Nov. 30, 1943. C. F. FINK 2,335,495

CORELESS INDUCTION HEATER

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Fig. 1.

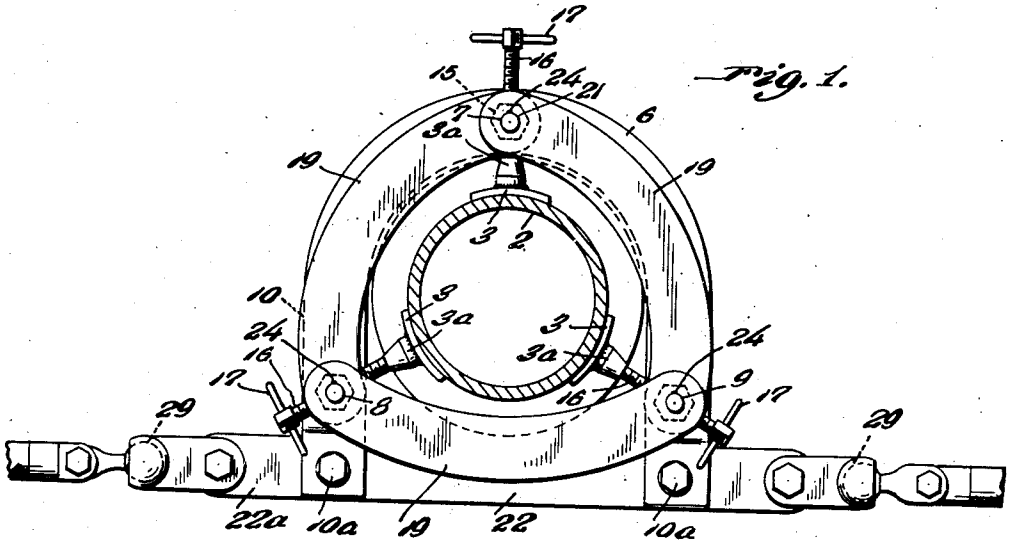


Fig. 5.

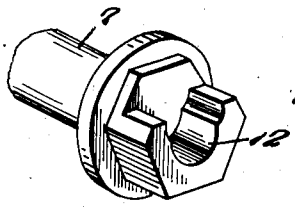


Fig. 5a.

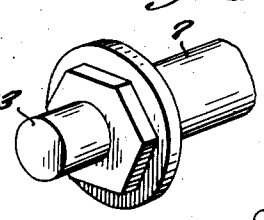


Fig. 6.

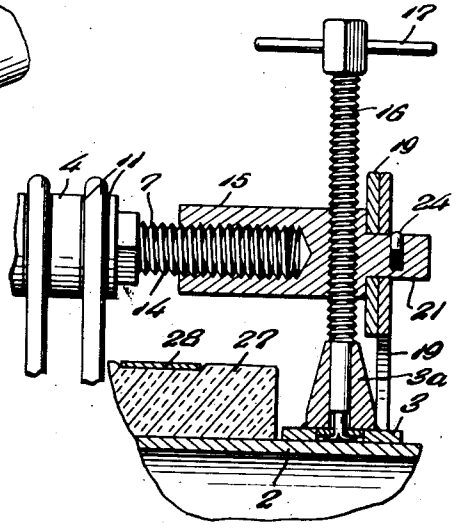
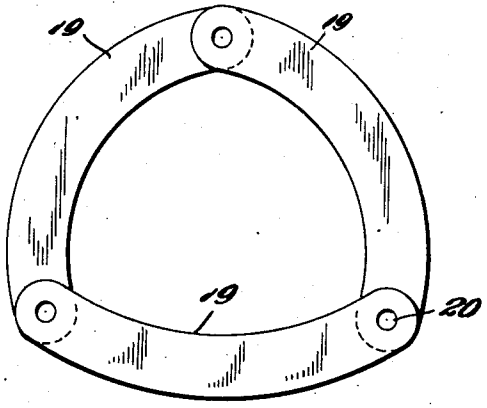


Fig. 8.



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Fig. 2.

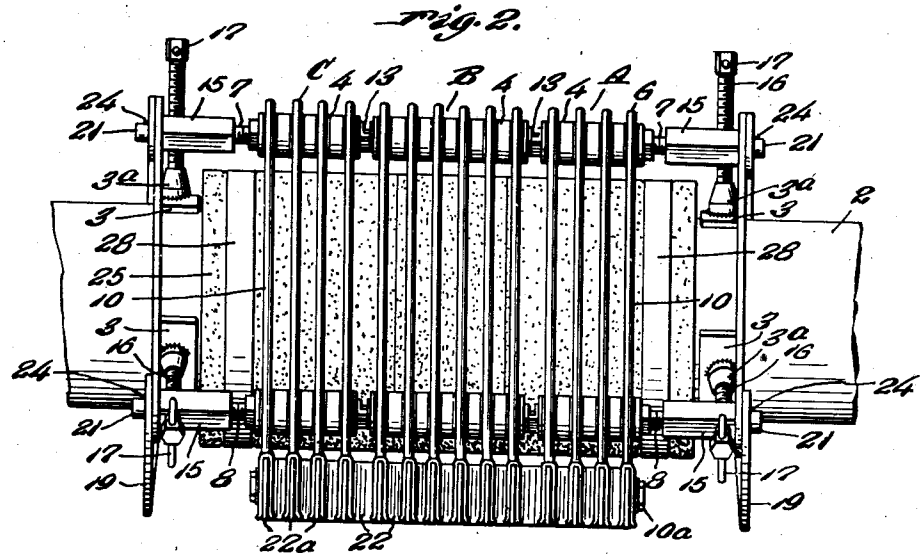
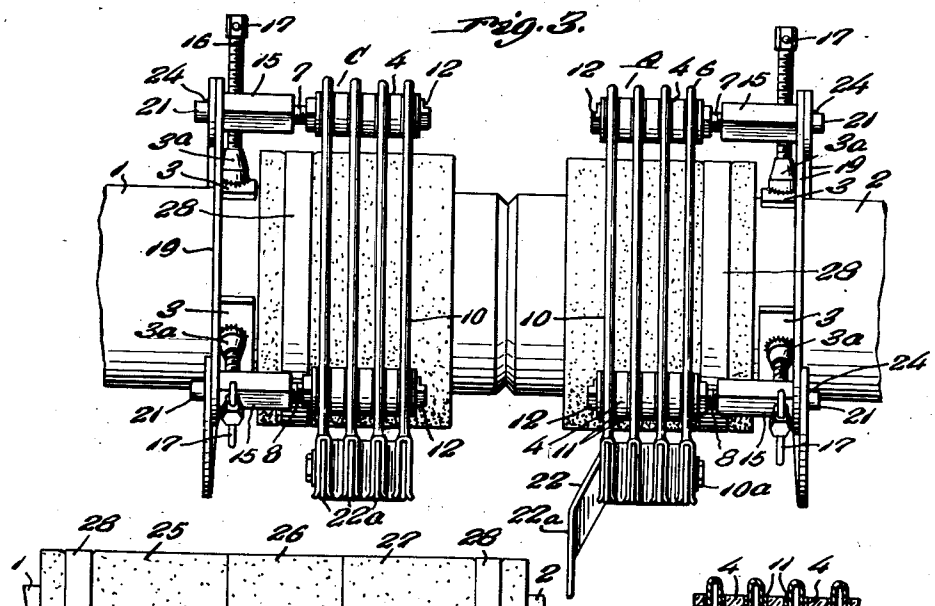


Fig. 3.



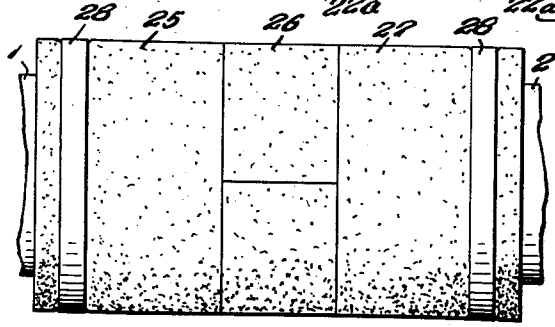


Fig. 7.

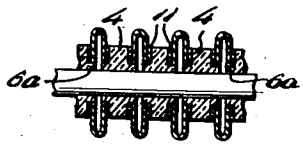


Fig. 4.

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CORELESS INDUCTION HEATER

Charles F. Fink, Baltimore, Md., assignor to Trimble & Fink Mfg. Co., Inc., Baltimore, Md., a corporation of Maryland

Application April 24, 1942, Serial No. 440,391

2 Claims. (Cl. 219—13)

The invention relates to apparatus for heating parts to be welded. It is of the induction type and involves electrical conducting means in, say, three sections connected together so that the middle section can be detached and removed after the parts to be welded have been heated to the required degree, said removal of the middle section enabling the workman to gain access to the heated parts for the application of the welding appliance.

The invention comprises means whereby the end sections of the induction heater will be supported in their proper positions after the middle section has been removed and thereby said middle section readily may be restored to its operating position between the end sections and connected up with said end sections for supplying sufficient heat to complete the work of normalizing the weld.

The invention is shown in the accompanying drawings in which Fig. 1 is an end view of the apparatus with my improvement associated therewith.

Fig. 2 is a side elevation of the heater in place upon the pipe or shaft sections to be welded together.

Fig. 3 is a view of the heater with its central section removed to expose the joint between the shaft or pipe sections to be welded.

Fig. 4 is a detail of the bolt connection between the turns of the induction coil.

Fig. 5 is a detail perspective view of the socket portion of the interfitting bolt ends between the center section of the induction coil and the end sections.

Fig. 5*a* is a perspective view of the bolt end which fits in the socket of Fig. 5.

Fig. 6 is a detail view of the support for the clamp.

Fig. 7 shows three asbestos insulators to surround the pipe or shaft section, the middle insulator being split into two parts.

Fig. 8 shows one set of the links.

In these drawings 1, 2 indicate the sections of the shaft, pipe or other member to be welded together. The apparatus is an improvement upon that disclosed in Letters Patent of the United States granted to Bela Ronay Oct. 17, 1939, No. 2,176,103, in which the induction coil is made in three sections A, B, C, connected together in such manner that the middle section B can be removed from between the end sections A and C. This enables the welder to gain access to the joint between the parts which have been heated to the required degree for the welding operation to be performed at the joint now exposed for the application of the welding tool thereto. Difficulty arises in replacing the middle section of the induction heater (which for convenience we will call an induction coil) in order to reheat the joint for its final or normalizing treatment because either one or both of the end sections of the induction coil may have sagged down out of its normal position owing to the fact that the middle section having been removed no longer serves as a means supplemental to the brackets or clamps 3, for holding the end sections accurately in position. These sections of the induction heater or coil are heavy in the larger units of the apparatus intended for welding shafts of ships or other sections of considerable size and hence when the middle section has to be reassembled for a final heating of the welded joint it is difficult for the operator to restore the displaced end sections accurately to their former positions and at the same time to properly reset the middle section into connection with both of the end sections. This difficulty is present no matter if the apparatus is intended for comparatively light work pieces as well as the heavier pieces such as shafts for naval vessels of great tonnage, or heavy pipe sections.

The so-called induction coil as herein shown is made up of flat copper bars in the three groups A, B, C before mentioned. These conducting bars are made of copper tubing flattened but with air ducts left therein for cooling. The bars are of U shape as shown at 6, there being four such bars in the end groups and six such bars in the middle section.

The bars of each group are desirably connected together at three points by the tie rods or bolts 7, 8 and 9. One of these bolts 7 is at the top or curved part of the inverted U shape member and the other two bolts 8 and 9 are at the lower portions of the straight sides 10 of the U shaped members, though other dispositions of these bolts as well as different numbers may be used and the apparatus may be set differently from that shown, according to the position of the parts to be welded, horizontal, vertical or inclined. The bolts carry porcelain insulators 4 and asbestos cushions 11.

The porcelain insulators are provided with bosses or extensions 6*a* to fit into seats in the conductor bars and the ring shaped cushions 11 of asbestos fit between the insulator members 4 and the side faces of the copper conductor bars.

Each of these bolts of the end sections of the coils has on its inner end an upwardly open sock-

et member 12 see Fig. 5 which receive the plain cylindrical end 13 of the bolts of the middle sections and these socket members therefore form the supporting element at the inner sides of the end sections for holding the middle section of the induction coil. This middle section of the induction coil like the end sections of said coil has its main portion composed of inverted U shaped bars spaced apart by porcelain insulations located on the bolts which pass through the bars of this section and present their ends 13 in proper relation for being received in the sockets 12 of the bolts of the end sections. The cross bolts 7, 8 and 9 of the end sections A and C of the induction coil are utilized as the means for mounting the clamps which bear on the shaft sections, or other parts, which are to be welded together, for supporting the induction coil from the said parts. For this purpose each bolt is screw threaded at 14 and receives thereon a metal block 15 through which passes a screw threaded rod 16 which has swivelled at 3a on its inner end the clamping plate 3 to bear on the shaft or pipe section which is to be welded. This screw threaded clamping rod has a handle 17 which may be operated by the workman for setting the clamping plate against the shaft or pipe section to be welded. Each of the three bolts has a clamping plate with means for operating it by which the induction coil section is supported from the work piece, shaft section, pipe section or other part to be welded. One of these clamps rests upon the upper surface of the work piece if this happens to be horizontally disposed and the other two clamps engage the work piece or pieces at points substantially at 120 degrees apart. When the middle section of the induction coil is in place with its three cross bolts engaging with their ends 13 in the sockets 12 of the bolts of the end sections, said end sections will be positioned by said middle section spaced apart and with the turns of its U shaped main part in planes at right angles to the axis of the work piece and the inner faces of the end sections will be substantially parallel with each other.

When, however, the middle section has to be replaced between the end sections, following the removal of said middle section to allow access to be had by the workman to the parts to be welded the clamps mentioned above, three at each end of the induction heating apparatus, no longer can be relied on alone to hold the end sections in their proper initial positions relative to each other and to the work piece, but on the contrary either or both end sections may sag down into an angular position relative to the work piece and to each other and this will preclude conveniently replacing the middle section in proper position rendering it necessary in most cases, for two persons to adjust and hold the end sections in proper separated relation while the middle section is placed back in the space between the end sections and with the bolt ends 13 resting in the sockets 12. These parts are of such relative dimensions that when the end 13 is in its companion socket 12 the contact of the two elements will enable the sections to assume correct relative positions in respect to each other and to the work piece.

In order to avoid the inconvenience and time necessary to reassemble the middle section with the end sections so that the induction member will reheat the weld and the adjacent parts of the work pieces for normalizing the parts which have been welded together the present invention provides means for supporting the end sections of the induction member firmly in accurate position at all times whether the middle section of the induction coil has been removed or not. In other words, means are provided whereby the end sections will be independently supported in their prescribed accurate position at all times irrespective of the presence or absence of the middle section of the induction member.

In making this improvement one object has been to use the Bela Ronay construction as far as possible including the U-shaped conductors 6–10 of copper connected by the straps or bridge member 22, similarly marked in the Ronay patent which are pivotally mounted at 10a in slots of one set of legs of the U-shaped member and have strong frictional engagement in slots of the other set of legs of the said U-shaped conductors in the manner of a knife switch, said straps being offset angularly with respect to the axis of the work piece, pipe or shaft sections as in the Bela Ronay patent above referred to. In this manner the assembly or group is substantially the same as a helical coil in that electric current flows through the U-shaped conductors and angularly disposed straps successively so as to induce a current in the work piece acting as a core, and heat the same. The straps 22 each have a straight extension 22a which serves as a handle for operating it to and away from its normal position so that the assembly may be opened to be placed about the work piece and then closed to receive current for inducing current in the work piece or pieces.

In the present invention the rods or bolts here marked 7, 8 and 9 which connect the U-shaped conductor bars 10 together (like the rods 13 and 14 of the Bela Ronay patent) are screw threaded and carry the blocks 15 through which the clamping screws 16 pass which carry plates 3 which bear on the work piece or pieces, so as to support the induction heater therefrom.

There are three of these clamps, one for each of the bolts 7, 8 and 9 and thus the connection between the induction heater and the work piece involves a three point bearing. The induction heating apparatus is spaced apart from the work piece or pieces insofar as its U-shaped members or bars and straps 22 are concerned, and when the middle section of the induction heater is removed the end sections, unless the present invention is employed, will sag down into an angular relation towards each other and thus as before pointed out they will have to be restored by hand to their parallel relationship to each other in order that the middle section B again may be introduced between them.

This sagging down of the end sections is due to the failure of the clamps to maintain their firm contact with the work piece. These clamps as before described are carried by the bolts or rods 7, 8 and 9 which connect the U-shaped members together and as the latter are of copper there will be some give in the position of these copper members, and when this relaxation or give of the copper bars takes place the sagging down of the sections will result, if and when the middle section is out of place. In order to avoid this relaxing of the U-shaped members, means are provided for connecting together the three bolts which connect together the straight legs of the U-shaped bars of each group comprised in each end section of the induction heater. This connecting means may assume different forms but, desirably, links 19 of rigid metal are employed which are perforated at their end portions as

shown at 20 and are slipped onto the projections 21 extending coaxially with the blocks 15 at the ends thereof. There are three of these links for each end section of the induction heater. One of these links extends beneath the work piece and connects the two lowermost bolts, and the other two links extend from the two lowermost bolts 8 and 9 to the uppermost bolt 7. The links are of flat comparatively wide metal members and they are set edgewise in respect to the direction of stress to which they are subjected. They will therefore resist the stresses and maintain the initial relation between the bolts and therefore between the clamps carried by the bolts so that the end sections will be held against displacement from their original setting and the end sections will be held ready to receive the middle section between them when the induction heater is to be restored to condition for performing its heating effect.

The links 19 are held in position on the projections 21 and backed by the end faces of the blocks 15 by cotter pins or spring pins indicated at 24.

Any suitable electric conductors may be employed to supply current to the induction heater elements and ball bearing joints may be employed, where necessary, in connecting the conductors with the heating organization, as indicated at 29.

The U-shaped elements of the heater are made from copper tubing flattened. The walls of the flattened pipe will be slightly spaced apart to get air circulation for cooling.

The pipe or shaft may be surrounded by asbestos collars in three sections as shown at 25, 26 and 27. Each of the sections of the heating coil has one of the rings or sections of asbestos within it. The end sections 25 and 27 are held in place by their brass bands 28.

The middle ring is split into halves and it may be removed so that the joint to be welded may be exposed.

It is noted that the present improvement is shown as applied to an organization having three clamps 3, 4 and 5 in respect to which rigid backing means are provided for holding the clamps against yielding, said rigid backing comprising the three rigid metal links 19 connected with the U-shaped copper bars by engaging the three bolts 7, 8 and 9 which mechanically connect said U-shaped bars into groups or coils but it will be understood that the invention is not limited to the number of clamps employed which instead of being three in number may be two in number as disclosed in the above mentioned patent of Bela Ronay, said two clamping organizations of Fig. 1 of the said patent being connected together in the present invention by a rigid link which will prevent any yieldable quality inherent in the U-shaped copper bars from relieving the pressure between said clamps and the work piece, and thus allowing an undesirable displacement of the coil or coils involving the U-shaped conductors relative to the work piece.

The invention is not limited to the use of three sections of the induction coil as disclosed herein, because one of the end sections may be used alone, or in combination with another section like the middle section of the coil or a single section like that shown in the Ronay patent may be equipped with the links tying together rigidly the bolts which support the clamps.

I claim as my invention:

1. An induction heater comprising co-axially arranged conductor sections, each section including a plurality of turns of an electrical conductor and holding means for maintaining the turns of that section in fixed relation, one of said sections removably fitting between two other sections and being supported thereby, said holding means of said other sections including portions which project away from the end of those sections which is opposite from the removable section, a set of clamps carried by said projecting portions of the holding means and extending toward the axis of the heater to bear upon a centrally located work piece and support the heater substantially concentrically about the work piece, and links having openings to receive the projecting portions of the holding means and interconnect the clamps to prevent their separation when the clamps are forcibly brought to bear upon the work piece to thereby provide a sufficiently rigid formation to support the section as a cantilever when the removable section is absent.

2. An induction heater comprising coaxially arranged conductor sections, each section including a plurality of turns of an electrical conductor and holding means for maintaining the turns of that section in fixed relation, one of said sections removably fitting between two other sections and being supported thereby, said holding means of said other sections including portions which project away from the end of those sections which is opposite from the removable section, a set of clamps connected to said projecting portions of the holding means and extending toward the axis of the heater to bear upon a centrally located workpiece and support the heater substantially concentrically about the workpiece, and non-extensible means other than a turn of the electrical conductor removably engageable with the projecting portions of the holding means, said non-extensible means being in sections to permit their assembly about the workpiece to form a complete circle interconnecting the holding means in a plane substantially perpendicular to the axis of the section and preventing separation of the holding means when the clamps are forcibly brought to bear upon the workpiece to thereby provide a sufficiently rigid formation to support the section as a cantilever when the removable section is absent.

CHARLES F. FINK.