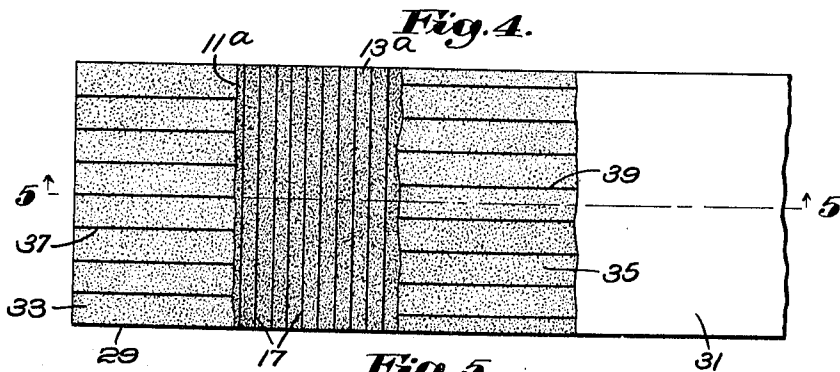
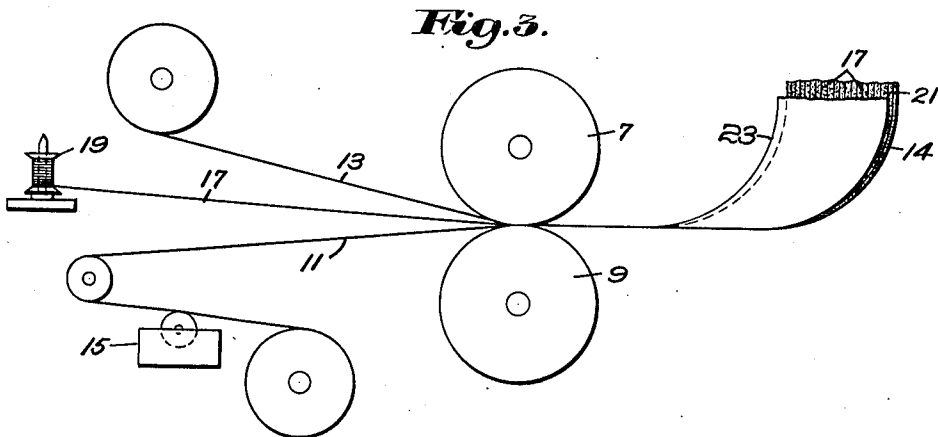
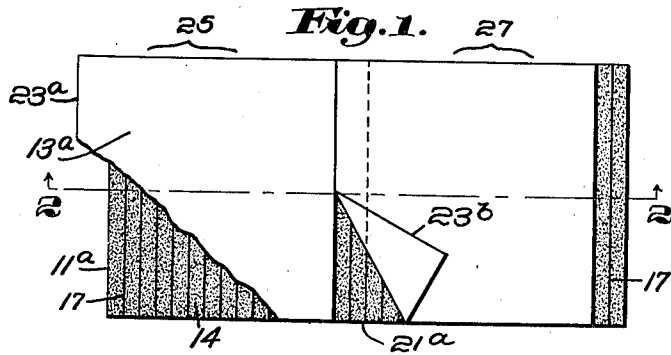


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 REINFORCED PAPER AND METHOD OF MAKING THE SAME.
 APPLICATION FILED MAY 10, 1918.

1,291,709.

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UNITED STATES PATENT OFFICE.

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REINFORCED PAPER AND METHOD OF MAKING THE SAME.

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To all whom it may concern:

Be it known that we, EDWARD H. ANGIER and LAWRENCE G. MILLER, citizens of the United States, and residents, respectively, of Framingham, county of Middlesex, and Cambridge, county of Middlesex, and of the State of Massachusetts, have invented an Improvement in Reinforced Paper and Methods of Making the Same, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to reinforced paper and a method of making the same and is particularly directed to paper reinforced by strands which extend, in whole or in part, transversely.

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

Figure 1 is a plan view of a portion of a paper web illustrative of our invention, part being broken away and part turned back to better disclose the structure;

Fig. 2 is a longitudinal section thereof;

Fig. 3 is a diagrammatic view illustrating a method of preparing the paper;

Fig. 4 is a plan view with parts broken away illustrating another form of reinforced web embodying our invention; and

Fig. 5 is a longitudinal section thereof.

For brevity we shall describe the laminated structure disclosed in Figs. 1 and 2 in connection with a preferable method of manufacturing the same, since the construction of the material will be clear from a description of the process of making it.

Referring, therefore, to Fig. 3, we there illustrate diagrammatically a pair of pressure rollers 7 and 9 adapted to receive in superposed relation webs of paper 11 and 13 from suitable supply rolls. The face of one of the webs, as 11, is covered with a suitable adhesive 14 as diagrammatically indicated by the representation of a coating roll 15. The adhesive used is preferably waterproof, asphalt or bitumen being particularly adapted for the purpose. Reinforcing strands 17 may be led to the bite of the rolls 7 and 9 from spools 19 mounted on a suitable creel. These strands are interposed between the two webs 11 and 13 and extend longitudinally of the same at suitable transverse in-

tervals. On rotation of the rolls 7 and 9, the threads 17 are drawn from the spools at the same time as the webs 11 and 13 are drawn from their supply rolls and any suitable tension may be applied thereto so that the strands will be stretched in the layer of adhesive interposed between the two webs and will thus form a true reinforcement for the paper.

As illustrated at the right hand side of Fig. 3, the edges of the webs 11 and 13 do not coincide. Herein the two webs are of equal width and are relatively offset. There is thus provided a projecting edge portion 21 consisting of one thickness of paper treated with a layer of asphalt in which may be embedded one or more of the reinforcing threads 17 and an opposite projecting edge 23 consisting solely of a thickness of paper. The laminated web thus provided may be divided in any suitable manner by cuts transverse to the length thereof, thus to provide sections such as the sections 25 and 27 in Fig. 1. Each of these sections will comprise two sheets of paper, as 11^a and 13^a, united by adhesive 14 and having parallel strands 17 embedded therein. Since edges of the webs 11 and 13 did not coincide, the sections will have one or more rabbeted edges. In the present example at one edge of the section 25 the sheet 13^a will project to form a flange or extension 23^a and at the other edge the other sheet 11^a will project as a flange 21^a having a coating of adhesive thereon in which may be incorporated a thread or threads, as shown in Fig. 2 where a portion of the section 27 is turned back. A number of sections, as 25 and 27, can be joined end to end to form a web of indefinite length with the reinforcing strands 17 extending transversely to the length of the web by joining the rabbeted edges of the sections in splice joints. Preferably this is effected by lapping the uncoated flange of one section, as 23^b of section 27, on the coated flange of another section, as 21^a of section 25, and pressing them together in such manner that the adhesive will unite the two flanges. There is thus provided a web composed of sections united by a splice joint, which in the example here illustrated is a rabbeted or scarf joint. In other words, the individual webs which form the compound web are made up of sections and the joints there-

of are broken. There is thus provided a web of indefinite length which is transversely reinforced and which although sectional is of ample longitudinal strength and which is of the same thickness throughout. In the drawing we have shown the sections 25 and 27 as square. Thus, if the webs 11 and 13 are 40 inches in width, a laminated web of uniform thickness, 40 inches in width and provided with transverse reinforcements, may be produced. Wider webs may, of course, be made by cutting the sections of the proper length, or if they are divided into narrower strips, a narrow tape will be produced suitable for use as a box stay or for similar purposes.

We are aware that it has been proposed to reinforce paper webs by means of strands applied transversely to the length thereof but the machines designed for this purpose have been slow and cumbersome and have not come into practical use. Either a large amount of reinforcing material was wasted or if it was attempted to introduce separate threads it was difficult to give them the proper tension so that they would be stretched across the paper webs. This difficulty is avoided in the present instances.

A transversely reinforced web such as has just been described may be combined with one or more other thicknesses of paper which preferably take the form of true or continuous webs and with longitudinal reinforcements to provide a sheet or web reinforced in both directions. In Figs. 4 and 5 we have shown such a structure and in that instance to both sides of the transversely reinforced web are secured other webs 29 and 31 by means of adhesive layers 33 and 35 in which are embedded longitudinal reinforcing strands 37 and 39. In the present instance the longitudinal strands 37 on one side of the transversely reinforced web are out of alinement or staggered with the threads 39 on the other side. This has the advantage that the transverse threads 17 are, as it were, bound down from both sides. A compound web as illustrated in Figs. 4 and 5 presents a perfectly smooth surface without joints and is of substantially uniform strength.

While any suitable adhesive may be used, we preferably use pitch or asphalt. A compound structure of the type disclosed made up of a number of comparatively thin layers will be much more flexible than a unitary device of the same thickness. Furthermore, pitch or asphalt will permit slight movement of the parts, promoting their flexibility so that when wrapped around a curved surface they will fit closely thereto. In one view of the material, it might be said that strain-resisting strands are provided for which the sheets of paper serve as a carrier and positioner while they also, while re-

lieved of strain, provide an impervious covering layer.

Obviously, compound sheets or strips of any given number of laminations and with the reinforcements combined in different ways can be constructed in accordance with the principles of our invention. The two illustrative embodiments will sufficiently illustrate the underlying principles. What we claim as new and desire to secure by Letters Patent is:

1. A method of preparing transversely reinforced paper which comprises the following steps:—coating a sheet with adhesive, inserting reinforcing strands in said adhesive coating, superposing a second sheet on the adhesive with edges offset from those of the first sheet and uniting lengths of the laminated material so made by securing together marginal portions provided by said offset edges in a splice joint whereby to provide a web of uniform thickness.

2. A method of preparing transversely reinforced paper which comprises the following steps:—coating a sheet with adhesive, inserting reinforcing strands in said adhesive coating, superposing a second sheet on the adhesive with edges offset from those of the first sheet, transversely dividing the sheet and securing together the strips so formed by overlapping in a splice joint the margins provided by the offset edges.

3. A method of preparing a transversely reinforced web characterized by dividing a longitudinally reinforced web and uniting the sections edge to edge by a splice joint of thickness uniform with the body of the section.

4. A method of preparing a transversely reinforced web characterized by preparing material reinforced by unwoven longitudinally extending strands with rabbeted side edges and uniting lengths of said material edge to edge by splice joints.

5. A reinforced paper comprising webs united by an adhesive layer in which are incorporated independent strands stretched transversely across said webs, each web comprising sections set end to end the joints of the two webs being out of alinement.

6. A reinforced web of indefinite length comprising two thicknesses of paper joined by a layer of waterproof adhesive in which are incorporated reinforcing strands extending transversely to the length of the web, said web being formed of sections united by scarf joints.

7. A reinforced paper comprising webs united by an adhesive layer in which are incorporated transverse strands, other webs on opposite sides thereof united thereto by adhesive layers and longitudinal strands in said latter layers, the elements of adjacent sets of longitudinal strands being out of alinement.

8. A reinforced paper comprising webs united by an adhesive layer in which are incorporated independent strands stretched transversely across said webs, each web comprising sections set end to end and true or continuous webs on opposite sides of said first mentioned webs united thereto by adhesive layers and longitudinal strands in said latter layers, the elements of adjacent sets of longitudinal strands being out of alinement.

9. A reinforced paper comprising webs united by an adhesive layer in which are incorporated independent strands stretched transversely across said webs, each web comprising sections set end to end, a true or continuous web on one side of said first-mentioned webs united thereto by an adhesive layer, longitudinal strands in the last-mentioned layer, and another true or continuous web adhesively secured on the opposite side of said first-mentioned webs, the whole providing a laminated material having no joints on the outer faces thereof.

10. A reinforced paper comprising webs united by an adhesive layer in which are incorporated independent strands stretched

transversely across said webs, each web comprising sections set end to end, the joints between the sections of the webs being out of alinement, a true or continuous web on one side of said first-mentioned webs united thereto by an adhesive layer, longitudinal strands in the last-mentioned layer, and another true or continuous web adhesively secured on the opposite side of said first-mentioned webs, the whole providing a laminated material having no joints on the outer faces thereof.

11. A reinforced paper comprising webs united by an adhesive layer in which are incorporated independent strands stretched transversely across said webs, each web comprising sections set end to end, the joints of the two webs being out of alinement, and true or continuous webs adhesively secured to opposite sides of the first webs, the whole providing a laminated material having no joints on the outer faces thereof.

In testimony whereof, we have signed our names to this specification.

EDWARD H. ANGIER.
LAWRENCE G. MILLER.