Sept. 29, 1953 R. G. ROSHONG ET AL 2,653,422

LAPPING MACHINE CONSTRUCTION

Filed Aug. 23, 1949 2 Sheets-Sheet 1

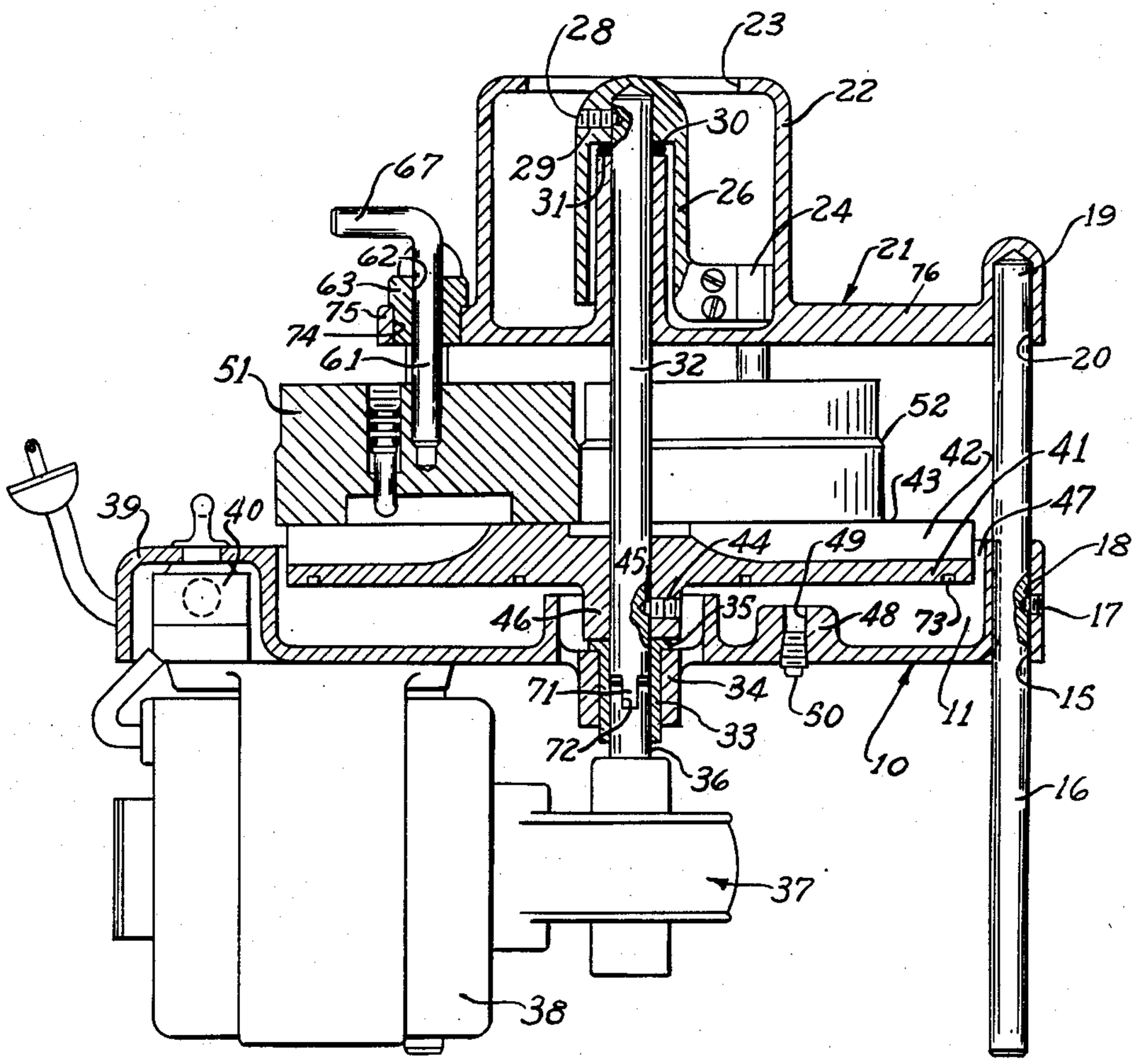

Fig. 1.

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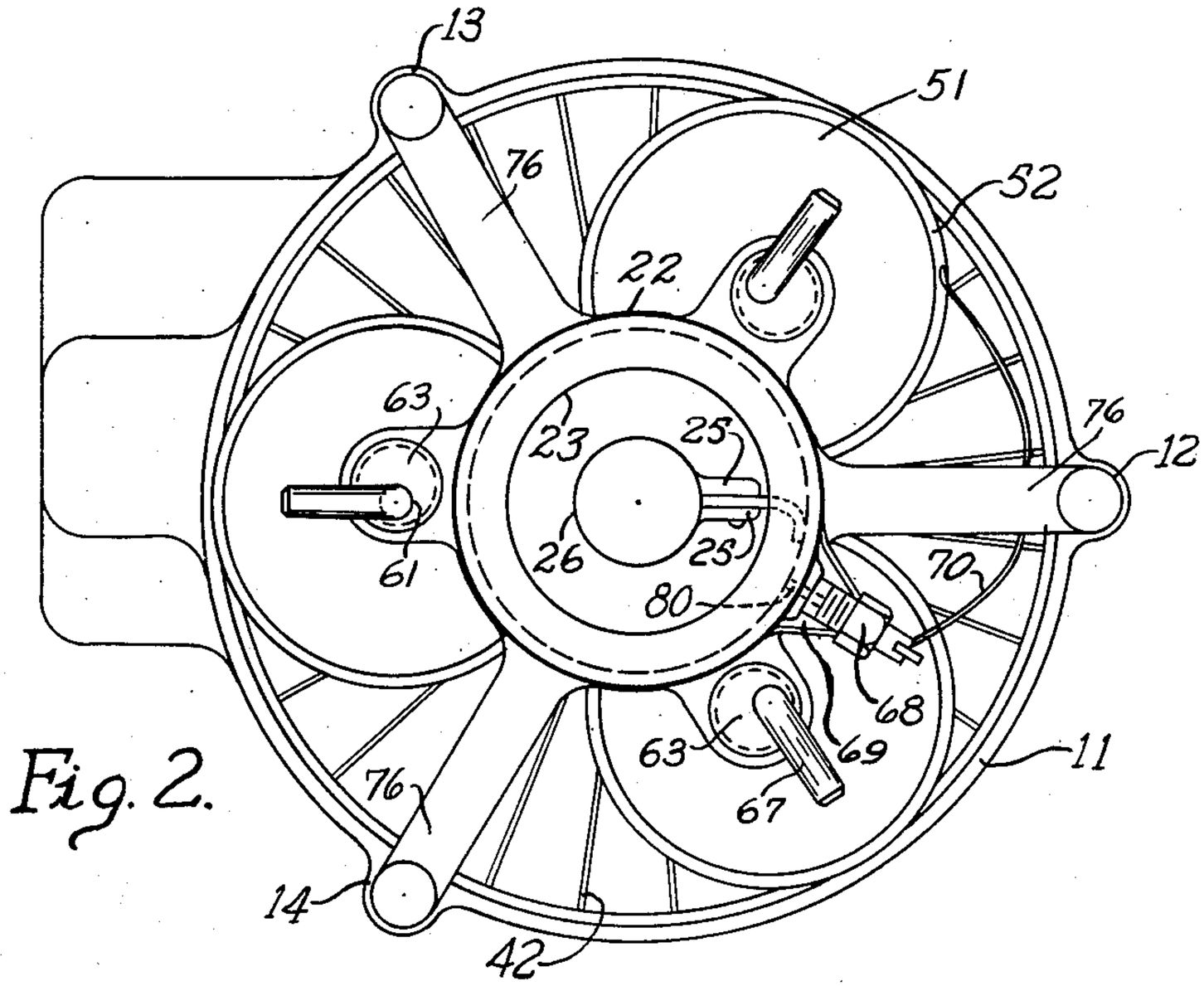

Fig. 2.

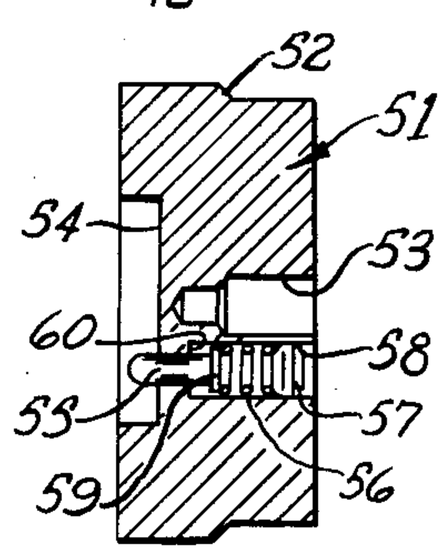

Fig. 3.

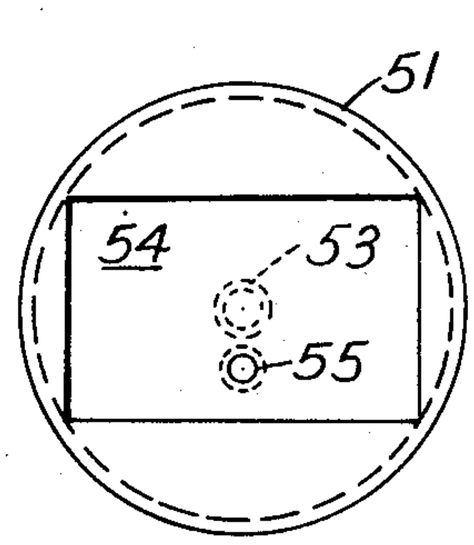

Fig. 4.

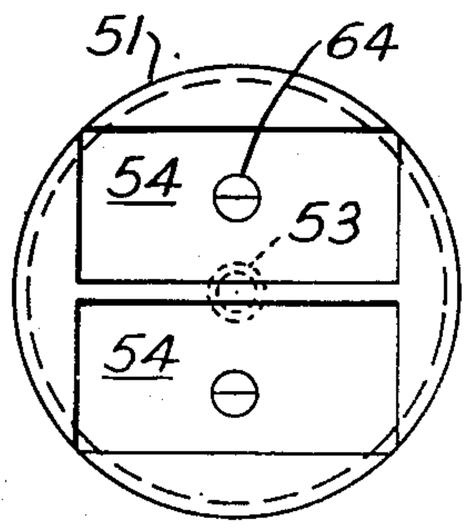

Fig. 5.

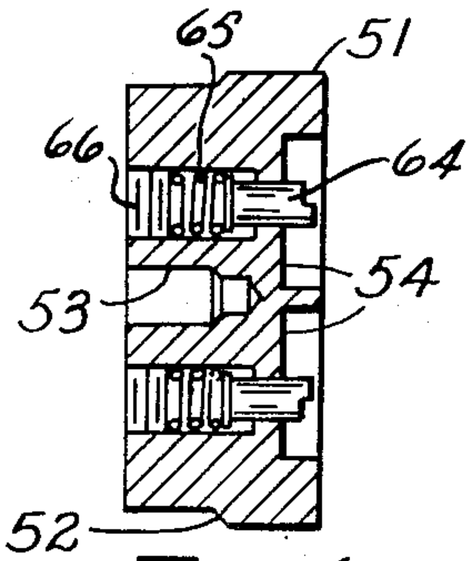

Fig. 6.

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LAPPING MACHINE CONSTRUCTION

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5 Claims. (Cl. 51—131)

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This invention relates to an abrading and polishing machine and particularly to machines for lapping surfaces to a predetermined contour.

The principal object of this invention is to provide a small, compact and inexpensive lapping machine for lapping objects such as blades, shears, valve discs, sealing washers and the like.

Another object of this invention is to provide a lapping machine in which the lapping platen of the machine and the abradant agitator used with the lapping platen are driven by a unitary drive.

Another object of this invention is to provide a support for an abradant agitator which likewise performs the function of positioning the work holders, said support and work holders being so spaced as to provide a maximum freedom of operation for the work holders.

Yet another object of this invention is to provide a tripod type of support for a lapping machine, said tripod serving also to support the abradant agitating means as well as the work holders.

Yet another object of this invention is to provide a work holder for the work to be lapped, said holder serving also to maintain the lap in a true condition automatically.

These and other objects and features of this invention will become apparent from the following detailed description when taken together with the accompanying drawings, in which

Fig. 1 is a side elevation partly in section of a machine embodying the features of this invention;

Fig. 2 is a plan view of the machine shown in Fig. 1;

Figs. 3 and 4 are a section and plan view, respectively, of a holder to be used with the machine of Figs. 1 and 2; and

Figs. 5 and 6 are alternative forms of holders to be used with the said lapping machine.

Referring now to Figs. 1 and 2 for a detailed description of the invention, there is shown a frame cross-member 10 which may be cast or otherwise formed to have a flange 11 extending upwardly therefrom, said flange 11 being enlarged at 12, 13 and 14 (Fig. 2) to form bosses extending generally in a vertical direction as viewed in Fig. 1. Said bosses are drilled to provide openings 15 through which extend rods 16 forming the support for cross-member 10, and the rods are positioned axially with respect to cross-member 10 by means of set screws 17 which are threaded into bosses 12, 13 and 14 and which extend into blind openings 18 in said rods to prevent relative axial movement therebetween.

It is apparent that the three rods will provide a three-point support which will not rock when the machine is in operation and hence will provide a stable support for the machine.

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The upper ends 19 of the rods 16 extend into openings 20 formed in another cross-member in the form of a spider 21 having one arm for each of the supporting rods 16. The openings 20 are blind holes having a close fit relative to rods 16 so that the weight of the cross-member is sufficient to hold said spider on the ends of the said supporting rods. The central portion of the spider 21 is formed as a receptacle 22 for retaining the abradant used in the lapping operation. Said receptacle 22 has an opening 23 in the upper end thereof through which the abradant is supplied. While the machine is in operation the abradant is continually agitated and pumped by a paddle 24 which may comprise a strip of leather or rubber clamped between a pair of lugs 25 extending from a sleeve 26 mounted on a central shaft 32. The sleeve 26 extends over the upper end of the said shaft 32 so as to be supported thereby and is locked to the shaft 32 by means of a set screw 28 which is screwed at 29 into the upper end of said sleeve 26. An anti-friction packing ring 30 preferably of the type shown as an O ring is interposed between the upper end of sleeve 26 and the end 31 of a journal formed integrally with spider 21. It is contemplated that anti-friction packing ring 30 will prevent the abradant from splashing into the bearing. The level of the abradant in the receptacle 22 will be such that the abrasive in the abradant will not enter the bearing and accelerate the wear thereof.

The shaft 32 extends downwardly into a bushing 33 supported in a centrally located boss 34 formed integrally with frame cross-member 10. Said bushing 33 has a flange 35 which acts as a thrust member and supports the weights of the rotating parts of the machine with the exception of the motor and reduction gear as will be pointed out hereinafter.

Shaft 32 is loosely coupled to a shaft 36 forming the output member of a worm and wheel type speed reducer shown generally at 37 and driven by an electric motor 38 which in turn is supported from the underside of frame cross-member 10. Said cross-member 10 has an inverted receptacle 39 formed therein opening on the underside of the cross-member, said receptacle serving to support a switch 40 which controls the operation of motor 38.

Resting upon flange 35 is a lapping platen 41 which is circular in plan view and is provided with a plurality of radially disposed serrations 42, the function of which is to receive excess grit and abrasive as well as the cuttings from the material being lapped. Other serrations 73 are formed on the under side of platen 41 to prevent the abradant from working its way radially inward to the bushing 33. The upper surface 43 of said platen is initially formed to have the de-

sired contour, whether concave, flat or convex. Said platen is driven from shaft 32 by a pin 44 which is screwed at 45 into the hub 46 thereof. It will be noted that platen 41 is of slightly smaller diameter than the inside diameter of flange 11 so that a space 47 is formed therebetween through which the excess abradant may fall into the additional space formed by frame cross-member 10 and flange 11. A boss 48 is formed on cross-member 10 and drilled at 49 to provide an opening through which the collected abradant vehicle may be drained as the abrasive suspended therein settles. Normally, a drain plug 50 serves to hold the abradant in said cross-member 10. The settled abrasive can be removed from the said cross-member 10 by raising lapping platen 41. This is accomplished by pulling up sleeve 26 which in turn pulls up shaft 32 and platen 41 through screws 29 and 45 respectively. The loose coupling referred to above being comprised of a tongue 71 on shaft 32 and a groove 72 in shaft 36, will separate to allow sleeve 26 to be pulled up.

Referring now to Figs. 3 to 6, inclusive, the work holders are comprised of substantially solid cylindrical blocks 51 having a tapered shoulder 52 on the cylindrical surface thereof. Each block has a blind hole 53 formed in the central part thereof on one side, and on the other side, a recess 54 having the general shape of the article to be lapped. For purposes of illustration, the article in the present instance is a blade for an electric shearing device and is substantially rectangular in shape. It has been found that shear blades cut best when ground slightly concave or hollow. In the present instance, the lap platen 41 is perfectly flat, but the concave surface is formed in the shearing blade nevertheless by means of a pin 55 which presses upon the plate at an unsupported point thereon so that the blade is sprung from its normal shape to one slightly convex at the surface of the lapping plate. The force for springing the blade is supplied by a spring 56 energized by the weight of the holder, the pressure of the spring being controlled by a screw 57 threaded into a suitable opening 58 in holder 51. Pin 55 is of smaller diameter than spring 56 and is provided with a head 59 which is adapted to abut on a shoulder 60 formed by the difference in diameters of the openings in which pin 55 and screw 57 are disposed and which serves to limit the outward movement of the pin.

Referring again to Figs. 1 and 2, the holders 51 are held against revolution about shaft 32 with platen 41 by rods 61 which are axially slidable in openings 62 in rotatable bushings 63. The openings 62 are eccentrically located with respect to the centers of bushings 63 as shown more clearly in Fig. 2 so that radial locations of the rods 61 relative to the platen 41 may be controlled by turning bushings 63 in openings 74 in the spider in which they are supported. Said openings 74 are disposed in bosses 75 in spider 21, the bosses being equidistantly spaced between the arms 76 of the spider 21 to avoid any interference between the work and the spider 21. It has been found that the position of the holder relative to the lap platen 41 in a radial direction determines the nature of the surface generated by lap platen 41. Thus, by locating the holders at their innermost radial position, a concave surface is formed on lap platen 41, and by locating the holders 51 at their outermost position radially of the platen 41 a

convex surface is formed thereon. Thus a surface having slight convexity, or slight concavity, or true flatness can be generated and maintained by properly locating the holders radially of the platen 41. This is brought about by the change in the amount of overhang of the holder relative to the outer or inner edges of the platen which, in turn, changes the unit pressure exerted by the holder at various points on the platen. The unit pressure becomes greatest at the point of overhang and the wear consequently becomes greatest at that point. If there is more overhang at the outer edge of the lap than at the inner edge, the platen will become convex, and if there is more overhang at the inner edge, then the platen will become convex. At some intermediate point, the wear will be uniform and a flat platen will result. The optimum position of the holders for any machine and article is best found by trial and error. The eccentric support for rod 61 therefore provides a simple means for adjusting the position of any one of the work holders operating on platen 41.

It will be noted that three equally spaced work holders are provided which have been found to be the maximum usable number of work holders in a machine of the size herein disclosed. Since there are three supporting rods 16, the use of three work holders results in a symmetrical disposition of the work holders and supporting rods.

The holder shown in Figs. 5 and 6 is a double holder for lapping two blades simultaneously. These blades may likewise be rectangular in shape and are pressed on an unsupported part thereof by pins 64 which are held against the blade by a spring 65, the pressure of which is controlled by a screw 66.

The holders are removed from the lapping platen by sliding rods 61 upward in the openings 62, the rods being bent at 67 to provide handles by which such movement can be effected.

The abradant is fed from the receptacle 22 to the tapered shoulder 52 on one of the work holders by means of a valve 68 which communicates with the interior of the receptacle through an opening 80 and allows the abradant to drip onto a trough 69 from which it is fed by a wire 70 to the said taper 52. It has been found that due to the curvature of the wiper 24, a small amount of the abradant will be trapped in the opening 80 and will be forced out of the opening and into the trough, thereby maintaining the opening free of accumulative abrasive.

In operation, switch 40 is turned to start motor 38 whereupon the drive from the motor is transmitted through the reduction gearing 37 to shaft 36 and thence to shaft 32. The rotation of shaft 32 is in turn transmitted to lap platen 41 through the pin 44 and to the abradant agitating paddle 24 and sleeve 26 through pin 28. The rotation of the platen automatically induces the rotation of each of the work holders resting thereupon. The rotation of the work holders in turn causes a rotation of the blades held therein so that the formation of a pattern on the lap surface is substantially avoided. The localized pressure provided by the pins 55 and 64 causes the lapping operation to be concentrated on those portions of the blades which are immediately adjacent the unsupported section, and since those portions are disposed inwardly of the edges of the blades, the resultant surface on the blades is concave when the spring pressure is released and the blades are removed. Simultaneously with the rotation of the lap plate, the valve 68 is

opened to permit the abradant to drip upon trough 69 and then pass along wire 70 to the taper 52 on the work holder. On taper 52 the abradant passes over the sides of the work holder by gravity to the lap platen where the rotation of the platen and work holder causes an even distribution of the abradant over the surface of the platen. The lapping process continues automatically until the blades are deemed to be completely lapped, whereupon the switch 40 is turned the opposite way to stop the motor and the rotation of the lap platen and paddle is likewise halted. After the lap platen 41 has stopped, rods 61 are withdrawn from their respective openings 53 to free the work holders and the work holders are then removed to permit the exchange of an unlapped blade for the lapped blade thereon.

It is understood that the weight of each work holder 51 is effective to cause the work holder itself to wear the surface of the platen. This wearing action by the work holder is preferably so arranged that the work holder will wear the platen faster than the work itself and since the work holders may be adjusted radially of the platen, any desired surface contour can be maintained for long periods of time by the work holders.

It is believed that the simplicity of the construction of the abrading and polishing machine described above is apparent both from the drawings and description and hence need not be elaborated upon further. The machine is highly adaptable to various work holders, and because each part of the machine is made to perform a multiplicity of functions, the cost of the machine is maintained at a minimum.

It is understood that the foregoing description is illustrative of preferred embodiments of this invention and that the scope of the invention is not to be limited thereto, but is to be determined by the appended claims.

What is claimed is:

1. A machine for finishing surfaces of articles, said machine comprising a platen, a machine frame for supporting the platen, a shaft passing through and secured to the platen, an abradant-supplying device, means on the frame for supporting the abradant-supplying device over the platen, a paddle in the abradant-supplying device, a sleeve secured to the shaft and to the paddle, a receptacle disposed below the platen for receiving excess abradant from the platen, means secured to the machine frame for driving the shaft, and an axially slidable driving connection between the shaft and the said shaft driving means, whereby said shaft, platen, sleeve and paddle may be raised from the receptacle to provide access to the said receptacle for cleaning purposes.

2. A machine for finishing surfaces of articles comprising a rotatable platen for operating upon the articles to be finished, an abradant-supplying device, and a frame for supporting the platen and abradant-supplying device, said frame comprising a cross-member having a plurality of arms, each arm having a socket substantially at the end thereof, supporting legs comprising rods extending into said sockets, a second cross-member, means for securing the second cross-member to the rods, means for supporting the platen from the second cross-member, a motor, and means connecting the motor to the platen to drive the platen, said motor being supported from the second cross-member.

3. A machine for finishing surfaces as described in claim 2, said first-mentioned cross-member having bosses, one disposed between each pair of arms, and means mounted in said bosses for holding the articles on the platen.

4. A machine for finishing surfaces of articles comprising a rotatable platen for operating upon the articles to be finished, a frame spaced from said platen, rotatable conditioning rings cooperating with the platen to maintain a desired surface on the latter, and means on the frame for holding the axes of the rings stationary relative to the frame, said holding means including a rotatable support for each ring and having an eccentrically disposed opening therein, and a pin disposed in each opening and extending into the ring so that each ring is rotatable about the axis of the pin, means for adjusting the angular position of each rotatable support, an abradant-supplying device on the frame disposed centrally of the platen, said frame including arms radiating from the abradant-supplying device, and means cooperating with the ends of the arms for holding the frame spaced from the platen, said holding means including bosses disposed between the arms and having openings to receive the said rotatable supports.

5. A machine for finishing surfaces of articles comprising a rotatable platen for operating upon the articles to be finished, a frame spaced from said platen, rotatable conditioning rings cooperating with the platen to maintain a desired surface on the latter, and means on the frame for holding the axes of the rings stationary relative to the frame, said holding means including a rotatable support for each ring and having an eccentrically disposed opening therein, and a pin disposed in each opening and extending into the ring so that each ring is rotatable about the axis of the pin, means for adjusting the angular position of each rotatable support, an abradant-supplying device on the frame disposed centrally of the platen and including a receptacle and a paddle within the receptacle, said frame including arms radiating from the abradant-supplying device, means cooperating with the ends of the arms for holding the frame spaced from the platen, said holding means including bosses disposed between the arms and having openings to receive the said rotatable supports, and a common drive shaft for the paddle and platen.

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