Oct. 12, 1926. 1,603,158

N. D. SMITH

BENDING FIBROUS MATERIALS

Filed Sept. 12, 1923 2 Sheets-Sheet 1

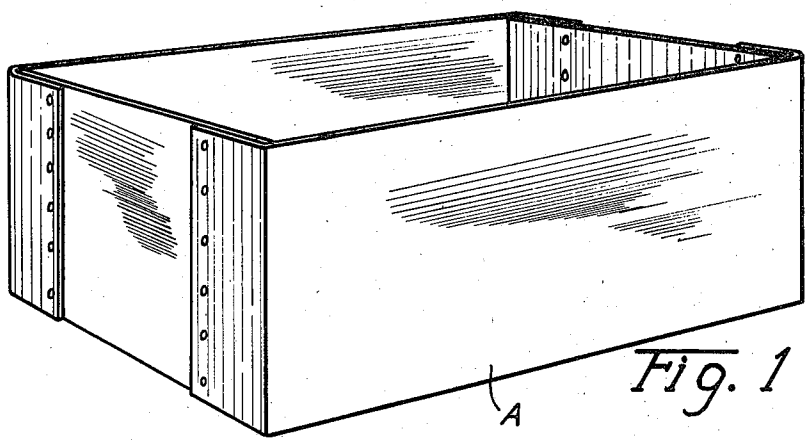


Fig. 1

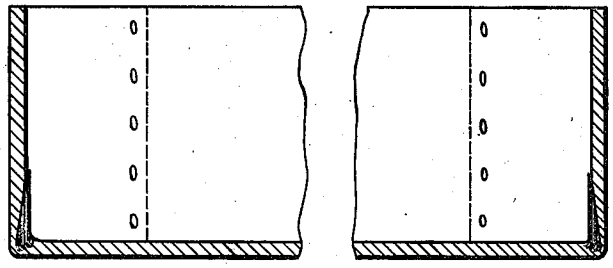


Fig. 2

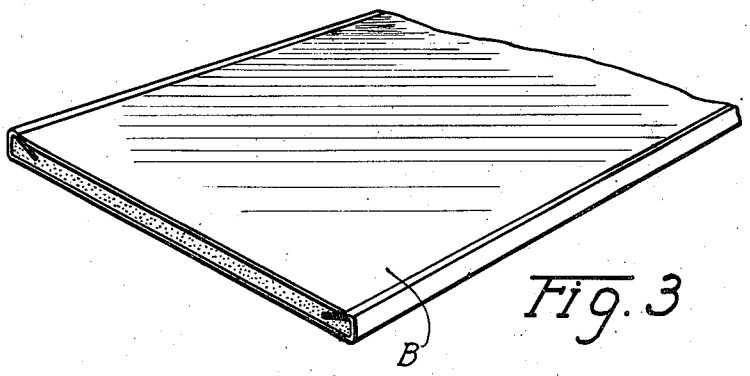


Fig. 3

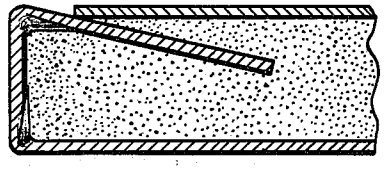


Fig. 4

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BENDING FIBROUS MATERIALS

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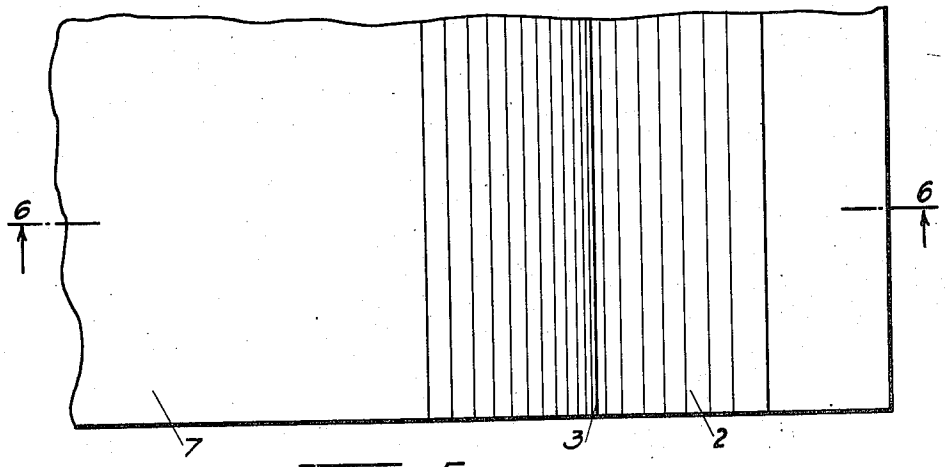


Fig. 5

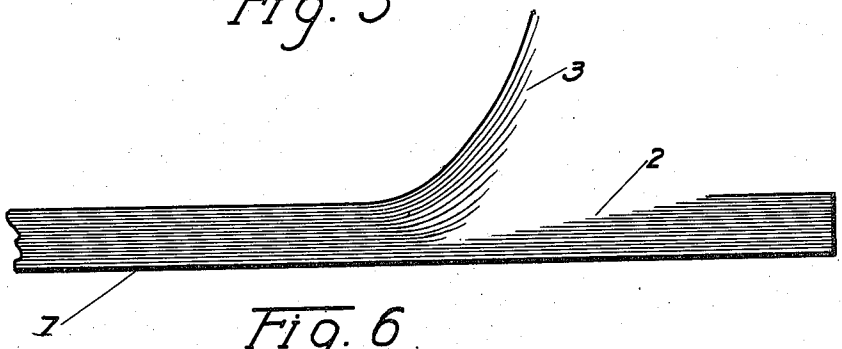


Fig. 6

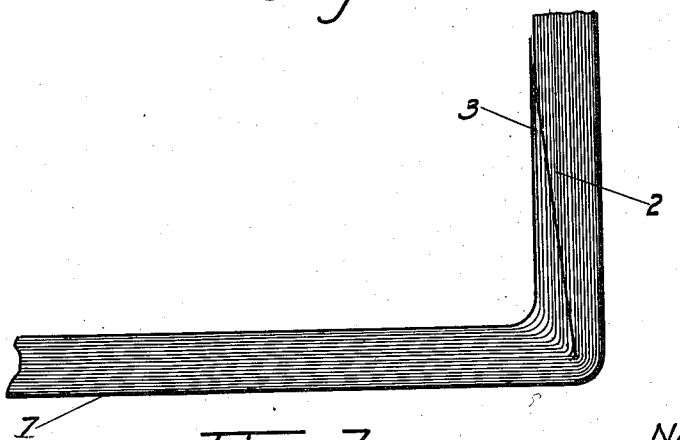


Fig. 7

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UNITED STATES PATENT OFFICE.

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BENDING FIBROUS MATERIALS.

Application filed September 12, 1923. Serial No. 662,359.

This invention relates to improvements in bending fibrous material and more particularly to the bending of fibrous material along straight lines as is necessary in forming rectilinear fibrous containers, such as card board or paper boxes and the like.

It is an object of this invention to so treat or act upon the fibers of the material along the line of the desired bend to allow the bending or folding of the material to be easily and positively accomplished without affecting the adjacent surface of the material and without detracting from the strength at the point or line in the material where the bend or fold actually takes place. It is a further object of this invention to sever and displace the fibers of the material from the main body along the line of the desired bend or fold in such a manner that after the bend or fold has been accomplished, the displaced fibers may be replaced in contact with that or approximately that portion of the material from which they were detached and then secured thereto.

While this invention has many applications, a concrete example is its use in the manufacture of paper or card board boxes or containers. In this art the fibrous material heretofore has been perforated, scored, reduced in thickness or crimped along the line of the desired bend or fold, all of which means either reduces the strength of the material at the point or line of bend or deforms the adjoining surfaces. Another example where this invention is particularly advantageous is in the plaster board art. In the manufacture of plaster board having a plaster composition core with fibrous cover sheets adhering thereto and in which one cover sheet is passed about the longitudinal edges of the board to contact with the other side of the core and the other sheet, it is customary to score the fibrous material to form square or angular corners and to provide straight edges on opposite sides of the board. This scoring removes a portion of the body of the paper or fibrous cover sheet along the line of the desired bend or fold and therefore the cover sheets at the corners of the edges are of less strength than the body of the sheet.

The advantages of the application of this invention to the above arts are obvious and similar advantages can be readily appreciated in analogous arts. In the rectilinear container and bound edge plaster board, the corner at the bend or fold is rigid and possesses greater resistance to blows and scuffing than the main body of the fibrous material so that additional strengthening means, such as interior or exterior strips at the corners, is not necessary.

While the preferred form of this invention is illustrated upon the accompanying sheets of drawing, in which like reference characters refer to like parts, yet it is to be understood that minor detail changes may be made without departing from the scope thereof.

In the drawings:

Figure 1 is a view in perspective of a conventional form of card board container with top removed.

Figure 2 is an enlarged view in transverse section, with parts broken away, of Figure 1.

Figure 3 is a view in perspective of a commercial form of bound edge plaster wallboard.

Figure 4 is an enlarged fragmentary view in transverse section at one of the longitudinal edges of Figure 3.

Figure 5, is a top plan view of a portion of fibrous material after preparatory angular cut has been made.

Figure 6 is a view in section taken on the line 6—6 of Figure 5.

Figure 7 is similar to Figure 6, illustrating this invention after a fold or bend has been made in the fabric shown in Figures 5 and 6.

The first four figures in the drawings illustrate commercial articles now in general use to which this invention has been applied and by referring to the enlarged details as shown in Figures 5, 6 and 7, the invention will be better understood and the particular features and advantages to the commercial constructions recognized.

Without perforating which both cuts through and removes portions of the material, scoring which removes portions of the material, or crimping which compresses and deforms the surface of the material, this invention contemplates the severing and displacing of the fibers of the material at an angle to the surface for a portion of the thickness of the fibrous material.

As shown in Figures 5 and 6 it is desired to make a bend in the fibrous material 1 along a straight line so that the surfaces on each side will be at right angles to each other. The fibers of the material are sev-

ered in a plane at an angle to the upper surface of the interior of the desired bend with the ends of the severed fibers below the plane 2 remaining normal and with the fibers 3 above the plane of severance displaced by being separated from their normal relation to each other and picked up. To accomplish a bend in the material along a straight line it is necessary that the plane of severance must enter the upper surface and terminate within the body of the material in lines parallel to the line of the desired bend and reducing the thickness of the normal fibers of the material below the severed fibers sufficiently to accomplish the bend. As the bend is made the separated severed fibers 3 on the interior of the bend engage and ride over the angular plane of severance 2 of the normal fibers, causing further displacement if necessary and when the bend is completed or the desired relation of the bent portions of the material is established the displaced fibers are bonded to each other and to the normal fibers in the plane of severance by glue, silicate of soda or other suitable adhesive and in the case of plaster board by a portion of the plastic core, if desired.

From Figures 6 and 7 it will be seen that the fibers 3 above the plane of severance, and on the interior of the bend, having been separated from each other are flexible so as to be adapted to have a sliding contact with the plane of severance on the contiguous portion if the angle of bend is greater than their picked up position or if less may be easily forced against such surface when the desired bend has been accomplished, and when any bend is made the fibers of the upper surface of the material will extend over the normal fibers beyond the entrance of the plane of severance on the contiguous portion as shown in Figure 7. From this figure it will be seen that the thickness of the material at the corner of the bend is increased by the separation and replacement of the picked up or displaced fibers. The adhesive may be applied at any time after the fibers have been severed and before or after the bend has been accomplished, as may be found to be most advantageous in accordance with the nature of the fibrous material.

The first seven figures in the drawings clearly illustrate the advantages of this invention. In the card board box A, shown in Figures 1 and 2, the fibers of the material are severed when the material is flat and in straight lines in the same relation to each other as such box material is now perforated, scored or crimped, and when the sides, ends and end flaps or portions for securing the sides to the ends are bent into proper relation, the corners formed by bending these portions are not only strong but present more body of material to resist blows and scuffing to which the edges are subject during handling, transportation or other use. The same may be said of the plaster board B, illustrated in Figures 3 and 4, in which the margins of the bottom covering sheet of fibrous material, usually chip or other paper, is customarily scored along parallel lines adjacent each longitudinal edge to produce the desired square edges of the board. In this case the severance of the fibers is preferably accomplished just before the composition core in plastic state is deposited upon the sheet and therefore folding over of the margins to enclose the plastic mass will provide sufficient bonding material to reunite the displaced severed fibers to the normal ones and inner surface of the cover sheet.

This invention is not restricted to its application to the two uses above described nor to its application to rectilinear containers, but contemplates its application to any art in which fibrous material is employed and in which it is necessary or desirable to bend or displace fibers from their normal relation to the material.

While the fibers may be severed by any desirable means which will perform the displacement without removing a substantial portion of the body of the fibrous material, it has been found that rotating or reciprocating knives or needles are the best adapted to accomplish the cut or severance of the character described and furthermore it has been found that the knives when so used quickly become dull and must be constantly sharpened and therefore the proposed use of reciprocating needles is contemplated in which the fibrous material is treated or acted upon in accordance with this invention.

While not necessary, it has been found that the most efficient manner to produce the severance of the fibers to accomplish the desired result is by passing the fibrous material under a fixed device provided with a plurality of reciprocating needles reciprocating in the plane of the desired plane of severance of the fibers of the material and to prevent a tearing or undesired displacement of the fibers as the material passes under the device it is preferable to arrange the needles so that a progressive severance occurs as the material passes thereunder by providing the first needle that engages the material of a length to just penetrate the upper surface of the material and gradually increasing the length of the needles thereafter to cause a gradual increase in the depth of the severance until the desired depth is reached. It is preferable to advance the fibrous material under the severing device at the rate of approximately 30 feet per minute with the needles reciprocating at the rate of approximately 3000 to 10000 times per minute according to ma-

terial being cut. With this approximate relation between the movement of the material and reciprocation of the needles, a severance of the fibers will be made in which the normal relation of the fibers on the underside of the place of severance will be undisturbed and the fibers on the upper side of the place from the top surface of the material to the bottom of the cut or plane of severance will be separated from each other and displaced upwardly so that the material directly below the plane of severance will be sufficiently flexible to allow the material to be bent out of its normal plane approximately along the line of reduced thickness at the bottom of the cut or severance of the fibers.

What I claim is:

1. An article of fibrous material having a portion of the material bent along a straight line at an angle thereto with the fibers severed but not removed, and displaced at an angle for a part of the thickness of the material toward the line of the bend.

2. An article of fibrous material having portions of the material bent along straight lines at an angle to the adjacent portions with the fibers severed and displaced at angles to the material on the inner side of the bend and having the displaced fibers after the board has been completed reunited to each other and to the part from which they were severed.

3. An article of fibrous material having a plurality of portions bent at angles to each other, with the fibers of a portion severed and displaced on the interior of the bend at an angle thereto for a part of its thickness terminating at the bend with the displaced fibers reunited after the bend has been completed to each other and to the material from which they were severed.

4. The method of bending fibrous material comprising severing the fibers in a plane entering at an angle into the material for a part of its thickness, displacing the fibers above the plane of severance, bending the material along the line of reduced thickness toward the displaced fibers and reuniting the displaced fibers to each other and to the material from which they were severed.

5. The method of bending fibrous material along a straight line to form an angular corner without reducing the strength or thickness of the material at the corner comprising severing the fibers at an angle to the material in a plane entering with the material at an angle thereto and terminating within the thickness of the material at the corner, displacing the fibers throughout above the plane of severance, bending the material along the termination of the plane of severance toward the displaced fibers to form a corner and reuniting the displaced fibers to each other and to the material from which they were severed.

6. The method of bending fibrous material along a straight line without reducing the strength of the material at the corner comprising advancing the material under means for severing the uppermost fibers at an angle to the upper surface for an equal distance into the material and disuniting the severed fibers throughout the portion above the plane of severance, bending the material along the termination of the plane of severance toward the displaced fibers, and reuniting the displaced fibers to each other and to the material from which they were severed.

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