

⑩



Europäisches Patentamt  
European Patent Office  
Office européen des brevets

⑪ Publication number:

**0 062 926  
B1**

⑫

## EUROPEAN PATENT SPECIFICATION

⑬ Date of publication of patent specification: **12.08.87**

⑭ Int. Cl.<sup>4</sup>: **H 05 B 6/08**

⑮ Application number: **82103183.8**

⑯ Date of filing: **15.04.82**

⑰ Inductive heating device.

⑱ Priority: **15.04.81 JP 54295/81 u**

⑲ Date of publication of application:  
**20.10.82 Bulletin 82/42**

⑳ Publication of the grant of the patent:  
**12.08.87 Bulletin 87/33**

㉑ Designated Contracting States:  
**DE FR GB**

㉒ References cited:  
**DE-B-1 185 744**

LEW-NACHRICHTEN, no. 17, 1975, pages 27-30,  
VEB Lokomotivbau-Elektrotechnische Werke  
'Hans Beimler', 1422 Hennigsdorf (DE); H.  
SEVERIN: "Voltage regulating unit for  
medium-frequency induction heating plants"

㉓ Proprietor: **mitsubishi denki kabushiki  
kaisha**

**2-3, Marunouchi 2-chome Chiyoda-ku  
Tokyo 100 (JP)**

㉔ Proprietor: **Toyo Tanso Co., Ltd.**  
**No. 7-12, Takeshima 5-chome Nishi Yodogawa-  
ku  
Osaka-shi Osaka (JP)**

㉕ Inventor: **Hoshikawa, Toru c/o Toyo Tanso Co.,  
Ltd.**

**Onohara Works No. 2181-2 Oaza Nakahime  
Onohara-cho Mitoyo-gun Kagawa (JP)**

Inventor: **Osaki, Yoshihiko c/o Mitsubishi Denki  
K.K.**

**Itami Works No. 80, Aza Nakano  
Minami Shimizu Amagasaki-shi Hyogo (JP)**

㉖ Representative: **Lehn, Werner, Dipl.-Ing. et al  
Hoffmann, Eitle & Partner Patentanwälte  
Arabellastrasse 4  
D-8000 München 81 (DE)**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European patent convention).

Courier Press, Leamington Spa, England.

**EP 0 062 926 B1**

## Description

The present invention relates to an inductive heating device in which a plurality of heating coils are selectively connected to a distribution board having at least one compensating capacitor for inductive heating of a workpiece.

Such a device is known from LEW-Nachrichten No. 17, 1975, pp 27-30.

A further conventional inductive heating device of the same general type to which the invention pertains is shown in Fig. 1. In Fig. 1, reference numeral 1 designates a plurality of heating coils, 2 switches for selectively activating the heating coils, 3 power-factor enhancing capacitors forming a parallel resonance circuit for compensating for the lag power factors of the heating coils 1, 4 a matching board on which the capacitors 3 are mounted, 5 a power source for supplying electrical power to the input terminal 6 of the matching board 4, 7 current supplying lines for supplying current to the heating coils 1, 8 a common current line provided on the matching board, and 9 an output terminal.

In this heating device, workpieces to be heated (not shown) are placed inside the heating coils. A processing cycle of loading a workpiece, heating the workpiece, cooling the workpiece and loading another workpiece is employed. In order to increase the percentage of time of utilization of the power source and the processing ability of the device, it is necessary to provide plural heating coils 1. For this purpose, switches 2 are provided to selectively switch the heating coils 1, with one switch being closed to connect a single coil to the matching board at any time.

If, however, heating coils 1 having, for example, a diameter of 500 to 3000 mm and a length of 500 to 5000 mm are provided and current is supplied to one heating coil at a time, sometimes it is impossible to supply current effectively to the heating coil which is farthest from the matching board 4 because of power transmission losses caused by power line voltage drops.

LEW-Nachrichten No. 17 1975, pages 27-30 discloses a voltage adjusting arrangement for medium frequency induction heating apparatus. The disclosure includes a bus bar compensation arrangement to which the various heating coils may be selectively connected. However, in this disclosure, each heating coil has its own compensating capacitance and thus represents a balanced load. It is true that further capacitances are connected directly to the bus bar, but these serve only for compensation of the bus bar itself and of the generators so far as this is necessary. Furthermore, no current return lines for the heating coils are illustrated. Therefore, this disclosure does not relate to a matching board for compensating impedances of the coils connected thereto and therefore provides no solution to problems arising with such a matching board as discussed with reference to Figure 1. The bus bar arrangement serves only to distribute power to the coils.

An object of the present invention is to provide

an inductive heating device employing a matching board for supplying a plurality of heating coils by which board proper matching may be achieved for each coil without undue power transmission losses in the supply lines.

According to the invention, the device defined in the first paragraph of this specification is characterised in that a plurality of pairs of output terminals are provided on said distribution board for respective ones of said heating coils, in that the distribution board is provided with two conductive lines across which said at least one capacitor is connected, and in that the output terminals of each said pair are connected to respective conductive lines and thereby to said at least one capacitor, whereby said distribution board provides capacitive compensation or matching for said heating coils.

Fig. 1 is a diagram showing the arrangement of a conventional inductive heating device, and

Fig. 2 is a diagram showing the arrangement of an inductive heating device according to the invention.

The invention will be described with references to Fig. 2. In Fig. 2, reference numerals 1 through 6 and 8 designate components identified by the same reference numerals as in Fig. 1. Reference numerals 10 through 15 designate output terminal pairs which are provided on the matching board 4 and are connected to the current collecting line 8. The pairs of output terminals 10 through 15 are connected through the switches 2 to corresponding ones of the heating coils 1. In the conventional device, the common current collecting line 8 merely functions to collect the currents from the various capacitors 3. On the other hand, in the device of the invention, the common current collecting line 8 serves as the current supplying lines (which are also provided in the conventional device) because a plurality of output terminals 10 through 15, each of which can be selectively connected to a separate one of the heating coils 1, are provided on the matching board 4. Preferably, connections are also provided directly between adjacent ones of said output terminals, i.e. one line of terminal pair 10 would be connected to the corresponding lines 11 and so on.

In a case where large currents flow in the device, connecting bus bars can be employed instead of the switches 2.

Not only is a separate common current supplying line for the heating coils eliminated, but also the voltage drops between the power source and the various coil input terminals are decreased and equalized.

In addition, the space needed for installation of the device is reduced.

## Claims

1. An inductive heating device in which a plurality of heating coils (1) are selectively connected to a distribution board (4) having at least one compensating capacitor (3) for inductive

heating of a workpiece, characterised in that a plurality of pairs of output terminals (10 to 15) are provided on said distribution board (4) for respective ones of said heating coils (1), in that the distribution board (4) is provided with two conductive lines (8) across which said at least one capacitor (3) is connected, and in that the output terminals of each said pair (10 to 15) are connected to respective conductive lines (8) and thereby to said at least one capacitor (3), whereby said distribution board (4) provides capacitive compensation or matching for said heating coils.

2. The inductive heating device of claim 1 further characterised by connecting means connected directly between each terminal of each pair and a respective corresponding terminal of an adjacent pair (10 to 15).

3. The inductive heating device of claim 1 or 2 characterised in that each of said output terminals (10 to 15) is directly connected to a most closely adjacent point on a respective said conductive line (8).

#### Patentansprüche

1. Induktive Heizvorrichtung, in der eine Vielzahl von Heizspulen (1) mit einer Verteilertafel selektiv verbunden ist, mit mindestens einem Kompensationskondensator (3) zum induktiven Aufwärmen eines Werkstücks, dadurch gekennzeichnet, daß eine Vielzahl von Paaren von Ausgangsanschlüssen (10 bis 15) auf der Verteilertafel (4) für die jeweiligen Heizspulen (1) vorgesehen ist, daß die Verteilertafel (4) mit zwei Leitungen (8) versehen ist, zwischen welche mindestens ein Kondensator (3) geschaltet ist, und daß die Ausgangsanschlüsse eines jeden Paares (10 bis 15) mit den entsprechenden Leitungen (8) und dadurch mit mindestens einem Kondensator (3) verbunden sind, wodurch die Verteilertafel (4) zur kapazitiven Kompensation oder Anpassung für die Heizspulen dient.

2. Induktive Heizvorrichtung nach Anspruch 1, gekennzeichnet durch Verbindungsmittel, die

direkt zwischen jebein Anschluß eines jebein Paares und einen Jeweilligen entsprechenden Anschluß eines benachbarten Paares (10 bis 15) geschaltet sind.

3. Induktive Heizvorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß jeder der Ausgangsanschlüsse (10 bis 15) direkt mit einem am nächsten benachbarten Punkt auf einer entsprechenden Leitung (8) verbunden ist.

#### Revendications

1. Appareil de chauffage par induction lequel un ensemble de serpentins réchauffeurs (1) sont connectés sélectivement à un panneau de distribution (4) comportant au moins un condensateur de compensation (3) pour un chauffage par induction d'une pièce à travailler, caractérisé en ce qu'un ensemble de paires de bornes de sortie (10 à 15) sont prévues sur le panneau de distribution (4) pour des serpentins respectifs des serpentins réchauffeurs (1), en ce que le panneau de distribution (4) est pourvu de deux lignes conductrices (8) entre lesquelles le condensateur (3) au moins est connecté, et en ce que les bornes de sortie de chaque paire (10 à 15) sont connectées aux lignes conductrices respectives (8) et ainsi au condensateur (3) au moins, le panneau de distribution (4) assurant de la sorte une compensation ou une adaptation capacitive pour les serpentins réchauffeurs.

2. Appareil de chauffage par induction selon la revendication 1, caractérisé en outre par un moyen de connexion connecté directement entre chaque borne de chaque paire et une borne correspondante respective d'une paire voisine (10 à 15).

3. Appareil de chauffage par induction selon l'une quelconque des revendications 1 et 2, caractérisé en ce que chacune des bornes de sortie (10 à 15) est connectée directement à un point le plus étroitement voisin sur une ligne conductrice respective (8).

5

10

15

20

25

30

35

40

45

50

55

60

65

3

FIG. 1

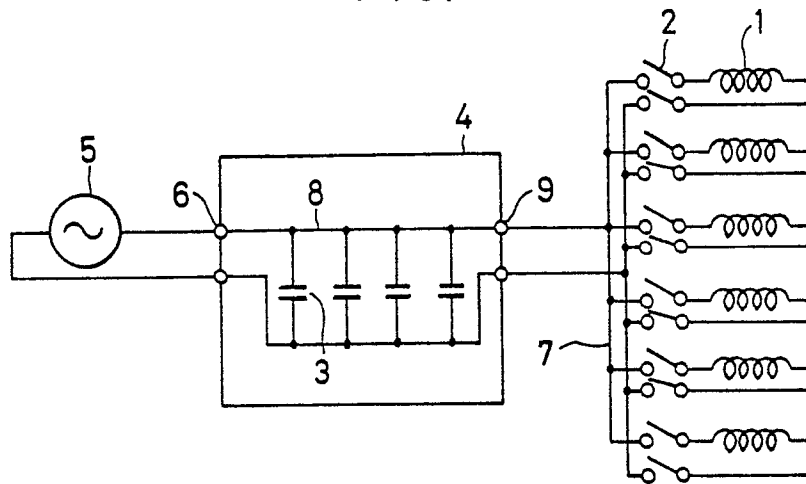


FIG. 2

