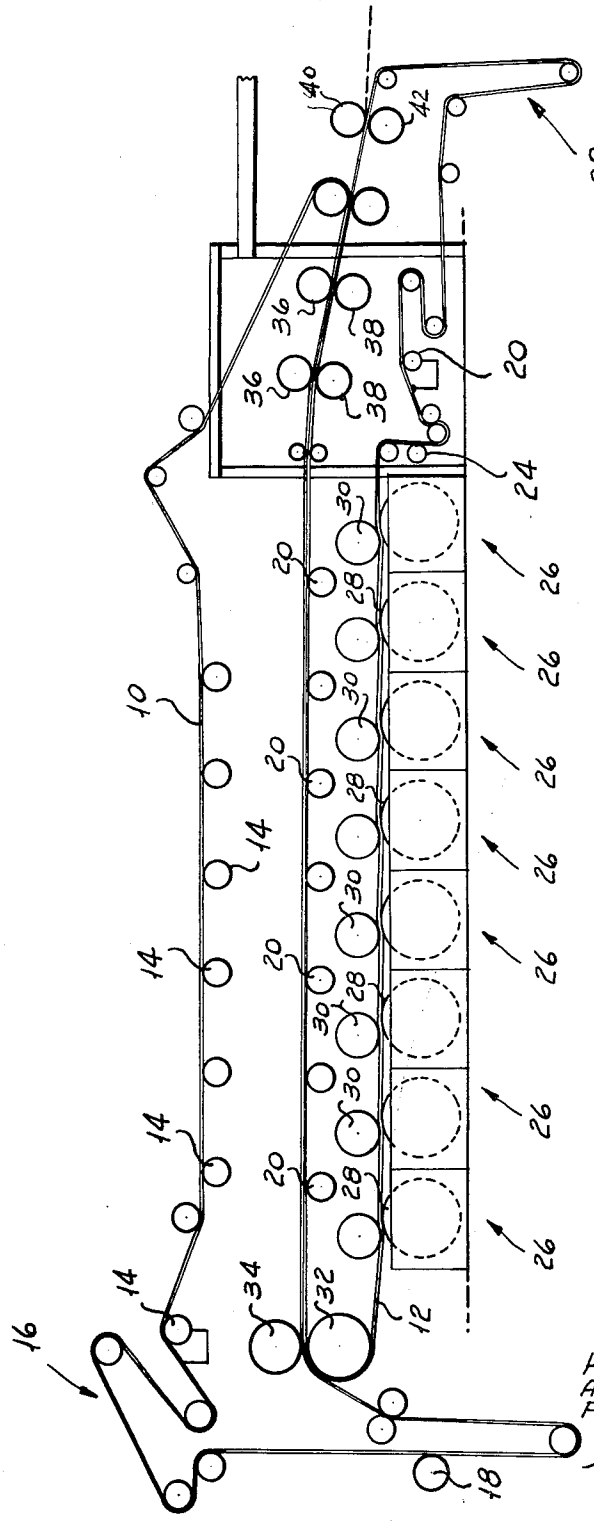
June 23, 1964 H. M. GREENHOUSE ETAL 3,138,518

METHOD OF MAKING STRIATED PAPERBOARD

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PRIOR ART

FIG 1

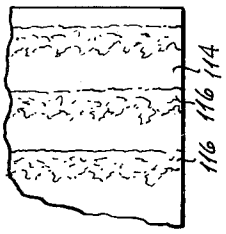


FIG 5

INVENTORS
HENRY M. GREENHOUSE
ARTHUR J. DIMICK
FRANCIS M. MYERS

Shenier & O'Connor

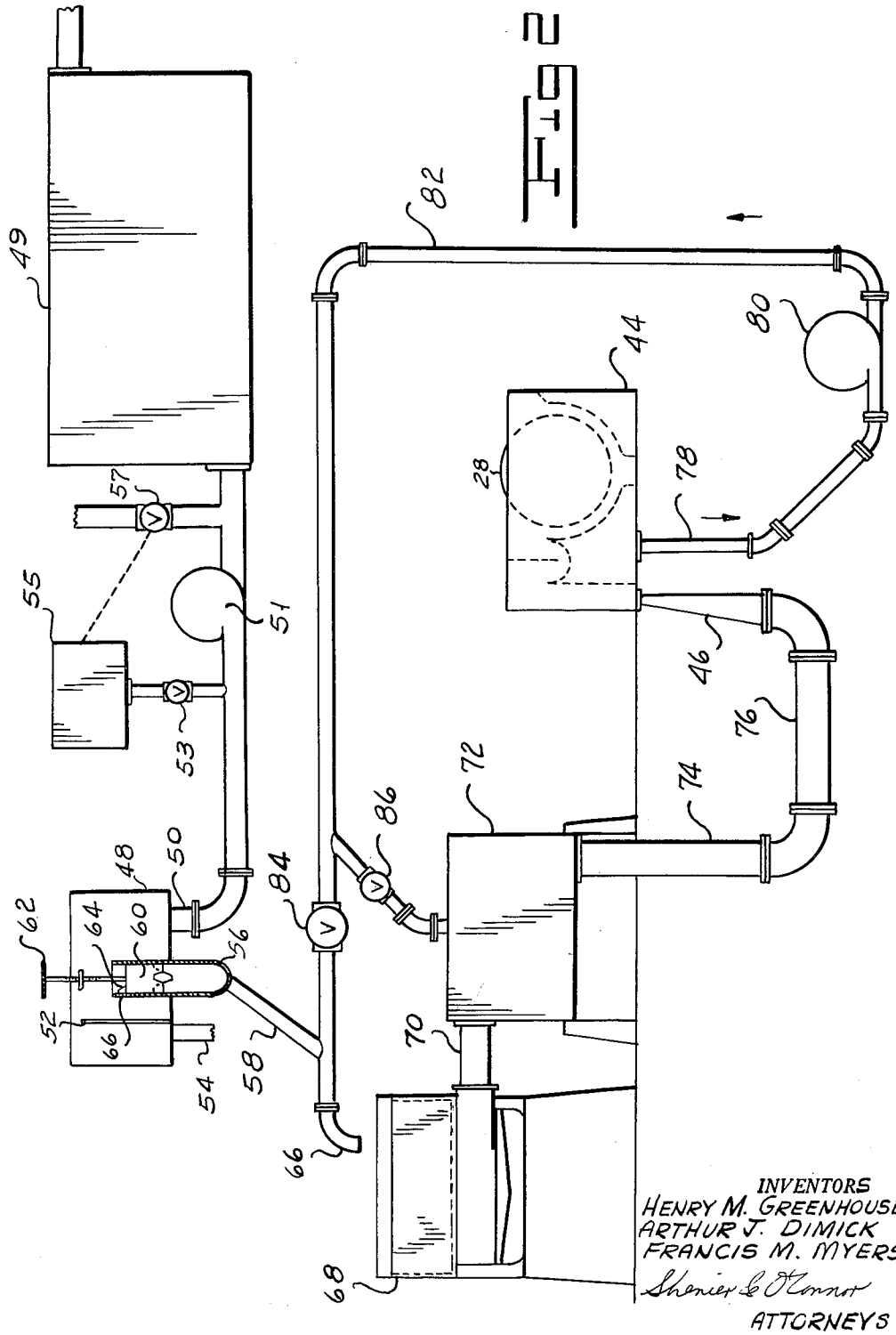
ATTORNEYS

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METHOD OF MAKING STRIATED PAPERBOARD

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FIG. 2



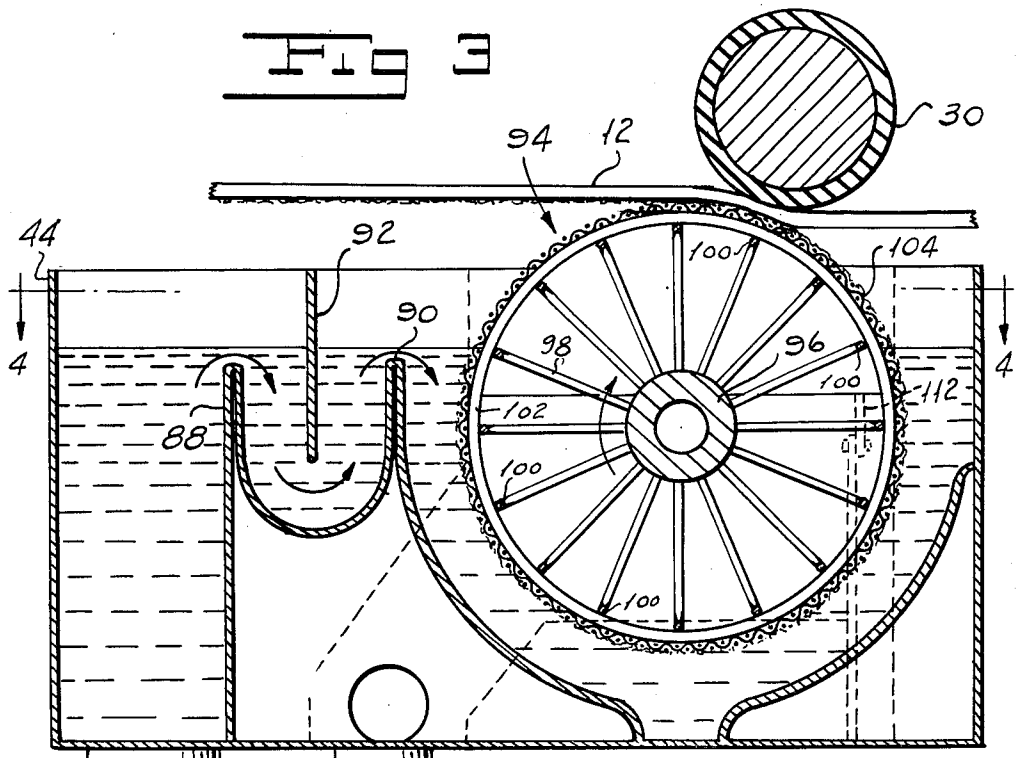
INVENTORS
HENRY M. GREENHOUSE
ARTHUR J. DIMICK
FRANCIS M. MYERS
Shenier & O'Connor
ATTORNEYS

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METHOD OF MAKING STRIATED PAPERBOARD

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Fig 3



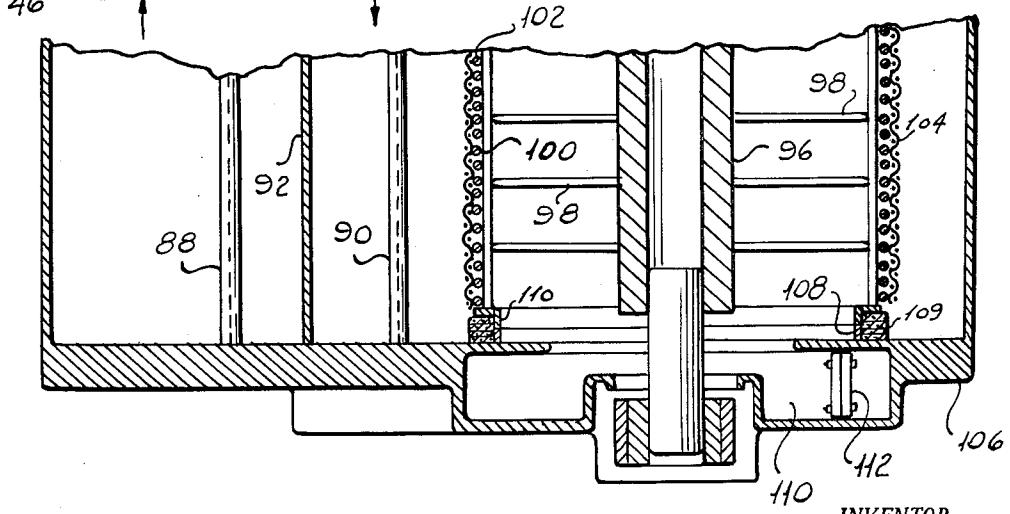


Fig 4

INVENTOR.
HENRY M. GREENHOUSE
ARTHUR J. DIMICK
FRANCIS M. MYERS
Shenier & O'Connor
ATTORNEYS

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3,138,518

METHOD OF MAKING STRIATED PAPERBOARD

Henry M. Greenhouse, Hudson, Arthur J. Dimick, Ghent, and Francis M. Myers, Valatie, N.Y., assignors to Columbia Box Board Mills, Inc., Chatham, N.Y., a corporation of New York

Filed July 13, 1961, Ser. No. 123,870
3 Claims. (Cl. 162—109)

Our invention relates to a method of making striated paperboard and more particularly to an improved method of making patterned paperboard and to the board produced by our process.

There are known in the prior art methods of making paperboard or box board which is intended for use in the manufacture of paper boxes and containers. In the methods of the prior art a plurality of successive layers of fibers are built up on a moving felt. When a number of layers corresponding to the thickness of the finished board have been built up on the felt, the wet board is passed through driers and the necessary finishing operations are performed on the board. The finished board in processes of the prior art has an appearance which is determined by the nature of the stock employed and by the finishing operations performed on the stock. Most generally, it is all of a flat color which is not particularly pleasing to the eye.

Where paperboard is to be used to make cartons or packages for goods to be merchandised, it is desirable that it be given an appearance which is pleasing to the eye. This is accomplished in the prior art by the various operations performed on the board after it is finished. For example, the finished board may be printed with suitable colors. Alternatively, a printed decorative paper can be pasted over the finished board. Colors can be applied to the board by spraying or the like performed on the finished board. While these methods of the prior art result in the desired decorative board, they all require operations to be performed subsequent to the board forming operation itself. Thus these methods of the prior art are time consuming and expensive. They require additional apparatus over that which is required for the board making operation.

We have invented a method of making striated paperboard which overcomes the defects of methods of decorating paperboard known in the prior art. Our method proudces decorative board as a direct result of the board manufacturing operation itself. It does not require the performance of any steps subsequent to the board forming operation. It is less time consuming and less expensive than are methods of the prior art. Our method does not necessitate the use of any additional equipment over that required for the normal paperboard making operation. Our method permits the manufacture of decorative board on existing cylinder board making machines without modification thereof.

One object of our invention is to provide a method of making striated paperboard which overcomes defects in methods of the prior art in making paperboard.

Another object of our invention is to provide a method of making striated paperboard which is more expeditious and which is less expensive than are methods of the prior art.

A further object of our invention is to provide a method of making striated paperboard which is performed in the course of manufacture of the paperboard.

Still another object of our invention is to provide a method of making striated paperboard which does not require the use of auxiliary equipment for applying decorations to the board.

Yet another object of our invention is to provide a

method of making striated paperboard on a cylinder board making machine without modification thereof.

Other and further objects of our invention will appear from the following description.

In general, our invention contemplates the provision of a method for making striated paperboard in which we control the process conditions in the last fiber-applying cylinder mold to cause fibers from the last vat to be deposited on the layer of fibers carried on the felt in a predetermined pattern. If desired, the fibers in the vat of the last fiber-applying mold may be made of a different color or type than those employed in the other vats of the machine to provide a desired constrast.

In the accompanying drawings which form part of the instant specification and which are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

FIGURE 1 is a schematic view of the wet end of a cylinder paperboard making machine.

FIGURE 2 is a schematic view of the water circulating system associated with the last vat of the machnie shown in FIGURE 1.

FIGURE 3 is a sectional view of the last cylinder of the paperboard making machine shown in FIGURE 1.

FIGURE 4 is a sectional view of the cylinder shown in FIGURE 3.

FIGURE 5 is a fragmentary plan view of a portion of the striated board produced by our method.

Referring now to FIGURE 1 of the drawings, one type of cylinder paperboard making machine on which our method can be practiced includes a top felt **10** and a bottom felt **12** on which the layers of fibrous material are deposited in a manner known to the art. As is known in the art the upper felt **10** is supported on a plurality of supporting and guiding rolls **14** and it has associated therewith a felt stretcher **16** as well as one or more whippers **18** and associated sprays. The bottom felt **12** likewise is supported with supporting and guiding rolls **20** as well as a felt stetcher **22** and one or more whippers **24**. The bottom felt passes through a plurality of vat sections indicated generally by the reference character **26**. A suitable suspension of fibrous material in water is supplied to the vats **26** from the machine stuff chests (not shown) through a suitable distributing box (not shown).

In the course of passing through one of the vat sections **26**, the bottom felt is pressed down on top of the cylinder **28** of the vat by means of a rubber-covered pressure roll **30**. As will be described in detail hereinafter, as the felt passes over the cylinder **28** it has deposited on the underside thereof a layer of fibrous material which is carried along by the felt through the remaining cylinders of the machine. At each cylinder another layer of fibers is picked up by the felt until it leaves the last cylinder section of the machine and passes around a suction drum **32** against which is pressed by a rubber covered roll **34**. The upper felt **10** also passes between the pressure roll **34** and the suction drum **32** so that the build up of fibers picked up on the lower felt **12** as it passes through the cylinder section of the machine is carried by the felts to pairs of squeeze and press rolls **36** and **38** which serve to squeeze some of the water out of the fibrous layer. After leaving the groups of rolls **36** and **38**, the wet board passes between a suction roll **40** and a drum **42** and thence out of the wet end of the machine to the drier. Since the structure thus far described is well known in the art, it will not be described in detail. The entire structure so far described is driven as a single unit as by applying power to the lower first press roll **38** and as required to auxiliary helper driver arrangements which may be applied to other press molds and sometimes to the cylinder molds.

As is pointed out hereinabove, in our method we cause

the fibers deposited on the felt **12** by the last fiber-applying cylinder section **26** of the machine to be disposed in a particular pattern. It is to be understood that we control conditions in the last section **26** which applies fibers. The last fiber-depositing section can, of course, be any cylinder after the first.

Referring now to FIGURE 2, we have shown the water system of this last fiber-applying unit of the machine as including a vat **44** of the counterflow type. The "furnish" or suspension of fibers in water is supplied to this vat through an inlet pipe **46**. Stock to the system is provided by a head box **48** to which material from the stuff chest **51** is fed by an inlet pipe **50**. Stock from the Jordan (not shown) feeds into the stuff chest **49** and is pumped to the head box **48** by the stock pump **51**. In order to regulate the consistency of the stock fed to the box **48**, a sample of the stock from the chest is fed through a valve **53** to a consistency regulator **55**. This regulator **55** may be of any suitable type known to the art. For example, it may be the well-known Trimbey regulator which controls a dilution water inlet valve **57** through a linkage **59** to dilute the stock from the chest as required to maintain the desired consistency of stock fed to box **48**. The overflow dam **52** inside the head box **48** serves to regulate the head of stock in the box, the overflow passing out through an outlet pipe **54**. In the form of head box **48** we have shown in FIGURE 2, the construction has been greatly simplified since in the practice of our method we are concerned only with the stock which is fed to the last cylinder vat of the machine.

From the box **48** stock passes to a distributing channel **56** leading to an inlet pipe **58**. Flow from the box is controlled by a regulating gate **60** the position of which is controlled by a hand wheel **62** which causes the gate to be raised or lowered to control the flow of the stock. A pointer **64** cooperating with a scale **66** may be used to indicate the position of the gate and thus the amount of stock being fed to the channel **56**. From pipe **58** the stock feeds into a screen dilution line **66** and into the screen **68** of the machine. The material discharges from the screen **68** through a pipe **70** to the mix box **72** associated with the last cylinder of the machine. Stock from the mix box flows through pipes **74** and **76** to the inlet pipe **46** of the last vat **44** of the machine. As will be explained hereinafter, white water from the vat **44** flows out through a pipe **78** and through the vat pump **80** to a pipe **82**. A screen valve **84** is adapted to be actuated to control the flow of white water back to the screen **68** to dilute the stock being fed into the unit through pipe **58**. A second valve or mix box valve **86** regulates the amount of white water being fed back into the mix box **72**.

Referring now to FIGURES 3 and 4, stock being fed into the vat **44** through pipe **46** is screened off from the making portion by two weirs **88** and **90**. A baffle **92** disposed between the weirs permits stock to flow under the baffle and into the area surrounding the cylinder indicated generally by the reference character **94** of the machine. This arrangement rectifies some of the irregularity of flow caused by the right angle turn into the vat approach piping. From the structure just described, it will be seen that the cylinder **94** is immersed in the suspension of stock to a predetermined level.

Each cylinder of the machine includes a core **96** carrying a plurality of spiders **98** to which there are secured a plurality of parallel rods **100** having a predetermined spaced relationship. A winding wire **102** is wound around the outside of the parallel rods **100**. The winding wire **102** carries a backing wire and a face wire both of which we have indicated by the reference character **104** in the drawings. In a particular embodiment of the cylinder mold **94**, the cylinder may have a 36" diameter with 3/8" cross rods, 0.092" diameter winding wire, a 14 mesh backing wire and a 40 mesh face wire. It is to be understood that while we have shown a cylinder of the counterflow

type of our method, we could as well employ a uniflow type vat.

In operation of the vat, as the bottom felt is driven it causes the cylinder **94** to rotate. The fibrous suspension from the inlet pipe **46** flows around the cylinder in the direction indicated by the arrows in FIGURE 3 and the cylinder itself rotates in the direction of the arrow adjacent the core in the cylinder **96**. Water from the suspension flows through the face and backing wire **104** into the interior of the cylinder and out to the end of the cylinder. One wall **106** of the vat **44** is provided with a chime ring **108** which cooperates with a second chime ring **110** on the cylinder itself. Ring **108** carries a garter strap **109** of a type known in the art made of felt which prevents the flow of fibers into the white water area **110** in the side **106** of the vat. An adjustable spill dam **112** is positioned at each of the vat to control the level of water within the cylinder. While we have shown the individually adjustable spill dams **112** it is to be understood that in practice means is provided for adjusting the dams in unison. We provide the other side of the vat with a similar arrrangement.

From the structure so far described it will be seen that a plurality of layers of fibers are built up on the under side of the bottom felt **12** as it passes through the units **26**. We so control the process conditions of the last fiber-applying unit of the machine as to cause fibers to be deposited in a predetermined pattern. We have discovered that the vat consistency, freeness and the mold head or difference in level of water inside and outside the cylinder **94** of the last vat can be regulated within limits to cause fibers from the suspension in the last cylinder to be deposited on the cylinder and thus on the felt **12** in a predetermined manner. Process conditions for any cylinder unit after the first can be controlled to produce our novel result so long as the controlled unit acts as the last fiber ply application.

In preparing the stock, we may use any natural or synthetic fibers. Suitable wood fibers may be obtained by any of the kraft, sulfite, groundwood, soda, semi-chemical, chemigroundwood, or other known processes. Viscose, vinyon, or glass synthetic fibers may be employed.

As is known in the art, the degree to which incoming stock can be diluted depends upon the amount of water drained through the mold. This drainage in turn depends upon the area of the drainage surface, the mold head, the temperature and dranage characteristics or freeness of stock, and the weight of the individual ply being formed in a particular mold section. As is pointed out thereinabove, we have discovered that when we control the vat consistency, the freeness and the mold head in the last cylinder unit **44** of the machine within certain limits, fibers are deposited by the last cylinder in a pattern on the fiber sheet carried by the lower felt **12**.

The first factor which we control in our process of making striated paperboard is the vat consistency or consistency of stock in the last vat **44** of the machine. We have discovered that if our novel result of a patterned deposit of fibers is to be produced in the last cylinder of the machine, the vat consistency or percentage by weight of fibers in water of the stock in the last cylinder **44** must be between the limits of 0.10% and 0.25%. Outside these limits either insufficient fibers to produce any pattern are picked up or so many fibers are picked up that a solid sheet results and no pattern appears. This vat consistency can readily be controlled by the consistency regulator **55** which regulates the consistency of the incoming stock. The vat consistency may also be controlled by recirculation.

Considering next the drainage characteristics or freeness of the stock, it is recognized that the drainage characteristics of different stocks vary widely. As is also known, the more a given type of fibers has been beaten or refined, the less freely will water drain through a

mat of fibers. It is clear further that the amount of drainage water through the cylinder mold is greater for the free stock than for slow stock. Various tests all of which are empirical are used to measure the "freeness" of the stock. One such test is described in the Technical Bulletin T 227 m–50 "Freeness of Pulp," published by the Technical Association of the Pulp and Paper Industry, 360 Lexington Avenue, New York, New York. By use of the test set forth in the publication, a freeness measure can be determined. In our process, we have discovered that for the range of vat consistencies outlined above we must use a stock having a Canadian Standard Freeness of between 200 cc. and 490 cc. as determined by the test set forth in the above bulletin. It will readily be appreciated by those skilled in the art that stock of an aquivalent freeness as determined by other tests could be employed.

A third factor which we control in our process is the mold head or difference in level of the stock in the vat **44** and of the water within the cylinder **28** of the last unit **44**. The essential requirement of the hydrostatic head is that it be kept constant during the process. The actual hydrostatic head which is employed depends upon vat consistency and freeness of the stock. Having a given freeness and vat consistency the head must be kept constant or the pattern of fibers may disappear completely. This factor of our process is controlled by positioning the spill gates **112** of the last unit at a height which determines the difference in level of stock outside the cylinder and of white water within the cylinder. For the limits of vat consistency and freeness given above, we have discovered that the mold head must be between 1½ inches and 3½ inches in order that the last layer of fibers be deposited on the moving sheet in a pattern.

From the foregoing, it will be seen that the features of our process which must be maintained are a vat consistency of between 0.10% and 0.25%, a Canadian Standard Freeness of between 200 cc. and 490 cc. and a constant hydrostatic had within the range of 1½ inches to 3½ inches. These limits of our process are critical. If an attempt is made to practice the process outside these limits, either no satisfactory deposit of fibers in any pattern will be formed or a substantially solid sheet of fibers will be deposited on the layer carried by the moving felt.

Referring to FIGURE 5, we have shown a fragment **114** of the board produced by our process in which there are deposited on the moving board in the last unit of the machine transversely extending spaced deposits **116** of fibers. Such a pattern was produced during one trial run of the process with a vat consistency of 0.21%, a freeness of 480 cc. and a constant hydrostatic head of 3 inches.

With conditions in the last cylinder unit controlled within the limits pointed out above, fibers are deposited by the last unit of the machine in a predetermined pattern. If desired, a dye may be added to the stock fed to the last unit. Any suitable dyestuffs such as acid, basic, direct and pigment dyestuffs may be employed. Preferably, the colors employed are such as will contrast with the color of the layer of fibers on which the patterned deposit of fibers are laid by the last cylinder of the machine.

In the practice of our process, deposits of layers of fibers are picked up by the moving felt **12** in the usual manner at its moves through the vats **26** up to the last vat. At the last vat, we control the vat consistency,

freeness and hydrostatic head within the limits outlined above. Under these conditions fibers are deposited in a pattern such as that shown in FIGURE 5. These fibers may be colored or they may be of a different characteristic as those used in the other sections of the machine to produce the desired patterned paperboard.

It will be seen that we have accomplished the objects of our invention. We have provided a method of making patterned paperboard which overcomes the defects of paperboard decorating methods known in the prior art. We produce a decorative board as a direct result of the board manufacturing operations. Our method does not require the performance of any steps subsequent to the board forming operation. It is less time consuming and less expensive than are methods of the prior art. Our method does not require additional equipment over that used in the normal paperboard making operation, but permits decorative board to be made on existing cylinder machines without modification thereof.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of our claims. It is further obvious that various changes may be made in details within the scope of our claims without departing from the spirit of our invention. It is, therefore, to be understood that our invention is not to be limited to the specific details shown and described.

Having thus described our invention, what we claim is:

1. In a method of making patterned paperboard on a cylinder machine having a last fiber-applying cylinder vat, the steps of controlling the vat consistency of stock in the last vat to between 0.10% and 0.25% by weight of fibers in water, controlling the freeness of stock to a Canadian Standard Freeness of between 200 cc. and 490 cc. and controlling the hydrostatic mold head to provide a head of between 1½ inches and 3½ inches in said last cylinder vat.

2. In a method of making patterned paperboard on a cylinder machine having a last cylinder vat, the steps of controlling the vat consistency of stock in the last vat to between 0.10% and 0.25% by weight of fibers in water, controlling the freeness of stock to provide a Canadian Standard Freeeness of between 200 cc. and 490 cc. controlling the hydrostatic mold head to provide hydrostatic mold head of between 1½ inches and 3½ inches in said last cylinder vat and adding a dye to the stock fed to said last cylinder vat.

3. In a method of making patterned paperboard on a cylinder machine having a last cylinder vat, the steps of controlling the vat consistency of stock in the last vat to about 0.21% by weight of fibers in water, controlling the Canadian Standard Freeness of stock to about 480 cc. and controlling the hydrostatic mold head to a constant head of about 3 inches in said last cylinder vat.

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