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3,280,516

ABRASIVE ROLL

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2 Sheets-Sheet 1

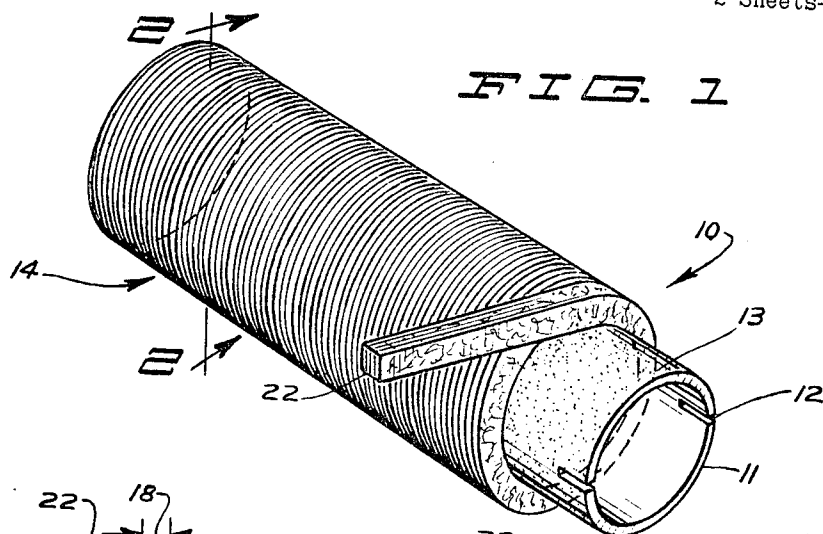


FIG. 1

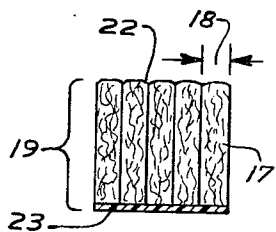


FIG. 3

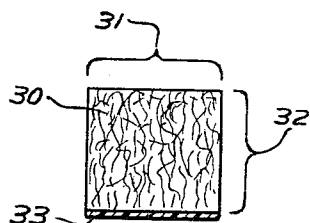


FIG. 4

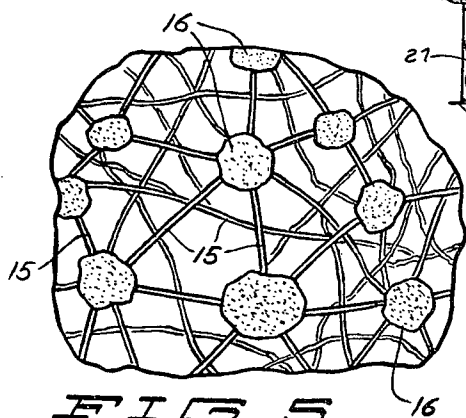


FIG. 5

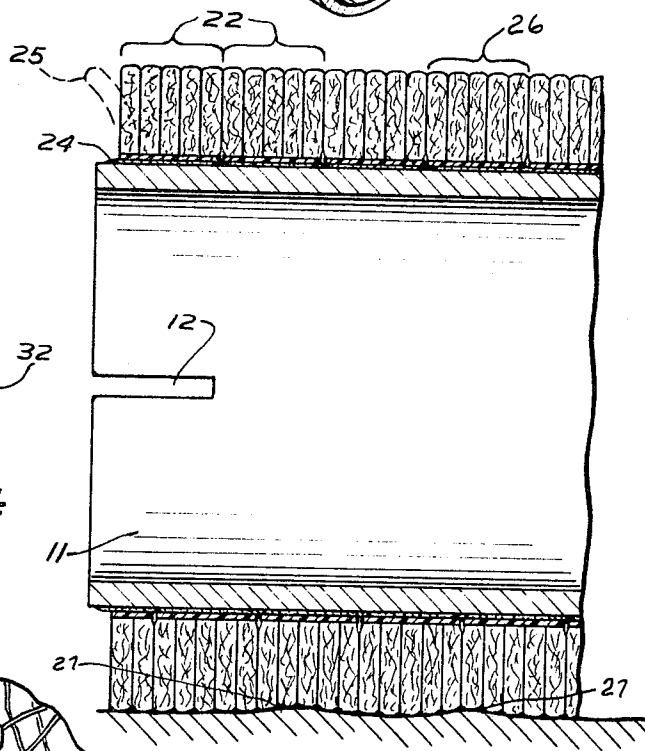


FIG. 2

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FIG. 6

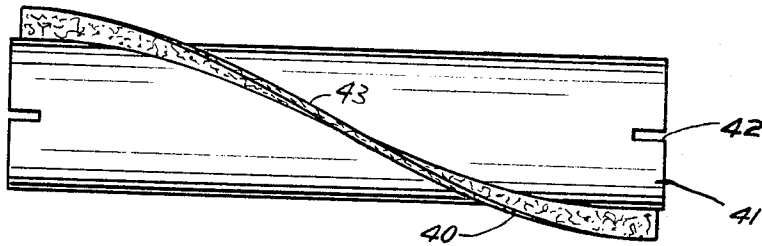
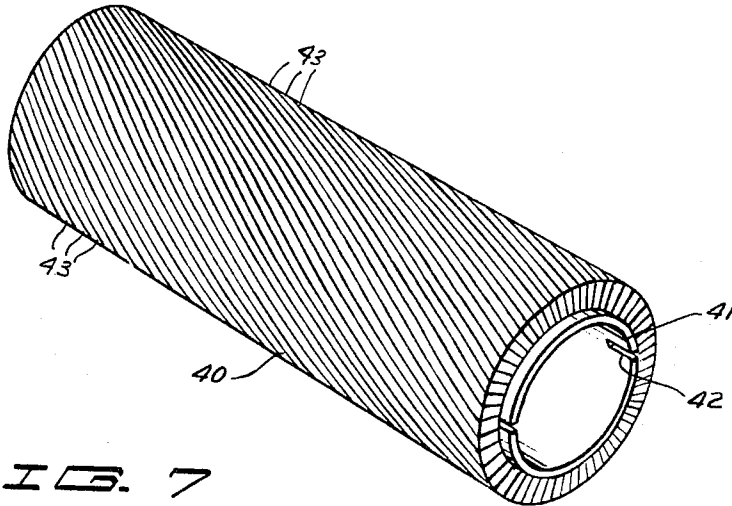


FIG. 7



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ABRASIVE ROLL

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6 Claims. (Cl. 51-358)

The present invention has relation to an abrading roll and more particularly to a roll which has an abrasive material on the outer surface thereof and which can be used for polishing, scrubbing or stripping floors or other objects.

Heretofore, there have been various powered machines utilizing rolls or wheels of many different degrees of abrasiveness. Several drawbacks to completely successful operation of prior art rolls arise.

Prior art abrasive floor conditioning rolls which utilize steel wool for the abrasive material, will leave black marks on the floor being conditioned and also leave particles of steel wool on the floor. Abrasive rolls which utilize sandpaper or similar material on the outer surface thereof will load up from varnish and dirt and it is necessary to change the sandpaper frequently.

Stiff brushes do not clean satisfactorily and therefore something more aggressive is necessary to accomplish the cleaning job.

The development of a new type of abrasive material, such as the lofty, non-woven web or mat containing abrasive particles as illustrated in United States Patent No. 2,958,593 issued to Hoover et al., have opened new fields for applications in the polishing art. The problems connected with use of this non-woven abrasive mat on powered rolls have been many. The lofty non-woven webs are not as resistant to tearing as conventional abrasive and anchoring the material to a roller so that it will stay in place during use has been difficult.

Many types of solutions to this fastening problem have been proposed. For example, there have been sheets of fibrous material merely rolled up onto a shaft or roller, much like a roll of paper, and having the outer longitudinal edge anchored to the main body of the roller. While this is satisfactory in some cases, the roll does have an irregularity where the outer edge of the sheet is joined to the main body of the roll and also the roll will not conform well to irregularities in the floor. Further, if the outer edge of the sheet which is wound onto the shaft catches onto a protrusion on the floor and tears loose, the entire roll will be destroyed very quickly.

Another form of roll that has been proposed is the use of longitudinally or axially extending radial strips of the fibrous material onto a central support, which is called the "flap" type roll. The strips extend parallel to the axis of rotation of the roll and the inner edge of each strip is glued to the center support. Extreme difficulty in gluing or fastening this type of flap to the roll is encountered. Each of the strips are loaded along its entire glue line at once during each revolution of the roll and tend to tear off easily.

A third form of attachment which has been proposed is the use of discs or "doughnuts" of the lofty fibrous material which are slipped onto a center roll or shaft and adhesively fastened in place. The roll is comprised as a plurality of discs, which, when the roll is rotated, move in planes parallel to the direction of movement of the roll over the floor or work piece being conditioned. This results in streaking when the roll is used on the floor. Material will be left between the discs at their junctions and the floor or work piece will then have a streaked appearance after the roll has passed over it. In cutting out discs from sheets of material a great amount of material is wasted, as well.

In order to combine the advantages of all of these rolls, namely prevent streaking, plenty of surface area for attaching the mat to a core or shaft and obtain good conformability to floor irregularities in a transverse direction, the roll of the present invention has been advanced. The fibrous non-woven material such as that illustrated in United States Patent No. 2,958,593, is cut into strips. If the strips used are narrow in relation to their depth, several strips are placed side by side and the edges backed with a suitable adhesive, such as epoxy or rubber base cement, which will retain some flexibility after drying. A strip unit (several narrow strips joined together) is thus made which has a width at least equal to its height or depth. The strip unit formed to be as wide as it is high is then wound onto a suitable cylindrical core in a spiral or helix and is fastened to the outer surface of the core with a suitable adhesive. Epoxy or rubber base cement which dries fast and is flexible when dry has been found to be suitable. With the material wound on the core in a spiral fashion and with the strips used having a width at least equal to their height, there is no problem in streaking inasmuch as the spiral pattern has a sufficient lead or offset so that there is no portion of the floor that is not covered. Also, there is no problem with conformability inasmuch as the individual strip segments (positioned side by side in the spiral wind) will move relative to one another and conform to irregularities in the floor.

The primary usage envisioned at the present time is in mobile powered floor conditioning machines. However, the rolls can also be used in abrading machines where the roll is rotated in place under power and the work piece is moved across the roll.

The roll is easy to make as the material can be firmly bonded to the outer surface of the roll. Only a small part of the total glue area bonding each strip is under load at any time. The stresses on a spiral strip are mainly shear forces. The adhesive and the non-woven material can resist shear forces better than tension. The flap type of strip strikes the floor along its entire length at once and this creates a force tending to tear the flap loose all along its glue joint. If there are any defects in the glue or unglued spots the flap will tend to tear loose. With a spiral strip only a small part of the glue joint of the strip is under force at one time. This insures that the load is distributed more evenly and that no tearing will result.

The resulting roll can also be used with water or other liquids for scrubbing.

Therefore, it is an object of the present invention to present an abrasive roll, which can be used for scrubbing, polishing, or stripping and which is covered with a lofty non-woven fibrous material.

It is a further object of the present invention to present a roll having an abrasive coating of lofty fibrous non-woven material which will conform to transverse irregularities in a floor during use.

It is still a further object of the present invention to present a roll having an outer covering made of a lofty fibrous non-woven material attached to the roll so that it will not be torn loose from the roll easily.

It is still a further object of the present invention to present an abrasive roll which can be used in a powered machine and which will not leave streaks on a floor or work piece.

Other objects of the present invention will become apparent as the description proceeds.

In the drawings,

FIG. 1 is a perspective view of an abrasive roll which can be used on a powered floor conditioning machine and which is shown in the process of being made according to the present invention;

FIG. 2 is a vertical sectional view of a finished roll taken as on line 2—2 in FIG. 1;

FIG. 3 is a fragmentary enlarged sectional view of a strip of fibrous non-woven material utilized on the roll of the present invention and showing a strip unit formed by fastening a plurality of individual strips with a suitable adhesive backing;

FIG. 4 is a fragmentary enlarged sectional view of a strip of fibrous non-woven material utilized in the roll of the present invention wherein the strip is of homogeneous cross section;

FIG. 5 is an enlarged view of the fibrous non-woven material utilized on the roll of the present invention;

FIG. 6 is a side elevational view of a partially completed floor conditioning roll made according to a modified form of the invention; and

FIG. 7 is a perspective view of the roll of FIG. 6 after completion.

Referring to the drawings and the numerals of reference thereon, an abrasive roll illustrated generally at 10 includes an inner cylindrical tubular core member 11 which is provided with driving slots 12 for receiving suitable end heads or bearings which will permit the cylindrical tube to be mounted in a machine and rotated under power about the longitudinal axis of the tube. The tube can be constructed in any usual or preferred manner and of any material, such as metal, plastic or paper. One form of the tube which can be used is that illustrated in the United States patent to Swanson et al.; Patent No. 2,879,539. The primary use of the roll of the present invention is with mobile powered floor conditioning equipment.

The outer surface 13 of the tube is smooth and regular. A covering mat or pad illustrated generally at 14 is of abrasive material made of a lofty, fibrous, non-woven mat which includes fibers 15 having abrasive particles 16 embedded therein, and substantially the same as shown in Hoover Patent No. 2,958,593.

In the first form of the invention the material initially is formed into strips 17 which have a narrow transverse dimension illustrated at 18 and a relatively high vertical height illustrated at 19. The depth of material on the roll must be sufficient so that the roll covering will compress to aid in conforming to irregularities. With longer rolls, as shown, a greater depth of mat is necessary. The strips 17, which are of a commercially available thickness, have to be edge wound to get the necessary radial thickness of mat. When individually edge wound the strips do not have a sufficient lead and also tend to fold over as shown in dotted lines at 25. In order to get sufficient mat thickness and avoid the folding over of the strips, the strips 17 are formed into a strip unit.

As shown in FIG. 3, five of the strips 17 are placed together in an assembly or unit 22. The strips are placed side by side and held closely together. The edge surfaces are placed along a common plane. A suitable adhesive coating 23 is applied to the edge surfaces thereof on one edge only. The adhesive coating 23 is of suitable epoxy or rubber base cement which is flexible when dry and which will hold the strips 17 together to form a strip unit 22.

The adhesive coating 23 forms a backing support, to hold the strip unit 22 together. After the adhesive coating has dried, the assembly strip is formed into a long continuous strip which has sufficient length so that it can be spirally wound onto the tube 11 as shown in FIG. 1 from one end of the tube to the other. In the spiral winding the outer surface 13 of the tube 11 is coated with a suitable adhesive illustrated by the coating 24.

A first end of the strip unit 22 is held on the tube at one end thereof. The strip is then wound into place in spiral manner. As can be seen in FIG. 2 the strip unit 22 is tightly wound onto the roll. The lead of the spiral in this form of the invention is one width of the strip unit 22. The width of the strip unit 22 is preferably substantially equal to its vertical height. This gives a suffi-

cient lead to the strip segments and will not fold over during winding.

The radial thickness of the mat must be great enough so that the irregularities encountered during use will not cause the mat to be compressed solidly against the core. Therefore, with short rolls the radial thickness can be less than with longer rolls because the average irregularity across the portion of the surface being worked on will be smaller. Also, greater radial depth will give longer life of the roll. In order to wind on the strips which have sufficient depth to be operable and will not "lay over" during winding it has been found that the minimum width of the strip varies and is dependent upon the vertical or radial depth of the strip and the outside diameter of the core. The minimum width of the strip, in order to obtain satisfactory winding stability, has been found to follow the formula

$$W = \frac{2 \times H}{D}$$

where W is the width of the strip, H is its radial height and D is the outside diameter of the core. For example, as shown, with a four inch diameter core and where the radial depth of the covering is to be one inch the width of the strip unit must be equal to or greater than 1/2 inch.

$$\left(W = \frac{2 \times 1}{4} = \frac{1}{2} \right)$$

Therefore the narrow strips 17 are built up to a unit that is a minimum of 1/2 inch wide and preferably to a width equal to its height, as shown.

It will be noted that in 189° of warp, the spiral wrapping of the strip unit 22 will give an offset of one half of the width of the strip unit. In a full revolution of 360° the strip segment will be offset one width of the strip unit. Thus the lead of the spiral in this form of the invention as shown, is equal to the width of the strip.

In the spiral winding a separate strip segment 26 is formed with each complete revolution of the strip. The strip segments are contiguous along their side surfaces but each strip segment can move in radial direction with respect to the adjacent strip segments. A longitudinally extending line on the periphery of the roll will contact a plurality of these strip segments. The strip segments have the spiral lead.

The lead of the segments is sufficient to prevent leaving streaks on the floor as the roll is rotated about its axis and the machine moves transverse to the axis of the roll. Also, it can be seen that any irregularities in the floor or work piece along the line of contact between the roll and work piece can cause compression of the individual strip segments, for example, if a floor is raised as shown at 27 only the segments above the irregularity will raise up. The other segments will not raise up but will continue to clean the portions of the floor on which they travel. This will give much better conformability of the roll in direction transverse to the movement of the machine and will greatly aid in obtaining a thorough cleaning or polishing job.

A strip segment is defined for the purposes of this application as a portion of a strip unit of material that extends around the roll for 360° or less. In other words, using a long strip unit and spirally wrapping it as shown in FIGS. 1 and 2 will result in a large number of strip segments being intersected by an axially extending radial plane.

In FIG. 4, there is shown a homogeneous strip unit 30 of non-woven fibrous material which has a width illustrated at 31 substantially equal to its height 32. This form of strip unit can be wound onto the tube merely by using one coating 33 of adhesive and wrapping the strip on the roll in spiral fashion as shown. The roll still gives adequate conformability and will not streak because of the spiral lead. The strip unit 30 would be used in place of the strip unit 22 and would function in

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the same manner. The strip unit 30 has a sufficient amount of width so that it would not fold over as illustrated at 25 when it is wrapped onto a tube. When the strip unit 30 is spirally wound onto the core, it forms a plurality of strip segments 26 which also are spiralled around the tube.

It should be noted that the folding over of narrow strips is due to the differential in stretch necessary to wrap a strip onto a cylindrical tube. This problem, of course, is more pronounced as the support tubes are reduced in diameter and the height of the strip increased. Therefore the minimum width of strip unit 30 follows the formula previously given.

Also, it can be seen that two strip units could be placed side by side and spirally wrapped as a pair onto the core. The lead of each strip segment would be double, but there would still be a plurality of strip segments spirally wound on the tube.

In the second form of the invention, shown in FIGS. 6 and 7, strip units 40 of lofty, non-woven, fibrous material, which is the same material as the strip units 22 and 30 are wound in a helical fashion onto a tube 41. The tube 41 is the same as tube 11 and has suitable driving slots 42 with the ends thereof. The roll will be rotated about its longitudinal axis in any usual or preferred manner. Suitable adhesive is used for applying the strip units 40 to the outer surface of the tube or core. The strips 40, as shown, are wrapped onto the tube approximately 180° in the length of the tube. It has been found that a spiral of about 180° for the length of the tube will give operationally satisfactory results. The strips will adhere better than radially extending strips. The load is applied to only a small section of each strip at the time.

In this form of the invention there are also a plurality of strip segments 43 spirally wound on the roll. The spiral lead of each segment is much greater in this form of the invention. However, it will be seen that a longitudinal line on the periphery of the roll will contact a plurality of strip segments. The strip segments can move relative to each other and this makes the roll conform to irregularities along the line of contact between the roll and the floor or work piece being conditioned. The roll shown in FIGS. 6 and 7 has strip segments thereon within the definition previously given inasmuch as the segments are wound onto the tube for less than 360°.

The strip units 40 may be constructed similarly to the strips 22 or 30. The minimum width of the units 40 is selected in accordance with the formula previously given to prevent the top portions of these strips from folding over when they are being wound on the core.

The lofty, non-woven, fibrous material can have any desired amount of abrasiveness. The material is commercially available. The resiliency, conformability to irregularities, and prevention of streaking of the rolls from spirally wound strip segments as presented in this application are much better than those previously available. The width of the strip unit wound onto the tube gives an improved lead to the spiral when wound as shown in FIGS. 1 and 2, so there will not be any streaking.

The fibrous, lofty material forming the strips does not stain tile or floors in any way, does a much better cleaning job than a brush would and is a very effective scrubbing tool. The material works well on concrete floors, is long lasting and does not load up like sandpaper. There is no need to change sheets of material, as in sandpaper usage. The roll as disclosed can be used with water and other cleaning solution for scrubbing without damaging the lofty material or the tube.

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Users of rolls made according to the present invention find that the rolls with spiral lead strips have sufficient resistance to the forces on the material so tearing of the material from the core is prevented. The roll will polish and clean without streaking and also last a longer time than conventional rolls available.

What is claimed is:

1. An abrading roll comprising a central cylindrical core, a layer of material comprised of non-woven fibers joined together to form a lofty mat, said layer comprising several strips placed side-by-side as a unit and spirally wound onto the core as a unit, and adhesively affixed to the outer surface thereof, the lead of each strip measured along the axis of said cylindrical core being equal to the total width of the unit, each of said strips having a vertical height much greater than its transverse dimension and being affixed to said core on the edge corresponding to the transverse dimension.

2. An abrading roll comprising a central cylindrical core, a layer of material comprised of non-woven fibers joined together to form a lofty mat attached to the outer surface of said core, said layer comprising a strip unit spirally wound onto the core and adhesively affixed to the outer surface thereof, said strip unit being made up of a plurality of individual strips, each having a vertical height much greater than its transverse dimension, said individual strips being adhesively bonded together along one edge thereof to form the strip unit.

3. The combination as specified in claim 2 wherein said strip unit has a width at least equal to its height.

4. The combination as specified in claim 3 wherein each strip segment is wound onto said roll with a lead equal to the width of the strip in 360° of rotation of the strip.

5. A strip unit of lofty, non-woven, fibrous material suitable for winding onto and forming a covering for a cylindrical core, said strip unit being comprised as a plurality of individual strips of said material each having a cross-sectional height substantially greater than its edge width, said strips being positioned on edge with first edge surfaces of the strips lying along a common plane and facing surfaces of the strips contiguous, and a layer of adhesive material on the said first edge surfaces to hold said individual strips together.

6. A method of making a strip unit having a width substantially equal to its height from a plurality of strips that have a narrow edge surface and a wide side surface and must be placed on edge during use, comprising the steps of: placing a sufficient number of the individual strips on edge with side surfaces contiguous so that the sum of the edge distances equals the desired width dimension of the strip unit, aligning first edge surfaces of each strip to lie on a common plane with facing side surfaces of the strips contiguous, and applying a layer of adhesive to the first edge surfaces of the strip.

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