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POLISHING OF SURFACES
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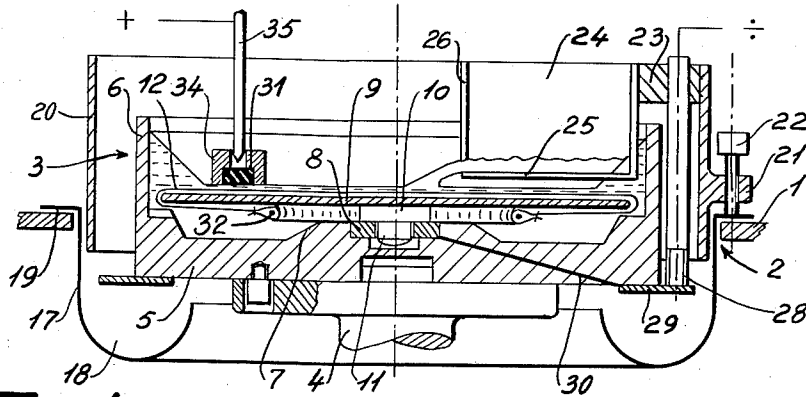


Fig. 1

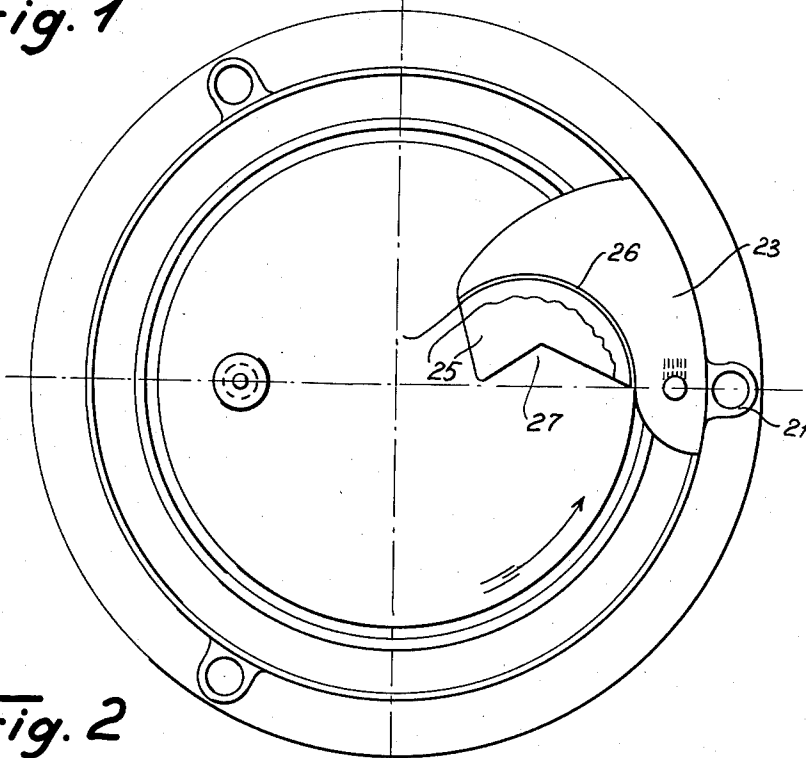


Fig. 2

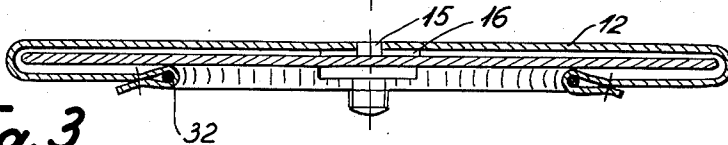


Fig. 3

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APPARATUS FOR THE ELECTRO-MECHANICAL POLISHING OF SURFACES

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This invention relates to an apparatus for the electro-mechanical polishing of surfaces, especially for metallographic purposes.

The principle of electro-mechanical polishing consists in subjecting a sample or workpiece to electrolytical polishing and at the same time to a sweeping action which may solely serve to secure a better uniformity of the electrolytical polishing effect or alternatively may add a polishing effect of a more or less abrasive nature. In the former case, the sweeping will be made by means of a cloth without the use of any abrasive material in the cloth or in the electrolyte and the effect of the sweeping will be to remove any films or deposits that may tend to build up as a consequence of the electrolytical polishing. In the latter case, an abrasive effect may be obtained by using a waterproof abrasive sheet or a cloth having abrasive particles distributed therein or again abrasive particles may be suspended in the electrolytic liquid used for the electrolytical polishing.

For the electro-mechanical polishing, apparatuses have been proposed, which comprise a revolving disc on which a polishing cloth or polishing sheet is stretched or clamped by means of a clamping ring, which at the same time forms a peripheral wall surrounding the disc and extending upwards therefrom so that the disc and ring combine to form a shallow cup in which a certain amount of electrolyte can be received. These known apparatuses suffer from the drawback that it is very difficult to avoid leakage of electrolyte between the engaging surfaces of the disc and the ring and beside the operation is relatively slow, because the speed of rotation must be kept low in order to keep a layer of electrolyte over the whole surface of the disc.

It is an object of the invention to construct an apparatus, which is capable of holding a quantity of electrolyte during operation in such a manner that no leakage of liquid will take place.

Another object of the invention is to construct an electro-mechanical polishing apparatus which is capable of satisfactory operation at a relatively high speed of rotation.

A further object of the invention is to devise an electro-mechanical polishing apparatus of a simple and reliable construction and which combines the advantages of non-leaking properties with the advantage of a simple and satisfactory attachment of a polishing cloth to the surface of a rotatable disc.

With these and other objects in view, which will be apparent to a man skilled in the art from the following description, the invention resides in the novel elements, combinations and structural arrangements set forth in the appended claims.

The invention will now be described in further detail with reference to the accompanying drawings, in which

Fig. 1 shows a vertical section through one form of an electro-mechanical polishing apparatus according to the invention,

Fig. 2 a plan view of same, and

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Fig. 3 on a larger scale a section through the polishing disc of the apparatus of Figures 1 and 2.

In the drawing, 1 represents a horizontal table carried by a frame, which is not shown in the drawing. The table 1 has a circular hole 2, in which an open-topped vessel 3 is arranged to revolve. The vessel 3 is carried by a vertical shaft 4, which is rotatably mounted in the frame of the apparatus and coupled to suitable driving means not shown in the drawing such as an electric motor and suitable gear mechanism. The vessel 3 has a bottom 5 and an upstanding peripheral wall 6, which is integral with the bottom 5. The peripheral wall 6 has an outer diameter which is smaller than the inner diameter of the hole 2 so that an annular gap is formed between the peripheral wall and the edge of the hole. The bottom 5 of the vessel is constructed with a central raised portion 7, at the middle of which a screw threaded metallic hub member 8 is embedded in such a manner as to have its upper surface flush with that of the raised portion 7. A polishing disc 9 is constructed on its underface with a hub portion 10 and a screw threaded pin 11 depending therefrom. By screwing the pin 11 into the screw threaded hole of the hub member 8, the polishing disc can be rigidly mounted in the vessel in a position slightly above the bottom of the latter.

12 is a polishing cloth which is stretched on the surface of the polishing disc 10 so as to form a smooth and crease-free polishing surface. The nature of this polishing cloth will be selected according to the nature of the work to be carried out. It has been found in many cases where the effect of the mechanical polishing is mainly that of removing films and deposits from a workpiece being polished, that a polishing cloth according to the following specification will be satisfactory:

Zein cloth, plain weave,
Warp: 2/60 metric count with 780 spinning twist and 760 twisting twist staplelength 4 inches, 63 picks per inch,
Weft: As warp.

In the embodiment shown, the polishing cloth is constructed with a doubled over marginal portion along the edge of which there is formed a casing to receive a rubber band or similar annular elastic member 32. The attachment of this polishing cloth to the polishing disc is performed simply by pulling the cloth around the edge of the polishing disc as a sort of elastic cover which will then be stretched taut on the upper surface of the polishing disc by means of the contracting force of the annular elastic member, or alternatively a simple, substantially non-elastic cord may be used which will then be tautened manually. At its centre, the polishing cloth has a hole 15, the edge of which is reinforced by means of a washer 16 of a thermoplastic material located on the inner side of the polishing cloth and united therewith by heat and pressure. The function of the hole 15 is to permit the escape of gases that will be developed at the surface of the polishing disc owing to the electrolytical action and, if not permitted to escape, might cause the polishing cloth to bulge.

Mounted in the hole 2 of the table 1 in a position around and below the rotatable vessel 3 is a stationary shield 17 which is constructed to form an annular trough 18 to receive any electrolyte that may splash over the edge of the vessel 3 in operation. The shield 17 rests on the edge of the hole 2 by means of a flanged portion 19.

A stationary cylindrical ring 20 is mounted around the revolving vessel 3 in such a manner as to extend downwards into the gap between the shield 17 and the vessel 3 and to extend upwards to a level above the upper edge of the peripheral wall 6 of the vessel 3. The ring 20 is

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provided with lugs 21 having threaded holes receiving screws 22 by means of which the ring is supported on the flange 19 of the shield 17 and thereby indirectly on the table 1. The ring 20 carries a bracket 23, which extends inwards from the ring and serves to support a scoop member 24, which extends downwards into the inner space of the vessel 3. The scoop member has a bottom wall 25 in a position adjacent the surface of the polishing cloth 12 and also a vertical upstanding wall 26, by means of which the scoop member is carried from the bracket 23. The upstanding wall 26 of the scoop member is curved in such a manner that the outer end portion of the same is directed substantially tangentially of the circular movement of the vessel while the inner end portion of the upstanding wall 26 is directed substantially towards the axis of rotation of the vessel. The bottom wall 25 is flat and is constructed with a substantially V-shaped notch 27 in its front edge.

It will be understood that when the vessel 3 revolves in the direction of the arrow shown in Figure 2, the liquid will be urged outwards and will tend to form a liquid ring adjacent the peripheral wall 6 as indicated in Figure 1. In fact, if no special measures were taken, the central portion of the polishing cloth would be dried out already at a very moderate speed of rotation. However, in the construction shown, liquid will constantly be scooped from the liquid ring by the scoop member 24 and thereby will be redirected towards the centre of the vessel so that there will be a constant flow of liquid from the centre towards the periphery. In this manner it is possible to keep a sufficient film of liquid on top of the polishing cloth even at relatively high speeds of rotation.

By adjusting the screws 22, the scoop member may be correctly positioned relative to the revolving vessel. In addition to this adjusting function, the ring 20 has the additional purpose of collecting any splashes from the revolving vessel so that the liquid thus collected may flow down into the annular trough 18. In this manner the surroundings are protected from splashes of electrolyte.

Current is supplied to the disc 9, which is effective as cathode in the electrolytic process, by means of a stationary contact 28 mounted in the bracket 23 and engaging a contact ring 29 mounted below the bottom of the vessel 3 and extending radially therefrom so as to form a free contact surface for engagement by the stationary contact 28. The contact ring 29 is connected to the metallic hub member 8 by means of an electric conductor 30. The anode in the electrolytic polishing process is formed by the workpiece itself, to which current is supplied in accordance with well known principles. Figure 1 shows a metallographic sample 31 which is embedded in a thermoplastic material 34 and to which current is supplied from the positive pole of a source through a metal rod 35 which at the same time serves to press the sample against the surface of the polishing cloth. The sample may be held by hand or by a sample holder in the same manner as in conventional mechanical polishing.

The direct current supply described may if desired be replaced by alternating current supply, such as is desirable for certain metallographic purposes.

If a sample slips during the performance of the electro-mechanical polishing, it is important that this should not be thrown out into the liquid ring because it might then give rise to splashing. In the illustrated apparatus, such a sample will in many cases jump into the lap of the scoop member to be caught thereby, but in some cases it might be arrested by the front edge of the bottom wall of this member and might then slide along this front edge into the liquid ring. The provision of the notch 27 in the said front edge serves to stop such outward travel of samples that are arrested already when striking the front edge.

I claim:

1. An apparatus for the electro-mechanical polishing of surfaces comprising a flat open-topped vessel mounted

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for rotation about a substantially vertical axis, said vessel having a bottom and an upstanding peripheral wall integral therewith, a flat disc forming a separate part mounted on the bottom of said vessel for rotation therewith, said disc being coaxially disposed with respect to said vessel and being located in its entirety below the upper edge of said side wall, a polishing cloth stretched on the top surface of said disc independently of said vessel, and means for supplying current to said disc.

2. An apparatus as in claim 1, in which said polishing cloth is in the form of a circular piece of cloth having a doubled over marginal portion provided with contraction means.

3. An apparatus as in claim 2, in which said contraction means is in the form of an annular elastic member in a casing formed along the edge of the polishing cloth.

4. An apparatus as in claim 1, in which cooperating screw means are provided in a central position on the underface of the polishing disc and the bottom of the vessel respectively.

5. An apparatus as in claim 4, and further comprising a contact ring mounted on said vessel and engaged by a stationary current supply contact, and an electric connection between said contact ring and said screw means at the bottom of said vessel.

6. An apparatus as in claim 1, in which scoop means is provided for scooping liquid adjacent the peripheral wall of said vessel and directing same towards the centre of the vessel.

7. An apparatus as in claim 6, in which said scoop means has a flat bottom wall and a curved upstanding wall directed substantially tangentially of the circular movement of the vessel at one end thereof and directed substantially towards the axis of rotation of the vessel at the other end thereof.

8. An apparatus as in claim 7, in which the bottom wall of said scoop is constructed with a substantially V-shaped notch in the front edge thereof.

9. An apparatus as in claim 1, in which said polishing cloth is in the form of a circular piece of cloth having a central hole.

10. An apparatus as in claim 9, in which the portion of said cloth immediately surrounding said hole is reinforced by means of a flat annular washer united with the fabric of the cloth.

11. An apparatus as in claim 10, in which said washer consists of a thermoplastic material.

12. An apparatus for the electro-mechanical polishing of surfaces, comprising a table having a circular hole, a flat open-topped vessel mounted for rotation about a substantially vertical axis coinciding with the axis of said hole, said vessel having a bottom and an upstanding peripheral wall integral therewith, the outer diameter of said peripheral wall being smaller than the diameter of said hole, a flat disc forming a separate part mounted on the bottom of said vessel for rotation therewith, said disc being coaxially disposed with respect to said vessel and being located in its entirety below the upper edge of said side wall, a polishing cloth attached to said disc independently of said vessel, means for supplying current to said disc, a stationary cylindrical supporting ring having a diameter smaller than that of the hole in said table, but larger than the outer diameter of said vessel, said supporting ring being constructed intermediate of its height with lugs having screw-threaded holes to receive screws for supporting said supporting ring in points adjacent the edge of the hole of said table, the supporting ring having such dimensions as to extend downwards below the level of the table and upwards above the level of the upper edge of the peripheral wall of said vessel, a bracket carried by said supporting ring and extending inwards therefrom above the level of the upper edge of said vessel, a scoop member carried by said bracket and extending downwards therefrom into the interior of said vessel, said scoop member being arranged to scoop liquid adjacent

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the peripheral wall of said vessel and to direct same towards the center of the vessel.

13. An apparatus as in claim 12 and further comprising a contact ring mounted on the underface of said vessel in a position so as to extend radially therefrom, a stationary current supply contact mounted in said bracket and engaging the upper surface of the radially extending portion of said contact ring, and an electric connection between said contact ring and said disc.

14. An apparatus as in claim 1 in which the bottom of

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said vessel is constructed with a raised portion at the middle thereof.

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