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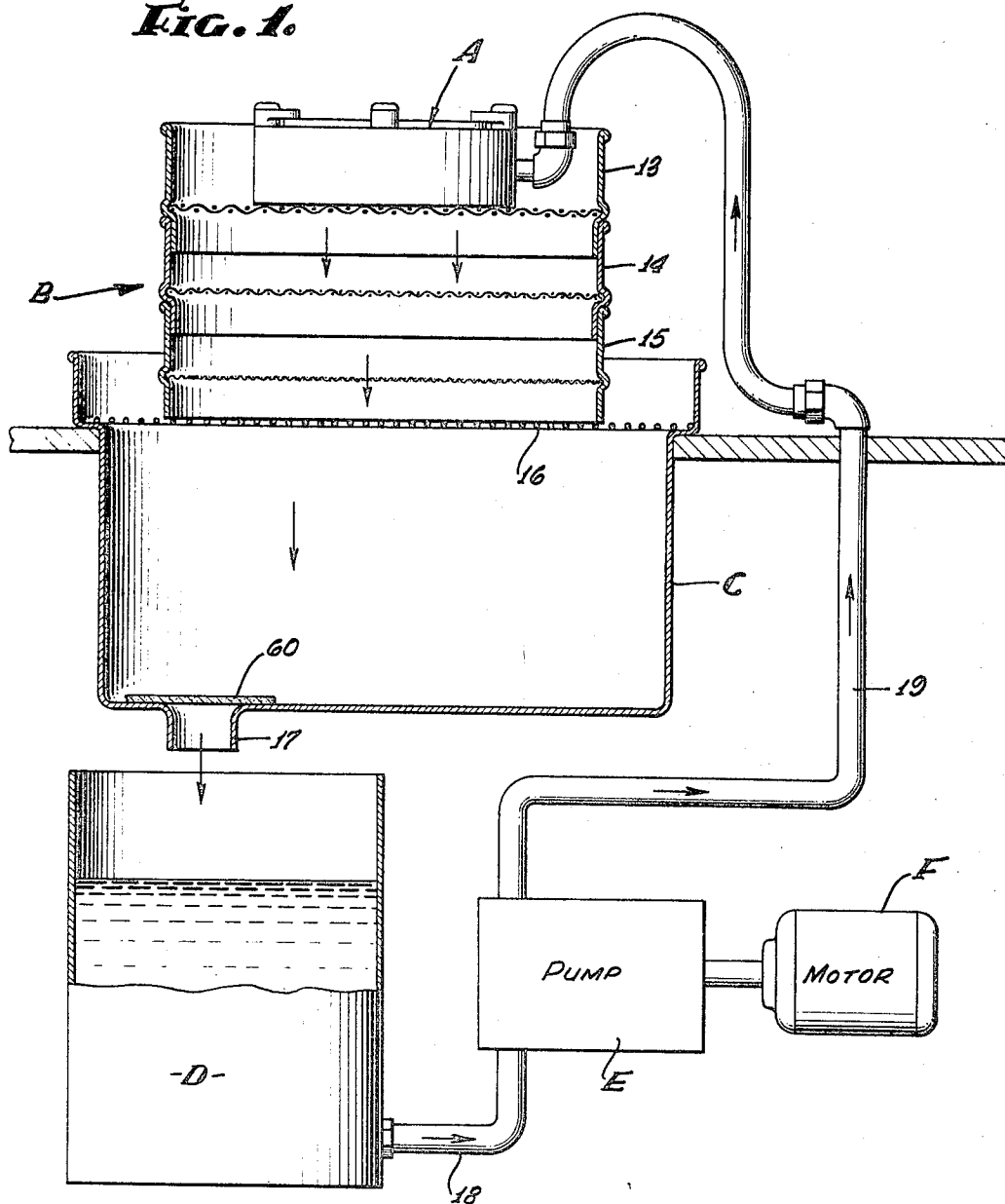
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ROUNDING AND POLISHING APPARATUS FOR CRYSTALLINE CARBON BODIES

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**Fig. 1.**



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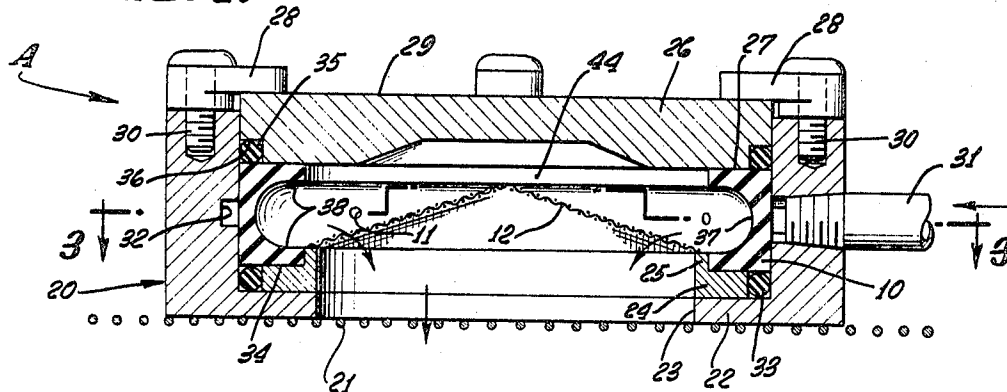
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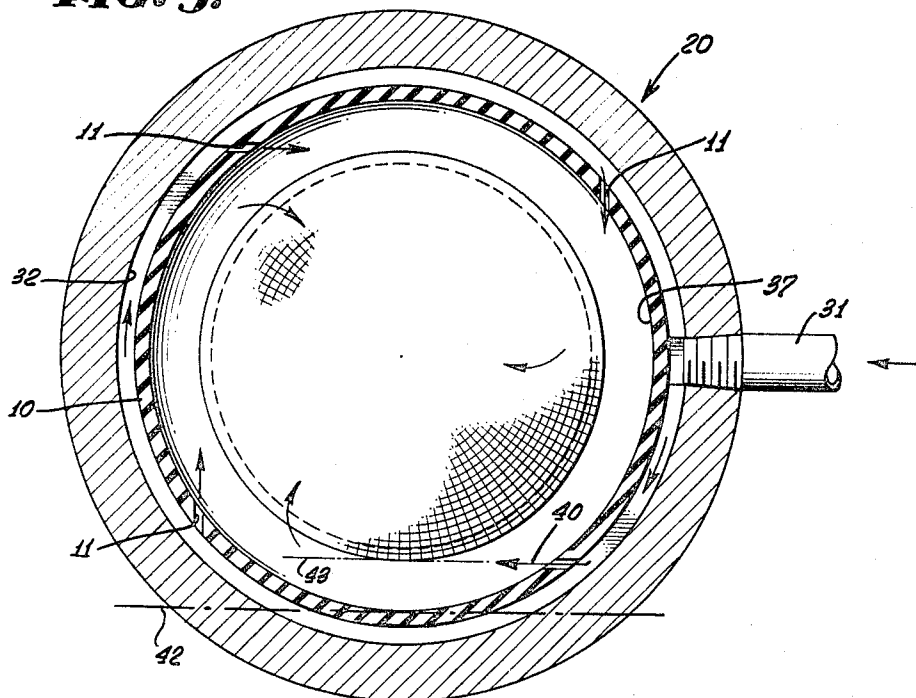
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**FIG. 2.**



**FIG. 3.**



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## ROUNDING AND POLISHING APPARATUS FOR CRYSTALLINE CARBON BODIES

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10 Claims

### ABSTRACT OF THE DISCLOSURE

Apparatus for shaping diamonds, including a toroidal raceway into which a nozzle jets fluid to drive diamonds around the raceway and against one another, the nozzle axis lying in the central plane of the raceway normal to the raceway axis, with the nozzle axis being disposed inwardly of a line parallel to the nozzle axis and tangent to the greatest diameter circle of the toroidal raceway.

The present invention relates to apparatus for rounding and polishing diamonds and similar bodies of crystalline carbon.

Heretofore diamonds used as cutting tool elements have been restored by removing highly friable fractured areas and repolishing them to produce a smooth, low-friction, glass-like surface over their entire peripheries. Polishing equipment heretofore used has been comparatively large and was effective when operating upon a large mass of diamonds, which, for example, would be of about 20,000 to 30,000 carats in weight, the operating period being quite lengthy. Such large masses require a maintenance of very large inventories, with the attendant undesirable and uneconomic aspect of tying up large capital for a substantial period.

An object of the present invention is to provide polishing apparatus for diamonds and the like capable of operating upon relatively small batches of diamonds or stones and producing the desired surface finish thereon, the operating period being of short duration. Accordingly, small inventories of diamonds need be maintained.

Another object of the invention is to provide polishing apparatus for diamonds and the like capable of producing a more uniform attrition on the stones in effecting their rounding and polishing.

A further object of the invention is to provide polishing apparatus for diamonds and the like in which a mass of diamonds is driven around a raceway, and in which the wall of the raceway has a comparatively long life.

An additional object of the invention is to provide polishing apparatus for diamonds and the like capable of driving a charge of diamonds around a raceway in such manner that the diamonds partake of a relatively gentle rolling action around the raceway wall, as distinguished from tumbling and bouncing on the wall.

Yet another object of the invention is to provide polishing apparatus for diamonds and the like capable of rounding and polishing the diamonds, in which the grits and powders produced are automatically removed from the apparatus and separated according to mesh size.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. Such form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is

not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIG. 1 is a somewhat diagrammatic view of a system for reconditioning diamonds, embodying a diamond polishing apparatus;

FIG. 2 is a vertical section through the diamond rounding and polishing apparatus;

FIG. 3 is a cross section taken along the lines 3—3 on FIG. 2.

A suitable charge of used diamonds is placed in the rounding and polishing apparatus A, and such charge is driven around a raceway portion 10 of the apparatus by liquid discharged from a nozzle or orifice 11, the diamonds or stones engaging one another and the wall of the raceway in effecting rounding and polishing of the diamonds. The grits and powders removed from a number of diamonds pass through a sieve or screen 12 and into a stack B of sieves 13, 14, 15 that support the rounding and polishing apparatus A, where the grits are classified according to particle size, which may also be true of the powders. The lowermost sieve 15 rests upon a supporting screen 16 of relatively large mesh through which the liquid and powders can pass downwardly into a receiving tank C, the liquid discharging from the lower tank outlet 17 into a reservoir D. A pump E driven by a motor F draws the liquid through a suction line 18 and forces it through a discharge line 19 leading back into the rounding and polishing apparatus A.

As disclosed most clearly in FIGS. 2 and 3, the rounding and polishing apparatus includes an outer body or housing 20 which is capable of resting upon the uppermost screen 21 of the uppermost sieve 13, this body having an inwardly directed flange portion 22 providing a large diameter lower opening 23 through the body. A screen carrier 24 in the form of a ring rests upon the flange 22, a suitable conical sieve or screen 12 being attached, as by solder, to the carrier 24. The raceway 10 is disposed within the body 20, its lower end resting upon the screen carrier 24 and surrounding an upwardly extending portion 25 of the latter. A cover 26 extends within the body or housing and bears upon the upper surface 27 of the raceway, the cover being secured in place by a plurality of removable clamps 28 engaging its upper surface 29 and secured to the body or housing by screws 30. The cover may, if desired, be made of an acrylic resin so that the interior of the apparatus is visible.

Fluid from the discharge line 19 is conducted to an inlet pipe 31 threadedly, or otherwise suitably secured, to the body 20 of the apparatus, and communicating with an internal circumferential groove 32 extending around the body of the apparatus. Leakage of fluid between the raceway 10 and the body 20 is prevented by a lower gasket 33 surrounding the screen carrier 24 and resting upon the body flange 22, the lower surface 34 of the raceway also engaging this gasket. An upper gasket 35 is disposed in a circumferential recess 36 in the cover 26, engaging the upper surface 27 of the raceway and wall of the body 20.

The inner wall 37 of the raceway is of toroidal form, a cross section of the wall being semicircular. The upper and lower ends of the toroidal wall 37 merge into opposed upper and lower flat surfaces 38.

The liquid from the inlet pipe 31 and internal groove 32 can pass through one or more orifices or nozzles 11 disposed in a central horizontal plane of the toroidal raceway 37 and into the interior of the latter. The centerline 40 of each nozzle is disposed inwardly of a tangent 42 to the maximum circle of the toroidal

raceway 37, and preferably does not extend inwardly of a tangent 43 to the innermost diameter of the raceway. It is found that such disposition of a nozzle 11 results in more effective operation of the apparatus in rounding and polishing stones disposed within the raceway.

The raceway 10 can be made of several suitable materials, as, for example, rubber, metal, or a carbide, such as tungsten carbide. The liquid used in the apparatus can be water, or it may be a mixture of water and a detergent, a soluble oil, or an emulsion of oil and water.

In the use of the apparatus, a charge of diamonds of random size is placed through the upper raceway opening 44 into the raceway after the cover 26 has been removed, and the cover is then replaced and secured in position by the clamps 28 and screws 30. The conical screen 12 deflects the stones or diamonds outwardly toward the raceway wall 37. The apparatus A is then placed upon the uppermost screen 21 and is connected to the discharge line 19 leading from the pump E. Liquid at the required pressure, which, for example, may be about 80 p.s.i., enters the internal groove 32 of the body and passes through a nozzle 11 (or several circumferentially spaced nozzles, if they are in the apparatus) to the interior of the raceway, the liquid jet issuing therefrom driving the stones around the raceway wall 37. The stones, tumbling against one another as they move around the raceway wall, effects their attrition against one another to round them and polish their surfaces. Because of the fact that the jet is nontangent to the outermost periphery of the raceway wall 37, a smooth flow of stones in the fluid stream around the raceway is obtained. The stones do not bounce and tumble against the raceway wall 37, which would have the effect of rapidly wearing the wall and shortening the raceway life.

Because of the toridal form of the raceway 37, the stones are confined in a smaller area at its extreme circumference by centrifugal force as they revolve around the axis of the raceway 10, which brings the stones into steady rubbing contact with each other to improve the attrition rate over the entire surface of each stone. In other words, there is a maximum concentration of the stones against one another because of the form of the raceway, which brings the stones into maximum contact with one another and enables the rounding and polishing action on the stones to occur at a faster rate.

The apparatus A is capable of operating effectively with relatively small charges of diamonds. As an example, good results have been achieved with a charge of from 100 to 150 carats of diamonds. With liquid at a pressure of 80 p.s.i. entering the body for about 20 minutes, which was then reduced to about 60 p.s.i. for an additional 20 minutes, very good results were achieved. Proper rounding and polishing of the stones was obtained, with about 92% to 96% of the original carat weight of stones being obtained as settable stones, 1% to about 2% of grits and powders being recovered, and there being a loss from about 1% to 4%.

The grits and powders produced pass with the liquid inwardly and through the conical sieve or screen 12, which is of too small a mesh to allow any sizeable stones from being removed from the apparatus. The grits and powders pass downwardly through the stacked sieves 13, 14, 15 that decrease progressively in mesh size so as to separate and classify the grits and powders on their several screens. The liquid and micron powders drop through the lowermost supporting screen 16 into the receiving tank C, the liquid passing through a filter 60 at the outlet 17 and dropping into the liquid reservoir D. Micron powders are prevented from passing through the outlet by the filter 60, and such powders can be recovered in any suitable manner as, for example, through evaporation of the liquid in which they are contained.

From the drawings and the foregoing description of the apparatus, it is apparent that it is capable of round-

ing and polishing relatively small batches of diamonds or stones in a comparatively short period of time. A more uniform attrition is attained on the stones, and the particular concave or toroidal shape of the raceway wall 37 results in its considerably greater life.

I claim:

1. In apparatus for shaping diamonds and the like: a housing having a circumferential raceway therein and adapted to contain the diamonds; said raceway having a concave inner wall facing toward the raceway axis; and one or more nozzle means for jetting fluid into said raceway to propel the diamonds around said inner wall, the axis of each of said one or more nozzle means lying in the central plane of said raceway wall normal to said raceway axis and passing through that portion of said inner wall which is of greatest diameter, each nozzle means axis and the entire jet of fluid issuing from each nozzle means being spaced from and disposed substantially inwardly of a line parallel to said nozzle means axis and tangent to the outermost surface of said inner wall, said tangent being a straight line touching the maximum diameter circle of said inner wall at a point and being normal to a radius of said maximum diameter circle extending to such point, said one or more nozzle means lying in said central plane constituting the sole instrumentality from which fluid jets into said raceway, whereby the jetting fluid drives the diamonds around said raceway and toward the outermost portion of said concave inner wall to concentrate the diamonds in said outermost portion.

2. In apparatus for shaping diamonds and the like: a housing having a circumferential raceway therein and adapted to contain the diamonds, said raceway having a generally toroidally-shaped inner wall facing toward the raceway axis; and one or more nozzle means for jetting fluid into said raceway to propel the diamonds around said inner wall, the axis of each of said one or more nozzle means lying in the central plane of said raceway wall normal to said raceway axis and passing through that portion of said inner wall which is of greatest diameter, each nozzle means axis and the entire jet of fluid issuing from each nozzle means being spaced from and disposed substantially inwardly of a line parallel to said nozzle means axis and tangent to the greatest diameter circle of said toroidally-shaped inner wall, said tangent being a straight line touching the maximum diameter circle of said inner wall at a point and being normal to a radius of said maximum diameter circle extending to such point, said one or more nozzle means lying in said central plane constituting the sole instrumentality from which fluid jets into said raceway, whereby the jetting fluid drives the diamonds around said raceway and toward the outermost portion of said toroidally-shaped inner wall to concentrate the diamonds in said outermost portion.

3. In apparatus for shaping diamonds and the like: a generally horizontally disposed housing having a circumferential raceway therein and adapted to contain diamonds, said raceway having a concave inner wall facing toward the generally vertical raceway axis; means for jetting fluid into said raceway to propel the diamonds around said inner wall; said housing having an outlet for fluid from the raceway inwardly of the raceway; and a screen tapering upwardly from the lower portion of said raceway toward the axis of said raceway through which fluid from the raceway can pass to said outlet and for gravitationally directing the diamonds outwardly toward the raceway.

4. In apparatus for shaping diamonds and the like: a generally horizontally disposed housing having a circumferential raceway therein and adapted to contain the diamonds, said raceway having a generally toroidally-shaped inner wall facing toward the generally vertical raceway axis; means for jetting fluid into said raceway to propel the diamonds around said inner wall; said housing having

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an outlet for fluid from the raceway inwardly of the raceway; and a screen tapering upwardly from the lower portion of said raceway toward the axis of said raceway through which fluid from the raceway can pass to said outlet and for gravitationally directing the diamonds outwardly toward said raceway.

5 5. In apparatus for shaping diamonds and the like: a generally horizontally disposed housing having a circumferential raceway therein and adapted to contain the diamonds; said raceway having a concave inner wall facing toward the generally vertical raceway axis; means for jetting fluid into said raceway to propel the diamonds around said inner wall; and deflector means in said housing tapering upwardly from a location closely contiguous the lower portion of said raceway toward the axis of said raceway for gravitationally directing the diamonds outwardly toward and to the raceway, the upper end of said deflector means being substantially above the lower half of said inner wall.

10 6. In apparatus for shaping diamonds and the like: a generally horizontally disposed housing having a circumferential raceway therein and adapted to contain the diamonds, said raceway having an inner wall facing toward the generally vertical raceway axis; means for jetting fluid into said raceway to propel the diamonds around said inner wall; and deflector means in said housing tapering upwardly from a location closely contiguous the lower portion of said raceway toward the axis of said raceway for gravitationally directing the diamonds outwardly toward and to the raceway, the upper end of said deflector means being substantially above the lower half of said inner wall.

15 7. In apparatus for shaping diamonds and the like: a generally horizontally disposed housing having a circumferential raceway therein, an upper entry into said raceway through which diamonds can be introduced into the raceway, and a lower outlet from said raceway inwardly of said raceway; said raceway having a concave inner wall facing toward the generally vertical raceway axis; means for jetting fluid into said raceway to propel the diamonds around said inner wall; and a screen in said housing tapering upwardly from the lower portion of said raceway toward the axis of said raceway through which fluid from the raceway can pass to said outlet and for gravitationally directing the diamonds outwardly toward the raceway.

20 8. In apparatus for shaping diamonds and the like: a generally horizontally disposed housing having a circumferential raceway therein, an upper entry into said raceway through which diamonds can be introduced, and a lower outlet from said raceway; said raceway having a generally toroidally-shaped inner wall facing toward the generally vertical raceway axis; means for jetting fluid into said raceway to propel the diamonds around said inner wall; and a screen tapering upwardly from the lower portion of said raceway toward the axis of said

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raceway through which fluid from the raceway can pass to said outlet and for gravitationally directing the diamonds laterally outwardly toward the raceway.

9. In apparatus for shaping diamonds and the like: a generally horizontally disposed housing having a circumferential raceway therein, an upper entry into said raceway through which diamonds can be introduced, and a lower outlet from said raceway; said raceway having a generally toroidally-shaped inner wall facing toward the generally vertical raceway axis; nozzle means for jetting fluid into said raceway to propel the diamonds around said inner wall, the axis of said nozzle means being disposed inwardly of a line parallel to said nozzle means axis and tangent to the greatest diameter circle of said toroidally-shaped wall; and a screen tapering upwardly from the lower portion of said raceway toward the axis of said raceway through which fluid from the raceway can pass to said outlet and for gravitationally directing the diamonds outwardly toward the raceway.

10 10. In apparatus for shaping diamonds and the like: a generally horizontally disposed housing having a circumferential raceway therein, an upper entry into said raceway through which diamonds can be introduced, and a lower outlet from said raceway; said raceway having a generally toroidally-shaped inner wall facing toward the generally vertical raceway axis; one or more nozzle means for jetting fluid into said raceway to propel the diamonds around said inner wall, the axis of each of said one or more nozzle means lying in the central plane of said raceway wall normal to the raceway axis, the axis of each of said nozzle means being disposed inwardly of a line parallel to said nozzle means axis and tangent to the greatest diameter circle of said toroidally-shaped wall; and a screen tapering upwardly from the lower portion of said raceway toward the axis of said raceway through which fluid from the raceway can pass to said outlet and for gravitationally directing the diamonds outwardly toward the raceway.

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