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(54) **A METHOD AND A ROBOTIC DEVICE FOR APPLYING PLASTER MASS**

(57) A method for applying plaster mass, the method comprising: providing a plastering platform with a movable plastering nozzle (1) configured to apply the plaster mass onto a wall; positioning the plastering nozzle (1) such that its axis is perpendicular to a plane of the wall; and moving the plastering nozzle (1) in a plane parallel to the plane of the wall, by performing successive movements in a vertical direction upwards and downwards, thereby applying vertical stripes of the plaster mass onto the wall.

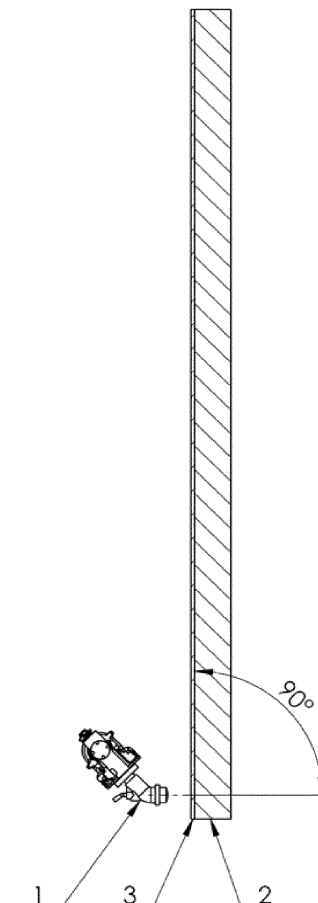


Fig. 1

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Description

BACKGROUND

[0001] The present invention relates to a method for applying plaster mass, suitable in particular while performing semi-automatic, automatic or autonomous plastering processes.

TECHNICAL FIELD

[0002] The application of a plaster mass in a wall plastering process is usually performed manually by a skilled plasterer using a plastering machine (e.g. a plaster pump) with a plastering nozzle. The plasterer applies a plaster mass on the wall in horizontal stripes, then distributes the plaster horizontally by means of dedicated tools, and successively levels the surface by movements of a leveling tool in various directions.

[0003] There are also known solutions for semi-automatic wall plastering. In these solutions the process of wall rendering is similar to manual rendering. Horizontal stripes of the plaster mass are applied, and next the mass is distributed and leveled by performing vertical movements of a tool (a derby float). Due to specific properties of the plaster mass, the resulting plaster covering of the wall may depart from desired quality requirements.

SUMMARY OF THE INVENTION

[0004] Due to the need to automate construction processes, including the plastering process, while ensuring compliance with quality standards, there is a need to develop a method for applying the plaster mass that is suitable for semi-automatic as well as automatic or autonomous plastering processes, and allows to meet the desired quality requirements of the final wall surface. Therefore, there is a need to develop an alternative method for applying the plaster mass on a wall.

[0005] The object of the present invention is a method for applying plaster mass, the method comprising: providing a plastering platform with a movable plastering nozzle configured to apply the plaster mass onto a wall; positioning the plastering nozzle such that its axis is perpendicular to a plane of the wall; and moving the plastering nozzle in a plane parallel to the plane of the wall, by performing successive movements in a vertical direction upwards and downwards, thereby applying vertical stripes of the plaster mass onto the wall.

[0006] Such method provides high quality of the resulting work product. As compared to prior art methods, wherein the plaster mass is applied first in a horizontal direction, and then the horizontally applied mass is leveled by moving a distributing tool in the vertical direction, the present invention allows to reduce fluctuations in geometric uniformity of the plaster on the wall surface, namely the resulting surface is less wavy in the vertical direction. This is because even if the applied plaster mass

is of variable hydration, the alternately applied (upwards and downwards) vertical stripes of the plaster mass are adjacent to each other vertically and therefore the mass is more uniform in adjacent stripes. Consequently, the leveling tool (a derby float) is not subject to variable load (which could result from variable properties of plaster mass applied in horizontal stripes) while performing the leveling along vertical stripes.

[0007] The method may further comprise moving the plastering nozzle between applying successive stripes such as to apply the plaster mass along a semicircle as the plastering nozzle changes direction of movement between upward and downward direction between successive stripes. This ensures the continuity of the rendering of subsequent plastered areas after the plastering platform is moved to the next position, elimination of the joints of the mass braids, and limited quality defects at the connection points of individual areas.

[0008] The method may further comprise adjusting a linear velocity of the plastering nozzle depending on a desired thickness of the plaster mass layer to be applied on the wall. In this way, it is possible to control the thickness of the mass with a constant performance of the plastering nozzle.

[0009] The method may comprise modifying a linear velocity of the plastering nozzle in real time. This is beneficial if information concerning the wall surface (such as its unevenness, recesses, convexities) is available (e.g. collected during the scanning of the plastered room) - then, it is possible to properly plan the speed of the plastering nozzle at each point, so that, for example, in places of recess, the nozzle speed can be reduced to apply more plaster mass at these places. As a result, during further smoothing, a more even surface is obtained (without the tendency to indentations and convexities).

[0010] The method may further comprise adjusting an angle of inclination the axis of the plastering nozzle with respect to the plane of the wall during the application of the plaster mass at corners of the wall. This allows a desired amount of plaster mass to be applied to surfaces that are more difficult to access, in case of the default perpendicular positioning of the plastering nozzle axis with respect to the wall.

[0011] The method may further comprise, after the plaster mass is applied onto the wall, distributing the plaster mass by a distributing tool by performing vertical movements of the distributing tool. This allows to maintain continuity and constant geometry of the plastering coating.

[0012] The method may further comprise, after the plaster mass is distributed in the vertical direction by means of the distributing tool, smoothing the plaster mass surface by means of the distributing tool by performing horizontal movements of the distributing tool. This allows to further reduce potential variations in smoothness of the wall surface.

BRIEF DESCRIPTION OF DRAWINGS

[0013] The invention is shown by means of example embodiments on a drawing, in which:

Fig. 1 presents schematically application of a plaster mass in a side view;

Fig. 2 presents schematically application of a plaster mass in a front view;

Fig. 3 presents schematically a change of the position of the plastering nozzle at corners of a wall in a side view;

Fig. 4 presents schematically distribution and application of the plaster mass in a side view, during a vertical movement downwards;

Fig. 5 presents schematically distribution and application of the plaster mass in a front view, during a vertical movement downwards;

Fig. 6 presents schematically distribution and application of the plaster mass in a side view, during a vertical movement upwards;

Fig. 7 presents schematically distribution and application of the plaster mass in a front view, during a vertical movement upwards.

DETAILED DESCRIPTION

[0014] The following detailed description is of the best currently contemplated modes of carrying out the invention. The description is not to be taken in a limiting sense but is made merely for the purpose of illustrating the general principles of the invention.

[0015] The method as presented herein may be used for a semi-automatic plastering process, wherein robotic plastering tools operated by an operator are used, wherein the operator is responsible, i.a. for proper positioning of the plastering unit with respect to the wall and for moving the unit to the subsequent working positions of the device. The method as presented herein can be also used for an automatic or autonomous plastering process, wherein robotic plastering devices are used that are able to independently (autonomously) move around the room being plastered and to start and finish work in subsequent working positions. Consequently, the invention also relates to a robotic plastering device having a plastering platform with a movable plastering nozzle configured to automatically or autonomously apply the plaster mass onto a wall according to the method as described herein. The operation of the robotic device may be effected by means of a pre-programmed controller configured to control movements of the plastering nozzle according to a predefined program (to provide automatic operation) or according to autonomous operation algorithms (to provide autonomous operation).

[0016] The method utilizes a plaster mass prepared in a standard plastering unit. The plaster mass can be prepared in a batch or can be prepared in a continuous process, wherein the hydration of the mass (and therefore its

properties) may vary.

[0017] The method may utilize various types of known semi-automatic or automatic plastering platforms, equipped with a movable plastering nozzle 1 for applying the plaster mass. The nozzle 1 can be mounted at an end of a lance. The plastering nozzle 1 has a slot-like output that applies the plaster mass onto the wall in a form of a stripe having a width dependent on the width of the slot of the nozzle and the distance between the nozzle and the wall.

[0018] The plastering nozzle 1 is positioned so that its axis is perpendicular to a wall 2 to be plastered. The axis of the nozzle is considered to be the axis along which the plaster mass is expelled from the nozzle, i.e. the axis of the opening of the nozzle. The plastering nozzle 1 is moved over a plane parallel to the wall 2. This movement is performed in a vertical direction upwards and downwards, applying vertical stripes of the plaster mass 3. The width of the applied plaster stripe (measured between points wherein the thickness of the plaster is at least 50% of the thickness of the plaster in the center of the stripe) can be from 50 to 150 mm. When changing the direction of movement, the plastering nozzle 1 can be moved along a semicircle 4, while maintaining a constant linear velocity (any differences in the thickness of the applied mass between an inner and an outer side of the arc will be leveled during the subsequent stage of distributing the mass). The distance between subsequent vertical stripes of the render depends on the properties of the plaster mass, the diameter of the plastering nozzle 1, and the distance between the nozzle and the wall. The linear velocity of the nozzle is adjusted based on the required thickness of the mass and can be modified in real time.

[0019] When applying the mass in wall corners (such as wall - wall, wall - ceiling, wall - floor corners), the angle of the axis of the plastering nozzle 1 can be modified with respect to the plastered wall in order to accurately render the corner spot, as shown in Fig. 3. In particular, the plastering nozzle 1 is inclined with respect to the default direction perpendicular to the plane of the wall (as shown in Fig. 1) by an angle β ranging up to 40 degrees.

[0020] After the rendering process is completed, the plaster mass is distributed using a dedicated distributing tool 5, in a vertical direction upwards 6 and downwards 7, along the line of application of the plaster mass by means of the plastering nozzle 1. Using the distributing tool 5, it is possible to make subsequent vertical passes from the bottom upwards (as in Figs. 4 and 5) or from the top downwards direction (as in Figs. 6 and 7) or in alternately upwards and downwards. The distributing tool 5 (for example, a derby float) may have a width several times greater than the width of the applied plaster stripes. For example, it may have a width from 0.5 m to 2 m. Thereafter, it is possible to additionally smoothen the mass by using a horizontal movement of the distributing tool 5 along the same direction or alternating directions.

First example - semi-automatic application

[0021] A gypsum plaster mass is prepared (the method can be used equivalently with a cement-lime or lime mass). The mass is applied semi-automatically by an operator, who is responsible for appropriate positioning of the plastering unit in relation to the wall and for installing and cleaning the derby float. Then the mass is applied by means of a plastering nozzle positioned at a distance of 120 mm from the wall, by moving the nozzle at a speed of 300-600 mm/s and applying the stripes having a thickness of 7-15 mm and a width of 75 mm. Thus, the plaster is applied over the entire surface of the wall. In the corners, the operator positions the nozzle at an angle between 0 and 40° so that the mass can be applied. Then, the applied mass is distributed and evened using a dedicated distributing tool (such as a derby float having a width of 800 mm), making alternating movements upwards and downwards. The wall is smoothened once, and then, additionally, a horizontal movement of a derby float with alternating directions is applied. Such process allows to obtain a plastered wall having parameters that meet construction standards.

Second embodiment - automatic application

[0022] A cement-lime plaster mass is prepared (the method can be used equivalently with gypsum or lime mass). The mass is applied automatically (without the help of the operator) by a unit that positions itself autonomously with respect to the plastered wall. The mass is automatically applied by means of a plastering nozzle set at a distance of 150 mm from the wall, by moving the nozzle at a speed of 300-600 mm/s and applying the stripes having a thickness of 7-15 mm and a width of 75 mm. Thus, the plaster is applied over the entire surface of the wall. In the corners, the nozzle is automatically set at an angle between 0 and 40° so that the mass can be applied. Then, the applied mass is automatically distributed and smoothened using a dedicated distributing tool (such as a derby float having a width of 800 mm), making alternating movements upwards and downwards. The wall is smoothened once, and then, additionally, a horizontal movement of the derby float with alternating directions is applied. Such process allows to obtain a plastered wall having parameters that meet construction standards.

[0023] While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications and other applications of the invention may be made. Therefore, the claimed invention as recited in the claims that follow is not limited to the embodiments described herein.

Claims

1. A method for applying plaster mass, the method

comprising:

- providing a plastering platform with a movable plastering nozzle (1) configured to apply the plaster mass onto a wall;
- positioning the plastering nozzle (1) such that its axis is perpendicular to a plane of the wall; and
- moving the plastering nozzle (1) in a plane parallel to the plane of the wall, by performing successive movements in a vertical direction upwards and downwards, thereby applying vertical stripes of the plaster mass onto the wall.

2. The method according to claim 1, further comprising moving the plastering nozzle (1) between applying successive stripes such as to apply the plaster mass along a semicircle as the plastering nozzle (1) changes direction of movement between upward and downward direction between successive stripes.
3. The method according to any of previous claims, further comprising adjusting a linear velocity of the plastering nozzle (1) depending on a desired thickness of the plaster mass layer to be applied on the wall.
4. The method according to any of previous claims, comprising modifying a linear velocity of the plastering nozzle (1) in real time.
5. The method according to any of previous claims, further comprising adjusting an angle of inclination the axis of the plastering nozzle (1) with respect to the plane of the wall during the application of the plaster mass at corners of the wall.
6. The method according to any of previous claims, further comprising, after the plaster mass is applied onto the wall, distributing the plaster mass by a distributing tool (5) by performing vertical movements of the distributing tool (5).
7. The method according to claim 6, further comprising, after the plaster mass is distributed in the vertical direction by means of the distributing tool (5), smoothing the plaster mass surface by means of the distributing tool (5) by performing horizontal movements of the distributing tool (5).
8. A robotic plastering device comprising a plastering platform with a movable plastering nozzle (1) configured to apply the plaster mass onto a wall by the method according to any of previous claims.

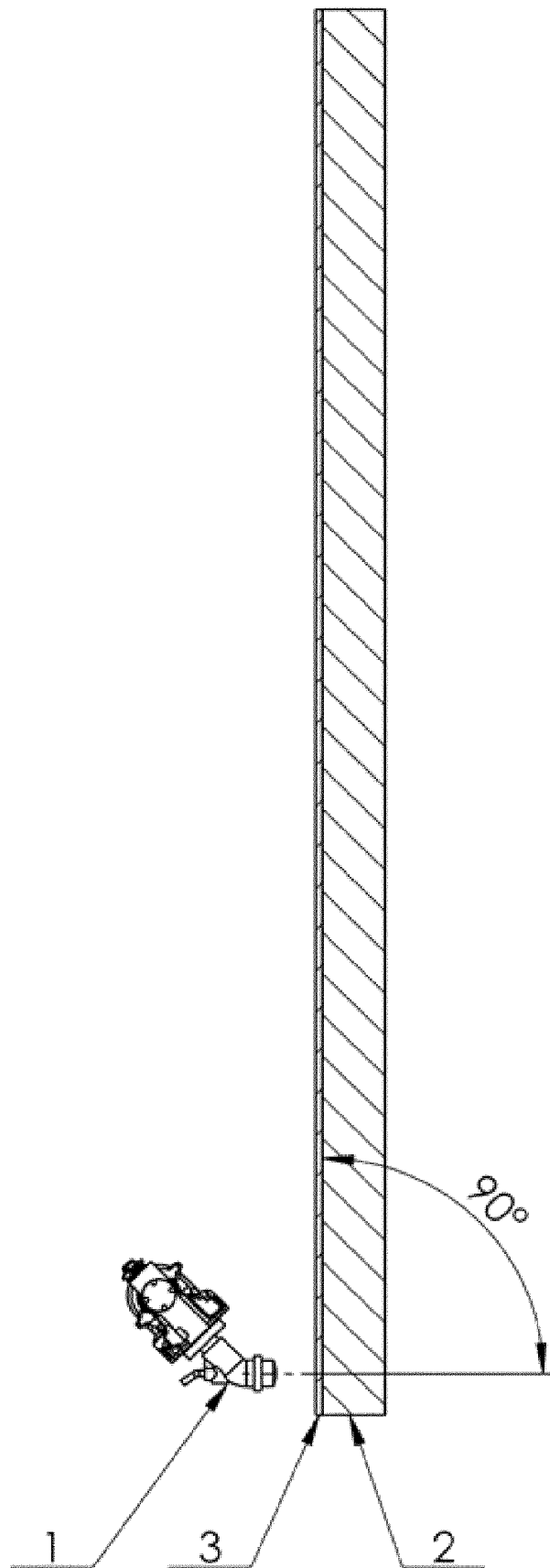


Fig. 1

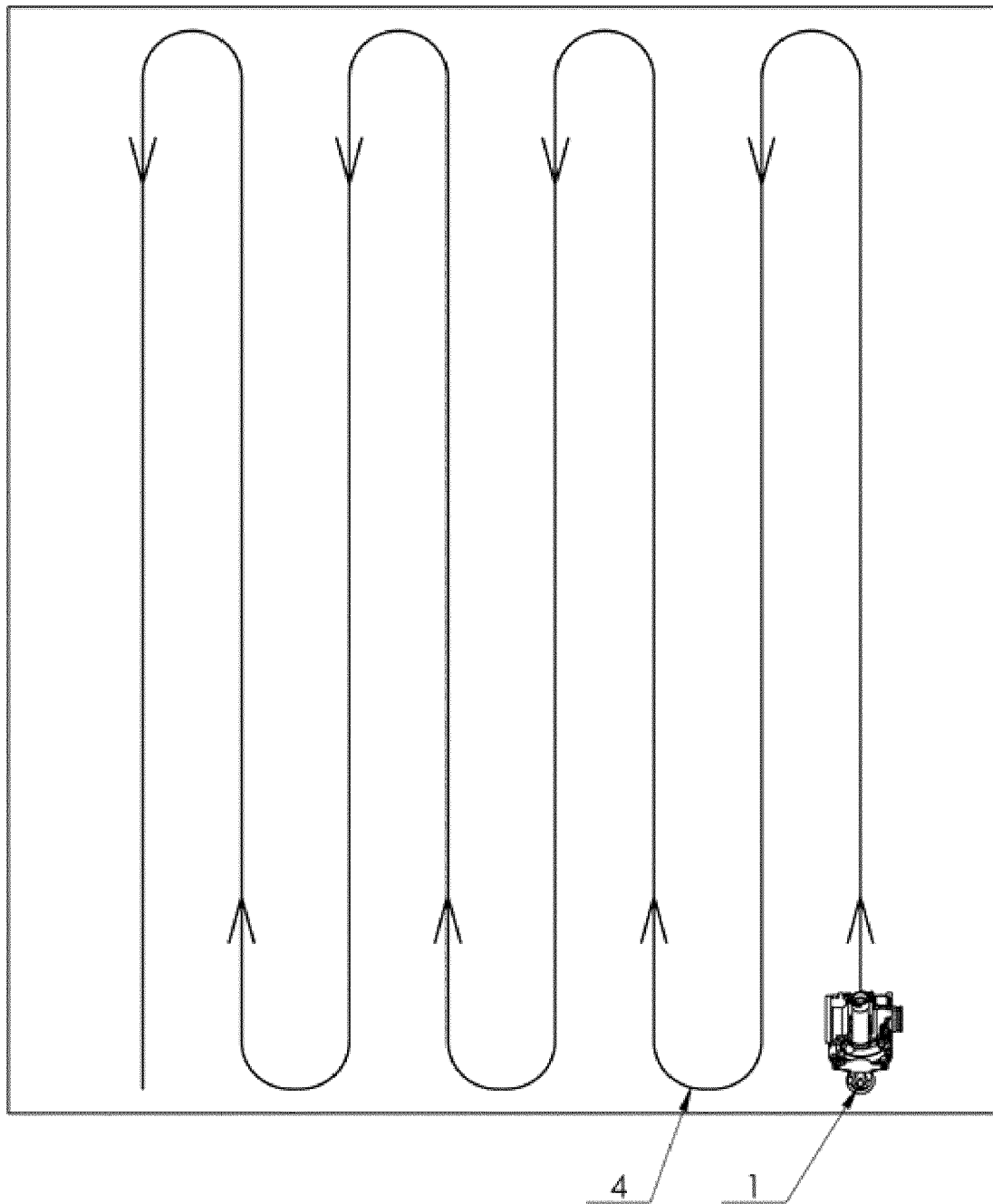


Fig. 2

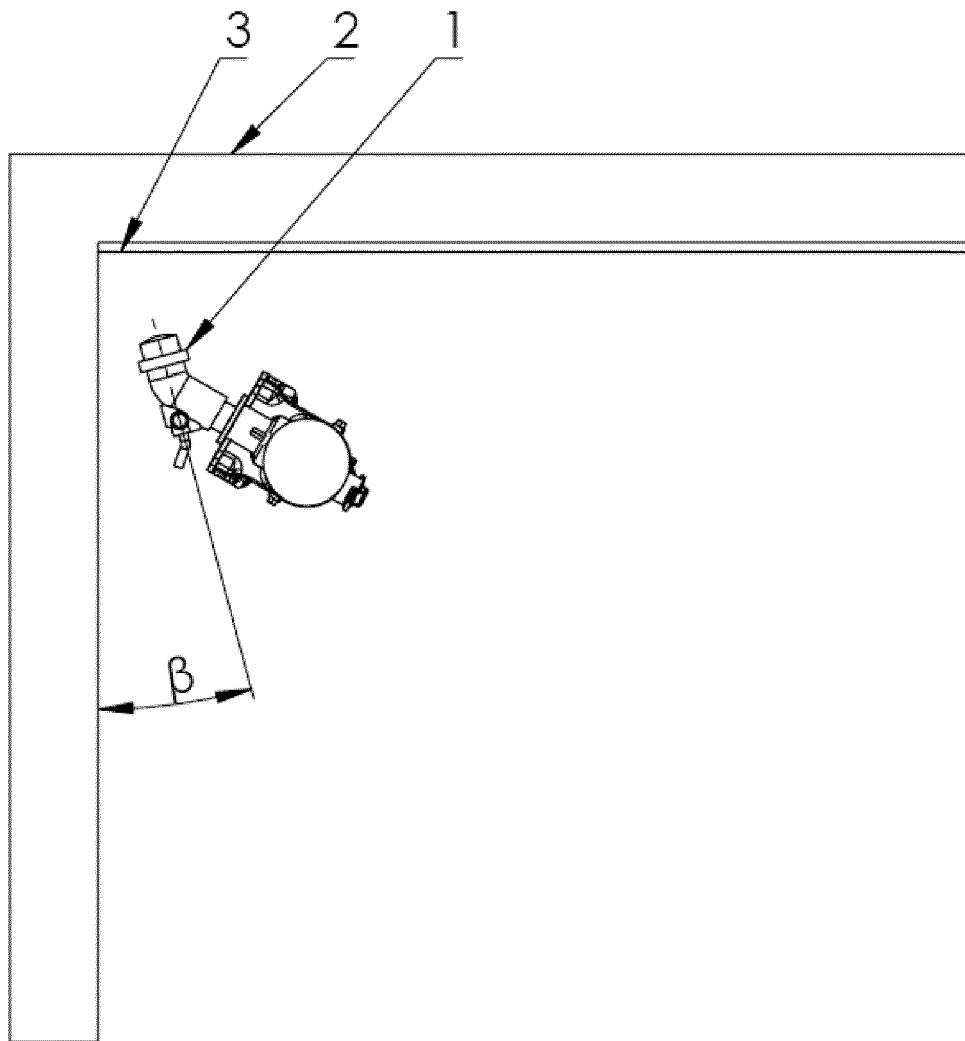


Fig. 3

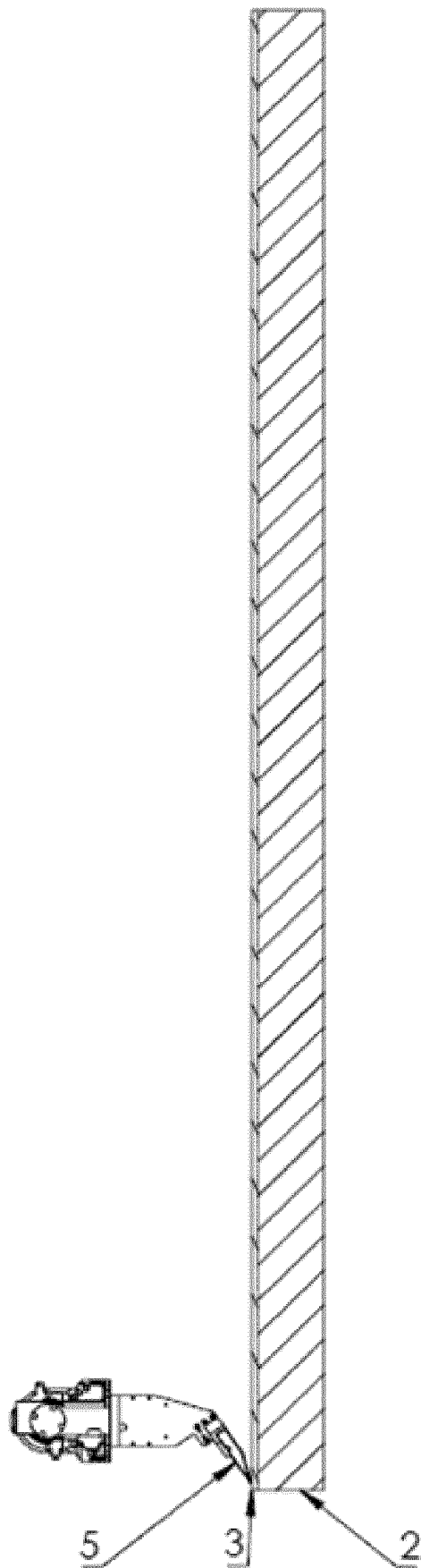


Fig. 4

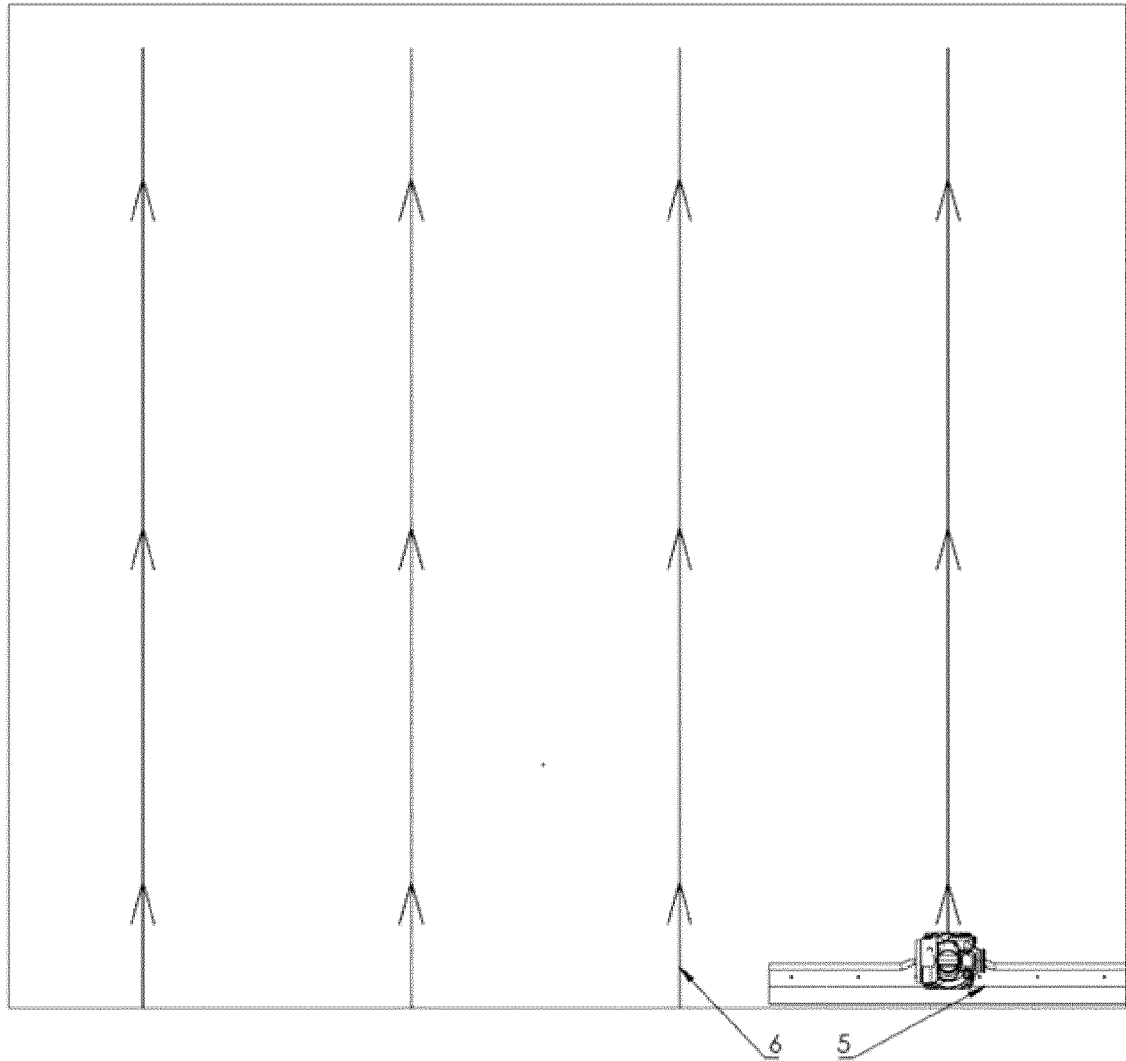


Fig. 5

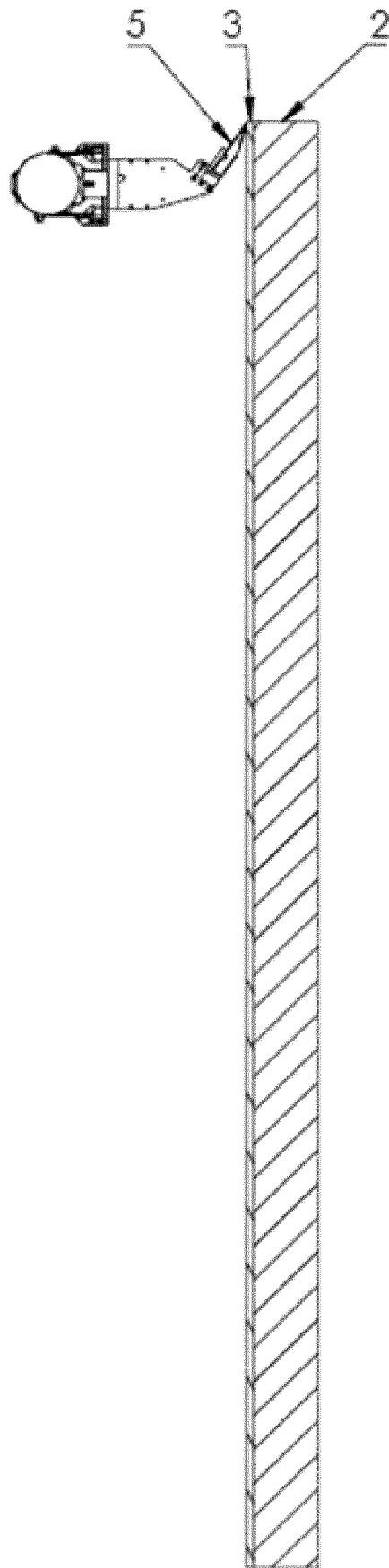


Fig. 6

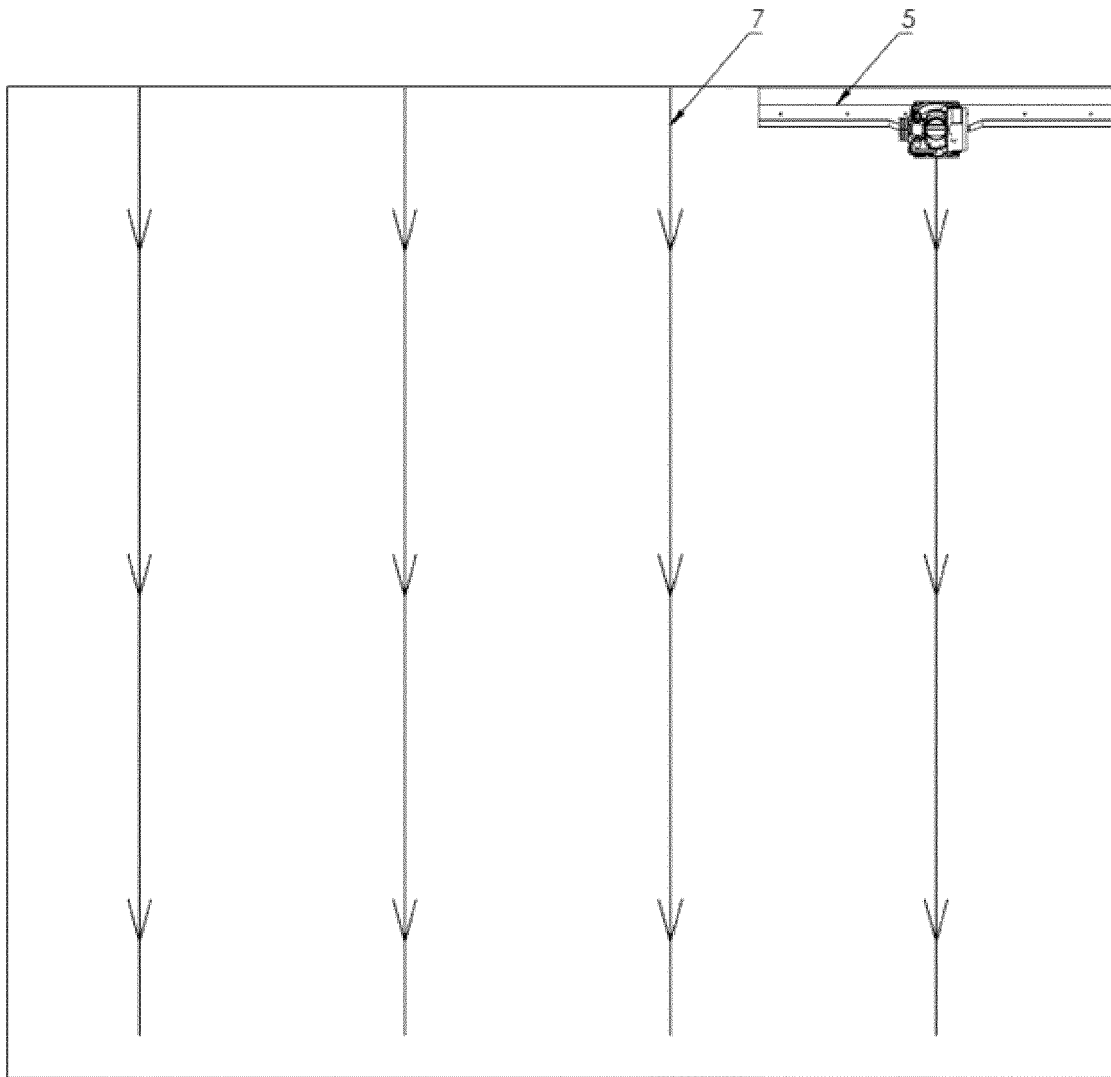


Fig. 7



EUROPEAN SEARCH REPORT

Application Number

EP 22 20 5729

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 113 482 293 A (CHINA FIRST METALLURGICAL GROUP CO LTD) 8 October 2021 (2021-10-08) * figures 1,4 *	1-8	INV. E04F21/12 B05B3/00 B05D1/00
A	WO 2016/109721 A1 (BOSCH GMBH ROBERT [DE]; ROAN PHILIP [US] ET AL.) 7 July 2016 (2016-07-07) * figure 4 *	1-8	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04F B65D C23D B05B B05D
The present search report has been drawn up for all claims			

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EPO FORM 1503 03.82 (P04C01)

Place of search Munich	Date of completion of the search 31 March 2023	Examiner Topcuoglu, Sadik Cem
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10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	CN 113482293 A	08-10-2021	NONE	
15	WO 2016109721 A1	07-07-2016	NONE	
20				
25				
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35				
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