Nov. 20, 1956 R. D. LAMBERT 2,770,844

METHOD AND MEANS FOR FELTING FIBROUS ELEMENTS

Filed July 29, 1953

Fig. 1

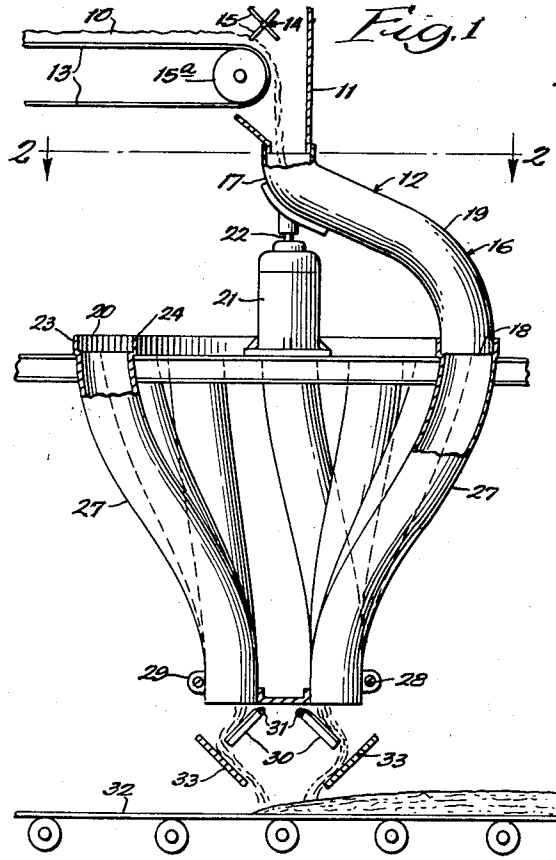


Fig. 3

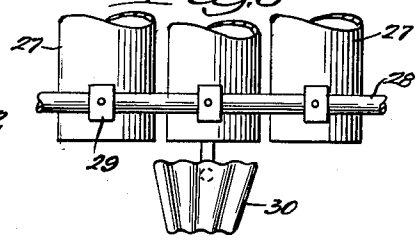


Fig. 4

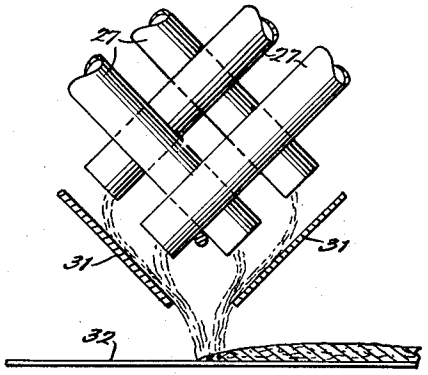


Fig. 5

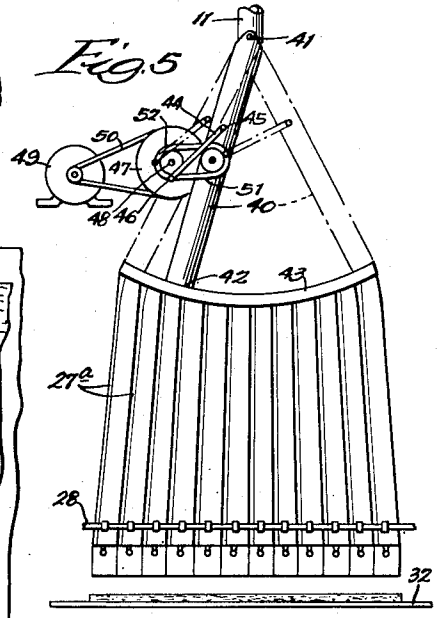
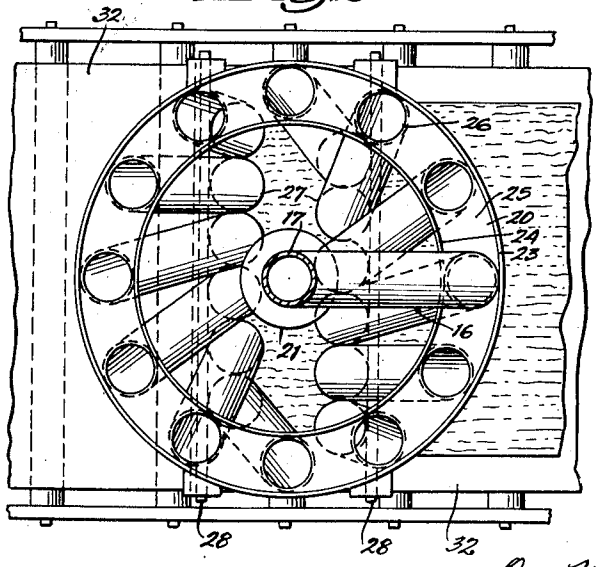


Fig. 2



INVENTOR:
Robert D. Lambert,

BY
Orms, McDougall, Williams & Hersh,
ATTORNEYS.

United States Patent Office 2,770,844
Patented Nov. 20, 1956

2,770,844

METHOD AND MEANS FOR FELTING FIBROUS ELEMENTS

Robert D. Lambert, Sandpoint, Idaho, assignor, by mesne assignments, to Changewood Corporation, Chicago, Ill., a corporation of Illinois

Application July 29, 1953, Serial No. 371,055

13 Claims. (Cl. 19—155)

This invention relates to the manufacture of structures molded of fibrous elements of small to substantial dimension such as up to about 5 inches in length or width and it relates more particularly to a method and apparatus for feeding fibrous elements of the type described to form a layer of predetermined thickness and distribution for molding into various objects, such as panels and boards, as by means of heat or pressure.

To the present, satisfactory means have not been available for handling fibrous elements of such large dimension and for feeding such fibrous elements and automatically depositing them in continuous fashion across a surface to form a layer of desired thickness and distribution and it is an object of this invention to provide a method and apparatus for accomplishing same.

More specifically, it is an object of this invention to provide a method and apparatus for handling fibrous elements, such as straw-like materials and woody wafers up to about 5 inches in length, in which the fibrous elements are fed continuously at a uniform rate and distributed for deposition uniformly across a collecting surface to form a fibrous layer, in which the fibrous elements are deposited onto the surface in a manner to achieve an interfelted relation effective to produce a strong and well integrated structure upon molding, in which deposition is achieved in a manner to lay the fibrous elements onto the collecting surface without disturbing adjacent elements or elements previously deposited thereon, and in which fibrous elements are continuously deposited in uniform distribution upon a collecting surface moving at a constant and uniform rate in one direction to deposit the fibrous elements as an endless layer of uniform thickness, and which handles the fibrous elements in a manner to avoid fracture or disintegration thereof during processing.

A further object is to provide apparatus for use in a method of the type described which is formed of relatively few simple parts and is simple and expedient in operation and control for the uniform deposition of fibrous elements across the width of a collecting surface, and it is a related object to produce apparatus of the type described which avoids the use of small metering orifices which might become plugged either with an abnormally long fibrous element or with adventitious objects to interfere with the normal operation of the device.

These and other objects and advantages of this invention will hereinafter appear, and for purposes of illustration, but not of limitation, embodiments of the invention are shown in the accompanying drawing in which:

Figure 1 is a side elevational view of one form of apparatus embodying features of this invention;

Figure 2 is a top plan view taken substantially along the line 2—2 of Figure 1;

Figure 3 is an enlarged fragmentary view of a portion of the apparatus shown in Figure 1;

Figure 4 is a schematic view of a modification which may be made in the lower portion of the apparatus shown in Figure 1, and

Figure 5 is a front elevational view of a modified form of apparatus embodying features of this invention.

The invention described and claimed herein embodies certain improvements in a felting head employing a gravity system for flowing fibrous elements of normal size for deposition onto a surface to produce fibrous structures. The improvement herein provides a simple and efficient means for deposition of the fibrous elements and a more uniform spreading of both large and small elements in the manufacture of fibrous structures. As used herein, the term "fibrous elements" is intended to include any free-flowing fibrous elements such as, for example, wooden wafers which may range in thickness from 0.001 to 0.125 inch or more and up to 5 inches in length or width, with or without tapered ends, such for example as wafers of the type described in copending applications Ser. No. 78,692, filed on February 28, 1949, now Patent No. 2,655,189; Ser. No. 192,284, filed on October 26, 1950, now abandoned, and Ser. No. 344,089, filed on March 23, 1953, or pieces of wooden veneer, or scraps thereof, cut into wafers or slivers of these dimensions, or chopped straw or bagasse or flax shives and the like.

Referring to the drawing, **10** indicates fibrous elements adapted to be introduced continuously in metered amounts into the inlet chute **11** leading into a distributor head **12**. It is preferred to make use of an endless belt **13** upon which the fibrous elements **10** are uniformly spread on the surface thereof as by means described in the copending application Ser. No. 200,041, filed on December 9, 1950, now abandoned, for displacement into the inlet chute by a picker **14** rotated in a counter-clockwise direction for engagement of the radially extending blades **15** with the fibrous elements on the surface of the belt **13** for displacement into the chute **11**. The blades **15** cooperates with the surface of the belt as it turns about the idler roller **15a**. The distributor head into which the fibrous elements are introduced comprises a tubular member **16** having an upper end portion **17** in communication with the underside of the chute **11** and an outlet end portion **18** positioned laterally thereof with a curvilinear main portion **19** therebetween through which the fibrous elements are capable of flow gravitationally from the inlet **17** to the outlet opening **18** which faces substantially vertically in the downward direction. The outlet end portion **18** extends into a circular trough **20** having a radius corresponding to the offset of the outlet end portion **18** from the center of the inlet **17** about which the tubing **16** is rotated by means of a driving motor **21** which supports the tubing at its center upon a drive shaft **22**.

The circular trough is formed with upright side walls **23** and **24** and a bottom wall **25** which has a plurality of preferably equally spaced openings **26** each of which leads into a separate down pipe **27** or conduit in communication with the opening and leading downwardly from the underside of the bottom wall. The lower end of the down pipes are fixed in a manner to permit crosswise adjustment on one or more arms **28** which extend across the surface upon which the fibrous elements are adapted to be deposited with the lower end portions of the down pipes being secured to the cross arms in side by side relation to space the outlet ends across the collecting surface. Attachment to the cross arms may be by means of a sleeve **29** or other bracket rigid with the pipes and slidably engaging the cross arms for lateral adjustment and with clamping means, such as a setscrew, for securing the sleeve to the arm when in adjusted position.

In order to arrest the downward flight of the fibrous elements upon issuing from the end of the down pipes **27** and in order to orient and spread the elements for deposition substantially in parallelism with the collecting surface without disturbing the fibrous elements previously

deposited thereon or deposited by adjacent conduits, a splash plate **30** is secured onto the end of each down pipe to extend downwardly therefrom in angular relation into the path of the elements issuing from the end of the down pipes to interrupt the flow thereof. The splash plates comprise relatively flat rigid panels with a swivel connection **31**, such as a ball and socket, connecting the upper end of each plate to the lower end of the corresponding down pipe so as to enable angular adjustment of the plate both in a vertical plane and in a crosswise plane to control the deflection of the fibrous elements for interfelting with one another and to avoid the formation of furrows as the fibrous elements are deposited to form a layer on the collecting surface. The collecting surface may constitute an endless screen but it is preferred to deposit the fibrous elements directly onto caul plates **32** positioned in end to end relation to provide a continuous surface moving constantly in one direction and upon which the fibrous elements are deposited and with which the layer of fibers are molded to produce panels or boards.

A series of distributor plates **33**, preferably formed with vertical corrugations, are positioned in the space between the splash plates **30** and the surface upon which the fibrous elements are deposited further to cooperate with the splash plates in controlling the spreading as well as the positioning of the elements. For this purpose, the distributor plates are disposed in alignment with the lower end of the splash plates and preferably positioned to incline at an opposite angle therewith to cause reversal of the direction of movement of the fibrous elements during travel from the down pipe and the splash plates onto the surface upon which the fibrous elements are deposited to form the layer for molding.

In operation, fibrous elements **10** advanced in metered amounts on belt **13** are displaced into the delivery chute **11** by the radially extending arms **15** of the picker **14** rotating in a counter-clockwise direction. The fibrous elements thus introduced into the chute **11** travel downwardly through the delivery tube **17** which is constantly being rotated by motor **21** thereby to parcel out the fibrous elements in uniform amounts about the circular trough **20**. The distributed elements pass through the openings in the bottom wall **25** of the trough **20** into the down pipes **27** through which they fall by gravity toward the surface of the collecting wall **32**. Since the distributor head parcels out the fibrous elements for delivery in substantially equal amounts to each of the openings, it will be apparent that the down pipes, when arranged in side by side relation to the delivery end, will distribute the fibrous elements substantially equally across the collecting wall and the splash plates and the distributor plates cooperating therewith will so control their movements as to gently lay the fibrous elements flatwise and in a desired interfelting relation onto the surface of the collecting wall.

If furrows form because of non-uniform distribution, the splash plates **30** may be adjusted to deflect the fibrous elements in one direction or the other, or the down pipes may individually be adjusted laterally on the cross-arm to overcome such non-uniformity. Depending upon the number of down pipes and the thickness of the layer of fibrous elements to be deposited, the down pipes may be arranged in one or more rows crosswise of the collecting wall, such as in two rows illustrated in Figure 1, or in four rows illustrated in Figure 4 of the drawing. When arranged in more than one row, it is expedient to arrange the splash plates and the distributor plates to deflect the fibrous elements in the direction towards each other as regards the direction of movement of the collecting wall to achieve a desired interfelting relation. While lateral distribution across the collecting wall may be achieved by proper adjustment of the down pipes, it has been found that the coverage of the down pipes can be greatly broadened and thereby enable the reduction in the number of

down pipes as a result of the use of splash plates and distributor plates in position to arrest the down flight of the fibrous elements and to lay the fibrous elements in proper relation on the collecting surface upon delivery.

Instead of securing distribution and delivery of equal amounts of fibrous elements in the down pipes by means of a rotating distributor head which operates in a circular trough, as illustrated in Figures 1 and 2, a somewhat similar type of distribution may be obtained with a modification in a distributor head formed of an elongate tubular member **40** pivoted at its upper end, as at **41**, intermediate the end of chute **11** for rocking movement as a pendulum while the upper end of the tubing **40** constantly remains in communication to receive fibrous elements introduced into the chute **11**. The lower end portion **42** of the tubular member **40** reciprocates throughout its arcuate movement in a similarly shaped arcuate trough **43** having openings spaced apart longitudinally in the bottom wall thereof with each opening in communication with a separate down pipe **27a**.

Various means may be provided for reciprocation of the tubular member **40**, depending upon the rate of movement desired in a particular portion of the trough and variation in movement to achieve more uniform distribution of fibrous elements for feeding into the down pipes. For example, as illustrated schematically in Figure 5 of the drawing, the tubular member **40** may be rocked about its pivot **41** in simple harmonic motion by means of a crank arm **44** pivoted at one end on a pin **45** secured to an intermediate portion of the tubular member while the other end is pivoted on a pin **46** offset from the axis of rotation of a wheel **47** rotatably mounted on a stub shaft **48**. The wheel is driven by means of an electrical motor **49** with which it is operatively connected by belts **50** and **51** operating between pulleys **52** for speed control. Movement of the tubular member at a more constant speed may be achieved by modification of the device described wherein the other end of the crank arm **44** is pivoted on a link of the endless member **51** in the form of a chain operating at constant speed about the sprockets **47** and **52**.

As described in the previous modification, the lower end portions of the pipes may be secured in one or more longitudinally spaced rows extending crosswise over the collecting surface. The spaced relation between the openings at the bottom wall of the arcuate trough may be compensated to account for the fact that while the rate of delivery of fibrous elements from the tubular member **40** will be constant and uniform, the linear speed at which the delivery end of the chute moves through the trough may vary from a higher speed at the center, but in any case to a lower speed or dwell at the end whereby a greater number of such elements will be delivered in the region towards and at the ends of the trough. By increasing the number of openings and the number of down pipes towards and at the ends of the trough and by properly spacing the openings therebetween in inverse proportion to the rate of travel of the delivery end of the distributor member over the surface of the trough, the amount of fibers entering each opening for passage through the down pipes may be kept substantially uniform. In general, the spacing of the down pipes in the trough is arranged to relate to the motion of the outlet **42** and the spacing at any part is inversely proportional to its relative speed over that part with respect to its speed over other parts of the trough, that is, the spacing is uniform where the speed is uniform and the spacing is approximately that of a sine wave spacing when the tubular member swings in a simple harmonic motion. As in the previously described modification, the down pipes are preferably provided at their ends with splash plates positioned to extend longitudinally at a desired downward tilt across the outlet end and also, if desirable, distributor plates which cooperate therewith to lay the fibrous elements gently in position of use upon the

collecting surface and which can be adjusted to obviate non-uniformities in the rate of delivery and operation.

It will be evident from the foregoing description that there is provided a new and improved method and apparatus for the handling of fibrous elements of substantial dimension for deposition thereof to form a uniform layer with the fibrous elements in interfelted relation for use in molding into a strong and well intergrated panel, board or other molded product. It will be apparent that the apparatus described herein eliminates the possibilities of fibrous elements becoming lodged in restricted distributor openings so as to interfere with the uniform distribution thereof in the manufacture of such fibrous structures and that means are provided for gently and uniformly laying the fibrous elements onto a collecting surface in a desired interfelted relation with a minimum amount of equipment and in such a manner as to avoid the necessity for the use of highly skilled labor to effect the operations thereof.

It will be understood that changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. A method of depositing fibrous elements upon a collecting surface to manufacture continuous layers with the fibrous elements in uniform distribution comprising the steps of advancing the said collecting surface continuously past a plurality of conveyor outlets which are positioned above and mutually aligned across said collecting surface, moving a distributor outlet uniformly to bring it successively into communication with a plurality of conveyor inlets which are at all times in communication respectively with the said conveyor outlets, and continuously feeding fibrous elements at a uniform rate into a distributor inlet which is at all times in communication with the said distributor outlet.

2. A method of depositing fibrous elements upon a collecting surface to manufacture continuous layers with the fibrous elements in uniform distribution comprising the steps of advancing the said collecting surface continuously past a plurality of conveyor outlets which are positioned above and mutually aligned across said collecting surface, moving a distributor outlet to bring it successively into communication with a plurality of conveyor inlets which are at all times in communication respectively with the said conveyor outlets and at a rate in proportion with the space between the conveyor inlets to provide for a uniform interval of time between communications between the distributor outlet and the conveyor inlets which are at all times in communication respectively with the said conveyor outlets, and continuously feeding fibrous elements at a uniform rate into a distributor inlet which is at all times in communication with the said distributor outlet.

3. A method of depositing fibrous elements upon a collecting surface to manufacture continuous layers with the fibrous elements in uniform distribution comprising the steps of advancing the said collecting surface continuously past a plurality of conveyor outlets which are positioned above and mutually aligned across the collecting surface in at least one row, moving a distributor outlet to bring it successively into communication with a plurality of conveyor inlets which are at all times in communication respectively with the said conveyor outlets and at a rate to provide for a uniform time interval in between, and continuously feeding fibrous elements at a uniform rate into a distributor inlet which is at all times in communication with the distributor outlet.

4. A method of depositing fibrous elements upon a collecting surface to manufacture continuous layers with the fibrous elements in uniform distribution comprising the steps of advancing the said collecting surface continuously past a plurality of conveyor outlets which are positioned above and mutually aligned across the collecting surface, moving a distributor outlet uniformly to bring it successively into communication with a plurality of conveyor inlets which are at all times in communication respectively with the said conveyor outlets, continuously feeding fibrous elements at a uniform rate into a distributor inlet which is at all times in communication with the said distributor outlet, and interrupting the flow of fibrous elements during passage from the distributor outlets to the collecting surface smoothly to lay the fibrous elements thereon.

5. A method of depositing fibrous elements upon a collecting surface to manufacture continuous layers with the fibrous elements in uniform distribution comprising the steps of advancing the said collecting surface continuously past a plurality of conveyor outlets which are positioned above and mutually aligned across the collecting surface, moving a distributor outlet uniformly to bring it successively into communication with a plurality of conveyor inlets which are at all times in communication respectively with the said conveyor outlets, continuously feeding fibrous elements at a uniform rate into a distributor inlet which is at all times in communication with the said distributor outlet, and deflecting the fibrous elements during passage from the distributor outlets to the collecting surface to broaden the area covered by the fibrous elements upon deposition on the said collecting surface.

6. Apparatus for depositing and collecting fibrous elements in a uniform layer comprising a collecting surface movable uniformly in one direction, a plurality of separate conveyors having individual inlets and having individual outlets positioned above and mutually aligned across said collecting surface, a distributor having a single inlet and a single outlet, means for continuously and uniformly moving said distributor to bring its outlets successively into communication with the inlets of said conveyors, and means for continuously and uniformly feeding fibrous elements into the inlet of said distributor.

7. Apparatus as claimed in claim 6 which includes means for adjusting the conveyor outlets in mutual lateral alignment across the collecting surface.

8. Apparatus for depositing and collecting fibrous elements in a uniform layer comprising a collecting surface movable uniformly in one direction, a plurality of separate conveyors having individual inlets and having individual outlets positioned above and mutually aligned across the collecting surface, a distributor having a single inlet and a single outlet, means for moving said distributor to bring its outlets successively into communication with the inlets of said conveyors, and means for continuously and uniformly feeding fibrous elements into the inlet of said distributor, the individual inlets of said conveyors being spaced one from the other in inverse proportion to the rate of movement of the distributor outlet to provide for substantially equal time intervals between communication of the distributor outlet with the successive conveyor inlets.

9. Apparatus as claimed in claim 6 in which the conveyor inlets are arranged in a circular path and in which the distributor outlet turns in a corresponding path.

10. Apparatus as claimed in claim 6 which includes a circular trough having equally spaced apart openings in the bottom wall thereof each of which is in communication with one of the inlets of the conveyors and in which the distributor outlet moves at a constant rate in a circular path within said trough.

11. Apparatus as claimed in claim 8 in which the distributor comprises a tubular member and in which the means for moving the distributor comprises means for actuating the tubular member in pendular movement whereby the distributor outlet reciprocates through a predetermined arc and in which the conveyor inlets are linearly arranged in an arcuate path corresponding to that of the distributor outlet.

12. Apparatus for depositing and collecting fibrous elements in a uniform layer comprising a collecting sur-

face movable uniformly in one direction, a plurality of separate conveyors having individual inlets and having individual outlets positioned above and mutually aligned across said collecting surface, a distributor having a single inlet and a single outlet, means for continuously and uniformly moving said distributor to bring its outlets successively into communication with the inlets of said conveyors, means for continuously and uniformly feeding fibrous elements into the inlet of said distributor, and inclined plates positioned between the conveyor outlets and the collecting surface and in the path of the fibrous elements issuing from the outlets to interrupt the flow of the said fibrous elements from the conveyor outlets to the collecting surface.

13. Apparatus as claimed in claim 12 which includes means for adjusting the angular relation of the plates to deflect the fibers laterally for deposition uniformly in an interfelted layer on the collecting surface.

References Cited in the file of this patent

UNITED STATES PATENTS

789,135	Baggaley	May 9, 1905
987,834	Selden	Mar. 28, 1911
1,743,939	Thomas	Jan. 14, 1930
2,103,769	Drill	Dec. 28, 1937
2,243,840	Delivuk	June 3, 1941
2,450,511	Harner et al.	Oct. 5, 1948