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INDUCTION HEATER FOR USE WITH PIPE BENDING APPARATUS

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Fig. 1.

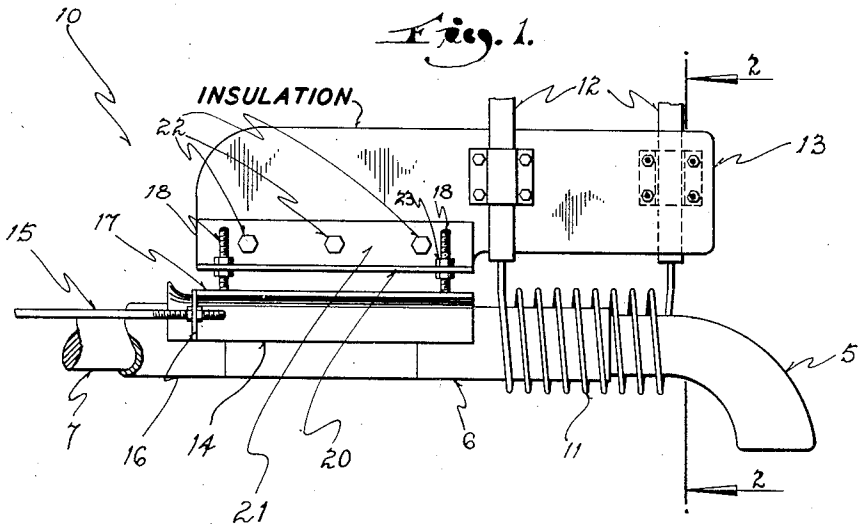
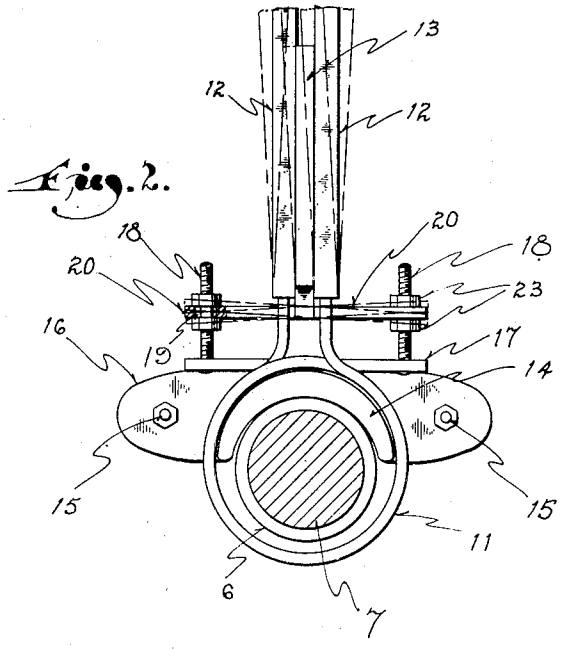


Fig. 2.



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INDUCTION HEATER FOR USE WITH PIPE BENDING APPARATUS

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6 Claims. (Cl. 219—13)

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This invention relates to the art of making pipe bends wherein lengths of tubing or pipe are moved along a mandrel rod and forced over a forming mandrel on the end of the rod to produce tube or pipe bends.

In this process it is necessary that the tubing be heated to enable deformation thereof and such heating has been customarily effected by locating the mandrel and part of the mandrel rod leading thereto in a furnace. Since the temperature of the tubing must be raised to a relatively high degree for best results, the furnaces used in the past were often provided with gas burners for directing a flame against the tubing entering the furnace and the mandrel located therein.

This procedure is objectionable, however, since it makes controlled heating of the tubing extremely difficult. It is highly desirable in some instances, depending upon the shape of the forming mandrel, that predetermined portions of the tubing be heated to higher degrees than other portions thereof to preclude rupturing of the tubing as the same is forced over the forming mandrel.

It is also well known that heating in the hereinbefore described manner is objectionable because of the high heat losses and the excessively high temperature conditions to which workmen supervising the heating and forming operations are subjected.

It is accordingly an object of this invention to provide an induction heating device for tubing or pipe to be deformed in the aforementioned manner so as to obtain the advantages of low heat losses and cooler operating conditions.

It is another object of this invention to provide an induction heating device for the tubing used in making pipe bends by which heating of the tubing may be readily controlled so as to obtain either uniform heating of all portions of the tubing or differential heating by concentration of heat over any desired portions of the tubing passing through the induction heating device.

Another object is to provide for the maintenance of a predetermined positional relationship between the induction coil of the heating device of this invention and the tubing passing therethrough, which relationship is determined by the tubing to be heated.

More specifically, it is an object of this invention to provide an induction heating device in which the induction coil is maintained in a predetermined position surrounding the tubing traveling therethrough by a support for the coil which rests on the tubing itself.

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With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawing illustrates one complete example of the physical embodiment of the invention constructed in accordance with the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a side elevational view of the induction heating device of this invention illustrating the manner of its use; and

Figure 2 is a view taken through Figure 1 on the plane of the line 2—2.

Referring now more particularly to the accompanying drawing in which like numerals indicate like parts the numeral 5 designates a forming mandrel over which lengths of tubing or pipe 6 are adapted to be forced to produce tubular elbows or bends. The tubing or pipe 6 is caused to travel axially along a mandrel rod 7 by means of a hydraulic ram (not shown) forming part of a drawbench of a type well known in the art.

It was previously the custom to situate the mandrel and a portion of the mandrel rod leading thereto inside a furance to have a flame play over the exterior of the tubing to heat the same to a sufficiently high temperature enabling ready deformation of the tubing as the same was forced over the mandrel.

There are many disadvantages to this manner of heating the tubing or pipe, however, chief among which are high heat losses, inability to control heating of the walls of the tubing, and extremely uncomfortable working conditions for attendants supervising the bending operation.

In the present invention the temperature of the tubing is raised to a sufficiently high degree for the forming operation by means of an induction heater generally designated 10. The induction heater comprises an induction coil 11 having a number of turns suitable for the length of the tubing to be bent, and having a diameter such that tubing of a number of sizes may pass axially therethrough to be heated prior to passage onto the mandrel.

The opposite ends of the induction coil 11 are secured to bus bars indicated at 12 in electrical conducting relationship thereto, and it will be understood that the interior of the bus bars as

well as the coil itself may be hollow to provide for circulation of a fluid cooling medium therethrough.

The bus bars 12 provide for connection of the induction coil with a suitable source of high frequency current and are mounted on opposite sides of a relatively flat supporting arm 13 of insulating material and at the rear end of said arm adjacent to the mandrel.

The supporting arm 13 is adjustably carried by a saddle 14 adapted to rest on the tubing 6. The underside of the saddle is concave to substantially conform to the periphery of the tubing upon which it rests, and the saddle is secured against motion in the direction of travel of the tubing by means of a pair of tie rods 15. These rods substantially straddle the mandrel rod and have one end adjustably anchored in a crosshead 16 on the saddle, and their other end secured in any suitable manner to the bed of the drawbench. These crosshead and tie rods could be reversed or formed in any desired manner to suitably anchor or hold the saddle in a stationary predetermined position.

A horizontal plate 17 is weled or otherwise secured on the top side of the saddle to provide flanges for adjustably mounting the supporting arm thereon. These flanges project from opposite sides of the saddle and have studs 18 anchored therein at the outer corners thereof and extending upwardly to pass through enlarged apertures 19 in the horizontal flanges 20 of a pair of angle irons having the supporting arm 13 received between their upstanding flanges 21. Rivets or bolts 22 secure the supporting arm in position between the angles.

As stated, the studs 18 extend up through enlarged holes 19 in the horizontal flanges of the angle irons and nuts 23 threaded onto the studs at opposite sides of said flanges provide for holding the supporting arm at any desired elevation above the saddle and consequently enable adjustment of the concentricity of the induction coil with respect to the tubing passing therethrough.

With the forming mandrel 5 directed downwardly as shown in Figure 1, it may be desirable to effect heating of the undersides of the tubing to higher temperatures than the remaining portions of the tubing which are to pass over the large radius curve of the mandrel. This is readily effected as seen in Figure 2 by upward adjustment of the supporting arm 13 on the studs 18 to a position in which the lower portion of the coil is closer to the periphery of the tubing passing therethrough than the remaining portions of the coil. If the upper sides of the tubing are to be heated to higher temperatures than the remaining portions of the tubing, it is only necessary to adjust the supporting arm downwardly to a position at which the upper portion of the coil is closer to the periphery of the tubing passing therethrough than the remaining portions of the coil.

It should be remembered, however, that in some instances it may be desirable to effect heating of the sides of the tubing to higher temperatures than the remaining portions, and this is readily accomplished by tilting the supporting arm 13 on its studs substantially about an axis parallel to the axis of the tubing passing beneath the saddle, as shown in construction lines in Figure 2.

Attention is also directed to the fact that the tie rods 15 which preclude longitudinal motion of the saddle axially of the tubing passing therebeneath have sufficient rigidity to prevent displacement of the saddle and the supporting arm from the tubing but have a degree of flexibility such as to allow the entire induction heating device to substantially float upon the exterior surface of the tubing traveling to the mandrel.

This assures proper positioning of the induction coil with respect to the tubing passing therethrough and this positional relationship is maintained with a high degree of accuracy because of the fact that the position of the coil, that is its concentricity with respect to the tubing, is determined by the tubing itself.

From the foregoing description taken in connection with the accompanying drawing, it will be readily apparent to those skilled in the art that the induction heating device of this invention provides for positive control of heating of the tubing and has the advantage of enabling increased production over past types of furnaces for this purpose.

What I claim as my invention is:

1. An induction heater for heating metal blanks supported for travel along a defined substantially horizontal path, comprising: an induction coil through which the blanks are adapted to pass to be heated thereby; a floating support for the induction coil for holding the same in predetermined position relative to the blanks passing therethrough, said support including a saddle adapted to engage over and ride directly on the blanks, said saddle being free to move up and down through variation in the blanks passing thereunder so as to automatically and continuously control the position of the coil relative to the blanks passing therethrough; and means for holding said support against motion in the direction of travel of said blanks.

2. An induction heater for heating cylindrical blanks supported for axial endwise travel along a defined substantially horizontal path toward a zone of treatment requiring heating of the blanks prior to passage thereof into said zone, comprising: and induction coil; a floating support for the induction coil for holding the coil substantially co-axially of said blanks so that the same pass axially through the coil to be heated thereby before reaching the treating zone, said support including a saddle at the end of the induction coil remote from the treating zone and adapted to ride upon the exterior of the blanks at their upper surfaces so as to automatically position the coil relative to the blanks passing beneath the saddle and through the coil; means for holding said floating support against motion in the direction of travel of the blanks; and an adjustable supporting connection between the saddle and said coil providing for adjustment of the induction coil in a direction crosswise of the path of travel of the blanks whereby the saddle may hold the coil at any desired degree of eccentricity to the blanks upon which the saddle rides.

3. An induction heater for heating tubular blanks supported for axial travel along a defined substantially horizontal path, comprising: an induction coil; means for mounting the induction coil in position to have the blanks pass axially therethrough to be heated thereby, said mounting means including a supporting arm to which the coil is secured, a saddle adapted to ride directly and substantially freely on the exterior of the upper surfaces of blanks traveling along said defined path to have its position relative to the axis of the blanks determined by the blanks

themselves, and an adjustable connection between the saddle and said supporting arm by which the coil may be adjusted to and away from said defined path to a number of different positions fixed with respect to the saddle so that the saddle automatically controls the position of the coil relative to the blanks in any position of adjustment of the coil; and means providing for attachment of the coil mounting means to a stationary support so as to prevent motion of the coil mounting means in the direction of travel of the blanks.

4. An induction heater for heating tubular blanks supported for axial travel along a defined substantially horizontal path, comprising: an induction coil; and means for mounting the induction coil in a position surrounding the blanks so that the same are heated by passage through the induction coil, said mounting means including a supporting arm, bus bars carried by said supporting arm and to which the opposite ends of the coil are secured, a floating saddle adapted to rest directly on the exterior of the blanks traveling in said defined path, said saddle being restrained against motion in the direction of travel of the blanks but being free to float up and down in accordance with variations in the blanks passing thereunder, and means for rigidly attaching the supporting arm to the saddle and for permitting adjustment of the supporting arm relatively to the saddle in a direction substantially crosswise of the axis of the blanks so that the induction coil carried by said arm may be moved toward and from concentricity with respect to the axis of the blanks passing therethrough, said attaching means assuring that the position of the coil with relation to blanks passing therethrough is at all times determined by the position of the saddle resting on the blanks.

5. An induction heater for heating lengths of pipe supported for axial travel along a defined substantially horizontal path toward a forming mandrel over which the lengths of pipe are to be bent, comprising: a saddle having a concave undersurface to adapt the same for direct engagement over the exterior of pipe traveling along said defined path so that the saddle is floatingly supported by said pipe; means for holding said saddle against motion in the direction of travel of the pipe while permitting the saddle a degree of up and down motion; a supporting arm rigidly carried by the saddle; means for adjustably connecting the supporting arm with the saddle in a manner enabling adjusting motion of the supporting arm relative to the saddle toward and from the axis of the pipe upon which the saddle rests and tilting motion of the arm about an axis substantially parallel to the axis of the pipe; and an induction coil carried by said supporting arm at one end of the saddle to have the pipe pass axially therethrough to be heated by the coil with a degree of uniformity depending upon the concentricity of the coil and pipe and determined by the position of adjustment of the supporting arm.

6. An induction heater for heating lengths of pipe supported for axial travel along a defined substantially horizontal path toward a forming mandrel over which the lengths of pipe are to be bent, comprising: a floating saddle having a concave undersurface to receive pipe traveling along said defined path so that the saddle is directly supported on said pipe, said saddle being free to float on the pipe and having flanges extending to opposite sides of the axis of the pipe; a supporting arm overlying the pipe and having laterally extending flanges overlying the saddle and said flanges thereon; means rigidly mounting the supporting arm from the saddle for adjusting motion relative thereto toward and from the axis of the pipe and for tilting motion of the arm substantially about an axis parallel to the pipe axis, including studs carried by one set of flanges at opposite sides of the axis of the pipe and passing through enlarged apertures in the other set of flanges; lock nuts on said studs for rigidly holding the supporting arm in any desired position of adjustment with respect to the saddle; and an induction coil carried by the supporting arm at one end of the saddle in a position to have the pipe pass axially therethrough to be heated thereby and to have its position relative to the pipe automatically regulated by the floating action of the saddle.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,861,869	Long	June 7, 1932
1,915,047	Blakeslee	June 20, 1933
1,915,082	Blakeslee	June 20, 1933
1,932,423	Sessions	Oct. 31, 1933
2,368,809	Denneen et al.	Feb. 6, 1945