May 20, 1952 R. G. ROSHONG 2,597,187

ADJUSTABLE LAP

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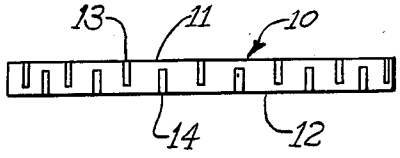


Fig. 1.

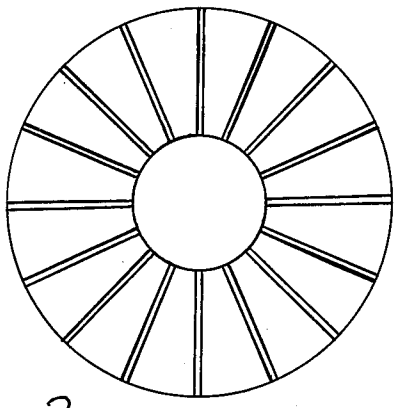


Fig. 2.

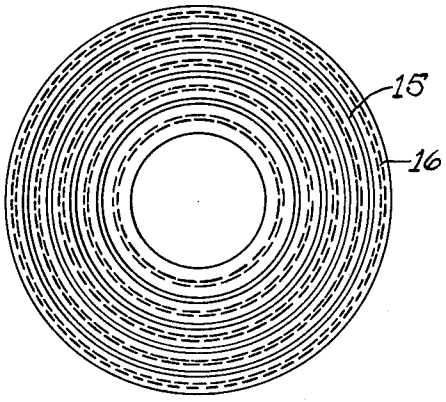


Fig. 3.

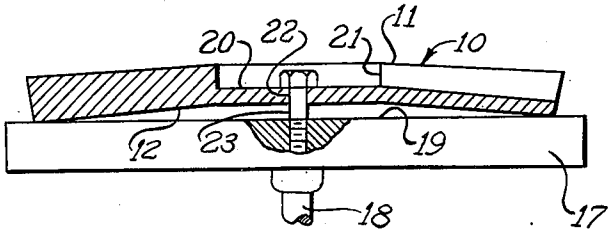


Fig. 4.

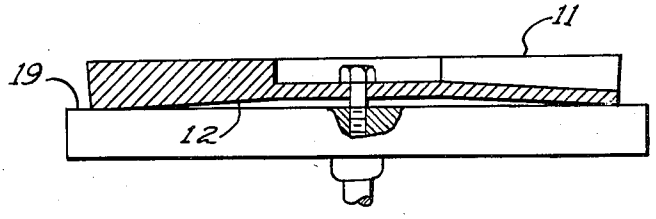


Fig. 5.

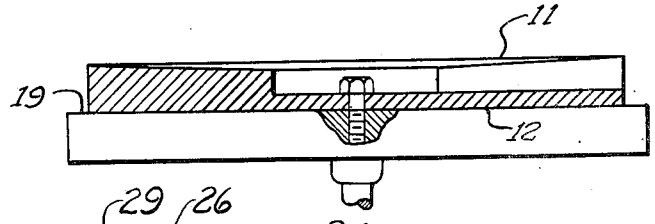


Fig. 6.

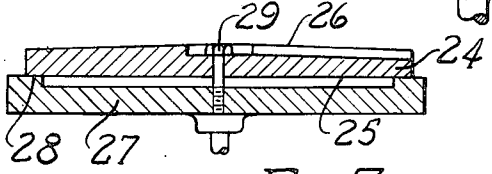


Fig. 7.

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ADJUSTABLE LAP

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4 Claims. (Cl. 51—209)

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This invention relates to grinding and lapping machines, and particularly to a tool for lapping surfaces to any desired contour, from a flat to either a concave or convex form.

In lapping machines as commonly constituted, the tool is a circular plate made of cast material and having grooves, either circular or radial, for carrying away excess grit and lubricant. The working surface of the plate is generally flat, and if it is desired to lap a surface which is other than flat, another plate having the desired curvature is substituted for the flat plate. Thus it is necessary to purchase and maintain a plurality of plates with each lapping machine if the machine is to be used to lap various forms of surfaces.

The principal object of this invention is to provide a tool for lapping surfaces, said tool being adapted to be used for forming convex, flat or concave surfaces.

Another object of this invention is to provide a tool for lapping surfaces, said tool being initially dished so as to form a convex surface, and means for distorting the tool to render the working surface of the tool either substantially flat or concave.

These and other objects 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 of a lapping plate embodying the present invention;

Fig. 2 is a plan view of the lapping plate of Fig. 1;

Fig. 3 is a plan view of a modification of the plate of Fig. 1;

Fig. 4 is an enlarged side elevation in section of the plate of Fig. 1 showing the means for mounting it on a rotating platen;

Figs. 5 and 6 are views similar to Fig. 4, showing the plate in different conditions of operation; and

Fig. 7 is a side elevation of a further modification of the plate of Fig. 1 and the support therefor.

Referring now to the drawings for a detailed description of the invention, there is shown in Fig. 1 a circular plate 10 having an upper working surface 11 and a lower working surface 12. The plate may be made of any desired material, but for purposes of illustration it will be described as cast iron of the grade commonly known as "Meehanite." Both the upper and lower surfaces 11 and 12 are formed with grooves 13 and 14, respectively, which are disposed substantially

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radially with respect to surfaces 11 and 12 and also substantially perpendicularly with respect to the planes of the said surfaces 11 and 12. The grooves 13 and 14 extend more than half-way through the plate and hence are staggered or out of register with one another so that grooves 14 are located midway between adjacent grooves 13. This results in a corrugated section. It is contemplated that in a lapping plate twelve inches in diameter the average thickness of the plate between grooves will be approximately 3/8", and the axial thickness from the surface 11 to the bottom of a groove will likewise be 3/8".

A lapping plate so proportioned will have a slight amount of resilience, even though made of cast iron. It is this resilience which is relied upon to distort the lapping plate from a convex to a concave form. When the grooves 13, 14 are disposed radially on the plate, surface 11 will be either conical or flat, but will not be frustospherical. To approach more nearly a frustospherical contour, the grooves may be made circular as shown in Fig. 3. There the grooves 15 and 16 are made of substantially the same width as the grooves 13, 14, but are concentrically disposed about the center of the plate, thus forming circular pleats or corrugations. This disposition of the grooves permits the plate to assume a curved shape.

Referring now to Figs. 4, 5 and 6, the means by which different curvatures may be obtained in plate 10 will be described. It will be observed that plate 10 is mounted on a rotatable platen 17 having a centrally located drive shaft 18. The upper surface 19 is preferably made flat. Plate 10 has a centrally located recess 20 which permits material being lapped to run out over the edge 21 of surface 11, thereby avoiding the formation of ridges or shoulders on the said surface 11. The lapping plate 10 is initially formed with a slightly dished shape so that surface 11 is convex and the bottom surface 12 is concave. These shapes are shown greatly exaggerated in Figs. 4, 5 and 6, the actual deviation from flatness in a disc twelve inches in diameter being a few hundredths of an inch.

Lapping plate 10 has an opening 22 through which is passed a bolt 23 threaded into platen 17. The depth of recess 20 is such that the head of bolt 23 does not protrude above surface 11 and hence it will not interfere with the work being lapped. The plate 10 is clamped to platen 17 by bolt 23 and the amount of curvature in the plate is controlled by bolt 23 also. Plate 10 is thinner at the center than at the outer periphery

and is initially formed in such a manner that the variation from flatness of surface 12 is greater than the variation from flatness of surface 11. Thus the maximum convex curvature is obtained when bolt 23 merely holds plate 10 on platen 17. By tightening bolt 23 beyond this point, plate 10 is distorted to make surface 11 flat as shown in Fig. 5, or to make surface 11 concave as shown in Fig. 6. In the last-mentioned figure, bottom surface 12 contacts upper surface 19 on platen 17 and thus determines the maximum concave curvature.

If the work to be lapped is to have a flat surface, then plate 10 is adjusted as shown in Fig. 5, and surface 11 is trued up with an appropriate truing tool before the work may be lapped. For a conical surface, the plate 10 is simply distorted to the desired cone angle and is ready to be used (assuming that it was true when it was flat). For a convex or concave frustro-spherical surface, the plate 10 is distorted to approximately the desired curvature and then a special truing tool, having the desired curvature, is used to perfect the surface. This procedure must be gone through each time the curvature is changed.

The form shown in Fig. 7 differs from the preceding forms in that the lapping plate 24 is initially formed with a substantially flat underside 25, the upper surface 26 being convex as before. Platen 27 has an annular bead 28 formed in the upper surface thereof, preferably at or near the outer edge of the platen. A bolt or screw 29 is utilized to flex the lap plate 24 from convex, through flat, to concave curvature as described with reference to the preceding forms.

It is obvious that with the Fig. 7 form, the desired effect can be obtained whether the bead is continuous or not, as long as the edge of the lap plate 24 contacts the bead before the center of the said lap plate contacts the center of the platen 27. The surface of platen 27 within the bead 28 is therefore chosen to approximate the curvature of the underside 25 of lapping plate 24 and the plate 24 is then distorted by moving its center toward the center of the platen 27.

The advantage of a distortable lapping plate over a fixed plate resides in the versatility of the distortable plate. One such plate may take the place of many fixed plates. The desired curvature may be obtained in a shorter time than would be the case if one fixed lap were to be shaped solely by a truing tool from one curvature to another.

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. In a lapping machine, a lapping tool comprising in combination a circular platen mounted for rotation about a vertical axis, said platen having a raised upper peripheral surface, a circular lapping plate of appreciable thickness and formed of a material having limited flexibility centrally disposed on said platen, there being a circular well formed in the upper surface of said plate the rim of which, in combination with the upper peripheral edge of the plate, defines a ring-like convex frusto-conical lapping surface, the lower peripheral edge of the plate resting upon said peripheral surface of the platen and the medial regions of the underneath surface of the plate being spaced from the surface of the platen, there being a series of spaced radially disposed grooves formed in the upper surface of said plate and extending completely across said lapping surface and of a depth sufficient to lend added flexibility to the plate as a whole, there being a similar series of spaced radially disposed grooves formed in the lower surface of said plate and of a depth sufficient to lend further flexibility to the plate as a whole, the grooves in the upper and lower surfaces of the plate being circumferentially staggered on opposite sides of the plate, and adjustable clamping means extending axially and centrally through said plate and cooperating with the platen for drawing the central regions of the plate toward the upper face of the platen to thus flex the plate and alter the contour of the lapping surface thereof from its original convex frusto-conical shape, through a planar condition to a shape wherein it assumes a concave frusto-conical condition.

2. In a lapping machine, a lapping tool comprising in combination a circular platen mounted for rotation about a vertical axis, said platen having a circular upper peripheral surface, a circular lapping plate formed of a material having limited flexibility and of appreciable thickness centrally disposed on said platen, there being a circular well formed in the upper surface of said plate the rim of which, in combination with the upper peripheral edge of the plate, defines a ring-like convex frusto-conical lapping surface, the lower peripheral edge of said plate resting upon said peripheral surface of the platen and the medial regions of the underneath surface of the plate being spaced from the upper surface of the platen, there being a series of spaced radially disposed grooves formed in the upper face of the plate and extending completely across said lapping surface and of a depth sufficient to lend added flexibility to the plate as a whole, and adjustable clamping means extending axially and centrally through said plate and cooperating with the platen for drawing the central regions of the plate toward the upper surface of the platen to thus flex the plate and alter the contour of the lapping surface thereof from its original convex frusto-conical shape, through a planar condition to a shape wherein it assumes a concave frusto-conical condition.

3. In a lapping machine, a lapping tool comprising in combination a circular platen mounted for rotation about a vertical axis, said platen having a circular upper peripheral surface, a circular lapping plate formed of a material having appreciable thickness and formed of a material having limited flexibility centrally disposed upon said platen, there being a circular well formed in the upper surface of said plate the rim of which, in combination with the upper peripheral edge of the plate, defines a ring-like lapping surface, the lower peripheral edge of said plate resting upon said peripheral surface of the platen and the medial regions of the underneath surface of the plate being spaced from the upper surface of the platen, there being a series of spaced radially disposed grooves formed in the upper surface of said plate and extending completely across said lapping surface and of a depth sufficient to lend further flexibility to the plate as a whole, there being a similar series of spaced radially disposed grooves formed in the lower surface of said plate and of a depth to lend further flexibility to the plate as a whole, the grooves in the upper and lower surfaces of the plate being circumferentially staggered on opposite sides of the plate, and a threaded member extending centrally

through said plate and cooperating with the platen for drawing the central regions of the plate toward the upper face of the platen to thus flex the plate and alter the contour of the lapping surface.

4. In a lapping machine, a lapping tool comprising in combination a circular platen mounted for rotation about a vertical axis, said platen having a raised upper peripheral surface, a circular lapping plate formed of a material having limited flexibility and of appreciable thickness centrally disposed on said platen, there being a circular well formed in the upper surface of said plate the rim of which, in combination with the upper peripheral edge of the plate, defines a ring-like convex frusto-conical lapping surface, the lower peripheral edge of said plate resting upon said peripheral surface of the platen and the medial regions of the underneath surface of the plate being spaced from the surface of the platen, there being a series of concentric circular grooves formed in the upper surface of said plate and of a depth sufficient to lend added flexibility to the plate as a whole, and a threaded member extending axially and centrally through the bottom of said recess and cooperating with the platen for drawing the central regions of the plate toward the upper face of the platen to thus flex the plate and alter the contour of the lapping surface thereof from its original convex frusto-conical shape, through a planar condition to a shape wherein it assumes a concave frusto-conical condition.

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