Dec. 21, 1926. 1,611,734

C. C. GAMM ET AL

MACHINE AND METHOD FOR FORMING CREASES IN FIBER BOARD

Filed Feb. 11, 1926 2 Sheets-Sheet 1

Fig. 1.

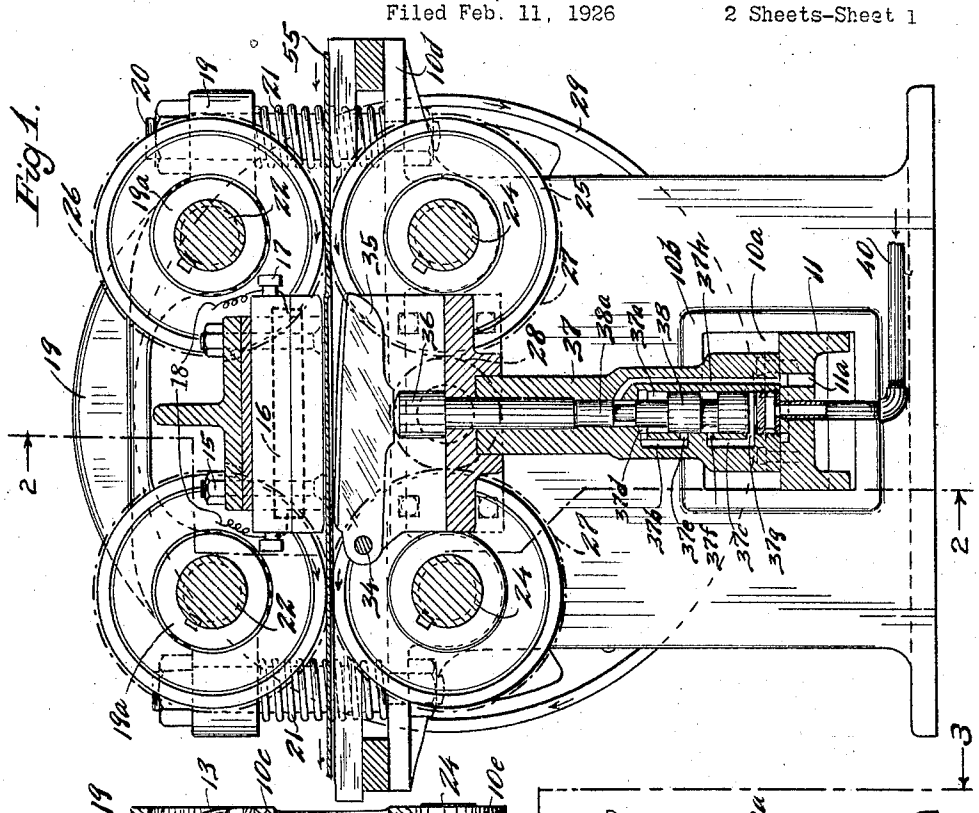
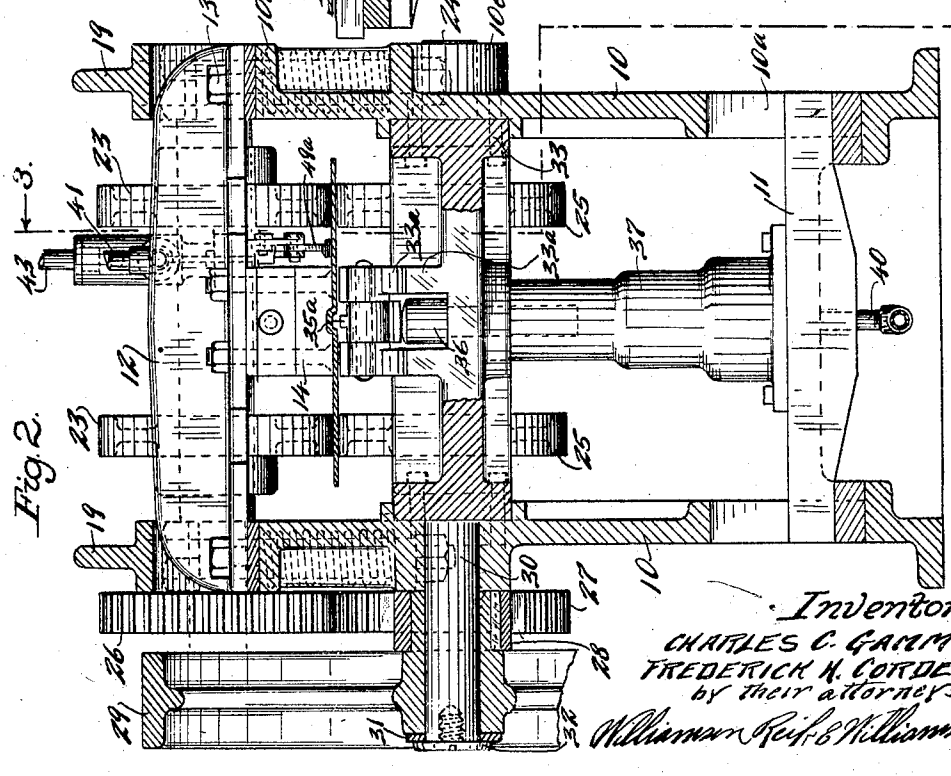


Fig. 2.



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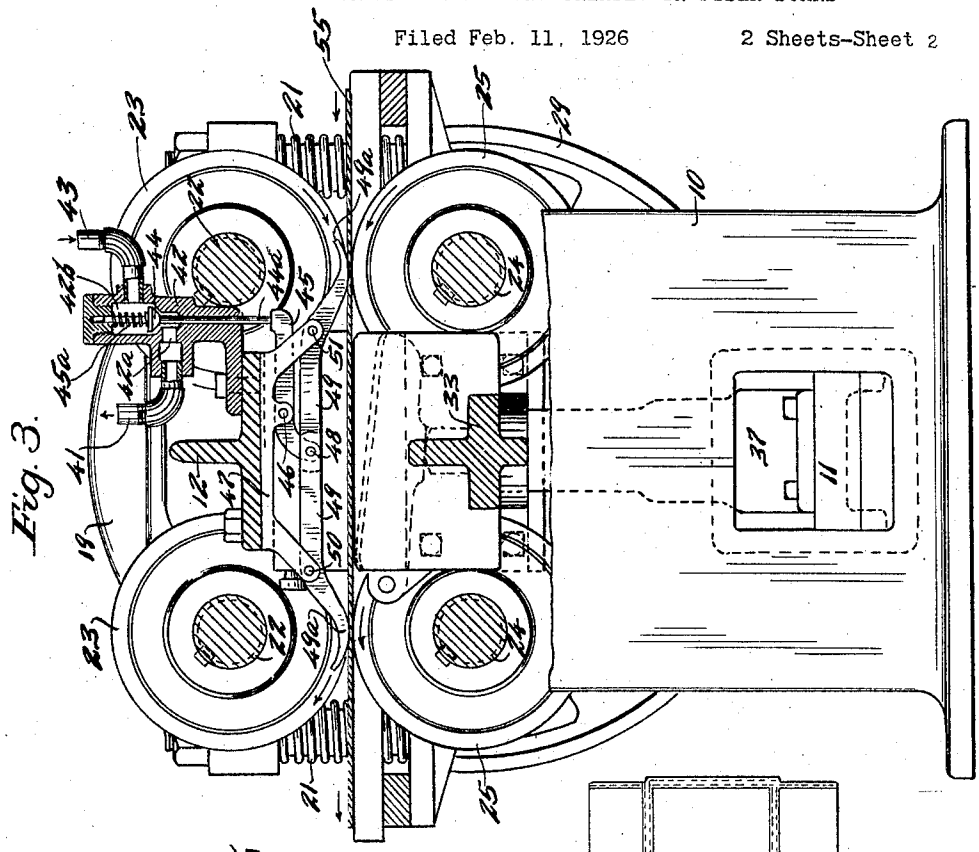


Fig. 3.

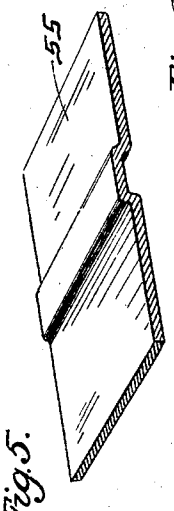


Fig. 5.

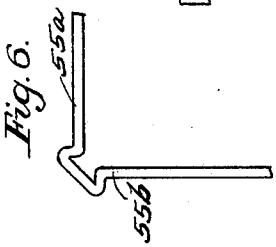


Fig. 6.

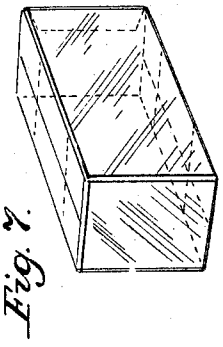


Fig. 7.

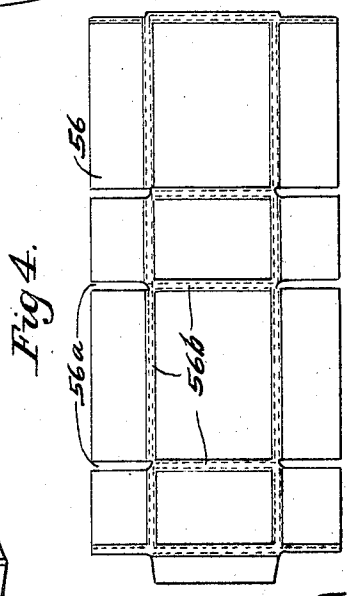


Fig. 4.

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UNITED STATES PATENT OFFICE.

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MACHINE AND METHOD FOR FORMING CREASES IN FIBER BOARD.

Application filed February 11, 1926. Serial No. 87,529.

This invention relates to a method and apparatus of forming a crease or groove in sheet or corrugated material. It is now a common practice to form containers, including rectangular boxes, of various kinds of fiber board and corrugated board and it is also a common practice to form creases in said material, along which the material is folded to form the container. While various methods and apparatus have heretofore been used in forming such creases in the material, certain objections have always existed. When the material is folded to form a container, the laminations of the material often separate so that the material expands and is rendered soft and of reduced strength and stiffness.

It is an object of this invention, therefore, to provide a simple and efficient method and apparatus for forming a crease or groove in fiber sheet or corrugated material.

It is a further object of the invention to provide a method and apparatus in which the said crease or raised groove is formed in the material by drawing the material between a male and female die having respectively a groove and rib thereon, co-operating to form the groove in the material, and in which one of said dies is rapidly reciprocated against the other, the material being continuously fed between said dies.

It is still another object of the invention to provide a machine having a fixed die, a movable die, feed rolls at each side of the dies for drawing material therebetween, means for rapidly reciprocating one of said dies against the other, together with means controlled by movement of the material for actuating said last mentioned means.

It is also an object of the invention to provide such a machine as set forth in the preceding paragraph, in which the movable die is pivotally mounted adjacent the fixed die.

It is still further an object of the invention to provide a method and apparatus for forming a crease or raised groove in fibrous sheet or corrugated material, by compacting the same between male and female die, one of which is heated.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawing, which like reference characters refer to the same parts throughout the different views and in which:—

Fig. 1 is a central vertical longitudinal section through the machine;

Fig. 2 is a vertical section formed on line 2—2 of Fig. 1, as indicated by the arrows;

Fig. 3 is a vertical section taken on line 3—3 of Fig. 2, as indicated by the arrows;

Fig. 4 is a plan view of a blank or a box having the creases formed therein;

Fig. 5 is a perspective view of a portion of a sheet of material having a groove formed therein;

Fig. 6 is an edge view of a sheet of material bent at the groove formed therein, to have its sides at right angles, and

Fig. 7 is a perspective view of a container formed of a sheet of material having the grooves formed therein.

Referring to the drawings, a machine is shown comprising side frames 10 having openings 10^a adjacent their lower ends, which openings are surrounded at the inner side of said frames by reinforcing ribs 10^b, said frames being connected together adjacent their lower ends, by a cross bar 11 having its ends disposed in the openings 10^a. The side frames 10 are connected at their upper ends by the cross rail 12 secured to central upstanding portions 10^c of frames 10 by the bolts 13. Secured to the central part of cross rail 12 is a fixed female die 14, the same being secured by the headed and nutted bolts 15 having their heads countersunk in the lower face of said die. The die 14 is adapted to be heated and for this purpose a heating element 16 is provided, indicated in dotted lines in Fig. 1, the die having binding posts 17 at its ends, to which the terminals of member 16 are connected, and which posts are adapted to receive the conductors 18, the heating element 17 preferably being of electrical type.

The side frame members 10 have also secured thereto and extending longitudinally thereof, the upper frame members 19, which frame members extend over the cross rail 12. Said frame members 19 have lugs at each end, bored to receive the headed and nutted bolts 20, the nuts of which surmount the lugs on member 19. The bolts 20 extend through the flanges 10^d of side

frame members 10, the under side of which flanges the heads of said bolts engage and said bolts are surrounded by comparatively heavy compression coil springs 21 disposed beneath the top of flanges 10^d and the bottom of the lugs on members 19. The members 19 have spaced bosses 19^a bored to receive and have journaled therein, the shafts 22 which extend across the machine from one member 19 to the other. The shafts 22 have secured thereto the feed rolls 23 spaced equal distances at each side of the fixed die 14. Side frame members 10 also have bosses 10^e bored to have journaled therein the shafts 24 which also extend from one side frame member to the other and have secured thereto the lower feed rolls 25, shafts 22 and 24 being vertically alined. The shafts 22 and 24 project at one side of the machine and have secured thereto the meshing gears 26 and 27. The gears 27 are driven by a gear 28 disposed between the same and carried on the hub of a pulley 29 journaled on a stub shaft 30 secured in a hub projecting from the side of one of the side frame members 10. Pulley 29 is held on shaft 30 by the collar 31 secured by the bolt 32 threaded into said shaft. The gears 26, 27 and 28 are indicated in dot and dash lines in Fig. 1.

Side frame members 10 are also connected by a cross head 33 having at its central portion upstanding spaced members 33^a. Members 33^a are formed as projecting lugs at one end and are bored to receive the pivot pin 34 extending therebetween and having pivoted thereon the lower movable die 35. The die 35 constitutes a male die adapted to co-operate with the fixed die 16 and has a central upstanding rib 35^a extending longitudinally of its top surface. A plunger 36 has its upper end disposed between members 33^a and has a reduced portion extending downwardly through cross head 33, a shoulder thus being formed to contact with said cross head and hold the plunger in position. The plunger 36 extends downwardly into the upper end of the cylinder 37, the lower end of which rests on the cross bar 11. Cylinder 37 is bored at 37^a to have slidably mounted therein the piston 38, said piston having spaced portions with a reduced portion therebetween. The piston 38 has a portion 38^a extending upwards into a reduced bore of cylinder 38, portion 38^a being also in two parts, with a connecting portion of reduced diameter. Cylinder 37 is further provided with fluid chambers 37^b and 37^c. Ports 37^d and 37^e extend respectively from the top and bottom of chamber 37^b into the cylinder bore 37^a, and similar ports 37^f and 37^g extend respectively from the top and bottom of chamber 37^f into the cylinder bore. A passage 37^h also extends through cylinder 38 and communicates with the reduced bore at the top of the cylinder at its upper end, and communicates with an exhaust passage 11^a extending from member 11 at its lower end. Air is supplied to the bottom of cylinder 37 by a fluid or air pipe 40 which extends downwardly through the cross bar 11. Pipe 40 is connected by suitable connections to a pipe 41 secured in an air supplying valve 42 mounted on the cross rail 12. Said valve has a passage 42^a communicating with the pipe 41, which passage communicates with a chamber 42^b in the valve which is supplied with air or other fluid by the supply pipe 43. The valve proper 44 has guiding stems at its upper and lower sides and is adapted to seat on a valve seat formed at the bottom of chamber 42^b so as to cut off communication between pipes 43 and 41. The valve 44 normally is pressed to its seat by a spring 45^a. The lower valve stem 44^a of valve 44 projects through the bottom of the valve casing 42 and rests upon the upper end of lever 45 pivoted at 46 to a bracket 47 secured to the under side of the cross rail 12. The other end of the lever 45 curves downward and is pivoted by pivot member 48 to the ends of a pair of levers 49 extending in opposite directions from pivot 48 and pivoted respectively by the pivots 50 and 51 to downwardly extending arms of bracket 47. The ends of levers 49 are formed as reversely curved fingers 49^a having their lower surfaces substantially at the bottom of the feed rolls 23, these fingers extending respectively towards opposite ends of the machine.

Operation.

In operation the pipe 43 will be connected to a suitable source of fluid under pressure, such as compressed air and power will be applied by a suitable belt to the pulley 29. When pulley 29 is driven the feed rolls 23 and 25 will be rotated through the gears 26, 27 and 28, so that rolls 23 and 25 are driven in opposite directions and in such a manner that they will tend to progress a sheet material therebetween. Electric current is supplied from a suitable source to the conductors 18, so that the die 14 is heated. The fibrous sheet of material illustrated as 55, which may be smooth or corrugated, is now fed between the rolls 23 and 25 as shown in Figs. 1 and 3, and between the dies 10 and 35. When the die 35 is in its upper position, the rib 35^a projects into the longitudinal groove in die 14. It will be noted that the free end of die 35 has its top surface inclining somewhat downwardly so that the rib in the die 35 is not at such a great height at this end of the die. As the material passes between the first rolls 23 and 25, it lifts the finger 49^a. This depresses the other end of the respective lever 49 and moves the short end of lever 45 downwardly. This raises the free end of lever 45 and

valve stem 44ª, so that valve 44 is lifted from its seat against the pressure of spring 45ª. Air thus is supplied from pipe 43 and from chamber 42ᵇ to the pipe 41. As stated, this pipe is connected to the pipe 40 and air is thus supplied to the cylinder 37 and to the bore 37ª therein.

The air supplied to the bottom of bore 37ª forces the piston 38 upward. When said piston reaches a certain point, the reduced portion of said piston affords communication between ports 37ᶠ and 37ᵉ and the air thus passes through the top of piston 38. The piston strikes against the top of the cylinder and rebounds and the air at the top thereof impells the same downward, when the air at the top is cut off and exhausted through the exhaust port 37ʰ. The piston is again urged upwardly, and thus reciprocates very rapidly. The piston and cylinder illustrated show merely a common commercial form of valveless reciprocating tool.

The piston 38 is thus rapidly reciprocated in the usual manner for an air driven reciprocating tool. The upper end 38ª of the piston then imparts a series of blows or impulses to the lower end of plunger 36. These impulses occur with great rapidity and the plunger 36 then imparts a like series of very rapid blows or impulses to the lower side of the movable die 35. This die is thus repeatedly raised and presses the material 55 against the die 14 and rib 35ª presses the material into the groove in die 14 so that a crease or groove is formed in the material, as illustrated in Fig. 5. This groove thus forms a rib on one side of the material. The upper die 14 being heated, an embossing effect is given to the material and the portion thereof which is pressed into the groove in the fixed die is compressed and compacted. When the material is bent to form a box, so that the portions 55ª and 55ᵇ at each side of the groove extend at right angles as shown in Fig. 6, there will be no opening of the layers or laminations of the material. The fibrous material used always contains a certain amount of moisture and the heating and compressing effect of the dies compacts the material so that the same is made stiffer and has less tendency to open up when bent, as shown in Fig. 6. The material moves continuously through the machine and after the same passes the rear end of the dies 35 and 14, the crease or groove is perfectly formed therein. It will be seen that owing to the downward inclination of the top of die 35, the groove is gradually formed as the material moves between the dies. The piston 38 and plunger 36 will continue to operate until the material has passed beyond the finger 49ª at the rear of the dies, as this finger will hold the valve 44 open. After the material has passed this last finger 49ª, the finger will be allowed to drop and the action of the fluid piston 38 will be stopped. It will thus be seen that the material can be quickly run through the machine and a perfect crease or groove formed therein.

From the above description it is apparent that applicant has provided a very simple and efficient method and apparatus for creasing or forming a groove in fibrous or corrugated sheet material, such as is now commonly used in the construction of containers.

In Fig. 4 a sheet of rectangular material 56 is shown, the same having been cut as shown at the slots 56ª and having been provided with creases or grooves along the lines 56ᵇ. After having been so creased, the box is folded as indicated in Fig. 7, to form a rectangular container, the overlapping sides being secured in any suitable manner, as by staples or adhesive.

The method and apparatus disclosed have been amply demonstrated in actual practice and found to be very successful and efficient. Not only is the operation performed in very rapid manner, but a very superior product is obtained.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of parts of the apparatus and in the steps and sequence of steps of the method, without departing from the scope of applicant's invention, which, generally stated, consists in a device and method capable of carrying out the objects above set forth, in the novel parts and combination of parts disclosed, as well as in the novel steps and sequence of steps disclosed, and also as set forth in the appended claims.

What is claimed is:

1. An apparatus for creasing fibrous sheet or corrugated material having in combination, a stationary die, a movable die, said dies being shaped to press the material therebetween and form a groove therein, means for feeding the material between said dies and means for rapidly reciprocating said movable die against the material to form said groove therein.

2. An apparatus for creasing fibrous sheet or corrugated material having in combination, a female die having a groove extending longitudinally through the surface thereof, a male die having a rib adapted to press the material into said groove, means for feeding material between said dies and means for rapidly reciprocating one of said dies whereby the material is compressed between the dies and a groove formed therein.

3. An apparatus for creasing fibrous sheet or corrugated material having in combination, a fixed die, a die adapted to aline and co-operate therewith and pivoted at one end to swing toward and from said fixed die, means for feeding the material between said

dies and means for rapidly reciprocating said movable die to form a groove in said material.

4. An apparatus for creasing fibrous sheet or corrugated material having in combination, a female die having a groove extending longitudinally through the surface thereof, a male die having a rib adapted to press the material into said groove, means for continuously moving the material between said dies and means for rapidly reciprocating one of said dies to form a groove in said material.

5. An apparatus for creasing fibrous sheet or corrugated material having in combination, a female die having a groove extending longitudinally through the surface thereof, a male die having a rib adapted to press the material into said groove, said dies being constructed and arranged to approach more closely at one end than the other, means for continuously feeding the material between said dies and means for rapidly reciprocating one of said dies to press the material therebetween, whereby a groove is formed in said material.

6. An apparatus for creasing fibrous sheet or corrugated material having in combination, a female die having a groove extending longitudinally through the surface thereof, a male die having a rib adapted to press the material into said groove, means for continuously feeding the material between said dies, means for rapidly reciprocating one of said dies to press the material therebetween, whereby a groove is formed in said material, and means controlled by the movement of the material, for rendering said last mentioned means operative.

7. An apparatus for creasing fibrous sheet or corrugated material having in combination, a female die having a groove extending longitudinally through the surface thereof, a male die having a rib adapted to press the material into said groove, means for continuously feeding the material between said dies, means for rapidly reciprocating one of said dies to press the material therebetween, whereby a groove is formed in said material, means controlled by the movement of the material, for rendering said last mentioned means operative, air operated means for actuating said last mentioned means, a valve for controlling the supply of air to said air operated means and means operated by the movement of the material, for controlling said valve.

8. A method of forming a crease or groove in fibrous sheet or corrugated material, which consists in progressing the material between a die having a groove extending longitudinally therethrough and a male die having a rib extending longitudinally thereof, adapted to co-operate with said groove and rapidly reciprocating one of said dies to press the material between said dies and form a groove therein.

9. A method of forming a crease or groove in fibrous sheet or corrugated material, which consists in progressing the material continuously between a female die having a groove extending longitudinally therethrough and a male die having a rib extending longitudinally thereof, adapted to co-operate with said groove, heating one of said dies and rapidly reciprocating one of said dies to press the material therebetween to emboss the same and form a groove therein.

10. A method of forming a crease or groove in fibrous sheet or corrugated material, which consists in progressing the material continuously between a pair of dies adapted to co-operate and form a groove in said material and rapidly reciprocating one of said dies to continuously form a groove in said material.

11. An apparatus for creasing fibrous sheet or corrugated material having in combination, an upper female die having a groove extending longitudinally through the surface thereof, a lower male die having a rib adapted to press the material into said groove, means for continuously moving the material between said dies and means imparting a series of rapid blows to said male die to cause the same to press the material against said female die and form a groove therein.

In testimony whereof we affix our signatures.

CHARLES C. GAMM.
FREDERICK H. CORDES.