July 19, 1949. A. S. TITCOMB 2,476,334

ABRASIVE WHEEL

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Fig. 1.

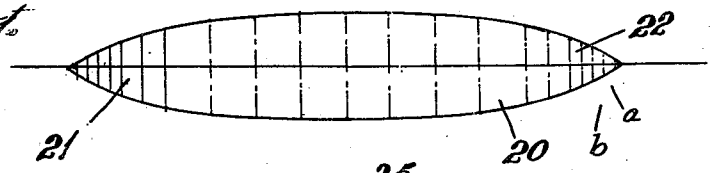


Fig. 2.

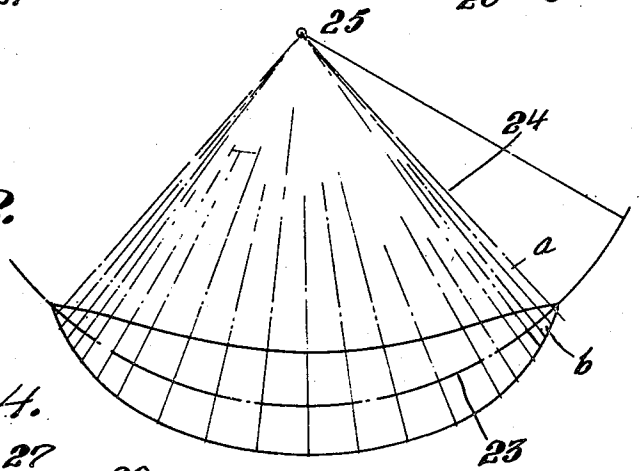


Fig. 4.

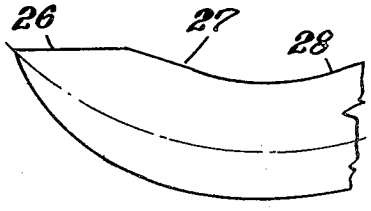


Fig. 3.

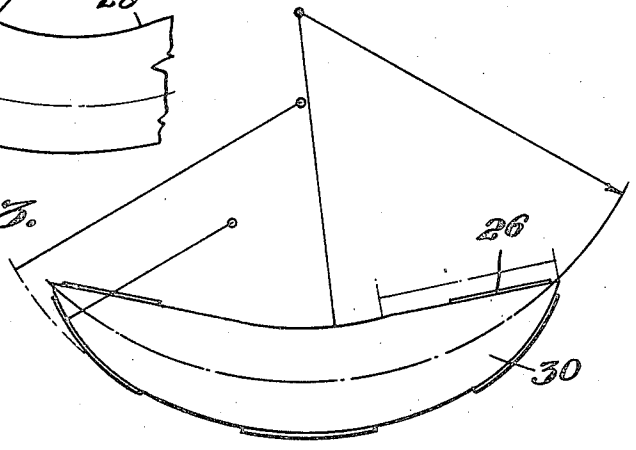
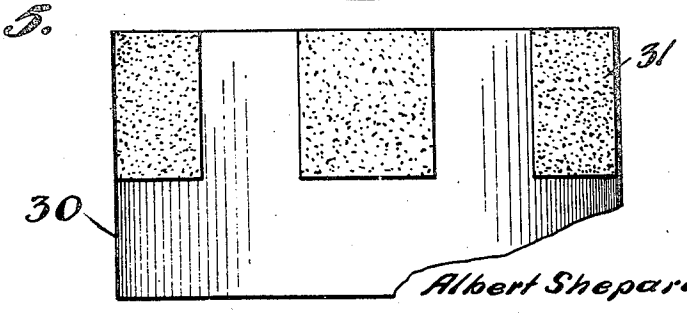


Fig. 5.



INVENTOR.
Albert Shepard Titcomb
BY
Barlow & Barlow
ATTORNEYS.

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Fig. 6.

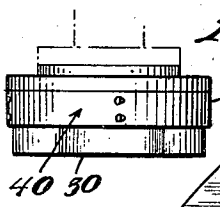


Fig. 7.

Fig. 9.

Fig. 8.

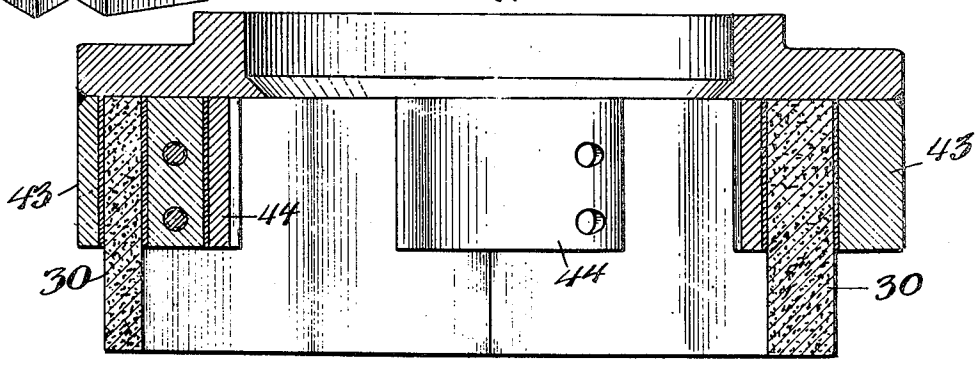
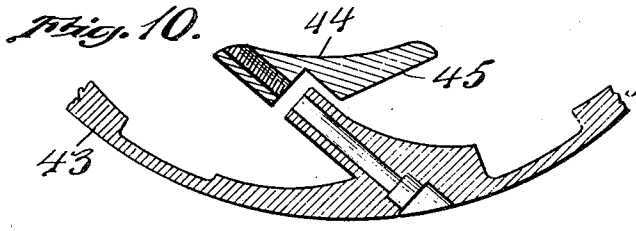


Fig. 10.



INVENTOR.
Albert Sheppard Titcomb
BY
Barlow & Barlow
ATTORNEYS.

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Fig. 11.

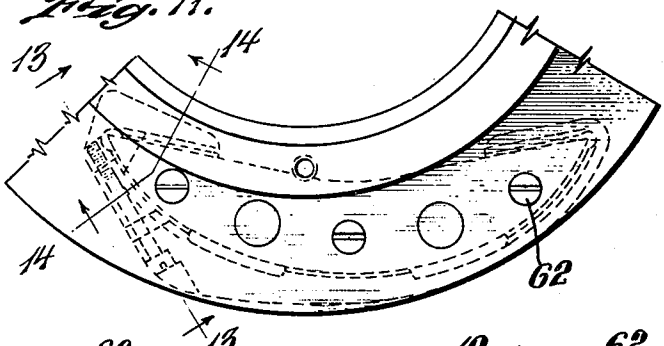


Fig. 12.

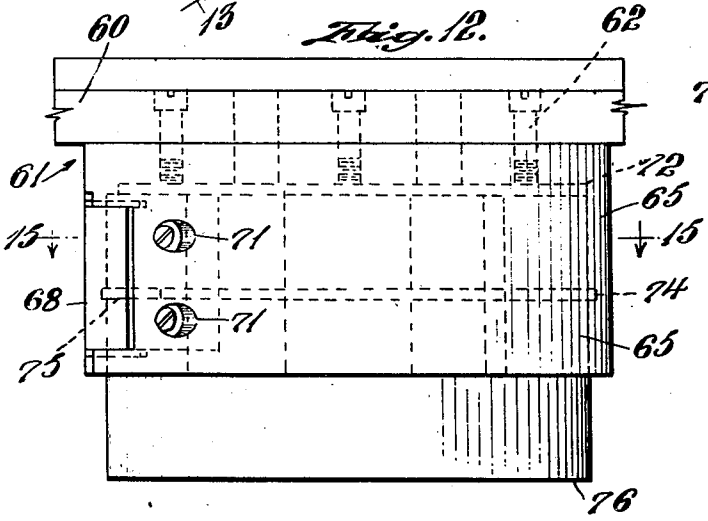


Fig. 13.

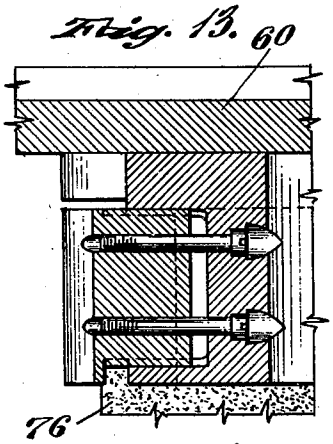


Fig. 14.

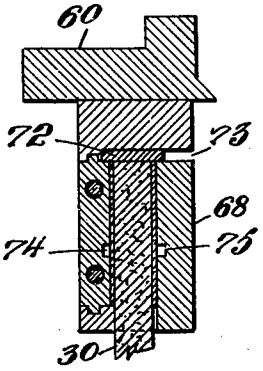


Fig. 15.

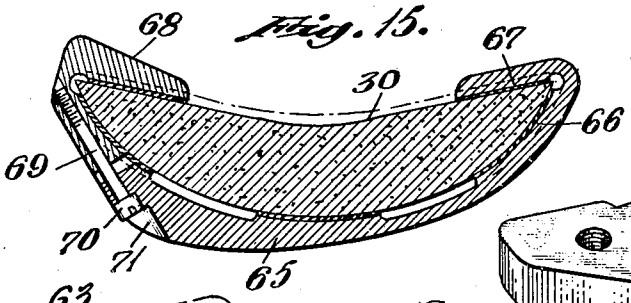


Fig. 16.

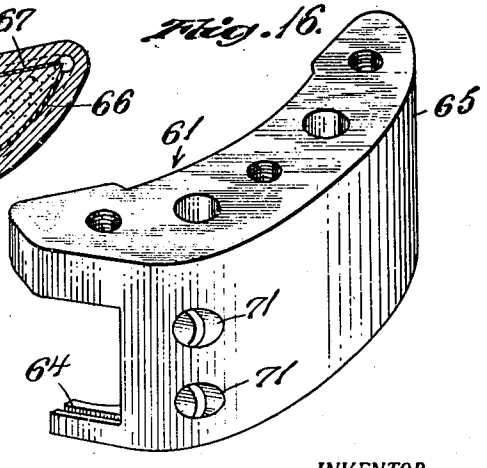
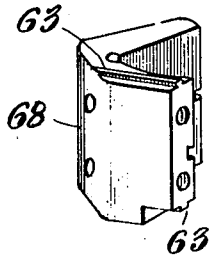


Fig. 17.

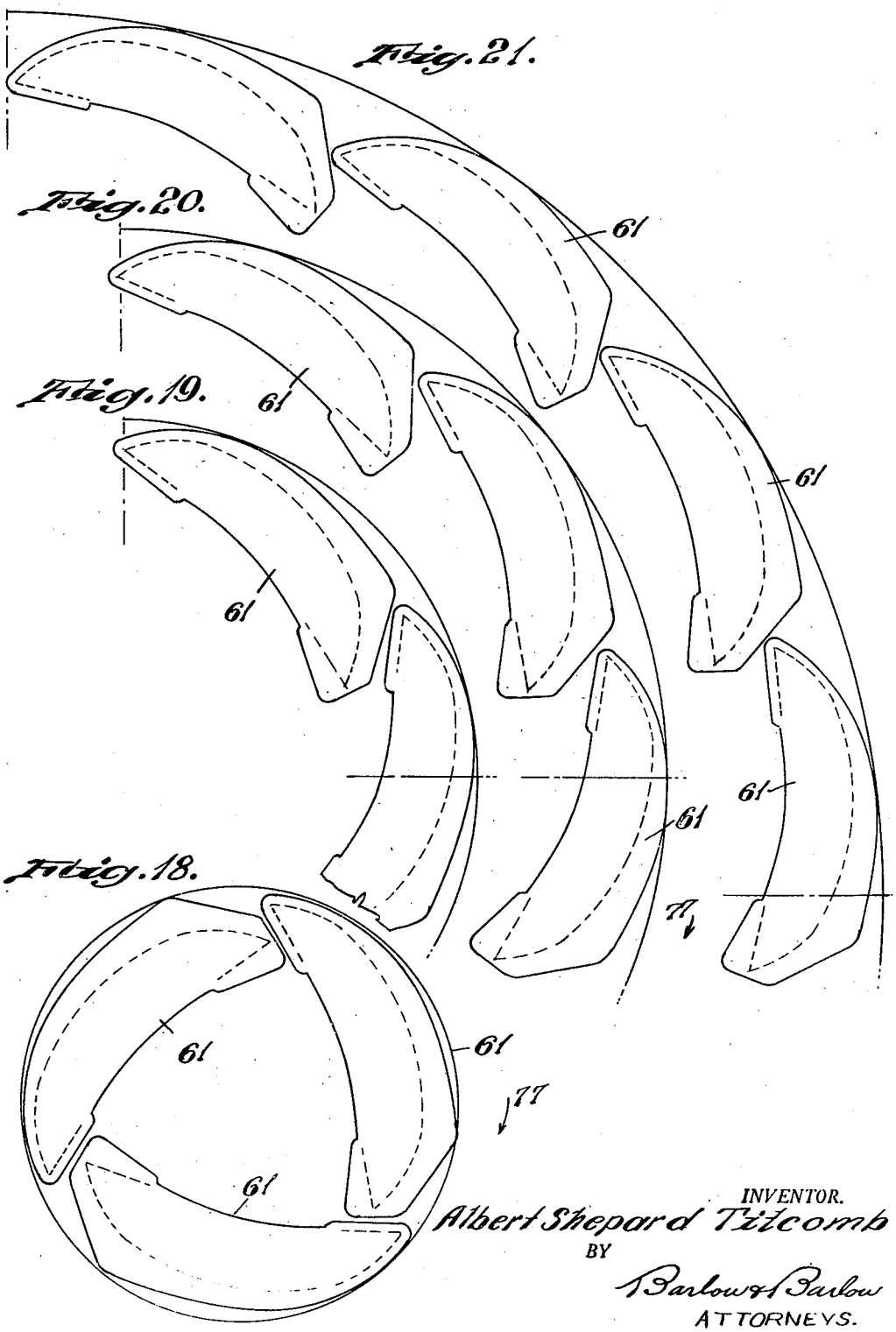


INVENTOR.
Albert Shepard Titcomb
BY
Barlow & Barlow
ATTORNEYS.

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INVENTOR.
Albert Shepard Titcomb
BY
Barlow & Barlow
ATTORNEYS.

Patented July 19, 1949 2,476,334

UNITED STATES PATENT OFFICE

2,476,334

ABRASIVE WHEEL

Albert Shepard Titcomb, Detroit, Mich.

Application June 27, 1946, Serial No. 679,807

17 Claims. (Cl. 51—209)

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This invention relates to an abrasive grinding wheel which is composed of a plurality of abrasive blocks.

Abrasive grinding wheels of this 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 work fastened to a base and where the revolving segments are pressed downward 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 wheel if not removed and the efficiency of the wheel depends to a substantial extent upon the 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 acting wheel. It has been found that if this loose stock is readily removed it is unnecessary to dress the wheel as frequently as otherwise. 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 throw the work off the magnetic chuck, generally used, sometimes with serious results.

One of the objects of this invention is to provide a grinding wheel which will have abrasive blocks of a shape which will be more advantageous than any shapes with which I am familiar for the purpose of a more efficient and freer cutting action in any unit of time.

Another object of this invention is to provide a grinding wheel which although providing a faster cut and making more chips of work while grinding material will not wear away as fast and the debris will not load up and therefore the wheel will maintain its efficiency for a longer time.

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

Another object of this invention is to provide abrasive blocks which will cause their leading edge to have a snow plow action upon the chips which are formed to spread the chips outwardly

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and inwardly of the wheel as the cutting surface of the block advances.

Another object of this invention is to provide a grinding wheel which will run cool and free of loading and thus prevent heating and warping of the work.

Another object of this invention is to provide a cutting wheel which will exert a downward pressure on the work at all times, thus preventing the work from being thrown from the magnetic table or fixtures upon which it rests while being ground.

Another object of this invention is to provide an arrangement of the abrasive blocks so that they will present a continuous cutting or grinding surface to the work.

Another object of this invention is to provide the abrasive blocks so arranged that the leading edge of one will overlap the trailing edge of the other so that some abrasive surface will be continually in engagement with the work.

Another object of the invention is to provide an adjustable plate to back up the abrasive blocks and which may be adjusted so that the block will be moved further out axially of the wheel as their wearing surfaces are used up.

Another object of this invention is to provide a plurality of different sized wheels by utilizing in the plurality of wheels a unit abrasive block which will be of a uniform size and shape, the arrangement being such that more blocks will be used in a larger wheel than in a smaller wheel, thus decreasing the number of shapes required to cover different diameters of grinding wheels.

Another object of this invention is to provide a clamping means which may be common in a plurality of wheels and of identical form so that one unit of clamping means may be utilized in a plurality of different sized wheels, thus enabling lower cost of manufacture through standardization and also a greater economy in case of need of replacement by 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:

Fig. 1 illustrates diagrammatically the basic formation of a segment having rather ideal snow plow properties in action if drawn in a straight line which is to be incorporated in the abrasive wheel;

Fig. 2 is a view similar to Fig. 1 but illustrating the segment as being developed into an arcuate form or shape desirable for grinding wheel purposes;

Fig. 3 is a plan view of block and pads illustrating a modified form of the shape of block shown in Fig. 2 as adaptable for practical manu-

facture providing flat surfaces on the inside for more suitable clamping of the block;

Fig. 4 is a fragmental view of a modification with an additional number of flat surfaces with curved fillets between;

Fig. 5 is an elevation of the block shown in Fig. 3;

Fig. 6 is an elevation of a wheel;

Fig. 7 is a fragmental sectional top view of a four-block wheel comprising a chuck and blocks constructed in accordance with this invention;

Fig. 8 is a sectional view on line 8—8 of Fig 7;

Fig 9 is a perspective view of the clamping member;

Fig. 10 is a sectional view of fragmental portions of the clamping member and the portion with which it is associated;

Fig. 11 is a plan view of a fragment of a modification showing a unit holding means or clamp which may be mounted upon any wheel body;

Fig. 12 is a side elevation thereof;

Fig. 13 is a sectional view on line 13—13 of Fig. 11;

Fig. 14 is a sectional view on line 14—14 of Fig. 11;

Fig. 15 is a sectional view on line 15—15 of Fig. 12;

Fig. 16 is a perspective view of the body part of the block holder;

Fig. 17 is a perspective view of the clamping member of the unit;

Fig. 18 is a diagrammatic view of the three units such as shown in Figs. 11–17 as mounted in a wheel;

Figs. 19, 20 and 21 are diagrammatic views illustrating quarter views of wheels embodying respectively six, nine, and fifteen segments if mounted on a full wheel and thus illustrating with Fig. 18 the flexibility of the method of variable placement and adaptability.

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 point end will have a snow-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 diameter and I 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 relation so that a continuous cutting surface is provided on the work thus preventing raising of work if the grinding pressure were removed between segments and at the same time providing necessary chip clearance between. 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 snowplow action referred to above.

In Fig. 1 I have illustrated at 20 a fundamental form of abrasive block which will have pointed ends 21 and 22 formed by reducing the curvature 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 shaped or developed from the fundamental form shown in Fig. 1 by determination of the general curvature of the block desired such as by the axis of center line of the block 23 and then laying off on either side of the center line equal dimensions each on radii as 24, from

the center of the axial center line 23, as are shown from the center 25. The different increments will correspond to the increments in the layout in Fig. 1 as *a*, *b* and so forth. In some cases the curvature for practical manufacture will be changed so that straight lines 26 as shown in Figs. 3 and 4 will be provided and which may be abruptly changed as at 27 and 28 for greater convenience in formation of molding of the segments.

Upon the opposite end and mid portions of each of the blocks designated 30 I have provided resilient pads or surfaces 31 for convenience in mounting the blocks in position.

One form of mounting of the blocks in a wheel is shown in Fig. 7 where the body of the wheel designated 40 is cast or otherwise manufactured with a cylindrical outer surface 41 and a plurality of recesses 42 (possibly with horizontal serrations) of a shape to fit one end of the block 30 by reason of the variation in the wall thickness of the body to provide for the proper shaping of these recesses. The wall 43 will be of an extent less than the vertical dimension of the block to be retained as is apparent from Fig. 8, and in order that each of these blocks may be held in position, its opposite end is engaged by the jaw 44 which has a flat surface 45 (possibly with vertical serrations) to engage the block and is moved in a direction indicated by the axis of the clamping screw 46 having a head 47 set into the wall as at 48 which will move this jaw along this axis and force the block 30 into its recess 42 with a firm action. A wedge action occurs in this clamping at both ends of the block and thus the block is held securely in position.

The arrangement of the blocks 30 are such that assuming direction of rotation to be as at 50, the leading edge 51 of one block will extend past the radial line of the trailing edge 52 of the next block or at least to the radial line from the center of the wheel to the outer cylindrical edge 41 so that as soon as the trailing edge of one block 30 passes from the work, the leading edge of the next block will be in engagement with it. By this arrangement also there is a spacing as at 53 between the abrasive blocks so that the cut material which is formed by action on the work may readily be passed out of the wheel along the edge 54 by "snow plow" action and centrifugal force while other cut material may move along the inner edge 55 of the block by snow plow action to be thrown by centrifugal force from the wheel through the space between other blocks.

In some cases instead of providing a solid body, units may be formed and detachably secured upon a plate such as shown at 60 in Fig. 12. In this case, each of the units designated generally 61 is secured to the plate or body 60 by means of bolts 62. The units consist of an arcuate shell member 65 (see Fig. 16) providing a socket 66 with an inner lip 67 while there is a movable jaw 68 which is slidably guided by tongue and groove toward the portion 65 so as to engage one end of the block and force this block into the recess 66. This clamping action is obtained by bolts 69 having heads 70 located in a recess 71 and which have threaded engagement with the jaw 68 to draw the jaw toward the portion 65 to clamp the block 30 in position. In order for the blocks 30 to be better located, I provide in each unit 61 a plate 72 which is located in a recess 73 in the socket 66 of the shell member 65. This plate may be located in the notches 74 in the

shell 65 and 75 in jaw 68 to support the block in a lower position after somewhat used, to position its grinding surface 76 in a lower position.

If I desire to make up a wheel say fourteen inches in diameter, I may use three of these segment units 61 as shown in Fig. 18, in which case the blocks will overlap a certain given distance. If I desire to make up a larger wheel, say for instance an eighteen inch wheel in Fig. 6, I may use four of these same units or a twenty-two inch wheel, five of these same units.

I find it, however, more desirable to make a different size for a series of wheels which would be 12, 16 and 20 inches respectively in which I would again use three, four, and five segments of a smaller size but with same end styles as Fig. 3 at 26 and 30. I also provide a still different sized segment in the wheels below this size such as in wheels, 6, 8 and 10 inches in diameter by chucks using three, four, and five segments respectively.

For the larger sized wheels from 24–60 inches, I may continue to use from six to fifteen of the larger segments depending upon the diameter desired and for illustration purposes I have shown in Figs. 19, 20 and 21 the layout for six, nine, and fifteen segments to make up 24 inch, 36 inch, and 60 inch wheels respectively, rotation being as shown by arrow 77, but in each case I will utilize the same unit in all three of these size wheels and the same identical segment, also 7 for 27 inch, 8 for 32 inch, and 12 for 48 inch as required.

From the foregoing, it will be apparent that I have provided a new shape block or segment which will have a large cutting surface which will remain clear of chips and be free cutting by reason of the snow plow action and this will enable me to cut faster in a given unit of time than where grinding wheels have been shaped as heretofore that have not been so arranged so as to remove the chips and prevent loading. At the same time I have overlapped the segments and still provided a means for escape of the cut material, and also enabled a continuous cutting surface to be formed, forming a constant holding down of the work to be ground, and by reason of the unit formation which I have provided, of blocks with clamps, one block of which may be utilized for several different sized wheels, an economy of storage or inventory of blocks may be had.

Claims to the abrasive block alone are made in my co-pending application, while this application is directed more particularly to the wheel wherein I claim:

1. The method of maintaining freecutting by maintaining the cutting surface of an abrasive segment free from foreign materials suspended in coolant used therewith, said materials being derived from chips of stock removed by the action of said abrasive segment grinding on said stock and from debris resulting from disintegration of the abrasive of said segments in said grinding action which comprises simultaneously rotatively moving a plurality of spaced bonded abrasive segments each having a leading plow-like acutely angled end circularly over the surface of said stock thus moving said chips and debris between the members and outwardly of their circular path.

2. The method as in claim 1 wherein the segments are so positioned as to move the majority of the chips and debris outwardly of their path of movement, partially by physical displacement and partially by centrifugal force.

3. The method of making a plurality of grinding discs having different diameters from a plurality of identical abrasive segments which comprises using a variable number of segments in the wheels, according to the diameter thereof, but in each disc arranging the segments with the leading ends thereof inwardly and the trailing ends thereof outwardly of a circle whose center is the axis of said disc, said segments substantially overlapping in a direction radial of the disc with a space between the segments sufficient to permit the outward discharge of debris by centrifugal force and physical displacement.

4. The method of making a plurality of grinding discs having different diameters from a plurality of identical abrasive segments which comprises using a variable number of segments in the wheels according to the diameter thereof, but in each disc arranging the segments with the leading ends thereof inwardly and the trailing ends thereof outwardly of a circle whose center is the axis of said disc, said segments being placed with a space between the segments sufficient to permit the outward discharge of debris by centrifugal force and physical displacement.

5. An individually detachable clamping unit to hold an individual bonded abrasive block comprising a body member having an end formed into a hollow V to receive one acuately angled end of the block in a wedging action, and a jaw on said body, means for movement of the jaw with relation to the body toward and from the body to bind the block of abrasive into such wedging action.

6. An individual clamping unit to hold a bonded abrasive block shaped as a pseudo hollow cylindrical segment formed between two arcs, said arcs being substantially equidistant throughout their course from an arcuate median line, the arcs modified equally at each end through a merging of the interior arc into flat planes carried to the arcuate median line, and through a merging of the exterior arc at each end into equal arcs of shorter radius which intersect the median line at the intersection of the flat planes merged with the interior arc thus forming acuately angled ends, said individual clamping unit comprising a shell body of divergent thickness formed between an outside arc and an inner arc forming a land for outer support of the abrasive block, the narrow end of the clamp being formed into a hollow V to receive one acutely angled end of the block in a wedging action, said end receiving the rotational stress and at the thicker end of the clamp shell, a jaw mounted for movement with relation to the shell toward and from the shell to bind the block of abrasive into wedging action and against the hollow V shaped end and the inside arc of the shell.

7. An abrasive wheel chuck for mounting abrasive blocks comprising a base disposed at right angles to its axis of rotation, a shell body as a permanent part of said base having a plurality of cavities, the outer side of each of which is formed by an arcuate section of said shell body having equally dimensioned, similar acutely V-shaped ends, each to receive one acutely angled end of an abrasive block of complementary outside shape in a wedging action to receive the rotational stress from said block, a plurality of jaws, opposed to each of said V-shaped ends, means to individually mount each jaw for movement with relation to said arcuate section of said shell body whereby each jaw urges the block of abrasive into each V in said wedging action.

8. An abrasive wheel chuck for mounting

abrasive blocks comprising a base disposed at right angles to its axis of rotation, a plurality of units, means to detachably individually secure each of said units to said base, each unit comprising a shell rigidly secured to said base and a jaw, means to mount the jaw for movement with relation to the shell toward and from the shell to bind a block of abrasive, said units each having a relatively long extent in the direction of its travel and cooperatively placed on the base to dispose the abrasive blocks with the leading end of one block extending substantially to the radial line to the trailing end of the next block and inwardly thereof at a lesser radial distance to provide a passage outwardly through the overlapped area for debris.

9. An abrasive wheel chuck for mounting abrasive blocks comprising a base disposed at right angles to its axis of rotation, a plurality of units, means to detachably individually secure each of said units to said base, each unit comprising a shell rigidly secured to said base and a jaw, means to mount the jaw for movement with relation to the shell toward and from the shell to bind a block of abrasive, said units each having a relatively long extent in the direction of its travel and cooperatively placed on the base to dispose the abrasive blocks with the leading end of one block extending at least to the same radial line as the trailing end of the next, but inwardly thereof at a lesser radial distance to provide a passage outwardly for debris.

10. An abrasive wheel chuck for mounting abrasive blocks comprising a base disposed at right angles to its axis of rotation, a plurality of units, means to detachably individually secure each of said units to said base, each unit comprising a shell rigidly secured to said base and a jaw, means to mount the jaw for movement with relation to the shell toward and from the shell to bind a block of abrasive, said units each having a relatively long extent in the direction of its travel and cooperatively placed on the base to dispose the abrasive blocks with the leading end of one block closely approaching but short of the radial line to the trailing end of the next block and inwardly thereof at a lesser radial distance to provide a passage outwardly for debris.

11. An abrasive disc comprising a wheel body for rotation about an axis and having a plurality of bonded abrasive projections, each of said abrasive projections having a relatively long extent in the general direction of its travel around said axis, and cooperatively located, said projections being positioned in circular echelon and each being disposed with the leading end of one extending at least to a radial line passing through the trailing end of the next but inwardly thereof to provide passages outwardly for debris incidental to grinding.

12. An abrasive disc, comprising a wheel body for rotation about an axis and having a plurality of bonded abrasive projections, each of said abrasive projections having a relatively long extent in the general direction of its travel around said axis, and cooperatively located in circular echelon so as to dispose the leading end of each projection inwardly and the trailing end of each projection outwardly from a circle whose center is at said axis.

13. An abrsive disc as in claim 12 wherein said leading end of one projection and the trailing end of the next projection extend susbtantially to the same radial line of the wheel.

14. An abrasive disc as in claim 12 wherein said leading end of one projection and the trailing end of the next projection extend at least to the same radial line of the wheel.

15. An abrasive disc as in claim 12, wherein said leading end of one projection and the trailing end of the next projection extend just short of a radial line between them.

16. An abrasive disc comprising a wheel body for rotation about an axis and having a plurality of spaced bonded abrasive projections, the ends of which present a working face perpendicular to the axis of rotation, each of said abrasive projections located outward of the axis of the wheel body and having a relatively long extent in the general direction of its travel around said axis, and cooperatively located so as to dispose the abrasive projections in circular echelon with the leading end of one extending inwardly thereof at a lesser radial distance from the axis than the trailing end of the next projection to provide a passage outwardly for debris, and each of said projections having an acutely tapering leading end portion whose flaring walls extend from and in generally perpendicular relation to the plane of said working face for spreading debris, accumulated on the work, out of the path of the advancing projections.

17. An abrasive disc comprising a wheel body for rotation about an axis, said wheel having a plurality of bonded abrasive projections, each of said projections being shaped as a pseudo-hollow cylindrical segment bounded by two arcs, said arcs each being substantially equidistant through their course from an arcuate median line, the arcs of each being modified equally at each end through a merging of the interior arc into substantially flat planes carried to the median line and from a merging of the exterior arc into arcs of lesser radius carried to meet the substantially flat planes merged with the interior arc at the median line, thus forming on each end of each projection, acutely angled ends, said projections being located cooperatively in circular echelon relationship, one being in advance of the other in the general direction of travel of said projections and so disposed with the leading end of one inwardly of the trailing end of the next, and with space between said projections to provide a passage outwardly for chips and debris.

ALBERT SHEPARD TITCOMB.

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