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(54) Cover for binding sheets.

(57) A cover for use in binding loose sheets without use of a machine comprises a sheet of cover stock with a central fold dividing the cover to a front cover portion and a back portion and a strip of pressure-sensitive adhesive along the fold has a removable liner. The sheets are bound by aligning the sheets along a longitudinal edge and then rolling the other edge over the first to shingle the sheets along the other edge and then pressing the shingled edges into the strip of adhesive.

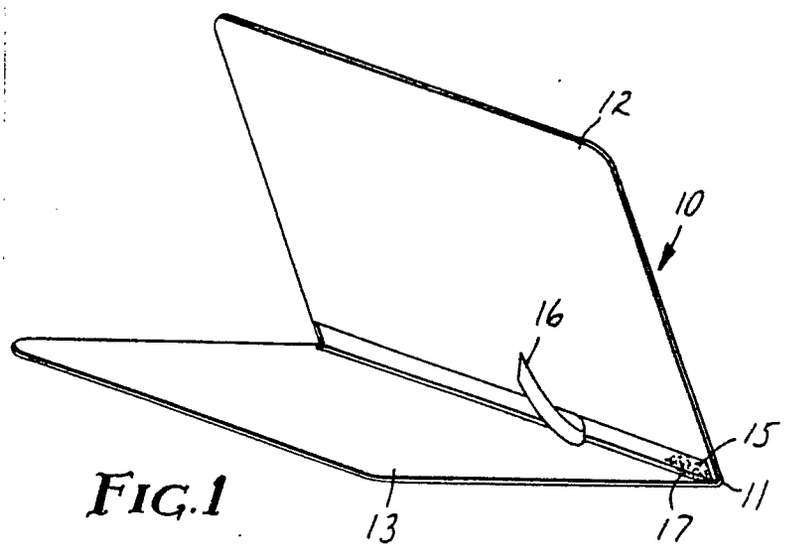

FIG.1

EP 0 246 851 A2

COVER FOR BINDING SHEETS

Technical Field

The present invention relates to a cover and process for the binding of a plurality of loose pages together using just a stiff strip of a binding adhesive to attach the pages together along shingled edges of the pages.

Background

The binding cover of the present invention is adapted to replace various binding systems for a plurality of pages up to about 25 pages. Prior binding systems for a small number of pages comprised staples, loose-leaf binders, mechanical fasteners, i.e., paper clips, prongs and fasteners as sold by Acco International Inc., Chicago, Illinois 60630, paper fasteners and washers as sold by Swingline, Inc., Long Island City, N.Y. 11101, plastic rivets, pins, slide strip binders and other jackets with built-in prongs for retaining perforated sheets. Binding by the use of performed covers having a hot melt adhesive requiring a mechanism or tool for effecting the binding operation is not considered relevant. The shingling of sheets to expose a marginal portion of each sheet and binding them together by use of adhesive contacting the edge of each sheet is known in the prior art. Such binding methods are taught by U.S.A. Pat. Nos. 1,765,194 and 2,455,971.

The assignee of this application has several applications copending for similar binding products incorporating pressure-sensitive adhesive for use in binding sheets together, and U.S.A. Patent Nos. 4,518,296; 4,558,888 and 4,562,102 directed to an apparatus for use in binding sheets together with the adjacent edges shingled.

The essential difference between the present invention and the prior art is that a cover corresponding to the present invention may be utilized to bind a plurality of sheets or papers together without the use of tools, fixtures, machines, electrical power, or lapsed time for heating or cooling the adhesive. Further, the shingling prior art states that only supple adhesive zones can be used to produce bound documents. The cover of the current invention consists of a stiff backing divided into a front and back portion with a strip of pressure-sensitive adhesive along the dividing line and a release material is provided to protect the adhesive prior to the binding operation.

The plurality of pages bound together by this binding cover reduces required storage space, allows stacking and the lay-flat feature provides for easy copying, reading, handling and page butting.

Disclosure of Invention

The present invention is directed to a backing for binding sheets together, which backing is formed of cover card stock creased across by a central fold score line to form a front and back portion. The cover portions have a length which is at least equal to the length of the paper to be bound plus some marginal dimension if desired, and a width corresponding to the width of the paper to be bound plus the width of the binding adhesive which is located on the back cover along one marginal longitudinal edge at the central fold score line and extending marginally across onto the front cover plus some marginal dimension if desired.

The band of binding adhesive is protected initially by a strip of a release material (such as a liner) which will allow for the easy exposure of the adhesive band as needed for binding.

In the alternative embodiment of the present invention a backing for binding sheets together is described which backing includes a flap attached along the fold line of the backing or the backing is formed of a sheet of cover card stock which has a length which is at least equal to the length of the paper to be bound plus the width of the binding adhesive along one marginal longitudinal edge at which a fold line connects the back panel to a flap which has a length corresponding to that of the backing and a width which is equal to the width of the band of binding adhesive adjacent the fold line and a narrow band of pressure sensitive adhesive is coated along the free edge of the flap for attachment of any desired additional cover member.

The band of binding adhesive and the band of adhesive for attaching the cover are each protected initially by a strip of release liner material which will be easily removed from the adhesive liner material which will be easily removed from the adhesive to expose the adhesive for binding. The binding adhesive is preferable an adhesive with good initial adhesion and preferably a value of at least 396.9 gms per 1.27 cm (fourteen (14) ounces per one-half inch) or greater as measured by the Pressure Sensitive Tape Council (PSTC) "Quick Stick" test No. 5.

Brief Description of Drawings

The present invention will be further described with reference to the accompanying drawing wherein:

Figure 1 is a perspective view of a cover according to the present invention;

Figure 2 is a view of a step in the binding process to align the pages to be bound;

Figure 3 is a view of a step in the binding process to shingle the edges of the pages to be bound;

Figure 4 is a perspective view illustrating the binding process;

Figure 5 is a perspective view showing a bound document;

Figure 6 is a perspective view of a bound document to be prepared for testing;

Figure 7 is an elevational view of a test fixture;

Figure 8 is a fragmentary diagrammatical view of a test device, fixture and sample;

Figure 9 is a fragmentary diagrammatical view of a test device and sample;

Figure 10 is an enlarged end elevational view of a second embodiment of the cover; and

Figure 11 is a view illustrating a step in an alternative binding process showing pages and cover alignment;

Figure 12 is a side elevation view illustrating the wrapping of the cover during the alternative binding process; and

Figure 13 is a side elevation view showing a further step of the alternative binding process to attach the cover member.

Detailed Description

Referring now to Figure 1, the backing of the present invention is illustrated and comprises a sheet 10 of cover stock which may be a paper composition having a caliper of about 0.22 mm (0.009 inch) and a basis weight of 36.3 kg (80 pounds) per ream (50.8 cm x 66.04 cm) (ream size 20 inches x 26 inches), which sheet has been formed with a flexible fold line 11 to form one longitudinal edge of the back portion 12 and one longitudinal edge of the front portion 13 and defining the line joining said portions of substantially the same dimensions. The sheet material along a zone adjacent the fold line 11 has a flexural rigidity of at least 2.26×10^{-4} newton-meter (0.002 inch-pounds) thus providing a backing which has a stiffness sufficient to allow easy handling during the binding process and gives the bound document security in use. The central fold line must not be so stiff as not to allow easy closure of the cover, therefore, it should have a flexural rigidity of less than 3.4×10^{-3} newton-meter (0.03 inch-pounds), it may be preferred to keep the entire backing within these limits. Stiffness and flexural rigidity are determined by test No. 409 of the Useful Methods tests published by the Technical Association of the Pulp and Paper Industry (TAPPI).

A narrow band of pressure-sensitive adhesive 15 is coated over the zone along a longitudinal edge of the back portion 12 adjacent to the central fold score line 11. The adhesive extends slightly across this fold line 11 and the adhesive 15 is covered by a protective release material such as a liner 16, a strip having a coating of silicone with a release value of between 10 and 25 grams per 2.54 cm. The adhesive is a very tacky pressure-sensitive adhesive which is in contact with the shingled edges of the sheets to be bound therein. Stress can occur during the final stages of the binding process which will cause the shingled edges to move, therefore, the adhesive must have good quick stick qualities, to allow the pages to stay attached after the initial adhesive contact, with minimal pressure and dwell time. In actual use adhesives with quick stick values less than 227 gms per 1.27 cm (8 ounces per 1/2 inch) do not work satisfactorily, and values greater than 340 gms per 1.27 cm (12 ounces per 1/2 inch) are preferred. Final adhesion of the bound document must be high enough that normal handling cannot cause pages to detach. Proper binding conditions are determined by using a 180° shear test and a 45° peel test described below. Acceptable values have been determined to be:

180° Shear = at least 400 grams/inch, with at least 600 grams/inch being preferred using 20 pound Bond paper and shingled 0.38 mm (0.015 inch).

45° Peel = at last 40 grams, with at least 70 grams being preferred.

A suitable adhesive for use with this binder is a normally tacky pressure-sensitive iso-octyl acrylate/acrylic acid copolymer in a 95.5:4.5 ratio. This pressure-sensitive adhesive has good initial adhesion which can be measured by the "Quick Stick" test 5 of the PSTC (Pressure Sensitive Tape Council).

The dimensions of the back portion 12 and front portion 13 of the backing are dependent on the length of the paper to be bound and the length is at least equal to the length of the paper to be bound but may be provided with an additional marginal dimension of, for example, 0.6 cm (0.25 inch). The width of the back portion corresponds to the width of the loose pages to be bound plus the width of the binding adhesive but may be provided with an additional marginal dimension of, for example, 0.6 cm (0.25 inch). The front portion is illustrated as having a dimension equal to the dimen-

sions of the back portion although the front portion could be narrower for a flap to which a transparent film or other cover stock could be joined to form the booklet cover.

The covers are preferably made for use in bindings containing a maximum of 25 sheets of paper 23. The dimensions of the cover portions is determined as outlined below where **L** = length, **W** = width, **t** = thickness:

$L_{cover} = L_{pages}$ + (margins x2)

L_{pages} = length of the pages

$W_{cover} = W_{pages} + W_{adhesive}$ + margin

W_{pages} = width of the pages

$W_{adhesive}$ = width of adhesive strip

$= \pi (N_{max} + 1) t_{page}$

t_{page} = thickness of the pages

N_{max} = maximum number of pages the binding can handle

$L_{adhesive} = L_{pages}$

$W_{extend\ adh.} = \pi t_{page}$

EXAMPLE 1-For binding 25 standard 0.127 mm, 21.6 cm x 27.9 cm (0.005 inch 8.5 inches x 11 inches) pages (US); the cover dimensions are as follows:

Cover length = at least 27.9 cm (11 inches), preferred being 29.2 cm (11.5 inches) (with edge margins).

Cover Width (folded) $_{minimum}$ = at least 22.6 cm (8.91 inches), preferred being at least 23.3 cm (9.16 inches) (with edge margin).

Adhesive length = 27.9 cm (11 inches).

Adhesive Width $_{minimum}$ = at least 10.4 mm (0.41 inch).

Width of Extended Adhesive 17 = at least 0.4 mm (0.016 inch).

EXAMPLE 2 -For binding 25 standard A-4, 0.127 mm thick by 21 cm x 29.5 cm size pages (OUS); the cover dimensions are as follows:

Cover length = at least 29.5 cm preferred being 30.77 cm (with edge margins).

Cover width (folded) $_{minimum}$ = at least 22.04 cm, preferred being at least 22.675 cm (with edge margin).

Adhesive length = 29.5 cm

Adhesive width $_{minimum}$ = at least 1.04 cm

Width of Extended Adhesive 17 = at least .04 cm

In binding a plurality of loose sheets 23 the same are bound by placing the loose pages in a stack, and removing the release liner 16 from the binding adhesive strip 15, standing up the loose pages and jogging them against a flat surface 25 along a longitudinal edge 21 (front left edge). The longitudinal edge 22 opposite the jogged edge is then clamped by the fingers (or an optional paper clamp) then the pages are rolled or folded back upon themselves, as illustrated in Figure 3, causing the upclamped longitudinal edge 21 to become shingled, exposing a margin of each sheet.

The amount of shingling (S) is equal to:

$$S = 2\pi t \quad N_{max} \quad \frac{x^\circ}{360^\circ}$$

where: t = the page thickness

N_{max} = the maximum number of pages

X° = the degree of wrap placed in the pages in performing the steps illustrated in Figure 3, for this method x° is approximately 180°

The folded pages are then slid along the inside of the front cover portion to the central fold score line 11, as illustrated in Figure 4, and the back cover portion is then closed so that the binding adhesive is pressed into contact with the shingled edges of the sheets. After the adhesive has been pressed into the shingled pages the folded sheets are released and allowed to lay straight. The cover portion 13 is then opened to the first page and the shingled pages 23 are again pressed into the adhesive, taking care to run a finger along the page edges, as illustrated in Figure 5.

A document can be tested to determine whether the adhesive used provided an adequate binding for the sheets. the following test was established to assess the peel strength of a page to the binding adhesive when removed at a 45° angle.

Referring to Figures 6, 7, and 8 the test is conducted as follows:

Using a paper cutter or guillotine the document or booklet 30 illustrated in Figure 6 is first cut to provide a section 31 of the booklet 7.6 to 10 cm (3 to 4 inches) wide at the bound edge and 15.24 cm (6 inches) long. This cut section is then placed on a fixture 35 illustrated in Figure 7, which fixture comprises a horizontally disposed portion 36 and an angled portion 37 disposed at 45° to the horizontally disposed portion 36. The document sample 31 is opened to expose the third sheet 39 and the remaining pages and the sheet 39 are then clamped along the upper marginal edge 40 of the angled portion by a clamp 41. The horizontal portion is then placed in the lower jaw 50 of an Instron tensile tester, made by Instron Corp. of Canton, Massachusetts, and the free end of the third sheet 39 is clamped in the upper jaw 51 of the Instron tensile tester. The Instron equipment is then calibrated to provide a crosshead speed of 25.4 cm (ten inches) per minute, the chart length is set for 25.4 cm (ten inches) per minute, the gauge length is set to 25.4 cm (ten inches), and the operator should use the the Gram Cell at 1000 grams full scale. Jaw separation is then initiated as shown in Figure 8 and the test results from the chart are recorded. Similar tests can be conducted with the sixth, ninth sheet, etc.

An acceptable average value for this peel test of a booklet would be at least 40 grams with at least 70 grams and above being preferred.

Another test method is a 180° shear test to establish whether the adhesive has sufficient shear strength to a document page. This test is done on an Instron tensile tester, see Figure 9, after preparation of a booklet sample as illustrated in Figure 6 wherein a 2.54 cm (one inch) wide sample 60 is cut from the finished booklet. Placing the top front page of the sample toward the operator, the operator positions the third sheet 61 from the sample 60 in the top jaw 51 of the Instron tensile tester and all of the remaining pages in the bottom jaw 50. Then calibrate the test equipment with a crosshead speed of 12.7 cm (5 inches) per minute, chart speed at 10 inches per minute, gauge length at 12.7 cm (5 inches) and use the Gram Cell at 1000 grams full scale. Then initiate jaw separation and record the force to break the bond. This test can be repeated for the sixth, ninth or twelfth sheet, etc. Acceptable values using this test are 400 grams per 2.54 cm (inch) but values of 600 grams per 2.54 cm (inch) and above are preferred.

It is to be understood that the strip of adhesive can be formed on the backing by coating a series of strips of adhesive to the desired width along the fold line, by applying a continuous strip of adhesive, or by applying an adhesive which has been previously coated onto a release liner and is then applied as a tape to the cover. In any event, spots, strips, or a continuous strip over an area adjacent the fold line, preferably on both sides thereof, are considered to constitute a band of adhesive.

An alternative embodiment and method of binding is illustrated in Figures 10 through 13.

As shown in Figure 10 the cover portion 13 is a flap with a band of adhesive 26 and a removable liner 27 positioned along the edge opposite the fold line 11. The binding adhesive 15 includes an additional or extended portion 17 which may extend across the fold line 11 onto the front cover portion 13 which extended adhesive has a width of about Pi (π) times the paper thickness. A removable liner 16 is applied onto the adhesive 15 and may have a low adhesion coating on both sides to also contact the small band of additional adhesive 17.

The cover stock is a paper composition having a caliper of about 0.28 mm (0.011 inch), which sheet has been formed with the fold line 11 along one longitudinal edge to join the back portion 12 to a front flap 13 of the same longitudinal dimension but substantially narrower. The cover stock is flexible and has a stiffness or flexural rigidity as determined by the Technical Association of the Pulp and Paper Industry (TAPPI) Useful Methods test 409 of between 6.78×10^{-4} and 5.65×10^{-5} newton-meter (6×10^{-3} and 5×10^{-5} inch pounds). Such a material provides a backing which is flexible but yet has a stiffness to give a bound document sufficient rigidity to hold the pages and to be placed on a shelf.

The dimensions of the back portion 12 of the backing illustrated in Figure 10 has a length which is dependent on the length of the sheets or pages 20 to be bound and is at least equal to the length of the pages to be bound. The width of the back portion 12 corresponds to the width of the loose pages 20 to be bound plus an extended width including the width of the band of binding adhesive 15 and the width of the flap 13 minus the width of the band of adhesive to bind the back page or πt, where t is the thickness of the back page. The width of the binding adhesive is determined by the product of the maximum number of pages to be bound plus 1 times the paper or page thickness (t) times pi (π). The flap has a width corresponding to at least the width of the band of adhesive plus pi times the thickness of a page to be bound but is less than R_{min} (see Figure 12) (R_{min} is the minimum radius of the wrapped back portion 12 and pages before they strike the flap) which is given by the formula

$$R_{min} = \frac{S}{2\pi} - tN_{max}$$

where S = the width of the back cover portion 12, t = the page thickness and N_{max} = the maximum number of pages. Thus, the total dimensions of the cover card stock sheet equals a length of pages to be bound and a width equal to the width of the pages plus the width of the adhesive band and the width of the flap.

The backing is preferably made for use in binding 10 to 25 sheets and includes a band of adhesive along the score line having a width equal to

$$2t\pi\ (N_{max} + 1)\ \frac{X°}{360°}$$

(t equals the sheet thickness, X° equals the minimum degree of shingling or 180°, and N equals the maximum number of pages to be bound).

In binding a plurality of loose sheets 23 the same are bound by placing the loose pages in a stack, removing the release liner 16 from the adhesive 15, placing the loose sheets onto the back portion 12, and standing up the pages in the cover to jog the pages in the cover along the marginal longitudinal edge 28 of the back portion. The longitudinal edges of the sheets and the edge 28 are then clamped by the fingers and the flap and the opposite longitudinal edge of the sheets are then

rolled back upon themselves, as illustrated in Figure 12, to drive the pages toward the score line 11 which rolling of the pages shingles the pages and exposes a margin of each page adjacent the opposite longitudinal edge, which margin and edge are then placed in contact with the adhesive 15. The amount of shingling is equal to

$$2\pi tN \frac{X°}{360°}$$

where:
t = the page thickness
N = the number of pages
X = the degrees of cover wrap in performing the step illustrated in Figure 12. A minimum cover wrap occurs at 180°.

The amount of shingling is limited by the curvature of the adhesive strip.

After the pages have been rolled with the cover and shingled against the band 15 of adhesive, the fingers clamping the pages adjacent edge 28 are released and the wrapped backing is allowed to open. A finger should then be run along the edges of the pages to press them more firmly against the adhesive 15. The flap may then be raised and the release liner 27 removed from the adhesive band 26. A cover 29 may then be placed upon the pages 20 and aligned as desired. The flap is then folded against the top surface of the cover 29 and the band of adhesive 26 will adhere the cover 29 in place on the flap 13.

A bound document can be tested to determine whether the adhesive used provided an adequate binding for the sheets in the same manner as described above.

Claims

1. A cover for binding loose sheets of known length, width and thickness comprising a folded flexible sheet of cover stock having a front and back portion separated by a fold line, said back portion having a length not less than the length of said papers to be bound and a width not less than the width of papers to be bound characterized in that the width of said back portion further includes an amount equal to the width of a band of binding adhesive, which band of pressure sensitive adhesive is adhered to the back portion adjacent to said fold line and the width of said band of adhesive is determined by the following formula:
$t\pi(N_{max} + 1)$
wherein: t = thickness of sheets
N_{max} = the maximum number of sheets to be bound
π = Pi

2. A cover according to claim 1 characterized in that said cover stock has a flexural rigidity of at least 23.06 gm-cm.

3. A cover according to claim 1 or 2 characterized in that said cover stock is paper having a caliper of about 0.228 mm and a 50.8 cm x 66.04 cm ream weight of 36.29 kg.

4. A cover according to claim 1 characterized in that the width of the back portion is greater than the width of the sheets and adhesive to include an additional width for marginal edges.

5. A cover according to claim 1 characterized in that said front portion has a length and width equal to said back portion.

6. A cover according to claim 1, 4 or 5 wherein the adhesive strip extends across the central fold score line onto the front portion.

7. A cover according to claim 1 characterized in that said front portion is narrow to form a flap which has a strip of a pressure-sensitive adhesive along the free edge of the flap for the attachment of a separate cover sheet, the flap has a width corresponding to the width of the band of binding adhesive plus an additional margin plus the width of said strip of adhesive for the attachment of a separate cover.

8. A cover according to any preceeding claim characterized in that said band of adhesive has a minimum adhesion value of:
Quick Stick = 0.22 kg per 1.27 cm, with a preferred value of 0.34 kg per 1.27 cm;
180° shear = 400 grams to 600 grams per 2.5 cm;
45° peel = 40 grams to 70 grams.

9. A cover according to claim 1 characterized in that a portion of the band of binding adhesive extends across the fold line, said portion having a minimum width of Pi times a page thickness, and wherein a double coated release liner is positioned at the fold line in contact with the band of adhesive and the extended adhesive portion is in contact with the backside of the liner.

10. A cover according to claim 1 or 9 characterized in that said band of adhesive has a minimum width as determined by the formula:
strip width =

$$2t\pi\ (N_{max} + 1)\ \frac{X°}{360°}$$

wherein: t equals the sheet thickness
X° equals the minimum degree of wrap of the sheets or 180°; and
N_{max} equals the maximum number of sheets to be bound.

11. A cover according to any preceding claim characterized in that said pressure-sensitive adhesive is a normally tacky pressure-sensitive iso-octyl acrylate/acrylic acid copolymer in a ratio of about 95:5.

12. A cover according to any preceding claim characterized in that said band of adhesive on said back portion is in contact with a low adhesion release material with a release value between 10 and 25 grams per 2.54 cm.

13. A cover according to any preceding claim characterized in that the fold line has a flexural rigidity of less than 3.4×10^{-3} newton-meter.

14. A method of binding loose sheets of paper of known length, width and thickness comprising the steps of
selecting a cover having a size corresponding to the size of the sheets to be bound, and a strip of pressure-sensitive adhesive along the central fold score line,
removing the release liner from the adhesive strip,
jogging the loose sheets to be bound against a flat surface along a longitudinal edge,
clamping the sheets together along the opposite longitudinal edge,
rolling the sheets upon themselves, causing the unclamped longitudinal edge to become shingled,
placing the sheets inside of the cover up to the central fold score line, and
pressing the adhesive strip into contact with the shingled edges of the rolled sheets.

15. A method according to claim 14 characterized in that said longitudinal edge of said cover opposite said fold line is aligned with a said longitudinal edge of said sheets during said jogging step, and said rear cover portion and said rolling and placing steps comprise rolling said sheets with said sheets against the inside surface of said rear cover portion until the unclamped edges of said sheets become shingled and said strip of pressure sensitive adhesive is completely covered, and unrolling the cover and then pressing the shingled edges into the adhesive.

16. A method of binding loose pages according to claim 15 characterized in that said method includes the step of removing a liner from an adhesive strip on the frontal portion of a said cover and attaching a separate front cover to said adhesive strip.

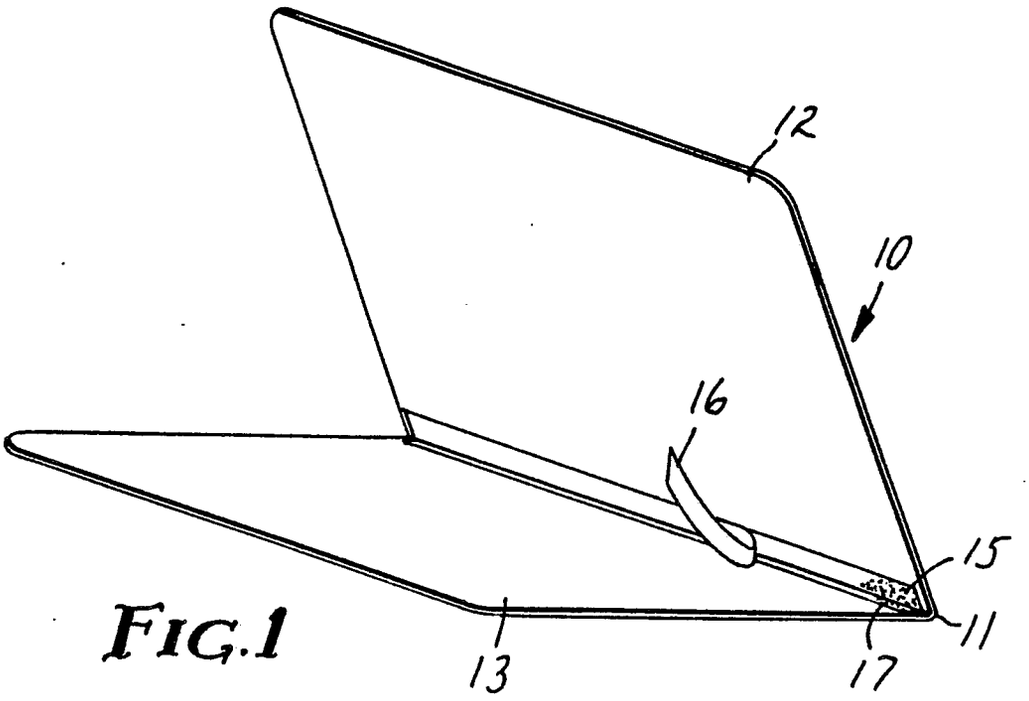

FIG.1

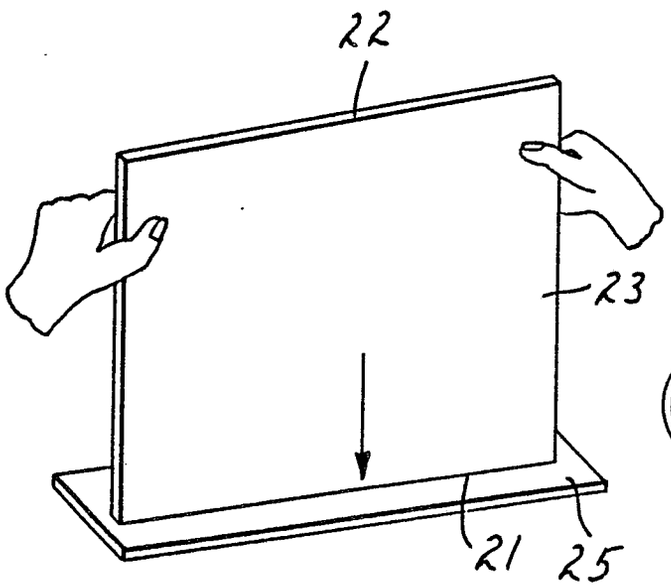

FIG.2

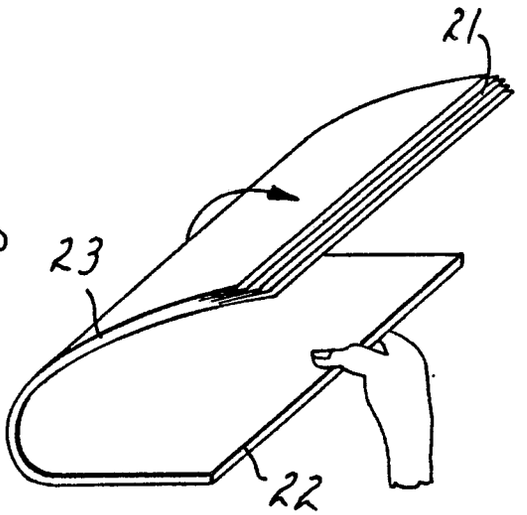

FIG.3

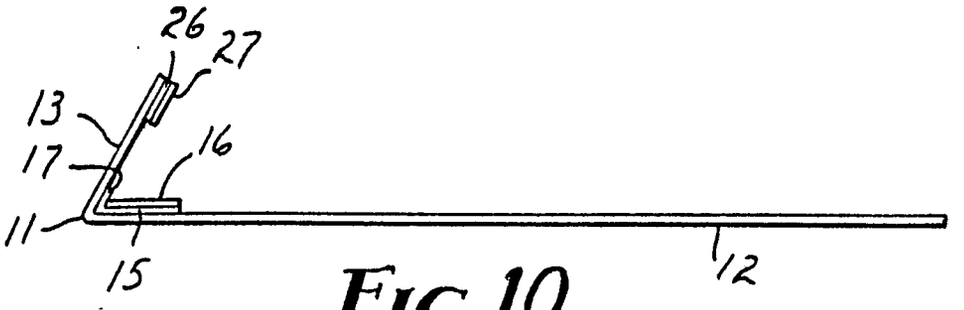

FIG.10

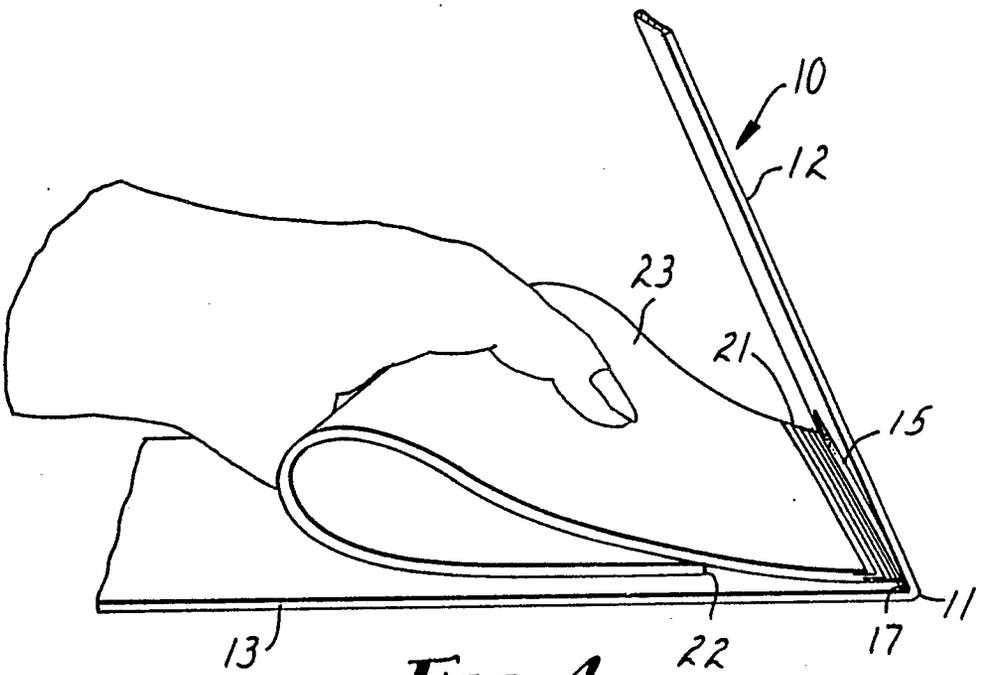

FIG. 4

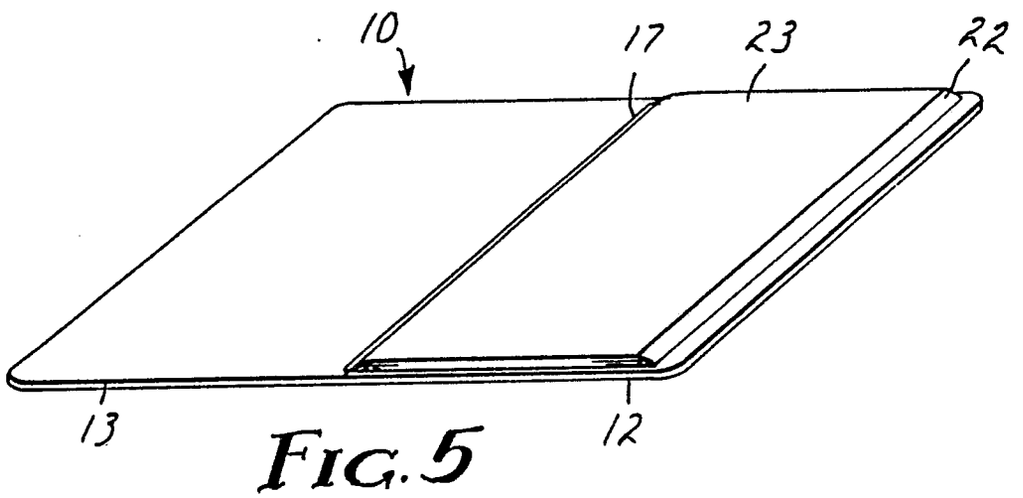

FIG. 5

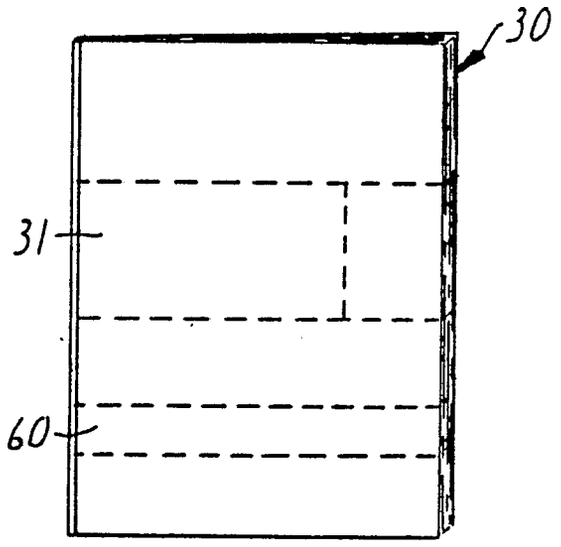

FIG. 6

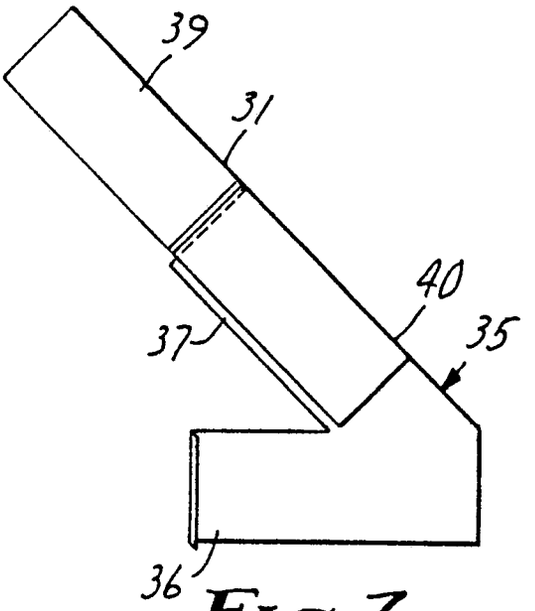

FIG. 7

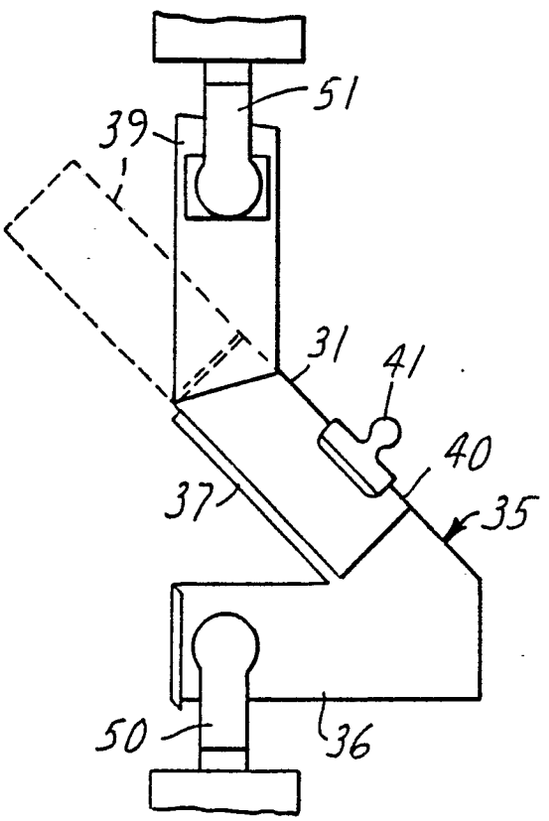

FIG. 8

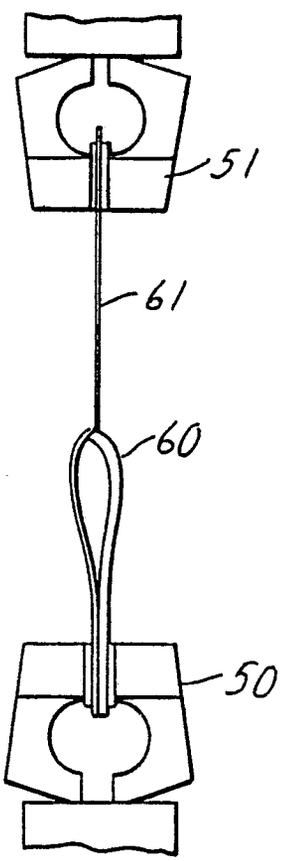

FIG. 9

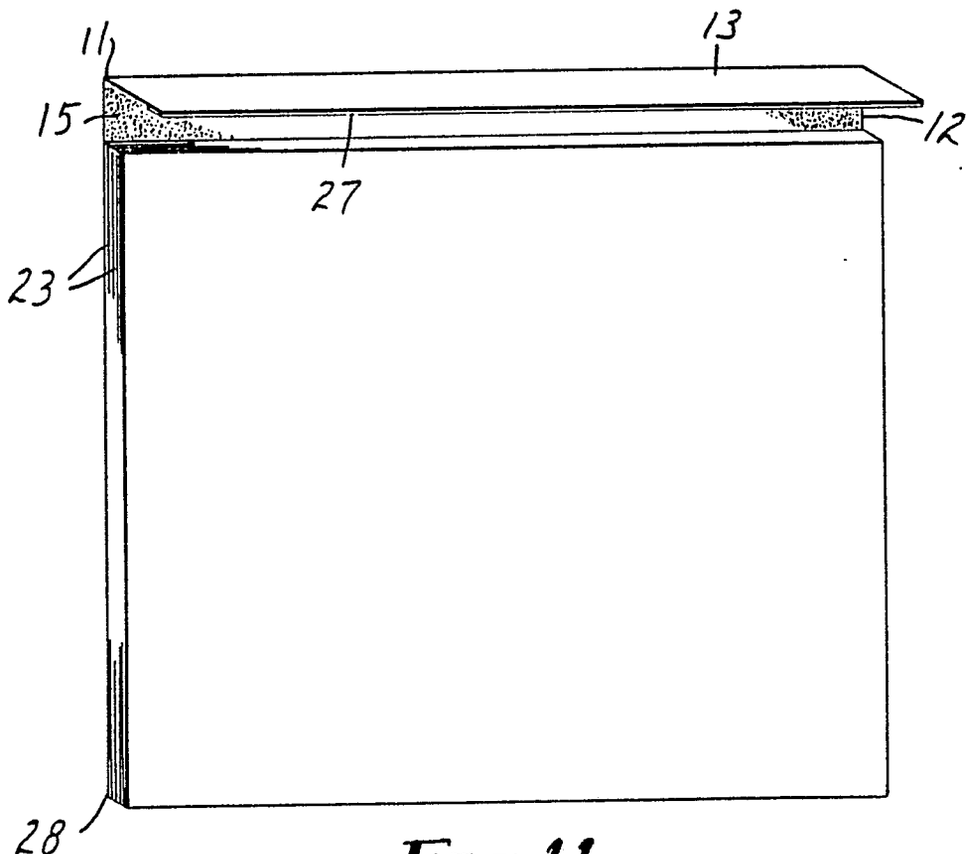

FIG.11

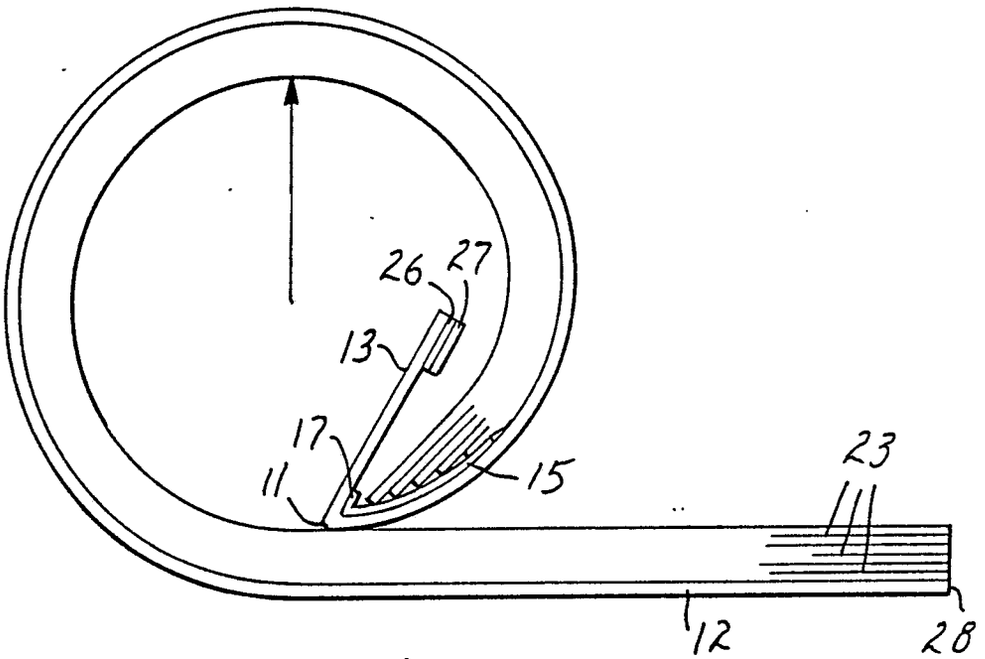

FIG.12

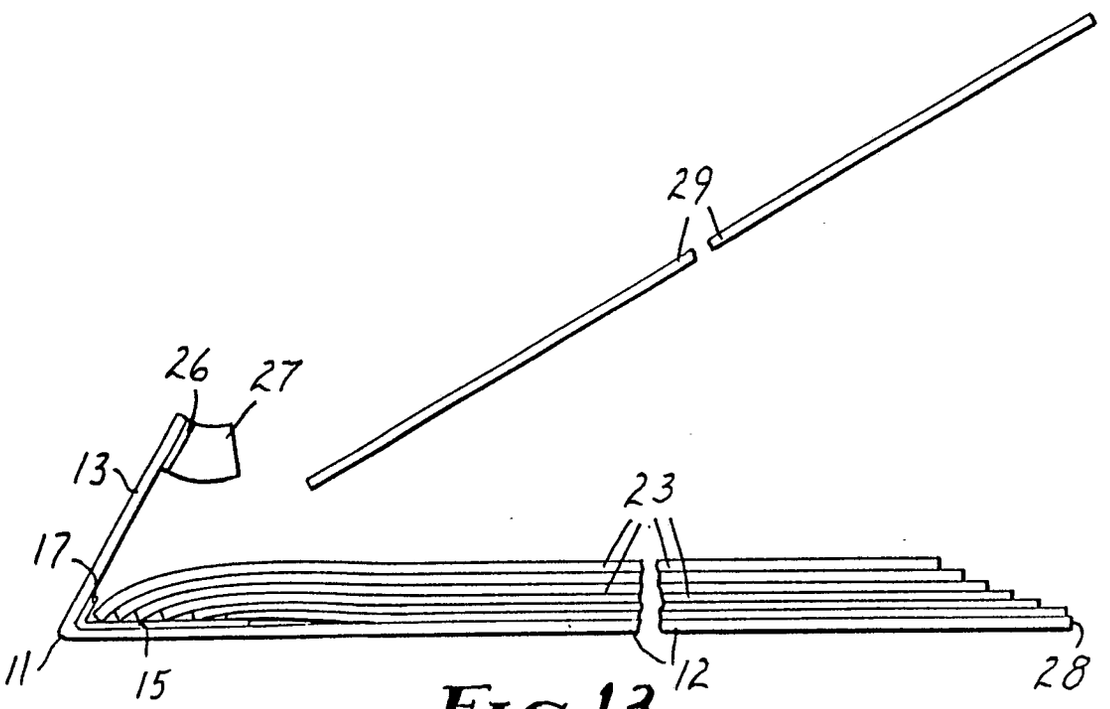

FIG.13