United States Patent [19]

Waldeck

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[45] **Dec. 30, 1975**

[54] **BOOKBINDING TAPE**

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[73] Assignee: **A. B. Dick Company,** Niles, Ill.

[22] Filed: **Mar. 18, 1974**

[21] Appl. No.: **452,194**

Related U.S. Application Data

[63] Continuation of Ser. No. 151,863, June 10, 1971, abandoned.

[52] **U.S. Cl.** **428/255;** 428/212; 428/337; 156/254

[51] **Int. Cl.²** **D03D 11/0**

[58] **Field of Search** ..... 161/167, 160, 92, 89; 117/28, 29, 15, 76 F; 428/255, 212, 337

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[57] **ABSTRACT**

A bookbinding tape having a substrate formed of a tough, flexible, scuff resistant high polymeric material and a low temperature reactivatable adhesive layer in which a coloring agent may be incorporated in the adhesive layer or in a separate layer between the adhesive layer and the substrate and indicia can be preprinted on the substrate beneath the adhesive layer and which can include a non-tacky layer on the adhesive layer to prevent blocking.

1 Claim, 7 Drawing Figures

FIG. 1

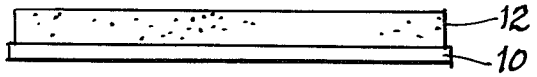


FIG. 2

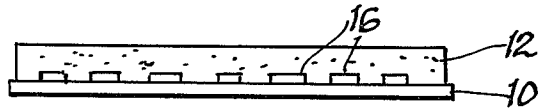


FIG. 3

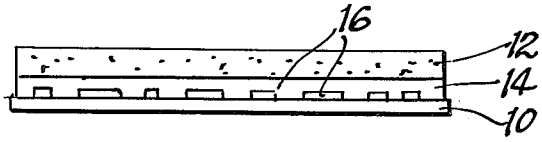


FIG. 4

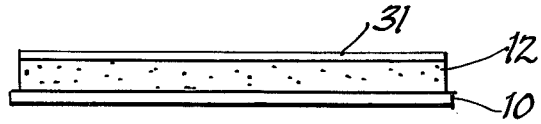
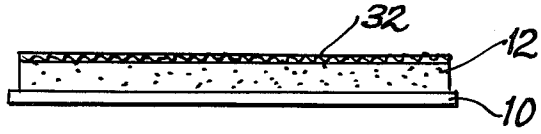


FIG. 5



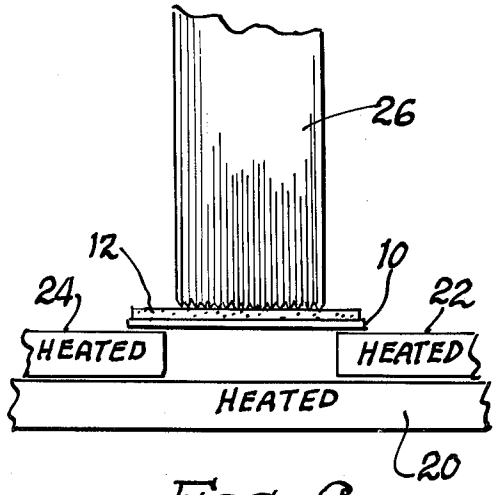


FIG. 6

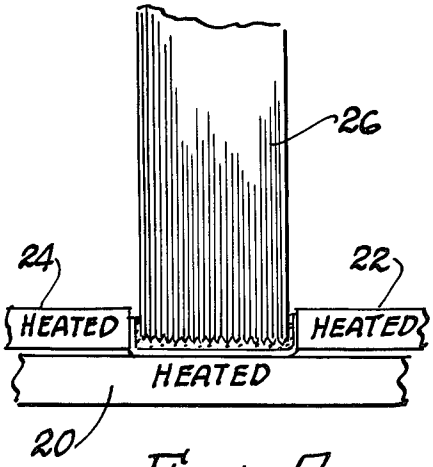


FIG. 7

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BOOKBINDING TAPE

This is a continuation of application Ser. No. 151,863, filed June 10, 1971, now abandoned.

This invention relates to the art of binding signatures or pages into books and to binding tapes for use in the manufacture of same and it relates more particularly to bookbinding tapes which are activated by heat and applied by pressure.

In the conventional bookbinding operation, signatures, in the form of a number of groups of folded sheets which eventually become pages of a book, are gathered or assembled in sequence for binding. Instead of such signatures, the bound book may be formed of separate leaves or pages.

To the present, a number of techniques have been employed commercially in the bookbinding art. In one low volume procedure, adhesive is applied directly to the signatures of the book, as by means of a brush or other suitable applicator, and the adhesive is secured by heat while the adhesive coated signatures are held together, with or without a suitable backing, to interbond the signatures one to another in forming the book section. This procedure is undesirable from the standpoint of the mess created during application and pressing of the wet adhesive as well as the time required for adhesive application and cure.

Another well known technique makes use of plastic spirals which are threaded through aligned openings in the signature portions. However, use of plastic spirals requires an inventory of a large number of plastic splines adapted for use with the different sizes of pages or signatures of which pamphlets or books are formed.

A system akin to the invention described and claimed herein resides in the use of bookbinding tapes by which the signatures are bound by the use of heat and pressure. Tapes which have been used to the present, as represented by Alpina welding foil, make use of a substrate generally formed of a heavy paper or buckram which is one side coated with an adhesive to provide a combination which requires temperatures in the range of 400°–500°F. for activation over a period of time ranging from 30–60 seconds to effect the desired assembly. In addition to the time and temperature requirements, such bookbinding tapes are difficult in that the paper backed tapes are characterized by low heat transfer, insufficient strength, poor flexibility, poor durability, and the limitation which requires that any printing or indicia be applied only to the exposed outer side of the binding tape where protection is not available to prevent scuffing, wear or removal of the indicia or printed paper.

It is an object of this invention to produce a bookbinding tape which has high heat transfer value thereby to require lower temperatures or less heat for activation of the adhesives with corresponding less deterioration or discoloration by thermal degradation; which can make use of binder systems activatable at lower temperatures thereby to enhance the binding operation by the need for less time, temperature or equipment; which is characterized by greater strength and flexibility with corresponding increase in utility; which has greater durability and resistance to handling thereby to enable increased mechanization in production while delivering a neater package; in which color coating, printing or the like indicia can be preprinted on the inner side of the substrate whereby the substrate itself

provides protection which prevents scruffing, wear or removal in use; which can be packaged as a continuous tape in substantially endless rolls without offset and with easy unwinding for application, and which can be applied in a simple and efficient manner with readily available equipment.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings, in which

FIG. 1 is an enlarged elevational view of a bookbinding tape embodying the features of this invention;

FIG. 2 is a view similar to that of FIG. 1 showing the modification which includes printed matter on the substrate;

FIG. 3 is a view similar to those of FIGS. 1 and 2 showing the modification which includes a color coating in combination with the printed matter;

FIG. 4 is an elevational view similar to that of FIG. 1 which includes an inter-leaver in the form of a layer or coating on the adhesive layer to block offset of the adhesive layer during manufacture, storage, shipment or other periods of non-use while in roll or other packaged form;

FIG. 5 is a view similar to that of FIG. 4 showing a modification of inter-leaver;

FIG. 6 is a schematic view showing the arrangement of elements at the start of a bookbinding operation, using a bookbinding tape of this invention; and

FIG. 7 is a schematic view of the elements shown in FIG. 5 in operative position for binding the signatures.

An important concept of this invention resides in the construction of a bookbinding tape with a substrate in the form of a strip **10** of high melting point, preferably transparent to translucent, high polymeric film forming material having an adhesive coating **12** on the inner surface and which is characterized by activation at lower temperature for a short period of time.

As a substrate, use can be made of a high polymeric material which has a melting point above 500° F. and which is tough, flexible and scruff resistant in strip or film form. Film forming materials suitable as a substrate may be represented by such polymers as polyethylene terephthalate (Mylar), polycarbonates, polysulfones, polyesters and the like high polymeric film forming materials. In practice, it is desirable to make use of a substrate having a thickness of at least 1 mil but less than 10 mils and preferably within the range of 2–5 mils.

Substrates of the type described allow for rapid heat transfer which permits use of an adhesive characterized by short reactivation time at low temperatures whereby the bookbinding operation can be carried out in a fraction of the time (4–10 seconds) and at considerably lower temperature (200°–300° F.) by comparison with the normal time of 40 seconds at such temperatures as 400°–500° F. required of the Alpina tapes of the type currently being used.

The adhesive coating **12** should be formulated of materials in which the adhesive properties can be reactivated at a temperature within the range of 100°–300° F. and preferably within the range of 150°–250° F. Representative of such adhesive materials which can be employed are ethylene vinyl acetate polymer (Elvax 200, marketed by E. I. duPont de Nemours & Co. Inc.) modified with equal parts of a terpene resin (Piccolyte, marketed by Pennsylvania Industrial Chemical Co.) or a rosinate; a polyvinyl acetate and blends thereof with

polyethylene or rubber or mixtures thereof such as the material marketed under the trade name "Thermogrip 6390", by USM Corporation.

The adhesive coating can be applied to the inner surface of the film substrate from an emulsion dispersion or solvent solution, but it is preferred to make application of the adhesive of the types described in the form of a hot melt. The coating can be applied by conventional techniques, such as flow coating, spray coating, dip coating and the like, but it is preferred to make use of a roll coating technique, especially when the adhesive is applied as a hot melt. The bonding effect desired of the bookbinding tape is incapable of being secured when the adhesive coating is less than 7 mils in thickness. However, it is unnecessary and often results in waste of material to provide a thickness of coating in excess of 25 mils. In the preferred practice of this invention, application is made of adhesive coating having a thickness within the range of 12–16 mils.

The hot melt or other coating can be applied to the film substrate after it has been sheeted to the desired width for use as a tape but it is more expedient to coat the sheet before it is subdivided into tapes of the desired thickness and packaged into rolls for storage, shipment, or use.

Having described the basic construction of the bookbinding tape of this invention, illustration will hereinafter be made with respect to the preparation and use of bookbinding tapes embodying features of the invention and the various modifications thereof.

EXAMPLE 1

Adhesive Composition:

50% by weight Elvax 220 (ethylene vinyl acetate polymer, marketed by E. I. du Pont)

50% by weight Piccolyte (a terpene resin, marketed by Pennsylvania Industrial Chemical Co.)

EXAMPLE 2

Adhesive Composition:

100% polyvinyl acetate blend with polyethylene and rubber (Thermogrip 6390, marketed by USM Corporation)

The adhesive compositions of Examples 1 and 2 are applied as a hot melt in thicknesses of 12 mils onto one side of a sheet of Mylar having a thickness of 5 mils. After the adhesive coating has cooled and set, the adhesive coated sheet was cut into strips having a width greater than the width of the combined signatures to be bound to provide an overlap for adhering to the side edges adjacent the signature portions.

Use is made of a combination mold having heated platens including a base platen **20** and side platens **22** and **24** which are spaced one from the other by an amount slightly greater than the width of signatures **26** to be combined and which are movable endwise as a group toward and away from the signatures while the side platens, which define a cavity therebetween, are movable laterally relative to the base platen to compress the signatures therebetween. A book binding device of the type described is available commercially and identified as the Alpina machine.

In use, the bookbinding tape is centered over the cavity between the group of signatures **26** and the cavity with the side having the adhesive coating **12** facing the signatures.

The heated platens are then displaced in the direction towards the signatures whereby the free lateral edge portions of the bookbinding tape are folded over by the side platens **22** and **24** to embrace the edge portions of the group of signatures **26.** The tape and the signatures are then compressed between the heated platens to reactivate the adhesive whereby the signatures become bound by the tape into a bound assembly.

With bookbinding tapes of Examples 1 and 2, satisfactory binding of the signatures is secured with the use of a bonding temperature of 264° F. for 10 seconds.

By way of modification, a bookbinding tape having an attractive color can be obtained by the formulation of the adhesive coating to contain a coloring agent, such as a pigment, or by the application of a separate coating **14** intermediate the substrate **10** and the adhesive coating **12.** In this arrangement, the substrate can continue to operate to protect the color coating as well as the adhesive binding the signatures in the book. This modification may be illustrated by the following examples:

EXAMPLE 3

Colored adhesive coating:

99% by weight Thermogrip 6390

1% by weight red pigment predispersed in polyethylene (Red S-3678 of Wilson Products Company)

The adhesive coating is applied as a hot melt onto 2 mil Mylar at a coating thickness of 12 mils.

The resulting bookbinding tape was activated for 5 seconds at 264° F. on the Alpina machine schematically illustrated in FIGS. **6** and **7.** The pigmented adhesive coating imparted good color intensity as well as good opacity. The bond strength, as determined on the Thwing-Albert Electro-Hydraulic Tensile Tester Model 30-LT, gave 6–8 pounds per linear inch per sheet. This test corresponds to the effort required to tear the sheet from the spine of the bound book.

EXAMPLE 4

Before application of the adhesive coating as in Example 2, the Mylar strip is first coated with a pigmented polyvinylidene chloride emulsion having the following composition:

50% by weight polyvinylidene chloride emulsion (Daran 220 - Dewey and Almy Chemical Company)

25% by weight water

25% by weight of a 1% non-ionic dispersion of Benzidine Yellow in aqueous medium

A coating of about 2–3 mils was applied to the inner side of the Mylar strip by roller coating technique and then the color coated Mylar was overcoated with a hot melt of Thermogrip 6390 in a coating thickness of 12 mils to produce an attractive yellow bookbinding tape.

Binding with the tape of Example 4 was conducted for 5 seconds at 264° F. on the Alpina machine with a resultant bond strength of 8.5 pounds per linear inch per sheet.

By way of a still further modification, the substrate can be preprinted on the side to be coated with the adhesive, with or without the coloration of Examples 3 and 4, as illustrated by the following:

EXAMPLE 5

A 200-gauge Mylar film **10** was preprinted by offset technique using a triacetate offset ink and a lithographic offset press to form a design **16** or other printed information such as the name of the author, title, publisher and the like. The preprinted side was coated with

a color coating **14** of Example **4** and the colored coating **14** was overcoated with the adhesive coat of Example 2 to produce an attractive, printed, colored bookbinding tape.

A book was bound in 5 seconds at 264° F. on the Alpina machine, giving a bond strength of 8.8 pounds per linear inch per sheet.

The use of a self-contained, prefabricated bookbinding tape embodying a low melting point adhesive layer raises a number of problems by reason of the fact that the adhesive will become tacky at low temperature such as at a temperature of 100° F. or more which may be encountered in storage or transportation. This tends to cause blocking or offset of the adhesive layer when packaged in roll form or when strips of tape are prepackaged in multiple layers. Such adhesions can cause unsatisfactory operation and raise problems in machine application of the tape.

Thus it is another important concept of this invention to fabricate a self-contained, prefabricated film tape of the type described with a low melting point adhesive layer, having an over-layer in the form of an interleaver which militates against blocking or sticking of the adhesive layer until use in a bookbinding operation and in which such material making up the over-layer does not interfere with the adhesive layer in the desired bookbinding operation. This concept for the elimination of blocking without interference with the bonding quality of the adhesive layer is capable of a number of ramifications.

As illustrated in FIG. **4,** an anti-blocking layer **31** is overcoated onto the adhesive layer in which the anti-blocking layer constitutes a thin layer of a material which presents a non-adhesive surface but which is present in such small amounts as not to interfere with the normal function of the adhesive. Such anti-blocking layer **31** can be formulated of materials such as microcrystalline wax, micronized polyethylene or the like finely divided resinous or waxy materials which may be dusted onto the adhesive surface to provide a thin layer which can later be fused to form a continuous thin protective layer for the adhesive. For such purposes, it is sufficient if the inter-leaving layer is provided in a coating weight of from 0.5 to 5 pounds per 3000 square feet of surface area and best results are secured when present in an amount within the range of 1–2 pounds per 3000 square feet of surface area.

This modification will be illustrated by the following examples:

EXAMPLE 6

An adhesive coating of 12 mils Thermogrip 6390 was applied as a hot melt onto 2 mil Mylar, as in Example 2. The adhesive layer was overcoated by dusting the surface with finely divided dry particles of micro-crystalline wax in a coating weight of about 1 pound per 3000 square feet of surface area. When heated to fuse, the wax forms into a continuous layer which has a non-tacky waxy feel.

When the bookbinding tape of Example 6 is heated to 264° F. for 5 seconds in the bookbinding operation, using an Alpina machine, the wax layer softens along with the adhesive coating but, because of the minute amount of wax present, it does not interfere with the binding operation of the adhesive. The resulting bond strength was 5 pounds per linear inch per sheet.

EXAMPLE 7

The procedure is the same as in Example 6 but instead of dusting the adhesive layer **12** with micro-crystalline wax, the adhesive layer was dusted with finely divided dry particles of micronized polyethylene marketed under the name Microthene FN-500 (U.S.I. Chemicals). When the dry powdered layer, applied in a coating weight of about 1 pound per 3000 square feet of surface area, is fused by heating to elevated temperature, a protective non-tacky layer **31** is formed over the adhesive layer **12** which is effective to minimize adhesions and offset. The resulting tape was non-tacky and gave no sign of blocking after being tightly rolled and aged for 1 week at 110° F.

A book bound in 5 seconds at 264° F., with the bookbinding tape of Example 7, gave a bond strength of 8.0 pounds per linear inch per sheet.

By way of modification, instead of applying a protective overcoating on the adhesive layer, a protective non-adhesive fabric can be laminated as an inter-leaver onto the adhesive coating to provide a non-tacky, non-adhesive surface having openings between the fibers through which the adhesive from the coating can flow when heated to reactivation temperature in a normal binding operation. Instead of making use of an open mesh fabric, use can be made of a fabric containing synthetic resinous fibers reducible to a flowable state at the elevated temperature for binding to enhance the adhesive function of the adhesive in the coating, as illustrated by the following examples:

EXAMPLE 8

A 12 mil coating of Thermogrip 6390 was hot melt coated onto 2 mil Mylar, as in Example 2. A standard stencil base tissue (Grade 251 of C. H. Dexter & Company) about 2 mils in thickness was laminated onto the adhesive layer.

Strips of tape, rolled together to form applicator rolls, were heated in an oven at 110° F. for 1 week with no indication of blocking or offset of the adhesive coating.

A book bound in 5 seconds at 264° F. on an Alpina machine, using the bookbinding tape of Example 8, gave a bond strength of 6.0 pounds per linear inch per sheet. The adhesive flowed about the fibers of the open mesh stencil tissue when heated to bookbinding temperature to form a tight bond with the signatures.

EXAMPLE 9

The procedure is the same as in Example 8 but instead of making use of a stencil base tissue, an open mesh gauze of cotton fibers having approximately 770 openings per square inch and a thickness of about 5–10 mils was laminated to provide a protective layer **32** on the surface of the adhesive layer **12** with the same results as in Example 8 except that a bond strength of 5.8 pounds per linear inch per sheet was secured.

EXAMPLE 10

The procedure was the same as in Examples 8 and 9 except that instead of making use of a stencil sheet or cotton gauze, an open net fabric woven of thermoplastic polyester fibers was laminated onto the surface of the adhesive layer with the same protective results as secured with the stencil tissue in Example 8 or the cotton gauze in Example 9.

Use of a net woven of synthetic resinous fibers, such as fibers of polyester resin, polyamide resin and the like, provides protection to minimize blocking. It not only lets the reactivated adhesive flow about the fibers into engagement with the signature but the synthetic thermoplastic resinous fibers can themselves be reduced to a plastic state at elevated temperature, especially in the presence of the adhesive to enhance the bond with the signatures at reactivation temperature. In this combination, it is desirable to make use of fibers of synthetic thermoplastic materials having a slightly higher softening point than that of the adhesive in the coating, such as a softening point temperature within the range of 250°–350° F.

In the combination described, where the fibers operate to enhance the adhesiveness of the bookbinding tape, a bond strength of 9.2 pounds per linear inch per sheet is achieved in a book bound for 5 seconds at 264° F. with an Alpina machine.

It will be understood that the composition and concentration or thickness are not critical to the foregoing concepts in which examples are given of materials, their method of application and amounts by way of illustration and not by way of limitation.

It will be understood that changes may be made in the details of formulation, application and use without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. A prefabricated bookbinding tape having a substrate in the form of a film having a thickness within the range of 0.5 to 10 mils formed of a high melting point, high heat transfer value, tough, flexible and scuff resistant high polymeric material, a low temperature heat-reactivatable adhesive layer having a thickness within the range of 7 to 25 mils on one side of the substrate and a non-tacky layer as an overlayer laminated on the adhesive layer to prevent blocking of the adhesive layer, said non-tacky layer being a thin open net fabric through which the adhesive from the adhesive layer can flow when heated to activation temperature, said fabric being formed to contain synthetic resinous fibers selected from the group consisting of polyamide and polyester resins and which are reducible to a flowable state at elevated temperatures corresponding to the heat reactivatable temperature of the adhesive layer, and which when reduced to a flowable state can lend adhesiveness to enhance the binding characteristics of the tape.

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