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3,207,685

APPARATUS FOR ELECTRO-CHEMICAL ETCHING

Filed Sept. 23, 1960

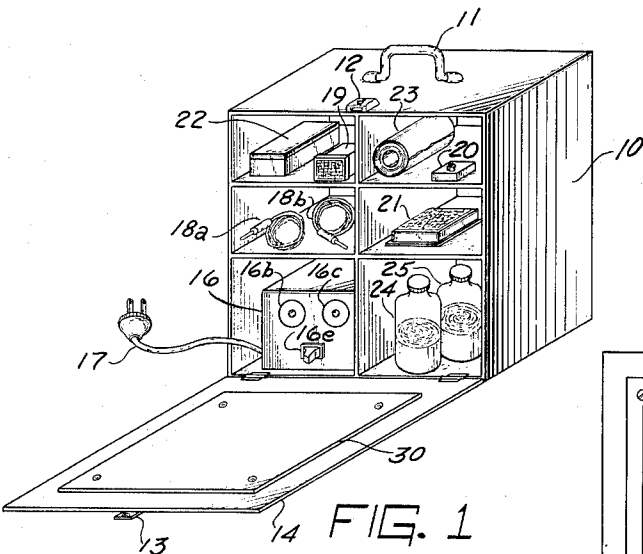
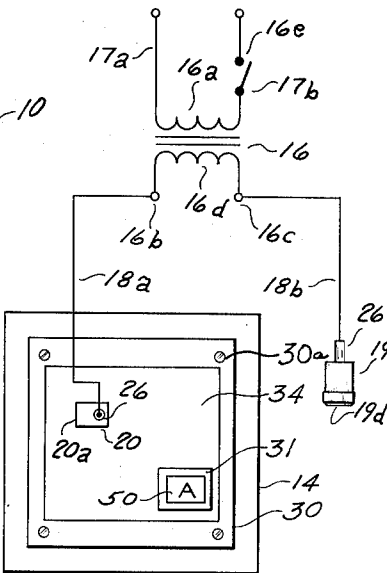


FIG. 2

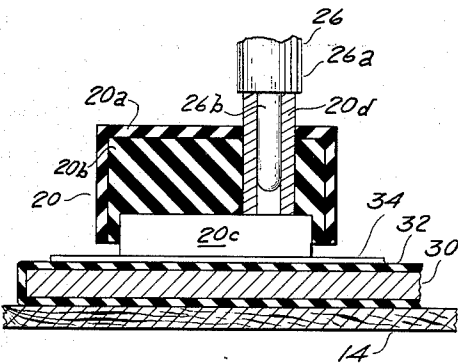


FIG. 3

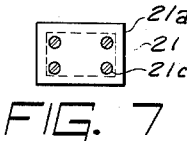


FIG. 7

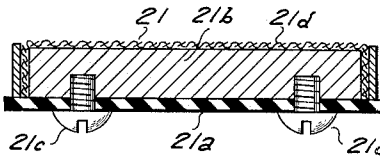


FIG. 6

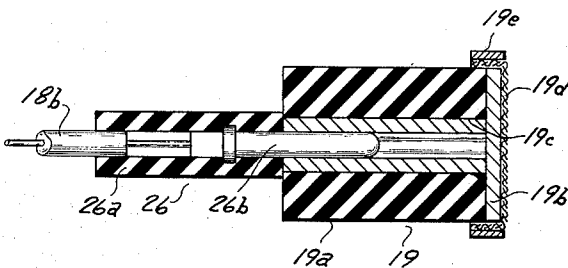


FIG. 4

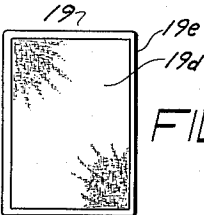


FIG. 5

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APPARATUS FOR ELECTRO-CHEMICAL ETCHING
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This invention relates generally to apparatus for electro-chemical etching. More particularly, it relates to improved portable apparatus for electro-chemical etching and to improved accessories employed therewith.

In the process of electro-chemical etching, a commercially available liquid electrolyte is applied to a metal surface which is to be etched through a non-conductive stencil which has appropriate indicia cut therein and a low amperage electrical current, either A.C. or D.C., is passed momentarily through the metal surface and the electrolyte to effect etching of those portions of the metal surface which are in contact with the electrolyte. This process is well adapted for marking metal products, tools, machine parts, scientific instruments, and so forth with identifying or informative data, part numbers, trade marks, and like indicia. Prior art apparatus for carrying out the process of electro-chemical etching while generally satisfactory for its intended purpose is often rather complicated, expensive and cumbersome. Not infrequently such apparatus is designed for etching parts of a specific shape only. Efforts have been made to provide portable electro-chemical etching apparatus in order to expand the field of use of such apparatus and to render it more economical but such apparatus heretofore has not proven entirely satisfactory for the reason that its utility was rather limited and it was very inconvenient to set up and use in view of the fact that the process requires such apparatus as a source of power, connection wires, a hand-pad hereinafter described, stencil material, chemical solutions, wiping cloths, small tools, etc.

Accordingly, it is an object of this invention to provide improved apparatus for carrying out the process of electro-chemical etching.

Another object is to provide improved portable apparatus of the aforesaid character.

Still another object is to provide improved apparatus of the aforesaid character which comprises a portable carrying case having a portion which opens to afford an electrically energizable working surface and to expose the interior of the case which contains a power supply unit, electrical conductors, stencil materials, chemical solutions, a hand-pad and other necessary accessories.

A further object of the invention is to provide an improved electrode which magnetically attaches to the energizable working surface of the aforesaid case or to certain types of objects to be etched to afford an electrical connection thereto.

A still further object of the invention is to provide an improved bench fixture which is adapted to be employed with the energizable working surface of the aforesaid case to increase the utility of the portable electro-chemical etching apparatus.

Another object of the invention is to provide improved apparatus of the aforesaid character which is economical to manufacture and operate, convenient and easy to use, susceptible to a wide variety of uses, and highly portable.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate preferred embodiments of the invention which will hereinafter be described in detail, it being understood that the embodiments illustrated are susceptible to modifications with respect to

details thereof without departing from the scope of the appended claims.

In the drawings:

FIG. 1 is an isometric view of a carrying case having electro-chemical etching apparatus and accessories therefor disposed within and showing a wall of the case folded down to afford an energizable working surface.

FIG. 2 is a top plan view of the folded-down wall shown in FIG. 1 showing a metal object thereon ready for etching and showing, in schematic form, the circuitry for the various components.

FIG. 3 is an enlarged view, partly in section, of a magnetically attachable electrode associated with the folded-down wall shown in FIGS. 1 and 2.

FIG. 4 is an enlarged view, partly in section, of a hand-pad device shown in FIGS. 1 and 2.

FIG. 5 is an end elevational view of the hand-pad device shown in FIG. 4.

FIG. 6 is an enlarged view, partly in section, of a bench-fixture device constructed in accordance with the invention for use on the folded-down wall of the case.

FIG. 7 is an elevational view, greatly reduced in scale, of the bottom side of the bench-fixture device shown in FIG. 6.

Referring to FIG. 1, there is shown portable electro-chemical etching apparatus and accessories therefor incorporating the invention. The numeral 10 designates a carrying case which, for example, is about the same size as that employed to house a small portable typewriter. The top wall of the case 10 is provided with a suitable carrying handle 11 and with a suitable latch 12 of well-known design which cooperates with a suitable member 13 on the front wall 14 of the case to latch the wall 14 in closed position when the apparatus is being transported or not in use. The front wall 14 may be assumed to be provided with a suitable hinge or hinges which enable it to be folded downward as shown in FIG. 1 to afford a working surface, as will hereinafter appear.

The interior of the case 10 is divided into a number of compartments which are adapted to accommodate the components, accessories and paraphernalia which comprise or are employed with the invention such as a transformer 16, its line cord 17, a coiled up pair of load leads 18a and 18b, a hand-pad device 19, a magnetically attachable electrode 20, a bench-fixture device 21, a box 22 of aluminum foil, a roll 23 of stencil material, a bottle 24 of etching electrolyte, and a bottle 25 of fixative solution.

Referring to FIGS. 1 and 2, there is shown the transformer 16 which, it may be assumed, is rigidly secured within the case 10 and affords a source of power for the etching process. The line cord 17 for the transformer 16, which may be assumed to be a step-down transformer, comprises the two conductors 17a and 17b, shown in FIG. 2, which are connected to the primary winding 16a of the transformer 16 and are adapted, for example, for connection to a source of 110 volt A.C. power supply such as is readily available in most domestic and commercial establishments.

The transformer 16 is provided with female plug-in type terminals 16b and 16c, shown schematically in FIG. 2, which are electrically connected to the secondary winding 16d of the transformer. If preferred, a line switch 16e may be provided in the circuit for the primary winding 16a of the transformer 16. The plug-in terminals 16b and 16c of the transformer 16 may be of any well-known type and could, for example, be adapted to accommodate a type of male jack 26 depicted in FIGS. 3 and 4 and hereinafter described.

The load leads 18a and 18b, shown disconnected and coiled up in FIG. 1, are shown in schematic form in FIG.

3

2 as being attached at one end to the terminals 16b and 16c of the transformer 16. The other end of the load lead 18a is connected to the magnetically attachable electrode 20, hereinafter described, and the other end of the load lead 18b is connected to the hand-pad device 19, hereinafter described. The load lead 18b, which may be assumed to be identical in construction to the load lead 18a, may, for example, comprise an insulated conductor about three feet in length which is provided at each end with a type of male jack 26 hereinbefore referred to and shown in FIGS. 3 and 4. The jack 26 comprises a hollow tubular insulating member 26a and an electrically conductive cylindrical member 26b is rigidly secured thereto and extends from one end thereof. The end of the conductor wire of the load lead 18b is electrically and mechanically connected as by welding or soldering to the conductive member 26b of the jack 26 within the tubular insulating member 26a.

Referring now to FIGS. 1, 2 and 3 it is seen that, in accordance with the invention, the surface of the front wall 14 of the case 10 is provided with a plate member 30 which, for example, is secured thereto by the screws 30a or other suitable means (not shown). The plate member 30 is concealed when the case 10 is closed by folding the front wall 14. The plate member 30 is fabricated of material, such as steel, which is both magnetizable and electrically conductive and affords a flat working surface upon which a metal object, such as 31 in FIG. 2, which is to be etched is placed. The plate member 30 is magnetizable so that the magnetically attachable electrode 20, hereinafter described, will attach thereto or thereagainst.

The plate member 30 is electrically conductive so that it will afford a current path between the magnetically attachable electrode 20 and the metal object 31 which is to be etched. It is to be understood that the liquid electrolytes have a corrosive action on metallic members such as the plate member 30 if care is not taken to have it removed if it accidentally spills thereon. Accordingly, it may be preferable to provide the plate member 30 with a corrosion-resistant coating 32, shown in FIG. 3, by "Bonderizing," "Parkerizing" it, or even painting it. Since such coatings are electrically non-conductive and this would interfere with the electrical connection between the magnetically attachable electrode 20 and the metal object 31, it is necessary to place a sheet 34 of electrically conductive material, such as aluminum foil, on the insulated surface of the plate member 30 and to place the metal object 31 and the magnetically attachable electrode 20 on top of the sheet, as FIGS. 2 and 3 make clear. In use, the sheet 34 is kept in place by the weight of the object 31 and by being clamped by the magnetically attachable electrode 20 which is attracted toward the plate member 30. A supply of aluminum foil for this purpose is conveniently carried in the case 10, as hereinbefore noted. The sheet 34 is readily disposable after etching operation if any electrolyte spills or splashes thereon.

The magnetically attachable electrode member 20, hereinbefore referred to, is shown in FIGS. 1, 2 and 3 and is seen to comprise an outer shell 20a, preferably fabricated from plastic insulating material such as "Bakelite" or the like, which is filled with a solidified insulating compound 20b such as epoxy resin or the like. An electrically conductive permanent magnet 20c having a flat lower surface is embedded in the compound 20b and projects a short distance below the outer shell 20a of the member 20, as FIG. 3 shows. The outer shell 20a and the compound 20b afford mechanical support for an electrically conductive cylindrical female plug-in device 20d which is electrically connected as by welding or soldering to the permanent magnet 20c. As FIG. 3 shows, the plug-in device 20d of the electrode member 20 is adapted to accommodate a jack 26 of the type hereinbefore described.

The magnetically attachable electrode 20 is an especially advantageous type of connector to employ in electro-

4

chemical etching processes for a number of reasons. For example, certain objects to be etched do not lend themselves readily to the attachment of an "alligator" clip or similar devices formerly employed because of their massive or irregular configuration. Such objects frequently, however, can be laid on the plate 30 or on the sheet 34 of conductive foil thereon and current passes from the electrode through the plate or sheet to the object. Since some objects, such as brass, are not magnetizable it would not be possible to attach the electrode member 20 directly thereto. Then, too, large magnetizable objects such as massive stationary machine parts which cannot be placed on the plate 30 or sheet 34 can be readied for etching merely by attaching the magnetically attachable electrode 20 directly thereto.

FIGS. 1, 2, 4 and 5 depict the hand-pad device 19 which is employed in the electro-chemical etching process. A wide variety of so-called "hand-pad" devices are known in the art of electro-chemical etching, but for purposes of illustration a relatively simplified version is depicted to aid in understanding the present invention. The hand-pad device 19 comprises an insulating handle 19a having an electrically conductive flat plate 19b rigidly secured to one end thereof by suitable means (not shown). An electrically conductive hollow cylindrical female plug-in device 19c which is disposed within the handle 19a is electrically connected, as by soldering or welding, to the plate 19b. The plug-in device 19c is adapted to accommodate the jack 26 on the end of the load lead 18b. A pad or sheet of liquid-absorbent material 19d, such as cloth or felt, is stretched over the conductive plate 19 of the hand-pad device 19 and is secured in place thereon by a force-fitted metal retaining band or ring 19e. The absorbent material 19d is adapted to be moistened with the electrolytic fluid employed in the etching process either by pouring the fluid thereon or by dipping the end of the hand-pad 19 into a shallow container (not shown) of the fluid. Electrolytes for use in electro-chemical etching are commercially available and, usually, are non-acid solutions of various metallic salts. As will be understood, more elaborate types of hand-pads are available which have a reservoir within which contains the electrolyte which continuously dampens the absorbent material.

In operation, the moistened end of the hand-pad 19 is pressed against the stencil 50, shown in FIG. 2 as having the indicia "A" cut therein, which lies on the surface of the metal object being etched. Various types of stencils are commercially available for electro-chemical etching processes and one type of stencil is fabricated of the same material and in the same manner as the well-known mimeograph stencil. Such stencils, in essence comprise a porous paper having wax-like material on one side which can be cut through with a stylus or by type-face.

In accordance with the invention there is provided a bench fixture device 21 shown in FIGS. 6 and 7 which has special utility with the plate member 30 or the sheet 34, whichever is employed. In essence, the bench fixture device 21 is a specialized type of hand-pad, as will hereinafter appear. The bench fixture device 21 comprises an insulated base 21a, fabricated of "Bakelite" or the like, upon which an electrically conductive block 21b is disposed. Preferably, the block 21b is fabricated of graphite because of its corrosion resistant qualities. The block 21b is secured to the base 21a by means such as the screws 21c which also serve as an electrical connection between the block and the plate 30 or the sheet 34, as the case may be, when the bench fixture is placed thereon. A pad or sheet of liquid-absorbent material 21d, such as cloth or felt, is stretched over the block 21b and is secured in place thereon by a force-fitted metal retaining ring or band 21e. The absorbent material 21d is adapted to be moistened with the electrolytic fluid. As will hereinafter be more fully explained, an object (not shown) to be etched is placed on the cloth surface of the bench fixture 21 and the load lead 18b is disconnected

from the hand-pad 19 and touched to the object being etched.

The invention is employed as follows.

The case 10 is disposed on a suitable working surface (not shown) and the front wall 14 is opened as shown in FIG. 1. The line cord 17 is plugged into a suitable outlet (not shown) and the line switch 16e is moved to on position. One end of the load lead 18a is inserted into the terminal 16b on the transformer 16 and one end of the load lead 18b is inserted into the terminal 16c on the transformer 16. The other end of the load lead 18a is plugged into the magnetically attachable electrode member 20. The other end of the load lead 18b is plugged into the hand-pad device 19.

If the plate member 30 on the front wall 14 of the case 10 is uncoated, as hereinbefore explained, the magnetically attachable electrode member 20 is placed directly on the plate 30 and will remain there. If the plate member 30 is of the coated type, the sheet 34 of foil is placed on the plate end and the electrode member 20 is placed on the foil. The metal object 31 is then placed on the plate 30 or on the foil 34, as the case may be, and the stencil 50 is placed on the surface of the metal object which is to be etched. The end surface 19d of the handpad 19 is moistened with electrolyte and is momentarily pressed against the indicia "A" on the stencil. A current path is thus established from terminal 16b of the transformer 16, through load lead 18a, magnet 20c of the electrode member 20, sheet 34 or plate 30 as the case may be, metal object 31, the electrolyte in the stencil indicia and the cloth 19d and the hand-pad 19, the plate 19b and the portion 19c of the hand-pad 19, and the load lead 18b, to the terminal 16c of the transformer and etching occurs.

The hand pad 19 and the stencil 50 are then removed and the etched surface is wiped dry and then fixitive solution may be wiped thereon to neutralize any remaining electrolyte solution or salts.

As hereinbefore mentioned, if an object to be etched is not portable and cannot be placed on the plate 30 or the foil 34, the following procedure may be followed.

The magnetically attachable electrode member 20, connected to the transformer 16 as hereinbefore described, is attached to some portion of the object by placing it thereagainst, provided the latter is magnetizable. The stencil 50 is then placed at the desired location and the hand-pad 19 connected as aforedescribed is applied as aforedescribed to effect etching.

The bench fixture device 21 is employed in the following manner. Assume that the electrode member 20 is connected to the plate 30 or the sheet 34 as hereinbefore described. Then, instead of placing the object to be etched on the plate or the sheet, as the case may be, the bench fixture 21 is placed thereon so that the members 21c are in contact therewith. The bench fixture device 21 is moistened with electrolyte and the stencil 50 is placed on the cloth portion 21d thereof in reversed position. The object to be etched is then laid on the stencil. The hand-pad 19 is disconnected from the load lead 18b and the exposed end 26b of the jack 26 on that end of the load lead is momentarily touched to the object being etched to effect etching as hereinbefore described. The bench fixture device 21 is more efficient for etching a number of small flat metal objects (not shown) with the same indicia since it is unnecessary to apply and remove the stencil for each operation. Only the object itself needs to be handled.

From all of the foregoing it is apparent that the invention disclosed herein is extremely compact, convenient and versatile and has a great variety of applications not found in prior art apparatus for electro-chemical etching.

What is claimed is:

1. In a device for use with electro-chemical etching apparatus having an electrically conductive horizontal surface upon which said device is adapted to rest, in combination, a rigid non-corrosive insulating base member, an

electrically conductive non-corrosive member having a flat upper surface and supported on said base member, an absorbent membrane disposed on the flat upper surface of said electrically conductive non-corrosive member and extending around the edges thereof, a force-fitted band extending around the edges of said electrically conductive non-corrosive member for securing said membrane to said electrically conductive non-corrosive member, and a plurality of electrically conductive fastening devices extending through said insulating base member and into said electrically conductive non-corrosive member to mechanically secure the latter to the former, said fastening devices adapted to rest upon the electrically conductive horizontal surface of said etching apparatus and to establish electrical connection between said horizontal surface and said electrically conductive non-corrosive member.

2. In a portable electro-chemical etching case having storage compartments for paraphernalia used in etching, having an alternating current transformer with a pair of output terminals mounted therein, and having a foldable cover which opens to provide a horizontal working surface and to make the said paraphernalia accessible, the improvement which comprises, in combination, an electrically conductive magnetizable plate secured to said horizontal working surface, said plate being adapted to have a metal object to be etched placed thereon and in electrical contact therewith, a magnetic terminal connector electrically connected to one of said transformer output terminals and adapted for electrical connection to said plate by means of magnetic attraction, and a manipulatable hand-pad electrically connected to the other of said transformer output terminals, said hand-pad adapted to apply etching fluid to said metal object and simultaneously establish an electrical current path between said metal object and said other transformer output terminal.

3. The combination according to claim 2 wherein said electrically conductive magnetizable plate has a chemically resistant electrically non-conductive protective coating thereon and wherein a sheet of disposable metallic foil is disposed between said coated plate and the said metal object and between said coated plate and said magnetic terminal connection to provide an electrical path between said magnetic terminal connector and said object.

4. The combination according to claim 2 wherein said magnetic terminal connector comprises a shell of molded electrical insulating material, a metallic magnet supported by said base by entrapment in resin filling said shell, a portion of said magnet projecting from the bottom of said base, and an electrically conductive plug-in type device mounted on said base in electrical contact with said magnet, said plug-in device being adapted for connection to a mating jack which is electrically connected to said one of said output terminals of said transformer.

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