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E. H. ANGIER

METHOD AND APPARATUS FOR PRODUCING COMPOUND PAPER

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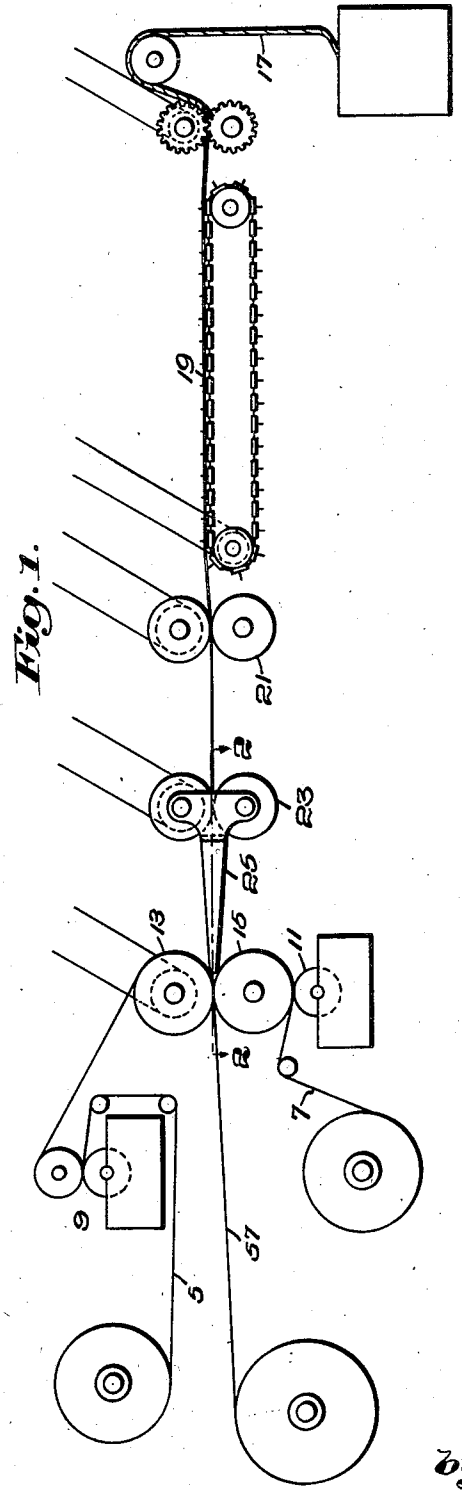


Fig. 1.

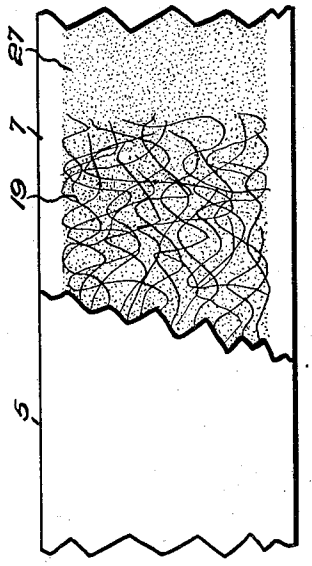


Fig. 3.

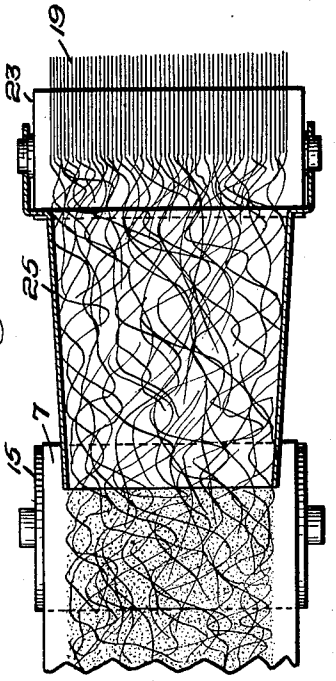


Fig. 2.

Inventor:
Edward H. Angier.
by Emery, Booth, Janney & Varney
Attys

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UNITED STATES PATENT OFFICE.

EDWARD H. ANGIER, OF FRAMINGHAM, MASSACHUSETTS.

METHOD AND APPARATUS FOR PRODUCING COMPOUND PAPER.

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This invention relates to a novel method and mechanism for producing an improved form of reinforced paper. The particular embodiment of the invention chosen for purposes of illustration is adapted to provide a duplex paper in the form of a narrow strip particularly adapted for application in helical form to the wrapping of articles, for example, in the manner customary in the wrapping of vehicle tires.

My invention will best be understood by reference to the following description taken in connection with the accompanying drawings, wherein:

Fig. 1 is a diagrammatic view in side elevation illustrating the production of the compound paper;

Fig. 2 is a section on the line 2—2 of Fig. 1 on an enlarged scale; and

Fig. 3 is a plan view of a portion of a compound paper strip with parts successively broken away.

Many kinds of reinforced paper have been made and practically used embodying two sheets of paper united by a suitable adhesive in which was embedded reinforcing yarns, fibers or wires. The most usual and most economical method of inserting the reinforcements has been to run them in longitudinally of the web of paper allowing them to be drawn out lengthwise by the action of squeeze rolls used to unite the sheets or webs of paper face to face. The result was a paper having reinforcements extending in one direction only. However, the word "reinforcement" might be considered somewhat misleading because under test so-called reinforced duplex paper does not show a higher tensile strength than the same paper without reinforcements. This statement is based on empirical observation but I suggest, without wishing in any way to be bound by the suggestion, that the lower tensile strength is due at least in part to the fact that the interposed fibers prevent that intimate uniting of the two sheets of paper necessary for heir most effective mutual reinforcement and that the so-called reinforcements have a limit of elasticity and coefficient of expansion different from those of the paper. Thus in the case of cotton yarns I believe that the yarns stretch and give to strains which break the paper and in the case of unspun fibers of sisal I believe that the fibers snap first. The effectiveness of the reinforcing materials was less to give tensile strength than to impart a toughness to the paper and a resistance to tearing, especially to the continuation of a tear once started.

In accordance with my present invention I provide a paper reinforced preferably with unspun fibers applied intentionally in a more or less miscellaneous manner to lend toughness to the paper and so arranged as to provide a resistance to tearing in all directions. For reinforcing material I preferably utilize relatively long unspun fibers, conveniently the fibers of sisal.

Referring now to the drawings, in Fig. 1 I have illustrated two sheets or webs of paper 5 and 7 as drawn from supply rolls through coating mechanisms 9 and 11 respectively adapted to smear one side thereof with a coating of a suitable adhesive such, for instance, as black asphalt and which are led through the pair of squeeze rolls 13 and 15 which press them together to form a compound web 57 which is rewound as indicated at the left of the figure. The method of reinforcing herein disclosed resembles those previously known in that the reinforcing materials are introduced at the bite of the squeeze rolls to be embedded in the adhesive coating uniting the two paper webs.

The sisal fibers are procured commercially in the form of a sliver 17 and by any suitable means, herein diagrammatically exemplified by the carding apron 19 and the pairs of drawing rolls 21 and 23 this sliver may be drawn out into a tenuous sheet or bat of fibers 19 which, because of the tension applied in the carding and drawing out process, will be arranged in a generally parallel relation as illustrated at the right of Fig. 2. The distribution of the fibers in this tenuous sheet is relatively sparse so that they may be distributed in the adhesive which unites the two sheets without preventing those sheets from being firmly united together, the adhesive passing through the interstices between the individual fibers. Of course, the fibers will to a certain extent overlap and be mixed together even in their combed out relation but in a sense it might be said that a sheet is prepared which is one fiber thick as contrasted with something in the nature of a sheet of felt and while the denseness of the fibers may considerably vary without departing from the spirit of my invention I

refer to a relatively sparse distribution and to a tenuous sheet to distinguish from a layer of fibers similar to a felt. Obviously, moreover, reasons of economy dictate the use of relatively few fibers so far as consistent with adequate reinforcement of the paper.

If the fibers were drawn out into generally parallel relation as shown at the right in Fig. 2 and were fed to the bite of the squeeze rolls 13 and 15 and drawn in between the sheets of the paper by the action of the rolls, they obviously would be extended substantially longitudinally of the paper, either in a state of tension or approximately straight. In accordance with my invention I provide for buckling the fibers by longitudinal compression and for securing them between the sheets of paper in this buckled condition so that while arranged in a more or less miscellaneous manner as regards the fibers as a whole, individual fibers will have an irregular wavy form as illustrated in Fig. 3. This may be effected by driving the last drawing out rolls 23 at a greater linear speed than the squeeze rolls 13 and 15 so that when the leading ends of the fibers are entered into the bite of the squeeze rolls a longitudinal compression will be applied to the fibers which will buckle them and cause them to assume a wavy contour and they will be pressed into adherence to the paper in this wavy or buckled condition as illustrated in Fig. 2. As a result of this buckling of the fibers and their more or less miscellaneous application they will be applied to the paper in such a way as to reinforce it in all directions against tearing as contrasted with making what might be denominated a grain as in a case where they are applied parallel. In the zone of application of the fibers, although they are relatively sparsely distributed in a tenuous sheet as already explained, the distribution is miscellaneous but relatively uniform and the paper is reinforced throughout. A further advantage of the wavy application of the fibers is that it provides yieldability in the fibers and if the paper bursts under a strain their wavy form facilitates their pulling free of the adhesive and straightening out for a limited length adjacent the break. In this way they may resist breakage and while the integrity of the wrapping is destroyed by the rupture of the paper the broken ends may hold together so that the wrapping will not unravel and fall away.

I prefer to provide means for limiting the lateral deflection of the fibers under the buckling action of the rolls 23 and for this purpose I have shown them fed from these rolls to the squeeze rolls 13 and 15 through a guide 25 having side walls as best illustrated in Fig. 2 which will limit the lateral deflection of the fibers. The fibers will thus pass to the paper as is illustrated in Fig. 2 and be applied thereto in a zone having straight marginal portions, the waves or sinuosities of the adjacent individual fibers defining this margin. The sinuosities might be described as tangent to the boundary line although that word is not to be understood in the strict geometrical sense as obviously some finite length of fiber at the crest of one or more waves may be flattened and made to lie along the marginal portion. By this flattening and crowding of the fibers to a common boundary an extra reinforcement against cross-tearing of the paper is provided along the edges thereof.

Preferably the coating mechanisms 10 and 11 are so arranged as to apply the asphalt along a central zone of the paper only, as illustrated in Fig. 3 wherein the asphalt is indicated at 27, leaving uncoated marginal portions. The width of the adhesive coated zone 27 may be equal to or slightly greater than the width to which the reinforcing fibers 19 are applied. This proceeding obviates smearing of the mechanism with asphalt and provides clean marginal portions for the duplex paper so that asphalt is not likely to be squeezed therefrom or leak therefrom in warm weather so as to be smeared on adjacent articles.

A considerable field for the use of reinforced paper is found in the wrapping of articles with a relatively narrow strip helically applied and this finds particular application in the case of the wrapping of articles of double curvature as, for example, vehicle tires or coils of wire or the like, a package being formed of the general kind disclosed in the patent to Dixon 351,584, Oct. 26, 1886. Material adapted for this use as contrasted with material in the form of a web or mill roll of perhaps 48 or 60 inches in width is adequately defined by reference thereto as a narrow strip, that used for tire wrapping, for example, being ordinarily from about an inch to six inches in width. In preparing material for this use I prefer to slit the paper into narrow strips before it is duplexed and reinforced and to combine these narrow strips separately. For example, we might consider the rolls of material 5 and 7 in Fig. 1 as being narrow strip material of this nature and such a proportion of parts is illustrated in Fig. 3. Narrow strips treated as described with edges unsecured and uncoated with asphalt are particularly adaptable for wrapping purposes in that they have clean edges and the adhesive is not likely to be squeezed out therefrom so as to gum up the wrapping machinery or soil the articles being wrapped. Such strips reinforced in the manner disclosed by buckled fibers defining inwardly of the margins of the strips a straight boundary provide a wrapping strip resistant against tearing and with a relatively flexible marginal portion which may

be easily folded over if desired as is sometimes done in such packages as I have referred to as is disclosed, for instance, in the patent to Dixon above mentioned.

I have described in detail the particular embodiment of my invention chosen by way of illustration and shown in the accompanying drawings. The particularity of the description has been for purposes of clarity and its detailed nature is not to be understood as definitive of the scope of the invention.

What I claim as new and desire to secure by Letters Patent I shall express in the following claims:

1. That method of reinforcing paper which comprises applying the ends of fibers to the paper, buckling the fibers by longitudinal compression and securing them to the paper in buckled condition.

2. That method of reinforcing paper which comprises applying adhesive thereto, applying ends of fibers to the adhesive, buckling the fibers by longitudinal compression and pressing the buckled fibers into the adhesive to be retained thereby.

3. That method of reinforcing paper which comprises applying the ends of fibers to the paper, buckling the fibers by longitudinal compression while delimiting the lateral extent of the buckling and securing them to the paper in buckled condition.

4. That method of reinforcing paper which comprises buckling fibers by longitudinal compression thereof and securing them to the paper in buckled condition.

5. That method of reinforcing paper which comprises buckling fibers by longitudinal compression thereof while delimiting the lateral extent of the buckling and securing them to the paper in buckled condition.

6. Mechanism for reinforcing paper comprising a pair of squeeze rolls, means for leading paper thereto and means for delivering fibers to the bite of said rolls comprising a delivery mechanism having a greater linear speed than the rolls.

7. Mechanism for reinforcing paper comprising a pair of squeeze rolls, means for leading paper thereto, means for delivering fibers to the bite of said rolls comprising a delivery mechanism having a greater linear speed than the rolls and lateral guides between said delivery mechanism and the bite for limiting lateral deflection of the fibers.

8. Mechanism for reinforcing paper comprising means to render it adhesive, means for supporting and advancing the same and means for feeding fibers lengthwise toward and on to the paper having a greater linear speed than the advancing means.

9. Mechanism for reinforcing paper comprising means for supporting and advancing the paper, mechanism for feeding fibers lengthwise toward the paper including means for laterally buckling the same and means for pressing the fibers in buckled condition into adherence to the paper.

In testimony whereof, I have signed my name to this specification.

EDWARD H. ANGIER.