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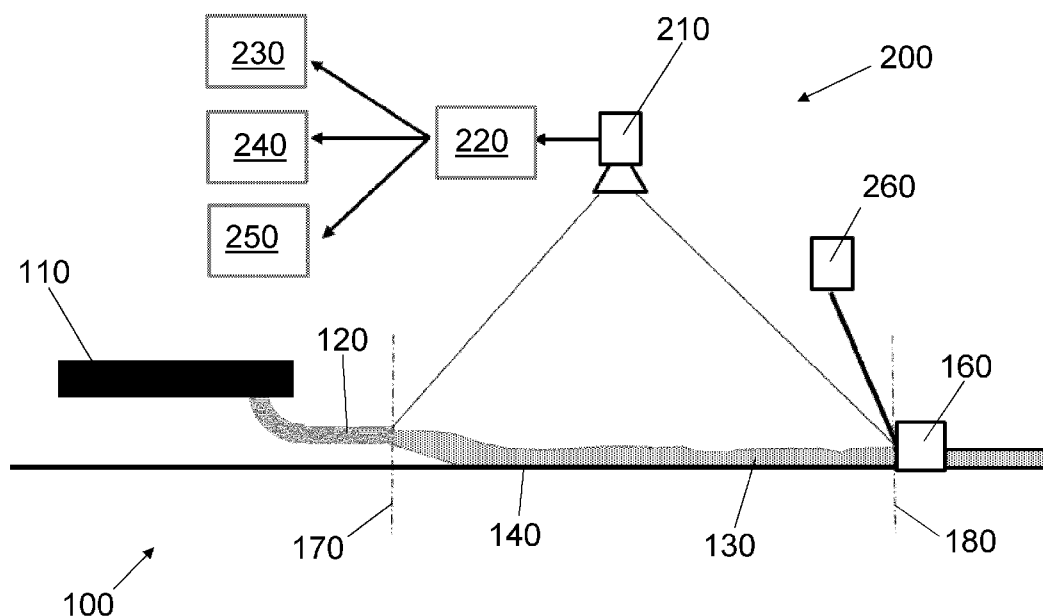


FIG. 2

(57) Abstract: The application describes a slurry spread quantification system (200) comprising a forming table including a forming area and at least one slurry outlet (120) configured to, in use, dispense a slurry (130) into the forming area, a sensor (210) trained on the forming area and configured to capture an image of the forming area; and a processor (220) operable to: analyse the image to identify the slurry (130); determine at least one characteristic of the slurry (130); and output at least one indication of the at least one characteristic of the slurry (130). A method, a computer implemented method and a non-transitory computer readable storage medium comprising instructions, that when executed on a computing device cause the computing device to control a system (200) as described are also discussed.

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A SLURRY SPREAD QUANTIFICATION SYSTEM AND A METHOD FOR QUANTIFYING A SLURRY SPREAD

Field of the Invention

5 The present invention relates to a slurry spread quantification system and method and finds particular, although not exclusive, utility in providing a stucco slurry spread quantification system capable of identifying a characteristic of a stucco slurry spread.

Background of the Invention

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Lightweight construction panels, such as plasterboard, (e.g. gypsum plasterboard) are commonly used to provide internal partitions in buildings. To provide a partition, it is typical to first construct a framework from wood, metal, or another suitable material, and affix sheets of plasterboard to the frame with screws or other fixings to provide a continuous partition surface. It is also known to affix said panels to solid walls, such as brick walls, to provide a more desirable finished surface. Said panels are typically used to construct walls and ceilings. Plasterboard is typically formed from a stucco slurry. Stucco and other additives are typically combined with water to form the slurry, which is then dried at elevated temperatures to form plasterboard.

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Typically, the stucco slurry is mixed and conveyed to a plasterboard forming table. A forming table conventionally includes slurry outlets that spread the slurry on to a moving sheet of paper. Another sheet of paper is provided from above and is applied to the slurry by a forming head that presses the paper onto the slurry and sets the thickness of the plasterboard. The plasterboard then typically travels along a production line away from the forming table to be cured, cut and distributed. Alternatively, other suitable materials could be used instead of paper sheets – for example one or both paper sheets could be replaced with glass fibre mats.

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30 It is desirable to provide consistency in both the properties of the slurry and the forming process so that the variability of the plasterboard produced is reduced. It is known to analyse the rheological properties of the stucco slurry via a slump test, wherein the rheology of the stucco slurry is tested by measuring a slump shape and/or subsidence of a cone-shaped volume of slurry after a support is removed.

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Slump tests may be undertaken every 2 hours.

However, although the slump test may provide, indirectly, some indication of the rheological properties of the stucco slurry, it does not provide any indication of a quality of the spread of the stucco slurry on the forming table of a plasterboard production line. Furthermore, the slump test is undertaken offline, which means that the result of the slump test may not be able to provide an indication of real-time process fluctuations.

It is also important to note that the results of any offline slump test relate to a static stucco slurry under no shear stress. However, on a plasterboard production line, the stucco slurry will be flowing from a mixer and, therefore, will be experiencing a level of shear stress. The influence of this shear stress on the observed rheology of the stucco slurry is not accounted for in offline slump tests. In addition, the offline slump test remains a qualitative method to assess the rheology of the stucco slurry, and the results of the offline tests are often observed to be operator dependent, reducing their reliability.

Typically, the quality of the stucco slurry spread on a plasterboard production line is estimated visually. Although operators may be trained to identify undesirable slurry spread characteristics visually, it is difficult to notice small changes in the slurry spread. Therefore, quality may drift unnoticed over time. Furthermore, different operators observing the stucco slurry spread may result in inconsistencies.

Accordingly, it is desirable to provide a slurry spread analysis or quantification system that is not susceptible to the above mentioned problems.

Objects and aspects of the present invention seek to alleviate at least these problems with prior known analysis systems and methods.

Summary of the Invention

According to a first aspect of the present invention, there is provided a slurry spread quantification system comprising: a forming table including a forming area and at least one slurry outlet configured to, in use, dispense a slurry into the forming area; a sensor trained on the forming area and configured to capture an image of the

forming area; and a processor operable to: analyse the image to identify the slurry; determine at least one characteristic of the slurry; and output at least one indication of the at least one characteristic of the slurry.

- 5 A key advantage of the present invention is that a characteristic of the slurry may be obtained immediately or shortly after the slurry has been spread. Accordingly, an undesirable spread may be identified based on the characteristic and corrected. Furthermore, use of the present invention may improve board quality. In particular, the present invention may be used to identify voids and other faults such as empty
- 10 edge boards. Determining the characteristic of the slurry may also be useful in optimising the slurry composition, for example by reducing the water content of a slurry to reduce drying time and the energy consumption associated with the drying process.
- 15 Preferably, the image is 1-dimensional. Alternatively, the image is 2-dimensional. Alternatively, the image is 3-dimensional. Where the characteristic to be determined from the image can be obtained from a 1-dimensional image, the image may be 1-dimensional, 2-dimensional or 3-dimensional. Where the image is 1-dimensional, it is preferred that the image would be captured along a line perpendicular to the
- 20 direction of movement of a sheet on to which the slurry is dispensed. Where the characteristic to be determined from the image can be obtained from a 2-dimensional image, the image may be 2-dimensional or 3-dimensional. Where the image is 2-dimensional, it is preferred that the image would be captured in a plane parallel to or perpendicular to the direction of movement of a sheet onto which the
- 25 slurry is dispensed.

- The slurry may be a construction slurry. A construction slurry may a slurry that is suitable for forming into a construction panel, such as plasterboard, cement board, or other board or panel used in the construction field. The slurry may be a stucco
- 30 slurry, which is typically used in the manufacture of plasterboard. Plasterboard may also be known as drywall, wallboard, sheet rock, gypsum board or similar. Stucco slurry typically comprises water and stucco. Additionally, stucco slurry may comprise one or more additives, such as starch, glass fibres, or other components known to provide beneficial properties to the plasterboard product. To form plasterboard, the
- 35 stucco in the stucco slurry may be hydrated and form a gypsum matrix. Stucco

slurry may not comprise cementitious material. During the manufacture of plasterboard, stucco slurry is typically spread onto a first sheet of paper, before a second sheet of paper is positioned on the stucco slurry. The present invention may be used to determine a characteristic of the stucco slurry spread before the second
5 sheet of paper is positioned. Alternatively, other suitable materials could be used instead of paper sheets – for example one or both paper sheets could be replaced with glass fibre mats.

The forming table may be an apparatus used to support the medium on to which the
10 slurry is being spread. The forming table may be a plasterboard forming table. Accordingly, the medium may be paper, glass fibre mats or other suitable sheet materials. The forming table may be used during a continuous production process. The forming area is an area or a portion of the forming table into or on to which the slurry outlet is configured to dispense slurry.

15 The slurry outlet may comprise a plurality of outlet apertures. Each of the outlet apertures may be configured to dispense slurry into a different portion of the forming area to each of the other outlet apertures. Additionally, each of the outlet apertures may be configured to dispense slurry with a different composition.

20 A roller and/or extruder may be provided in the forming area to further spread the slurry. A desirable spread may be a spread which covers a predetermined area of the medium onto which the slurry is spread before and/or after the slurry is further spread by the roller and/or extruder.

25 The sensor may comprise a visual light camera, an infrared light camera, an ultraviolet light camera and/or a laser sensor. In some instances, the slurry may be a similar colour to the medium onto which the slurry is spread. Accordingly, the processor may not be able to differentiate the slurry from the medium if the sensor is
30 a visual light camera. However, in said instances, the processor may be able to differentiate the slurry from the medium if the sensor comprises an infrared light camera, an ultraviolet camera and/or a laser sensor. As such, the choice of sensor may depend on inherent characteristics of the slurry and/or medium onto which the slurry is spread. The sensor may comprise an emitter configured to cooperate with
35 the visual light camera, the infrared light camera, the ultraviolet camera and/or the

laser sensor. For example, the sensor may comprise a visible white light emitter and a visual light camera.

5 The analysis of the image to identify the slurry may include analysing one or more of a shape, a colour, a contrast and/or a brightness of at least a portion of the image. In this way, the processor may be able to differentiate between the slurry and the medium onto which the slurry is spread. The processor may be configured to compare data acquired, in use, by the sensor with a predetermined dataset including data corresponding to allowable slurry spreads. Accordingly, the processor may be
10 operable to identify an undesirable slurry spread. The image analysis may be carried out offline and/or online.

The processor may take, as an input from a user or otherwise, a field of the image which is to be analysed, an area of the image including slurry only, an area of the
15 image including only the medium onto which the slurry is spread, and/or a field corresponding to the slurry outlet. The processor may be configured to identify the slurry and the medium onto which the slurry is spread within the field of the image that is to be analysed. The processor may also be configured to record slurry characteristics, such as colour or brightness. If the slurry outlet includes two or more
20 outlet apertures, the processor may be configured to identify a joining point at which slurry from a first outlet aperture meets slurry from a second outlet aperture. The processor may be configured to split the image along a line passing between two outlet apertures and the joining point. Alternatively, and/or additionally, the processor may be configured to split the image into two or more image portions
25 along a length of the forming area. The processor may be configured to calculate a slurry coverage ratio or percentage for each image portion. The processor may be configured to output the calculated ratios.

30 The at least one characteristic of the slurry may include one or more of an area, a depth, a shape, a width, a height, a velocity and/or a rheological property. For example, when producing plasterboard, a consistent area of slurry within a region of interest, a consistent slurry depth, a consistent shape, a consistent width, and a slurry with consistent rheological properties are all desirable. An inconsistency in the characteristic may be indicative of an undesirable slurry spread.

The processor may be configured to analyse the image with pixel characterisation to identify the slurry. The sensor may be configured to capture an image including a plurality of pixels. The processor may be configured to compare one or more pixels with one or more other pixels. Each pixel or cluster of pixels may be characterised into a group with other pixels determined to be similar. A first group of pixels may be attributed to the slurry and a second group of pixels may be attributed to the medium onto which the slurry is spread. A third group of pixels, and/or pixels not characterised into the first group or the second group, may be attributed to an inclusion and/or other foreign object.

The sensor may be configured to provide a continuous image feed. The processor may be configured to provide a continuously updating output. In this way, the at least one indication of the characteristic of the slurry may be output, and the slurry spread may be monitored, continuously. As such, fluctuations in the characteristic may be monitored and minimised. For example, a drift in the characteristic may indicate a drift in the rheological properties or the composition of the slurry.

The system may comprise a mixer. The mixer may be configured to mix ingredients to form the slurry. The mixer may be configured to provide the slurry to the at least one slurry outlet. The system may comprise a forming table vibration system. The processor may be further configured to control operation of the mixer and/or to control operation of the forming table vibration system. The processor may be configured to change at least one operation of the mixer and/or at least one operation of the forming table vibration system in response to the at least one indication falling outside of a predetermined acceptable range. In this way, the system may automatically correct an identified undesirable characteristic of the slurry spread.

Preferably, controlling operation of the mixer may include, but is not limited to, at least one of altering the composition of the slurry entering the mixer, altering the composition of slurry within the mixer, altering the density of a foam entering the mixer, altering the density of a foam before it enters the slurry that enters the mixer, and altering the speed of a rotor within the mixer.

Preferably, controlling operation of the forming table vibration system may include, but is not limited to, altering the frequency of vibrations and/or altering the amplitude of vibrations.

- 5 Any envisaged alteration may be made alone or in combination with any number of additional alterations.

The processor may be configured to effect a continuous change in operation of the mixer and/or the forming table vibration system. A continuous change may be a gradual change. A continuous change may mean that the processor does not effect
10 a significant change in operation of the mixer and/or the forming table vibration system in a relatively short time. Significant changes in operation of the mixer and/or forming table vibration system may be effected over a relatively long time. Accordingly, the processor may not cause a significant change in the characteristic of the slurry spread in a relatively short time.

15 The processor may be configured to calculate a sum of or average of the at least one indication over a predetermined time period. The processor may be configured to change operation of the mixer and/or the forming table vibration system in response to the sum of or average of the at least one indication over the
20 predetermined time period falling outside of a predetermined acceptable range. Accordingly, a one off or otherwise isolated undesirable characteristic identification may not result in a change in operation. The average may be the mean, median or mode of the at least one indication.

25 The processor may be configured to identify a desired change in the at least one characteristic. The processor may be configured to consult a predetermined list of mixer operation changes and/or forming table vibration system operation changes and corresponding changes in the at least one characteristic. The processor may be configured to identify a predetermined mixer operation change and/or a
30 predetermined forming table vibration system operation change which causes a corresponding change in the at least one characteristic that is similar to the desired change in the at least one characteristic. The processor may be configured to change at least one operation of the mixer according to the identified predetermined mixer operation change. The processor may be configured to change at least one
35 operation of the forming table vibration system according to the identified

predetermined forming table vibration system operation change. The processor may be configured to carry out each of the above steps in order to improve or otherwise change the operation of the mixer and/or the forming table vibration system in order to produce a more desirable slurry spread. In this way, the processor may be configured to automatically correct an identified at least one characteristic.

An upper and/or lower threshold value may be provided for the acceptable level of the indication of the at least one characteristic of the slurry. Operation of the mixer and/or the forming table vibration system may be changed if the value exceeds or falls below the upper or the lower threshold value respectively. Fluctuation within the predetermined acceptable threshold values may not effect a change in operation. A tolerance may be applied to predetermined acceptable values.

The system may be configured to alter an amount of water, a fluidizer, a retarder, an accelerator, stucco, and/or other additives or ingredients within the slurry. A predetermined range may be provided for acceptable range of values of each ingredient. The system may be configured to change operation of the mixer by changing the amount of any or each ingredient within its predetermined acceptable range of values.

There may be a delay between changing operation of the mixer and/or the forming table vibration system and detecting the results of change in operation. Accordingly, the system may not make a second change to the operation of the mixer and/or the forming table vibration system immediately or within a specified time period after a first change to the operation of the mixer and/or the forming table vibration system.

The processor may be configured to amend the predetermined list of mixer operation changes and/or forming table vibration system operation changes to add new entries including mixer operation changes and/or forming table vibration system operation changes and corresponding changes in the at least one characteristic identified through use of the system. The processor may be configured to delete entries which include mixer operation changes and/or forming table vibration system operation changes where the measured corresponding change in the at least one characteristic differs from the corresponding change in the at least one characteristic

included in the predetermined list. In this way, the processor may be configured to learn and improve operation of the system through use.

Analysis steps described herein may form part of a neural network. The neural network may be periodically retrained. The retraining may comprise manual or user amendment of the predetermined list of mixer operation changes. Alternatively and/or additionally, the analysis steps described herein may form part of a machine learning, regression fitting and/or deep learning process.

The system may be in communication with at least one other slurry spread quantification system. Each slurry spread quantification system may make use of a single predetermined list of mixer operation changes and/or forming table vibration system operation changes. Accordingly, the neural network may extend to a plurality of slurry spread quantification systems. In this way, the operation of the systems may be refined more quickly and/or more extensively. The plurality of slurry spread quantification systems may be arranged, in use, in a single geographic region. Ingredients may differ in each geographic region. Accordingly, an identified change in mixer operation and/or forming table vibration system operation in one geographic region may not be applicable to another geographic region.

The processor may be configured to analyse a first portion of the image separately from a second portion of the image. The first portion may be a first half of the image and the second portion may be a second half of the image. The first and second halves may be longitudinal halves. Accordingly, the two halves may be separated by a line running centrally along the forming area away from the slurry outlet.

The processor may be configured to analyse a third portion of the image separately from the first and second portions. It is to be appreciated that the processor may be configured to analyse any number of separate portions.

The processor may be configured to compare the at least one characteristic of the first portion to the at least one characteristic of the second portion to identify a difference between the first portion and the second portion. The at least one identifier may include a value related to the identified difference between the first portion and the second portion. The processor may be configured to identify a

symmetry between the first portion and the second portion. The processor may be configured to output a value indicative of the identified symmetry.

5 The system may find particular utility in the testing and analysis of new slurry outlet designs. For example, the system may be used as a tool for quantifying different slurry outlet spout designs during research and development. The system may be used to quantify an amount of slurry exiting each of the slurry outlet spouts. The system may be used to optimize the slurry outlet geometries to improve the slurry spread on the forming table. Furthermore, the system may be used to optimize
10 forming table designs.

The system may further comprise a display. The display may be configured to display the at least one indication of the at least one characteristic of the slurry. The display may be configured to display historical indications of the at least one
15 characteristic of the slurry. The display may be configured to display changes made to the operation of the mixer.

According to a second aspect of the present invention, there is provided a method for quantifying a slurry spread with the slurry spread quantification system of the first
20 aspect of the present invention, the method comprising the steps: dispensing slurry into the forming area; capturing, by the sensor, an image of the forming area; analysing, by the processor, the image to identify the slurry; determining, by the processor, at least one characteristic of the slurry; and outputting, by the processor, at least one indication of the at least one characteristic of the slurry.

25 Preferably, the slurry is identified by differentiating it from the medium on to which the slurry is spread.

According to a third aspect of the present invention, there is provided a computer
30 implemented method for controlling a system according to the first aspect of the present invention.

According to a fourth aspect of the present invention, there is provided at least one non-transitory computer readable storage medium comprising instructions, that when

executed on a computing device cause the computing device to control a system according to the first aspect of the present invention.

It is to be understood that each and/or any feature and/or advantage associated with the first aspect of the present invention may also be included and/or apply to each and/or any of the second, third and fourth aspects of the present invention.

Although some aspects of the present invention are described herein in relation to stucco slurry spreading, it is to be understood that the present invention also finds utility in other fields, such as in the production of foodstuffs. For example, the present invention may find utility in a jam or cream spreading process. Furthermore, the present invention finds utility in the production of cement board.

Detailed Description

An embodiment of the present invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Figure 1 is a schematic plan view of stucco slurry spreading apparatus; and

Figure 2 is a schematic side view of the stucco slurry spreading apparatus shown in Figure 1 along with a slurry spread quantification system.

Figure 1 is a schematic plan view of stucco slurry spreading apparatus 100. The apparatus 100 includes a mixer 110 configured to mix ingredients into a slurry. The mixer 110 includes two slurry outlets 120 configured to dispense slurry 130 onto a moving sheet of paper 140. Other numbers of slurry outlets 120 are envisaged. The paper 140 moves away from the mixer 110, from left to right in the view shown in Figure 1, and forms one surface of the final plasterboard product. The mixer 110 may be a continuous mixer such that ingredients are continually or periodically introduced into the mixer and slurry is continually dispensed from the mixer 110.

Due to the inherent viscosity of the slurry 130, the slurry 130 flattens and spreads over time on the paper 140. Accordingly, the area of the slurry 130, seen from the plan view as shown in Figure 1, increases as it moves away from the mixer 110 and

has more time to spread when compared to slurry 130 that has more recently been dispensed.

5 The slurry 130 from each of the two slurry outlets 120 eventually spreads enough to meet the slurry of the other slurry outlet 130 at a meet point 150. The slurry from each of the two slurry outlets 120 then forms a single slurry 130 mass that continues to spread over the paper 140 and increase in area, in the view shown in Figure 1.

10 The slurry 130 may have a non-uniform depth or other undesirable spread characteristic. The slurry 130 and paper 140 pass through or by an extruder 160, which is configured to flatten the slurry 130 to a uniform and predetermined depth corresponding to the desired thickness of the plasterboard product.

15 The slurry 130 characteristics and the slurry 130 spread characteristics in the region between the slurry outlets 120 and the extruder 160 may be of interest. Accordingly, a slurry spread quantification system, as shown in Figure 2, may be provided to analyse the slurry 130 in the region bounded by lines 170, 180 aligned with outlet apertures of the two slurry outlets 120 and the entrance to the extruder 160 respectively. However, it is also envisaged that slurry 130 spread characteristics in the region downstream of the extruder 160 may be of interest. In such
20 embodiments, the extruder 160 is located within the forming area.

Figure 2 is a schematic side view of the stucco slurry spreading apparatus 100 shown in Figure 1 along with a slurry spread quantification system 200. The slurry
25 spread quantification system 200 includes a camera 210 configured to capture a video feed of the slurry 130 and paper 140 between the lines 170, 180 bounding the region of interest. The camera 210 is configured to provide the video feed to a processor 220.

30 The processor 220 is configured to analyse the video feed from the camera 210 to determine a characteristic of the slurry 130 and/or a characteristic of the slurry 130 spread. For example, the processor 220 may be configured to determine an area of the slurry 130 and an area of the paper 140 within the region of interest, and output a value corresponding to the percentage of the paper 140 that is covered by the slurry
35 130. Other characteristics are envisaged.

The processor 220 may be configured to carry out a number of analysis steps in order to provide the value corresponding to the percentage of the paper 140 that is covered by the slurry 130. The processor 220 may be configured to receive, as an input from a user, a field of the video related to a region of interest, a field of the video including paper 140 only, a field of the video including slurry 130 only, and a field of the video related to the slurry outlets 120. The field of the video related to the slurry outlets 120 may be a field of the video that has a width equal to the width of the slurry outlets 120 and a length which is sufficient to include the meet point (not shown in Figure 2).

The processor 220 may then, via pixel characterisation or any other analysis technique, determine areas within the field of the video related to the region of interest that corresponds to the paper 140 and to the slurry 130. If pixel characterisation is used, the processor 220 may identify pixels which are similar to the pixels within the field of the video including slurry 130 only and determine said pixels include slurry, and identify pixels which are similar to the pixels within the field of the video including paper 140 only and determine said pixels include paper. The processor 220 may then be able to calculate a total percentage area, within the region of interest, of the paper 140 that is covered by slurry 130.

In addition, the processor 220 may be configured to split the video feed images into portions and analyse each portion separately. Each image may be split into two halves, along a line bisecting the two slurry outlets 120 and the meet point (not shown in Figure 2), and a symmetry between the two halves assessed.

The processor 220 is configured to provide information, such as the value corresponding to the percentage of the paper 140 that is covered by the slurry 130, to a display 230. The display 230 may show the information in a graph or otherwise.

The processor 220 is also configured to provide information, such as the value corresponding to the percentage of the paper 140 that is covered by the slurry 130, to an automation system 240. The automation system 240 may control operation of the mixer 110 as described above. The automation system 240 may control operation of the mixer 110 in response to the information provided by the processor

220. For example, if the area of the paper 140 covered by the slurry 130 is lower than a predetermined acceptable range, the mixer 110 may be operated to add more water and/or fluidizer to the slurry to decrease viscosity.

- 5 The processor 220 is also configured to provide information, such as the value corresponding to the percentage of the paper 140 that is covered by the slurry 130, to a supervision system 250. The supervision system 250 may allow a user to supervise production.
- 10 A laser sensor 260 is also provided and is configured to measure a spread characteristic, such as a depth, of the slurry 130 at the entrance to the extruder 160. The laser sensor 260 may provide measurements or other information to the processor 220.

CLAIMS

1. A slurry spread quantification system comprising:
 - a forming table including a forming area and at least one slurry outlet
 - 5 configured to, in use, dispense a slurry into the forming area;
 - a sensor trained on the forming area and configured to capture an image
 - of the forming area; and
 - a processor operable to:
 - analyse the image to identify the slurry;
 - 10 determine at least one characteristic of the slurry; and
 - output at least one indication of the at least one characteristic of
 - the slurry.
2. The slurry spread quantification system of claim 1, wherein the analysis of the
- 15 image to identify the slurry includes analysing one or more of a shape, a
- colour, a contrast and/or a brightness of at least a portion of the image.
3. The slurry spread quantification system of claim 1 or claim 2, wherein the at
- least one characteristic of the slurry includes one or more of an area, a depth,
- 20 a shape, a width, a velocity and/or a rheological property
4. The slurry spread quantification system of any preceding claim, wherein the
- sensor is configured to provide a continuous image feed, and the processor is
- configured to provide a continuously updating output.
- 25 5. The slurry spread quantification system of any preceding claim, wherein the
- system comprises a mixer configured to mix ingredients to form the slurry and
- provide the slurry to the at least one slurry outlet and/or a forming table
- vibration system, and wherein the processor is further configured to control
- 30 operation of the mixer and/or the forming table vibration system.
6. The slurry spread quantification system of claim 5, wherein in response to the
- at least one indication falling outside of a predetermined acceptable range
- the processor is configured to change at least one operation of the forming
- 35 table vibration system and/or operation of the mixer.

7. The slurry spread quantification system of claim 6, wherein the processor is configured to effect a continuous change in operation of the mixer and/or the forming table vibration system.

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8. The slurry spread quantification system of claim 6 or claim 7, wherein the processor is configured to calculate a sum of or average of the at least one indication over a predetermined time period and change operation of the mixer and/or the forming table vibration system in response to the sum of or average of the at least one indication over the predetermined time period falling outside of a predetermined acceptable range.

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9. The slurry spread quantification system of any one of claims 6 to 8, wherein the processor is configured to:

15

identify a desired change in the at least one characteristic;
consult a predetermined list of mixer operation changes and/or forming table vibration system operation changes and corresponding changes in the at least one characteristic;

20

identify a predetermined mixer operation change and/or a predetermined forming table vibration system operation change which causes a corresponding change in the at least one characteristic that is similar to the desired change in the at least one characteristic; and

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change at least one operation of the mixer according to the identified predetermined mixer operation change and/or change at least one operation of the forming table vibration system according to the identified predetermined forming table vibration system operation change.

30

10. The slurry spread quantification system of claim 9, wherein the processor is configured to amend the predetermined list of mixer operation changes and/or the predetermined list of forming table vibration system changes to add new entries including mixer operation changes and/or forming table vibration system operation changes and corresponding changes in the at least one characteristic identified through use of the system, and/or delete

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entries which include mixer operation changes and/or forming table vibration system operation changes where the measured corresponding change in the at least one characteristic differs from the corresponding change in the at least one characteristic included in the predetermined list.

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11. The slurry spread quantification system of any preceding claim, wherein the processor is configured to analyse a first portion of the image separately from a second portion of the image.

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12. The slurry spread quantification system of claim 11, wherein the processor is configured to compare the at least one characteristic of the first portion to the at least one characteristic of the second portion to identify a difference between the first portion and the second portion, and the at least one identifier includes a value related to the identified difference between the first portion and the second portion.

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13. A method for quantifying a slurry spread with the slurry spread quantification system of any preceding claim, the method comprising the steps:
dispensing slurry into the forming area;
capturing, by the sensor, an image of the forming area;
analysing, by the processor, the image to identify the slurry;
determining, by the processor, at least one characteristic of the slurry; and
outputting, by the processor, at least one indication of the at least one characteristic of the slurry.

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14. Computer implemented method for controlling a system according to any of claims 1 to 12.

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15. At least one non-transitory computer readable storage medium comprising instructions, that when executed on a computing device cause the computing device to control a system according to any of claims 1 to 12.

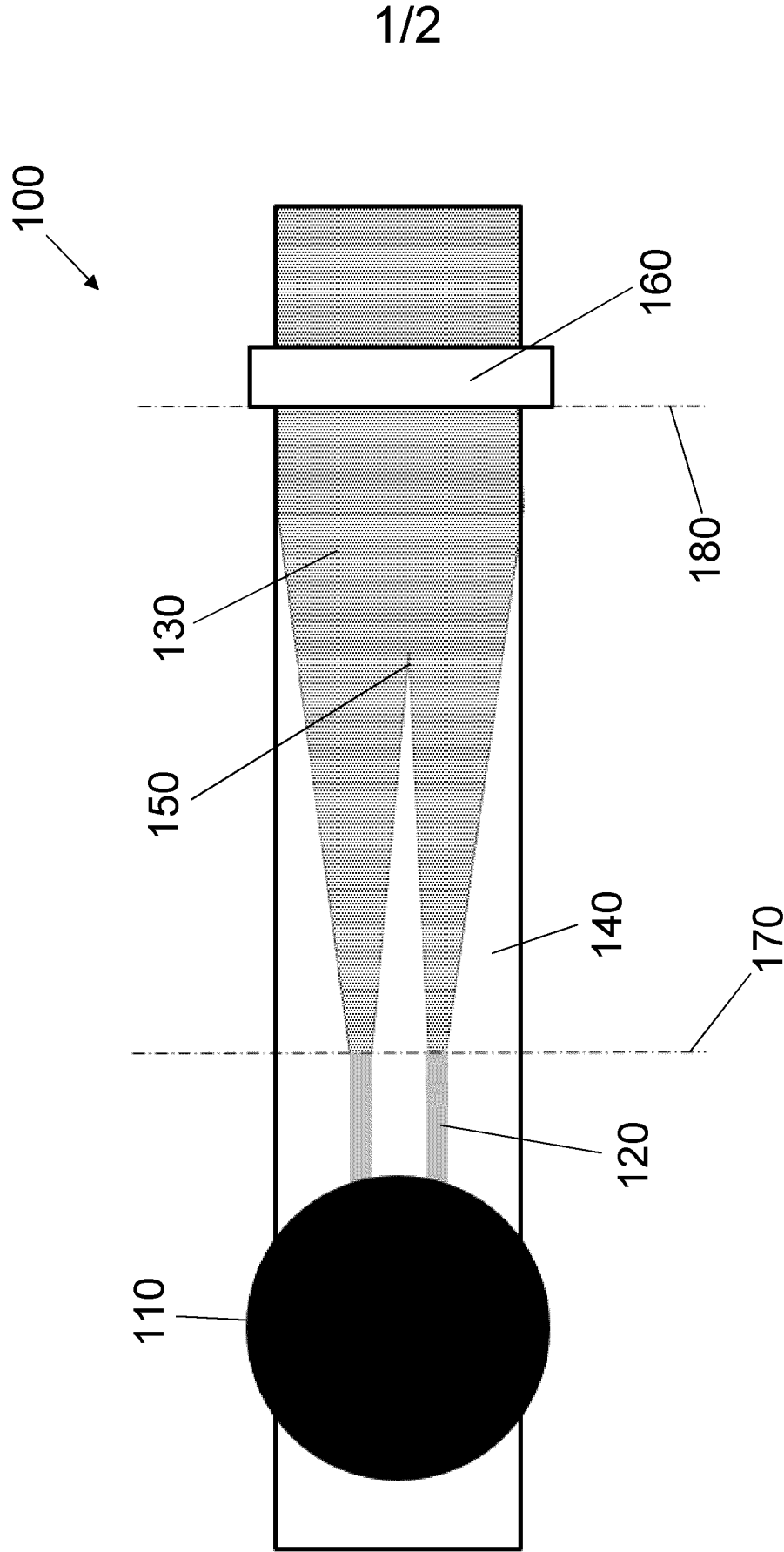


FIG. 1

2/2

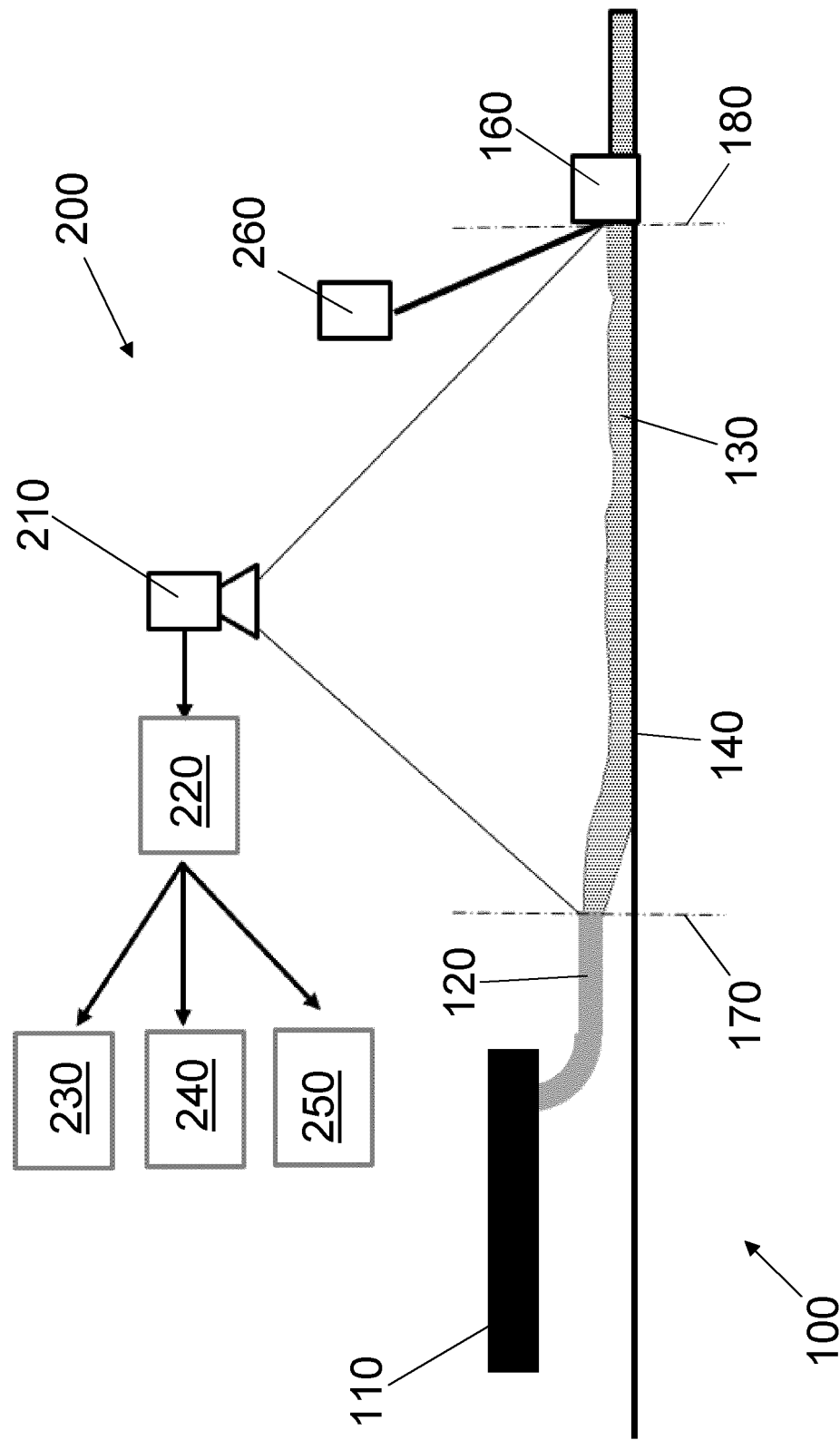


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2021/073937

A. CLASSIFICATION OF SUBJECT MATTER INV. B28B17/00 B28B19/00 B28B5/02 G06T7/00 G01B11/06 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) B28B G01B G06T G01N Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
29 November 2021		09/12/2021
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Papakostas, Ioannis

INTERNATIONAL SEARCH REPORT

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