Feb. 5, 1957 E. V. BROGAN 2,780,706

INDUCTION-HEATING APPARATUS AND IMPROVED TRACK SUPPORT THEREFOR

Filed Nov. 3, 1954

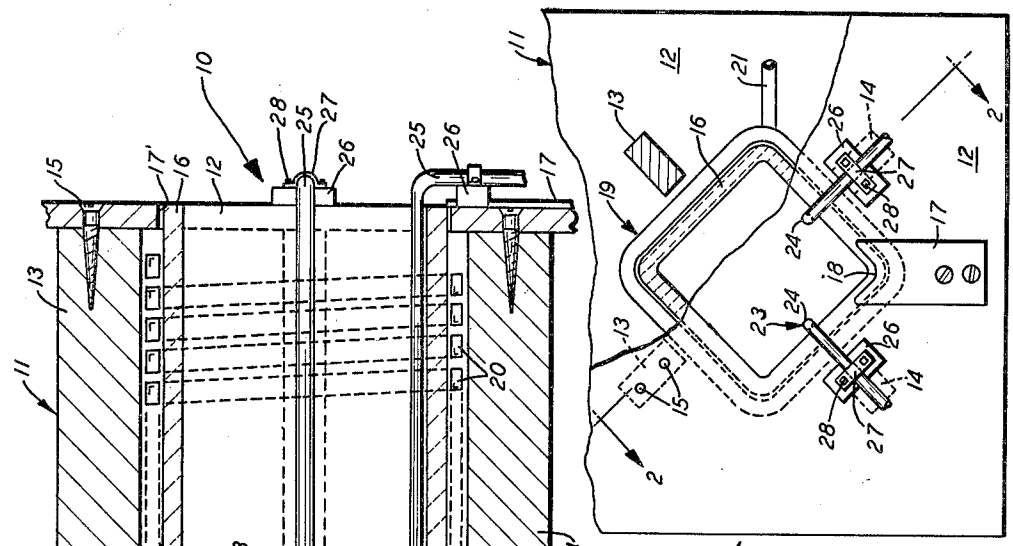

FIG. 1

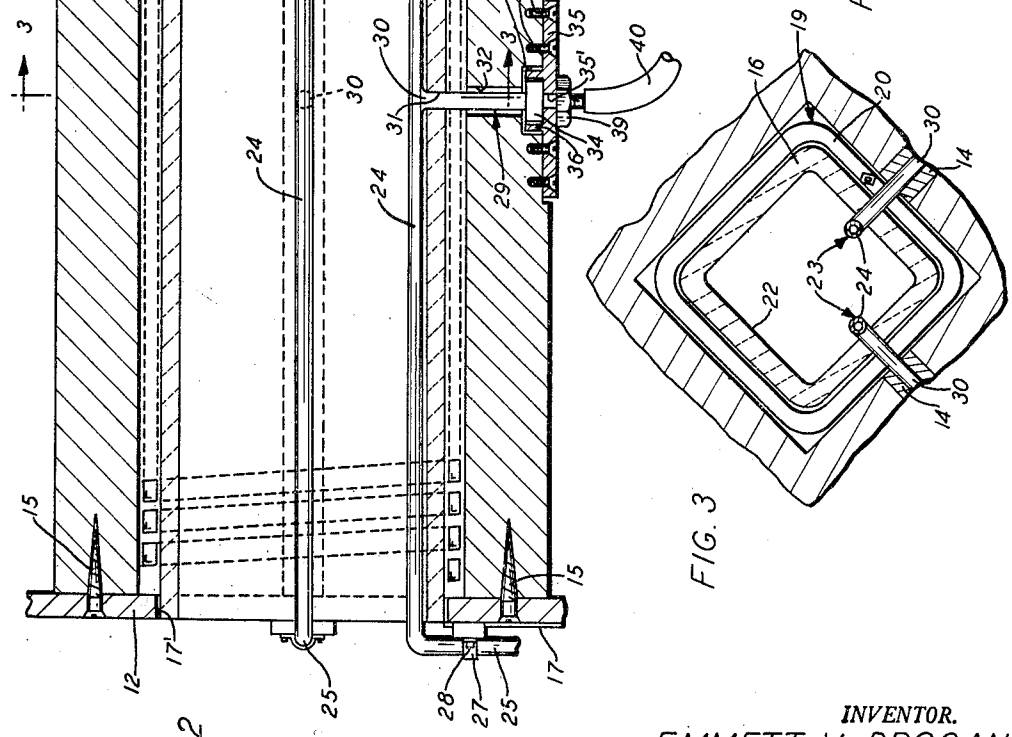

FIG. 2

FIG. 3

INVENTOR.
EMMETT V. BROGAN
BY Paul O. Pippel

ATTORNEY

United States Patent Office 2,780,706
Patented Feb. 5, 1957

2,780,706

INDUCTION-HEATING APPARATUS AND IMPROVED TRACK SUPPORT THEREFOR

Emmett V. Brogan, Louisville, Ky., assignor to International Harvester Company, a corporation of New Jersey

Application November 3, 1954, Serial No. 466,478

7 Claims. (Cl. 219—10.67)

This invention relates to an improvement in induction-heating devices having a water-cooled track for supporting articles to be heated as they move through an induction-heating zone.

The apparatus with which the present invention is concerned is particularly adapted for heating, by induction, steel billets and the like preliminarily to their being worked upon by a forging apparatus. The conventional heating device for heating billets employs a refractory which is properly supported by a supporting structure. The refractory is surrounded by a hollow induction coil which is suitably connected to a source of electrical current. In conventional devices of this type, the refractory generally consists of a plurality of small refractory sections which are cemented together to form a complete whole. The refractory serves to insulate the heat from the outer induction coil, and also prevents the possibility of scale material falling down into the coil sections of the inductor, causing electrical failures in the heating coil. Conventional practice has been to move the billet along a track consisting of a pair of track sections which are rigidly and securely embedded within the refractory member. Such conventional track sections must be made of a particularly hard material so that they can withstand the tremendous heat and pressures to which they are subjected during the movement of the billets through the refractory member. In order to dissipate some of the heat, the track sections are generally made of conduit type of construction and a suitable cooling medium is transported through the track sections. In practice, it has been found that the conventional type of coil thus described is exceedingly unsatisfactory since the weight of the billets on the refractory would cause the refractory to become damaged over a relatively short period of time, consequently necessitating frequent maintenance. Therefore, to use the refractory as a structural support has been unsatisfactory, and it is a prime object of this invention to provide an improved track arrangement for an induction-heat unit whereby the weight of the articles passing through the coil are supported free of the refractory.

A still further object of the invention is to provide a conduit type of track arrangement for an induction-heating apparatus designed to heat billets and the like in transit through an induction coil, the track being supported on its ends and between its ends by suitable support means whereby track sections are completely free and independent of the refractory about which the induction coil is normally positioned.

Still a further object is to provide an improved supporting means for supporting the track sections of an induction-heating unit intermediate the ends of the track sections, and for also providing cooling means for said supporting means.

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

In the drawing:

Figure 1 is an end view in elevation, with certain portions broken away, of an induction-heating apparatus particularly adapted for heating billets and the like which are pushed through the device;

Figure 2 is a cross-sectional view through an induction-heating device taken substantially along the line 2—2 of Figure 1; and

Figure 3 is a cross-sectional view through an induction-heating device particularly taken along the line 3—3 of Figure 2.

Referring now particularly to Figures 1 and 2, an induction-heating device is generally designated by the reference character **10**. The induction-heating device **10** comprises a support **11** consisting primarily of end supports **12**, the said end supports **12** being horizontally spaced and positioned in an upright manner. A plurality of horizontally extending bars **13** and **14** are suitably connected to the end supports **12** by means of fasteners **15**, thus providing a rigid supporting structure for the induction-heating device **10**. A ceramic, or refractory, tube **16** is supported on the support **11**. The refractory tube **16** is made of a suitable ceramic material which may be cast, or formed, in one single piece. The tube **16**, which is preferred in this construction, is of substantially rectangular design and cross section, and is positioned, as best shown in Figure 3, on the support **11** with its sides extending in relatively diverging relation with respect to the normal horizontal plane of the induction-heating device. Plates **17**, having V-shaped notches **18**, are connected to the end supports **12** for maintaining the tube **16** against relative horizontal movement with respect to the support **11**. The ends of the tube **16** are thus supported in openings **17'** in the end supports **12**. A hollow inductor coil is generally designated by the reference character **19**. The inductor coil may be of conventional construction, consisting of a plurality of coil turns **20** which are wound around the refractory tube **16** in a spiral manner. As shown in Figure 1, the inductor coil **19** may include leads **21** extending to a suitable source of electrical energy.

The refractory tube **16** is provided with an inner wall **22**. A track is generally designated at **23**. The track **23** serves to support billets and other steel articles which are fed to the induction-heating device for heating. Such a heating operation may be desired as a preliminary step to a forging operation, and one or more steel billets may be supported on the track **23** and heated by induction as they travel from one end of the induction-heating device to the other.

The track **23** comprises a pair of laterally spaced substantially parallel track sections **24**. The track sections **24** are of tubular, or conduit-like, construction, and may be suitably made of a material having the trade-name of Stellite, or they may be made of a similar hard material that will wear well despite extreme heat and pressure which may be exerted on the said track sections by the billets that are heated. The track sections **24** also include end portions **25** which extend outwardly of the tubular refractory **16**, the said end portions **25** extending substantially parallel to the outer faces of the end supports **12**. The end portions **25** of each track section **24** may be suitably connected to a reservoir (not shown) containing a suitable source of cooling liquid under pressure.

Spacer members **26** are provided on the outer faces of the end supports **12** for suitably spacing the end portions **25**. Brackets **27** removably support the end portions **25** on the spacers **26**. Fasteners **28** are provided for suitably connecting the brackets **27**, the end portions **25**, and the spacers **26** to the end supports **12**.

A center support is generally designated at **29**. A cen-

ter support 29 of this type is provided for each of the track sections 24, and one of these supports is illustrated in detail in Figure 2. Each center support 29 includes a conduit 30 which is in communication with the track sections 24 and connected thereto in supporting relation. Each conduit 30 extends through an opening 31 provided in the ceramic tube 16, and through openings 32 provided in the horizontal supporting members 14. The horizontal supporting members, adjacent to the opening 32, are also provided with an enlarged undercut portion 33. Each of the conduits 30 is also provided with a shoulder 34 which is disposed within the recess formed by the undercut 33. A connector plate 35 is provided with an opening 35' through which the conduit 30 extends and projects outwardly therefrom. The connector plate 35 also includes a socket 36 which supports the shoulder 34. Screws 37 suitably connect the connector plate 35 to the horizontal support 14. Thus, the shoulder 34 rests upon the connector plate 35 and is supported on the horizontal support 14; therefore, providing an intermediate support for the track sections 24 which maintains them in suitably spaced relation with respect to the inner wall of the refractory tube. The end of the conduit 30 is threaded, and a nut 39 securely tightens the shoulder 34 against the connector plate 35. A flexible tube 40 is connected to the end of the conduit 30, the flexible tube 40 providing a suitable drain for the cooling liquid which may be transported through the track sections 24.

Thus, it can be seen that the track sections 24 are firmly supported on their ends by means of the brackets 27 which engage and firmly grasp the end portions 25 of the said track sections 24. Therefore the track sections 24 are suitably spaced from the inner wall 22 of the refractory tube. Furthermore, the center support 29 serves to insure that the said spacing may be maintained; and despite the transportation of heavy billets through the heating unit, complete support is provided for the track sections so that the refractory tube will not be subjected to unusual strains which might result in premature cracking and failure. Likewise, the conduit 30, which forms the support, is also cooled by cooling liquid that flows through the track sections; the said cooling liquid being directed to a suitable drain which may be provided at the end of the flexible hose 40.

Thus, an improved supporting structure and track has been provided that will support the billets and other objects which may be subjected to heat treatment, independent of the ceramic, or refractory, tube. Hence, service failures are greatly minimized, and a simple arrangement is provided whereby the refractory may be replaced by merely disconnecting the center support and the brackets which support the ends of the track sections. Furthermore, adequate cooling is effected for the center supports and the track sections. Thus the objects of the invention have been fully achieved, and it must be understood that changes and modifications may be made without departing from the spirit of the invention or the scope thereof as defined in the appended claims.

What is claimed is:

1. An induction-heating device comprising a pair of horizontally spaced upright end supports having openings in substantially horizontal alignment, horizontally extending support members connected at opposite ends to the upright members, a one-piece ceramic tubular insulating member having an elongated opening in registry with the openings of said end supports, said insulating member extending horizontally between said end supports and being supported thereon, a hollow induction coil extending spirally about said tubular member, said coil being adapted to connect to a source of electrical energy, a track for supporting an object to be heated while it is being transported through said tubular insulating member, said track comprising a pair of spaced hollow track members, said track members being relatively laterally spaced and horizontally extending coextensive with the length of said tubular insulating member, each of said track members having hollow end portions disposed outwardly of the tubular insulating member and extending substantially parallel to the outer sides of said end supports, brackets connecting said end portions to said end supports to support said track members in spaced relation relative to the inner wall of said insulating member, a center support for each track member, each of said horizontal support members having substantially vertically disposed openings adjacent said center support, each center support comprising a conduit in communication with one of said track members and supported in one of said openings, a shoulder on said conduit, a connector member engaging said shoulder, and means removably connecting said connector member to said horizontal support member, said conduits being adapted to convey cooling liquid in said track members and to support the track members at a position between said end supports.

2. An induction-heating device comprising a pair of horizontally spaced upright end supports, horizontally extending support members connected at opposite ends to the upright members, a ceramic tubular insulating member having an inner cylindrical wall, said insulating member extending horizontally between said end supports and being supported thereon, a hollow induction coil extending spirally about said tubular member, said coil being adapted to connect to a source of electrical energy, a track for supporting an object to be heated while it is being transported through said tubular insulating member, said track comprising a pair of hollow track members, said track members being relatively laterally spaced and horizontally extending coextensive with the length of said tubular insulating member, each of said track members having hollow end portions disposed outwardly of the tubular insulating member and extending substantially parallel to the outer sides of said end supports, brackets connecting said end portions to said end supports to support said track members in spaced relation relative to the inner wall of said insulating member, a center support for each track member, each of said horizontal support members having substantially vertically disposed openings adjacent said center support, each center support comprising a conduit in communication with one of said track members and supported in said opening, a shoulder on said conduit, a connector member engaging said shoulder, and means removably connecting said connector member to said horizontal support member, said conduits being adapted to convey cooling liquid in said track members and to support the track members at a position between said end supports.

3. An induction-heating device comprising a pair of horizontally spaced upright end supports, horizontally extending support members connected at opposite ends to the upright members, a tubular insulating member having an inner cylindrical wall, said insulating member extending horizontally between said end supports and being supported thereon, a hollow induction coil extending about said tubular member, said coil being adapted to connect to a source of electrical energy, a track for supporting an object to be heated while it is being transported through said tubular insulating member, said track comprising a pair of hollow track members, each of said track members having hollow end portions disposed outwardly of the tubular insulating member, brackets connecting said end portions to said end supports to support said track members in spaced relation relative to the inner wall of said insulating member, a center support for each track member, each center support comprising a conduit in communication with one of said track members, and means removably connecting said center supports to said horizontal support members, said conduits being adapted to convey cooling liquid in said track members and to support the track members at a position between said end supports.

4. An induction-heating device comprising a pair of

horizontally spaced upright end supports, horizontally extending support members connected at opposite ends to the upright members, a tubular insulating member having an inner cylindrical wall supported on said supports, an induction coil extending about said tubular member, a track for supporting an object to be heated while it is being transported through said tubular insulating member, said track comprising a pair of hollow track members, each of said track members having hollow end portions disposed outwardly of the tubular insulating member, brackets connecting said end portions to said end supports to support said track members in spaced relation relative to the inner wall of said insulating member, a center support for each track member, each center support comprising a conduit in communication with one of said track members, and means removably connecting said conduits to said horizontal support members, said conduits being adapted to convey cooling liquid in said track members and to support the track members free of the cylindrical wall.

5. An induction-heating device comprising a supporting structure, a one-piece ceramic tubular insulating member carried on said structure, a hollow induction coil encircling said insulating member, a track for supporting an object to be heated while it is being transported through said tubular insulating member, said track comprising a spaced hollow track member, said track member having hollow end portions, brackets connecting said end portions to said structure to support said track members in spaced relation relative to the inner wall of said insulating member, a track support positioned between the ends of the hollow end portions, said support including at least one conduit extending laterally into said tubular member and communicating with one of said hollow track members, and means removably connecting said conduit relative to said supporting structure, said conduit being adapted to convey cooling liquid in said track member and to support the track member free of the cylindrical wall.

6. An induction-heating device comprising a supporting structure, a tubular electrical insulator extending horizontally and carried on said structure, an induction

coil disposed about said insulator, a track extending horizontally coextensive with the inner wall of said insulator for supporting objects in transit to be heated by the coil, said track including a pair of relatively laterally spaced tubular track sections, means connecting opposite end portions of said track sections to said supporting structure to space said sections relative to the inner wall of said insulator, a track support for supporting each track section within said insulator at a point between its opposite ends, each track support including a conduit extending laterally into said insulator, said conduit being in communication with one of said track sections, and means connecting said conduits to said supporting structure whereby said conduits support said track sections free of said insulator and said conduits are adapted to conduct cooling liquid transported within said track sections.

7. An induction-heating device comprising a supporting structure, a tubular electrical insulator extending horizontally and being carried on said supporting structure, an induction coil disposed about said insulator, a track extending horizontally coextensive with the inner wall of said insulator for supporting objects in transit to be heated by the coil, said track including a pair of tubular track sections, first means connecting portions of said track sections to said supporting structure to space said sections relative to the inner wall of said insulator, second means within said insulator for supporting each track section between its opposite ends, said second means including conduits extending laterally through said insulator wall and being in communication with said track sections, and means connecting said conduits to said supporting structure whereby said conduits support said track sections and said conduits are adapted to conduct cooling liquid transported within said track sections.

References Cited in the file of this patent

UNITED STATES PATENTS

2,490,106	Strickland	Dec. 6, 1949
2,563,883	Strickland	Aug. 14, 1951
2,572,073	Strickland et al.	Oct. 23, 1951
2,665,368	Cutliff et al.	Jan. 5, 1954