Aug. 31, 1943. F. H. KEMP 2,328,459

FINISHING STONE

Filed Sept. 29, 1941

FIG.1.

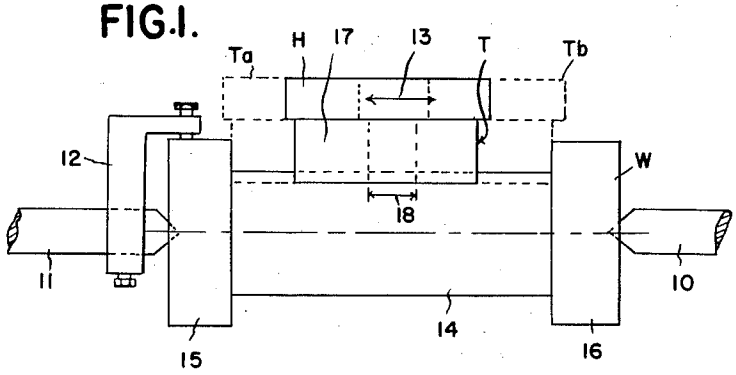


FIG.4.

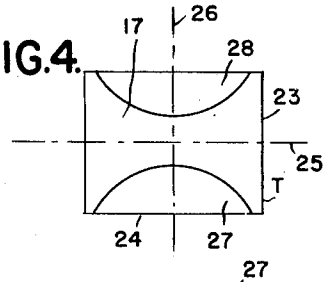


FIG.2.

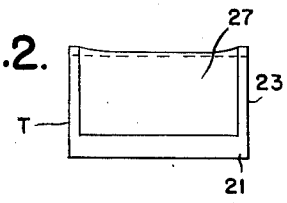


FIG.3.

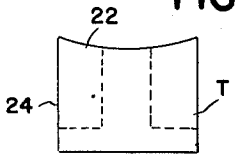


FIG.5.

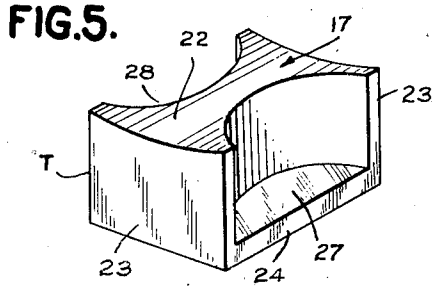
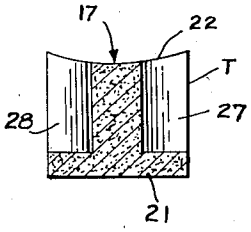


FIG.6.



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FINISHING STONE

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3 Claims. (Cl. 51—204)

The present invention relates to a finishing stone, and more particularly to a finishing stone having a certain shape which renders it useful in the finishing of rotating cylindrical work pieces.

At the present time rotating cylindrical work pieces are finished by a process commonly known as "superfinishing," in which the work piece is rotated in contact with a finishing stone, and the finishing stone is reciprocated axially of the work piece. By suitable variations in speed, the direction of relative motion between the stone and the work piece is continuously changed, so that in effect the work piece is finished by a relative rubbing action which takes place in all directions.

One of the important practices of this "superfinishing" method is in finishing an external cylindrical surface which is located between shoulders or which extends up to a single shoulder. In finishing such a surface it is very desirable to insure finishing of the cylindrical surface clear up to the shoulder, and in the past considerable difficulty has been encountered in extending the finishing action uniformly up to the shoulder. There has been a tendency for the finishing stone to wear away adjacent its end or ends and thus leave excess material at the corner formed by the intersection of the cylindrical surface and the adjacent shoulder. Furthermore, it has been found that there was a tendency for the cylindrical surface to be finished with a slight concavity. This was very undesirable, and it would be preferable to impart a slight convexity to the cylindrical surface while at the same time extending the finishing action fully up to the shoulder.

It is accordingly an object of the present invention to form a finishing stone of a particular shape, such that its operating surface in contact with the surface of the work piece is of varying width so as to vary the finishing action thereof.

More specifically, it is an object of the invention to provide a finishing stone for the purpose set forth, having a finishing portion of varying cross-section and having a reinforcing backing portion which is of rectangular shape.

It is a further object of the invention to provide a finishing stone for the purpose set forth having a working or finishing portion which is of generally hourglass cross-section and having a reinforcing backing portion of rectangular cross section.

Other objects of the invention will be apparent as the description proceeds, and when taken in conjunction with the accompanying drawing, wherein:

Figure 1 is a diagrammatic view illustrating the usage of my improved finishing stone;

Figure 2 is a side elevation of my improved finishing stone;

Figure 3 is an end view of my improved finishing stone; and

Figure 4 is a top plan view of my improved finishing stone.

Fig. 5 is a perspective view of the hone.

Fig. 6 is a section of the hone taken along transverse axis 26.

Referring first to Figure 1, I have shown a work piece W mounted for rotation between centers 10 and 11, the center 11 being shown as provided with a drive dog 12 in order to impart rotation to the work piece W.

I have shown my improved finishing stone at T, mounted in a holder H, and this stone, during rotation of the work piece, is reciprocated in the direction of the arrow 13, between limits shown by the dotted line positions of the tool indicated at T_a, T_b. The work piece W has a cylindrical surface 14 which is to be finished, and at the ends of the work piece are flanges 15 and 16. Reciprocation of the tool T is between a left-hand position T_a, in which the finishing portion 17 of the tool engages the flange 15, and a right-hand position T_b, in which the finishing portion 17 engages the right-hand flange or abutment 16. Accordingly, throughout the reciprocation of the tool T, a middle zone of the surface 14 located centrally between the flanges 15 and 16 is always in contact with the abrading or finishing surface of the stone. This middle zone has been indicated in the figure at 18. Furthermore, it will be apparent that as the stone reciprocates back and forth in the direction of the arrow 13, that portion of the cylindrical surface 14 which is closely adjacent a flange 15 or 16 is contacted only for a very limited time.

On the other hand, all portions of the working surface of the tool T are constantly in contact with the cylindrical surface 14 so that, other conditions being equal, the working surface of the stone T would be worn away uniformly.

It has been found that when the working portion of the stone 17 is of rectangular cross-section, the cylindrical surface 14 is finished in a nonuniform manner, and specifically it is found that the surface 14, when finished, is slightly dished or concave, and in addition excess material is left thereon adjacent the flanges 15 and 16. The amount of this concavity is of course very small but it is none the less undesirable, and it is accordingly important to correct or control the exact shape finally imparted to the surface 14.

I have found that the final shape of the surface 14 may be accurately controlled by design-

ing the tool in accordance with the disclosure herein.

Referring now to Figures 2 to 4, I have shown my improved stone T as having the working or finishing portion 17, which is of the general hourglass formation best seen in Figure 4. The stone is provided with a reinforcing back 21, which is of rectangular cross-section and is of sufficient thickness to properly reinforce the finishing portion 17. The reinforcing back 21 is adapted to be clamped in a holder H which, in turn, is reciprocated by suitable mechanism forming no part of the present invention, and accordingly not illustrated herein. The working surface of the tool is indicated at 22 and occupies a portion of a cylinder equal to the cylindrical surface being finished, so that the working surface 22 is in surface to surface contact with the cylindrical surface 14 of the work piece.

In order to simplify a description of my improved stone T, the same is described as having a back 21, working surface 22, ends 23 and sides 24. By referring to Figure 4, I have shown a longitudinal axis 25 and a transverse axis 26. It will be noted, by referring to Figure 4, that the finishing portion 17 of my stone is symmetrical, both about the longitudinal axis 25 and the transverse axis 26.

I have shown the portion 17 as shaped in the hourglass conformation previously referred to by the provision of cylindrically formed recesses 27 and 28, and these recesses, as seen in the figures, are open at the top and at the sides of the stone and are of uniform cross-section from the top or working surface 22 of the stone to the reinforcing back 21. In other words, as the working or finishing portion 17 of the stone is worn away in protracted usage, the shape of the working surface thereof has not changed.

Comparing Figures 1 and 4, it will be noted that the portion 18 of the cylindrical surface 14, which is always in contact with a portion of the stone, is contacted by the narrowest width of the stone when the stone is in intermediate position. In the same manner, the portions of the cylindrical surface 14 which are closely adjacent to the flanges 15 or 16, are contacted by portions of the stone T which have the maximum transverse width.

Recesses 27 and 28, shown in Figure 4, may conveniently have their inner wall of cylindrical shape, although this is by no means necessary. Thus the ends of the recesses 27 and 28 may, if desired, be cylindrically formed, or otherwise, and the central portions may be flat surfaces tangent to the curved end surfaces of the recesses. This would result in a finishing stone having a working surface, the central portion of which for a predetermined distance from the transverse axis 26 is of uniform width, the surface increasing in width thereafter toward either end. The cylindrically walled recesses are easily formed, and for this reason are preferred.

In some cases the cylindrical surface of the work piece may have a shoulder at only one end thereof, the other end being free so that the finishing stone, to obtain the result taught here, may then have a working surface of maximum width at one end, which is of reduced width towards the other end. Such a stone would be represented by half of the stone shown in Figure 4, either to the right or left of the transverse axis 26.

By modifying the variation in transverse width of the working surface, different results can be obtained. The exact modification will depend upon the material being finished, the characteristics of the material making up the stone, and other considerations. Thus for example, in properly designing my improved stone, the cylindrical surface 14 may be accurately finished so as to show no concavity or convexity from end to end. If desired, by properly designing my improved finishing stone, the surface 14 may be finished with a very slight concavity, or a very slight convexity. In any case the cylindrical surface 14 will be completely finished right up to the flanges 15 or 16.

By making my improved stone symmetrical about a longitudinal axis, such as the axis 25, it is possible to provide a maximum variation in transverse width of the working surface 22, while at the same time preserving sufficient strength for efficient handling. This is rendered possible because of the rectangular reinforcing back 21, which may be clamped in the holder H without any tendency to break down the acute corners of the finishing portion 17 of the structure, as would be the case if the reinforcing backing 21 were omitted.

It is of course not necessary that the stone be absolutely symmetrical without a rectangular axis, but my improved result can be obtained to the fullest advantage only when the stone is modified so as to have outwardly and upwardly opening recesses in both sides thereof.

The present invention is concerned primarily with the shape imparted to the finishing stone for a specific purpose and not with the material employed in the make-up of the stone. The material employed may be an artificial bonded abrasive of any suitable type, many of which are now on the market.

While I have illustrated my improved stone as contacting an external cylindrical surface, it will be readily appreciated that a stone having a similar configuration may advantageously be used in finishing an internal cylindrical surface where such surface extends to an inwardly extending shoulder or portion which limits reciprocation of the stone. Thus for example, a stone of this type will be useful in finishing internal cylindrical walls down to the bottom thereof.

While I have illustrated and described only a single form of stone and have referred in the description to certain modifications thereof, it will be understood that this specific disclosure has been made solely to enable those skilled in the art to practice the present invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. A one piece finishing stone of the class described comprising a solid block of abrasive material provided at the top and bottom, respectively, thereof with a transversely curved working surface and a substantially flat back, said block being provided in opposite sides thereof with longitudinally extending laterally opening concave recesses having opposite ends thereof terminating short of and spaced from opposite ends of the block, said recesses also opening upwardly through the transversely curved working surface at the top of the block but terminating short of said flat back at the bottom of the block whereby portions of the back form bottoms for the recesses and constitute webs for attachment to a holder for the block.

2. A finishing stone of the class described comprising a solid block of abrasive material

having laterally opening concave recesses in opposite sides thereof, a transversely dished working face at the top of said block between said recesses, and a substantially flat back at the bottom of said block extending across and forming bottoms for said recesses, the portions of said back forming bottoms for said recesses constituting connecting webs between opposite ends of the block for attachment to a holder for the block.

3. A finishing stone of the class described comprising a solid block of abrasive material provided at the top thereof throughout its length with a transversely curved working surface and provided in opposite sides thereof with laterally opening concave recesses, said block having a substantially flat back, said recesses also opening upwardly through the transversely curved working surface at the top of the block but spaced from the back of the block so as to provide reinforcing webs integral with the ends of the block for attachment to a holder for the block.

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