April 8, 1958 J. N. MASON 2,830,003

ADHESIVE TAPE

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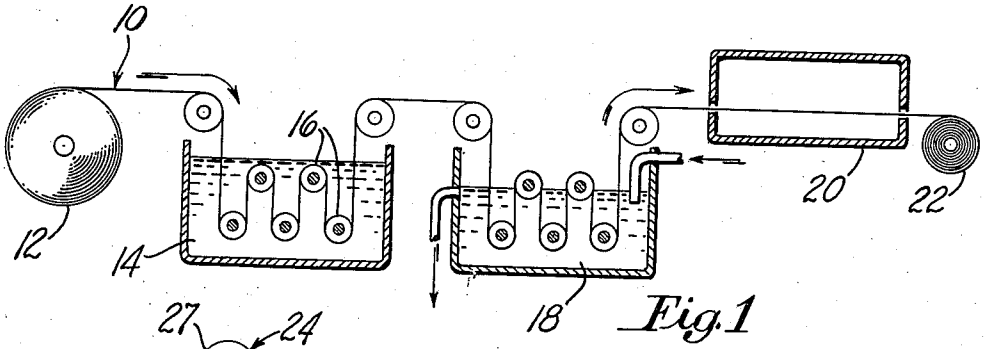


Fig. 1

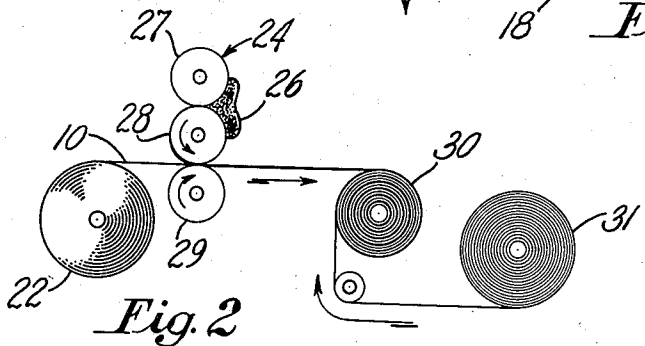


Fig. 2

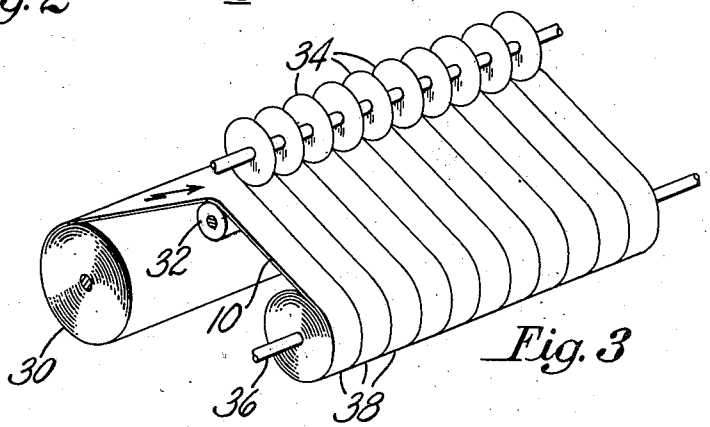


Fig. 3

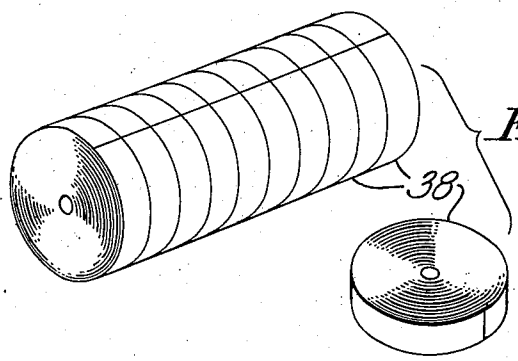


Fig. 4

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ADHESIVE TAPE

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6 Claims. (Cl. 154—121)

The present invention relates to pressure sensitive adhesive tape and to a novel method of making it, and is more particularly concerned with tapes comprising a fabric backing web and a pressure-sensitive adhesive coating on one or both sides of the fabric.

Tapes of this type are typically used in electric wiring work to protect or cover an electric conductor, about which the tape is wound either directly or over a preliminary winding of insulation. To give satisfactory service the tape should provide a strong impervious and durable covering for the conductor.

Since in practically all applications employing adhesive tape of this type the tape is manually wound to the conductor, generally directly from the roll, and is then torn from the roll, the resistance of the tape to tearing should not be excessive. The tape should, however, have a substantial fabric backing of considerable wear resistance to adequately serve its purpose, and in addition should be of substantial and uniform thickness to permit easy handling and a uniform product.

An ideal fabric for tapes should accordingly possess the rather inconsistent properties of substantial uniform thickness, adequate tensile strength and wearing properties and be in addition, readily torn. Numerous means for providing these characteristics have been proposed, most all of them having serious drawbacks. For instance, warp threads of low strength may be used, but such are of small diameter and thus not only result in a tape of reduced thickness but also in a non-uniform weave which frequently leads to the formation of open spaces or "pinholes" in the finished product. Another way of reducing the tear resistance is to use a fabric that has been treated with a filler to stiffen it such that upon tearing the normal elongation of the warp threads is prevented. The tearing stresses are thus applied to the warp threads in a "one at a time" sequence, and the fabric is more easily torn. The stiffness of the fabric, however, is generally undesirable since it makes the tape difficult to handle.

The principal object of the present invention is to provide easily tearable fabric backed pressure-sensitive adhesive tape in which the disadvantages of the prior tapes are avoided. The invention consists in first treating a cotton backing fabric with a solution of a reagent which is reactive with cellulose to cause chemical degradation and weakening of the fabric, such that between about 75 and 90% of the original tensile strength is retained.

Numerous reagents will react with cotton to cause degradation of the cellulose and weakening of the fabric, such as acids, and oxidizing agents, all of which cause cleavage or other degradation of the cellulose molecules. The conditions of treatment may vary according to the particular reagent, and those such as concentration, time, and temperature are inter-dependent in accocrdance with well-known concepts of chemical kinetics. In any case, the treatment will be carried out to the extent that the fabric loses between about 10 and 25% of its original tensile strength. The fabric is then washed of excess reagent, and dried.

Cotton fabric so treated is admirably suited for use in the manufacture of pressure sensitive adhesive tape, which may typically be carried out by applying a layer of pressure sensitive material to one, or if desired to

both, sides of the fabric, conveniently by calendering the material onto the fabric. The coated fabric is then rolled, preferably with an interleaving sheet of a liner, e. g. waxed or lacquered paper, and then cut into separate rolls of tape which are ready for their customary use.

This invention will be better understood and appreciated from the following detailed description of a preferred embodiment selected for purposes of illustration and shown in the accompanying drawings in which:

Fig. 1 is a diagrammatic illustration of a continuous process for treating fabric in accordance with this invention,

Fig. 2 diagrammatically illustrates the application of pressure sensitive adhesive tapes to the fabric,

Fig. 3 shows schematically the cutting of the rolled coated fabric into individual rolls of tape, and

Fig. 4 is a perspective view of the finished stack of tape rolls.

The first step in carrying out the invention, as shown schematically in Fig. 1, consists in treating the fabric **10**, such as an unbleached cotton muslin having an initial tensile strength warpwise of 52 lbs. per lineal inch, by feeding it from a roll **12** through a bath **14** of the treating solution in which the fabric passes up and down around feed rollers **16**. The rollers **16** are so arranged as to hold the fabric in the bath **14** for the time necessary under the conditions of treatment to bring about the desired loss in strength.

Typically, the treating solution consists of an aqueous solution of sodium hypochlorite of concentration giving 0.3% by weight of free available chlorine. At a temperature of 140° F. the fabric should remain in the solution for about 45 minutes.

When the fabric emerges from the bath **14** it is passed through a rinsing tank **18** fed with fresh water to remove excess reagent, and is then passed through a drier **20** and the dried treated fabric is collected on a roll **22**.

Application of a pressure sensitive adhesive coating, as suggested by Fig. 2, is conveniently accomplished by feeding the treated fabric from the roll **22** through a calender coating machine **24** which applies a layer of the pressure sensitive adhesive material **26** to a surface of the fabric **10**. Typically, the calender coating machine consists of three rollers **27**, **28** and **29** driven together in well-known fashion. The adhesive material **26** is retained as a reservoir between the upper and center rollers **27** and **28**, which are so spaced apart that the required amount is carried around by the center roller **28**. The fabric **10** is fed between the center roller **28** and the lower roller **29**, and picks up the layer of adhesive material from the center roller. After leaving the calender coating machine **24**, the fabric is wound into a roll **30**, preferably together with a liner sheet **31** of, for instance, waxed paper interleaved with the coated fabric to prevent blocking.

Tape is formed from the coated sheet as shown in Fig. 3 by feeding it from the roll **30** over an arbor **32** against which run several spaced knife disks **34** cutting the sheet into strips. The strips are wound simultaneously onto a mandrel **36** as a plurality of tape rolls **38**, which may be separated when the mandrel is removed as suggested by Fig. 4.

The pressure-sensitive adhesive material may be any of a number of well-known compositions, and its precise formulation forms no part of this invention. One preferred formula for insulating tape is made up as follows:

	Parts by weight
Natural crepe rubber	55–75
Terpene resin	20–25
Light petroleum process oil	10–15
Paraffin oil	0.5
Tri-methyl-di-hydro quinoline	1.0

The ingredients are combined in a rubber mixing machine of conventional type and are milled together to a pasty consistency suitable for application by means of the calender.

Other treatments which may also be used to weaken the fabric backing material consist in immersing the fabric in aqueous acidic solutions, which have the effect of causing degradation of the cellulose. Any of the strong mineral acids as well as strong organic acids may be used, such as sulfuric acid, hydrochloric acid, nitric acid, acetic acid, to name but a few. In a typical acid treatment using sulfuric acid, satisfactory weakening may be attained by immersing the fabric in a 0.8% sulfuric acid solution at 145° F. for 45 minutes. Similar results may be achieved with stronger solutions, e. g. a 5% sulfuric acid solution at 120° F. for 20 minutes. Stronger solutions do, however, react more rapidly and the time of immersion then becomes increasingly critical.

The foregoing examples have been given as illustrative of this invention and not by way of implying limitation to the invention. It is rather contemplated that obvious modifications will occur to those skilled in the art, and that such may be made without departing from the scope of this invention.

Having thus disclosed my invention and described in detail preferred embodiments thereof, I claim and desire to secure by Letters Patent:

1. The process of making easily tearable woven fabric-backed pressure sensitive adhesive tape comprising passing a web of woven cellulosic fabric through a treating bath of a treating solution comprising a reagent reactive with cellulose to cause degradation and weakening of the fabric and maintaining said solution in contact with said fabric until the tensile strength of said fabric has been reduced by from about 10 to 25 percent of its original tensile strength, whereby a fabric of the desired dimensions but of greatly reduced strength is produced, rinsing and drying the fabric, applying a surface layer of a pressure-sensitive adhesive composition to the fabric, winding the fabric with a liner web into a roll and cutting the fabric roll into separate rolls of tape.

2. The process of making easily tearable woven fabric-backed pressure sensitive adhesive tape comprising passing a web of woven cellulosic fabric through a treating bath of a treating solution comprising a reagent reactive with cellulose to cause degradation and weakening of the fabric and maintaining said solution in contact with said fabric until the tensile strength of said fabric has been reduced by from 10 to 25 percent of its original tensile strength, whereby a fabric of the desired dimensions but of greatly reduced strength is produced, rinsing and drying the fabric, and applying a surface layer of a pressure-sensitive adhesive composition to the fabric.

3. In the process of making easily tearable fabric-backed pressure sensitive adhesive tape wherein a surface coating is applied to a cellulosic fabric backing, the improvement comprising passing the fabric through an aqueous solution of a reagent reactive with cellulose to cause degradation and weakening of the fabric to reduce the tensile strength of said fabric by from 10–25% of its original tensile strength.

4. The process of making easily tearable woven fabric-backed pressure sensitive adhesive tape comprising passing a web of woven cellulosic fabric through a treating bath of a treating solution comprising an oxidizing agent reactive with cellulose to cause degradation and weakening of the fabric and maintaining said solution in contact with said fabric until the tensile strength of said fabric has been reduced by from about 10 to 25 percent of its original tensile strength, whereby a fabric of the desired dimensions but of greatly reduced strength is produced, rinsing and drying the fabric, and applying a surface layer of a pressure-sensitive adhesive composition to the fabric.

5. The method defined by claim 4 wherein the treating solution of an oxidizing agent is an aqueous hypochlorite solution containing about 0.3% of available chlorine having a temperature of about 140° F., and the time of the treatment is about 45 minutes.

6. The method defined by claim 2 wherein the solution is an aqueous solution of a sulfuric acid of concentration between 0.8 and 5% at a temperature between about 120° F. and 145° F., and the time of treatment is between about 20 and 45 minutes, said treatment being effective to reduce the tensile strength of the fabric by between 10 and 25% of its original tensile strength.

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