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APPARATUS FOR ELECTRICALLY ETCHING METALLIC ARTICLES

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Fig. 1.

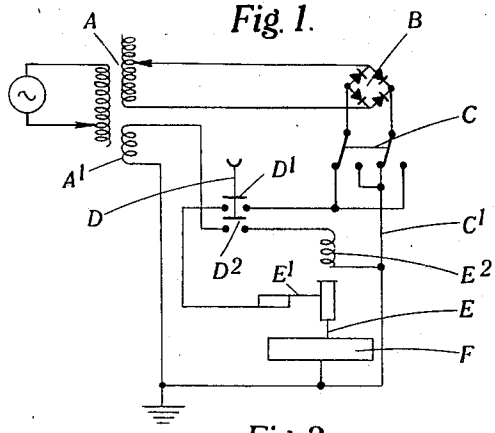


Fig. 2.

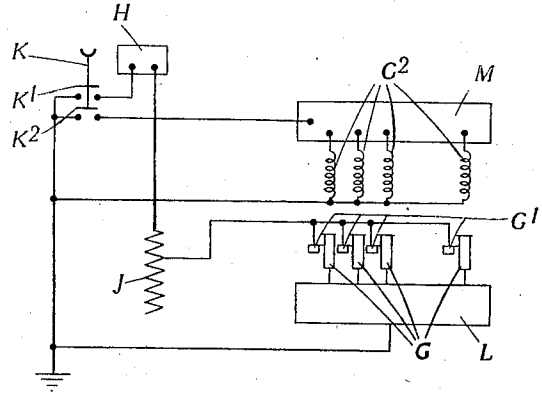
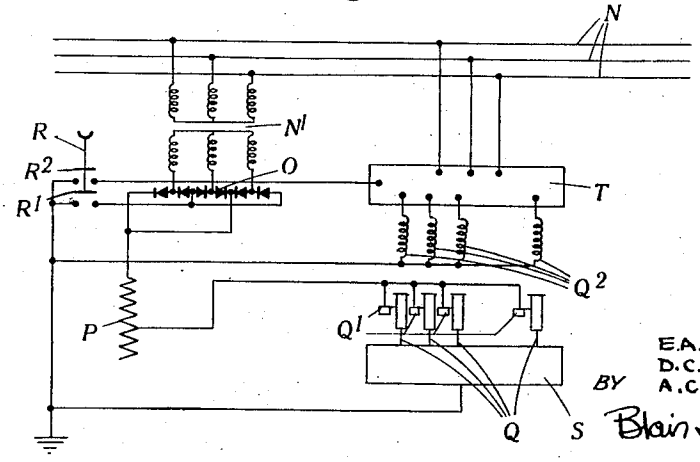


Fig. 3.



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APPARATUS FOR ELECTRICALLY ETCHING METALLIC ARTICLES

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5 Claims. (Cl. 219—8)

This invention relates to apparatus for electrically etching metallic articles and of the kind comprising a stylus or javelin electrically connected to one pole of a source of etching current supply whose other pole is connected to the article or work, the javelin being rapidly vibrated to and from the work so as alternately to make and break the contact between the work and the javelin, whereby the arc formed between them during their separation etches the surface of the work.

If in such apparatus both the etching current and the current for controlling the vibration of the javelin are directly supplied from alternating current supply mains, the javelin point vibrates at twice the frequency of the mains, and the relative polarity of the javelin point and the article or work, at the moment of etching, continually alternates. It has been found that certain characteristics in the appearance of the mark produced on the work by the javelin point are connected with the polarity of the work at the moment of etching, that is to say if the work is negative the etch is light in appearance whereas if the work is positive the etch is dark in appearance. The etching will thus consist of a mixture of dark and light spots and, though this is not objectionable when etching on some materials, it is undesirable on others, and one object of the present invention is to overcome this difficulty.

Another object of the invention is to avoid a number of difficulties which arise when the apparatus comprises a multiplicity of etching points, for example for intensive production. For instance, if the apparatus comprises an autotransformer with voltage regulation to provide for variation in the depth and width of etching required, a second transformer supplying current to electromagnets for vibrating the javelins, and a third transformer supplying etching current to the several javelins, difficulties arise due to lack of synchronism at the etching points. Thus, if one point makes contact with the work before the other points it will receive an excess of current. Moreover, there are also difficulties due to voltage surges in the transformers. If, on the other hand, the apparatus comprises an autotransformer and a second transformer as above indicated, and a number of transformers supplying etching current to the several javelins respectively, each etching circuit is segregated and synchronisation of the operations at the several etching points becomes less important so far as the effects of voltage surges are concerned. If an alternating current supply is employed for supplying both the etching and operating currents, however, synchronisation must necessarily remain of importance since in its absence contact with the work may not be made by each javelin at peak voltage so that there will be a risk of noticeable variation in the etching. Further, with this arrangement it is difficult to eliminate interaction between conductors which may be long and in close proximity.

Other objects of the invention will be apparent from the appended claims and from the following description of the accompanying drawing, in which

Figure 1 shows diagrammatically one simple arrangement according to the invention employing a single etching point, and

Figures 2 and 3 show diagrammatically two alternative arrangements wherein a number of etching points are used.

In the simple arrangement shown in Figure 1, the etching current is derived from alternating current mains at regular frequency through a transformer A whose output voltage, which is variable at will, is applied across one diagonal of a selenium rectifier bridge B. A double-pole double-throw reversing switch C is connected across the other diagonal of the rectifier B, two of the contacts of the reversing switch being connected through one pole D^1 of a double-pole control switch D to the stylus or javelin E whilst the other two contacts of the reversing switch C are connected through an earthed lead C^1 to the article or work F. The javelin E is mounted to vibrate on the reed or spring diagrammatically indicated at E^1 and one end of the coil E^2 of an electromagnet for vibrating the javelin E is connected to the said earthed lead C^1 whilst the other end of the coil is connected through the second pole D^2 of the double-pole control switch D to an earthed tertiary winding A^1 of the transformer A.

With the double-pole control switch D closed and the reversing switch C in one of its two alternative positions a unidirectional pulsating voltage is applied to the work and javelin, the work F being positive and the javelin E negative. At the same time alternating current is supplied to the coil E^2 of the electromagnet for vibrating the javelin. The javelin is thus always at negative polarity relatively to the work at the time of etching, so that the etch is dark in appearance, that is to say a "black" etch is produced. Should it be desired to produce an etch which is light in appearance, i. e. a "white" etch, the re-

versing switch C is moved into its second position so that the javelin will always be at positive polarity relatively to the work at the time of etching. The width and depth of the etched lines can be determined at will by adjusting the output of the transformer A as applied to the rectifier B whose output is unsmoothed.

It will be understood that where alteration in the appearance of the etch produced is not required the reversing switch C may be omitted so that the etch will either be "white" or "black" according to whether the javelin or the work is connected to the positive output terminal of the rectifier B. It is, however, advantageous to provide for ready reversal of the polarities of the javelin and work since it is desirable that some metals, for example those that are highly polished, be etched "white," whereas others, which are dull will require "white" etching, if the surface is dark and "black" etching if the surface is light.

It will be appreciated that, for convenience, the apparatus has been described as including one etching point only and it would be more usual in practice to provide a multiplicity of such points. Figures 2 and 3 show two such arrangements.

In the arrangement of Figure 2, the etching voltage is applied to the javelins G from a D. C. generator or battery, indicated at H, one pole of which is connected through a variable resistance J to all the javelins, whilst the other pole is connected through one contact K^1 of a double-pole control switch K to the work L, which is connected to earth. The variable resistance J provides for adjustment of the etching voltage to determine the depth and width of the etch at each etching point.

Each of the javelins G is mounted on a reed or spring G^1 and is vibrated by an electromagnet G^2. The electromagnets G^2 are energised respectively from individual phases of a multiphase generator, indicated at M, under the control of the second contact K^2 of the control switch K, the number of phases of the generator being at least as great as and preferably equal to the number of javelins, so that the javelins will be vibrated successively and in sequence by the electromagnets.

In the preferred arrangement of Figure 3, the etching current is supplied from three-phase alternating current mains N through a transformer N^1 to a three-phase rectifier O having a smoothed output. One of the terminals of the rectifier is connected through a variable resistance P to all the javelins Q, whilst the other terminal is connected through one contact R^1 of a double-pole control switch R to the work S and to earth.

Each javelin Q is mounted on a reed or spring Q^1 and is vibrated by an electromagnet Q^2, the electromagnets being respectively connected to the output phases of a multi-phase transformer or phase converter T having a three-phase input supplied from the mains N, the number of output phases of the transformer corresponding to the number of javelins. The electromagnet circuits are also controlled by the second contact R^2 of the control switch R, so that by closing this switch the etching circuits and the electromagnet circuits are closed simultaneouly, for the sequential operation of the javelins.

Thus the arrangement is such that only one javelin is in contact with the work at any time so that the rectifier is called upon to supply current sufficient for only one etching point. Apart from this advantage, mechanical vibration in the apparatus is reduced and cutting out of individual etching points is facilitated. Further, the relative polarity of each javelin and the work remains unchanged thus avoiding the mixed "black" and "white" etch which results with alternate variation of the relative polarities of the javelins and work. In this respect, a reversing switch may be provided in the etching circuit, as in the arrangement of Figure 1, so that the polarities of the javelins and the work can be reversed at will.

It will be understood that the arrangements described have been given by way of example only and may be modified in various ways within the scope of the invention. Thus for instance means other than the variable resistance may be employed for controlling the etching voltage.

What we claim as our invention and desire to secure by Letters Patent is:

1. Apparatus for electrically etching metal articles, comprising in combination with the work to be etched, a plurality of javelins, means whereby a unidirectional etching voltage is applied to the javelins and the work, and alternating current means for rapidly vibrating the javelins to and from the work in a predetermined sequence.

2. Apparatus for electrically etching metal articles, comprising in combination with the work to be etched, a plurality of javelins, means whereby a unidirectional etching voltage is applied to the javelins and the work, electromagnets for rapidly vibrating the javelins to and from the work, and alternating current means for so energising the electromagnets that the vibrations of the individual javelins are out of phase with one another.

3. Apparatus for electrically etching metal articles, comprising in combination with the work to be etched, a plurality of javelins, means whereby a unidirectional etching voltage is applied to the javelins and the work, a source of alternating current, and electromagnets successively energised from such source for rapidly vibrating the javelins to and from the work in a predetermined sequence so that only one javelin is in contact with the work at any time.

4. Apparatus for electrically etching metal articles, comprising in combination with the work to be etched, a plurality of javelins, means whereby a unidirectional etching voltage is applied to the javelins and the work, a source of multiphase current, and electromagnets respectively energised from the several output phases of such sources for rapidly vibrating the javelins to and from the work, whereby the vibrations of the individual javelins will be out of phase with one another.

5. Apparatus for electrically etching metal articles, comprising in combination with the work to be etched, a plurality of javelins, a source of alternating current, a rectifier, means whereby a unidirectional etching voltage is applied to the javelins and the work from the alternating current source through the rectifier, a phase-converter energised from the alternating current source and having a number of output phases appropriate to the number of javelins, and electromagnets respectively energised from such output phases for rapidly vibrating the javelins to and from the work, whereby the vibrations of the individual javelins will be out of phase with one another.

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