

[72]	Inventors	Stephen A. Boettcher Deerfield (Riverwoods); Louis F. Simonetti, Morton Grove, Ill.
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[73]	Assignee	Speedfam Corporation Des Plaines, Ill.

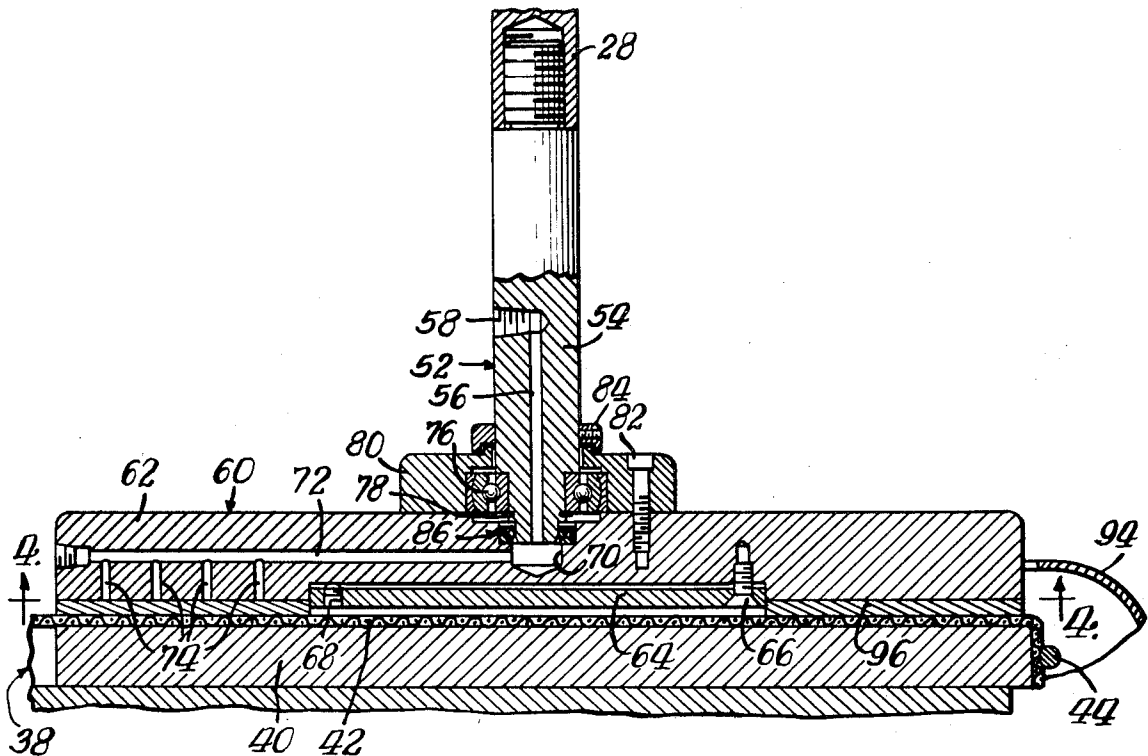
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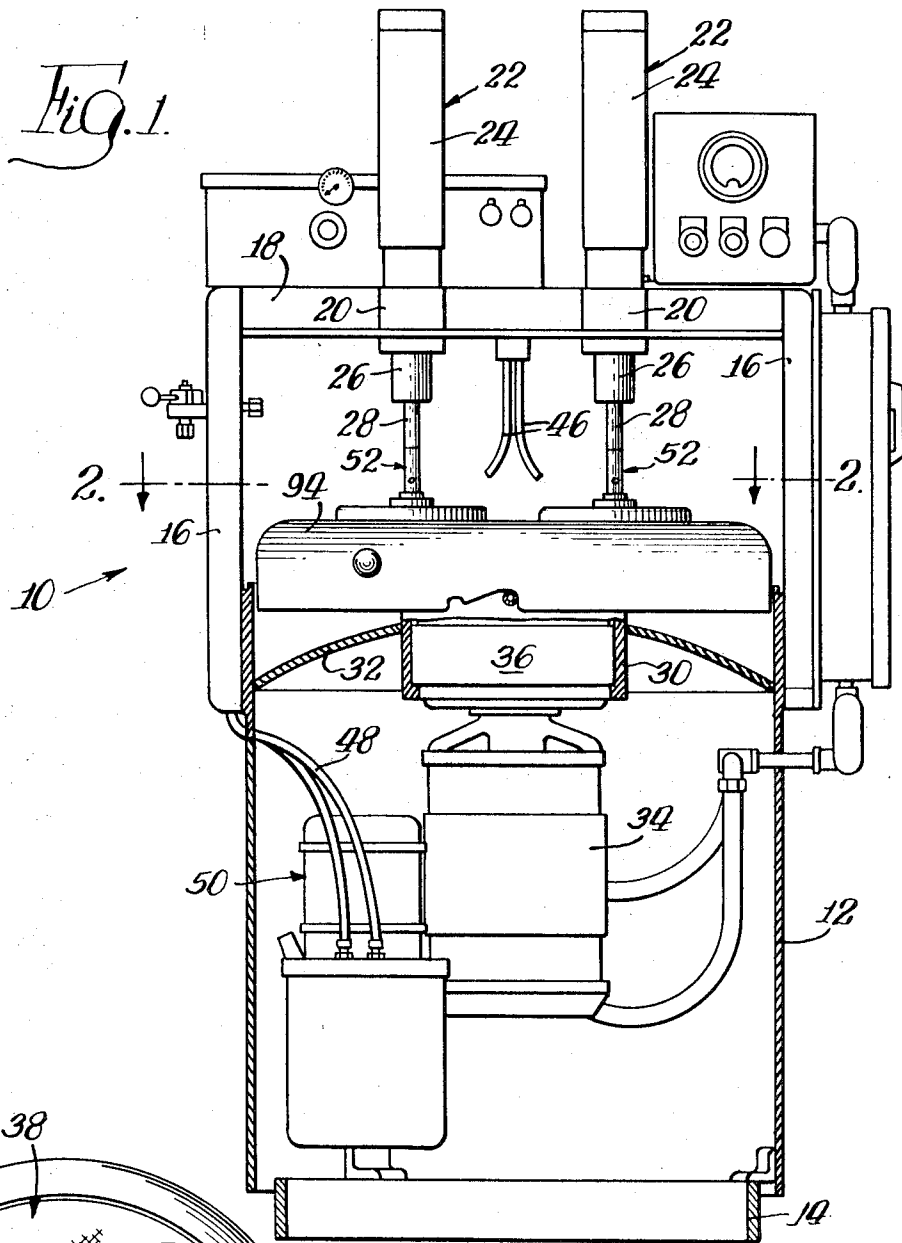
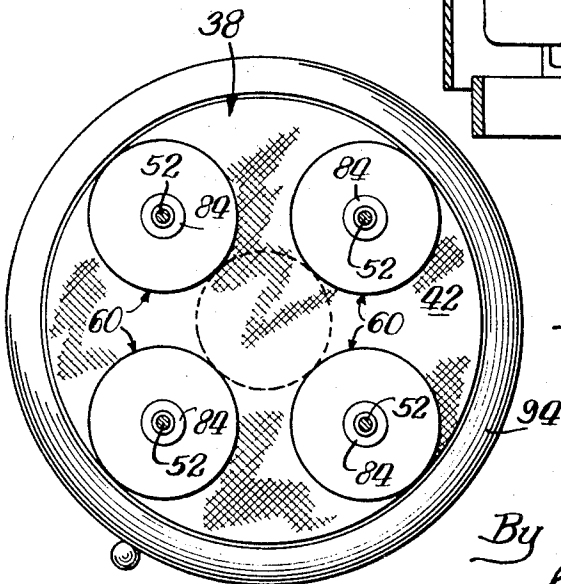
Primary Examiner—Lester M. Swingle
Attorney—Johnson, Diener, Emrich, Verbeck & Wagner

[54] POLISHING MACHINE
6 Claims, 4 Drawing Figs.

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51/235
[51] Int. Cl..... B24b 7/04
[50] Field of Search..... 51/131, 235

ABSTRACT: A polishing machine spindle assembly and associated load plate unit having passageway means opening at the lower surface of the unit and adapted to be placed under vacuum for maintaining a workpiece in engagement with the lower surface of the unit.





Inventors:-
 Stephen A. Boettcher,
 Louis F. Simonetti,
 By Brown, Jackson,
 Boettcher & Siemmer Attys.,

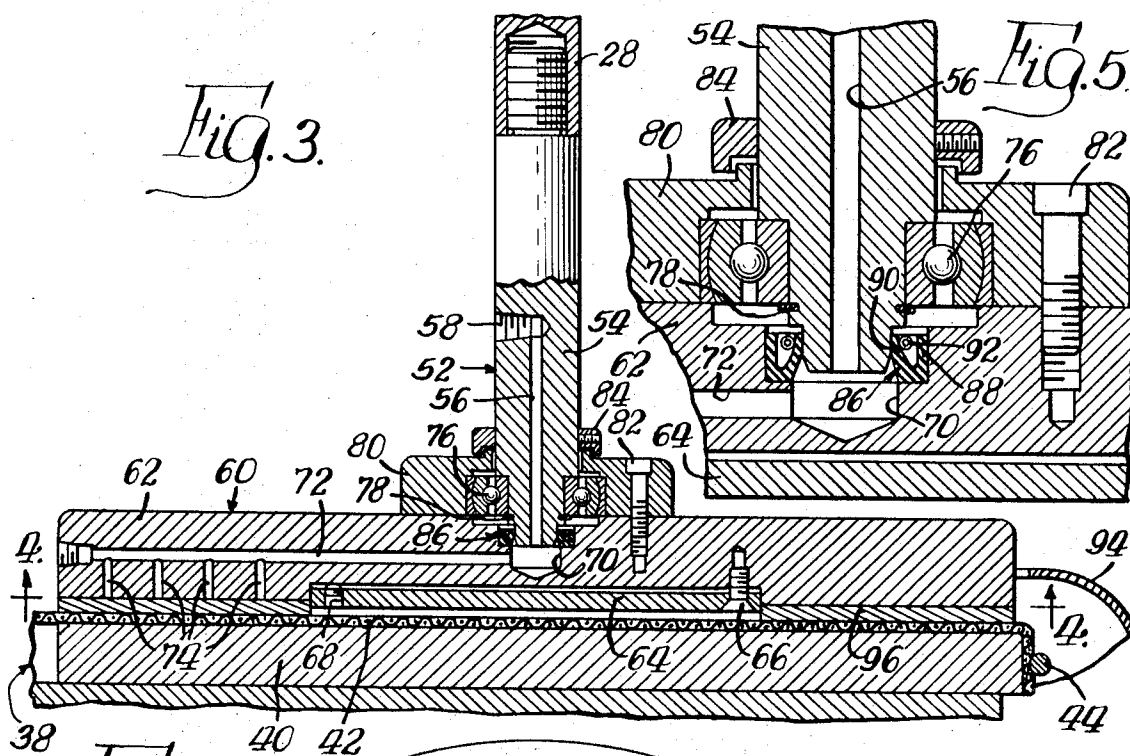
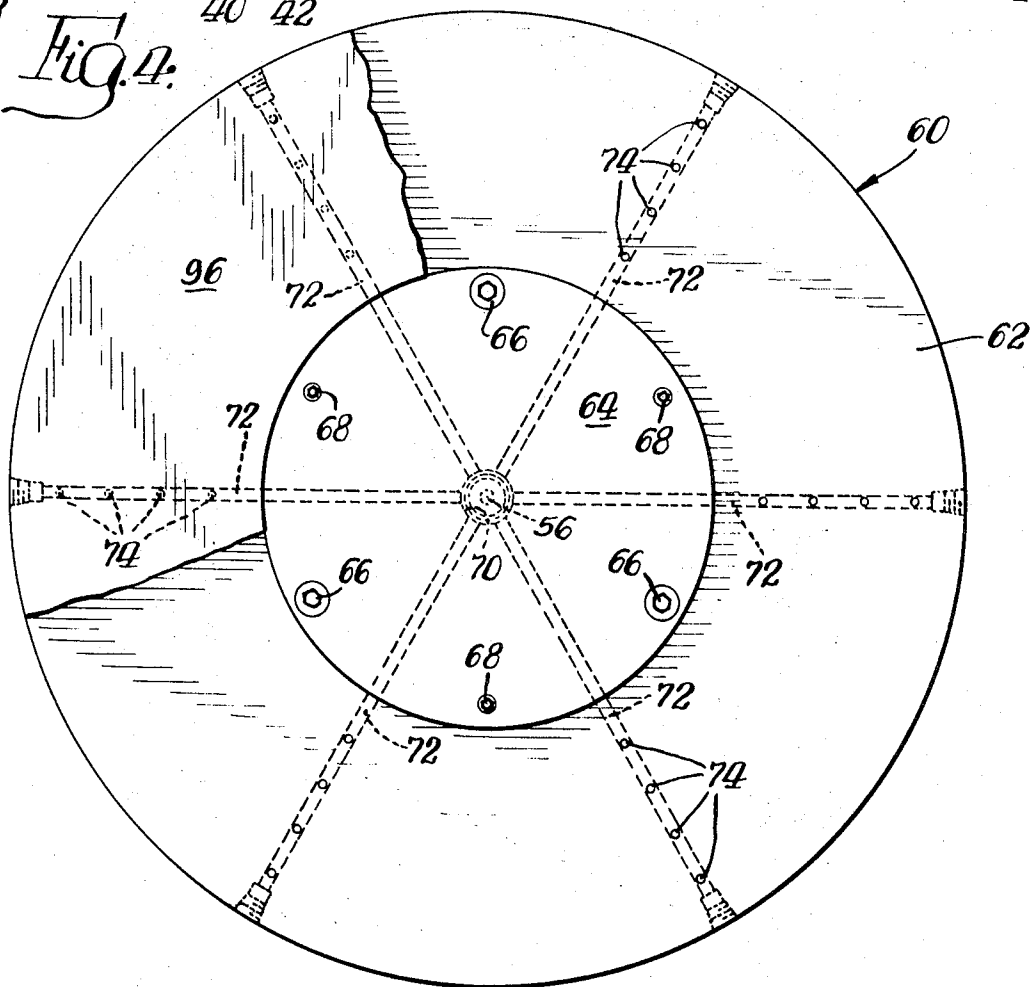


Fig. 4.



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POLISHING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a polishing machine comprised of a rotatable polishing wheel assembly, and means for urging workpieces to be polished into engagement with the upper surface of the polishing wheel assembly.

2. Description of the Prior Art

One type of polishing machine comprises a horizontal rotatable backing wheel, a polishing cloth extending across the upper surface of the backing wheel, a load plate unit adapted to receive workpieces at the lower surface thereof and to be positioned over the backing wheel with the workpieces engaging the polishing cloth, and means, including a vertical spindle assembly, for centering and applying pressure to the load plate unit. Conventionally, a plurality of workpieces to be polished are affixed, for example by paraffin, the lower surface of the load plate unit. In this manner, the workpieces are maintained in position relative to the load plate unit, and are movable therewith, during the polishing operation.

The foregoing arrangement is particularly adapted for polishing relatively small workpieces, but is not generally satisfactory for polishing relatively large workpieces.

SUMMARY OF THE INVENTION

In accordance with the present invention, the load plate unit is provided with a central upwardly directed aperture, and with passageway means communicating with the aperture and opening at the lower surface of the unit. Additionally, the spindle assembly is provided with passageway means communicating with the aperture and adapted to be placed under vacuum for creating a vacuum in the passageway means of the load plate unit whereby a workpiece may be maintained in engagement with the lower surface of the unit.

With the arrangement of the present invention, the workpiece is retained directly against the lower surface of the load plate unit, without the use of any intervening adhesive medium such as paraffin, and optimum conditions of polishing, particularly with respect to relatively large workpieces, are thereby attained. The load plate unit is especially adapted for use in polishing annular aluminum memory discs designed for incorporation in computer apparatus and the like.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view, with portions being broken away and shown in section, of a polishing machine incorporating the principles of the present invention;

FIG. 2 is a horizontal view, taken substantially along the line 2-2 in FIG. 1, looking in the direction indicated by the arrows;

FIG. 3 is a vertical median sectional view, on an enlarged scale, of the load plate unit and spindle assembly of the present invention, and of other machine components associated therewith;

FIG. 4 is a horizontal view, taken substantially along the line 4-4 in FIG. 3, looking in the direction indicated by the arrows; and

FIG. 5 is a vertical median sectional view, on a further enlarged scale, of a portion of the load plate unit and spindle assembly of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is indicated generally by the reference numeral 10 a polishing machine incorporating the principles of the present invention. The polishing machine 10 comprises a framework including a substantially cylindrical housing 12 supported by a base ring 14. Suitably secured to the opposite sides of the housing 12 are the lower ends of vertical columns 16. Extending between the upper ends of the columns 16 is a horizontal bridge member 18 provided with

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opposed pairs of lateral arms 20. Mounted at the outer end of each of the four arms 20 is a vertical pneumatic piston and cylinder assembly 22 which includes a cylinder 24, a stabilizer sleeve 26 and a piston rod 28.

A cylindrical collar 30 is mounted at the upper end of the housing 12 by means of an annular inclined wall 32. Also mounted in the housing 12 is a main drive motor 34 operatively connected to a conventional speed reducer unit 36 supported in the collar 30. The output shaft of the speed reducer 36, in a known manner, is connected to, and serves to effect rotation of, a generally horizontal polishing wheel assembly 38 shown in FIGS. 2 and 3.

The polishing wheel assembly 38 is comprised of an annular backing wheel 40 and a polishing cloth 42 extending across the upper face thereof. The backing wheel 40 is preferably formed of a metal, such as brass, having a high heat conductivity. The polishing cloth 42, which may for example be either sail cloth or a synthetic nonwoven cloth, is retained in position by means of a ring or hoop member 44 suitably clamped about the outer periphery of the backing wheel 40. In place of cloth, a felt material may be either clamped to the backing wheel 40 or glued thereon.

A freely flowing polishing slurry is adapted to be fed to the polishing wheel assembly 38 by tubes or spouts 46 extending downwardly from the bridge member 18 as shown in FIG. 1. The slurry is delivered to the spouts 46 through tubing 48 connected to a sump pump unit 50 located in the lower portion of the housing 12. The polishing slurry flowing from the polishing wheel assembly 38 is collected by the inclined wall 32, which serves as a drip pan, and is directed to a drain. The polishing slurry may, by way of example, comprise a polishing compound—such as one having an abrasive base of iron oxide, cerium oxide or zirconium oxide—suspended or mixed in water.

Secured in the lower end of each of this piston rods 28 is a nonrotatable vertical spindle assembly 52. Each spindle assembly 52, as shown in FIG. 3, comprises a spindle 54 having passageway means therein defined by a central axial opening 56 and a radial opening 58 which is adapted to be connected to a conventional vacuum-producing source.

Mounted at the lower end of each spindle assembly 52 is generally horizontal circular load plate unit 60 which comprises a plate 62, and a central disc 64 secured in the underside thereof by bolts 66. The disc 64 projects beyond the lower surface of the plate 62 and may be adjustably positioned axially of the plate 62 by setscrews 68. The plate 62, as shown in FIGS. 3 and 4, is provided with a central axial upwardly directed aperture 70, radially extending passageway means in the form of a plurality of radial passageways 72 communicating with the aperture 70, and axially extending passageway means in the form of a plurality of axial ports 74 radially spaced along each of the radial passageways 72. The axial ports 74 at their one ends communicate with the radial passageways 72 and at their other ends open at the lower surface of the plate 62.

Arranged between the spindle 54 and the plate 62 is a floating or swivel connection in the form of a universal ball bearing assembly 76. The bearing assembly 76 is maintained in assembled position by a snapping 78 engaged in the spindle 54, and by a bearing retainer 80 secured, as by bolts 82, to the plate 62. Suitably secured to the spindle 54 immediately above the bearing retainer 80 is a collar 84 which serves to shield the bearing assembly 76 from polishing mixture and other foreign material. The lower end section of the spindle 54 projects into the aperture 70 with the spindle opening 56 in communication therewith. Mounted within the aperture 70 is a seal member 86 which, as shown in FIG. 5, comprises an outer body portion 88 seated in the plate 62, and a flexible inner lip portion 90 maintained in engagement with the adjacent periphery of the spindle 54 by a garter spring 92. The seal member 86 and garter spring 92 serve as rotary vacuum seal means.

Additionally, the polishing wheel assembly 38 is surrounded by an annular thin-walled shroud or shield 94. The shroud 94

is normally maintained in a lowered position, as shown in FIGS. 1 and 2, to accommodate loading and unloading of the polishing machine, and is adapted to be slightly elevated to the position shown in FIG. 3 during polishing operations.

In preparation for polishing, the pneumatic assemblies 22 are suitably actuated to retract the piston rods 28 and the spindle assemblies 52 upwardly. A workpiece to be polished, such as an annular aluminum disc 96, is engaged at the underside of each load plate 62, with the central disc 64 serving to locate the annular disc. At the same time, the passageway means in the spindle 54 is placed under vacuum conditions for creating a vacuum in the passageway means of the load plate unit 60. By reason of the resultant vacuum conditions in the axial ports 74 of the load plate 62, the workpiece 96 is maintained in engagement with the lower surface of the load plate. The pneumatic assemblies 22 are then actuated to distend the piston rods 28 and the spindle assemblies 52 downwardly until the workpieces 96 are engaged under the desired pressure with the polishing cloth 42.

Next, the polishing wheel assembly 38 is rotated and polishing material is delivered from the spouts 46 to the surface thereof. Meanwhile, vacuum conditions are continued in the passageway means of the spindle assemblies 52 and the load plate units 60, so that the workpieces 96 are retained in position relative to the load plate units, and are movable therewith, during the polishing operation. The universal connections, and the rotary vacuum seals, between the spindles 54 and the load plates 62 accommodate free rotation and floating of the load plate units 60, as workpieces are being polished.

Upon completion of the polishing operation, drive of the polishing wheel assembly 38, and delivery of polishing material thereto, are interrupted; the spindle assemblies 52 are retracted and the load plate units 60 withdrawn upwardly; and the workpieces 96 are removed from the load plates 62.

The diameter of each load plate unit 60, the diameter of each central locating disc 64 and the axially adjusted position of each disc 64 may be varied to accommodate workpieces of different sizes. Also, it will be appreciated that in the drawings certain elements—for example, the cloth 42—have been exaggerated from the true scale for sake of clarity and illustration.

While there has been shown and described a preferred embodiment of the present invention, it will be understood by those skilled in the art that various rearrangements and modifications may be made therein without departing from the spirit and scope of the invention.

We claim:

1. In a polishing machine having framework, a polishing wheel assembly mounted on the framework on a vertical axis, means for rotating the polishing wheel assembly, at least one vertical spindle assembly supported from the framework above the polishing wheel assembly, a generally horizontal circular load plate unit adapted to receive at least one workpiece at the lower surface thereof for engagement with the polishing wheel assembly, and means mounting the load plate unit on the spindle assembly, the improvement which comprises said load plate unit having a central upwardly directed aperture, said load plate unit having passageway means communicating with said aperture and opening at said lower surface of said

unit, said spindle assembly having a lower section that projects into said aperture and including passageway means communicating with said aperture and adapted to be placed under vacuum for creating a vacuum in said passageway means of said load plate unit whereby to maintain a workpiece in engagement with the lower surface of said unit, said mounting means comprising swivel connection means, and rotary vacuum seal means between said lower section of said spindle assembly and said load plate unit adjacent said aperture.

2. The improvement of claim 1 wherein said passageway means of said load plate unit includes radially extending passageway means communicating with said aperture, and axially extending passageway means communicating with said radially extending passageway means and opening at said lower surface of said load plate unit.

3. The improvement of claim 2 wherein said radially extending passageway means is comprised of a plurality of radial passageways, and said axially extending passageway means is comprised of a plurality of axial ports radially spaced along said radial passageways.

4. In a polishing machine having framework, a polishing wheel assembly mounted on the framework on a vertical axis, means for rotating the polishing wheel assembly, at least one vertical spindle assembly supported from the framework above the polishing wheel assembly, a generally horizontal circular load plate unit adapted to receive at least one workpiece at the lower surface thereof for engagement with the polishing wheel assembly, and means mounting the load plate unit on the spindle assembly, the improvement which comprises said load plate unit having a central upwardly directed aperture, said load plate unit having passageway means communicating with said aperture and opening at said lower surface of said unit, said spindle assembly having passageway means communicating with said aperture and adapted to be placed under vacuum for creating a vacuum in said passageway means of said load plate unit whereby to maintain a workpiece in engagement with the lower surface of said unit, and said load plate unit including a central disc at said lower surface of said unit for locating an annular workpiece engaged with said lower surface of said unit.

5. The improvement of claim 1 wherein said passageway means of said spindle assembly is defined by a central axial opening which communicates with said aperture and a radial opening which communicates with said axial opening and is adapted to be connected to a vacuum producing source.

6. For use in a polishing machine, a circular load plate unit having an aperture which opens axially at one side of said unit, and having passageway means including a plurality of radially extending passageways communicating with said aperture and a plurality of axial ports radially spaced along said radially extending passageways in communicating relation therewith and opening at the other side of said load plate unit, said passageway means being adapted to maintain a workpiece in engagement with said other side of said unit when a vacuum is created in said passageway means, said load plate including an adjustable central disc at said other side of said unit for locating an annular workpiece engaged with said other side of said unit.

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