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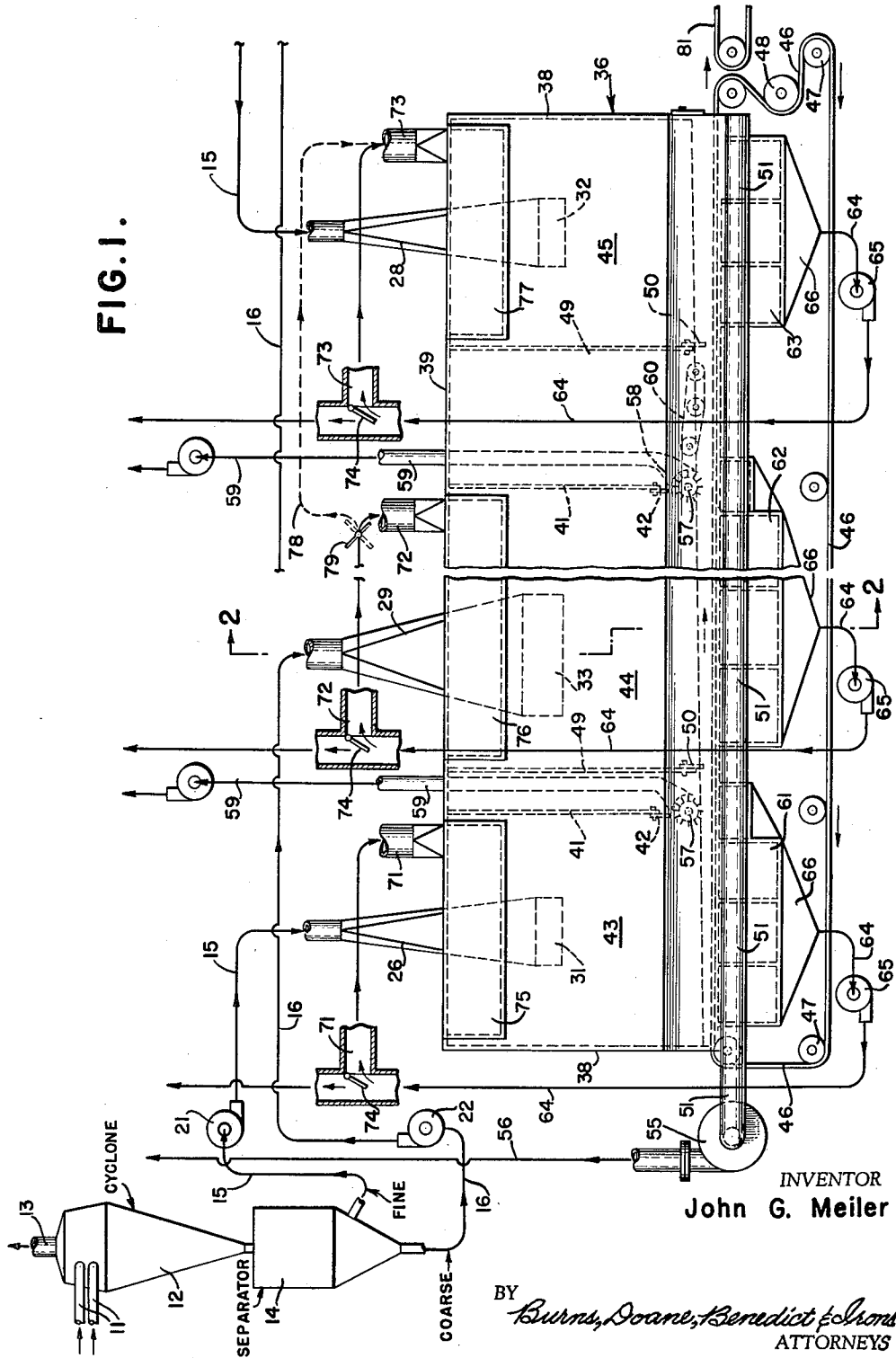
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METHOD AND APPARATUS FOR FORMING A MAT

Filed March 3, 1959

3 Sheets-Sheet 1



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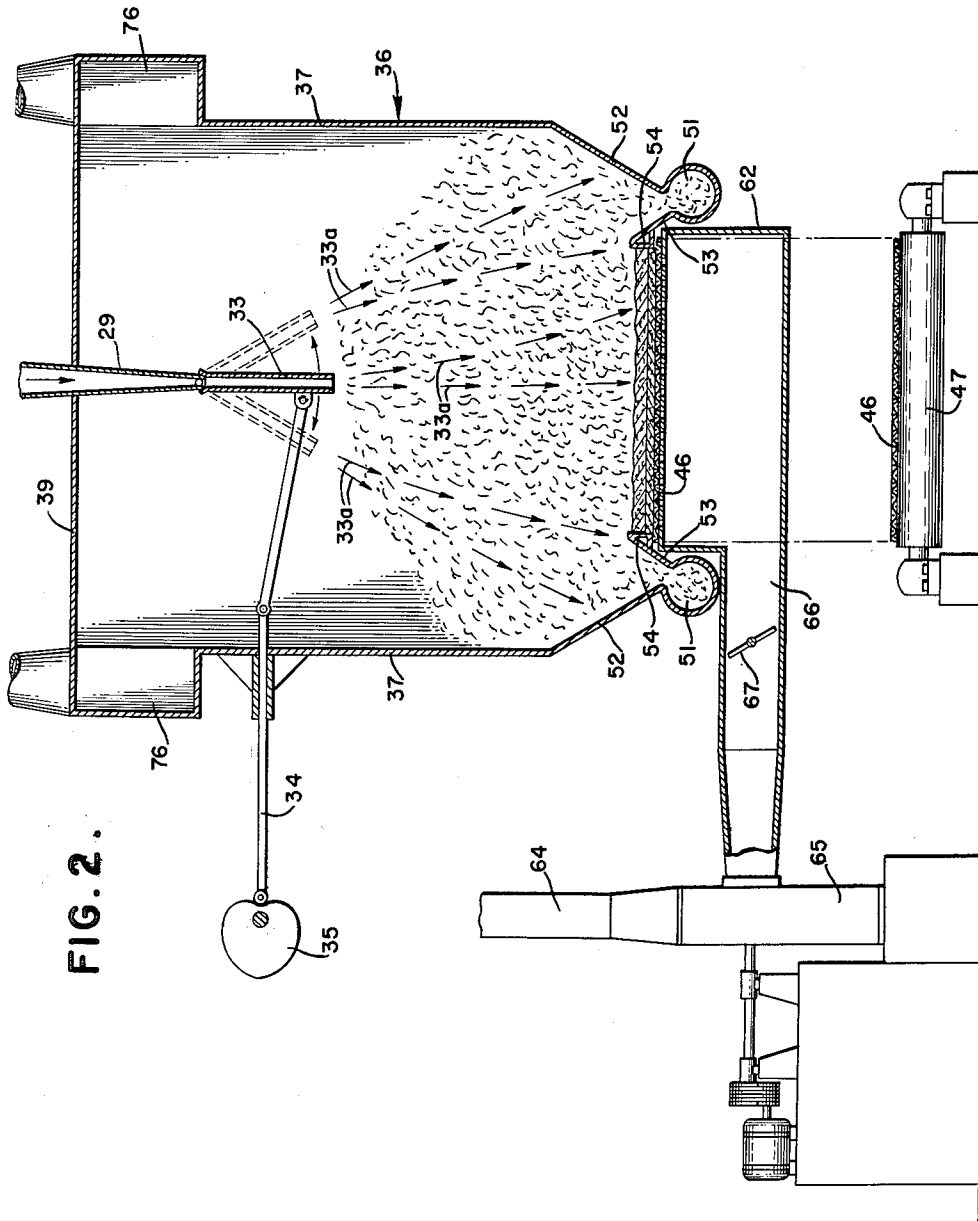
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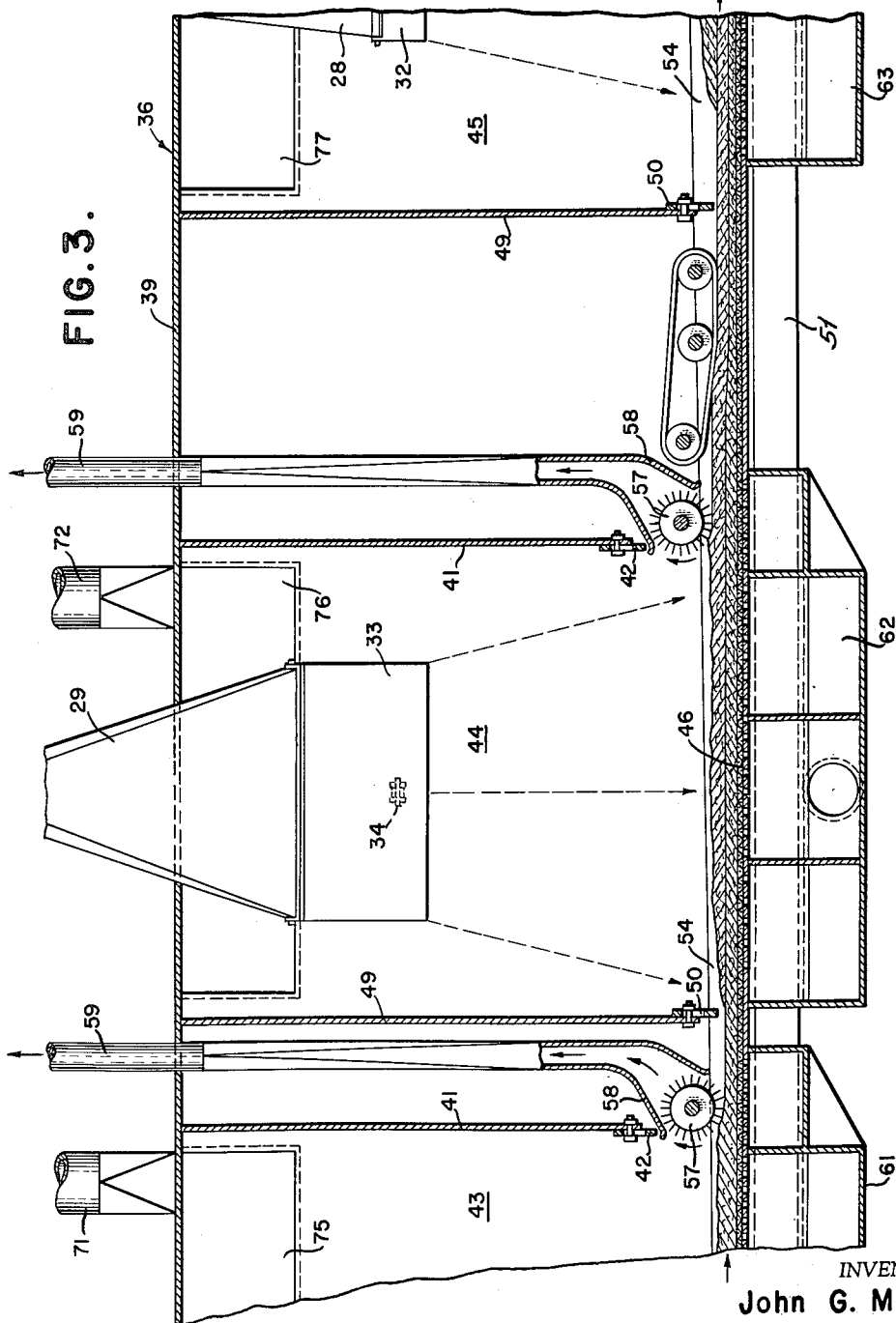
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3 Sheets-Sheet 3



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3,071,822
**METHOD AND APPARATUS FOR
FORMING A MAT**

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This invention relates to the formation of particles into mats and, more particularly, into air-laid mats for consolidation into unitary sheets.

In the dry process for making hardboard, wood chips are steamed and softened in a cooker to permit reduction of the chips to fibers in a refiner. The fibers are then then conveyed in a gaseous stream to a felter and formed into a mat which is consolidated by heat and pressure into the finished board.

The term "dry process" indicates that the fibers are conveyed to and deposited as a mat in the felter by a gaseous rather than a liquid vehicle. The fibers are not completely dry in the sense of containing no moisture. Indeed, in various prior art dry processes, the fiber moisture content has varied from 5% or below to above 100% based on the dry weight of the fiber.

In one conventional type of mat-forming apparatus, the fibers are continuously deposited out of an air stream onto a moving foraminous belt to form the mat. Among the desired characteristics of such apparatus are economical high capacity operation which (1) is sufficiently flexible to form mats of various thicknesses with single or strongly interlocked plural layers with coarse fibers in the inner layers and fine fibers in one or both outer layers; (2) achieves random orientation and thus tenacious felting of the fibers; (3) stratifies but does not separate the fibers according to size within individual layers; and (4) forms the mat so that material quantities of the surface fines will not be removed by operations subsequent to felting.

One primary disadvantage of certain prior art felters of the moving foraminous belt type has been their inability to maintain uniform distribution of fibers throughout each layer of the mat and still embrace all of the desirable characteristics specified above. A number of factors contribute to such lack of uniformity. The fibers, while being conveyed to the felter, tend to agglomerate in the air stream to form clots which are deposited on the mat. Clots, which descend to the mat, are also formed by collection of the fibers on the walls of the felter housing in positions where they drop on the mat, impingement of the fibers against each other or against surfaces in their path, and static electricity. Moreover, it is difficult to distribute the fibers uniformly across the surface of the foraminous belt without excessively concentrating them in certain areas, particularly along the confined edges of the mat. Further, even if uniform initial deposition is achieved, the air which projects additional fibers onto the mat at high velocity tends to disturb the previously laid fibers by (1) direct impingement on the mat surface, (2) billowing and forming eddy currents in the vicinity of the mat, and (3) creating pressures which result in cross currents adjacent the mat.

To overcome the disadvantages of the prior art, a primary object of the invention is to provide an improved high capacity method and apparatus for producing an air-laid mat containing one or more layers of randomly oriented particles uniformly distributed in a plurality of strata within each layer.

Another object of the invention is to provide an improved method and apparatus for forming particles into an air-laid felt wherein the deposition of clotted particles onto the mat is minimized.

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An additional object of the invention is to provide a method and apparatus for conveying a relatively high velocity stream of gas containing a high concentration of particles and depositing such particles uniformly across a mat at a velocity sufficiently low to minimize disturbance of previously deposited particles.

A further object of this invention is to provide an improved method and apparatus for forming a stratified mat on a moving foraminous member without irregular distribution or excessive concentration of particles at the edges of the mat.

A still further object of the invention is to provide an improved apparatus for air conveying and uniformly distributing particles across a mat characterized by an open flow path for the particles with a minimum of surfaces against which the particles impinge.

Yet another object of the invention is to provide a felter for air-laying a fiber mat including an improved combination of elements withdrawing the conveying air from the deposition area.

The invention is especially useful in and is described primarily in respect to the production of hardboard to form a mat of wood particles in the form of ultimate fibers and opened-up aggregates of ultimate fibers, i.e., loosened but still adhering collections of ultimate fibers. Many different kinds of wood, both coniferous species such as fir, cedar, hemlock and Douglas fir, and deciduous species such as hickory, oak, beech, birch and maple, may be used. It will be understood, however, that the invention is also useful in the production of paper and in the formation of mats from particles of many materials other than wood.

Broadly, the invention presented herein includes an improved method of forming a mat from particles which comprises conveying a stream of gas containing a high concentration of said particles at a velocity sufficiently high to distribute said particles throughout the stream without material agglomeration of said particles, discharging said stream into the air to progressively expand and reduce the velocity of said stream, and collecting said particles out of said stream on a foraminous member disposed transversely to the direction of discharge of said stream when the impact velocity of said stream in the direction of discharge remains substantial but not greater than 2500 f.p.m. to prevent material disturbance of particles previously collected on said foraminous member.

The invention further embraces an improved apparatus for forming a mat from particles which, in combination, comprises a housing, a foraminous particle-receiving member positioned in said housing with the edges of said member spaced from the adjacent walls of said housing, means spaced from said member to project toward said member a stream of gas and particles to be deposited on and laterally outside of both edges of said member, means to withdraw gas from the area within the edges of said member by suction applied through said member, and means to withdraw particles and gas which descend into the areas laterally outside of said member by suction applied laterally outside of said member.

The invention having been generally described, a preferred specific embodiment for the accomplishment of the stated objects and others will now be set forth in detail with reference to the accompanying drawings in which:

FIGURE 1 constitutes a schematic diagram depicting the felter components and the flow paths of the air and fiber streams to and from the felter;

FIGURE 2 is a vertical sectional view taken along the lines 2—2 of FIGURE 1 showing the interior of the felter; and

FIGURE 3 is a fragmentary vertical sectional view taken longitudinally through the felter housing.

With reference to FIGURE 1, a stream of heated air

or other gas containing a high concentration of wood fibers which have been formed from wood chips by any suitable cooking and refining operation is conveyed in conduits 11 and dried by the heated gas to a predetermined moisture content. The air-fiber stream is admitted into cyclone 12, where much of the air is removed from the stream and additional drying is effected. The moisture content of the fiber, as it emerges from the cyclone 12 and throughout the felting operation, is preferably about 8 to 12% by weight of dry fiber. The air which is separated in the cyclone is discharged through conduit 13. The remaining air and fibers are passed into a centrifugal separator 14, where the fibers are separated into fine and coarse components, which are discharged from the separator into conduits 15 and 16, respectively, for conveyance to the felter.

Various additives are mixed with the fibers at some point or points in the system prior to the felting operation. A resin binder is normally mixed with the fibers to a ratio of from about 0.5 to about 10% based on the dry weight of the fiber. If uniform resin content throughout the mat is desired, the resin may be added prior to classification of the fibers as, for example, during the refining operation. If it is desired, however, that the fine fibers, which ultimately will constitute the outer layer or layers of the mat, receive a different and usually higher percentage of resin than the coarse fibers, which will constitute the inner layers of the mat, the resin may be added subsequent to classification. In the latter event, the fine and coarse components of fiber may be discharged from the separator into separate resin blenders, not shown, where the desired percentages of resin binder are mixed with the fibers. If desired, different types of resin may be mixed with the fibers in each blender to impart any desired characteristics to the separate layers.

If, in the case where resin is added after drying and classification, additional water is added with the resin to the fibers, it may be desirable to subject the fibers to an additional drying operation, as in drying cyclones, to reduce the moisture content to the desired level.

Further, a water repellent, such as wax, may be added to the fibers either in the cooker prior to refining or in the blenders, if such are used. Normally from about 0.5 to about 4% of such water repellent based on the dry weight of the fibers is employed.

The air and fiber streams containing additives in desired proportions are propelled through the conduits 15 and 16 at a controlled velocity by fans 21 and 22, respectively. The amount of air which is introduced into the streams at the fans is controlled to produce a predetermined air-to-fiber ratio in each stream. Such control of the air-to-fiber ratio and the velocity of the air-fiber streams, which are emitted from the fans and conveyed to the felter, is particularly important for several reasons. For maximum felting capacity, the air-to-fiber ratio in the conduits leading to the felter should be as small as possible and the conveying velocity should be relatively high. If for any given velocity, however, the air-to-fiber ratio is too low, the fiber tends to agglomerate to form clots which, if deposited on the mat, destroy the uniformity of fiber deposition. Thus, the most effective velocity and air-to-fiber ratio in the conduits immediately before entry into the felter are those which permit maximum capacity operation consistent with the prevention of material amounts of fiber agglomeration. Specifically, it has been found that velocities of 4000-8000 f.p.m. and ratios of air-to-fiber of from about 18 to about 47 cu. ft. per lb. in the conduits 15 and 16 between the fans 21 and 22 and the felter heads 26 and 29 provide an adequate supply of fibers and effectively prevent material fiber agglomeration. A preferred velocity range is from 4000-6000 f.p.m. Preferably, the air-to-fiber ratio for the fine fibers should be slightly higher than for the coarse fibers. Preferred specific quantities of air and fiber which are conveyed at the stated velocities

are (1) from 2500-4500 c.f.m. and preferably 3000 c.f.m. of air to 8667 lbs. per hour for coarse fibers and (2) from 757-1480 c.f.m. and preferably 900 c.f.m. of air to 1900 lbs. per hour for fine fibers.

The fine fibers are conveyed to felter head 26 and the coarse fibers are conveyed to felter head 29. A second coarse fiber felter head identical to the head 29, but for the sake of simplicity omitted from the drawings, is provided at a position slightly downstream from the head 29 but in the same compartment therewith. At a further downstream position is a second fine fiber felting head 28. A separate system, including conduits, cyclones, separators, and, if desired, blenders, which may be identical to those feeding fibers to the felter heads 26 and 29, is provided to feed air-fiber streams to the second fine and coarse fiber felter heads. It will be apparent that any desired arrangement of fine and coarse fiber felter heads may be used. For example, the head 26 may be omitted and a fine fiber felting head provided on the downstream end of the felter only. Thus, the mat and resulting board will have a layer of fine fibers on one face only. The other layers of the mat, including the opposite face, will be comprised of coarse fibers. In many respects, a board with fine fibers on one face only is highly desirable. Moreover, as many coarse fiber felter heads as desired may be used, depending upon the number of layers of coarse fibers which are to be deposited. Further, if desired, only one felter head may be used to deposit a single layer of any desired size fibers such as a mixture of fine and coarse fibers.

The end portion of each of the felter heads becomes progressively flattened in one direction and divergent in a direction normal thereto and terminates in a flat nozzle which is elongated longitudinally of the housing. Each of the nozzles 31, 32 and 33 of the heads 26, 28 and 29, respectively, is pivotally mounted and may be laterally oscillated by a connecting rod 34 (FIGURE 2) which in turn is reciprocated by a cam 35 operated by any suitable motor. Alternatively, any appropriate means for oscillating the nozzles may be provided.

Moreover, the cross sectional area of each felter head at the outlet of the nozzle is approximately equal to the cross sectional area of the conveying conduit ahead of the felter. Thus, the velocity of the air-fiber stream is substantially unchanged by passage through the head. It is especially desirable that no decrease in velocity of the stream occur in the nozzle. It sometimes may be desirable to permit the velocity to increase in the nozzle such as by progressively decreasing the area of the nozzle from the inlet to the outlet end thereof. The only moving part in the head is the nozzle itself and no other surface interrupts the open flow path through the head. It is desirable to minimize the generation of static electricity which tends to cause clotting of the fibers.

The nozzles extend downwardly into an elongated housing 36 having side walls 37 (FIGURE 2), end walls 38, and a top wall 39. The nozzles are mounted for oscillation laterally across the housing. The housing 36 is divided into a first end felting compartment 43 containing the fine fiber nozzle 31, a middle felting compartment 44 containing the two coarse fiber nozzles 33, and a second end felting compartment 45 containing the second fine fiber nozzle 32. Transverse partitions 41, each of which includes a vertically adjustable sole plate 42, are situated at the rear of felting compartments 43 and 44. The front walls of felting compartments 44 and 45 comprise transverse partitions 49 having adjustable sole plates 50. If desired, any suitable means may be provided to vibrate the partitions 41 and 49 and the end walls 38 of the felter housing to prevent the collection of fibers on such partitions and walls.

Extending longitudinally through the lower portion of the housing is the horizontal upper run of an endless foraminous belt 46 which is driven by any suitable means, not shown, longitudinally through the housing about pul-

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leys 47 and a tensioning roller 48. As more fully described hereinafter, a stream of air and fibers is projected downwardly from each of the nozzles onto the moving belt which receives a layer of fine fibers from the head 26, two layers of coarse fibers from the two heads 29, and a second layer of fine fibers from the head 28. Each such layer is composed of a plurality of strata as described in detail hereinafter. Thus, the mat becomes progressively thicker as the belt moves through the housing and emerges with coarse middle layers and fine face layers.

Situated immediately below each of the transverse partitions 41 end extending laterally across the entire surface of the belt 46 is a shave-off rotor 57 which comprises a cylinder having a plurality of radially projecting pins on the peripheral surface thereof. The shave-off rotors 57 are rotated in a clock-wise direction by any suitable means, not shown. Thus, the lower portions of the rotors move in a direction opposite to the movement of the belt to remove excess fibers and level the mat. Such rotors are preferably mounted for vertical adjustment to permit reduction of the mat to any desired thickness. A vacuum hood 58 is mounted closely surrounding the upper and rear portions of each of the shave-off rotors 57 and sufficient suction is applied to the vacuum hoods through conduits 59 to withdraw the shaved-off fibers. The shave-off devices are situated below the partitions 41 so that any fibers which collect on the partitions and fall in clumps will be drawn into the vacuum hoods 58 instead of falling onto the mat. As shown in FIGURE 1, the fibers withdrawn through the hoods 58 are conveyed back to an appropriate element of the system ahead of the felt for recovery.

A plurality of multiple-celled suction chambers 61, 62 and 63 are positioned immediately below the upper run of the belt 46 opposite the felting compartments 43, 44 and 45, respectively, to withdraw air through the mat and to retain the deposited fibers on the belt. Further, the suction chambers 61 and 62 have cells positioned below the shave-off rotors 57 to retain the mat against the belt while it is being leveled. Each of the suction chambers is provided with a manifold 66 shown schematically in FIGURE 1 in communication with each of its cells and with a conduit 64 through which suction is applied by a fan 65. The flow through the manifold 66 is controlled by a damper 67. Alternatively or in addition, separate means such as dampers or restricted openings may be provided in the outlets of each of the cells in each of the suction boxes to permit separate control of the amount of suction in each cell. In addition, suitable baffles may be mounted in the suction chambers. The construction of the suction boxes should be such as to promote uniform air flow through the different parts of the mat surface. Such uniform air flow is highly desirable.

The air and fines which pass through the belt into the suction chambers may be returned through the conduits 64 to an appropriate point or points in the system ahead of the felt for recovery. Alternatively, all or any portion of such air and fines may be re-introduced into the upper portion of the same felting compartment from which they were withdrawn through conduits 71, 72 and 73 and manifolds 75, 76 and 77 which are in fluid communication with the felting compartments 43, 44 and 45, respectively. The percentage of air and fines which is thus returned to the housing may be controlled by adjustment of the dampers 74. As a further alternative, all or any portion of the air and fines which are withdrawn through the belt from the coarse felting compartment 44 may be re-introduced into the fine felting compartment 45 through the conduit 78, shown as a dotted line in FIGURE 1, and manifold 77. The amount of air and fines which are passed into the conduit 78 from the conduit 72 may be controlled by adjustment of damper 79. It will be understood that various other arrangements may be employed whereby fines which pass through the belt in

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any compartment may be re-introduced into any other compartment.

The air and fibers are projected downwardly from each of the nozzles in a progressively expanding stream. The form of each stream is illustrated by the arrows 33a in FIGURE 2. It can be seen that the stream lags behind the moving nozzle. FIGURE 2 also shows the composite pattern of airborne fibers in the felting compartment resulting from a full cycle of nozzle oscillation. It will be understood that the pattern is composite and not an instantaneous picture at any one position of the nozzle. For example, when the nozzle is at the extreme end of a stroke, the airborne fiber pattern will be much heavier on that side of the compartment than on the other.

The flat oscillating nozzles distribute the fibers back and forth across the moving belt. The frequency of nozzle oscillation relative to the speed of the belt is controlled so that the stratum of fibers deposited by each oscillation, i.e., each pass of the nozzle across the belt, overlaps the stratum deposited by the next preceding oscillation in the opposite direction. The degree of stratification may be controlled by varying the frequency of nozzle oscillation relative to the speed of the belt. Desirably, a maximum number of strata is formed in the layer deposited by each nozzle. Preferably, the nozzles are oscillated at about sixty strokes or more per minute depending upon the speed of the belt. The rate of oscillation of the nozzles could be increased as the belt speed is increased.

The streams leaving the nozzles have approximately the same velocity and cross sectional area as the streams being conveyed in the conduits 15 and 16 to the nozzles. Although the conveying velocity of 4000-8000 f.p.m. is satisfactory in the conduits 15 and 16 leading to the nozzles, the maximum velocity of the air-fiber stream immediately above the mat surface which will not disturb the mat surface is about 2500 f.p.m. Preferably, the impinging velocity of the stream at the mat surface should not be above about 2000 f.p.m. Accordingly, the oscillating nozzles are spaced sufficiently above the mat surface to reduce the velocity of the streams to not greater than about 2500 f.p.m., and preferably to about 2000 f.p.m. or below, before they impinge on the mat surface. However, the velocity of the stream as it impinges on the mat surface should remain substantial, i.e., sufficient to prevent agglomeration, and to deposit the fibers on the belt in separate strata as the nozzles oscillate.

The decrease in velocity without significant agglomeration is permitted, due to the spreading of the stream and an increase in the air-to-fiber ratio below the nozzle. The spacing of the oscillating nozzles above the mat is sufficient to expand each stream of fibers, as shown by the arrows 33a, to an area at the mat of about twenty and preferably twenty-five times the area of the stream when discharged, i.e., the cross sectional area of the nozzle. The additional air moving into the housing through the manifolds 75, 76 and 77 is inducted into the air and fiber below the nozzles and increases the air-to-fiber ratio. The spreading of the fibers and the increase in air-to-fiber ratio is sufficient at the decreased velocity to prevent material agglomeration of the fibers before reaching the mat.

Moreover, the amplitude of nozzle oscillation is sufficiently great to further spread the fibers over a composite area which is much greater than twenty-five times the area of the nozzle and wider than the belt 46 to deposit the fibers across the entire width of the belt and laterally outside of both edges thereof, the belt being substantially narrower than the housing to leave spaces between the edges of the belt and the walls 37. Such additional spreading of the fibers further decreases the likelihood of fiber agglomeration.

Situated in the spaces between the belt 46 and the side walls 37 are a pair of side waste troughs 51 having upwardly diverging side walls 52 and 53 to receive the fibers which are deposited into such spaces. The walls 52 merge

into the side walls 37 of the housing. The walls 53 extend to the edges of the belt 46 and are connected to the top of vertical members 54 which form side walls for the fiber-collecting area above the belt 46. As best seen in FIGURE 3, the side walls 54 are tapered upwardly from the inlet end of the housing toward the outlet end to confine the mat which becomes progressively thicker as fibers are deposited by the various felting heads on the belt as it moves longitudinally through the three compartments of the housing. The side waste troughs extend longitudinally along the entire housing. The fibers which are deposited in the side waste troughs and the air in the area around such troughs are withdrawn by suction fans 55 through conduits 56 and returned to an appropriate point in the system ahead of the felter for recovery. Alternatively, separate side waste troughs may be provided in each felting compartment. The advantage of using a separate trough in each compartment is that the coarse and fine fibers which are removed by the side waste troughs may be separately recovered and returned to the system between the separator 14 and the felter. The fine fibers thus recovered could be returned to the fine compartments and the coarse fibers could be returned to the coarse compartment without the necessity for reclassification. As a further alternative, the side waste troughs may be omitted from one or both of the fine felting compartments.

The projection of the edges of the fiber stream into the side waste troughs and the withdrawal therefrom of the air and fibers thus projected is highly advantageous. The period of dwell at the end of each nozzle oscillation is minimized by appropriate design of the cams 35 but is impossible to eliminate. Because of such dwell and the reversal of the direction of the nozzles, an unavoidable turbulent condition exists at the edges of the fiber deposition space where the fibers move in different directions and impinge against one another, thus causing agglomeration. Additional agglomeration is caused by impingement of the fibers against the side walls of the felter housing. Accordingly, fiber deposition at the edges of the deposition space is materially less uniform than in the center portion of such space. Thus, the non-uniform edge portions are deposited in the side waste troughs instead of on the mat surface where uniform deposition is maintained. Moreover, fibers which collect on the side walls and descend in clumps are deposited in the side waste troughs rather than on the mat.

It is also important that the large quantities of air which are blown into the felter housing be removed without creating sufficient turbulence caused by billowing and eddy currents in areas adjacent to the surface of the mat to disturb the fibers previously deposited on the belt. Air from the area overlying the belt surface is removed through the belt by the suction chambers situated therebeneath. Air and fibers are removed from the lower corners of the housing by suction through the side waste troughs. Because of the nozzle oscillation, air is blown into the lower corners of the housing intermittently rather than continuously. This intermittent application of air affords ample time for each of the side waste suction means to remove the air and dissipate any turbulence. If suction were not applied to the side waste troughs, the only avenue of escape of air from the lower corners of the housing would be through the foraminous belt into the suction chambers therebeneath. The resulting turbulence of the air in the lower corners of the housing would seriously disturb the fibers along the marginal portions of the mat.

If the pressure immediately above the mat is non-uniform, cross currents adjacent the mat are created by air flowing from a high pressure area to a low pressure area. Preferably, sufficient suction is applied to the side waste troughs and to the suction chambers beneath the belt to maintain a reasonably uniform pressure, slightly below atmospheric pressure, in the area immediately above the mat. The spreading of the streams and the reduction of

velocity afforded by the oscillating nozzle spaced above the mat surface is further advantageous because it reduces the amount of such suction which is required. The air velocity through the mat is a function of the pressure differential immediately above and below the mat.

Positioned between the last coarse fiber felting head and the last fine fiber felting head 32 is an endless belt pre-compaction press 60 as shown diagrammatically in FIGURES 1 and 3. The press 60 is isolated from the adjacent felting compartments 44 and 45 by the partitions 41 and 49 to prevent deposition of fibers on the press belt, which fibers would otherwise be non-uniformly deposited on the mat by the rotating press belt. Because the press 60 is normally quite bulky, the felter housing may be discontinued in the area overlying the press. In that case, the felting compartments on each side of the press are contained in separate housings. Further, the belt 46 may be discontinued in the area under the press 60. In that case, separate endless belts are employed in each of the felter compartments on opposite sides of the press.

The press 60 extends across the entire width of the mat and is situated closely adjacent the belt to pre-compact the mat to a self-sustaining state, preferably to a specific gravity of greater than about 0.2. After emerging from the felter, the mat is subjected to a second pre-compaction operation to compress the fines. The relatively low pressure precompaction operations referred to here, which merely compress the mat to a self-sustaining state, are not to be confused with the high pressure pressing operations used in compacting the mat to the final density of the finished board. It is important that a pre-compaction operation be performed prior to deposition of the fines because pre-compaction solely after the fines are deposited results in the expression of air from the coarse layers which tends to blow the fines off of the face layers. It is also important that the mat be again pre-compacted after deposition of the fines to prevent removal of the fines in subsequent operations such as final consolidation to finished board.

The partially compacted mat is removed from the felter by endless belt conveyor 81. The mat is then cut into required length, transferred to cauls and placed into a hot press where it is subjected to sufficient heat and pressure to compact the mat to the desired density and set the resin binder. Conventionally, but not necessarily, the mat is compressed to a specific gravity of from 0.8 to 1.2.

The invention has been described with respect to a preferred specific embodiment. It is apparent, however, that modifications may be made by those skilled in the art without departing from the scope of the invention as embraced by the appended claims.

I claim:

1. A method of forming a mat from particles which comprises conveying a stream of gas containing a high concentration of said particles at a velocity sufficiently high to distribute said particles throughout the stream without material agglomeration of said particles, discharging said stream into the air to progressively spread the particles and reduce the velocity of said stream and simultaneously laterally oscillating said stream to further spread the particles over a wide area, collecting a substantial portion of said particles out of a central portion of said area to form a mat on a horizontal foraminous member disposed transversely to the direction of discharge of said stream when the velocity of said stream in the direction of discharge remains substantial but has been sufficiently reduced to prevent material disturbance of particles previously collected on said foraminous member, withdrawing by suction through said foraminous member gas from said central portion, and withdrawing by suction particles and gas from the edges of said area through paths passing outside of said foraminous member.

2. The method according to claim 1 wherein said particles comprise wood fibers.

3. A method of forming a mat from wood fibers which comprises conveying a stream of gas containing said fibers at a gas-to-fiber ratio of from about 18 to about 47 cu. ft. per lb. and at a velocity of from about 4000 to about 8000 f.p.m. to distribute said fibers throughout the stream without material agglomeration of said fibers, discharging said stream into the air to progressively spread the fibers and reduce the velocity of said stream and simultaneously laterally oscillating said stream to further spread the fibers over a wide area, collecting a substantial portion of said fibers out of a central portion of said area to form a mat on a horizontal foraminous member disposed transversely to the direction of discharge of said stream when the velocity of said stream in the direction of discharge remains substantial but has been reduced to a maximum of 2500 f.p.m. to minimize disturbance of fibers previously collected on said foraminous member, withdrawing by suction through said foraminous member gas from said central portion, and withdrawing by suction fibers and gas from the areas laterally outside of said central portion through paths passing outside of said foraminous member.

4. The method of claim 3 wherein said stream of gas and fibers is conveyed prior to discharge at a velocity of from about 4000 to about 6000 f.p.m.

5. A method according to claim 4 wherein said fibers are collected after the fiber stream has been spread to at least 20 times the size of said stream when discharged and the velocity of said stream has been reduced to a maximum of 2000 f.p.m.

6. In an apparatus for forming a mat from particles, the combination which comprises a housing, a foraminous particle-receiving member positioned in said housing with the edges of said member spaced from the adjacent walls of said housing, means spaced from said member to project toward said member along an unobstructed path a stream of gas and particles to be deposited on said member as a mat and laterally outside of both edges of said member, means to withdraw gas from the area within the edges of said member by suction applied through said member, and means to withdraw particles and gas from the areas laterally outside of said member by suction applied laterally outside of said member.

7. In an apparatus for forming a mat from particles, the combination which comprises a housing, a foraminous particle-receiving member positioned in said housing with the edges of said member spaced from the adjacent walls of said housing, means spaced from said member to project gas and particles toward said member along an unobstructed path at substantial velocity in a stream moving back and forth laterally of said member at sufficient amplitude to deposit said particles onto said member as a mat and laterally outside of both edges thereof, means to withdraw gas from the area within the edges of said member by suction applied through said member, and means to withdraw particles and gas from the areas laterally outside of said member by suction applied laterally outside of said member.

8. In an apparatus for forming a mat from particles, the combination which comprises a housing, a foraminous particle-receiving member positioned in said housing with the edges of said member spaced from the adjacent walls of said housing, means spaced from said member to project gas and particles toward said member along an unobstructed path at substantial velocity in a stream moving back and forth laterally of said member at sufficient amplitude to deposit said gas and particles onto said member as a mat and laterally outside of both edges thereof, means to effect relative movement between said foraminous member and said projecting means in a direction transverse to the direction of said movement of said stream, means to withdraw gas from the area within the edges of said member by suction applied through said member, and

means to withdraw particles and gas from the areas laterally outside of said member by suction applied laterally outside of said member.

9. In an apparatus for forming a mat from particles, the combination which comprises a housing, an elongated horizontal foraminous particle-receiving member positioned in said housing with the edges of said member spaced from the adjacent walls of said housing, means mounted above said member to project gas and particles downwardly along an unobstructed path at substantial velocity in a stream moving back and forth laterally of said member at sufficient amplitude to deposit said gas and particles onto said member as a mat and laterally outside of both edges thereof, means to effect relative movement between said foraminous member and said projecting means longitudinally of said member, means to withdraw gas from the area overlying said member by suction applied through said member, and means to withdraw particles and gas which descend into the areas laterally outside of said member by suction applied laterally outside of said member.

10. In an apparatus for forming a mat from particles, the combination which comprises a housing, an elongated horizontal foraminous particle-receiving member positioned in and longitudinally movable through said housing with the edges of said member spaced from the adjacent walls of said housing, means to convey a stream of gas and particles to said housing and including a movable nozzle positioned to discharge said stream along an unobstructed path at substantial velocity downwardly into said housing toward said member, means to move said nozzle back and forth laterally of said member at sufficient amplitude to distribute said stream across said member as a mat and laterally outside of both edges thereof, means to withdraw gas from the area overlying said member by suction applied through said foraminous member, and means to withdraw particles and gas which descend into the areas laterally outside of said member by suction applied laterally outside of said member.

11. In an apparatus for forming a mat from particles, the combination which comprises a housing, an elongated horizontal foraminous particle-receiving member positioned in and longitudinally movable through said housing with the edges of said member spaced from the adjacent walls of said housing, means to convey a stream of gas and particles to said housing and including an oscillatable nozzle positioned to discharge said stream at substantial velocity downwardly into said housing toward said member, means to oscillate said nozzle laterally of said member at sufficient amplitude to distribute said stream across said member and laterally outside of both edges thereof, a pair of elongated troughs mounted in the spaces adjacent the edges of said member to receive particles deposited laterally outside of said member, means to apply suction through said foraminous member to withdraw gas from the area overlying said member, and means to apply suction through said troughs to withdraw particles which are deposited in said troughs and gas from the areas around said troughs to minimize gas turbulence adjacent the edges of said member.

12. In an apparatus for forming a plural layer particle mat with each layer containing multiple strata, the combination which comprises housing means, an elongated horizontal foraminous particle-receiving member mounted for longitudinal movement through said housing means with the edges of said member spaced from the adjacent walls of said housing means, a plurality of horizontally spaced felting heads mounted above said member, the last and next to last felting heads in the direction of movement of said member being adapted to discharge relatively fine and relatively coarse particles, respectively, each of said felting heads including a nozzle elongated horizontally of said member and directed downwardly toward said member to discharge at substantial velocity a stream of gas and particles to be deposited in a layer

on said member to form a plural layer particle mat with fine particles in the surface layer and coarse particles in the next underlying layer as said member moves progressively past said heads, each of said nozzles being spaced above said member a sufficient distance to permit the velocity of the stream to be reduced prior to deposition of said particles to a level which will minimize disturbance of previously deposited particles, each of said nozzles being oscillatable laterally of said member at sufficient amplitude to distribute said stream across and laterally outside of both edges of said member at sufficient frequency relative to the speed of said member to deposit overlapping strata of particles by successive passes of the nozzle, means positioned above said member between said coarse and fine felting heads to level and control the thickness of the fiber deposit on said member, means to apply suction through said member and to withdraw gas from the area overlying said member, and means to apply suction laterally outside of said member and to withdraw particles and gas which descend into the areas laterally outside of said member.

13. In an apparatus for forming a mat from particles, the combination which comprises a housing, an elongated horizontal foraminous particle-receiving member positioned in and longitudinally movable through said housing with the edges of said member spaced from the adjacent walls of said housing, means to convey to said housing a stream of gas containing a high concentration of said particles at a velocity sufficiently high to distribute said particles throughout the stream without material agglomeration of said particles, a nozzle mounted above said member in fluid communication with said conveyor means to discharge said stream downwardly into said housing along an unobstructed path toward said member, thus progressively expanding and reducing the velocity of said stream until the particles are deposited as a mat on said member, said nozzle being spaced above said member a sufficient distance to permit sufficient reduction of the velocity of said stream prior to deposition of said particles to prevent material disturbance of particles previously deposited on said member, said nozzle being oscillatable laterally of said member at sufficient amplitude to distribute said stream across and laterally outside of both edges of said member, means to withdraw gas from the area overlying said member by suction applied through said foraminous member, and means to withdraw particles and gas which descend into the areas laterally outside of said member by suction applied laterally outside of said member.

14. In an apparatus for forming a mat from particles, the combination which comprises a housing, an elongated horizontal foraminous particle-receiving member positioned in and longitudinally movable through said housing with the edges of said member spaced from the adjacent walls of said housing, means to convey to said housing a stream of gas containing a high concentration of said particles at a velocity sufficiently high to distribute said particles throughout the stream without material agglomeration of said particles, a nozzle mounted above said member in fluid communication with said conveyor means to discharge said stream downwardly into said housing along an unobstructed path toward said member, thus progressively expanding and reducing the velocity of said stream until the particles are deposited as a mat on said member, said nozzle being spaced above said member a sufficient distance to permit sufficient reduction of the velocity of said stream prior to deposition of said particles to prevent material disturbance of particles previously deposited on said member, said nozzle being oscillatable laterally of said member at sufficient amplitude to distribute said stream across and laterally outside of both edges of said member, means to withdraw gas from the area overlying said member by suction applied through said foraminous member, and means to withdraw particles and gas which descend into the areas laterally outside of

said member by suction applied laterally outside of said member, and means to recirculate the gas and particles withdrawn by said first-named suction means through the upper portion of said housing.

15. A method of forming particles into a mat to be compressed into boards which comprises conveying a stream of gas containing a high concentration of said particles at a velocity sufficiently high to distribute said particles throughout the stream without substantial agglomeration of said particles, discharging said stream into the air to progressively spread the particles and reduce the velocity of said stream and simultaneously moving said stream back and forth to further spread the particles over an area wider than the width of the boards to be produced, collecting particles from said area to form a mat on an elongated foraminous member disposed transversely to the direction of discharge of said stream and moving relative to the location of said discharge in a direction transverse to said back and forth movement of said stream when the velocity of said stream in the direction of discharge remains substantial to minimize agglomeration but has been sufficiently reduced to prevent substantial disturbance of particles previously collected on said foraminous member, said particles moving from said discharge to said mat along an unobstructed path, withdrawing said gas by suction applied from the side of said foraminous member opposite said particle discharge, and separating from both edges of said mat the particles deposited outside of the width of the boards to be produced.

16. The method according to claim 15 wherein said particles comprise wood fibers, said discharge is downward and said foraminous member is horizontal.

17. A method of forming wood fibers into a mat to be compressed into boards which comprises conveying a stream of gas containing said fibers at a gas-to-fiber ratio of from about 18 to about 47 cu. ft. per lb. and at a velocity of from about 4000 to about 8000 f.p.m. to distribute said fibers throughout the stream without substantial agglomeration of said fibers, discharging said stream downwardly into the air to progressively spread the fibers and reduce the velocity of said stream and simultaneously laterally oscillating said stream to further spread the fibers over an area wider than the width of the boards to be produced, collecting fibers from said area to form a mat on a horizontally moving elongated foraminous member disposed transversely to the direction of discharge of said stream when the velocity of said stream in the direction of discharge remains substantial but has been reduced to a level not greater than 2500 f.p.m. to minimize disturbance of fibers previously collected on said foraminous member, said fibers moving from said discharge to said mat along an unobstructed path, withdrawing said gas by suction applied from below said foraminous member, and separating from both edges of said mat the fibers deposited outside of the width of the boards to be produced.

18. The method according to claim 17 wherein said stream of gas and fibers is conveyed prior to discharge at a velocity of from about 4000 to about 6000 f.p.m.

19. The method according to claim 18 wherein said fibers are collected after the velocity of said stream has been reduced to a level not greater than 2000 f.p.m.

20. In an apparatus for forming particles into a mat to be compressed into boards the combination which comprises a housing, an elongated foraminous particle-receiving member positioned in said housing, means spaced from and directed toward said member to project a stream of gas and particles toward said member along an unobstructed path at substantial velocity to deposit said gas and particles onto said member as a mat, means to move said projecting means to move said stream back and forth laterally of said member at sufficient amplitude to deposit said particles over an area wider than the width of

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the boards to be produced, means to effect relative movement between said foraminous member and said projecting means in a direction longitudinally of said member and transverse to the direction of said movement of said stream, means to withdraw gas by suction applied from the side of said foraminous member opposite said projecting means, and means to separate from both edges of said mat the particles deposited outside of the width of the boards to be produced.

21. An apparatus as recited in claim 20 wherein said

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member is horizontal and said projecting means is directed vertically downwardly.

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