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H. E. SMITH

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METHOD OF MAKING A POLISHING WHEEL

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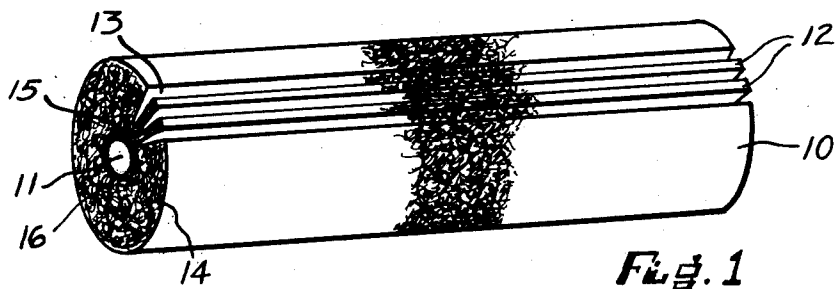


Fig. 1

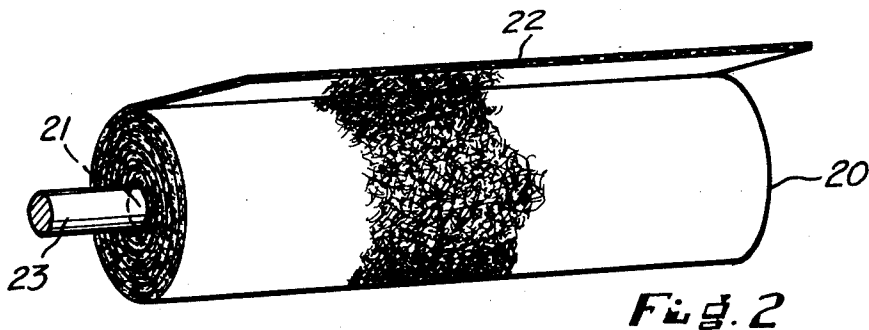


Fig. 2

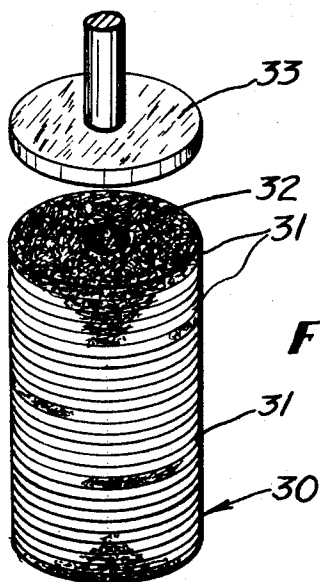


Fig. 3

INVENTOR.
HUGH E. SMITH
BY *Hugh E. Smith*

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METHOD OF MAKING A POLISHING WHEEL

Hugh E. Smith, Troy, N.Y., assignor to Norton Company,
Troy, N.Y., a corporation of Massachusetts
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The present invention relates in general to polishing and abrading wheels and more specifically to wheels formed from lofty, non-woven fibrous abrasive or non-abrasive materials and having a plurality of flaps extending from and forming an integral part of a central hub member, and to methods for making such wheels.

Heretofore, there have been a variety of abrasive and/or polishing wheels of the so-called "flap wheel type," e.g. wheels having a plurality of abrasive coated leaves or flaps extending radially from a central hub member. The majority of such wheels have been made from conventional coated abrasives wherein the abrasive flap consists of a flexible backing member having a layer of abrasive grains adhesively bonded thereto. Wheels of this type are illustrated by the patent to T. J. Miller et al., No. 2,842,902.

Regardless of the type of "flap wheels," one of the major problems and the chief variant among the numerous patents in this field is that of the means for holding the individual flaps to the central core member. This problem becomes particularly acute when the wheels to be produced have a face width exceeding about 10" to 12". As is pointed out in U.S. 2,842,902, referred to above, a problem of bending or buckling of the flap exists. In this particular patent this is overcome for narrow face width wheels by forming a resin block at the base of the flaps. For wider wheels this will not work and constructions such as that illustrated in U.S. 3,004,373 issued to R. A. Brooks have been used. Other solutions have involved the use of heavy cage structures such as illustrated in U.S. 2,785,516 to F. E. Hendrickson and the use of segmented sections of abrasives assembled on a central cylinder such as is illustrated in U.S. 2,816,402 to J. J. Ballato.

All of these prior art flap wheels have been fairly expensive to assemble and have suffered from non-uniformity of flap resistance to tear-out in operation since essentially each flap or group of flaps has been anchored separately. The further development of new types of abrasives such as the lofty, non-woven webs illustrated in U.S. 3,020,139 to J. E. Camp et al. have again complicated the problem since these are generally less strong and resistant to tearing than the conventional coated abrasives and the use of such materials in flap wheels has posed new and difficult problems in connection with the anchoring of the flaps to the central hub member.

The present invention, therefore, has as its principal object the formation of a new and improved flap wheel from a lofty, non-woven fibrous material.

A further object is the provision of a new method for forming abrasive and non-abrasive flap wheels.

An additional object is a method for providing an improved holding means for the flaps of "flap wheel" type polishing or abrading wheels.

Another object is the provision of a method for producing wheels of this type having any desired face width.

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 a partially completed wheel constructed in accordance with the present invention.

FIGURE 2 is a perspective view of one type of roll

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from which wheels of the present invention may be formed.

FIGURE 3 is a perspective view of another type of roll from which wheels of the present invention may be formed.

Generally, the present invention is directed to the formation of flap type wheels from fibrous materials of various types and preferably of the types illustrated in U.S. 3,020,139 (supra) or in U.S. 2,958,593 to Hoover et al.

More specifically, the wheels of the present invention are preferably formed by first preparing essentially a solid unitary cylinder of the lofty, non-woven fibrous material having the desired width and diameter of the finished wheel. The fibrous material is bonded in this unitary cylindrical form by any suitable adhesive such as natural or synthetic rubber latex-based adhesives or synthetic resin-based adhesives such as the phenolic or epoxy types. Preferably, a center hole is provided in this cylinder at the time of forming the same as is more fully described below. Then a plurality of spaced cuts (usually radial) are made entirely around the periphery of the cylinder, each cut extending over the full width of the cylinder and into the cylinder to a predetermined depth short of the center of such cylinder. This produces a structure wherein the flaps produced by such cuts remain integrally attached to one another through that portion of the center of the cylinder remaining uncut. This provides a simple, strong means for retaining the individual flaps in the wheel without the use of auxiliary holding devices, special adhesive applications or the like. Of course, if desired for additional strength, adhesive can be introduced through the central opening in the cylinder and distributed by spinning the cylinder to reinforce the uncut central portion of the fibrous material forming the wheel. This step can take place either after or before the cutting to produce the individual flaps. The working surface of the flaps are, of course, the outer periphery and that face of each flap in the direction of rotation of the wheel. This contrasts with an abrasive disc, for example, where the working surface is the cylinder face itself and not the periphery or the interior of the cylinder as represented by the face of the flap.

Wheels of this type made from non-woven nylon fibers randomly oriented and bonded to form lofty webs of the type illustrated in U.S. 3,020,139 may be made either abrasive or non-abrasive. For example, using the material of Example 2 of U.S. 3,020,139, a fine non-abrasive wheel is produced which is suitable for fine buffing or polishing operations. Using the abrasive-coated web of Example 1 of such patent the finished wheel is a fairly aggressive abrading wheel.

The cylinder referred to above is illustrated in both FIGURES 2 and 3 of the present drawing. FIGURE 2 shows the cylinder 20 having a central opening 21 being formed by winding a non-woven web 22 such as those described in U.S. 3,020,139 around a mandrel 23 to form a convolute structure. This type of formation is described in detail in U.S. 3,020,139. A suitable adhesive (not shown) coats the surface of the web 22 to adhere the convolutions one to the other. FIGURE 3 illustrates the formation of a cylinder 30 by stacking discs 31 of non-woven, abrasive-containing material such as that described in U.S. 3,020,139 one upon the other. These discs have been pre-stamped to cut out a center hole 32 in each. Again, the surfaces of each disc are adhesively coated so that they will adhere to each other upon contact. A suitable ram or press (schematically shown at 33) is used to compress the stack of discs to the desired density although this step may be omitted if an extremely low density wheel is desired.

Regardless of the method used to form the cylinder, in

each instance where a unitary cylinder is first formed, the flaps are produced by the cuts described above. Referring now to FIGURE 1, a cylinder 10 formed of fibrous material such as that described in U.S. 3,020,139, having a center hole 11 is shown partially cut to form a plurality of radially extending flaps 12. The radial cuts 13 are spaced one from the other at any desired distance on the periphery 14 of the wheel 10 depending upon the desired thickness of the flap 12. Of course, the finished wheel will have the radial cuts and resultant flaps entirely around the periphery but for purposes of clear illustration only a portion of the wheel 10 is shown divided into flaps 12. It will be noted that the radial cuts 13, while preferably extending the full width of the wheel 10 do not extend into the center hole 11 of such wheel, but leave an uncut portion 15 of the cylinder interconnecting each of the flaps 12. This portion 15 may be reinforced, if desired, with a layer of adhesive 16 which partially permeates into the material of portion 14 as illustrated.

The flap-producing cuts may be made in the fibrous cylinder by any of a number of conventional means such as circular saw, band saw, abrasive cut-off wheel or the like.

While directed primarily to wheels made from non-woven, randomly oriented nylon fibers, the wheels can, if desired, be made from other non-woven fibrous materials. It has been found that unless the fibrous material is non-woven in nature, the resultant flaps will be weak and of little commercial value as a polishing or abrading tool.

The depth of the cut may be varied as desired depending upon the strength of the fibrous material and its resistance to tearing. It is generally necessary to leave at least $\frac{1}{2}$ " of unsevered fibrous material between the base of each cut and the center hole in order to have proper anchorage of the flaps. The minimum depth of cut is, however, entirely flexible dependent only upon the length of flap desired. Likewise, the width of the flaps or the spacing of the radial cuts from one another may be varied within wide limits, determined primarily by the strength of the fibrous material. Generally, it is undesirable to have any flap less than $\frac{1}{8}$ " in thickness at the thinnest point.

While the easiest type of cut is one radial to the cylinder, it is sometimes desirable to make the cuts at an angle to the radius of the cylinder. For example, if it is desired to make the individual flaps uniform in width from the periphery of the cylinder to the base of the cut, a combination of straight and angular cuts can be made with removal of the fibrous material between individual

flaps. Likewise, if desired, the cuts may be made tangential to any desired circle having as its center the center of the cylinder. In such instance the cuts will not be radial to the cylinder.

Also, while it is preferred to first form the unitary cylinder and then produce the flaps by cuts extending across the cylinder, it may be desirable to first cut or die out flaps in individual discs and then assemble the same into a unitary cylinder. It is also possible where a "soft" wheel is desired to use a plurality of adjacent discs unattached to one another and with the flaps produced either by pre-cutting or by cutting after assembly into cylindrical form.

Obviously, many other variations and modifications can be made without departing from the spirit of the invention as disclosed herein and, therefore, only such limitations should be imposed as are contained in the appended claims.

1. A method for the manufacture of a polishing wheel which comprises:

- (a) Forming a self-sustaining cylinder of lofty, non-woven fibrous material;
- (b) Providing a plurality of cuts extending the full length of said cylinder and spaced at substantially equal intervals from one another around the entire periphery of said cylinder;
- (c) Terminating said cuts short of the depth of said fibrous material whereby a plurality of flexible flaps are produced having a common interconnecting unsevered mass of fibrous material integrally joined to each flap; and

- (d) Impregnating at least said interconnecting unsevered mass of fibrous material with an adhesive to reinforce said unsevered mass of fibrous material.

2. A method as in claim 1 wherein said cylinder is formed by winding a web of lofty, non-woven fibrous material upon itself and securing the same in self-sustaining configuration by an adhesive bond.

3. A method as in claim 1 wherein said cylinder is formed by assembling a plurality of thin cylinders to form a thicker cylinder held in self-sustaining form by an adhesive.

References Cited in the file of this patent

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