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APPARATUS AND PROCESS FOR FORMING MATS FROM POURABLE MATERIAL

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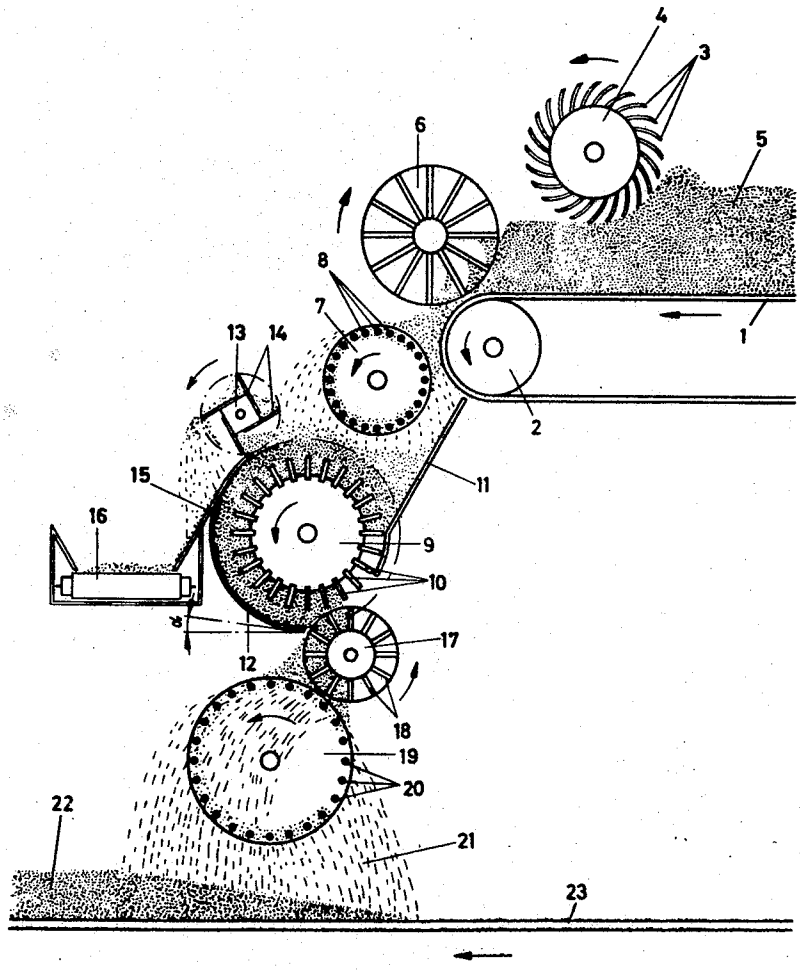

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APPARATUS AND PROCESS FOR FORMING MATS FROM POURABLE MATERIAL

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ABSTRACT OF THE DISCLOSURE

The present invention concerns an apparatus for forming a uniform mat from pourable material on a moving support, using a volumetric fine metering device with a rotating surface provided with sweeps, a guide wall with a guide surface opposite the downwardly moving portion of said surface, and a leveling member disposed in the vicinity of the upper part of the guide surface.

This invention is broadly concerned with a novel apparatus and a new process or method for forming a uniform mat from pourable or particle material onto a moving support, using a volumetric fine metering device with a rotating surface provided with sweeps or vanes, a guide wall with a guide surface opposite the downwardly moving portion of said rotating surface, and further a leveling member disposed in the vicinity of the upper part of the guide surface.

The presently known apparatus of the type above mentioned have the grave disadvantage that sufficiently uniform mats can not be produced. If, for example, a mat of wood chips, fibers or the like is produced with such an apparatus and the mat is then pressed in a normally heated press, it has been found that the pressed board does not have the desired uniformity and accuracy in regards to its thickness and density These boards require considerable subsequent treatment as a result of which the economy of the method of manufacture suffers.

The invention is based on solving the problem of producing mats or particle blanks of great uniformity and accuracy from pourable particles so that the boards obtained by the pressing of such mats are as free as possible of faults, and thus require no or a minimum of subsequent processing, independently of whether narrow or wide mats are formed.

The inventor of the present invention has now found that the above disadvantages can be attributed to two causes. First, the extent to which the cells between the sweeps or vanes of the rotating surface (conveyor member) are filled is not constant since it depends to a great extent upon the quantity of particles present on the input side of the fine metering device. In the previously proposed apparatus this quantity of particles is too great and also not sufficiently constant. This is true even when the quantity of particles fed to the rotating part of the fine metering device is regulated by special control means, such as by a contents senser which controls by means of electric means the working of a coarse metering device arranged upstream. Second, the above described shortcoming resides in the fact that the said cells of the fine metering device are irregularly and jerkily discharged as soon as the material being conveyed ceases to be retained by the said guide surface.

According to this invention there is provided apparatus of the kind described so constructed that the leveling member serves to feed excess material present in the vicinity of the input side of the fine metering device to a conveyor. The conveyor, in turn, serves to convey

the excess material back to the input side of a coarse metering device which is arranged upstream of the fine metering device. Additionally, in the vicinity of the lower limit of the said guide surface a movable comb member is provided.

The conveyor member of the fine metering device, provided with a movable surface and sweeps, is advantageously formed as a conveyor roller which cooperates, on the one hand, with a rotary leveling roller and, on the other hand, with a rotating comb roller. An arcuate guide wall extends between the leveling and comb rollers. The apparatus thus becomes particularly compact, economical, sturdy, and maintenance free.

An embodiment, by way of example, of the apparatus and process according to the invention is shown diagrammatically in the accompanying drawing.

Coarse metering device consists of a conveyor belt **1** arranged to rotate in the direction of the arrow and guided over a roller **2** and a material retaining metering roller **4** with prongs or fingers **3** which is disposed at a certain level thereabove. The pourable material **5** is poured onto the conveyor belt from a bin (not shown) in a manner well known. The height of the heap of material lying upstream of the metering roller **4** can be kept constant within predetermined limits by means of a suitable conventional control of the bin discharge members.

A bladed delivery roller is designated by **6**, and serves to throw the particles onto a so-called cage roller. This consists of two end plates **7** and a plurality of spaced and mutually parallel rods **8**. Owing to the fact that the particles pass through the rotating cage roller twice, a uniform distribution and loosening or unmatting of the particles results.

The particles metered and loosened and unmatting in the manner described, are now subjected to an accurate metering by means of a metering conveyor roller **9**, a leveling roller **13** and a comb roller **17**. The actual metering or conveyor roller **9** rotates about a horizontal axis. The drive is preferably infinitely variable (not shown) so that the quantity fed can be adjusted as required to the desired amount during the operation. Sweeping blades **10** or prongs are arranged on the outer surface of the roller **9**.

A sheet metal wall **11** together with the part of the roller extending thereabove forms a kind of storage chamber for the material which is being fed. The lower side of the sheet metal member is bent in such a manner that temporarily stored particles of material can not drop out between the blades **10** and the wall **11**.

An arcuate wall **12** which guides the particles is located at a certain spacing from the blades **10** on the downwardly moving surface portion of roller **9**. This wall is in the shape of a segment, sector or section of a hollow cylinder or hollow tube. Conveyor roller **9** and guide wall **12** thus bound a precisely defined path for the passage of the particles of material.

The quantity of particles conveyed per unit of time depends only on the speed of rotation of the roller **9**, provided that care is taken to maintain the degree of filling in the said passage constant. For this purpose leveling roller **13** is provided. The roller **13** has several rake-like members **14** which throw excess material onto an oblique plane **15** from where the material slides onto a conveyor belt **16** at right angles to the longitudinal direction of the belt **1**. From there it is fed back to the storage bin or the heap of material **5**.

It is apparent that the particle flow coming from the coarse metering device must be slightly stronger than the quantity of particles actually fed or used. In general, an excess of 10–15% is critical and will suffice to compensate for unavoidable variations, and to ensure a uni-

form action of the metering device over its whole width. Under certain circumstances the supply of the particle material will be automatically regulated in dependence on the excess of material. For example a weighing device (not shown) responsive to the material conveyed on the conveyor belt **16**, can be arranged to increase or decrease the speed of the roller **2** as required.

The angle α which is formed between the lower end of the guide surface of wall **12** and a horizontal plane is also of critical importance. This angle should be so chosen that with a selected material for the guide wall and with particles having certain properties, the material near the delivery portion of the guide surface does not suddenly break off and start to slide and thus destroy the uniformity of the feeding process. It has been found that with a smooth sheet metal guide wall **12** and when using wood shavings, an angle α of about 5–10° prevents, on the one hand, a sliding of the material and, on the other hand, is able to keep low the magnitude of the force required in addition to the gravitational force for the further movement of the particles. By "gravitational force" is meant that component of the force, which acts parallel to a tangent to the discharge end of the guide wall **12**.

The material conveyed as described along the guide surface by means of the conveyor roller **9** and under the action of gravity, is now seized by comb roller **17** which rotates rapidly and counter to the direction of flow of the particles. This roller **17**, which is provided with throwing elements **18**, projects the material obliquely downwardly. It is possible to speak of a "milling" of the particle flow by the blades or prongs of the comb roller **17**, projecting into the path of movement of the material.

A further cage roller **19** with rods **20** separates the now accurately metered particle flow, as indicated at **21**, as a result of which any roof tile like piling up of the particles is avoided, and the quality of the distribution is further improved. The mat formed on the uniformly moving conveyor base **23** is designated by **22**.

It can be seen from the drawing that the axis of the rollers shown extend in a direction perpendicular to the direction of movement of the conveyor members. All rollers are at least as long as the width of the mat **22** to be formed. It is further apparent that the rollers are provided with end discs or flanges. It is now possible, for example, to provide the apparatus with two lateral sealing walls, one of which extends in a plane together with the discs on the end of the shafts on one side of the apparatus and the other in a plane together with all the discs on the other side. These sealing walls extending parallel to one another can extend as far as the immediate vicinity of the conveyor base **23**, as a result of which the lateral boundary of the mat **22** will be particularly sharply defined.

The construction of the apparatus, the arrangement and method of which has been described, permits by means of a relatively simple modification a continuous or periodic control of the quality of the distribution and/or of the weight or the quantity fed. This quality control modification consists in connecting to each of the rotating members a similar more or less long member. All such additional members will be on the same side of the apparatus, and will be separated from the original member only by the end discs. Thus, e.g., the metering conveyor roller **9** may be supplemented by a preferably shorter roller which is mounted on the same shaft. Such an additional unit would normally be separated from the mat forming apparatus proper by one of the lateral sealing walls. After carrying out the necessary measurement, the material metered and fed by this additional device is either pressed into test boards or returned directly to the delivery point.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Apparatus for forming a uniform mat from pourable material onto a moving support, said apparatus having a coarse metering device and a volumetric fine metering device with a rotating surface provided with sweeps, a guide wall with a guide surface opposite the downwardly moving portion of said rotating surface, and a leveling member disposed adjacent to the upper part of the guide surface characterized in that said leveling member is arranged to convey excess material present in the vicinity of the input side of the fine metering device to a conveyor device serving to convey it back to the input of a coarse metering device which is disposed upstream of said fine metering device.

2. Apparatus according to claim **1** characterized by a unmatting separating member provided with apertures, and movably mounted above the said fine metering device.

3. Apparatus according to claim **2** characterized in that the lower exit end of the inner guide surface of the guide wall has an inclination such that with a selected material and with predetermined properties of the particles used for the formation of the mat, particles can only slide along the guide surface if, besides the gravity component, a small additional force acts upon the particles in the direction toward the lower edge thereof.

4. Apparatus according to claim **3** characterized by an infinitely variable drive for said metering device.

5. Apparatus according to claim **4** characterized in that the coarse metering device includes a conveyor belt for the material and a rotatable and retaining metering member, mounted thereabove.

6. Apparatus according to claim **5** characterized in that the speed of the conveyor belt for the material is controlled in dependence on the excess of material appearing in the fine metering device.

7. Apparatus according to claim **1** characterized in that the lower exit end of the inner guide surface of the guide wall has an inclination such that with a selected material and with predetermined properties of the particles used for the formation of the mat, particles can only slide along the guide surface if, besides the gravity component, a small additional force acts upon the particles in the direction toward the lower edge thereof.

8. Apparatus for forming a uniform mat from pourable material onto a moving support, said apparatus having a coarse metering device and a volumetric fine metering device with a rotating surface provided with sweeps, a guide wall with a guide surface opposite the downwardly moving portion of said rotating surface, and a leveling member disposed adjacent to the upper part of the guide surface characterized in that said leveling member is arranged to convey excess material present in the vicinity of the input side of the fine metering device to a conveyor device serving to convey it back to the input of a coarse metering device which is disposed upstream of said fine metering device, and a moving comb member, said moving comb member arranged adjacent to and cooperating with the lower portion of said guide surface.

9. Apparatus according to claim **8** characterized in that the fine metering device is a roller provided with bladed sweeps and in that the said guide wall comprises a hollow cylindrical sector spaced from the free ends of the said sweeps.

10. Apparatus according to claim **9** characterized in that the leveling member extends over the whole width of the metering roller and comprises a leveling roller rotatable in the same direction as the said metering roller whereby said leveling roller removes the excess material and throws it onto a moving belt to be fed back to the input side of said coarse metering device.

11. Apparatus according to claim **10** characterized in that said comb member extends over the whole width of the metering roller and consists of a comb roller provided with bladed throwing elements, said comb roller being rotatable in the same direction as the metering conveyor roller but at a higher peripheral speed than the latter, the said throwing elements protruding into the path of movement of material reaching the end of the guide surface.

12. Apparatus according to claim 9 characterized in that said comb member extends over the whole width of the metering roller and consists of a comb roller provided with bladed throwing element, said comb roller being rotatable in the same direction as the metering conveyor roller but at a higher peripheral speed than the latter, the said throwing elements protruding into the path of movement of material reaching the end of the guide surface.

13. Apparatus according to claim 12 characterized in that between the comb roller and the moving support, a rotatable and hollow distributing and feed roller is located, the surface of which is provided with apertures for the passage of the material to be distributed.

14. Apparatus according to claim 13 characterized by an unmatting separating member, said separating member being a hollow roller provided with apertures and movably mounted above the said fine metering device.

15. A method for forming a mat of pourable material in a uniform layer of constant thickness and constant density comprising the steps of feeding a large quantity

of material to a measuring roller, returning the excess material to a feeding area, and throwing the measured quantities of particles against a separating device so that the particles will fall onto the mat being formed in a uniform separated condition.

16. The method as set forth in claim 15 comprising feeding an excess quantity of material to a coarse approximate measuring device, and subsequently passing the material to an initial separation device to break up clumps or matted balls of material before permitting the material to fall into a fine measuring and metering device.

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