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APPARATUS FOR FORMING FIBROUS SHEETS OR PAPERBOARD

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Fig. 1

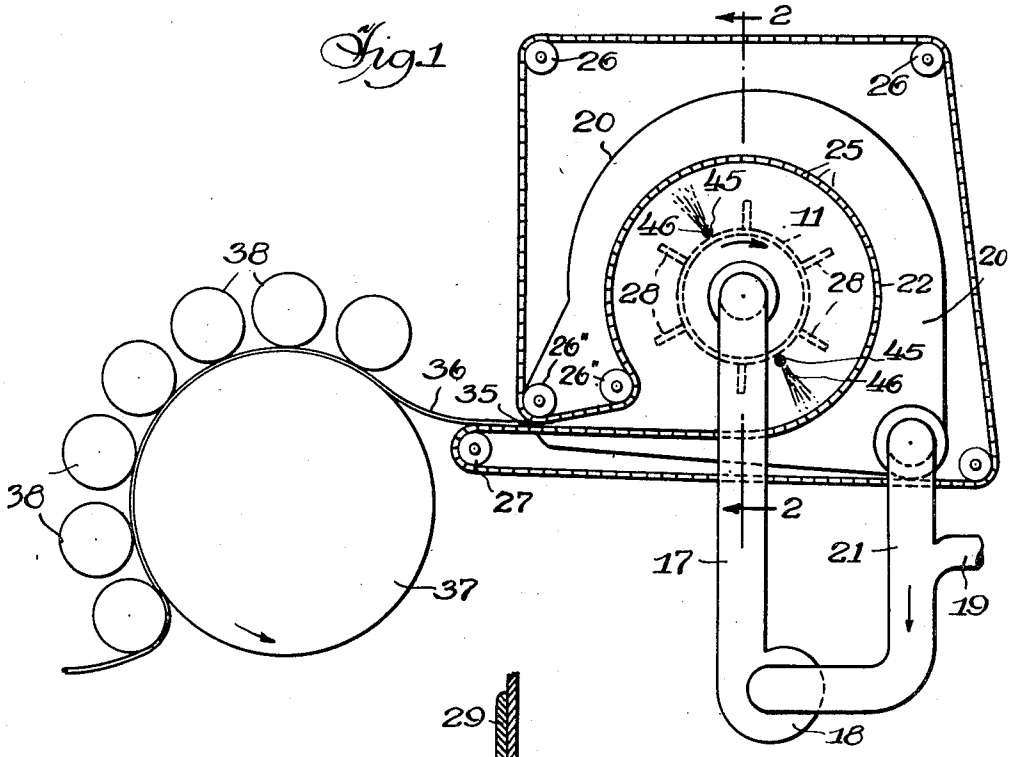


Fig. 4

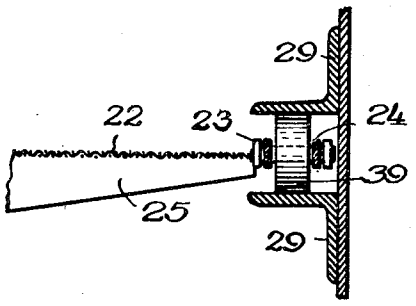


Fig. 3

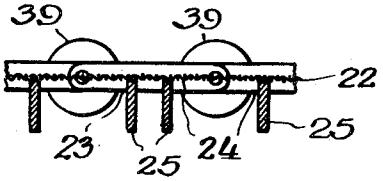
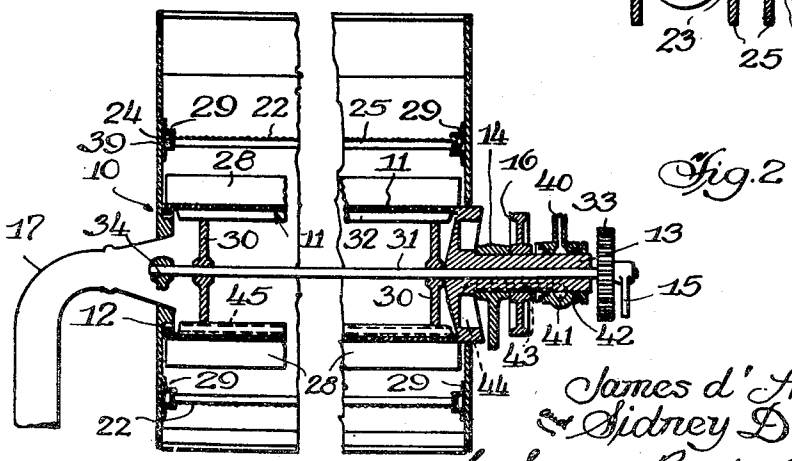


Fig. 2



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APPARATUS FOR FORMING FIBROUS SHEETS OR PAPERBOARD

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8 Claims. (Cl. 154—29)

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Our invention relates to improvements in methods and apparatus for forming fibrous sheets or paper board.

One object of the invention is to provide means and a method by which air laid fibers may be distributed uniformly and formed into a felted product in a manner comparable to that found in products made by the usual water-forming method.

Another object is to provide apparatus for forming a mat of uniform density by blowing fibrous material through a foraminous partition and depositing the fiber loosely on a conveyor and thereafter compressing the mat.

A further object is to provide apparatus for forming building board of uniform consistency by depositing on a moving screen, by means of pressure and suction, an air-borne mixture of fiber and fine particles of a thermal-setting adhesive, to which heat and pressure are subsequently applied.

Another object is to provide apparatus having a forming area of great extent in comparison with the rate of deposition of the material.

An additional object is to provide an improved method of forming a mat of evenly distributed dense material containing a thermal-setting adhesive.

A further object is to provide an improved method of forming such material by the employment of a very dilute and highly dispersed suspension of the fibers in the stream of air.

An additional object is to provide a method of forming building board comprising fibrous material and an adhesive, which consists of applying suction to the screen on which said material is deposited and thereafter applying heat and pressure.

Other objects and advantages will hereafter appear.

In the drawings Fig. 1 is an end elevation somewhat diagrammatic in form, of a machine for making the product.

Fig. 2 is a section on the line 2—2 of Fig. 1;

Figs. 3 and 4 show various details.

In the machine selected for illustrative purposes, the fibers and a binder in the form of a finely powdered thermoplastic material are blown through a perforated rotating drum from the inside, more or less radially outwardly, to a concentrically arranged wire mesh screen which is spaced from the drum and which constitutes part of an endless belt or conveyor of foraminous material on which the felted material or uniformly distributed bat is formed.

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The machine has a suitable frame 10 which supports a rotatable cylinder or perforated drum 11, mounted on roller bearing 12. Said drum is driven at one end by a hollow shaft 13, which is mounted in suitable bearing 14 at one side of the machine, the opposite end of said drum being open. A gear or pulley 16 is fixed to said hollow shaft to rotate said drum.

The fiber with or without an adhesive mixed with it, is blown through a conduit 17 into the open end of the drum, by a suitable blower 18 having an inlet pipe 19 communicating with a supply of fiber, or fiber dispersed in air and finely ground thermal-setting adhesives, and communicating also with an opening in the housing 20 by an additional conduit 21, thus forming in part a closed circuit.

It has proved difficult to secure uniform dispersion of air-borne fibers so as to provide a uniform bat or sheet, but we overcome this difficulty by causing the fibers to pass through a coarse screen spaced a short distance from the forming wire, said screen in this case consisting of the perforated periphery of the drum.

The forming wire may consist, for example, of 40–60 steel wire screen 22 supported by chains comprising roller 39, links 23, 24 and cross bars 25 which permit use of a wide conveyor screen without undue sagging. Said chains which form the endless conveyor pass over idle rollers 26 and a driving roller 27, the direction of rotation being indicated by the arrow and the direction of rotation of the drum being preferably the same as that of said conveyor

The drum has radial blades 28 attached thereto which act as fan blades to blow the material against the conveyor screen when the drum is rotating. Said blades may be solid or perforated with the perforations so spaced that the air currents formed by the rotation of the drum aid in uniformly distributing the fibers in the form of a bat or felt. The cylindrical portion of the conveyor forms a chamber within the housing 20, into which the air-borne fiber is delivered, said chamber comprising the annular space between the drum and the cylindrical wire surface which surrounds it. The fibers which are not caught by the wire screen are drawn out of the housing by the conveyor through the pipe 21 and again discharged into the drum, thus forming a closed circuit. The blower not only delivers the fibers to the drum under a slight pressure but creates a slight suction on the wire mesh conveyor.

Within the drum a fanning frame is mounted comprising spiders 30 fixed to a shaft 31 with a

plurality of scrapers 32 mounted to scrape the inside of the drum to prevent the fibers from plugging the perforations. Said shaft may be rotated by a pulley or gear 33 thereon. Said shaft is mounted at one end in the bearing 15, passing through the sleeve 13. It is mounted in a suitable bearing 34 at the other end within the air circulating system and at the axis of rotation of the drum.

The movement of the conveyor carries the felted product or bat out of the housing on a tangential span of said conveyor, a flapper valve 35 being provided at the exit to prevent the leakage of an excessive amount of air into the housing. The bat, indicated at 36, is passed over a heating roll 37, around part of the periphery, on which press rolls 38 are mounted. Thus the thermo-plastic material reacts under the heat and pressure provided, resulting in a dense compact product which may be used as a building board or for other purposes, depending on the degree of heat and pressure employed.

Said bat may also be delivered from the apparatus in the form of a product having low density, through suitable attachments to cut the same into conventional widths for building purposes, i. e. 16" widths, or for other purposes. The fibrous material may also be placed between sheets of asphalt coated paper and made into moisture proof packages, or mats for use in building construction. The link roller chains and cross connections are preferably designed so that they will pass around a driving sprocket and also will produce both flat and concave cylindrical surfaces, without wrinkling of the wire. In other words, the wire sections should abut without overlapping.

Where it is not desired to use a thermo-setting adhesive because of the loss in bulk which necessarily accompanies such use when the bat is heated and compressed as a final step of the operation, an adhesive in solution may be sprayed onto the fibers as the mat is being formed. Any suitable adhesive may be used, as for example, water soluble adhesives or those in colloidal suspension. The liquid employed may be pumped through the pipe 40 (Fig. 2), into the annular space 41 and associated parts which comprise a stationary joint, mounted on the revolving sleeve or hollow shaft 13, suitable packing material 42 being provided to prevent leakage. Said liquid is then conveyed to the axial passages 43 in said hollow shaft to radial pipes 44 and thence to pipes 45 having suitable atomizing nozzles 46 mounted thereon, such as shown in Fig. 1, to distribute the adhesive continuously on the bat as it is being formed on the cylindrical surface presented by the screen.

The portion of the travelling screen between the lower left end pair of idler wheels 26"—26" is not subject to the sprays from the nozzles just mentioned and it is thus possible to form a thin layer of fibers on the wire at that point, so that said adhesive does not come in contact with the screen when the latter reaches the cylindrical portion of the forming surface.

One feature of the method employed is that a very high rate of air circulation may be used if desired, without requiring a very large volume of air. Also the air stream charged with fibers may be very dilute, i. e. the fibers may be highly dispersed, and it is possible to use a forming area of considerable extent under the circumstances. The use of a closed air system for the fibers is also desirable, in that it is convenient to mingle with said fibers any material which it is desired to add, and the existence of a chamber between the fan and the forming surface is also desirable.

We are aware that various changes may be made in the form and arrangement of the parts comprising the equipment described, without departing from the spirit of the invention as defined in the appended claims.

We claim:

1. In combination, a perforated drum, an endless conveyor mounted to travel in part along the arc of a circle concentric with and outside of and spaced from said drum, means for blowing fibrous material through the perforations in said drum onto said conveyor, said conveyor comprising a screen and channel members formed to guide the edges of said screen along said arc and in a closed loop tangential thereto.

2. In combination, a perforated drum, means for rotating the same, a housing for said drum, an arc-shaped track in said housing concentric with said drum but spaced therefrom, chains guided by said track, and wire mesh screen extending from one chain to the other, a conduit communicating with the interior of said drums at one end to blow fibrous material through said perforations and onto said screen to form a mat, and means for advancing said chain.

3. In combination, a perforated drum, means for rotating the same, a housing for said drum, an arc-shaped track in said housing concentric with said drum but spaced therefrom, chains guided by said track, and wire mesh screen extending from one chain to the other, a conduit communicating with the interior of said drum at one end to blow fibrous material through said perforations and onto said screen to form a mat, means for advancing said chain, said chain having a span extending tangentially from said arc, to feed the finished mat out of said housing.

4. In combination, a housing having a perforated rotatable drum therein, an arc-shaped track mounted in the side walls of said housing and comprising an incomplete circle, an endless conveyor comprising chains slidable in said track, cross pieces connecting said chains and a wire mesh screen mounted on said cross pieces, said track extending tangentially outward through an opening in said housing, idle rollers on which said conveyor is mounted outside of said housing, a conduit communicating with one end of said drum and a blower for delivering fiber and finely ground thermo-setting adhesive to said perforated drum and onto said screen.

5. In combination, a housing having a perforated rotatable drum therein, an arc-shaped track mounted in the side walls of said housing and comprising an incomplete circle, an endless conveyor comprising chains slidable in said track, cross pieces connecting said chains and a wire mesh screen mounted on said cross pieces, said track extending tangentially outward through an opening in said housing, idle rollers on which said conveyor is mounted outside of said housing, a conduit communicating with one end of said drum, a blower for delivering fiber and finely ground thermo-setting adhesive to said perforated drum and onto said screen, and means for compressing the mat formed on said conveyor.

6. In combination, a housing having a perforated rotatable drum therein, an arc-shaped track mounted in the side walls of said housing and comprising an incomplete circle, an endless conveyor comprising chains slidable in said track, cross pieces connecting said chains and a wire mesh screen mounted on said cross pieces, said

track extending tangentially outward through an opening in said housing, idle rollers on which said conveyor is mounted outside of said housing, a conduit communicating with one end of said drum, a blower for delivering fiber and finely ground thermo-setting adhesive to said perforated drum and onto said screen, and a conduit extending from the space between said conveyor and the wall of said housing to said blower to return loose fibers to said drum.

7. In combination, a housing having a perforated rotatable drum therein, an arc-shaped track mounted in the side walls of said housing and comprising an incomplete circle, an endless conveyor comprising chains slidable in said track, cross pieces connecting said chains and a wire mesh screen mounted on said cross pieces, said track extending tangentially outward through an opening in said housing, idle rollers on which said conveyor is mounted outside of said housing, a conduit communicating with one end of said drum, a blower for delivering fiber and finely ground thermo-setting adhesive to said perforated drum and onto said screen, a heated roll adjacent the end of said tangential track over which the felted material passes to cause said adhesive to harden, and pressure rolls around the periphery of said heated roll.

8. In combination, a housing having a perforated rotatable drum therein, an arc-shaped track

mounted in the side walls of said housing and comprising an incomplete circle, an endless conveyor comprising chains slidable in said track, cross pieces connecting said chains and a wire mesh screen mounted on said cross pieces, said track extending tangentially outward through an opening in said housing, idle rollers on which said conveyor is mounted outside of said housing, a conduit communicating with one end of said drum, a blower for delivering air with highly dispersed fibers and finely ground thermo-setting adhesive therein, and means outside of said housing for applying heat and pressure to the felted material to harden the same.

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