Jur. 27, 1933. J. H. SPOHN, JR 1,915,626

MULTI-PLY PAPER

Filed Dec. 20, 1926 2 Sheets-Sheet 1

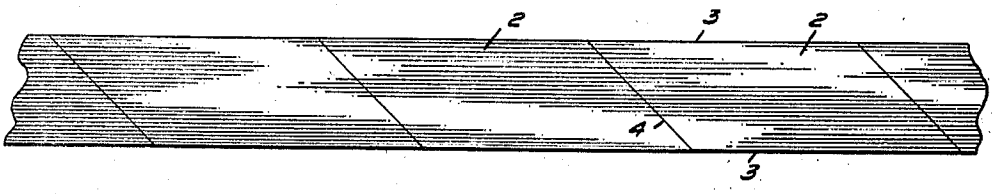


FIG. 3.

FIG. 1.

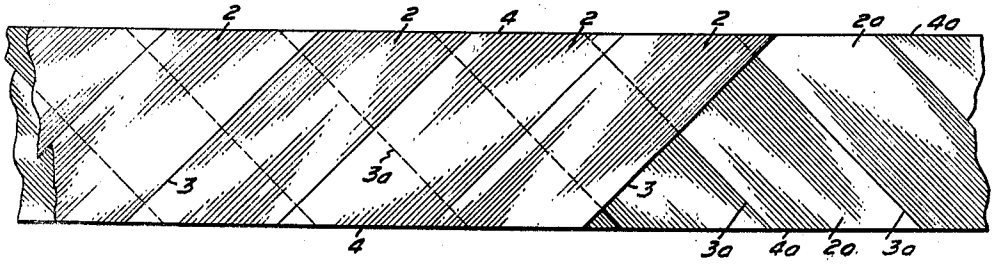
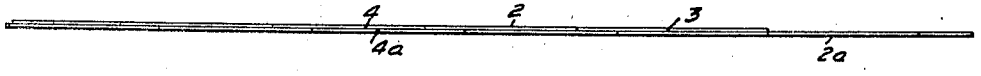


FIG. 2.



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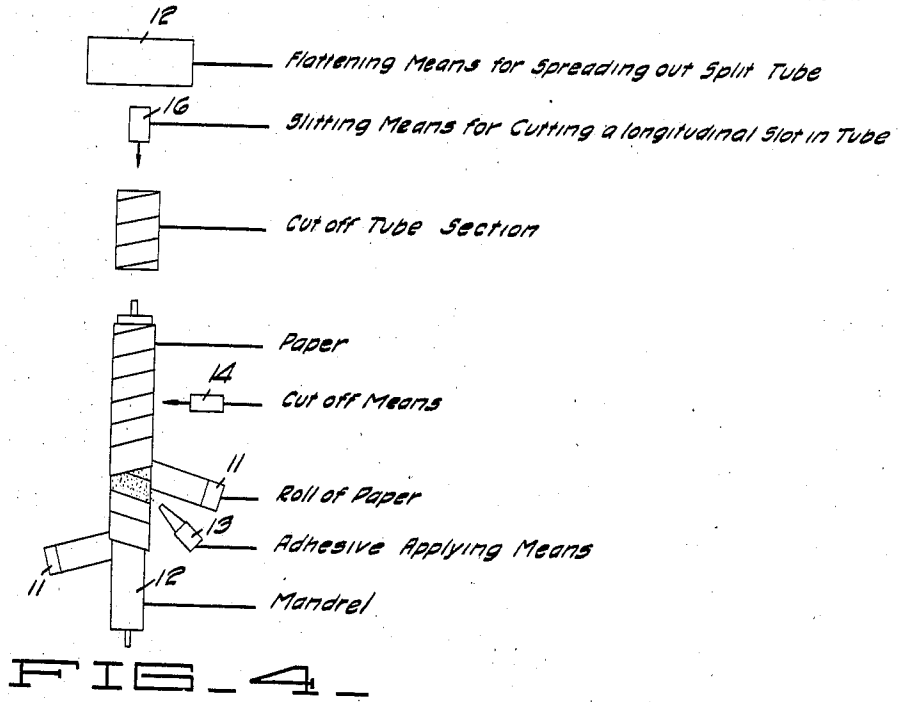


FIG_4_

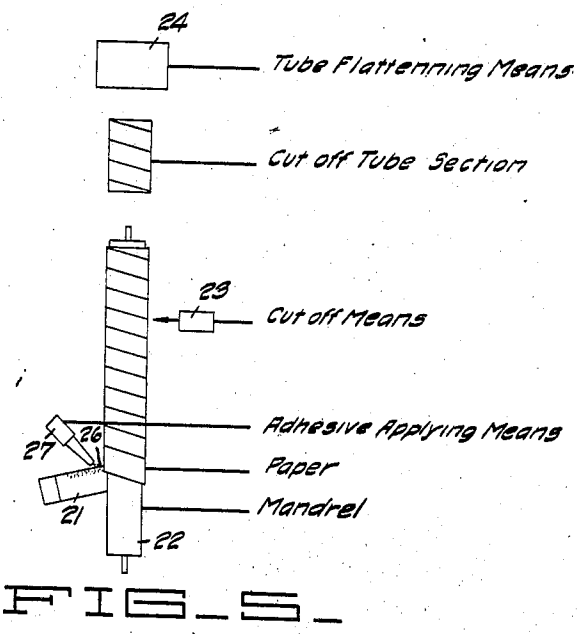


FIG_5_

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UNITED STATES PATENT OFFICE

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MULTI-PLY PAPER

Application filed January 28, 1931. Serial No. 511,887.

The invention relates to multi-ply paper, paper board or fiber board for use in the manufacture of cartons and packing boxes and as a reinforcing band or strip along the edges of packing boxes and cartons. The major portion of the paper and paper board which is used for wrapping and packing purposes is formed in a continuous web on paper machines. The paper manufactured on these machines has a very definite grain in the direction of the length of the web or sheet due to the fact that in the process of manufacture, the fibers which form the paper or paper board become more or less alined in the direction of the length of the web or sheet. The result is a paper having a very definite grain in the direction of the length of the sheet thereby reducing the resistance of the paper to rupturing, cracking or tearing along a line extending in the direction of the length of the sheet. When such paper or paper board is employed in the manufacture of cartons and packing cases it presents a decided weakness along a line parallel to the length of the sheet, so that the box or carton possesses a minimum of strength in that direction. This weakness is particularly noticeable along the edges of the packing case at which the grain of the paper extends in the same direction as the edge. At this point, the paper is readily cracked or ruptured and the result is a very unsatisfactory situation.

In accordance with my invention, I produce a long strip or sheet of paper or paper board having an increased resistance to rupturing, cracking or tearing along a line extending in the direction of the length of the strip or sheet, so that when this strip or sheet is used in the formation of a packing box, or is used as reinforcement along the edges, the edges are not more vulnerable than any other part of the packing case. An object of my invention therefore is to produce a long paper strip having increased resistance to rupturing, cracking or tearing along a line extending in the direction of the length of the strip and across the strip.

A further object is to provide a paper strip having substantially the same resistance to tearing in all directions or in other words, a paper strip in which the effect of the grain of the fiber has been eliminated.

The invention possesses other advantageous features, some of which, with the foregoing will be set forth at length in the following description, where I shall outline in full that form of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings, I have shown one form of material embodying my invention, but it is to be understood that I do not limit myself to such form, since the invention, as set forth in the claims, may be embodied in a plurality of forms.

Referring to said drawings, Figure 1 is a portion of a strip of paper embodying my invention, a portion of the upper layer of the strip being omitted to better disclose the construction.

Figure 2 is a side elevation on an exaggerated scale, of the strip shown in Figure 1.

Figure 3 is a portion of a strip of paper formed on a paper making machine, indicating the manner in which the paper is cut to form sheets which are subsequently combined to form the multi-ply paper of my invention.

Figures 4 and 5 are diagrammatic showings of certain means for manufacturing the multi-ply paper of my invention.

The multi-ply paper or paper board of my invention comprises two layers of paper or paper board sheets adhesively secured together, the fibers in the sheets forming one layer being disposed at an angle to the fibers in the sheets forming the other layer and the fibers in both layers being disposed at an angle to the longitudinal axis of the strip. The sheets 2 forming the upper layer are in the form of parallelograms having included acute and obtuse angles and the fibers in the sheets 2 lie principally in the direction of the length of the sheets. The longitudinal edges 3 of the sheets, with which the fibers are principally parallel, are preferably arranged in substantial abutment and the end edges 4 of the sheet are alined and form the edge of the multi-ply strip, although the longitudinal edges may overlap when desired. The side

edges 3 preferably form an acute angle of 45 degrees with the side edges 4. The sheets 2*a* which form the lower layer of the strip are arranged in the same manner as the sheets 2 their longitudinal edges 3*a* are in substantial abutment, and these edges form an acute angle of substantially 45 degrees with the side edges 4*a*. The sheets 2*a* however are arranged so that the longitudinal edges 3*a* are substantially at right angles to the longitudinal edges 3, so that the fibers in the sheets 2*a* are substantially at right angles to the fibers in the sheets 2. The sheets 2 and 2*a* forming the two layers are adhesively secured together by glue or any other desirable adhesive. The result is a long paper strip of any desired width in which the effect of fiber grain has been eliminated or neutralized by forming the strip so that the fibers in one layer are at right angles to the fibers in the other layer, and so that all of the fibers are at an angle, preferably an angle of 45 degrees to the longitudinal axis of the strip. A paper strip of this character has no particular directional weakness, so that it lends itself admirably for the manufacture of articles which are subjected to strains in various directions. While I have herein referred to a two-ply strip, it is to be understood that the strip may compose two or more plys, with the fibers in each ply at an angle to the fibers in the contiguous ply.

The strip may be made in any desired manner. The sheet of paper as it is made on the paper machine may be cut on the bias as shown in Figure 3 and the separate sections arranged by a suitable machine so that they assume the relationship shown in Figure 1. The adhesive is applied between the two layers and the multi-ply strip is subjected to pressure to cause firm adhesion of the two layers.

When desired, the strip may be first formed as a tube, as in the manufacture of paper tubes as is shown in Figure 4, by rotating two spools 11 of the paper around a cylindrical mandrel 12 and simultaneously advancing the tube thus formed on the mandrel. At the same time an adhesive is applied by applying means indicated at 13 to cause the overlying strips to be secured together. After being formed on the mandrel, a length of the tube is cut off by the cut-off means 14. The tube is then slit longitudinally by slitting means 16 and opened out and rolled flat by the means indicated at 17.

The result of these operations is a strip of multi-ply paper comprising two layers of paper sheets adhesively secured together, each sheet comprising a parallelogram, the longitudinal edges of the parallelograms forming one layer and being parallel to each other. The longitudinal edges of the parallelograms forming the other layer are parallel to each other and cross the longitudinal edges of the parallelograms of the first mentioned layer.

A further method, as is shown in Figure 5, comprises winding a single strip 21 of paper, either wet or dry, around a mandrel 22, either round or flat, and then flattening and pressing the tube thus formed, a suitable adhesive having been introduced into the tube to cause the opposite sides to adhere. These last operations are secured by the cut-off means 23 which severs a length of tube from that on the mandrel for subsequent flattening by tube flattening means 24. An adhesive is applied to the inside of the tube prior to flattening so that the inner faces of the flattened tube adhere. The strip of paper is preferably wound upon the mandrel with a slight overlap as at 26 so that the single strip tube preserves its form, after being removed from the mandrel. Adhesive is applied by the applying means 27 so that the overlap is maintained.

The result is a multi-ply strip, each layer of the strip comprising a series of parallelograms, but differing from the previously described construction in that the parallelograms of both layers form part of a continuous folded strip of paper.

I claim:

1. The method of forming a flat multi-ply paper board comprising supplying a strip of paper to a rotating member, supplying a second strip of paper to said member, said second strip being supplied angularly with respect to the first strip and to the member, securing said strips together to form a tube upon the member, removing the tube from the member, and forming the tube into a flat paper board.

2. The method of forming a flat multi-ply paper board comprising forming a tube of several angularly positioned paper strips, and deforming the tube into a flat multi-ply paper board.

In testimony whereof, I have hereunto set my hand.

JOHN H. SPOHN, JR.