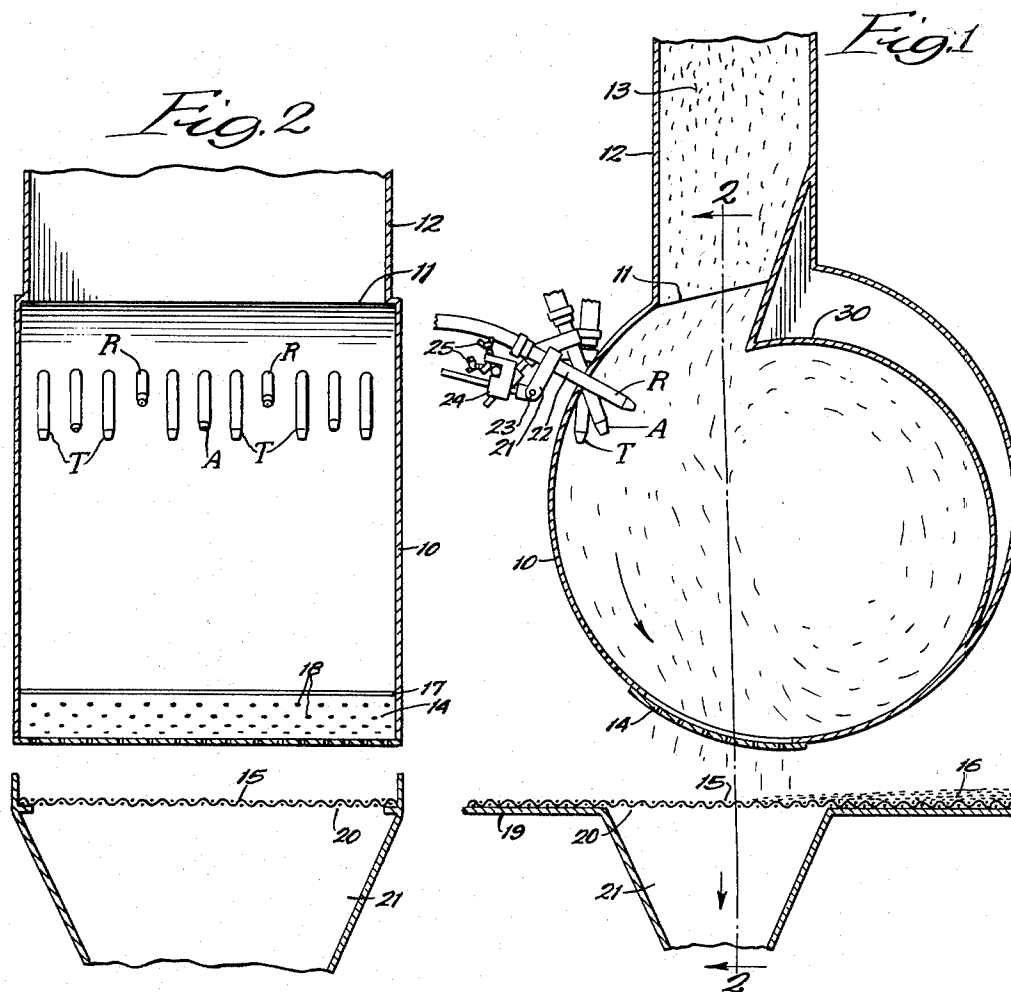


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APPARATUS FOR DEPOSITION OF DRY FIBERS IN
THE MANUFACTURE OF FIBROUS STRUCTURES
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APPARATUS FOR DEPOSITION OF DRY FIBERS IN THE MANUFACTURE OF FIBROUS STRUCTURES

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3 Claims. (Cl. 19—156)

This invention relates to the air deposition of dry fibers in the manufacture of fibrous structures such as continuous, nonwoven webs and fabrics formed of fibrous elements, such as separated fibers or wafers, and it relates more particularly to an improvement in the apparatus for the manufacture of fibrous structures which is described in my copending application Ser. No. 313,316, filed on October 6, 1952.

Briefly described, the method and apparatus of the aforementioned copending application embodies the use of an elongate cylindrical housing having one or more inlet openings in the upper end through which fibers are introduced and which has a foraminous separating wall in a spaced portion thereof through which fibers entrained in a stream of air are carried through the separating wall for substantially linear flow to a collecting wall spaced a short distance below the foraminous separating wall and upon which the fibers are deposited in an interfelted relation. The collecting wall may be foraminous to enable air to be withdrawn from the underside for holding the deposited fibers onto the surface thereof and the amount of air withdrawn through the collecting wall is preferably adapted to be greater than the amount passing through the forams of the separating wall so that air will flow slowly from the surrounding atmosphere into the space between the separating wall and the collecting wall but in amounts incapable of interfering with the linear flow of fibers. By the balancing of the air flow as described, an apparatus may be supplied which for the first time permits the area between the separating wall and the collecting wall to remain open to the atmosphere without blowing fibers out into the room.

The entrainment of fibers in the air stream within the housing and the subsequent passage of substantially uniformly controlled volumes of air and fibers from the housing through the openings of the separating wall to the collecting wall is achieved by an air scrubber in which streams of air at high velocity are introduced tangentially into the housing to cause the air and the fibers therein to circulate rapidly in one direction about the housing. This causes the fibers within the housing to become entrained within the air stream. The circulating air and entrained fibers, of which there is always an excess available, over the face of the separating wall and under positive pressure, not only keeps the openings in the wall substantially free of clogging fibers but because of the pressure, resulting from the excess of both air and fibers, generates a "shower head" effect which results in the passage of equal volumes of both air and entrained fibers through each of the openings of the separating wall to the collecting wall. The volume of air and fibers passing through the separating wall in response to the "shower head" effect constitutes a relatively small proportion of air and fibers circulating within the housing.

It is an object of this invention to provide improvements in the method and apparatus for the air deposi-

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tion of dry fibers in the manufacture of fibrous structures and it is a related object to provide a method and apparatus for the air deposition of dry fibers using a fiber depositing head based upon an air scrubber in which means are provided for reducing fiber agglomeration and maintaining fiber separation and distribution for the passage of uniform volumes of fiber through the forams of the separating wall and the formulation of a fibrous structure having a uniform distribution of fibers on the collecting wall; and in which a minimum number of fiber bundles are formed to interfere with the smooth and uniform transfer of fibers from within the housing to the collecting wall or deposit undesirable bundles of fibers in the web which is formed on the collecting wall.

These and other objects and advantages of the 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 schematic view in sectional elevation showing a fiber depositing head embodying features of this invention;

Figure 2 is a sectional view taken substantially along the line 2—2 of Figure 1.

It has been found that a uniform distribution of fibers in the air stream within the housing may be secured and agglomeration of fibers into bundles may be lessened when some of the air streams are introduced into the housing at angles varying from tangential, as before, to radial with at least some of the jets introducing streams of air in a substantially radial direction into the housing while most of the jets continue to be introduced substantially tangentially.

The fiber depositing head in which the concept of this invention has primary application comprises a cylindrical housing 10 which may be of variable width depending upon the width of the fabric to be formed. In a unit of medium capacity, the housing 10 may be 1½ feet in diameter and 4 feet in width. A feed opening 11 extends practically completely across the upper portion of the housing in communication with a feed duct 12 through which fibrous elements 13 in the form of separated fibers of wood, cellulose, synthetic fibers, mineral fibers or pulp fibers, or fibrous elements of substantial dimension, such as thin wafers or cut strands, may be fed, preferably at a continuous and constant rate into the housing.

A foraminous separating wall 14 is provided in the lower portion of the housing through which fibrous elements entrained in air pass on their way towards a collecting wall 15 upon which the fibers are separated in interfelted relation to form a web 16 on the surface thereof. The foraminous separating wall may constitute a separable foraminous member secured in position across an opening 17 within the housing in a manner to permit exchange so that the type of openings or an arrangement of openings 18 best suited for particular fibers may be used for most efficient production. The openings in the separating wall may comprise a plurality of spaced apart apertures controlled as to size and spacing for particular fibrous elements as described in the copending application Ser. No. 61,674, or the openings may be in the form of one or more continuous slots extending across the housing in circumferentially spaced apart relation, as described in the copending application Ser. No. 313,316.

The collecting wall 15 is preferably formed of an endless screen adapted to be advanced in one direction continuously across the area beneath the foraminous separating wall 14 or it may be in the form of a series of caulk plates upon which the fibrous elements are deposited to

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produce an interfelted structure for molding into panels while on the caul plates. The foraminous collecting wall which is preferred in the manufacture of webs of separated fibers, as shown, is supported upon a rigid surface 19 having an opening 20 in the area lying beneath the separating wall. A suction box 21 is provided in communication with the opening and serves for use in withdrawing a volume of air from the underside of the collection wall which is at least equal to and preferably larger than the volume of air which passes with the fibers through the separating wall with the result that the deficiency is made up by a slight inflow of air into the space between the separating wall and the collecting wall from the surrounding atmosphere. When this difference in air volumes is small, the inflow of air is of such character as not to interfere with the substantially linear movement of the fibers from the separating wall to the collecting wall with the result that the fiber depositing area can be allowed to remain open to the atmosphere without disturbing the distribution of fibers and without loss of fibers into the atmosphere.

Marked improvements have been found to result with respect to the distribution and separation of the fibers within the housing when, instead of introducing all of the air streams tangentially into the housing, some of the air streams are introduced radially while others are introduced at angles therebetween, although such inbetween jets are not necessary. It is best when the greatest number of inlets are positioned to introduce the streams tangentially while fewer are spaced across the housing and positioned to introduce the streams radially, while possibly still a few others are positioned to introduce the air streams at angles therebetween.

One satisfactory arrangement is illustrated in the drawings where eleven inlets are illustrated as extending across the housing. The first, third, fifth, seventh, ninth and eleventh inlets indicated by the letter T are positioned to introduce the streams of high velocity air tangentially into the housing. The fourth and eighth, indicated by the letter R are positioned to introduce the streams of air radially into the housing, and the second, sixth and tenth inlets, indicated by the letter A, are positioned to introduce their streams of air at an angle between radial and tangential.

In theory, it is believed that the tangential streams of air introduced into the housing impart the forces for circulating movement of the air and fibers about the housing to provide the layer which moves constantly under positive pressure across the forams of the separating wall and from which a small proportion entrained in air peels off for passage with the air through the forams of the separating wall to the collecting wall. While the radial streams of air introduced into the housing would seem to interfere with this circulating movement, they, in fact, do not impart such interference and instead appear to improve the entrainment and the distribution of the fibers in the circulating streams of air with the result that fiber clumping is markedly reduced as compared to that which exists in the absence of such radial streams. Because of the greater degree of separation and reduced clumping, the production of a more uniform layer of separated fibers is secured with less interference and interruptions to keep the forams of the separating wall clear for passage of uniform volumes of air and fibers therethrough.

The air streams introduced at angles between radial and tangential are not always necessary but they assist both in circulating the air and fibers about the housing over the separating wall and maintaining more complete fiber separation and distribution. The more important function of the inbetween inlets is to impinge upon the face of the separating wall and thereby assist in the removal of any fibers which might become entrapped and upon which agglomerates might form to interfere with the fiber depositing process or to provide clumps which drop onto the fabric and constitute an impurity therein.

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Various means for the adjustment of the angular relation of the air inlets may be provided. As illustrated in Figure 1, one such means includes an arm 21 which engages the nozzle 22 outwardly of the housing and is pivoted at one end, as at 23, upon rocker arm 24 which is adapted to be secured in a vertical angle of adjustment by the screw and nut means 25 illustrated.

Further to assist in the smoothness of operation of the fiber depositing head and the introduction of fibers therein, a baffle plate 30 is provided of curvilinear construction which is secured to the inner wall of the housing in advance of the inlet opening to provide a curvilinear wall therein which terminates at a level below the inlet opening so as to deflect the circulating air stream beyond the inlet opening during circulating movements. The effect of such deflection of the air stream by the baffle 30 causes a negative pressure to exist at the inlet opening with the result that the fibers fed into the opening through the feed chute are positively drawn into the housing and turbulence which ordinarily might exist in the feed opening is thus substantially completely eliminated.

It will be understood that further 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.

We claim:

1. Apparatus for the air deposition of dry fibers in the manufacture of fibrous structures comprising a substantially cylindrical housing having an inlet in one portion through which fibers are fed into the housing, an outlet in another portion which forms a foraminous separating wall through which fibers are able to pass, a collecting wall spaced a short distance from the separating wall having forams therein dimensioned to prevent passage of fibers, means for feeding dry fibers through the inlet into the housing and a plurality of air nozzles in the housing through which streams of air at high velocity are directed into the housing, some of said nozzles being positioned to direct streams of air tangentially into the housing, others of said nozzles being positioned to direct their streams of air radially into the housing whereby the air and contained fibers are caused to circulate rapidly about the housing in one direction as a composite stream having a substantially uniform distribution of the fibers entrained therein for passage with the air through the separating wall to the collecting wall.

2. Apparatus for the air deposition of dry fibers in the manufacture of fibrous structures comprising a substantially cylindrical housing having a fiber inlet in one portion through which fibers are fed into the housing, an outlet in another portion which forms a foraminous separating wall through which fibers are able to pass, a collecting wall spaced a short distance from the separating wall having forams therein dimensioned to prevent passage of fibers, means for feeding dry fibers through the inlet into the housing, and a plurality of air inlets in the housing through which streams of air at high velocity are directed into the housing, some of said air inlets being positioned to direct their streams of air tangentially into the housing, others of said air inlets being positioned to direct their streams of air radially into the housing, while still others are positioned to direct their streams of air into the housing at angles between tangential and radial whereby the air and entrained fibers are caused to circulate as a composite stream rapidly about the housing and entrain the fibers therein in uniform distribution and maintain separation so that a small portion of the air and fibers contained within the housing will pass together through the separating wall to the collecting wall.

3. Apparatus for the air deposition of dry fibers in the manufacture of fibrous structures comprising a substantially cylindrical housing having an inlet in one portion through which fibers are fed into the housing, an outlet in another portion which forms a foraminous sep-

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arating wall through which fibers are able to pass, a collecting wall spaced a short distance from the separating wall having foramens therein dimensioned to prevent passage of fibers, means for feeding dry fibers through the inlet into the housing at a rate to maintain a load of fibers within the housing, a plurality of air nozzles arranged transversely across the housing through which streams of air at high velocity are directed into the housing, most of said air nozzles being positioned to direct their streams of air tangentially into the housing, others of said nozzles being positioned to direct their streams of air radially into the housing, while still others are positioned to direct their streams of air into the housing at an angle between tangential and radial whereby the

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air and entrained fibers are caused to circulate rapidly as a composite stream about the housing in one direction and the fibers within the housing entrained in the air stream in uniform distribution and in a manner to maintain substantial separation for passage with the air through the separating wall to the collecting wall.

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