Feb. 20, 1973 K. C. WALTERS 3,716,951

CUP GRINDING WHEELS

Filed May 5, 1971

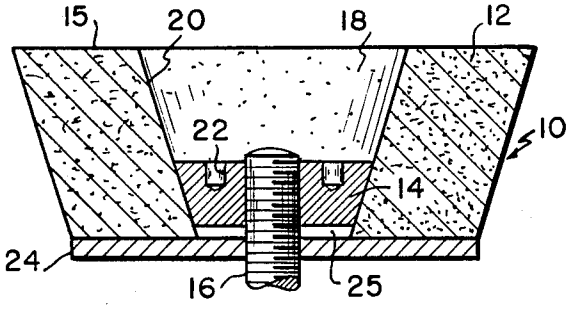


Fig. 1

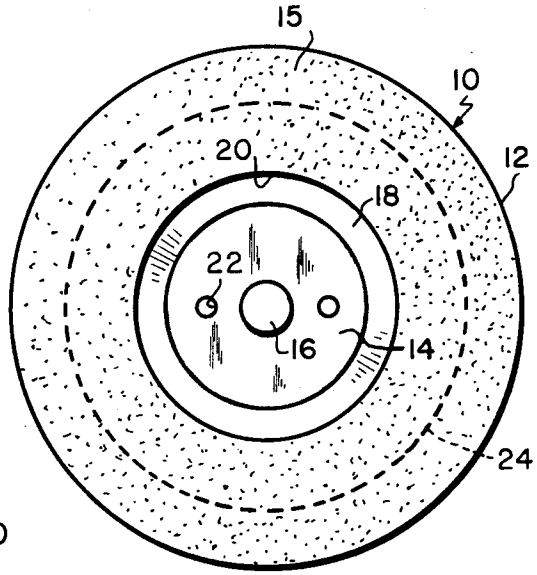


Fig. 2

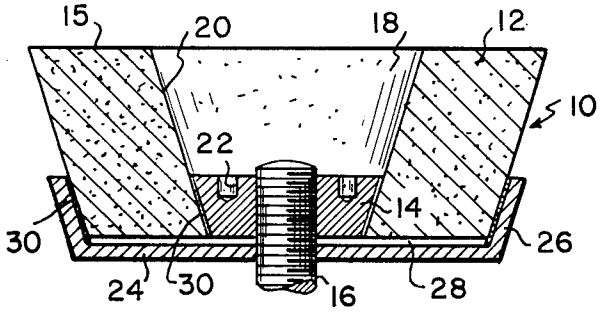


Fig. 3

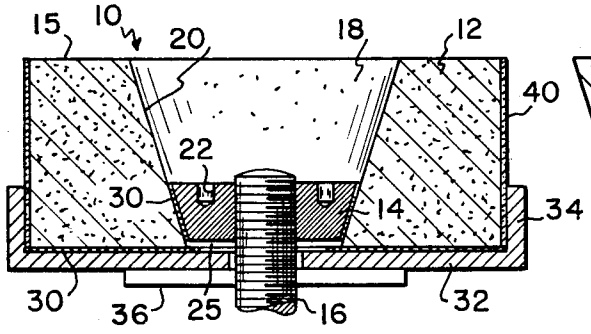


Fig. 4

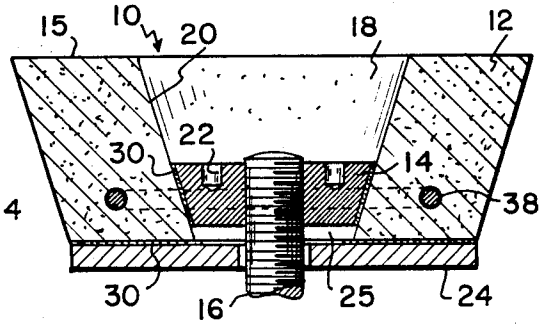


Fig. 5

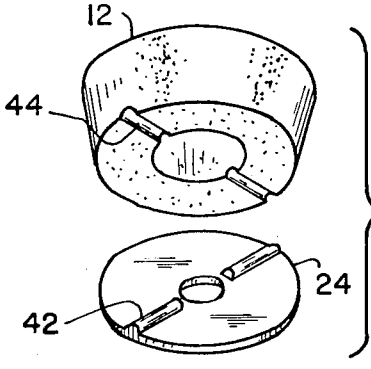


Fig. 6

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CUP GRINDING WHEELS

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ABSTRACT OF THE DISCLOSURE

A cup grinding wheel has a frusto-conical central opening therethrough. A frusto-conical shaped nut engages a spindle of a grinding tool and the opening of the cup grinding wheel to secure the cup grinding wheel to an adapter plate separate from or integral with the grinding tool.

My invention relates to grinding equipment and, more particularly, to cup grinding wheels.

The cup grinding wheels employed in snagging and other heavy duty industrial grinding operations are generally either straight sided (type 6 cup wheel) or have flared sidewalls (type 11 cup wheel). These conventional cup grinding wheels are molded with or without a metal portion and contain a bushing on the rearward surface, i.e., the surface opposite the grinding surface. The bushing, which may be knurled and contain prongs to key the abrasive, includes a central threaded bore which screws on the spindle of a grinding tool. The metal portion normally has a series of prongs which extend into the abrasive to also secure the abrasive to the metal portion containing the bushing.

Each cup grinding wheel is used until the abrasive wears away to a point adjacent the spindle which extends through the bushing and then the unused abrasive portion, including the metal portion and bushing, is discarded. Because of the necessity for the back portion and bushing, the cup grinding wheel is molded in a minimum two-step operation with the metal portion and bushing molded to the unused portion of the abrasive and then the abrasive sides and grinding surface added in a later step. Additional steps are normally required where various abrasive reinforcers are employed. The cup grinding wheels are normally mounted onto the grinding tool by screwing the bushing onto the spindle so that the metal portion seats firmly against an unrelieved and flat flange. A blotter is normally used between this connection. Safety guards are suggested by the American Standards Association for all cup grinding wheels.

My invention provides a cup grinding wheel in which only the unused abrasive portion is discarded. This thereby eliminates the costly metal discards resulting from known practices. My invention further is amenable to a one-step manufacturing process, thereby eliminating a minimum of one processing step employed heretofore. My invention also permits elimination of the flange and replaces it with an adapter plate which can be both a revolving guard and adapter all in one. In addition, a larger area for dispersement of driving forces is provided. All of this is accomplished without a sacrifice of grinding wheel strength properties.

My invention is a grinding wheel of the cup type having a frusto-conical central opening therethrough. A nut, shaped similar to the opening, engages a grinding tool spindle and the walls which define the opening to secure the cup wheel to an adapter plate, either integral with or separate from the grinding tool. The nut is dimensioned so as to not contact the adapter plate and, thus, define a space therebetween.

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

FIG. 1 is a section through the center of my grinding assembly;

FIG. 2 is a plan view of the unit of FIG. 1;

FIG. 3 is a section through a grinding assembly having an adapter plate with an outwardly extending rim;

FIG. 4 is a section through a grinding assembly secured by a standard flange; and

FIG. 5 is a section through a grinding assembly having a cup wheel reinforced with a metal ring.

FIG. 6 is an exploded isometric showing an alternate embodiment.

The grinding assembly, generally designated **10**, includes the abrasive cup wheel **12** and securing nut **14** for securing the cup wheel **12** to a threaded spindle **16** of a grinding tool, not shown.

The abrasive cup grinding wheel **12** has a central opening **18** extending completely therethrough, FIGS. 1–5. Opening **18** is defined by interior wall **20** and is frusto-conical shaped. The outer periphery of cup grinding wheel **12** can take on any form with the straight walls of type 6 cup wheels, FIG. 4, or the flared sidewalls of type 11 cup wheels, FIGS. 1, 3 and 5, being exemplary. The actual grinding is conducted along the forward surface **15** and not the sides.

The nut **14** is also frusto-conical shaped and the sides of the nut **14** have the same angulation as the wall **20** of opening **18**. However, the nut **14** is dimensioned so that its smallest cross section or small base is larger than the smallest cross section of the opening **18** so that nut **14** easily fits into opening **18** from the large end, but cannot extend through or reach the small end. Nut **14** contains tool engaging slots **22** along the upper surface thereof. These slots **22**, of which two are shown, but of which there can be more, are engaged by a tool for tightening on the spindle **16**, as will be described hereinafter.

The grinding assembly **10** is positioned on a working tool (not shown) having a flat and unrelieved adapter plate **24**, and a spindle **16** extending therethrough, FIG. 1. The adapter plate can be threaded, FIGS. 1 and 3, or unthreaded, FIG. 5. The cup grinding wheel **12** is placed against adapter plate **24** with the spindle **16** being positioned in the opening **18**. Nut **14** is then tightened down on spindle **16**. As this occurs, the frusto-conical surface of nut **14** engages the wall **20** which defines opening **18** to securably engage the cup grinding wheel **12** in place against the adapter plate **14**. Because of the difference in cross sectional dimension of the frusto-conical shaped nut and opening **18**, a space **25** exists at all times between the smaller base of nut **14** and the surface of adapter plate **24**. The resultant driving forces exerted on the cup wheel **12** are distributed along the interface of the grinding wheel **12** and the adapter plate **24** and also along the cup wheel **12** and the nut outer side surface.

The adapter plate **24** may include an annular rim **26** about the periphery thereof in which case the rim **26** should extend from the flat and unrelieved portion of plate **24** at an inclination similar to the outer surface of the cup grinding wheel **12**, FIG. 3. The adapter plate **24** and rim **26** are dimensioned so that the grinding wheel **12** snugly fits within the annular rim **26**, but does not engage the flat and unrelieved portion of the adapter plate **24**. Therefore, when nut **14** is tightened in place, the grinding wheel **12** is securably engaged in place against the rim portion **26** and the nut **14**, so as to always define a space **28** between the rearward surface of the cup grinding wheel **12** and the nut **14** and also between the cup grinding wheel **12** and the flat and unrelieved portion of the adapter plate **24**. The resultant forces in this embodiment are distributed along the interface of the grinding wheel **12** and the nut **14** and the grinding wheel **12** and the annular rim **26**. Standard blotters **30**

can be employed at these interfaces, FIG. 3. The adapter plate **24** with rim **26**, therefore, acts as a combination guard, as well as a backing plate.

Existing grinding tools can easily be adapted to my cup-type grinding wheel **12** by merely attaching the adapter plate to the grinding tool. Where it is not desired to secure such an adapter plate to the grinding tool, a standard flange **36** can be employed, FIG. 4. Adapter plate **32** having right angle annular rim **34** extending from the periphery thereof to engage a straight sided cup grinding wheel **12**, is merely positioned over the spindle and against standard flange **36** which forms part of the tool. In this particular embodiment, a blotter **30** is employed between the adapter plate **32** and the cup grinding wheel **12** and between the nut **14** and the cup grinding wheel **12**. In addition, reinforcement and support can be achieved by employing fiberglass sides **40** about the periphery of the abrasive grinding wheel **12**, FIG. 4. This reinforcement addition is simplified by the elimination of the processing step discussed hereinbefore. Because of the right angle sidewalls, the resultant space **26** is only between the nut and the adapter plate **32**. The rim **34** in this embodiment is for safety purposes since it is not a major source of force distribution to the cup wheel **12**. Of course, a similar type safety ring could be added to the embodiments of FIGS. 1 and 3 by adding a nonforce distributing annular rim. The cup wheel **12** may also have an integral metal backing (not shown) as is sometimes presently employed, and still be utilized in accordance with my invention.

If desired, an annular reinforcing metal ring **38** can be molded into the cup grinding wheel **12** in the area between the various pressure points where the forces are distributed, FIG. 5. In the embodiment of FIG. 5, blotters **30** are employed between the nut **14** and the grinding wheel **12** and also between the cup grinding wheel **12** and the adapter plate **24**.

An additional nonslip feature can be added to the grinding unit, FIG. 6, although the tests referred to hereinafter have shown that slippage is not a problem with my grinding wheel because of the particular distribution of driving forces. The grinding wheel **12** has a recessed slot **44** along the surface which engages the adapter plate **24**. This slot **44** mates with a raised rib **42** on the adapter plate **24** so that after the nut is tightened, and additional nonslip feature is present.

A series of tests have been conducted on my cup grinding wheels. Wheels were tested both with and without the metal ring reinforcement and the fiberglas reinforcement. Initially the nut was tightened in place to the maximum limit of the torque wrench, 150 foot pounds, without showing any evidence of cracking. The wheels were then sped to destruction in the laboratory speed tester as were standard cup grinding wheels of the same specification. The standard wheel had an average bursting speed of 18,850 surface feet per minute whereas all the test wheels, whether they were reinforced or not, had an average bursting speed in excess of 20,000 surface feet per minute. This increase in resistance to failure is attributable to a large measure to the better distribution of driving forces of the grinding tool to the grinding wheel.

I claim:

1. A grinding assembly for insertion on a grinding tool including an adapter plate and an outwardly extending spindle comprising a cup grinding wheel having a frusto-conical central opening extending completely therethrough defined by an inner wall, the wheel adapted to engage the adapter plate and loosely accommodate the spindle and a frusto-conical shaped nut, the sidewall of which is at the same angulation as said wall with the smallest base of the nut being larger than the smallest cross section of the opening, said nut adapted to engage the spindle and the wall to secure the cup grinding wheel against the adapter plate with a small space between the nut and the adapter plate.

2. In combination, a grinding tool adapter plate having an outwardly extending rim along the periphery thereof and a grinding tool spindle projecting therethrough, a cup grinding wheel having a frusto-conical shaped central opening extending completely therethrough defined by an inner wall, said wheel positioned to engage the rim and loosely accommodate the spindle in the central opening and a frusto-conical shaped nut, the sidewall of which is at the same angulation as said wall with the smallest base of the nut being larger than the smallest cross section of the opening, said nut engaging the spindle and the wall to force the cup grinding wheel against the rim with a small space between the wheel and the remainder of the adapter plate.

3. A grinding unit assembly for insertion on a grinding machine including a spindle having a flange thereabout comprising an adapter plate to engage the flange about the spindle, a cup grinding wheel having a frusto-conical central opening therethrough defined by a wall to loosely accommodate the spindle and a frusto-conical shaped nut, the sidewall of which is at the same angulation as said wall, the nut dimensioned to contact the wall along the sidewall to securably engage the cup grinding wheel against the adapter plate and form a space between the nut and the adapter plate.

4. The grinding assembly of claim **2** wherein the cup grinding wheel includes a reinforcing ring positioned internally thereof in an area near to the nut sidewall and the adapter plate.

5. The grinding assembly of claim **1** wherein the cup grinding wheel includes a fiberglas reinforcement about the outer surface thereof.

6. The grinding assembly of claim **1** wherein the nut includes tool engaging means recessed in an upper surface thereof.

7. The grinding unit assembly of claim **3** wherein the adapter plate has an outwardly extending rim along the periphery thereof, said nut securably engaging the grinding cup wheel against the rim to form a space between the cup wheel and the remainder of the adapter plate.

8. The grinding unit of claim **3** wherein the adapter plate includes a raised rib to matingly cooperate with a recessed slot in the surface of the cup grinding wheel which engages the adapter plate.

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