

Aug. 16, 1966

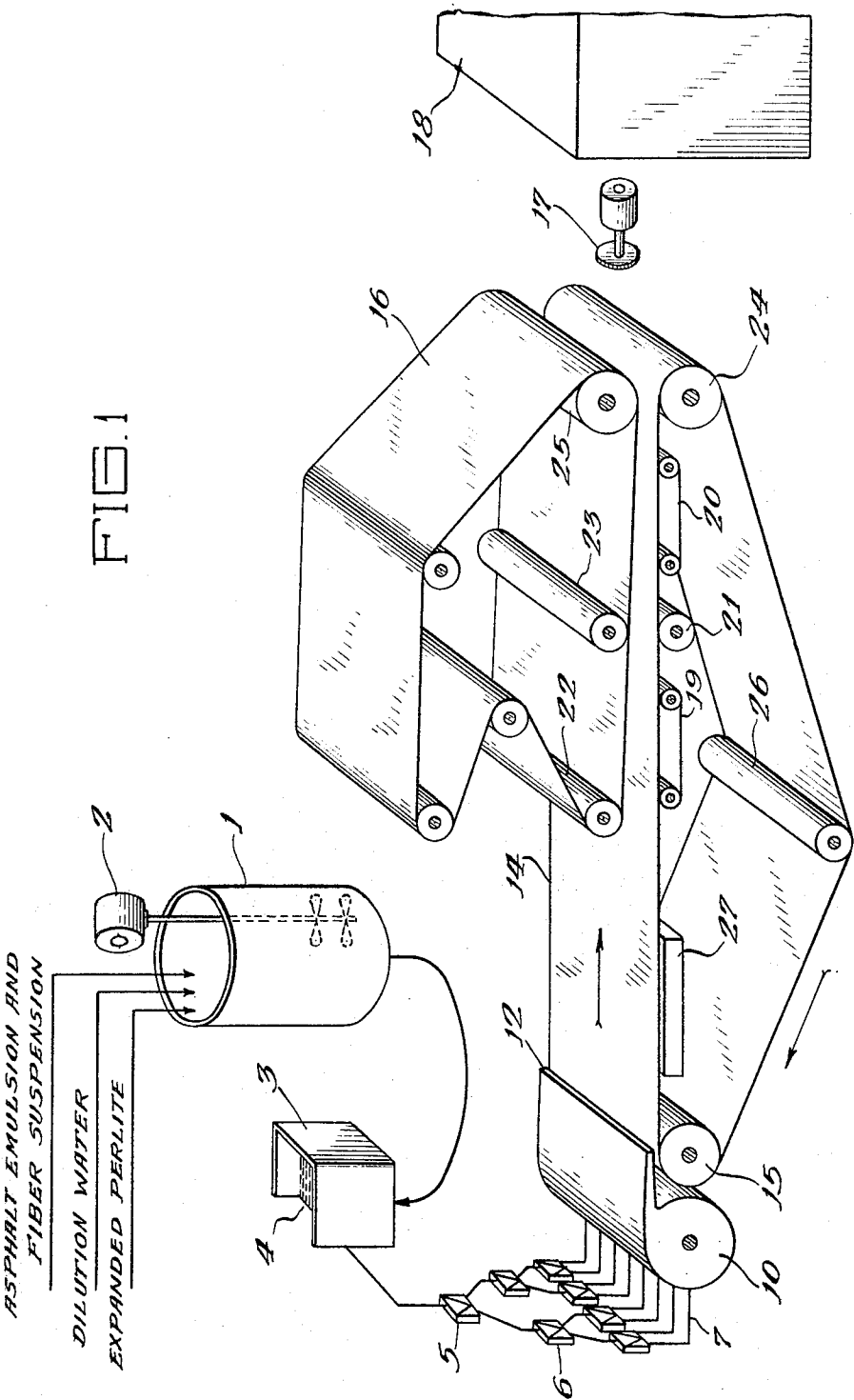
E. STAVER, JR

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PAPER STOCK SLURRY FEED APPARATUS AND PROCESS

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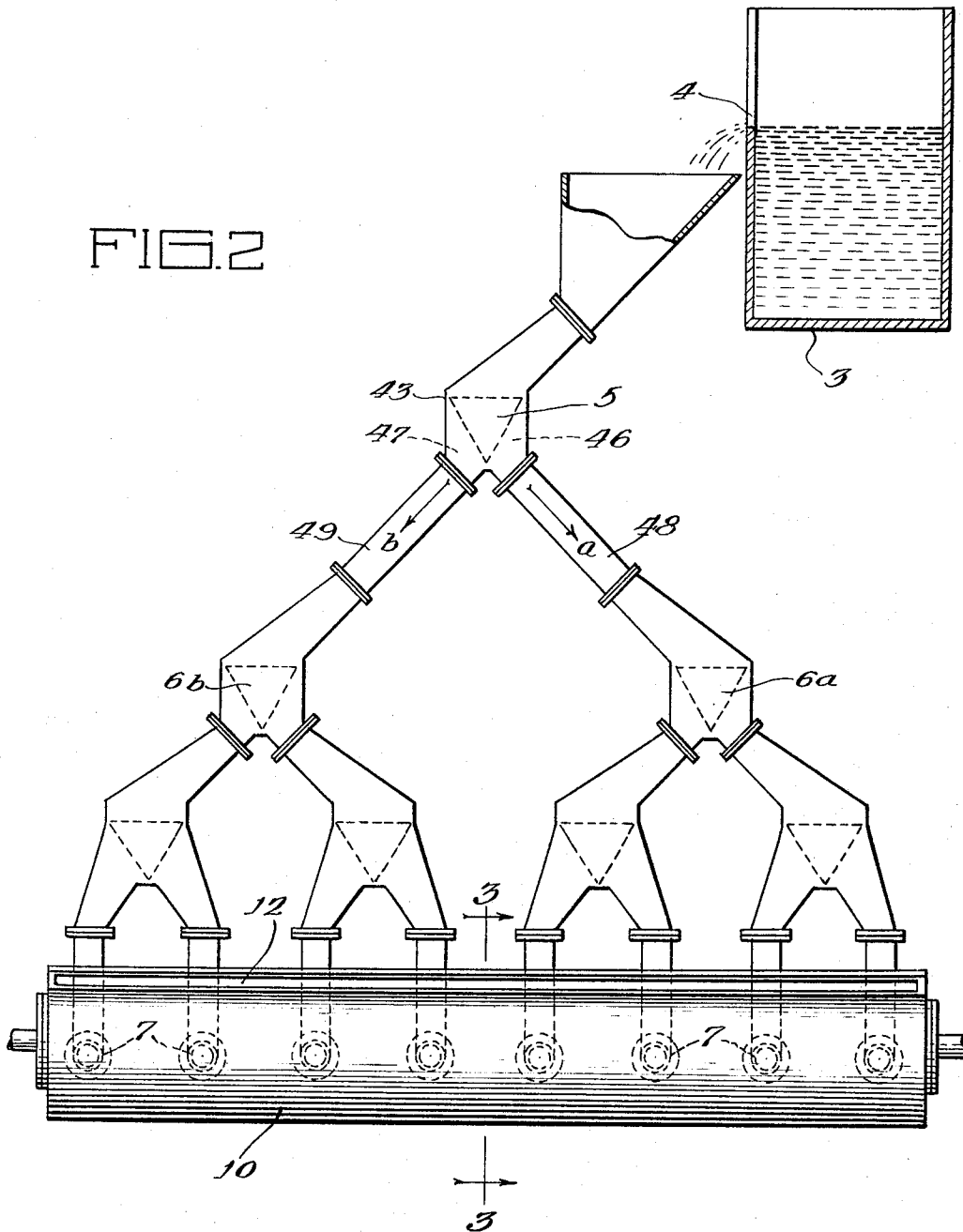
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FIG. 2



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FIG. 3

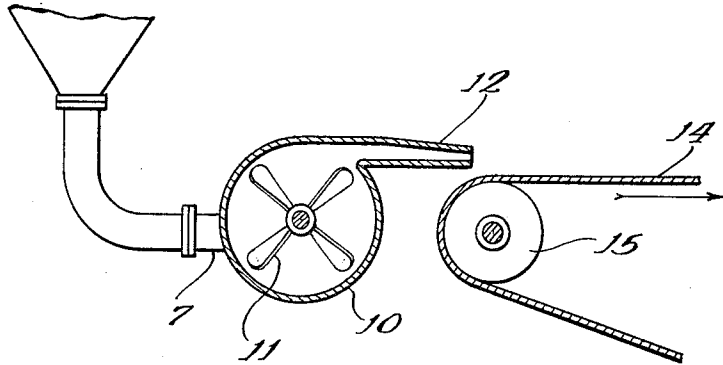
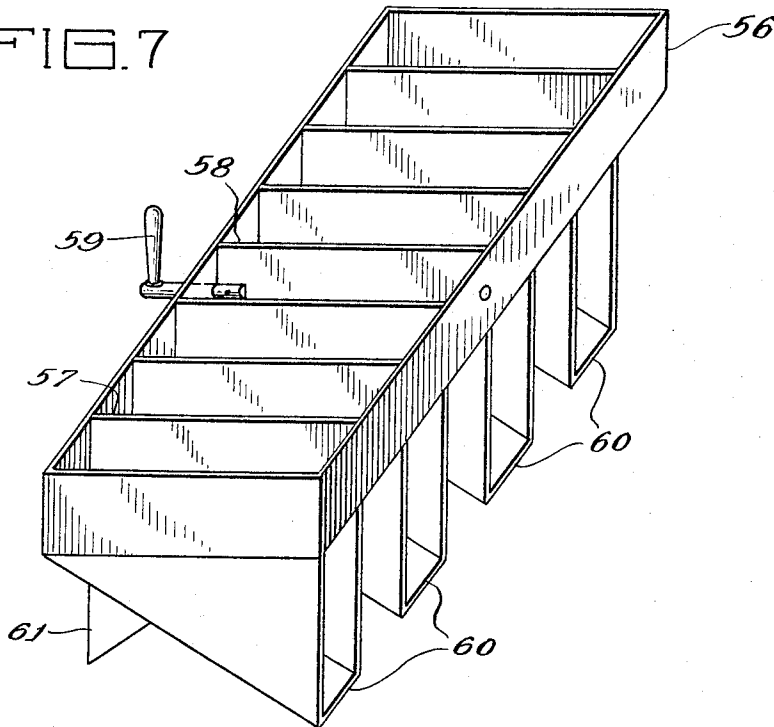


FIG. 7



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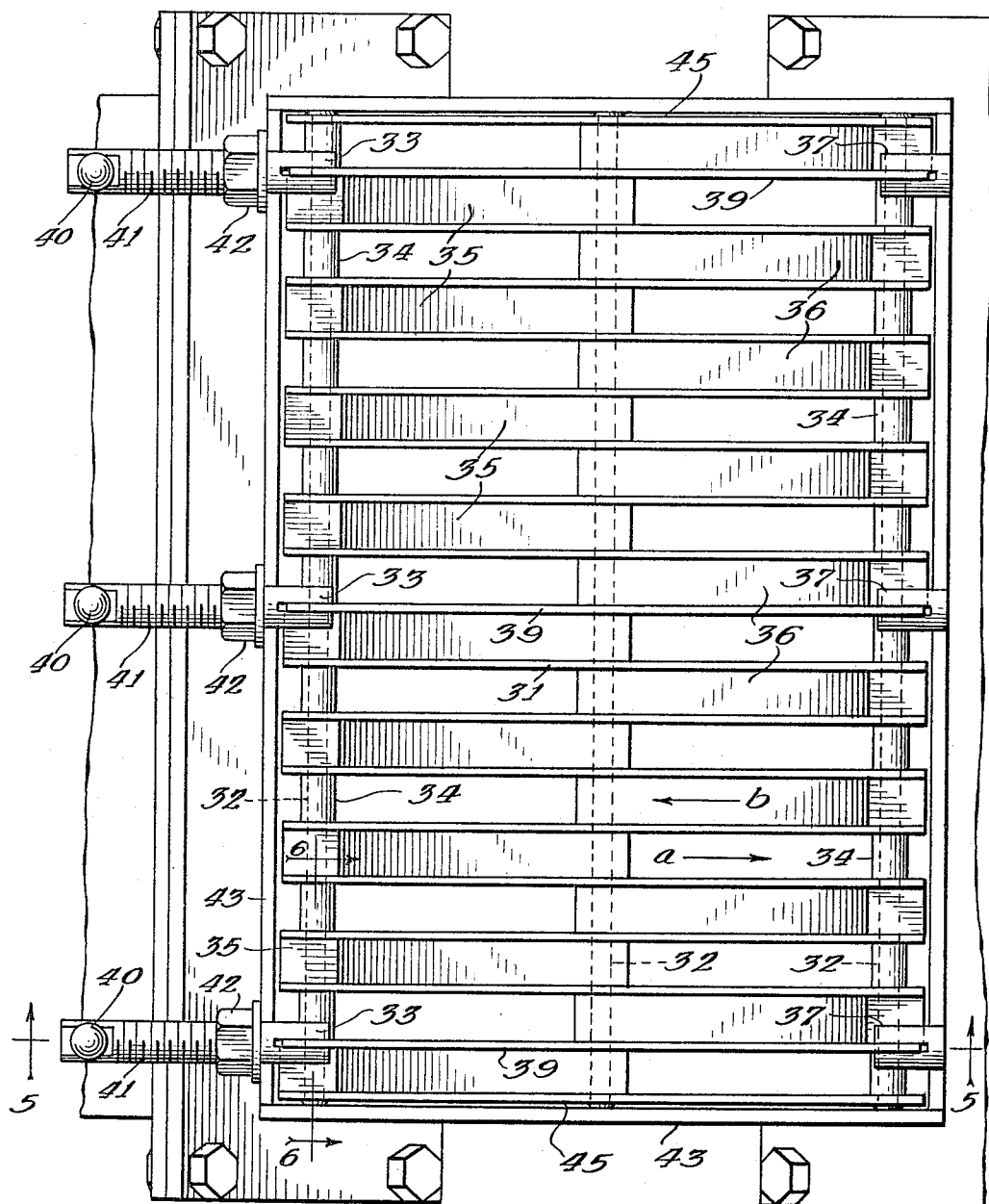
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FIG. 4



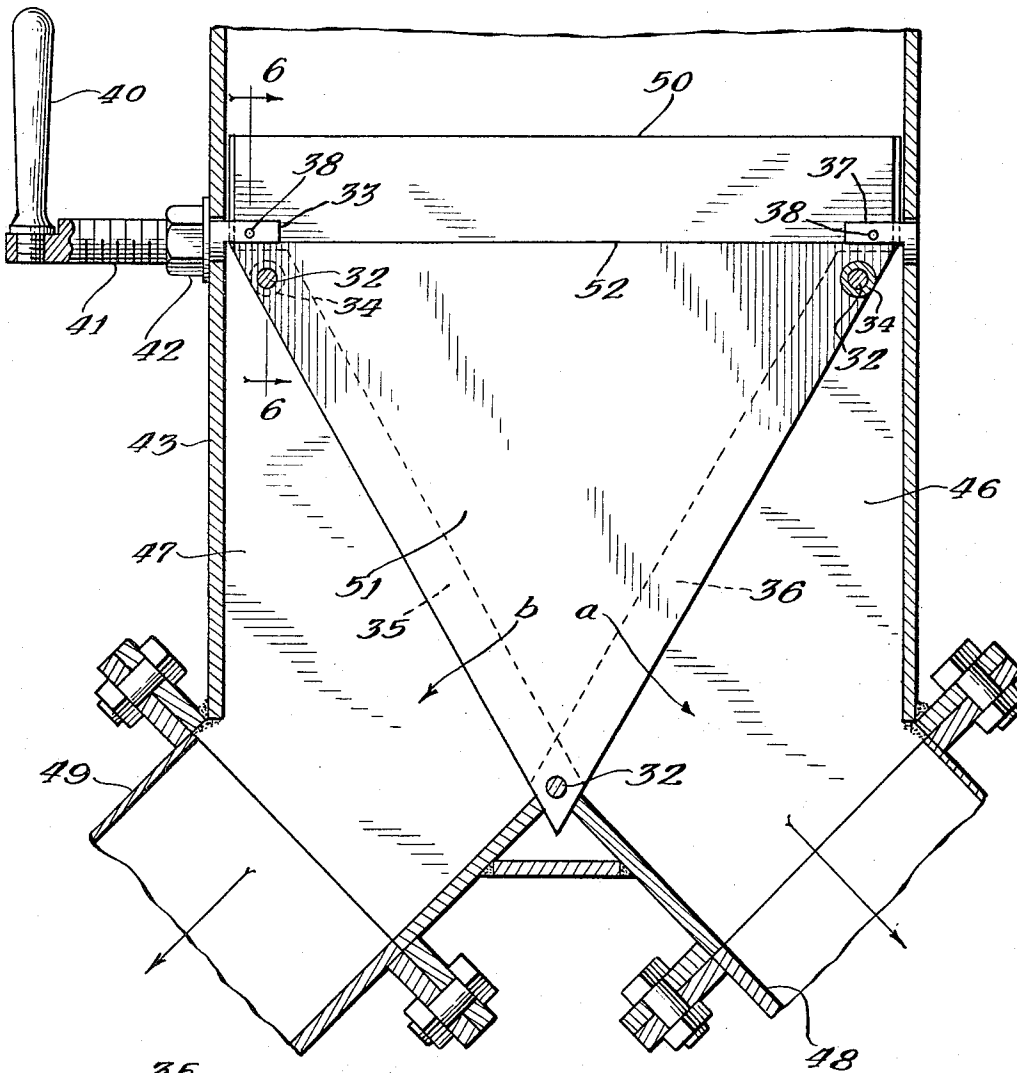
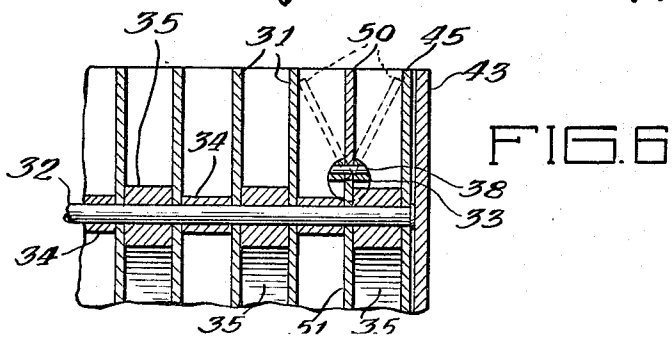
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FIG. 5



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PAPER STOCK SLURRY FEED APPARATUS AND PROCESS

Ellsworth Staver, Jr., Highland Park, Ill., assignor to Great Lakes Carbon Corporation, New York, N.Y., a corporation of Delaware

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13 Claims. (Cl. 162—216)

This invention relates to the production of a uniform slurry feed for a board forming machine. More particularly this invention relates to an apparatus and a process for obtaining a slurry feed of uniform composition by a series of splitting and recombining steps prior to feeding the slurry to a board forming machine. Yet more particularly this invention relates to a process and an apparatus for feeding a uniform slurry containing the components of a building board to the headbox of a Fourdrinier machine whereby the slurry is distributed evenly across the moving belt or wire of the machine.

Machines such as the Fourdrinier and the Oliver cylindrical press have been used for many years for the production of paper, cardboard, and insulating boards. The basic operation of the Fourdrinier machine consists of distributing a slurry or furnish of material on to a moving foraminous web or belt, generally made out of a material such as felt or, preferably, bronze wire, and removing the water by draining, vacuum withdrawal and pressing while advancing the slurry on the belt. The slurry is generally fed to the belt through a distributor called a headbox or a flow-box. This headbox is located at the charging end of the moving belt, and is positioned crosswise to the belt. It is usually made of a material such as metal or wood and has at its discharge end an adjustable slot slightly narrower than the belt, this slot being called a slice. This slice constitutes an adjustable nozzle through which the pulp or slurry flows, generally by gravity, onto the belt, the adjustment enabling the operator to control the volume flow of slurry onto the belt. There are several types of headboxes which are in operation, the type used generally being dependent upon the operating conditions to be maintained, and the properties and type of material being fed to the machine. When slow feed rates and belt speeds are desired or preferable an open headbox is used. On the other hand if fast feed rates are desired the headbox is closed and the feed is expelled through the orifice under pressure. A flow-box operates in substantially the same way as a headbox, however it is somewhat simpler in operation and construction.

As mentioned before, the belt of the machine is preferably made out of bronze. It consists of a bronze wire screen typically having about 20 openings per inch, and it generally moves at a rate of between about four or five feet per minute and about 1200 feet per minute depending upon the compositions of the slurry, and the product desired. Generally the speeds used when producing paper are much greater than those when producing cardboard or building board products.

The slurry or pulp as it is discharged from the headbox onto the moving belt usually contains from about 92% to about 99.9% water. Much of this water rapidly settles out of the slurry and drains through the screen which comprises the belt. As the belt advances further, the slurry passes under two or more compression rollers where additional water is squeezed out. At the same time suction is applied to the underside of the belt to assist in the water removal. The final compression rolls reduce the substantially dewatered stock to the approximate thickness desired in the final product. The board or paper is then removed from the end of the belt, cut if desired, and then dried in appropriate ovens or dryers or on heated rolls.

Instead of a Fourdrinier machine, it is also a common practice to produce cardboard, laminated paper, or boards on an Oliver cylinder press. This machine resembles in operation a cylindrical filter, and consists of at least one wire covered rotary cylinder. The cylinder dips into a vat containing dilute paper stock, or the board composition made up as a slurry. The stock is deposited upon the screen of the cylinder, and by means of suction applied to the inner side of the cylinder, the water is removed through the screen into the cylinder. As the cylinder reaches the top of its arc, the wet paper or board is transferred to a moving felt where additional water is removed by applying compression to the material.

In producing paper or a board on a Fourdrinier machine, the pulp or slurry stock generally enters the headbox or flow box through a singular inlet, from a source such as a slurry tank, etc. From the headbox it is then deposited by gravitational flow or under pressure across the full width of the moving belt, this width ranging from perhaps four feet to as much as twenty feet. Because of the foraminous nature of the belt and the relatively free filtering tendency of the stock, dewatering commences immediately after deposition. If the stock is not uniformly distributed on to the belt, this rapid removal of water substantially precludes the stock from evening itself out across the width of the belt. Failure to accomplish this results in a non-uniform distribution of material on the belt, with a tendency for the material to be thicker in some portions than in others. This in turn results in the production of a non-uniform product of low quality in which the density, strength and physical appearance are adversely affected.

The uneven distribution to the belt may be caused by a number of factors such as irregularities in the dimensions of the headbox or other parts co-operating therewith; the difficulties of converting the singular slurry stream entering the headbox inlet through a circular conduit to a smooth flat discharge stream many times wider than the inlet; surging or pulsing of the slurry into the headbox; and non-uniformity of the slurry composition reaching the headbox. For these reasons, the unevenness of slurry distribution on to the moving belt cannot be pinpointed to specific hills and valleys at fixed locations across the belt. In fact, whereas the slurry might be feeding in too thick a layer at a given point at one instant, it could be feeding insufficiently at a later time at the same point.

Attempts have been made at correcting or compensating for the above problems but they have not been altogether successful. For instance, it has been tried dividing the slurry into a number of separate streams which are separately fed into the headbox. Also different arrangements have been tried using flow meters, vanes and valves both within the headbox and outside of it to compensate for irregularities. None of these have completely solved the problem of uneven distribution to the belt, however.

It is an object of this invention to obtain a uniform flow of slurry to a board forming machine.

It is another object of this invention to provide a means for gravity feeding a slurry of uniform composition to the headbox or other distribution inlet of such a machine so as to produce an even distribution of stock on to the moving belt.

It is yet another object of this invention to provide a method and apparatus for use in connection with a headbox of a Fourdrinier machine, to insure a uniform deposition of a slurry onto the web or belt of the machine, regardless of the variations in viscosity, density and other physical characteristics of the slurry.

Still another object of this invention is to provide free flow means for a slurry containing expanded perlite, as-

phalt, fibers, and various other materials and/or chemicals which may be deemed necessary or desirable whereby the slurry is fed uniformly to a board forming machine.

These and other objects will become apparent in light of the following description and diagrams of which:

FIGURE 1 represents a diagrammatical flowsheet in perspective showing the production of a building board on a Fourdrinier machine and utilizing the novel splitting arrangement for feeding slurry to the headbox of the machine.

FIGURE 2 is an elevation view of the arrangement of conduits and splitters for dividing a slurry stream into 8 streams of equal volume and feeding the streams into a headbox.

FIGURE 3 is a sectional view along line 3—3 of FIGURE 2 showing an inlet of one conduit into the headbox.

FIGURE 4 is a top view of a preferred embodiment of the splitter positioned within a box attached to the conduits.

FIGURE 5 is an end view of the same splitter.

FIGURE 6 is a partial sectional view taken along line 6—6 of FIGURE 5 showing one of the adjustable flow control vanes.

FIGURE 7 is an isometric view of an alternate design for the splitter.

Basically my invention relates to a means for supplying a slurry of uniform composition to the distribution inlet of a board forming machine. More specifically this invention relates to an apparatus for and a method of dividing a main slurry stream under gravitational flow into a number of smaller streams and then re-combining the smaller streams into two or more larger streams, said re-combining being sequentially different than the division. The process of splitting and recombining is repeated as many times as desired, and the multiple recombined streams are then fed at spaced apart points to the headbox of the board forming machine.

The process of producing a building board utilizing my novel splitter is shown in FIGURE 1. The materials which go into the manufacture of the board are slurried together with a quantity of water in a slurry tank 1, agitation being provided by a mixer 2. From the slurry tank, the slurry passes to box 3 having an overflow weir 4. The slurry in the box seeks the same level as in the slurry tank and in so doing overflows the weir and flows by gravity into the first splitter 5. Here it is divided into 2 streams each of which flows by gravity to another splitter 6. The streams are repeatedly split a number of times whereupon the plurality of split streams 7 are fed at evenly spaced inlets into the headbox 10 of a Fourdrinier machine.

The slurry is fed through the slice 12 of the headbox onto the moving foraminous belt 14 at a point where the belt passes over the lower breast roll 15. At this point, the speed of the slurry feeding onto the belt is the same as the speed of the belt. The slurry is de-watered, compressed between the lower belt and upper belt 16, cut into specified lengths with wet saw 17 and dried in dryer 18.

FIGURES 4 and 5 show in detail a preferred embodiment of my novel splitter device set inside of an appropriate box or trough attached to suitable conduits.

The splitter comprises a plurality of fixed, spaced apart, vertically disposed partitions 31, 39 and end plates 45 in substantial alignment, defining vertical passages for the flow of slurry. These one piece partitions are shown as being pentagonal in shape with one side in a horizontal plane forming the top or leading edge of the splitter, two parallel sides perpendicular to the top and two sides sloping downward to a point which forms the bottom of the splitter. The partitions and end plates are maintained in fixed alignment by the use of three metal rods 32 extending through holes in the plates. The spacing between the

plates is maintained by the use of tubular spacers 34, and bars, 35, 36, the spacers being used at the top of the partitions in an alternate arrangement with the bars. The bars are the means by which the material as it passes through the splitter is diverted or deflected to either one side or the other side. These bars, which are as wide as and define the lateral dimensions of the passageways are secured both at their top and bottom by holes therein through which the rods pass. The bar in a given passage (a) is attached at the bottom and at one side of the top, whereas the bar in the adjacent passage (b) is also attached to the bottom and to the other side of the top. The side of the passage opposite that of the bar is open, thus providing a discharge for the slurry through that passageway. On the side opposite the top side to which the bar is connected, the hollow tubular spacer 34, the same width as the bar, is used to maintain the parallel relationship of the plates. The spacer is held in place by the rod passing therethrough.

The use of the materials as above described allow for easy fabrication of the apparatus and provide for precise control over the construction thereof and the size of the passageways. However, it is understood that the parallel plates and deflectors can be welded together or secured by means other than rods and tubular spacers.

The slurry or other material is preferably fed by unrestricted gravity flow from a flume or weir 4 substantially the same width as the splitter and positioned above it. The material flows downward by gravity and is split by the parallel partitions into a number of small streams, in this case 18 small streams. As these streams flow between the partitions, they contact and are deflected by the angularly disposed deflector bars 35 and 36. Because of the alternate arrangement of these deflectors, the streams in adjacent passages are directed to flow in opposing directions ((a) and (b)) whereas the streams in alternate passages are caused to flow in substantially the same direction. Thus a given amount of slurry is diverted in one direction (a), through one-half of the passages, and the other portion of the slurry is directed in another direction (b) through the other passages in what is termed an averaging effect. As the number of partitions is increased, the number of parallel streams becomes greater and their volume differences are proportionately reduced. Thus the volumes of the recombined effluent streams are more nearly equal. Practical limitations usually determine the optimum number of partitions to be used. The streams all flowing in one direction are re-combined into an effluent stream, thus producing two separate effluents. These two effluent streams are each conducted through separate conduits, 48 and 49 to two more splitters 6a and 6b where they are again split into a plurality of parallel streams which are recombined as before to produce a total of four streams. This process of splitting and recombining can be repeated as many times as it is necessary or desirable, prior to the slurry being introduced as a multiplicity of separate effluent streams into the distributor inlet 7 of the headbox 10. Thus, when using two-way splitters, the distributor inlet can be provided with 2, 4, 8 or any multiple thereof separate conduits into which equal volumes of slurry of uniform composition are introduced. The repeated splitting and recombining steps are preferably carried out with the slurry flowing by gravity in unrestricted flow. The necessity of pumps and other conveying equipment is thus eliminated.

The attainment of equal volumes in the split streams is thus made dependent upon the preciseness with which the splitter is fabricated, and the manner in which the slurry is fed to the distributor. In order to compensate for variations in the spacing between partitions, inaccuracies in the machining of parts, etc., it is provided, and is considered a part of this invention, that the upper portion of a specified number of partitions in the splitter should be made movable. These partitions 39 are the same shape as the other partitions but are made of two pieces

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50 and 51 juxtaposed at 52. The lower piece 51 forms a triangle and is held in an immovable position by the deflector bars, spacers and rods. The upper part 50 is rectangular in shape and is pivotally movable about its axis 52, to form an adjustable vane. It is held in place between two slotted means 33 and 37 which are rotatably mounted in circular holes in the box or through 43. Pins 38 or other suitable fastening means such as rivets prevent loosening and slipping of the vane in the slots. The slotted connection 33 is one end of a bolt or a threaded rod which has been cut longitudinally to form a crescent. This bolt or rod 41 is threaded to handle 40 at the other end and is held immovable by nut 42 tightened against the box 43. By loosening the nut 42 and turning the handle 40, this upper part or vane can be pivoted about its horizontal axis 52, in such a manner as to reduce the opening or gap between the vane and the immovable partition on one side of it while correspondingly increasing the gap between the vane and the partition on the other side of it. In fact, if desired, the vane may be pivoted until it is in contact with the next adjacent partition as shown in FIGURE 6, thus completely closing off one passage while doubling the size of the other passage.

FIGURES 4 and 5 show 3 movable vanes. However, it is contemplated that as many or as few vanes may be used as deemed necessary.

The whole splitter assembly is designed to fit inside of a box 43, which is connected to the discharged conduits 46 and 47 by flanges or other means. As shown in FIGURE 2 each discharge conduit conveys the respective slurry stream to another splitting device 6a or 6b where the same procedure of splitting the stream into several smaller streams of approximately equal size and then recombining these streams in an alternate sequence is carried out. The initial splitting and re-combining is repeated two more times, resulting in the production of 8 separate streams of equal volume and uniform composition, these streams all originating from point source of slurry such as the slurry blending tank. These eight streams are then distributed in a uniform manner through inlet 7 to the headbox 10 of the Fourdrinier or other board forming machine. Having 8 inlets to the headbox rather than a singular inlet, especially where the inlets are spaced across the width of the headbox, insures a uniform distribution of slurry in the headbox, resulting in a more uniform flow of slurry from the headbox to the web. This substantially eliminates or precludes the possibility of uneven flow rates to the belt, which uneven flow rates usually result in the production of a non-uniform, inferior board product.

Of course it is understood that there is no requirement that the original slurry stream be split into eight separate streams. This is merely a matter of convenience, dictated by the volume of slurry being fed to the headbox, the size of the headbox, feed rates to the board forming machine, and composition of the slurry. In fact it may be found desirable in the case of a smaller machine using a smaller headbox, to split the initial slurry into two parts and then repeat the splitting of these two streams only once, thus providing four streams which are introduced into the headbox. On the other hand, four stepwise splitting and recombining steps may be used to provide 16 inlet streams. In general, the splitting and recombining steps may be repeated as many times as deemed necessary, and of course the number of repetitions will determine the number of ultimate effluent streams which will be introduced into the headbox or other distribution inlet of the board forming machine.

In a broad embodiment of this invention, utilizing the novel splitter feeding device as hereinbefore mentioned, a light weight building product is produced containing between about 40% and about 80% by weight of expanded perlite, about 50% and about 10% of an organic or inorganic fiber, preferably shredded or re-pulped newsprint, and up to 30% of a bituminous water proofing

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agent, preferably asphalt. These components are slurried together with a sufficient amount of water to make a slurry containing between about 3 and 8% solids, the higher solids content being preferred to preclude separation of the light weight perlite particles from the other components. When asphalt is used in the form of emulsion, a small amount of alum is added to the slurry to break the emulsion and facilitate the waterproofing of the board. A suitable mixing container such as a blender equipped with a rotary mixer, is utilized to prepare the slurry. This slurry is then fed from the mixing vessel, preferably by gravity flow into a device such as an overflow weir or a flume, from which it flows in a substantially steady rate, by gravity, into the novel splitting device which comprises the subject matter of this invention.

The weir or flume is positioned above the first splitter and is preferably sized so that the slurry stream flow is distributed across the entire length of the splitter. A plurality of fixed, spaced apart, substantially parallel vertical partitions or plates in the first splitter separate the stream into a number of smaller streams, the volume of which are determined by the distance between adjacent plates, and the uniformity with which the slurry flows from the weir or flume. These separate streams are then recombined into two or more volumetrically equal streams in a sequentially rearranged manner, and these streams flow into suitable discharge conduits. Where two effluents are desired, alternate parallel streams are discharged into the same conduit. If it is desired to produce 3 effluents, then each third consecutive stream is discharged into a common discharge conduit. It can be seen that a number of different effluents can be obtained by merely directing the parallel slurry streams in a repetitive sequence into separate conduits. It is obvious that by splitting and recombining in this manner, the necessity of maintaining a completely uniform flow from the weir to the splitter is obviated.

Each discharge conduit from the first splitter directs its proportionate share of the slurry to another splitter, where the same process of splitting and recombining is repeated. Thus, if the first splitter divides the slurry and recombines it into 2 effluents, then 2 splitters are used in the second splitting stage; if 3 effluents are produced, then 3 splitters are used in the second stage. Many different arrangements and combinations of the splitters may be used without departing from the scope of the invention.

By suitably splitting the slurry into a multiplicity of streams and recombining certain of the streams in a fixed sequence, and by repeating the step as many times as desired, a plurality of streams of equal volume and of uniform consistency are produced which are fed into the headbox of the board forming machine. The feed inlets to the headbox are equally spaced across the width of the headbox, preferably less than 30 inches apart. As the number of inlets increases and the spacing between them decreases, the uniformity in consistency and distribution of the feed to the belt increases. As seen in FIGURE 3, these inlets 7 are desirably located below the centerline of the headbox 10. A slowly rotating agitator 11 within the headbox insures that separation of the solid components in the slurry does not occur prior to deposition on the belt.

From the headbox, the slurry flows through the slice 12 and is uniformly distributed as a mat on to the belt 14 passing over the lower breast roll 15 of the Fourdrinier machine. The belt, generally moving at a speed of between 4 and 24 feet per minute, which speed is determined by such factors as product characteristics and other process equipment limitations, picks up the slurry and moves it in a horizontal plane away from the slice of the headbox. Because of the porosity of the mat, the water is relatively free filtering, and rapidly separates from the board components, draining through the foraminous belt into trough 27 from which it is removed. Where a 1 inch board is being produced, the initial thick-

ness of slurry deposited on the belt at the breast roll is approximately 4 inches. As the belt moves along and the water is removed, the board composition is contacted with the upper belt 16 passing around the upper breast roll 22, prepress rolls 21, 23 and press rolls 24 and 25 which serve to reduce the thickness of the board to approximately 1 inch. At the same time the foraminous belt passes over one or more suction boxes 19 and 20 which serve to remove additional water. Before reaching the first upper breast roll, the board has become sufficiently self-sustaining to dispense with the deckle straps (not shown) which are used when the slurry is initially deposited on the belt, to keep it on the belt. The final thickness of the board leaving the end of the belt is slightly greater than that desired in the specifications of the final product inasmuch as there is a slight amount of shrinkage, amounting to 2 to 4%, which occurs when the board is dried in the oven. Where a thinner board is desired, the depth of the deposited slurry at the charging end of the belt is reduced proportionately. Thus, a 3" layer is deposited for a ¾" board, and a 2" layer for a ½" board.

As the board leaves the end of the foraminous belt of the Fourdrinier machine, it is cut with a wet saw into pieces of a specified length, and these are transported to a dryer 18 such as a multiple deck gas fired dryer. After drying, the boards are trimmed and cut to final size.

Expanded perlite, the preferred light weight material used in the teachings of this invention, is produced by rapidly heating a finely divided perlite ore to a temperature of between about 1300° F. and about 1800° F. Perlite ore is essentially a volcanic glass having an approximate composition of about 65 to 75% silicon dioxide (SiO₂), about 12 to 18% alumina and about 1 to 5% combined water plus other minor constituents. Upon heating to these elevated temperatures, the volcanic glass softens and a portion of the combined water vaporizes. The vaporization causes the softened particle to expand to a very low density product having a loose bulk density of between about 1 and about 15 pounds per cubic foot. Desirably, the expanded perlite used in making lightweight insulating board has a density of between about 3 and about 10 pounds per cubic foot, and preferably between about 3 and about 5 pounds per cubic foot. A typical particle size distribution of perlite of the preferred loose bulk density is:

	Percent
+30 mesh (Tyler) -----	23-32
-30 mesh and +100 mesh -----	63-77
-100 mesh -----	0-5

Although expanded perlite is preferred, it is possible to substitute either wholly or in part, other lightweight materials in preparation of this insulating board. For instance other minerals or glasses which contain water and which are capable of expanding upon heating may be used. In addition materials which are naturally porous and lightweight may be used along with, or in place of expanded perlite. Furthermore, lightweight inorganic or organic, synthetic or natural beads or spheres may be used.

Newsprint, because of its relatively low cost and ease of procurement, is the preferred fiber used in the board composition. Normally the newsprint is shredded or chopped, and is then pulverized prior to blending with the other components and slurring. Other organic or inorganic fibers may be used in place of or in addition to the newsprint fibers. Suitable organic fibers for this purpose are shredded wood, cellophane rags, bark, hemp, animal fibers and cotton linters. Suitable inorganic fibers, oftentimes preferable in the use of high temperatures insulating boards, are asbestos, rock wool and glass.

The asphalt waterproofing agent is usually blended into the slurry as an emulsion containing from about 40% to about 60% asphalt, in which case an emulsion breaker such as alum may be added. However, depending upon

the physical properties of the asphalt, it is possible to incorporate it as a finely divided solid, or it may be distributed by hot spraying on to one or more of the components prior to slurring. In place of or in addition to asphalt, other waterproofing agents such as various waxes, linseed oils and drying oils, silicones, resins and various stearates and oleates may be used.

This invention is not limited to the production of a board containing only three components, it being within the contemplation of the invention that other materials may be incorporated to the mix or slurry to impart special or additional qualities to the final product. Thus other materials which serve as plasticizers, thickeners, foaming agents, gels, surfactants, coloring agents, etc., may be incorporated into the board mix slurry. Alternatively they may be mixed with one or more of the components before slurring or may be distributed onto or within the board after formation on the machine. Furthermore, chemicals such as lime and caustic can be added to alter the pH of the slurry, if this is found necessary.

There are many variations and alterations which can be made in the design and construction of the splitter device without departing from the scope and concept of my invention. For example the splitter may be so designed as to divide the stream into any number of smaller streams of approximately equal volume which streams may in turn be combined into three or more effluent streams. This is accomplished by arranging the spacers between the parallel partitions in such a way that every third passageway discharges into a common duct. Thus, three effluent streams of approximately equal volumes are produced. The process of splitting and recombining of these streams may be carried out either by using additional three way splitters, or if preferable using two way splitters or even four-way splitters. Thus the total number of effluent streams entering the headbox or distribution inlet of the board forming machine may be varied within wide limits, without departing from the basic concept of the invention. Likewise some of the partitions can be made movable so as to vary the volume of slurry passing through a given number of the passageways resulting in a close control over the volume of slurry in the effluent streams. As another alternative design, FIGURE 7 shows a two way splitter provided with discharge outlets at the sides. The splitter comprises a rectangular trough or frame 56 in which are located several vertical immovable partitions 57 and at least one adjustable partition 58. This movable partition can be adjusted by lever 59 in the same manner as hereinbefore described to vary the relative volumes of the streams passing on either side of it. The partitions serve to split the slurry into a number of smaller streams which flow by gravity through the passageways defined by the partitions and the trough. These streams contact sloping deflector plates 60 and 61, the alternate plates in alignment and sloping in the same direction and adjacent plates sloping, and diverting the streams in different directions. The plates cause the streams to be discharged out either side of the splitter. Open or closed discharge ducts or conduits (not shown) are provided at each side of the splitter to recombine the small streams flowing in the same direction into two effluent streams, and to convey these two effluents to the next splitters or to the headbox of the board forming machine.

The materials used in the construction of the splitting device form no part of this invention. However it is preferable to construct the partitions and deflector plates out of a material which will resist abrasion and wear and will not readily deform. For example in splitting and re-combining a slurry containing perlite, asphalt emulsion, and shredded newsprint, the use of ½ inch stainless steel partition plates, and ¾ inch square deflectors bars, is found to be very suitable. The partition plates can be assembled using ¾" diameter stainless steel rods with stainless steel tubing used as spacers between the parti-

tions. Alternatively, the immovable plates can be welded or brazed into place. The conduits connecting the splitters with one another and with the headbox of the board machine may likewise be constructed of materials such as stainless steel or of structural steel. When splitting and re-combining slurries or fluids having corrosive properties, or when using the splitter to split up slurries under extreme temperature or pressure conditions, the selection of a suitable material for the construction of the splitter is much more critical. In such case the use of special alloys and high temperature ceramic materials must be resorted to in order to accomplish the desired results.

A great number of different arrangements can be utilized to vary the size of adjacent passageways without departing from the scope of the invention. Thus instead of using vanes, as shown in FIGURES 1 and 2, it is contemplated that the whole partition can be moved from side to side in order to close the space between it and its adjacent partition on the one side while correspondingly increasing the gap or space on the other side. Likewise, inserts may be used to partially block portions of the certain specified or designated passages, thus reducing the amount of slurry entering that particular passageway. Regardless of what method is used to block off portions of the designated channels, it should be remembered that the purpose of so doing it is to regulate the relative volume of adjacent channels, thus enabling the operator to exercise close control over the amount of slurry entering the respective discharge conduits. It is possible by the practice of this invention to so regulate the relative spacings of the vertical partition plates through the use of vanes, etc., so as to produce one effluent stream having perhaps twice the volume of the other effluent stream. Likewise it is possible to entirely block the passageways leading to one of the effluent discharge conduits, thus diverting the complete flow to the other discharge conduit.

The following examples are presented to clarify the teachings of the invention, with no intention of limiting the invention thereto.

Example 1

70 parts by weight of expanded perlite having a density of 3 to 5 pounds per cubic foot was mixed with 24 parts of re-pulped newsprint and 6 parts of an asphalt emulsion along with approximately 1950 parts of water in a blender using a Lightnin mixer. The slurried mix was fed to a box having an overflow weir 18 inches wide. The slurry overflowed from the weir directly into the first splitter also 18 inches wide and having 18 partitions, made of $\frac{1}{8}$ inch stainless steel. The spacing between these partitions was $\frac{7}{8}$ inch. The slurry was split into 18 streams which flowed by gravity and were recombined into 2 discharge conduits. Each conduit led to another splitter identical to the first splitter and the two slurry streams were each divided into 18 streams. Each series of 18 streams was alternately recombined into 2 effluent streams of approximately equal volume thus making 4 discharge streams. Each of these four streams was again passed through a conduit to a splitter similar in design and size to the first one and the splitting and recombining repeated. Thus a total of 7 splitters were used to produce 8 streams of equal size, and these streams were fed into a distribution inlet of a 12 foot wide headbox, the feed inlets to the headbox being spaced on 18 inch centers distributed along the width of the box. From the headbox, the slurry flowed onto the belt of the Fourdrinier machine traveling at a belt speed of approximately 6 feet per minute, the volume of flow onto the belt being approximately 226 gallons per minute. The slurry was pressed into a one inch board on the machine, and was dried. An examination of the board revealed that it had very uniform physical properties throughout.

A slurry was made of the same composition as that

used above. However, instead of passing through the splitting and re-combining apparatus of the invention, the slurry was fed directly from the blending tank into the headbox through a unitary inlet. Approximately the same flow rates were used into the headbox as were used from the headbox onto the moving belt. It was visually observed during the feeding of the materials from the headbox onto the moving belt that the slurry did not emerge or discharge from the headbox uniformly across its entire width, but at times would emerge in a greater quantity at one edge of the belt than at the other. This of course resulted in the mat being thicker at some places than at others, and upon compression into a uniform thickness board, it was revealed that there was a non-uniformity of board density and composition throughout. This non-uniformity adversely affected the physical properties of the board, and showed that the board was of an inferior grade.

Example 2

A run was made using a slurry composition similar to that of Example 1. The splitter was similar in design to that previously used differing in that the immovable partitions were welded into place instead of being held by spacers, rods and bars. It was also provided with 3 movable vanes. Flow measuring devices were placed in the 2 effluent conduits leading from the first splitter to the next two splitters. The heat generated from welding the partitions into place caused some of them to warp, resulting in non-uniformly sized passageways. The measuring devices showed that as a result of this, a greater volume of slurry was being discharged into one conduit than into the other, ultimately resulting in a greater volume input to one side of the headbox than to the other. By proper regulation of the 3 movable vanes the unequal flows were corrected to provide effluents of equal volume, thus insuring a uniform distribution to the headbox.

I claim as my invention:

1. An apparatus for distributing a slurry of uniform composition to a plurality of evenly spaced inlets across the headbox of a board forming machine comprising:

a plurality of fixed, spaced apart substantially parallel vertically disposed partitions in substantial alignment and defining passages for the gravitational flow of the slurry;

means in a first passageway for diverting the slurry passing therethrough in a predetermined direction;

means in a second passageway adjacent the first for diverting the slurry passing therethrough in a predetermined direction different than that of the first;

means in the other remaining passageways for alternately diverting the slurry streams in the same order and direction as in the first and the second passageways respectively;

conduit means for collecting all of the streams diverted in the direction of the stream leaving the first passageway;

conduit means for collecting all of the streams diverted in the direction of the stream leaving the second passageway; and

means for varying the spaced apart distance of the inlet of at least two of the adjacent partitions.

2. An apparatus for distributing a slurry of uniform composition to a plurality of inlets spaced evenly across the width of the headbox of a board forming machine comprising:

a plurality of fixed, spaced apart substantially parallel vertically disposed partitions in substantial alignment and defining passages for flow of the slurry;

means in a first passageway for diverting the slurry passing therethrough in a predetermined direction;

means in a second passageway adjacent the first for diverting the slurry passing therethrough in a predetermined direction different from that of the first;

means in a third passageway adjacent the second for

diverting the slurry passing therethrough in a direction different than that of the streams in the first passageway and in the second passageway; means in the other additional passageways for consecutively diverting the streams in the same order and directions as in the first, second and third passageways;

separate conduit means for collecting each of the streams diverted in the three different directions; and means for varying the spaced apart distance of at least two adjacent partitions.

3. An apparatus for distributing a slurry of uniform composition to a plurality of inlets evenly spaced across the width of the distributor of a board forming machine comprising;

a plurality of fixed, spaced apart, vertically disposed partitions in substantial alignment and defining passages for flow of the slurry, the inlet side of at least one of which partitions is movable in relation to its distance from the next adjacent partition inlet to vary the relative volumetric flow through those adjacent passages;

flow diverting spacers between the partitions to direct the flow of adjacent passages in dissimilar directions and of alternate passages in substantially the same direction; and

at least one discharge conduit for each series of diverted streams flowing in the same direction.

4. A method of providing an even distribution of a slurry of uniform composition across the width of the belt of a board forming machine comprising;

splitting the slurry flowing by gravity, into a plurality of smaller parallel streams;

recombining alternate parallel streams into two effluents, of substantially equal volume;

repeating the splitting and recombining of the effluents at least one more time; and

separately feeding the final effluent streams of equal volume to the board forming machine at spaced apart intervals across the width of the belt.

5. A method according to claim 4 including the step of regulating the volume ratio of at least two adjacent parallel streams in each splitting step.

6. A method of providing even distribution of a slurry of uniform composition across the width of the moving foraminous belt of a board forming machine comprising;

splitting the slurry, flowing by gravity, into a plurality of substantially parallel streams;

recombining the streams into three effluent streams, each effluent stream comprising the slurry from each third split parallel stream;

repeating the splitting and recombining of each effluent at least one more time; and

separately feeding the final effluent streams of equal volume to the board forming machine at evenly spaced apart intervals across the width of the belt.

7. A method according to claim 6 including the step of regulating the volume ratio of at least two adjacent parallel streams in each splitting step.

8. In a process for uniformly distributing an aqueous slurry containing from about 3% to about 8% by weight of solids comprising between about 60% and about 80% of expanded perlite, between about 35% and about 15% fibers and up to 10% of asphalt emulsion across the width of the belt of a board forming machine, the steps comprising:

splitting the slurry into a plurality of parallel flowing streams;

recombining alternate streams into two effluents;

repeating the splitting and recombining of the effluents at least one more time;

regulating the volume ratio of at least two adjacent parallel streams in each splitting step; and

separately feeding the final effluent streams to the head-box of a board forming machine at spaced apart intervals across the width of the box.

9. A method of providing an even distribution of a slurry of uniform composition across the width of a board forming machine comprising;

splitting the slurry flowing by gravity into a plurality of smaller parallel streams;

recombining alternate parallel streams into at least two effluents but fewer in number than the aforesaid split parallel streams;

repeating the splitting and recombining of the effluents at least one more time; and

separately feeding the final effluent streams of approximately equal volume to the board forming machine at spaced apart intervals across the width of the machine.

10. A process according to claim 9 including repeatedly splitting and recombining the separate effluent streams and feeding the final multiple effluents in spaced apart streams to the distribution inlet of the board machine.

11. In the production of a lightweight building board from materials comprising essentially expanded perlite, fibers, and a bituminous waterproofing agent including the step of forming an aqueous slurry of feed materials containing between about 3% to about 8% by weight of said materials, the method of distributing said slurry uniformly across the width of a board forming machine comprising;

splitting the slurry flowing by gravity, into a plurality of smaller parallel streams;

recombining alternate parallel streams into two effluents, of substantially equal volume;

repeating and splitting and recombining of the effluents at least one more time; and

separately feeding the final effluent streams of equal volume to the board forming machine at spaced apart intervals across the width of the belt.

12. A process according to claim 11 wherein the slurry passes through the consecutive splitting and recombining steps under gravitational flow.

13. A process according to claim 12 including regulating the volume ratio of at least two adjacent parallel streams in each splitting step.

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DONALL H. SYLVESTER, *Primary Examiner.*
J. H. NEWSOME, *Assistant Examiner.*