereof as defined in the appended claims.

What is claimed is:

1. An induction heating unit comprising a pair of longitudinally spaced, substantially parallel supports having center openings in longitudinal alignment, a one-piece refractory tube supported within the openings, a hollow induction coil spirally wrapped around said tube and supported thereby, longitudinally extending members connecting said spaced supports, said members being circumferentially spaced about and engaging said induction coil in supporting relation, a track extending longitudinally within said tube, said track comprising a pair of laterally spaced tubular track sections supported on the interior sur-

face of the tube and projecting therefrom, each tubular track section presenting a continuous track surface projecting outwardly from the inner peripheral surface of the tube for supporting an object to be heated, tubular end portions on said track sections extending laterally with respect to the sections and the refractory tube, means for supplying and discharging cooling liquid to and from said track sections including a manifold extending longitudinally substantially parallel with said refractory tube, an inlet conduit for each track section, an outlet conduit for each track section, the inlet conduits being connected to said manifold for communication therewith and extending through said spaced supports, and first removable conduit connections connecting said inlet conduits with the tubular end portions at one end of said track sections, and second removable conduit connections connected to the tubular end portions at the other end of said track sections.

2. An induction heating unit comprising a pair of longitudinally spaced substantially parallel supports having center openings in longitudinal alignment, a one-piece refractory tube supported by said parallel supports, a hollow induction coil encircling said tube, said induction coil including a plurality of spirally disposed coils, longitudinally extending supporting members circumferentially spaced about said tube for supporting said induction coil and tube, means connecting the end portions of said supporting members to said spaced supports, a track extending longitudinally within said tube, said track including a pair of laterally spaced tubular track sections supported on the interior surface of the tube and projecting therefrom to present a continuous track section projecting outwardly from the inner peripheral surface of the tube for supporting an article to be heated, laterally extending tubular end portions on each end of each track section, means for removably connecting each track section to said refractory tube comprising inlet conduits supported by one of the parallel supports, inlet fittings connecting the inlet conduits to the tubular end portions at one end of the track sections, outlet conduits supported by the other parallel support, outlet fittings connecting the outlet conduits to the tubular end portions at the other ends of said track sections, means supplying a cooling liquid to said tubular track sections and to said induction coil including a manifold extending longitudinally and being supported by said parallel supports, coolant connections connecting said manifold and said induction coil, and means connecting said inlet conduits and said manifold.

3. An induction heating unit comprising a pair of longitudinally spaced substantially parallel supports having center openings in longitudinal alignment, a one-piece refractory tube supported by said parallel supports, a hollow induction coil encircling said tube, said induction coil including a plurality of coil turns, longitudinally extending supporting members circumferentially spaced about said tube for engaging and supporting said induction coil and tube, means connecting the end portions of said supporting members to said spaced supports, a track extending longitudinally within said tube, said track including a pair of laterally spaced tubular track sections supported on the interior surface of the tube and projecting therefrom to present a continuous projecting track section for supporting an article to be heated, laterally extending tubular end portions on each end of each track section, means for removably connecting each track section to said refractory tube comprising inlet conduits supported by one of the parallel supports, inlet fittings connecting the inlet conduits to the tubular end portions at one end of the track sections, outlet conduits supported by the other parallel support, outlet fittings connecting the outlet conduits to the tubular end portions at the other ends of said track sections, means supplying a cooling liquid to said tubular track sections and to said induction coil including a manifold extending longitudinally and being supported by said parallel supports, coolant connections connecting said manifold and said induction coil, and means connecting said inlet conduits and said manifold.

4. An induction heating unit comprising a pair of longitudinally spaced substantially parallel supports having center openings in longitudinal alignment, a one-piece refractory tube supported by said parallel supports, a hollow induction coil encircling said tube, said induction coil including a plurality of interconnected coil turns, longitudinally extending supporting members circumferentially spaced about said tube for engaging said coil and supporting said tube along its length, means connecting the end portions of said supporting members to said spaced supports, a track extending longitudinally within said tube, said track including a pair of laterally spaced tubular track sections supported on the interior surface of the tube and projecting therefrom to present a continuous projecting track section for supporting an article to be heated, laterally extending tubular end portions on each end of each track section, means for removably connecting each track section to said refractory tube comprising inlet conduits supported by one of the parallel supports, inlet fittings connecting the inlet conduits to the tubular end portions at one end of the track sections, outlet conduits supported by the other parallel support, outlet fittings connecting the outlet conduits to the tubular end portions at the other ends of said rack sections, means supplying a cooling liquid to said tubular track sections including a manifold extending longitudinally and being supported by said parallel supports, and means connecting said inlet conduits and said manifold.

5. An induction heating unit comprising a pair of longitudinally spaced parallel supports, a one-piece refractory tube supported on said supports, a hollow induction coil encircling said refractory tube, a track extending longitudinally within said tube, said track including a pair of laterally spaced tubular track sections supported on the inner cylindrical surface of said tube and projecting therefrom to provide a continuous projecting track section for supporting an article to be heated, tubular end portions on each end of each track section, means for removably connecting said track sections with respect to said refractory tube comprising inlet and outlet conduits, inlet fittings connecting the inlet conduits to the end portions of the track sections at one end, and outlet fittings connecting the outlet conduits to the end portions of the track sections at the other ends of said track sections, and means for supplying a coolant liquid to said track sections through said inlet conduits, said means including a manifold disposed longitudinally between said supports, and conduit means connecting said inlet conduits to said manifold.

6. An induction heating unit comprising a pair

of longitudinally spaced parallel supports, a one-piece refractory tube supported on said supports, a hollow induction coil encircling said refractory tube, a track extending longitudinally within said tube, said track including a pair of laterally spaced tubular track sections supported on the inner cylindrical surface of said tube and projecting therefrom to provide a continuous track section disposed from the inner peripheral surface of the tube in spaced relation for supporting an article to be heated, tubular end portions on each end of each track section, means for removably connecting said track sections with respect to said refractory tube comprising inlet and outlet conduits, inlet fittings connecting the inlet conduits to the end portions of the track sections at one end, and outlet fittings connecting the outlet conduits to the end portions of the track sections at the other ends of said track sections, and means for supplying a coolant liquid to said track sections.

7. An induction heating unit comprising a pair of longitudinally spaced, substantially parallel supports having center openings in longitudinal alignment, a one-piece refractory tube supported within the opening, a hollow induction coil spirally wrapped around said tube and supported thereby, a track extending longitudinally within said tube, said track comprising a pair of laterally spaced tubular track sections supported on the inner surface of the tube and projecting therefrom, each tube presenting a continuous track surface disposed in spaced relation from the inner peripheral surface of the tube, for supporting an object to be heated, tubular end portions on said track sections extending laterally with respect to the sections and the refractory tube, means for supplying and discharging cooling liquid to and from said track sections including a manifold extending longitudinally substantially parallel with said refractory tube, an inlet conduit for each track section, an outlet conduit for each track section, the inlet conduits being connected to said manifold for communication therewith and extending through said spaced supports, and first removable conduit connections connecting said inlet conduits with the tubular end portions at one end of said track sections, and second removable conduit connections connected to the tubular end portions at the other end of said track sections.

8. An induction heating unit comprising a pair of longitudinally spaced parallel supports, an integral refractory tube supported on said supports, a hollow induction coil encircling said refractory tube, a pair of laterally spaced tubular track sections supported on the inner cylindrical surface of said tube and projecting therefrom to provide a continuous track section disposed throughout its length in spaced relation from the inner peripheral surface of said tube, for supporting an article to be heated, tubular end portions on each end of each track section, means for removably connecting said track sections with respect to said refractory tube comprising inlet and outlet conduits, inlet fittings connecting the inlet conduits to the end portions of the track sections at one end, and outlet fittings connecting the outlet conduits to the end portions of the track sections at the other ends of said track sections, and means for supplying a coolant liquid to said track sections.

9. An induction heating unit comprising a pair of longitudinally spaced supports, a one-piece refractory tube supported on said supports, a hollow induction coil encircling said refractory tube, a track extending longitudinally within said tube, said track including a pair of laterally spaced tubular track sections supported on the inner cylindrical surface of said tube and projecting therefrom to provide a continuous track section disposed from the inner peripheral surface of the tube in spaced relation for supporting an article to be heated, means for removably connecting said track sections with respect to said refractory tube, and inlet and outlet connections on said tubular track sections for supplying coolant liquid to said tracks sections and for discharging the same therefrom.

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EMMETT V. BROGAN.

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