(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 021 274**
**A1**

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **80103297.0**

(51) Int. Cl.³: **H 01 F 13/00**

(22) Date of filing: **13.06.80**

(30) Priority: **25.06.79 IT 6834579**

(43) Date of publication of application: **07.01.81**
**Bulletin 81/1**

(84) Designated Contracting States: **CH DE FR GB LI SE**

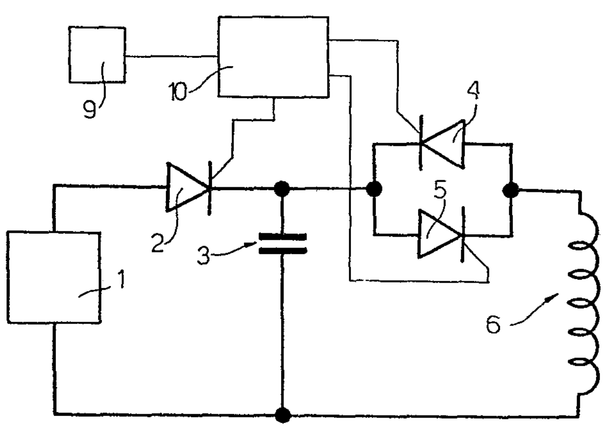
(71) Applicant: **RIV-SKF OFFICINE DI VILLAR PEROSA S.p.A, Via Mazzini 53, I-10123 Torino (IT)**

(72) Inventor: **Moretti, Roberto, Strada Torino 73/4, I-10024 Moncalieri (Torino) (IT)**

(74) Representative: **Bongiovanni, Guido et al, c/o Ingg. Carlo e Mario Torta Via Viotti 9, I-10121 Torino (IT)**

(54) **Demagnetizing device.**

(57) A demagnetizing device is described.
The main feature of said device is that it comprises at least an inductor (6) apt to generate a magnetic field into which a piece to be demagnetized is immersed; at least a capacitor (3); a feeding circuit (1) generating a D.C. voltage; and switch means (2, 4, 5) apt to connect the said capacitor initially to the said feeding circuit (1) to charge the said capacitor (3), and then to the said inductor (6) to generate an oscillating magnetic field of decreasing amplitude.




EP 0 021 274 A1

0021274

DEMAGNETIZING DEVICE

The present invention concerns a demagnetizer device.

As is known, it is possible that a workpiece, during a common machining operation, receives a partial magnetization. This event enhances the retention, on the workpiece, of small metal machining residuals or metal powders in general, which, if not removed, may successively give rise to various disadvantages, such as for example the disadvantage of facilitating the formation of rust or incrustations on the workpiece. To obviate such drawbacks, demagnetizing devices are being used at present time, which devices allow to reduce to a negligible level the value of the residual induction.

To obtain a good demagnetization it is necessary to subject the piece to be demagnetized to a series of magnetization and demagnetization cycles by means of an alternate magnetic field of decreasing intensity; in particular, the initial intensity of the field must have an amplitude sufficient to saturate the material, whilst the decrement of such intensity must be sufficiently gradual till complete disappearance of the field.

In the presently known demagnetizing devices, the results described hereinabove are obtained by passing the piece to be demagnetized through a large solenoid supplied with alternating current. The number of turns and the feeding current of the solenoid are chosen in such a way that at the centre of the solenoid the field generated is sufficient to bring to saturation the piece to be demagnetized. As the piece comes out from the solenoid the intensity of the magnetic field decreases gradually till it completely disappears at a suitable distance from

BAD ORIGINAL

the solenoid.

Since a very high magnetic field is often required for obtaining also a depth demagnetization of pieces of considerable dimensions, it is necessary to provide solenoids having a vary large number of turns, even in the order of some thousands and supplied with a current in the order of some hundreds of amperes. Since such solenoids have to be fed continuously, and since at the same time a conveniently large cross-section of the wire of the respective winding is required for continuously conveying such a high current, these solenoids generally result in being very cumbersome. In addition, since the required power varies depending on the dimensions of the piece to be demagnetized and is generally between 1000 and 6000 Watt, the result is a continuous and considerable consumption of electric energy.

Moreover, the demagnetizing devices of this type require that the piece to be demagnetized be displaced slowly within the solenoid, so that the number of pieces which can be demagnetized in a pre-established period of time results in being correspondingly reduced.

The object of the present invention is to provide a demagnetizing device which will allow to overcome the disadvantages of the prior art demagnetizing devices described hereinabove.

According to the present invention there is provided a demagnetizing device, characterized in comprising at least an inductor apt to generate a magnetic field into which a piece to be demagnetized is immersed; at least a capacitor; a feeding circuit generating a D.C. voltage; and switch means apt to connect the said capacitor initially to the said feeding circuit to charge the said capacitor, and then to the said inductor in order to generate an oscillating magnetic field of decreasing amplitude.

For a better understanding of the present invention, a preferred embodiment will now be described in detail, by way of a non limiting example, with reference to annexed drawing; in which:

FIGURE 1 is a functional type block diagram of a device according to the present invention, and

FIGURE 2 shows the behaviour of an electric signal at a point of the block diagramm shown in Fig. 1.

Referring now in particular to Fig. 1, a feeding circuit 1, at the ends of which there is present a D.C. voltage of pre-established value, for example between 500 and 1000 V, has a positive terminal which is connected, through an anode cathode junction of a contrlled silicon diode 2, to a first terminal of a capacitor 3, a second terminal of which is connected to the other terminal of the feeding circuit 1.

Connected in parallel to the capacitor 3 is a series circuit comprising a pair of controlled silicon diodes 4 and 5 connected in anti-parallel, and an inductor 6 connected in series to the said diodes.

A proximity detector circuit 9, formed for example by means of an oscillator locked by the presence of a metal body disposed near a respective core, transmits an output signal to a processor and control circuit 10. This latter, according to the ON-OFF type signal received from the circuit 9, transmits respectively an enable signal to the grid of the controlled diode 2 or, alternatively, to the grids of the controlled diodes 4 and 5. The proximity

BAD ORIGINAL

detector circuit 9 is housed near the coil 6 and, for example, in case this latter is formed by means of a solenoid, the said circuit 9 could be disposed within the solenoid itself.

Fig. 2 shows the behaviour of the intensity of the current flowing within the inductor 6 when this latter is connected in parallel to the previously charged capacitor 3. In particular, to indicates the moment at which the electric connection between the inductor 6 and the capacitor 3 takes place and Io indicates the maximum value to which the current is brought during the damped free oscillation which follows the said moment. Since the magnetic field inside the inductor 6 is directly proportional to the value assumed by the said current, Fig. 2 illustrates also the behaviour of the said magnetic field.

The operation of the circuit shown in Fig. 1 will now be described supposing that the inductor has a solenoid structure and that the pieces to be demagnetized are supplied at a pre-established rate into the interior of the said solenoid, for example by means of conveyor band movable along the axis of the solenoid.

When the piece to be demagnetized is out of the zone tested by the proximity detector circuit 9, this latter emits a signal, for example a positive signal, to the processor circuit 10 which in turn transmits an enable signal to the grid of the controlled diode 2 and disable signals to the grids of the controlled diodes 4 and 5. Accordingly, the controlled diode 2 is conductive and the feeding circuit 1 charges the capacitor 3 up to the off-load voltage value of the feeding circuit.

When the piece to be demagnetized reaches the zone scanned by the detector circuit 9 (instant to of Fig. 2), this latter circuit emits a signal, for example a negative signal, to the processor circuit 10 which enables the controlled diodes 4 and 5 and disables the controlled diode 2, so that the controlled capacitor 3 results in being connected in parallel to the inductor 6. Thus, a damped free oscillation is obtained which produces in inductor 6 the circulation of a null mean value sinusoidal type current (Fig.2) whose frequency depends on the capacity and inductance values of the capacitor 3 and the inductance 6 respectively, and whose amplitude instead results in being exponentially decreasing. In particular, of fundamental importance is the maximum value assumed by the current during the said oscillation; this value, indicated by Io in Fig. 2, must be sufficient to completely saturate the piece to be demagnetized, in order to guarantee the almost complete elimination of any residual induction in the piece. The value Io which is assumed by the current within the inductor 6 substantially only once and for a very short period of time, namely during the first half period of damped oscillation, may also be of the order of some hundreds of Ampere.

From the analysis of the characteristics of the present invention it is possible to see that the device of the invention allows to avoid the above-mentioned disadvantages of the prior art devices.

First of all, current flows through the inductor 6 for a very short period of time, in general in the order of some tens of ms, so that the said inductor may be underdimensioned, having enough time to cool during an interval comprised between two consecutive demagnetization

BAD ORIGINAL

cycles and required for the recharge of the capacitor 3. Accordingly, the dimensions of the said inductor may be very moderate, and in addition the power required is drastically reduced because it is sufficient to supply energy only during the charge of the capacitor 3.

Owing to the rapidity with which a complete cycle of demagnetization takes place, no limit is imposed to the movement of the piece to be demagnetized within the inductor 6, except a short period of time which has to elapse between two consecutive pieces in order to permit the capacitor to be charged to the desired voltage value.

Finally, it is clear that modifications and variations may be made to the described functional diagram of the device according to the present invention, without departing from the scope of the invention.

For example, any detector circuit 9 or processor circuit 10 may be used for the control of the controlled diodes 2, 4 and 5, and these latter may advantageously by substituted by more sophisticated switching devices, provided a capacitor is charged to a pre-established voltage and is discharged, in consequence of the reception of a control signal, onto an inductor so as to generate damped free oscillations of current and, consequently, magnetic field.

## CLAIMS

1.- A demagnetizing device, characterized in comprising at least an inductor apt to generate a magnetic field into which a piece to be demagnetized is immersed; at least a capacitor; a feeding circuit generating a D.C. voltage; and switch means apt to connect the said capacitor initially to the said feeding circuit to charge the said capacitor, and then to the said inductor to generate an oscillating magnetic field of decreasing amplitude.

2.- A demagnetizing device as claimed in Claim 1, characterized in comprising a detector device for detecting the presence of the said piece to be demagnetized, the said detector device being apt to enable the said switch means so as to connect in parallel the said capacitor to the said inductor.

3.- A demagnetizing device as claimed in Claim 2, characterized in that the the said detector device comprises a locked oscillator.

4.- A demagnetizing device as claimed in any of the preceding Claims, characterized in that the said switch means comprise at least a first controlled diode connected between the said said feeding circuit and the said capacitor.

5.- A demagnetizing device as claimed in any of the preceding Claims, characterized in that the said switch means comprise at least a pair of controlled diodes connected to one another according to a so-called "anti-parallel" configuration and mounted between the said capacitor and the said inductor.

BAD ORIGINAL

0021274

-1/1

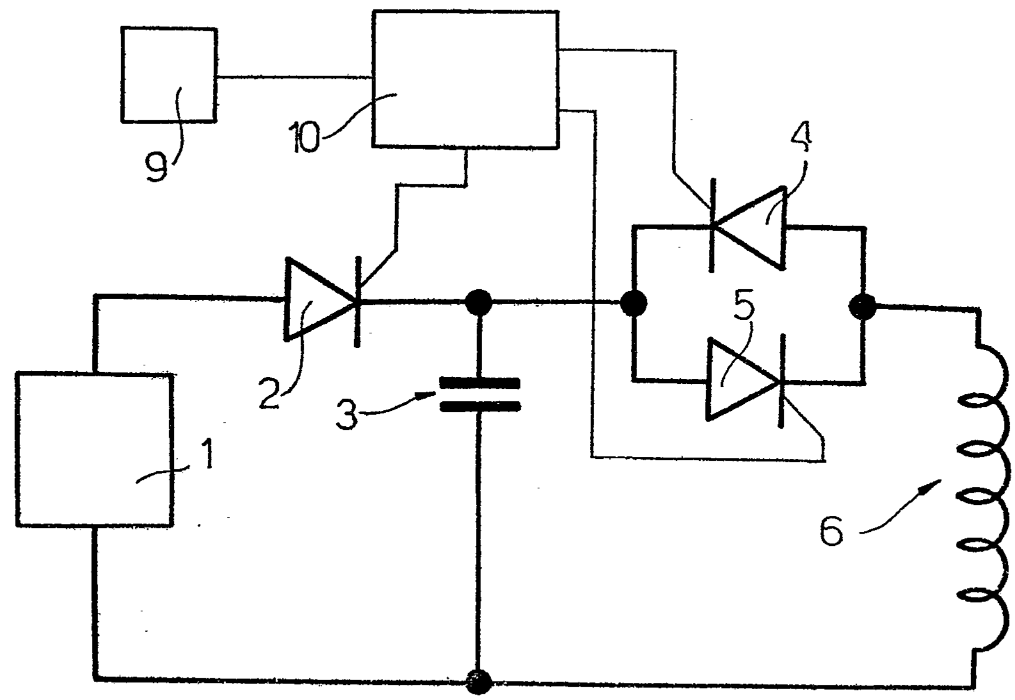



Fig.1

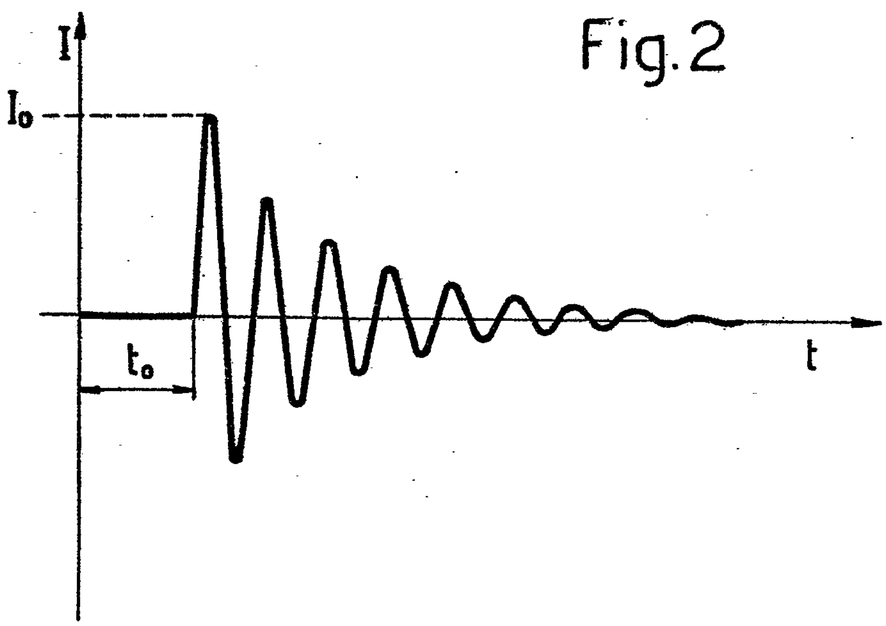



Fig.2

European Patent Office

# EUROPEAN SEARCH REPORT

0021274

Application number

EP 80 10 3297

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim |
|---|---|---|
| | GB - A - 1 481 190 (DEUTSCHE EDELSTAHLWERKE)<br>* Page 1, lines 43-61; page 2, lines 12-24 *<br>-- | 1 |
| | SU - A - 609 129 (GORKI AUTO WKS)<br>* Last paragraph of abstract *<br>-- | 4 |
| | DE - A - 2 059 290 (KLAUSCHENZ & PERROT)<br>* Page 12, paragraphs 1-3 *<br>-- | 5 |
| A | FR - A - 2 369 662 (SCHLUMBERGER) | |
| A | US - A - 3 418 542 (F.W. BELL) | |
| A | FR - A - 946 815 (JARDILLIER)<br>---- | |

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

H 01 F 13/00

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

H 01 F 13/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 05-09-1980 | VANHULLE |

EPO Form 1503.1 06.78