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Amended claims in accordance with Rule 137(2) EPC.

(54) **SATURATED EXTREME LOW LIQUOR RATIO CONVEYOR-DRIVING ATMOSPHERIC FABRIC DYEING MACHINE**

(57) A saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine includes a machine body 1 having an interior space having a rectangular lateral cross-section for effective use of the space and to accommodate an increased loading capacity of fabric. A conveyor device 2 is installed inside the machine body 1 to convey fabrics for circuiting movement. A dyeing tube 12 is equipped above the machine body 1 and connected to the machine body 1, at which

a first nozzle 5 and a second nozzle 13 are respectively equipped to allow selection between one single nozzle or two nozzles to jet dye liquid. A fabric plaiting down device 8 and a fabric guide device 9 are arranged at the rear end of the dyeing tube 12 and in the interior space of the machine body 1 and are adjustable for oscillation angle and amplitude in a left-right direction for optimization of oscillating and guiding the fabric to fall onto a conveyor device 2.

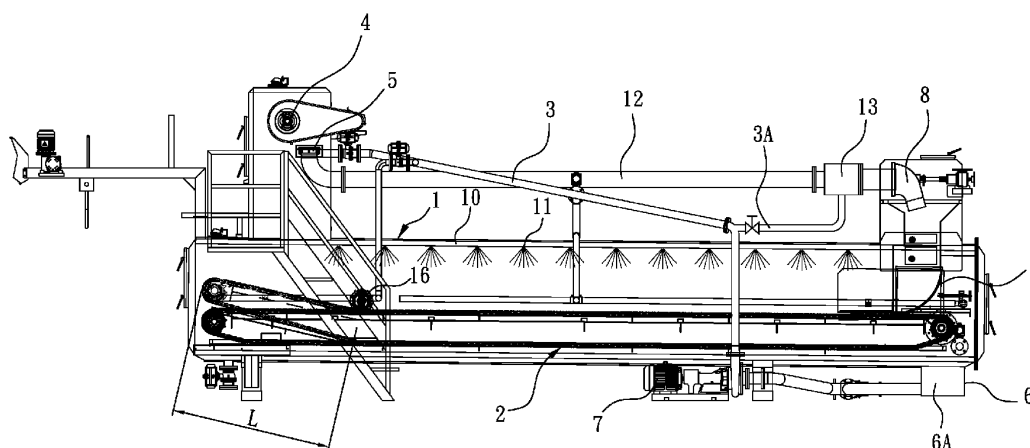


FIG. 1

Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine, and more particularly to a fabric dyeing machine that makes use of a mechanical force (a conveyor device), as a substitute of hydraulic buoyance force that is traditionally used, to drive fabric for circulation in order to carry out atmospheric dyeing of the fabric in a rectangular or non-circular machine shape body.

DESCRIPTION OF THE PRIOR ART

[0002] A known high-temperature conveyor-driving dyeing machine has a machine body that is a pressure vessel. To accommodate the internal environment of the machine body that is generally of a high pressure and a high temperature, the machine body must be designed as a cylindrical vessel and thus, the interior of the machine body is correspondingly cylindrical. However, such a cylindrical internal space often suffers being hard for optimization due to constraints on installation of related peripheral equipment, components, or devices caused by the machine body space, and provides a relatively small effective space for accommodating fabric, leading to small capacity of fabric dyeing and being hard to an operator to do maintenance and service. Consequentially, the known cylindrical body of a fabric dyeing machine is inherently involved with certain shortcomings.

[0003] Further, in the known fabric dyeing machine, a plaiting down device that is used to arrange the fabric cannot be optimized in respect of adjustment of swing angle and amplitude due to constraints caused by the shape of the machine body, and consequentially, a fabric guide device that is used to guide the fabric cannot be optimized in respect of adjustment of guiding angle, so as to result in undesired limitation of functionality.

[0004] Further, in the known fabric dyeing machine, a conveyor device installed inside the machine body is arranged, together with a dyeing tank of the machine body, parallel to the dyeing tank. In an attempt to be re-set as in an inclination angle, a main body of the dyeing tank of the machine body has to be made inclined. However, since the relative position among related components inside the dyeing tank is not changed, the performance of the dyeing tank of the machine body may not be optimized in respect of change of types of fabric or its loading capacity.

SUMMARY OF THE INVENTION

[0005] The primary objective of the present invention is to provide a technical solution that allows full use of an internal space of a rectangular machine body of a dyeing machine so as to allow for optimization of arrangement of a main body of a dyeing tank and an internal structure

thereof to thereby enhance the performance of the dyeing machine, allowing an increase of the capacity of fabric that can be loaded in the dyeing tank of the dyeing machine and allowing an operator to carry out maintenance and servicing operations in an easier way.

[0006] Another objective of the present invention is to provide a fabric dyeing machine that selection can be made between a single nozzle solution or a dual nozzle solution to proceed with jet-dyeing of fabric inside a dyeing tube and driving of the fabric to move according to the type, structure, and amount of the fabric conveyed therein.

[0007] A further objective of the present invention is to provide a fabric dyeing machine that allows adjustment of oscillation angle and amplitude of a fabric plaiting down device and also allows adjustment of a fabric guiding angle of a fabric guide device.

[0008] Yet a further objective of the present invention is to provide a fabric dyeing machine that allows adjustment of an inclination angle of a front end, or a rear end, or both of a conveyor device installed in an interior of a machine body.

[0009] The present invention provides a low-temperature fabric dyeing machine operated in a temperature lower than 110°C, including a conveyor device for driving. The machine body has an interior space in which the conveyor device is installed. The interior space of the machine body has a lateral cross-section that is rectangular in shape or is similar to a rectangular shape, so as to allow a dyeing tank of the interior of the machine body to receive an increased capacity of fabric. A dyeing tube is equipped above the machine body and is connected to a front end and a rear end of the machine body. A first nozzle is equipped at a front end of the dyeing tube, and a second nozzle is installed at a rear end or a suitable location of the dyeing tube. A fabric plaiting down device is installed in the interior space of the machine body and at a rear end of the dyeing tank. Disposed below and corresponding to the location of the fabric plaiting down device is a fabric guide device. The conveyor device is installed along a length and a width of the machine body and is provided, at a length of a front end or a rear end or both thereof, with an inclination adjusting section having a slope that is adjustable. A spraying device is installed at a suitable location in the interior of the machine body to wash and clean the interior of the spraying device and to wet the fabric in dyeing. A water storage tank is designed at a bottom of the machine body and includes, in an interior thereof, built-in heat exchanger and filter net. The built-in heat exchanger has an outer casing that is connected by a pipeline to a pump, and the pump is connected by a first and a second connection tubes to the first nozzle and the second nozzle in order to convey the dye liquid that is recovered from a bottom of the dyeing tank to the nozzles.

[0010] Preferably, the fabric plaiting down device is adjustable in respect of angle and amplitude of oscillation in a left-right direction in order to accommodate different

kinds of fabric for more orderly depositing the fabric on the conveyor to increase the loading capacity of fabric to be dyed.

[0011] Preferably, the fabric guide device is movable for varying a position thereof in a front-rear direction and is adjustable for an incline angle thereof in order to adjust a slope for guiding the fabric to responsively guide different types of fabric to smoothly move onto the conveyor.

[0012] Preferably, the spraying device comprises a water supply tube, and the water supply tube is constructed with a plurality of spraying holes, so that water spraying from each of the spraying holes to wash and clean the interior of the machine body and to wet the fabric in dyeing.

[0013] Based on the above-described structural arrangement of the saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine, the present invention provides the following advantages:

(1) In a dyeing process of fabric, no soaking in dye liquid of a high liquid level is necessary, and absorption of liquid to a saturation condition would be sufficient, such that compared to the prior art soaking dyeing machine, the consumption of water, steam, electricity, and some chemicals can be greatly reduced and consequently, waste water and emission of CO₂ can be greatly reduced to completely resolve the issues of environmental protection.

(2) The interior space of a machine body of the dyeing machine can be full and effectively used to make the performance and structure of the dyeing machine optimized, so as to increase the capacity of fabric that can be accommodated in a dyeing tank of the machine body and to allow an operator to easily carry out operations of maintenance and servicing for the interior of the machine body.

(3) Selection can be made between one single nozzle or two nozzles according to the property of the fabric or the thickness of the fabric in order to inject dye liquid inside the dyeing tube and to drive the fabric to move to thereby enhance an effect of uniform dyeing.

(4) The fabric plaiting down device is adjustable in respect of the oscillation angle and amplitude in a left-right direction and the fabric guide device is movable for shifting of position thereof in a front-rear direction and is adjustable for an angle the fabric guide device to adjust a slope of guiding the fabric so as to responsively guide fabric of different types and different capacity to orderly deposit on and enter a conveyor to thereby make operation smooth and increase the capacity of fabric to be dyed.

(5) The conveyor device installed in the interior of the machine body is adjustable in respect of an inclination angle of a front end, or a rear end, or both thereof in order to make conveyance of fabric of different types and different amounts smoother and also to reduce a distance from a fabric driving reel to

the conveyor to reduce the tension of the fabric.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is an inside cross-sectional view showing an overall structure of a saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine according to the present invention.

FIG. 2 is a schematic top view showing a machine body structure of the saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine according to the present invention.

FIG. 3 is a schematic front view showing the machine body structure of the saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine according to the present invention.

FIG. 4 is a schematic side view showing the machine body structure of the saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] As shown in FIGS. 1-4, the present invention provides a saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine, which comprises a dyeing tube 12, which is arranged above a machine body 1 to allow fabric to pass therethrough and which is designed in a horizontal condition or a slightly inclined condition. A fabric driving reel 4 is arranged at, and set at a position higher than, a front end of the machine body 1. A first nozzle 5 is arranged at a front end of the dyeing tube 12. A second nozzle 13 and a fabric plaiting down device 8 are arranged at a rear end of the dyeing tube 12. The fabric plaiting down device 8 is adjustable in respect of an oscillation angle and an oscillation amplitude in a left-right direction, so that the fabric, upon falling after coming out from the rear end of the dyeing tube 12, is subject to oscillation of the fabric plaiting down device 8 to fall, in an alternating and orderly manner, down onto the fabric guide device 9 that is located at a lower side thereof. The fabric guide device 9 comprises a curved or arc surface or an inclined surface and is adjustable in respect of location and angle thereof in a front-rear direction in order to responsively accommodate the fabric in dyeing that falls down from the fabric plaiting down device 8 for directing and guiding the fabric onto the conveyor device 2.

[0016] The machine body 1 is equipped, in an interior of a dyeing tank thereof, with a conveyor device 2. The conveyor device 2 is arranged along a length and a width of the machine body 1 and is equipped, at a lengthwise position from a front end thereof, with a sprocket 16 (or other mechanical components). A curvable or bendable inclination adjusting section L is equipped between the

sprocket 16 (or other mechanical components) and a front end of the conveyor device 2. The inclination adjusting section L is adjustable in respect of an inclination angle thereof. Namely, when the inclination angle of the inclination adjusting section L is made larger, a distance between the front end of the conveyor device 2 and the fabric driving reel 4 gets shorter, helping reduce the tension induced in the self-weight of fabric and also helping prevent from or eliminate the rearward fabrics incline and overlap toward the frontward fabrics when the fabric leaves from the conveyor device 2. Preferably, a rear end of the conveyor device 2 also adopts the same arrangement as the front end thereof, so as to smooth the falling of the fabric through the fabric plaiting down device 8 down onto the conveyor device 2 to prevent or alleviate the fabric inclining or overlapping frontward. The fabric, as being conveyed by the conveyor device 2, is driven to the front end to be pulled upward by the fabric driving reel 4 for feeding into the nozzle to thereby complete circulation of the movement thereof.

[0017] A spraying device 10 is provided in an interior of the machine body 1 and is set at an upper side at a proper location. The spraying device 10 is designed with a plurality of spraying holes 11 arranged along a length thereof. The spraying device 10 can be directly connected to a water inlet pipe or can be extended to an output portion of a pump, so that upon supply of water or upon opening of a valve during operation of the pump, water or dyeing liquid may be sprayed upward, or downward, or toward all sides from the spraying holes 11 in order to wash and clean the interior of the machine body 1 and also to wet the fabric in dyeing.

[0018] The present invention also equipped a water storage tank 6 arranged at a bottom of the machine body 1 to include therein a built-in combination of a heat exchanger and filter net 6A. The water storage tank 6 is connected through a pipeline to a pump 7, and the pump 7 is connected by a first connection tube 3 to the first nozzle 5 and is connected by a second connection tube 3A to the second nozzle 13. Impurity contained in the dye liquid inside the machine body 1 is subject to filtering by the filter net, and the dye liquid enters the built-in combination of heat exchanger and filter net 6A to subject to heat exchange for heating or cooling. The dye liquid, after being subject to heat exchange and filtering, is pumped by the pump 7 to supply to the first nozzle 5 and the second nozzle 13 for jetting therefrom to dye the fabric inside the dyeing tube 12 and to drive the fabric to move through the dyeing tube 12, and as such, the dye liquid can be repeatedly recycled and cyclically used and conveyed.

[0019] An inlet port of the pump 7 is connected by a connection tube to a chemicals tank 14, and when chemical agents or dyestuff are supplied, the pump 7, during operation thereof, retrieves the chemicals or dyestuff from the chemicals tank 14 to be mixed with the dye liquid that is moved in the circulation thereof to be supplied through the first connection tube 3 and the second con-

nection tube 3A to the first nozzle 5 and the second nozzle 13 for being mixed with the dye liquid inside the dyeing tube 12 to proceed with dyeing on the fabric. In response to differences of property and amount of fabric in different batches, the present invention allows for selection of activation of just the first nozzle 5 to jet the dye liquid, or simultaneous activation of both the first nozzle 5 and the second nozzle 13 to jet the dye liquid in order to achieve the best effect of jet-dyeing of the fabric.

[0020] The present invention provides a saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine, which could make a full use of the interior space of the machine body of the dyeing machine to achieve arrangement and installation of internal components or devices that are more appropriate and more convenient to thereby optimize the performance and structure of the dyeing machine and also to allow the dyeing tank of the machine body to accommodate an increased loading capacity of fabric and to ease operations of maintenance and service for an operator and which also allows for selection between one single nozzle or two nozzles for jetting dye liquid inside a dyeing tube to drive the movement and dyeing of the fabric according to the property of the fabric so as to enhance the effect of uniform dyeing and alleviate the shortcoming of crease mark, and which is equipped with a fabric plaiting down device that allows adjustment of an oscillation angle and amplitude in a left-right direction and a fabric guide device that allows shifting of position in a front-rear direction and adjustment of an incline angle for guiding fabric so as to responsively guide fabric of different types to smoothly and orderly enter a conveyor device, and also allows adjustment of an inclination slope of each of two ends of the conveyor device disposed in the interior of the machine so as to responsively direct different batches of fabric in dyeing for circulating and conveyance to thereby prevent or alleviate the rearward fabrics incline and overlap toward the frontward fabrics. Thus, the present invention is a low-temperature fabric dyeing machine, operated in a temperature lower than 110°C, which involves great improvement.

Claims

1. A saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine comprising a machine body 1 having an interior space in which a conveyor device 2 is installed to convey fabric for circulating movement, the interior space of the machine body 1 being of lateral cross-section that has a rectangular shape or a shape similar to a rectangle, so as to allow for optimization of an internal structure in the interior space of the machine body 1 to enhance performance of the dyeing machine and also to increase loading capacity of the fabric to be dyed, wherein the conveyor device 2 is set in a parallel arrangement along a length and a width of the ma-

chine body 1 and is designed, at a length of a front end or a rear end or both thereof, with an inclination adjusting section L having an adjustable or fixed inclination angle, and a built-in heat exchanger and filter net 6A assembly is equipped in a water storage tank 6 mounted to a bottom of the machine body 1; wherein a dyeing tube 12 is equipped above the machine body 1 and is connected to a front end and a rear end of the machine body 1, a first nozzle 5 being equipped at a front end of the dyeing tube 12, a second nozzle 13 being equipped at a rear end of the dyeing tube 12, a fabric plaiting down device 8 being equipped at the rear end of the dyeing tube 12 and located in a lower part of the machine body 1; a fabric guide device 9 being equipped at a location corresponding to and below the fabric plaiting down device 8.

2. The saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim 1, wherein the conveyor device 2 is arranged in a horizontal condition in entirety thereof and involving no inclination adjusting section L.
3. The saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim 1, wherein the fabric plaiting down device 8 is adjustable in respect of an angle and an amplitude for guiding the fabric in a left-right direction.
4. The saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim 1, wherein the fabric guide device 9 is designed at a fixed position or is adjustable in respect of a position thereof in a front-rear direction in order to adjust a position where the fabric falls onto the fabric guide device 9.
5. The saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim 1, wherein the fabric guide device 9 is designed at a fixed angle or is adjustable in respect of an angle thereof in order to adjust an angle, which defines sloping, with which the fabric falls onto the conveyor device 2.
6. The saturated extreme low liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim 1, wherein the machine body 1 is equipped with a single nozzle only.

Amended claims in accordance with Rule 137(2) EPC.

1. A saturated liquor ratio conveyor-driving atmospheric fabric dyeing machine comprising a machine body 1 having an interior space in which a conveyor device

(2) is installed to convey fabric for circulating movement, **characterized in that:** the interior space of the machine body (1) is of lateral cross-section that has a rectangular shape or a shape similar to a rectangle, so as to allow for optimization of an internal structure in the interior space of the machine body (1) to enhance performance of the dyeing machine and also to increase loading capacity of the fabric to be dyed, wherein the conveyor device (2) is set in a parallel arrangement along a length and a width of the machine body (1) and is designed, at a length of a front end or a rear end or both thereof, with an inclination adjusting section (L) having an adjustable or fixed inclination angle, and a built-in heat exchanger and filter net (6A) assembly is equipped in a water storage tank (6) mounted to a bottom of the machine body (1);

wherein a dyeing tube (12) is equipped above the machine body (1) and is connected to a front end and a rear end of the machine body (1), a first nozzle (5) being equipped at a front end of the dyeing tube (12), a second nozzle (13) being equipped at a rear end of the dyeing tube (12), a fabric plaiting down device (8) being equipped at the rear end of the dyeing tube (12) and located in a lower part of the machine body (1); a fabric guide device (9) being equipped at a location corresponding to and below the fabric plaiting down device (8).

2. The saturated liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim (1), wherein the conveyor device (2) is arranged in a horizontal condition in entirety thereof and involving no inclination adjusting section (L).
3. The saturated liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim 1, wherein the fabric plaiting down device (8) is adjustable in respect of an angle and an amplitude for guiding the fabric in a left-right direction.
4. The saturated liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim 1, wherein the fabric guide device (9) is designed at a fixed position or is adjustable in respect of a position thereof in a front-rear direction in order to adjust a position where the fabric falls onto the fabric guide device (9).
5. The saturated liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim 1, wherein the fabric guide device (9) is designed at a fixed angle or is adjustable in respect of an angle thereof in order to adjust an angle, which defines sloping, with which the fabric falls onto the conveyor device (2).
6. The saturated liquor ratio conveyor-driving atmospheric fabric dyeing machine according to claim 1, wherein the machine body (1) is equipped with a single nozzle only.

pheric fabric dyeing machine according to claim 1,
wherein the machine body (1) is equipped with a
single nozzle only.

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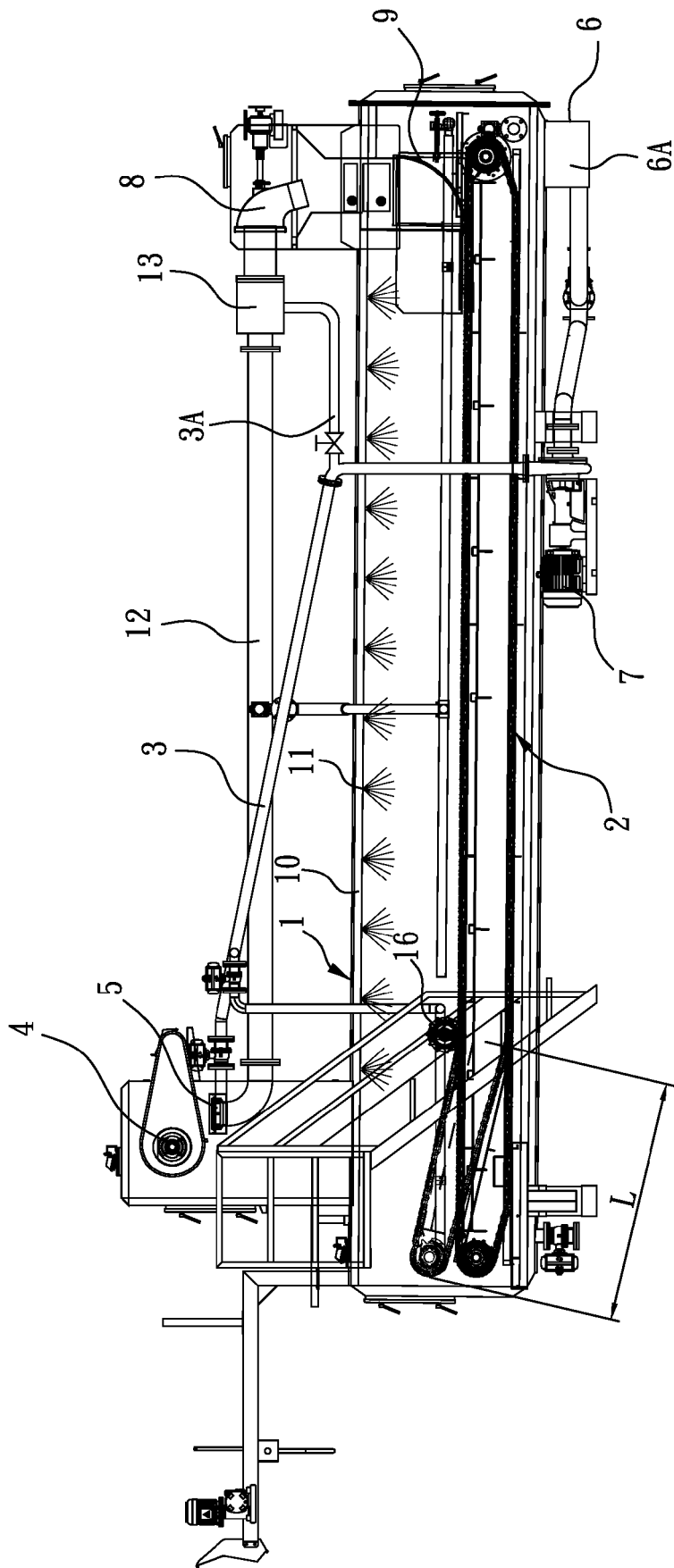


FIG. 1

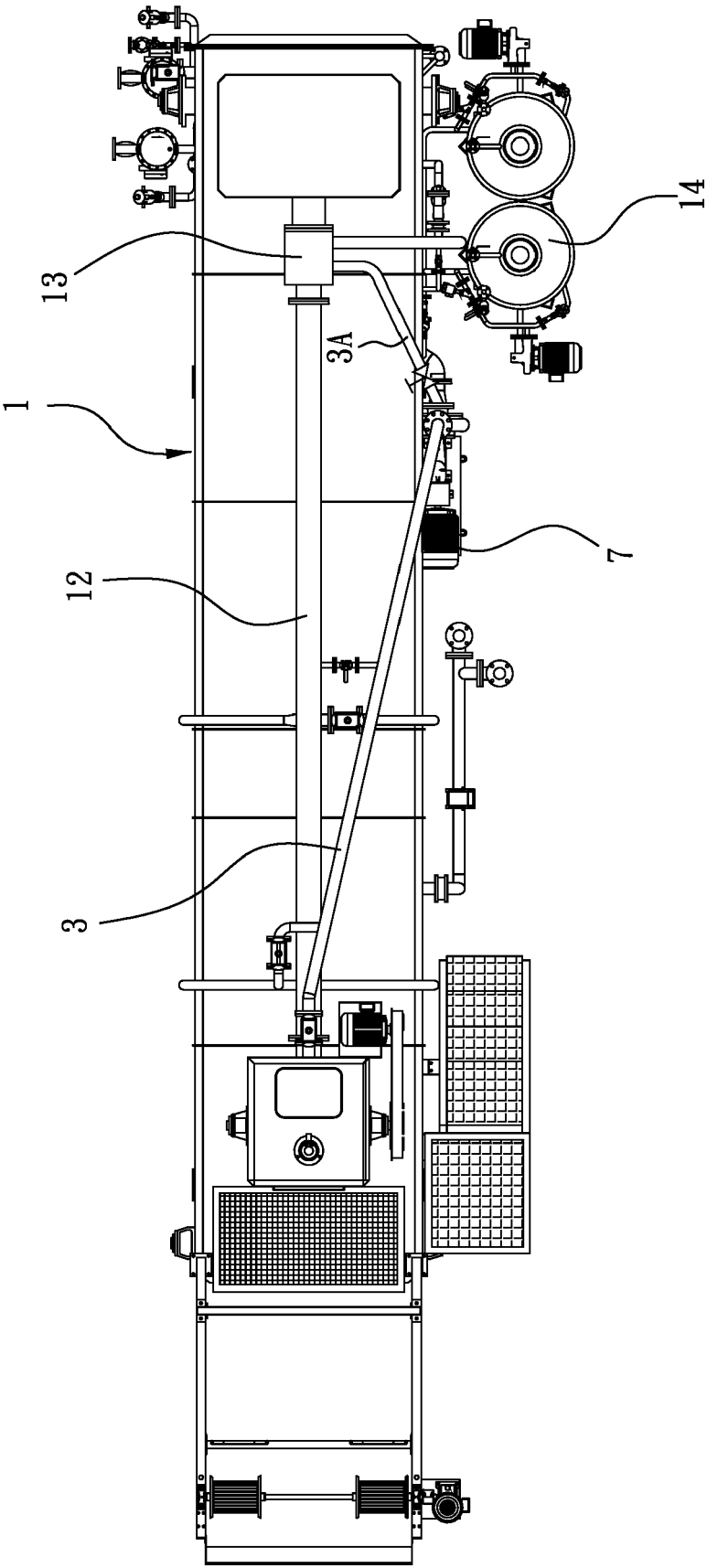


FIG. 2

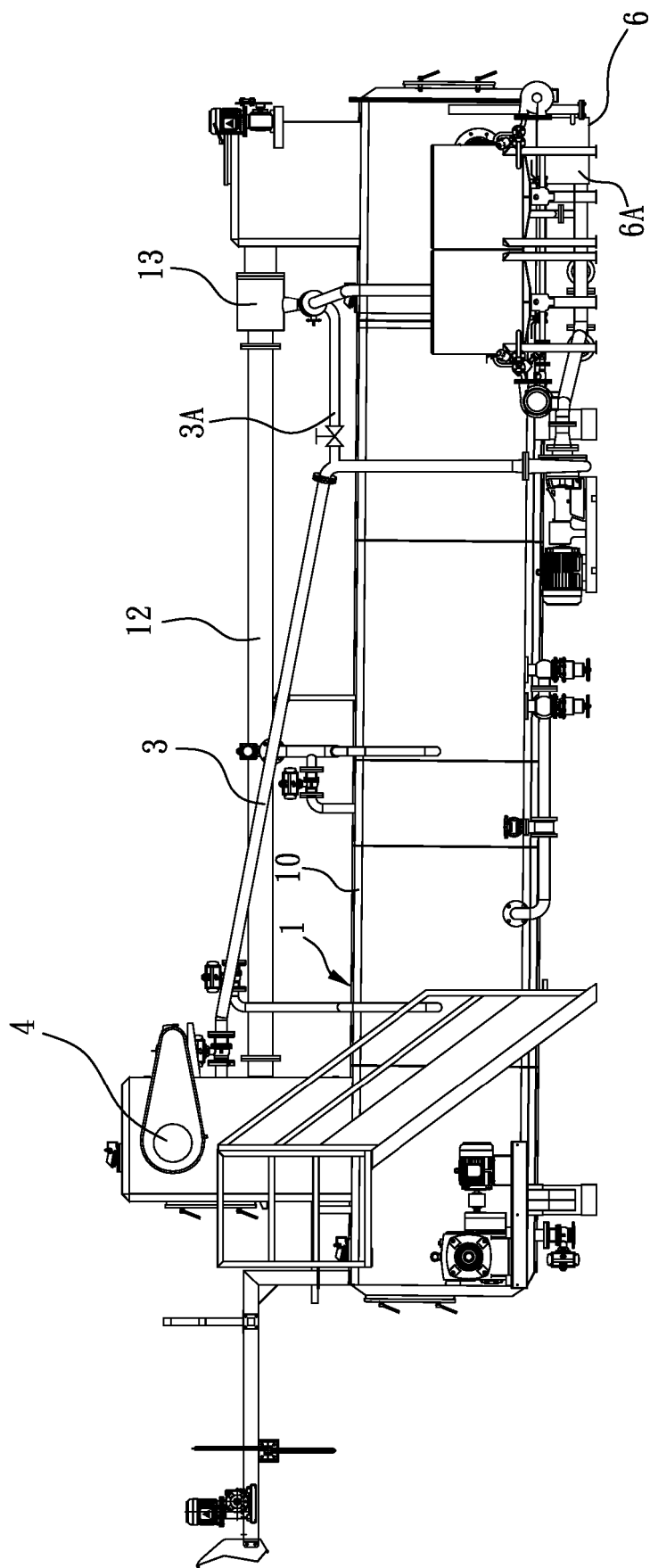


FIG. 3

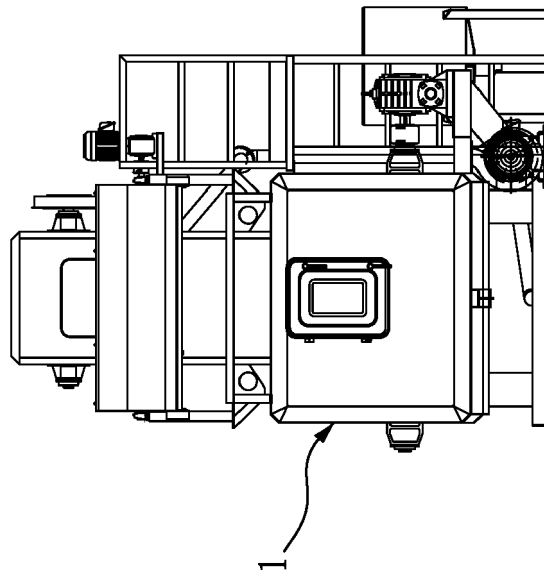


FIG. 4



EUROPEAN SEARCH REPORT

Application Number
EP 21 16 9053

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EPO FORM 1503 03.82 (P04C01)

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			TECHNICAL FIELDS SEARCHED (IPC)
			D06B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 September 2021	Examiner Iamandi, Daniela
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 16 9053

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82