March 21, 1950 A. S. TITCOMB 2,501,422

ABRASIVE BLOCK OR SEGMENT

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Fig. 1.

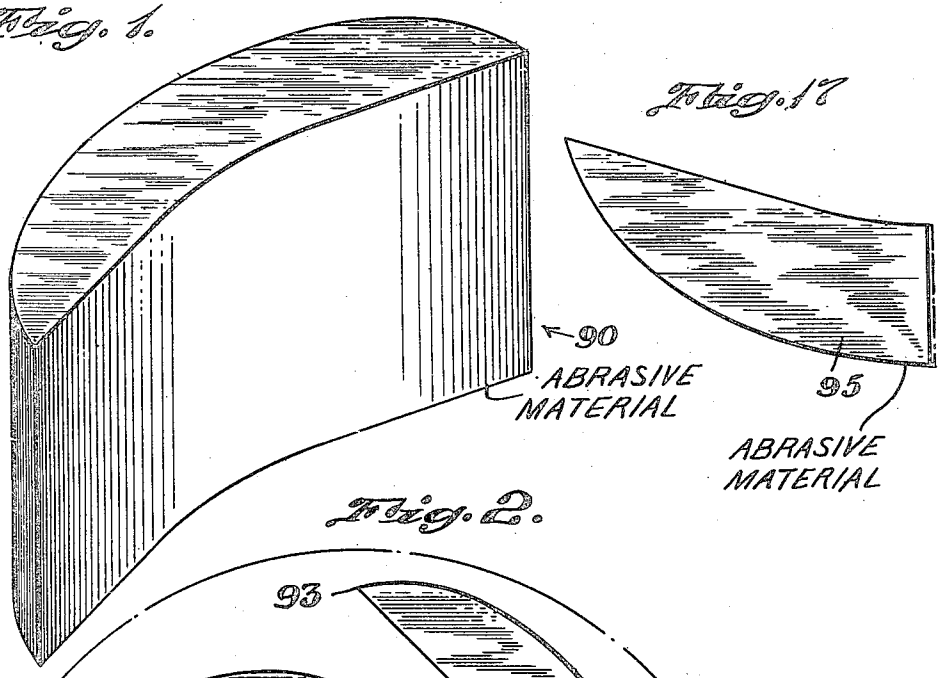
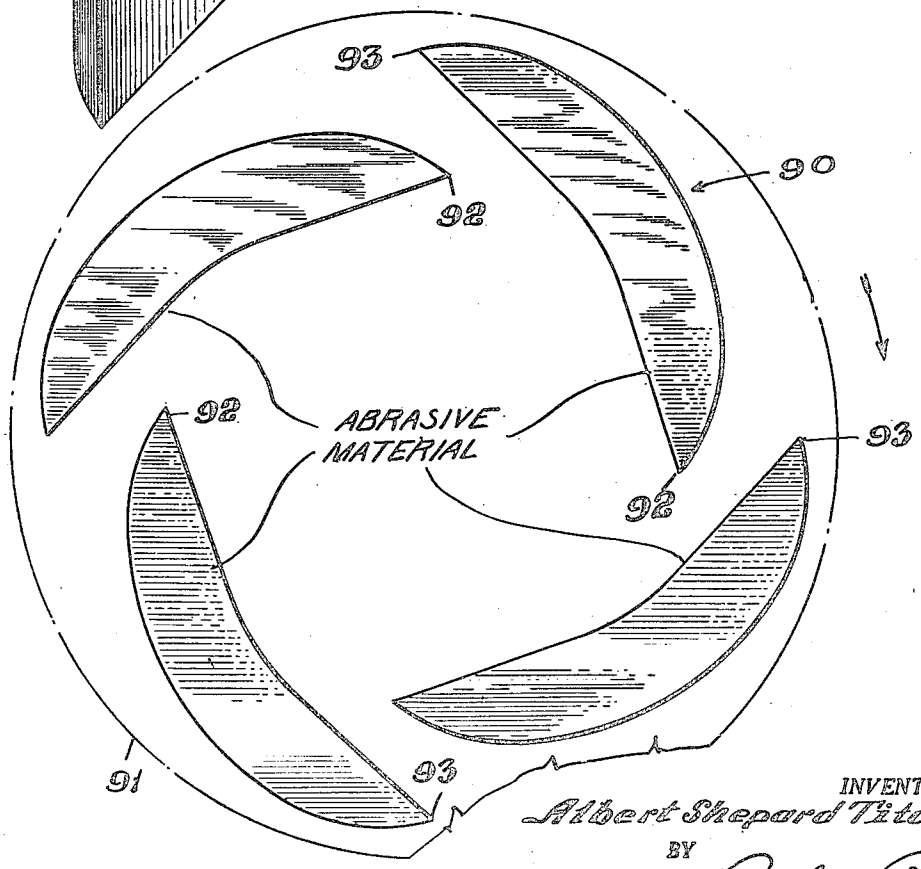


Fig. 17

Fig. 2.



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Fig. 3.

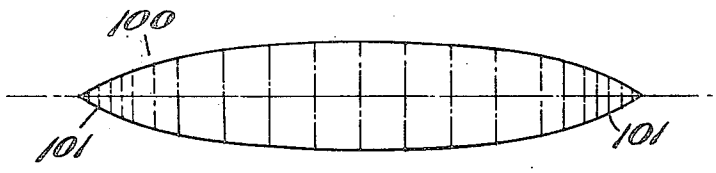


Fig. 4.

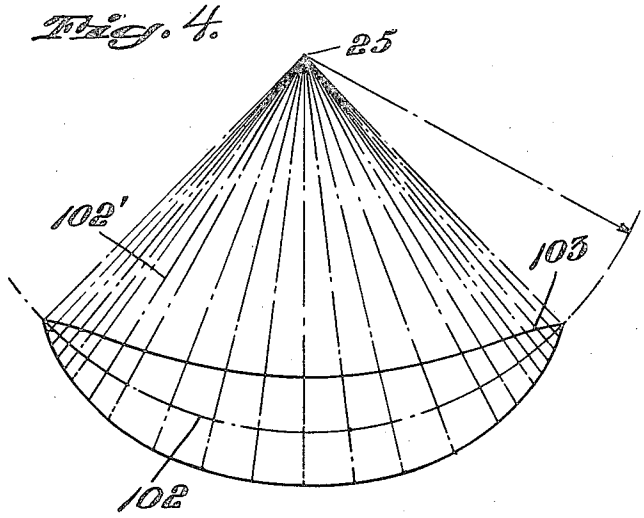
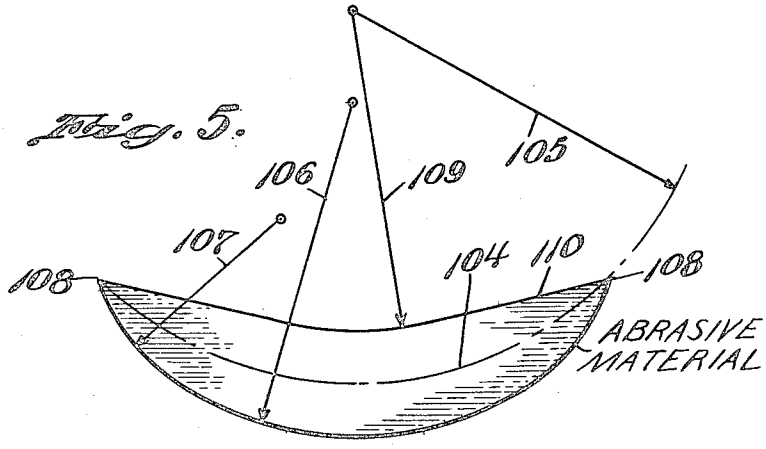


Fig. 5.



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Fig. 18.

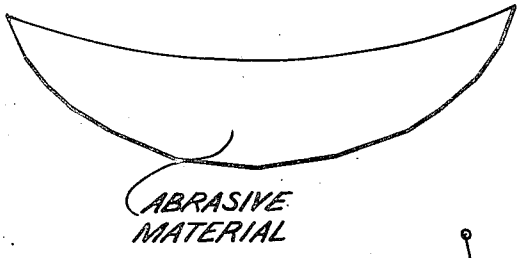


Fig. 6

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Fig. 7.

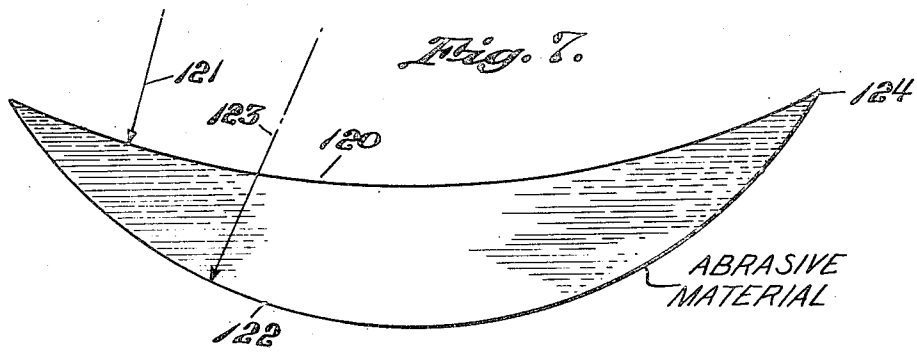


Fig. 8.

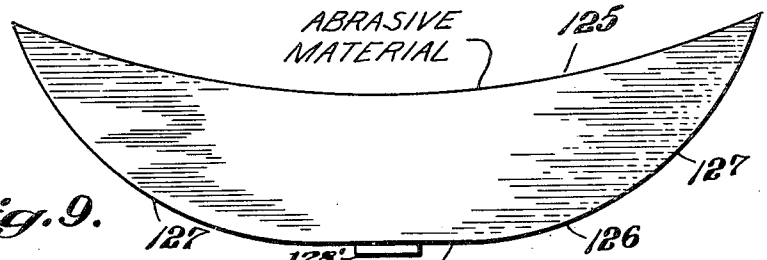


Fig. 9.

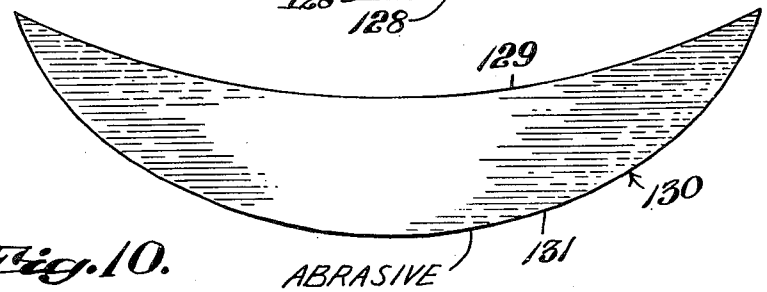
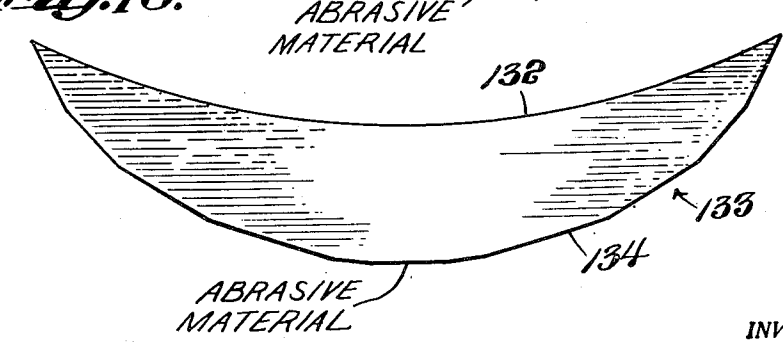


Fig. 10.



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Fig. 11.



Fig. 12.



Fig. 13.

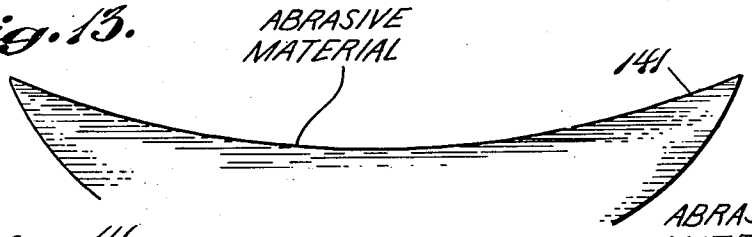


Fig. 14.

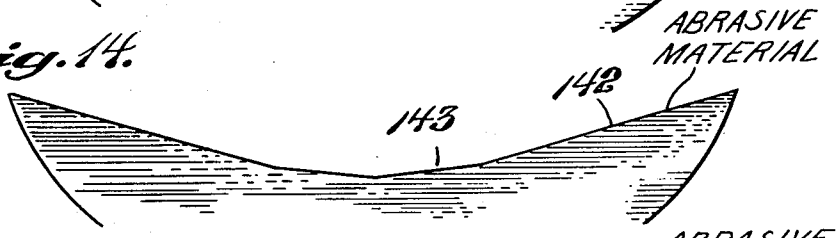
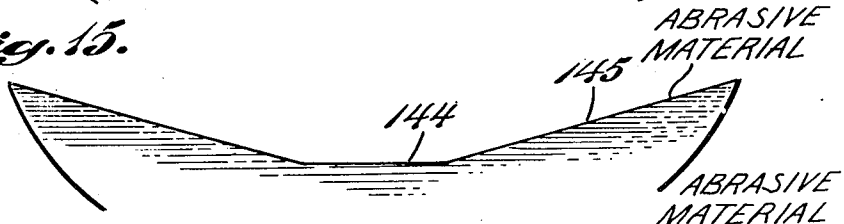


Fig. 15.



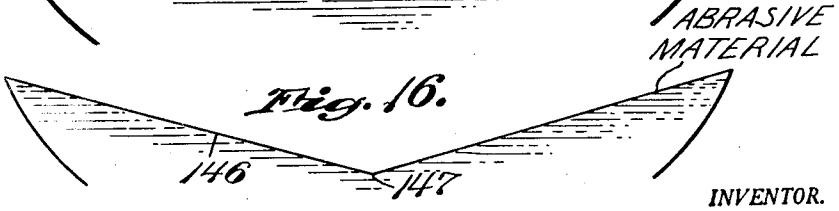


Fig. 16.

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UNITED STATES PATENT OFFICE

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ABRASIVE BLOCK OR SEGMENT

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Application June 1, 1949, Serial No. 96,476

17 Claims. (Cl. 51—209)

1

This invention relates to an abrasive grinding wheel which is composed of a plurality of spaced abrasive surfaces, and more particularly to the abrasive block or segment which is utilized for such a wheel. This application is a continuation-in-part of my co-pending application Serial No. 679,807, issued July 19, 1949, Patent Number 2,476,334, which claims more particularly the wheel as a whole, while this application is directed specifically to the segment or block per se which goes into such wheel.

Abrasive grinding wheels of the above character have heretofore been constructed of a grinding segment composed of abrasive material shaped like a hollow cylinder, known in the trade as an "inverted cup." The sides of the cup are often made of segments each locking into the next segment or sometimes by segments with spaces in between with locking devices to hold the sides of the cup to the upper base of the grinding wheel by means of what is known in the trade as the chuck. This wheel is intended for operating on a mounting at the bottom of a rotating vertical spindle on work fastened to a movable base (either rotary or reciprocative) and where the revolving segments are pressed downward against the work. It is also intended for operating on a mounting at one end of a horizontal spindle on work fastened to a reciprocating table so that the revolving segments are pressed against the work. When the wheel is applied to the work, chips of the work and also of the cutting wheel are formed by removal of the stock of each. This removed stock will load up or interfere with the efficient cutting action of the usual types of wheels, the cutting efficiency of a wheel depending to a substantial extent upon the elimination or removal of this debris. Thus, the particular shape of the block and arrangement of the several blocks in the wheel are therefore very important from the standpoint of an efficient cutting wheel. It has been found that if this loose stock is readily removed from the grinding before it becomes embedded into the cutting surface of the wheel or segment, it is unnecessary to dress the wheel as frequently as otherwise and even often eliminates such dressing entirely. This is because the loose stock fills in the crevices, that is, loads the wheel so that the cutting edges of the rough surface are neutralized and forms a smooth uncutting wheel which causes heating, burning, and warpage of the work being ground. This friction instead of cutting action often causes sufficient friction to

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throw the work off the magnetic chuck, generally used, sometimes with serious results.

One of the objects of this invention is to provide a block for an abrasive grinding wheel, which block will be of such shape that it will provide a more efficient and freer cutting wheel action than similar segmental block wheels have heretofore accomplished.

Another object of this invention is to provide a shape of abrasive block so that chips will be self-removed efficiently and thus prevent loading of the wheel.

Another object of this invention is to provide an abrasive block which will cause its leading edge to have an efficient plow action upon the chips which are formed to spread the chips outwardly and inwardly of the wheel as the cutting surface of the block advances.

Another object of this invention is to provide an abrasive block which, when in a wheel, will run cool and free of loading and thus prevent heating and warping of the work.

Another object of this invention is to provide an abrasive block which will be of such form that it may be utilized in a plurality of different diameter wheels, thus enabling lower cost to manufacture through the standardization and also greater economy in cases where there is need of replacement through damage.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a perspective view of an abrasive block formed in accordance with this invention;

Figure 2 is a plan view of several of the abrasive blocks arranged in the form which they will assume in a grinding wheel utilizing abrasive blocks of this shape;

Figure 3 is a diagrammatic view of the basic form of a segment or block having rather ideal plow-like properties when in action if the same were drawn in a straight line;

Figure 4 is a view similar to Figure 3, but illustrating the segment as being developed into an arcuate form or shape desirable for grinding wheel purposes;

Figure 5 is a plan view of a block illustrating a modified shape so far as Figure 4 is concerned, but showing diagrammatically by means of radius lines the shaping of the block such as is shown in Figure 3;

Figure 6 is a diagrammatic view illustrating a further modification showing the arcuate lines

forming the edges of the block and their radius lines where true arcs go to make up the segment formed;

Figure 7 is a diagrammatic view illustrating a segment formed from two arcs;

Figures 8, 9, 10, 11, and 12 are diagrammatic views each showing an inner edge having a single arc, while the outer surface of the segment is formed arcuate each of different form by different formations of the surface;

Figures 13 to 16 and 18 are diagrammatic views illustrating segments each of modified form and showing the inner surfaces of the segments each different but formed from flat and curved surfaces of varying form although generally of the same characteristics; and

Figure 17 illustrates a segment which is substantially one-half of the segment shown in Figure 1.

In proceeding with this invention, I have constructed an abrasive block or segment of an elongated shape which will have pointed ends. The leading pointed end will be so positioned in the wheel that the opposite flaring edges from the leading end will have a plow action upon the chips and debris removed by the preceding segment. These blocks are all of the same size and shape for standardization and for grinding wheels of different diameters, and I usually mount more upon a larger wheel than on a smaller wheel in order to provide the size of grinding wheel desired. The blocks may also be arranged in overlapping circular echelon relation so that a continuous cutting surface is provided on the work, thus preventing the opportunity for the stock being ground to rise, and at the same time providing necessary chip clearance between blocks or segments. The overlapping relation will be so spaced that the chips removed from the work may be thrown aside from the wheel by centrifugal force as well as by physical displacement of the plow action referred to above. Coolant is usually delivered at a location just inwardly of the circular cutting annulus of the wheel and flows to the work surface within this annulus. For greater detail concerning the wheel itself, reference is made to the above-mentioned copending application.

By the term "arcuate" I mean a line which may be shaped like the bow of a bow and arrow and formed of portions of several true arcs struck from centers or a line which may be formed of flat surfaces at obtuse angles to each other and polygonal in plan or a line made up of arcs and flat surfaces generally in the form of the median line or either edge depicted in the various views.

A line of less curvature means nearer a straight line and greater or sharper curvature would mean further from a straight line.

With reference to the drawings, Figure 1 shows a perspective view of an abrasive block or segment 90 of a commercial form which is the subject of this invention. Four of such blocks are shown in Figure 2 in the arrangement which will occur when assembled as an abrasive wheel indicated by dot and dash lines 91. In each case the leading end 92 of the block will be nearer the center of the wheel than the trailing end 93 so as to arrange the blocks in a circular echelon relation with the leading end of one block usually overlapping the trailing end of the next block so that engagement with the work is continuous.

In Figure 3 I have illustrated at 100 a fundamental form of abrasive block which will have pointed ends 101 formed by reducing the thickness from the extreme width along a substantial length. As most grinding wheels are formed in circular shape, the abrasive block which will be used will be of arcuate shape and will be developed from the fundamental form shown in Figure 3 by determination of the general curvature of the block desired which may be the median line or center line of the block 102 from which the shape is developed. Figure 4 designates such median line with the opposite edges layed off on either side of the median line as equal dimensions along radii 102' from the center of the median line, or if this median line is not a true arc having a center but is rather arcuate in form, the layout will be along lines at right angles to the portion of the arcuate line at different points along its length. In Figure 4 the inside arcuate edge of the block is shown to have a reverse curve 103 as it approaches the median line to form an acutely angled end.

A form which is found to be suitable is shown in Figure 5 where the median line 104 is formed on the arc of a circle having a radius 105, while the inner and outer edges of the block are arcuate, the outer surface having a center arc from radius 106 with arcs from shorter radii at each end such as 107 joining the center arc to the median line at 108. The inner edge of the block is also arcuate having a center arc from radius 109 which is connected by straight lines such as 110 to the ends 108 which are on the median line. A perspective view of the block so formed is shown in Figure 1. In each case, however, acutely angled ends are provided.

In some cases, as shown in Figure 6, there may be a single inner arc for the inner surface of the block which is designated 112 and struck from the radius 113, while the median line may be an arc 114 having radius 115 with the outer surface 116 arcuate and formed from arcs having radii 117 and other radii 118 of shorter radius at the ends, thus forming acutely angled ends 119. In some cases I may provide a segment formed of two arcs, as shown in Figure 7, there being an inner arc 120 formed on radii 121 and an outer arc 122 formed on radii 123, thus also providing acutely angled ends 124 but of a much thinner and more fragile character.

In Figure 8 I have shown an inner surface formed from a single arc 125, while the outer surface 126 is formed arcuate having arcs 127 at either end joined by a flat portion 128 which may be raised as at 128'. In Figure 9 I have shown the inner surface 129 formed from an arc of a single radius, while the outer surface 130 is formed from a plurality of flat surfaces 131 each in an obtuse angle to each other but generally conforming to the shape defined in Figure 6. In Figure 10 the same general arrangement, as shown in Figure 9, is provided, there being an arc of uniform radius 132, while the outer surface 133 is formed from a plurality of flat surfaces 134 longer than the flat surfaces 131 and each at an obtuse angle to the next one but all generally conforming to the shape of the arcuate surface 116 of Figure 6.

Modifications of the outer surface of the segment are shown as in Figure 11, there being a curved middle portion 135 joined by three flat surfaces 136, 137, and 138 to form the end portion of the block, while in Figure 12 the outer surface is composed of an arc 139 joined by a single flat surface 140 at either end of the block to connect with the inner surface of the block.

The inner surface of the block may also be formed arcuate in several different forms and these are shown in Figures 13, 14, 15, and 16. In Figure 13 the inner surface is formed from a plurality of short flats 141 each at an obtuse angle to each other, while in Figure 14 there are longer flat surfaces 142 connected by shorter flat surfaces 148 each at an obtuse angle. In Figure 15 three flat surfaces are provided, there being a middle flat surface 144 and end flat surfaces 145, while in Figure 16 two flat surfaces 146 are provided meeting at the center 147.

The above blocks all provide practical schemes of forming blocks which may be disposed in the circular relation which is shown in the wheel of Figure 2, it being merely necessary to utilize one of these many forms for many wheels of different diameter which may be desired. The holders for the blocks or clamps will, of course, be uniform and of a shape to cooperate with the particular shape of block desired. From a strength characteristic standpoint it is desirable to have the ends of thicker or heavier section in order that they may be stronger and the form which I have shown in Figures 1, 2, and 5 is found to be the more suitable in this regard rather than the more fragile section of Fig. 7. The many forms illustrated, however, indicate the variations which may be adopted and combinations of which come within the purview of this invention.

In Figure 17 I have shown a block 95 which is substantially one-half of the block shown in Figure 1, which in some cases it may be desirable to use.

I claim:

1. A bonded abrasive block shaped as a pseudo hollow cylindrical segment, formed between two arcuate surfaces, said arcuate surfaces being perpendicular to an end surface and substantially equidistant throughout their course from an arcuate median, said inner and outer arcuate surfaces meeting at said median in an acutely angled sharp end.

2. A bonded abrasive block as in claim 1 wherein one of said arcuate surfaces comprises an arcuate surface merging into a flat plane carried to the arcuate median.

3. A bonded abrasive block as in claim 1 wherein said inner surface comprises an arcuate surface merging into a flat plane carried to the arcuate median.

4. A bonded abrasive block as in claim 1 wherein one of said surfaces comprises an arc merging into an arc of shorter radius intersecting said median.

5. A bonded abrasive block as in claim 1 wherein said exterior surface comprises a mid arc merging into an arc of shorter radius intersecting said median.

6. A bonded abrasive block as in claim 1 wherein one of said surfaces comprises a flat surface modified by an arcuate surface intersecting said median.

7. A bonded abrasive block as in claim 1 wherein said exterior surface comprises a flat surface modified by an arcuate surface intersecting said median.

8. A bonded abrasive block as in claim 1 wherein said inner surface is modified at its acutely angled end through a merging of the interior arcuate surface into an arcuate surface of reverse direction carried to said median.

9. A bonded abrasive block as in claim 1 wherein said opposite ends are symmetrical.

10. A bonded abrasive block shaped as a pseudo hollow cylindrical segment of symmetrical form comprising leading, center and trailing portions, said center portion being formed between inner and outer arcuate surfaces both perpendicular to an end surface, said leading and trailing portions being symmetrical and meeting in acutely angled sharp ends formed through modifications of at least one of said inner and outer arcuate surfaces.

11. A bonded abrasive block as in claim 10 wherein one of said arcuate surfaces merges into a flat plane carried to said end.

12. A bonded abrasive block as in claim 10 wherein said inner arcuate surface merges into a flat plane carried to the said end.

13. A bonded abrasive block as in claim 10 wherein one of said arcuate surfaces merges into an arc of shorter radius carried to said end.

14. A bonded abrasive block as in claim 10 wherein said exterior surface comprises a mid arc merging into an arc of shorter radius carried to said end.

15. A bonded abrasive block as in claim 10 wherein said inner arcuate surface is modified at its acutely angled end through a merging of the interior arcuate surface into an arcuate surface of reverse direction carried to said end.

16. A bonded abrasive block as in claim 10 wherein one of said surfaces comprises a flat surface modified by an arcuate surface carried to said end.

17. A bonded abrasive block as in claim 10 wherein said exterior surface comprises a flat surface modified by an arcuate surface carried to said end.

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