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SYSTEM AND UNIVERSAL APPARATUS FOR THE COMPLETE PREPARING OF METALLOGRAPHIC SAMPLES

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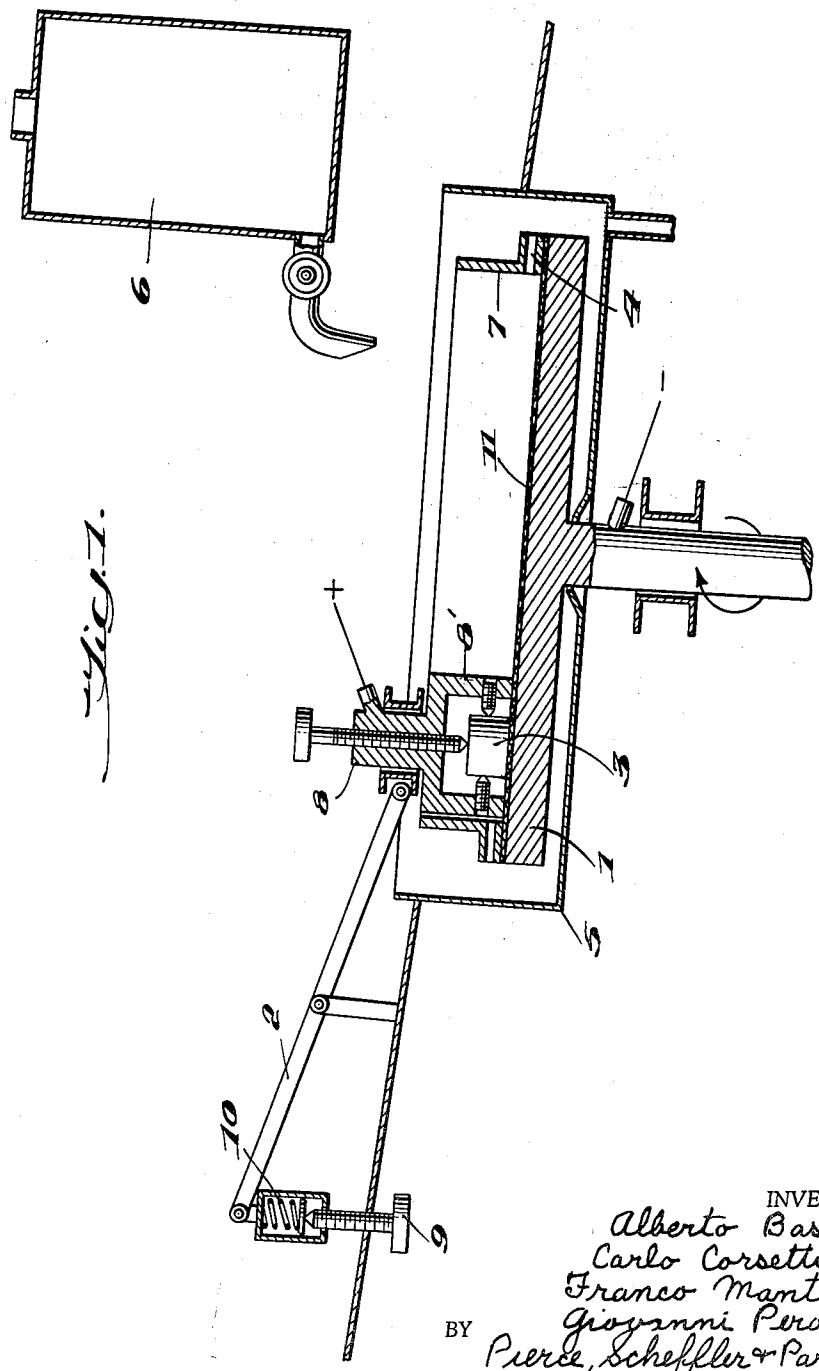

Fig. 1.

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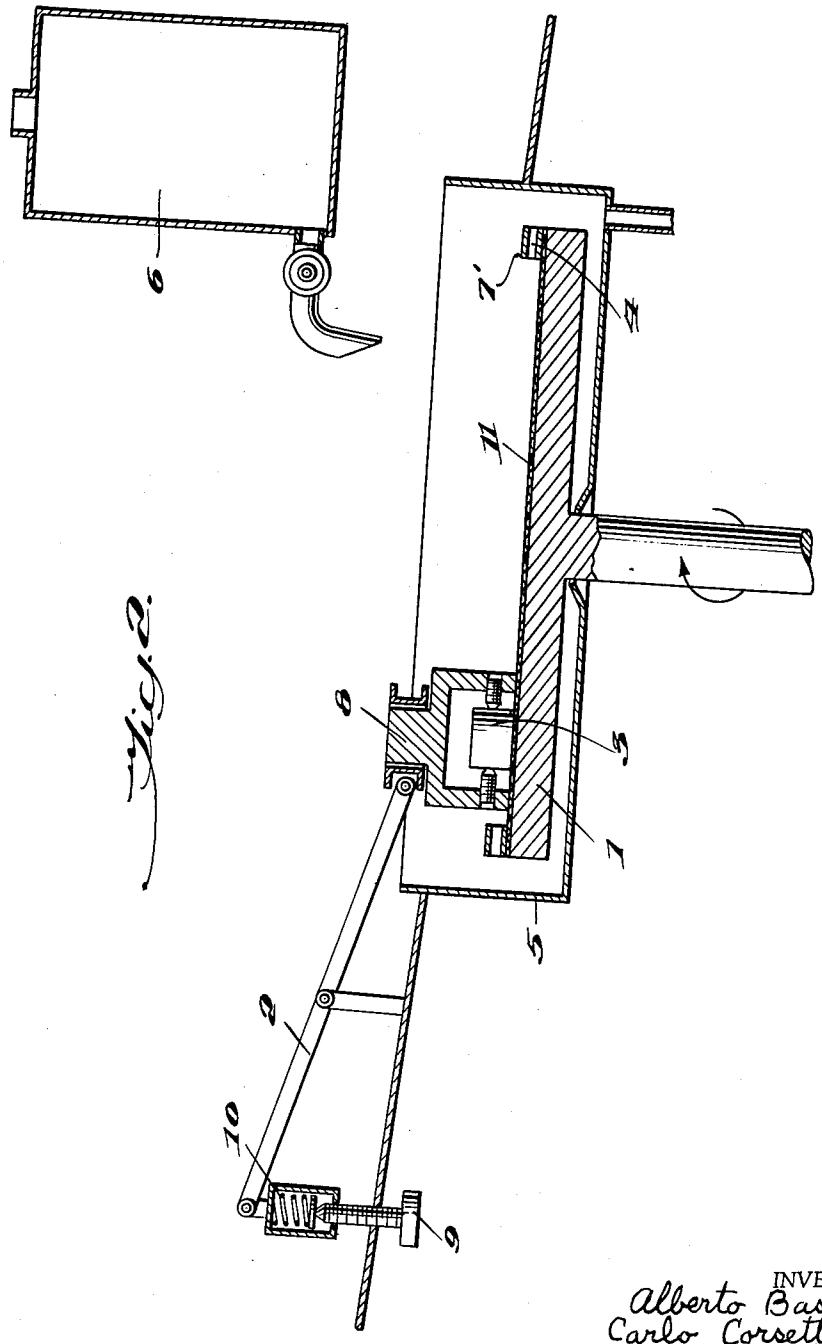

Fig. 2.

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SYSTEM AND UNIVERSAL APPARATUS FOR THE COMPLETE PREPARING OF METALLOGRAPHIC SAMPLES

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The present invention concerns a system and universal apparatus enabling one to carry out all operations necessary for the preparation of metallographic samples to be observed at the microscope.

The apparatus according to the invention enables one to carry out preliminary smoothing and mechanical polishing as well as electrolytic polishing and anodic etching of metals.

The system and apparatus according to the invention are quite novel as a principle and afford considerable advantages over standard and conventional electrolytic cells and other apparatus to be found in the trade for the mechanical preparation of metallographic samples.

The apparatus according to the invention is a universal apparatus which serves at will:

(*a*) For the electrolytic cleansing and anodic etching of metals by a novel system of rotating electrodes;

(*b*) For the preliminary smoothing and cleansing of metallographic samples by the mechanical method, for instance, by means of abrasive papers, abrasive pastes or diamond pastes with the aid of water, organic liquids or suspensions of alumina etc.

Moreover, the apparatus according to the invention affords the following considerable advantages:

(1) Rapidity and easiness of the operations thanks to the easy mounting of the samples, whence the apparatus is very well suitable for the treatment of irradiated materials.

(2) Possibility of automation of both the electrolytical and the mechanical operations.

(3) Absolute reproducibility of results.

(4) Possibility of adjusting the pressure exerted upon the sample down to very low values, whence it is possible to prepare samples of materials such as uranium, lead, magnesium, etc. which easily undergo surface structural alterations.

(5) Simplification of the operations of anodic etching. In fact, the nearly total elimination of polarisation phenomena as obtained thanks to the twofold rotation of the electrodes, enhances the energy of chemical attack and permits the electrolytic operation also after the mere mechanical preliminary smoothing on abrasive papers. Hence the polishing operation can be avoided.

(6) Possibility of inspecting at the microscope in polarized light isotropic materials such as austenitic nickel steels after anodic etching of short duration (<1 minute).

The electrolytic cleansing and the anodic etching according to the present invention consists essentially in that the cathode constituted by a support for the electrolytic liquid, as well as the anode, constituted by the sample to be treated, are made to rotate at contact with each other; the pressure at which said contact takes place is conveniently adjustable and the speeds of rotation may be equal or different and conveniently adjustable too.

The mechanical preparation of metallographic samples according to the present invention essentially consists in that the sample is held stationary by a sample-carrying support and is pressed with adjustable pressure against a rotary plate carrying the abrasive papers for smoothing, or fabrics for polishing, while water or a liquid is dripped onto the rotating plate.

It is clear that if it were found to be convenient for the treatment of some metal also with the mechanical preparation the sample might be rotated, as with the electrolytic preparation.

The apparatus according to the invention is substantially identical for the one and the other type of preparation. It comprises essentially a rotating plate, a sample carrier, an arm carrying the sample carrier to press it with the desired adjustable pressure against the rotating plate, a tank from which a liquid which drips onto the rotating plate, and a collecting bin surrounding the rotating plate for collecting said liquid.

In the following detailed description and in the accompanying drawings referred to therein, there are diagrammatically described and illustrated, by way of example:

In FIG. 1, the apparatus embodied for electrolytic cleansing and for anodic etching; and

In FIG. 2, the apparatus as embodied for mechanical cleansing and smoothing.

In both figures, identical or corresponding parts are indicated by the same reference numerals.

The apparatus as embodied for electrolytic cleansing and for anodic etching, as illustrated in FIG. 1, is constituted essentially by: a rotating plate 1, carrying at its periphery a ring 7, in which there are provided some holes 4; a sample-carrier 8 accommodated on the plate 1 in such a way that its external surface 8' is in contact with the ring 7 and adapted to sustain the sample 3 at contact with the plate 1; an arm 2 sustaining the sample carrier 8 and pressing it against the plate 1 with a pressure adjustable by means of a screw 9 and spring 10; a collecting bin 5 surrounding the plate 1 and having a discharge mouth; a tank 6 arranged above the plate 1 in such a way as to make the electrolytic liquid drip onto said plate.

The plate 1 is covered by a fabric 11 resistant against the acids, which acts as a support for the electrolytic liquid. Conveniently the plate is covered by two fabrics, of which the lower one is very thick and has the function of acting as a support for the electrolytic liquid and of sufficiently separating the two metal electrodes to avoid short-circuits, and the upper one is very soft and has the function of ensuring the rubbing of the sample on a surface that cannot damage it. The rotation of the plate 1 is controlled by any means, not shown.

The rotation of the support 8 takes place by means of friction between its external surface 8', which to this end may be covered by a rubber sheath, and the inner surface of the ring 7 which may be conveniently knurled.

By means of the holes a constant level of electrolytic liquid is obtained on the plate 1 and so is its continuous renewal. The discharged liquid is collected in the bin 5, from which it may be recycled, be it by hand or automatically.

The rotation of the cathode, constituted by the support 1 for the electrolytic liquid, permits the depolarization of the electrodes and the consequent elimination of the more or less serious defects of polishing of the sample.

The rotation of the sample 3 is convenient in order to attain a uniform distribution of the electrolyte over the surface of said sample, which is given a uniform etching or polishing.

The derivation of the movement of rotation of the sample-carrier, might be effected, instead of by means of friction as illustrated, even by means of a gearing transmission or the like, and as well by such a transmission as to enable adjustment of the speed of rotation of the sample-carrier 8 with respect to that of the plate 1. The adjustment of the contact pressure between the sample 3 and the plate 1 is necessary for the treatment of the various kinds of metals and in order to be able

to pass from polishing over to anodic etching of the sample.

The apparatus illustrated in FIG. 2 is embodied as for the mechanical preparation of the samples 3. As will be seen, this is essentially the same apparatus, constituted by the same main parts 1, 2, 5, 6, 9, 10 and 11, as the apparatus for electrolytic preparation. As distinct from the embodiment for electrolytic operation, with the mechanical variant the electric connections are dispensed with and the peripherical ring 7 of the plate 1 is replaced by another ring 7' which leaves the sample-carrier 8 stationary in lieu of rotating it, as in the preceding case. The plate 1 is covered by abrasive paper for carrying out the preliminary smoothing, or by convenient fabrics 11 for the polishing of metals. The peripherical ring 7' serves to fasten said papers or said fabrics 11 on the plate 1.

From the tank 6, water is dripped in the case of preliminary smoothing by abrasive paper, and a suspension of alumina or of organic liquid for the polishing with standard abrasives or diamond pastes. The liquids dripping from the tank 6 onto the plate 1, issue by centrifugal force through the holes 4 and are collected in the bin 5, with a discharge mouth as in the preceding case.

It will be understood that in the practical realization of the universal apparatus according to the invention, the adaptations for the one or the other kind of preparation may be constituted by the mere replacement of the ring 7, or they may more conveniently be constituted by the replacement of the entire rotating plate 1 with the peripheral ring 7' and the respective means (abrasive papers or fabrics) fixed on said plate.

Also the apparatus illustrated in FIG. 1 as embodied for the electrolytic preparation of the samples, may be used as it is for mechanical preparation, merely taking away the electric connections. On the other hand, though with less satisfactory results the apparatus illustrated in FIG. 2 is employable for electrolytic operation provided the respective electric connections are applied.

We claim:

1. Apparatus for carrying out electrolytic cleaning and anodic etching of metallographic samples comprising a horizontal circular plate mounted for rotation around a vertical axis, means for rotating the plate; a fabric covering on said plate, means for rotatably holding the sample in contact with said fabric adjacent the periphery of said plate, means for rotating said last named means, means for supplying liquid on to said plate and means for supplying electric current to said plate and said means for holding a sample.

2. Apparatus as defined in claim 1 in which the fabric is adapted to absorb and hold an electrolytic liquid.

3. Apparatus as defined in claim 1 in which the plate is provided with a peripheral upstanding flange and is provided with openings adjacent the lower edge thereof for the discharge of liquid from said plate.

4. Apparatus as defined in claim 3 in which the means for holding the sample is mounted for rotation about a vertical axis and has a cylindrical outer surface positioned to bear against the inner surface of said flange to rotate the same.

5. Apparatus as defined in claim 4 in which the means for holding the sample is mounted on one end of a pivoted arm and means for varying the vertical pressure on the other end of said arm.

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