REINFORCED ABRASIVE WHEELS

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Filed: Oct. 12, 1971

Appl. No.: 188,338

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ABSTRACT

Abrasive wheels are reinforced by one or more disc-like layers of open-mesh triaxial fabric, preferably of glass composition. If uniform, the mesh openings are relatively large, preferably with a side length of at least a half inch. A simple fabric layer may be sandwiched by layers of bonded abrasive material, or a pair of fabric layers may sandwich and be bonded to an intervening layer of abrasive material.

10 Claims, 6 Drawing Figures
REINFORCED ABRASIVE WHEELS

This invention relates to abrasive wheels or rotary blades reinforced with one or more layers of fabric. Fabric-reinforced abrasive wheels are known and are especially useful as cut-off wheels for masonry materials. For economical construction the reinforcing fabric is used as a facing material, partially embedded into the side (usually both sides) of such a wheel, although it is also known to sandwich it between two layers of abrasive material, subsequently bonded together in conventional manner.

With ordinary woven fabric, in which warp and filling yarns intersect at right angles (i.e., orthogonally), attempts to confer the desired reinforcing strength to the wheel may lead to the use of too heavy or close-meshed fabric, which impairs bonding of the abrasive material to the fabric and also, with facing fabric, hinders the cutting action of the blade. Use of glass fabric, which is strong but slippery, requires pre-bonding of the fabric itself to maintain its weave during manufacturing and does not eliminate the foregoing problems with the necessarily close mesh normally used, such as in the range from 2½ to 7 (per inch).

A primary object of the present invention is improvement in the structure of fabric-reinforced abrasive wheels.

Another object is improvement in the functioning of fabric-reinforced abrasive wheels.

A further object is accomplishment of the foregoing objects in economical fashion.

Other objects of the invention, together with means and methods for attaining the various objects, will be apparent from the following description, and the accompanying diagrams.

FIG. 1 is a side elevation of an abrasive wheel faced with triaxial fabric of uniform mesh size and useful according to the present invention;

FIG. 2 is a schematic flat view, on an enlarged scale, of triaxial fabric with uniform mesh openings;

FIG. 3 is a similar view of another pattern of triaxial fabric useful according to this invention;

FIG. 4 is an exploded edge elevation of such fabric and other components of an abrasive blade of this invention preparatory to formation by molding or pressing;

FIG. 5 is a fragmentary transverse section through an internally reinforced abrasive wheel so formed; and

FIG. 6 is a similar section through an externally reinforced wheel so formed.

In general, the objects of the present invention are accomplished in an abrasive wheel characterized by component reinforcing material comprising at least one disc-like layer of open-mesh triaxial fabric.

FIG. 1 shows abrasive wheel 10 faced with triaxial fabric 11, and having a central opening to receive a saw spindle (not shown).

FIG. 2 shows fabric 11 on a much larger scale than in the preceding view. Respective component yarns 13a, 13b, and 13c are variously shown, in accordance with whichever of the three axes they parallel: 13a, unshaded; 13b, shaded; and 13c, stippled. For clarity the yarns themselves are somewhat exaggerated in lateral dimension, giving mesh openings 12 a hexagonal, rather than triangular, appearance. In actuality either appearance may prevail, depending upon the relative lateral spacing and diameter of the yarns in the fabric.

FIG. 3 shows, on a like scale, triaxial fabric 21 having several different sets of mesh openings, as follows: triangular openings 24 of intermediate size, smaller hexagonal openings 22 (which may be triangular instead), and larger lozenge-shaped openings 26. Central opening 25, formed by stamping out a disc of the fabric, subsequently accommodates the spindle of a saw mechanism in which a blade reinforced with such fabric is useful. It will be apparent that the fabric of FIG. 3 corresponds in weave to that of FIG. 2 less every third yarn “course” along each of the three axes. The respective yarns in this view are designated as 23a, 23b, and 23c.

Such triaxial fabrics (as well as others) are disclosed in Dow U.S. Pat. No. 3,446,251, and machinery for weaving triaxial fabrics is disclosed by Skelton in Textile Research Journal, 41:637.

FIG. 4 shows schematically, exploded in elevation, upper and lower layers 31 and 39 sandwiching the component materials of such an abrasive wheel, including upper and lower layers 33 and 37 of triaxial fabric, themselves sandwiching thicker layer of abrasive material 35. It will be understood that the items shown in FIG. 4 are compressed vertically and heated sufficiently to bond the abrasive granules of the middle layer to one another and to the facing layers in a suitable mold. The abrasive and bonding components are similarly conventional, comprising an abrasive such as alumina, silicon carbide, or boron nitride and a bonding component such as phenol-formaldehyde or other thermosetting resin or a suitably hardenable rubber.

FIG. 5 shows, fragmentarily, resulting abrasive wheel or rotary blade 30 composed of central layer 35 of abrasive material sandwiched by upper and lower facing layers of such fabric. FIG. 6 shows alternative wheel 40 composed of upper and lower layers 42 and 44 of abrasive material sandwiching intermediate triaxial fabric layer 43. Of course, if desired, both intermediate and facing layers of such fabric may be used together with layered abrasive material intervening, for a highly reinforced wheel. The open meshes of the fabric are filled with the abrasive material and bonded thereto during the molding or pressing steps, of course, forming a unitary product.

Unlike previous glass fabrics, which require structural stabilization by resin-impregnation or similar pre-bonding treatment preparatory to use as reinforcement, the fabrics used according to this invention are sufficiently stable, as woven, by reason of the mutual contiguity of all three courses at their crossover locations. The locking effect so obtained is absent, of course, from orthogonally woven open-mesh fabrics, in which the warp yarns and the filling yarns intersect loosely at 90°.

Less reinforcing yarn is required according to this invention because triaxial fabrics have a high degree of isotropy, in contrast to the anisotropy of orthogonally woven fabrics, which are notably weak in the diagonal directions. Not only is use of a lighter fabric more economical in that regard, the resulting lesser degree of covering of the abrasive wheel face makes for more efficient cutting, which is another welcome economy for the wheel user. Not only may the overall denser be reduced up to about one-third, but in the uniform mesh of FIG. 2 it is unnecessary for the length of the side of a
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mesh opening to be less than a half inch long, whereas five to the inch is a common value for orthogonal meshes.

Notwithstanding the description and illustration of certain embodiments of this invention, modifications may be made therein, as by adding, combining, or subdividing parts or steps, or by substituting equivalents while retaining many or most of the advantages and benefits of the present invention. The invention itself is defined in the following claims.

The claimed invention:

1. Abrasive wheel including component reinforcing material comprising at least one disc-like layer of open-mesh triaxial woven fabric.

2. Abrasive wheel according to claim 1, wherein such fabric has substantially uniform mesh openings.

3. Abrasive wheel according to claim 2, wherein the length of a side of such mesh opening is at least ½ inch.

4. Abrasive cut-off wheel comprising a layer of bonded abrasive material sandwiched by a pair of layers of triaxial woven reinforcing fabric bonded thereto.

5. Abrasive wheel according to claim 4, wherein the reinforcing fabric is composed of glass and is otherwise unbonded.

6. Abrasive wheel according to claim 1, having a central opening therethrough for a drive spindle and wherein the fabric has a corresponding central opening.

7. Abrasive cut-off wheel comprising a layer of triaxial woven reinforcing fabric and a pair of layers of bonded abrasive material sandwiching and bonding the fabric layer.

8. Abrasive cut-off wheel according to claim 7, wherein the reinforcing fabric is composed of glass and is otherwise unbonded.

9. Abrasive wheel including component reinforcing material comprising at least one disc-like layer of open-mesh triaxial woven fabric having triangular mesh openings.

10. Abrasive wheel including component reinforcing material comprising at least one disc-like layer of open-mesh triaxial woven fabric having hexagonal mesh openings:

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