

[54] **PATTERN EMBOSSING OF FLOCKED FABRIC**

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[58] Field of Search ..... 118/63, 62, 58, 213, 235, 118/239, 244, 258; 8/114.5

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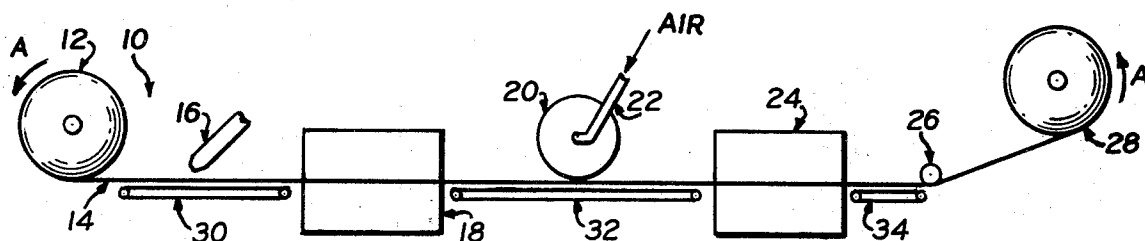
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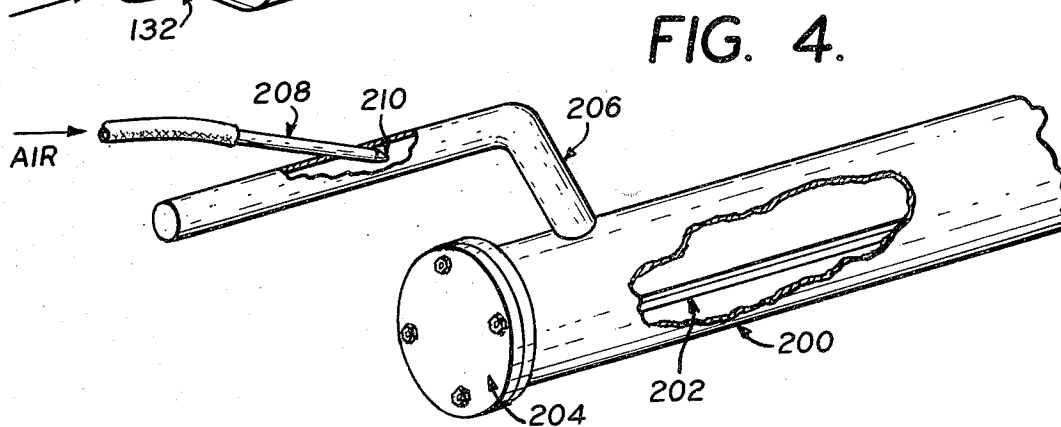
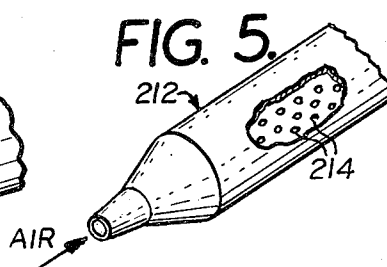
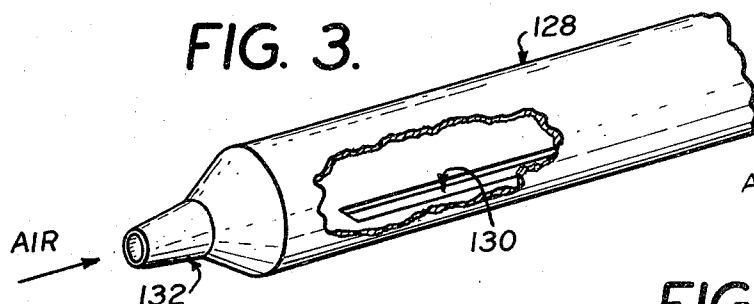
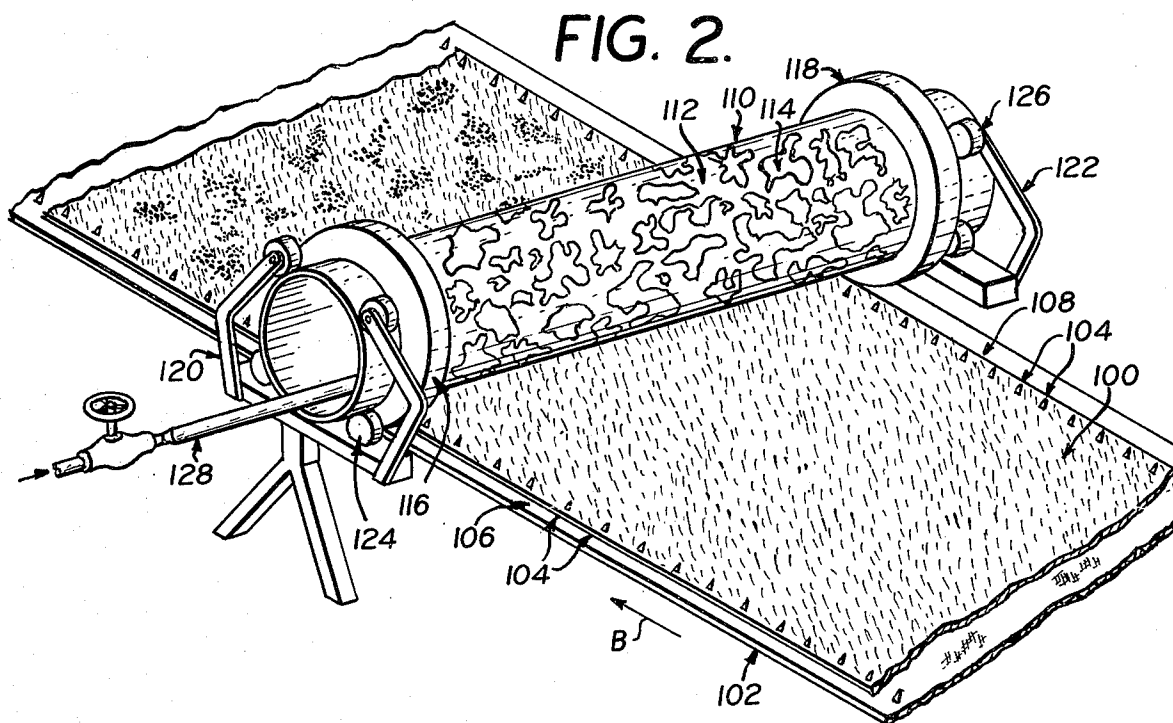
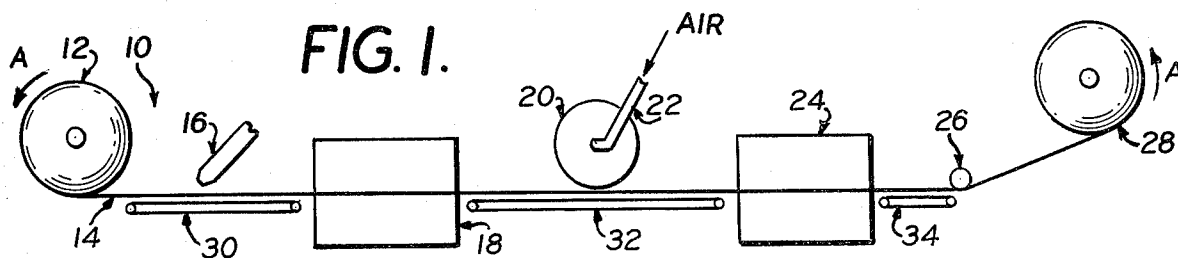
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### [57] ABSTRACT

A process for producing a pattern effect in a fabric having raised fibers in the form of a flock or pile secured to a substrate by an adhesive binder by first distributing the raised fibers onto a substrate coated with a binder and while the binder is in a plastic or fluid state, passing the flocked substrate under a rotating cylindrical stencil while air, under pressure is directed through the open portions of the stencil and against the raised fibers and thereafter curing the binder to give it a permanent set. An apparatus for carrying out the process is also described comprising a substrate delivery station, a fabric receiving station, and a means for conveying the fabric one station to the other. The apparatus further includes a binder coating means, for distributing the raised fibers onto the coated substrate, and a cylindrical stencil rotatably mounted above the substrate and a means for directing air through the stenciled portions of the rotating screen against the raised fibers on the substrate.

**5 Claims, 5 Drawing Figures**





## PATTERN EMBOSING OF FLOCKED FABRIC

### CROSS REFERENCE TO RELATED APPLICATIONS

This application is a divisional of copending Application Ser. No. 317,816, filed on Dec. 22, 1972.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

This invention pertains to the field of patterning of substrates carrying raised fibers secured by a binder. More particularly, this invention concerns a method for producing a patterned effect in flocked and pile fabrics.

#### 2. Description of the Prior Art

Textile fabrics comprising laminates of raised fibers such as a flock or pile secured to a base or substrate material by an adhesive binder are well known. Additionally, various methods for texturizing or producing patterned effects in such textiles are known. Generally, these include chemical methods, such as, chemical shrinking techniques, and physical methods, such as, mechanically cutting, compressing, or compacting areas of the upstanding fibers of the flock or pile.

These methods, however, tend to require complicated equipment resulting in relatively high production costs. Additionally, it is difficult to produce patterns which are permanent to washing or dry cleaning.

### SUMMARY OF THE INVENTION

I have discovered a new method for producing a novel flock or pile substrate having pattern designs therein. This method comprises coating a substrate or backing material with a suitable adhesive binder, distributing the raised fibers comprising the flock or pile in a uniform manner on the coated substrate, passing the substrate under a rotating cylindrical stencil and simultaneously forcing air, under pressure, through the opened portions of the stencil, the air being directed at the raised fibers of the substrate; and then curing the binder.

In a preferred embodiment of the process, the stencil is embodied in a cylindrical screen which can rotate simultaneously with the movement of the substrate thereunder.

The present invention further comprises an apparatus for carrying out the foregoing process comprising a substrate delivery station, a substrate receiving station, means for conveying the substrate from one station to the other, means for applying a binder to the substrate, means for distributing the raised fibers onto the coated substrate, means for setting or curing the binder and orientation means disposed between the flocking means and the binder curing means for orienting the raised fibers in a pre-determined pattern including a cylindrical stencil rotatably mounted above and in close proximity to the raised fibers, means for rotating the stencil, and means for directing air through the opened portions of the stencil and against the raised fibers.

By means of the present invention, highly unusual and varied patterned effects may be obtained in flock and pile fabrics at relatively low processing costs.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of the process of the present invention.

FIG. 2 is a perspective view of an apparatus in accordance with the present invention.

FIG. 3 is a partly broken, detailed perspective view of an element in the present invention;

FIG. 4 is a view similar to that of FIG. 3 of another embodiment of the same element of the present invention.

FIG. 5 is a view similar to that of FIG. 3 of yet another embodiment of the same element of the present invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

It is understood that while for purposes of illustration, the following description has been cast in terms of a conventional flocking operation, the present process may be utilized for patterning any type of fabric which is composed of a substrate or bottom layer, and a top layer of raised fibrous material, e.g., pile, which is secured to the substrate by a binder which at some stage in the operation is in a flexible or plastic state and which subsequently can be given a permanent set.

Referring to the drawings and in particular FIG. 1, the process of the present invention is carried out as follows: a roll 12 of substrate material 14 suitable for flocking is unwound in the direction indicated by arrow A. The substrate 14 may be any type of material suitable for a flocking operation such as fabric, formed or unformed, plastic, paper, and the like.

A thin coating of a flocking adhesive or binder is applied at knife 16. Thereafter, the coated substrate passes through flocking box 18. The flocking box may be any type conventionally used in the art such as the beater bar type or an electrostatic flocking unit or a combination of both.

Thereafter, the flocked substrate is passed under a stencil through which air, under pressure, is directed through the open spaces thereof. As shown, the stencil is in the form of a cylindrical screen 20 having blocked out areas as described hereinbelow and has an air distribution tube 22 inserted into the interior of the cylindrical stencil. Tube 22 is connected to a suitable source of pressurized air, not shown.

By virtue of the air being directed through the open portions of the stencil and against the flock, the flock is oriented in a direction dictated by the air flow. That is to say, those portions of the flock passing underneath the open portion of the stencil would be oriented by the air whereas those portions passing the blocked-off areas of the stencil would not be subject to the air flow.

It is understood, that at this point, the flock binder is in a plastic or flexible state such that the flock material is not rigidly held and can have its position changed by the flow of air. Additionally, it is apparent that the surface of the stencil should be sufficiently close to the flock so that the air flow pattern does not become diffuse. After being oriented, the flock substrate is passed through a curing box 24 of the conventional type known in the art wherein the binding material is set or cured. The substrate then passes under guide roll 26 and is wound onto take-up roll 28.

The substrate is conveyed in a conventional manner by belt or apron conveyors 30, 32 and 34.

The conventional steps of flocking such as the applying of the binder at 16, the actual flocking step itself in flocking box 18, and the curing step 24 are well known in the art (see for example U.S. Pat. No. 3,079,212, incorporated herein by reference).

Any type of flock binder or adhesive may be used in the present process. Such adhesives are well known in

the art and are generally classified as water base and/or solvent base adhesives.

Water base adhesives consist of a binder, generally an emulsion polymer, and a viscosity builder. They may also contain plasticizers, thermosetting resins, curing catalysts, stabilizers and other additives well known in the art.

The emulsion polymers generally used include acrylic, vinyl-acrylic, vinyl, urethane and styrene-butadiene latexes. In order that the upstanding fibers be held in the desired position until the adhesive is fully cured, it is generally necessary to raise the viscosity of the latex to about 30 to 100 thousand centipoises. The viscosity is dictated by the nature of the backing and the method of contacting the upstanding fibers with the adhesive layer. For example, where the backing is a loose weave fabric and the beater bar method is employed, a viscosity of from 70 to 100 thousand centipoises or higher will be necessary to prevent undue penetration of adhesive into the backing which would result in a boardy hand and would leave insufficient adhesive on the surface to securely bind the fibers. On the other hand where a relatively impervious backing is used, a much lower viscosity, e.g., about 20 to 30 thousand centipoises is sufficient.

Suitable thickeners include water soluble polymers such as carboxymethyl cellulose, hydroxyethyl cellulose, polyoxyethylenes, and natural gums as well as alkali swellable polymers such as highly carboxylated acrylic emulsion polymers.

Plasticizers may be added to alter the hand of the finished goods or to improve the flow and leveling characteristics of the adhesives. Where the primary goal is the latter, fugitive plasticizers such as the phthalate esters may be employed. If the intent is to alter the hand of the finished goods, then more permanent plasticizers such as low molecular weight polyesters may be used.

Thermosetting resins such as methylol-melamines, urea formaldehyde condensates or phenol-formaldehyde condensates may be incorporated to improve durability or abrasion resistance of the finished goods.

Catalysts such as oxalic acid or diammonium phosphate can be used to increase the rate of cure of the adhesive.

More specialized additives include ultra-violet absorbers where the backing, such as urethane foam, is subject to photo degradation and dyes or pigments to impart a color to the adhesive layer. When a breathable film is desired, adhesives may be chemically or mechanically foamed.

Solvent adhesives include both fully reacted soluble polymers such as acrylic homo and copolymers, polyesters, polyamides, or polyurethanes and two package systems such as polyester polyols with diisocyanates or isocyanate prepolymers and epoxies with polyamines. The polymer or prepolymer is dissolved in a suitable solvent which is preferably low boiling, and then thickened to the proper viscosity in a manner similar to that used for the water base adhesives. Catalysts, crosslinking agents, stabilizers, pigments, or dyes may also be incorporated.

The speed of the substrate is generally within the range normally used in commercial flocking processes, e.g., 25 to 150 ft./min. The air pressure must be sufficient, of course, such that it can exert a force on the areas of the flock of raised fibers which the air contacts. The particular range of air pressure used depends on a number of factors, such as, for example, the

distance of the stencil from the flock. In either event, it is easily within the skill of the practitioner to vary the air pressure so as to determine the proper air pressure or velocity needed to create the desired patterning effect.

We have found, that with cylindrical stencils, air pressures within the range from about 30 p.s.i. to 100 p.s.i. and preferably from about 60 p.s.i. to 100 p.s.i. may be used.

Referring now to FIGS. 1 and 2, the present invention also comprises an apparatus for carrying out the above described process. The apparatus is shown in full in the schematic diagram on FIG. 1 and an embodiment of the flock orienting means is shown in detail in FIG. 2.

Referring first to FIG. 1, the invention comprises a substrate delivery station 12 and a flock substrate receiving station or take-up roll 28. Conveyors 30, 32 and 34 as well as a conventional drive mechanism on take-up roll 28 serve to convey the substrate from the delivery station 12 to take-up roll 28.

A doctor blade 16 is disposed above the substrate for the purposes of coating a film of a flock binder onto the substrate. Such blades and their use are well known and conventional in the art. Likewise, flocking station 18 is disposed after doctor blade 16 and the coated substrate passes therethrough during which time it is flocked. Alternately, the binder can be applied by other means well known in the art, e.g., roll coaters, curtain coaters, etc.

Additionally, subsequent to flocking station 18 is a curing station 24, also a conventional mechanism in the art. Curing may be done either by heating or by UV irradiation.

Disposed between the flocking box 18 and the curing box 24 is a cylindrical, rotatably mounted stencil 20, and a high pressure air pipe 22 directed into the interior portion of stencil 20.

The rotary stencil is shown in greater detail and in perspective in FIG. 2. Referring now to FIG. 2, the flocked substrate 100 (prior to curing of the binder) is resting on and being conveyed in the direction of arrow B by conveying belt 102. Belt 102 has holders designated as 104 projecting upward therefrom for the purpose of maintaining the substrate in a flat form. Typically, belt 102 may be a tenter frame or a conventional type conveyor belt or blanket, vacuum belt, etc., adapted to maintain the substrate in a flatten form. The conveyor 102 is wider than the substrate 100 such that on either side of the substrate there exists borders 106 and 108.

Stencil 110 is a cylindrical screen, which has blocked out portions 112 and open portions 114. The stencil may be prepared in any manner normally used for such stencils such as by covering with paper and then cutting out the selected portions in the appropriate design. Additionally, such stencil can be of the type used in a rotary screen printing operation.

Located on either end of the rotary stencil is a round wheel or flange type member 116 and 118. Each of these wheels rest on the adjacent border portion of conveyor 102. Thus, wheel 116 rests on border 106 and wheel 118 rests on border 108.

Wheels 116 and 118 may be of any type of suitable materials such as plastic, metal, wood, rubber, etc. I have found that foamed rubber padding is particularly suitable inasmuch as it minimizes any damage to the conveyor 102. The extending ends of cylindrical screen

110 protrude through the wheels 116 and 118 and rest in support brackets 120 and 122, respectively, which are adapted for rotatable support of screen 110. As can be seen, brackets 120 and 122 have roller systems designated generally as 124 and 126 on which the end portions of stencil 110 rest. Thus, by virtue of brackets 120 and 122, the bulk of the weight of cylindrical screen 110 is supported by the brackets and wheels 116 and 118 rest lightly on border portions 106 and 108 such that movement of conveyor 102 in the direction of arrow B causes rotation of stencil 110 in the direction of arrow C, while the axis of the stencil is maintained in a position substantially perpendicular to the direction of the conveyor movement.

Inserted into the interior portion of rotary stencil 110 is an air distribution tube 128. This tube extends substantially through the entire length of cylindrical stencil 110. FIG. 3 shows a detailed view, partly broken, of the air tube 128. As seen, the lower portion of tube 128 has a slot 130 therein which runs parallel to the longitudinal axis of the tube. A source of compressed air is attached to mouth 132 of tube 128. Tube 128 and the slot 130 therein, are disposed in such a manner as to achieve the most uniform distribution of air throughout the length of cylindrical stencil 110. Additionally, it is possible to have both ends of tube 128 attached to sources of pressurized air.

Tube 128 is fixed in a slot-down position in close proximity to the lowest point in cylinder 110, i.e., at a point such that the slot is as close as possible to the flock portion of the substrate. This is in order to maintain a precise air flow pattern against the flock and to avoid diffusion.

FIG. 5 shows a detailed view, partly broken, of another type of air tube 212 which can be used in place of the slotted tube 128 in the apparatus of the present invention. As shown, the lower portion of tube 212 has a plurality of openings 214 therein for directing the air against the inner surface of the stencil. The openings are circular in shape and may be spaced so as to produce a uniform flow of air along the longitudinal axis of the cylindrical stencil.

Additionally, we have found, that it is particularly preferable to have a greater air volume delivery into the air distribution tube than was available from normal plant air pressure sources. In order to obtain such an increased volume, the embodiment illustrated in FIG. 4 was developed. In FIG. 4, air distribution tube 200 is shown having a slot in the bottom thereof 202 which is similar to the slot 130 in tube 128 of FIG. 3. The ends of tube 200 are closed as shown by cover 204.

Attached to one end of tube 200 in an air inlet pipe 206 one end of which is connected to and opens into tube 200. The other end of pipe 206 is open to the atmosphere. Between the two ends of pipe 206 there is inserted a smaller tube 208 which is attached to a source of pressurized air. Tube 208 is inserted at an angle into pipe 206 such that the air flowing there-through and into pipe 208 is directed substantially towards that end of pipe 206 which is connected to the air distribution tube 200. By virtue of this direction input of high pressure air through tube 208, additional air is sucked into the end of pipe 206 which is open to the atmosphere which results in a greater volume of air being introduced to tube 200. As shown, the tip of tube 208 designated 210 has a smaller diameter than the middle portion of the tube 208 which results in a venturi type effect, i.e., the creation of a vacuum just be-

hind tip 210 which results in the sucking in of air from the atmosphere. Understandably, it is not necessary that tube 208 actually enter the interior portion of pipe 206 in order to achieve such an effect. Thus, the tip

210 of tube 208 can be flush with the wall of pipe 206. Understandably, if sufficient air pressure is available without the need for a venturi configuration as shown in FIG. 4, the direct connection of the air pressure source to an air distribution tube such as that shown in FIG. 3 provides satisfactory results.

The foregoing described process and apparatus has been used to produce a number of various type fabrics. Generally, cylindrical stencils having 6 to 38 inch diameters made of screens of 24-28 and 32 mesh have been used. It is usually desirable that the length of the cylindrical be slightly longer than the width of the fabric. Accordingly, in conventional runs, cylindrical stencils having a length up to 74 inches have been used.

Source air pressures of about 60-100 p.s.i. have been used although this is not necessarily the pressure of the air exit tube. Tubes having various width slots, e.g., 1/16 of inch and 1/8 inch drilled holes have been used. Typically, tubes varying in diameter from 1/2 inch to 3 inches have been used. With larger diameter tubes, e.g., 3 inches, excellent results have been obtained by using a conventional high pressure air blower as the air source.

Substrate speeds through the apparatus are generally in the range from 18 yards per minute to 32 yards per minute although speeds lower and higher than this may be used depending on the particular end result desired and the nature of the final fabric.

As can be seen from the foregoing, the present invention can be practiced in a variety of ways to produce essentially an infinite number of unique patterns in fabrics of this type, i.e., substrates having raised fibers attached thereto by use of an adhesive binder.

Variations can, of course be made without departing from the spirit and scope of the invention.

Having thus described my invention what I desire to secure and claim by Letter Patent is:

1. An apparatus for producing a patterned effect in a laminate composed of a substrate having raised fibers secured thereto by an adhesive binder comprising:

- a. a substrate delivery station;
- b. a patterned laminate receiving station;
- c. conveying means operatively related to said substrate and said stations for moving the substrate from the delivery station to the receiving station;
- d. coating means operatively mounted between said stations for applying a binder to the substrate;
- e. raised fiber application means operatively mounted subsequent to the coating means for applying raised fibers to the coated substrate;
- f. binder setting means operatively mounted subsequent to the raised fiber application means for permanently setting the binder; and
- g. fiber orienting means operatively mounted between the raised fiber application means and the binder setting means for orienting the raised fibers on said substrate in a pre-determined pattern, said fiber orienting means including a cylindrical stencil rotatably mounted above and in close proximity to the raised fibers on said substrate, means for directing air, under pressure, through the open portions of the stencil and against the raised fibers, and means in driving relation for rotating the stencil, wherein the air directing means comprises at least

one tube mounted within the cylindrical stencil, the tube being disposed parallel to the longitudinal axis of the stencil and having an air exit therein, and the tube being positioned so that the air exit faces towards the raised fibers and wherein the tube has an air inlet pipe connected thereto for introducing air into said tube, the other end of the air inlet pipe being open to the atmosphere, said pipe having an air inlet disposed between the ends thereof and adapted for directionally introducing air under pressure into said pipe at an angle away from the open end thereof, the air inlet having a venturi conformation creating a vacuum in said pipe such that air from the atmosphere is drawn into the open end of the pipe.

2. The apparatus of claim 1 wherein the air exit consists of a longitudinal slot in said tube.

3. The apparatus of claim 1 wherein the air exit consists of a plurality of apertures uniformly distributed along said tube.

4. The apparatus of claim 1 wherein the means for rotating the stencil is the same as the means for conveying the substrate.

5. An apparatus for producing a patterned flocked fabric comprising:

- a. a substrate delivery station;
- b. a flocked substrate receiving station;
- c. coating means operatively mounted between said stations for applying a flock binder to the substrate;

d. flocking means operatively mounted subsequent to the coating means for flocking the coated substrate;

e. binder setting means operatively mounted subsequent to the flocking means for permanently setting the flock binder;

f. flock orienting means operatively mounted between the flocking means and the binder setting means for orienting the flock portion of the flocked substrate, said flock orienting means including a cylindrical stencil rotatably mounted above and in close proximity to the flock portion of the substrate, and an air-directing means operatively mounted in said stencil for directing air, under pressure, through the open portions of the stencil and against the flock fibers; and

g. a conveyor belt for moving the substrate from the substrate delivery station sequentially to the coating means, the flocking means, the flock orienting means and the binder setting means wherein said conveyor belt has a width greater than the substrate so as to provide a border portion on either side of the substrate, the cylindrical stencil having a wheel disposed at each end thereof, engaging the respective border of the conveyor belt such that longitudinal movement of the conveyor belt causes rotary movement of the stencil.

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