A semi-reinforced grinding wheel having square-shaped open-mesh fabric reinforcing layers which are orientated out of phase with one another.

9 Claims, 4 Drawing Figures
This invention relates to reinforced grinding wheels, and more particularly to semi-reinforced grinding wheels having open-mesh fabric reinforcement.

Reinforced cut-off wheels and other grinding wheels of the straight and depressed center types normally contain discs of reinforcing fabric woven from continuous filament material such as glass or nylon in an open-mesh weave so that the abrasive grains can pass through the openings of the cloth during fabrication of the wheel. In the past the cloth discs have been cut from bolts of the cloth and this has resulted in undue waste material.

For economy, some reinforced grinding wheels are manufactured which do not have their reinforcing discs extending outwardly the full radial extent of the wheel, and these are commonly referred to as semi-reinforced wheels. Heretofore, in semi-reinforced cut-off wheels having a pair of laterally spaced reinforcing glass-cloth layers at opposite sides, it has been considered necessary to have the layers matched in size and strand orientation so as to prevent warpage of the wheel. Such wheels have not only had completely non-reinforced outer ring areas, but have a tendency to shear along the outer periphery of the reinforcement, particularly in response to side loads applied on the outer non-reinforced zone. In an effort to reduce this tendency some semi-reinforced cut-off wheels have been constructed and tested having two different diameters of reinforcing cloth discs, but this can create dis horny problems.

The present invention primarily aims to provide an improved semi-reinforced grinding wheel which will substantially eliminate the aforementioned waste of reinforcing cloth experienced in the past, and yet will give, for a given roll of reinforcing cloth, significantly stronger and safer wheels without reduction in total number of wheels produced from the roll and without otherwise changing the wheel forming process or the quantity of materials required.

These objectives are achieved by departing from the prior art teachings by using square rather than round reinforcing layers and orientating them out of phase with another so that corner portions of one are located between the corners of another.

In the accompanying drawings:

FIG. 1 is a perspective view, with part of the body broken away, of a cut-off wheel made in accordance with the present invention;

FIG. 2 is a fragmentary cross-sectional view taken as indicated by the line 2—2 of FIG. 1;

FIG. 3 is a perspective view, with part of the body broken away, of a relatively thick straight grinding wheel made in accordance with the present invention; and

FIG. 4 is a fragmentary cross-sectional view taken as indicated by the line 4—4 in FIG. 3 and with the cross-section of the fabric layers being schematic.

For purposes of example, in the drawings I have shown the invention applied to straight grinding wheels, but it is equally applicable to reinforced depressed center wheels as will be apparent to those skilled in the art. Furthermore, the invention is applicable to both resinoid and rubber grinding wheels, and to both hot-press and cold-press wheels, and does not place any limitation on the types of abrasives conventionally used.

The reinforcing fabric used in the present invention can be any open-mesh weave, such, for example, as plain, basket and leno weaves, using continuous filament yarns, and the warp and weft can be of single strand or multi-filament construction. Glass cloth is preferred but the invention is applicable to the use of nylon and other suitable synthetic fiber cloths. It is preferred that the cloth strands be initially impregnated with a suitable resin as described, for example, in U.S. Pat. No. 25,303, to lend protection from the abrasive materials in the grinding wheel, particularly during the pressing operation used in forming the wheel. Said patent also discloses examples of suitable resins and abrasives for the body of a wheel embodying the reinforcing arrangement of this invention.

The mesh size of the reinforcing cloth is not critical with respect to the present invention. Normally it is preferred to use open mesh in the range of about 2½ to 10 openings per inch in both directions depending on the abrasive grit size, the wheel thickness, and the reinforcing strength requirements in the given instance. As is well known in the grinding wheel art, it is desired that the mesh size be large enough to permit free passage of the abrasive through the fabric openings during molding of the wheel.

A cut-off wheel is illustrated in FIG. 1 of the type having a pair of glass fabric reinforcing layers 10–11 at the outer faces of the disc-shaped body 12 of the wheel. This body is of a suitable resin or rubber based material containing the desired abrasive. Suitable mixtures and molding techniques are disclosed in U.S. Pat. Nos. 2,138,882; 2,656,654; 2,745,224 and 25,303, the particular mixture, abrasive and molding technique used (whether cold press or hot press) not being critical to the practice of the present invention. In any regard the body material bonds to the abrasive and reinforcing plies 10–11 when cured. A conventional arbor bushing 13 may be provided.

In accordance with the present invention, the fabric reinforcing layers 10–11 are given a square outline rather than being circular, and so can be cut from a roll or sheet of the selected open-mesh glass cloth or other fabric with virtually no waste since for production, the fabric can be obtained in a width which is for practical purposes an exact multiple of the width of the fabric squares 10–11. It is preferred that the squares be cut to a size giving a diagonal dimension which is substantially equal to the diameter of the wheel body 12, but it is contemplated that in some instances, for the sake of further economy, this preference will not be strictly adhered to, particularly when more than two reinforcing layers are provided. Center holes are cut in the reinforcing layers to accommodate the bushing 13.

Further in accordance with this invention, the fabric reinforcing squares 10–11 are positioned such that the curves of the layer 11 are spaced circumferentially of the wheel from the corners of the layer 10, and preferably the orientation is such that the two squares are phased 45 degrees from one another so as to provide reinforcement over a maximum area of the wheel. This phasing, contrary to what would be expected by those skilled in the art, does not result in undue warping of the finished cut-off wheel, while giving a definitely superior semi-reinforced product compared to that achieved when the reinforcing fabric is provided in discs whose diameter is the width of the squares 10–11.
Not only is the cut-off wheel of the present invention stronger because there is greater reinforced area near the periphery of the wheel, but because there is not the weakness of having a common reinforcement border line on opposite sides of the wheel as found when concentric matching fabric discs are used for reinforcement in the prior semi-reinforced cut-off wheels.

In FIG. 3 the invention is shown applied to a thick straight wheel having its abrasive containing body disc and center bushing designated 22 and 23, respectively. For purposes of example, four heavy duty open-mesh fabric reinforcing layers 24 through 27 are shown, the warp and weft of which may each be formed by multiple continuous glass filaments giving the ribbon-like appearance thereto shown in FIG. 3. In this example the four reinforcing plys are all completely buried in the body 22, and the alternate layers 24 and 26 are phased 45° with respect to the layers 23 and 25. In the alternative, the outer reinforcing layers 24 and 27 can be made concentric to one another and the two inner layers 25–26 can both be phased 45 degrees relative to the outer layers.

Although the illustrated examples of embodiments of the present invention have shown 45 degree phasing of the reinforcing layers, which is preferred, particularly when there are only two reinforcing plys, it will be appreciated that the teachings of the invention are such as to suggest to one skilled in the art that when more than two layers or reinforcement are provided, all of the layers can be phased apart from one another. For example, if there are three layers, the corners of the layers can be 30° apart and where there are four layers the corners can be phased 22½ degrees apart instead of the arrangement illustrated in FIG. 3.

Furthermore, although I have illustrated perfect squares for the reinforcing layers, it is intended that if the same happen to be made somewhat oversize, for example, and are beveled correspondingly at the corners, such are still considered "square" in interpreting the claims to follow.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A semi-reinforced grinding wheel comprising a cured disc or bonding material containing abrasive grit and having a reinforcing layer of open-mesh cloth with some of said grit extending through the mesh openings, said cloth layer having a square shape with its vertices extending substantially to the periphery of said disc and its peripheral edges being parallel to the warp and weft of the cloth.

2. A semi-reinforced grinding wheel comprising a cured disc of bonding material containing abrasive grit and a pair of laterally spaced reinforcing layers of open-mesh cloth with some of said grit extending through the mesh openings, said layers having a regular polygonal shape and being orientated so that the vertices of each layer are centered circumferentially of the disc with respect to the vertices of the other layer.

3. A semi-reinforced grinding wheel according to claim 2 in which said polygonal shape is square and each reinforcing layer has its warp and weft parallel to respective of its peripheral edges.

4. A semi-reinforced cut-off wheel comprising a thin cured disc of bonding material containing abrasive grit and a laterally spaced pair of outer reinforcing layers of open-mesh glass cloth with some of said grit extending into the mesh openings of said layers, said cloth layers each having a square outline with its corners extending substantially to the periphery of said disc, the corners of each said layer being spaced apart circumferentially of said disc from the corners of the other layer.

5. A semi-reinforced cut-off wheel according to claim 4 in which the corners of each said cloth layer are centered between the corners of the other cloth layer.

6. A semi-reinforced cut-off wheel according to claim 5 in which the directions of the warp and weft of the cloth reinforcing layers are parallel to respective peripheral edges of such layers.

7. A semi-reinforced grinding wheel comprising a cured disc of bonding material having multiple laterally spaced square layers of reinforcing cloth of like peripheral size centered relative to the disc, each of said layers being arranged with its corners spaced circumferentially of the disc with respect to the corners of one of the other of said layers.

8. A semi-reinforced grinding wheel according to claim 7 in which one of said layers is arranged with its corners centered circumferentially of the disc with respect to the corners of one of the other of said layers.

9. A semi-reinforced grinding wheel comprising a cured disc of bonding material containing abrasive material and multiple laterally spaced polygonal-shaped layers of reinforcing cloth, said layers being arranged with the vertices of one staggered circumferentially of the disc relative to the vertices of another.