

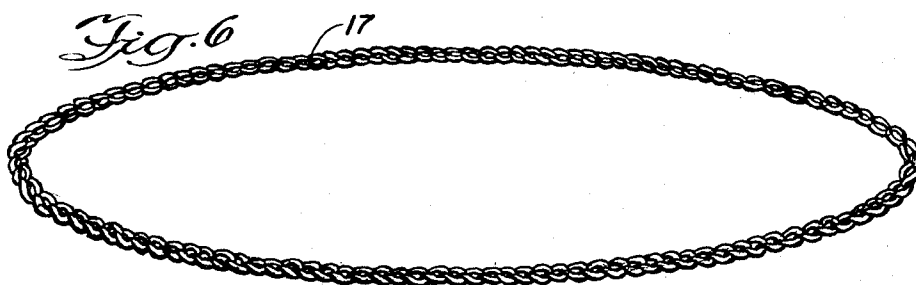
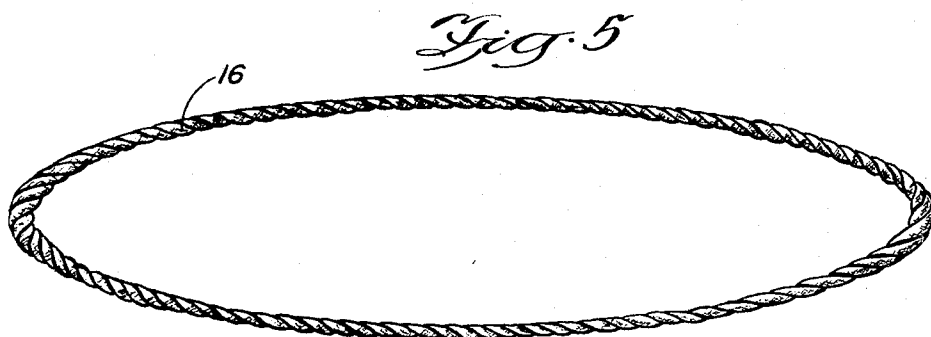
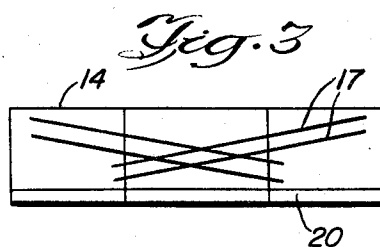
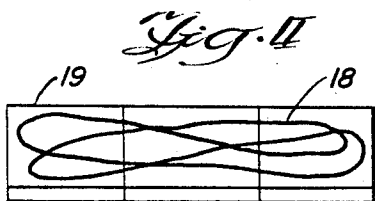
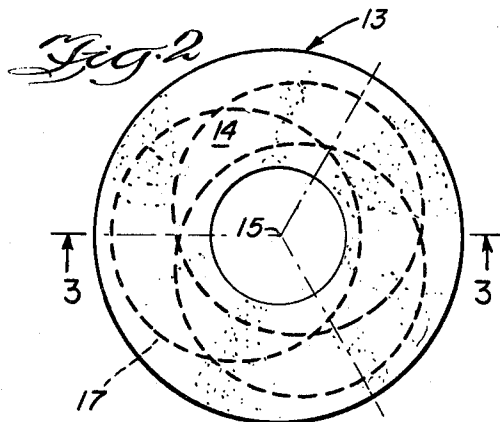
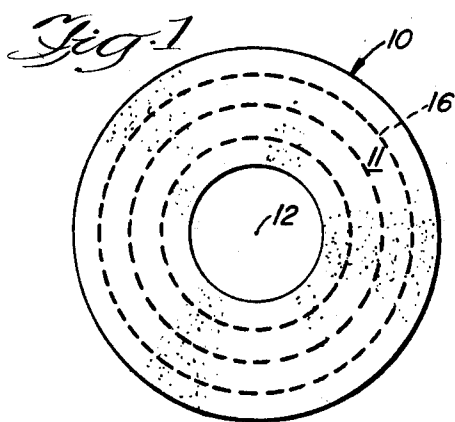
Sept. 10, 1968

F. O. SHOEMAKER

3,400,497

ABRASIVE DISC

Filed Dec. 7, 1965



INVENTOR
Frank O Shoemaker
BY
Hofgren, Wagner, Cullen, Steelman & McCord
ATTORNEYS

1

3,400,497

ABRASIVE DISC

Frank O. Shoemaker, Palos Park, Ill., assignor to Titan Abrasives Company, a corporation of Illinois
Filed Dec. 7, 1965, Ser. No. 512,132
3 Claims. (Cl. 51—209)

ABSTRACT OF THE DISCLOSURE

A rotatable abrasive disc for grinding articles at a side grinding surface of the the disc and including a reinforcing member comprising abradable glass fibers embedded in the disc and positioned around the axis with the member being substantially entirely at an acute angle to the side grinding surface and those portions adjacent the surface so that only small portions of the reinforcing member are exposed as the abrasive body and glass fiber reinforcing member are worn away at the surface during the grinding, the result being that the reinforcing member continues its reinforcing even during the time that the side of the disc is being worn away.

Abrasive discs are made of grains of an abrasive material held by a binder so that the disc is usable for grinding metal and the like. With the disc, which is usually annular, the grinding is at a side surface while the disc is rotated about a central axis. One of the dangers in such a disc is that the centrifugal forces set up by the rotation can become so great at high speeds as to cause disruption of the disc with resulting danger of injury to personnel and damage to property.

One of the features of this invention is to provide a reinforced abrasive disc in which a glass fiber ring or rings are arranged in the disc at an angle to the side grinding surface so that only small portions of the reinforcing ring or rings are exposed as the disc is worn away at the grinding surface with these portions being successive over a long period of time before the ring is completely removed by abrasion with the articles being ground.

Other features and advantages of the invention will be apparent from the following description of certain embodiments thereof as shown in the accompanying drawings. Of the drawings:

FIGURE 1 is a plan view of one embodiment of an abrasive disc embodying the invention with the plurality of concentric reinforcing glass fiber rings shown in broken lines.

FIGURE 2 is a view similar to FIGURE 1 but illustrating a second embodiment.

FIGURE 3 is a semi-diagrammatic sectional view substantially along line 3—3 of FIGURE 2 showing the arrangement of the glass fiber rings of FIGURE 2.

FIGURE 4 is a view similar to FIGURE 3 but illustrating a third embodiment of the invention.

FIGURE 5 is a perspective view of one embodiment of a reinforcing glass fiber ring.

FIGURE 6 is a view similar to FIGURE 5 but illustrating an alternate embodiment of a glass fiber ring.

The abrasive discs illustrated in the drawings are each of annular configuration, as illustrated in FIGURES 1 and 2, and the grinding is done on a side surface of each disc. Thus, in the embodiment of FIGURE 1 the abrasive disc 10 has a side grinding surface 11 and the disc is mounted when in use for rotation about its central axis indicated at 12. Similarly, the disc 13 in FIGURE 2 has a corresponding side grinding surface 14 and is rotatable about a central axis indicated at 15.

Customarily, abrasive discs of this type are made of abrasive grains held by a cured resin binder. The abrasive

2

grains that may be used include aluminum oxide, silicon carbide, boron carbide, corundum, garnet, emery and any of the other customary abrasive materials, or mixtures thereof. These may be employed in the standard grinding grades. The grit size is of the usual grades as graded by the United States Bureau of Standards. These abrasive materials and their uses for particular jobs are well understood by those skilled in the art and are not changed in the abrasive articles of this invention.

The resin binders that may be used in this invention are those customarily employed in the art. The preferred resin is a thermoset resin and preferably a thermoset aldehyde condensation product resin. Such resins are the phenolic compound-aldehyde resins and amine-aldehyde resins and particularly those made with primary amines and especially the primary aromatic amines. Excellent examples of such condensation products are the phenol-formaldehyde resins and the aromatic amine-aldehyde resins, particularly those produced from primary amines such as aniline. These resins and their uses are standard to the abrasive industry. One such dry resin that has found wide use is a phenol-formaldehyde resin known as "Bakelite BR-5417." A liquid resin is one known as "Bakelite BR-7534."

In making the abrasive discs of this invention the glass fiber rings 16 and 17 are formed as illustrated in FIGURES 5 and 6 and then embedded in the uncured and uncompressed soft mixture of grains and resin binder before the discs are molded and cured. In each instance the glass fiber rings are made of glass rovings each consisting of a plurality of glass yarns. In the FIGURE 5 embodiment the rovings are twisted together and joined to make a continuous ring. In the embodiment of FIGURE 6 the rovings are braided and spliced to make a continuous ring. Each glass fiber of the roving is a monofiber filament and the roving itself is a yarn consisting of a large number of glass monofibers twisted together. Thus, a typical yarn contains approximately 200 continuous monofilaments each of about 0.004 inch diameter.

As the ingredients of the abrasive article must be thoroughly mixed before being molded and heated to set the resin, it is customary to use an ingredient having wetting action in order to insure uniform distribution of the bond. A liquid type resin is an example of such an ingredient and may be used in making the abrasive articles of this invention. The liquid is added in the usual manner and in the usual amount. Furfural, furfural alcohol, acetone, or any of several materials are well known as capable of wetting the abrasive grains and are used for this purpose.

In one example of making an abrasive disc according to this invention 800 parts of fused aluminum oxide grains were mixed with 20 parts of Bakelite BR-7534 liquid resin. 50 parts of finely divided cryolite and 30 parts of Bakelite BR-5417 were added. All parts are by weight. Both the dry resin and the cryolite filler were ground so that 99% passed through a 200 mesh screen. The ingredients were thoroughly mixed to achieve substantially uniform distribution.

After the ingredients had been thusly mixed the glass fiber rings were formed by twisting four of the yarns together and knitting at the ends to make a continuous ring as shown in FIGURE 5. Three of these rings of varying diameters, as indicated in FIGURE 1, were then placed concentrically in a mold and surrounded by the above uncured abrasive mixture.

The mixture was cold molded into the shape of a self-supporting disc and this disc heated to cure the resin. The initial temperature was about 180° F. and this temperature was slowly raised to about 360° F. over a forty hour

period. Such baking temperatures and times are customary in the abrasive article art. At the end of this time the abrasive disc was removed from the oven and was found to be a relatively hard, fast cutting and cool cutting abrasive disc.

The uncured or "green" mixture of abrasive grains, binder, fillers and any of the other customary ingredients can be molded cold and then cured by heating, as explained in the example above, or can be molded and cured in a heated press. During the curing operation the temperature may be raised to any amount so long as it is not high enough to break down the resin. Ordinarily the maximum temperature is less than 400° F. The curing time is ordinarily from 40 to 120 hours, although this will depend upon the type and amount of resin employed as well as other factors, as is well known. In the same manner the maximum temperature will also depend upon the type of resin used and an excellent resin has been found to be a phenolformaldehyde condensation product such as those set out in the above example.

At the end of the curing, the glass fiber reinforced disc is removed from the mold. In placing the glass fibers in the uncured abrasive mixture care was taken that each ring was at an acute angle to the side of the mixture that was to become the side grinding surface, in the manner illustrated in FIGURE 3. Then, after the disc had been cured and removed from the mold the rings retain this acute angle relationship so that during grinding at the side surface 11 or 14 only small portions of the ring became exposed as the abrasive body was worn away at the grinding surface.

In a second embodiment of the invention the disc was prepared in the same manner, but here the rings were as indicated at 17 in that the glass rovings were braided. In this embodiment, however, they were at an acute angle to the grinding surface as in the first embodiment.

In third and fourth embodiments similar glass fiber rings were used, but here the rings, indicated at 18 in FIGURE 4, were randomly located but with care being taken that no substantial portion of any ring was parallel to the side grinding surface 19.

Preferably, the glass fiber rings are coated with a curable resin before being embedded in the fluent mixture of abrasive grains and resin binder. An example of one such coating is a mixture of 75% by weight of "Bakelite BR-7534" liquid phenolic resin and 25% by weight of tricresyl phosphate. This mixture was used to impregnate each ring and the resin in the mixture was then cured by heating the resin impregnated ring to a relatively non-tacky state. This heating was for about 5 minutes at 250° F. which cured the resin from the A stage to approximately the B stage. Then, during the final molding, as illustrated in each of the above 2 examples, the resin was further cured and thus the reinforcing rings became firmly bonded in the cured abrasive disc.

These discs are made in varying sizes. One such size is a disc 20 inches in outside diameter, 6 inches in inside diameter and 2 inches thick. In order to support the abrasive disc for grinding at the side grinding surface 11, 14 or 19, each disc is mounted with its opposite surface on a metal backing plate, as illustrated at 20.

The reinforcing glass fiber rings arranged in the manner described herein produce a number of very important advantages. Thus, the rings provide the reinforcing of the abrasive article to prevent accidents when in use, but the ring does not interfere with the grinding because each ring is arranged at an angle to the side grinding surface.

This is true because the rings being arranged at an acute angle are ground away in very small portions that are too small to measurably reduce the grinding action. Furthermore, because the rings are ground away slowly, they contribute their reinforcing function until entirely removed.

Having described my invention as related to the embodiments shown in the accompanying drawings, it is my intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. A rotatable abrasive disc for grinding articles, comprising: an abrasive body comprising abrasive grains held by a binder rotatable about an axis during said grinding; means forming a radial grinding surface on said body; and reinforcing means comprising a member embedded in said body comprising force resisting abradable glass fibers and positioned around said axis, said member being substantially at an acute angle to said grinding surface so that only small portions of said member are exposed as said body and member are worn away at said surface during said grinding.

2. The disc of claim 1 wherein said means comprises a plurality of rings spaced from each other in said disc.

3. The disc of claim 2 wherein each of said rings is asymmetrical with respect to said axis.

References Cited

UNITED STATES PATENTS

228,257	6/1880	Hart	51—206
2,147,438	2/1939	Hassler	51—206
2,643,494	8/1953	Erickson	51—206
3,141,271	7/1964	Fischer	51—206
3,262,231	7/1966	Polch	51—206
3,315,418	4/1967	Zawodni	51—206

LESTER M. SWINGLE, *Primary Examiner*.

D. G. KELLY, *Assistant Examiner*.