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METHOD OF ELECTROLYTICALLY MARKING A METALLIC ARTICLE

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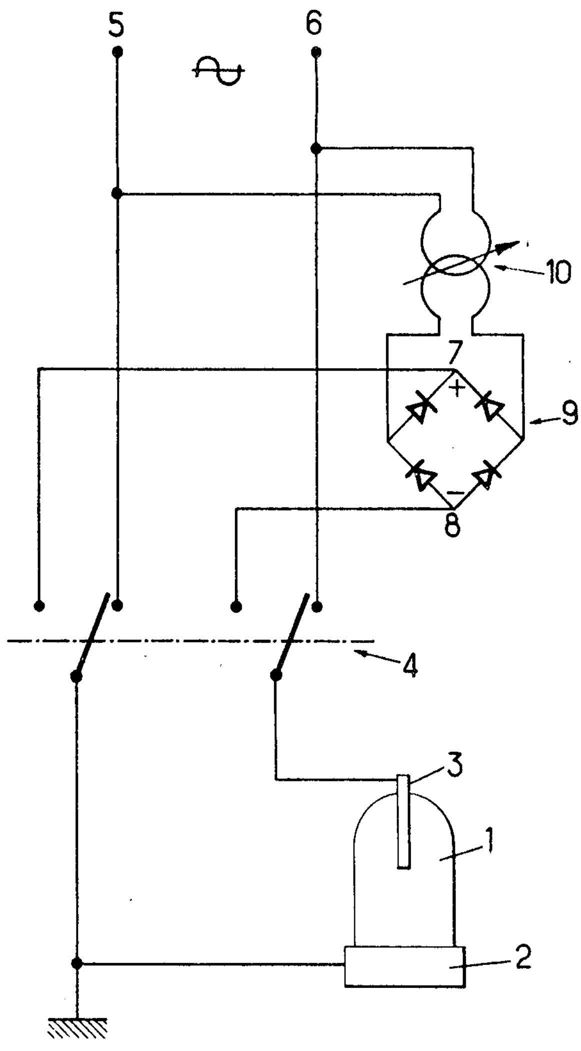

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METHOD OF ELECTROLYTICALLY MARKING A METALLIC ARTICLE

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ABSTRACT OF THE DISCLOSURE

Method of electrolytically marking a metallic article by first applying an alternating current between an electrode and said article and then applying a direct current therebetween.

SUMMARY OF THE INVENTION

This invention relates to the marking of metallic articles, and in particular to the marking of precision components such as bearing races.

It is not practical to mark articles which have already been machined by means of a press because this would alter the precision and press-marking can therefore be employed only in the case of blanks. Articles may be marked by means of an electric pencil, but this operation, which is carried out by hand, is relatively expensive. For that reason electrolytic marking through a stencil is often used, but this process has the disadvantage of being relatively slow if the marking is to have a substantial depth, or conversely, of producing only a shallow mark in a short time, in which case the mark is rapidly erased in the course of use.

The object of the invention is to improve the process of the electrolytic marking in order to permit rapid marking, but nevertheless obtain a sufficient depth of mark.

The invention consists, in applying successively, between the electrodes of an electrolytic marking apparatus of a known type, a pulse of alternating current alternating at a frequency of several tenths of a second, at a suitable low voltage of the order of 24 volts, followed by a pulse of direct current lasting several seconds at a voltage depending on the depth of the cut, with the member to be marked constituting the anode.

In order that the invention may be better understood, a particular application to the problem of marking ball bearing races on an assembly line will now be described.

The tool used is an electrolytic head of a conventional type closed by a stencil which is to be applied to the surface of the article to be marked, which constitutes one of the electrodes. The other electrode, for example made of stainless steel, is within the head. The electrolyte used in the head is a solution consisting of a mixture of sodium nitrite and a conventional complexing agent. This solution may be more or less diluted in water.

If the two electrodes are connected to a source of continuous low voltage current (20 to 30 volts for example) with the article to be marked being in the position of the anode, the portions of the article opposite the permeable parts of the stencil are hollowed out. In accordance with the theory of electrolysis, the voltage between the electrodes must become equal to a small counter-electromotive force plus a voltage drop proportional to the voltage multiplied by the internal resistance. At the voltages at which we operate the counter-electromotive force is practically negligible as compared with the voltage drop so that the intensity must be proportional to the voltage drop that is to say constant, if a constant voltage is applied. Since, on the other hand, the depth of the mark is proportional to the quantity of electricity which has passed

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through the electrolytic head, it must be proportional to time if the voltage is constant.

In practice it is found that this is not true, that is to say, that if a constant voltage is applied, the intensity begins at a relatively low value, and then increases slowly up to a limiting value. This delay in the establishment of the intensity is probably due to the fact that, despite all the washing and cleaning to which the articles have been subjected before marking, there always remains some grease so that the electrolysis starts through an almost monomolecular layer of greasy material which is progressively eliminated as the electrolysis continues.

If enough time is available to produce this electrolysis, the delay in starting may in practice be ignored. It is entirely different, however, if only a little time is available for electrolysis. For example, in the case which we are interested, if it be supposed that continuous manufacture of ball bearing races at the rate of 1200 races per hour is taking place, this leaves only three seconds between each race, that is to say, allowing for the time for putting in place and removing each race by the automatic machinery used, there remains an effective marking time of 2.1 seconds. It follows that this relatively short time lies in the transitory electrolysis starting zone during which there is a notably reduced intensity.

If the electrolytic head is supplied by means of an alternating voltage having a substantially equivalent effective value, it will be seen that the marking takes place on the contrary quite rapidly, but then it does not increase. The depth of cut is about two microns, regardless of the time of marking. On the contrary, the increase in time of marking produces a blurring of the edges of the mark, so that the mark becomes rapidly less clear about its edges.

If we now operate according to the invention, that is to say if an alternating voltage is applied for a short period of several tenths of a second before applying the direct current, we obtain in the same total time a depth of mark substantially greater than is obtained using direct current alone, and greater than is obtained with alternating current alone, with in this case, greater clarity. The reason is that the alternating current very quickly removes the layer of greasy material from the surface of the article so that a simple flash of 0.2 to 0.5 second suffices to clean it completely. It follows that, when the direct current is applied immediately thereafter, the voltage immediately attains its maximum value. Consequently, the time of application of the alternating current, far from constituting a loss of time, results, on the contrary, in an appreciable gain in the final result, provided that the flash of alternating current is sufficiently short with respect to the period of application of the direct current.

In the example discussed above, in which there is a total available marking time of 2.1 seconds, voltages of 20 to 40 volts, whether alternating or direct, and a solution containing 20% sodium nitrite and a substantially corresponding quantity of a complexing agent, it is found that:

(A) If only alternating current is applied for the total time the depth of marking does not exceed 2 microns with the further phenomena of blurring indicated above. The mark is relatively pale and disappears easily during use.

(B) If only a direct current is applied during the entire time, this time falls within the transitory electrolysis starting period described above, and the depth of the mark is of the order of 3 microns (whereas, on the contrary, if one could apply this voltage for 5 seconds, the mark would be 10 microns deep, which demonstrates the non-proportionality).

(C) If, finally, the procedure according to the invention is used by applying a flash of alternating current lasting 0.3 second, followed immediately by the application of direct current for 1.8 seconds, the mark is about 4 microns deep and perfectly sharp. This is sufficient for current purposes which is not the case with A and B. Naturally the figures hereinbefore indicated are only approximate and dependent upon the conductivity of the electrolysis bath, that is to say the concentration of sodium nitrite and the voltage used, especially in the direct current phase of the electrolysis.

By way of example, the attached drawing show the circuit diagram of an installation adapted to carry out the invention. This shows the electrolytic head **1** of a conventional type applied to the article **2**, and containing the electrode **3**, which is made of stainless steel. The parts **2** and **3** are connected by conductive wires and a bipolar inverting switch **4** to the two terminals **5** and **6** respectively of a source of low voltage alternating current, for example 22 volts, when it is swung to the right of the figure, and to the two terminals **7** and **8** of a source of direct current of variable voltage when it is swung to the left side of the figure, the positive terminal being connected to the member **2** as indicated above. The source of direct adjustable voltage current may consist of a rectifying bridge **9** supplied from the terminals **5** and **6** by a transformer **10** at a variable transforming ratio. The control of the bipolar switch **4** may be actuated directly by the automatic means for feeding articles to the marking device.

Of course, the product may also be applied to the marking of any article of ferrous metal, but it is particularly useful as, as has been seen, in connection with articles manufactured on a large scale which must be marked in a very short time.

What is claimed is:

1. The method of electrolytically marking a metallic article by means of an electrolytic marking head provided with an electrode, which method comprises the steps of applying alternating current between said electrode and article for from 0.2 to 0.5 second and immediately thereafter applying a direct current between said electrode connected as a cathode and said article connected as an anode for a substantially longer period of time.

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