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(54) **A METHOD FOR MANUFACTURING A TEXTILE PADDING PRODUCT**

(57) The present invention relates to a method for manufacturing a textile padding product, in particular as a padding for comforters and garments.

In particular, the present invention relates to a method for manufacturing a textile padding product, comprising the following operational steps:

- a) cutting the input material made of silk to obtain pieces of fabric;
- b) garnetting pieces of fabric of step a) to obtain a silk fiber staple;

c) optionally, blending the silk fiber staple with fibers other than silk and/or feathers in defined amounts;

d) lubricating the silk fiber staple of the step b) or of the blend of step c);

e) carding the lubricated staple material output from step d);

f) textile sizing the carded textile material of step e) by providing overlapping staple tissues of crossed fibers;

g) quilting or needling the overlapping and crossed staple tissues of step f) to obtain a padding material.

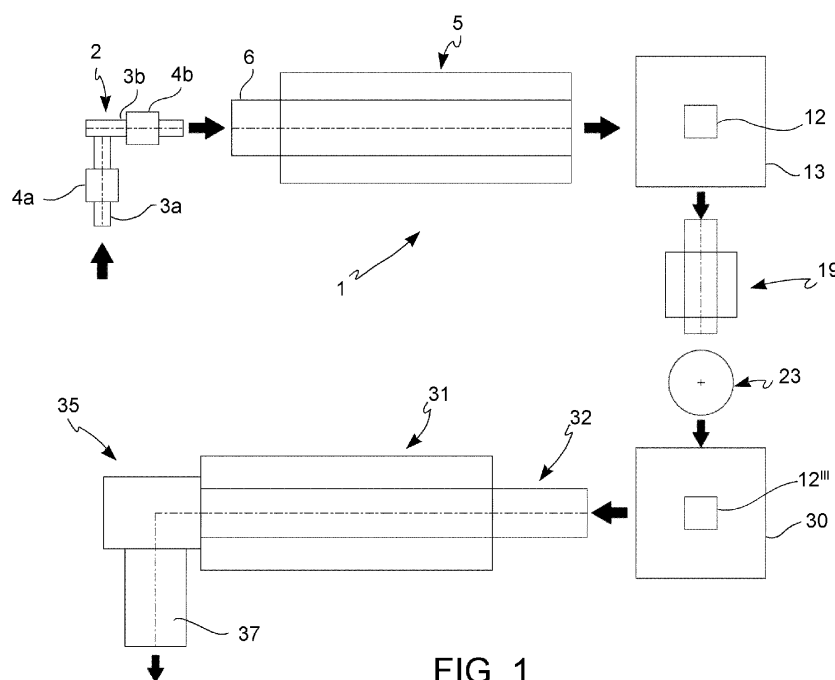


FIG. 1

Description

[0001] The present invention relates to a method for manufacturing a textile padding product, in particular as a padding for comforters and garments.

[0002] Silk is one of the most widely used materials in the textile industry for the production of garments, underwear or other similar high-quality products.

[0003] The properties of silk have been known for a long time and can be summarized as follows:

- high resistance, since it is the natural fiber of greater strength;
- lightness and softness;
- hypoallergenic and antibacterial properties;
- hygroscopicity, which allows good perspiration;
- thermoregulation, keeping the body warm in winter and cool in summer;
- protective action, because silk absorbs ultraviolet rays thus protecting the skin.

[0004] The silk textile industry produces considerable amounts of processing waste, in the form of finished fabrics, either dyed or undyed, printed silk and the like. Since the cost of silk is high, this waste is a problem for the cost-effectiveness of the process.

[0005] In this context, it is the technical object underlying the present invention to provide a method which allows the reuse of waste from the silk industry, as well as of discarded silk clothing or underwear, to obtain a product of high quality and technical features.

[0006] The specified technical object is substantially achieved by a method for manufacturing a silk textile padding product, possibly blended with other fibers and/or feathers, wherein said method comprises the technical features set out in one or more of the appended claims, the definitions of which form an integral part of the present description.

[0007] Further features and advantages of the present invention will become more apparent in the indicative and therefore non-limiting description of a preferred, but not exclusive embodiment of the invention, with reference to the drawings, in which:

figure 1 is a diagrammatic view of a system for carrying out the method according to the invention;
figure 2 is a simplified side view of a first detail of the system in figure 1;
figure 3 is a simplified side view, according to direction A in figure 2, of a second detail of the system in figure 1;
figure 4 is a simplified side view, according to direction B in figure 3, of a third detail of the system in

figure 1;

figure 5 is a simplified side view of a garnett machine of the system according to the invention;

figure 6 is a simplified side view of the carding willow of the system according to the invention;

figure 7 is a simplified side view of a lubricating tank of the system according to the invention;

figure 8A is a simplified side view of a textile sizing machine of the system according to the invention;

figure 8B is a simplified side view of the textile sizing machine in figure 8A, according to direction C in figure 8A;

figure 9 is a simplified side view of a condenser of the system according to the invention;

figure 10 is a simplified cross-section side view of an alternative machine which can be used in the step of garnetting.

[0008] The method for manufacturing a textile padding product according to the present invention uses as input material:

- silk processing waste, such as finished fabrics, dyed or not dyed, printed fabrics and the like,
- used clothing, garments, underwear or the like made of silk.

[0009] The method comprises the following operational steps:

- a) cutting the input material made of silk to obtain pieces of fabric;
- b) garnetting pieces of fabric of step a) to obtain a silk fiber staple;
- c) optionally, blending the silk fiber staple with fibers other than silk and/or feathers in defined amounts;
- d) lubricating the silk fiber staple of the step b) or of the blend of step c);
- e) carding the lubricated staple material output from step d);
- f) textile sizing the carded textile material of step e) by providing overlapping staple tissues of crossed fibers;
- g) quilting or needling the overlapping and crossed staple tissues of step f) to obtain a padding material.

[0010] The method of the invention will now be described in detail with reference to the figures, which illustrate a system 1 for implementing such a method and the individual parts of the system itself, with the sole exception of the machine for the step g) of quilting or needling.

[0011] With reference to figure 1, the step a) of cutting the input material is performed in a cutting unit 2 which comprises:

- a first conveyor 3a operatively associated with a first cutting machine 4a, and
- a second conveyor 3b, arranged orthogonally down-

stream of the first conveyor 3a, the second conveyor 3b being operatively associated with a second cutter machine 4b.

[0012] The cutting machines 4a, 4b, of the known and commercially available type, comprise a pair of presser cylinders which withhold the input material and a rotating blade drum (typically two or three blades) in contrast with a fixed blade, to cut the input material into fixed dimensions. The first cutting machine 4a obtains strips of fabric, which are placed transversely on the second conveyor 3b. In such a manner, the strips of fabric are cut orthogonally by the second cutting machine 4b to provide pieces of fabric of rectangular-shape. Preferably, such fabric rectangles have dimensions of 80-100 mm x 120-150 mm.

[0013] With reference to Figures 1, 2 and 5, the step b) is performed in a garnetting unit which comprises a garnett machine 5. The step of garnetting allows to obtain the mechanical separation of the threads forming the pieces of fabric and of the fibers forming said threads. Upon leaving the step of garnetting (b), a silk fiber staple is obtained, preferably composed of fibers from 18 to 25 mm in length.

[0014] The garnetting unit, of the type known per se, is formed as a whole by:

- a loader 6 of the silk fabric pieces, and
- said garnett machine 5.

[0015] The loader 6 comprises:

- i) a flat belt,
- ii) a wired belt,
- iii) one or two metal reels or combs.

[0016] The flat belt has the function of pushing the pieces of silk fabric towards the wired belt inclined between 60° and 80°.

[0017] The wired belt has the function of a loading belt to transfer the pieces of silk fabric to a feeding table of the garnett machine 5.

[0018] The reels or combs are cylinders or studded bars which dose the pieces of silk fabric fed by loading wired belt and which detach them therefrom by sending them to the feeding belt of the garnett machine 5.

[0019] Thereby, the constant and uniform loading of the garnett machine 5 is achieved. Preferably, a series of maximum and minimum level photocells detect the thickness of the input material, modify the speed of the feeding belts or control, through a control unit with which they are operationally associated, the temporary suspension of the input of the fabric pieces from cutting unit 2 to the loader 6.

[0020] The garnett machine 5 (figure 5), of known and commercial type, comprises a feeding table 7, three or four carding assemblies 8, each comprising a plurality of pairs of working cylinders/strippers 9 of equal diameter

and arranged adjacent to each other, coupled to a main drum 10.

[0021] The garnett machine 5 also comprises taker-in cylinders 109 (typically two cylinders), a cleaner cylinder 110, a doffer cylinder 111, flywheels 112 and combers 113, in a configuration known in the art.

[0022] The garnett machine 5 is also provided with a rigid liner adapted to work the silk fiber, to open the fibers and orient them in one direction. This will prevent the formation of tangles of fibers of different lengths known as "neps". The type of rigid lining is chosen according to the pitch, thickness, inclination, density and population/cm² best suited to open the pieces of silk fabric.

[0023] A fleece doffing comb 114, which has the function of detaching the frayed fiber staple tissue from the last comb, is arranged in the final portion of the garnett machine 5. This is how silk staple fibers are obtained.

[0024] Alternatively, with reference to figure 10, step b) of garnetting may be carried out in a double carding opener 205, comprising two successive working assemblies, in which the first section 205a comprises two entrance cylinders 206, a main drum 210a and three working cylinders 209, all covered with a rigid lining, while the second section 205b consists of one opening drum 210b and five working cylinders 209, also covered with rigid lining.

[0025] The distinctive feature of this machine is its flexibility of application, by virtue of all possible fitting combinations and the several speed and distance adjustments between the cylinders and drums, which allows to process a wide variety of textile materials.

[0026] The garnett machine 5 is connected downstream, through a pipeline 11 and a hopper 11a, to a condenser 12 placed above a first storage tank 13.

[0027] With reference to figures 2, 3 and 9, the condenser 12, also of the known and commercial type, comprises a vacuum source 14, typically a centrifugal fan, connected, through a special pipe 15, to a perforated cylinder 16 with a horizontal axis, placed inside a containment casing 17. The hopper 11a leads into the containment casing 17, in its upper portion, and is put under vacuum through the holes of the perforated cylinder 16.

[0028] The perforated cylinder 16 is rotatable around its horizontal axis and is separated into two semi-cylindrical portions 16a, 16b by means of a bulkhead 18 so that the vacuum pipe 15 leads into only one of the two portions 16a, 16b, when one of these portions 16a, 16b is in its upper position (as shown in Figure 9).

[0029] The silk fiber staple coming out of the garnett machine 5 is then sucked into the containment casing 17 and then into the semi-cylindrical portion 16a placed on top. When, by rotation of the perforated cylinder 16, the portion 16a turns downwards and is therefore no longer under vacuum from the vacuum source 14, the silk fiber staple falls by gravity into the first storage tank 13. At the same time, the other semi-cylindrical portion 16b is arranged upwards and under vacuum, so that it will be filled with silk fiber staple, which it will then release when the

rotation of the perforated cylinder 16 brings it downwards, and so forth.

[0030] This pneumatic conveying system avoids the contact of the fibers with the fan blades which, by friction, would form neps on the finest fibers, causing roping phenomena on the longest fibers.

[0031] With reference to figures 1, 3 and 6, the optional step c) of blending the silk fiber staple with fibers other than silk and/or feathers is performed in a blending unit 19 by a carding willow 20, to make the fiber blend more homogeneous.

[0032] Various types of fibers can be used, either natural, man-made or synthetic.

[0033] Natural fibers other than silk which can be used in the method of the invention are linen, cotton, hemp, wool, angora, cashmere, mohair, and vicuña.

[0034] The term "man-made fibers" means fibers obtained from a yarn of natural substances which are normally not spun. Specific examples of man-made fibers are those obtained from cellulosic fibers, such as rayon viscose, cuprammonium rayon, cellulose nitrate, cellulose diacetate, and cellulose triacetate.

[0035] The term "synthetic fibers" means non-natural fibers derived from chemical processes. Specific examples of synthetic fibers are acrylic, nylon (polyamide), polyester, aramids (Kevlar®), polytetrafluoroethylene (Gore-tex®) and polyurethane (Elastam®).

[0036] The feathers are typically goose or duck feathers or duck neck down.

[0037] The percentage by weight of silk fiber staple with respect to the weight of fibers other than silk and/or of feathers is in the 40-99% range, preferably 50-90%, more preferably 60-80%.

[0038] The fibers other than silk and/or feathers can be dosed manually by weighing, then added to the first storage tank 13.

[0039] From the first storage tank 13, the blend thus formed is transferred to the carding willow machine 20 through a condenser 12' which is very similar to the condenser 12 described above.

[0040] The carding willow machine 20 is entirely similar to a carding assembly, consisting of feeding belt 20a, taker-in cylinders, working cylinders 21, clearers, drum 22, and unloading reel. The studs with which it is equipped are large, sturdy and sparse and their purpose is to open and blend the transiting fiber blocks.

[0041] Downstream of the blending unit 19 is a lubricating unit 23, into which the blend of silk fiber staple and other fibers and/or feathers is directly transferred from the carding willow 20.

[0042] With reference to figures 1, 3 and 7, the lubricating unit 23 comprises a lubricating cell 24 and a condenser 12" placed above lubricating cell 24, for the direct transfer of the silk fiber staple from storage tank 13 to lubricating cell 24, if step c) is omitted (100% silk fiber staple).

[0043] In some embodiments, the three condensers 12, 12', 12" may be replaced by a single condenser 12,

which can be moved, according to requirements, from the position on the first storage tank 13 to the position on the carding willow 20 (if the method comprises the aforesaid step c)) or to the position on the lubricating cell 24 (if step c) is omitted).

[0044] The step d) of lubricating is an operation known per se in the textile industry, in particular in the processing of wool, and provides the treatment of the silk fiber staple, or of the blend of silk fiber staple with other fibers and/or feather, with a stable emulsion of water, oils and antistatic and cohesive substances, with the aim of increasing the inter-fibrous coefficient of friction, promoting the cohesion of the card staple tissue, and decreasing that between the material and the metal linings of the machines.

[0045] An example of composition which can be used in the step of lubricating is as follows:

2 - 3 cc/liter of antistatic substance;
2 - 3 cc/liter of synthetic lubricating blend with vegetable oils;
Water q.s.

[0046] The solution is prepared by first pouring cold water into the blending container and, under stirring, adding the synthetic lubrication and antistatic mixture.

[0047] The quantity of solution to be prepared is 4% by weight of the material to be processed.

[0048] The lubrication cell 24 comprises a lubrication tank 25, in which the silk fiber staple or the blend of silk fiber staple with other fibers and/or feather is loaded, and a series of atomizing nozzles 26 which spray the lubrication emulsion from a tank 27 from which a pump 28 draws onto the fibers inside the tank 25.

[0049] The silk fiber staple or the blend of silk fiber staple with other fibers and/or feathers coming out of the lubrication unit 23 is sucked, through a tube 29, into a condenser 12", similar to the condenser 12 described above, which conveys it to a second storage tank 30.

[0050] The silk fiber staple or the blend of silk fiber staple with other fibers and/or feathers is then transferred from the second storage tank 30 to the step e) of carding, comprising a carding machine 31, by means of an electronic loader 32 which provides a regular and homogeneous feed to ensure a constant weight of the final product.

[0051] The loader 32, which is a commercial machine known per se, comprises:

- a flat belt, placed on the bottom of the loader 32, which pushes forward the silk fiber staple or the blend of silk fiber staple with other fibers and/or feathers;
- a loading wired belt, which receives the silk fiber staple or the silk fiber staple blend with other fibers and/or feathers from the flat belt and transports it to a precision scale until it reaches a predefined weight for a predefined time;
- a dosing wired belt, which doses the amount of silk fiber staple or the blend of silk fiber staple with other

fibers and/or feathers that the loading wire belt engages during the transfer;

- an unloading wired belt, which drops the silk fiber staple or the blend of silk fiber staple with other fibers and/or feather onto the scale provided with an electronic load cell.

[0052] This operation, which is controlled by a control unit, allows to obtain, as said, a homogeneous weight of the material which is fed into the carding machine 31.

[0053] The carding machine 31, known per se and commercially available itself comprises two taker-in cylinders 131 and an air blade to keep them clean and to direct the fiber to the doffer 132 without creating unwanted accumulations. Then, through the action of a conveyor cylinder 133, the diluted fiber will be transferred to the large drum 34 to begin the actual carding process. More precisely, the carding process consists of the intimate blending between the fibers and aims to orient the fibers in one direction, parallel to the working axis. This process can be achieved through the carding action which takes place between the large drum 34 and a plurality of working cylinders 33 (with a larger diameter than the working cylinders 8 of the garnett machine 5). The working cylinder 33, in addition to orienting the fibers in the same direction, acts as a temporary storage of fibers which, through the clearer, are then reinserted on the large drum 34 and overlapping on those transiting on its surface. It is precisely the different peripheral speed between large drum 34 (about 400 m/min) and working cylinder 33 (about 7 m/min) which allows the overlapping of the fibers. The more the carding units mounted on the machine, the greater will be the carding effect.

[0054] At the end of the processing, a fleece doffing comb 114 removes a very thin and impalpable layer of fibers which is sent to the step of textile sizing.

[0055] The step f) of textile sizing allows to obtain overlapping staple tissues of crossed fibers by means of a band-feed machine 35, diagrammatically shown in figure 4 and 8.

[0056] The band-feed machine 35 is known and described in international PCT application published with number WO 2016/189360 to NUOVA COSMATEx S.r.l.

[0057] Briefly, the band-feed machine 35 allows to overlap, cross and transfer textile fibers and comprises:

- a first conveyor belt 36 for conveying a staple tissue of input textile fibers;
- a depositing device 135 of the staple tissue for receiving the textile fibers coming from the first conveyor belt and depositing them on a second conveyor belt 136, wherein the depositing device moves in a reciprocating manner along a direction X;
- the second conveyor belt 136 is adapted to move the textile fibers along a direction Y perpendicular to the direction X, with reciprocating motion forwards and backwards, wherein, in the complex of motion, the forward component is predominant with respect

to the backward one so as to produce a flow of textile fibers which are overlapping and crossed;

- a laying device 138 of the overlapping staple tissues and a conveyor system 137 to remove the overlapping and crossed textile fibers from the band-feed machine 35.

[0058] The step g) of quilting or needling the overlapping and crossed staple tissues at the exit of step f) is a method which allows the overlapping and crossed veils to be joined to form a padding material according to the invention. The choice of quilting rather than needling depends on the desired volume and compactness.

[0059] Needling is the process by which compactness is given to the fiber mat obtained by overlapping several layers of staple tissue at the exit of the band-feed machine 35 through vertical movement of the needles. The result is a textile material provided with a given consistency due to the penetration of part of the fibers dragged vertically by the motion of the needles.

[0060] Such an operation is performed in a conventional machine (not shown) which comprises a plate (needle table) which is as long as the size of the desired product, moved alternately from top to bottom at high speed, equipped with long needles characterized by the presence of hooks or serrations.

[0061] The needles quilt the fiber mat, dragging them partially therewith and making them penetrate and be cohesive. There are two perforated plates at the needle table, between which the fiber mat being processed passes: the lower one, said needling plate, has the function of supporting the mat during needling, while the upper one, referred to as the stripping plate, is used to prevent the needle from dragging the fibers during its ascending motion. The population and type of needles, the number of movements of the plate per minute, the depth of movement and the product feed rate are adjustable according to needs.

[0062] The quilting operation, on the other hand, is performed by binding the textile structures together through stitches appropriately arranged and distanced.

[0063] The process according to the invention allows to obtain padding material based on silk fiber staple or blend of silk fiber staple and other fibers and/or feathers in the form of mat, adapted to be used as a padding for garments, duvets and similar products.

[0064] The high percentage (up to 100%) of silk fibers allows to obtain high features of lightness, transpiration and thermoregulation. At the same time, the use of silk from waste or discarded textile products creates a circular economy model, virtuously recycles waste and reduces the cost of raw material acquisition.

[0065] It is apparent that only some particular embodiments of the present invention have been described, to which those skilled in the art will be able to make all changes required to adapt it to particular applications, without departing from the scope of protection of the present invention.

Claims

1. A method for manufacturing a textile padding product, comprising the following operational steps:

a) cutting the input material made of silk to obtain pieces of fabric;
 b) garnetting pieces of fabric of step a) to obtain a silk fiber staple;
 c) optionally, blending the silk fiber staple with fibers other than silk and/or feathers in defined amounts;
 d) lubricating the silk fiber staple of the step b) or of the blend of step c);
 e) carding the lubricated staple material output from step d);
 f) textile sizing the carded textile material of step e) by providing overlapping staple tissues of crossed fibers;
 g) quilting or needling the overlapping and crossed staple tissues of step f) to obtain a padding material.

2. The method according to claim 1, wherein the input material is chosen from:

- silk processing waste, such as finished fabrics, dyed or not dyed, printed fabrics and the like,
 - used clothing, garments, underwear or the like made of silk.

3. The method according to claim 1 or 2, wherein the step a) of cutting the input material is performed in a cutting unit (2) which comprises:

- a first conveyor (3a) operatively associated with a first cutting machine (4a), and
 - a second conveyor (3b), arranged orthogonally downstream of the first conveyor (3a), the second conveyor (3b) being operatively associated with a second cutter machine (4b), in order to obtain pieces of fabric preferably in rectangular shape, more preferably having size of 80-100 mm x 120-150 mm.

4. The method according to any one of claims from 1 to 3, wherein step b) is performed in a garnetting unit which comprises a loader (6) of the pieces of silk fabric and a garnetting machine (5), in which:

- the loader (6) comprises i) a flat belt, ii) a wired belt and iii) one or two metal reels or combs;
 - the garnett machine (5) comprises a feeding table (7), carding assemblies (8), each comprising a plurality of pairs of working cylinders/stripers (9) of equal diameter arranged mutually adjacently, coupled to a main drum (10), the garnett machine (5) may also be provided with a

rigid seal adapted to work the silk fiber so as to open the fibers and orient them towards a direction.

5. The method according to any one of claims from 1 to 4, wherein the optional step c) of mixing the silk fiber staple with fibers other than silk and/or feather is performed in a mixing unit (19) by means of a carding willow machine (20).

6. The method according to any one of claims from 1 to 5, wherein in the optional step c), the feather is goose or duck feather or goose or duck neck down and/or the fibers other than silk are chosen among:

- natural fibers, such as linen, cotton, hemp, wool, angora, cashmere, mohair and vicuña fibers;
 - man-made fibers, such as cellulosic fibers, such as rayon viscose, cuprammonium rayon, cellulose nitrate, cellulose diacetate and cellulose triacetate;
 - synthetic fibers, such as acrylic, nylon (polyamide), polyester, aramid, polytetrafluoroethylene and polyurethane.

7. The method according to any one of claims from 1 to 6, wherein the percentage by weight of silk fiber staple with respect to the weight of fibers other than silk and/or of feathers is in the 40-99% range, preferably 50-90%, more preferably 60-80%.

8. The method according to any one of claims from 1 to 7, wherein step d) of lubricating comprises treating the silk fiber staple, or the mixture of silk fiber staple with other fibers and/or feather, with a stable emulsion of water, oils and antistatic and cohesive substances.

9. The method according to any one of claims from 1 to 8, wherein the step f) of textile sizing is performed in a band-feed machine (35) comprising:

- a first conveyor belt (36) for conveying a web of input textile fibers;
 - a laying device for receiving the textile fibers coming from the first conveyor belt and depositing them on a second conveyor belt, wherein the laying device moves in alternating manner along a first direction (X);
 - the second conveyor belt is adapted to move the textile fibers along a direction (Y) perpendicular to the first direction (X), with reciprocating motion forwards and backwards, wherein, in the complex of motion, the forward component is predominant with respect to the backward one so as to produce a flow of textile fibers which are overlapping and crossed;

- a conveyor system to remove the overlapping and crossed textile fibers from the band-feed machine (35).

10. A padding material based on silk fiber staple or blend of silk fiber staple and other fibers and/or feather in the form of a mat, wherein the amount by weight of silk fibers is comprised between 40% and 100%.

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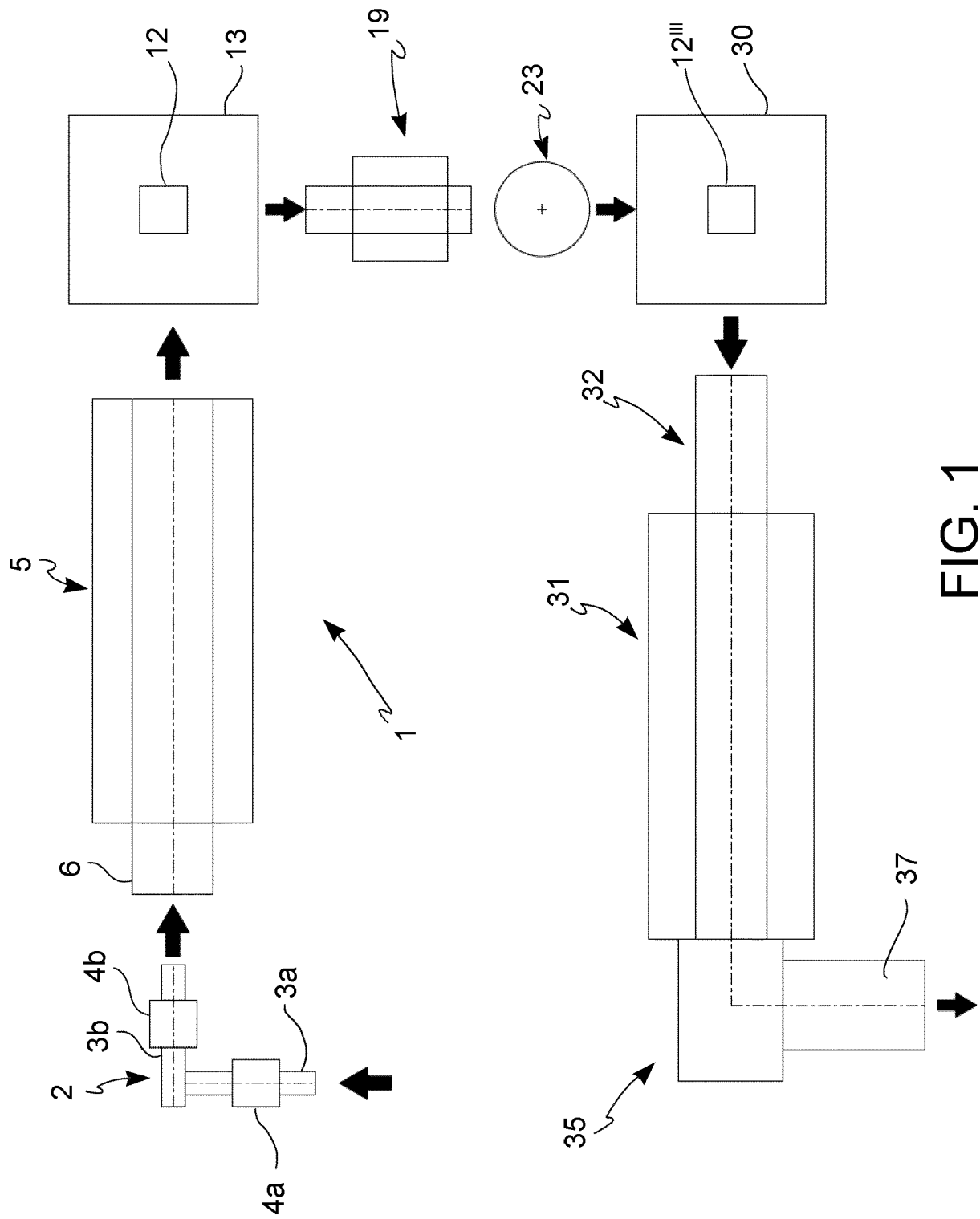


FIG. 1

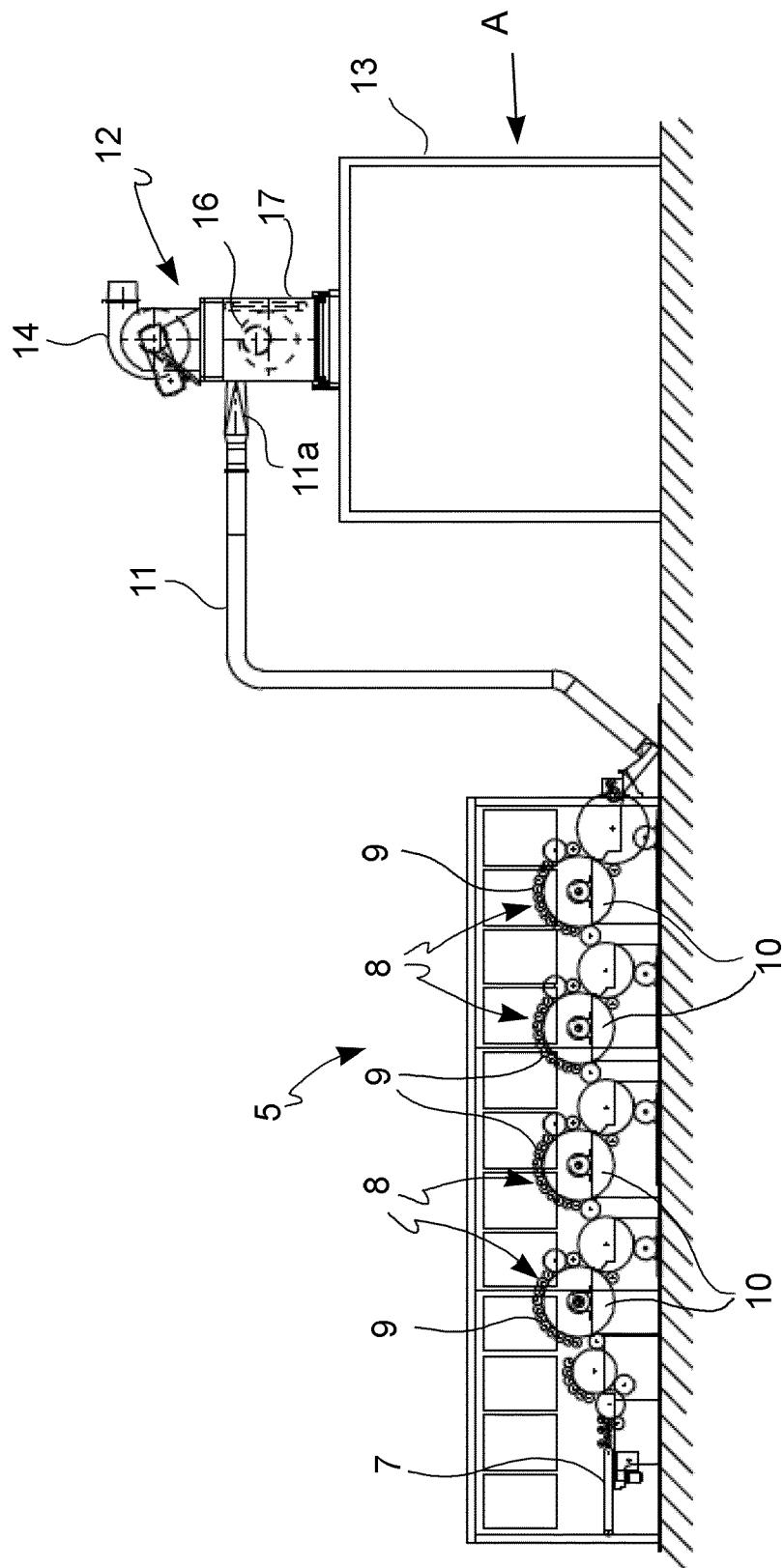


FIG. 2

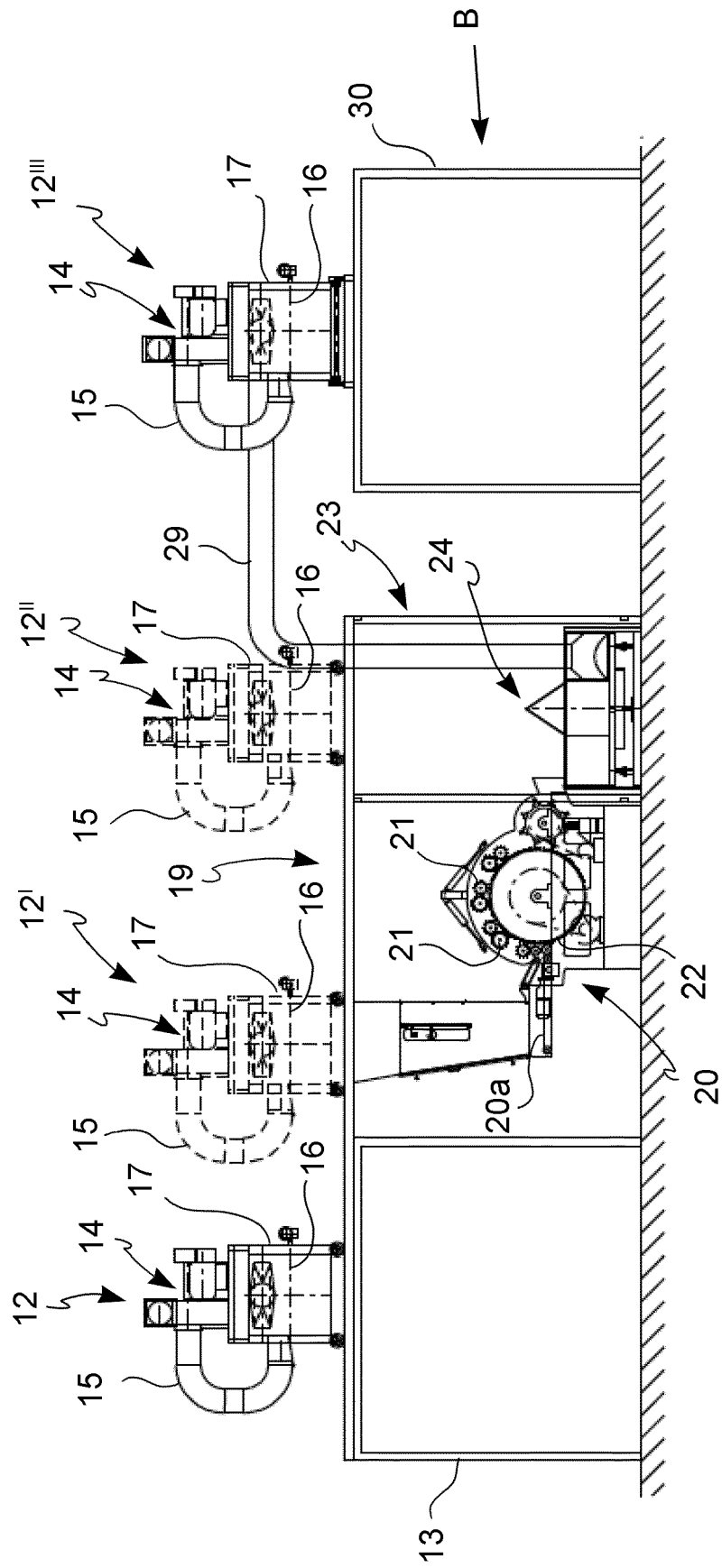


FIG. 3

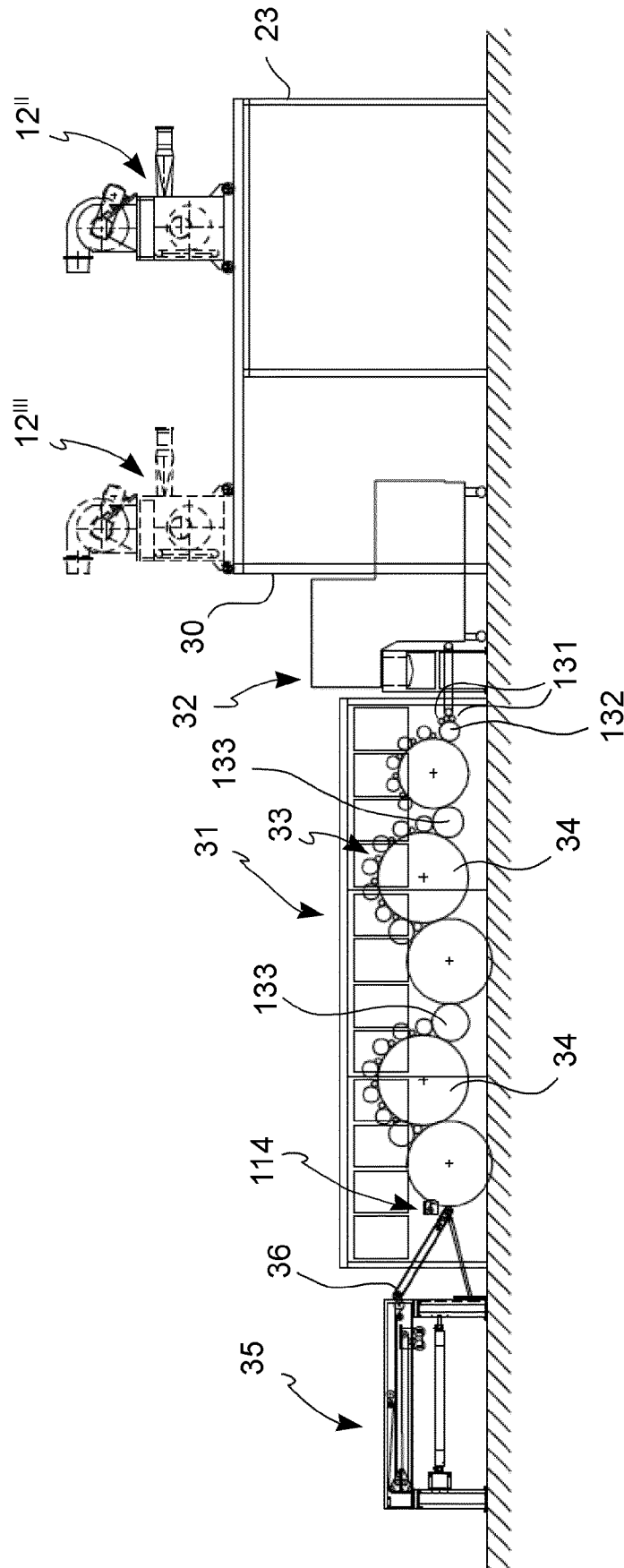


FIG. 4

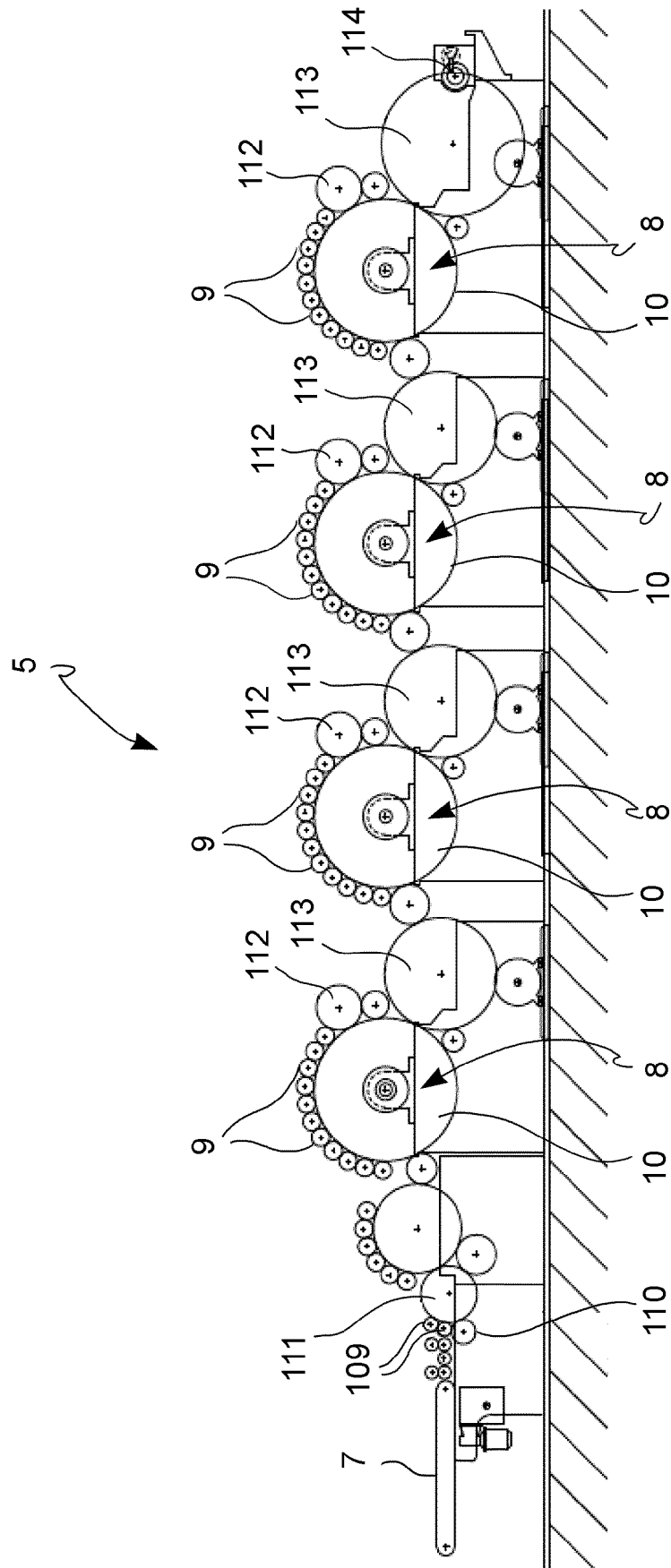


FIG. 5

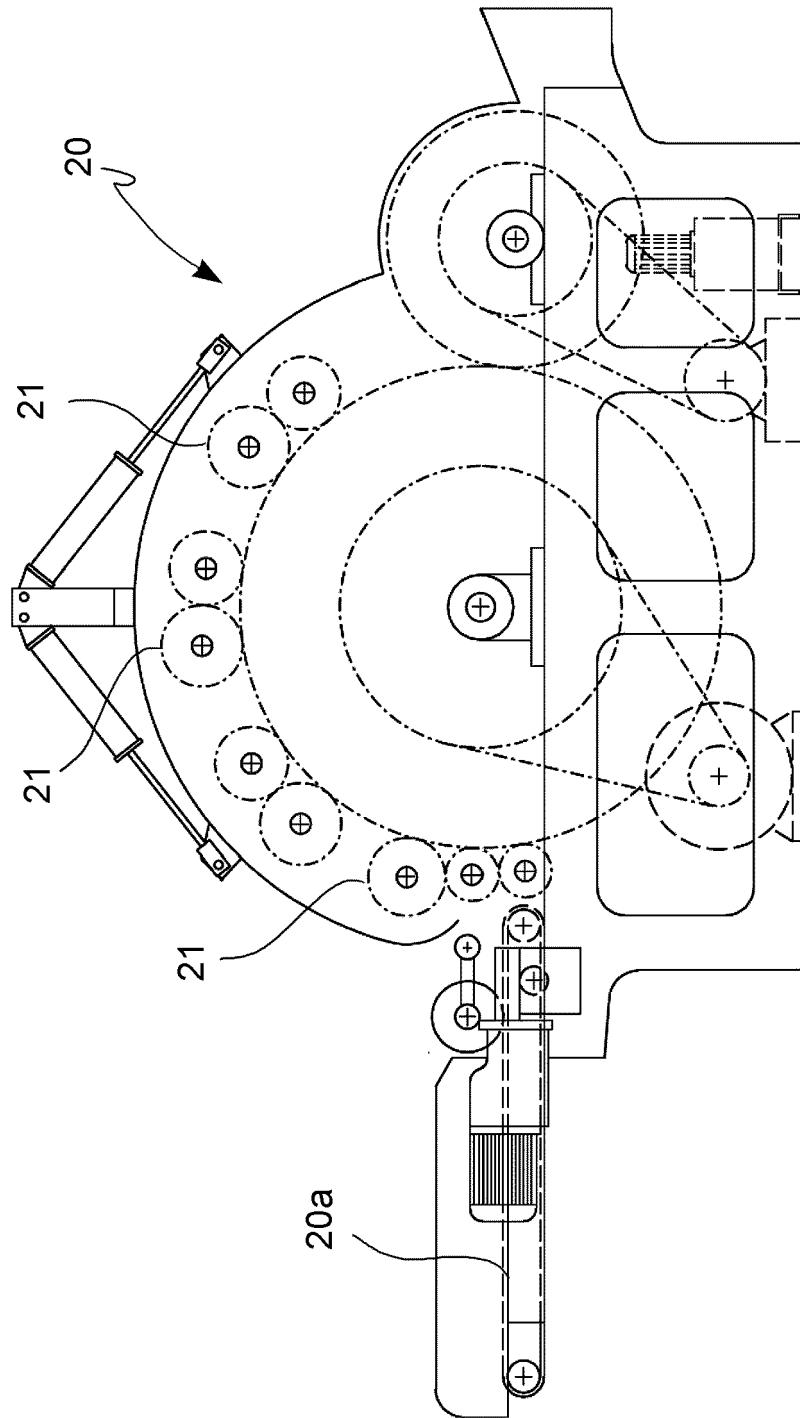
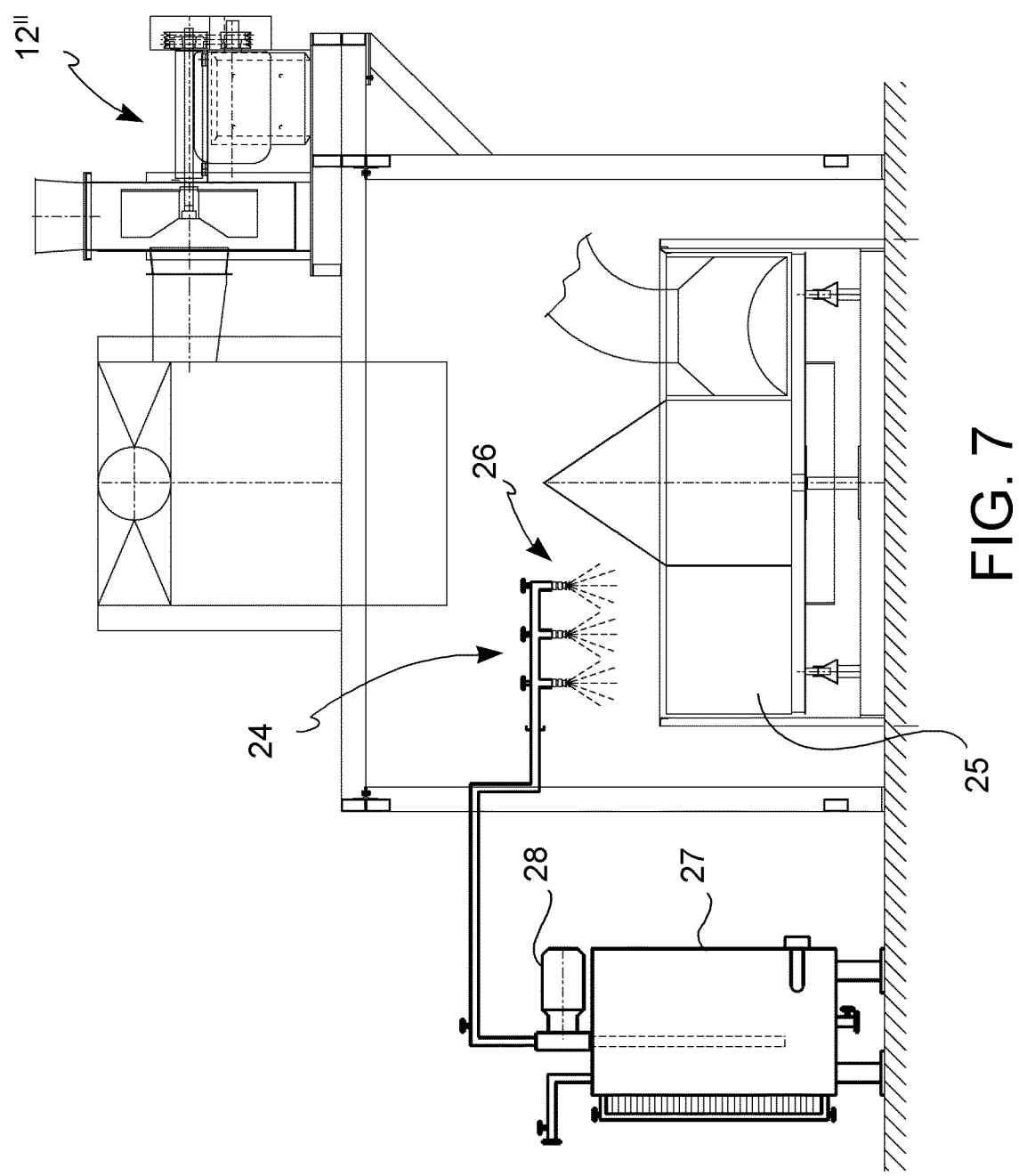


FIG. 6



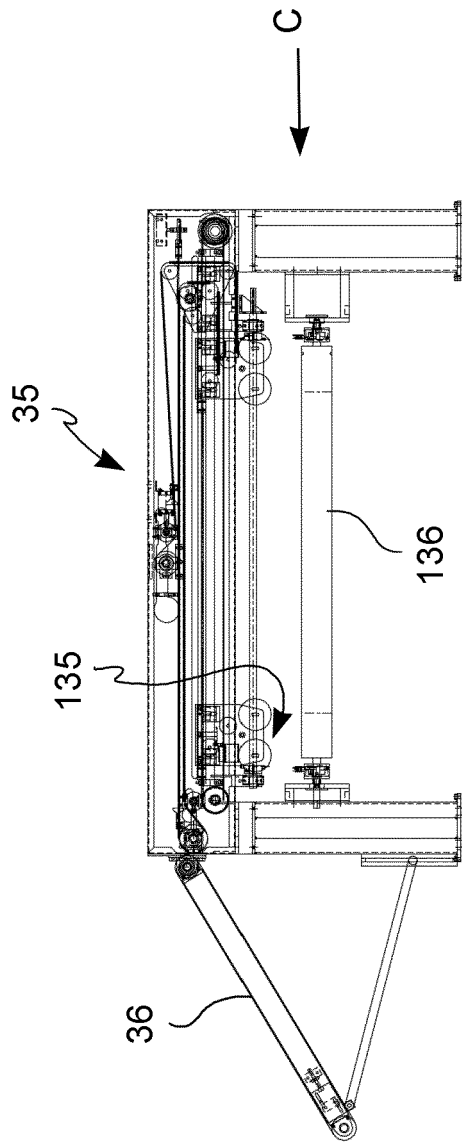


FIG. 8A

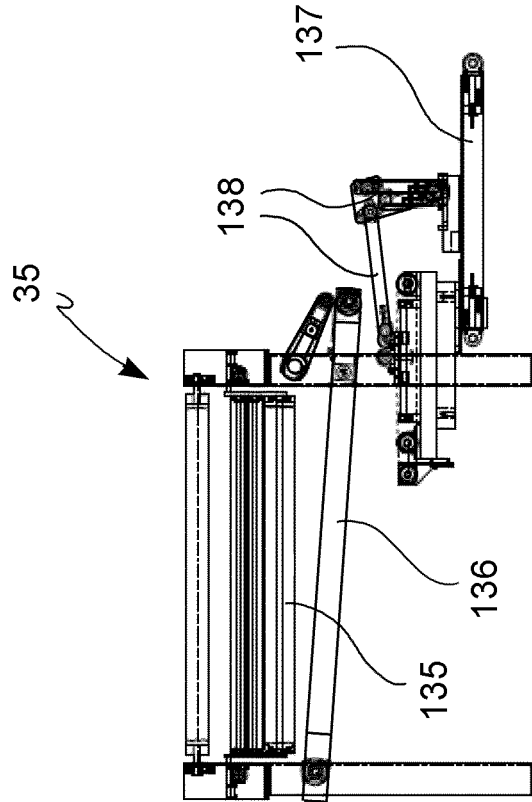


FIG. 8B

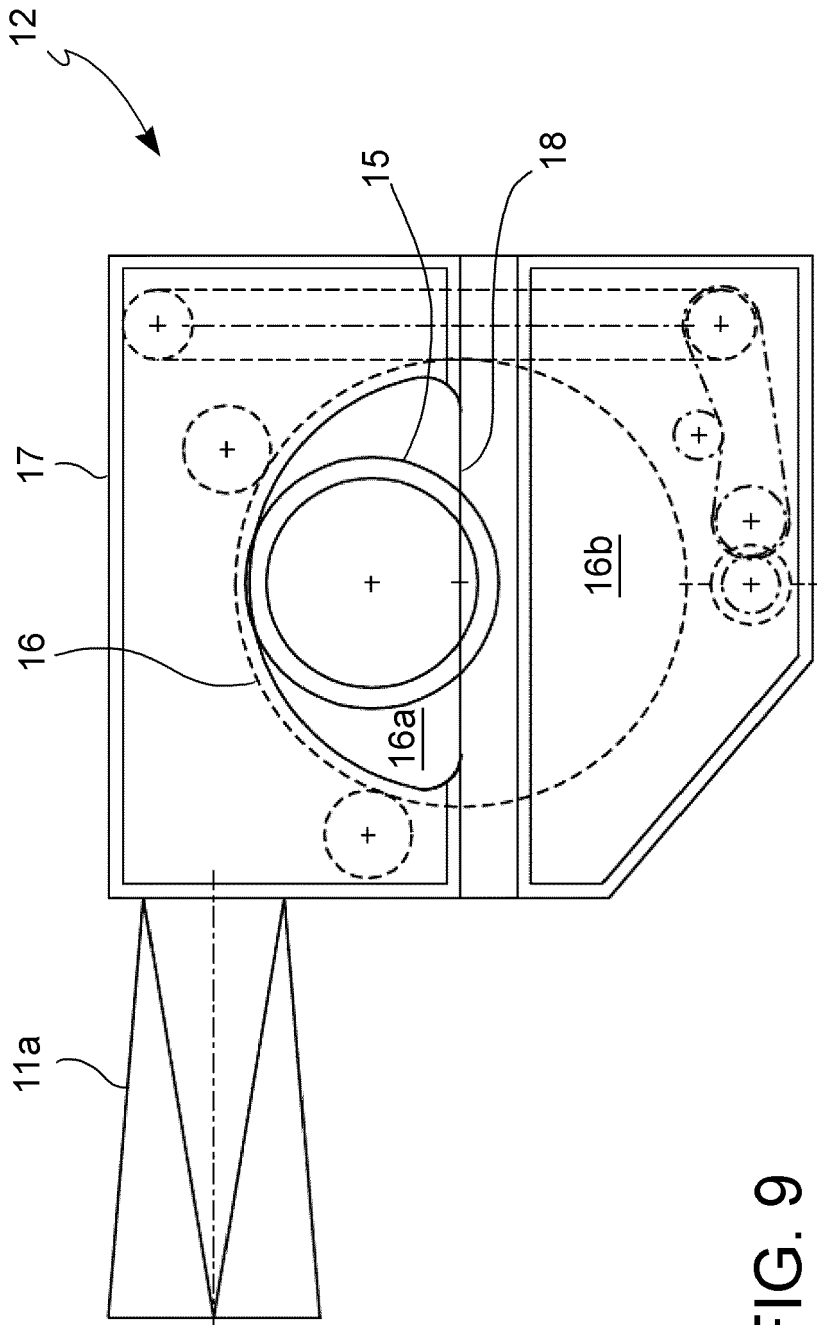


FIG. 9

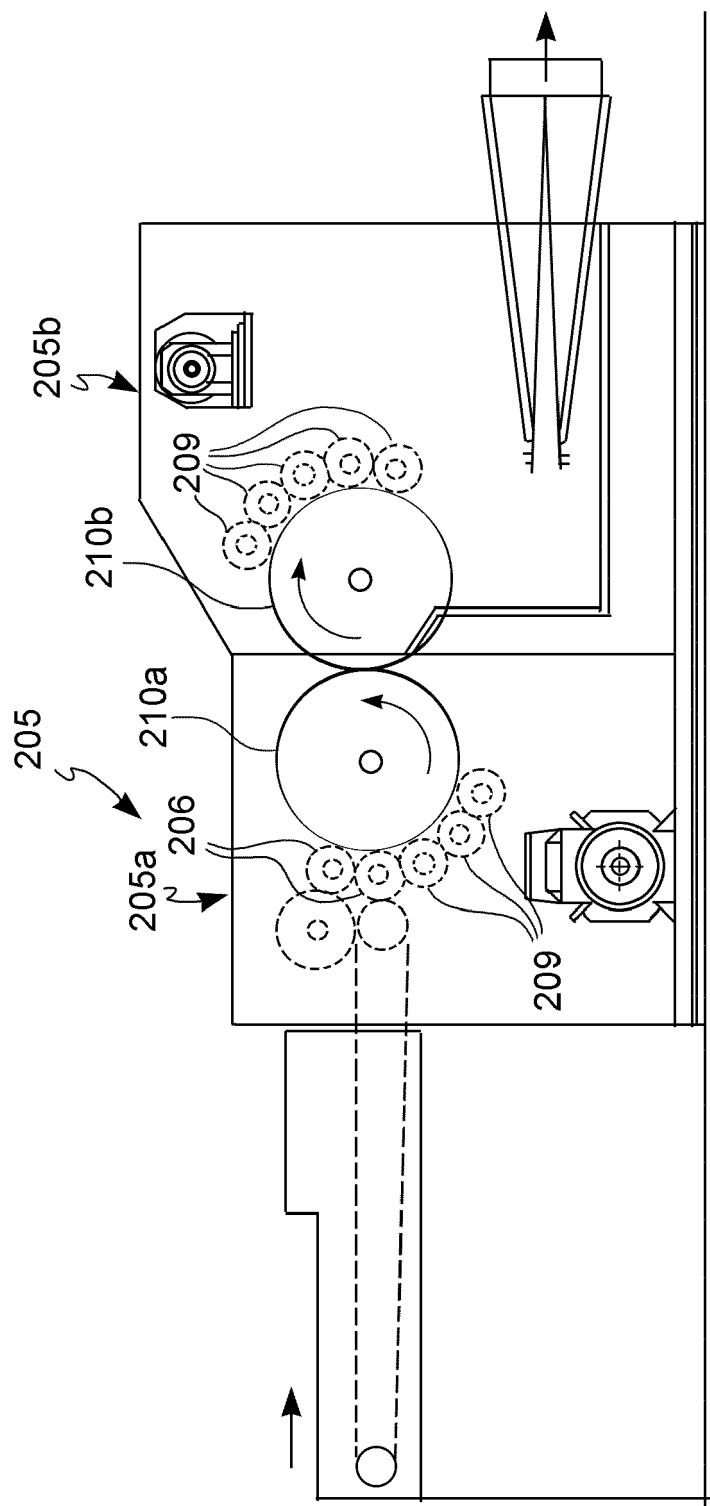


FIG. 10



EUROPEAN SEARCH REPORT

Application Number
EP 20 16 1725

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP H08 199456 A (KAMIYA HIDEKI) 6 August 1996 (1996-08-06)	10	INV. D04H1/02
Y	* paragraph [0001]; figure 1 * * paragraphs [0019], [0021], [0027] - [0028], [0030], [0033], [0036] - [0037] * * paragraph [0034] * * paragraphs [0040] - [0041]; figure 2 *	1-9	D04H1/4266 D04H1/4274 D04H1/498 D04H1/46 D04H1/52 D04H1/736 D04H1/74 D01G11/04
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