The present invention relates to improved pattern marking cloths and to methods of making the same.

Pattern marking cloths are used in the textile and related industries for guiding an operator during the cutting of fabrics and light sheet materials to a predetermined pattern. In the clothing industry, for example, a number of layers of fabric are placed on top of each other to form a "stack" of material and a pattern marking cloth with a pattern marked thereon is placed on the top layer. All of the layers are cut simultaneously along with the pattern marking cloth itself.

The particular pattern on the pattern marking cloth is traced or otherwise copied from a master pattern copy which is retained and from which subsequent patterns are traced. Normally, the master pattern copy is a sheet material of a durable and permanent nature made from sheet metal, parchment, heavy paper, or the like, which is perforated with a series of holes or openings which define the desired pattern.

The master pattern copy is normally used by being placed on top of a blank pattern marking cloth and the pattern traced onto the marking cloth. If a perforated master pattern copy is used, finely divided chalk or other powdered material is applied and allowed to sift through the holes in the master pattern copy to mark the pattern marking cloth in the desired pattern. This traced or chalk-marked pattern marking cloth is then placed on the top of the stack of material to be cut and the cutting operation proceeds as described previously.

A few of the reasons for using a pattern marking cloth in the cutting operation are to preserve the master pattern intact so that it may be used over and over again, and because a pattern marking cloth readily clings or adheres to the stack of material to be cut eliminating pinning and reducing possible errors in the cutting operation. Furthermore, if expensive fabrics are being cut, the pattern marking cloth protects the stack of material, especially the top layer, from becoming soiled during the operation.

The pattern marking cloth of the present invention comprises a layer of overlapping, intersecting fibers held together by a binder material substantially uniformly distributed throughout the fibrous layer to produce a self-sustaining nonwoven fabric. The nonwoven fabric has a pattern on one of its surfaces a light-sensitive stabilized diazo compound and an azo-coupling agent which are capable of forming an azo dye when treated with an alkaline medium. The other surface of the fabric is fibrous and non-slippery and readily clings to other materials.

In the used desired pattern is first drawn on transparent paper to produce a master pattern copy. The master pattern is placed on top of the pattern marking cloth of the present invention, in contact with the surface containing the diazo compound and the azo-coupling agent, and this laminate subjected to ultra-violet light. The light bleaches out or decomposes the diazo compound except in those areas which are protected by the drawing lines of the desired pattern on the transparent sheet. The pattern marking cloth is then treated with an alkaline medium such as ammonia vapor to produce the colored azo dye in the protected areas. The pattern marking cloth is then placed on a stack of material to be cut with the fibrous and non-slippery side in contact with the material to be cut. The entire stack is then cut by simply cutting along the pattern of the azo dye appearing in the pattern marking cloth.

In accordance with the present invention, a pattern marking cloth is produced by forming a layer of overlapping, intersecting fibers and applying to the layer a binder to hold the fibers together and form a self-sustaining nonwoven fabric. The fabric is substantially uniformly impregnated with a diazo compound and an azo-coupling agent. A second layer of overlapping, intersecting fibers is produced and a binder applied to the layer to produce a self-sustaining nonwoven fabric. The binder is applied on one side of the layer so that the resultant fabric contains a smooth side (the side on which the binder was applied) and a fibrous non-slippery side (the opposite side from which the binder has been applied). The two layers are laminated together by placing the smooth side of the second layer in contact with the first layer so that the resulting laminate has on one surface the diazo compound and azo-coupling agent and on the other surface closely bonded fibers which present a non-slipper and clinging surface in the final fabric.

The invention will be further described in conjunction with the accompanying drawings, wherein:

FIG. 1 is an exploded perspective view of a pattern marking cloth of the present invention with a transparent master pattern in place on the surface of the cloth containing the diazo compound and the azo-coupling agent.

FIG. 2 is a cross-sectional view of one embodiment of the pattern marking cloth of the present invention.

FIG. 3 is a simplified flow diagram of an embodiment of the method of the present invention.

Referring to the drawings, in FIG. 1 there is shown a pattern marking cloth of the present invention. On the surface of the cloth containing the diazo compound and the azo-coupling agent there is a transparent master pattern sheet having traced on its surface the desired final pattern. When the laminate is subjected to ultra-violet light the diazo compound in the pattern marking cloth which is unprotected by the lines in the transparent master pattern sheet is bleached or decomposed out of the pattern marking cloth. The pattern marking cloth is then treated with an alkaline medium, such as ammonia vapor, to react the diazo compound and azo-coupling agent and form a colored azo dye in those areas which were protected by the pattern of the master pattern sheet. The ammonia vapor is used to prevent running of the azo dye and to form a well-defined pattern. The pattern marking cloth, after being treated with the ammonia vapor, has the desired pattern on its surface and may now be placed on the stack of material to be cut in the desired pattern and the cutting operation commenced.

As shown in FIG. 2 the pattern marking cloth 15 consists of a layer of overlapping and intersecting fibers 16 held together with a binder applied in a predetermined pattern of spaced binder areas 17. On one surface of the cloth there is uniformly distributed a diazo compound and a azo-coupling agent 18. The other surface of the cloth has loose fibers 19 which form a non-slippery surface.

The compounds used in accordance with the present invention to form the azo dye when the pattern marking cloth is treated with an alkaline medium are the light-sensitive diazo compounds in stable form, for example, as metal salt complexes of diazo compounds. Such compounds are generally classified by the formula

$$R-N-X$$

wherein R represents an aryl radical and X is a halogen. Choice of the diazo compound depends upon its properties, i.e., stability to pre-coupling and to decomposition,
degree of sensitivity to light, and to some extent the shade desired in the finished product.

The second compound used to form the azo dye in the finished cloth is called an azo-coupling agent. Theoretically, any azo-coupling agent can be used; however, care should be exercised in the selection of the proper coupling agent in order to obtain the desired properties of shades, stability, light-sensitivity, etc. Suitable coupling agents and compounds which possess phenolic-hydroxyl groups such as phenols and naphthols, the aromatic amines, heterocyclic compounds such as pyrrole, indole, and the like.

As the diazo compound and the coupling agent are present together in the light-sensitive layer, care should be taken that the combination is sufficiently stable to prevent decomposition readily on exposure to light.

The diazo compound and the azo-coupling agent react when the pattern marking cloth is treated with an alkaline medium such as ammonium vapor. This reaction forms a colored azo dye and takes place according to the following general equation:

\[ R-N=O + HI' \rightarrow R = N-N = R' + HCl \]

where R represents an aryl radical and R' represents an alkyl or aryl radical capable of coupling.

It is desirable that alkaline vapors or gases be used to react the diazo compound and azo-coupling agent. The use of the vapor prevents running of the dye and the production of a blurred pattern as is the case when liquids are used, unless the liquid is handled very carefully.

The layers of overlapping and intersecting fibers used to produce the marking cloths of the present invention may be assembled by any of the known methods such as by carding, garnetting, air-laying, water-laying, etc. The fibers in these layers may have a general orientation predominantly in one direction or they may be isotropic, that is, with random fiber orientation.

The layers of fibers used in the present inventive concept may be formed from substantially any type of fibrous material, such as natural cellulose fibers, including cotton and flax, synthetic cellulosic materials including regenerated cellulose or rayon fibers, cellulose esters, including cellulose acetate and triacetate, and other synthetic fibers including polyamides, polyesters, acrylics, etc.

The weight of the webs used in accordance with the present invention may vary relatively widely. Within the more specific aspects of the present case, weights of from about 150 grams to about 900 grams have been found satisfactory. Lighter or heavier weights may be used where particular circumstances demand or warrant such weights.

The materials used to hold the layers of overlapping, intersecting fibers together to produce a self-sustaining nonwoven fabric may be any of the commonly employed bonding agents. Examples of such bonding agents are the polvinyl acetate polymers and copolymers, the polvinyl chloride polymers and copolymers, acrylic polymers, polyethylene, etc.

The bonding agent may be applied relatively uniformly throughout the entire layer of overlapping and intersecting fibers, or it may be applied in a pattern of spaced binder areas such as circles, squares, lines, or other configurations.

As shown in the flow sheet, Fig. 3, a layer of overlapping intersecting fibers is assembled and bonded with a suitable bonding agent and thereafter dried to form a self-sustaining nonwoven fabric. The nonwoven fabric is impregnated with a diazo compound and an azo-coupling agent and the impregnated fabric dried.

A second layer of overlapping and intersecting fibers is assembled having on one surface absorbent fibers and on the other surface non-absorbent fibers or a percentage of non-absorbent fibers. A binder material is applied to the second layer to produce a self-sustaining nonwoven fabric.

The binder is applied to the surface containing the absorbent fibers so that this surface will be relatively smooth while the surface containing the non-absorbent fibers will be fibrous and non-slipping. The bonded layer is then dried to produce a nonwoven fabric.

The two layers are then laminated together with the smooth surface of the second layer in contact with the layer containing the diazo compound and coupling agent. An adhesive may be applied between the two layers or if a thermoplastic binder such as polvinyl acetate has been used, heat and pressure may be applied to the laminate to adhere the layers together.

The two-sided feature of a bonded layer of overlapping and intersecting fibers may be developed in many ways. Normally, the layer of overlapping and intersecting fibers to be bonded is built up from several layers of fibers to attain the desired weight in the final fabric. It is a relatively simple matter to use relatively absorbent fibers such as bleached cotton, flax and rayon in the layers on one side of the final fabric, and relatively non-absorbent fibers such as unbleached cotton, cellulose acetate, polyamides, polyesters or acrylics in the layers on the other side. The binder which is used to bond the nonwoven fabric is then applied to the side having the absorbent fibers. As a result, that side of the nonwoven fabric becomes relatively smooth and aided with the surface fibers being "laid down" and well-bonded. The other side, however, partially because the binder is not applied thereto but must work its way through thereto, plus the fact that the fibers thereof are relatively non-absorbent and thus do not accept the binder as well, remains nappy, fuzzy, fibrous, and relatively non-slipping.

Another method of developing the two-sided characteristics is to prepare the fabric to be used and to brush or nap just one side thereof and to allow the other side to remain as it is naturally prepared.

The invention will be further illustrated in greater detail by the following specific examples. It should be understood, however, that although these examples may describe in particular detail some of the more specific features of the invention, they are given primarily for purposes of illustration and the invention in its broader aspects is not to be construed as limited thereto.

**Example 1**

A card web weighing 165 grains per square yard and being composed of 100% extra dull rayon, 1½ denier, and 1½ inch staple length is wetted with water to a 200% by weight pick-up and then printed in a wavy-line pattern with a polvinyl acetate resin emulsion. The wavy lines run the width of the web and there are approximately 4 lines per inch with the lines approximately one-tenth of an inch wide. Approximately 35 grains per square yard (dry add-on) of resin solids are applied to the card web which is dried at about 290° F. The web is passed through a diazo solution of the following composition:

- Citric acid: 480 grams
- Thiourea: 840 grams
- Zinc chloride: 240 grams
- Diethylene glycol: 350 grams
- Developer Aid: 350 grams

**Azo-coupling agent**: 1200 grams

**Diazo compound**: 240 grams

**Water**: 400 pounds

(Sold by the Andrews Paper and Chemical Co. under the trade name "Developaid")

(Sold by the Andrews Paper and Chemical Co. under the name "Comparator 11")

(Sold by the Andrews Paper and Chemical Co. under the name "Diazor S")

The impregnation is controlled so that approximately 400 grains of the above solution is applied per square yard,
The web is dried at approximately 290°F. and the final web contains less than about 5% by weight of the diazo compound and coupling agent.

Separately, a laminate of card webs composed of 3 webs of 100% extra dull rayon (1.5 denier, 1.9% inch staple length) each card web weighing 85 grains per square yard and 1 web of 25% grey cotton comber and 75% extra dull rayon (1.5 denier, 1.9% inch staple length) weighing 85 grains per square yard are wetted with water to 200% by weight pick-up and printed in a wavy-line pattern with polyvinyl acetate emulsion resin. The wavy lines of the pattern run the width of the web and there are approximately 12 lines per inch, each line being about one thirty-second of an inch in width. The resin emulsion is applied to the side of the laminate comprising the 3 card webs of 100% extra dull rayon. Approximately 40 grains per yard of resin solids are applied to the laminate which is thereafter dried.

This sheet and the sheet containing the diazo compound and coupling agent are combined. The surface of the second sheet containing 100% extra dull rayon is placed in contact with the sheet containing the diazo compound and coupling agent. The combination is passed through a two-roll calender, one roll is of paper and the other of steel. The steel roll is heated to a temperature of 270°F. Slight pressure is applied as the combination is passed through the calender. The hot calendering softens the acetate binder in both sheets and causes the sheets to adhere one to the other.

The resultant fabric is relatively soft and dimensionally stable. It is a fabric which is smooth and even on one side and fibrous and nappy on the other side. This construction allows the fabric to clearly print a pattern from a master sheet on the smooth side and allows and fibrous surface of the fabric to cling, without shifting, to a stack of material in the cutting operation.

A transparent sheet containing the desired pattern is placed on the surface of the fabric containing the diazo compound and coupling agent. This combination is then placed under an ultra-violet light and the diazo compound decomposed in those areas not covered by the pencil marks in the transparent master pattern sheet. The transparent sheet is then removed and the fabric treated with ammonia vapor. The ammonia vapor reacts with the diazo compound and the coupling agent to form a colored azo dye in those areas which were protected from the ultra-violet light. This produces the desired pattern on the pattern marking cloth.

The printed pattern marking cloth is then placed on the top of the stack of fabrics to be cut and the fabrics are then cut following the pattern made on the pattern marking cloth which is cut at the same time.

**Example 2**

The procedures of Example 1 are followed substantially as described therein with the exception that the diazo compound is replaced with a monodiico derivative of p-amino derivative of p-amino derivative of naphthalene, in which the p-amino group contains an alkyl substituent, and the coupling agent is replaced with a hydroxy derivative of naphthalene. The remainder of the procedure is as set forth in Example 1. The color developed from the azo dye is a blue shade. The properties and characteristics of the resultant pattern marking cloth are comparable to those made in Example 1.

Although several specific examples of the inventive concept have been described for purposes of illustration, the invention should not be construed as limited thereby nor to the specific features mentioned therein except as the same may be included in the claims appended hereto. It is understood that changes, modifications and variations may be made without departing from the spirit and scope of the claimed invention.

What is claimed is:

1. A nonwoven pattern marking cloth comprising a first layer of overlapping, intersecting fibers bonded substantially uniformly throughout to provide a self-sustaining fabric and a second layer of overlapping, intersecting fibers intermittently bonded to provide a pliable fabric having a fibrous surface, said second layer being substantially thicker than said first layer, said layers being bonded together in facewise engagement to provide a laminate, the exposed surface of said first layer being impregnated substantially uniformly with a mixture of a light-sensitive, stabilized diazo compound and an azo-coupling agent, said impregnated surface being adapted to receive a pattern outline relatively permanently formed by an alkaline medium, and said marking cloth being characterized by softness, pliability and clingability.

2. A method of making a pattern marking cloth which comprises:

   (1) assembling a first layer of overlapping, intersecting fibers and uniformly impregnating said first layer with a binder to provide a self-sustaining nonwoven fabric,

   (2) assembling a second layer of overlapping, intersecting fibers bonded together by an intermediate pattern of spaced binder areas to provide a fibrous surface, said second layer being substantially thicker than said first layer,

   (3) laminating said layers together in facewise engagement,

   (4) coating substantially uniformly the exposed surface of said first layer with a mixture of a light-sensitive, stabilized diazo compound and an azo-coupling agent,

   (5) causing a pattern outline to be drawn on said coated fabric,

   (6) exposing said coated outline to ultra-violet light to bleach out said coated surface except for said outline, and

   (7) exposing said coated surface to an alkaline medium to develop a color azo dye in said outline, whereby a soft pliable pattern marking cloth is provided.

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