June 17, 1958 G. L. HAYWOOD 2,838,891

COATED ABRASIVES

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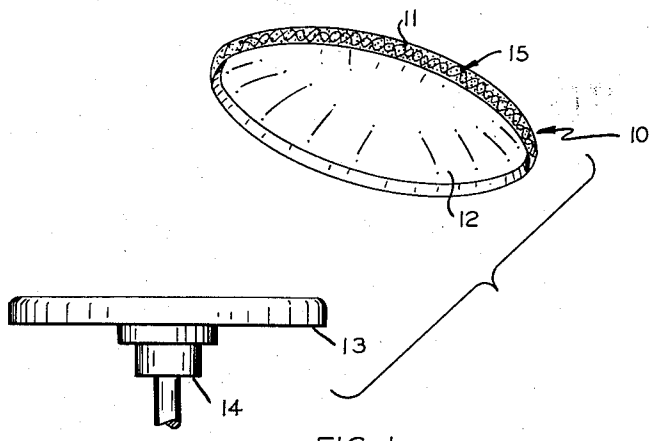


FIG. 1

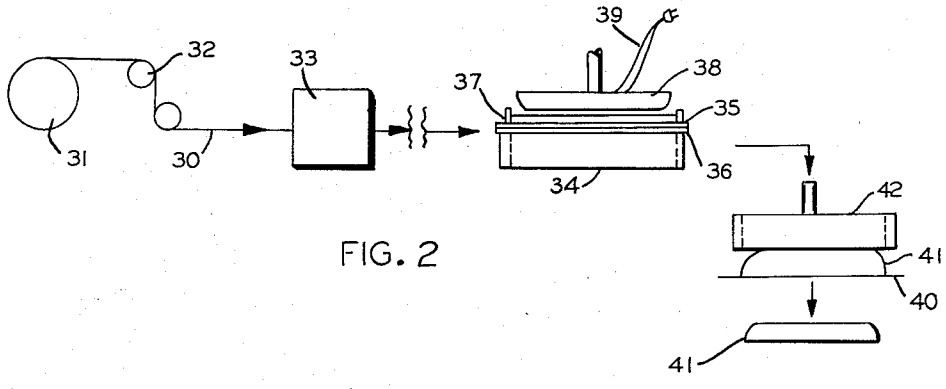


FIG. 2

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COATED ABRASIVES

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1 Claim. (Cl. 51—195)

The present invention relates generally to the manufacture and treatment of coated abrasive items and more specifically to a method of producing a permanent deformation in a piece of coated abrasive material and to the products formed thereby.

Sandpaper, or "coated abrasive" as usch material is more properly called, is made today in a variety of forms and shapes for many industrial uses. Generally the coated abrasive material is produced in the form of wide webs which are wound upon themselves to form large rolls known as "jumbo's." From these jumbo rolls the material is cut in the form of sheets, discs, small rolls, etc. for use by the ultimate consumer.

The majority of these "converted" forms of coated abrasives today are produced by a simple cutting or dieing operation which separates the converted form from the large sheet of material without causing any substantial deformation of the coated abrasive material so separated. Certain applications, however, require that the converted form of coated abrasive conform to a surface, such as that of a disc back-up pad or the like, which is not planar in nature but may be cone-shaped or of other similar configuration as, for example, that illustrated in U. S. Patent No. 2,480,508. In such instances it is common practice to cut a plurality of notches in the edges of the coated abrasive material to permit such material to conform to the back-up surface without wrinkling. Such practice is illustrated in U. S. Patent No. 2,480,508 referred to above.

It has been recognized that it would be desirable to be able to form the coated abrasive item in the desired shape without the necessity of cutting out any segments, and attempts have been made to press the coated abrasive material into the desired shape. These pressing attempts have heretofore had limited success since the pressing has caused the formation of wrinkles in the surface of the material and around the edges thereof which made the products generally unacceptable.

Accordingly, it is an object of the present invention to provide a method for producing a permanent deformation in coated abrasive material.

A further object of the invention is to provide a method for producing a permanent deformation in coated abrasive material without concurrently producing a wrinkled surface thereon.

Another object of the invention is to provide a coated abrasive product which is permanently deformed from its normal planar configuration.

Additional objects, if not specifically set forth herein, will be readily apparent to one skilled in the art from the following detailed description of the invention.

In the drawings:

Figure 1 is a perspective view of one type of coated abrasive product which can be produced by the present invention and of the back-up pad to which it is designed to conform.

Figure 2 is a schematic representation of one means by

which the method of the present invention may be carried out.

Generally, the present invention involves the formation of a plurality of cracks or fractures in the adhesive coat used to bond the abrasive grain to the backing of a piece of coated abrasive, and the simultaneous or subsequent permanent realignment, displacement and/or stretching of the fibers of the backing in the areas thus freed of bonding by the adhesive coat, through the application of pressure to such backing.

More specifically, pressure is applied to the backing through a punch, shaped to the desired configuration of the finished item. The backing itself, prior to the application of pressure, is treated to soften the fibers thereof and to condition the backing to permit slippage of the fibers when pressure is applied. This softening treatment may utilize either water or solvent as is more fully described below.

It is critical to the success of the present method that the edges of the coated abrasive material defining the deformation to be produced be held against any substantial movement during the period of application of the deforming pressure. Unless this is done and unless the backing has first been softened, sharp wrinkles will be produced at the edges and extending up into the deformed area.

In order that the deformation produced by this method be permanent in nature, it is necessary that the moisture or solvent in the backing be driven out after the deformation is produced. This can be accomplished by maintaining the deforming pressure for a sufficient period of time to permit the backing to reach equilibrium at the normal room conditions prevailing during the deforming operation. However, in the interest of mass production it is preferable to apply heat to the backing, either during forming or immediately thereafter, in order to drive out the moisture or solvent and to set the material in the deformed shape.

Referring now to the drawings, Figure 1 illustrates one form of coated abrasive product which is capable of being produced by the present invention. Numeral **10** designates the coated abrasive item which in this instance is a disc having a deep saucer-shaped configuration. As illustrated, the adhesively-bonded grain coating **11** of the disc is on the outer convex portion of the disc and the backing **12** of the coated abrasive material forms the interior concave portion thereof. A back-up pad **13** is also shown having the same configuration as the disc **10**. Pad **13** has suitable means **14** provided on the reverse side thereof to permit mounting on a power head of conventional design. The disc **10**, in use, is placed on the pad **13** and held thereon by means of a coating of adhesive (not shown) between the pad and the inside of the disc. This adhesive may be of the rubber cement type, pressure-sensitive, or any other known form of adhesive. It will be observed that disc **10** has throughout the abrasive surface **11** thereof a plurality of fine cracks or fractures **15**. These, in effect, separate the adhesive coating holding the grain to the backing **12** into many islands or spaced areas, freeing the backing from the adhesive over the areas of the minute fractures **15**. It is believed that the fibers of the backing, when treated according to the present invention, slip and are displaced in these areas as the disc is formed. Such fractures **15** are preferably formed by flexing of the coated abrasive material before subjecting it to deformation through use of any of the flexing procedures known to the art. For example, the material may be passed over a small diameter bar at 90° to the length direction thereof and/or over one or more similar bars disposed at 45° to the length direction thereof, the coated abrasive material making a sharp bend as it passes over such bars, to produce a single, double or triple flexed

material as is known in the art. Other flexing methods which result in the formation of plural fractures in the grain-bonding adhesive coat or coats may also be used if desired. While it is preferable to produce the fractures in the adhesive coat prior to deforming the material into the desired configuration, it is possible to utilize the pressure applying means which imparts the desired configuration to the material (as described in connection with Fig. 2 below) to also produce the fractures in the adhesive coat of the material. This latter procedure is apt to be somewhat unsatisfactory in that the fractures so produced tend to be larger and much less uniform than those produced by conventional flexing methods.

Referring now to Figure 2, there is shown schematically a diagram of the process of the present invention. The coated abrasive material **30** comes from the jumbo or storage roll **31** through a flexing operation indicated at **32** and into a softening treatment step **33**. In this step, the moisture or solvent may be put into the backing in various ways. The backing may be wet with liquid water and allowed to dwell for a sufficient period to permit penetration. This type of wetting can be carried out using wet rolls, brush, spray, etc. Also, the backing may be wet through use of moist steam. However, for rapid production it is preferable to place the material, either after blanks of the desired size have been cut or while still in jumbo form, in a high humidity storage area. The material is left in such area for a period of time which permits even penetration of moisture through the backing. The amount of moisture required for best results will vary somewhat depending particularly upon the nature of the backing material and the nature of any prior treatments it may have received, i. e., cloth finishes of various types, etc. Generally, however, exposure of the material to a relative humidity of 65% for at least 24 hours will be sufficient. Surface moisture is undesirable, and where direct wetting of the backing is the method employed, a dwell period of about 2 minutes at normal room conditions should be employed to permit the surface moisture to dissipate. Polar solvents such as methanol, acetone or the like may be substituted for water in this step.

Following the softening step, the material, cut into blanks of at least ⅛" greater dimensions than the item to be produced, is placed over a female mold **34**. This mold may be shaped to the configuration desired in the finished item or it may be, as shown in Figure 2, merely a ring member. The coated abrasive material comprising a fibrous backing **35** and an adhesive-grain coating **36** is placed, grain side down over mold **34**. A clamping member **37** is placed over the coated abrasive material and firmly engages and holds the edges of such material uniformly around the portion to be deformed and against the top of the mold member **34**. This feature of uniformly holding the edges is extremely important to the success of the present method. A male punch member **38** then is placed over the coated abrasive material and the material is depressed into the female mold **34**. Since the coated abrasive material is firmly held entirely and uniformly around the periphery of the mold **34**, only the central portion thereof is free to be deformed. The fibers of the coated abrasive backing slip and are displaced as described above to permit the material to conform to the shaped male punch. While heat may be applied later or dispensed with, as mentioned previously, it is preferred to have the punch **38** heated as by electrical means indicated at **39**. This permits rapid removal of water or solvent from the backing and quick setting-up of the fibers of the backing in their new displaced relationships.

The punch is then lifted and the coated abrasive item, now permanently deformed into the desired configuration, is ejected. A lip member **40** remains around the edge of the formed coated abrasive item **41** where the clamping member **37** engaged the material. Therefore the final step in the process requires the cutting off of this lip member **40** as by means of a ring punch **42** or the like, leaving the final item **41** similar to that shown at **10** in Figure 1.

While described in connection with a saucer-shaped disc item, the process is applicable to the formation of many coated abrasive items. For example, molded rolls may be produced wherein the coated abrasive is in the form of a long, narrow web having a U-shaped cross-section (in which case the material is held only along the sides of the web), and other coated abrasive items wherein permanent deformation of the material from its normally planar form is desired.

The term "permanently deformed" as used herein is intended to mean that the coated abrasive material is so altered in form that it will not return to its original shape and dimensions under any normal conditions of storage or usage.

The term "fibrous" as used herein is intended to cover backing materials such as paper, vulcanized fiber, cloth or the like made from both natural or synthetic yarns, fibers or filaments. In the case of woven backings, either the closely woven jeans and drills or the more open mesh cloth materials may be used.

Obviously many variations and modifications not specifically set forth herein may be made without departing from the spirit and scope of the invention disclosed above, and therefore only such limitations should be imposed as appear in the appended claim.

I claim:

A wrinkle-free, non-interrupted coated abrasive disc which has been permanently deformed from a normally planar form to a form wherein the periphery of said disc is curved downwardly a substantially uniform distance below the plane containing the center of said disc, said curvature being substantially nearer the periphery than the center of said disc, comprising: a fibrous backing member; adhesive means on one side of said backing member firmly bonding thereto abrasive grain; a plurality of fine fractures in said adhesive means extending through to said backing member; and a plurality of fibers in said backing member in the areas covered by said fine fractures permanently displaced from the positions they occupied in said backing member when said member was in normally planar form.

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