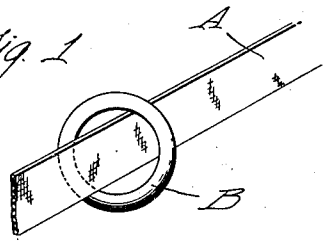
Aug. 21, 1934. F. A. KNOLL 1,970,755

SECURING TOGETHER FABRIC MATERIALS

Filed Oct. 19, 1932

Fig. 1



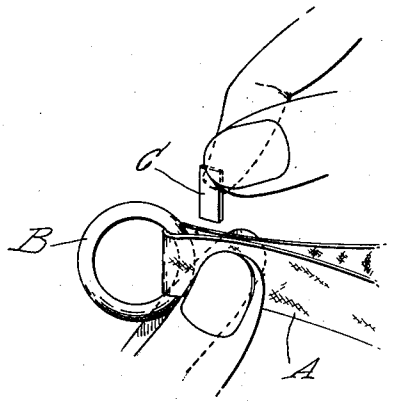


Fig. 2

Fig. 3

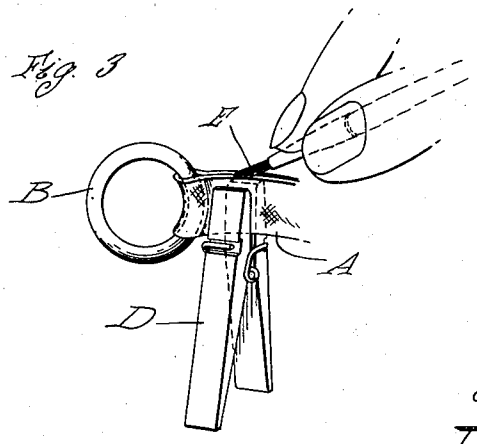
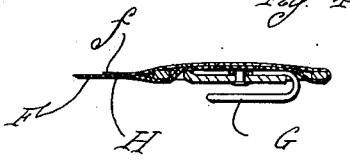


Fig. 4



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SECURING TOGETHER FABRIC MATERIALS

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Application October 19, 1932, Serial No. 638,516

8 Claims. (Cl. 154—42)

This invention relates to the forming of seams, laps, joints, or bonds between two parts by means of cementing and without sewing.

In sewing together or seaming two parts of textile or fibrous material, if one or more of the parts is in the form of an elastic band or fabric having rubber strands or strips embedded therein, the passing of a sewing needle through such material frequently breaks or weakens these strands so that a defect in the material results. The use of glue and other adhesives for fastening such materials together is not satisfactory when such materials are exposed to moisture, such for example as perspiration from the body or washing water, since these adhesives become dissolved in water or softened by moisture. It is also known that celluloid can be secured to leather or to other pieces of celluloid by applying to the celluloid a volatile solvent which makes a temporary solution of the celluloid, which solution constitutes a cement and may be used for making a joint, but the cement so made, as well as similar cements heretofore used, does not penetrate to a sufficient extent into the fibers of the materials, and therefore, produces a comparatively weak joint or bond, particularly in connection with fibrous materials, for the reason that if only a few fibers of one face of the material are cemented to another member, such fibers can readily break or separate from other fibers. Accordingly an object of my invention is to cause cement to penetrate the pores or interstices of the material to such an extent that a very secure bond is formed.

Other objects of this invention are to produce a joint or seam in which a solution of a cellulose material is employed as a cement, and in which the cement is caused to penetrate into the fibers and interstices of a porous member or textile material; also to provide a process of forming joints of this kind, by means of which the cellulose cement is caused to penetrate further into the porous member or fabric than has heretofore been possible, and which, consequently, produces a more secure joint or seam; also to produce a seam or bond of this kind in which a volatile solvent is caused to penetrate or moisten the textile material before the solvent forms a cement, to cause the cement to penetrate the textile material by diffusion; also to improve seams of this kind and processes of making the same in other respects hereinafter specified.

In the accompanying drawing:

Fig. 1 is a perspective view of a ring through which a strip of textile material has been passed prior to making a joint between two parts of the textile material.

Fig. 2 is a perspective view showing the textile material bent over and showing a strip of cellulose material soluble in a volatile solvent being inserted between the two parts of the textile material to be joined together.

Fig. 3 is a perspective view similar to Fig. 2 and showing the parts to be joined clamped together and showing solvent being applied to an edge of the textile material.

Fig. 4 is a sectional view of a joint embodying this invention.

In the carrying out of my improved process, I moisten or wet the portion of the fabric or porous material adjacent to the joint or seam with the solvent for the cellulose material and then cause this solvent to make a solution of the cellulose material, preferably while the fabric or porous member is pressed into contact with the cellulose material. The cement formed by the dissolving action of the solvent on the cellulose material then adheres to the fabric in the usual manner and in addition, the solution or cement tends to penetrate into the moistened or wetted portions of the fabric by diffusion and because of progressively dilute solutions formed. Consequently, when the solvent has evaporated, the cement will have penetrated deeply into the fabric and forms a very secure bond with the fabric. Similarly two pieces of fabric can be secured together by placing between them a thin layer of cellulose material which is soluble in the solvent used. When fabrics are employed which are of a cellulose composition, such as cellulose acetate, which itself is soluble in the solvent, then the thin layer of cellulose material between the two parts of fabric can be dispensed with.

A convenient manner in which my invention may be carried out, and which is stated to illustrate one embodiment of my invention is as follows: A piece or band of fabric A may, for example, be passed through a ring B as shown in Fig. 1 and then doubled over as shown in Fig. 2. I then insert between the two parts of fabric at the parts thereof where the seam is to be made, a thin piece C of celluloid or other cellulose product soluble in a volatile organic solvent, such as acetone, alcohol, or other solvents of this type. These several parts are clamped while dry in their desired positions, for example, by means of a clamp D, Fig. 3, and I then apply solvent to the parts of the fabric or band which are clamped, this solvent being, for example, applied by a brush E. As a result, the solvent will quickly penetrate

through the fabric by capillary action, and will come in contact with the cellulose material or celluloid, forming immediately a solution of the cellulose product. Because of the diffusing action of liquids, this solution will quickly diffuse through the portions of the fabric adjacent to the cellulose and which have become wetted with the solvent. In this manner, the solvent, which has much greater penetrating powers than the cement formed by dissolving the cellulose product in the solvent, causes the cement by the diffusing action to penetrate into portions of the fabric material which would otherwise not be reached by the cement. Consequently, when the solvent has evaporated, which in ordinary cases takes place within four or five minutes after the application of the solvent to the fabric, the cement will have penetrated the fabric part more thoroughly and to a considerably greater distance from the cellulose material than in the case when cellulose cement only is used for making the seam. Furthermore, the forming of seams of this kind is very greatly facilitated for the reason that the several materials are clamped together while dry, so that they are easily handled and the solvent is applied only after the clamping has been completed. If it were attempted to moisten the celluloid with solvent before inserting the same between two parts of the fabric, the rapid evaporation of the solvent would prevent the making of a satisfactory seam or joint, and the handling of the wetted celluloid would be very difficult because of its slippery nature and of the tendency of the cellulose cement formed on the wetted surface thereof to adhere to the fingers or implements with which the celluloid is handled. Furthermore, cement of this kind will penetrate the dry fabric to a lesser degree than when the fabric is wetted with the solvent. By clamping the parts together, another advantage results, namely, that rapid initial drying or evaporation of the solvent is prevented, thus giving the solvent a longer time to draw the cement into the fabric.

When liquid cellulose cement is used in the usual manner for securing together two parts, or when such cement is formed by wetting a surface of a part of soluble cellulose material with a solvent therefor, the cement is of a certain consistency and will penetrate only to a limited extent into the fabric, thus forming a joint which is not particularly strong. By means of the improved process herein described, a progressive dilution of the cement occurs. The portions of the fabric or porous member wetted with the solvent which contact with the soluble cellulose material, will form a relatively thick or concentrated cement at the point of contact. This concentrated cement is in turn dissolved by the diffusing action in the solvent in the fabric located a little farther removed from the surface of contact, and this more dilute cement consequently penetrates farther into the fabric, and in turn forms with additional solvent a still more dilute cement. In this manner, the cement becomes progressively more diluted as it penetrates farther into the fabric. In this manner, the joint is formed by a number of different solutions of cement of progressively greater dilution, so that a very thorough penetration of the cement into the fabric results, and also a correspondingly stronger joint or seam. This penetration of the cement into the fabric can be increased by delaying evaporation of the solvent, which may be done by the use of a clamp which delays the evaporation of the solvent by reducing the surface of the fabric exposed to the atmosphere, or the same result can be accomplished by selecting solvents which evaporate at a slower or faster rate as may be desired for the particular case. A mixture of solvents may be used to obtain the desired kind of evaporation, or the solvents may be mixed with other materials which retard evaporation. For example, if acetone is used as a solvent, it may be mixed with a small amount of water to retard evaporation. Obviously, if evaporation is retarded, a greater penetration of the cement into the fabric can be effected.

The process described is quite rapid in that the parts can easily be clamped in their desired positions, and after being wetted with a solvent, the solvent evaporates in the course of a few minutes, whereupon the joint will be completed.

When it is desired to secure the fabric to a solid part, such for example as the ring B, this can be very easily done if the ring is made of celluloid or similar cellulose material, or is covered with material of this kind, by applying sufficient solvent to the fabric to penetrate the parts thereof extending around the ring, whereupon a similar action occurs, namely, the forming of a cellulose cement and the penetration of the same into the fibers of the fabric. It will be understood that it is not necessary to apply pressure to the parts which are secured together, for example, as by means of the clamp D, this being merely a convenient manner of holding the parts together, and a secure joint between the cellulose material and the fabric A will be formed without applying pressure to the part of the fabric touching the ring.

In Fig. 4, the invention is shown as applied to securing a fabric band F to a hook-shaped member G, this member being made at least partially of a cellulose material soluble in the solvent employed. The fabric band is passed through slots of the hook member G, and the end *f* of the band is placed against the other portion of the band and a cellulose member H is placed between the parts at the joint. Upon wetting the band with solvent, the end *f* thereof will be securely seamed to the body portion and if sufficient solvent is applied to the band to wet the portions thereof adjacent to the hook member G, the band will also be secured to this hook member.

The invention has been found to be very desirable for use in connection with the forming of seams in elastic bands or fabrics, such for example as are used in garters, suspenders, and various other articles of clothing, or in elastic bandages used for surgical and other purposes. In such cases, it has been found that the solvents used have no effect whatever upon rubber, and consequently, the rubber in the elastic webs is in no way injured. Furthermore, while the cellulose cement does not form a secure bond with the rubber, yet by causing this cement to penetrate the fibers and spaces between fibers surrounding the rubber cords or bands embedded in the fabric, and by cementing the fibers more closely to each other, a very secure adherence of the rubber bands to the fabric results, so that, for example, when the cut end *f* is seamed as illustrated in Fig. 4, the cement seam anchors the rubber bands or cords to the fabric of the elastic material in such a way that there is no tendency for these bands to pull through the textile material surrounding the same. The puncturing or perforating of these bands by a sewing needle is, of course, also eliminated by my improved seam.

My improved seam also secures or cements the fibers of the fabric together, so that unravelling of the fabric is prevented. Consequently, when the seam is applied to a cut end of a fabric, the usual hemming of the cut edge is eliminated.

The solvents used also have no chemical action whatever upon cotton, rayon, silk, wool and other materials commonly used in textile fabrics, except artificial fibers made from cellulose esters, such as cellulose acetate, or from materials soluble in cellulose esters, and when fabrics made from such artificial fibers are used, my improved seam can be made without the use of celluloid or other soluble cellulose material, since the seam in that case can be made by means of the cement formed by the dissolving of portions of these fibers in the solvent.

The completed seams are very lasting in their nature, since cellulose material of the nature employed in the making of seams is in no way affected by moisture, perspiration, soap, or other substances with which garments or articles of clothing ordinarily come into contact.

I claim as my invention:

1. A process of securing together two parts, at least one of which is a cellulose product soluble in a volatile organic solvent, and the other of which is a textile material, which includes clamping the two parts together while dry in the positions in which they are to be secured, then applying said volatile organic solvent to a portion of the textile material adjacent to the clamped parts in a quantity sufficient to penetrate the textile material by capillary action to the abutting faces of the portions of said parts, which are clamped together, and cause substantial diffusion of said product into said textile material, and maintaining the parts clamped continuously until at least the major portion of said solvent has evaporated.

2. The process of securing together two parts of textile material, which includes placing between the two parts a cellulose product soluble in a volatile organic solvent, clamping said parts and said cellulose product together, and applying said volatile organic solvent to the textile material adjacent to the clamped portions in quantity sufficient to cause the solvent to penetrate by capillary action to the cellulose product to form a cellulose solution and to cause the cellulose solution to penetrate the textile material, and maintaining the parts clamped continuously until the solvent has substantially evaporated, and maximum penetration of the textile material by said solvent obtained.

3. A process of securing together two fibrous members, including first placing between the faces to be secured together a thin dry layer of a cellulose product soluble in a volatile solvent which is inert with reference to said fibrous members, pressing said fibrous members toward each other and against said cellulose layer, and then moistening the portions of said fibrous members adjacent to said cellulose layer with said solvent to cause said solvent to penetrate by capillary action into the fibrous material and into contact with said cellulose layer to form therewith a cementitious solution, and to cause said solution to penetrate by diffusion into portions of said fibrous members wetted with said solvent, and maintaining continuous pressure on said fibrous members until evaporation of at least a substantial part of said solvent.

4. A seam connecting two parts of elastic fabric containing rubber strands, including a thin sheet of a cellulose product soluble in a volatile solvent which is inert with reference to said elastic fabric and rubber, said elastic fabric adjacent to said cellulose sheet being penetrated by diffusion of a portion of said sheet to form a secure bond between said elastic fabric and said layer and about said rubber strands to anchor said strands relatively to the fabric.

5. A seam connecting two parts of elastic fabric containing rubber strands, said parts being disposed face to face, with a thin sheet of cellulose material interposed between said parts and united to said parts by substantial diffusion of a portion of said sheet, through a readily volatile solvent thereof, into the fabric of said parts and around said strands, whereby said parts will be securely attached to one another and the strands will be securely anchored against movement in said parts at the seam.

6. A connection for an elastic fabric of the type having rubber strands running in the interior thereof, which comprises a celluloid object abutting flat against a face of a minor portion only of said fabric and united thereto by substantial diffusion of a portion of said object, through a readily volatile solvent thereof, into said fabric and around said strands at the abutting face portion of the fabric, whereby the object and fabric are securely united to one another through said object and said strands are securely anchored against movement in said fabric at said abutting faces.

7. A process of securing together two parts, at least one of which is a cellulose product soluble in a volatile organic solvent, and the other of which is a textile material, which includes clamping the two parts together while dry in the positions in which they are to be secured, then applying said volatile organic solvent to a portion of the textile material adjacent to the clamped parts in a quantity sufficient to penetrate the textile material by capillary action to the abutting faces of the portions of said parts which are clamped together, and cause substantial diffusion of said product into said textile material, and maintaining the parts clamped together continuously without relative sliding movement of abutting faces thereof until at least the parts are firmly attached to one another.

8. An improved article comprising a body of cellulose material, and a freely stretchable textile fabric having an elastic strand incorporated therein, said fabric being disposed with a portion only of a face abutting flat against said body and united thereto at said face by substantial diffusion of a portion of said body, through a readily volatile solvent thereof, into said fabric at said face for a depth approximately to said strand, whereby said fabric and body are firmly united to one another and said strand is anchored in the fabric at said portion of said face.

FLOYD A. KNOLL.