

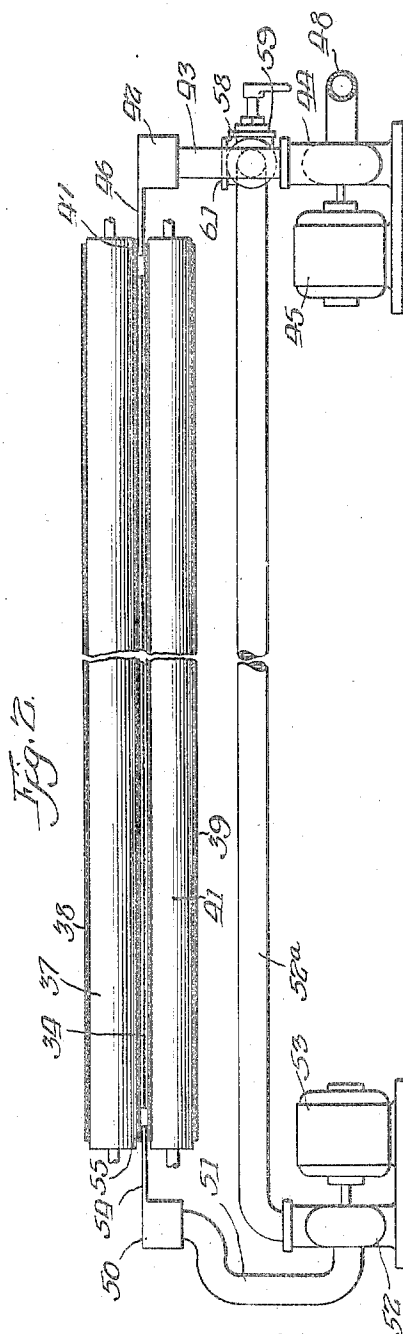
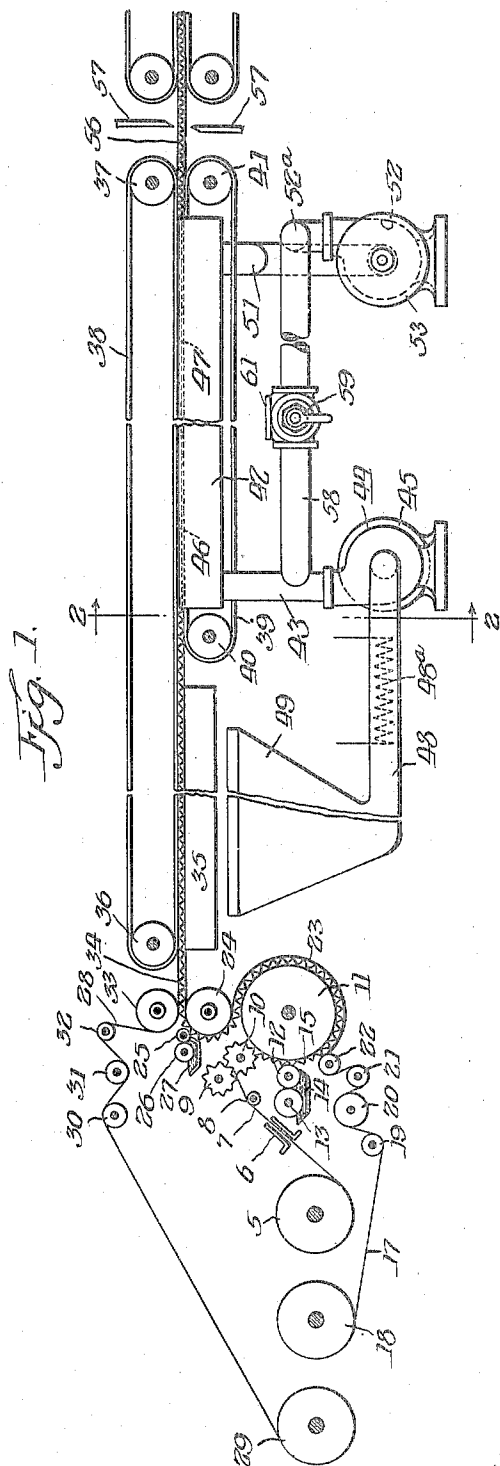
March 25, 1941.

C. W. GRIMM

2,236,056

APPARATUS AND METHOD OF MAKING CORRUGATED BOARD

Filed Feb. 4, 1938



Inventor:
Carl W. Grimm:

By William H. Abbott

Atty:

UNITED STATES PATENT OFFICE

2,236,056

APPARATUS AND METHOD OF MAKING
CORRUGATED BOARDCarl W. Grimm, Oak Park, Ill., assignor to Henry
Pratt Company, Chicago, Ill., a corporation of
Illinois

Application February 4, 1938, Serial No. 188,653

6 Claims. (Cl. 154—32)

This invention relates to the method and apparatus for making corrugated straw board and the like, and more particularly to a method and apparatus for seasoning or conditioning double-faced corrugated board.

The practice of making a corrugated paper board known to the art is, roughly, a continuous three-step operation. The first step comprises steaming and/or heating a strip of straw board and forming corrugations therein by passing it over heated fluted rolls, applying an adhesive such as silicate of soda or a starch compound to the tips of the corrugations on one side, bringing a paper liner in contact with the tips of the corrugations to form a single-faced corrugated board, comprising a corrugated strip of straw paper bonded to a smooth surface strip. The second step of the operation comprises applying an adhesive of the type described to the tips of the exposed corrugated surface and bringing a paper liner in contact with it to form a double-faced corrugated board. The result of these two operations is a moist, soft paper board comprising two smooth outer paper surfaces loosely bonded to an inner core of corrugated paper. The third step comprises setting the adhesive and seasoning or conditioning the board. In this step the corrugated strip is passed through a heating zone adapted to reduce the viscosity of the adhesive to form a secure bond between the liners and the corrugated core and conveying the strip of corrugated board between rollers to season the board sufficiently so that it may be printed, scored, slitted and cut. The cut boards are then piled in stacks where the drying out or conditioning operation is completed.

In the manufacture of double-faced corrugated board, the problem of conditioning or drying out the board prior to the slitting and cutting of the strip has presented numerous difficulties. After the strip has passed from the heating zone, the corrugated straw core is moist and soft and the entire board is tender and susceptible to crushing during the scoring, cutting and subsequent handling operations. Losses due to crushing the moist, soft core during these finishing operations are considerable and are even greater on moist days, since very few of the factories making corrugated board are air-conditioned. Obviously, very little moisture can be removed from the board during the short interval between the step of setting the adhesive and the slitting and cutting steps. This is particularly true in the modern laminating machines operating at a high rate of speed, for ex-

ample, between 175 and 325 feet of paper board per minute. Furthermore, in the methods known to the art it is sometimes necessary that corrugated board be piled in stacks for drying before it can be used.

The present invention relates to the conditioning or drying steps and contemplates removing sufficient moisture from the board to form a stiff corrugated board that can be slitted, scored, cut and handled without crushing or otherwise rendering the board unfit for use. Immediately after the adhesive setting step, a great part of the moisture contained in the corrugated assembly is in the vapor state, and it has been found that practically all of this moisture can be removed by passing a stream of air through the corrugated core prior to the slitting and scoring steps. In the devices of the art this vapor is frequently sealed in the corrugated core during the scoring step, and consequently the boards frequently remain in the piles for several days before they become dry enough for handling and use.

The present invention contemplates passing a continuous stream of air through the moist, corrugated core over a considerable length of the strip, while it is moving on the conveyor belts immediately after leaving the heating or adhesive setting zone. Satisfactory results have been obtained by continuously blowing a thin stream of air into one side of the core and drawing it out the other. In this manner a maximum amount of moisture can be removed, assuring a firm, dry board in a minimum period. By blowing air in one side of the board and drawing out the moist air from the other side of the strip, the possibility of destroying the bond between the liners and the core is negligible.

It has been discovered that this desirable result can be achieved by disposing thin, elongated nozzles along both sides of the portions of the conveyor belts conveying the corrugated assembly away from the heating zone. The conveyor belts are usually wider than the corrugated assembly, for example, 80-inch belts may be employed to convey 60-inch corrugated board. By positioning the nozzles slightly inside the conveyor belts, the conveyor belts function as an extension of the nozzle. A steady stream of air from any suitable source, for example, in one embodiment air is drawn from below the heating zone, is blown into one side of the conveyor belts, picks up moisture through its passage through the corrugated core and is drawn out the other side through thin, elongated outlets, likewise extend-

ing slightly inside the edges of the conveyor belts.

A feature of the invention is that it may be employed in any of the well-known corrugating machines, in that it functions equally satisfactorily in machines employing silicate of soda or a starch compound as an adhesive.

A further feature of the invention is that it enables the corrugated assembly to move faster through the machine and also shortens the length of the machine.

A further feature of the invention is that it permits the use of much wetter straw paper and liner in corrugating machines than was possible prior to this invention.

An object of the invention is to provide an improved corrugated board that can be manufactured with substantially greater speed and less cost.

The invention will be readily understood from the following description in connection with the accompanying drawing, wherein an embodiment of the invention as applied to the manufacture of corrugated paper board is illustrated, in which:

Fig. 1 is a broken side elevation of a device embodying my invention, wherein the other mechanisms employed in the manufacture of corrugated board are shown diagrammatically, and

Fig. 2 is a broken sectional view taken along lines 2-2 of Fig. 1.

Referring to Fig. 1, the various mechanisms employed in the steps of corrugating straw board, applying adhesive to the device of the corrugations and connecting the liners to the corrugated core are shown diagrammatically. The invention may be employed with various other types of corrugating machinery other than that illustrated in Fig. 1 and, furthermore, it is not limited to the manufacture of corrugated paper board but may be applied to the manufacture of numerous other types of laminated products, made by similar methods.

In Fig. 1 the reference character 5 indicates a supply of straw board adapted to form the core of the corrugated assembly. This strip of straw board is unwound from the roll 5 and in operation passes between steam jets 6 which moisten and soften the strip of straw board 7. The strip 7 then passes over the guide roll 8 and between two corrugated rolls 9 and 10 forming transverse fluted sections in the straw strip.

The corrugated strip then passes onto a larger roll 11 and comes in contact with the adhesive applying roll 12. This roll is supplied with a suitable adhesive such as silicate of soda or a starch compound by means of the roll 13 which is suspended in an adhesive container 14. The adhesive supplying roll 12 causes the adhesive to be applied to the convex portion on one side of the corrugated strip passing around the roll 11. A little further along the roll, the corrugated strip 15 comes in contact with a liner 17 fed from a supply roll 18 by means of the guide and tension rolls 19, 20, 21 and 22. The guide roll 22 causes a strip of paper 17 to come into intimate contact with the adhesive coated portions of the corrugated strip 15 to form a single-faced corrugated board. The roll 11 is preferably heated in order to partially set the adhesive.

The single-faced corrugated strip 23 then passes around the roll 24 in such manner that the tips of the unlined corrugated side are brought into contact with an adhesive applying

roll 25. Roll 25 is supplied with an adhesive from roll 26 suspended in the adhesive container 27. The adhesive coated corrugated tips of the strip are then brought into contact with a second strip 28 of paper fed from the supply roll 29 over guide and tensioning rolls 30, 31, 32 and 33.

After passing between the rolls 24 and 33 the double-faced corrugated board 34 comprising the corrugated core 15 and liners 17 and 28 is drawn over a series of hot plates 35 by an endless belt 36 driven by rolls 36 and 37. The temperature of the hot plates is such that it will cause the adhesive to set rapidly, forming a secure bond between the two liners and the corrugated tips of the core. The temperature at which the hot plates are kept will vary in accordance with the steam pressure available.

The soft, moist, corrugated assembly 34 is then drawn over an endless belt 39 moving on rollers 40 and 41. Disposed along the sides of the belts 38 and 39 conveying the moist corrugated assembly as it comes off the hot plates 35 is an elongated box 42 having substantially a square cross section and formed of any suitable material, for example, stainless steel. The box 42 has an opening in its bottom at one end thereof into which is fitted a pipe 43 connected to a blower 44 powered by motor 45. The blower is of conventional type, for example, a Buffalo Forge Volume fan (type "V," size 22) having a blower capacity of 3740 feet per minute at 3400 R. P. M. and delivering 600 cubic feet of air per minute has been found suitable. A thin nozzle 46 having an opening of about an eighth of an inch extends along the entire upper inner edge of the box 42. As clearly shown in Fig. 2, the end portion 47 of the nozzle is adapted to extend between the conveyor belts 38 and 40. An inlet pipe 48 feeds air, which may be heated, into the blower 44. In the embodiment shown in Fig. 1, the inlet pipe is provided with a flaring inlet 49 positioned below the hot plates 35 and adapted to draw hot air therefrom without impairing the effectiveness of the hot plates. It is frequently desirable to employ air hotter than that drawn from the hot plates 35, and, accordingly, heating coils 48a are shown in the inlet pipe 48. In some cases preheated air is not desired and the air may be drawn from any other suitable source.

A box 50 similar in construction and outline to the box 42 is disposed along the other side of the belts 38 and 39 and has an outlet pipe 51 communicating with a suction device 52 driven by a motor 53. The exhaust or suction device 52 may be similar in construction to the blower 44 and is preferably operated at the same speed. The suction device 52 discharges the moist air to the atmosphere through the line 52a. In like fashion the box 50 is provided along its entire inner upper edge with a narrow inlet 54 having a portion 55 extending between the belts 38 and 40.

It will be readily understood that as the moist, tender, corrugated assembly 34 passes between the belts 38 and 40 a continuous stream of hot air issues from the nozzle 46 and is forced and sucked through the fluted, moist core of the assembly and drawn out through the outlet 54 by the suction device 52. It is apparent that the overlapping sections of the belts 38 and 39 serve as extensions of the nozzles 46 and 54. By blowing and sucking hot air through the corrugated mass instead of merely blowing it through by means of a powerful blast, it has been found that

the possibility of severing the still weak bond between the adhesive bearing core and the liners is eliminated. In practice it has been found that 600 cubic feet of hot air per minute may be forced through the moist corrugated mass. The quantity and temperature of the air may be varied. Satisfactory results have been obtained with air heated to 275° F. However, the temperature of the air may range from 50° F. to 400° F. depending upon the desired drying of the board and atmospheric conditions within the plant. It will thus be seen that a dry, strong, corrugated board 56 emerges from the rolls 37 and 39 and may be scored or cut to any desired length by means of the cutters 57 without danger of crushing the newly formed board during the cutting or scoring steps.

Due to varying atmospheric conditions within a corrugated paper factory, it sometimes occurs that too much moisture is withdrawn by the improved conditioning device producing a brittle board. To remedy this condition the speed of the blower and suction device may be lowered, thereby withdrawing less moisture, or some of the moist air may be returned from the exhaust outlet 52a to the blower and reintroduced in the corrugated assembly. Accordingly, a by-pass 58 from the exhaust outlet line to the blower inlet is provided. The exhaust outlet has an angle valve 59 controlling the flow of the moist air to the atmosphere through the elbow 61 of valve 59 or returning it to the blower.

It will thus be seen that the improvement contemplates substantially complete control of the moisture content of the corrugated board, and that the improved conditioning mechanism enables the production of a board of any degree of dryness with a marked decrease in production time and damaged board.

A modification of the improved method is to operate the suction device 52 more rapidly than the blower 44, thus maintaining a pressure somewhat lower than atmospheric between the belts 38 and 40. For example, the exhaust device 52 may be operated at 3400 R. P. M. and the blower 44 at 3360 R. P. M. The reduced pressure tends to retard condensation of the water vapor contained in the moist corrugated assembly and facilitates the removal of moisture in the hot air.

A further modification contemplates eliminating the hot plates 35 from the assembly. In this modification the corrugated assembly passes through the improved conditioning device as soon as it is formed, thereby decreasing the length of the entire corrugating mechanism and the time consumed in the manufacture of the board. In this modification superheated steam of a temperature of approximately 400° F. is forced from the blower through the wind box 42, the nozzle 46 and between the liners of the corrugated assembly and is drawn out through the nozzle 54 into the wind box 50. During this step the extreme heat employed tends to set the adhesive uniting the liners to the corrugated tip and at the same time removes the moisture from the wet corrugated assembly.

The foregoing methods and apparatus are to be considered merely as illustrative of the invention. Other modifications and improvements within the scope of the invention will probably become apparent to those skilled in this art.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. The method of conditioning a moist corru-

gated paper assembly formed of a corrugated core and liners adhering thereto, which comprises continuously forcing a stream of heated dry air into one side of said assembly, withdrawing moist air from the other side of said assembly after said air has passed through said corrugated core, and returning such portion of said moist air to said incoming stream of air as may be necessary to secure a properly conditioned corrugated assembly from which excess moisture has been removed.

2. In a machine for manufacturing corrugated paper board, or the like, in continuous strips, means for continuously forming corrugations in a strip of paper, means for applying adhesives to the tips of said corrugations, means for bringing paper liners into contact with said tips to form a continuous corrugated paper assembly, conveyor belts overlapping said corrugated paper assembly, nozzles disposed along either side of said belts and extending slightly therebetween, whereby said belts form an extension of said nozzles, a blower in communication with one of said nozzles, a suction device in communication with the other of said nozzles, and a line connecting said blower and suction device whereby fluid may be recirculated through the corrugated paper assembly.

3. In a machine for manufacturing corrugated paper board comprising a corrugated paper core and a paper liner attached thereto, means for continuously applying adhesives to one paper portion of said assembly in a series of spaced relatively narrow applications, means for bringing the paper portion with the applied adhesive continuously into contact with the other paper portion to form an assembly, a heating means to set said adhesives, and endless belts carrying said assembly therebetween and away from said heating means, thin elongated nozzles disposed along the sides of said belts and extending therebetween, a blower connected to one of said nozzles and having an inlet adjacent said heating means, and a suction device connected to the other of said nozzles.

4. In a machine for manufacturing corrugated paper board, or the like, in continuous strips, means for continuously forming corrugations in a strip of paper, means for applying adhesive to the tips of said corrugations, means for bringing paper liners into contact with said tips to form a continuous corrugated paper assembly, heating means to set the adhesive on said corrugated tips, conveying means to remove said assembly away from said heating means, elongated nozzles disposed in close proximity to and extending along either side of said conveying means, a blower having an inlet adjacent to said heating means and in communication with one of said nozzles, and a suction device connected to the other of said nozzles.

5. The method of conditioning a moist corrugated paper assembly formed of a corrugated core and liners adhering thereto, which comprises continuously forcing a stream of superheated steam into one side of said assembly, withdrawing moist steam from the other side of said assembly after said steam has passed through said corrugated core to reduce the moisture content of said assembly, and returning such portion of said moist steam to said incoming stream of superheated steam as may be necessary to secure a properly moistened corrugated assembly.

6. The method of conditioning a moist corrugated paper assembly formed of a corrugated

core and liners adhering thereto, which comprises continuously forcing a stream of gaseous drying medium into one side of said assembly, withdrawing the moistened medium from the
5 other side of said assembly after said medium has passed through said corrugated core to re-

move excess moisture from said assembly, and returning such portion of said moistened medium to said incoming stream of gaseous drying medium as may be necessary to secure a properly moistened corrugated assembly.

CARL W. GRIMM.