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INDUCTOR FOR HEATING THE ENDS OF ELONGATED STOCK

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Fig. 1

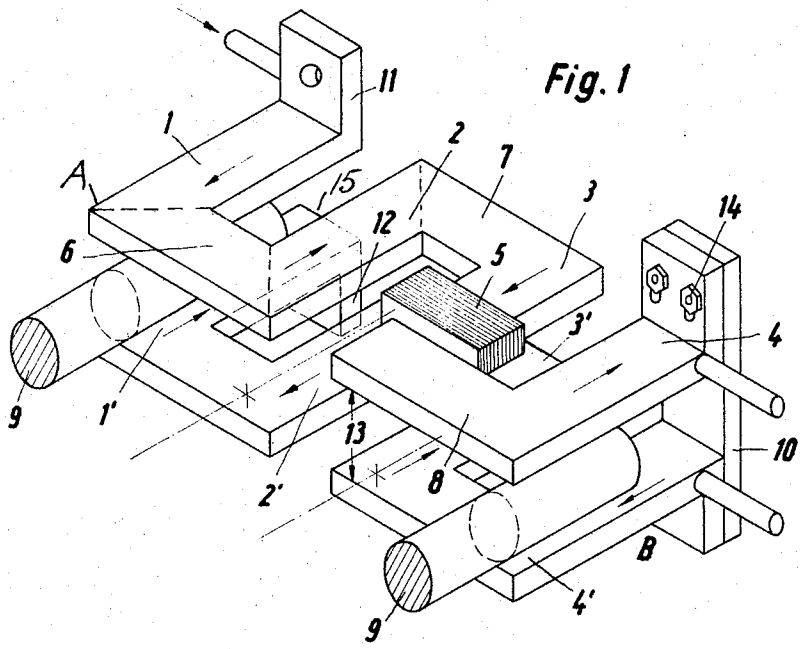
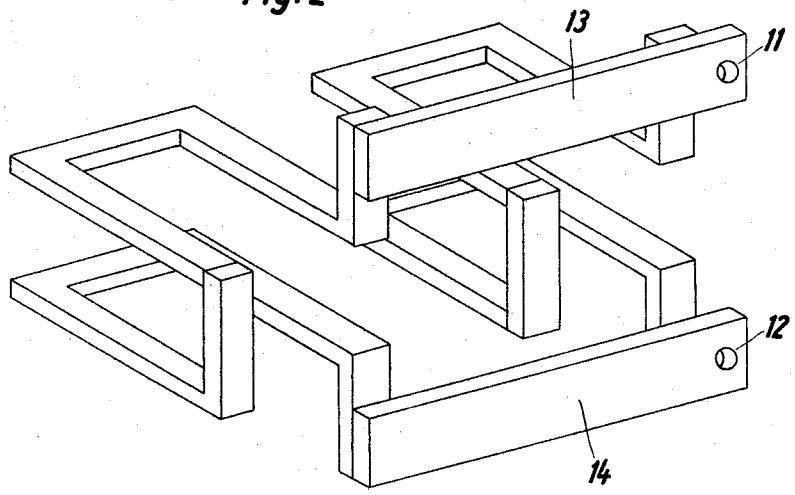


Fig. 2



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INDUCTOR FOR HEATING THE ENDS OF ELONGATED STOCK

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5 Claims. (Cl. 219—10.79)

This invention relates to an inductor which is intended electroinductively to heat the ends of elongated stock, such as bars, rods or tubes, for instance for the purpose of subjecting the ends of the stock to a following hot forming process.

For such purposes it is known to make use of cylindrical induction coils into which the end of a rod or like workpiece is insertable and from which it is retractable after having attained the desired temperature. Such an arrangement is open to the objection that it forces the work to be moved contrary to the general direction of travel of the stock when withdrawing it from the induction coil.

As known, this drawback can be overcome by using a so-called tunnel inductor. Such a tunnel inductor may be regarded as consisting of a conductor coil laid out in the form of a rectangle wtih two upwardly extending sides rising from two parallel breaks in the rectangle. The arrangement thus defines an open U-shaped gap enclosed by closely adjacent conductors. The end of the work is passed through this U-shaped gap in such manner that the long end of the work which is not to be heat treated projects straight from the open side of the gap. Although this arrangement permits heating to proceed in continuous process and the work need not at any time be moved in a direction contrary to the general direction of travel of the stock, it does have the drawback of being complex and expensive to provide because the hollow conductors must be bevel cut and soldered at the points of the right angled breaks. The height of the U-shaped gap cannot be varied, so that any change in the dimentions of the treated work necessitates the provision of a different tunnel inductor. It is proposed to eliminate these shortcomings which are inherent in known inductors. According to the invention this is achieved by providing two conductors in the form of rectangularly meandering bands arranged in two preferably parallel tiers. The straight cross members of the meander loops in the two tiers vertically align in such manner that each vertically aligning pair forms a heating station. Conveniently the straight cross members of the loops which form the heating stations carry laminated sheet metal stacks for the purpose of concentrating the magnetic fields and at the same time for preventing the creation of a coupling effect between parallel cross members of neighbouring loops in the same plane.

Occasionally it may be an advantage to connect each loop to a special separate transformer.

In an arrangement according to the invention the ends of rods, bars, tubes or the like are inserted parallel to the cross members of the loops and moved in succession from one heating station to the next, so that movement contrary to the general direction of flow of material need not take place.

Preferably the arrangement is such that each conductor band comprises an even number of parallel cross members forming heating sections. Alternatively, each conductor band may contain an odd number of cross members. However, certain difficulties then arise in connection with taking the current from one tier to the next.

The spacing of the two conductor bands and hence the clear height of the heating stations may be made adjustable. Variations can be easily effected by lengthening or shortening the length of the connection between the two conductor bands.

Compared with the production of a tunnel inductor the production of inductors according to the invention is substantially simpler because in each of the two cross members forming a heating zone only two bevel cuts and two soldered joints are required.

Apart from these advantages relating to the manufacture and convenience of handling of a device according to the invention compared with a so-called tunnel inductor, a striking feature is the more favourable consumption of power.

Two preferred embodiments of the invention are schematically shown in the drawings.

The inductor in FIGURE 1 consists of two rectangularly meandering conductor bands A and B located in two tiers. The cross members of the meander loops are straight. Band A comprises cross members **1**, **2**, **3** and **4**. These are all parallel and they are fitted with laminated sheet metal stacks **5**, as is conventional in the technique of inductor construction.

The two cross members **1** and **2** are interconnected by a longitudinal conducting member **6**. The cross members **2** and **3** are connected by a member **7** and the cross members **3** and **4** are similarly cross connected by a member **8**. Conductor band B is identically constructed. The cross members **1'**, **2'**, **3'** and **4'** of the second band B align vertically with the corresponding cross members **1**, **2**, **3** and **4** of conductor band A. Each of the two cross members constituting a heating zone involves only two mitre joints **15**, viz., there are four such joints only at each heating zone. Each gap between members **1** and **1'**, **2** and **2'**, **3** and **3'**, **4** and **4'** forms a heating station into which the end **9** of an elongated workpiece, for instance of a rod, can be inserted. The workpiece remains at each heating station for a certain length of time and is then shifted sideways to the next heating station.

The two conductor bands A and B are series-connected by a transverse connection **10**. The two conductor bands A and B are themselves connected to the current source by lug ends **11** and **12**.

The distance **13** between the conductor bands, which determines the clear height of each heating station, is readily adjustable by increasing or reducing the length of the transverse connection **10**. This can be conveniently done by a bolt **14** passing through a slot or by using a water-cooled cable as the transverse connection **10**.

The arrows indicate the direction in which the current flows through the two conductors.

In the illustrated embodiment the conductor bands A and B each comprise four cross members forming heating stations. It will be readily appreciated that there might be only two such cross members or a larger even number of cross members. The provision of an odd number of cross members is less convenient.

In the inductor shown in FIGURE 2 the individual rectangular meander loops are connected in parallel by bars **13** and **14** of which the ends **11** and **12** are connected to the transformer.

In certain circumstances it may be useful to move the treated work continuously. In such a case the arrangement may be modified to permit the inductor to be displaced against the resistance of a spring and to travel with the work during the heating process. When heating has been completed the inductor is released and restored to starting position by the spring. Especially when treating relatively long and heavy work or when the heating periods are only short, synchronous movement of the in-

ductor with the work may be mechanically simpler than a stepwise relative movement.

What we claim is:

1. An inductor for heating the ends of elongated work such as bars, rods and tubes, comprising conductors in the form of rectangularly meandering lengths formed and arranged in two tiers in such manner that parallel opposite cross portions of the meandering lengths pass the current in opposite directions and together form heating stations extending lengthwise of said cross portions, so that the work can be displaced laterally from one heating station to another.

2. An inductor for heating the ends of elongated work such as bars, rods and tubes, comprising two meandering conductors forming rectangular loops in parallel planes with at least 3 cross portions in one such plane disposed opposite cross portions disposed in the other plane to form between the said opposite portions heating zones which extend lengthwise of the said portions, said portions being connected so that the current in one portion will flow in a direction opposite that in the opposite portion.

3. An inductor for heating the ends of elongated work such as bars, rods and tubes, comprising two rectangularly meandering band-like conductors each comprising at least three parallel straight cross portions, means connecting the said conductors to dispose the loops in parallel planes so that cross portions in one plane are disposed opposite cross portions in the other plane to form between said opposite portions, in which the current will flow in opposite directions, heating zones which extend lengthwise of the said portions and so that the work can be displaced laterally from one heating zone formed by two opposite cross portions to following such heating zones.

4. An inductor according to claim 1, comprising rectangularly looped meandering conductors connected so that each lies in a plane parallel to and spaced from that of the other with the cross portions of one opposite those of the other, said conductors being connected to be electrically in series, each conductor comprising at least three parallel portions disposed opposite corresponding parallel portions of the other conductor and connected so that opposite portions of each pair of parallel portions forming a heating zone are connected so that the current in one said portion will flow in the opposite direction to that in the other.

5. An inductor according to claim 1, comprising rectangularly looped meandering conductors connected so that each comprises looped portions lying in the same parallel spaced planes as those of the other conductor, said conductors being connected to be electrically in parallel and providing at least four heating stations each comprising parallel opposite portions of the corresponding conductor, said conductors being arranged so that the work can be laterally displaced from one said heating zone to the next.

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