April 20, 1954 E. C. WITSENBURG 2,676,242

DEVICE FOR TREATING WORKPIECES THROUGH INDUCTIVE HEATING IN A HIGH-FREQUENCY MAGNETIC FIELD

Filed March 1, 1948 3 Sheets-Sheet 1

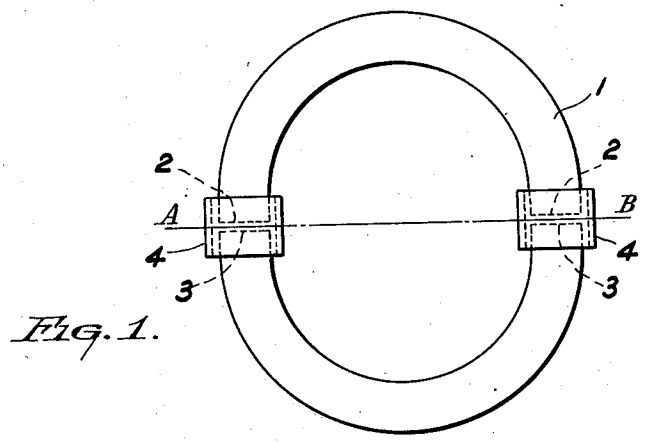


Fig. 1.

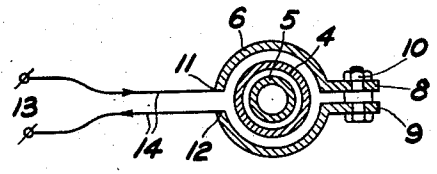


Fig. 2.

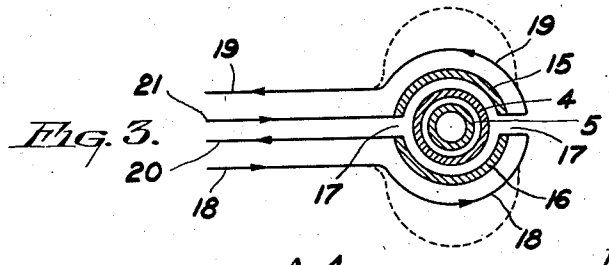


Fig. 3.

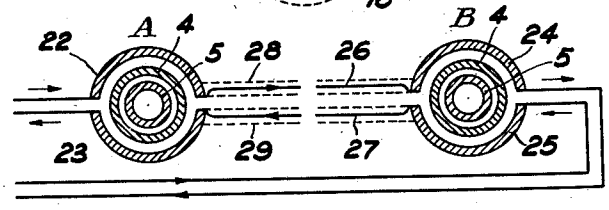


Fig. 4a.

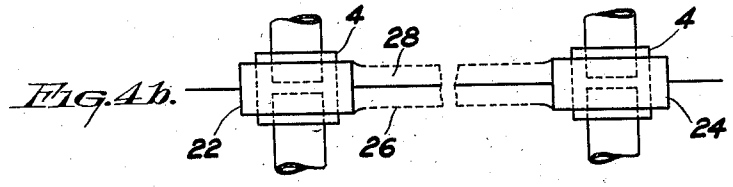


Fig. 4b.

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Filed March 1, 1948 3 Sheets-Sheet 2

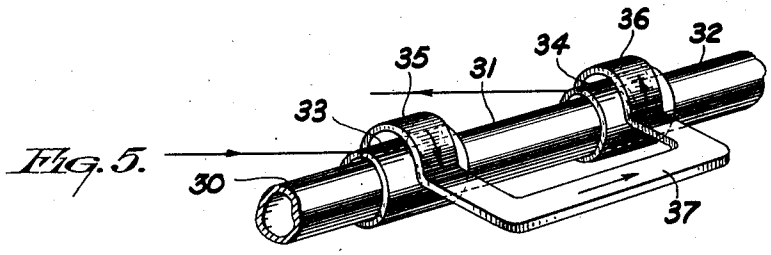


Fig. 5.

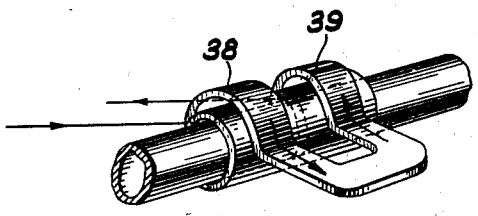


Fig. 6.

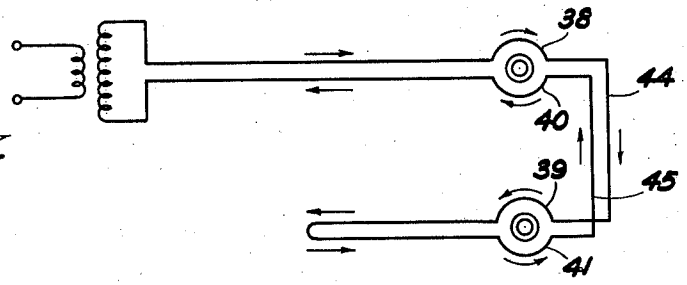


Fig. 7.

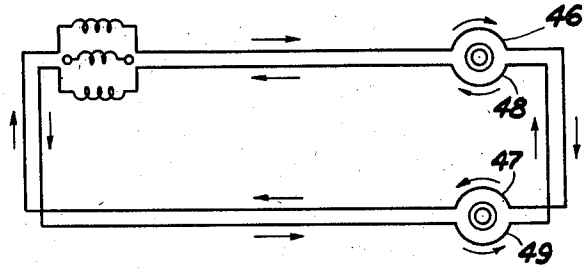


Fig. 8.

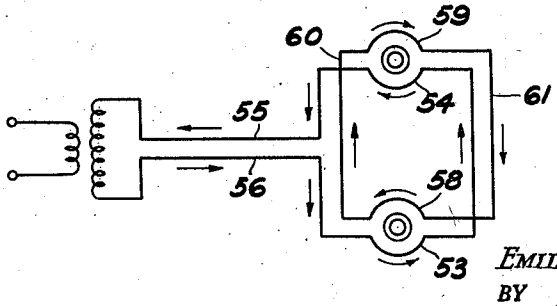


Fig. 9.

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DEVICE FOR TREATING WORKPIECES THROUGH INDUCTIVE HEATING IN A HIGH-FREQUENCY MAGNETIC FIELD

Filed March 1, 1948 3 Sheets-Sheet 3

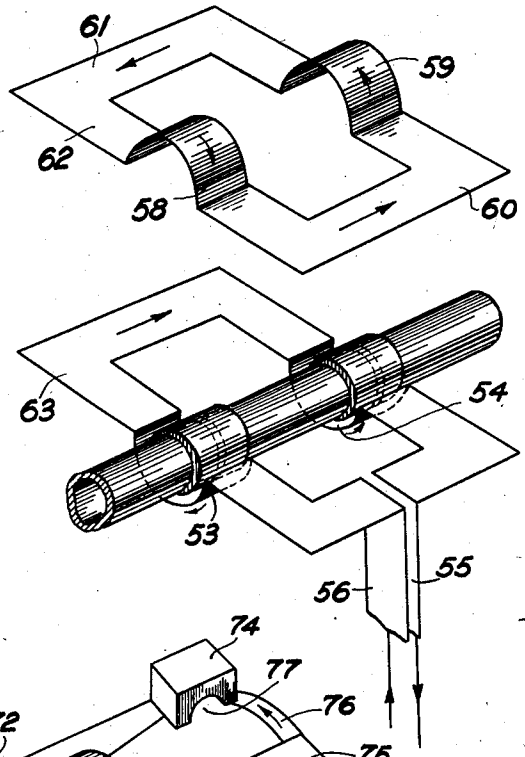


Fig. 10.

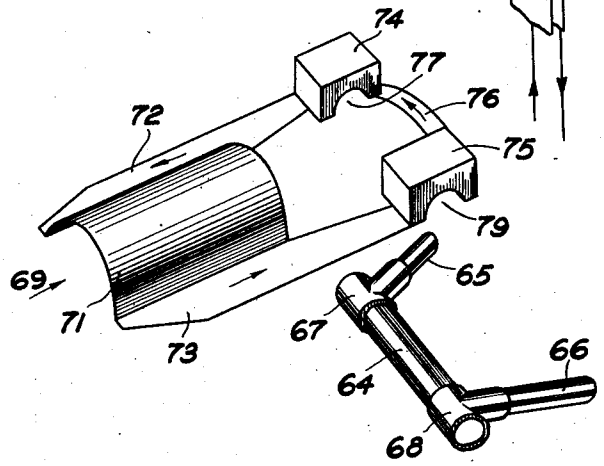
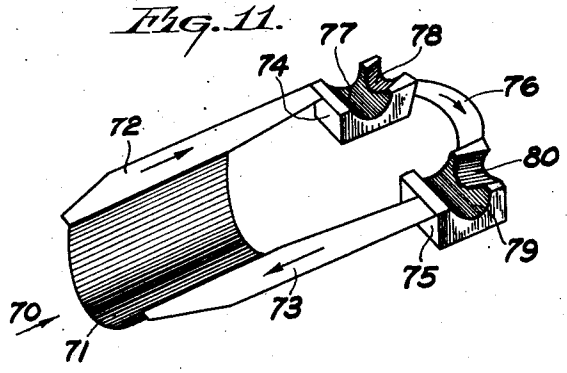


Fig. 11.



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2,676,242

DEVICE FOR TREATING WORKPIECES THROUGH INDUCTIVE HEATING IN A HIGH-FREQUENCY MAGNETIC FIELD

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Application March 1, 1948, Serial No. 12,434

Claims priority, application Netherlands March 25, 1947

12 Claims. (Cl. 219—10.57)

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For treating work pieces by way of inductive heating in a high-frequency magnetic field it is customary either to move an inductance which comprises one or more turns and is connected through conductors to the supply, for instance the secondary winding of a high-frequency transformer, to the area of the work piece to be treated or to introduce the work piece into the coil, or again to provide the coil in the work piece if the parts to be treated are hollow.

It often occurs, however, that the work pieces to be treated have a complicated shape so that the use of an inductance of the kind referred to is impossible or undesirable, since, for instance, they would require the use of an unduly large coil. Work pieces of the first-mentioned kind are, for instance, bicycle frames consisting of tubes, the component parts of which are to be soldered together and which are assembled in a gauge before being interconnected to form a rigid mechanical assembly. This method has the advantage that the component parts occupy the required position with respect to each other prior to the interconnection. Due to the shape of the frame, however, it is impossible to slip a coil on and off. As an example of a non-closed work piece on which an excessively large coil might be slipped, we may mention a shaft which requires to be hardened at a point at either side of which there are located parts of larger diameter over which the coil must be slipped.

For treating work pieces of the said type by high-frequency heating, the work piece, at the area(s) to be treated, might be surrounded by a turn consisting of two separate members which are traversed in series by the heating current and which, at the ends where they are electrically interconnected, are detachably secured together thus permitting the work piece easily to be removed by loosening the attachment. Since, however, the electrical connection constitutes at the same time the mechanical connection between the two members, this method has the disadvantage that for loosening the mechanical connection on terminating a treatment the electrical circuit must be broken at any one time with the consequent difficulties experienced during the next treatment in conjunction with the resulting varying electrical contact resistance at the point of contact.

The present invention has for its object to provide an apparatus by means of which work pieces of the aforesaid type can be treated by high-frequency heating without the said disadvantages.

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In the apparatus according to the invention the work piece is provided between two or more pairs of metal members and the members of each pair are spatially separated from one another and electrically insulated from one another, the members of each pair located at the same side of the work piece being traversed in series by high-frequency current in a sense opposite to that of the members at the other side of the work piece, and each pair of members being constructed and positioned at the corresponding area to be treated in a manner such that the members can be separated from each other without breaking the circuit.

Each pair of members consists of two bodies which form, as it were, both separated and separately fed halves of a single turn which surrounds the work piece so closely as to induce the required heating current therein. The electrical insulation between the members of each pair, which is necessary in connection with the indicated direction of the current in the members, may, for instance, be obtained by separating the members from each other by a small air-gap or a layer of insulating material which may be provided at one end or at both ends facing each other of one or both members.

The presence of at least two pairs of members in the apparatus according to the invention permits work pieces having the complicated e. g. closed form referred to easily to be replaced by spatial separation of the members of each pair without interrupting the current. If the latter were accomplished by means of only one pair of members (at the area to be treated) this would involve the disadvantage of deficient operation of the apparatus, since the conductors supplying and carrying off the current respectively through the two members were to be provided in such manner, with a view to easily replacing the work pieces, that the high-frequency fields produced by them would largely neutralize each other or would be insufficient at the work piece. The use of at least two pairs of members, which yields the aforesaid advantage of easy replacement of the work piece and as a result of which the energy supplied to the work piece is most effectively employed, is consequently essential to the correct operation of the apparatus according to the invention. This will be explained more fully with reference to the accompanying drawings.

The use of more than two pairs of members is advisable if the work piece is required to be treated at more than two points preferably located close together. In this connection it will

be appreciated that the apparatus according to the invention is also suitable for use in the case of work pieces on which the inductance can be slipped in the usual manner, since this operation may then be omitted, which, on treating several areas simultaneously, is advantageous with a view to saving time.

Two pairs of members may also be used for treating a single area of the work piece. In this case two successive pairs of members are located closely adjacent each other so that both the intermediate area of the work piece and the area to be treated or part thereof are also heated effectively.

The said properties of the device according to the invention show best to advantage if the members of each set that are located at the same side of the work piece constitute a rigid mechanical assembly and the mechanical connection constitutes at the same time the electrical conductor between these members. On replacing the work piece or for treating other areas of the same work piece a single manipulation is sufficient to separate the members of the two elements simultaneously without breaking the circuit. This construction has the additional advantage of obtaining in a simple manner that the conductors, in which the currents flow in opposite senses, extend parallel with and at a short distance from one another, which is desirable with a view to reducing the electrical losses in the circuit and obtaining the maximum efficiency of the apparatus.

The apparatus may be supplied in such manner that the current flows successively through the series-connected members located at one side of the work piece and through the likewise series-connected members located at the other side of the work piece. In a very suitable construction of the apparatus the members of each pair located at the same side of the work piece are connected in series to separate supplies, since this permits the circuits for the members located at both sides of the work piece to be kept entirely separated from each other, which has the advantage that they can be spatially separated from each other in a very simple manner. In a preferably used construction of this type of apparatus the said supplies consist of the separated halves of a metal bushing which functions as a secondary transformer element, these halves surrounding the primary winding similarly to the inductive members at the work piece. Since it will often be possible to provide this transformer in the immediate proximity of the work piece it is advantageous in this case that the secondary transformer elements and the said members likewise constitute a rigid assembly which serves as a conductor at the same time.

In a further construction exclusively the members located at one side of the work piece are connected in series to a supply, whereas the members located at the other side and the respective interconnectors form a circuit which is closed in itself and in which, by the circuit connected to the supply, a current is induced which is oppositely directed to the current flowing in the latter. This construction has the advantage that for replacing the work piece use may be made of a part of the apparatus which is not connected to a supply. By providing that this part constitutes a rigid mechanical assembly it can be removed in an extremely simple and easy manner.

In order that the invention may be clearly understood and readily carried into effect it will now be explained more fully with reference to the accompanying drawings which represent, by way of example, several embodiments thereof.

In these drawings Fig. 1 is an elevation of a work piece which is to be provided with a soldered joint.

Fig. 2 is a cross-section of an apparatus which does not form part of the invention and by means of which a soldered joint is to be provided by high-frequency heating at the areas A and B shown in cross-section in Fig. 1.

Fig. 3 represents a device which also does not form part of the invention and by means of which the soldered joint can be established at the same points in Fig. 1.

Fig. 4*a* represents a sectional view of an apparatus according to the invention for the same purpose.

Fig. 4*b* is a plan view of the apparatus shown in Fig. 4*a*.

Fig. 5 shows an apparatus according to the invention for establishing simultaneously two soldered joints located in line with one another on the work piece.

Fig. 6 represents another device according to the invention for establishing a soldered joint at a single point of the work piece.

Figs. 7, 8 and 9 represent diagrammatically an electrical circuit-arrangement for feeding the device according to the invention.

Fig. 10 represents a device according to the invention equipped with the circuit-arrangement shown in Fig. 9.

Fig. 11 represents a device for establishing soldered joints in a bicycle frame and equipped with the circuit-arrangement shown in Fig. 8.

The work piece shown in Fig. 1 consists of a ring 1 which is interrupted at A and B where a soldered joint is required to be provided, by high-frequency inductive heating, between the free ends 2 and 3. To this end a sleeve 4 is slipped over the areas to be soldered and solder is provided between the ends of the ring and this sleeve.

The shape of the work piece is as simple as possible, since it serves only to explain the principle of the apparatus according to the invention. In this case it is possible for the usual inductance supplying the high-frequency heating current and consisting of one or more turns that are connected, through condensers, to a high-frequency generator, to be previously provided at A and B about sleeves 4. However, it is not possible to remove the coils after establishing the soldered joint, so that they cannot be used in this case. The same difficulty is experienced with work pieces of more complicated shape e. g. closed bicycle frames, the diverse parts of which are required to be interconnected at several points. In this case it is even impossible to provide the coils previously. The same difficulty occurs in locally hardening various work pieces e. g. crank shafts.

This difficulty might be avoided by providing similarly to Fig. 2 where the reference numeral 4 denotes the sleeve shown in Fig. 1 and 5 denotes one of the free ends of the ring 1, a coil about the joints to be soldered, which coil comprises two metal members 6 and 7 (represented in cross-section) which jointly surround the work piece and are mechanically and electrically interconnected by means of a bolt 10 so as to be detachable at 8 and 9. To produce the heat required for soldering, the ends 11 and 12 of members 6 and 7 are connected to a source of a high-frequency voltage 13. Consequently the mem-

bers 6 and 7 are traversed in series by the high-frequency heating current. For establishing the soldered joint the members connected to the supply, for instance through flexible conductors 14, should be provided separately about the work and subsequently be connected by means of the bolt. The reverse takes place after the soldered joint has been established and the work piece must be removed or a soldered joint is required to be established at any other point of the same work. These operations are annoying due to repeated completion and interruption of the circuit, with the result that the contact resistance between the tags 8 and 9 is different for each soldered joint. Since this contact-resistance may be of the order of magnitude of the circuit-resistance it will be appreciated that a reproducible effect is not ensured.

The said disadvantage might be avoided by making the coil consist of two metal members 15 and 16, as represented diagrammatically in Fig. 3. The members are electrically insulated from one another and positioned in such manner that they are adapted to be spatially separated from one another without breaking the circuit. The electrical insulation may, for instance, consist of an air-gap 17 or of insulating material e. g. mica. In the last-mentioned case the member 15 may rest on the member 16. In the other case the members are required to be supported separately.

As indicated by arrows showing how the current is supplied to and carried off from the members, the latter are traversed by the current in opposite senses, thus producing a current in the work piece in the same manner as if the work piece were surrounded by a single continuous turn. In this feeding system division of the coil into two members adapted to be readily separated spatially from one another, for instance by removing the member 15, has the advantage that comparatively little time is lost in replacing the work piece, whilst the circuit remains completed so that difficulties arising from contact resistances do not occur.

However, this type of apparatus has the disadvantage that, as clearly appears from the drawings, the supply and carry-off conductors 18 and 19 require to be bent back from the connection to the members 16 and 15 to permit the members, after terminating the soldering operation, to be separated from one another for replacement of the work piece. This means that due to the opposite senses of the current flowing in the members and the said conductors no or substantially no high-frequency induction will occur in the work piece, since it is located in a practically fieldless space. The efficiency of the apparatus will consequently be very low and cannot be improved by making the conductors extend as indicated in dotted lines. In this respect it is pointed out that in view of the efficiency it is advantageous that the conductors 18, 20 and 19, 21 respectively should extend in pairs as closely as possible parallel with each other, so that no leakage fields are set up between them.

The apparatus according to the invention has neither the disadvantage of that shown in Figure 2, nor of that shown in Figure 3, whilst the advantages are maintained, as will appear from the description of Figures 4*a* and 4*b* elucidating the principle of the invention.

The reference numerals 4 and 5 again denote the sleeve and one end of the ring at A and B in Figure 1. According to the invention the work piece is surrounded at two points A and B by two pairs of members 22, 23 and 24, 25 respectively which are interconnected by conductors 26, 27 and fed as indicated by arrows. The members closely surround the ring at the points to be soldered so that they are capable of inducing the required heating current therein.

Furthermore the members of each pair are constructed and positioned as described in regard to the coil halves shown in Figure 3.

In spite of its closed form the work piece, similarly to the apparatus shown in Fig. 3, may readily be removed simply by lifting the members 22 and 24. In this case the circuit, similarly to Figure 3, is not broken. In this case also, as clearly appears from the drawing, the form of the conductors does not entail difficulties since, in contradistinction to Figure 3, they need not be bent back. This results from the fact that, according to the invention, (at least) two pairs of members are used.

The members of each set, which are located at the same side of the work piece, are preferably interconnected to form a rigid mechanical assembly by means of bridge pieces 28, 29 represented diagrammatically in dotted lines. In the case represented this permits the members 22 and 24 to be removed simultaneously. The connecting pieces act at the same time as electrical conductors by making them from electrically conducting material.

Figure 5 shows how the apparatus according to the invention may be constructed if the soldered joints of the work piece are located in line with each other. The work piece may be imagined to consist of a number of tubular pieces which are required to be interconnected and form parts of a closed construction so that it is not possible to slip inductances having closed turns on the tubes. The tubular pieces are designated 30, 31, 32. At the areas to be soldered sleeves 33 and 34 are provided. At these points the tubes are surrounded by members as described with reference to the other form of construction. For the sake of clarity only one member (in the present case the upper one) 35, 36 of each pair of members has been represented. In the case under view the electrical and mechanical connection between the members (35, 36) located at the same side of the work piece is formed by a metal strip 37. Of course, both the construction shown in Figure 4 and that shown in Figure 5 may likewise be used where a conventional inductance may be slipped on. In this case the apparatus represented offers the advantage that two soldered joints of the work piece can be provided simultaneously and more rapidly.

Figure 6 represents a construction which may be imagined to ensue from Figure 5 by moving towards each other both members of each pair (35 and 36) located at the same side of the work piece. If the work piece is required to be provided with a single soldered joint, this extremely simple and concise construction may be employed by providing the members at both sides of the soldered joint and so close together that the intermediate area of the work piece is likewise heated effectively.

The circuit-arrangement represented diagrammatically in Figure 7 illustrates how the members referred to can be fed electrically. The members located at two points at the same side of the work piece are designated 38, 39 and 40, 41

respectively. The members 38, 39 located at one side of the work piece are connected, in series with each other and with the members 40, 41 at the other side of the work piece, to the secondary 42 of a high-frequency transformer, the primary of which is designated 43. As described hereinbefore the members 38, 39 and 40, 41 respectively may be interconnected mechanically and electrically by means of rigid coupling members 44 and 45 respectively, whereas the other connections represented may, at least in part, consist of flexible cords. In this case the work piece can easily be replaced by lifting the assembly 38, 44, 39.

Figure 8 represents a preferably used circuit-arrangement in which the members of each pair 46, 47 and 48, 49 respectively, which are located at the same side of the work piece, are connected to separate supplies, in the present case the secondary transformer elements 50, 51 each of which consists of one half of a metal bushing. Both halves jointly surround the primary transformer winding 52. They may be separated spatially from one another similarly to the members 38, 40 and 39, 41 respectively without breaking the associated circuits. This is clearly shown in Figure 8 in which the path followed by the current is indicated by arrows. This form of construction will be used when the transformer should have such a size that it can easily be provided in the vicinity of the work piece, since in this case it is possible and very advantageous to unite each of the two secondary transformer elements mechanically to the associated members of each set to form a rigid assembly and this preferably by means of connecting pieces which function as electrical conductors at the same time. If the members referred to are mechanically and electrically interconnected in the same manner the apparatus obtained is as simple as possible in respect of its supply and the handling of which is easy in regard to replacement of the work piece. It is pointed out that these advantages (simple construction and easy operation) which are fundamentally entirely different from one another are obtained by employing one and the same principle viz. division both of the inductances and of the secondary transformer winding into two equal parts, thus forming two circuits which are adapted to be completely separated spatially and in which flexible electrical conductors can be dispensed with.

It will be appreciated that the members 50 and 51 may, if desired, also be constructed as normal secondary windings. In either case the advantage is obtained that there are two circuits which are completely separated from one another.

A further construction, in which this is the case, is shown in Figure 9. Only the members 53 and 54 located at one side of the work piece are connected in series to a secondary transformer winding 57 through conductors 55 and 56. The members 58 and 59 located at the other side of the work piece together with the intermediate conductors 60, 61 form a circuit which is closed in itself. As indicated by arrows a current which is oppositely directed to the current produced in the circuit connected to the transformer winding 57 is set up, as required, in the said closed circuit. In this case also the assembly of members (58, 59) and conductors (60, 61) is preferably constructed to form a rigid mechanical assembly with the result that the spatial separation between the respective members for replacing the work piece can again be effected in an extremely simple manner by lifting the assembly by a single movement. An outstanding advantage of this construction consists in that the parts to be removed constitute an assembly which is as compact as possible and not connected to a supply.

The circuit-arrangement shown in Figure 10 is embodied in the construction represented in Figure 9. For the sake of clearness corresponding component parts bear the same reference numerals in both figures. Since in this case all interconductors between the upper members 58, 59 and the lower members 53, 54 consist of flat strips, a satisfactory induction effect between both parts is ensured in the working state, when the upper part 62 extends at a short distance from and parallel with the lower part 63.

Figure 11 depicts how the circuit-arrangement shown in Figure 8 is embodied in an apparatus for soldering together tubular parts of a closed bicycle frame. These parts are designated 64, 65, 66. For the sake of simplicity not the whole frame is represented, but it is obvious that the handle bar and the front fork of the bicycle are fitted in tube 64. On these parts the conventional sleeves 67 and 68 are slipped. At these points the parts are secured together by means of solder provided between them and the sleeves. The parts 65 and 66 are supported in a gauge (not represented) in such manner that they occupy the required position with respect to one another and part 64.

In the present case the apparatus according to the invention comprises two parts 69 and 70 which are mirror-images of one another and entirely made of metal e. g. copper. Each part consists of a cylindrical shell 71 which is connected by means of strips 72 and 73, to members 74 and 75 respectively which are interconnected by strips 76 and provided with recesses 77, 78 and 79, 80 respectively, which are completely visible only in the lower part 70.

From the drawings it appears that the shape of the recesses is chosen in accordance with that of the sleeves 67 and 68 of the bicycle frame, since during the soldering operation the members will surround the frame at these two points. To this end the part 70 is positioned in such manner that the sleeves engage the recesses on fitting the frame in the gauge. Subsequently the upper part 69 of the apparatus is moved towards the bottom part in a manner such that the recesses of part 69 surround the sleeves also at the upper side. Care should be taken that the parts 69 and 70 are electrically insulated both from one another and from the sleeves, which is ensured by correct positioning the various parts, for instance in part by causing part 69 to rest on part 70 with the interposition of mica strips. If desired, such insulating material may also be provided in the recesses 77, 78 and 79, 80 respectively so that the frame may likewise be supported at these points and the members 74 and 75 serve at the same time as part of the gauge.

The cylindrical space between the shells 71 houses the primary winding of a transformer to which is supplied the high-frequency current producing the heat for the soldering operation. In this manner the shells 71 form both separated halves of a single secondary winding. Due to this the currents flowing in parts 69 and 70 will steadily be directed oppositely to one another, as indicated by arrows in the drawings. The opera-

tion of the apparatus is obvious from what has been said before with reference to the preceding figures, notably Figures 5, 6 and 8.

If, in a bicycle frame, connections similar to that as described are required to be established at the crankshaft and the saddle, apparatus according to the invention may advantageously be used at each of these points. In this case the primary windings of the supply transformers (Figures 6, 7 or 8) may be connected in series. In order that the heating may be controlled at will at each individual area to be treated, it is advisable to provide each apparatus with a regulating device e. g. a variable shunt. Of course, such a method may also be used for complicated work other than bicycle frames.

In connection with the energy to be used it will, in the majority of cases, be necessary to cool the aforesaid members and, if required, also the conductors, for instance by means of a liquid. For the sake of simplicity such a cooling device has not been represented in the drawings. It may, for instance, consist in soldering tubes to the members and the conductors, through which tubes the cooling liquid flows.

What I claim is:

1. An inductive heating coil assembly for treating work pieces in a high-frequency magnetic field comprising a pair of complementary conductive members adapted to surround the work piece at opposing sides thereof, each member being constituted by an even number of half-turn sections disposed in spaced relation and connected in series, connecting means for supplying a high-frequency current to one of said members in a given direction, and connecting means free of connection to said first mentioned connecting means for supplying a high-frequency current to the other of said members in the opposite direction.

2. An arrangement, as set forth in claim 1, wherein the sections of each member are positioned in close proximity to heat effectively the intermediate area of the work piece under treatment.

3. An arrangement, as set forth in claim 1, further including bridge elements mechanically linking the sections of each member.

4. An arrangement, as set forth in claim 1, wherein the sections of each member are connected by inflexible conductors which mechanically link said sections to form a rigid structure.

5. In an induction heating system, the combination comprising a high-frequency power source including a transformer provided with a primary winding and a single-turn secondary winding defined by a pair of electrically separate half turn segments, a coil assembly for treating work pieces in a high-frequency magnetic field including a pair of complementary conductive members adapted to surround the work piece at opposing sides thereof, each member being constituted by an even number of serially-connected half-turn sections disposed in spaced relation, means connecting the ends of one of said segments to the free ends of one of said members, and means connecting the ends of the other of said segments to the free ends of the other of said members.

6. An arrangement, as set forth in claim 5, wherein the sections in each member are rigidly interconnected and wherein said segments are mechanically linked to the free ends of said sections to form a rigid mechanical assembly.

7. An induction heating coil assembly for treating work pieces in a high-frequency magnetic field comprising first and second complementary conductive members adapted to surround the work piece at opposing sides thereof, said first member being constituted by an even number of half-turn coil sections and conductors each interconnecting corresponding ends of said sections to form a closed circuit, said second member being constituted by an even number of half-turn coil sections and conductors connecting said sections in series, and means to apply a high-frequency current to said serially-connected sections of said second member, the conductors of said first and second members being arranged to effect inductive coupling between said members when positioned to surround the work piece.

8. A device for heating a workpiece having a substantially circular perimeter by induced high frequency currents generated in a transformer having a primary, comprising in combination, a heating head structure including a first part and a second part being movably arranged with respect to each other, each of said parts being adapted for arrangement in the neighborhood of a part of the substantially circular perimeter of the workpiece so as to form together a heating head structure surrounding the substantially circular perimeter of the workpiece; a first secondary element forming part of the heating transformer; a second secondary element forming part of the heating transformer, said secondary elements being electrically independent and arranged movable with respect to each other and to the primary; substantially rigid first conductors connecting said first part of said heating head with said first secondary element; and substantially rigid second conductors connecting said second part of said heating transformer to said second secondary element, said first part, said first conductors and said first secondary element forming a first rigid unit, said second part, said second conductors, and said second secondard element forming a second rigid unit, said rigid units being movably arranged with respect to each other so that said heating head structure can be opened for an exchange of the workpiece.

9. A device for heating a workpiece having a substantially circular perimeter by induced high frequency currents generated in a transformer having a primary, comprising in combination, a heating head structure including a first part and a second part being movably arranged with respect to each other, each of said parts being adapted for arrangement in the neighborhood of a part of the substantially circular perimeter of the workpiece so as to form together a heating head structure surrounding the substantially circular perimeter of the workpiece; a first secondary winding forming part of the heating transformer; a second secondary winding forming part of the heating transformer, said secondary windings being electrically independent and arranged movable with respect to each other and to the primary; substantially rigid first conductors connecting said first part of said heating head with said first secondary winding; and substantially rigid second conductors connecting said second part of said heating transformer to said second secondary winding, said first part, said first conductors and said first secondary winding forming a first rigid unit, said second part, said second conductors, and said second secondary winding forming a second rigid unit, said rigid units being movably arranged with

respect to each other so that said heating head structure can be opened for an exchange of the workpiece.

10. A device for heating a workpiece having a substantially circular perimeter by induced high frequency currents generated in a transformer having a primary, comprising in combination, a heating head structure including a first part and a second part being movably arranged with respect to each other, each of said parts being adapted for arrangement in the neighborhood of a part of the substantially circular perimeter of the workpiece so as to form together a heating head structure surrounding the substantially circular perimeter of the workpiece; a first secondary winding forming part of the heating transformer; a second secondary winding forming part of the heating transformer, said secondary windings being electrically independent and arranged movable with respect to each other and to the primary; substantially rigid first conductors connecting said first part of said heating head wtih said first secondary winding; and substantially rigid second conductors connecting said second part of said heating transformer to said second secondary winding, said first part, said first conductors and said first secondary winding forming a first rigid unit, said second part, said second conductors, and said second secondary winding forming a second rigid unit, said rigid units being arranged displaceably along the axis of the primary of the transformer so that said heating head structure can be opened for an exchange of the workpiece.

11. A device for heating a workpiece having a substantially circular perimeter by induced high frequency currents generated in a transformer having a primary, comprising in combination, a heating head structure including a first part and a second part being movably arranged with respect to each other, each of said parts being adapted for arrangement in the neighborhood of a part of the substantially circular perimeter of the workpiece so as to form together a heating head structure surrounding the substantially circular perimeter of the workpiece; a first secondary winding forming part of the heating transformer; a second secondary winding forming part of the heating transformer, said secondary windings being electrically independent and arranged movable with respect to each other and to the primary, each of said secondary windings having the shape of a circular band wound on the primary; substantially rigid first conductors connecting said first part of said heating head with said first secondary winding; and substantially rigid second conductors connecting said second part of said heating transformer to said second secondary winding, said first part, said first conductors and said first secondary winding forming a first rigid unit, said second part, said second conductors, and said second secondary winding forming a second rigid unit, said rigid units being movably arranged with respect to each other so that said heating head structure can be opened for an exchange of the workpiece, said rigid conductors being strip-shaped and having substantially the same cross-section as the secondaries to which they are connected.

12. A device for heating a workpiece having a substantially circular perimeter by induced high frequency currents generated in a transformer having a primary, comprising in combination, a heating head structure including a first part and a second part being movably arranged with respect to each other, each of said parts being adapted for arrangement in the neighborhood of a part of the substantially circular perimeter of the workpiece so as to form together a heating head structure surrounding the substantially circular perimeter of the workpiece; a first secondary semi-circular element forming part of the heating transformer, said secondary elements being electrically independent and arranged movable with respect to each other and to the primary; substantially rigid first conductors connecting said first part of said heating head with said first secondary semi-circular element; and substantially rigid second conductors connecting said second part of said heating transformer to said secondary semi-circular element, said first part, said first conductors and said first semi-circular element forming a first rigid unit, said second part, said second conductors, and said secondary semi-circular element forming a second rigid unit, said rigid units being movably arranged with respect to each other so that said heating head structure can be opened for an exchange of the workpiece.

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