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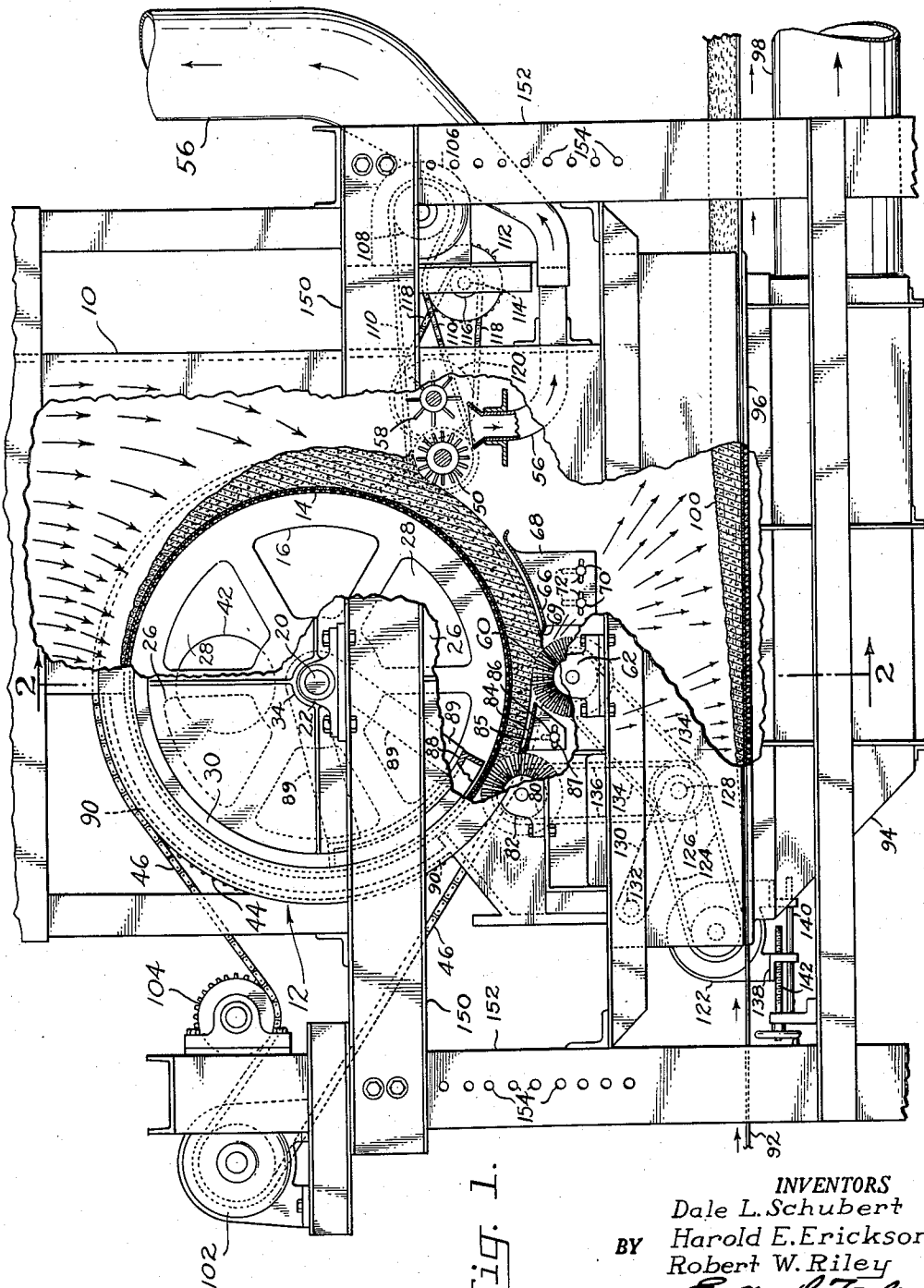
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MAT FORMING METHOD AND APPARATUS

Filed May 14. 1956

3 Sheets-Sheet 1



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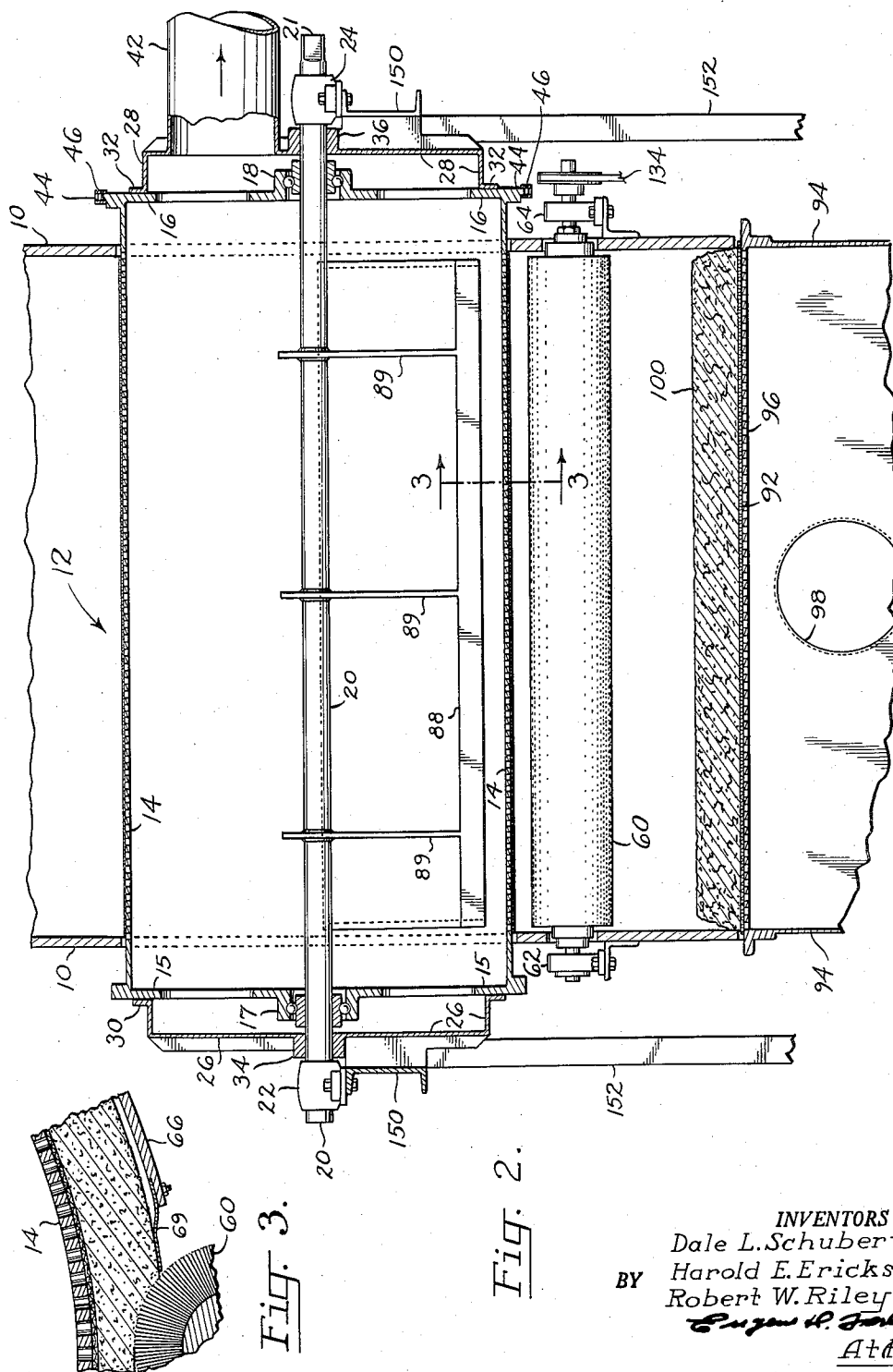
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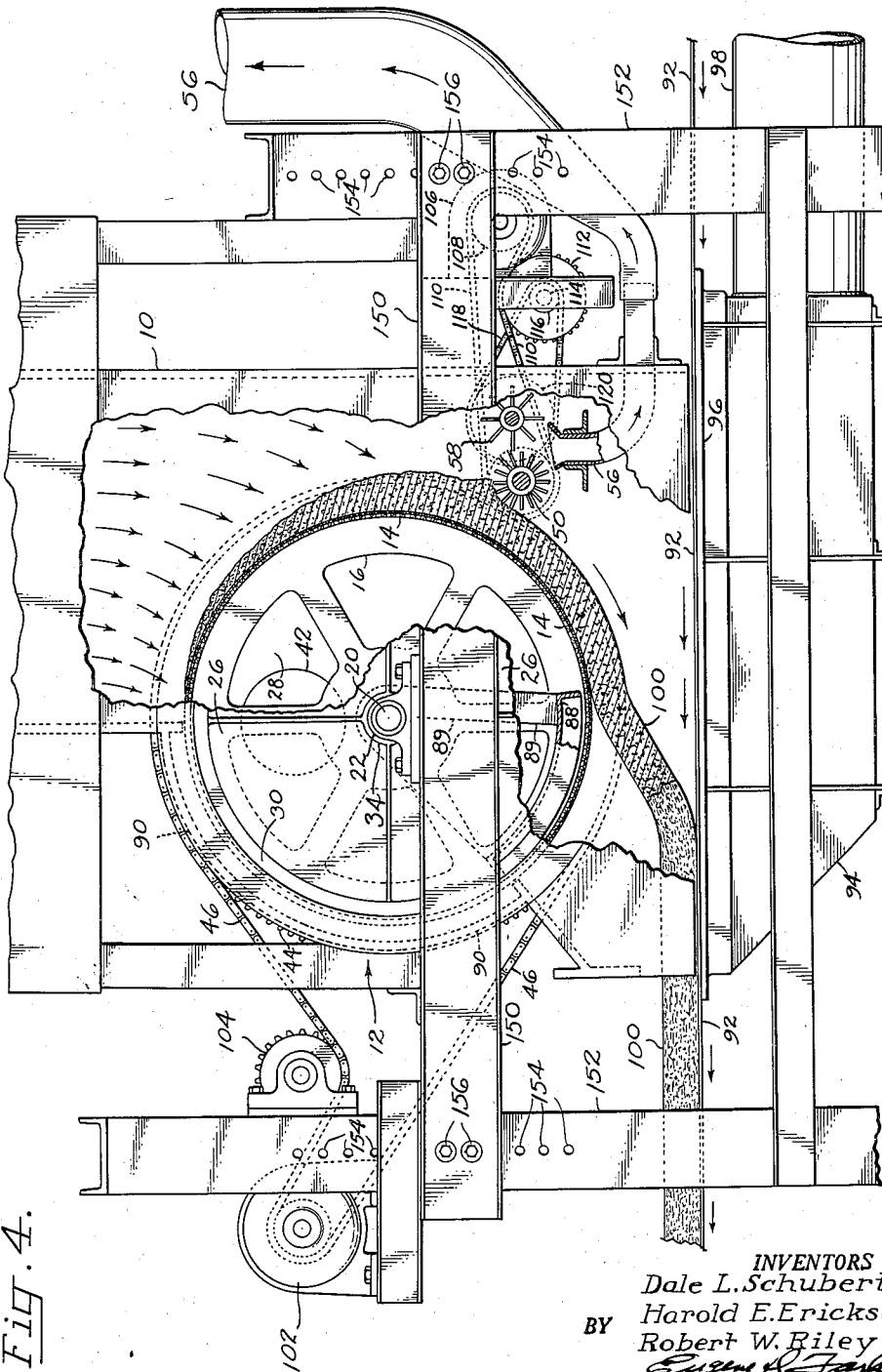
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MAT FORMING METHOD AND APPARATUS

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36 Claims. (Cl. 154—1)

This invention pertains to method and apparatus for forming solid particles into a mat which thereafter may be consolidated into a product of uniform thickness and density.

In making consolidated products such as hardboard and other pressed fiberboards, it is common practice to reduce wood, cane, straw and other lignocellulose to small particles. These are formed dry or moist into a mat which thereafter is transferred into a hot press and consolidated to the desired density and thickness.

In these operations control of the composition of the mat is of primary importance in determining the uniformity of the pressed product. Irregularities in thickness and density of the mat are reflected in the properties of the pressed product, which accordingly may not meet the standards for products of this class. Control of the uniformity of the mat is difficult of accomplishment, however, because of the irregularity in size and shape of its component particles and their tendency to aggregate into clumps or flocs.

Accordingly it is the general object of this invention to provide apparatus for forming solid particles into uniform mats which thereafter may be pressed into consolidated products of uniform density.

It is another object of this invention to provide an apparatus for forming uniform mats from fibrous wood particles.

It is another object of this invention to provide a method and apparatus for forming mats having an increased concentration of relatively small particles on their surfaces which may be pressed into consolidated products having smooth surfaces.

It is another object of this invention to provide high capacity apparatus for forming solid particles, particularly wood fibers and granules, continuously into mats suitable for pressing into composition boards of uniform properties.

The manner in which the foregoing and other objects of this invention are accomplished will be apparent from the following specification and claims considered together with the drawings wherein like numerals of reference indicate like parts, and wherein:

Fig. 1 is a view in side elevation, partly in section, illustrating the herein described mat forming apparatus;

Fig. 2 is a fragmentary view in end elevation further illustrating the herein described mat forming apparatus, taken along line 2—2 of Fig. 1;

Fig. 3 is a detail fragmentary view taken along line 3—3 of Fig. 2; and

Fig. 4 is a view in side elevation, partly in section, of a modified form of the herein described mat forming apparatus.

Generally stated, the presently described mat forming method comprises entraining solid particles of varying sizes in an air stream and passing the air stream adjacent one surface of a foraminous member provided with openings of a particle-filtering size. A reduced air pressure is applied to the opposite surface of the foraminous mem-

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ber for filtering out the particles and fractionating them according to their respective sizes.

This builds up on the foraminous member a mat having relatively small particles concentrated in the region adjacent the foraminous member, and having also a relatively uniform density because of the tendency of the particles to follow the air stream and fill up the low spots on the mat. The mat then is shaved off to a predetermined depth, leaving on the foraminous member a residual mat having an increased content of the relatively small particles. The residual mat then may be separated from the foraminous member and hot pressed to form a consolidated product having a smooth face surface because of its predominant content of small particles.

If desired, the mat may be shaved off in stages, and the resulting mat fractions dispersed separately, and re-deposited on a supporting surface. This builds up a re-formed mat having a predominant amount of relatively fine particles adjacent one of its surfaces and a predominant amount of relatively coarse products adjacent the other of its surfaces. This mat then may be hot pressed into another consolidated product.

The apparatus employed in executing the above method, broadly considered, comprises means for entraining solid particles of varying sizes in an air stream, a foraminous member containing openings of particle-filtering size placed adjacent the air stream, and means for applying a reduced air pressure to the foraminous member for filtering out the particles and fractionating them according to their respective sizes, building up a mat thereon.

Means then are provided for shaving off the surface of the mat to a predetermined depth and for separating the residual mat from the foraminous member. Dispersing means may be present for dispersing the shaved fraction of the mat and the residual mat separately. A support member is positioned adjacent the dispersing means for receiving the dispersed particles, thereby building up another mat of substantially uniform density which may have a relatively high concentration of the smaller particles adjacent one of its surfaces. This mat then may be hot pressed to form a consolidated product of substantially uniform density having a smooth exterior surface.

Considering the foregoing in greater detail and with particular reference to the drawings:

Solid particles, particularly defiberized wood particles, are introduced in a substantially continuous flow into a chute or hopper 10, preferably by means of an oscillating spout or other device which distributes the fibers uniformly over a substantial area. A foraminous drum 12 mounted for rotation at the lower end of chute 10 is offset horizontally from the center line of the chute so that fibrous particles gravitating downwardly in the latter will impinge upon a segment only of the drum surface, for example, the right hand segment as viewed in Fig. 1.

The drum assembly includes a perforated cylinder 14 and end walls 15, 16. It is mounted rotatably through bearings 17, 18 on a stationary shaft 20. This shaft has an adjustment nut 21 on one of its ends and is clamped to the frame by means of clamps 22, 24.

Stationary sealing members or headers 26, 28 provided respectively with flanges 30, 32 overlie the end walls, the flanges being in sliding engagement therewith. These members are mounted on bearings 34, 36 through which shaft 20 extends and are secured to structural members of the frame.

A vacuum conduit 42 communicates with one of the sealing members, for example member 28 in Fig. 2. A gear 44 engaged by drive chain 46 is mounted on one of the end walls, for example, end wall 16. Accordingly there is provided a foraminous drum assembly which may be rotated by means of chain 46 while a

vacuum simultaneously may be applied to the interior of the drum through conduit 42.

The vacuum thus applied generates an air stream which passes downwardly through chute 10 with increasing intensity as it reaches the region of the drum. The air stream passes through the openings in foraminous cylinder 14, into the interior of the drum and out through conduit 42.

As the air stream traverses this path, it picks up and entrains the fibrous particles which are introduced into chute 10 and impinges them upon the outer surface of cylinder 14. Since the openings therethrough are of restricted size, the particles are filtered out of the air stream and deposited on the surface of the cylinder, where they build up into a mat the thickness of which increases as the cylinder continues to revolve within the chute.

As the cylinder revolves, a clean surface is introduced continuously into the chute. Since the openings on this surface are unclogged by deposited fibrous particles, the air stream passes through them easily and preferentially. On the other hand, the air stream passes with comparative difficulty through the areas of the cylinder which have been in the hopper for a greater period of time and over which a mat of substantial thickness has been deposited.

The result is to cause a deviation in the path of travel of the fibrous particles, since the particles follow the air stream and the air stream follows the course of least resistance. The amount of this deviation is dependent upon the size and density of the particles. Where the particles are all of wood and the density accordingly is substantially uniform, the effect of the deviation is to carry the particles of small size, i.e. the fines, preferentially toward the freshly exposed surface of the drum, as is indicated by the arrows in Fig. 1.

The larger particles, being less affected by the change in direction of the air stream, deviate less and hence are concentrated on the outer surface of the mat, i.e. that surface farthest removed from the drum. In this manner a fractionation of the particles is achieved and a mat is built up having the fines concentrated near one surface and the coarse particles near the other.

The tendency of the air stream to follow the path of least resistance has a further desirable effect. If, as is usually the case, valleys or depressed areas develop on the mat surface, less resistance will be offered to the passage of the air stream in these areas which accordingly will pass the stream with increased intensity. As a result, a greater density of particles will be deposited in the depressed areas until they are filled. As a consequence, the surface of the mat is maintained quite uniform and the finished mat has a substantially uniform density throughout.

To level the surface of the mat further, there is provided a shaving roll 50 journaled in bearings and driven at a suitable rate. This roll is spaced from the periphery of drum 12 a distance correlated with the rate of building up the mat thereon so that the surface of the mat may be shaved off continuously. The material removed by the roll is transferred to storage via conduit 56 or recycled to hopper 10. Roll 50 is kept clean by means of a cooperating picker roll 58 which engages the roll and rotates in the opposite direction.

The level mat present on drum 12 downstream from shaving roll 50 next is shaved off by roll 60, which preferably is a brushing roll. This roll is journaled in bearings 62, 64 and is spaced more closely to the periphery of drum 12 than is roll 50. Accordingly it shaves off a second portion of the mat, the material removed comprising largely the coarser particles.

Since wood fibers and related materials have a pronounced tendency to floc together and form clumps, means are associated with roll 50 for separating the individual fibers from each other. In the illustrated form,

such means comprise a plate 66 mounted on brackets 68. The plate is arcuate and substantially concentric with drum 12 and the surface of the mat built up thereon. It is provided with a thin, flexible extension 69 which almost contacts roll 60. Because of its flexibility, this extension is held pressed tightly against the surface of the mat by the force exerted by the vacuum present in the drum (Fig. 3).

As roll 60 rotates in the indicated direction, its bristles engage the fibers, which are restrained by the plate extension, tears them apart from each other, and disperses them in a fibrous stream which travels downwardly from the drum.

To compensate for wear, for varying fiber size, etc., the position of plate 66 relative to roll 60 may be varied both vertically and horizontally. This may be accomplished, for example, by providing adjustment bolts 70 working in slots 72 in brackets 68. Accordingly roll 60 not only removes a predetermined coarse fraction of the particles from the mat, but disperses the component particles of the fraction and drives them downwardly in the indicated direction.

Another roll 80, which preferably also is a brushing roll, is positioned downstream from roll 60. It is set to remove from the periphery of drum 12 substantially all of the particles remaining thereon. Since these are the particles which are closest to the drum surface, they comprise a large proportion of the particles of relatively small size. Roll 80 is mounted in bearings 82 and driven from a suitable source. It cooperates with a plate 84 supported on standards 85. Plate 84 is arcuate, concentric with both the drum and mat surface and provided with a thin, flexible extension plate extending in close proximity to roll 80. Also, it is provided with an adjustment bolt 86 working in two-way slot 87.

As roll 80 rotates in a clockwise direction as viewed in Fig. 1, it strips the relatively fine particles from the drum, combs them out against the edge of plate 84, disperses the individual fibers, and drives them downwardly along with the stream emanating from roll 60.

Substantially complete removal of the particles from the drum surface by the action of stripping roll 80 is made possible by releasing the vacuum in the region adjacent the roll. This may be accomplished by providing a drum segment to which vacuum is not applied, this being the left hand segment as viewed in the drawings.

To this end there is provided an arcuate sealing plate 88 which is in sealing relationship to the interior of the drum over a predetermined area. This plate is supported by arms 89 which are rigid to shaft 20. Accordingly its position may be shifted by releasing clamps 22, 24, and adjusting the angular position of the arms by applying a wrench to nut 21, after which clamps 22, 24 again may be tightened. The balance of the periphery of the drum is sealed off by means of an external sealing plate 90.

In this manner there is afforded a region, i.e. the 12 to 7 o'clock region as viewed in Fig. 1, wherein vacuum is applied to the drum periphery, and another region, i.e. the 7 to 12 o'clock region, which is adjustable in extent and to which vacuum is not applied. The latter region commences substantially at the location of shaving roll 80 which accordingly is enabled to remove the released particles cleanly from the drum surface.

Support means are provided for intercepting the flows of fine and coarse particles from rolls 60, 80 and for building them up into a mat. Where the continuous production of a fiberboard is contemplated, the support means may comprise a screen 92 which passes over a vacuum bed 94 having a flat, foraminous surface 96. The vacuum bed is exhausted by attachment to a source of vacuum through conduit 98.

As a consequence, there is built up on screen 92 a mat 100 having the fines on the lower surface and the coarse particles on the upper surface. It is to be observed that the same effects of preferential deposit of the fines adja-

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cent the foraminous surface, and preferential filling up of the valleys in the mat to produce a mat of uniform density, are obtained here as are obtained when the primary mat is formed on drum 12.

The drive for the various units of the apparatus is as follows. Drum 12 is driven by a motor 102 which drives chain 46 the drive including also an idler sprocket 104.

Shaving roll 50 is driven from a motor 106, a sprocket 108 on which engages chain 110. The latter chain in turn engages a sprocket on brush 50. It also engages a sprocket 112 on rotatably mounted shaft 114. A second sprocket 116 is keyed to this shaft and is engaged by a chain 118. The latter chain in turn engages a sprocket 120 on the shaft of picker roll 58.

Shaving roll 60 and stripping roll 80 are driven by motor 122 through an adjustable drive which includes belt 124 and pulley 126 on floating shaft 128. Shaft 128 is journaled between link members 130 which in turn are pivotally mounted on a shaft 132. Roll 60 is driven by means of belt 134 which engages a pulley (not shown) keyed to shaft 128. Roll 80 is driven by a belt 136 which engages a pulley (not shown), also keyed to shaft 128. To make possible adjustment of the tension on the belts of this assembly, motor 122 is mounted on supports 138 which slide on rods 140 and are adjustable by means of screw 142. In this manner there is provided a common adjustable drive for both rolls 60, 80.

When it is desired to provide a mat having a particularly high concentration of fines on one surface, the shaved mat formed on drum 12 may be transferred directly to supporting screen 92. Apparatus for achieving this result is illustrated in Fig. 4.

This apparatus is substantially identical with that illustrated in Figs. 1-3, with the exception that rolls 60, 80 and related mechanism have been eliminated. As a consequence, when the drum bearing the felt reaches the region to which vacuum is not applied, i.e. the 6 o'clock region in Fig. 4, it drops downwardly from the drum onto traveling screen 92.

Where this screen is traveling to the left, the fines will appear on the top surface of the mat after it has been transferred. However, if the direction of travel of the screen is reversed so that it travels to the right, then the surface of the mat including the coarser particles will be toward the top.

To facilitate such a direct transfer of the mat from drum 12 onto screen 92, means are provided for adjusting the vertical position of the entire drum assembly so that it may be lowered into close proximity to the screen where a direct transfer may be made without damaging the mat. Accordingly, the drum assembly is mounted on and supported by horizontal beams 150. These in turn are releasably connected to uprights 152 having a plurality of vertically spaced apart perforations 154. The horizontal beams then may be raised or lowered to the desired position and releasably secured to uprights 152 by means of bolts 156.

Operation

The operation of the herein described mat forming apparatus is as follows:

Solid particles, for example, wood fibers of varying size are introduced into chute 10 by means of an oscillating spout or other apparatus designed to distribute the fibers across the area of the chute. As the fibers gravitate downwardly, they approach a foraminous, rotatably mounted drum 12. The air is removed from the interior of the drum through conduit 42 so that an air stream is generated which draws air from the chute through the openings in the drum and out conduit 42.

Accordingly the particles are entrained in this air stream and drawn against the outer surface of the drum, where they are filtered out from the air stream because of the restricted size of the openings in the drum periphery. This causes a preferential deposit of the fine particles in

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the freshly exposed surface of the drum, and a preferential deposit of the thick particles on the surface of the drum which has been exposed to the air stream for a longer period of time. Also, it produces a preferential filling of any valleys which may be formed in the deposit on the drum because of the increased air flow through the same.

The primary mat deposited on the drum is shaved and leveled by means of roll 50. It is then further shaved by means of a second roll 60 which is set to shave off a layer of the mat of predetermined thickness. This layer includes predominantly particles of larger size. These particles are then separated from each other and dispersed by forcing them against the edge of adjustable plate 66.

The remainder of the particles on the drum are shaved off by a third roll 80. These particles comprise preponderantly the fine particles. They are separated from each other and dispersed by contact of the roll with the edge of a second plate 84.

In this manner there are formed two streams of dispersed fibers, one emanating from roll 60 and the other from roll 80. These streams are directed downwardly against a screen 92 traversing a foraminous plate 96 stationed over a vacuum bed 94, which may be evacuated by means of conduit 98.

The two streams thus build up a somewhat laminar mat on the screen, although a well defined boundary is not present between the laminae. Thus the fine particles from roll 80 are deposited first on the screen and then covered by the relatively coarse particles from roll 60. Here, as in the case of the foraminous drum 12, the effect is to deposit the fines first and preferentially on the surface of the foraminous member, thus achieving a fractionation of the feed. The mat then may be divided into sections by suitable means and pressed into a consolidated product which is of uniform density and which, because of the increased proportion of fines on its surface, will have a smooth surface.

In the alternative, where it is desired to transfer the mat on drum 12 directly to screen 92, rolls 60, 80 and associated equipment may be removed and the entire drum assembly lowered from the position of Fig. 1 to the position of Fig. 4. The mat then may be transferred directly from the drum to the screen without danger of its disintegration. In this case the fine particles appear predominantly on the surface of the mat.

In this manner there are provided method and apparatus for forming a mat of wood fibers and like solid particles which achieve a separation of the feed into fine and coarse particles and its deposit in a mat using what is in effect a single felting head, rather than the multiple felting heads which heretofore have been used in the art for this purpose. Also, the fibers are separated from each other and dispersed so that flocs are not present in the mat. This, together with the control afforded by the double mat formation, results in the production of a felt which is of uniform density and which may be pressed into a composite product of uniform thickness and density.

It is to be understood that the form of our invention herewith shown and described is to be taken as a preferred embodiment of the same and that various changes may be effectuated without departing from the spirit of our invention as defined by the appended claims.

Having thus described our invention, we claim:

1. A method of forming a mat which comprises entraining solid particles of varying size in a gaseous stream, passing the stream with the entrained particles adjacent one surface of a foraminous member containing openings smaller than the particles to be matted, applying a lower gaseous pressure to the opposite surface of the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having the smaller particles concentrated in the region adjacent the foraminous member, and

shaving off the surface of the mat to a predetermined depth, thereby leaving on the foraminous member a residual mat having an increased proportion of the smaller particles.

2. A method of forming a mat which comprises entraining solid particles of varying size in a gaseous stream, passing the stream with the entrained particles adjacent one surface of a foraminous member containing openings smaller than the particles to be matted, applying a lower gaseous pressure to the opposite surface of the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having the smaller particles concentrated in the region adjacent the foraminous member, shaving off the surface of the mat to a predetermined depth, thereby leaving on the foraminous member a residual mat having an increased proportion of the smaller particles, separating the residual mat from the foraminous member, and hot-pressing the same to form a consolidated product.

3. The method of claim 2 wherein the solid particles comprise particles of wood.

4. A method of forming a mat which comprises entraining solid particles of varying size in a gaseous stream, passing the stream with the entrained particles adjacent one surface of a foraminous member containing openings smaller than the particles to be matted, applying a lower gaseous pressure to the opposite surface of the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having the smaller particles concentrated in the region adjacent the foraminous member, shaving off the surface of the mat to a predetermined depth, thereby leaving on the foraminous member a residual mat having an increased content of the smaller particles, removing the residual mat from the foraminous member, dispersing the two particle fractions thus formed independently of each other, and depositing the dispersed fractions on a supporting surface in substantially superimposed relation to each other, thereby building up on the supporting surface a mat having an increased concentration of small particles on one of its surfaces and an increased concentration of the coarser particles on the other of its surfaces.

5. The method of claim 4 including the step of hot-pressing the final mat to a consolidated product.

6. The method of claim 4 wherein the solid particles comprise particles of wood.

7. A method of forming a mat which comprises entraining solid particles of varying size in a gaseous stream, passing the stream with the entrained particles adjacent one surface of a foraminous member containing openings smaller than the particles to be matted, applying a lower gaseous pressure to the opposite surface of the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having the smaller particles concentrated in the region adjacent the foraminous member, and shaving off the surface of the mat, the individual particles being separated from each other during the shaving operation, and reforming the separated particles into a second mat.

8. A method of forming a mat which comprises entraining solid particles of varying size in a gaseous stream, passing the stream with the entrained particles adjacent one surface of a foraminous member containing openings smaller than the particles to be matted applying a lower gaseous pressure to the opposite surface of the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having the smaller

particles concentrated in the region adjacent the foraminous member, shaving off the surface of the mat to a predetermined depth, the individual particles being separated from each other during the shaving operation, thereby leaving on the foraminous member a residual mat having an increased content of the smaller particles, separating the residual mat from the foraminous member, the component particles of the residual mat being substantially separated from each other during the removal operation, and separately depositing the two particle fractions thus produced on a supporting surface, one upon the other, to form a mat having an increased concentration of the smaller particles on one of its surfaces and an increased proportion of the larger particles on the other of its surfaces.

9. Mat forming apparatus comprising means for entraining solid particles of varying size in an air stream, a foraminous member positioned in the path of the air stream, means for applying reduced air pressure to one side of the foraminous member, the direction of application of the reduced air pressure being at an angle to the air stream, thereby causing deviation of the particles from their air stream path to an extent determined by their respective sizes, and their separation from the air stream on the surface of the foraminous member to build up a mat having the smaller particles concentrated in the region adjacent the foraminous member, and shaving means adjacent the foraminous member for shaving off the mat surface to a predetermined depth while the mat is held on the foraminous member by said reduced pressure, thereby leaving on the foraminous member a residual mat having an increased proportion of the smaller particles.

10. Mat forming apparatus comprising means for entraining solid particles of varying size in an air stream, a foraminous member positioned in the path of the air stream, means for applying reduced air pressure to one side of the foraminous member, the direction of application of the reduced air pressure being at an angle to the air stream, thereby causing deviation of the particles from their air stream paths to an extent determined by their respective sizes, and their separation from the air stream on the surface of the foraminous member to build up a mat having the smaller particles concentrated in the region adjacent the foraminous member, shaving means adjacent the foraminous member for shaving off the mat surface to a predetermined depth while the mat is held on the foraminous member by said reduced pressure, thereby leaving on the foraminous member a residual mat having an increased proportion of the smaller particles, and stripping means adjacent the foraminous member for shaving off the residual mat from the surface of the foraminous member.

11. Mat forming apparatus comprising means for entraining solid particles of varying size in an air stream, a foraminous member positioned in the path of the air stream, means for applying reduced air pressure to one side of the foraminous member, the direction of application of the reduced air pressure being at an angle to the air stream, thereby causing deviation of the particles from their air stream paths to an extent determined by their respective sizes, and their separation from the air stream on the surface of the foraminous member to build up a mat having the smaller particles concentrated in the region adjacent the foraminous member, shaving means adjacent the foraminous member for shaving off the mat surface to a predetermined depth while the mat is held on the foraminous member by said reduced pressure, thereby leaving on the foraminous member a residual mat having an increased proportion of the smaller particles, and a support member positioned for receiving the particles as they are removed from the foraminous member for building up a laminar mat thereon.

12. The apparatus of claim 11 wherein the support member comprises a horizontal perforated member and

means for applying vacuum to the side thereof opposite the mat.

13. Mat forming apparatus comprising a foraminous drum, means for applying vacuum to the interior of the drum, means for directing a flow of solid particles of varying sizes against the exterior surface of the drum, the direction of flow being at an angle to the direction of the applied vacuum thereby directing the flow of the light particles preferentially toward a selected area of the drum, and shaving means adjacent the drum positioned for removing the surface of the mat on the drum to a predetermined depth while the mat is held on the drum by said vacuum, thereby leaving on the drum a residual mat having an increased content of the smaller particles.

14. Mat forming apparatus comprising a foraminous drum, means for applying vacuum to the interior of the drum, means for directing a flow of solid particles of varying sizes against the exterior surface of the drum, the direction of flow being at an angle to the direction of the applied vacuum thereby directing the flow of the light particles preferentially toward a selected area of the drum, shaving means adjacent the drum positioned for removing the surface of the mat on the drum to a predetermined depth while the mat is held on the drum by said vacuum, thereby leaving on the drum a residual mat having an increased content of the smaller particles, and particle dispersing means associated with the shaving means for dispersing the particles shaved from the mat.

15. The apparatus of claim 14 wherein the shaving means comprises a shaving roll and the particle dispersing means comprises a plate placed adjacent the roll for contact therewith, thereby drawing the particles between the roll and the plate and separating them from each other.

16. The apparatus of claim 14 wherein the shaving means comprises a shaving roll and the particle dispersing means comprises a plate placed adjacent the roll for contact therewith, thereby drawing the particles between the roll and the plate and separating them from each other, and stripping means for removing the residual mat from the surface of the drum.

17. The apparatus of claim 16 including a dispersing means for dispersing the particles removed by the stripping means.

18. The apparatus of claim 16 wherein the stripping means comprises a stripping roll and the dispersing means comprises a plate positioned for contact by the roll, the particles being drawn between the roll and the plate for separating them from each other.

19. Mat forming apparatus comprising a foraminous drum, means for applying vacuum to the interior of the drum, means for directing a flow of solid particles of varying sizes against the exterior surface of the drum, the direction of flow being at an angle to the direction of the applied vacuum thereby directing the flow of the light particles preferentially toward a selected area of the drum, shaving means positioned for removing the surface of the mat on the drum to a predetermined depth, thereby leaving on the drum a residual mat having an increased content of the smaller particles, particle dispersing means associated with the shaving means for dispersing the particles shaved from the mat, and an endless conveyor positioned beneath the drum, the shaving means and the dispersing means for building thereupon a mat of particles having the smaller particles concentrated in one portion and the coarser particles concentrated in another portion.

20. The apparatus of claim 19 wherein the endless conveyor is foraminous and placed over a vacuum chamber for assisting in building up a mat on the conveyor.

21. A method of forming a mat which comprises entraining solid particles of varying size in a gaseous stream, passing the stream with the entrained particles adjacent one surface of a foraminous member containing openings,

smaller than the particles to be matted, applying a lower gaseous pressure to the opposite surface of the foraminous member for filtering out the particles from the gaseous stream, thereby building up a mat on the foraminous member, shaving off the surface of the mat to a predetermined depth, thereby leaving a residual mat on the foraminous member, removing the residual mat from the foraminous member, dispersing the two particle fractions thus formed independently of each other, and depositing the dispersed fractions on a supporting surface in substantially superimposed relation to each other, thereby building up a reformed mat on the supporting surface.

22. Mat forming apparatus comprising a foraminous drum, means for applying vacuum to the interior of the drum, means for directing a flow of solid particles of varying sizes against the exterior surface of the drum thereby building up a mat thereon, shaving means positioned for removing the surface of the mat on the drum to a predetermined depth thereby leaving a residual mat on the drum, stripping means positioned for removing the residual mat from the drum, particle dispersing means associated with the shaving means and stripping means for dispersing the particles removed from the drum, and support means placed adjacent the dispersing means for receiving the dispersed particles and building them up into a mat.

23. A method of forming a mat of solid particles of varying sizes, which comprises depositing said particles on a supporting surface selectively according to their respective sizes, thereby building up a mat having particles which increase in size progressively outward from said supporting surface, shaving off predetermined thicknesses of the mat to form separate fractions of particles of varying sizes, and redepositing said separate fractions on a supporting surface in substantially superimposed relation to each other with the smaller particles being redeposited first.

24. A method of forming a mat of solid particles of varying sizes, which comprises depositing said particles on a supporting surface selectively according to their respective sizes, thereby building up a mat having particles which increase in size progressively outward from said supporting surface, shaving off the surface of the mat to leave on the supporting surface a residual mat of predetermined thickness, and removing the residual mat from said supporting surface.

25. A method of forming a mat of solid particles of varying sizes, which comprises depositing said particles on a supporting surface selectively according to their respective sizes, thereby building up a mat having particles which increase in size progressively outward from said supporting surface, shaving off the surface of the mat to leave on the supporting surface a residual mat of predetermined thickness, shaving off predetermined thicknesses of the residual mat to form separate fractions of particles of varying sizes, and redepositing said separate fractions on a supporting surface in substantially superimposed relation to each other with the smaller particles being redeposited first.

26. A method of forming a mat which comprises entraining solid particles of varying sizes in a gaseous stream, applying a lower gaseous pressure to one surface of a foraminous member containing openings smaller than the particles to be matted, passing the stream with the entrained particles adjacent the opposite surface of the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having particles which increase in size progressively outward from the supporting surface of said foraminous member, shaving off predetermined thicknesses of the mat to form separate fractions of particles of varying sizes, and redepositing said separate fractions on a supporting surface in substantially superimposed relation to each other.

27. A method of forming a mat which comprises entraining solid particles of varying sizes in a gaseous stream, applying a lower gaseous pressure to one surface of a foraminous member containing openings smaller than the particles to be matted, passing the stream with the entrained particles adjacent the opposite surface of the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having particles which increase in size progressively outward from the supporting surface of said foraminous member, shaving off the surface of the mat to leave on the foraminous member a residual mat of predetermined thickness, shaving off predetermined thicknesses of the residual mat to form separate fractions of particles of varying sizes, and redepositing said separate fractions on a supporting surface in substantially superimposed relation to each other with the smaller particles being redepositing first.

28. A method of forming a mat which comprises entraining solid particles in a gaseous stream, applying a lower gaseous pressure to a longitudinal segment only of one surface of a foraminous rotary member containing openings smaller than the particles to be matted, said segment being defined by trailing and leading ends, passing the stream with the entrained particles adjacent the opposite surface of said segment of the foraminous member for filtering out the particles from the gaseous stream, thereby building up a mat on the foraminous member, and shaving off the surface of the mat within said segment to leave on the foraminous member a residual mat of predetermined thickness.

29. A method of forming a mat which comprises entraining solid particles of varying sizes in a gaseous stream, applying a lower gaseous pressure to a longitudinal segment only of one surface of a foraminous rotary member containing openings smaller than the particles to be matted, said segment being defined by trailing and leading ends, passing the stream with the entrained particles adjacent the opposite surface of said segment of the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having particles which increase in size progressively outward from the supporting surface of said foraminous member, shaving off the surface of the mat within said segment to leave on the foraminous member a residual mat of predetermined thickness and removing the residual mat in a continuous strip from said foraminous member adjacent the leading end.

30. A method of forming a mat which comprises entraining solid particles of varying sizes in a gaseous stream, applying a lower gaseous pressure to one surface of a foraminous rotary member containing openings smaller than the particles to be matted, passing the stream with the entrained particles adjacent the opposite surface of the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having particles which increase in size progressively outward from the supporting surface of said foraminous member, shaving off predetermined thicknesses of the mat to form separate fractions of particles of varying sizes, and redepositing said separate fractions on a supporting surface in substantially superimposed relation to each other.

31. A method of forming a mat which comprises entraining solid particles of varying sizes in a gaseous stream, applying a lower gaseous pressure to a longitudinal segment only of one surface of a foraminous rotary member containing openings smaller than the particles to be matted, said segment being defined by trailing and leading ends, passing the stream with the entrained particles adjacent the opposite surface of said segment of

the foraminous member for filtering out the particles from the gaseous stream and fractionating them substantially according to their respective sizes, thereby building up on the foraminous member a mat having particles which increase in size progressively outward from the supporting surface of said foraminous member, shaving off the surface of the mat within said segment to leave on the foraminous member a residual mat of predetermined thickness, shaving off predetermined thicknesses of the residual mat within said segment to form separate fractions of particles of varying sizes, and redepositing said separate fractions on a supporting surface in substantially superimposed relation to each other.

32. Mat forming apparatus comprising means for entraining solid particles in an air stream, a foraminous rotary member, means for applying reduced air pressure to a longitudinal segment only of one side of the foraminous member, said segment being defined by trailing and leading ends, means positioning at least a portion of the segment of the foraminous member in the path of the air stream, whereby to build up a mat on the surface of the foraminous member, shaving means positioned adjacent the said segment of a foraminous member for shaving off the surface of the mat, thereby leaving on the foraminous member a residual mat of predetermined thickness, and movable support means beneath the leading end of the segment of the foraminous member and arranged to receive the residual mat as the latter is removed in a continuous strip from said leading end.

33. Mat forming apparatus comprising means for entraining solid particles of varying sizes in an air stream, a foraminous rotary member, means for applying reduced air pressure to a longitudinal segment only of one side of the foraminous member, said segment being defined by trailing and leading ends, means positioning at least a portion of the segment of the foraminous member in the path of the air stream, the direction of application of the reduced air pressure being at an angle to the air stream, thereby causing deviation of the particles from their air stream path to an extent determined by their respective sizes and their separation from the air stream on the surface of the foraminous member to build up a mat thereon having particles which increase in size progressively outward from said surface, shaving means positioned adjacent the said segment of the foraminous member for shaving off the surface of the mat, thereby leaving on the foraminous member a residual mat of predetermined thickness, and movable support means beneath the leading end of the segment of the foraminous member and arranged to receive the residual mat as the latter is removed in a continuous strip from the leading end.

34. Mat forming apparatus comprising means for entraining solid particles of varying sizes in an air stream, a foraminous rotary member, means for applying reduced air pressure to one side of the foraminous member, means positioning at least a portion of the foraminous member in the path of the air stream, the direction of application of the reduced air pressure being at an angle to the air stream, thereby causing deviation of the particles from their air stream path to an extent determined by their respective sizes and their separation from the air stream on the surface of the foraminous member to build up a mat thereon having particles which increase in size progressively outward from said surface, a plurality of shaving means positioned adjacent the foraminous member at spaced intervals for shaving off successive predetermined thicknesses of the mat whereby to form separate fractions of particles of varying sizes, and movable support means beneath said shaving means and arranged to receive thereon said separate fractions in substantially superimposed relation to each other.

35. The apparatus of claim 34 wherein the movable support means and said shaving means are arranged to receive thereon said separate fractions in substantially

superimposed relation to each other with the smaller particles being deposited on the support means first.

36. Mat forming apparatus comprising means for entraining solid particles of varying sizes in an air stream, a foraminous rotary member, means for applying reduced air pressure to a longitudinal segment only of one side of the foraminous member, said segment being defined by trailing and leading ends, means poistioning at least a portion of the segment of the foraminous member in the path of the air stream, the direction of the application of the reduced air pressure being at an angle to the air stream, thereby causing deviation of the particles from their air stream path to an extent determined by their respective sizes and their separation from the air stream on the surface of the foraminous member to build up a mat thereon having particles which increase in size progressively outward from said surface, a plurality of shaving means positioned adjacent the said segment of the foraminous member at spaced intervals toward said leading end for shaving off successive predetermined thicknesses of the mat whereby to form separate fractions of particles of varying sizes, and movable support means beneath said shaving means and arranged to re-

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ceive thereon said separate fractions in substantially superimposed relation to each other with the smaller particles being deposited on the support means first.

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