

[54] **EXPANSIBLE WHEEL**

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[58] Field of Search **51/353, 372, 374; 279/1 C, 2**

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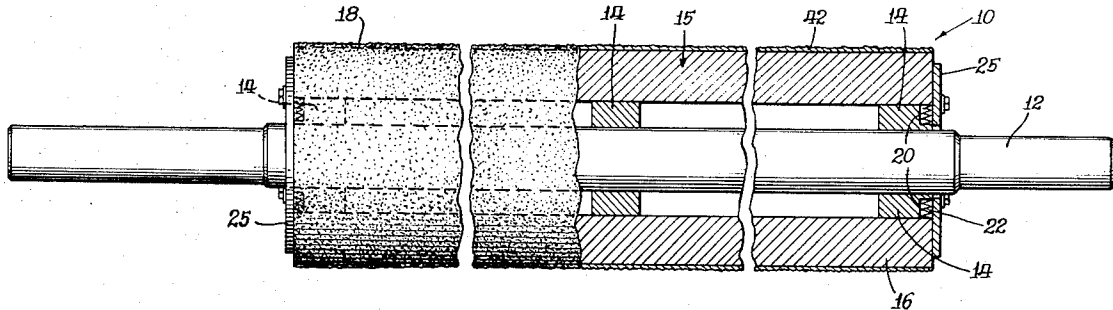
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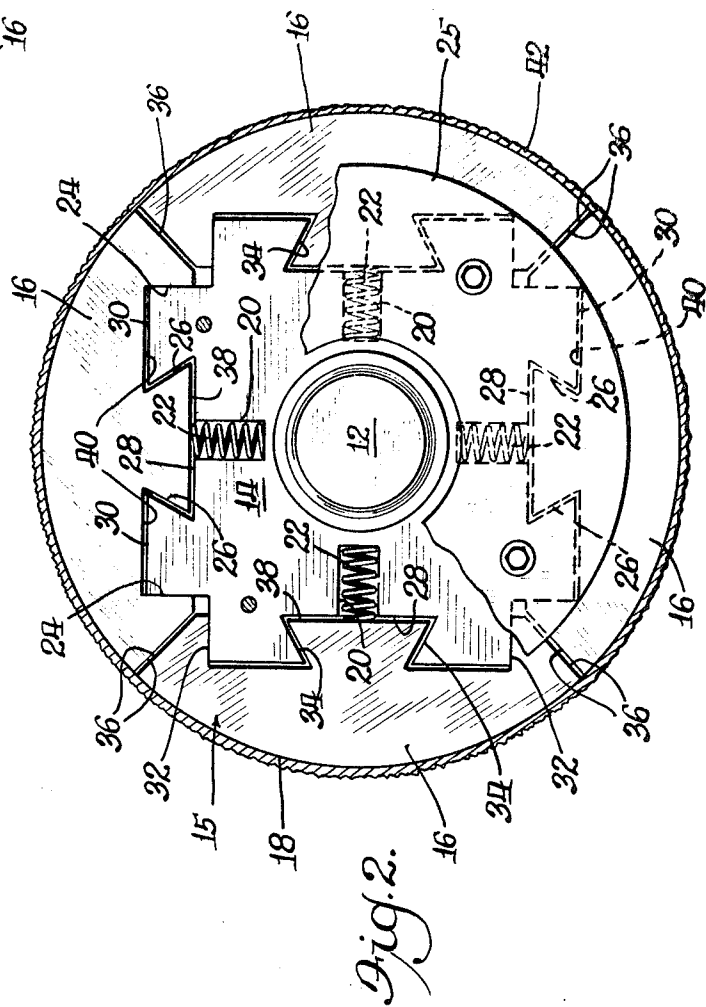
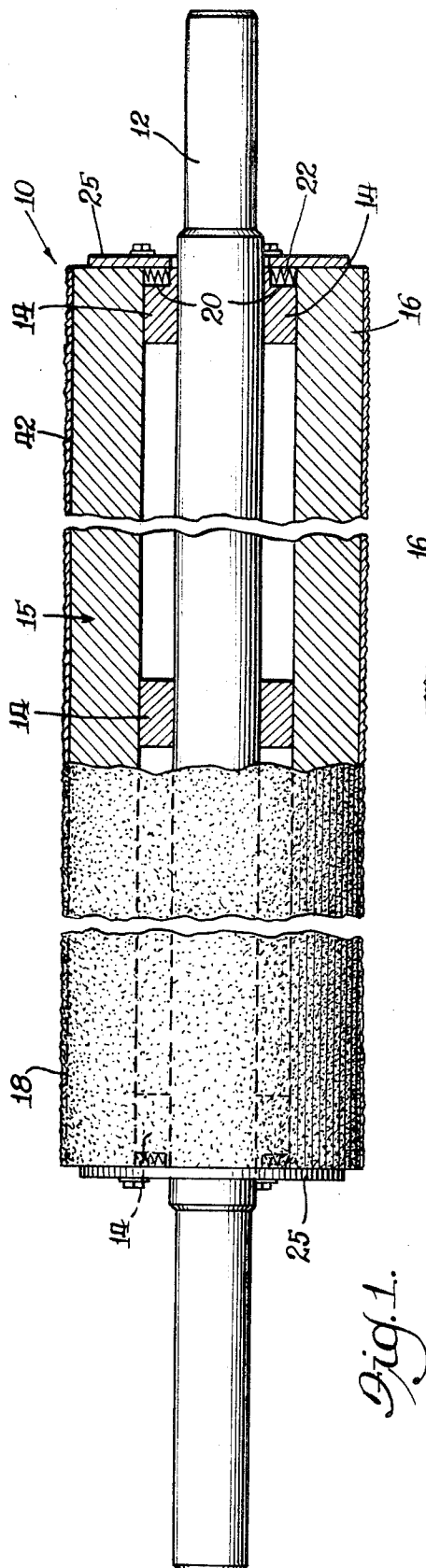
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[57] **ABSTRACT**

A rotatable hub supports solid rim segments movable relative thereto between a first position relatively close to the hub in which a flexible, abrasive sleeve is not engaged, to a second position in which the sleeve is engaged, to a third position relatively far from the hub. Springs and centrifugal force both urge the rim segments away from the first position.

8 Claims, 2 Drawing Figures





EXPANSIBLE WHEEL

The present invention relates generally to improvements in abrasive wheels and in particular to an expansible arbor which carries a flexible, abrasive sleeve.

In the arts involved in planing, sanding, texturing or shredding of products such as wood, plastic, fiberglass, etc., there are many cutting knives and wheels used to process such materials. The speed at which these devices are operable is generally low, and their useful working life similarly is low.

There has long been a need for some means of processing such materials at a fast rate and in an economical manner. Abrasive wheels used for such purposes heretofore have been impractical because, in the main, they were fixedly mounted on rotating hubs. Thus the cost of manufacture, shipment, etc. was, in many instances, prohibitively high. The useful life of such devices was not sufficiently long enough to be economical if the hubs had to be discarded along with the abrasive sleeves.

The present invention has for an object the use of an expansible arbor having a rim comprising solid rim segments which, under the influence of spring tension and centrifugal force, engage a flexible, abrasive sleeve in such a manner as to provide a rigid abrasive tool.

Another object of this invention is to provide an expansible arbor which may easily be adapted to engage and disengage an associated abrasive sleeve.

Another object of this invention is to provide an expansible arbor and abrasive sleeve combination engageable by utilization of a relatively small spring force at low speeds and a relatively large centrifugal force at high speeds.

Still another object of this invention is to provide an arbor and sleeve combination incorporating a safety feature to insure that the arbor elements will be restrained from flying away from the associated shaft under the influence of centrifugal force should the sleeve fail for any reason.

Still another object of this invention is the provision of an expansible arbor and abrasive sleeve combination wherein the arbor incorporates centrifugal weights of relatively high heat conductive material for dissipating heat generated from high speed abrasive operations.

These and other objects of this invention will be apparent from the specification herein, including the drawing, in which:

FIG. 1 is a side elevational view, partially in section, of the improved arbor and sleeve combination; and

FIG. 2 is an end view, partially in section, showing the details of the arbor construction.

The abrasive wheel 10 includes a rotatable shaft 12 suitably carried by a motor or drive element (not shown) for high speed rotation. Spaced hubs 14 are welded or otherwise fixed to shaft 12 for rotation therewith. In the embodiment shown herein, three hubs are evenly spaced along the length of the shaft, although it should be understood that the number of hubs will be determined by the length of the shaft as well as the use to which the abrasive wheel is to be put.

A rim 15 is carried by hubs 14 and includes the rim segments 16 movable radially toward and away from shaft 12 in a manner to be described hereinafter. In the preferred embodiment four rim segments 16 are shown. Outer surfaces 18 of rim segments 16 are truly round for purposes that will be more fully described hereinafter.

At selected hubs 14 a spring well 20 is provided for each rim segment. A suitable spring 22 is located in each spring well 20 in order to bias each rim segment 16 away from shaft 12 along a radius thereof. An end plate 25 is suitably secured to selected hubs 14 to keep rim segments in position.

Hubs 14 define complementary pairs of guide surfaces 24. Each pair of guide surfaces 24 straddles and is parallel to a radius of shaft 12. In the embodiment shown herein each hub 14 defines four pairs of guide surfaces 24, one for each rim segment 16.

Inwardly of guide surfaces 24 hubs 14 define four pairs of restraining surfaces 26, each pair converging outwardly toward a radius of shaft 12. Hubs 14 also define inner surfaces 28 and outer surfaces 30. Each inner surface 28 is perpendicular to a radius of shaft 12 and, with a corresponding pair of restraining surfaces 26, takes the form of a dove-tail configuration. Similarly, outer surfaces 30 are perpendicular to a radius of shaft 12 and connect guide surfaces 24 with restraining surfaces 26.

Each rim segment 16 is formed with a pair of guide surfaces 32 spaced from and parallel to a radius of shaft 12 so as to slidably engage guide surfaces 24 of hubs 14. This slidable engagement allows each rim segment 16 to move radially relative to shaft 12.

In a like manner, rim segments 16 are provided with restraining surfaces 34 which converge outwardly toward the radius of shaft 12. In the embodiment shown, restraining surfaces 34 of rim segments 16 and restraining surfaces 26 of hubs 14 are both formed at an angle of 30° with the associated radius of shaft 12 so as to abut and limit the outward movement of rim segments 16 along the radius. This abutting relationship defines a stop for determining the maximum outward position of rim segment 16.

Each rim segment 16 is provided with a pair of end surfaces 36 which are flat and which are coincident with corresponding radii of shaft 12 when rim segments 16 are in an inward position to be described more fully hereinafter.

Rim segments 16 are movable under the guidance of guide surfaces 24 and 32 radially relative to shaft 12 from a first position relatively close to shaft 12, to a second, intermediate position, to a third position relatively far from shaft 12. It is this third position which is determined by the abutment of restraining surfaces 26 and 34.

The first position of rim segments 16 is determined by abutment of end surfaces 36 of adjacent rim segments 16. Inner surfaces 28 and 38 and outer surfaces 30 and 40 are in spaced relationship. Similarly, in this position restraining surfaces 26 and 34 are in a spaced relationship.

In the manufacture of the expansible arbor described herein, suitable shims are inserted between end surfaces 26 and 34 so as to position the rim segments 16 in their second intermediate position. To secure the rim segments 16 for machining the true round, threaded holes have been provided through the rim segments 16 at a position in line with the drive hubs 14. These threaded holes accommodate screws which serve as jack screws to force rim segments 16 away from center position to the point where the dovetail surface 26 is forced tight against the shims. With the shims in place and the jack screws secured, outer surfaces 18 of rim

segments 16 are formed in true round. The jack screws and shims are thereafter removed.

A flexible, abrasive sleeve 42 has an inside diameter such that it is easily slidable over rim segments 16 when they are in their first position. With sleeve 42 around rim segments 16, they expand under the influence of springs 22 to initially engage sleeve 42. This engagement takes place when rim segments 16 are in their second, intermediate position; that is, when outer surfaces 18 thereof are in true round. Thus, abrasive sleeve 42, although flexible, is held rigidly in true round under the influence of centrifugal force. In this position restraining surfaces 26 and 34 are spaced from one another.

Sleeve 42 is between 0.030 and 0.080 inches in thickness and has tungsten carbide bits brazed throughout the outer surface thereof. A method for forming such a sleeve is disclosed in my co-pending application Ser. No. 69,364, filed Sept. 3, 1970 now U.S. Pat. No. 3,687,647, issued Aug. 29, 1972.

It is anticipated that with the use of a high horsepower motor this abrasive wheel, being 63 inches long and 9 inches in diameter in a preferred embodiment, may operate at speeds between 900 and 6,000 rpm. As the speed exceeds approximately 500 rpm, centrifugal force acts upon rim segments 16 to further strengthen the rigidity of sleeve 42.

In the event sleeve 42 should rupture in use, restraining surfaces 26 and 34 will engage immediately due to centrifugal force, thereby preventing rim segments 16 from flying away from the hub 14.

Rim segments 16 are formed from aluminum and act as a very good heat sink, as heat generation becomes a problem during high speed operation. Additionally, as aluminum is a relatively light metal, centrifugal forces are kept under control at high speed operations.

Hubs 14 are formed of steel and have the advantage of placing torsional stresses only on the shaft; no bending stresses are involved. With a device of this nature the processing of wood, plastics, fiberglass, etc., may be had at capacities up to 1,200 linear feet per minute.

It is contemplated that more than one sleeve may be used with a single arbor at any given time.

Although a single preferred embodiment of the invention is disclosed herein, it should be understood that equivalent modifications may be designed without departing from the scope of the invention which is determined from the claims that follow.

I claim:

1. An abrasive wheel comprising a rotatable shaft, hub means supported by said shaft for rotation therewith, rim means supported for movement relative to said hub means from a proximal position relative said shaft to an intermediate position to a distal position relative said shaft, resilient means urging said rim means away from said proximal position, and abrasive sleeve means supported by said rim means when in said intermediate position and being free of support by said rim means when in said proximal position, said rim means includes a plurality of rim segments constructed and arranged such that they abut to determine said proximal position, said hub means and said rim segments being constructed and arranged such that they abut to determine said distal position.

2. The invention according to claim 1 wherein said hub means defines a plurality of guide surfaces parallel to a radius of said shaft and a plurality of restraining surfaces transverse thereto, and said rim means in-

cludes a plurality of rim segments each defining a guide surface parallel to a radius of said shaft and a restraining surface transverse thereto, said guide surfaces being cooperable for guiding said movement of said rim segments radially of said shaft, said restraining surfaces abutting when said rim segments are in said distal position.

3. The invention according to claim 1 wherein said hub means includes a plurality of spaced hubs each defining spaced guide surfaces parallel to a radius of said shaft and restraining surfaces transverse thereto, and said rim means includes a plurality of rim segments associated with each hub, each rim segment defining a spaced guide surface parallel to a radius of said shaft and a restraining surface transverse thereto, associated hub and rim segment guide surfaces being cooperable for radially guiding said movement of said rim segments, associated hub and rim segment restraining surfaces abutting to determine said distal position.

4. An expansible arbor adapted for use with an abrasive sleeve, said arbor comprising a rotatable shaft, a plurality of spaced hubs fixedly mounted on said shaft for rotation therewith, each of said hubs defining a plurality of pairs of guide surfaces, each pair of guide surfaces being parallel to and spaced from an associated radius of said shaft, each of said hubs further defining a plurality of pairs of retaining surfaces, each pair of retaining surfaces converging toward an associated radius of said shaft, a plurality of rim segments associated with each hub, each of said rim segments movable relative to an associated hub between a proximal position relative said shaft, an intermediate position, and a distal position relative said shaft, each of said rim segments defining a pair of guide surfaces cooperable with a pair of hub guide surfaces for guiding said movement of said rim segment along said associated radius of said shaft, each of said rim segments further defining a pair of retaining surfaces cooperable with a pair of hub restraining surfaces for preventing movement of said rim segment beyond said distal position, said rim segments being adapted to engage an abrasive sleeve in said intermediate position, and resilient means associated with said hubs and said rim segments for urging said rim segments away from said proximal position.

5. The invention according to claim 4 wherein each of said hubs is formed from a relatively heavy, low heat conductive material and each of said rim segments is formed from a light, high heat conductive material relative to said hubs.

6. An abrasive wheel comprising a rotatable shaft; a plurality of hubs mounted on said shaft for rotation therewith, each hub defining a plurality of guides; a plurality of solid centrifugal weights associated with said hubs, each weight movable toward and away from said shaft under the guidance of corresponding guides defined by said hubs; a flexible, abrasive sleeve engageable with said weights; said movement of each weight being determined by engagement of said weight with other weights, a second position determined by engagement of said weight with said sleeve, and a third position relatively far from said shaft determined by engagement of said weight with said hubs; and a plurality of springs associated with said hubs and said weights urging said weights away from said first position; said weights being movable away from said first position under the influence of centrifugal force upon rotation of said shaft.

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7. The invention according to claim 6 wherein said weights solidly engage said sleeve when in said second position thereby holding said sleeve so as to form a solid abrasive wheel.

8. An abrasive wheel comprising a rotatable shaft, 5
hub means supported by said shaft for rotation there-
with, rim means supported for movement relative to
said hub means from a proximal position relative said
shaft to an intermediate position to a distal position re-
lative said shaft, resilient means urging said rim means 10
away from said proximal position, and abrasive sleeve
means supported by said rim means when in said inter-

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mediate position and being free of support by said rim
means when in said proximal position, said rim means
comprising a plurality of spaced rim segments each
having flat parallel surfaces engaging complementary
surfaces of the hub means substantially parallel to the
rotational axis of said shaft, each of said segments hav-
ing between its parallel surfaces a pair of flat surfaces
converging radially outwardly toward said sleeve and
engageable with complementary converging surfaces of
the hub means to determine said distal position.

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