Sept. 8, 1970 R. H. KLEEMEIER ET AL 3,527,001

HOLDER FOR ABRASIVE PRODUCT

Filed June 1, 1967

FIG. 1

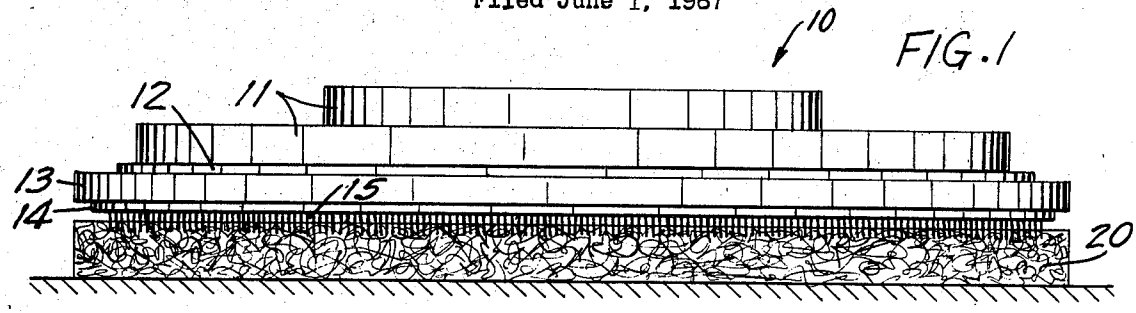


FIG. 2

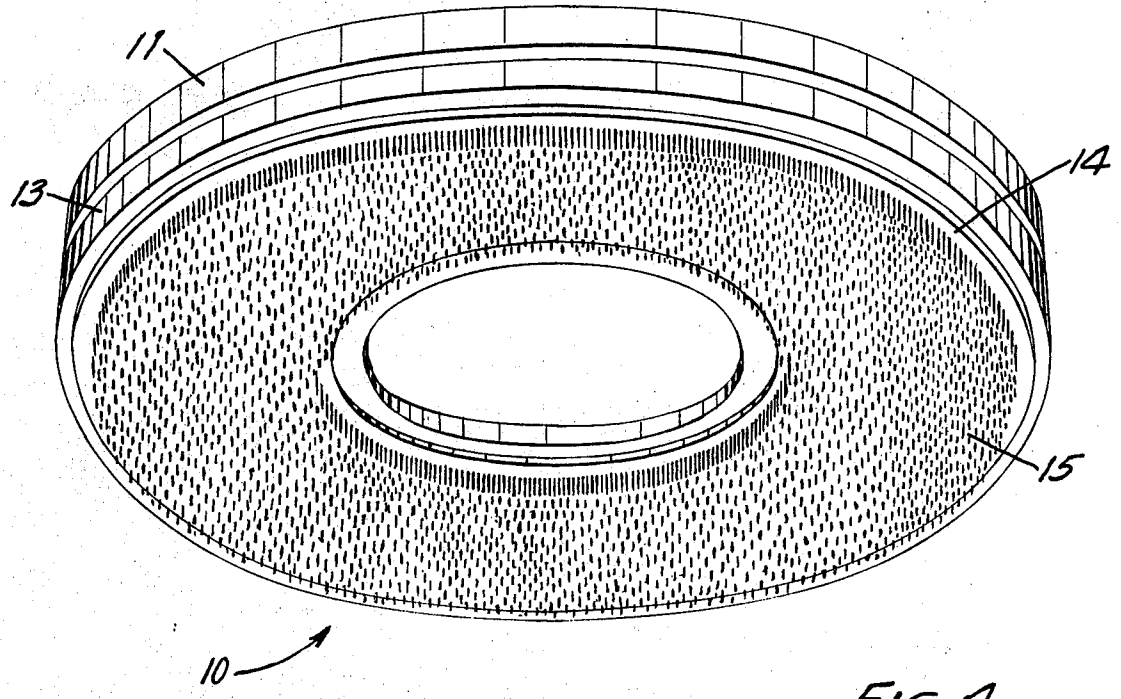


FIG. 3

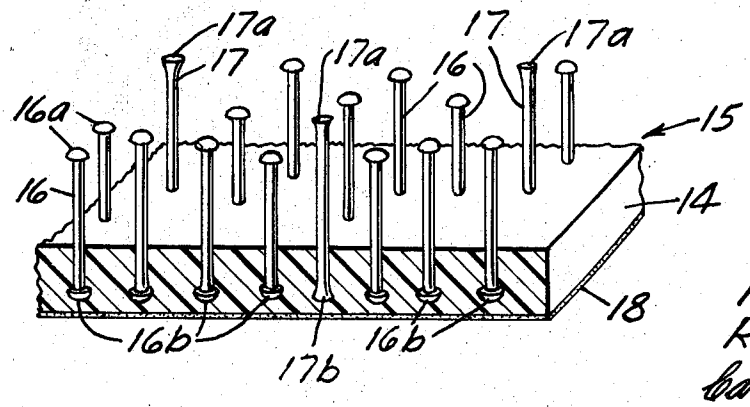
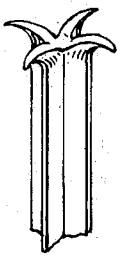


FIG. 4



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HOLDER FOR ABRASIVE PRODUCT

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U.S. Cl. 51—358 10 Claims

ABSTRACT OF THE DISCLOSURE

Fibrous low density abrasive products are firmly but removably gripped by a device which is surfaced with a multiplicity of filament segments having enlarged heads. The segments, which penetrate the fibrous product and engage the fibers thereof, may either constitute the pile in an open pile fabric or individually have their lower ends embedded in a resinous layer. A particular application involves a device for holding and driving fibrous pads used on a floor surfacing machine.

BACKGROUND OF THE INVENTION

The invention relates to holders for nonwoven fibrous products, a preferred embodiment being a holder for fibrous floor surfacing pads, or discs.

For many years low density steel wool discs about 1 inch thick have been used to clean floors. The discs are typically positioned on the floor and a circular driving member positioned thereover, the driving member being connected to a motor which slowly rotates the disc as the machine is moved along the floor. In more recent years, steel wool discs have been largely replaced with low density nonwoven fibrous abrasive discs of the type disclosed and claimed in Hoover et al., U.S. Pat. 2,958,-953. A number of techniques have been used to establish driving connection between the driving member and a low density abrasive disc. One common way is simply to employ the fiber- or steel-bristled brush which floor surfacing machines also frequently use, positioning the bristles directly over and in contact with the fibrous disc. Although this method functions to a degree, the driving connection may be broken and the disc displaced from center by either deliberately lifting the machine to move it or accidentally encountering some rough spot on the floor which snags the disc. The comparatively mild gripping action does, however, make it convenient for the operator to invert the fibrous disc and thus equalize wear on the two sides.

The device just described is sometimes modified by replacing the brush with a driving pad having a protuberated rubber surface such as that obtained in certain types of conveyor belting. In still another variation, the brush may be replaced with a metal disc having several prongs extending from one face thereof. In each of these variations, the same problems of inadequate gripping and eccentric displacement occur.

Another type of driving assembly for low density abrasive discs features a generally hat-shaped member, the "crown" of the hat fitting into the central opening of an annular fibrous disc and engaging a holding member attached to the driving assembly, while the "brim" frictionally grips the portion of the fibrous disc immediately circumjacent to the center hole. Although this assembly grips the fibrous disc effectively and keeps it from falling off when the machine is lifted or dislodging when it encounters an obstacle in the floor, installation involves inverting the machine in order to gain access to the holding mechanism. Devices of this type are thus inconvenient in operations where the fibrous disc is frequently inverted or replaced with a different product.

SUMMARY

The present invention provides for lofty fibrous products such as floor surfacing discs, a holding and driving device which is simple, convenient, and versatile. It firmly grips a fibrous disc so that it is not dislodged when the machine is lifted from the floor or when an obstacle is encountered in its path, yet the pad can be quickly removed and inverted or replaced with minimum effort. The holder comprises a base member having a substantially planar surface from which a multiplicity of stic synthetic polymeric filament segments protrude at substantially right angles. Exposed ends of the filament segments are provided with enlarged heads which engage fibers in the disc. Modified forms of the device can be used as holders for other configurations of lofty fibrous cleaning or polishing products.

BRIEF DESCRIPTION OF THE DRAWING

Understanding of the invention will be facilitated by referring to the accompanying drawing, in which like numbers refer to like parts in the several views, and in which:

FIG. 1 is a side view of a holder made in accordance with the present invention;

FIG. 2 is a perspective view of the holder shown in FIG. 1;

FIG. 3 is an enlarged perspective view showing a portion of the disc-driving face of the device shown in FIGS. 1 and 2; and

FIG. 4 is an enlarged view of a headed filament segment suitable for holders of the invention.

In the drawings, holder **10** comprises upper member **11**, designed for attachment to a conventional rotary floor surfacing machine. Rigid plate, or base member, **12** is affixed to the lower surface of member **11** in any convenient manner, e.g., by adhesive, screws, etc. Affixed to the lower surface of plate **12**, e.g., by an adhesive, is sponge rubber or equivalent layer **13**. To the lower surface of sponge rubber layer **13** is adhered flexible resin layer **14**, in which are embedded one end of each of a multiplicity of filament segments **16** and **17**, combining to form driving layer **15**. A normally tacky and pressure-sensitive adhesive layer **18** may be coated on the opposite face of flexible resin layer **14** for convenience in attachment to sponge rubber layer **13**.

DESCRIPTION OF PREFERRED EMBODIMENTS

The portion of the floor pad holder which is designed to engage a fibrous low density disc may constitute a pile fabric generally similar to that shown in U.S. Pat. 3,-138,841, which shows a woven fabric having an upstanding pile layer formed from flexible monofilaments having an enlarged holding means at their terminal ends, specifically a mushroom-shaped portion with a substantially spherical top surface and a substantially flat bottom surface. The presently preferred embodiment of the invention, however, utilizes a fibrous disc-engaging layer in which one end of each of many individual filament segments is embedded in a flexible resin. The manner of producing this structure will now be described.

To the adhesive surface of a normally tacky and pressure-sensitive adhesive sheet is laminated an open-mesh fabric such as a glass scrim cloth. The laminate is then passed over a taut fabric which is set in vibratory motion by a rotating rectangular bar. Disposed on the taut cloth surface and kept constantly bouncing by the rotating bar are filament segments of appropriate length and diameter. The vibratory motion causes filament segments to embed themselves, on end, in the por-

tion of the adhesive surface which is not masked by the scrim cloth. Loose fibers are shaken free, and the filament-coated laminate is then passed around a cold roll, with the filaments bristling outward from the backing. A heating element is brought close to the end of the fibers, causing them to melt and form knob-like enlarged heads. A curable layer of flexible resin, e.g., ⅛ inch thick, is then coated on a temporary carrier and the exposed heads of the filaments forced into the resin layer, which is thereafter cured. The scrim cloth-masked tape is then removed, and the now-exposed ends of the filament segments are exposed to a heating element to provide them with heads in the manner previously employed for their opposite ends.

Although virtually any synthetic filament which is capable of being provided with an enlarged head may be employed in the practice of this invention, it has been found that filaments of polypropylene, nylon, or blends thereof are particularly suitable. The specific type or blend of filament segments may be modified to suit the particular low density fibrous pad to be driven and the environment in which it is to be used. For example, nylon filament segments are comparatively stiff, resist crushing, and are generally suitable for almost any type of product; they are, however, somewhat difficult to head. Polypropylene filaments develop particularly suitable heads, smoothly rounded at their outer extremities and essentially flat at the lower portion, but are appreciably less stiff than nylon. Polypropylene filament segments may be used alone, provided that a comparatively thick pad is to be driven, the holder is to be hand held, or the pad is not subjected to the extreme pressures which a floor surfacing machine often encounters, particularly when it is "heeled," run over a door edging, etc.

A satisfactory compromise has been reached by providing a blend which constitutes a majority of polypropylene filament segments and a minority of the stiffer nylon filament segments. If the filament segments are initially all the same initial length and if they are headed by exposure to heat, the finished product will have nylon filament segments with less distinct heads and somewhat greater length than the polypropylene filament segments. There is, in fact, probably some advantage to having filament segments of different lengths, so as to permit engagement of fibers in the floor surfacing pad at a variety of levels, and, whether headed or not, the nylon fibers minimize crushing of the polypropylene.

Taking all factors into consideration, a driving pad which has proved extremely effective has included a filamentary driving layer having a 4:1 14-mil polypropylene: 20-mil nylon filament population ratio, the distance from the lower portion of the head on the polypropylene fibers to the resinous layer in which they are embedded being on the order of 3/16 inch. A portion of such a structure is shown in FIG. 3. The 4:1 ratio of filament provides a driving layer **15** which has excellent penetrating and holding power for a variety of fibrous discs made up of either comparatively coarse or comparatively fine fibers. The heads **16***a* on polypropylene fibers **16** are advantageously on the order of 40 mils in diameter, with heads **17***a* on nylon fibers **17** being somewhat smaller because of their higher melting temperature and somewhat different flow characteristics; the same size difference is noted between feet **16***b* of polypropylene filament segments **16** and feet **17***b* of nylon filament segments **17**.

One effective resin for anchoring filament segments is a flexible polyamide-cured bisphenol A type epoxy. As shown in FIG. 3, the face of the cured resin layer opposite that from which the filament segments protrude is advantageously provided with a normally tacky and pressure-sensitive adhesive, so as to facilitate attachment either to sponge rubber layer **13** or directly to a rigid surface such as a plate or roll. The sponge rubber or synthetic foam layer **13** to which resinous layer **14** is affixed in the presently prefered embodiment of the invention may be on the order of ⅜ inch thick, and is readily compressible to permit accommodation to irregularities in the floor being cleaned. Sponge rubber layer **13** is itself preferably affixed to an aluminum plate **12** which is slightly smaller in diameter, providing a rigid firm base, the edge of which is protected by sponge rubber layer **13**, so as to prevent scratching or gouging of surfaces with which plate **12** might otherwise come in contact.

In order to be most effective, the distance between the under surface of head **16***a* at the end of filament segments **16** and the surface from which filament segments **16** emanate should be on the order of 2 to 30 millimeters; lesser distances complicate securing adequate mechanical adhesion to the fibrous disc being driven, and greater distances tend to make the filament segments **16**, **17** so flexible that they bend over rather than penetrate the fibrous low density abrasive product. It has been found that a diameter on the order of 0.25 to 0.5 millimeter has been extremely satisfactory, smaller filaments tending to be unduly flexible and larger filaments tending either to penetrate the fibrous disc with difficulty or to provide a comparatively small amount of under-head holding surface per filament. It has similarly been found that it is difficult to obtain adequate penetration or adhesion if the filament population lies outside the range of 2–60 per square centimeter of backing material, and the population is preferably on the order of 15 to 50 filaments per square centimeter.

It will likewise be apparent that if the filaments deviate excessively from 90° to the backing to which they are connected, penetration of the fibrous abrasive disc will be rendered more difficult; generally speaking, the deviation from perpendicularly should not exceed about 15°.

Filaments having multi-lobal, e.g., X-shaped, cross sections may also be employed in the practice of this invention. When one end of such a filament is heated, it develops holding means comprising hooks or claws which serve to grip the fibers of a low density abrasive pad effectively. FIG. 4 illustrates a headed X-shaped filament segment of this type.

What is claimed is:

1. For use in gripping and propelling low density fibrous abrasive products, a holder comprising in combination: a rigid base member having a surface, a means for attachment to a floor surfacing machine, a multiplicity of stiff synthetic polymeric filament segments affixed over said surface and extending substantially perpendicularly therefrom, exposed ends of said filament segment being provided with enlarged holding means to permit gripping and imparting motion to low density fibrous abrasive pads.

2. The holder of claim **1** wherein the filament segments are multi-lobal in cross section and the enlarged holding means comprises a plurality of hook-like members.

3. For use in gripping and propelling low density fibrous abrasive products, a holder comprising in combination: a rigid base member having a substantially planar surface, a means for attachment to a surfacing machine, a multiplicity of stiff synthetic polymeric filament segments affixed over said surface and extending substantially perpendicularly therefrom, exposed ends of said filament segments being provided with heads significantly greater in diameter than said filament segments, the distance between said surface and the portions of said head closest thereto being on the order of 2 to 30 millimeters, said heads overlying less than half the area of said surface to permit gripping and imparting motion to low density fibrous abrasive pads.

4. The holder of claim **3** wherein the diameter of the filament segments is on the order of 0.25 to 0.5 millimeter.

5. The holder of claim **4** wherein the number of exposed ends is on the order of 2 to 60 per square centimeter of said surface.

6. The holder of claim 5 wherein the filament segments are formed of polymers selected from the class consisting of polypropylene, nylon, and blends thereof.

7. The holder of claim 6 wherein a majority of the filament segments are formed from polypropylene and a minority of the filament segments are formed from nylon.

8. The holder of claim 5 wherein the filament segments are affixed to said base member by a layer of flexible resin in which one end of each filament segment is embedded, said end being provided with an enlarged portion.

9. A driving unit for a floor surfacing machine comprising in combination: a circular plate having means for connecting to the driving motor of a floor surfacing machine, one face of said plate having adhered thereto a sheeted layer from which protrude a multiplicity of filament segments, exposed ends of said segments being provided with heads significantly greater than said filament segments to permit gripping and imparting rotational motion to low density fibrous abrasive discs.

10. The driving unit of claim 9, wherein a layer of elastomeric sponge is adhered to one surface of the plate, and a layer of flexible resin is adhered to the exposed face of said sponge layer, said filament segments being provided with enlarged portions at their lower ends and

embedded in said resin layer, said filament segments being 0.25 to 0.5 mm. in diameter and having heads with a cross-sectional area several times as great as that of said filament segments, the distance between the exposed surface of said resin layer and the lower portion of said heads being on the order of 3–8 mm. and the density of filament population being on the order of 15 to 50 per square centimeter.

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U.S. Cl. X.R.

15—230.17; 51—177