

March 9, 1971

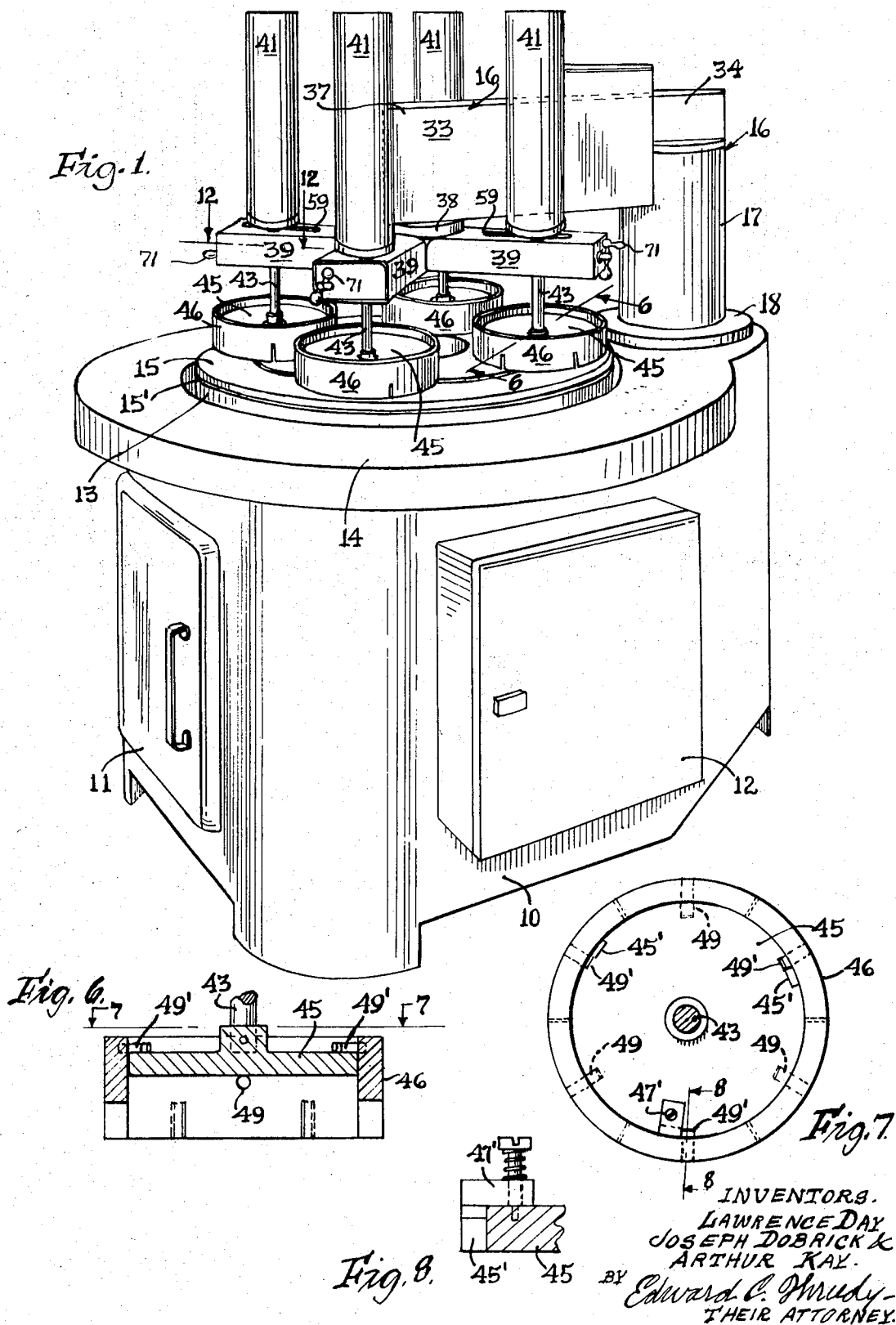
L. DAY ET AL

3,568,371

LAPPING AND POLISHING MACHINE

Filed March 12, 1969

4 Sheets-Sheet 1



March 9, 1971

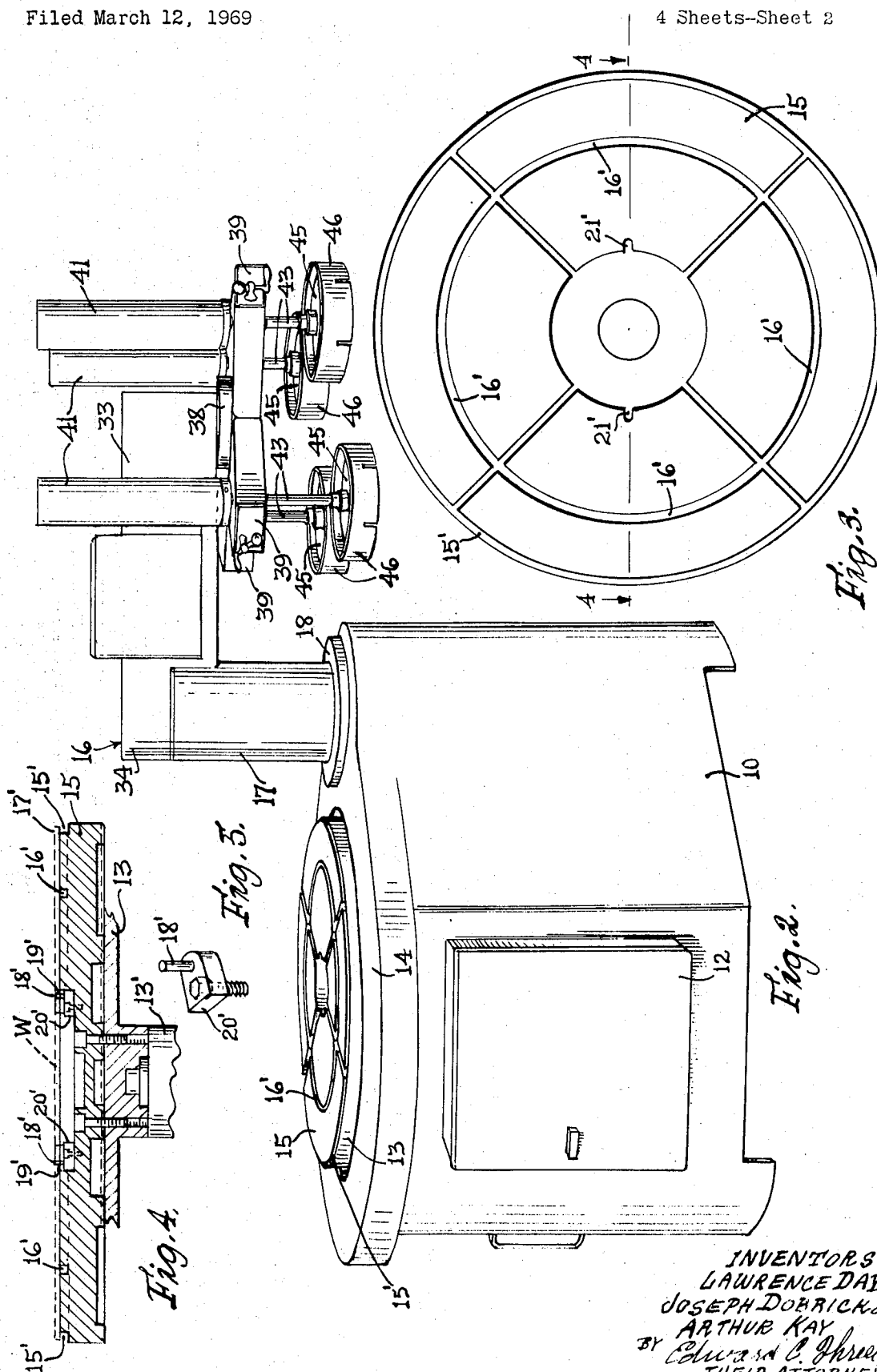
L. DAY ET AL

3,568,371

LAPPING AND POLISHING MACHINE

Filed March 12, 1969

4 Sheets--Sheet 2



INVENTORS.
LAWRENCE DAY
JOSEPH DOBRIK &
ARTHUR KAY
BY Edward C. Phrederick
THEIR ATTORNEY.

March 9, 1971

L. DAY ET AL

3,568,371

LAPPING AND POLISHING MACHINE

Filed March 12, 1969

4 Sheets-Sheet 3

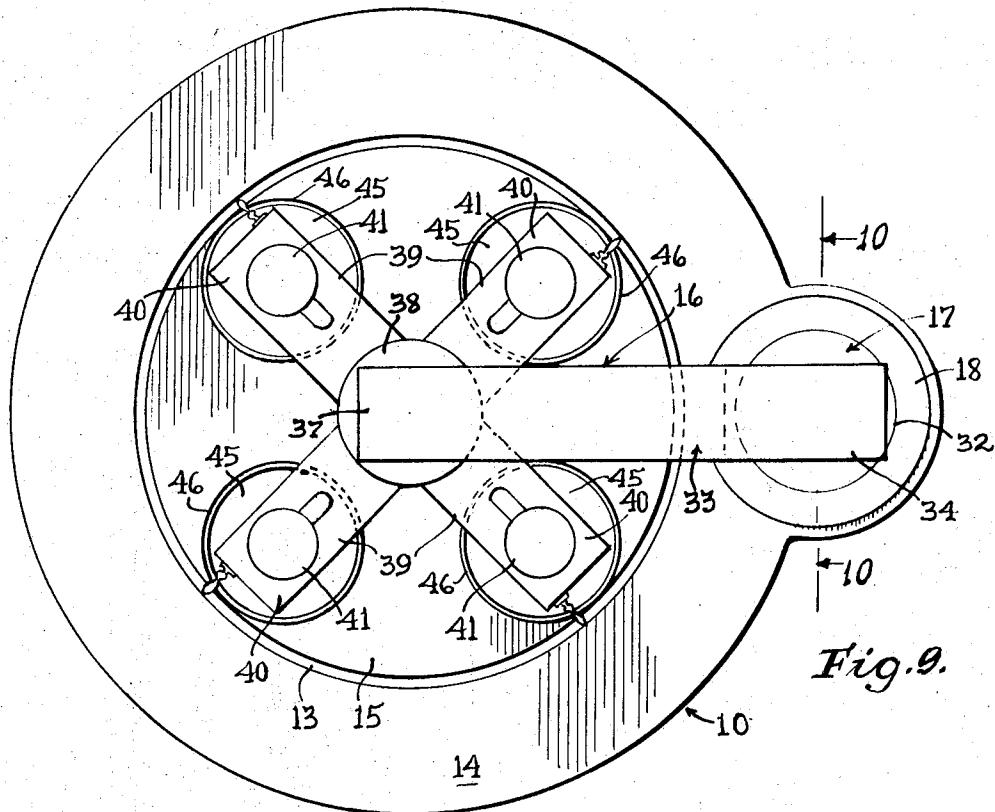


Fig. 9.

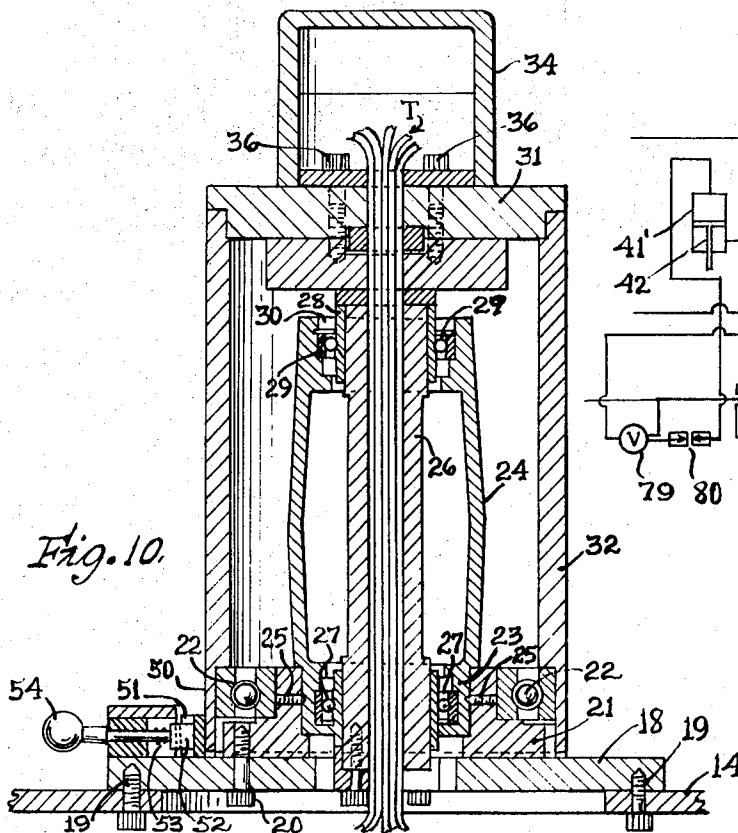


Fig. 10.

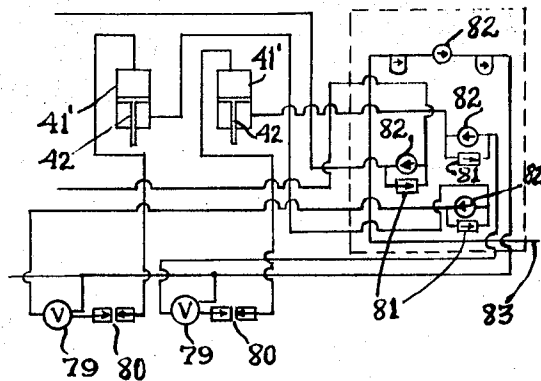


Fig. 11

INVENTORS.
LAWRENCE DAY
JOSEPH DOBRICK &
ARTHUR KAY
BY Edward C. Shuck
THEIR ATTORNEY

March 9, 1971

L. DAY ET AL

3,568,371

LAPPING AND POLISHING MACHINE

Filed March 12, 1969

4 Sheets-Sheet 4

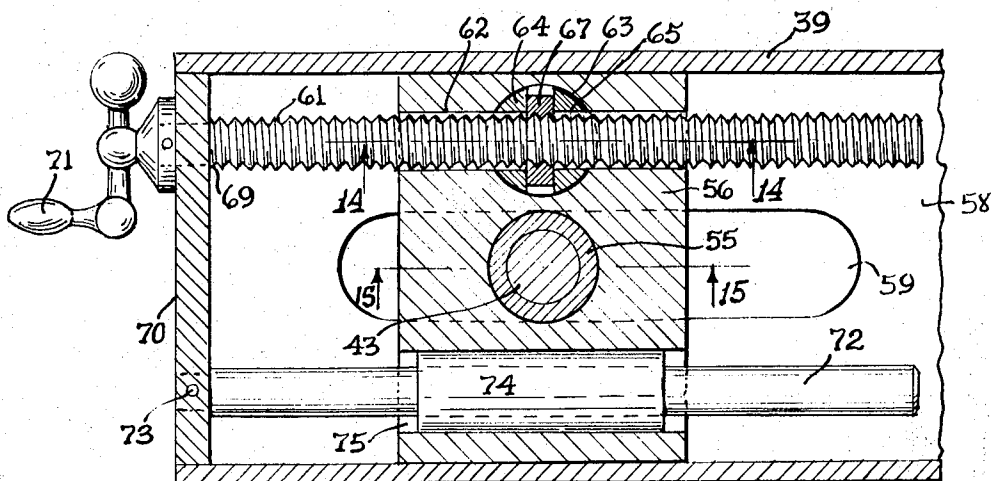


Fig. 12

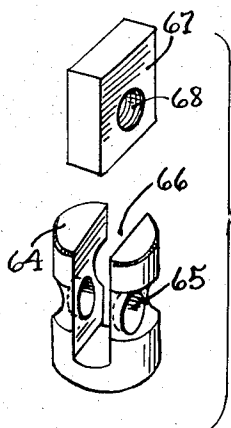


Fig. 13.

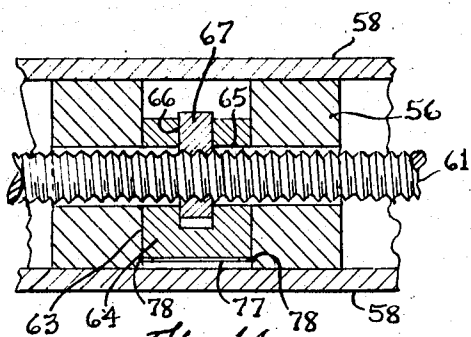


Fig. 14.

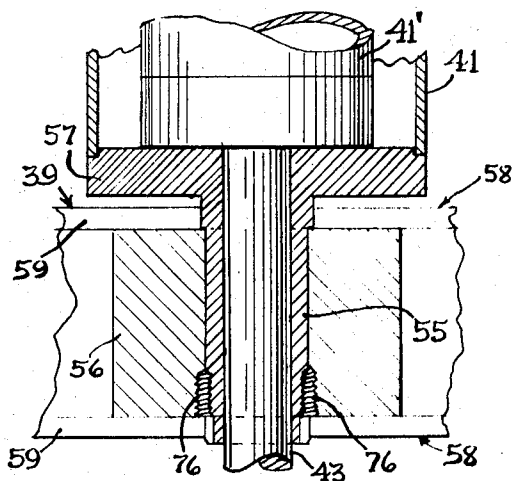


Fig. 15.

INVENTORS.
LAWRENCE DAY
JOSEPH DOBRICK &
ARTHUR KAY
BY Edward C. Hershey
THEIR ATTORNEY.

1

3,568,371

LAPPING AND POLISHING MACHINE

Lawrence Day and Joseph Dobrick, Chicago, and Arthur Kay, Evanston, Ill., assignors to Spitfire Tool & Machine Co., Inc., Chicago, Ill.

Filed Mar. 12, 1969, Ser. No. 806,513

Int. Cl. B24b 5/00, 29/00

U.S. Cl. 51—161

10 Claims

ABSTRACT OF THE DISCLOSURE

A machine for lapping and polishing work placed upon a work table disposed beneath a superstructure rotatable about a vertical axis at one side of the machine and carrying a plurality of lapping rings and pressure plates within the rings, the rings and pressure plates being elevated vertically with respect to the superstructure for movement as a unit therewith from position upon and over the work plate to provide an unobstructed area with respect to the work plate.

SUMMARY OF THE INVENTION

The polishing and lapping machine of this invention constitutes an improvement over that disclosed in our Pat. No. 3,032,937 dated May 8, 1962. The improvement of the present invention comprises pivotally supporting a superstructure for movement about a vertical axis at one side of the machine.

Such superstructure carries a plurality of pneumatic cylinders, each having operable therein a piston having piston rods carrying a pressure plate, the pressure plate in turn carries a lapping ring.

In the normal operation of the machine the superstructure is disposed over the work table to locate the lapping rings upon the work placed on the table with the weight of the pressure plates disposed upon the rings. At the completion of the polishing and lapping operation each ring and its respective pressure plate is elevated to a position above the work table from which position the rings and pressure plates, as a unit, are rotated with the superstructure about a vertical axis to one side of the machine, thus to provide an unobstructed area over the table permitting the operator to have free access to such area. The provision of this unobstructed area permits the operator to conveniently and expeditiously place work upon the work table and remove the same therefrom. It also permits the operator to have unobstructed access to the work table for cleansing purposes and the like.

The invention comprises the novel combination and arrangement of parts to be hereinafter described and claimed. The invention will be best understood by reference to the accompanying drawings showing a preferred form of construction and in which:

FIG. 1 is a perspective view of the invention showing the lapping rings and pressure plates disposed over and upon the work table;

FIG. 2 is a perspective view similar to FIG. 1 but showing the lapping rings and their respective pressure plates disposed from position over the work table;

FIG. 3 is a plan view of a preferred form of work table embodied in the invention;

FIG. 4 is a sectional detailed view taken substantially on line 4—4 of FIG. 3;

FIG. 5 is a perspective view of a work holding pin;

FIG. 6 is a sectional detailed view taken substantially on line 6—6 of FIG. 1;

FIG. 7 is a plan view taken substantially on line 7—7 of FIG. 6;

2

FIG. 8 is a fragmentary sectional detailed view taken substantially on line 8—8 of FIG. 7;

FIG. 9 is a plan view of the machine illustrated in FIG. 1;

FIG. 10 is a sectional detailed view taken substantially on line 10—10 of FIG. 9;

FIG. 11 is a schematic detail of the pneumatic circuit embodied in the invention;

FIG. 12 is a fragmentary sectional detailed view taken substantially on line 12—12 of FIG. 1;

FIG. 13 are perspective views of a feed nut assembly embodied in the invention;

FIG. 14 is a fragmentary sectional detailed view taken substantially on line 14—14 of FIG. 12; and

FIG. 15 is a fragmentary sectional detailed view taken substantially on line 15—15 of FIG. 12.

The conventional polishing and lapping machine with which this invention is concerned comprises a base cabinet 10 having a hinged door 11 and within which is housed a motor (not shown) for rotating a sub-plate 13 carried by a motor-driven spindle 13' (FIG. 4). A control cabinet 12 is attached to one side of the cabinet 10, FIG. 1, to house the control instruments (not shown) used for controlling the operation of the machine.

The cabinet comprises a top wall 14 surrounding the sub-plate 13. The means for rotating the sub-plate 13 and its supporting spindle 13' is not shown as any desirable and well-known motor means may be provided therefor.

When the machine is used for lapping or polishing work there is mounted on the sub-plate 13 a work table 15. Such table 15 may be bolted to the sub-plate 13 as shown in FIG. 4.

The top wall 14 adjacent a side of the work table 15 supports a superstructure 16. The support for such structure 16 is indicated at 17 and comprises a base plate 18 (FIG. 10) secured to the top wall 14 as at 19. Secured to the base plate 18 as at 20 is a collar 21 supporting a ball bearing 22 of any approved construction. The collar 21 has projected therein a reduced portion 23 of a post 24, the post 24 being connected to the collar as at 25. The post 24 is of a hollow construction and embraces a hollow shaft 26, the lower end of which projects into the center of the collar 21 and is supported therefrom by a ball bearing construction 27. The upper end portion of the shaft 26 has welded or otherwise secured thereto a ball bearing sleeve 28 supporting a ball bearing construction 29, which is mounted in the recessed end portion 30 of the post 24 (FIG. 10). The sleeve 28 is secured by welding or the like to a cap 31 which in turn is secured in any suitable manner to a sleeve 32. The sleeve 32 embraces and is adapted to revolve about the post 24, and is supported by the bearing structure 22 (FIG. 4). By this arrangement the sleeve 32 may be freely rotated about the post 24 for reasons hereinafter made apparent.

The superstructure 16 comprises a horizontally extending hollow boom 33 which has an end portion 34 secured as at 36 to the cap 31, and to the sleeve 32 by welding or the like (FIGS. 9, 10). The end portion 37 of the boom 33 is disposed approximately at a point which is centrally located with respect to the table 15. To the underside of the end portion 37 of the boom 33 is secured in any suitable manner a supporting disc 38.

Secured to such disc 38 (FIG. 9) in any suitable manner are horizontally extending arms 39 extending radially from the disc 38. Such arms 39 are hollow in construction for reasons which will presently be made apparent.

Extending upwardly from and secured in any suitable manner to the outer end portions 40 of each of the arms 39 is a tubular housing 41. Within such housing 41 is a pneumatic cylinder 41' (FIG. 15) having a piston 42 car-

3

ried by a piston rod 43. The piston rod 43 extends through a bearing 55 formed in a block 56 slidably mounted in the arm 39. The bearing 55 is formed as an integral part of a plate 57 which closes the end portion of the housing 41 to which it is attached in any suitable manner. The top and bottom walls 58 of the arm 39 are provided with elongated slots 59 through which the bearing 55 is adjustably positioned. The block 56 is adapted to be adjusted longitudinally within the arm 39 to properly position the lapping and polishing ring 46 and its pressure plate 45 with respect to the work upon the table 15. This adjustment is accomplished by means of a feed screw 61 (FIG. 12) which extends through a bore 62 formed in the block 56. In this block 56 is provided an opening 63 into which is positioned a cylindrically formed carrier 64 having a transverse opening 65 through which the feed screw 61 freely passes. A slot 66 is formed longitudinally in the carrier 64. Mounted in this slot 66 is a feed nut 67 having a threaded opening 68 which registers with the opening 65, and through which the feed screw 61 threadably passes. A shoulder 69 on the feed screw 61 engages the wall 70 of the arm 39, and prevents the feed screw from moving longitudinally when rotated by a handle 71.

The block 56 is guided in its longitudinal adjustment within the arm 39 by a stud shaft 72 connected as at 73 to the wall 70, and projecting through a bearing structure 74 mounted in an opening 75 formed in the block 56.

As shown in FIG. 15 the bushing 55 is connected to the block 56 by stud screws 76. In FIG. 14 the carrier 64 is retained in the opening 63 by a split ring 77, the edges of which engage recesses 78 formed in the block.

By rotating the feed screw 61 in either of its two directions the housing 41 and the ring 46 and its respective pressure plate 45 may be adjusted properly with respect to the work to be lapped or polished.

Such pressure plate 45 is positioned within the lapping ring 46 which is removably attached to the pressure plate in the following manner.

Carried by the ring 46 and extending inwardly at predetermined points circumferentially about such ring are pins 49 which engage the underside of the pressure plate supporting the latter within the ring.

Also carried by the ring 46 and extending inwardly at predetermined points circumferentially about such ring and in a plane above the pins 49 are pins 49'.

Formed in the pressure plate 45 are slots 45' through which the pins 49' pass when the plate 45 is positioned within the ring 46 upon the pins 49. In mounting the pressure plate 45 within the ring 46 such plate is rotated a short distance about its axis to dispose the slots 45' out of registration with the pins 49' in which position a stop 47' is yieldably mounted as seen in FIG. 8 with a portion thereof engaging one of the slots 45' in the path of the adjacent pin 49' thus to prevent rotation of the ring 46 into a position to permit withdrawal of the plate 45 from the ring 46.

The pistons 42 are each pneumatically actuated within their respective cylinders 41' to move the rings 46 and their respective pressure plate 45 from and into engagement with the work on the table 15. This may be accomplished in any well-known approved manner. For the purpose of explanation we have shown in FIG. 11 a suggested pneumatic system for accomplishing the foregoing results. In such FIG. 11 two pistons 42 have been illustrated, it being noted that the machine shown in the drawings embodies four such pistons. In such FIG. 11 there are employed for each piston a variable positioned valve indicated at 79. In one position the valve permits the flow of air under pressure to the upper portion of the cylinder 41' and allows the exhaust of the air from the lower portion thereof. In another position the air is admitted to the lower portion of the cylinder 41' while the air is permitted to exhaust from the upper portion of the cylinder. The symbols indicated at 80 (FIG. 11) are two-way flow control valves of a well-known construction. The symbols indicated at 81 are a well-known type of

4

check valves. Those indicated at 82 are regulators. The regulators permit the flow of air in the directions indicated by the arrows while the check valves 81 permit the flow of air in the direction indicated by the arrows. The main supply air line in the sketch shown in FIG. 11 is indicated at 83. This system, as shown in FIG. 11, is merely a suggested system, and of itself does not constitute our invention.

As heretofore indicated, the machine may be used for lapping or polishing work. In the present instance the work indicated at W (FIG. 4) is in the form of a flat circular disc removably mounted upon the table 15.

To mount the work upon the table 15 the rings 46 and pressure plates 45 are pneumatically elevated at which time the superstructure is released by removal of the latch head 52 from the keeper 51 (FIG. 10) so that the entire superstructure with the lapping rings and pressure plates may be pivoted from a position over the table to a position at one side of the machine. In such position of the superstructure and rings and pressure plates the work table is completely unobstructed, permitting the operator to have free access to the work table 15.

The table 15 as shown in FIG. 3 is circular in plan view, and provides a peripheral groove 15' in its peripheral edge. A similar groove 16' is formed inwardly of such edge.

The work to be lapped or polished is a relatively flat circular disc. Such disc may be of a size comparable to the diameter of the table 15 with the edge portion 17' (FIG. 4) extending to a position over the groove 15' or of a diameter such that when placed upon the table the peripheral edge thereof will extend slightly over the groove 16', the arrangement being in either case such that the workman may expeditiously remove the disc from the work table by grasping between the thumb and the index finger of his hand the overlying edge portion 17', the groove 15' facilitating this grasping of the disc. In the case of the disc extending slightly over the groove 16' such groove likewise facilitates the engagement of the workman's thumb and index finger with the edge of the disc therewith to provide expeditious removal of the disc from the table 15.

The disc is rotatably and removably attached to the table 15 by means of oppositely disposed pins 18' which engage in openings 19' formed in the disc, and carried by a mounting block 20' secured to the table 15 in cut-out portions 21' (FIG. 3).

When the work is properly removably attached through the medium of the pins 18' to the table, the superstructure, together with the rings and pressure plates, are then pivoted to their operating position over the work, at which time by pneumatic action the pistons 42 are permitted to move downwardly to place the rings and the pressure plates upon the work.

In this position of the rings 46 and pressure plates 45 the superstructure 17 is latched against rotation relative to the post 24 (FIG. 10). This is accomplished by providing in the lower end portion 50 of the sleeve 32 a keeper slot 51 into which a latch 52 is urged by a spring 53 as shown in FIG. 10. The latch 52 is retracted from engagement in the keeper slot 51 by the operator grasping a finger knob 54 (FIG. 10).

The air supply lines employed in the system shown in FIG. 11 are of flexible plastic tubes T, which extend upwardly through the hollow shaft 26 into and through the support 17 into the arms 39 and from thence into the housing 41 with their end portions disposed above and below the pistons 42.

As the tubes are of a flexible character they will not interfere with the pivotal movement of the superstructure.

The advantages of a machine constructed in accordance with the foregoing description will be obvious to those skilled in the art.

While we have illustrated and described the preferred form of construction for carrying our invention into effect, this is capable of variation and modification without de-

5

parting from the spirit of the invention. We, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves of such variations and modifications as come within the scope of the appended claims.

Having thus described our invention, what we claim as new and desire to protect by Letters Patent is:

1. An improvement in a lapping and polishing machine having a rotatable work table for supporting work to be lapped and polished, the improvement comprising:

- (a) a plurality of lapping rings and pressure plates arranged in the rings,
 - (b) each of said rings and its respective pressure plate being elevated from a position upon work supported by the table to a position thereabove and at one side of the machine clear of said work table and work thereon,
 - (c) means for moving said rings and pressure plates as a unit to said position at one side of the machine comprising
 - (d) a superstructure movably positioned over and above said table,
 - (e) means for supporting said superstructure for horizontal movement from said position over and above said table to said position at one side of the machine, and
 - (f) means carried by the superstructure for elevating each of said rings and its respective pressure plate from and into position upon said work when said superstructure is disposed over and above said table.
2. The lapping and polishing machine defined in claim 1 wherein the means for elevating each of said rings and its respective pressure plate from and into position upon said work comprises:
- (g) a plurality of pneumatic cylinders carried by the superstructure and including pneumatically actuated pistons and rods, and
 - (h) means connecting the rings and pressure plates to said rods for movement therewith.
3. The lapping and polishing machine defined in claim

6

1 characterized by the provision of means for latching said superstructure in a position with the rings and pressure plates disposed over said work table.

4. The lapping and polishing machine defined in claim 2 characterized by the provision of means for latching said superstructure in a position with the rings and pressure plates disposed over said work table.

5. The lapping and polishing machine defined in claim 1 characterized by the provision of means for detachably connecting each ring to its respective pressure plate.

6. The lapping and polishing machine defined in claim 2 characterized by the provision of means for detachably connecting each ring to its respective pressure plate.

7. The lapping and polishing machine defined by claim 3 characterized by the provision of means for detachably connecting each ring to its respective pressure plate.

8. The lapping and polishing machine defined by claim 3 characterized by the provision of means for detachably connecting each ring to its respective pressure plate.

9. The lapping and polishing machine defined by claim 1 wherein the means for supporting said superstructure includes a fixed post and a sleeve carried by and rotatable about said post and carrying said superstructure.

10. The lapping and polishing machine defined by claim 3 characterized by the provision of a fixed post and a sleeve carried by and rotatable about said post and carrying said superstructure.

References Cited

UNITED STATES PATENTS

2,382,903	8/1945	Pash	51—161
2,963,830	12/1960	Hook	51—131
3,032,937	5/1962	Day	51—128
3,304,662	2/1967	Boettcher	51—131

HAROLD D. WHITEHEAD, Primary Examiner

U.S. Cl. X.R.

51—131, 132