April 9, 1957 L. G. SIMJIAN 2,787,854

METHOD OF TREATING AN OBJECT

Filed Nov. 18, 1955

FIG. 1

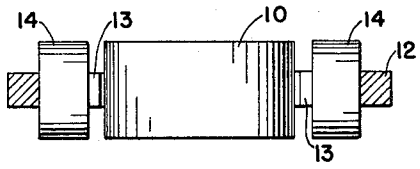


FIG. 2

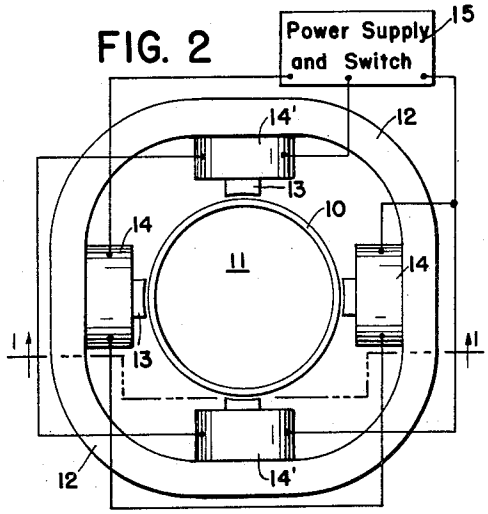


FIG. 3

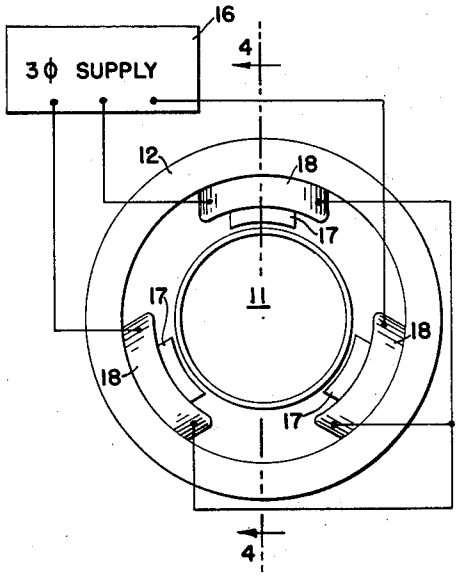


FIG. 4

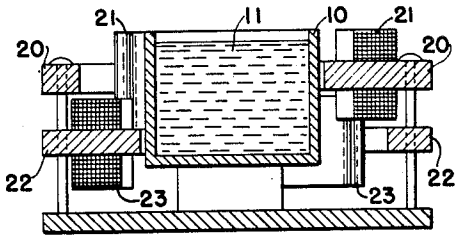


FIG. 5

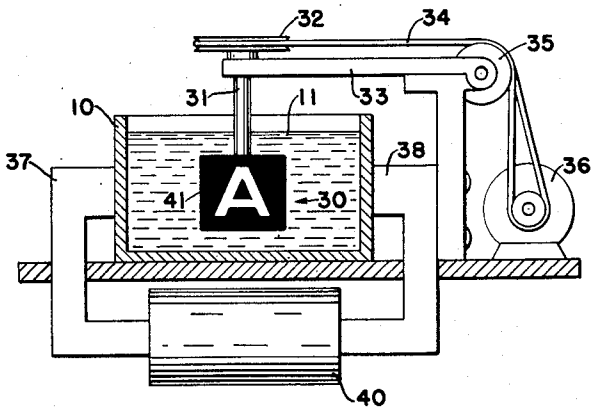
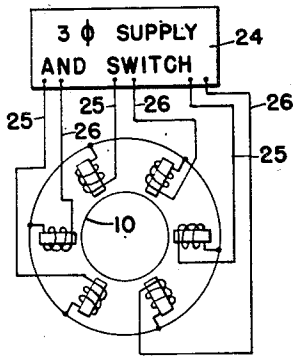


FIG. 6



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METHOD OF TREATING AN OBJECT

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7 Claims. (Cl. 41—39)

This invention relates to a method for treating plain or irregular surfaces, parts of which have been masked by an applied covering. It has particular reference to a method of abrading which uses magnetic particles, the consistency of which is modified by the application of a magnetic field.

One of the major disadvantages of the present system of etching by acid solutions is the difficulty of properly masking or covering areas which are not to be etched. Another difficulty in the acid etch method is the tendency of under-cutting. In order to prevent under-cutting it is often necessary to stop the etching process and apply an insulating material to the sides of the small cavities which are being formed in the surface. The present invention solves these difficulties by using an abrasive or polishing bath which does not under-cut and which does not use any acid or corrosive liquid. An abrasive mixture is employed which consists of an abrasive powder such as Carborundum, a magnetic powder such as iron filings, and a liquid. The object to be abraded is first provided with a mask which may be a resinous or rubber compound applied by spraying or any other suitable means. The abrasive mixture is housed in a container in which the object to be abraded is placed. An alternating magnetic field is applied to the mixture in such a manner as to magnetize it and vary the consistency of the mixture.

One of the objects of this invention is to provide an abrading device which avoids one or more of the disadvantages and limitations of prior art arrangements.

Another object of the invention is to abrade an irregular object without resorting to manual manipulation of any kind.

Another object of the invention is to abrade away portions of a surface without under-cutting.

Another object of the invention is to abrade the surface of an irregular object and remove scale, dirt, and paint from selected unmasked areas.

Another object of the invention is to vary the texture of the abraded surface of an object by providing abrading mixtures containing abrasive particles of varying size.

One feature of the invention includes an object having a masked portion and an exposed portion. The exposed portion is placed in contact with a mixture which includes abrasive particles and magnetic particles. A magnetic field of varying strength is applied to the mixture for varying its consistency and producing an abrading action on the exposed portion.

For a better understanding of the present invention together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawings.

Fig. 1 is a side view of the abrading device showing some parts in section.

Fig. 2 is a plan view of the abrading device shown in Fig. 1, with another set of pole pieces added.

Fig. 3 is a plan view of an abrading device similar to Fig. 2, using a three-phase supply.

Fig. 4 is a cross sectional view of an abrading device similar to that shown in Fig. 3 but having a double set of three-phase electromagnets.

Fig. 5 is a cross sectional view showing an abrading bath in which the object to be abraded is rotated by outside means.

Fig. 6 is a schematic wiring diagram showing how connections should be made to the electromagnets in the device shown in Fig. 4.

Referring now to Fig. 1 a non-magnetic container **10** is employed for retaining a mixture **11** (Fig. 2) which includes magnetic particles, abrasive particles and a liquid. A magnetic core **12** is arranged so that its pole pieces **13** project to a position which is adjacent to the walls of the container. A set of magnetic windings **14** is placed on the magnetic core **12** to introduce a magnetic flux in the mixture. This flux is cyclically changed by means of a switch interrupting the current flow through the magnetic winding or by some other means creating a cyclically changing magnetic field, as for instance, low frequency alternating current.

Fig. 2 is substantially the same arrangement as that shown in Fig. 1 but a second pair of magnetic windings **14'** is added. The windings of the coils **14** and **14'** are connected to a power supply and switch arrangement **15**. Power supply and switch combination **15** may be operated essentially in two modes of operation. All pole pieces may be energized simultaneously and cyclically interrupted by the switch or if the switch is of the single pole double throw type, one set of opposed coils is energized during one time interval and the second set of coils is energized during a second interval. In this way the intensity and direction of the magnetic field is cyclically changed.

It will be apparent that the power supply, either A.-C. or D.-C., and switch combination **15** may be replaced by a two phase A.-C. supply in which case a rotating magnetic field is obtained which acts on the magnetic particles in the mixture causing them to turn in circles. Since the magnetic particles carry with them abrasive particles, agitation of the magnetic particles due to changing the magnetic field causes abrading of the surface which is not masked by a protective covering.

It will be evident that various types of abraded surfaces may be produced by using different mixtures which contain abrasive particles of varying size. After the first abrading process, which cuts away a considerable portion of the surface area, the abraded surface may be polished by the application of a mixture which contains finely powdered aluminum oxide or rouge.

The device shown in Fig. 3 is similar to that shown in Fig. 2 except that a three-phase supply **16** is employed and only three pole pieces **17** are necessary. The action is the same, a rotating magnetic field is established by the alternating current through windings **18** and the magnetic particles in mixture **11** are given a circular motion as before.

The devices shown in Figs. 1, 2, and 3, are suitable for small objects such as name plates, printing plates, and glass objects. If it is desired to abrade thicker and more complicated articles the arrangement shown in Fig. 4 can be employed. This device includes the usual container **10** and mixture **11** but employs two or more magnetic systems in different planes. The first of these includes a core **20** having three windings **21** (only two shown in Fig. 4). A second core **22**, similar to core **20**, is mounted adjacent to the bottom of container **10** and includes three windings **23**. The pole pieces of core **22** are displaced from the pole pieces of core **20** by an angle of sixty mechanical degrees, thereby providing an additional mixing action when both these magnetic systems are in operation. The wiring arrangement for such a multiple system is shown in Fig. 6 and

comprises a three-phase supply 24 which includes a switching arrangement which periodically switches from windings 21 to windings 23 and back again. The switching means may be a relay operating device or a commutator operated by a motor. At one interval of time, coils 23 are connected together with supply lines 25. After a few cycles, the switching device switches the current to lines 26 and windings 23. The three-phase magnetic flux from either one of the sets of windings produces a circular motion of the iron filings within the mixture.

The arrangement shown in Fig. 5 comprises a support for an object 30 held within mixture 11 in container 10, such support including a shaft 31 to which is secured a pulley 32 mounted on a hinged arm 33. Pulley 32 is turned by a flexible belt 34 which passes over a multiple pulley 35 and is operated by a motor 36. The magnetic field pattern may be a single phase or some convenient poly-phase arrangement, indicated in Fig. 5 by pole pieces 37 and 38 and energized by winding 40. The object is coated with a masking substance 41 wherever no abrading action is desired. When the object 30 is slowly turned within bath 11 the abrading action is made more uniform and dead spots are avoided.

From the above description it will be evident that an abrading mixture comprising magnetic particles, abrasive particles, and a liquid can be employed in conjunction with a magnetic field to abrade metal surfaces and to provide an efficient abrading action on all unmasked surfaces.

While there have been described and illustrated specific examples of the abrading device, it will be obvious that various changes and modifications may be made therein without departing from the field of the invention which should be limited only by the scope of the appended claims.

I claim:

1. A method of treating an object comprising the steps of masking certain portions of an object; bringing the object in contact with a mixture which includes magnetic particles; and cyclically varying the consistency of said mixture so as to abrade the unmasked portions of said article.

2. A method of treating an object comprising the steps of masking certain portions of an object; bringing the object in contact with a mixture which includes discrete magnetic particles; and cyclically varying the consistency of said mixture by magnetic means so as to abrade the unmasked portions of said article.

3. A method of treating an object comprising the steps of masking certain portions of an object; bringing the object in contact with a mixture which includes abrasive magnetic particles; and cyclically varying the consistency of said mixture so as to abrade the unmasked portions of said article.

4. A method of treating selected portions of an object comprising the steps of masking the non-selected portions of the article; exposing the unmasked portions to a mixture which includes abrasive magnetic particles; and cyclically varying the consistency of said mixture by magnetic means so as to abrade the unmasked portions of said article.

5. A method of treating selected portions of an object comprising the steps of masking the non-selected portions of the article; exposing the unmasked portions to a mixture which includes abrasive magnetic particles and a liquid; and cyclically varying the consistency of said mixture by magnetic means so as to abrade the selected portions of said article.

6. A method of treating selected portions of an object comprising the steps of masking the non-selected portions of the article; exposing the unmasked portions to a mixture which includes discrete abrasive particles and discrete magnetic particles; and cyclically varying the consistency of said mixture by magnetic means so as to abrade the selected portions of said article.

7. A method of treating selected portions of an object comprising the steps of masking the non-selected portions of the article; exposing the unmasked portions to a mixture which includes discrete abrasive particles, discrete magnetic particles and a liquid; and cyclically varying the consistency of said mixture by magnetic means so as to abrade the selected portions of said article.

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