(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 018 415 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.07.2000 Bulletin 2000/28

(51) Int. Cl.[7]: **B27N 1/02**

(21) Application number: **99124874.1**

(22) Date of filing: **16.12.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **07.01.1999 IT MI990014**

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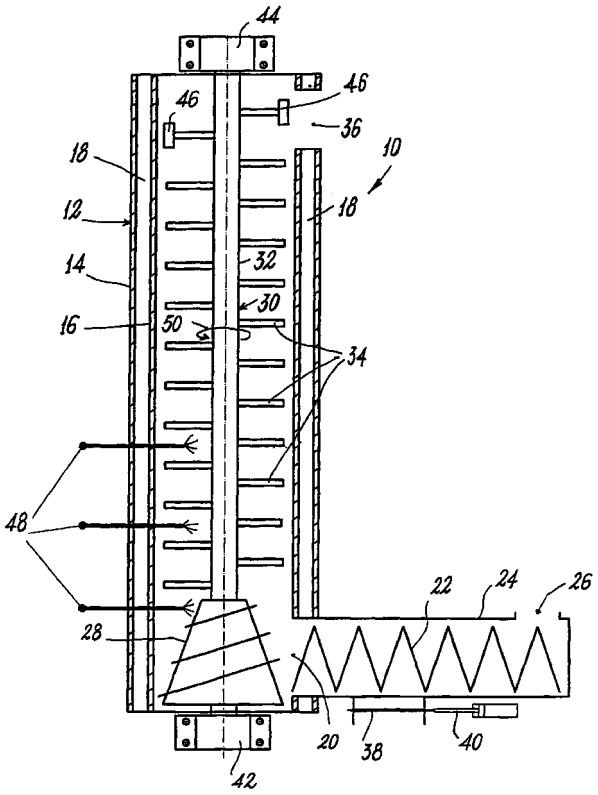
(54) Vertical mixing machine for chipboard production

(57) The gluing machine (10) for chipboard production plants comprises a cylindrical mixing chamber (12) in which a feed aperture (20), an exit aperture (36) and a mixing member (30) are provided. The mixing chamber (12) is positioned vertically and the feed aperture (20) is provided in the lower part of the mixing chamber (12), whereas the exit aperture (36) is provided in the upper part of the mixing chamber (12). Means (22) are provided to feed the wood particles into the mixing chamber (12) via the feed aperture (20).



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Description

[0001] This invention relates to those gluing machines used in chipboard production plants to distribute a sufficient quantity of liquid glue throughout a mass of wood particles or chips to enable this mass to be transformed into chipboard panels by subsequent operations.

[0002] Traditional gluing machines comprise a normally cylindrical mixing chamber of substantially horizontal axis, into one end of which wood particles of the desired size are fed by gravity in a suitably metered quantity. A predetermined quantity of liquid glue of thermosetting type is also fed into the chamber, usually by spraying. The gluing machine also comprises means for mixing them together more or less intensely and for transferring the resultant mass, after a predetermined time, to an exit aperture through which this latter, called hereinafter the mixture, which is formed from wood particles wetted with glue, leaves.

[0003] For the subsequent use of the mixture the glue should be distributed uniformly over the surface of each particle, by applying to the surface of each particle a glue quantity which is proportional to its area. It has however been found that in known gluing machines this does not happen to the optimum degree. In this respect, in the resultant mixture the glue "wets" the particles of smaller size with greater uniformity. In any batch of wood particles, even if of rigorously controlled particle size distribution, there is a considerable variety of particle sizes, hence the glue distribution over the surface of the particles does not correspond to the said optimum.

[0004] It is well known to the expert of the art that traditional gluing machines offer a rather low level of filling of the mixing chamber, which does not exceed 40% of the chamber volume, with a wood particle retention time in the mixing chamber varying from 20 to 30 seconds, depending on the capacity.

[0005] To obtain improved glue distribution it has already been proposed to increase the mixing time of the wood particles with the glue, and to increase mixing intensity. One manner of increasing mixing intensity is to increase the speed of the mixing member. In some known gluing machines the peripheral speed of the mixing member can in fact reach 14-17 m/s, but with the result that the wood particles break, with consequent change in their size distribution, which is no longer an optimum. High mixing speed also leads to mixing temperature rise with consequent polymerization of the glue, which partly loses its effectiveness.

[0006] Another solution used to improve glue distribution is to obstruct the outflow of the mixture from the mixing chamber of the gluing machine, which is equivalent to prolonging the wood particle retention time in the chamber, with the result of prolonging mixing with the glue. This solution tends to increase mixing chamber filling, but only in the vicinity of its exit door. The door setting is indicated in terms of percentage, with 0% corresponding to the door completely open and 100% to the door completely closed. However too high a door closure percentage cannot be used because this excessively increases mixture temperature, with consequent glue polymerization.

[0007] Another method already used to prolong the mixing time is to instal after the first gluing machine a second gluing machine the sole purpose of which is to remix the mixture leaving the first. This solution leads to considerable improvement in the glue distribution, but at a significant increase in plant and running costs, in addition to increased overall plant size.

[0008] As already stated, all known gluing machines have a degree of mixing chamber filling which reaches a maximum of 40%, hence the mixing chamber must have a volume much greater than that effectively occupied by the mixture. This results in significant dimensions which have to be taken into account in designing the plant.

[0009] An object of this invention is to obviate the aforedescribed drawbacks of known gluing machines.

[0010] A further object is to provide a gluing machine which is of simple construction, reliable operation and easy maintenance and cleaning.

[0011] The said objects are attained by the gluing machine of the invention, comprising a cylindrical mixing chamber in which a feed aperture, an exit aperture and a mixing member are provided, characterised in that the mixing chamber is positioned vertically, the feed aperture is provided in the lower part of the mixing chamber and the exit aperture (36) is provided in the upper part of the mixing chamber (12), means being provided to feed the wood particles into the mixing chamber via the feed aperture.

[0012] The means for feeding the wood particles into the mixing chamber preferably comprise a feeder screw.

[0013] Conveniently, to facilitate the upward movement through the mixing chamber of the wood particles fed via the feed aperture, a vertical screw is provided in the lower part of the mixing chamber.

[0014] The invention will be more apparent from the following description of one embodiment thereof. In this description reference is made to the accompanying drawing, on which the single figure shows a schematic vertical section through the gluing machine of the invention.

[0015] As can be seen from the figure, the gluing machine 10 has a vertical cylindrical chamber 12 formed from two concentric cylindrical steel shells 14 and 16, spaced apart to form an interspace 18 the function of which is explained hereinafter. The cylindrical chamber 12 has a feed aperture 20 which communicates with one end of a motorized feeder screw 22 enclosed in a relative cylindrical casing 24. As can be seen the screw 22 is substantially horizontal, although this is not essential. In the top of the far end of the casing 24 there is provided an aperture 26 through which

the wood particles are fed by gravity, these being thrust into the cylindrical chamber 12 by the action of the screw 22.

[0016] As can be seen in the figure, the lower part of the cylindrical chamber 12 contains a vertical motorized frusto-conical screw 28 coaxial with the chamber 12, its rotation upwardly urging the wood particles fed into the chamber 12 by the action of the feed screw 22.

[0017] Above the vertical frusto-conical screw 28 there is provided a mixing member 30 consisting essentially of a coaxial motorized shaft 32 from which mixing arms 34 radially extend, these being indicated very schematically in the figure, but of conventional type. The mixing arms 34 can have different shapes depending on the height at which they are positioned. As in the specific case shown in the figure, the mixing member 30 can be rigidly connected to the vertical screw 28 (so that both are driven by one and the same motor), this latter being keyed onto the shaft 32, which is rotatably supported at its ends by supports 42, 44. It is however apparent that the shaft of the mixing member and the vertical screw can be driven independently, even at different speeds, by relative motors. It should also be noted that the vertical screw can be of a shape different from frusto-conical (for example cylindrical).

[0018] As can be seen from the figure, an exit aperture 36 is provided close to the top of the cylindrical chamber 12. In the illustrated example, radial "blades" 46 are provided on the shaft 32 to facilitate discharge of the mixture from the mixing chamber 12 through the exit aperture 36 by overflowing.

[0019] The side walls of the chamber 12 and the mixing member 30 are cooled in conventional manner to prevent the mixture, as a result of heating caused by remixing, from reaching a temperature which would cause the glue to polymerize, one result of which would be the rapid fouling of those parts of the gluing machine 10 which come into contact with the mixture.

[0020] A gate 38 which closes a relative aperture is provided in the bottom of the casing 24 of the feeder screw 22, in this specific case the gate 38 being operated by a conventional pneumatic device indicated overall by 40 in the figure.

[0021] The glue is injected into the interior of the mixing chamber 12 at various points distributed over various heights (as indicated schematically in the figure, in which three nozzles 48 located at different heights are visible, fed with liquid glue) in order to wet the wood particles with the glue in successive stages. As is well known to the expert of the art, injecting the glue in successive stages enables the so-called particle "surfacing" effect to be obtained, by which glue absorption by the particles is reduced, with consequent reduction in the amount of glue required.

[0022] The operation of the aforedescribed gluing machine is described briefly below, but should be clear to an expert of the art from the aforegoing.

[0023] As stated, the mass of wood particles is fed by gravity through the aperture 26 provided in the casing 24 of the screw 22. By rotating this latter the wood particles are gradually urged towards the mixing chamber 12, then through the feed aperture 20 and into the bottom of the chamber 12, where they encounter the vertical screw 28 which when rotated urges them upwards. During their upward movement the wood particles are struck in successive stages by jets of glue leaving the nozzles 48, and are simultaneously remixed by the mixing member 30. The overall effect due to the action of the mixing member 30 and the vertical screw 28 is a combined horizontal and vertical remixing enabling optimum results to be obtained, ie a very uniform glue coating on the wood particle surface.

[0024] The mixture of wood particles and glue finally leaves from the exit aperture 36 by overflow aided by the action of the blades 46.

[0025] The gluing machine is cooled by circulating a cooling fluid, such as water, through the interspace 18 between the cylindrical shells 14 and 16. Cavities (not shown) are also provided in the mixing member 30 for circulation of a cooling fluid.

[0026] It is important to note that with such a gluing machine, 60-70% filling of the mixing chamber 12 can be achieved, this being considerably higher than known gluing machines (40% at most). Such a degree of filling enables good mixing to be obtained with low rotational speed of the mixing member. Specifically, the peripheral speed of the mixing member 30 can be maintained at around 7-10 m/s, enabling the wood particle size distribution to be maintained while at the same time achieving a decidedly higher particle/glue mixture retention time within the mixing chamber 12, of the order of 60-70 seconds, compared with known gluing machines. Such a high retention time would be counter-productive in a traditional gluing machine in which the mixing speed is much higher (14-17 m/s). The particle temperature would in fact rise with consequent pre-polymerization of the glue.

[0027] From the aforegoing it will be apparent that the gluing machine of the invention has a rather simple structure, and is therefore easy to construct. As no fouling occurs on those parts which come into contact with the mixture of wood particles and glue, maintenance and cleaning are much simpler than in known gluing machines. In addition, as the installed power requirement is less, such a gluing machine consumes significantly lesser energy than known gluing machines, besides being of much smaller overall plan dimensions.

[0028] A further advantage of the gluing machine of the invention is that as it extends vertically and has its mixture exit aperture at the top (ie at a much greater height than in known gluing machines), some of the mechanical conveyors (not shown) required to transfer the mixture from the exit 36 of the gluing machine to a panel forming machine (not shown) can be eliminated, this latter being located in the relative plant at a much higher level than with known gluing machines. Shorten-

ing the conveyor transfer path reduces transfer time and hence the tendency of the glue contained in the mixture to polymerize.

[0029] When the gluing machine 10 is to be emptied for maintenance purposes or for an extended shutdown, this can be achieved very easily by reversing the direction of rotation of the vertical screw 28 and horizontal screw 22 and opening the gate 38, on which the material contained in the mixing chamber 12 flows out from the gate aperture.

Claims

1. A gluing machine (10) for chipboard production plants, comprising a cylindrical mixing chamber (12) in which a feed aperture (20), an exit aperture (36) and a mixing member (30) are provided, characterised in that the mixing chamber (12) is positioned vertically, the feed aperture (20) is provided in the lower part of the mixing chamber (12) and the exit aperture (36) is provided in the upper part of the mixing chamber (12), means (22) being provided to feed the wood particles into the mixing chamber (12) via the feed aperture (20).

2. A gluing machine (10) as claimed in claim 1, wherein the mixing member (30) comprises a motorized vertical shaft (32) positioned coaxial to the mixing chamber (12), mixing arms (34) radially extending from the shaft.

3. A gluing machine (10) as claimed in claim 1, wherein the means for feeding the wood particles into the mixing chamber (12) comprise a motorized feeder screw (22).

4. A gluing machine (10) as claimed in claim 1, wherein a motorized vertical screw (28) is provided in the lower part of the mixing chamber (12) to upwardly urge the wood particles fed through the feed aperture (20).

5. A gluing machine (10) as claimed in claims 2 and 4, wherein the vertical screw (28) is frusto-conical and tapers upwards.

6. A gluing machine (10) as claimed in claims 2 and 4, wherein the vertical screw (28) is keyed onto the shaft (32) of the mixing member (30).

7. A gluing machine (10) as claimed in claim 2, wherein radial blades extend from the shaft (32) of the mixing member (30) in correspondence with the exit aperture (36), to facilitate mixture discharge by overflowing.

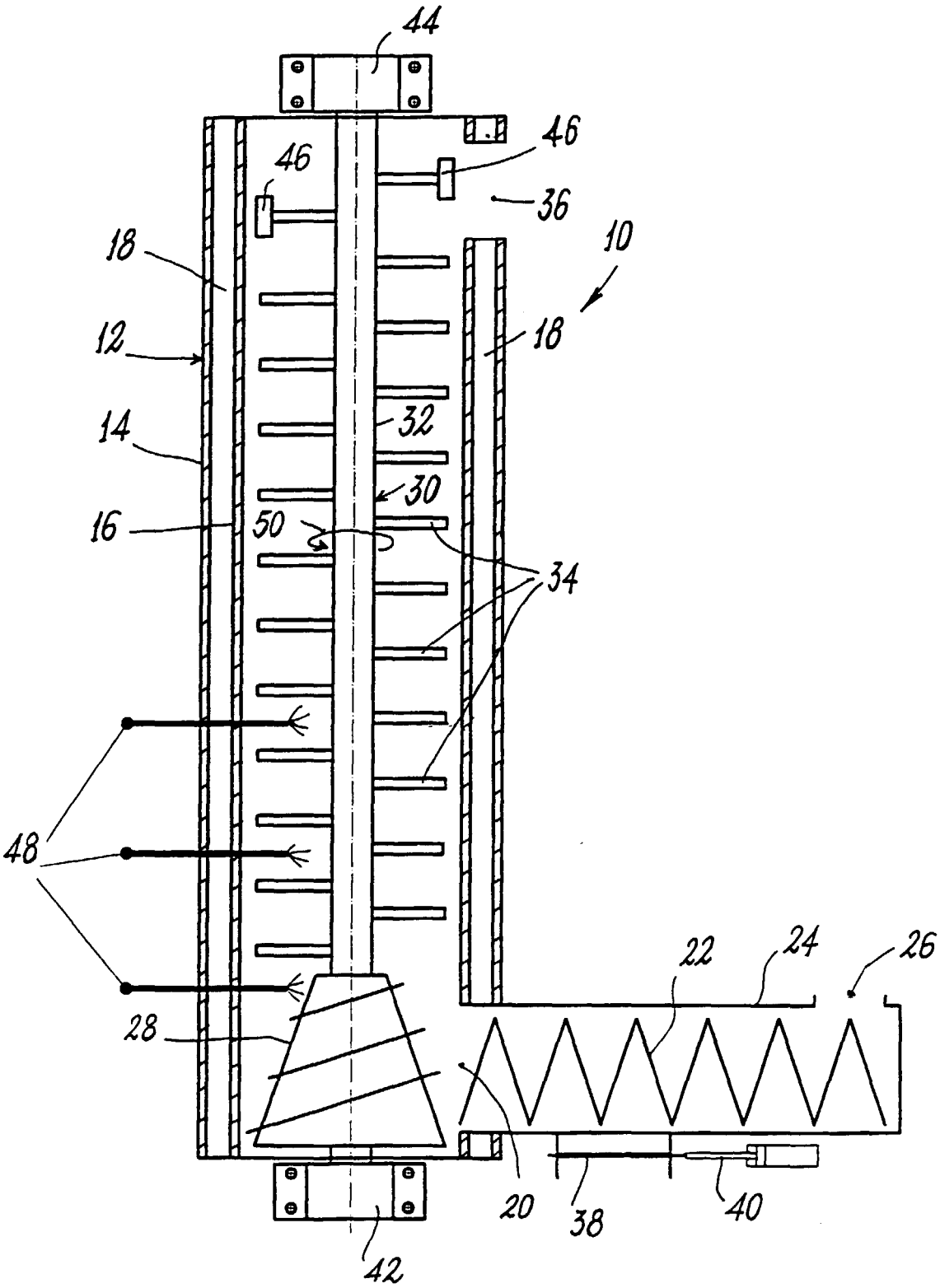
8. A gluing machine (10) as claimed in claim 1, wherein the side wall of the mixing chamber (12) is formed from two coaxial cylindrical shells (14, 16) spaced apart to form an interspace (18) through which cooling fluid can circulate.

9. A gluing machine (10) as claimed in claim 1, wherein means are provided to cool the mixing member (30).

10. A gluing machine (10) as claimed in claim 1, wherein the casing (24) of the feeder screw (22) comprises a closable lower aperture (38).

11. A gluing machine (10) as claimed in claim 10, wherein the closable lower aperture in the casing (24) of the screw (22) is closed by a gate (38) operated by a pneumatic device (40).

12. A gluing machine (10) as claimed in claim 2, wherein the mixing member (30) has a peripheral speed of between 7 and 10 m/s.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EUROPEAN SEARCH REPORT

Application Number
EP 99 12 4874

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	DE 30 49 555 A (LOEDIGE RUDOLF DR ING) 29 July 1982 (1982-07-29) * claims; figure 1 *	1-12	B27N1/02
A	DE 196 17 660 A (RETTENMAIER & SOEHNE GMBH & CO) 6 November 1997 (1997-11-06)		
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B27N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 April 2000	Soederberg, J

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 12 4874

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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