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G. J. GOEPFERT ET AL
ABRASIVE ARTICLE OF MANUFACTURE

2,520,763

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Fig. 1.

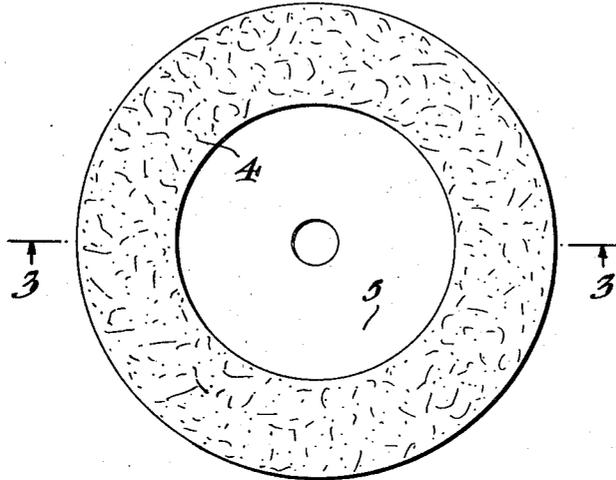


Fig. 2.

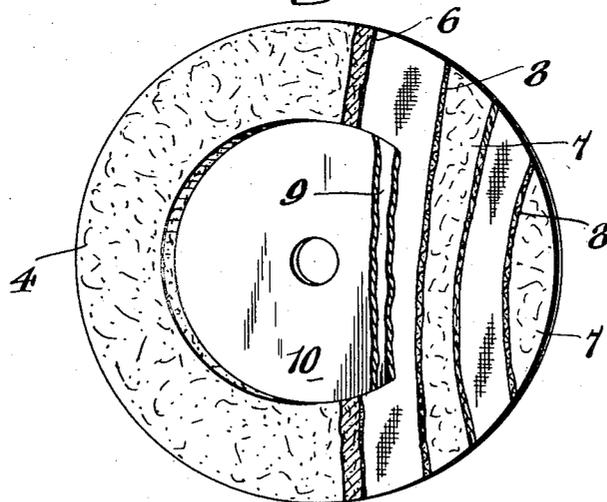
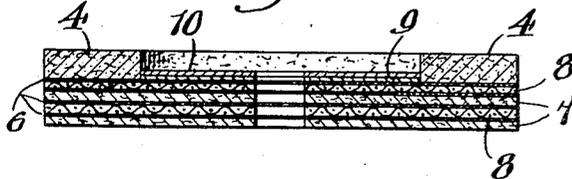


Fig. 3.



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ABRASIVE ARTICLE OF MANUFACTURE

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11 Claims. (Cl. 51—195)

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This invention relates to abrasive discs comprising an annular abrasive element adhesively secured to a backing which is relatively thin and lightweight in character and comprises several laminations of fibrous material. The backing is not of sufficient thickness to render the disc totally inflexible in use although it is relatively stiff in character. This invention is particularly concerned with discs of the described type in which the discs and especially the center or abrasive-free central portion of this discs are suitably reinforced or strengthened against breakdown in use.

backing can be constructed so as to be useful under severe operating conditions without breakdown of the backing in the unsupported portions thereof by reinforcing the backing by means of a thin metallic plate built into the central part of the disc to constitute a part of the backing. This metallic disc which constitutes one lamination of the backing is not coextensive in area with the entire backing but is usually substantially coextensive with the abrasive-free central portion of the backing only. Therefore, the metallic reinforcing plate does not interfere with the operation of the disc throughout its useful life but permits the abrasive element as well as the underlying portion of the backing to wear away in the usual manner. One material which has been found highly satisfactory for use as the reinforcing plate is aluminum sheeting .010" to .015" in thickness, for example .012" in thickness, although other metallic reinforcing materials may be used such as galvanized iron sheeting or the like and the thickness may be varied from the figure given.

Discs of the described type have frequently failed in use because of the breakdown of the backing in the central part of the disc where the backing is unprotected and reinforced by the overlying abrasive element. Such failures are commonly characterized by either a sudden tearing of the unprotected portion of the backing as a result of sudden torsional strains exerted upon the backing upon contact of the disc with the work being surfaced or a gradual breakdown of the backing about the arbor hole so that the disc is no longer usable.

Referring further to the drawing, Figures 1, 2 and 3 depict an abrasive disc made in accordance with the present invention and which as therein shown consists of an annular abrasive element 4 adhesively secured to one side of a backing 5 by means of an adhesive 6. The abrasive element 4 is composed of a coiled strip of abrasive-included felted fibrous sheet material which, during the forming of the disc, is compressed to form an annular abrasive-included fibrous mass approximately $\frac{1}{8}$ " thick adhesively secured to the backing. An abrasive-included fibrous sheet material suitable for use in carrying out the present invention is that shown and described in U. S. Patent No. 2,284,738. In order to provide an abrasive element having a final thickness of $\frac{1}{8}$ " a strip of abrasive-included sheet material approximately $\frac{1}{4}$ " in width should be used. Coiled strip material of greater or lesser widths may be used in which case the final abrasive element will differ correspondingly in thickness.

It is an object of the present invention to overcome the disadvantages and weaknesses of the discs as heretofore made and provide an abrasive disc that will stand up under more rigorous conditions of use.

It is a further object to provide an abrasive disc in which the backing will resist sudden or gradual breakdown during operation.

It is a still further object to provide abrasive articles of the described type in which the backing is suitably reinforced without interference with the ability of the disc to wear away at the periphery.

In order that the invention may be more clearly understood reference is made to the drawings in which one particular embodiment of the present invention is shown and in which:

Figure 1 is a top plan view of an abrasive disc made in accordance with the present invention;

Figure 2 is a top view of the abrasive disc shown in Figure 1, but in which the abrasive element and various laminations of the backing and reinforcement are shown partially cut away to more clearly bring out the structural features of the disc; and

Figure 3 is a vertical cross-sectional view taken along the line 3—3 of Figure 1.

We have discovered that abrasive discs of the described type comprising an annular abrasive element adhesively secured to a yieldable fibrous

The disc backing is composed of alternate layers of a carded, felted or non-woven fibrous sheet material 7 and adhesively sized fabric such as burlap 8. As the fibrous sheet material 7 we prefer to use a carded cotton sheeting such as that disclosed and described in U. S. Patent No. 2,055,410 although strong paper or other non-woven fibrous material may be used in its place. The layers of carded or felted fibrous material are impregnated with a suitable adhesive such as a rubber or synthetic rubber

3 latex, casein, thermoplastic resin, or thermosetting resin such as a plasticized phenol aldehyde resin or the like, separately or in combination. The fabric layers are also sized with a suitable adhesive of the same type or sized with a thermosetting resin such as a phenol formaldehyde resin. The impregnating and sizing adhesives are usually sufficient to serve as the combining adhesive or cement to hold the various plies of the backing and the abrasive element securely together, although additional adhesive can be used in the combining operation if desired. The central reinforcing plate 9 consists of a sheet of aluminum .012" in thickness to which is adhesively secured a surface layer of paper 10.

An abrasive disc of the type shown in Figures 1, 2 and 3 is made as follows:

The various fibrous materials which comprise the backing are first impregnated or sized with suitable adhesives in any of the several ways well-known in the art such as by spraying, dipping, roll coating or the like, and the adhesively treated material dried to a condition suitable for handling. The materials are then dried out or otherwise cut into disc-shaped pieces of the desired size, as, for example, 7" or 9" discs provided with arbor holes of the desired dimension, and placed in a mold in the order shown in the drawing. Hard aluminum sheeting .012" thick is then dried out on a hard metal surface into suitably arborescent discs, discs of approximately 3" diameter being cut for use in abrasive discs of 7" diameter and discs of approximately 5" diameter being cut for use in discs of 9" diameter. The aluminum is degreased and two coats of adhesive applied to both surfaces with an air drying interval between coats of 15 minutes and a final air drying period of 30 minutes before use. An adhesive or cement which has been found highly satisfactory under the above conditions of use is composed of the following ingredients, the percentages being by weight:

43%—polyvinyl butyral modified-phenol formaldehyde resin (such as that known and sold by the Bakelite Corporation, of Bloomfield, New Jersey, under the trade-mark designation "Bakelite No. BJ16320")

57%—alcohol thinner

The adhesively coated aluminum disc together with a top disc-shaped piece of paper of equal size is then placed in the mold upon the layers of the backing and held in position in the center of the mold by an arbor pin and an overlying metal disc or plate of substantially the same diameter as the non-abrasive center. Finally, a closely coiled, $\frac{1}{8}$ " wide strip of abrasive-included fibrous sheet material, such as that disclosed and described in U. S. Patent No. 2,284,738, sufficient to cover the backing for a distance approximately 2" in from the periphery of the disc is placed in the mold and the entire assembly hot pressed at 3500 pounds per square inch (based on the area of the abrasive element only) to adhesively combine the plies of the backing and unite them to the abrasive element to form the desired abrasive disc.

Having described the invention in detail, it is desired to claim:

1. An abrasive disc comprising an annular layer of abrasive material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to a flexible laminated fibrous backing, said backing

4 being reinforced by a thin metal sheet .010" to .015" thick which is substantially coextensive with the abrasive-free central area of the fibrous backing.

2. An abrasive disc comprising an annular layer of abrasive-containing, fibrous material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to a flexible laminated fibrous backing, said backing being reinforced by a thin metal sheet which is substantially coextensive with the abrasive-free central area of the fibrous backing.

3. An abrasive disc comprising an annular layer of abrasive material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to one side of a flexible laminated fibrous backing and extending radially in from the periphery thereof, the layers of said backing being adhesively united and comprising several fibrous laminations including at least one layer of felted cotton fabric and at least one layer of burlap extending from the arbor of the disc to the periphery thereof, said backing being reinforced by a thin sheet metal disc incorporated as a part of the backing and extending radially out from the arbor of the disc, but substantially smaller in diameter than the fibrous laminations of said backing.

4. An abrasive disc comprising an annular layer of abrasive material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to a flexible laminated fibrous backing, said backing being reinforced by a thin aluminum sheet .010" to .015" thick which is substantially coextensive with the abrasive-free central area of the fibrous backing.

5. An abrasive disc comprising an annular layer of abrasive material adhesively secured to one side of a flexible laminated fibrous backing, said backing comprising the following adhesively combined layers in the order named from the disc back surface to the abrasive side of the disc: a layer of felted cotton, a layer of burlap, a layer of felted cotton, a layer of burlap, a sheet of aluminum .010" to .015" thick and a layer of paper, said aluminum and paper being substantially coextensive in area with the abrasive-free central area of the fibrous backing.

6. An abrasive disc comprising an annular layer of abrasive material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to one side of a flexible laminated fibrous backing comprising a plurality of adhesively combined layers of felted fibrous material and woven fabric, said backing being reinforced by a thin sheet metal disc incorporated as part of the backing and extending radially outward from the arbor of the disc, but substantially smaller in diameter than the fibrous laminations of said backing.

7. An abrasive disc comprising an annular layer of abrasive material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to one side of a flexible laminated fibrous backing comprising a plurality of layers of felted fibrous material and woven fabric adhesively combined by means of a heat-hardened resin, said backing being reinforced by a thin sheet metal disc incorporated as part of the backing and extending radially outward from the arbor of the disc, but

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substantially smaller in diameter than the fibrous laminations of said backing.

8. An abrasive disc comprising an annular layer of abrasive material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to one side of a flexible laminated fibrous backing comprising a plurality of layers of felted fibrous material and woven fabric adhesively combined by means of a heat-hardened phenolic resin, said backing being reinforced by a thin sheet metal disc incorporated as part of the backing and extending radially outward from the arbor of the disc, but substantially smaller in diameter than the fibrous laminations of said backing.

9. An abrasive disc comprising an annular layer of abrasive material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to one side of a flexible laminated fibrous backing and extending radially in from the periphery thereof, the layers of said backing being adhesively united and comprising several fibrous laminations including at least one layer of paper, and at least one layer of burlap extending from the arbor of the disc to the periphery thereof, said backing being reinforced by a thin sheet metal disc incorporated as a part of the backing and extending radially out from the arbor of the disc, but substantially smaller in diameter than the fibrous laminations of said backing.

10. An abrasive disc comprising an annular layer of abrasive material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to one side of a flexible laminated fibrous backing and extending radially in from the periphery thereof, the layers of said backing being adhesively united and comprising several fibrous laminations including at least one layer of felted

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resin-impregnated cotton fabric and at least one layer of resin-sized burlap extending from the arbor of the disc to the periphery thereof, said backing being reinforced by a thin sheet metal disc incorporated as a part of the backing and extending radially out from the arbor of the disc, but substantially smaller in diameter than the fibrous laminations of said backing.

11. An abrasive disc comprising an annular layer of abrasive material of a thickness which is insufficient to render the abrasive disk rigid, said abrasive material being adhesively secured to one side of a flexible laminated fibrous backing comprising a plurality of resin impregnated layers of felted fibrous material and woven fabric adhesively combined by means of a heat-hardened resin, said backing being reinforced by a thin sheet metal disc incorporated as part of the backing and extending radially outward from the arbor of the disc, but substantially smaller in diameter than the fibrous laminations of said backing.

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Certificate of Correction

Patent No. 2,520,763

August 29, 1950

GEORGE J. GOEPFERT ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 1, line 8, for the word "This" read *The*; line 11, for "this" read *the*; line 17, for "reinforced" read *unreinforced*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of July, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.