

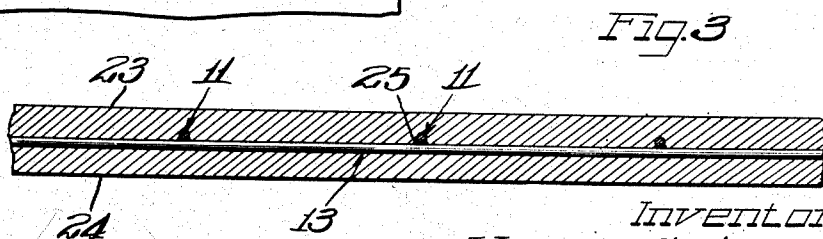
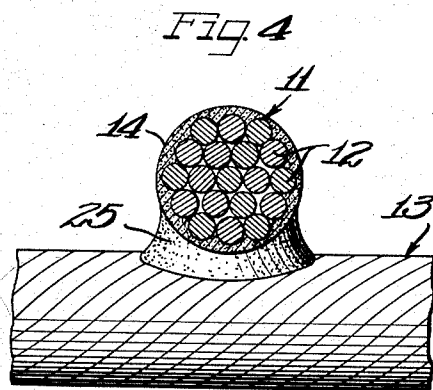
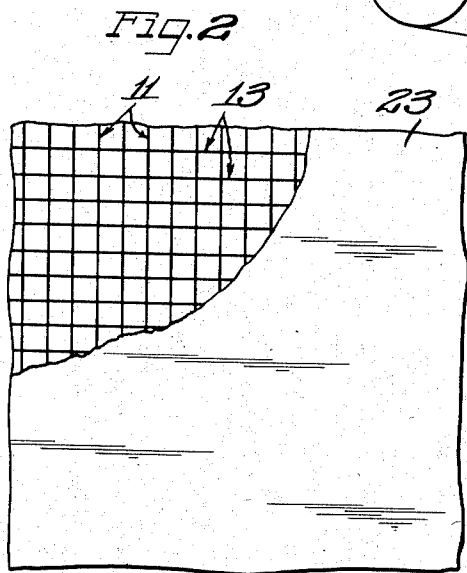
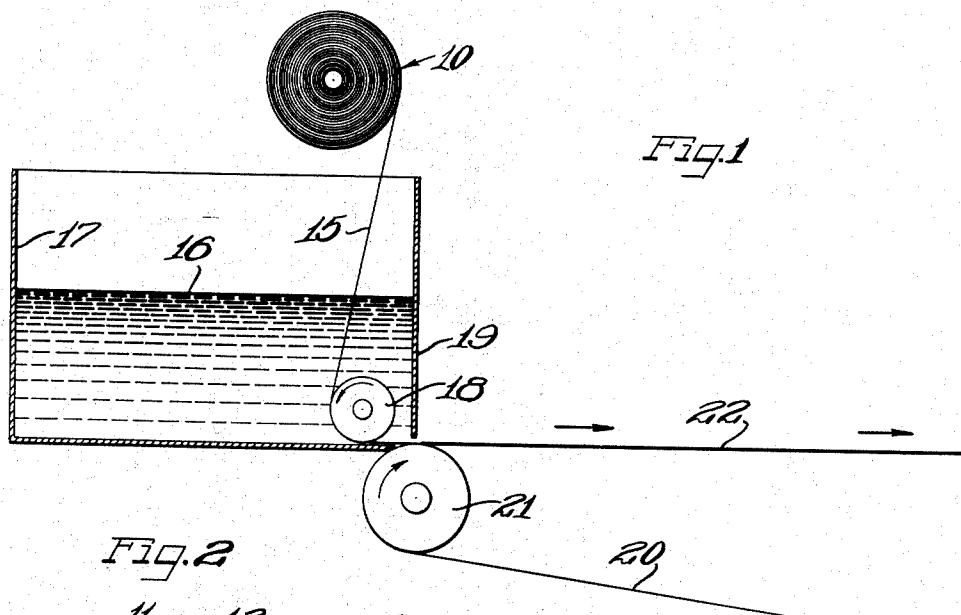
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REINFORCED PAPER AND METHOD OF MAKING SAME

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REINFORCED PAPER AND METHOD OF
MAKING SAME

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The present invention relates to a reinforced paper structure and to a method of producing the same.

Several different types of strand or fabric reinforced paper have been known previously. Such reinforced papers have generally been essentially laminated structures, in the making of which a reinforcing material is interposed between preformed, separate, dried sheets of a paper stock and then bonded to the paper by means of a suitable adhesive composition. For some applications, such reinforced papers have not been satisfactory. Very often the bond between the reinforcing paper is not as strong as required. Where relatively large amounts of adhesive have been used to increase the bond strength, the laminated paper construction becomes too stiff and brittle for wrapping and forming purposes. Furthermore, reinforced laminated papers are usually characterized by a visible ribbing formed in the external surfaces of the sheet by the reinforcing strands.

The foregoing disadvantages of conventional reinforced papers have been eliminated in the product of the present invention. In the reinforced paper of this invention, reinforcing crossed strands of glass fibers, as for instance in the form of scrim are imbedded directly within the web of paper fibers during formation of the fibrous mat. The reinforcing reticular mesh of glass fiber strands is bonded to the adjoining fibers of the mat without producing any noticeable ribbing on the surfaces of reinforced papers.

The reinforced papers of the present invention are also characterized by the presence of lateral and longitudinal reinforcing means, resulting in increased strength and tear resistance in both directions.

An object of the present invention is to provide an improved reinforced paper including reinforcing means in the form of a fiber glass mesh imbedded in a mat of paper fibers and bonded to the adjoining fibers.

Another object of the present invention is to provide a smooth surface reinforced paper containing thin reinforcing strands of woven glass fibers.

Another object of the present invention is to provide means for imbedding a reticular mesh of glass fiber strands in a mat of paper fibers during the process of depositing the fibrous mat on the forming wire of a conventional Fourdrinier paper making machine.

Another object of the present invention is to provide a method for producing a smooth surfaced, laterally and longitudinally reinforced paper.

A further description of the present invention will be made in connection with the accompanying sheets of drawings in which:

Figure 1 is a fragmentary schematic view of a headbox assembly of a conventional Fourdrinier machine illustrating the manner in which the reinforcing mesh of the present invention is imbedded within a mat of paper fibers;

Figure 2 is a fragmentary view of a reinforced paper produced according to the method of the present invention, with a portion thereof broken away to illustrate the reinforcing mesh imbedded within the paper fibers;

Figure 3 is an enlarged cross-sectional view of a paper produced according to the present invention; and

Figure 4 is a greatly enlarged fragmentary view at the intersection of two reinforcing strands making up a portion of the reinforcing mesh.

As shown on the drawings:

In Figure 1, there is illustrated an assembly which might be employed in the practice of the method of the

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present invention. This assembly includes a coiled roll 10 of the reinforcing mesh, consisting of a mesh of glass fiber strands. The structure of an individual strand is best illustrated in the greatly magnified view of Figure 4. As shown in that drawing, the reinforcing mesh includes a plurality of longitudinally extending glass fiber strands 11 consisting of a plurality of twisted, individual glass fibers 12 and a similar strand 13 extending in a lateral direction. In order to bond the strands 11 and 13 together, I prefer to coat the longitudinally extending strands with a thermoplastic resinous composition having adhesive properties. For this purpose, I may use such material as asphalt, or polyamide resins. Other suitable thermoplastic materials such as the "Staybelite" esters (glycerol, monoethylene or polyethylene glycol esters of hydrogenated rosin) may also be employed.

A continuous coating 14 of the thermoplastic resinous composition is provided on the longitudinally extending strands 11 about the surface of the glass fibers 12 and this coating bonds the oriented strands into an integral mesh. The thermoplastic bond between the longitudinally extending strands 11 and cross strands 13 as indicated at 25 (Fig. 4).

Returning to the assembly shown in Figure 1, a single ply 15 of the reinforcing mesh is continuously uncoiled from the roll 10 and immersed in a dilute aqueous suspension of paper fibers 16 contained in a conventional headbox 17 of a Fourdrinier paper making machine. The ply 15 passes under a revolving perforated roll 18 and under slice 19 to a moving forming wire 20 trained around a breast roll 21. The height of the perforated roll 18 is adjusted so that the ply 15 is included approximately midway between the deposited web of paper fibers as the fibrous mat is deposited upon the forming wire 20.

A large portion of the water contained in the pulp fibers deposited on the forming wire 20 is drained off as the suspension of paper fibers and the reinforcing mesh imbedded therein travel along the forming wire 20. The resulting wet reinforced mesh 22 is then put through the usual press rollers and over a series of conventional steam drier rolls to remove the remaining water and to soften the thermoplastic resinous coating on the reinforcing mesh. During this treatment on the steam drier rolls, the asphalt or other thermoplastic material becomes softened and bonds itself to the adjoining paper fibers, thus providing an integral paper web having the reinforcing mesh imbedded midway between the surfaces of the paper.

The structure of the final product is illustrated in Figures 2 and 3. As shown in these figures, the mesh imbedded in the paper consists of spaced, generally parallel strands 11 extending in the machine direction of the paper and of spaced substantially parallel strands 12 extending in the across-the-machine direction of the paper. The coating 14 of thermoplastic material bonded on each of the strands 11 not only bonds the strands 11 and 13 into a coherent network, but also bonds the resulting mesh to the adjoining paper fibers, so that the resulting mesh is firmly imbedded in the fibrous web. I prefer to use small diameter glass strands in making up the mesh so that when the mesh network is deposited within the fibrous mat, as illustrated in Figure 3, the outer surfaces of the reinforced paper, generally indicated at 23 and 24, are substantially smooth, even after passage through the steam drier rolls.

The reinforced paper of the present invention has substantial longitudinal and lateral strength while still being sufficiently flexible to be used for wrapping purposes. One of the advantages of the reinforced paper of the present invention is the fact that a lower basis weight paper can be employed for the same purposes that previously required high basis weight paper. Because the reinforcing mesh used in the paper of the present invention has very substantial strength even though the strands making up the mesh are relatively fine, the reinforced paper of the present invention can be run at a much faster rate than is possible with conventional reinforced papers.

It will be evident that various modifications and

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variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. A relatively smooth surfaced flexible reenforced paper comprising a flexible reticular mesh of glass fiber strands contained within and wholly covered by a surrounding matrix of an integrated felted web of paper fibers, the glass strands running in one direction having a continuous thin coating of a thermoplastic adhesive substance secured thereto and securing said strands to the glass strands running in the transverse direction and also securing the glass strands to the adjoining fibers of said web.

2. A smooth surfaced flexible reenforced paper comprising a flexible reticular mesh of glass fiber strands interpenetrated with and wholly covered by a surrounding web of integrated felted paper fibers, the glass fiber strands running in one direction having a thin continuous coating of asphalt securing said glass fiber strands to the glass fiber strands running in the transverse direction and also securing the glass fiber strands to the fibers of said web immediately adjacent thereto and in contact therewith.

3. A method of making a flexible reenforced paper, which comprises immersing a reticular mesh of glass strands in an aqueous suspension of paper fibers, said mesh consisting of crossed strands of fibers having interstices therebetween and having a coating of a thermoplastic resinous material on strands running in one direction, depositing the paper fibers and the mesh suspended therein on a moving forming wire, the amount of deposited fibers being sufficient to fill the interstices and to cover wholly said mesh, draining the wire from said suspension, and pressing and heating the resulting web to bond said mesh to the paper fibers immediately adjacent the resin-bearing strands by means of the adhesiveness of the thermoplastic resinous material, so as to form a relatively smooth surfaced reenforced paper.

4. A method of making a flexible reenforced paper, which comprises immersing a flexible reticular mesh of glass fiber strands in an aqueous suspension of paper fibers, said mesh consisting of crossed strands of fibers having a coating of asphalt on strands running in one direction and having interstices therebetween, depositing the paper fibers in an amount sufficient to fill the interstices and completely cover the mesh suspended therein on a forming wire, draining the water from said sus-

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pension, and pressing and heating the resulting web to bond said mesh to the paper fibers adjoining said mesh by means of the adhesiveness of said asphalt.

5. A method of making a flexible reenforced paper, which comprises depositing moistened paper fibers on a flexible reticular mesh of glass fiber strands, said mesh consisting of crossed strands of fibers having a coating of asphalt on strands running in one direction and having interstices therebetween, the paper fibers being deposited in an amount sufficient to fill the interstices and completely cover the mesh, draining the water from the moistened paper fibers, and pressing and heating the resulting product to bond said mesh to the paper fibers adjoining said mesh by means of the adhesiveness of said asphalt.

6. A method of making a flexible reenforced paper, which comprises depositing moistened paper fibers on a flexible reticular mesh of glass fiber strands, said mesh consisting of crossed strands of fibers having a coating of thermoplastic resinous binder material on strands running in one direction and having interstices therebetween, the paper fibers being deposited in an amount sufficient to fill the interstices and completely cover the mesh, draining the water from the moistened paper fibers, and pressing and heating the resulting product to bond said mesh to the paper fibers adjoining said mesh by means of the adhesiveness of said resinous binder material.

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