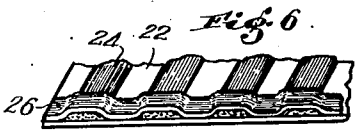
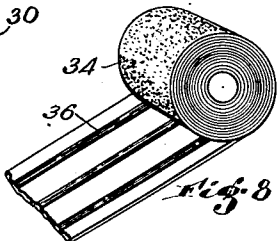
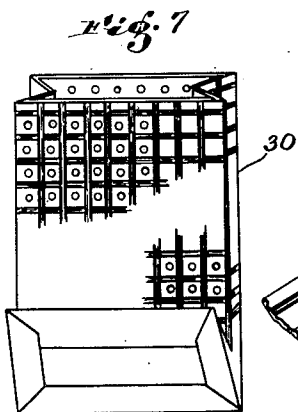
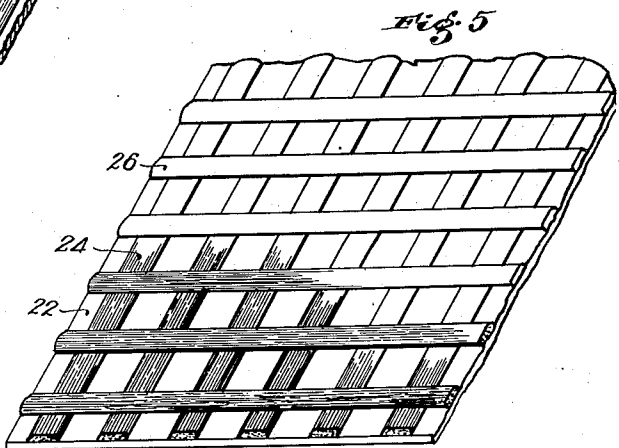
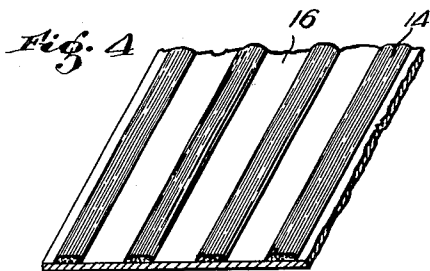
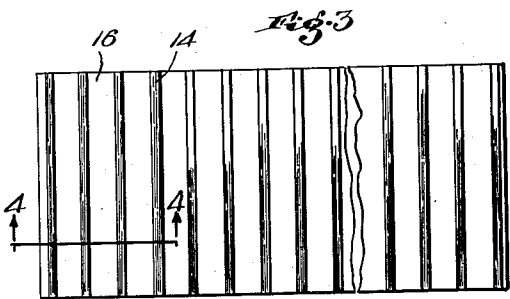
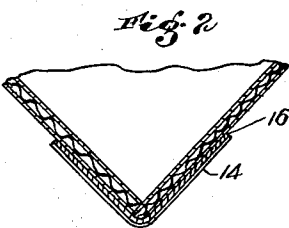
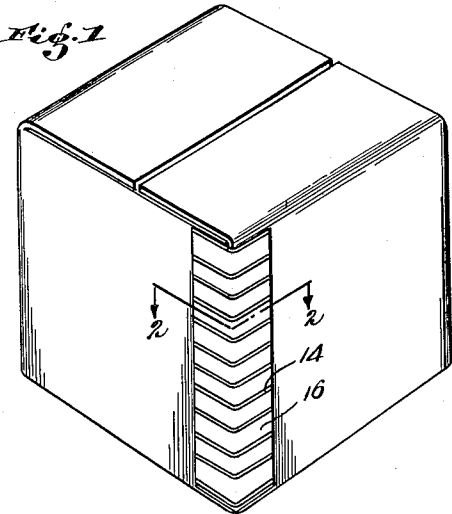


Sept. 16, 1952

A. E. CARLSON  
REINFORCED PAPER ARTICLE  
Filed Aug. 10, 1949

2,610,936



Inventor  
Arthur E. Carlson  
by Kenway, Jenney, Witter  
& Hildreth, Attys.

## UNITED STATES PATENT OFFICE

2,610,936

## REINFORCED PAPER ARTICLE

Arthur E. Carlson, Hingham, Mass.

Application August 10, 1949, Serial No. 109,482

17 Claims. (Cl. 154-53.5)

1

The present invention relates to reinforced materials and articles of paper or other flexible sheet material, which may be formed into tapes and sheets, as well as into flexible bags and the like. By way of example, the invention is particularly applicable to the provision of stay strips or tapes for securing and reinforcing the corners of paper cartons and the like. In addition, the invention comprehends the provision of sheets and wrappings, as well as containers and bags of paper or other thin flexible material, economical to manufacture yet possessing very substantial resistance to tearing and rupture as compared with conventional paper articles.

The problem of enhancing the tear resistance of paper has received particular attention in connection with the provision of stay strips or tapes for securing the corners of paper cartons. Because paper stock exhibits its greatest strength longitudinally and is relatively weaker transversely, the problem is especially acute, since the need in corner reinforcement is for transverse strength. Accordingly, stay tapes have customarily employed some form of transverse reinforcement, such as cords, open-weave fabric, or unspun natural fibers, embedded in an asphaltum adhesive between two plies of paper stock.

Such a construction is necessarily relatively thick, not only because of the two layers of paper and the intermediate reinforcing material, but also because of the very substantial amounts of adhesive that are necessary to bond the plies around the intervening cords or fibers. In view of the large amounts of adhesive required, only a low-cost adhesive such as asphaltum is economically feasible, yet asphaltum is unsatisfactory because of its brittleness at low temperature and softness at elevated temperatures, and its presence interferes with and renders difficult the reclamation and reuse of the paper. Furthermore, reinforced paper of such form of construction is not well suited for bags nor as wrappings for foodstuffs, upholstered furniture, clothing and other products because of the hazard of discoloration and contamination from the asphaltum.

It is therefore an object of the present invention to provide a novel form and construction of reinforced paper, particularly adapted for use in sheet form for wrappings and flexible containers of superior tear resistance, which will avoid many of the drawbacks and disadvantages of existing tapes and papers.

More particularly, it is an object of the invention to provide a reinforced paper which may readily be manufactured in strip or sheet form,

2

requiring a minimum of paper and employing a non-asphaltic adhesive, yet providing a tear resistance fully the equal of the relatively bulkier two-ply reinforced papers and tapes heretofore available.

In accordance with these objects, one of the features of the invention involves the provision of a reinforced paper or tape employing only a single ply or thickness of paper stock with thin reinforcing means applied to one face thereof in such fashion as to impair neither the utility nor the appearance of the finished product. More specifically, these reinforcing elements consist of narrow bands or ribbons disposed at spaced intervals along the paper, with adhesive employed only at the zone of contact between reinforcing bands and paper. As will more fully appear, these bands or ribbons are made up of a multiplicity of extremely fine continuous synthetic filaments, thus providing a high aggregate tensile strength with minimum thickness. Such construction not only makes the most effective use of the materials, but it permits a non-asphaltic adhesive economically to be employed.

In the drawings illustrating the invention in its several embodiments, Fig. 1 shows my improved stay tape as utilized in reinforcing the manufacturer's joint of a paper carton; Fig. 2 is a sectional detail thereof; Fig. 3 is a view, approximately full scale, of a typical form of stay tape, showing the reinforced face; Fig. 4 is an oblique view and sectional detail of the tape, on a substantially enlarged scale; Fig. 5 is a similarly taken view of a modified form wherein reinforcements are provided in both directions; Fig. 6 is a fragmentary detail showing in somewhat exaggerated manner for purposes of illustrating the crossing relationship of the reinforcing elements of Fig. 5; Fig. 7 is a view of a reinforced paper bag embodying the reinforced paper of Fig. 5; and Fig. 8 is a view of a reinforced paper tape wherein the reinforcing elements are arranged longitudinally of the strip.

In making up a stay tape such as shown in Figs. 1-4, a kraft paper stock of 60 to 80 lbs. per ream will be found suitable. Such stock or web corresponds approximately to or will be only slightly heavier than one of the plies of the conventional reinforced tapes heretofore available. Such stock, without the reinforcing to be described, would provide inadequate tear resistance when used along the manufacturer's joint of a corrugated carton or box.

To increase the transverse strength of this paper stock, reinforcing bands or ribbons in-

licated at 14 are provided at intervals. It will be understood that in manufacturing these stay strips, the paper stock will be of substantial width, and the elements 14 will extend thereacross, after which the stock will be cut into strips 16 of appropriate width for corner stays.

The reenforcing elements 14 are characterized by being formed of a great number of very fine continuous filaments of an organic synthetic material, such as rayon or nylon. In comparison with the vegetable or animal fibers heretofore used, these fine untwisted synthetic filaments permit a thin flat ribbon-like band to be obtained having a very high tensile strength in the aggregate, yet only a few thousandths of an inch in thickness.

"Filament," as used herein, is a tiny member. In the textile industry hundreds of such filaments are twisted together to form a yarn for weaving. Applicant does not use the term filament in the sense of a large member where a single filament constitutes a weaving material. Such filaments are properly referred to as mono-filaments.

A "compact thin ribbon," as used herein, consists of a plurality of substantially parallel contacting filaments of synthetic yieldable material, which ribbon has a thickness equal to the diameter of a number of filaments and a width many times greater than the thickness.

For these reenforcing ribbons, I prefer to employ a very considerable number of individual filaments, at least approximately one hundred and preferably as many as five hundred or more filaments of rayon, nylon, or other untwisted synthetic material. Thus, a ribbon of 1650 denier rayon, approximately 0.0625" wide and only about 0.0035" in thickness, may contain as many as one thousand individual filaments arranged in a plurality of levels. Such ribbons, spaced about four to the inch over the paper, afford a very marked increase in tensile strength as compared with the unreenforced paper, even though the ribbon adds but little to the overall thickness of the paper. Alternatively, a somewhat smaller ribbon, of approximately 800 denier, may be used by increasing the number of ribbons per inch of paper. While the individual filaments of the ribbon are considerably weaker than the natural fibers such as sisal that heretofore have been employed, nevertheless when the filaments are arranged in a flat, compact untwisted band, the aggregate strength of the unit as a whole is very considerable and extremely effective to reinforce the paper stock in the direction of the ribbon.

To secure these reenforcing elements to the paper stock while employing a minimum of adhesive, the adhesive is employed only at the interface between the paper and the ribbons of filaments. This is accomplished most readily by coating the ribbon with adhesive before bringing the ribbon into contact with the paper. Because of the multiplicity of fine filaments and their arrangement in a flat ribbon, the ribbon readily takes up by capillary action a sufficient quantity of adhesive to saturate the ribbon and thereby insure a firm bond of all filaments to one another and to the paper.

While various types of adhesive may be employed, I prefer to use a non-asphaltic waterproof adhesive, for example, an adhesive employing a synthetic resin, or a latex-base adhesive. Such an adhesive, though appreciably more expensive than the black asphaltum usually employed in stay tapes, possesses marked ad-

vantages over the low cost asphalt. Because of the localized application of the adhesive, wherein the ribbons of fine filaments are relied on to carry the adhesive to the paper, only small amounts of adhesive, in some cases as little as ten pounds per ream of paper, may be required to provide a strong bond of all filaments, as compared with as much as one hundred pounds of asphalt per ream of paper which may be employed in the case of the two ply laminated tapes in order to bond the plies of paper and reenforcing cords or fibers.

The adhesively-wetted reenforcing ribbons are preferably secured to the kraft stock at evenly spaced intervals, as closely spaced as may be necessary to attain the desired strength. In general, approximately three to six ribbons per inch will be satisfactory. Upon bringing the ribbons into contact with the paper, pressure may be applied to accelerate the bonding of the adhesive, pressure also serving to spread out the filaments and indent the ribbon slightly in the paper, thereby reducing to a minimum the height of the reenforcing ribbons above the adjacent paper stock. If desired, the filaments or bands may be dyed, or coloring added to the adhesive, to cause the color of the ribbons to blend with the paper stock and thus be relatively inconspicuous in the finished product.

Because of the localized application of adhesive beneath the reenforcing bands of filaments, the paper stock between bands is uncoated, and may therefore receive a subsequently applied adhesive. Thus, where it is desired to employ the reenforcing tape with the reenforcing elements toward the box, the reinforced face of the tape may be coated with the usual gumming or water-soluble adhesive, or with other suitable adhesive. The thinness of the reenforcing bands of filaments is such that the tape may be caused firmly to adhere to the box without requiring that excessive amounts of adhesive be employed. It is also possible to apply the adhesive to the unreenforced face of the tape, in order that the reenforcing bands may be disposed on the outside of the tape as shown in Figs. 1 and 2. Because of their thinness and uniform spacing, there will be no sacrifice in appearance in allowing the reenforcing elements to be exposed on the exterior of the tape, nor will displacement of the bands or individual filaments occur through abrasion, in view of the saturation of the filaments by the adhesive preliminary to applying the ribbons or bands to the paper stock.

Accordingly, whichever face of the stay tape is applied to the corner of the carton, there results a strongly reenforced joint, well capable of resisting bursting stresses to which the box or carton may be subjected, yet low in cost and of slight overall thickness by reason of the single ply construction with reenforcing elements thinner than even a single average sisal fiber. This overall thinness of the tape, approximately half the thickness of conventional reenforced tapes results in greater pliability, which in turn makes possible higher speeds of operation of carton taping equipment. The increased pliability likewise permits improved bonding to the carton, yet with less adhesive than customarily required.

The construction of the invention is likewise well adapted to provide paper sheets such as wrappings and other articles having two-way reenforcement. Such a sheet is illustrated in Fig. 5, wherein the paper stock 22 is provided with one set of spaced bands or ribbons 24 formed of

5

a plurality of untwisted continuous synthetic filaments, extending in one direction of the paper, while a similar set of ribbons 26, of the same or different interval spacing, is arranged transversely of the first set. As clearly seen to the left of Figure 5, the exposed surfaces of the ribbons 26 are arcuate and the unexposed surfaces, that is, the surfaces of the ribbon 26 in contact with the sheet 22, are substantially flat. As shown in greater detail in the fragmentary view, Fig. 6, intimate overall contact between the thin ribbons or bands and the paper stock results, as compared with the relatively poor contact that would result if cords or sisal fibers were employed.

Such two-way reinforced sheet material lends itself especially well to the fabrication of wrapping sheets, bags, or other forms of containers. For certain purposes, the paper stock may be waterproofed, as by a latex coating applied either before or after the reinforcing elements are applied. In view of the use of a latex tape adhesive as the preferred bonding adhesive, either alternative may be followed. Such paper, reinforced on one side, provides a highly satisfactory moisture vapor barrier for wrapping foods and the like without risk of rupture or tearing of the wrap, such as might occur with unreinforced paper.

The two-way reinforced paper likewise permits the equivalent of an open-weave or mesh bag to be provided, while using conventional paper bag machinery. By applying the two-way reinforcement to the kraft stock, waterproofed or not as may be desired, with apertures in the areas between reinforcing bands, a relatively open mesh is approximated. Such sheet material may readily be formed on conventional paper bag machinery into bags 30 such as shown in Fig. 7. Such a bag provides at low cost an open or ventilated container for fruit, vegetables and the like, strongly resistant to tearing and, if waterproofed, substantially unaffected by moisture.

For flexible containers and bags of exceptional strength, more than one layer of reinforced sheet paper may be employed. In such event, the separate plies may advantageously be unbonded one to another, with all or only some of the individual layers bearing the thin-ribbon reinforcing elements. By reason of the great tensile strength of these ribbons, the hazard of tearing is substantially reduced, and even though the bag may accidentally become punctured in one or more spots, the perforation will not develop into a tear as is the case with more conventional materials.

The invention may also be effectively utilized in providing gummed tapes of exceptional strength longitudinally. For such purposes, the reinforcing ribbons may be applied lengthwise of the web of paper stock, after which the papers may be slit into strips of suitable width to form rolls 34 (Fig. 8), in which two or more reinforcing ribbons 36 of continuous fine filaments are adhesively secured to the back or ungummed surface of the paper. Such a construction provides a greatly increased longitudinal strength at but slight increase in cost over plain gummed tape.

Reference is made to my copending application Serial No. 216,054, filed March 16, 1951, as a continuation-in-part of this application.

While the invention has been described in various forms and embodiments, illustrating the features of the invention as applied to tapes having lateral and longitudinal reinforcements, as well as to sheet material which may be formed into

6

wrappers, bags and the like, it will be understood that such description is for purposes of illustration rather than by way of limitation, and that the invention may be embodied in other constructions and arrangements within the spirit of the appended claims. It will also be understood that while the invention has been particularly described in conjunction with the reinforcement of paper, it may be utilized effectively for the provision of reinforced sheet material other than paper, for example thin sheet material or films of cellulose acetate or other synthetic thin flexible material.

I claim as my invention:

1. A reinforced paper article comprising a single ply of paper and a plurality of reinforcing elements secured to one face thereof in spaced substantially parallel relation, the reinforcing elements consisting of a multiplicity of fine continuous untwisted organic synthetic filaments disposed in substantially parallel relation in a thin compact ribbon, the elements being secured to the paper by adhesive applied only between the reinforcing ribbons and the paper.

2. A reinforced tape comprising a single paper strip having a plurality of reinforcing elements arranged on one face thereof in spaced and substantially parallel relation, each element consisting of a multiplicity of fine substantially continuous filaments of organic synthetic material disposed in substantially parallel and substantially untwisted relation in a compact thin ribbon of substantially greater width than the thickness thereof, said filaments in each said ribbon being adhesively secured together and to said face of said paper strip to maintain said ribbon in said compact thin shape.

3. A stay tape comprising a single paper strip having a plurality of reinforcing elements arranged on one face thereof at spaced intervals along said strip and extending transversely thereof, each said element consisting of a multiplicity of fine substantially continuous filaments of organic synthetic material disposed in substantially untwisted and parallel relation in a compact thin ribbon of substantially greater width than the thickness thereof, said filaments in each said ribbon being adhesively secured together and to said face of said strip maintaining said ribbon in compact thin shape with a corresponding wide exposed area.

4. A reinforced tape comprising a single paper strip having a plurality of reinforcing elements arranged on one face thereof at spaced intervals along said strip and extending longitudinally thereof, each said element consisting of a multiplicity of fine substantially continuous filaments of organic synthetic material disposed in substantially untwisted and parallel relation in a compact thin ribbon of substantially greater width than thickness, said filaments in each said ribbon being adhesively secured together and to said face of said paper strip maintaining said ribbons in compact thin shape.

5. A reinforced sheet paper product comprising a single sheet of paper having a plurality of reinforcing elements arranged on one face thereof in substantially parallel spaced relation, each said element consisting of a multiplicity of fine substantially continuous filaments of organic synthetic material disposed in substantially parallel and substantially untwisted relation in a compact thin ribbon of substantially greater width than thickness, a second plurality of similar reinforcing elements arranged on a face of said paper

7

sheet in a direction substantially transverse to the direction of the first-mentioned reinforcing elements, said filaments in said reinforcing elements in each said plurality thereof being adhesively secured together and to the adjacent face of said paper sheet maintaining said elements in compact thin shape.

6. A reinforced sheet paper product comprising a single paper having a plurality of reinforcing elements arranged on one face thereof in substantially parallel spaced relation, each said element consisting of a multiplicity of fine substantially continuous filaments of organic synthetic material disposed in substantially parallel and substantially untwisted relation in a compact thin ribbon, a second plurality of similar reinforcing elements arranged on a face of said paper sheet in a direction substantially transverse to the direction of the first-mentioned reinforcing elements, said filaments in said reinforcing elements in each said plurality thereof being adhesively secured together and to the adjacent face of said paper sheet maintaining said elements in compact thin shape, said paper sheet being perforated intermediate the reinforcing elements to provide a relatively open tear-resistant reinforced sheet.

7. A reinforced waterproof paper comprising a single sheet of waterproof paper having a coating of waterproofing material thereon, and a plurality of reinforcing elements adhesively secured to a surface of the paper in spaced relation with each other, the reinforcing elements consisting of a multiplicity of fine substantially continuous and substantially untwisted filaments of organic synthetic material disposed in substantially parallel relation to form compact thin ribbons, the bonding adhesive between paper and ribbons having a base similar to and compatible with the character of the waterproofing material with which the paper is coated.

8. A reinforced waterproof paper comprising a single sheet of waterproof paper having a latex-base coating of waterproofing material thereon, and a plurality of reinforcing elements adhesively secured to a surface of the paper in spaced relation with each other, the reinforcing elements consisting of a multiplicity of fine substantially continuous and substantially untwisted filaments of organic synthetic material disposed in substantially parallel relation to form compact thin ribbons, the bonding adhesive between paper and ribbons having a latex base similar to and compatible with the character of the waterproofing material with which the paper is coated.

9. A stay tape comprising a single paper strip having a plurality of reinforcing elements adhesively secured to one face thereof in substantially parallel spaced relation extending transversely of the tape, each element consisting of approximately 100 to 1000 untwisted filaments of organic synthetic material of approximately 800 to 1650 denier, the filaments being arranged in the form of a compact thin ribbon of approximately 0.0035 inch in thickness, there being between three and six ribbons per inch of tape, the adhesive for bonding the ribbons to the paper being disposed solely at the zone of contact between ribbons and paper.

10. A reinforced bag comprising a single sheet of paper provided with a plurality of ribbon-like reinforcing elements arranged in rows and tiers to define open spaces on said sheet, each of said ribbon-like elements consisting of a multiplicity of fine substantially continuous filaments

8

of organic synthetic material disposed in substantially untwisted and parallel relation to form a compact thin ribbon of substantially greater width than thickness, said filaments in each said ribbon being adhesively secured together and to said paper sheet maintaining said ribbons in compact thin shape, and said sheet having a plurality of ventilating apertures therein each extending through one of said open spaces.

11. A reinforced paper product comprising a single paper web a plurality of elongate reinforcing elements overlying one surface of said web in spaced relation, each of said reinforcing elements consisting essentially of a multiplicity of fine substantially continuous and substantially untwisted organic synthetic filaments arranged in close side by side and overlying relation to form a thin band, adhesive material substantially saturating each said band and securing said filaments therein to each other and to said web surface in compact form minimizing the projection of each said band above the plane of said surface, and each said band being of substantially greater width than the maximum thickness thereof to provide a correspondingly wide area for intimate adhesive contact between said adhesive-saturated band and said web surface.

12. A reinforced paper product comprising a single paper web, a plurality of elongate reinforcing elements overlying one surface of said web in spaced and substantially parallel relation, each of said reinforcing elements consisting essentially of a multiplicity of fine substantially continuous and substantially untwisted organic synthetic filaments arranged in close side by side relation in a plurality of levels to form a thin band equal in thickness to the combined thickness of a plurality of said filaments, adhesive material substantially saturating each said band to secure said band to said web surface and to secure said levels of filaments together in compact form, and each said band being of substantially greater average width than the maximum thickness thereof to provide a correspondingly wide area for intimate adhesive contact between said adhesive-saturated band and said web surface.

13. A reinforced paper product comprising a single paper web, a plurality of elongate reinforcing elements overlying one surface of said web in spaced and substantially parallel relation, each of said reinforcing elements consisting essentially of a multiplicity of fine substantially continuous and substantially untwisted synthetic filaments arranged in close side by side and overlying relation to form a thin band, adhesive material substantially saturating each said band and securing said filaments therein to each other and to said web surface in compact form minimizing the projection of each said band above the plane of said surface, said adhesive material being localized within said bands and in the areas between said bands and said web leaving the remainder of said web surface substantially free thereof, and each said band being of substantially greater width than the maximum thickness thereof to provide a correspondingly wide area for intimate adhesive contact between said adhesive-saturated band and said web surface.

14. A stay tape comprising a single paper web, a plurality of elongate reinforcing elements overlying one surface of said web and extending transversely of said web in spaced relation, each of said reinforcing elements consisting essentially of a multiplicity of fine substantially continuous

and substantially untwisted organic synthetic filaments arranged in close side by side and overlying relation to form a thin band, adhesive material substantially saturating each said band and securing said filaments therein to each other and to said web surface in compact form minimizing the projection of each said band above the plane of said surface, each said band being of substantially greater width than the maximum thickness thereof to provide a correspondingly wide area for intimate adhesive contact between said adhesive-saturated band and said web surface, and said web also having a coating of adhesive substantially covering one surface thereof.

15. A stay tape comprising a single paper web, a plurality of elongate reenforcing elements overlying one surface of said web and extending transversely of said web in spaced and substantially parallel relation, each of said reenforcing elements consisting essentially of a multiplicity of fine substantially continuous and substantially untwisted organic synthetic filaments arranged in close side by side and overlying relation to form a thin band, adhesive material substantially saturating each said band and securing said filaments therein to each other and to said web surface in compact form minimizing the projection of each said band above the plane of said surface, a coating of adhesive material overlying said web surface, each said band being of substantially greater width than the maximum thickness thereof to provide a correspondingly wide area for intimate adhesive contact between said adhesive-saturated band and said web surface, and each said band being substantially flat across at least the major portion of the surface exposed.

16. A reenforced stay tape comprising a single strip of paper, a plurality of reenforcing elements each consisting of a multiplicity of fine substantially continuous and substantially untwisted organic synthetic filaments forming a compact thin ribbon of substantially greater width than the thickness thereof and having arcuate exposed

and flat unexposed shape, said reenforcing elements being arranged transversely at spaced intervals upon the paper, adhesive material originally drawn into the ribbon by capillary attraction in sufficient quantity to saturate the ribbon and bonding all the filaments to one another and to the paper, the adhesive material being substantially confined to the areas of the paper covered by the ribbons and to thereby prevent displacement of the ribbons and individual filaments through abrasion, and adhesive material applied to the surface of the paper opposite the ribbons.

17. A reenforced stay tape as defined in claim 16 wherein the adhesive material bonding the reenforcing elements to the paper is a waterproof adhesive material having a dye incorporated therein to produce a desired color in said reenforcing elements while bonding the filaments therein together and to the paper, said adhesive material having substantially constant strength characteristics throughout the normal temperature range of use.

ARTHUR E. CARLSON.

#### REFERENCES CITED

The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

| Number    | Name     | Date          |
|-----------|----------|---------------|
| 272,323   | Redlick  | Feb. 13, 1883 |
| 850,697   | Voss     | Apr. 16, 1907 |
| 1,195,430 | Angier   | Aug. 22, 1916 |
| 1,679,721 | Howard   | Aug. 7, 1928  |
| 1,866,513 | Ballard  | July 5, 1932  |
| 2,024,224 | Humphner | Dec. 17, 1935 |
| 2,283,202 | Guyard   | May 19, 1942  |
| 2,521,055 | Foster   | Sept. 5, 1950 |

#### FOREIGN PATENTS

| Number  | Country   | Date           |
|---------|-----------|----------------|
| 470,558 | Germany   | Jan. 19, 1929  |
| 105,265 | Australia | Sept. 22, 1938 |