

[54] SEGMENTED GRINDING WHEEL
ASSEMBLY

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[22] Filed: Oct. 5, 1970
[21] Appl. No.: 77,896

[52] U.S. Cl.51/356, 51/206 NF, 51/206.5
[51] Int. Cl.B24d 5/08, B24d 5/10
[58] Field of Search..51/168, 267, 266, 206.4, 206.5,
51/356, 206 NF

[56] References Cited

UNITED STATES PATENTS

1,783,729	12/1930	Larsson	51/206.5
2,769,286	11/1956	Beth	51/206.4
2,887,276	5/1959	Minarik	51/267
1,805,949	5/1931	Larsson	51/206.5
843,624	2/1907	Peirce	51/267

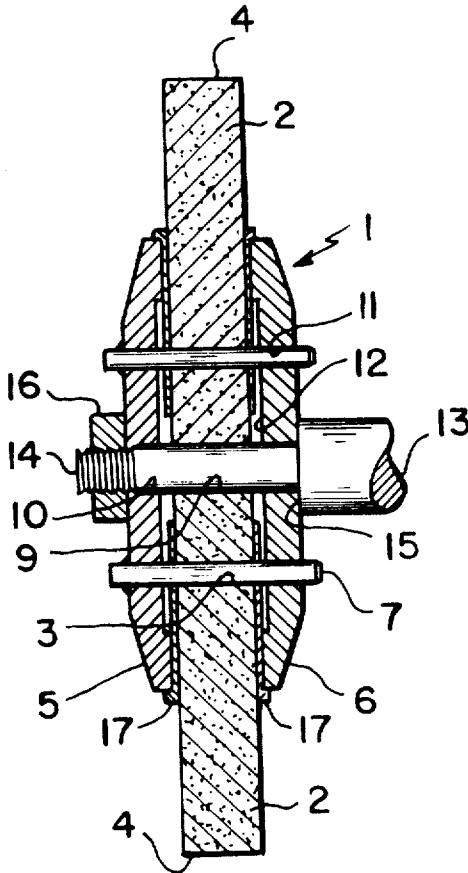
639,955	12/1899	Warner	51/267
1,998,919	4/1935	Ball et al	51/168

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[57] ABSTRACT

A grinding wheel for snagging operations having a plurality of pie-shaped abrasive segments forming a radially constant work surface with a small space between successive segments. In a preferred embodiment each segment has at least two spaced holes cooperating with a like number of pins permanently secured to a first flange. A second flange having a similar plurality of aligned holes is also mounted by appropriate spindle and mounting structure on the pins with the abrasive segments positioned therebetween. Provisions are also made to cool the segments by a coolant exiting from the spindle into the spaces between the successive segments.

13 Claims, 12 Drawing Figures



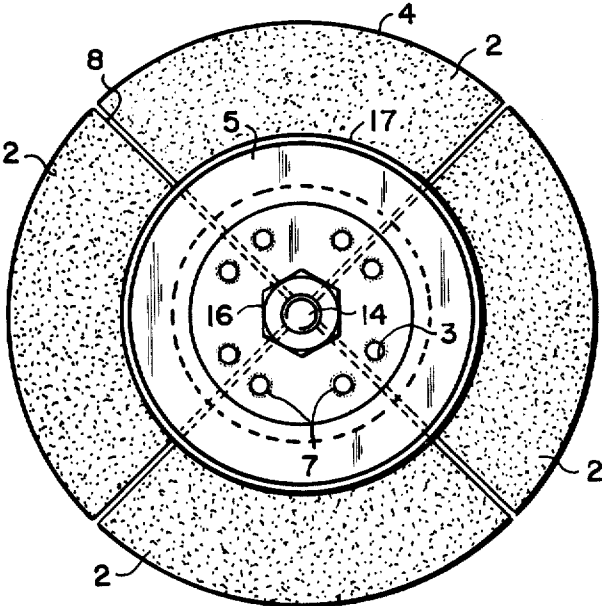


Fig. 2

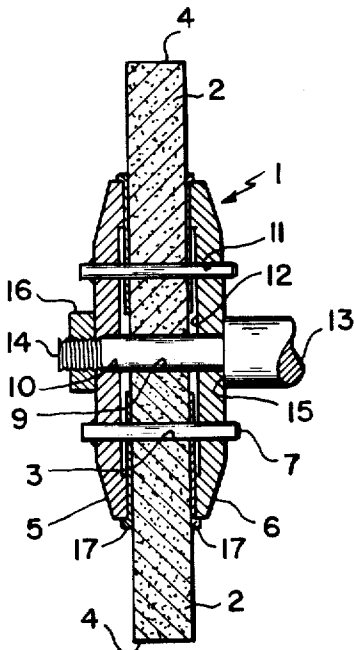


Fig. 1

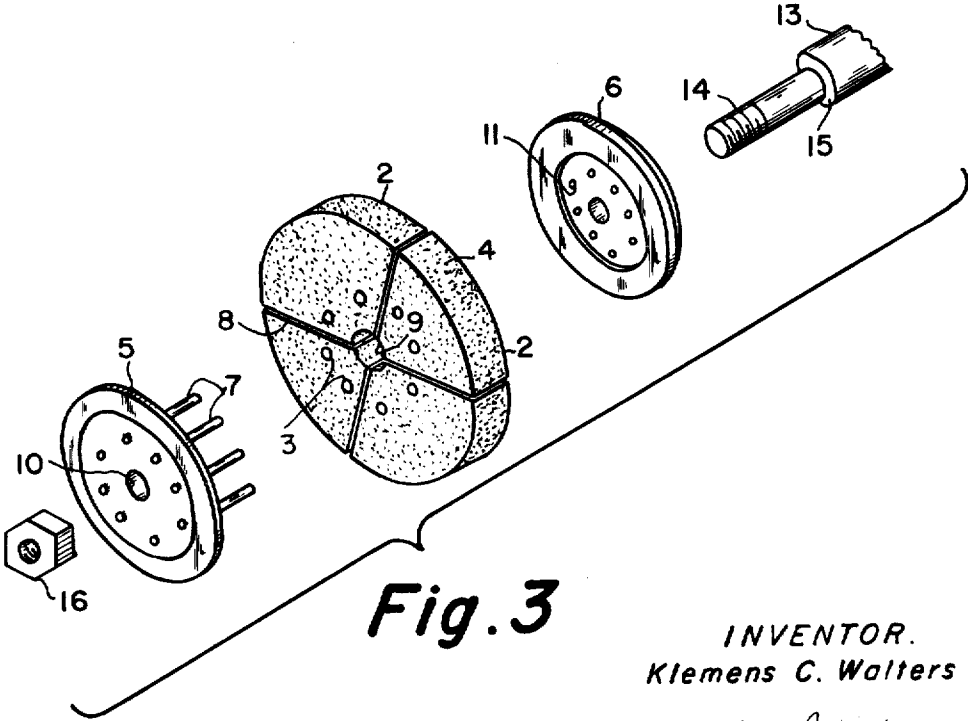


Fig. 3

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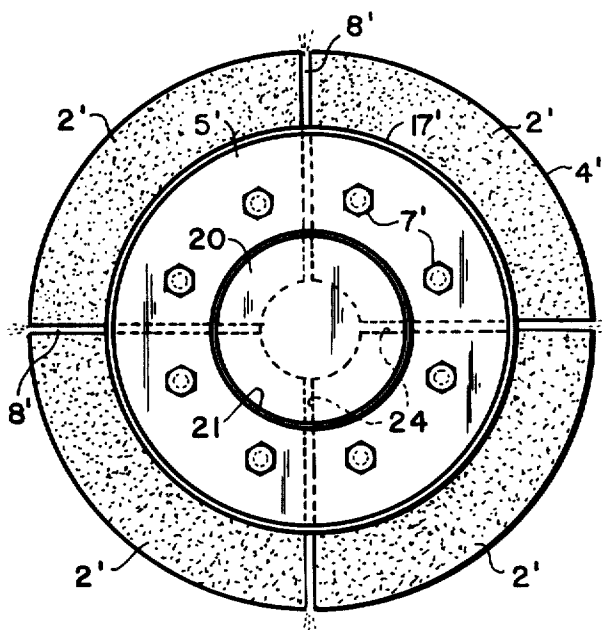


Fig. 5

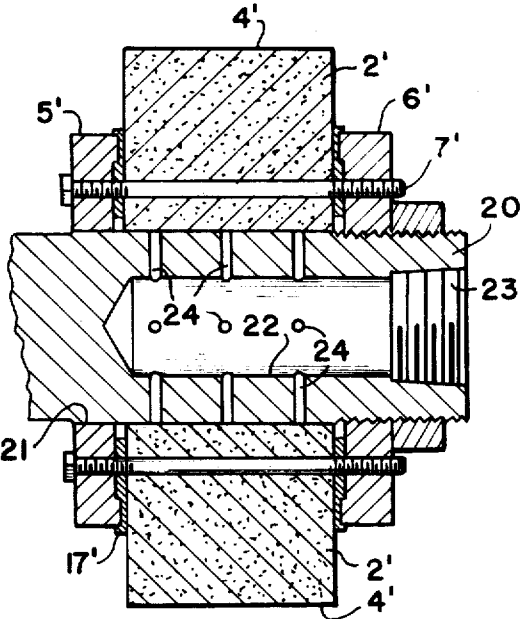


Fig. 4

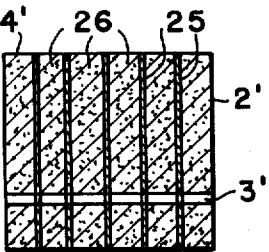
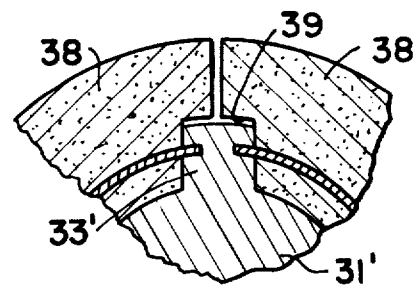
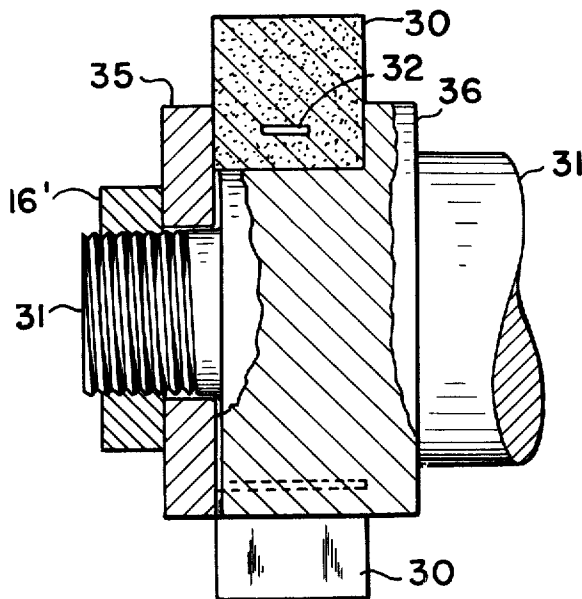
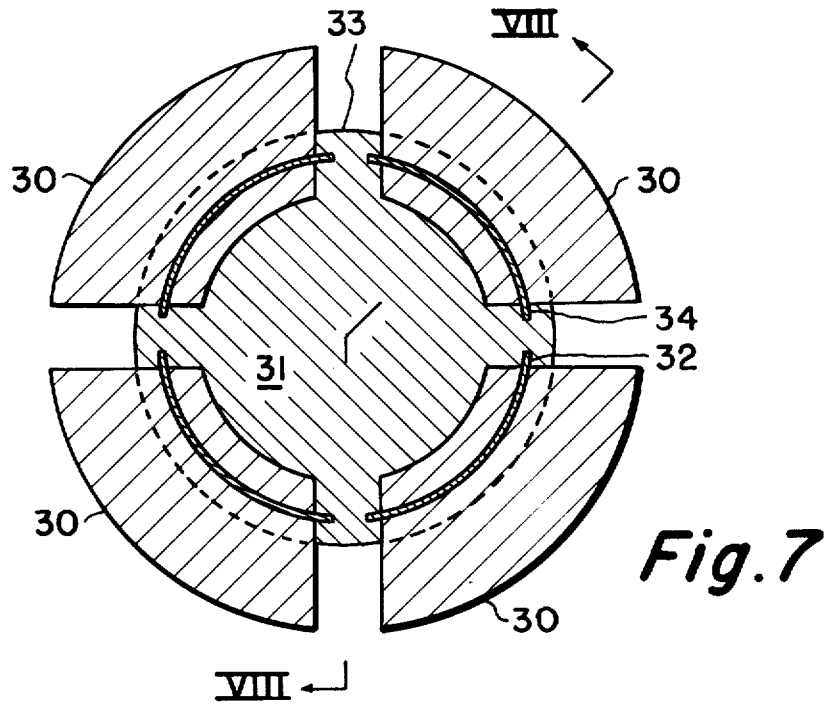


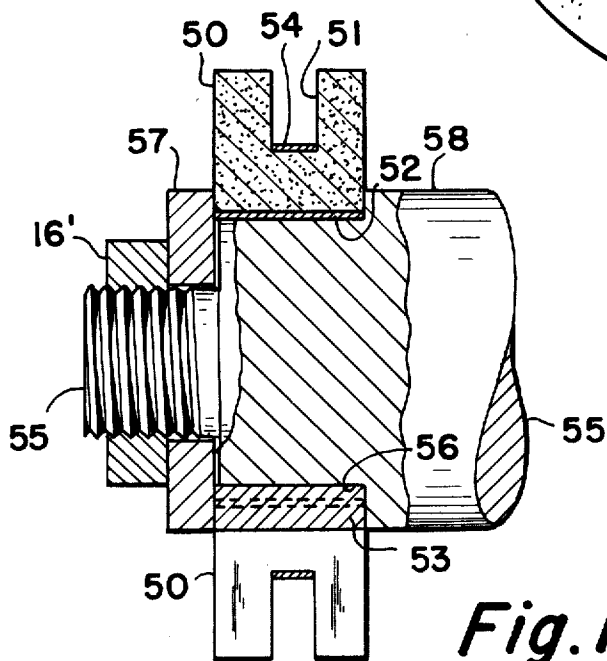
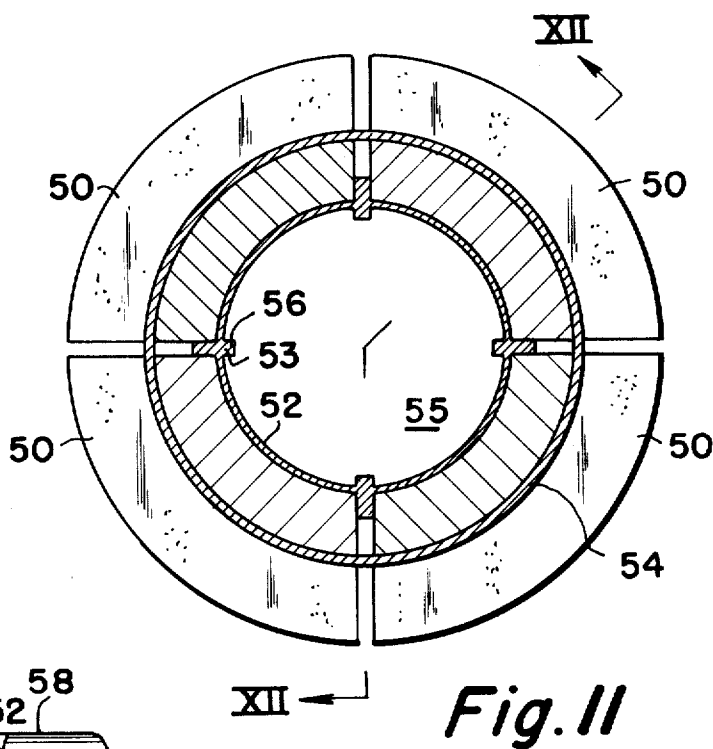
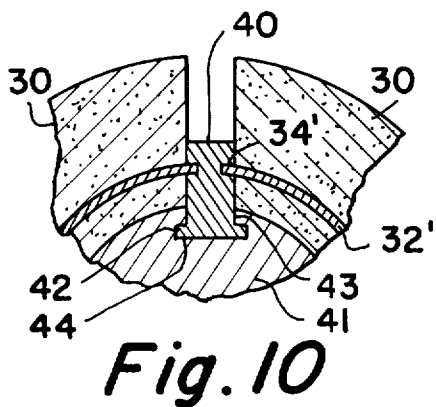
Fig. 6

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SEGMENTED GRINDING WHEEL ASSEMBLY

My invention relates to a segmented grinding wheel and, more particularly, to the grinding wheel unit which is mounted on the spindle of a grinding unit. The characteristics of abrasive wheels are unique among cutting tools since the particular strength of an abrasive wheel is closely limited by the operation since it must be designed so that when the outer abrasive layer becomes dull from grinding, the dull grains break away exposing new cutting edges. This inherent characteristic of grinding wheels in general has prompted numerous designs in abrasive wheels and abrasive wheel mountings to insure the safe operation of a tool which, by its very nature, must break down during operation.

This problem is compounded in heavy duty grinding operations, such as the snagging of stainless steel, because of the inherent toughness of the materials being ground and the desire to accomplish the grinding in a minimum of time.

A premature or unsuspected failure of a grinding wheel is a very dangerous condition because of the large centrifugal forces developed during grinding at normal speeds of 12,500 surface ft./min. which can propel broken sections of abrasive at high speeds and over large areas. As the size of the wheel increases, the danger of failure increases. Therefore, some large wheels used in snagging operations are made of individual abrasive segments positioned about a central spindle and secured thereto by various connecting means. The grinding surface on these segmented wheels is along the sides rather than along the radial surface of the segments. Attempts have been made to achieve proper grinding in snagging operations by using individual sections of abrasive materials positioned on the periphery of a metal disc, but efficiency is relatively low because of the interrupted grinding surface. In addition, mounting the abrasive material is also troublesome.

An additional problem with grinding wheels is that the power drive of the spindle is indirectly received by the abrasive wheel or segment through the contacting surface of the flanges, therefore, providing a source of slippage and loss of efficiency.

My invention greatly reduces the hazards of premature failures by improving the mounting of the abrasive segments. In addition, my invention provides an efficient and inexpensive way to mount abrasive segments to form a grinding wheel whereby the individual segments can be readily replaced. My invention further provides a system integral with the grinding unit as opposed to separate therefrom for lubricating the abrasive segments and, in addition, my invention also provides a more direct power drive to the segments than has been employed heretofore, thereby minimizing slippage. My invention also increases efficiency in heavy duty grinding operations by providing a radially constant grinding surface.

My invention is a segmented grinding wheel unit comprising a plurality of abrasive segments, each having at least two spaced holes therethrough which are mounted between two flanges. One flange has permanently secured pins depending perpendicular therefrom which cooperate with the holes in the segments so that the segments form a radially constant grinding surface having a space between successive segments. The second flange has cooperating holes

which also are aligned with the pins and the entire grinding unit is then secured to a spindle which can contain a coolant means to supply coolant into the spaces between the segments. The segments may also be connected to the spindle by means of metal strips extending through the segments or a metal strip holding a group of segments in place about a second metal strip which is, in turn, held to the spindle. In all embodiments flanges aid in the securing of the segments.

In the accompanying drawings, I have shown my presently preferred embodiments in which:

FIG. 1 is a full section through a segmented grinding wheel assembly;

FIG. 2 is an end elevation of the segmented grinding wheel assembly;

FIG. 3 is an exploded view of the segmented grinding wheel assembly;

FIG. 4 is a full section through a grinding wheel assembly containing coolant means;

FIG. 5 is an end elevation of the assembly of FIG. 4;

FIG. 6 is a section of a reinforced segment;

FIG. 7 is a section showing a modified means for assembling the grinding wheel;

FIG. 8 is a full section taken along section lines VIII—VIII of FIG. 7;

FIG. 9 is a modification of the embodiment shown in FIG. 7;

FIG. 10 is a further modification of the embodiment shown in FIG. 7;

FIG. 11 is a section showing another modified means for assembling the wheel; and

FIG. 12 is a full section taken along section lines XII—XII of FIG. 11.

My segmented grinding wheel assembly 1, shown in FIGS. 1–3, is made up of four individual abrasive segments 2. The number of individual segments employed is a variable primarily dependent on the size of the wheel. For example, as many as six or eight segments are employed for a segmented wheel having a diameter of 24 inches, whereas as few as three segments are employed with a wheel having a diameter of 6 inches. Each abrasive segment 2, which is basically pie-shaped, has two holes 3 equally spaced inward from the work surface 4 of the segment.

The segments 2 are mounted between flanges 5 and 6 to form the segmented grinding wheel unit. Flange 5 has eight pins 7 which are permanently and rigidly secured thereto by a convenient connecting means, for example, welding, and which extend normal from the flange. These pins 7 are positioned to cooperate with the two holes 3 of each of the four segments 2 to form a succession of segments having a space 8 (see FIG. 2) between each successive segment and forming a radially constant work surface like a typical grinding wheel. The space 8 is necessary for proper heat dissipation during grinding. The segments 2, when positioned on flange 5, form a central opening 9 axially aligned with a central arbor hole 10 in flange 5.

Flange 6, which also has a central arbor hole 10, has eight holes 11 which are aligned with the pins 7 so that the pins 7 pass through holes 3 after the segments 2 have been positioned therebetween. Standard safety requirements generally require the flanges to be of equal bearing surface and the same diameter, that diameter being not less than one third of the diameter

of the wheel. In addition, the flanges should have a slight recess 12 extending from the arbor hole 10 on the side contacting the abrasive to balance the bending stresses and pressures on the wheel itself as illustrated in FIG. 1.

The grinding unit formed of the flanges 5 and 6 and segments 2 is positioned through arbor hole 10 on a spindle 13 which is driven by suitable driving means (not shown). Spindle 13 has threads 14 on its outer end and an inner flange 15 against which flange 6 abuts. Nut 16 is threaded on the threads 14 of spindle 13 to secure the wheel assembly against the inner flange 15 of spindle 13. A blotter 17 (compressible washer) can be inserted on either side of segments 2 inside of flanges 5 and 6 to insure uniform distribution of the flange pressure, as illustrated in FIG. 1. However, since the driving torque is transmitted from the spindle through the flange to the wheel, and since there is a direct positive drive through the pins 7 instead of a mere frictional drive employed heretofore, the blotter can be eliminated for many grinding applications, as shown in FIG. 3.

Another embodiment is illustrated in FIGS. 4 and 5 where a cooling media is supplied through the spindle into the spaces between the segments. Parts similar to the earlier embodiment will have the same numeral followed by a prime.

The segmented wheel unit formed of segments 2', flange 5' with pins 7' and flange 6' are similar to the earlier embodiment except that the flanges and segments are dimensioned so that the arbor hole 21 is larger than the arbor hole 10 of the earlier embodiment. The reason for the larger arbor hole 21 is that a larger spindle 20 is employed which has a hollow portion 22 extending to a coolant inlet means 23. Four groups of three passageways 24 each extend from the hollow portion 22 of spindle 20 to the spindle's outer surface and in alignment with the spaces 8' between the segments 21. Standard coolants can then be directed uniformly between the segments 2' to insure proper cooling. This uniformity of supplying coolant is very important since an uneven accumulation of coolant can cause excessive out of balance for the overall wheel by excessive wear of a particular segment. Therefore, the number of vertical passageways 24 feeding into a particular space 8' will vary depending on the dimension of the particular segments employed.

Since grinding speeds are continuing to increase, sometimes exceeding 25,000 surface ft./min., the segments themselves can be reinforced to insure a safe operation. For example, thin layers of fiberglass 25 can be intermittently spaced and hot pressed as a reinforcer with layers of abrasive 26, as illustrated in FIG. 6. Of course, the holes 3' would extend through both the abrasive portion 26 and the fiberglass portion 25 to accommodate the pins of the flanges.

In FIGS. 7 and 8 I have shown another means of connecting a plurality of pie-shaped abrasive segments 30 to a spindle 31 to form a radially constant grinding surface. Each segment 30 has a metal strip 32 extending laterally through the segment 30 and continuing slightly beyond the segment. This metal strip 32 is formed integral with the segment during the forming operation of the segment.

The spindle 31 has outwardly extending lugs 33 which extend upwardly between the spaced segments 30. These lugs 33 have oppositely positioned slots 34 which accommodate the extended portions of the metal strips 32 of successive segments, respectively.

Flanges 35 and 36 are also employed to secure the segments 30 in place and to the spindle 31. These flanges 35 and 36 can be normal grinding wheel flanges or they can be modified as per the earlier embodiment to contain connecting pins passing directly through the segments. In any event, the flanges 35 and 36 should extend radially outward beyond the metal strips to insure maximum securement.

The embodiment shown in FIG. 9 is modified slightly over that shown in FIGS. 7-8 in that the segment 38 has a recessed portion 39 which cooperates with the lug 33' of spindle 31' so that the space between successive segments is minimized.

The lug need not be formed as part of the spindle. In FIG. 10 the lug 40 is separate from spindle 41 and is attached thereto by means of outwardly extending flanges 42 at the bottom of lug 40 which cooperate with an inwardly extending groove 43 terminating in keyway 44 of spindle 41. The lug 40 has slots 34' for cooperation with metal strips 32' of segment 30 in the same manner as the embodiment of FIGS. 7-8.

The substantially pie-shaped abrasive segments may also be formed into a radially constant grinding surface by use of a steel strip positioned within grooves of the abrasive segments. This is shown in FIGS. 11 and 12 wherein each segment 50 has a lateral groove 51 extending inwardly along the entire length of the grinding surface. These segments 50 are placed about a continuous steel band 52 which has protruding lugs 53 which extend both outwardly and inwardly from band 52. The segments 50 are positioned and dimensioned so that the outwardly extending protuberances of lug 53 form the space between successive segments 50. The segments 50 are held securely against band 52 by a tightly fastened continuous metal strip 54 which is tightly positioned within the grooves 51 of the segments to hold them firmly against band 52. Each segment may have more than one extended groove thereby resulting in a series of bands holding the segments to the inner band.

This subassembly is then positioned onto spindle 55 by inserting the inwardly protruding portion of lugs 53 into cooperating recesses 56 on spindle 55. Flanges 57 and 58 are coupled to the spindle 55 in normal fashion to further hold the segments 50 in place. As in the earlier embodiments, the flanges may further hold the segments in place by means of connecting pins extending through holes in the segment. In any event, the flanges should extend radially outward beyond the metal strips 54 to maximize securement.

While I have shown and described preferred embodiments of my invention, it may be otherwise embodied within the scope of the appended claims.

I claim:

1. A segmented grinding wheel comprising:

- A. A plurality of substantially pie-shaped abrasive segments, each segment having at least two holes in spaced apart relationship;
- B. A first flange having an arbor hole and a plurality of pins permanently secured thereto and depending normal therefrom, said pins positioned in

spaced apart relationship to cooperate with the holes of each segment so that a space exists between successive segments when the plurality of segments are positioned on said first flange, said segments positioned about the arbor hole and forming a radially constant abrasive work surface; and

C. A second flange having an arbor hole and a plurality of spaced apart openings therethrough, said spaced apart openings aligned to cooperate with said pins of the first flange after the segments have been positioned thereon, said first and second flanges and segments forming a grinding wheel unit.

2. The segmented grinding wheel of claim 1 including a spindle positioned through said arbor holes, said spindle having holding means against which the wheel unit is positioned and mounting means to secure the wheel unit against the holding means.

3. The segmented grinding wheel assembly of claim 1 wherein the grinding wheel unit has a blotter positioned between the segments and the flanges.

4. The segmented grinding wheel assembly of claim 1 wherein said flanges have an internal recess extending radially outward for a short distance from the arbor hole.

5. The segmented grinding wheel assembly of claim 1 wherein layers of reinforcement are intermittently spaced between layers of abrasive to form the segments.

6. The segmented grinding wheel of claim 2 wherein said spindle has an axially aligned internal first passageway extending from a coolant inlet means and a plurality of second passageways extending outwardly from the first passageway to the surface of the spindle, said second passageways aligned with the space between successive segments to direct a coolant thereto.

7. The segmented grinding wheel assembly of claim 5 wherein fibreglas forms the intermittent layers of reinforcement.

8. A segmented grinding wheel comprising:

A. A spindle;

B. A plurality of substantially pie-shaped abrasive segments closely spaced and positioned about the spindle, each segment having a metal strip extending laterally therethrough and continuing slightly outwardly therefrom;

C. Mounting means extending upwardly from the spindle between adjacent segments and having oppositely disposed slots engaging the outwardly extending metal strips of adjacent segments to firmly secure said segments about the spindle in slightly spaced relationship and to form a radially constant abrasive work surface; and

D. Flange means mountably attached to said spindle on either side of said segments to further secure

said segments thereto, said flange means dimensioned to extend radially outwardly beyond the mounting means.

9. The segmented grinding wheel of claim 8 wherein the mounting means is an integral extension of the spindle.

10. The segmented grinding wheel of claim 8 wherein the mounting means terminates in oppositely extending flanges and the spindle has a plurality of inwardly extending grooves terminating in outwardly extending keyways, said grooves and keyways cooperating with the flanges of the mounting means to secure the mounting means to said spindle.

11. The segmented grinding wheel of claim 8 wherein each of the abrasive segments has at least two holes therethrough and said flange means includes a first and second flange, said first flange having a plurality of pins depending normal therefrom to fit through the holes of the segments and said second flange having a plurality of openings therethrough aligned to cooperate with the pins of the first flange to secure the segments thereinbetween.

12. A segmented grinding wheel comprising:

A. A spindle having grooved receiving means;

B. A grinding unit mounted to the spindle and having

i. A circular metal band having a plurality of pairs of oppositely disposed lugs, one of each pair cooperating with the grooved receiving means to secure the band to the spindle;

ii. A plurality of substantially pie-shaped abrasive segments closely spaced and positioned about the metal band to form a radially constant abrasive work surface, the other of each pair of disposed lugs extending between adjacent segments, each segment having at least one laterally extending groove depending inwardly from the grinding surface;

iii. Circular metal strips tightly secured about the segments to hold them about the metal band, each circular strip positioned within said lateral grooves; and

C. Flange means positioned on either side of the segments and about the spindle to further secure the grinding unit in place about the spindle, said flange means dimensioned to extend radially outward to a position between the metal strip and the grinding surface.

13. The segmented grinding wheel of claim 12 wherein each of the abrasive segments has at least two holes therethrough and said flange means includes a first and second flange, said first flange having a plurality of pins depending normal therefrom to fit through the holes of the segments and said second flange having a plurality of openings therethrough aligned to cooperate with the pins of the first flange to secure the segments thereinbetween.

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