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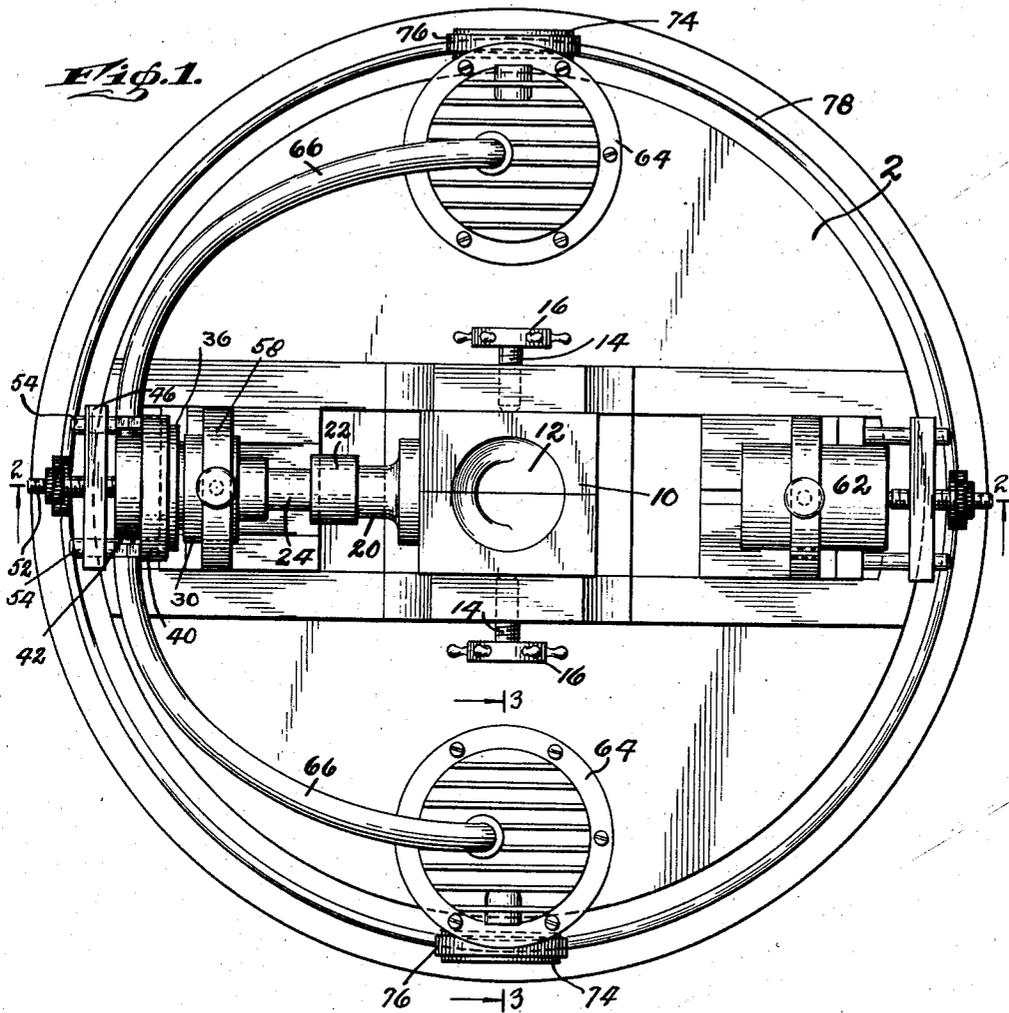
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2,257,475

APPARATUS FOR THE MANUFACTURE OF DIAMOND CUTTING TOOLS

Filed April 26, 1941

2 Sheets-Sheet 1



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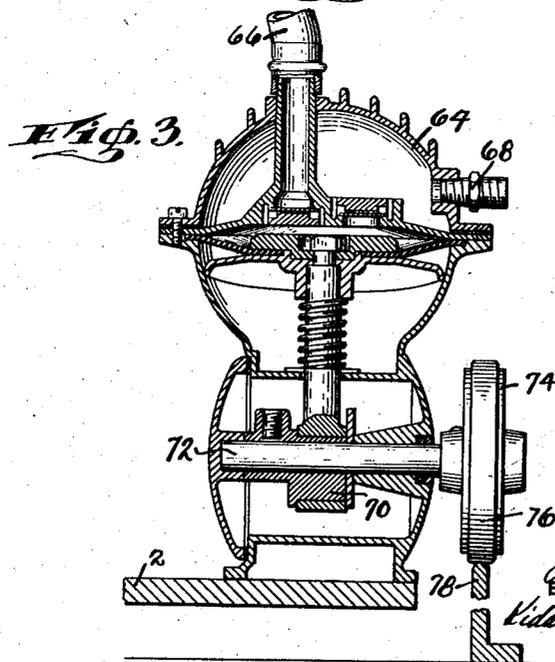
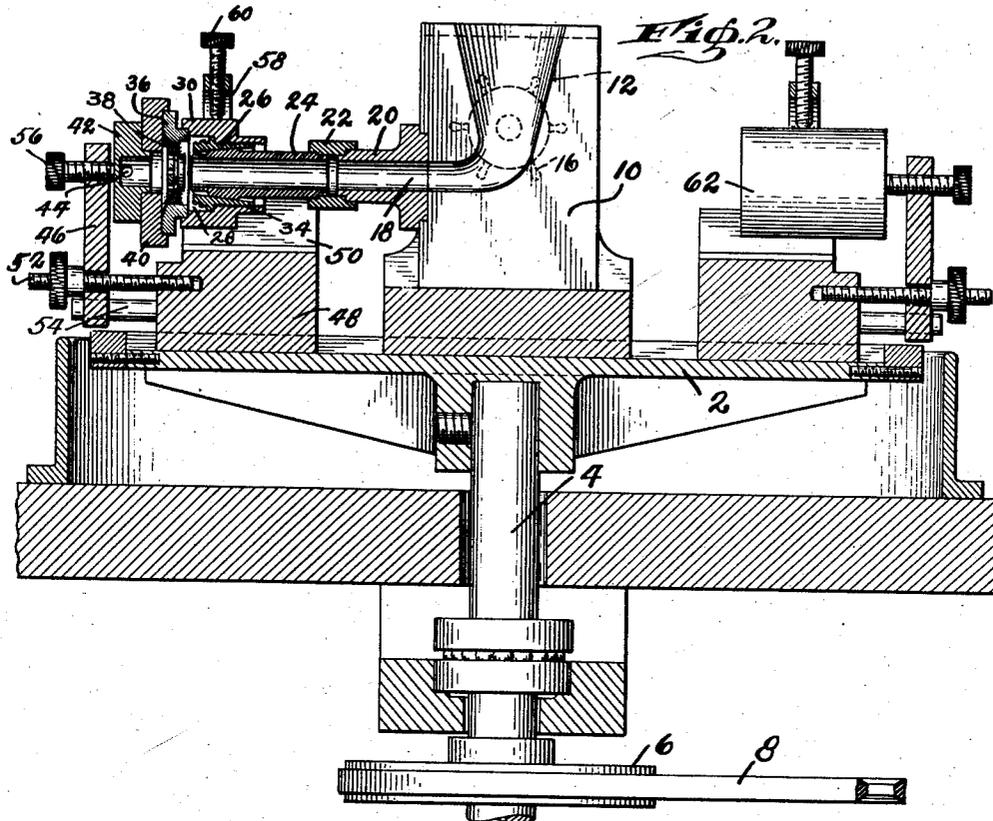
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# UNITED STATES PATENT OFFICE

2,257,475

## APPARATUS FOR THE MANUFACTURE OF DIAMOND CUTTING TOOLS

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Application April 26, 1941, Serial No. 390,475

4 Claims. (Cl. 22-65)

This invention is directed to an improved apparatus which is particularly adapted for the casting of diamond core bits in which commercial diamonds are held in a metal matrix and function as the cutting or attrition medium.

The apparatus operates on the centrifugal principle, that is to say, the molten metal which ultimately is to constitute the matrix for the diamonds is poured into the center of the rotating apparatus and thrown by centrifugal force outwardly away from the axis of rotation about the diamonds so as to embed the same in the metal.

It is quite important, to obtain the best in bits, not only to have the diamonds properly embedded in the matrix but to have the matrix free of blow-holes and other imperfections caused by poor casting.

It is to be understood, of course, that in tools of the bit type the diamonds are initially positioned in the position which they are to occupy in the finished tool, and in the practice of my invention they are temporarily anchored in this position by a suitable adhesive, for example; when the equipment is rotated centrifugal force will retain them in this position throughout the instant required for the molten metal to set in the casting operation. However, in the casting operation gases are generated in the mold and the present equipment provides for not only exhausting these gases but for exhausting the air from the mold. By withdrawing the air of the mold as well as the gases generated by the molten metal itself and by employing centrifugal casting, air pockets and imperfect castings are avoided.

In the accompanying drawings:

Fig. 1 is a plan view of an apparatus suitable for the practice of my invention;

Fig. 2 is a section on the line 2-2 of Fig. 3; and

Fig. 3 is a section taken on the line 3-3 of Fig. 1.

Referring to the drawings in detail: 2 designates a turntable which is mounted on a vertically extending drive shaft 4, driven through the medium of pulley 6 and belt 8 from any suitable source of power.

Mounted at the center of the turntable 2 is a split block 10 which may be held in position on the turntable by any suitable means, this block, however, essentially being provided with a vertically extending funnel shaped cavity 12. This cavity constitutes the pouring cavity of the apparatus into which the molten metal is poured during the casting operation.

In the construction, as illustrated, the two

parts of the block 10 are held in position by screws 14 operated by small hand wheels 16. The lower part of the funnel shaped pouring cavity 12 extends horizontally, as viewed in Fig. 2, as shown at 18, in alignment with a horizontally extending sleeve 20, the end of which is set into the side of the block 10.

Aligned with the sleeve 20 and secured thereto by a split yoke 22 is a removable guide tube 24, the bore of this guide tube 24 being in line with the bore of the sleeve 20.

The end of the guide tube 24 remote from the sleeve 20 receives a bit coupling 26. This coupling is preformed, is usually of steel and the bit is to be cast on the end thereof.

The bit coupling and guide tube extend into the mold cavity 28 of the mold member 30, the bit coupling being threaded into the mold member 30 as illustrated at 34.

The outer end of the mold member 30 is provided with an annular depression for the reception of a removable die plate 36. This die plate is provided with openings 38 for the reception of the diamonds which are to be set in the face of the diamond core bits. These openings 38 extend completely through the die plate.

The die plate 36 carries an end plate 40 and this plate 40 carries a plug 42 which extends into the end plate 40 and is provided with a port 44. At this point it is to be noted that this port 44 is in communication with the mold cavity 28 through the diamond-receiving openings 38 in the die plate 36.

The die plate 36, end plate 40 and the plug 42 are clamped in position against the end of the mold member 30 by a clamp plate 46. This plate is connected to a block 48 mounted on the turntable 2, this block being provided with a cradle 50 which receives and supports the mold member 30.

The clamp plate may be adjusted by a bolt 52, the plate 46 sliding away from or toward the block 48 on pins 54.

Threaded into the upper end of the clamp plate 46 is a bolt 56, the inner end of which bears against the plug 42. By proper adjustment of the bolts 52 and 56 it will be evident that the parts may all be clamped securely in position.

In addition to the clamping mechanism just described I provide a yoke 58 for holding the mold member 30 in the cradle 50. This yoke 58 is provided with a clamping screw 60 which contacts the mold member 30 directly.

At the opposite side of the turntable 2 from the equipment just described, I provide counter-

weighting mechanism which may take any suitable form and has been designated 62.

It is one of the primary objects of this invention to provide means for exhausting the mold cavity 28 so as to eliminate imperfections in the finished casting or matrix. To this end, therefore, I mount a pair of diaphragm exhaust pumps 64 on the turntable 2 at or adjacent the periphery of the turntable, and preferably diametrically opposite each other, as viewed in Fig. 1.

Each of these pumps is provided with suction 66 and exhaust 68. Each pump is driven through a crank 70. The drive shaft for each pump is designated 72 and it will be seen that each of these shafts is provided with a drive pulley 74 which is preferably rubber tired, as indicated at 76.

78 designates a fixed circular track which is concentric with the turntable 2, the pulleys 74 riding on this track.

The intake 66 for each of the exhaust pumps 64 is connected to the ported plug 42 which, as above pointed out, is set into the end plate 40.

It will be understood by those skilled in this art that the openings 38 in the die plate 36 are arranged in a predetermined pattern depending upon the desired arrangement of the diamonds in the end of the core bit.

In operating my apparatus, but before the die plate 36 is placed in position in the mold, the diamonds are disposed in the openings 38 by hand. After the diamonds have been so disposed or positioned they are anchored temporarily in place in the die plate by any suitable adhesive. Inasmuch as the stones are thus secured to the die plate, it will be obvious that in production these die plates with the stones anchored therein may be made up in advance.

The die plate with the stones anchored thereto is then placed in the mold, as illustrated in Fig. 2, and the parts clamped in position. The machine is then started in operation, that is, the turntable 2 is rotated, and as the mold revolves about the axis of rotation of the turntable the exhaust pumps 64 will be driven through the pulleys 74 so as to exhaust the mold cavity 30, the air and gases passing out of the mold cavity around the stones of the die plate. With the turntable rotating and the pumps operating a charge of molten metal is poured into the cavity 12 and is immediately thrown outwardly by centrifugal action to the outer end of the guide tube 24 and into the mold cavity 28 about the stones in the mold bottom or die plate 36 and about the end of the bit coupling 26.

The metal is chilled practically instantly upon striking the metal in the mold. Inasmuch as the pumps 64 are working throughout this whole operation, it will be quite obvious that not only is the mold cavity 28 exhausted of air in advance of the casting operation but any gases developed during the actual casting operation will likewise be exhausted and consequently a dense, perfect matrix is assured.

It is to be distinctly understood that the pumps 64 do not retain the stones in the perforations in the die plate 36 during the casting operation, nor are they employed for this purpose, there being no tendency for the stones to become displaced during the casting operation, inasmuch as the stones initially are held in these openings by the adhesive above referred to and held in place during the casting operation by centrifugal action. It should be noted, too, that the casting metal actually has no tendency to displace the

diamonds during the casting operation because the metal is flowing generally toward and about the diamonds and not at any pronounced angle thereto so that the effect of the molten metal being thrown outwardly away from the center or axis of rotation of the turntable 2 is to prevent the diamonds from becoming displaced or from "floating."

The sole purpose and function of the pumps 64 is to exhaust the mold cavity 28 as far as possible and to withdraw any gases which are formed during the casting operation. By employing two pumps operating alternately a fairly constant suction is produced.

I have found that this equipment produces cast bits of great excellence and without the exercise of a great deal of skill on the part of the operator. The diamonds are not disarranged during the casting operation, the metal of the matrix is properly distributed about the diamonds so that they are properly set in the matrix and the matrix itself is uniformly free of blowholes, gas pockets and other imperfections.

It is to be understood that changes may be made in the details of construction and arrangement of parts above described without departing from the spirit and scope of my invention.

What I claim is:

1. In molding apparatus wherein the mold is mounted on a turntable rotatable on a vertical axis and wherein a die plate standing in a vertical plane constitutes the mold bottom in which cutting stones are supported in a predetermined pattern, suction means for exhausting the mold cavity comprising a pump affixed to the turntable and stationary means engaged by the pump so that as the turntable is rotated the pump will be driven.

2. In molding apparatus wherein the mold is mounted on a turntable rotatable on a vertical axis and wherein a die plate standing in a vertical plane constitutes the mold bottom in which cutting stones are supported in a predetermined pattern, suction means for exhausting the mold cavity comprising a pump mounted on the turntable and a cooperating stationary track whereby as the turntable is rotated the pump will be driven.

3. In molding apparatus wherein the mold is mounted on a turntable rotatable on a vertical axis and wherein a die plate standing in a vertical plane constitutes the mold bottom in which cutting stones are supported in a predetermined pattern, suction means for exhausting the mold cavity comprising an exhaust pump mounted on the turntable, a drive shaft for the pump carrying a pulley, and a fixed track upon which the pulley rides as the turntable rotates thereby to drive the pulley.

4. In centrifugal molding apparatus wherein the mold is mounted off center upon a turntable rotatable about a vertical axis, and the bottom of the mold is composed of a vertically extending die plate to the face of which cutting stones are initially held by a suitable adhesive and during the casting operation by centrifugal force and the impact of the metal being cast about, the stones, an exhaust port to the rear of the die plate and an exhaust pump carried by the turntable and connected to said port, said pump being driven by the turntable through a drive pulley carried by the pump and a fixed track upon which the pulley rides.

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