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J. K. SHAW

PROCESS OF AND APPARATUS FOR MAKING FIBER BOARDS

Filed March 26, 1920

3 Sheets-Sheet 1

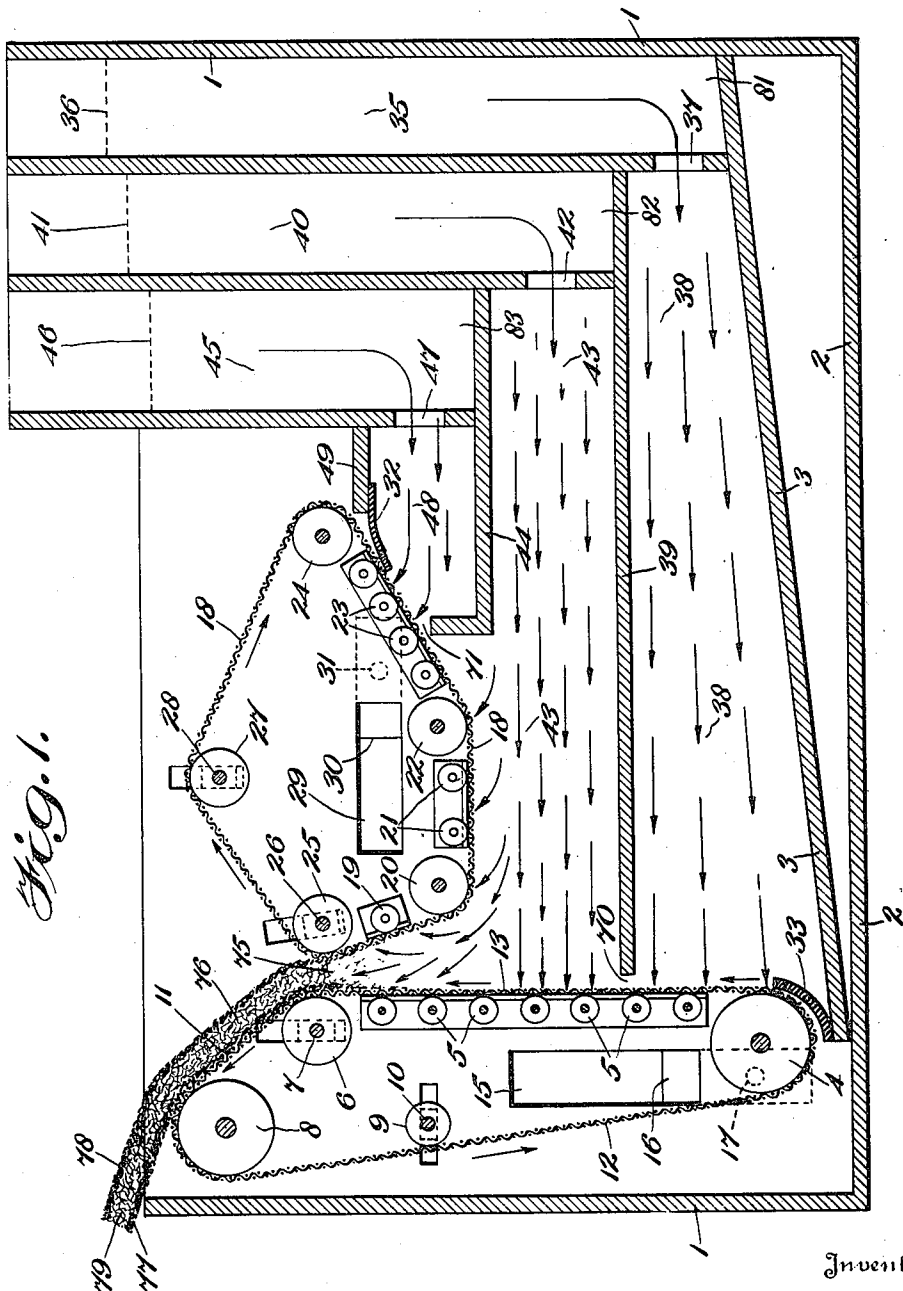


Fig. 1.

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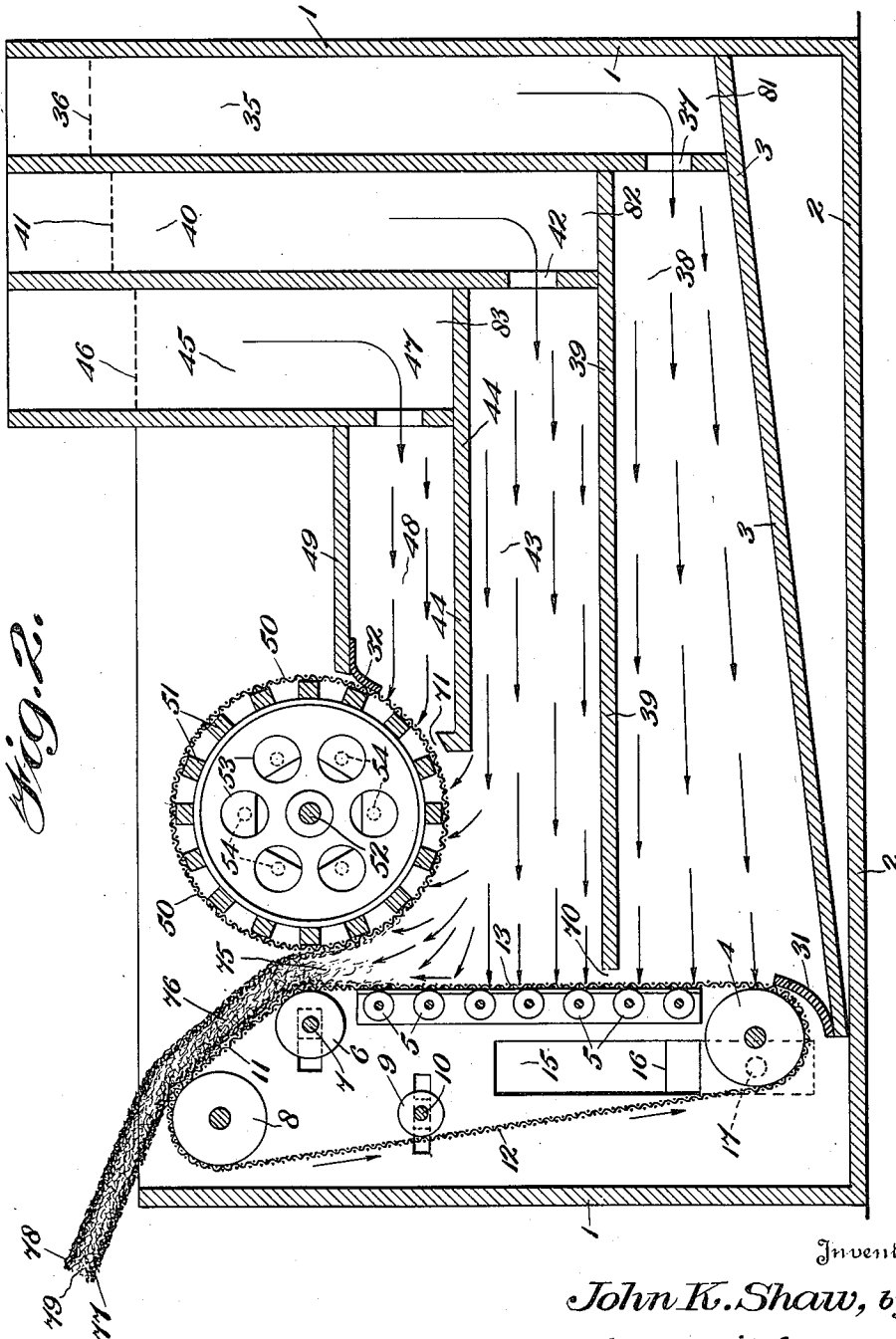
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3 Sheets-Sheet 2



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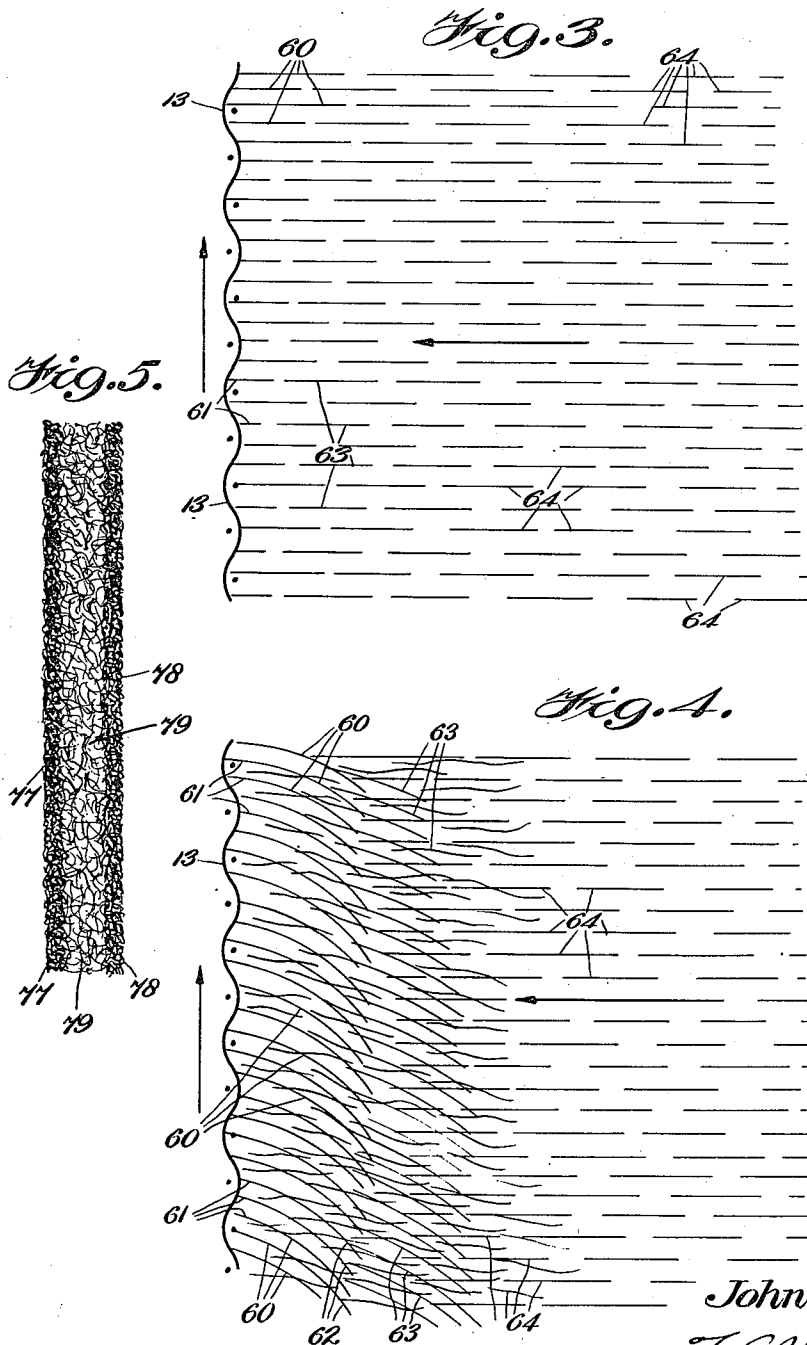
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Filed March 26, 1920

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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PROCESS OF AND APPARATUS FOR MAKING FIBER BOARDS.

Application filed March 26, 1920. Serial No. 363,990.

To all whom it may concern:

Be it known that I, JOHN K. SHAW, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Processes of and Apparatus for Making Fiber Boards; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a process of and an apparatus for interlacing fibers preparatory to making fiber boards, and has for its object to provide a method and a means which will be more efficient in action and less expensive to operate than those heretofore proposed.

With these and other objects in view the invention consists in the novel steps and combinations of steps constituting the process, and in the novel parts, and combinations of parts constituting the apparatus, all as will be more fully hereinafter disclosed and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification, in which like numerals designate like parts in all the views:—

Figure 1 is a diagrammatic sectional view of an apparatus made in accordance with this invention;

Figure 2 is a view similar to Figure 1, showing a slightly modified form of apparatus;

Figure 3 is a diagrammatic view illustrating the disposition of the individual fibers before reaching the traveling surface;

Figure 4 is a view similar to Figure 3, illustrating the action of the traveling surface upon the individual fibers; and,

Figure 5 is a diagrammatic sectional view of a fiber board made in accordance with this invention.

Referring to Figure 1, 1 indicates any suitable tank for holding the stock consisting of water and cooked fibers, 2 the bottom of said tank, 3 an inclined false bottom located above the bottom 2, 4 a roll or drum near the lower end of said false bottom 3, 5 a plurality of supporting rolls, 6 a guide

and compression roll adjustable on the slide, or other movable means 7, 8 a guide roll similar to the roll 4, and 9 a guide and tensioning roll adjustable on the means 10. Passing over the rolls just mentioned is the endless foraminous belt or surface 11, conveniently made of wire cloth, and having the oppositely moving portions or runs 12 and 13.

Between the runs 12 and 13 is located the water outlet 15, provided with the controlling means or gate 16 which may be suitably manipulated as by the handle or other device 17. Coacting with the foraminous surface or belt 11, and in close proximity thereto, as regards one portion thereof, is the foraminous belt 18, passing over and around the series of guide rolls 19, 20, 21, 22, 23, and 24. Said belt 18 also passes over the compression and guide roll 25 coacting with the compression roll 6, and adjustably mounted on the movable means 26. 27 represents a tension and guide roll, adjustably mounted on the means 28, and 29 an outlet for the water passing through the belt 18, controlled by the gate 30 and adjustable through the handle 31. 32 and 33 represent suitable water seals made of flexible material for the belts 11 and 18 respectively.

35 represents a channel or passage for water and fibers which may be maintained at any desired hydrostatic head 36, 37 an opening from the channel 35 into the tank space, or chamber 38, and 39 a top or partition separating said chamber space 38 from the remainder of the tank. 40 represents a second channel for water and pulp fibers, 41 the head thereof, 42 an opening from said channel into the tank chamber or space 43, and 44 a partition which with the partition 39 serves to separate said space 43 from the rest of the tank. 45 represents a third channel for water and fibers having a head 46, 47 an opening into the tank chamber space 48, and 49 a partition coacting with the partition 44 to segregate said space 48 from the remainder of the tank.

In the somewhat modified form of the invention shown in Figure 2, the parts are similar to those just described, except, instead of the endless belt form of foraminous surface 18, I have substituted the hollow roll form of foraminous surface 50,

supported on the drum members 51, and rotating on the axis 52. Suitable openings 53 controlled by the members 54 serve to permit the water entering the drum to escape.

The operation of this machine will be understood from what follows:—

It is preferred to use long fibers, but of course fibers of any usual length may be employed. By reason of the direction of flow of the water through the chambers 38, 43, and 48, and by reason of the natural tendency of the flowing water to laterally separate said fibers, the latter will be brought into positions more or less parallel to each other, and more or less perpendicular to the line of travel of the surface 13, while at the same time, all of said fibers will occupy positions more or less staggered with relation to their neighbors as shown. Accordingly, a large percentage of the forward ends 61 of said fibers will first contact with said surface 13, and will be carried along by the belt from the positions shown in Figure 3, to those shown in Figure 4, for the rear ends 62 of said fibers will have lagged behind the front ends 61, in the water, so that the front row of said fibers assumes a somewhat curved or bent shape. The second row, or those fibers 63 immediately following, and which have not reached the surface 13, but have reached the rear ends 62 of the fibers 60, are now forced by the oncoming water, to contact at their forward ends against the curved fibers 60. And, as said fibers 63, originally, due to their parallel positions, as shown at 63 in Figure 3, were more or less staggered or interlaced with the fibers 60 before the latter became curved, it is evident that this interlacing or entangling action between the fibers 60 and 63 will be enhanced or increased by the oncoming water after said curvature takes place.

It results from the actions just described that said fibers 63 become themselves more or less curved, as indicated in Figure 4, due to the transverse movement of the fibers 60, and that a third row of fibers 64 also become interlaced or staggered with the fibers 60 and 63 that have preceded said fibers 64.

It thus results that, owing to the floating of the fibers into parallel, interlaced or staggered positions, and in a direction transverse to the traveling surface 13, the entanglement of the fibers is continuous between successive rows; and the pressure of the water causes the whole to be very loosely assembled in their interlaced positions on said surface, thus forming an open mass of fibers more compact next to the wire than away from it. This mass is carried through the opening 70 into the space 43, with one or more partially curved and partially entan-

gled layers similar to the fibers 60 and 63 clinging to it.

In said chamber space 43, other fibers similar to the fibers 64 become interlaced and entangled with the layers on the belt, and the process of entanglement and massing proceeds as before. In the meantime, layers of fibers in all respects similar to the layers 60, 63 and 64 are interlaced, entangled and massed on the traveling belt 18 from the space or chamber 48. This second mass of fibers are carried through the opening 71 by the belt 18, in a condition similar to the first mentioned mass that passes the opening 70, and the fibers in the space 43 interlace, and become entangled with said second mass in a manner similar to that described in connection with said first named mass.

The result is, owing to these parallel and staggered relations, the fibers in the space 43, constitute a third mass of fibers which are interlaced and entangled with each other, as well as with each of said first named masses.

As a result of the foregoing entanglements of the various fibers and the motion of the surfaces 13 and 18, the mass of fibers are carried through the opening 75 between the compression or compacting rolls 6 and 25, and is formed into the sheet or board 76, all as will be readily understood.

An important feature of this invention resides not only in being able to thus interlace, or entangle, the fibers in the body of the sheet, but also in being able to vary the kind, size and class, of fibers in different portions of the sheet. That is to say, I may feed to the channel 35, one kind of fibers, which may be relatively short or more expensive fibers than are those fed to the channel 40, and I may feed to the channel 45, the same class of fibers as are fed to the channel 35, or I may feed a totally different class of fibers. In other words, I may provide as many channels 35, 40 and 45, as there are different characters of fibers in the finished board, and I may place in the first channel 35 and in the last channel 45 any characters of fibers I desire, whereupon the finished board will be provided with an outer layer 77 corresponding to the fibers that are fed to the channel 35, with another outer layer 78 corresponding to the fibers that are fed to the channel 45, and with one or more intermediate layers 79 corresponding to the character of the fibers which are fed to the channel 40 and to any other channels which may be located intermediate of the channels 35 and 45. Of course, if there is more than one intermediate channel such as 40, then the apparatus would have to be correspondingly changed to accommodate the same.

But, the important feature to be emphasized in this invention is the fact that no matter how many kinds of fibers, or how

many layers of fibers that are present in the finished board, the fibers of each layer will be interlaced or entangled with the fibers of its adjacent layer, so that the board will not consist of separate and distinct layers, as is common in ordinary fiber boards, and somewhat like the leaves of a book, that can be peeled off, but its body portion will consist of fibers that are firmly interwoven, and its outer layers will be firmly interwoven with said body portion. I am thus enabled to produce a fiber board or sheet interwoven throughout and having comparatively inexpensive fibers on its interior and comparatively expensive fibers on its exterior, so that a highly ornamental appearance can be imparted to the finished product at a minimum of expense.

I do not wish to be limited to any particular character of fibers, for my invention is applicable to fibers in general. It is only necessary to float the fibers in such a manner as to get them into parallel and staggered positions as indicated in Figure 3, and to then entangle or interlace them as is illustrated in Figure 4.

The process is facilitated by the fact that the openings 37, 42 and 47 are of a less area than are the spaces 38, 43 and 48 into which the fibers are led. In other words, the fibers must first pass through the openings at a relatively high velocity and in a comparatively close relation to each other; and they are then immediately released into a wider space, where they take on a lesser velocity, and naturally, spread out as they pass along with the water, thus assuming the parallel relations indicated in Figure 3.

I further prefer to permit a very large proportion of the water, say 90% of the same, to escape through the opening 15, while a very much smaller proportion, say 10% escapes through the opening 29. The gates 16 and 30 are conveniently manipulated to effect this division of the water, while maintaining the desired proper steady flow through the surfaces 13 and 18 to produce the desired results. But, of course, the proportions of water that escape through the two openings mentioned may be widely varied according to the results sought in the finished board.

The rolls 6 and 25 are readily adjusted by the means illustrated to produce any desired compression in the openings 75 between said rolls, so that the fiber board may be given any desired degree of porosity. In fact, by using relatively large fibers in the channel 40, and relatively fine fibers in the channels 35 and 45, I am enabled to control the air spaces in the body of the board, and thereby to control its heat insulating qualities.

In the same way, by using one character

of fibers, say, of bagasse, in the channel 40, and another character of fibers, say of wood or bagasse in the channels 35 and 45, I am enabled to give the outside of the board any desired appearance, while controlling the character of the fibers on the interior thereof. In fact, I may, in this manner, make up my layers of interlaced fibers from materials as distinct as cow's hair, asbestos and mineral wool. I am also enabled to have one or more layers waterproofed while one, or more other layers are fireproofed, or I can dye the fibers of one or more layers in colors which will contrast with the natural or dyed colors of the other layers.

The heads 36, 41, and 46 of the liquid in the channels 35, 40 and 45 are so maintained that there will be a minimum tendency of liquid to flow between the chambers or spaces 38, 43 and 48. In other words, the pressures of the liquid in the last mentioned chambers are maintained as nearly equal as possible, and thus a minimum tendency of the fibers to mix in the said spaces is secured.

The pockets 81, 82 and 83 at the bottoms of the channels 35, 40 and 45 respectively serve to catch the tangled knots or masses of fibers in a sort of churning action, which loosens up said masses to a greater or less extent, and facilitates their disintegration and the ultimate straightening out of the fibers after leaving said channels. It will now be clear that by placing the traveling foraminous surfaces 13 and 18 directly across the straight line paths of travel of the fibers after the latter have assumed their parallel and staggered positions, I am enabled to produce a much more pronounced interlacing effect between the fibers than has heretofore been possible.

It will further be clear that the process of causing the fibers to assume their said parallel and staggered positions is facilitated by the restricted orifices such as 37, 42 and 47, by the pockets such as 81, 82 and 83, and especially by the relatively wide chambers or spaces such as 38, 43, and 48 through which the fibers travel in substantially straight paths for a considerable distance before being caught by said traveling surfaces 13 and 18. In fact, after being relatively squeezed through an opening such as 37 and subjected to a relatively high velocity in said opening, the fibers are suddenly subjected to the action of the more slowly moving water in the space or chamber 38, and to forces acting at right angles to said path, thus opening out the fibers or causing individual fibers to laterally separate, while moving toward said surfaces.

It is obvious that those skilled in the art may vary the details of the construction as well as the details of the process, without departing from the spirit of the invention,

and therefore, I do not wish to be limited to the above disclosure except as may be required by the claims.

What I claim is:—

1. The process of interlacing fibers during the manufacture of fiber sheets which consists in passing said fibers through a restricted opening, then floating said fibers into a larger chamber in a direction transverse to the line of travel of a foraminous surface; and causing the floating fibers to be carried by said surface in a direction transverse to their path of flotation, substantially as described.

2. The process of making a fiber board which consists in imparting to said fibers a relatively high velocity in a restricted passage, and floating fibers into a larger chamber transversely of the line of travel of a foraminous surface; causing said fibers to be carried by said surface transversely of the line of flotation of said fibers; and compacting the mass of fibers on said surface into the desired board, substantially as described.

3. The process of making fiber sheets which consists in floating fibers through restricted passages into relatively large chambers, floating one set of fibers in its chamber transversely of the line of travel of one foraminous surface; floating another set of fibers in its chamber transversely of the line of travel of a second foraminous surface; causing said surfaces to move said fibers transversely of their respective lines of flotation; and compacting the moved fibers into the desired sheet, substantially as described.

4. The process of making a fiber board of different kinds of fibers interlaced with each other, which consists in floating one set of fibers from a restricted passage into a relatively larger chamber, and transversely of the line of travel of, and onto a travelling foraminous surface; floating a second set of fibers onto said first mentioned fibers while the latter are in motion; floating a third set of fibers onto a second travelling foraminous surface; floating other fibers onto said third set of fibers while the latter are in motion; and compacting all of said fibers into the desired board, substantially as described.

5. In a machine for making a fiber board the combination of a plurality of movable foraminous surfaces; a plurality of separated channels for floating different kinds of fibers separately to said surfaces; and means for maintaining substantially the

same hydrostatic pressure in each channel, substantially as described.

6. In a machine for making a fiber board of layers of interlaced fibers, the combination of a plurality of movable foraminous surfaces; chambers in which said surfaces are located; and restricted channels communicating with said chambers, substantially as described.

7. In a machine for making a fiber board of layers of interlaced fibers, the combination of a plurality of movable foraminous surfaces; chambers extending in directions transverse to, and in which said surfaces are located; and restricted channels having openings communicating with said chambers, substantially as described.

8. In a machine for making a fiber board, the combination of an endless belt foraminous surface; a second endless belt foraminous surface; chambers adapted to float fibers to said surfaces; means to prevent the fibers in one chamber from mixing with the fibers in the adjoining chamber; means for exerting different hydrostatic pressures in said chambers; means for feeding fibers to said chambers; and means causing said surfaces to compact the mass of fibers fed thereto, substantially as described.

9. In a machine for making a fiber board the combination of a channel for feeding fibers; a chamber communicating with said channel for floating a set of fibers and causing them to assume parallel positions; a second channel and a second chamber for floating a second set of fibers; and a foraminous surface adapted to move across said chambers, substantially as described.

10. In a machine for making a fiber board the combination of a pair of foraminous surfaces; a plurality of chambers across which said surfaces move; means for moving said surfaces; means for adjusting said surfaces relatively to each other; means for floating a different kind of fiber to each of said surfaces, and maintaining different hydrostatic pressures in said chambers, substantially as described.

11. In a machine for making a fiber board the combination of a pair of endless belt foraminous surfaces; means for moving said surfaces; means for adjusting said surfaces relatively to each other; means for regulating the amount of water flowing through each surface; and means for feeding a different kind of fiber to each of said surfaces, substantially as described.

In testimony whereof I affix my signature.

JOHN K. SHAW.