June 15, 1954

P. BROWN

2,680,996

CORRUGATED PAPER MACHINE

Filed Nov. 3, 1951

4 Sheets-Sheet 1

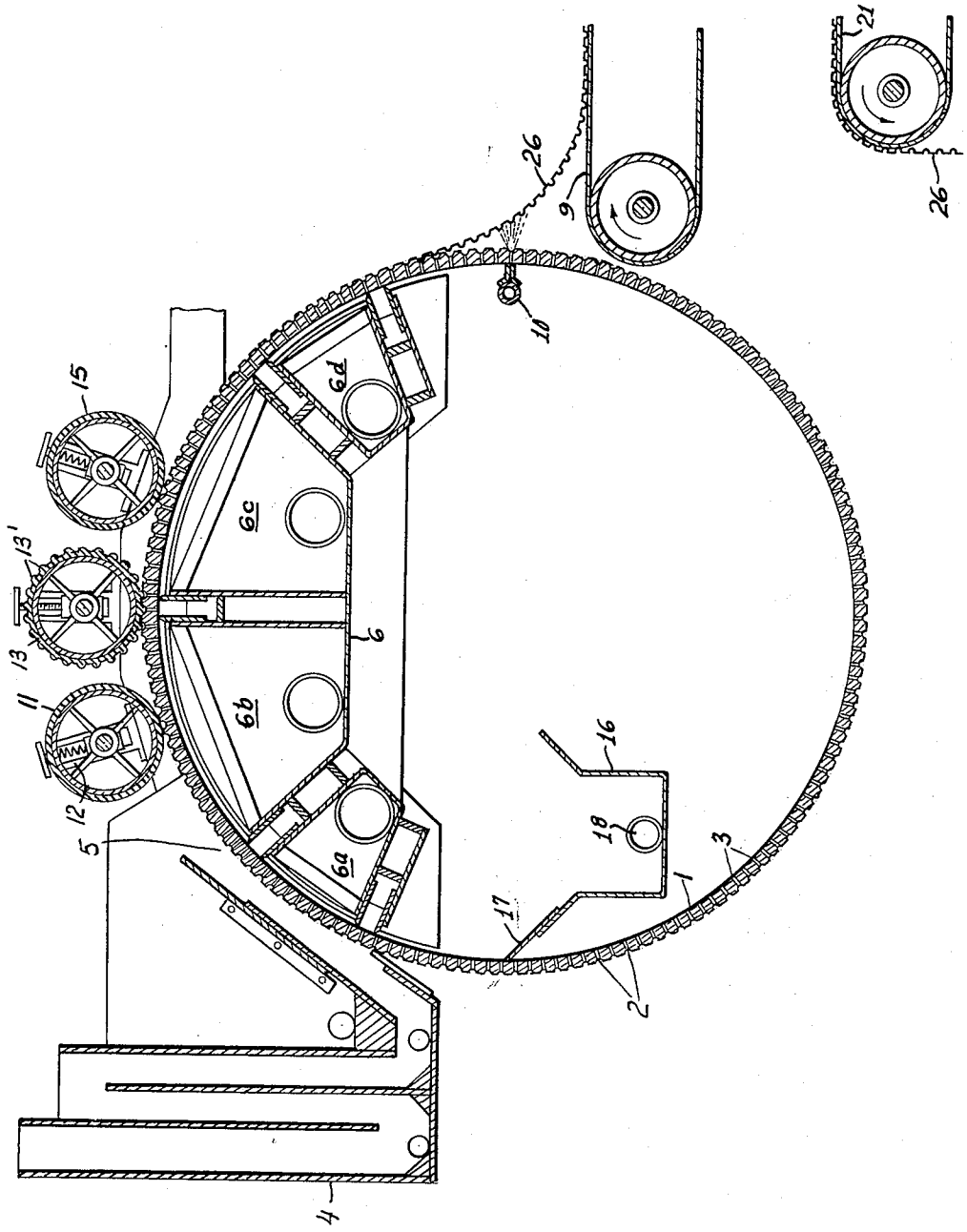


Fig. 1.

INVENTOR
PAUL BROWN

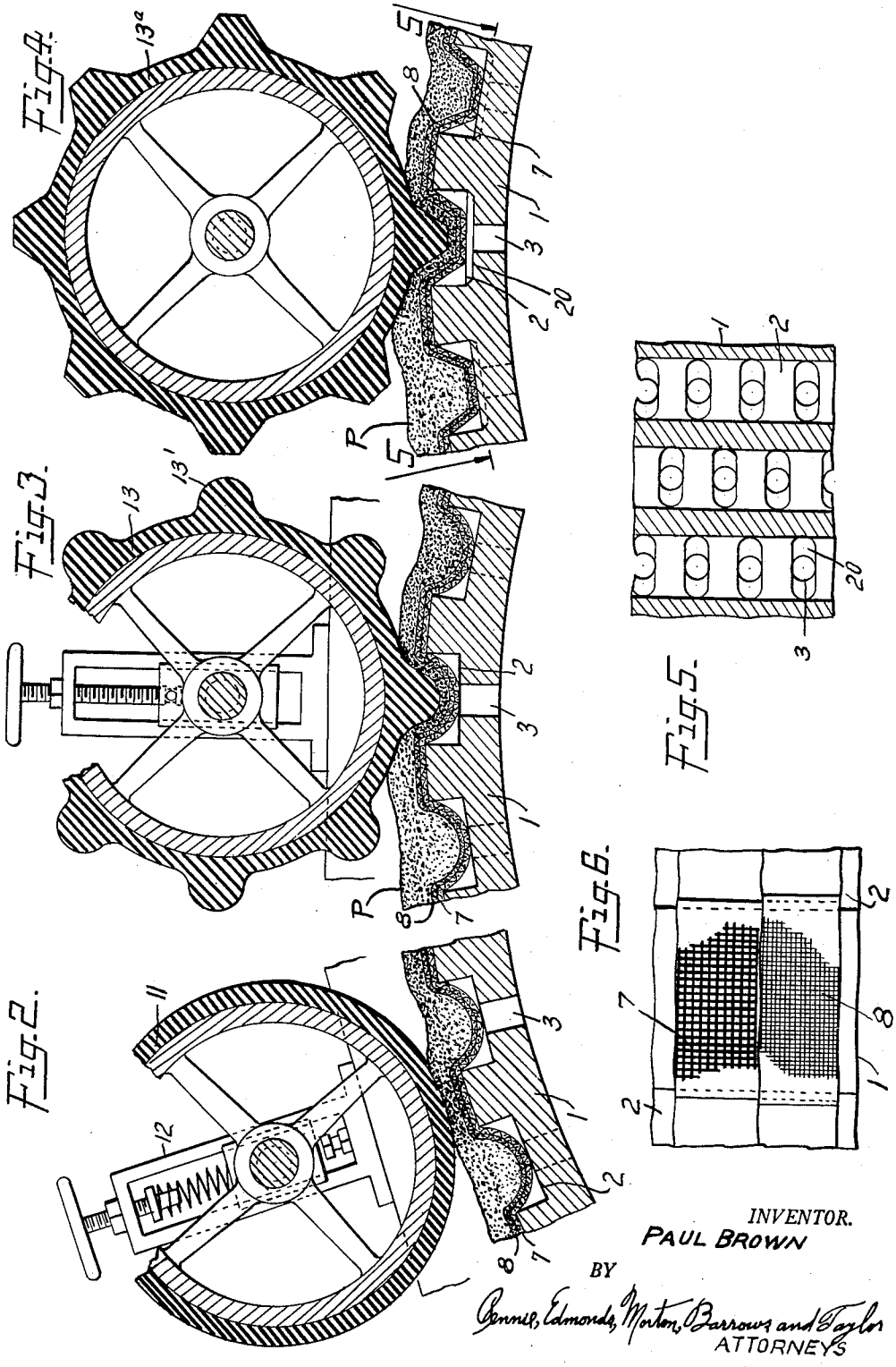
BY
Connie, Edmonds, Morton, Barrows and Taylor
ATTORNEYS

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CORRUGATED PAPER MACHINE

Filed Nov. 3, 1951

4 Sheets-Sheet 2



INVENTOR.
PAUL BROWN

BY

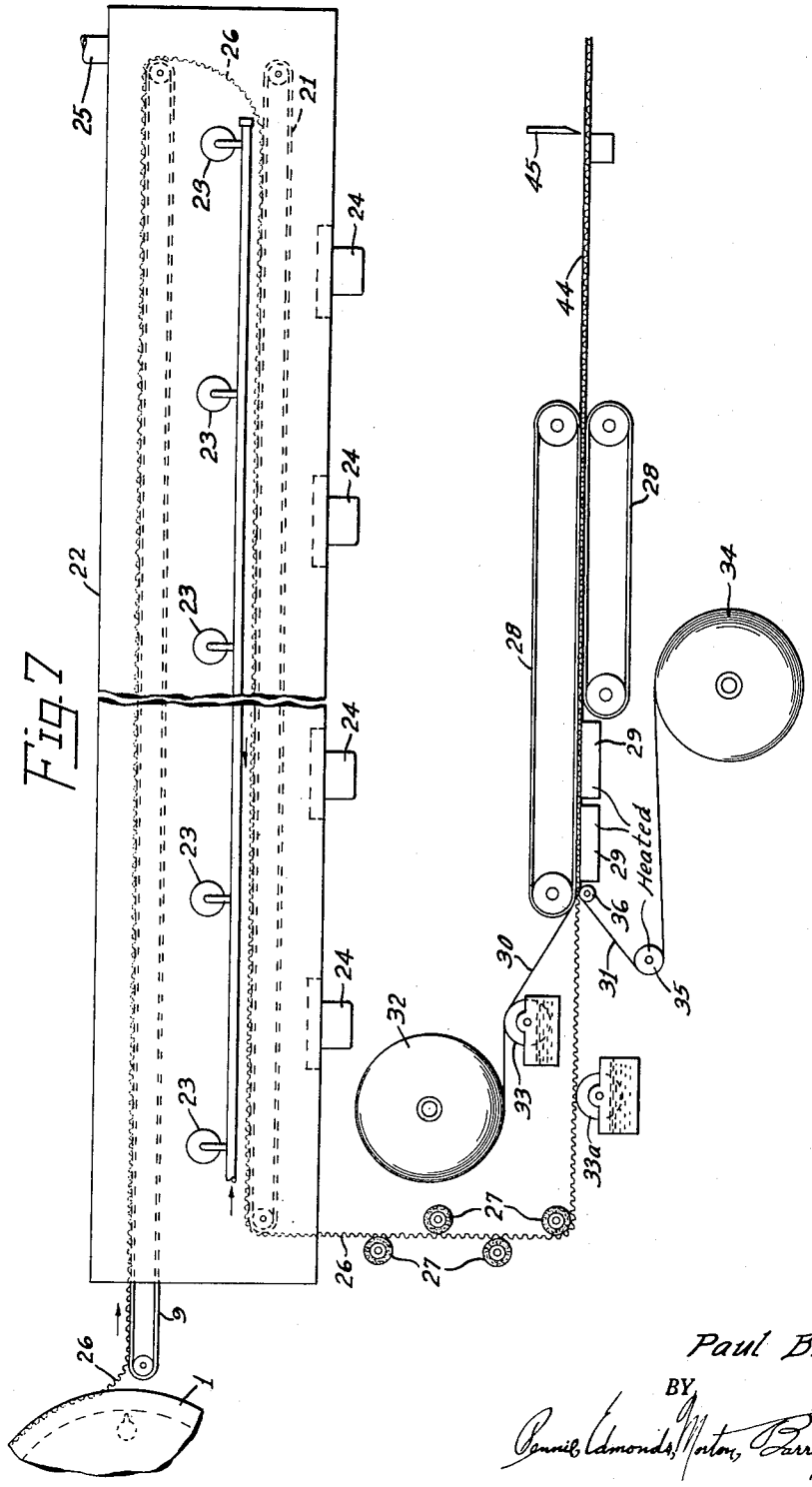
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Fig. 7



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Fig. 8

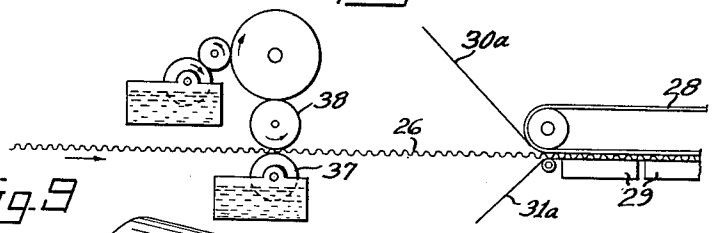


Fig. 9

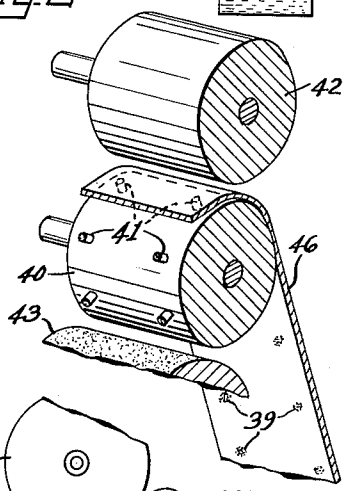
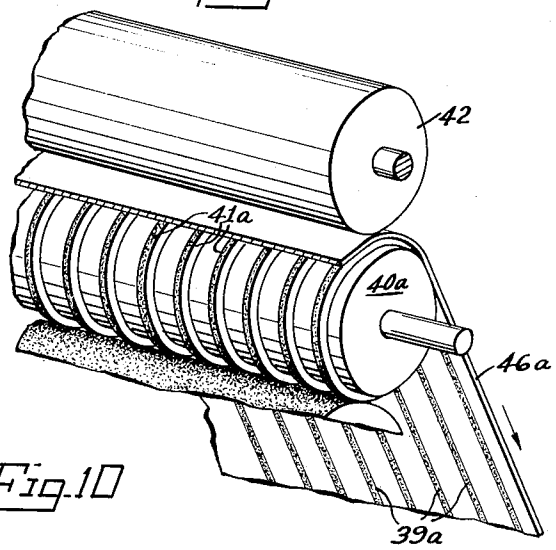


Fig. 9a



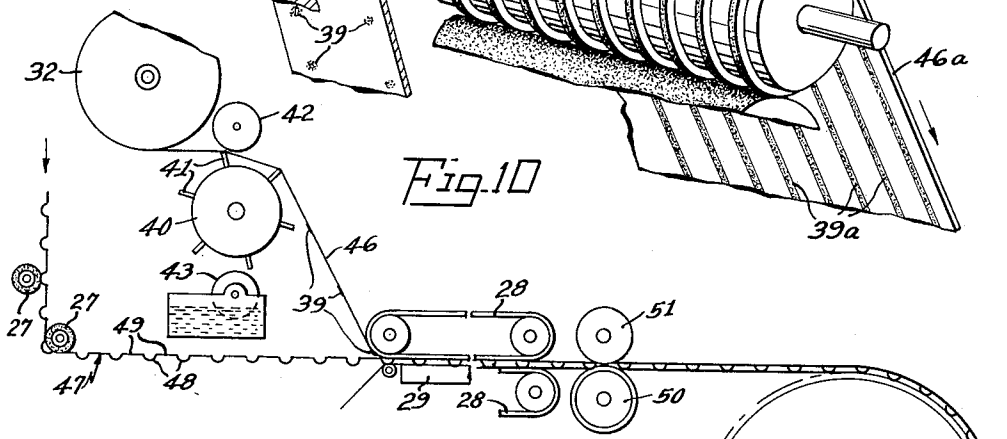


Fig. 10

Fig. 11

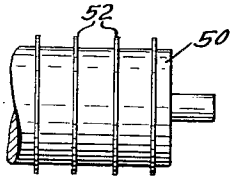
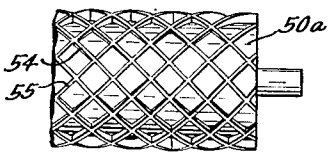


Fig. 12



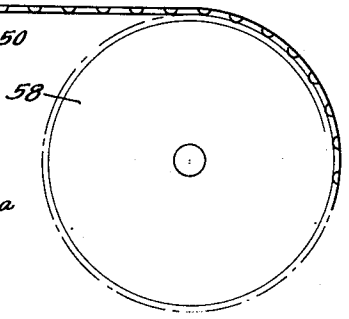


Fig. 13

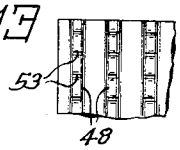
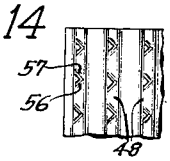


Fig. 14



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Patented June 15, 1954

2,680,996

UNITED STATES PATENT OFFICE

2,680,996

CORRUGATED PAPER MACHINE

Paul Brown, Walpole, N. H., assignor to Packaging Materials Corp., Providence, R. I., a corporation of Rhode Island

Application November 3, 1951, Serial No. 254,691

12 Claims. (Cl. 92—39)

1

This invention relates to machines for molding corrugated paper board.

The invention has for its object to provide certain improvements applicable to machines of the type generally disclosed in U. S. Letters Patent No. 2,221,200 to Eugene L. Perry, by virtue of which improvements a molded corrugated board may be fabricated at a much higher rate of production than obtainable with the machine of the Perry patent.

A further object of the invention is to provide a machine of the character described in the above-mentioned patent on which corrugated board having different characteristics of stiffness and density may be manufactured by making certain simple adjustments of the machine.

A further object of the invention is to provide an improved machine of the character described wherein a much greater percentage of the water in the pulp is extracted before drying than in machines as heretofore constructed without unduly increasing the density of the fiber, whereby the manufacturing cost of the molded sheet is greatly reduced.

Another object of the invention is to provide a machine which will produce at a lower cost than heretofore corrugated board having a backing sheet adhesively secured thereto.

Further objects of the invention will appear from the following specification and drawings, wherein

Fig. 1 is a diagrammatic sectional view through the cylinder of the machine on a plane transverse to its axis of rotation, showing a preferred arrangement of the several elements;

Fig. 2 is an enlarged sectional detail of the cylinder wall and one of the press rollers shown in Fig. 1;

Fig. 3 is a similar view showing an additional press roller which is used in making one type of board;

Fig. 4 is a sectional view similar to Fig. 3 but showing a modified form of the parts therein disclosed;

Fig. 5 is a detail sectional view on line 5—5 of Fig. 4;

Fig. 6 is a plan view on a much enlarged scale of a portion of the cylinder wall;

Fig. 7 is a diagrammatic view showing the arrangement of the apparatus for drying the corrugated board and securing thereto by adhesive one or more backing sheets;

Fig. 8 is a diagrammatic view of a modified form of the mechanism for applying backing sheets;

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Fig. 9 is a fragmentary perspective showing a modification of the adhesive applying mechanism;

Fig. 9*a* shows another modification;

Fig. 10 is a diagrammatic view of another modification for applying a single backing sheet and also creasing the ribs of the corrugated sheet;

Fig. 11 is a detail of one form of creasing roller;

Fig. 12 is a similar detail showing another form of creasing roller;

Fig. 13 is a fragmentary view showing the creasing produced by the roller of Fig. 11; and

Fig. 14 is a similar view showing the creasing produced by the roller of Fig. 12.

Referring to the drawings, 1 indicates the cylinder upon which the corrugated board is molded, the cylinder having grooves 2 corresponding to the position of the ribs in the molded sheet, and grooves 2 being separated by parallel ridges. The grooves are preferably of substantially rectangular cross section and at intervals along the bottom of the grooves, holes 3 are provided leading to the interior of the cylinder.

A flow box 4 of any suitable design is mounted adjacent the path of the cylinder at a location above the plane of the horizontal axis of the cylinder and to one side of the vertical axial plane of the cylinder on the side of the cylinder where the surface of the cylinder is moving upwardly. Within the cylinder is a suction box 6, the edges of which are provided in the usual manner with packing contacting the inner surface of the cylinder, whereby pulp will be drawn into the grooves 2 and against the face of the cylinder and a substantial portion of the water in the pulp will be withdrawn through the perforations in the bottom of the grooves during the passage of that portion of the drum wall over the suction box.

Suction box 6 is divided into a plurality of chambers 6*a*, 6*b*, 6*c* and 6*d*, each having a separate connection to a suitable vacuum pump or other source of suction. The chambers are divided from one another by walls also provided with packing contacting the inner surface of the cylinder 1 so that different degrees of vacuum can be maintained in the different chambers. Chamber 6*a* surrounds an area which is opposite flow box 4 and the degree of vacuum maintained in this chamber is the lowest inasmuch as the pulp at this stage is still in liquid suspension and too high a vacuum would cause substantial amounts of pulp to be drawn through with the

water. A considerably higher vacuum is maintained in chambers 6b, 6c and 6d.

The surface of the drum containing the corrugations is covered with one or more sheets of foraminous material such as wire screening. The screening is not shown in Fig. 1 because of the small scale of that figure, but it will be understood that the screening covers the entire corrugated surface of the drum, and preferably two sheets of screening are used. The construction and arrangement of the screens is shown in Figs. 2, 3, 4, and 6. The under sheet 7 is of comparatively coarse mesh, while the outer layer 8 of screening is of comparatively fine mesh. The layers of screening are corrugated so that the outer surface of the screen 8 corresponds to the desired contour of the face of the finished corrugated paper containing recesses in which the ribs of the corrugated paper are molded. In order to facilitate the proper draining of water from the pulp and also to adequately draw the pulp into the recesses or grooves in the wire screening which overlies the grooves 2 in the surface of the cylinder, the grooves in the cylinder and those in the screens are of different contour. Thus, the grooves in the cylinder are of rectangular cross section, while the grooves in the screens are of a different size and shape, for example, of semicircular cross section, as shown in Fig. 2. As here shown, the crowns of the ribs on the under side of the screening contact the bottoms of the respective grooves 2 along the middle line thereof, leaving spaces in the corners of each angular groove to provide an unimpeded passage for the water squeezed and drawn out of the pulp in its passage through the machine, while at the same time providing ample support for the screening.

I also preferably provide a series of press rollers contacting the pulp at it moves with the cylinder from the flow box to the endless conveyor 9 by which the sheet of molded pulp is removed from the drum. In starting up, an air blast device 10 is employed to blow the end of the web of pulp of the cylinder.

The first roller 11 of this series is preferably a rubber covered roll, the rubber being fairly soft and having a smooth surface. The roller 11 is mounted in spring pressed bearings, such as shown at 12, having provisions for adjusting the spring pressure. The pulp on the cylinder as it approaches the press roller 11 has been but loosely compacted by the suction, as shown at the left of Fig. 2, and contains a high percentage of water. As the pulp passes under the roller 11 the pulp is compressed and a large portion of the entrained water is expressed through the screens and drawn into the suction box. After passing the roller 11 the layer of pulp expands considerably as indicated at the right of Fig. 2.

The pulp is again compressed with the extraction of more water before the board reaches the conveyer 9. In Fig. 1 I have shown a ribbed press roller 13 arranged over the cylinder 1 beyond the roller 11. This roller 13 is not necessarily used for making the soft flexible packing sheets for which the board is principally used but only for board having greatly increased fiber in both ribs and intermediate portions, such as described in my co-pending application filed concurrently herewith. In making the soft board the roller 13 may be omitted and the advancing cylinder carries the pulp layer from the roller 11 to a second roller of the same construction and arrangement as the roller 11, positioned as shown

at 15 in Fig. 1. The roller 15 overlies a later suction chamber and on passing under the roller 15 over this suction chamber, the pulp is further compressed and more water is expressed from it and carried away by the suction.

The spring pressure on the rollers 11 and 15 and the suction maintained in the suction chambers 6b, 6c and 6d are so adjusted that the water-solids ratio of the pulp is altered from in the order of 99.5–.5 to 78–22. With the water content so reduced the paper board is self-sustaining and is easily removed from the cylinder by the conveyor 9. The large water removal by the rollers 11 and 15 and the suction chambers without unduly compacting the pulp is largely due to the screen construction above described which permits a free withdrawal of the water as it is expressed from the paper.

Any wet pulp or liquid material that flows down the inside of cylinder 1 below the flow box 4 is removed by means of a trough 16 having a doctor blade 17 and an outlet 18. The water left in the pulp as it leaves the cylinder must be removed by evaporation. By machines as previously constructed the best water-pulp ratio heretofore obtainable was approximately 83–17. The finished board has about 8% to 10% moisture content and the reduction in the amount of water which has to be evaporated for each ton of paper is reduced by about a ton and a half by the use of the new machine.

For making board such as disclosed in my co-pending application of even date herewith entitled "Packaging Materials," Serial No. 254,692, the second roller 13 is used preferably in addition to the smooth-faced roller 11. Also, preferably I flow a deeper or thicker pulp from sluice box 4. This is indicated by the depth of the pulp P, as it approaches roller 13 after leaving roller 11 (Fig. 3). Roller 13 is provided with ribs 13' positioned to register in timed relation with the grooves 2 in the cylinder as the cylinder and press rollers are rotated. In the form shown in Fig. 3 ribs 13 are of substantially semicircular cross section, and the bearings of roller 13 which are adjustable as shown, are set so that the surface of the rib is spaced from the surface of the groove in the fine mesh screen 8 which covers the grooves 2 of the cylinder, about the same distance at the middle of the grooves as along the sides.

By this construction the pulp in the grooves which has been picked up during the passage of the cylinder past the sluice box will be compressed by the passage of the drum under roller 13, and the whole sheet will be reduced to a definite thickness which bears a relation to the thickness of the finished sheet. However, since the pulp is by nature quite resilient, as soon as it passes roller 13 it springs back to a considerable extent as indicated at the right of roller 13 in Fig. 3. Hence, the effect of roller 13 is not to produce highly compressed fiber in the ribs of the finished sheet but the combined effect of flowing a thicker mass of pulp onto cylinder 1 and the use of the ribbed roller 13, is to put more fiber into the ribs formed in the grooves in the wire mesh 8 than in the intervening portions, or what appears on the opposite side of the finished sheet as low, flat-topped ribs. In this way, the structure of the ribs formed in the channels of the fine mesh 8 is rendered denser than the fiber in the opposite, flat-topped ribs, thus substantially increasing the strength and rigidity of the finished sheet. There being more fiber in the rounded ribs than in the opposite, flat-topped

ribs, or intervening portions, the compressing effect of ribbed roller 13 is to render the fiber in these rounded ribs more dense than the fiber in the intervening portions.

The press roller 13 is preferably positively driven by gearing, not shown, in synchronism with the cylinder 1. That is to say, the roll and the cylinder have the same peripheral speed, so that the ribs on roller 13 will properly register with the corrugations in the surface of the cylinder but will at the same time be maintained at a suitable distance out of contact with the surface of the cylinder.

The ribbed roller 13 may also be positioned at a point over one of the suction chambers 6b or 6c, but it is preferable to arrange these chambers as shown, that is, with one suction chamber 6b on one side of the point of contact between the ribbed roller 6c wholly to the other side, so that there will be no likelihood of the suction disturbing the distribution of the pulp in the grooves of the cylinder during the pulp-compressing operation.

In making this board, I also preferably use the third roll 15 beyond the ribbed roller 13. The suction chamber 6c which underlies the roller 15 serves to extract from the pulp the water expressed by the rollers 13 and 15.

The improved corrugated board as disclosed in my above mentioned copending application may also be made by flowing a still thicker or deeper pulp, that is, some deeper than indicated at P in Fig. 3, from the sluice box and with the use of one or more of the smooth press rollers 11, that is, without employing the ribbed roller 13. The difference in the density of the fibers in the ribs and in the intermediate portions of the board will not be as great, however, as when roller 13 is used, and the percentage of moisture will be higher.

The board formed on the machine as above described has exceptional tear resistance and is a relatively stiff board, particularly in the direction of the corrugations, because of the increased fiber content both in the ribs and the intermediate portions, and when sheets so made are provided with backing sheets, as shown and described in my copending application filed contemporaneously herewith, a strong, rigid, corrugated board is formed which is particularly suitable for the manufacture of packing cases and the like, as well as light weight boxes, all as fully described in my said co-pending application.

In Figs. 4 and 5 I have shown a modified construction for producing sheets having corrugations of trapezoidal cross section as disclosed in Patent No. 2,484,047 to Eugene L. Perry. As here shown, the grooves in the coarse screen 7 and fine screen 8 forming the surface covering of the cylinder 1 are of trapezoidal cross section, while the underlying grooves 2 are of rectangular cross section to thereby leave free spaces in the corners of the grooves for the reception of water as it is drawn out of the pulp by the suction in the box 6 and pressed out by the rolls 11 and 15. In order to facilitate the drainage of water from the grooves 2, shallow grooves 20 may be provided on each side of the holes 3 leading into the open corner spaces of the grooves 2. Between the holes 3 the bottom face of the groove 2 is flat and forms a solid support for the contacting outer surfaces of the ribs in the screens 7 and 8 which are seated in the grooves 2.

A press roll 13a of the same construction as the previously described press roll 13, but with trapezoidal ribs, as shown in Fig. 4, may be used for making sheets for general packing purposes in order to insure sheets of uniform thickness and surface contour. In Fig. 4 I have shown such a roll as used in making a sheet with trapezoidal ribs. The bearings of the roll are so adjusted as to compress the fiber in the grooves of the cylinder in about the same manner as previously described in connection with roll 13.

The ribbed roll 13a insures the formation in the back of the sheet of shallow grooves underlying the molded ribs on the opposite side of the sheet in the same way as roller 13. Such grooves will usually be formed in the surface of the sheet by suction alone, but it is desirable to provide a press roller in order that the ribs be uniform throughout the sheet.

The machine herein disclosed is employed for manufacturing the corrugated sheet used in making the packing sheet of my co-pending application Serial No. 218,314 filed March 30, 1951, now Patent No. 2,627,484. The roll 13 may be removed altogether in the manufacture of such sheets, but it is preferable to use the roll 13 adjusted to lightly compress the sheet in order that variations in the consistency of the pulp and in the suction maintained in the suction boxes will not alter the thickness of the sheet.

It has been mentioned previously that the water left in the pulp as it leaves the cylinder must be removed by evaporation. This is accomplished by the drying apparatus illustrated diagrammatically in the upper portion of Fig. 7. It comprises two endless conveyors arranged within a suitable housing. One of these conveyers is the conveyer 9 previously referred to and the second conveyer is indicated by reference numeral 21 and is arranged parallel to and somewhat below conveyer 9, the two conveyers being of approximately the same length. The elongated housing 22 is of sheet metal appropriately insulated to conserve heat and provided with a sufficient number of heaters 23 with automatic control to maintain the air within housing 22 at the desired temperature.

Blowers 24 are also provided to circulate the heated air within the housing to bring it repeatedly into contact with the traveling web of pulp, to draw in the desired amount of fresh air and to cause the moisture-laden air to be discharged, for example, through one or more outlets, such as indicated at 25. It will be understood that the pulp web leaving molding cylinder 1 is taken by the upper surface of conveyer 9 and carried to the right to the end of the drying chamber where the web leaves this conveyer and descends onto the upper portion of the lower conveyer 21.

Housing 22 and the conveyers 9 and 21 are of such length and so coordinated as to conveyer speed, air temperature, etc., that the pulp web or corrugated board 26 will be substantially dry when it leaves the chamber at the left as shown in Fig. 7. In a typical installation the length of housing 22 is from 100 to 125 feet. It will be understood that chamber 22 is a wholly closed structure except at the points of introduction and discharge of the pulp web.

Either the soft type of corrugated board, which is produced by flowing a pulp of moderate thickness from the sluice box 4 and without the use of press rolls 13 or 13a, or the harder type of corrugated board, which is produced by flowing a thicker pulp from the sluice box, or by the use of the corrugated press rolls 13 or 13a, or by

both flowing a thicker pulp and using these press rolls, may be provided with a backing sheet on one or both sides. A backing sheet of comparatively lightweight kraft paper is usually applied to one side only of the soft type of corrugated board to form a cushioned wrapping paper, a new product more fully described in my co-pending application entitled "Cushioned Wrapping Material" filed of even date herewith, and which may be employed in stores, etc., like any other wrapping paper where it is desired to protect glassware or other fragile goods.

The harder type of corrugated board has a somewhat thicker sheet of kraft paper applied to it on both sides for the purpose of making a corrugated paper product which is suitable for use in making shipping cases for heavy articles, and only one backing sheet for lightweight boxes.

Corrugated board for these purposes can be made by the apparatus of this invention at less cost than the corrugated board which is customarily employed in making shipping cases and cartons due to the fact that the complete corrugated board is produced in one continuous operation. That is to say, the corrugated web passes from the molding machine, to the drying apparatus to remove the excess moisture, and thence to the laminating apparatus by which a backing sheet is applied to one or both surfaces of the corrugated web, and the finished product is cut up into sheets of commercial dimensions, or wound upon a take-up roller. The material moves forward without stopping from the time that the pulp is flowed onto the drum of the molding apparatus until it is delivered in finished condition. The dry web **26** emerging from the lower left end of the drying housing **22** preferably is carried between a series of tension or guide rollers **27**. The lowermost roll **27** serves to direct the web **26** to the laminating apparatus.

This is shown in Fig. 7, lower part, and may be of conventional construction comprising upper and lower endless pressing belts **28**, the lower belt being shorter and providing space ahead of it for heaters **29** to heat the assembled layers and accelerate drying. An upper backing web **30** of kraft paper of suitable weight and a lower backing web **31** of similar paper and usually of the same weight are drawn between the pressure belts which cause the backing webs to adhere to the opposite faces of the board **26** by means of previously applied adhesive. Suitable adhesive, such as sodium silicate, may be applied to either the corrugated web **26** or to webs **30** and **31**.

Web **30** comes from a magazine roll **32** and passes over an adhesive applying roller **33**, whereas adhesive is applied to the lower side of corrugated web **26** by an adhesive roller **33***a*. Web **31** is from a magazine roll **34** and passes over a heated roller **35** and thence over a pressing roller **36** below the front end of upper belt **28**. Regardless of the manner of applying the adhesive and whether one or two backing sheets are applied to board **26** the completed laminated corrugated web **44** is carried to the right to a cutting knife **45** arranged to cut it into sections of any desired length.

Referring to Fig. 8, the arrangement here is such that the web of corrugated board **26** receives the adhesive on both upper and lower sides. Web **26** passes in contact with a lower adhesive roller **37** which applies the adhesive to the bottom of the web, and with an upper adhesive roller **38** which applies the adhesive to the top of web **26**.

It will be understood that if it is desired not to apply any backing sheet to the web **26**, the laminating mechanism may be omitted and the web passed directly to a take-up roll (not shown).

Figs. 9 and 9*a* show two ways of applying the adhesive in spaced and limited areas to make the cushioned wrapping material referred to above. In Fig. 9 the adhesive is applied in spots **39** to one of the backing sheets, for example, the upper backing sheet **46** (Fig. 10), only one backing sheet being used. These spots are distributed uniformly over the surface of sheet **46**, being considerably separated and of comparatively small size. The purpose is to provide a cushioned wrapping material of much greater flexibility than if the adhesive were applied throughout the entire area of the backing sheet, all as set forth more particularly in my co-pending application above mentioned. The adhesive may be applied in this manner by any suitable mechanism such, for example, as the roller **40** which is provided with projections **41** suitably arranged to print the spots **39** of adhesive on the web as the web passes between roller **40** and press roller **42**. It will be understood that the adhesive is received by projections **41** from an adhesive transfer roller **43**.

The adhesive may also be applied in stripes instead of in spots, with the stripes running crosswise of the ribs and lengthwise of the corrugated board. In fact this is the preferred method of application, and an adhesive roll **40***a* is shown in Fig. 9*a* for applying the adhesive in a series of stripes **39***a* formed by the circular ribs **41***a*. Roll **40** or roll **40***a* may be arranged to apply the adhesive either to web **30***a* as shown in Fig. 10 or to the corrugated web in a manner somewhat similar to the showing of Fig. 8. Although the single web of backing material **46** may be applied to a web of the type shown at **26** in the previous figures, wherein the ribs on opposite sides of the sheet are of about the same size, it is preferable to employ for the cushioned wrapping material a web such as indicated by numeral **47**. Web **47** is molded in exactly the same manner as web **26** but is provided with a series of rounded ribs **48** on one surface of comparatively thick molded fiber connected by intermediate portions **49** which appear on the opposite side as relatively flat and thinner ribs.

The spots of adhesive may be applied to these portions **49** at intervals by roll **40**, and Fig. 10 is intended to indicate that spots **39** have a spacing substantially equal to a multiple of the ribs **48**, that is, a row of adhesive spots is applied across the sheet on, for example, every second connecting portion **49**. It will be understood that the spacing of the adhesive spots **39** laterally is preferably about the same as the longitudinal spacing just described. The spacing and size of the spots **39** or the stripes **39***a* may be varied considerably.

As the laminated material issues from the right-hand end of the laminating apparatus it passes between a creasing roller **50** and a cooperating presser roll **51**, and then is drawn onto a take-up roll **53**. Creasing roller **50** is provided with a series of circular knives **52** (Fig. 11) which are spaced apart lengthwise of the roller. These knives are suitably constructed to press indentations **53** (Fig. 14) in the lower surfaces of ribs **48** to facilitate the bending of the material in a direction lengthwise of the ribs, as more

particularly set forth in my co-pending application above referred to.

In place of the straight creasing roll 50, a different form of creasing roll 50a may be employed which is provided with a series of crossed helically arranged knives 54 and 55 (Fig. 12). The arrangement of these knives is such that they form pairs of double creases or indentations 56 and 57 (Fig. 14) in ribs 48. These double indentations aid in increasing the flexibility of the ribbed sheet in two or more directions.

The web 46 consists of a comparatively thin or light weight kraft sheet, whereas body is supplied to the cushioned wrapping material by means of the molded web 47, which is made from used pulp. By applying the web 46 in the manner described so that the web is not caused to adhere throughout its entire surface to the corrugated web 47, but only in limited and spaced areas as indicated, combined with the creasing of the ribs 48 of the corrugated sheet, a wrapping material is provided which can readily be folded around fragile articles such as glassware, and at the same time affords a cushioning protection which has proved extremely effective in preventing breakage.

By the apparatus of the present invention various products mentioned, namely, the double-faced corrugated board, the single-faced corrugated board, the cushioned wrapping material and the corrugated sheet or board, 26 or 47 by itself, all can be produced in one continuous operation. That is to say, the pulp is flowed continuously onto the molding cylinder 1, which is rotated continuously at uniform speed. Conveyors 9 and 21 of the drying apparatus 22 are also operated continuously and at the same uniform speed as the surface speed of cylinder 1. The endless presser belts 28 of the laminator, as well as the scoring or creasing rolls 53, 51 are also operated at this same speed.

The pulp passes directly from molding cylinder 1 to the drying chamber 22 and thence directly to the laminator and to the scoring rolls if these are used. The motion of the pulp web is continuous from the time it is first formed until the complete product is delivered from the cutting knives 45 or onto the take-up roll 53, or the like. Hence, the apparatus embodies not only the advantages of continuous production as distinguished from batch production, but also the advantages resulting from producing the complete product in one continuous operation instead of in a series of separate steps.

It will be understood that various changes in the arrangement and details of the apparatus may be made without exceeding the scope of the invention which is defined in the appended claims.

I claim:

1. In a machine for molding corrugated paper board the combination of a molding cylinder having a grooved outer surface, means for applying a layer of paper pulp to said surface with said grooves substantially filled with pulp, holes in the cylinder wall within said grooves for the extraction of water from the pulp, and a roll having ribs thereon corresponding with the grooves of the cylinder and means for maintaining said roll with the surface of its ribs spaced from the surface of the grooves by a definite distance whereby the pulp in said grooves is pressed to a definite thickness.

2. In a machine for molding corrugated paper board the combination of a molding cylinder having a grooved outer surface, means for applying a continuous layer of paper pulp to said surface with said grooves substantially filled with pulp, holes in the cylinder wall within said grooves for the extraction of water from the pulp, and a roll having ribs thereon of a height substantially equal to the depth of said grooves and means for maintaining said roll with its surface spaced from the surface of the cylinder by a distance substantially equal to the layer of pulp on the surface of the cylinder between said grooves.

3. In a machine for molding corrugated paper board the combination of a molding cylinder having a grooved outer surface, means for applying a layer of paper pulp to said surface with said grooves substantially filled with pulp, holes in the cylinder wall along the bottoms of said grooves for the extraction of water from the pulp, and means for pressing said pulp comprising a roll having ribs thereon corresponding with the grooves of the cylinder and means for maintaining said roll with its surface spaced a definite distance from the surface of the cylinder, a second press roll of cylindrical contour, and yielding means for maintaining said roll in contact with the pulp on the surface of said cylinder.

4. In a machine for molding corrugated paper board the combination of a molding cylinder having a grooved outer surface, means for applying a layer of paper pulp to said surface with said grooves substantially filled with pulp, holes in the cylinder wall along the bottoms of said grooves for the extraction of water from the pulp, and means for pressing said pulp comprising a roll having ribs thereon corresponding with the grooves of the cylinder and means for maintaining said roll with its surface spaced a definite distance from the surface of the cylinder, a second press roll of cylindrical contour and a suction box positioned within said cylinder underlying said second roll.

5. In a machine for molding corrugated paper board the combination of a cylinder having a grooved outer surface, means for applying a layer of paper pulp to said surface with said grooves substantially filled with pulp, holes in the cylinder wall along the bottoms of said grooves for the extraction of water from the pulp, a press roll having a smooth cylindrical surface contacting the outer surface of the pulp deposited on said cylinder and yielding means for maintaining said roll in contact with said pulp.

6. In a machine for molding corrugated paper board the combination of a cylinder having a grooved outer surface, means for applying a layer of paper pulp to said surface with said grooves substantially filled with pulp, holes in the cylinder wall along the bottoms of said grooves for the extraction of water from the pulp, a press roll having a smooth cylindrical surface contacting the outer surface of the pulp deposited on said cylinder, yielding means for maintaining said roll in contact with said pulp, and a suction box within said cylinder underlying said roll.

7. In a machine for molding corrugated paper board the combination of a cylinder having a grooved surface, passages through the walls of said cylinder along the bottoms of said grooves, a pulp molding form for said cylinder of corrugated foraminous sheet material having portions extending into said grooves forming recesses to mold the ribs of the corrugated board, a flow box arranged for depositing paper pulp on said molding form, said recess portions of

said mold form being of a different contour from the said grooves, thereby providing drainage spaces between the walls of said grooves and the foraminous sheet material, a press roll contacting the outer surface of the pulp deposited on said cylinder and yielding means for maintaining said roll in contact with said pulp.

8. In a machine for molding corrugated paper board the combination of a cylinder having grooves in its surface with ridges between the grooves, passages through the walls of said cylinder along the bottoms of said grooves, a pulp molding form of corrugated foraminous sheet material surrounding said cylinder, a flow box arranged for depositing paper pulp on said corrugated molding form, said sheet material having portions extending into the grooves of said cylinder forming recesses to mold the ribs of the corrugated board, and portions extending over the ridges of said cylinder to mold the intervening portions of the corrugated board, the recess portions of said molding form being of a different contour from the said grooves, thereby providing unimpeded passages between the walls of said grooves and the foraminous material of said molding form for the rapid drainage of water from said paper pulp to the passages in the bottoms of said grooves.

9. In a machine for molding corrugated paper board the combination of a cylinder having grooves in its surface with ridges between the grooves, passages through the walls of said cylinder along the bottoms of said grooves, a pulp molding form of corrugated foraminous sheet material surrounding said cylinder, a flow box arranged for depositing paper pulp on said corrugated molding form, said sheet material having portions extending into the grooves of said cylinder forming recesses to mold the ribs of the corrugated board, and portions extending over the ridges of said cylinder to mold the intervening portions of the corrugated board, the recess portions of said molding form contacting said grooves only along their top edges and along the mid portion of the bottom wall, thereby providing spaces between the walls of said grooves and the foraminous material of said molding form for the rapid drainage of water from said paper pulp to the passages in the bottoms of said grooves.

10. In a machine for molding corrugated paper board the combination of a cylinder having grooves in its surface with ridges between the grooves, a pulp molding form of corrugated coarse mesh screening and superimposed fine mesh screening surrounding said cylinder, a flow box arranged for depositing paper pulp on said corrugated molding form, a suction box on the interior of said cylinder arranged to apply suction to the inner surface of the wall of said cylinder, passages through the walls of said cylinder along the bottoms of said grooves, said corrugated screening having portions extending into the grooves of said cylinder forming recesses to mold the ribs of the corrugated board, and portions extending over the ridges of said cylinder to mold the intervening portions of the corrugated board, the portions of said screening within said grooves being of a different contour from the said grooves, thereby providing unimpeded passages between the walls of said grooves and the screening for the drainage of water from said paper pulp to the passages in the bottoms of said grooves.

11. In a machine for molding corrugated paper board the combination of a cylinder having parallel grooves of rectangular cross section in its surface with parallel ridges between the grooves, passages through the walls of said cylinder along the bottoms of said grooves, a pulp molding form of corrugated coarse mesh screening and superimposed fine mesh screening surrounding said cylinder, a flow box arranged for depositing paper pulp on said corrugated molding form, said corrugated screening having portions extending into the grooves of said cylinder forming recesses to mold the ribs of the corrugated board, and portions extending over the ridges of said cylinder to mold the intervening portions of the corrugated board, the recess portions of said screening within said grooves being of semi-circular cross section contacting the mid portions of the bottoms of said grooves, thereby providing approximately triangular spaces between the walls of said grooves and said screening for the rapid drainage of water from said paper pulp to the passages in the bottoms of said grooves.

12. In a machine for molding corrugated paper board the combination of a cylinder having grooves in its surface with ridges between the grooves, a pulp molding form of corrugated foraminous sheet material surrounding said cylinder, a flow box arranged for depositing paper pulp on said corrugated molding form, said sheet material having portions extending into the grooves of said cylinder forming recesses to mold the ribs of the corrugated board, and portions extending over the ridges of said cylinder to mold the intervening portions of the corrugated board, the recess portions of said molding form being of a different contour from the said grooves leaving spaces between the foraminous material and the walls of the grooves, the walls of the cylinder having unimpeded passages extending to said spaces for the rapid drainage of water from said paper pulp.

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