Nov. 17, 1959 S. A. BOETTCHER 2,912,802

LAPPING MACHINE

Original Filed June 28, 1956 3 Sheets-Sheet 1

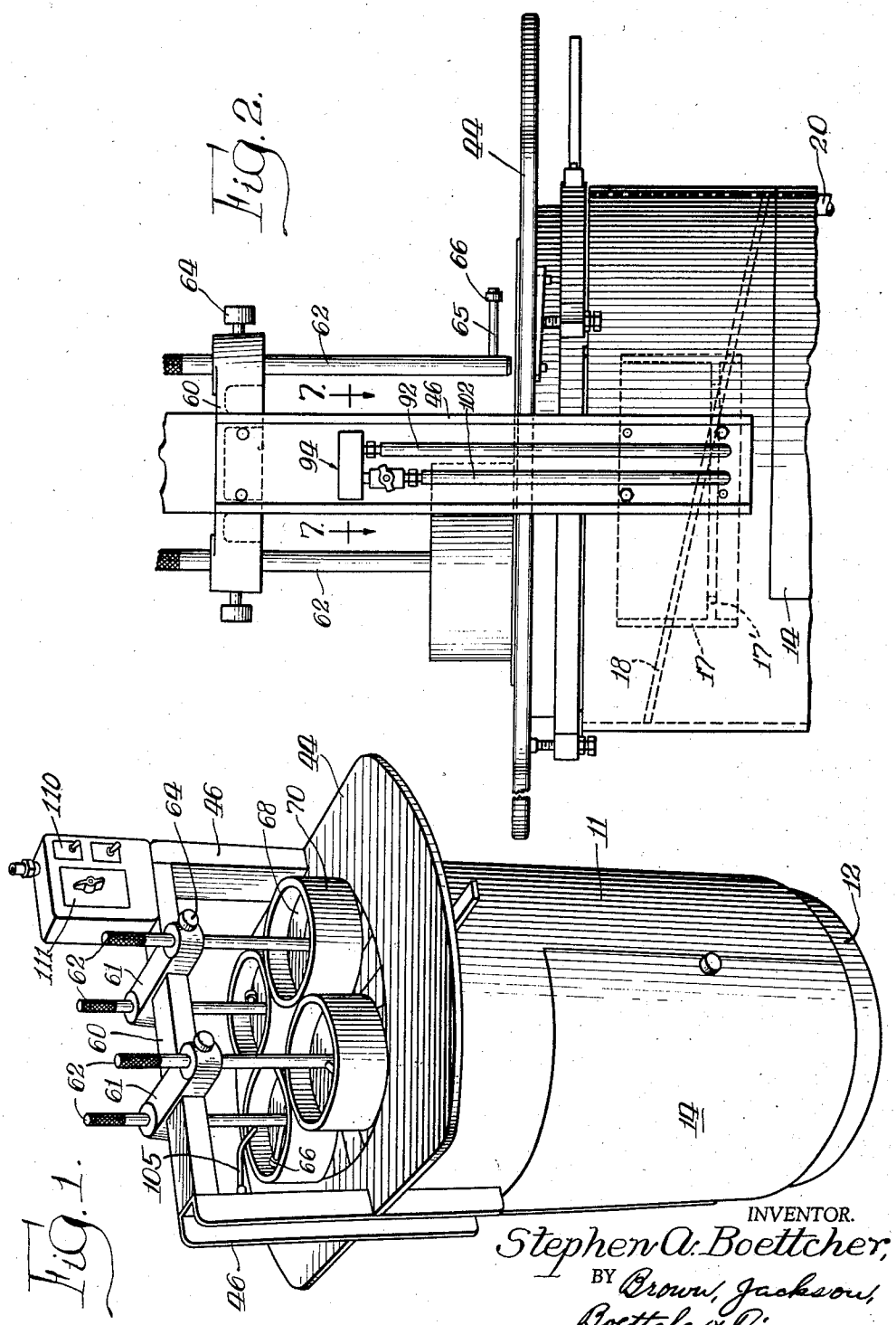

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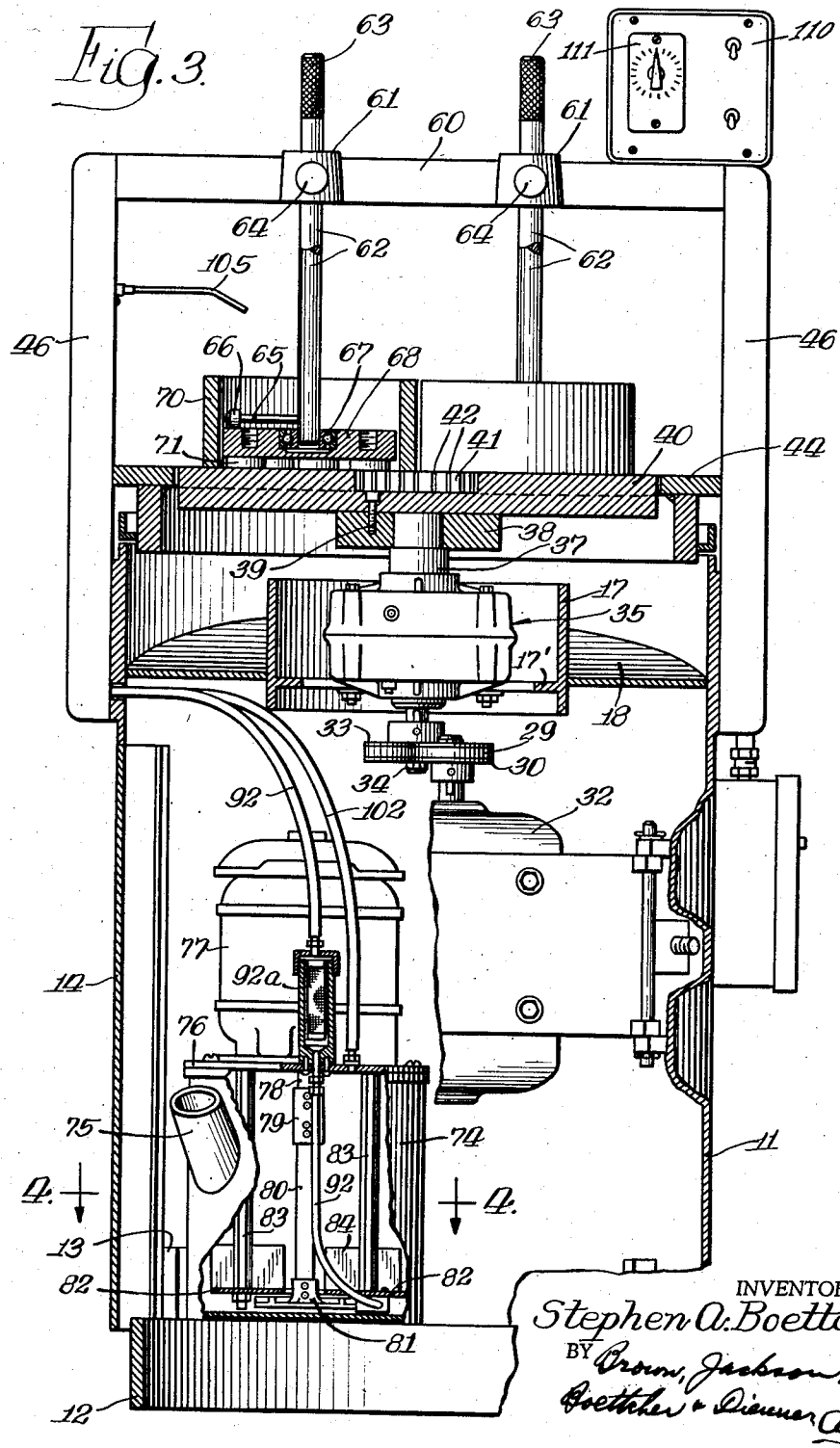
Fig. 3.



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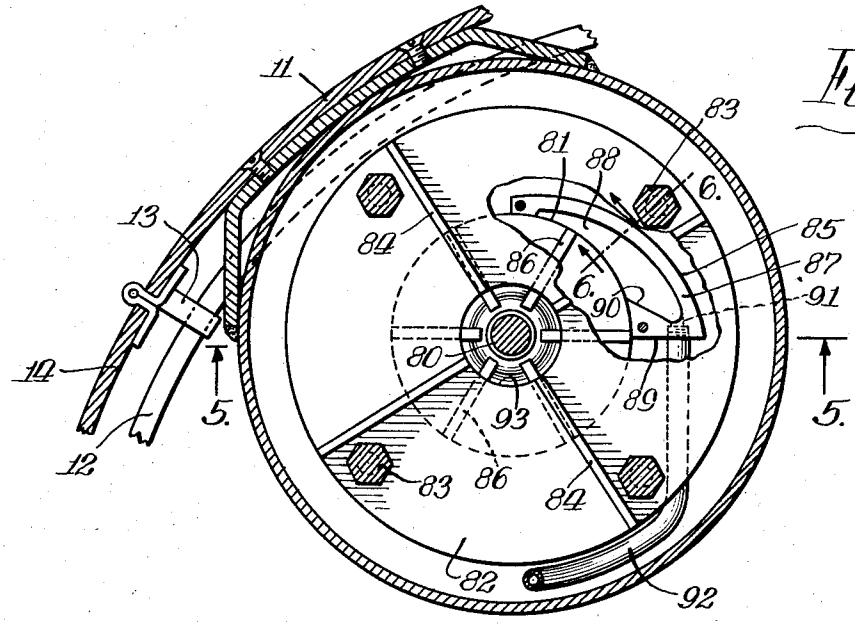


Fig. 4.

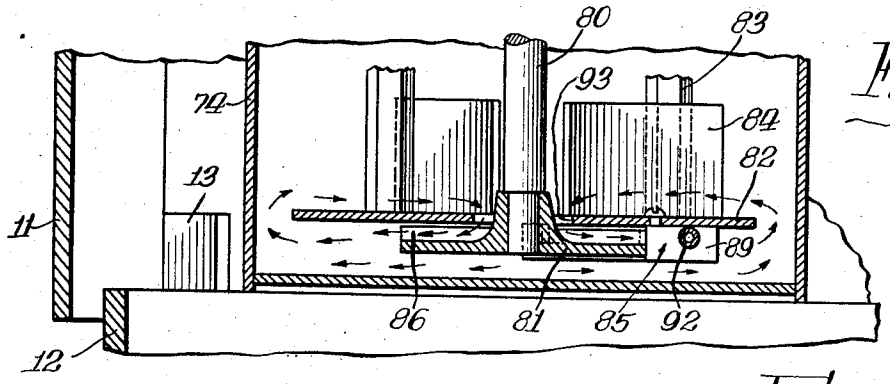


Fig. 5.

Fig. 7.

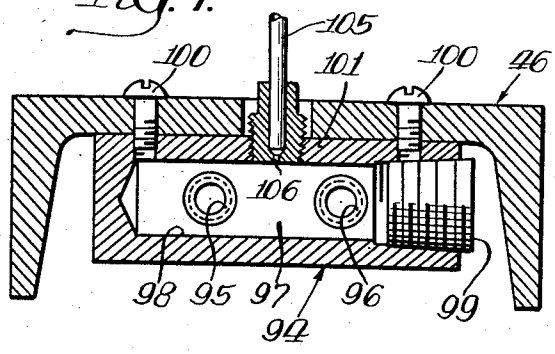
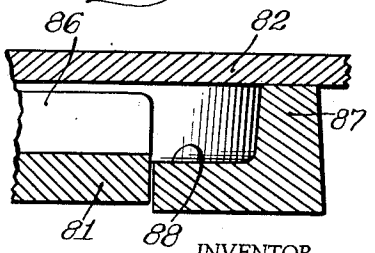


Fig. 6.



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2,912,802

LAPPING MACHINE

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Original application June 28, 1956, Serial No. 594,416. Divided and this application July 10, 1957, Serial No. 675,510

4 Claims. (Cl. 51—263)

My invention relates to lapping machines and the like, wherein a fluid carrier and abrasive mixture is fed to the operating surface, and its purpose is to provide means for placing the abrasive particles in temporary fairly uniform distribution in the carrier and feeding the mixture to the operating surface.

This application is a division of my co-pending application, Serial No. 594,416, filed June 28, 1956.

A lapping machine embodying my invention is illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of the machine;

Figure 2 is a partial side elevational view, showing the upper portions of the machine illustrated in Figure 1;

Figure 3 is a vertical cross-sectional view taken substantially at the vertical center line of the machine;

Figure 4 is a partial cross-sectional view taken substantially at line 4—4 of Figure 3, and on a somewhat larger scale;

Figure 5 is a cross-sectional view taken substantially at line 5—5 of Figure 4 and looking in the direction of the arrows;

Figure 6 is a partial cross-sectional view, on a larger scale, taken at line 6—6 of Figure 4 and looking in the direction of the arrows; and

Figure 7 is a cross-sectional view taken substantially on the line 7—7 of Figure 2, and on a somewhat larger scale.

As seen in Figures 1, 2 and 3, the machine has a substantially cylindrical pedestal 11 supported by an underlying concentrically related base ring 12. The pedestal 11 has an access door 14, making the interior accessible to the operator.

As shown in Figures 2 and 3, a cylindrical collar 17 is disposed within the upper end of pedestal 11; the same being mounted slightly off center with the longitudinal axis of the pedestal by means of an inclined, elliptically-shaped drip pan 18 securely welded at its outer periphery to the inside surface of the pedestal 11 and at its inner periphery to the outside surface of the collar 17. Pan 18 is provided for the purpose of catching abrasive and carrier mixture used in the lapping operation. A vertical down-spout 20 leads from the lower end of the drip pan 18 to convey the mixture to a removable tank (not shown) within the pedestal housing 11.

Mounted within the pedestal 11 is a main drive motor 32, operatively connected by means of sheave wheels 30 and 33 and a V-belt 29 with shaft 34 of a conventional gear reducer unit 35.

The gear reducer unit 35 is mounted within the ring 17, resting on and bolted to the internal flange 17', with the output shaft 37 thereof carrying a hub member 38 keyed or otherwise rigidly fixed to the shaft 37 for rotation therewith. Hub 38, in turn, has secured thereto, as by screw means 39, rotatable lapping wheel or plate 40, supporting the same.

The lapping wheel 40 is a circular wear-resisting metallic alloy disc with a central well-bore 41, providing

an annular lapping area. A plurality of radial slots 42, 42 are cut downwardly to the depth of the well-bore from the upper lapping surface of the lap wheel, according to conventional practice, to trap and carry abrasive oil mixture fed to the lapping wheel for discharge to the drip pan 18.

Surrounding the lapping wheel 40 is a staging table 44, from which work pieces can be moved onto the lapping surface and to which they can be returned when the lapping operation is completed.

Vertical channel columns 46, 46 are mounted in upright position at diametrically opposite sides of the pedestal housing 11, joined at the top by bridge member 60, which is provided with two intermediary transverse arms 61, 61. At the outer end of each of the arms 61, 61, is a vertical bore for receiving a vertical spindle 62; there being four such spindles in the machine illustrated in the drawings. Each of the spindles 62 has a knurled upper end 63 for manual grasping and each spindle can be held by a set screw 64.

Near the lower end, each spindle 62 is provided with a radially extending arm 65, at the outer end of which a roller 66 is mounted. The lower end of each spindle takes into a ball bearing 67 in the center of a circular weight plate 68, the spindle thus serving to define the axis of rotation of such weight plate.

These weight plates fit, with slight clearance, within the truing-retainer rings 70. It will be noted, in Figure 3, for example, that work pieces, indicated at 71, are arranged beneath the weight plates 68 and are positioned freely within the confines of the rings 70. Each spindle 62 is therefore associated with a weight plate and a truing-retainer ring, such elements cooperating in the lapping of a plurality of work pieces confined by the ring, with a vertical positioning of the spindle, as explained above, serving to regulate the amount and position of the pressure, other than that imposed by gravitational weight of the weight plate, at which the work pieces engage the surface of the lapping wheel. In operation, each ring and associated weight plate rotate about the axis defined by the associated spindle, altogether controllably serving accurately to lap the lower surfaces of the work pieces and continuously to dress the lapping wheel for maintenance of its planar condition.

As shown in Figure 3, a cylindrical tank 74 is suitably mounted within the pedestal 11. Such tank constitutes a sump well for the novel abrasive and carrier mixture circulating means of the present invention. The tank 74 is equipped with a filling spout 75 and is closed off at its top by a plate 76 upon which is mounted a pump motor 77 having an armature shaft 78 which is coupled, as at 79, to an extended impeller shaft 80. At the lower end of the impeller shaft 80 is mounted a vane type centrifugal impeller 81 which is disposed beneath a baffle plate 82 carried by vertical rods 83 depending from the cover plate 76. Baffles 84 project upwardly from plate 82 in radial relation to the axis of shaft 80; these details are best illustrated in Figures 4 and 5 of the drawings.

It will be seen that the impeller 81 works beneath the baffle plate 82 constantly to circulate the abrasive and carrier mixture within the tank 74 and to centrifugally impact the same against a partial scroll member 85 disposed beneath the baffle plate 82 and adjacent a portion of the periphery of the impeller 81; the impeller 81 has vanes 86 which throw the mixture peripherally outward, a portion into the scroll member 85. Figure 6 is a cross-sectional showing of the scroll member 85, constituting a curvilinear outer wall 87, a bottom wall 88 of flaring formation, and an end wall 89, best shown in Figure 4, having a pocket 90 for trapping mixture centrifugally thrown against the wall 87. At the apex of

the pocket 90 is an opening 91 communicating with a discharge tube 92.

One of the features of this scroll impeller is its relationship to the baffle plate 82 which is formed with a central opening 93, for the passage of the shaft 80 and hub of impeller 81, enlarged for circulatory purposes, as will be noted from the arrows in Figure 5. This circulation keeps the mixture agitated and the abrasive particles in adequately uniform suspension in the carrier.

The centrifugal impact of the mixture into the scroll member 85 effectively drives it through the discharge tube 92, which includes the lint filter 92*a* and leads upwardly and outwardly through the wall of pedestal 11 and upwardly along one of the columns 46, as illustrated in Figures 3 and 2.

As shown in Figure 2, the discharge tube 92 terminates at a distributor manifold 94 located within the channel column 46 and which is shown in cross-section in Figure 7 of the drawings. The manifold 94 is formed as a prismatic block having openings 95 and 96 in its lower wall 97. A bore 98 is formed in the block 94; the same being closed by plug 99. Screws 100 hold the manifold block 94 in the channel column 46. The tube 92 leads into the opening 96. Also communicating with the bore 98 is a return line 102 leading from the opening 95 back to the tank 74, thus completing the pump circuit. A valve 103 is located in line 102, conveniently adjacent the manifold block 94.

Leading from the wall 101 of manifold 94, and passing through the web wall of the column 46, is a valveless bleed-off tube 105 disposed in overhanging relation to the lapping wheel 40. Such bleed-off line is to permit restricted feed of the circulating abrasive mixture passing through the manifold 94 to the surface of the lapping wheel, drop by drop, the same being gauged by the valveless orifice 106 at inner end of the tube 105, as seen in Figure 7 of the drawings.

The valve 103 in the return line 102 serves as a means for regulating the back pressure on the centrifugal pump; and, by regulating the opening of this valve, the amount of mixture delivered, by the effect of the centrifugally acting impeller 81, to the discharge line 92 is correspondingly regulated.

In order to control the energization of the drive motor 32 and the pump motor 77, I equip my machine with a conventional timing switch 110, conveniently mounted on the bridge member 60. The timer section 111 of the switch serves to regulate the length of lapping time, and suitable electrical interconnection is made between such timer and the motors 32 and 77, so that, at the expiration of a given preselected lapping period, both the drive motor 32 and pump motor 77 are automatically shut down.

I have illustrated and described a specific embodiment of my invention, and it is to be understood that modifications may be made, or equivalents substituted, without departing from its spirit and scope; consequently, while I make claims to the specific construction, I also make claims of such scope as to include such modifications and equivalent substitutions.

I claim:

1. In a lapping machine, a disk rotatable on a vertical axis and having a horizontally planar lapping surface, a tank for containing a mixture of a flowing carrier and abrasive particles, circulating means for constantly propelling mixture from said tank through a chamber above said disk, an open drip outlet of constant size from said chamber, for dripping such mixture onto said lapping surface, and a valve in the return line from said chamber to said tank to regulate the back pressure on said circulating means.

2. In a lapping machine, a disk rotatable on a vertical axis and having a horizontal planar lapping surface, a tank for containing a mixture of a flowing carrier and abrasive particles, a horizontal vane-type centrifugal impeller in said tank, a horizontal baffle being spaced from the wall of said tank and over said impeller, said baffle having a central opening and radial vertical vanes, a motor having an extended shaft passing with clearance through said opening and driving said impeller, thus producing local circulation in the lower portion of said tank, a partial scroll element at the periphery of said impeller to receive mixture from said impeller, and a mixture line extending from said scroll to a position above said disk.

3. In combination, a disc rotatable on a vertical axis and having a horizontal lapping surface, a tank for containing a mixture of a flowing carrier and abrasive particles, a horizontal vane-type centrifugal impeller in said tank, a horizontal baffle over said impeller, said baffle being spaced from the wall of said tank and having a central opening, stationary vertical radial vanes positioned above the plane of said baffle, a motor having an extended shaft passing with clearance through said opening in said baffle and driving said impeller, thus producing local circulation in the lower portion of said tank, a partial scroll element at the periphery of said impeller to receive mixture from said impeller, and a mixture line extending from said scroll to a position above said disc.

4. In a lapping machine or the like, a rotatable element with an operating surface to be engaged by work pieces, and means for feeding a mixture of a flowing carrier and abrasive particles to said surface, said means comprising a tank, a driven open vane-type centrifugal impeller in the lower portion of said tank, said impeller having plate-like vanes creating local agitation and circulation of such mixture within said tank, a segmental scroll element operatively juxtaposed to a portion only of the periphery of said impeller, and a duct for conveying mixture accumulated under pressure in the chamber of said scroll element to said operating surface.

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