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(71) Applicant: **SANTONI S.P.A.** [IT/IT]; Via Carlo Fenzi, 14, 25135 Brescia (IT).

(72) Inventors: **RIZZI, Stefano**; Via Panigada 20, 25126 Brescia (IT). **ANDREOLI, Marco**; Via Scuole 25, 25045 Castegnato (BS) (IT). **LONATI, Andrea**; Via Del Goletto,48, 25123 Brescia (IT).

(74) Agent: **ROSA, Daniele**; c/o PGA S.P.A., piazza della Vittoria 7, 25121 Brescia (IT).

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(54) Title: TAKE-DOWN AND/OR COLLECTION GROUP OF A FABRIC MANUFACTURED BY A CIRCULAR WEFT KNITTING MACHINE

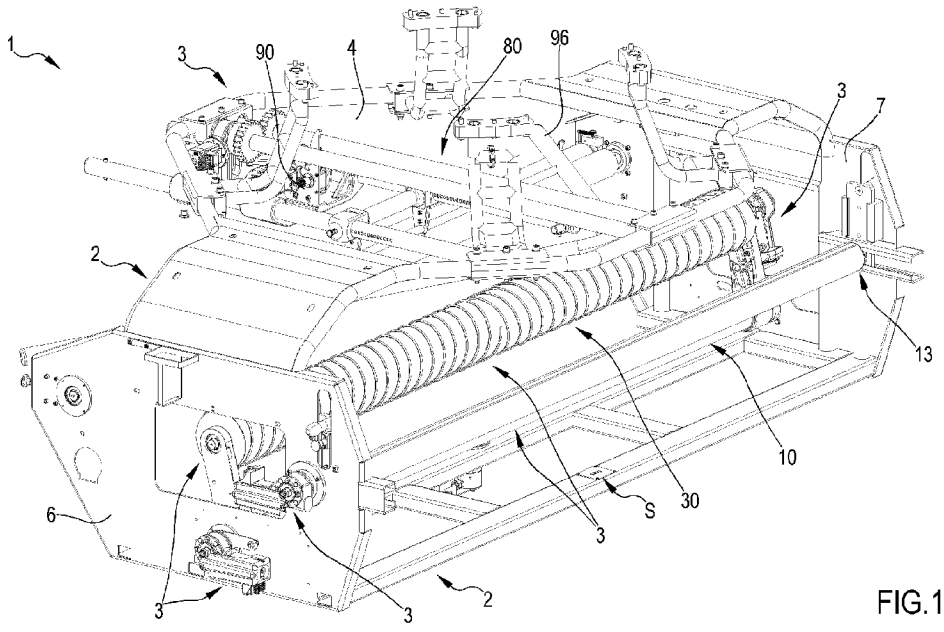

FIG.1

(57) Abstract: A take-down and/or collection group (1) of a fabric (F), manufactured by a circular weft knitting machine (100) comprising a textile head (T) and a base (B); the take-down and/or collection group comprises a frame (2), mounted in a rotating manner to the circular knitting machine, and operating organs (3) supported by the frame, comprising a collection roller (10) and configured to open and spread the fabric (F) manufactured by the circular knitting machine, wrapping it in a single layer and continuously on the collection roller (10); the operating organs comprise a first motor group (20) associated at the collection roller and active on the rotation axis (11) of the collection roller, in such a way that the collection roller results axially motorized, i.e. is put in rotation around the rotation axis by the first motor group.

[Continued on next page]

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DESCRIPTION

"Take-down and/or collection group of a fabric manufactured by a circular weft knitting machine"

Field of the invention

The present invention has as its object a take-down and/or collection group of the fabric manufactured by a circular weft knitting machine.

In greater detail, the present invention refers to a take-down and/or collection group, for a circular knitting machine, provided with operating organs able to manage in a controlled manner the collection of the fabric on a collection roller.

The present invention has as its object also a circular weft knitting machine comprising said take-down and/or collection group.

In addition, the present invention concerns a collection method of the fabric manufactured by a circular weft knitting machine by means of a take-down and/or collection group.

Background of the invention

The present invention is placed first of all in the technical field of circular weft knitting machines.

In the present text with the "knitting machine" it is generally intended a circular knitting machine adapted to the manufacturing of textile items and provided with at least one needle-bearing organ or needle-bearing cylinder in a rotating manner mounted in a bearing structure of the machine and supporting a plurality of needles movable parallel to a rotation axis of the needle-bearing cylinder to manufacture a weft knitted fabric. Furthermore, the textile machine is provided with a plurality of yarn feed points, or knitting "falls", where the yarn is supplied to the machine needles. This textile machine can, for example, be of the single-needle bed or double-needle bed type. Circular textile machines can comprise a variable number of falls, e.g. 1, 2, 4, 6, 8 or more knitting falls.

More in detail, the present invention is in the technical field of circular knitting machines belonging to a typology referred to in the industry with the term "OPEN". Such a typology comprises circular knitting machines provided with at least one needle-bearing organ, a cam device, to control the movement of the needles, and especially a take-down and collection group able to collect the fabric manufactured by the machine in a single layer, typically by wrapping it on a roller. The single layer fabric, deriving from the needle-bearing organ and collected by the take-down and collection group, can be obtained by means of cutting and stretching (or "opening") of a tubular fabric (if - as in most cases - the machine continuously manufactures a tubular fabric) or, alternatively, it can be manufactured directly "in the open", i.e. as a single continuous layer of fabric (having a determined width). In other words, the take-down and collection group collects (by wrapping it on a roller) a single layer fabric and not a cylindrically developed tubular: the single layer fabric has a continuous "stripe" conformation

(or cloth or patch) of particular width and can be obtained by “opening” a tubular, by means of a continuous cut carried out parallel to the direction of longitudinal development of the manufactured tubular fabric, or derive from the machine already as “open” fabric, in a single layer: hence the term “open” used to identify this typology of machine. “Open” type knitting machines can sometimes comprise an only collection unit, i.e. without a taking-down function: this is the case, for example, in machines where the taking-down is carried out directly at the needle bed; in this case, the fabric manufactured by the needle-bearing organ descends into the collection unit, which takes care of wrapping it on a roller, typically by means of a winder. In any case, an “open” type machine is definable as a circular weft knitting machine in which the manufactured fabric is collected “in the open”, i.e. as a single layer, by wrapping it on a collection roller.

The circular weft knitting machines of the technical field of the present invention can be of single needle bed (with single needle-bearing cylinder) or double needle bed (with needle-bearing cylinder and needle-bearing plate) type.

The description and claims of the present patent application, where they indicate an "open type" knitting machine, therefore identify - specifically - a textile machine having the characteristics above described for "open" machines, characteristics which clearly and unambiguously identify and define such a typology in the reference field, and are clearly understandable to a person skilled in the art. The nomenclature used in the claims must therefore be correctly interpreted in light of this information about the technical reference field. In particular, the characteristic according to which the machine object of the present invention is of the "open" type is to be understood as a precise technical characteristic, which constitutes a limitation and is not to be interpreted as a mere example of a textile machine, among the many existing typologies, on which the further technical characteristics described in the claims are to be incorporated.

The “open” type circular weft knitting machine are provided with a base which constitutes the bearing structure thereof and which supports and houses all the machine components, in particular the textile head (comprising the needle-bearing organ, a plurality of needles and command means of these needles) and the take-down and collection group. The base allows furthermore to firmly lean the machine in the place where it operates.

The open type machines typically have a needle-bearing organ, i.e. a needle-bearing cylinder or a needle-bearing plate, having a diameter in the order of 30 to 40 inches, but there are also exemplars having a smaller diameter, e.g. 24 inches, or greater than 40 inches.

In the “open” type machine that manufacture a tubular fabric (i.e. do not manufacture a directly “in the open” fabric), the take-down and/or collection group comprises cutting organs adapted to longitudinally cut the tubular fabric deriving from the needle-bearing organ so as to make it "open" and therefore wrappable in a single layer on the collection roller.

The take-down and collection group comprises typically further organs, such as flattening means of the tubular fabric, spreading means to open the fabric after cutting, tensioning roller for the controlled advancement of the

fabric on its path towards the collection roller, as well as actuators and mechanical synchronizing means of the movements of the various organs.

Among the means determining the advancement of the fabric towards the collection roller, of particular importance is a roller called spreader roller, also called a spiral roller or tensioning roller, which intercepts the fabric upstream of the collection roller and is configured to progressively open it, in the sense of its width, and eliminate wrinkles and folds in such a way that the fabric reaches the collection roller on which it is wrapped as open and spread as possible, in all its width. An example of a spreading roller having such a purpose is shown in patent document WO0050678: such a roller has two helical embossed elements which develop in the opposite direction from the center towards the two ends of the roller.

The take-down and collection group is typically mounted to the machine underneath the needle-bearing organ (in a collection space specifically designed for such a group) and is able to rotate integrally with the needle-bearing organ to follow its fabric manufacturing and collect the fabric on a roll.

The take-down and collection groups of known type are typically connected, directly or indirectly, to the needle-bearing organ of the textile head through connection means configured to transmit the motion of the needle-bearing organ to the take-down and/or collection group so that it can move, i.e. rotate, synchronously with the needle-bearing organ. By way of example, said connection means comprise one or more brackets connected to the textile head by means of fastening means such as screws and/or bolts.

Examples of take-down and collection groups for knitting machine of “open” type are shown in patent documents EP0456576, EP0696658 and WO0050678. More in detail, these take-down and collection groups have a frame supporting all the organs of the group and arranged in the machine below the textile head. The entire frame rotates integrally with the needle-bearing organ, and is furthermore laid at the lower base of the machine by means of supporting means (comprising e.g. a bearing) which support its weight and at the same time allow it to rotate; the supporting means at the bottom can be driven (e.g. by a motor) to determine the rotation of the entire frame.

The document WO2014191868A1 in the name of the Applicant describes a take-down and collection group for a circular knitting machine of the “open” type.

In solutions of the known type, the take-down and collection group typically comprises an idle collection roller, i.e. free to rotate around its own axis. Its rotation is provided by a pair of motorized rollers on which the collection roller is laid. The open piece of fabric, to be wrapped onto the collection roller, is tucked between the collection roller itself and the two motorized rollers below. The rotation of the motorized rollers causes both the advancement of the fabric and the rotation of the collection roller, on which the fabric is progressively wrapped. So substantially the collection roller is driven tangentially (by contact) by the driven rollers, which are responsible for rotating it. The contact between the collection roller and the motorized rollers is always kept, in such a way as to support the advancement of the fabric cloth: it is therefore evident that, as the fabric wrapped to the

collection roller increases, the diameter of the latter increases and therefore its position must vary; in particular, the collection roller automatically moves vertically as its diameter increases, while the motorized rollers continue to rotate in the same position.

In known solutions, motorized rollers typically have a constant peripheral speed; the collection roller is idle, so its angular speed changes as its diameter increases, i.e. as the collected fabric increases.

Furthermore, given the configuration of the rollers, as the weight of the collection roller increases, the fabric is pressed more: in essence, it is as if the fabric being wrapped “self-presses” more due to the greater weight of the collection roller. This determines a greater or lower stretching of the fabric depending on the diameter assumed by the collection roller. For this reason typically the fabric wrapped to the collection roller does not take on a perfectly "cylindrical" roll shape, but rather has a very variable roll shape, e.g. narrower and wider at different points, both along the lateral extension and in different radial portions. In some cases, as the diameter of the collection roller increases, the fabric tends to enlarge.

In other known solutions the motorized rollers, which continuously rotate the collection roller, may be placed above the collection roller or to the side of it; in any case the driving action of the motorized rollers is tangential to the collection roller.

Summary

In the collection of the textile fabric manufactured by the circular weft knitting machines, in particular of the “open” type, i.e. with collection of the fabric in a single layer, the Applicant has noted certain limitations and drawbacks, and believes that the known solutions can be improved in several aspects.

First of all, as shown above, the known take-down and collection groups are not able to operate an effective and uniform wrapping of the fabric on the collection roller: in particular, the known elements of the take-down and collection groups can introduce unwanted creases, wrinkles and/or overlaps in the fabric wrapped on the collection roller, which can damage the fabric, compromise its quality, complicate the subsequent finishing or packaging processes carried out on the fabric, or can even require further operations of regulation of the fabric on the collection roller. The performance limitations of the known take-down and collection groups typically determine a reduced effectiveness in spreading the outer edges of the fabric, which tend to “curl” or wrap on themselves, in a longitudinal direction, forming on each side what is called a “cigarette” in technical jargon.

The non-uniform wrapping of the fabric on the collection roller is therefore a major drawback for circular knitting machines of the “open” type.

The Applicant has also noticed that in the known take-down and collection groups the different elements cooperating with the fabric from the needle-bearing organ to the collection roller, i.e. spreading means, spreading rollers, taking-down rollers, tensioning rollers and the collection roller itself, are arranged with each

other in a sub-optimal manner, generating misalignments and/or wrinkles in the fabric, wrappings of the lateral edges of the fabric, and determining an uneven and flat wrapping of the fabric on the collection roller.

A further limitation noticed in the known take-down and collection groups is the reduced volume or flow rate, in terms of accumulable fabric length, of the collection roller. Considering that typically the circular knitting machines of the "open" type operate for large productions, i.e. they realize very long cloths of fabric working continuously even for long periods of time, the saturation of the collection roller forces a machine stop (for the replacement of the roller itself) which has a negative impact, both in terms of time and cost, on the textile manufacturing. The maximum flow rate of the collection roller is determined by the free space within the take-down and collection group, within which the collection roller can increase as the fabric is wrapped; in known solutions, this free space is limited due to the elements present and how they are operated.

Another drawback of the known take-down and collection groups is represented by the fact that the motorized rollers, on which the collection roller is laid, introduce unwanted overvoltage into the fabric during collection, which can vary depending on the type of fabric and the friction between the fabric and the motorized rollers. This overtension can also be transferred onto already collected layers of fabric (i.e. onto previous wrappings of the collection roller). Furthermore, it should be considered that as the amount of fabric wrapped to the collection roller increases, so does the weight of the collection roller itself and therefore also the friction force between the fabric and the motorized rollers (as the weight is discharged onto them): in this condition, the unwanted overvoltage introduced into the fabric by the action of the motorized rollers also increases. In such a situation of high weight/friction on the motorized rollers, it can happen that the motorized rollers also move several layers (or flaps) of fabric wrapped to the collection roller at the same time, for example two, three or more layers (i.e. the last outer layer plus other previously wrapped layers). This is obviously undesired, as the motorized rollers should only act on the last layer of fabric being wrapped to the collection roller.

Another drawback of the known take-down and collection groups is represented by the difficulty in the control of the collection of the fabric; it is in fact difficult to know precisely the state of the different organs that cooperate to the collection of the fabric deriving from the textile head, and typically it is not possible to have precise parameters that are representative of the operational state in which the take-down and collection group is in. This can lead to errors in the collection of the fabric, can introduce defects into the collected fabric, and generally makes it difficult to co-ordinate the operations performed by the take-down and collection group with the operations performed by the other parts of the knitting machine, in particular by the textile head where the fabric is manufactured.

Again, the known take-down and collection groups are characterized by a complex structure and a high cost of implementation and maintenance.

In this situation, a purpose at the basis of the present invention, in its various aspects and/or embodiments, is to provide a take-down and/or collection group for circular knitting machines (in particular of the “open” type), a

circular weft knitting machine of the "open" type, and a collection method of the fabric manufactured by a circular weft knitting machine that can be able to solve one or more of the above-mentioned drawbacks.

Another purpose of the present invention is to provide a take-down and/or collection group, a circular weft knitting machine of the "open" type and a collection method of the fabric which allow to implement an improved control and an evolved management of the collection of the fabric manufactured.

Another purpose of the present invention is to provide a take-down and/or collection group, a circular weft knitting machine of the "open" type and a collection method of the fabric able to operate in an innovative manner with respect to the known solutions.

Another purpose of the present invention is to provide a take-down and/or collection group, for a circular weft knitting machine of the "open" type, which allows to increase the amount of wrappable fabric on the collection roller.

Another purpose of the present invention is to provide a take-down and/or collection group, for a circular weft knitting machine of the "open" type, having high technological characteristics.

Another purpose of the present invention is to provide a take-down and/or collection group, a circular weft knitting machine of the "open" type and a collection method of the fabric able to prevent the formation of misalignments and/or wrinkles in the collected fabric, and/or prevent the wrapping of lateral edges of the fabric.

Another purpose of the present invention is to provide a take-down and/or collection group, a circular weft knitting machine of the "open" type and a collection method of the fabric able to realize a uniform and flat wrapping of the fabric on the collection roller.

Another purpose of the present invention is to provide a take-down and/or collection group, a circular weft knitting machine of the "open" type and a collection method of the fabric able to open and spread the fabric effectively.

Another purpose of the present invention is to provide a take-down and/or collection group, a circular weft knitting machine of the "open" type and a collection method of the fabric with improved performance, for example in terms of productivity and/or quality and uniformity of the manufactured knitwear, with respect to known solutions.

Another purpose of the present invention is to provide a take-down and/or collection group and a collection method of the fabric that are versatile and adaptable to different textile needs and different fabric typologies and dimensions.

It is furthermore purpose of the present invention to propose a solution to realize a take-down and/or collection group, for a circular weft knitting machine of the "open" type, able to be subjected easily to operations of maintenance and replacement of its parts.

Another purpose of the present invention is to provide a take-down and/or collection group, for a circular weft knitting machine of the “open” type, characterized by a high operational reliability and/or a lower susceptibility to failures and malfunctions.

Another purpose of the present invention is to provide a take-down and/or collection group and a circular weft knitting machine of the “open” type characterized by a simple and rational structure.

Another purpose of the present invention is to create alternative solutions, with respect to the known technique, in the realization of take-down and collection groups, in particular for “open” type circular weft knitting machines, and/or to open up new design fields.

These purposes and any others, which will become clearer in the following description, are substantially reached by a take-down and/or collection group for circular knitting machines (in particular of the “open” type), a circular weft knitting machine of the “open” type, and a collection method of the fabric manufactured by a circular weft knitting machine, according to one or more of the attached claims, as well as according to the following aspects and/or embodiments, variously combined, possibly also with the above-mentioned claims.

In the present description and in the attached claims the terms “upper”, “lower”, “lower”, “below”, “horizontal”, “vertical”, are relative to the positioning of the take-down and/or collection group and the knitting machine in normal operation, for example with the central axis of rotation of the needle-bearing organ placed vertically.

In the present description and in the attached claims the terms “axial”, “longitudinal”, “circumferential”, “radial” are referred from time to time to a determined axis for a determined element or component.

Aspects of the invention are listed below.

In a first aspect thereof, the present invention refers to a take-down and/or collection group of a fabric manufactured by a circular weft knitting machine.

In an aspect the take-down and/or collection group comprises:

- a textile head provided with at least one needle-bearing organ rotating around a central axis, having shape of needle-bearing cylinder or needle-bearing plate, of a plurality of needles movably mounted to said at least one needle-bearing organ, and of command organs adapted to selectively actuate said plurality of needles and to allow the manufacturing of a fabric;
- a base constituting the bearing structure of the knitting machine and configured to support said textile head, said base defining, below said textile head, a housing volume.

In an aspect the take-down and/or collection group comprises:

- a frame configured to be mounted in a rotating manner to said circular knitting machine in said housing volume;
- operating organs operatively associated to, and supported by, said frame and comprising at least one collection roller developing along a rotation axis and longitudinally extending between two ends, the operating organs being configured at least to open and spread, or also eventually to draw it from said needle-bearing

organ, the fabric manufactured by the circular knitting machine, wrapping it in a single layer and continuously on said collection roller.

In an aspect said operating organs comprise at least one first motor group associated at the collection roller and active on the rotation axis of the collection roller, in such a way that the collection roller results axially motorized, i.e. is put in rotation around said rotation axis by said first motor group. In an aspect said first motor group is directly active on the rotation axis of the collection roller.

In an aspect the driving torque necessary to the rotation of the collection roller is generated by said first motor group directly at the collection roller.

In an aspect the collection roller, actuated by said first motor group, is mounted hanging in said frame, in such a way to result hanging in said take-down and/or collection group, and in such a way that the entire surface of the fabric wrapped on the collection roller does not result in contact with said operating organs or other elements of the take-down and/or collection group.

In an aspect the collection roller remains, in use, with its rotation axis in a fixed position with respect to the frame, during all the steps of the collection of the fabric and regardless of the amount of fabric wrapped to the collection roller.

In an aspect said first motor group is fixed at one of the two ends of the collection roller, and from this position it puts in rotation the collection roller directly on said rotation axis.

In an aspect the take-down and/or collection group comprises at least one sensor of contactless type (contactless), associated to said frame or to said operating organs and configured to measure a distance value between the sensor itself and a surface of said collection roller, upon which a determined quantity of fabric is wrapped in a single layer.

In an aspect the take-down and/or collection group is configured to process a measure of the radius of the collection roller as a function of said distance value measured by the contactless sensor.

In an aspect said contactless sensor can be by way of example: laser sensor, time-of-flight sensor, infrared sensor, ultrasound sensor, optical sensor, sensor with camera, inductive sensor, capacitive sensor, magnetic sensor; LVDT sensor.

In an aspect said determined amount of single layer fabric can be equal to zero, corresponding to an empty collection roller condition, or greater than zero, corresponding to a collection roller condition with wrapped fabric.

In an aspect said contactless sensor is positioned below the collection roller, preferably in a fixed position with respect to it. In this case the sensor is, with knitting machine in use, rotating together with the take-down and/or collection group.

In an aspect said contactless sensor is preferably mounted to the frame of the take-down and/or collection group.

In an aspect said contactless sensor is oriented towards the rotation axis of the collection roller, i.e. has a detection direction that intersects the rotation axis of the collection roller.

In an alternative aspect, said contactless sensor is located in a fixed position with respect to the collection roller and keeps this fixed position also with knitting machine in use and with take-down and/or collection group in rotation. Preferably the contactless sensor is located in a fixed position on said base.

In an aspect, said collection roller:

- has an outer collection surface, corresponding to the outermost layer of the fabric wrapped to the collection roller;
- has, instant by instant during the collection of the fabric, a radius of the collection roller, corresponding to the radial distance between the outer collection surface and the rotation axis;
- has, instant by instant during the collection of the fabric, an angular speed of rotation around the rotation axis;
- has, instant by instant during the collection of the fabric, a tangential speed, i.e. the linear speed at said outer collection surface.

In an aspect said tangential speed is, instant by instant, equal to the product of the angular velocity by the radius of the collection roller.

In an aspect said tangential speed:

- has a preferably constant value during the entire collection of the fabric;
- has a preferably constant value at times during discrete steps of the collection of the fabric;
- is function of the rotation speed of the needle-bearing organ producing the fabric;
- corresponds substantially to the advancement linear speed of the fabric in the take-down and/or collection group, and to the linear amount of fabric that is wrapped to the collection roller per time unit.

In an aspect said first motor group is configured to progressively reduce said angular speed of the collection roller as said radius of the collection roller increases, in such a way to keep said tangential speed of the collection roller constant.

In fact, since the tangential speed is equal to the product of the angular speed by the radius of the collection roller, as the radius of the collection roller increases, the angular speed must decrease in order to keep the tangential speed constant.

In an aspect the take-down and/or collection group is configured to measure, through said contactless sensor, said distance value and process said measure of the radius of the collection roller in real time, i.e. instant by instant, thus continuously monitoring the measure of the radius of the collection roller.

In an aspect, the take-down and/or collection group defines an articulated path of the fabric exiting from said textile head which ends on said collection roller. In particular, the take-down and/or collection group defines said articulated path starting from an upper opening of the frame and terminating in said collection roller.

In an aspect the collection roller comprises:

- a rod extending between two ends and onto which the fabric collected by the take-down and/or collection group is wrapped, forming a reel of fabric around said rod;
- two supports placed at the two ends of the rod and configured to support in rotation said rod.

In an aspect the frame comprises, at said first lateral portion and of said second lateral portion, two housing seats configured to receive the collection roller at the two ends thereof.

In an aspect each housing seat comprises a housing channel configured for the loading and unloading of the collection roller.

In an aspect the loading of the collection roller occurs by means of insertion of said two supports in the two housing channels, whereas the unloading of the collection roller occurs by means of extraction of said two supports from the two housing channels.

In an aspect each housing seat is configured to receive a respective fastener, configured to the maintaining the position of the support of the collection roller positioned, during use, in the housing seat.

In an aspect the first motor group comprises:

- a first electric motor, preferably a stepper motor;
- a mechanical transmission, mounted downstream of said first electric motor and directly active on said rod of the collection roller to put it selectively in rotation.

In an aspect said mechanical transmission is interposed between the first electric motor and the rod of the collection roller.

In an aspect said mechanical transmission ends with a shaft bearing a motor organ configured to directly transfer a controlled rotating motion to the rod of the collection roller.

In an aspect said rod of the collection roller comprises a guided organ directly gearable to the motor organ for receiving from it the controlled rotating motion and putting the rod of the collection roller in rotation.

In an aspect the guided organ is integral with the shaft of the collection roller, preferably at one end thereof.

In an aspect the guided organ is coaxial to the rod of the collection roller.

In an aspect said guided organ:

- engages on the motor organ when the collection roller is mounted on the frame, i.e. when the supports of the collection roller are inserted in the housing seats of the frame;
- disengages from the motor organ when the collection roller is demounted from the frame, i.e. when the supports of the collection roller are extracted from the housing seats of the frame.

In an aspect said first motor group is mounted, preferably in fixed position during the use of the take-down and/or collection group, to the first lateral portion or to the second lateral portion of the frame. In this way the motor organ is in a fixed position with respect to the frame and is ready to receive the guided organ when the collection roller is mounted to the frame.

In an aspect the first motor group comprises:

- said first electric motor, of stepper type, provided with an output shaft;
- said mechanical transmission comprising:
    - an endless screw transmission / helicoidal toothed wheel comprising:
        - an endless screw connected to, and put in rotation by, said output shaft of the first electric motor, and
        - a helicoidal toothed wheel geared to said endless screw and mounted (for example coupled) on said shaft bearing the motor organ.

In an aspect the operating organs comprise at least one spreading roller, or tensioning roller, mounted to the frame in position upstream (preferably immediately upstream) with respect to said collection roller. The spreading roller is configured to interact with the fabric advancing towards the collection roller in such a way to spread it before the wrapping on the collection roller.

In an aspect, said spreading roller longitudinally extends, between two lateral ends, in a direction substantially parallel to said rotation axis of the collection roller and is configured to rotate around a rotation axis thereof.

In an aspect, said spreading roller is mounted in a movable manner, for example rotatable or translatable or rototranslatable, to said frame and is configured to be able to vary an operating distance that separates it from said collection roller.

In an aspect said operating distance corresponds to the linear distance between the rotation axis of the spreading roller and the respective rotation axis of the collection roller.

In an aspect the operating organs comprise a second motor group active on the spreading roller for selectively moving it in such a way to increase or decrease the operating distance that separates it from said collection roller, preferably keeping the spreading roller parallel to the collection roller.

In an aspect the movement of the spreading roller by effect of the second motor group is a rotation or a translation or a rototranslation.

In an aspect, said spreading roller:

- has an outer operating surface, that contacts the fabric in its transit toward the collection roller and acts on the fabric itself for enlarging and spreading it;
- has a radius of the spreading roller having a constant value and corresponding to the radial distance between the outer operating surface and the rotation axis of the spreading roller.

In an aspect the spreading roller is configured to be moved, during the collection, by varying said operating distance that separates it from said collection roller, in such a way to keep constant, instant by instant, an optimal separation value equal to a distance between the outer operating surface of the spreading roller and the outer collection surface of the collection roller.

In an aspect said second motor group is configured to move the spreading roller on the basis of said measure of the radius of the collection roller processed as a function of said distance value measured by said contactless

sensor, by varying said operating distance that separates the spreading roller from the collection roller in such a way to keep constant, instant by instant, said optimal separation value.

In an aspect said second motor group is configured to progressively increase said operating distance as said radius of the collection roller increases, keeping said optimal separation value constant during the collection of the fabric.

In an alternative aspect, said operating distance corresponds to a linear distance between the outer collection surface of the collection roller and the outer operating surface of the spreading roller. In this case the operating distance is the linear interval between the surfaces of the two rollers and therefore is variable, during the collection of the fabric, depending on the radius of the collection roller; in fact the radius of the collection roller increases as the fabric is collected.

In an aspect said spreading roller is mounted, with its two lateral ends, to the first lateral portion and to the second lateral portion of the frame, in such a way that the rotation axis of the spreading roller is substantially parallel to the longitudinal axis of the frame.

In an aspect, said spreading roller is mounted to said frame by means of a pair of movable arms. In an aspect each of the two movable arms extends between a lower end, at which it is hinged to the frame, and an upper end, at which it is connected to a lateral end of the spreading roller; the distance between the lower end and the upper end defines a length of the movable arm.

In an aspect said second motor group comprises an actuator active on at least one of the two movable arms, for determining the selective oscillation of the two arms clockwise and counterclockwise and moving the spreading roller along said circumference arc trajectory.

In an aspect one of the two movable arms is actuated by said second motor group and the other movable arm is hinged in idle mode (i.e. free to rotate) to the frame, such that a rotation (i.e. an oscillatory motion) of said one of the two movable arms corresponds to an equal and corresponding rotation of said other movable arm.

In a possible embodiment, not shown, said second motor group comprises a linear guide to which the spreading roller is mounted and configured to move the spreading roller in order to selectively vary said operating distance.

In an aspect, said operating organs comprise at least one transfer roller (or taking-down roller) mounted to the frame in an upstream position with respect to said collection roller, preferably upstream of said spreading roller.

In an aspect, said operating organs comprise flattening or approaching organs of the fabric deriving from the textile head in the form of a closed tubular fabric.

In an aspect, said operating organs comprise cutting organs arranged downstream of the flattening organs and adapted to longitudinally cut, along a preferably vertical generatrix line, the textile fabric of tubular shape manufactured by the textile head so as to subsequently open and wrap it in a single layer on the collection roller, as it occurs typically in circular knitting machines of the “open” type.

In an aspect the take-down and/or collection group comprises at least one control unit configured to command the functioning of said operating organs.

In an aspect said control unit is connected to said contactless sensor and is configured:

- to receive from the contactless sensor a signal representative of said distance value and determine said measure of the radius of the collection roller; or
- to directly receive from the contactless sensor said measure of the radius of the collection roller.

In an aspect said control unit is connected to said operating organs for sending command signals to them able to modify and control the operating configuration thereof.

In an aspect said control unit is configured to:

- send to said first motor group a command signal for progressively reducing said angular speed of the collection roller in such a way to keep said tangential speed of the collection roller constant;
- send to said first motor group a command signal for progressively reducing said angular speed of the collection roller as said radius of the collection roller increases, in such a way to keep said tangential speed of the collection roller constant;
- send to said second motor group a command signal for moving the spreading roller on the basis of said measure of the radius of the collection roller, by varying said operating distance in such a way to keep constant, during the collection of the fabric, said optimal separation value;
- send to said second motor group a command signal for progressively increasing said operating distance as said radius of the collection roller increases, keeping constant, during the collection of the fabric, said optimal separation value;
- send to said third motor group a command signal for putting in rotation the spreading roller at a determined speed for generating a correct spreading and enlarging action of the fabric in transit on the spreading roller.

In an aspect the control unit of the take-down and/or collection group can be shared with the textile machine, for example it can be positioned in said base or in said textile head and operate the control of the entire textile machine.

In an aspect the take-down and/or collection group of the fabric in manufacturing is arranged downstream of the textile head with respect to a supply direction of said fabric in manufacturing.

In an aspect the take-down and/or collection group is configured to rotate integrally with, or in a coordinated manner with respect to, said needle-bearing organ during the manufacturing of the fabric.

In an aspect said circular weft knitting machine can be of single needle bed (only with a needle-bearing cylinder) or a double needle bed (with needle-bearing cylinder and needle-bearing plate) type.

In an aspect said circular weft knitting machine can be of the type with rotating needle-bearing organ (with non-rotating needle control organs and take-down and/or collection group rotating together with the needle-bearing

organ during the manufacturing of the fabric) or fixed needle-bearing organ (with rotating needle control organs and take-down and/or collection group fixed during the manufacturing of the fabric).

In an aspect, the take-down and/or collection group is hanging below the textile head. In an aspect, the take-down and/or collection group is hanging to and supported by the needle-bearing organ.

In a different aspect, the take-down and/or collection group is laid on the ground or on the base and is constrained to the needle-bearing organ.

In an aspect, if the needle-bearing organ is of the rotating type, the take-down and collection group is dragged in rotation during the manufacturing of the fabric by the rotation of said needle-bearing organ and rotates integrally with said needle-bearing organ, i.e. without any relative rotational motion with respect to said needle-bearing organ. The motor that moves the needle-bearing organ and the take-down and/or collection group can therefore be one, with consequent space and cost savings.

In an aspect, if the needle-bearing organ is of the fixed type, the take-down and collection group is fixed, i.e. without any relative rotational motion with respect to said needle-bearing organ.

In an independent aspect thereof, the invention concerns a circular weft knitting machine comprising:

- a textile head provided with at least one needle-bearing organ rotating around a central axis, having shape of needle-bearing cylinder or needle-bearing plate, of a plurality of needles movably mounted to said at least one needle-bearing organ, and of command organs adapted to selectively actuate said plurality of needles and to allow the manufacturing of a fabric;
- a base constituting the bearing structure of the knitting machine and configured to support said textile head, said base defining, below said textile head, a housing volume;
- a take-down and/or collection group according to one or more of the preceding aspects.

In an aspect the circular knitting machine is of the “open” type, i.e. it is configured to manufacture fabric and collect it in the open, i.e. as single layer and continuously, by wrapping it on the collection roller of the take-down and/or collection group.

In an aspect the single layer fabric, deriving from the needle-bearing organ and collected by the take-down and collection group, is obtained:

- by means of cutting and stretching, or “opening”, of a tubular fabric, if the textile head continuously manufactures a tubular fabric; or
- directly “in the open”, i.e. as continuous single layer of fabric having a determined width;

in both cases the take-down and/or collection group by collecting, by wrapping it on the collection roller, a single layer fabric and not a cylindrical development tubular.

In an aspect the single layer fabric has a continuous stripe conformation of particular width and is obtained:

- by opening a tubular, by means of a continuous cut carried out parallel to the direction of longitudinal development of the manufactured tubular fabric; or

- directly by the textile head, which already manufactures it as an “open”, single layer and continuous fabric.

In an independent aspect thereof, the invention refers to a collection method of the fabric manufactured by a circular weft knitting machine, the method comprising the steps of:

- arranging and operating said circular weft knitting machine;
- arranging and operating said take-down and/or collection group;
- processing a measure of the radius of the collection roller as a function of said distance value measured by the contactless sensor, wherein said radius corresponds to the radial distance between an outer collection surface, corresponding to the outermost layer of the fabric wrapped to the collection roller, and the rotation axis;
- automatically modifying the configuration of said operating organs on the basis of said measure of the radius of the collection roller processed as a function of said distance value measured by the contactless sensor.

In an aspect said step of automatically modifying comprises a step of synchronizing the operating organs on determined working parameters necessary to guarantee the correct tensioning and the correct spreading of the fabric.

In an aspect the method comprises a step of varying the angular speed of the collection roller in such a way as to keep it properly regulated as always, i.e. under control during the collection of the fabric, the tangential speed of the collection roller.

In an aspect the step of always keeping appropriately regulated the tangential speed comprises:

- keeping the tangential speed at a preferably constant value during the entire collection of the fabric;
- keeping the tangential speed at a preferably constant value at times during discrete steps of the collection of the fabric;
- keeping the tangential speed at a value that is a function of the rotation speed of the needle-bearing organ that manufactures the fabric;
- setting the tangential speed so that it corresponds to the advancement linear speed of the fabric in the take-down and/or collection group, and to the linear amount of fabric that is wrapped to the collection roller in the time unit. In an aspect the method comprises a step of progressively reducing said angular speed of the collection roller as said radius of the collection roller increases, so as to keep said tangential speed of the collection roller constant.

In an aspect the method provides that the step of processing a measure of the radius of the collection roller as a function of said distance value is carried out in real time, i.e. instant by instant, thus continuously monitoring the measure of the radius of the collection roller.

In an aspect the method comprises the steps of:

- arranging, in said operating organs, at least one spreading roller, or tensioning roller, mounted to the frame in position upstream with respect to said collection roller and configured to interact with the fabric advancing towards the collection roller in such a way to spread it before the wrapping on the collection roller;

- moving the spreading roller on the basis of said measure of the radius of the collection roller processed as a function of said distance value measured by said contactless sensor, by varying an operating distance that separates the spreading roller from the collection roller in such a way to keep constant, instant by instant, an optimal separation value, wherein said optimal separation value is operating value corresponding to the ideal distance at which to keep the spreading roller with respect to the collection roller for carrying out an optimal spreading of the fabric which passes from the spreading roller to the collection roller.

In an aspect the method comprises a step of putting in rotation the spreading roller around its own rotation axis for generating the spreading and enlarging action of the fabric in transit on the spreading roller.

Further features and advantages will result better from the detailed description of a preferred embodiment of a take-down and/or collection group for circular knitting machines of the "open" type, a circular weft knitting machine of the "open" type, and a collection method of the fabric, according to the present invention.

Description of figures

This description will be expressed herein with reference to the attached figures, provided for illustrative purposes only and therefore not limitative, in which:

- figure 1 shows a perspective view of a possible embodiment of a take-down and/or collection group for circular knitting machines of the "open" type according to the present invention,
- figure 2 shows a plant view from above, of the take-down and/or collection group of figure 1;
- figure 3 shows a front view of the take-down and/or collection group of figure 1;
- figure 4 shows a left lateral view of the take-down and/or collection group of figure 1;
- figure 5 shows a right lateral view of the take-down and/or collection group of figure 1;
- figure 6 shows a further perspective view of the take-down and/or collection group of figure 1, with some parts removed;
- figure 7 shows an enlargement of a portion of the take-down and/or collection group of figure 6, seen from the outside;
- figure 8 shows an enlargement of the portion of the take-down and/or collection group of figure 6, seen from the inside;
- figure 9 shows a rear perspective view of the take-down and/or collection group of figure 1;
- figure 10 shows an enlargement of a portion of the take-down and/or collection group of figure 9, in this case an upper and rear portion;
- figure 11 shows a cross-sectional view of the take-down and/or collection group of figure 1; the section is carried out on a vertical plane, orthogonal to the longitudinal axis of the frame and, with take-down group mounted, parallel to the central axis of the knitting machine;

- figure 12 shows a perspective view of the take-down and/or collection group of figure 1, sectioned along the above-mentioned plan according to figure 11;
- figure 13 shows a perspective view of an exemplary embodiment of a motor group according to the present invention;
- figure 14 shows a further perspective view of the motor group of figure 13;
- figure 15 shows the motor group of figure 13, associated to a motorized axis (exemplary type) according to the present invention;
- figure 16 shows a further perspective view of the take-down and/or collection group of figure 1, with some parts removed; figure 16 shows furthermore - by way of example - a fabric manufactured by a circular knitting machine and sent to the take-down and/or collection group; a certain length of such fabric is advancing within the take-down and/or collection group, while a determined quantity is already wrapped, in a single layer, to the collection roller;
- figure 17 is a lateral view of the take-down and/or collection group of figure 16 (comprising the fabric within it);
- figure 18 shows a perspective view from above of a possible exemplary embodiment of a circular weft knitting machine according to the present invention, to which it is in a rotating manner mounted the take-down and/or collection group of figure 1; from the knitting machine of figure 18 were removed some parts; the figure shows, in particular, the base and the textile head of the circular knitting machine, further than the take-down and/or collection group;
- figure 19 shows a further perspective view (from below) of the circular weft knitting machine of figure 18;
- figure 20 shows a perspective view of a possible exemplary embodiment of a circular weft knitting machine according to the present invention; in this figure the knitting machine is shown with the textile head complete with every part, with the cone-holder structure placed above the textile head and with the closing cages that close the operating space occupied by the take-down and/or collection group (which is then closed inside these cages).

Detailed description

With reference to the above-mentioned figures, a take-down and/or collection group according to the present invention, intended to be mounted in a circular weft knitting machine (indicated by the reference 100), has been overall indicated with reference number 1.

The circular weft knitting machine 100 comprises:

- a textile head T provided with at least one needle-bearing organ C rotating around a central axis X, having shape of needle-bearing cylinder or needle-bearing plate, of a plurality of needles movably mounted to said at

least one needle-bearing organ, and of command organs adapted to selectively actuate said plurality of needles and to allow the manufacturing of a fabric F;

- a base B constituting the bearing structure of the knitting machine and configured to support said textile head T; the base B defines, below the textile head T, a housing volume.

The needle-bearing cylinder C is usually mounted, as in figures 18-20, vertically on the base B with needles vertically arranged which protrude further than an upper edge of the needle-bearing cylinder.

From a textile technology point of view, the structure of the entire circular knitting machine 100 and the operation of the needle-bearing organ C (for example the cooperation between needles and threads, etc.) are not described in detail, as they are known in the technical field of the present invention.

The take-down and/or collection group 1 comprises:

- a frame 2 configured to be mounted in a rotating manner to the circular knitting machine 100 in said housing volume;

- operating organs 3, operatively associated to the frame 2 and supported thereby, and comprising at least one collection roller 10 developing along a rotation axis 11 and longitudinally extending between the two ends 12 and 13.

The operating organs 3 are configured at least to open and spread, or also eventually to draw it from the needle-bearing organ C, the fabric F manufactured by the circular knitting machine, wrapping it in a single layer and continuously on the collection roller 10.

The operating organs 3 comprise at least one first motor group 20 associated at the collection roller 10 and active on the rotation axis 11 of the collection roller, in such a way that the collection roller 10 results axially motorized, i.e. is put in rotation around the rotation axis 11 by the first motor group 20.

With the expression “active on the rotation axis of the collection roller” it is intended that the first motor group 20 acts, preferably directly, on the shaft (or rod or cylindrical bar) that defines the collection roller 10, and around it the roller itself rotates. In other words, the first motor group 20 operates, preferably directly, on the collection roller 10 for placing it in rotation around its rotation axis 11. The driving action of the first motor group 20 occurs directly on an element belonging to the collection roller 10, in particular on an element which is part of the axis of the collection roller, or analogously on an element integral with the axis of the roller. The driving action of the first motor group 20, which places the collection roller 10 in rotation around its rotation axis 11, must not necessarily be an action coaxial to the rotation axis 11, but rather generally an action transferred directly onto the axis, and which determines its rotation. For example, the action of the first motor group 20 can occur parallel or angularly with respect to the rotation axis 11 of the collection roller 10, but in any case it occurs - preferably directly - on the collection roller 10.

Preferably the first motor group 20 is configured to put in rotation the collection roller 10 with a variable and selectable angular speed.

Preferably the first motor group 20 is configured to put in rotation the collection roller 10 with a variable and selectable angular speed regardless of the rotation speed of the needle-bearing organ C.

Preferably, for example under determined operating conditions, the first motor group 20 can be configured to put in rotation the collection roller 10 with a variable and selectable angular speed in a manner coordinated with the needle-bearing organ C, preferably in a manner coordinated - for example proportional - with the rotation speed of the needle-bearing organ C.

Preferably the first motor group 20 can be configured to put in rotation the collection roller 10 with a variable and selectable angular speed also under condition of constant rotation speed of the needle-bearing organ C.

Preferably the driving torque necessary to the rotation of the collection roller 10 is generated by the first motor group 20 directly at the collection roller 10 itself.

Preferably the operating organs 3 of the take-down and/or collection group 1 are without, i.e. do not comprise, motorized rollers in contact with the collection roller 10 and/or with the fabric F wrapped on the collection roller 10.

Preferably the collection roller 10, actuated by the first motor group 20, is mounted hanging in the frame 2, in such a way to result hanging in the take-down and/or collection group 1, and in such a way that the entire surface of the fabric F wrapped on the collection roller 10 does not result in contact with the operating organs 3 or other elements of the take-down and/or collection group.

Preferably the collection roller 10 is mounted to the frame 2 in such a way that the entire surface of the fabric F wrapped on collection roller 10 results free and not leaning against any element.

Preferably the collection roller 10 is in a rotating manner mounted to the frame at the two ends 12 and 13 thereof, in such a way to result exclusively supported by the two ends.

Preferably the collection roller 10 remains, in use, with its rotation axis 11 in a fixed position with respect to the frame 2, during all the steps of collection of the fabric and regardless of the amount of fabric wrapped on collection roller 10.

Preferably the first motor group 20 is fixed at one of the two ends (in the embodiment of figures at the end 12) of the collection roller 10, and from this position it puts in rotation the collection roller directly on the rotation axis 11.

Preferably the take-down and/or collection group 1 comprises at least one sensor S of contactless type (*contactless*), preferably associated to the frame 2 or to the operating organs 3 and configured to measure a distance value between the sensor S itself and a surface of the collection roller 10, upon which a determined quantity of fabric F is wrapped in a single layer.

Preferably the take-down and/or collection group 1 is configured to process a measure of the radius R of the collection roller 10 as a function of the distance value measured by the contactless sensor S.

Preferably the sensor S of contactless type can be by way of example:

- laser sensor;
- time-of-flight sensor (time of flight);
- infrared sensor;
- ultrasound sensor;
- optical sensor;
- sensor with camera;
- inductive sensor;
- capacitive sensor;
- magnetic sensor;
- LVDT sensor.

Preferably said determined amount of single layer fabric F can be equal to zero, corresponding to an empty condition of the collection roller 10, or greater than zero, corresponding to a condition of collection roller 10 with fabric F wrapped on it.

Preferably the take-down and/or collection group 1 is configured to modify the configuration of operating organs 3 on the basis of the measure of the radius R of the collection roller 10 processed as a function of the distance value measured by the contactless sensor S.

Preferably the contactless sensor S is positioned below the collection roller 10, preferably in a fixed position with respect to it. In this case the sensor S is, with knitting machine in use, rotating together with the take-down and/or collection group 1.

Preferably the contactless sensor S is oriented towards the rotation axis 11 of the collection roller 10, i.e. has a detection direction that intersects the rotation axis 11 of the collection roller 10.

Preferably, as shown by way of example in figures, the contactless sensor S is mounted to the frame 2 of the take-down and/or collection group 1.

Alternatively, in a not shown embodiment, the contactless sensor can be located in a fixed position with respect to the collection roller and keep this fixed position also with knitting machine in use and with take-down and/or collection group in rotation. Preferably, in this case, the contactless sensor is located in a fixed position on the base. In this case then the sensor results, with knitting machine in use, fixed and does not rotate with the take-down and/or collection group.

The contactless sensor S can be synchronized with the rotation speed of the take-down and/or collection group 1 so as to manage the measurement of the above-mentioned distance value between the sensor itself and the collection roller 10. By way of example, the contactless sensor S can operate one measurement per revolution of the take-down and/or collection group 1 in rotation, or with a determined sampling frequency.

Preferably the collection roller 10:

- has an outer collection surface 15, corresponding to the outermost layer of the fabric F wrapped on collection roller 10;
- has, instant by instant during the collection of the fabric, a radius R of the collection roller, corresponding to the radial distance between the outer collection surface 15 and the rotation axis 11;
- has, instant by instant during the collection of the fabric, an angular speed of rotation around the rotation axis 11;
- has, instant by instant during the collection of the fabric, a tangential speed, i.e. the linear speed at the outer collection surface 15.

Preferably the first motor group 20 is configured to vary the angular speed of the collection roller 10 in such a way to always keep opportunely regulated, i.e. under control during the collection of the fabric F, the tangential speed of the collection roller 10.

Preferably the tangential speed is, instant by instant, equal to the product of the angular speed by the radius R of the collection roller 10.

Said tangential speed:
- has a preferably constant value during the entire collection of the fabric F;
- has a preferably constant value at tracts during discrete steps of the collection of the fabric F;
- is function of rotation speed of the needle-bearing organ C that manufactures the fabric F;
- corresponds substantially to the advancement linear speed of the fabric F in the take-down and/or collection group 1, and to the linear amount of fabric F that is wrapped on collection roller 10 per time unit.

Preferably the first motor group 20 is configured to progressively reduce the angular speed of the collection roller 10 as the radius R of the collection roller increases, in such a way to keep the tangential speed of the collection roller 10 constant. In fact, since the tangential speed is equal to the product of the angular speed by the radius R of the collection roller 10, as the radius R of the collection roller increases, the angular speed must decrease in order to keep the tangential speed constant.

Preferably the take-down and/or collection group 1 is configured to measure, through the contactless sensor S, the distance value and process the measure of the radius R of the collection roller 10 in real time, i.e. instant by instant, thus continuously monitoring the measure of the radius R of the collection roller.

Preferably, the take-down and/or collection group 1 defines an articulated path of the fabric F exiting from the textile head T which ends on the collection roller 10. In particular, the take-down and/or collection group 1 defines an articulated path that begins from an upper opening 4 of the frame 2 and ends in the collection roller 10.

Preferably, the frame 2 is mounted in the knitting machine in such a way as to rotate around a vertical axis preferably coinciding with the central axis X of the textile head T. Preferably the vertical axis coincides, in use,

with a direction orthogonal to a bearing plane of the knitting machine, in particular to a bearing plane of the base B. Preferably the development of the frame 2 along its vertical axis coincides with the height of the frame.

Preferably the frame 2 develops along a longitudinal axis 5 between a first lateral portion 6 and a second lateral portion 7. Preferably, the longitudinal axis 5 is orthogonal to the vertical axis. Preferably, the development of the frame 2 along the longitudinal axis coincides with the width of the frame. Preferably, the development of the frame 2 along the longitudinal axis 5, i.e. the width of the frame, coincides with the dimension of greater development of the frame 2.

Preferably the collection roller 10 is mounted, with its two ends 12 and 13, to the first lateral portion 6 and to the second lateral portion 7 of the frame 2, in such a way that the rotation axis 11 of the collection roller 10 is substantially parallel to the longitudinal axis 5 of the frame 2.

Preferably the collection roller 10 comprises:

- a rod 16 extending between two ends and onto which the fabric F collected by the take-down and/or collection group 1 is wrapped, forming a reel of fabric around the rod 16;
- two supports 17 and 18 placed at the two ends of the rod 16 and configured to support in rotation the rod.

Preferably the rod 16 is mounted in a rotating manner to the two supports 17 and 18 in such a way that the collection roller 10 forms a unitary assembly.

Preferably the two supports 17 and 18 are associable, preferably in a removable manner, to the frame 2, in such a way to allow the mounting and dismounting of the collection roller 10 to and from the frame 2.

Preferably the frame 2 comprises, at the first lateral portion 6 and the second lateral portion 7, two housing seats 8 and 9 configured to receive the collection roller 10 at the two ends 12 and 13 thereof.

Preferably each housing seat 8 and 9 is configured to receive a respective support 17 and 18 of the collection roller 10.

Preferably each housing seat 8 and 9 comprises a housing channel configured for the loading and unloading of the collection roller 10.

Preferably the loading of the collection roller 10 occurs by means of insertion of the two supports 17 and 18 in the two housing channels, whereas the unloading of the collection roller 10 occurs by means of extraction of the two supports 17 and 18 from the two housing channels. The disassembly of the collection roller 10 from the frame 2, in order to carry out the unloading of the collection roller, typically occurs when the roller is full, i.e. when it has wrapped the maximum amount of wearable fabric F around itself, or when the fabric manufacturing by the knitting machine 100 is finished.

This maximum amount of wearable fabric is a flow rate value of the collection roller 10, and can correspond to a maximum radius R of the outer collection surface 15 or to a maximum weight of the collection roller 10 (for example on the basis of the type of fabric collected, the dimensions, the yarn of which it is composed, etc.).

Preferably the housing channel develops in a direction substantially orthogonal to the longitudinal axis 5 of the frame (and to the rotation axis 11 of the collection roller). In this way the loading and unloading of the collection roller 10, i.e. the insertion and the extraction of supports 17 and 18 in and from the housing channels, occur with a translatory movement of the collection roller 10 with respect to the frame 2, and frontally with respect to the frame 2.

Preferably the housing channel can be oriented at a determined angle with respect to a plane orthogonal to the central X axis of the knitting machine 100, so as to provide a chute for the loading and unloading of the collection roller 10.

Preferably each of the two supports 17 and 18 of the collection roller comprises a respective bearing. Preferably each bearing comprises an inner ring, integral with the rotating rod 16 of the collection roller 10, an outer ring housable in the respective housing seat 8 and 9 of the frame 2, and rolling elements interposed between inner ring and outer ring.

Preferably each housing seat (8, 9) is configured to receive a respective fastener (8A, 9A in figures), configured for the keeping of the position of the support (17, 18) of the collection roller 10 positioned, during the use, in the housing seat.

Preferably the fastener is configured to lock, in use, the position of the outer ring of the bearing of the respective support.

Preferably the first motor group 20 comprises:

- a first electric motor 21, preferably a stepper motor;
- a mechanical transmission 22, mounted downstream of the first electric motor 21 and directly active on said rod 16 of the collection roller 10 to put in selectively in rotation.

Preferably the mechanical transmission 22 is interposed between the first electric motor 21 and the rod 16 of the collection roller 10.

Preferably the mechanical transmission 22 comprises an endless screw transmission, or a gear transmission, for example a pair of conical wheels, or an epicycloidal gearbox.

Preferably the mechanical transmission 22 ends with a shaft bearing a motor organ 23 configured to directly transfer a controlled rotating motion to the rod 16 of the collection roller 10.

Preferably the motor organ 23 is a gear, for example a first toothed wheel 23.

Preferably the rod 16 of the collection roller 10 comprises a guided organ 19 directly gearable to the motor organ 23 for receiving from it the controlled rotating motion and placing the rod 16 of the collection roller 10.

Preferably the guided organ 19 is integral with the rod 16 of the collection roller 10, preferably at an end thereof (the end 12 in figures).

Preferably the guided organ 19 is coaxial to the rod 16 of the collection roller 10.

Preferably the guided organ 19 is a gear, for example a second toothed wheel 19.

It is to be noted that since the guided organ 19 is integral with the rod 16 of the collection roller 10 (and coaxial to it), and since the motor organ 23 is directly gearable to the guided organ 19 for transmitting a rotary motion, the action of the first motor group 20 occurs directly on the rotation axis 11 of the collection roller 10, which is thus directly put in rotation.

Preferably the engagement of the guided organ 19 with the motor organ 23 occurs by means of meshing of the first toothed wheel with the second toothed wheel.

Preferably the motor organ 23 and the guided organ 19 have respective rotation axes parallel to each other.

Preferably the guided organ 19:

- engages on the motor organ 23 when the collection roller 10 is mounted on the frame 2, i.e. when the supports 17 and 18 of the collection roller 10 are inserted in the housing seats 8 and 9 of the frame 2;
- disengages from the motor organ 23 when the collection roller 10 is demounted from the frame 2, i.e. when the supports 17 and 18 of the collection roller 10 are extracted from the housing seats 8 and 9 of the frame 2.

In particular, the mounting of the collection roller 10 to the frame 2 determines the meshing of the second toothed wheel with the first toothed wheel, and vice versa the demounting of the collection roller 10 from the frame 2 determines the detachment and the distancing of the second toothed wheel from the first toothed wheel.

Preferably the rotation axis of the first toothed wheel 23 and the respective rotation axis of the second toothed wheel 19 are parallel to each other and parallel to the rotation axis 11 of the collection roller 10.

Preferably the first motor group 20 is mounted, preferably in fixed position during the use of the take-down and/or collection group 1, to the first lateral portion 6 (as in figures) or to the second lateral portion 7 of the frame. In this manner the motor organ 23 is in fixed position with respect to the frame 2 and is ready to receive the guided organ 19 when the collection roller 10 is mounted to the frame 2.

Preferably the first motor group 20 comprises:

- the first electric motor 21, of stepper type, provided with an output shaft;
- the mechanical transmission 22 comprising:
    - an endless screw transmission / helicoidal toothed wheel comprising:
        - an endless screw connected to, and put in rotation by, said output shaft of the first electric motor 21, and
        - a helicoidal toothed wheel geared to the endless screw and mounted (for example coupled) on the shaft bearing the motor organ 23.

The rotation axis of the endless screw and the rotation axis of the helicoidal toothed wheel are axes to each other skewed and orthogonal; consequently, the rotation axis of the output shaft of the first electric motor 21 and the rotation axis of the shaft bearing the motor organ 23 are also axes skewed and orthogonal to each other.

The endless screw is driving, while the helicoidal toothed wheel is guided.

It is to be noted that the output shaft of the electric motor and the endless screw and the helicoidal toothed wheel of the mechanical transmission are not visible in figures 13-15 since they are inner components; however, the electric motor and the mechanical transmission can be advantageously commercial products from catalog, and their inner components are known in the art.

It is to be noted that the transmission ratio is a function of the number of start threads of the endless screw. For example if the endless screw has a one start thread, with each revolution of the endless screw the helicoidal wheel shifts by one tooth (advancing or receding depending on the direction of rotation of the screw).

Preferably the first motor group 20 comprises a flange 24 mounted on the frame 2 and bearing the mechanical transmission 22.

Preferably the flange 24 is crossed by, and supports in rotation, the shaft bearing the motor organ 23.

Preferably the first electric motor 21 is mounted directly to the mechanical transmission 22 and is supported by it. In this configuration the flange 24 supports the entire first motor group 20 by mounting it to the frame 2.

Preferably the operating organs 3 comprise at least one spreading roller 30 (also referred to as tensioning roller), mounted to the frame 2 in upstream position (preferably immediately upstream along the path of the fabric F) with respect to the collection roller 10. The spreading roller 30 is configured to interact with the fabric F advancing toward the collection roller 10 in such a way as to spread it before the wrapping on the collection roller.

Preferably the spreading roller 30 longitudinally extends, between two lateral ends 32 and 33, in a direction substantially parallel to the rotation axis 11 of the collection roller 10 and is configured to rotate around a rotation axis 31 thereof. In other words, the spreading roller 30 is arranged parallel to the collection roller 10 and is configured to enlarge and spread the fabric toward its ends 32 and 33.

Preferably the spreading roller 30 is mounted in a movable manner, for example rotatable or translatable or rototranslatable, to the frame 2 and is configured to be able to vary an operating distance that separates it from the collection roller 10.

Preferably this operating distance corresponds to the linear distance between the rotation axis 31 of the spreading roller 30 and the respective rotation axis 11 of the collection roller 10.

Preferably the operating organs 3 comprise a second motor group 40 active on the spreading roller 30 for selectively moving it in such a way to increase or decrease the operating distance that separates it from the collection roller 10, preferably keeping the spreading roller 30 parallel to the collection roller 10.

Preferably the movement of the spreading roller 30 by effect of the second motor group 40 is a rotation or a translation or a rototranslation.

Preferably the spreading roller 30:

- has an outer operating surface 35, that contacts the fabric F in its transit toward the collection roller 10 and acts on the fabric itself for enlarging and spreading it;

- has a radius of the spreading roller 30 having a constant value and corresponding to the radial distance between the outer operating surface 35 and the rotation axis 31 of the spreading roller.

In an aspect the spreading roller 30 is configured to be moved, during the collection, by varying the operating distance that separates it from the collection roller, in such a way to keep constant, instant by instant, an optimal separation value equal to a distance between the outer operating surface 35 of the spreading roller 30 and the outer collection surface 15 of the collection roller 10.

Preferably this optimal separation value is an operating value (for example set when setting up the knitting machine) corresponding to the ideal distance at which to keep the spreading roller 30 with respect to the collection roller 10 for carrying out an optimal spreading of the fabric F which passes from the spreading roller to the collection roller.

Preferably the second motor group 40 is configured to move the spreading roller 30 on the basis of the measure of the radius R of the collection roller 10 processed as a function of the distance value measured by the contactless sensor S, by varying the operating distance that separates the spreading roller 30 from the collection roller 10 in such a way to keep constant, instant by instant, the optimal separation value.

Preferably the second motor group 40 is configured to progressively increase the operating distance as the radius R of the collection roller 10 increases, keeping said optimal separation value constant during the collection of the fabric F.

In fact, as the radius R of the collection roller 10 increases its outer collection surface 15 approaches the spreading roller 30, so the latter must be progressively distanced. In other words, as the radius R of the collection roller 10 increases, the operating distance (if calculated as the distance between the rotation axes 11 and 31) necessary to keep constant the optimal separation value increases.

Alternatively, the operating distance can correspond directly to a linear distance between the outer collection surface 15 of the collection roller 10 and the outer operating surface 35 of the spreading roller 30. In this case the operating distance is the linear interval between the surfaces of the two rollers 10 and 30 and therefore is variable, during the collection of the fabric F, depending on the radius R of the collection roller; in fact the radius of the collection roller 10 increases as the fabric F is collected.

In this case the second motor group 40 is configured to selectively move the spreading roller 30 so as to keep the operating distance that separates it from the collection roller 10 constant.

Preferably the spreading roller 30 is mounted, with its two lateral ends 32 and 33, respectively to the first lateral portion 6 and to the second lateral portion 7 of the frame 2, in such a way that the rotation axis 31 of the spreading roller 30 is substantially parallel to the longitudinal axis 5 of the frame 2.

Preferably the operating organs 3 comprise a third motor group 50 active on the spreading roller 30 for putting in rotation around its rotation axis 31 and generating the spreading and enlarging actions of the fabric in transit on the spreading roller 30.

Preferably the spreading roller 30 comprises two embossed elements 36 and 37 in helical or spiral shape (or double helical or double spiral) developing in the opposite direction from the center of the spreading roller 30 toward its two lateral ends 32 and 33; the embossed elements 36 and 37 operate, thanks to the rotation of the spreading roller 30, a progressive spreading and enlarging action of the fabric F in contact with the spreading roller.

It is now described in more detail the embodiment of the spreading roller 30 by way of example shown in figures.

Preferably the spreading roller 30 is mounted to the frame 2 by means of a pair of movable arms 61 and 62.

Preferably each of the two movable arms 61 and 62 extends between a lower end, at which it is hinged to the frame 2, and an upper end, at which it is connected at a lateral end (32 or 33) of the spreading roller 30; the distance between the lower end and the upper end defines a length of the movable arm. Preferably the two movable arms 61 and 62 are identical to each other.

The two movable arms 61 and 62 are configured to oscillate, i.e. tilt, in unison by rotating around a common oscillation axis 63 passing through the lower ends of both arms, where they are hinged to the frame 2.

The oscillation of the two arms 61 and 62 determines a rotary motion of the spreading roller 30 along a circumference arc trajectory having a center on the common oscillation axis 63 and radius equal to the length of the movable arms; in the movement along that trajectory, the spreading roller 30 keeps its own rotation axis 31 parallel to the respective rotation axis 11 of the collection roller 10.

Preferably the two movable arms 61 and 62 can selectively oscillate clockwise and counterclockwise to decrease and increase the operating distance that separates the spreading roller 30 from the collection roller 10.

Preferably the second motor group 40 comprises an actuator 41 active on at least one of the two movable arms, for determining the selective oscillation of the two arms clockwise and counterclockwise and moving the spreading roller 30 along said circumference arc trajectory.

Preferably one of the two movable arms (the arm 61 in figures) is actuated by the second motor group 40 and the other movable arm (the arm 62 in figures) is hinged to the frame 2 and dragged into oscillation; thereby, a rotation (i.e., an oscillatory motion) of one of the two movable arms corresponds to an equal and corresponding rotation of the other movable arm. The two movable arms 61 and 62 are always moved in a synchronous manner, so as to obtain an isoconstrained (and not unstable) structure.

Preferably the actuator 41 is an electric motor, more preferably a stepper motor, or alternatively a cylinder, for example pneumatic or oleodynamic.

Preferably the second motor group 40 can comprise a mechanical transmission 42 associated to the actuator 41, for example interposed between the actuator 41 and the movable arm moved by the actuator.

Preferably the mechanical transmission 42 is an endless screw transmission, or a gear transmission, for example a pair of conical wheels, or an epicycloidal reducer.

In a possible embodiment, not shown, the second motor group can comprise a linear guide to which the spreading roller is mounted and configured to move the spreading roller in order to selectively vary the operating distance. In this case, the variation of the distance between the two rollers occurs by means of a translatory movement (of approaching or distancing of the spreading roller with respect to the collection roller) instead of by means of the above-mentioned rotary or rototranslatory movement obtained through the oscillation of the two movable arms.

Preferably the operating organs 3 comprise at least one transfer roller 70 (or taking-down roller) mounted to the frame 2 in position upstream with respect to the collection roller 10, preferably upstream of the spreading roller 30.

Preferably the transfer roller 70 is configured to draw and/or tension the fabric F (so as to allow an optimal wrapping, i.e., without creases) and address it along the articulated path towards the collection roller 10.

Preferably the transfer roller 70 longitudinally extends in a direction substantially parallel to the rotation axis of the collection roller 10 and is configured to rotate around a longitudinal rotation axis 71 thereof.

Preferably the operating organs 3 comprise at least one pair of transfer rollers (or taking-down rollers) 72 and 73.

In a possible embodiment, the operating organs can also comprise a plurality of transfer rollers arranged in series along the articulated path of the fabric.

Preferably operating organs 3 comprise flattening or approaching organs 80 of the fabric F deriving from the textile head T in the form of a closed tubular fabric. These flattening or approaching organs 80 are arranged preferably substantially at the upper opening 4 of the frame 2.

Preferably the flattening or approaching organs comprise a pair of rollers 81 and 82 arranged parallel to each other. Alternatively, the flattening or approaching organs 80 can comprise a pair of bars arranged parallel to each other. These rollers/bars are arranged side-by-side between them in such a way as to define a substantially rectilinear transition for the fabric, such as to determine a substantial flattening of the tubular shape of the fabric along one of its diameters, which has two layers approaching or substantially in contact with each other.

Preferably operating organs 3 comprise cutting organs 90 arranged downstream of the flattening organs 80 and adapted to longitudinally cut, along a preferably vertical generatrix line, the textile fabric of tubular shape manufactured by the textile head T so as to subsequently open and wrap it in a single layer on the collection roller, as it occurs typically in circular knitting machines of the “open” type.

Preferably the operating organs comprise spreading organs 95 of the fabric F in the open, deriving directly as single layer from the needle-bearing organ or obtained from the action of the cutting organs 90. These spreading organs 95 are arranged downstream of the cutting organs 90 and upstream of the transfer roller 70 (or of the transfer rollers 72 and 73 if more than one), of the spreading roller 30 and of the collection roller 10 along the

articulated path of the fabric F. The spreading organs 95 are configured to open the fabric F exiting from the flattening organs 80 and longitudinally cut by means of the cutting organs 90.

Preferably the spreading organs 95 comprise at least one spreading bar 96 mounted, preferably in a fixed manner take-down and/or collection group in use, to the frame 2 and structured to determine an opening, by means of progressive distancing, of two lateral edges of the fabric F; the fabric F passes on the spreading bar 96 along its articulated path and spreads on the spreading bar as single layer of fabric F.

The spreading bar 96 can be regulated in its position (for example before the take-down and/or collection group starts to operate); preferably such registration occurs by means of a translation along a direction parallel to the longitudinal development (or the rotation axes) of the flattening rollers 80.

Preferably, the spreading bar 96 is longitudinally positioned between the first lateral portion 6 and the second lateral portion 7 of the frame 2.

Eventually the spreading bar 96 can also not be connected to the lateral portions 6 and 7 of the frame; for example, the spreading bar 96 can be mounted to a suitable supporting structure integral with the frame 2.

Preferably the spreading bar 96 has an overall rounded "V" conformation, i.e., it has the curvilinear central, or arc of a circumference, portion and two straight portions protruding, in opposite directions, from two sides of the central portion and terminating at, respectively, the first lateral portion 6 and the second lateral portion 7.

Preferably the spreading bar 96 has a substantially symmetrical conformation with respect to a symmetry plane.

Preferably the axis 11 of the collection roller 10 is orthogonal to the symmetry plane of the spreading bar 96.

Preferably the operating organs 3 comprise a coupling structure 97 configured to mount the cutting organs 90 and/or the spreading organs 95 on the frame 2.

Preferably the operating organs 3 of the take-down and/or collection group 1 can comprise other motor groups configured to move relative moving components. Preferably the operating organs 3 comprise one or more of the following motor groups:

- a respective motor group 75 of said at least one transfer roller 70 configured to determine a rotation of the transfer roller around the respective rotation axis 71;
- a respective motor group 85 of the flattening or approaching organs 80 configured to determine a rotation of the flattening or approaching rollers 81 and 82 around a relative longitudinal rotation axis;
- a respective motor group 91 of the cutting organs 90 configured to actuate the cutting organs and determine the longitudinal opening of the tubular fabric exiting from the textile head T.

It is to be noted that, with particular reference to figures 16 and 17, the articulated path of the fabric F:

- the fabric is manufactured (in the embodiment of figures, in tubular shape) by the needle-bearing organ C of the textile head T and drops inside the needle-bearing organ itself and then passes into the upper opening 4 of the frame 2;
- the fabric, still in tubular shape, passes through the two flattening rollers 81 and 82;

- the fabric is subjected progressively to longitudinal cutting by the cutting organs 90 (especially by a cutter), and in this way the tubular fabric is opened;
- by means of the spreading bar 96 the fabric (just opened by the cutter) is stretched, so that its two left and right flaps are opened;
- the fabric F, single-layered (i.e., flapped) and stretched, passes to the two transfer rollers 72 and 73, where it undergoes taking-down; in particular, the fabric passes behind the back roller 72, then from underneath enters the space between the back roller 72 and the front roller 73, passes over the front roller 73 and continues to the spreading roller;
- the fabric F reaches the spreading roller 30 and passes over it, contacting the embossed elements 36 and 37;
- from the spreading roller 30 the fabric F passes to the collection roller, where it is wrapped; wrapping can occur with a clockwise rotation of the collection roller (in which case the fabric F passes under the collection roller) or with a counterclockwise rotation of the collection roller (in which case the fabric F passes over the collection roller).

The fabric F, before reaching the spreading roller 30, can optionally pass under a fixed bar 64 which connects the two movable arms 61 and 62 and is preferably coaxial to said common oscillation axis 63. In this case the fabric F, deriving from transfer rollers 70, passes under the fixed bar 64, goes back, rises above the spreading roller 30, goes around it and continues toward the collection roller 10. The deviation of the trajectory of the fabric by passing it underneath the fixed bar 64 can serve if one wishes to wrap around more, i.e. at a greater angle, than the spreading roller.

The fixed bar 64, placed below of the spreading roller, is configured to mechanically reinforce the structure that supports the spreading roller; this structure also comprises the two movable arms 61 and 62.

Preferably the position of the cutter can be set (for example by sliding on special guides) typically during the setting of the take-down and/or collection group, for example according to the dimensions of the tubular fabric manufactured by the knitting machine.

The passage of the fabric F on the spreading roller necessarily occurs above the latter (and not below) as the embossed (spiral) elements then act correctly on the fabric to enlarge and spread it. If the fabric were to pass under the spreading roller, the embossed elements would act in the opposite way, closing the fabric instead of opening it. Obviously, the spreading roller and its reliefs can be suitably modified to operate with rotations in the opposite direction or with different paths of the fabric.

The take-down and/or collection group can comprise/use at least one control unit configured to control the operating conditions put in place by the group itself and/or to control the steps of the collection method of the fabric. The control unit can be a single unit or be formed by a plurality of different control units according to the designing choices and the operating needs.

As control unit it is intended an electronic-type component, which can comprise at least one of: a digital processor (CPU), an analogue type circuit, or a combination of one or more digital processors with one or more analogue type circuits. The control unit can be "configured" or "programmed" to carry out certain steps: this can be realized in practice with any means that allows to configure or program the control unit. For example, in case of a control unit comprising one or more CPU and one or more memories, one or more programs can be stored in appropriate memory banks attached to the CPU or CPUs; the program or programs contain instructions which, when carried out by the CPU or CPUs, program or configure the control unit to carry out the operations described in relation to the control unit. Alternatively, if the control unit is or comprises analogue type circuitry, then the circuit of the control unit can be designed to include circuitry configured, in use, to process electrical signals in such a way as to carry out the steps relative to the control unit.

Preferably the take-down and/or collection group 1 comprises at least one control unit configured to command the functioning of operating organs 3.

Preferably the control unit is connected to the contactless sensor S and is configured:

- to receive from the contactless sensor S a signal representative of the distance value and determine the measure of the radius R of the collection roller 10; or
- to receive from the contactless sensor S directly the measure of the radius R of the collection roller 10.

Preferably the control unit is connected to the operating organs 3 for sending command signals to them able to modify and control the operating configuration thereof.

Preferably the control unit is configured to:

- send to the first motor group 20 a command signal for varying the angular speed of the collection roller 10 in such a way to keep always opportunely regulated the tangential speed of the collection roller 10;
- send to the first motor group 20 a command signal for progressively reducing the angular speed of the collection roller 10 as the radius R of the collection roller 10 increases, in such a way to keep the tangential speed of the collection roller 10 constant;
- send to the second motor group 40 a command signal for moving the spreading roller 30 on the basis of the measure of the radius R of the collection roller 10, by varying the operating distance in such a way to keep constant, during the collection of the fabric F, said optimal separation value;
- send to the second motor group 40 a command signal for progressively increasing the operating distance as the radius R of the collection roller 10 increases, keeping constant, during the collection of the fabric F, said optimal separation value;
- send to the third motor group 50 a command signal for putting in rotation the spreading roller 30 at a determined speed for generating a correct spreading and enlargement action of the fabric F in transit on the spreading roller 30.

Preferably the control unit of the take-down and/or collection group 1 can be shared with the knitting machine 100, for example can be positioned in the base B or in the textile head T and operate the control of the entire knitting machine.

Preferably the take-down and/or collection group 1 of the fabric F in manufacturing is arranged downstream of the textile head T with respect to a supply direction of the fabric in manufacturing.

Preferably the take-down and/or collection group 1 is configured to rotate integrally with, or in a coordinated manner with respect to, said needle-bearing organ C during the manufacturing of the fabric F.

Preferably the circular knitting machine 100 can be of single needle bed (only with a needle-bearing cylinder) or a double needle bed (with needle-bearing cylinder and needle-bearing plate) type).

Preferably the circular knitting machine 100 can be of the type with rotating needle-bearing organ (with non-rotating needle control organs and take-down and/or collection group rotating together with the needle-bearing organ during the manufacturing of the fabric) or fixed needle-bearing organ (with rotating needle control organs and take-down and/or collection group fixed during the manufacturing of the fabric). The embodiment shown in figures is a circular knitting machine with rotating needle-bearing organ and take-down and/or collection group rotating together with it.

Preferably the take-down and/or collection group 1 is hanging below of the textile head T. Preferably the take-down and/or collection group 1 is hanging to and supported by the needle-bearing organ C. In this situation, preferably, the regulation is done by rotating by a predefined angle the take-down and/or collection group with respect to the textile head while, preferably, this group remains hanging.

In a different embodiment, not shown, the take-down and/or collection group can laid on the ground or on the base and be constrained to the needle-bearing organ.

Preferably, if the needle-bearing organ C is of the rotating type, the take-down and collection group 1 is dragged in rotation during the manufacturing of the fabric F by the rotation of the needle-bearing organ C and rotates integrally with the needle-bearing organ, i.e. without any relative rotational motion with respect to the needle-bearing organ. The motor that moves (i.e. out in rotation) the needle-bearing organ C and the take-down and/or collection group 1 can therefore be one, with consequent space, cost and energy savings.

In a possible embodiment (not shown), if the needle-bearing organ is of the fixed type, the take-down and collection group is fixed, i.e. without any relative rotational motion with respect to the needle-bearing organ.

In a preferred embodiment, and as shown in figures, the circular knitting machine 100 is of the “open” type, i.e. is configured to manufacture fabric F and collect it in the open, i.e. as single layer and continuously, by wrapping it on the collection roller 10 of the take-down and/or collection group 1.

The single layer fabric F, deriving from the needle-bearing organ and collected by the take-down and collection group, is obtainable:

- by means of cutting and stretching, or “opening”, of a tubular fabric, if the textile head T continuously manufactures a tubular fabric; or
- directly “in the open”, i.e. as continuous single layer of fabric F having a determined width;

In both cases the take-down and collection group 1 collects, by wrapping it on the collection roller 10, a single layer fabric F and not a cylindrical development tubular.

The single layer fabric F has a continuous stripe conformation of particular width and is obtained:

- by opening a tubular, by means of a continuous cut carried out parallel to the direction of longitudinal development of the manufactured tubular fabric; or
- directly by the textile head, which already manufactures it as an "open", single layer and continuous fabric.

The circular knitting machine, as shown by way of example in figure 20, can comprise other components, such as:

- components of the textile head, such as coverings, cams, wire guides, etc.;
- a P cone-holder structure placed above the textile head T;
- a plurality of closing cages G that close the operating space occupied by the take-down and/or collection group 1 (that results then closed inside such cages).

The closing cages G are movably mounted (e.g. hinged) to the base B at least between a closing configuration, in which they prevent the access to the operating space, and an opening configuration, in which they allow the access to the operating space.

The cages G are adapted to allow the safe operation of the knitting machine 100: actually, the take-down and/or collection group 1 operates by rotating around the operating space, and it is therefore necessary to make this volume inaccessible during the operation of the machine, to avoid accidental contacts with moving organs. On the contrary, the cages must also allow the access to the inside of the operating space for configuration and maintenance operations of the machine and for the loading/unloading of the collection roller of the fabric, reason for which the cages can be opened individually and selectively, manually or automatically.

The collection method of the fabric manufactured by a circular weft knitting machine, according to the present invention, comprises the steps of:

- arranging and operating the circular knitting machine 100;
- arranging and operating the take-down and/or collection group 1;
- processing a measure of the radius R of the collection roller 10 as a function of the distance value measured by the contactless sensor S, wherein the radius R corresponds to the radial distance between the outer collection surface 15, corresponding to the outermost layer of the fabric F wrapped on collection roller 10, and the rotation axis 11;

- automatically modifying the configuration of the operating organs 3 on the basis of said measure of the radius R of the collection roller 10 processed as a function of the distance value measured by the contactless sensor S.

Preferably the step of automatically modifying comprises a step of synchronizing the operating organs 3 on determined working parameters necessary to guarantee the correct tensioning and the correct spreading of the fabric F.

Preferably the method comprises a step of varying the angular speed of the collection roller 10 in such a way to keep the tangential speed of the collection roller 10 regulated, always opportunely regulated, i.e. under control during the collection of the fabric F.

Preferably the step of keeping always the tangential speed opportunely regulated comprises:

- keeping the tangential speed at a preferably constant value during the entire collection of the fabric F;
- keeping the tangential speed at a preferably constant value at times during discrete steps of the collection of the fabric F;
- keeping the tangential speed at a value that is a function of the rotation speed of the needle-bearing organ C that manufactures the fabric;
- setting the tangential speed so that it corresponds to the advancement linear speed of the fabric F in the take-down and/or collection group 1, and to the linear amount of fabric F that is wrapped on collection roller 10 in the time unit.

Preferably the method comprises a step of progressively reducing the angular speed of the collection roller 10 as the radius R increases, so as to keep the tangential speed of the collection roller constant.

Preferably the method provides that the step of processing a measure of the radius R of the collection roller 10 as a function of the distance value is carried out in real time, i.e. instant by instant, thus continuously monitoring the measure of the radius R of the collection roller 10.

Preferably the method comprises the steps of:

- arranging, in the operating organs 3, at least one spreading roller 30, mounted to the frame 2 in position upstream with respect to the collection roller 10 and configured to interact with the fabric F advancing towards the collection roller in such a way to spread it before the wrapping on the collection roller 10;
- moving the spreading roller 30 on the basis of the measure of the radius R of the collection roller 10 processed as a function of the distance value measured by the contactless sensor S, by varying an operating distance that separates the spreading roller 30 from the collection roller 10 in such a way to keep constant, instant by instant, an optimal separation value, wherein that optimal separation value is an operating value corresponding to the ideal distance at which to keep the spreading roller 30 with respect to the collection roller 10 for carrying out an optimal spreading of the fabric F which passes from the spreading roller to the collection roller.

Preferably the method comprises a step of putting in rotation the spreading roller 30 around its own rotation axis 31 for generating the spreading and enlarging action of the fabric F in transit on the spreading roller.

Preferably the method comprises a step of monitoring the functioning of the collection of the fabric F, said step of monitoring comprising the step of:

- detecting abnormal variations of the measure of the radius R of the collection roller 10 which may be indicators of anomalies;
- eventually, generating a signal representative of said anomaly.

Preferably as "anomaly" it is intended, for example:

- an oscillating value of the measure of the radius R, i.e. first increasing then decreasing (i.e. not strictly increasing over time);
- a void value of the measure of the radius R;
- a variance or ovality (i.e. deviation of the diameter from a cylindrical shape) of the fabric roll.

The oscillating value of the measure of the radius R can be representative of a non-uniform collection of the fabric F in determined portions of the collection roller 10, or the formation of wrinkles or accumulations of fabric in longitudinal portions of the collection roller.

Preferably the step of monitoring comprises a step of stopping the collection of the fabric F, and preferably stopping the entire knitting machine 100, in case of generation of the signal representative of an anomaly.

Preferably the method comprises the steps of:

- comparing the measure of the radius R of the collection roller 10 with a maximum radius value;
- upon reaching the maximum radius value, stopping the manufacturing by the circular knitting machine 100.

The maximum radius value corresponds to a condition of full collection roller 10, which must be unloaded from the take-down and/or collection group 1 and replaced with an empty collection roller (which can also be the same roller from which the reel of fabric previously wrapped has been removed).

The collection roller 10 is considered "full" when it has wrapped the maximum amount of wearable fabric F, that is a flow rate value of the collection roller 10 corresponding to a maximum radius of the outer collection surface 15 or to a maximum weight of the collection roller 10.

Preferably the step of comparing the measure of the radius R of the collection roller 10 with a maximum radius value is carried out continuously during the entire collection of the fabric F.

Substantially the collection method of the fabric corresponds to a procedure for controlling the operation of the take-down and/or collection group 1.

The present invention reaches important advantages.

First of all, the Applicant has verified that the invention allows to solve the problems and overcome the above-mentioned limits typical of the known solutions, and then to obtain the predetermined purposes. In particular, the take-down and/or collection group 1 is characterized by an innovative structure and operation, which provide

a specific operating mode of the collection roller, through the first motor group, the presence of the contactless sensor and a regulation of the position of the spreading roller. This advantageously allows to:

- implement a better control and an evolved management of the collection of the manufactured fabric;
- prevent the formation of misalignments and/or wrinkles in the collected fabric, and prevent the rolling up of lateral edges of the fabric;
- open and spread the fabric effectively at all times, realizing a uniform and flat wrapping of the fabric on the collection roller;
- achieve improved performance, for example in terms of productivity and/or quality and uniformity of the collected knit, with respect to known solutions;
- dynamically control, even in real time, the organs involved in the treatment of the fabric up to its collection;
- adapt the take-down and/or collection group to different textile needs and to different typologies and dimensions of fabric;
- easily subject the operating organs to maintenance and replacement operations of their own parts;
- provide a system having a high reliability of operation and a lower susceptibility to failures and malfunctions.

It should be considered that the take-down and/or collection group of the present invention also allows to obtain a further very important advantage, which is represented by the possibility of increasing the maximum amount of fabric that can be wrapped on the collection roller. In fact, since the collection roller is axially, and directly, motorized by the first motor group, there is no need to prepare the lower motorized rollers which, in the known technique, put the collection roller in rotation. This allows to completely free the space underneath the collection roller, which can therefore grow larger (with respect to the known technique and with the same dimensions of the frame) without interfering with other elements of the take-down and/or collection group. A larger roll means a much larger quantity of collected fabric: in fact, it must be taken into account that the volume of a cylinder (the fabric roll) increases with the square of the radius, so allowing an increase of the radius of the collection roller corresponds to being able to wrap much more fabric.

A further advantage of the solution at the basis of the present invention lies in the possibility of accurately measuring the length of the fabric wrapped on the collection roller, thanks to the presence of the contactless sensor and motor groups, which allow to always precisely know the radius taken by the collection roller as the fabric is wrapped, and the (angular and tangential) speed of the collection roller under all operating conditions.

The solution at the basis of the present invention allows to obtain a further advantage, represented by the absence of over tensions introduced in the fabric reel wrapped around the collection roller. In fact, the operating of the collection roller is of axial (and not tangential) type and are not present lower motorized rollers, typical of known solutions, that as above shown introduce over tensions in the fabric and can drag, in an undesired manner, more fabric layers also already wrapped on the collection roller. The solution of the present invention always operates with high and constant performance even as the radius and consequently the weight of the

collection roller increases, and even with high weight there are no problems of friction, tension or drag of the fabric on the collection roller.

The solution at the basis of the present invention makes sure that the fabric wrapped on the collection roller has precise and uniform characteristics in every part, from the beginning to the end of the collection; for example, the weight per square meter of the collected fabric remains constant from the beginning to the end of the roll and over the entire width.

CLAIMS

1. Take-down and/or collection group (1) of a fabric (F) manufactured by a circular weft knitting machine (100), said circular knitting machine comprising:

- a textile head (200) provided with at least one needle-bearing organ (C) rotating around a central axis, having shape of needle-bearing cylinder or needle-bearing plate, with a plurality of needles movably mounted to said at least one needle-bearing organ (C), and with command organs adapted to selectively actuate said plurality of needles and to allow the manufacturing of a fabric (F);
- a base (B) constituting the bearing structure of the knitting machine and configured to support said textile head (T), said base (B) defining, below said textile head (T), a housing volume;

the take-down and/or collection group (1) comprising:

- a frame (2) configured to be mounted in a rotating manner to said circular knitting machine (100) in said housing volume;
- operating organs (3) operatively associated to, and supported by, said frame (2) and comprising at least one collection roller (10) developing along a rotation axis (11) and longitudinally extending between two ends (12, 13), the operating organs (3) being configured at least to open and spread, or also eventually to draw it from said needle-bearing organ (C), the fabric (F) manufactured by the circular knitting machine (100), wrapping it in a single layer and continuously on said collection roller (10);

wherein said operating organs (3) comprise at least one first motor group (20) associated at the collection roller (10) and active on the rotation axis (11) of the collection roller, in such a way that the collection roller (10) results axially motorized, i.e. is put in rotation around said rotation axis (11) by said first motor group (20).

2. Take-down and/or collection group (1) according to claim 1, wherein said first motor group (20) is directly active on the rotation axis (11) of the collection roller (10), and/or wherein:

- said first motor group (20) is configured to put in rotation the collection roller (10) with a variable and selectable angular speed, and/or
- said first motor group (20) is configured to put in rotation the collection roller (10) with a variable and selectable angular speed regardless of the rotation speed of the needle-bearing organ, and/or
- said first motor group (20) is configured to put in rotation the collection roller (10) with a variable and selectable angular speed in a manner coordinated with the rotation of the needle-bearing organ (C), preferably in a coordinated - e.g. proportional - manner with the rotation speed of the needle-bearing organ (C), and/or
- said first motor group (20) is configured to put in rotation the collection roller (10) with a variable and selectable angular speed also under condition of constant rotation speed of the needle-bearing organ (C).

3. Take-down and/or collection group (1) according to claim 1 or 2, wherein said operating organs (3) of the take-down and/or collection group are without, i.e. do not comprise, motorized rollers in contact with the collection roller (10) and/or with the fabric (F) wrapped on the collection roller (10), and/or wherein the collection

roller (10) is mounted hanging in said frame (2), in such a way to result hanging in said take-down and/or collection group (1), and in such a way that the entire surface of the fabric (F) wrapped on the collection roller (10) does not result in contact with said operating organs (3) or other elements of the take-down and/or collection group, and/or wherein the collection roller (10) is mounted on said frame (2) in such a way that the entire surface of the fabric (F) wrapped on the collection roller results free and not leaning against any element, and/or wherein the collection roller (10) is rotatably mounted to said frame (2) at the two ends (12, 13) thereof, in such a way to result exclusively supported by said two ends, and/or wherein said first motor group (20) is fixed at one of the two ends (12; 13) of the collection roller (10), and from this position it puts in rotation the collection roller (10) directly on said rotation axis (11).

4. Take-down and/or collection group (1) according to any one of the preceding claims, comprising at least one sensor (S) of contactless type (contactless), associated to said frame (2) or to said operating organs (3) and configured to measure a distance value between the sensor (S) itself and a surface of said collection roller (10), upon which a determined quantity of fabric (F) is wrapped in a single layer, and/or wherein the take-down and/or collection group (1) is configured to process a measure of the radius (R) of the collection roller (10) as a function of said distance value measured by the contactless sensor (S), and/or wherein said contactless sensor (S) is a sensor chosen among one of the following types: laser sensor, time-of-flight sensor, infrared sensor, ultrasound sensor, optical sensor, sensor with camera, inductive sensor, capacitive sensor, magnetic sensor, and/or wherein the take-down and/or collection group (1) is configured to modify the configuration of said operating organs (3) on the basis of said measure of the radius (R) of the collection roller (10) processed as a function of said distance value measured by the contactless sensor (S), and/or wherein said contactless sensor (S) is oriented towards the rotation axis (11) of the collection roller (10), i.e. has a detection direction that intersects the rotation axis (11) of the collection roller (10).

5. Take-down and/or collection group (1) according to any one of the preceding claims, wherein said collection roller (10):

- has an outer collection surface (15), corresponding to the outermost layer of the fabric (F) wrapped to the collection roller (10);
- has, instant by instant during the collection of the fabric (F), a radius (R) of the collection roller (10), corresponding to the radial distance between the outer collection surface (15) and the rotation axis (11);
- has, instant by instant during the collection of the fabric (F), an angular speed of rotation around the rotation axis (11);
- has, instant by instant during the collection of the fabric (F), a tangential speed, i.e. the linear speed of the roller at said outer collection surface (15),

and/or wherein said first motor group (20) is configured to vary said angular speed of the collection roller (10) in such a way to always keep opportunely regulated, i.e. under control during the collection of the fabric (F),

said tangential speed of the collection roller (10), and/or wherein said first motor group (20) is configured to progressively reduce said angular speed of the collection roller (10) as said radius (R) of the collection roller (10) increases, in such a way to keep said tangential speed of the collection roller (10) constant.

6. Take-down and/or collection group (1) according to any one of the preceding claims, wherein the collection roller (10) comprises:

- a rod (16) extending between two ends and onto which the fabric (F) collected by the take-down and/or collection group is wrapped, forming a reel of fabric around said rod (16);
- two supports (17, 18) placed at the two ends of the rod and configured to support in rotation said rod (16),

and wherein said two supports (17, 18) are associable, preferably in a removable manner, to said frame (2), in such a way to allow the mounting and dismounting of the collection roller (10) to and from the frame (2),

and/or wherein the frame (2) comprises, at a first lateral portion (6) thereof and at a second lateral portion (7) thereof, two housing seats (8, 9) configured to receive the collection roller (10) at the two ends (12, 13) thereof, and/or wherein each housing seat (8, 9) is configured to receive a respective support (17, 18) of the collection roller (10), and/or wherein each housing seat (8, 9) comprises a housing channel configured for the loading and unloading of the collection roller (10), and/or wherein the loading of the collection roller (10) occurs by means of insertion of said two supports (17, 18) in the two housing channels, whereas the unloading of the collection roller (10) occurs by means of extraction of said two supports (17, 18) from the two housing channels.

7. Take-down and/or collection group (1) according to any one of the preceding claims, wherein the first motor group (20) comprises:

- a first electric motor (21), preferably a stepper motor;
- a mechanical transmission (22), mounted downstream of said first electric motor (21) and directly active on said rod (16) of the collection roller (10) to put it selectively in rotation,

and/or wherein said mechanical transmission (22) comprises an endless screw transmission, or a gear transmission, for example a pair of bevel gears, or a epicycloidal gearbox, and/or wherein said mechanical transmission (22) ends with a shaft bearing a motor organ (23) configured to directly transfer a controlled rotating motion to the rod (16) of the collection roller (10), and/or wherein said rod (16) of the collection roller (10) comprises a guided organ (19) directly gearable to the motor organ (23) for receiving from it the controlled rotating motion and putting the rod (16) of the collection roller (10) in rotation,

and/or wherein said guided organ (19):

- engages on the motor organ (23) when the collection roller (10) is mounted on the frame (2), i.e. when the supports (17, 18) of the collection roller (10) are inserted in the housing seats (8, 9) of the frame (2);
- disengages from the motor organ (23) when the collection roller (10) is demounted from the frame (2), i.e. when the supports (17, 18) of the collection roller (10) are extracted from the housing seats (8, 9) of the frame (2),

and/or wherein the first motor group (20) comprises:

- said first electric motor (21), of stepper type, provided with an output shaft;
- said mechanical transmission (22) comprising:
    - a endless screw transmission / helicoidal toothed wheel comprising:
        - an endless screw connected to, and put in rotation by, said output shaft of the first electric motor (21), and
        - a helicoidal toothed wheel geared to said endless screw and mounted on said shaft bearing the motor organ (23).

8. Take-down and/or collection group (1) according to any one of the preceding claims, wherein the operating organs (3) comprise at least one spreading roller (30), or tensioning roller, mounted to the frame (2) in position upstream with respect to said collection roller (10), the spreading roller (30) being configured to interact with the fabric (F) advancing towards the collection roller (10) in such a way to spread it before the wrapping on the collection roller, wherein the spreading roller (30) longitudinally extends, between two lateral ends (32, 33), in a direction substantially parallel to said rotation axis (11) of the collection roller (10) and is configured to rotate around a rotation axis (31) thereof, and/or wherein the spreading roller (30) is mounted in a movable manner, for example rotatable or translatable or rototranslatable, to said frame (2) and is configured to be able to vary an operating distance that separates it from said collection roller (10), wherein said operating distance corresponds to the linear distance between the rotation axis (31) of the spreading roller (30) and the respective rotation axis (11) of the collection roller (10), and/or wherein the operating organs (3) comprise a second motor group (40) active on the spreading roller (30) for selectively moving it in such a way to increase or decrease the operating distance that separates it from said collection roller (10), preferably keeping the spreading roller (30) parallel to the collection roller (10) and with a rotating or translating or rototranslating movement.

9. Take-down and/or collection group (1) according to any one of the preceding claims, wherein the spreading roller (30):

- has an outer operating surface (35), that contacts the fabric (F) in its transit toward the collection roller (10) and acts on the fabric itself for enlarging and spreading it;
- has a radius of the spreading roller (30) having a constant value and corresponding to the radial distance between the outer operating surface (35) and the rotation axis (31) of the spreading roller (30),

and wherein the spreading roller (30) is configured to be moved, during the collection, by varying said operating distance that separates it from said collection roller (10), in such a way to keep constant, instant by instant, an optimal separation value equal to a distance between the outer operating surface (35) of the spreading roller (30) and the outer collection surface (15) of the collection roller (10), wherein said optimal separation value is an operating value corresponding to an ideal distance at which to keep the spreading roller (30) with respect to

the collection roller (10) for carrying out an optimal spreading of the fabric (F) which passes from the spreading roller to the collection roller,

and/or wherein said second motor group (40) is configured to move the spreading roller (30) on the basis of said measure of the radius (R) of the collection roller (10) processed as a function of said distance value measured by said contactless sensor (S), by varying said operating distance that separates the spreading roller (30) from the collection roller (10) in such a way to keep constant, instant by instant, said optimal separation value, and/or wherein said second motor group (40) is configured to progressively increase said operating distance as said radius (R) of the collection roller (10) increases, keeping said optimal separation value constant during the collection of the fabric (F).

10. Take-down and/or collection group (1) according to any one of the preceding claims, comprising at least one control unit configured to command the functioning of said operating organs (3),

wherein said control unit is connected to said contactless sensor (S) and is configured:

- to receive from the contactless sensor (S) a signal representative of said distance value and determining said measure of the radius (R) of the collection roller (10); or
- to directly receive from the contactless sensor (S) said measure of the radius (R) of the collection roller (10),

and/or wherein said control unit is connected to said operating organs (3) for sending command signals to them able to modify and control the operating configuration thereof,

and/or wherein said control unit is configured to:

- send to said first motor group (20) a command signal for varying said angular speed of the collection roller (10) in such a way to keep said tangential speed of the collection roller (10) always opportunely regulated;
- send to said first motor group (20) a command signal for progressively reducing said angular speed of the collection roller (10) as said radius (R) of the collection roller increases, in such a way to keep said tangential speed of the collection roller (10) constant;
- send to said second motor group (40) a command signal for moving the spreading roller (30) on the basis of said measure of the radius (R) of the collection roller (10), by varying said operating distance in such a way to keep constant, during the collection of the fabric (F), said optimal separation value;
- send to said second motor group (40) a command signal for progressively increasing said operating distance as said radius (R) of the collection roller (10) increases, keeping constant, during the collection of the fabric (F), said optimal separation value.

11. Circular weft knitting machine (100) comprising:

- a textile head (T) provided with at least one needle-bearing organ (C) rotating around a central axis, having shape of needle-bearing cylinder or needle-bearing plate, of a plurality of needles movably mounted to said at least one needle-bearing organ, and of command organs adapted to selectively actuate said plurality of needles and to allow the manufacturing of a fabric;

- a base (B) constituting the bearing structure of the textile machine and configured to support said textile head (T), said base (B) defining, below said textile head (T), a housing volume;
- a take-down and/or collection group (1) according to one or more of the preceding claims;

wherein the circular knitting machine (100) is preferably of “open” type, i.e. is configured to manufacture fabric (F) and collect it in the open, i.e. as single layer and continuously, by wrapping it on the collection roller (10) of the take-down and/or collection group (1), the single layer fabric (F) being preferably obtained:

- by means of cutting and stretching, or “opening”, of a tubular fabric, if the textile head (T) continuously manufactures a tubular fabric; or
- directly “in the open”, i.e. as continuous single layer of fabric having a determined width;

in both cases the take-down and/or collection group (1) by collecting, by wrapping it on the collection roller (10), a single layer fabric and not a cylindrical development tubular.

12. Collection method of the fabric (F) manufactured by a circular weft knitting machine (100), the method comprising the steps of:

- arranging and operating a circular weft knitting machine (100) comprising at least:
    - a textile head (T) provided with at least one needle-bearing organ (C) rotating around a central axis, having shape of needle-bearing cylinder or needle-bearing plate, of a plurality of needles movably mounted to said at least one needle-bearing organ, and of command organs adapted to selectively actuate said plurality of needles and to allow the manufacturing of a fabric;
    - a base (B) constituting the bearing structure of the textile machine and configured to support said textile head (T), said base defining, below said textile head, a housing volume;
- arranging and operating a take-down and/or collection group (1) comprising:
    - a frame (2) mounted in a rotating manner to said circular knitting machine (100) in said housing volume;
    - operating organs (3) operatively associated to, and supported by, said frame (2) and comprising at least one collection roller (10) developing along a rotation axis (11) and extending longitudinally between two ends (12, 13), the operating organs (3) being configured at least to open and spread, or also eventually to draw it from said needle-bearing organ (C), the fabric (F) manufactured by the circular knitting machine (100), by wrapping it in a single layer and continuously on said collection roller (10);
    - at least one contactless sensor (S), associated to said frame (2) or to said operating organs (3) and configured to measure a distance value between the sensor itself and a surface of said collection roller (10), upon which a determined quantity of fabric (F) is wrapped in a single layer;
- processing a measure of the radius (R) of the collection roller (10) as a function of said distance value measured by the contactless sensor (S), wherein said radius (R) corresponds to the radial distance between

an outer collection surface (15), corresponding to the outermost layer of the fabric (F) wrapped to the collection roller (10), and the rotation axis (11);

- automatically modifying the configuration of said operating organs (3) on the basis of said measure of the radius (R) of the collection roller (10) processed as a function of said distance value measured by the contactless sensor (S).

13. Collection method of the fabric (F) according to claim 12, wherein said step of automatically modifying comprises a step of synchronizing the operating organs (3) on determined working parameters necessary to guarantee the correct tensioning and the correct spreading of the fabric (F), and/or wherein the method comprises a step of varying the angular speed of the collection roller (10) in such a way to keep the tangential speed of the collection roller (10) always opportunely regulated, i.e. under control during the collection of the fabric (F), and/or wherein the method comprises a step of progressively reducing said angular speed of the collection roller (10) as said radius (R) of the collection roller (10) increases, in such a way to keep said tangential speed of the collection roller (10) constant, and/or wherein the method provides that the step of processing a measure of the radius (R) of the collection roller (10) as a function of said distance value is carried out in real time, i.e., instant by instant, thereby monitoring in a continuous manner the measure of the radius (R) of the collection roller (10).

14. Collection method of the fabric (F) according to claim 12 or 13, comprising the steps of:

- arranging, in said operating organs (3), at least one spreading roller (30), or tensioning roller, mounted to the frame (2) in position upstream with respect to said collection roller (10) and configured to interact with the fabric (F) advancing towards the collection roller in such a way to spread it before the wrapping on the collection roller (10);

- moving the spreading roller (30) on the basis of said measure of the radius (R) of the collection roller (10) processed as a function of said distance value measured by said contactless sensor (S), by varying an operating distance that separates the spreading roller (30) from the collection roller (10) in such a way to keep constant, instant by instant, an optimal separation value, wherein said optimal separation value being an operating value corresponding to the ideal distance at which to keep the spreading roller (30) with respect to the collection roller (10) for carrying out an optimal spreading of the fabric (F) which passes from the spreading roller (30) to the collection roller (10).

15. Collection method of the fabric (F) according to claim 12 or 13 or 14, comprising a step of monitoring the functioning of the collection of the fabric (F), said step of monitoring comprising the step of:

- detecting abnormal variations of said measure of the radius (R) of the collection roller (10) which may be indicators of anomalies such as:

  - an oscillating value of the measure of the radius (R), i.e. first increasing then decreasing;

  - a void value of the measure of the radius (R);

- a variance or ovality, i.e. deviation of the diameter from a cylindrical shape, of the fabric roll (F),

- eventually, generating a signal representative of said anomaly;

and/or wherein the method comprises the steps of:

- comparing said measure of the radius (R) of the collection roller (10) with a maximum radius value;

- upon reaching said maximum radius value, stopping the manufacturing by the circular knitting machine (100).

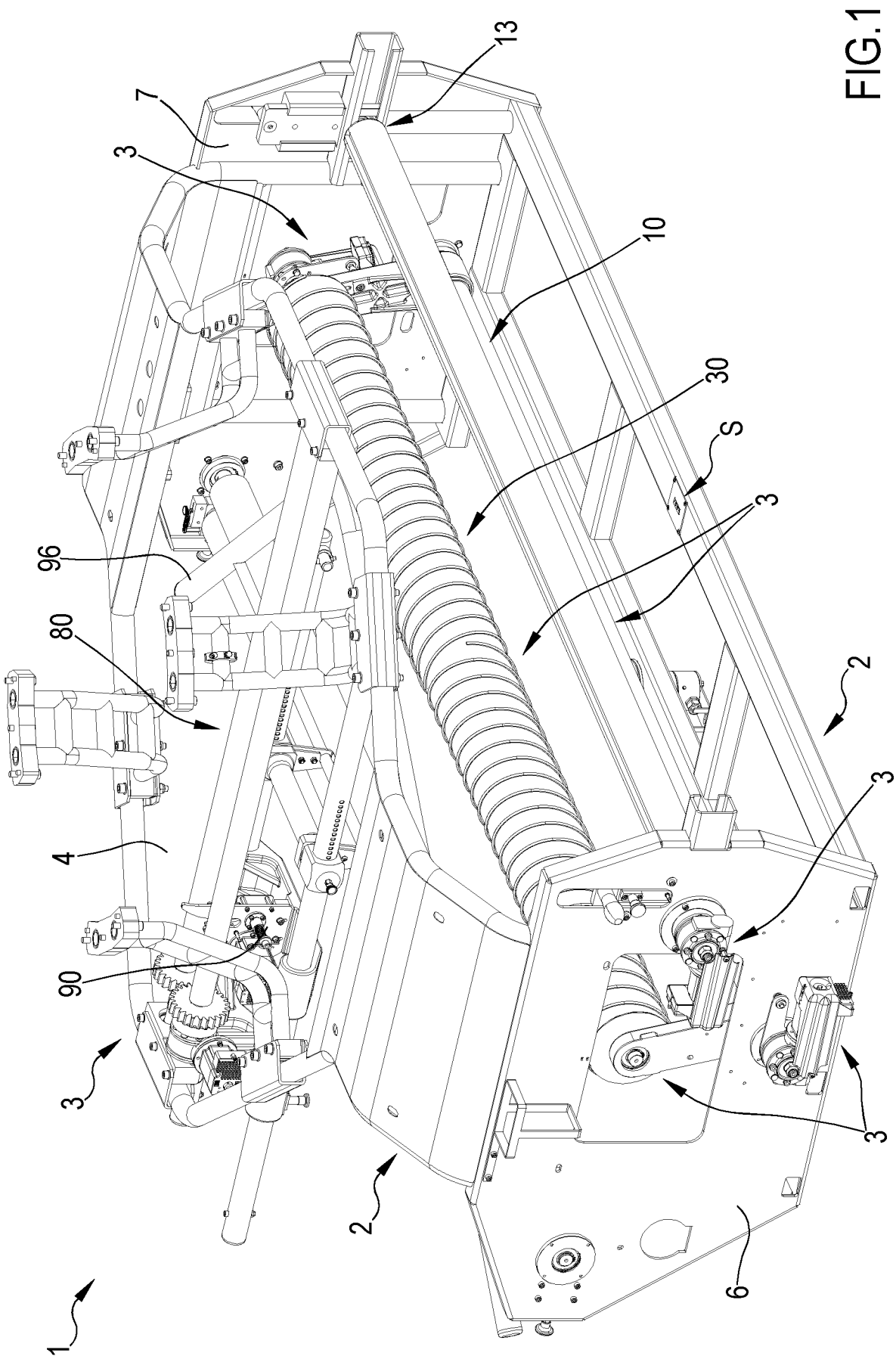


FIG.1

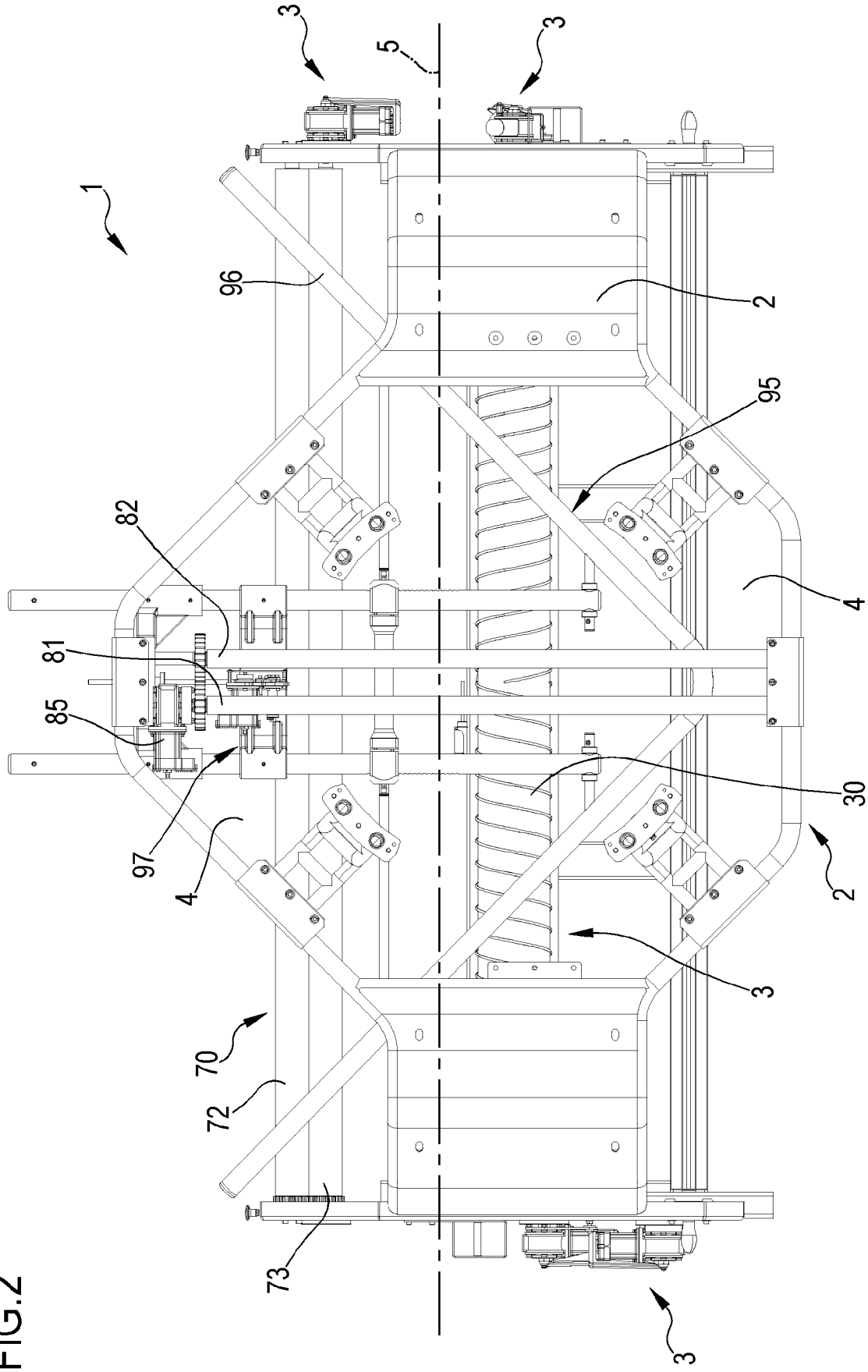


FIG.2

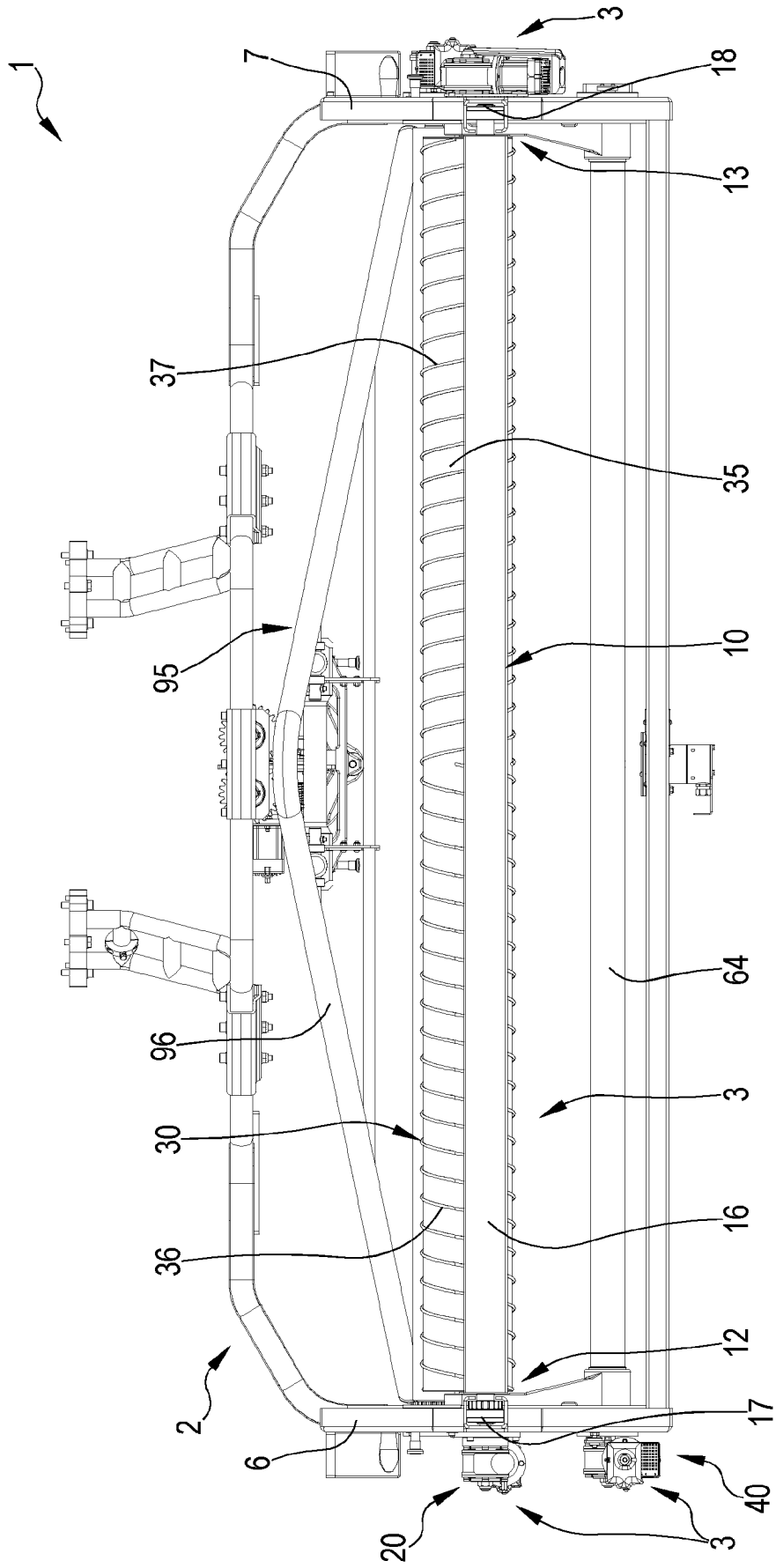
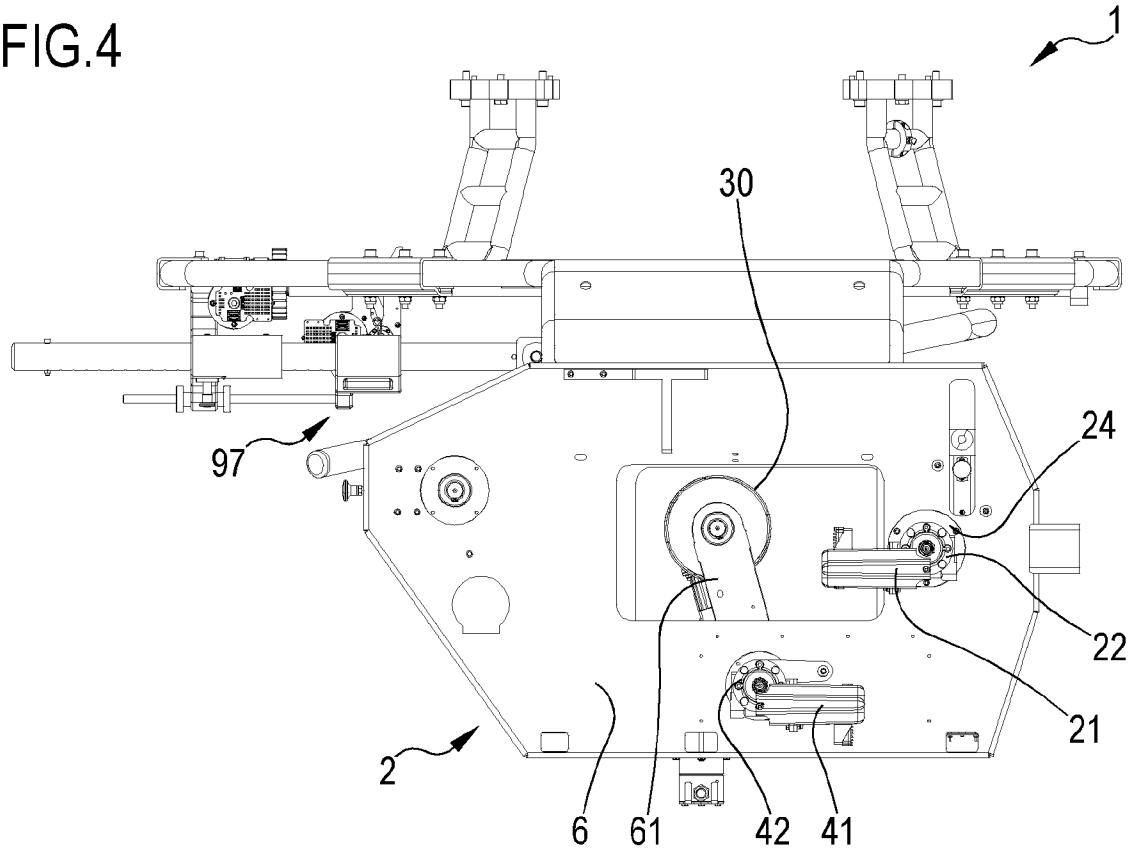


FIG.3

FIG.4



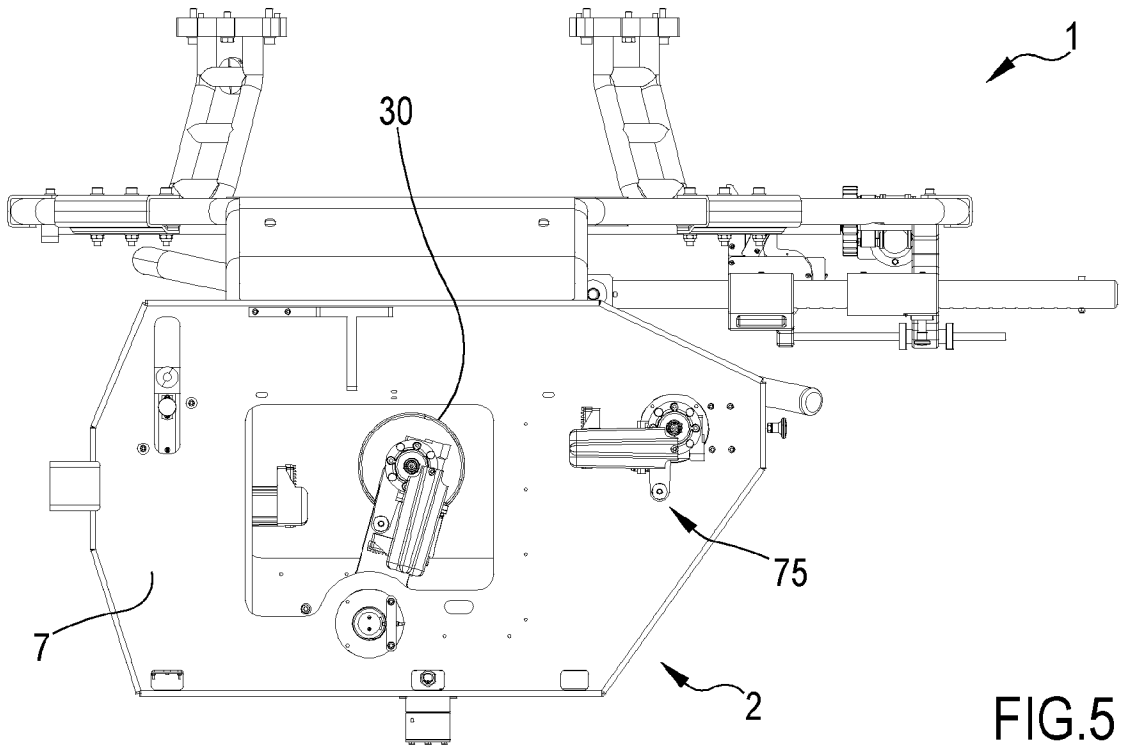


FIG.5

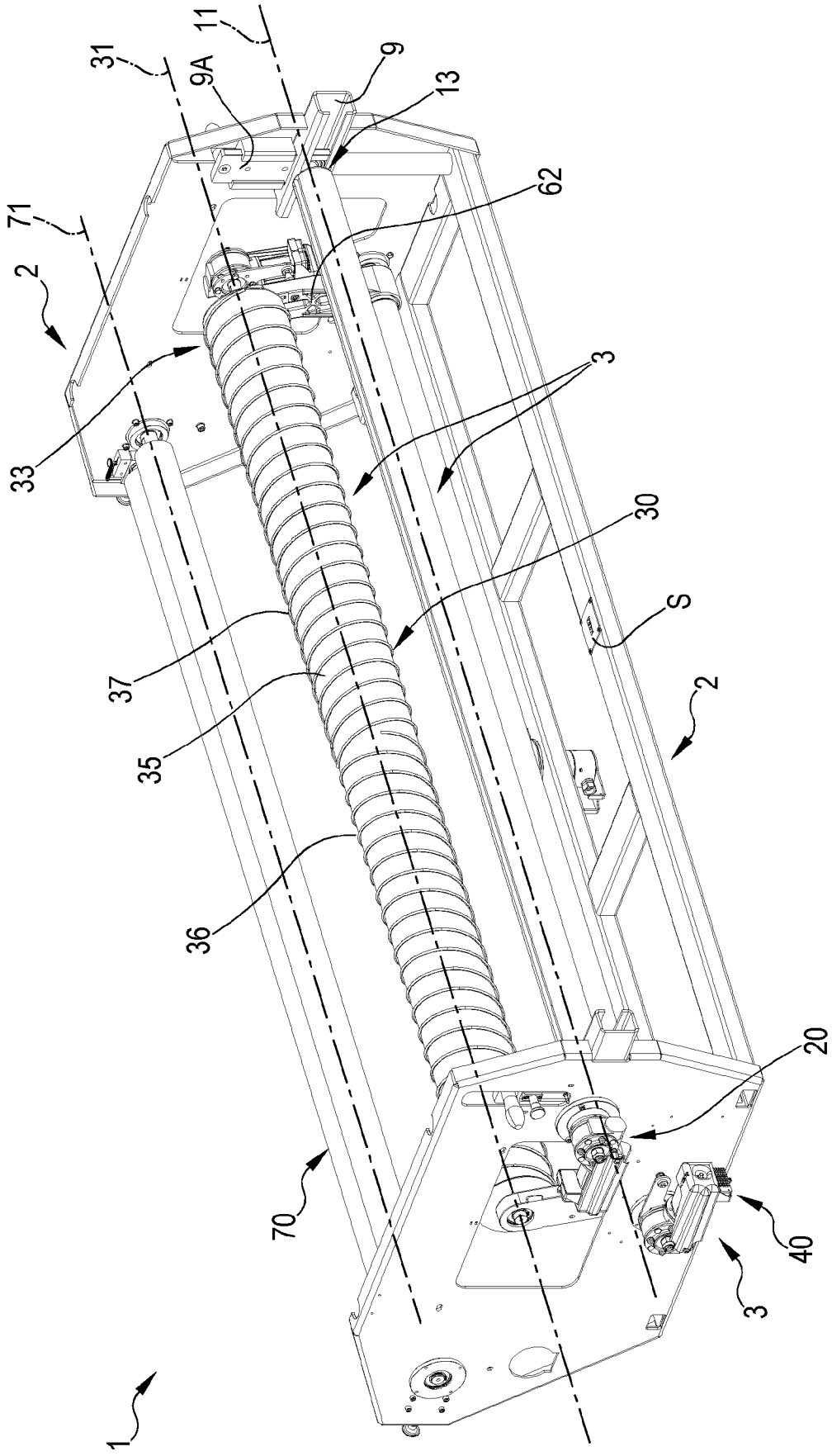


FIG.6

FIG.7

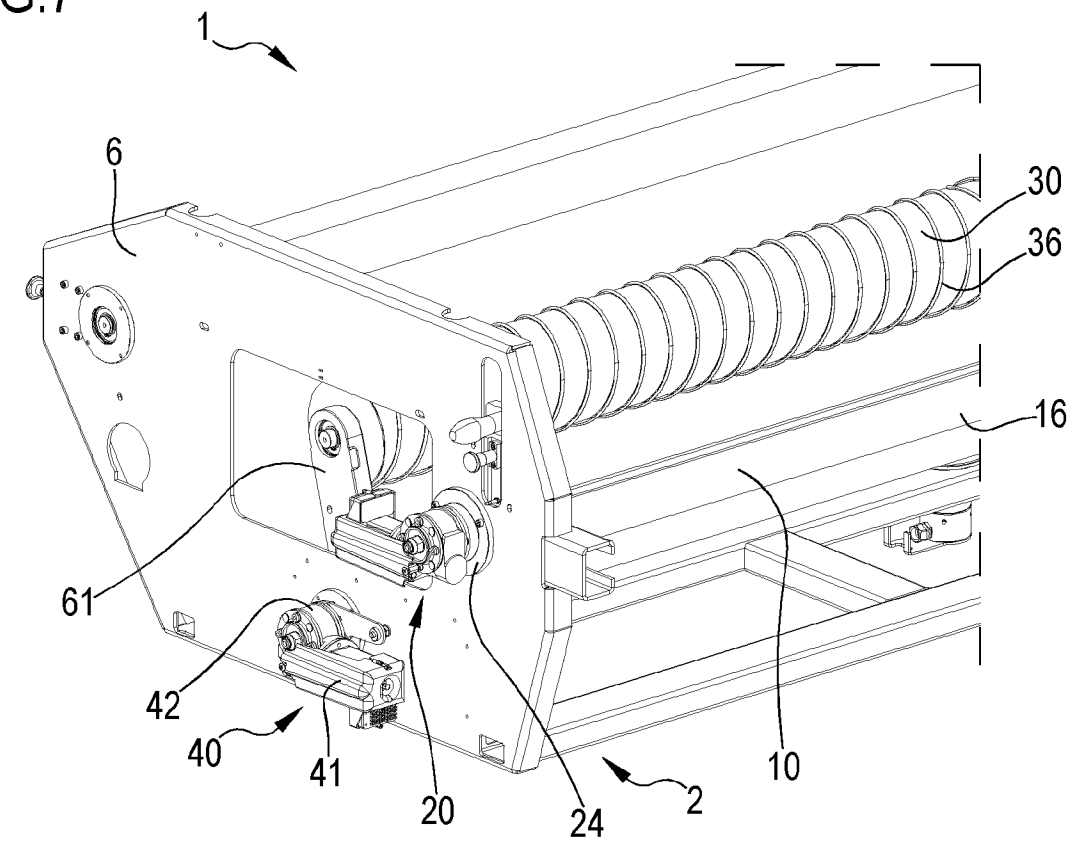

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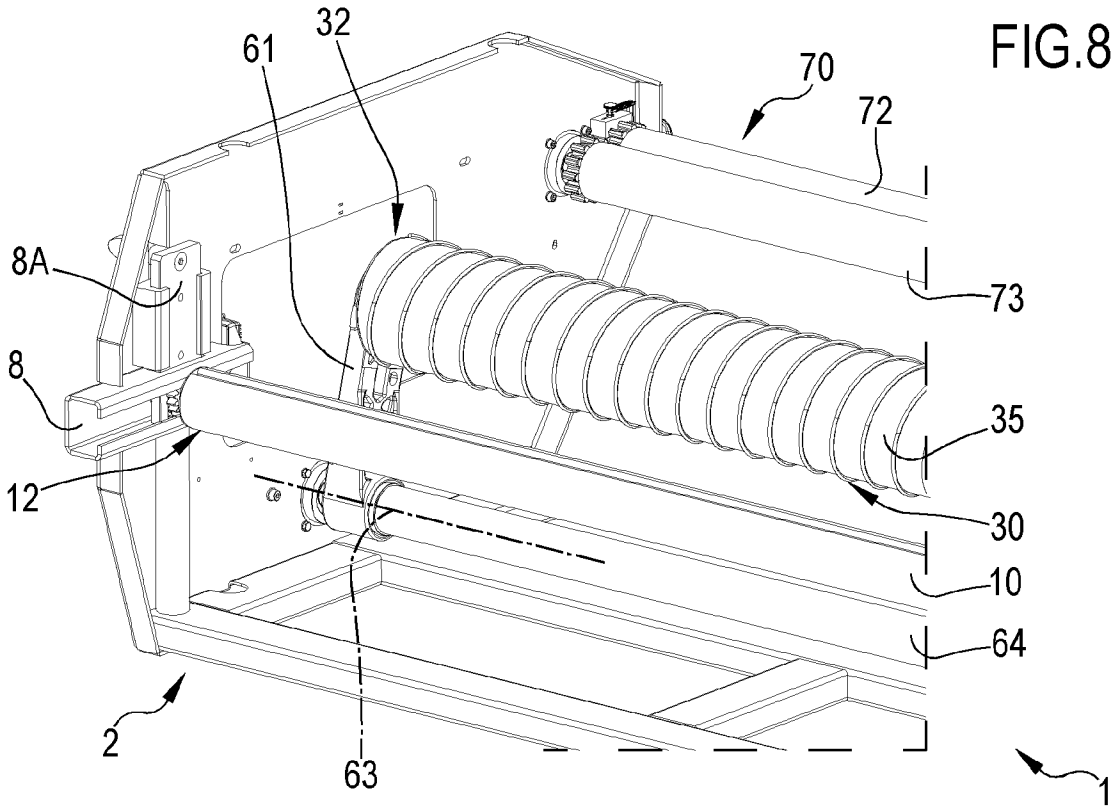
FIG.8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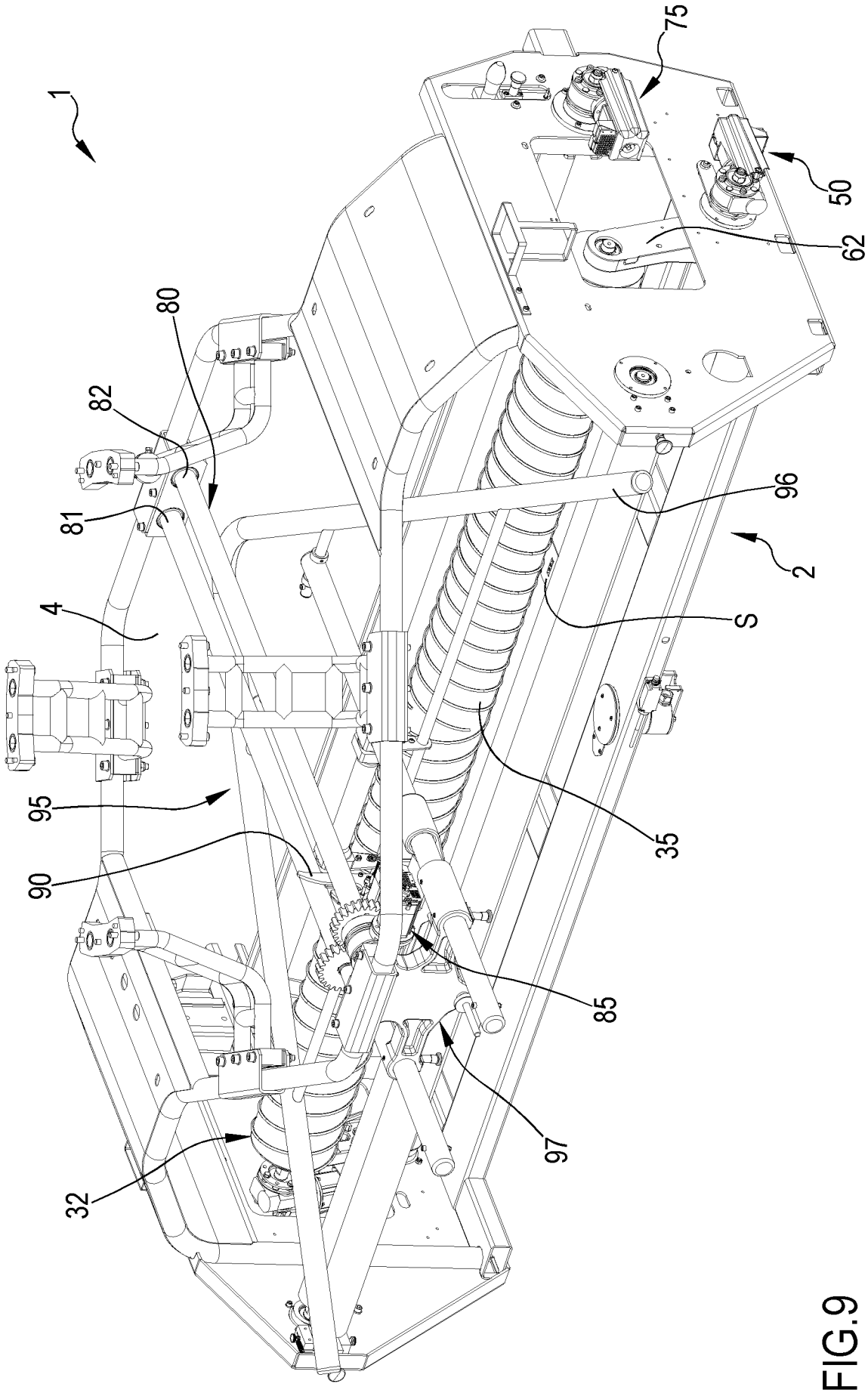
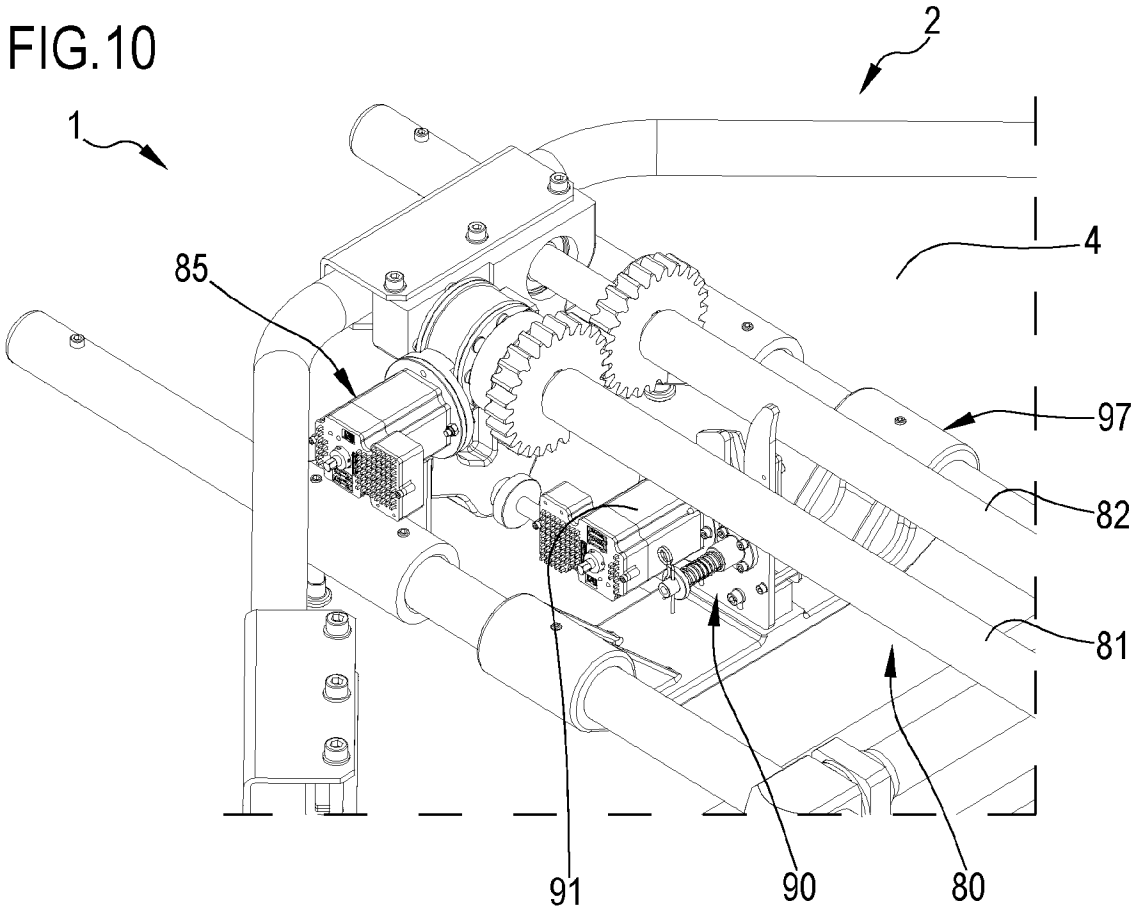


FIG.9

FIG.10



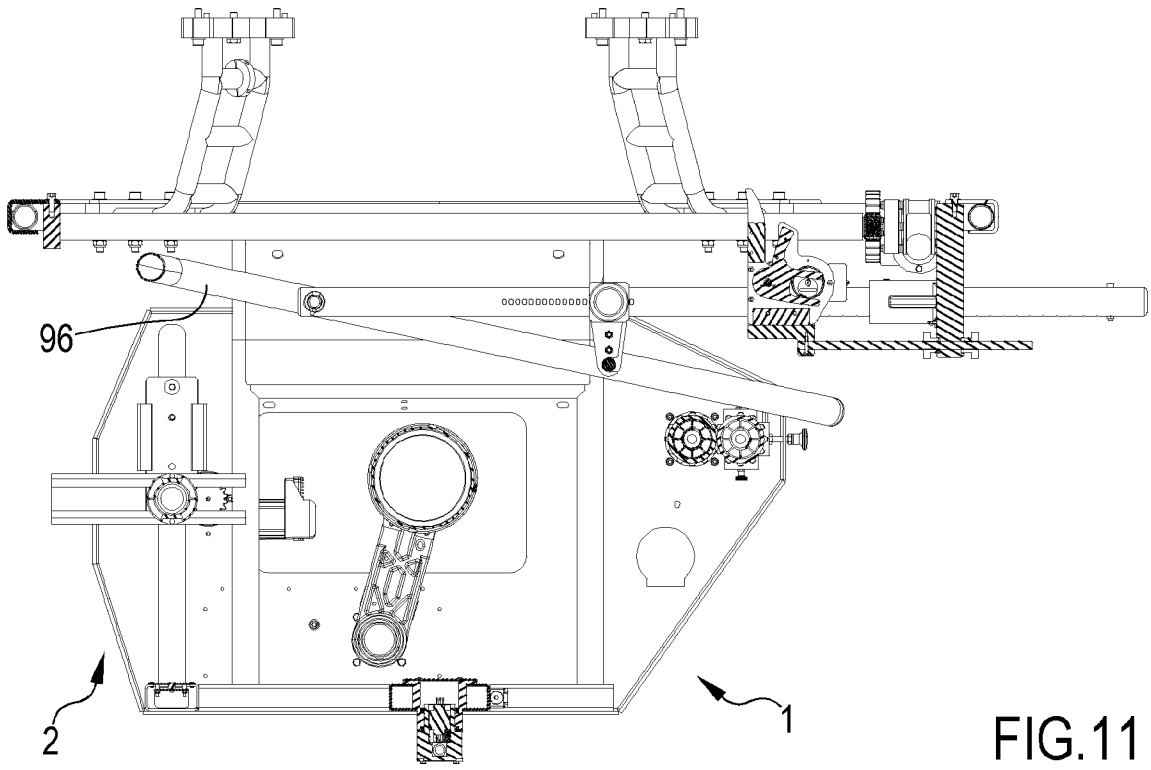


FIG.11

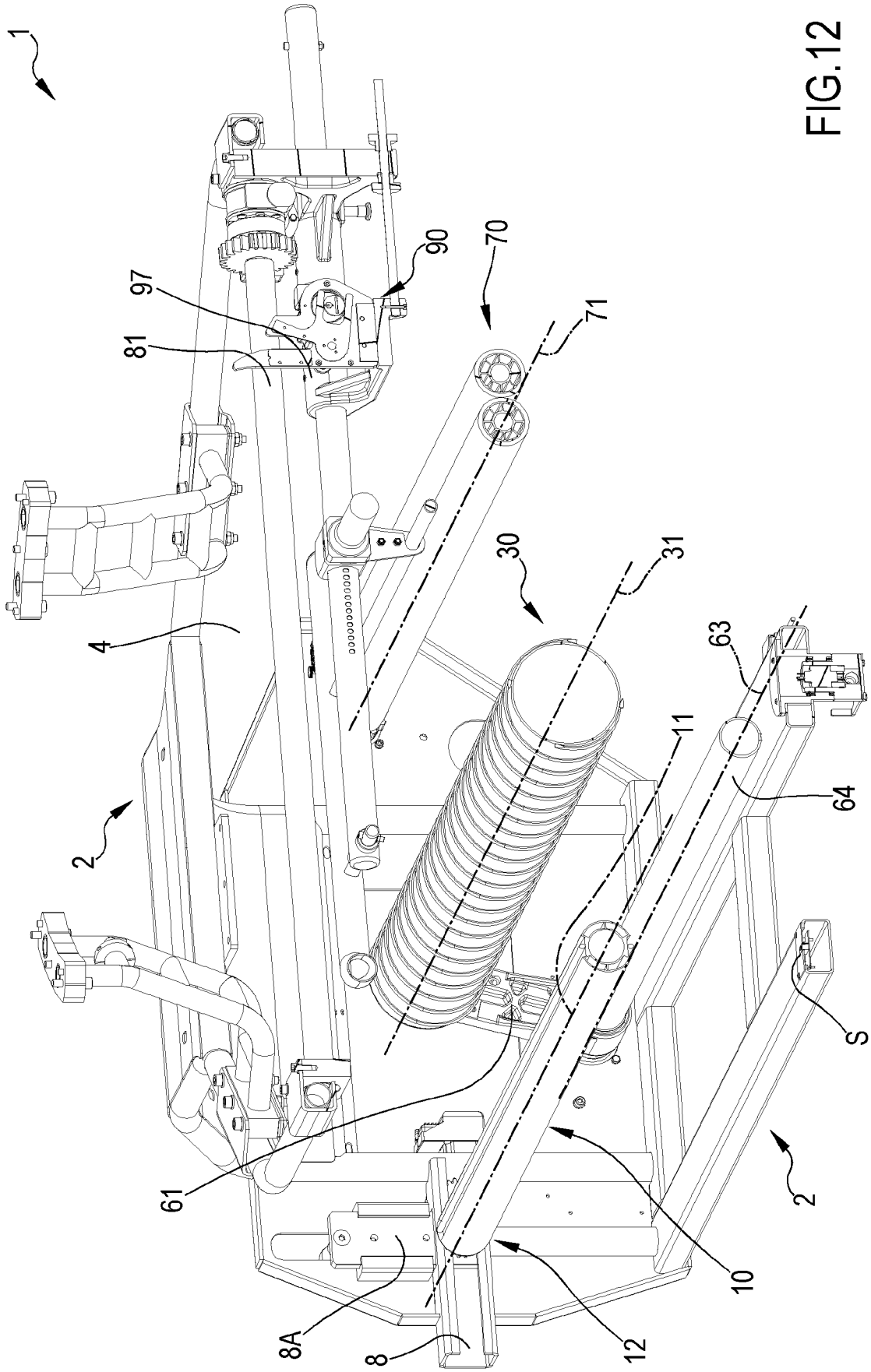


FIG.12

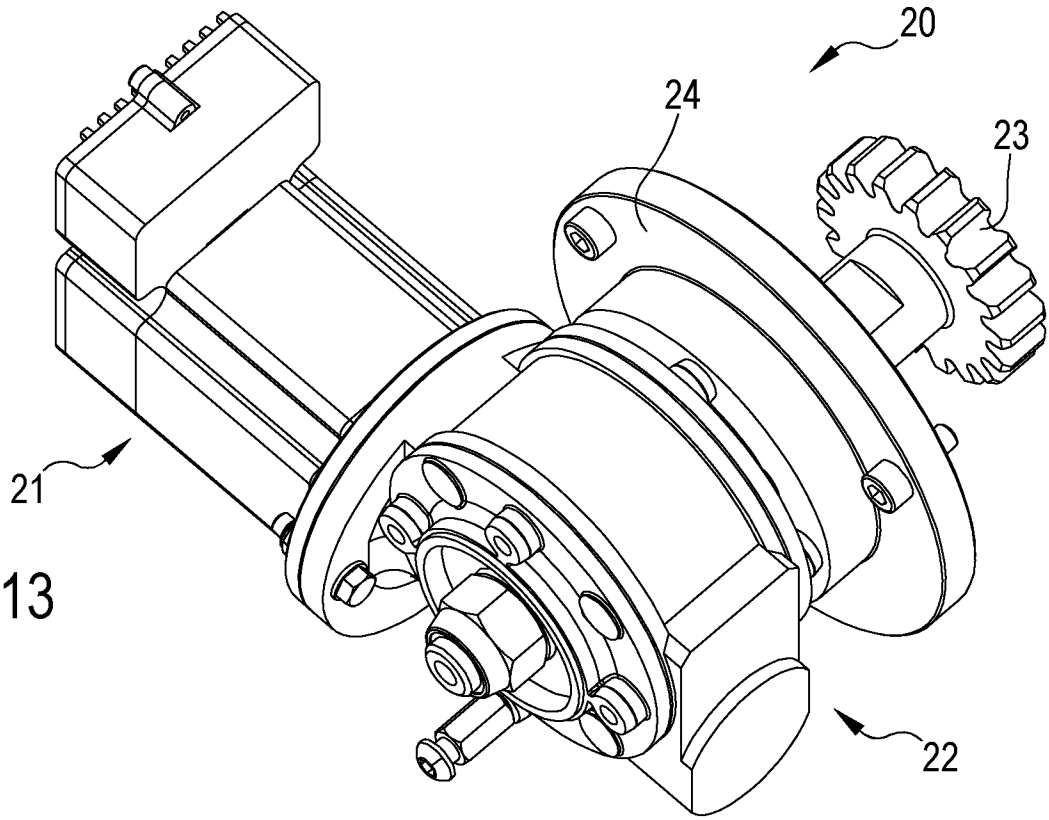


FIG.13

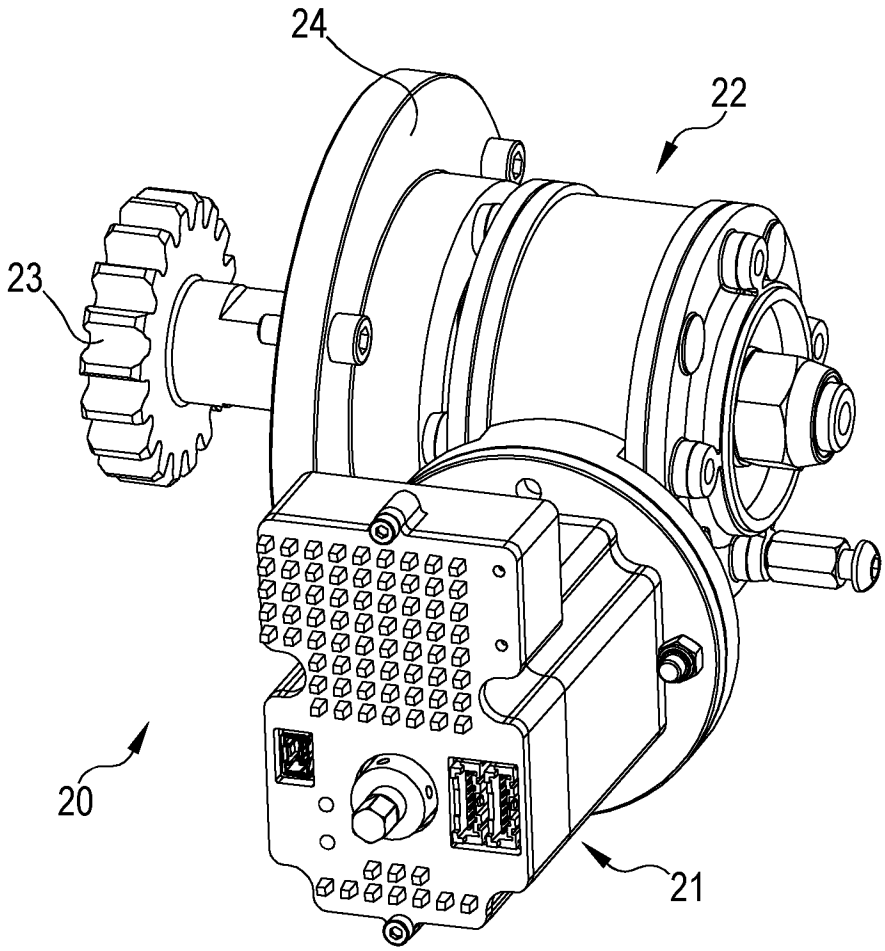


FIG.14

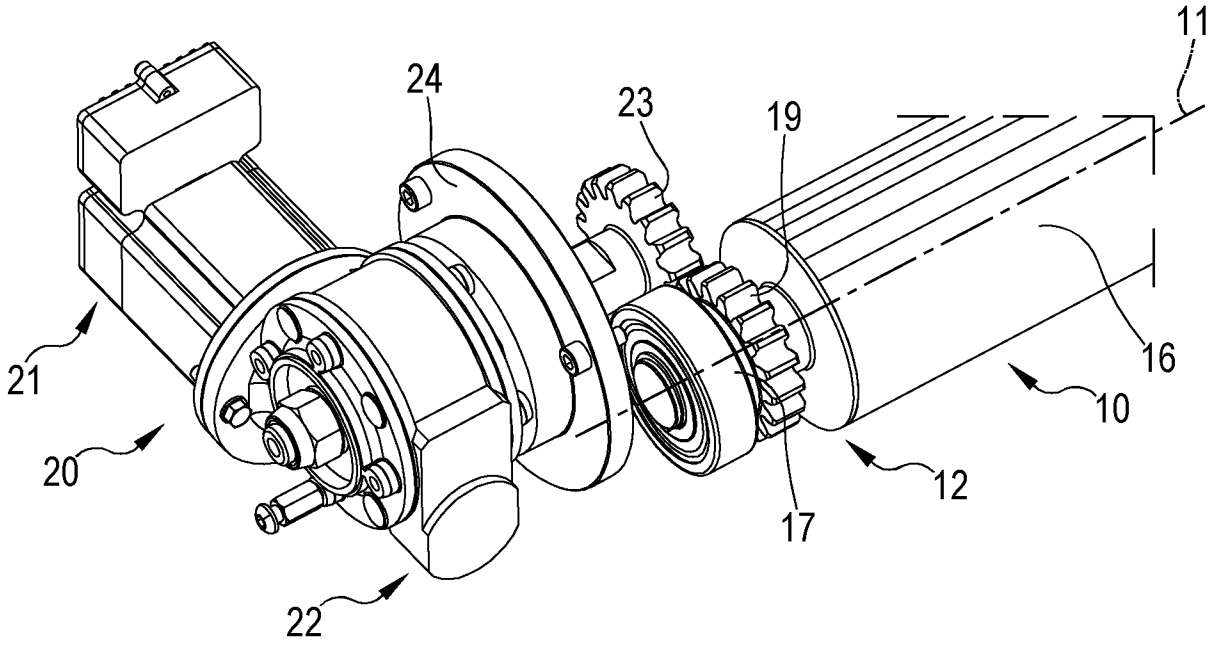


FIG.15

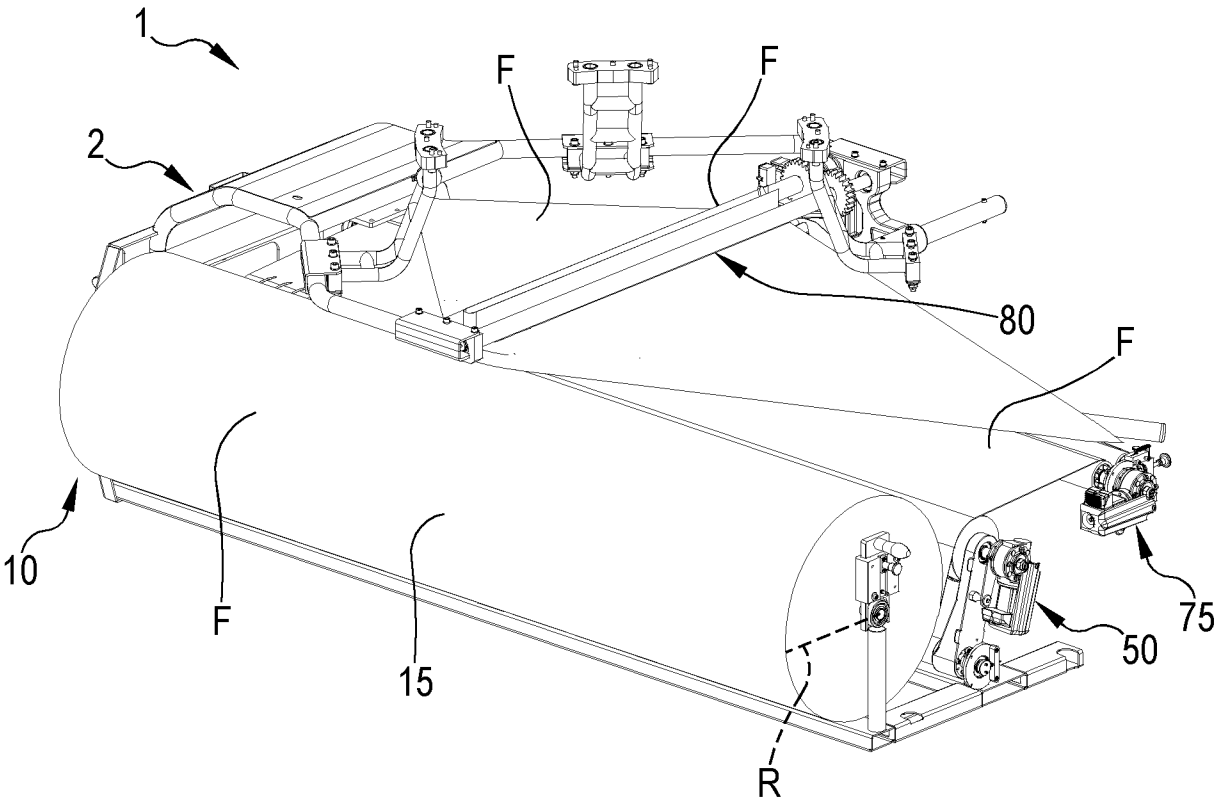


FIG.16

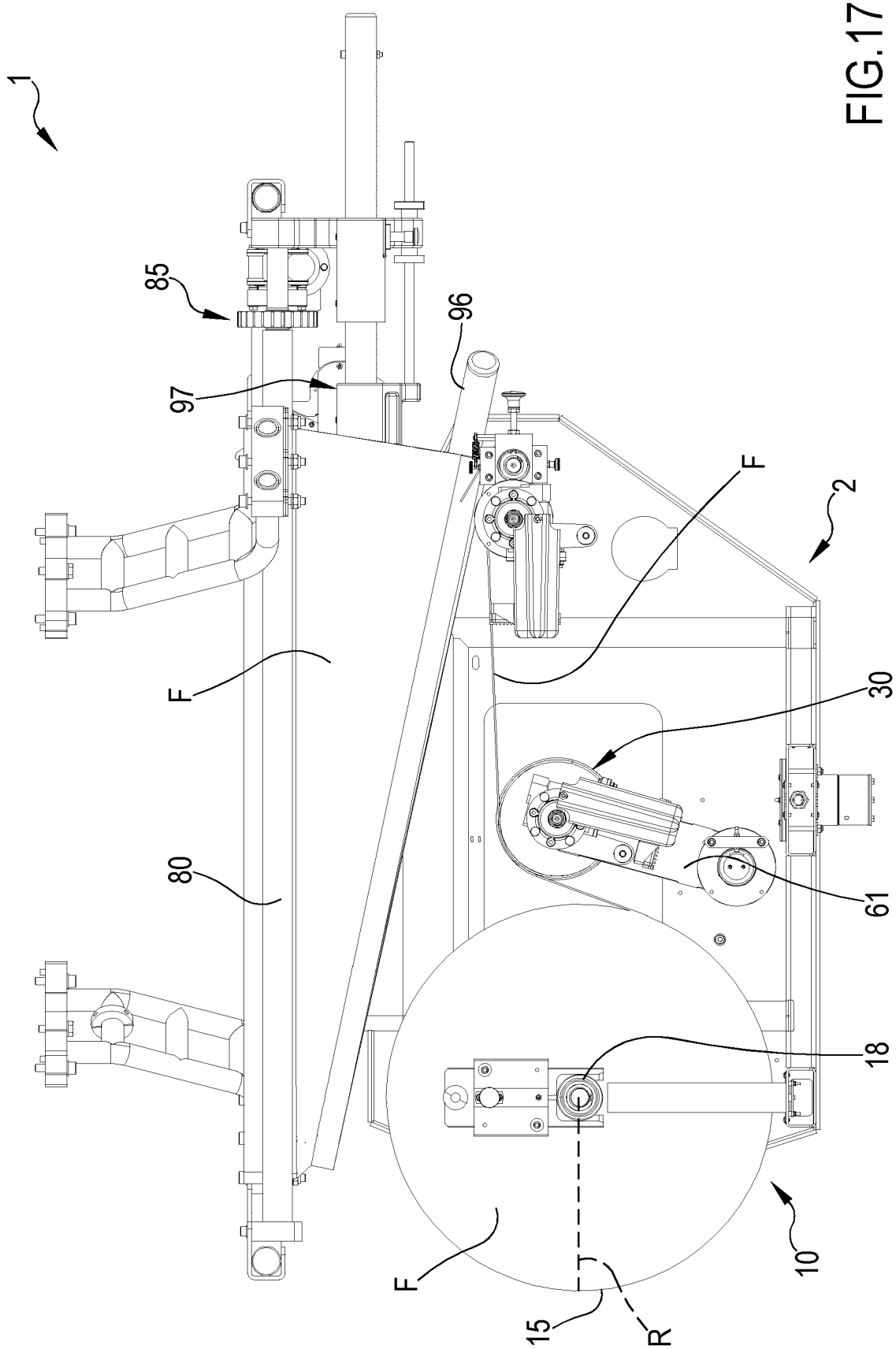


FIG.17

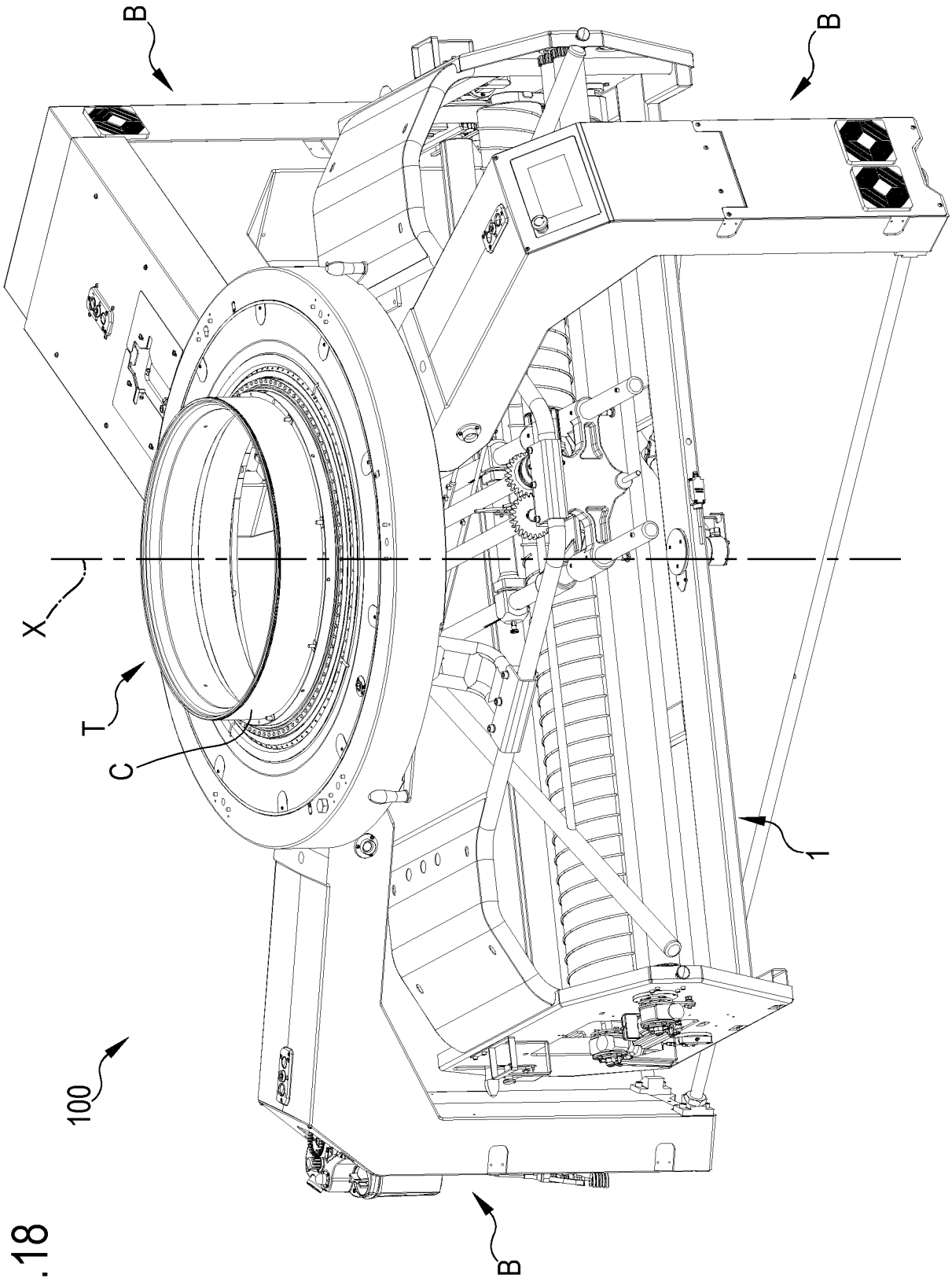


FIG.18

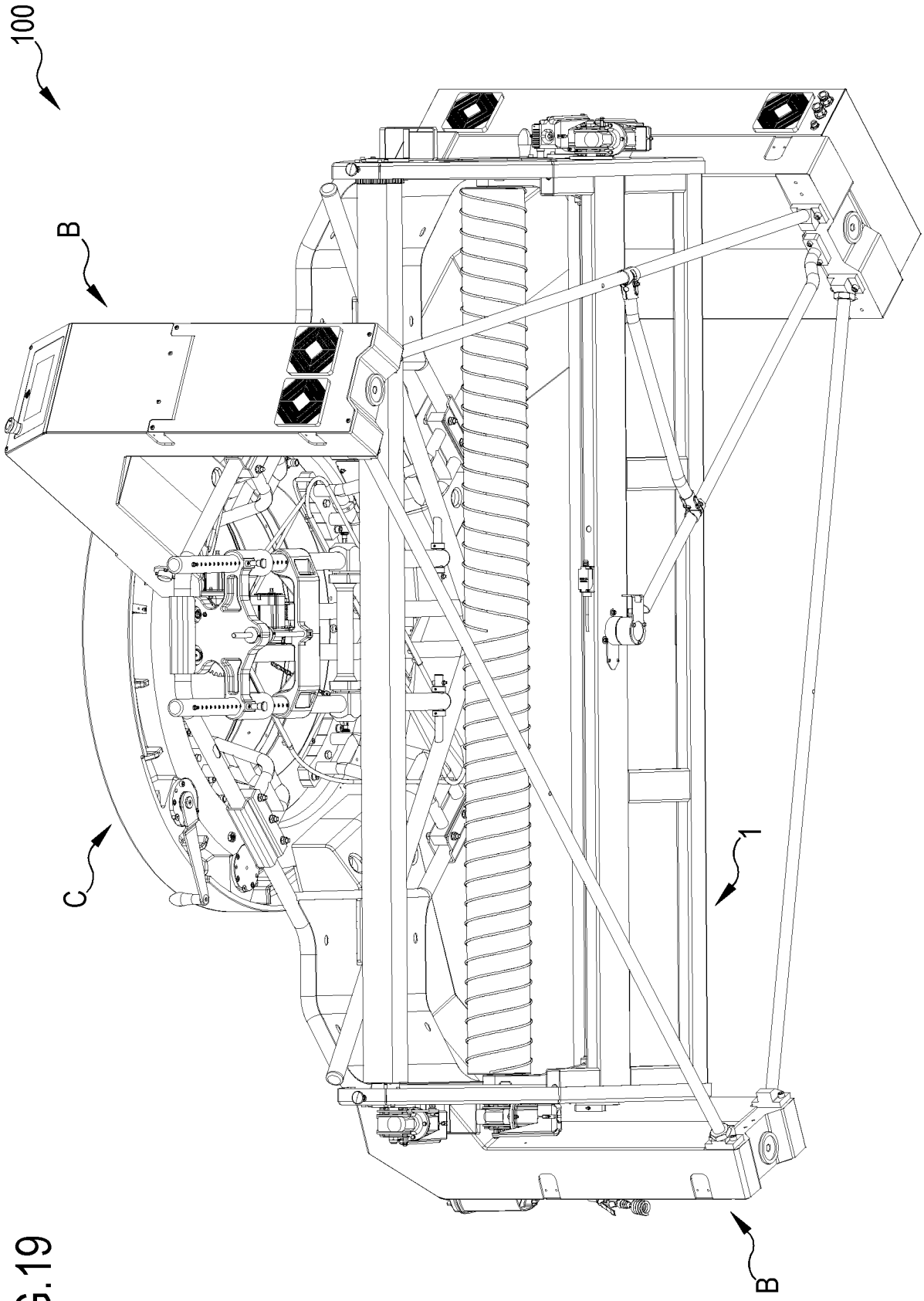


FIG.19

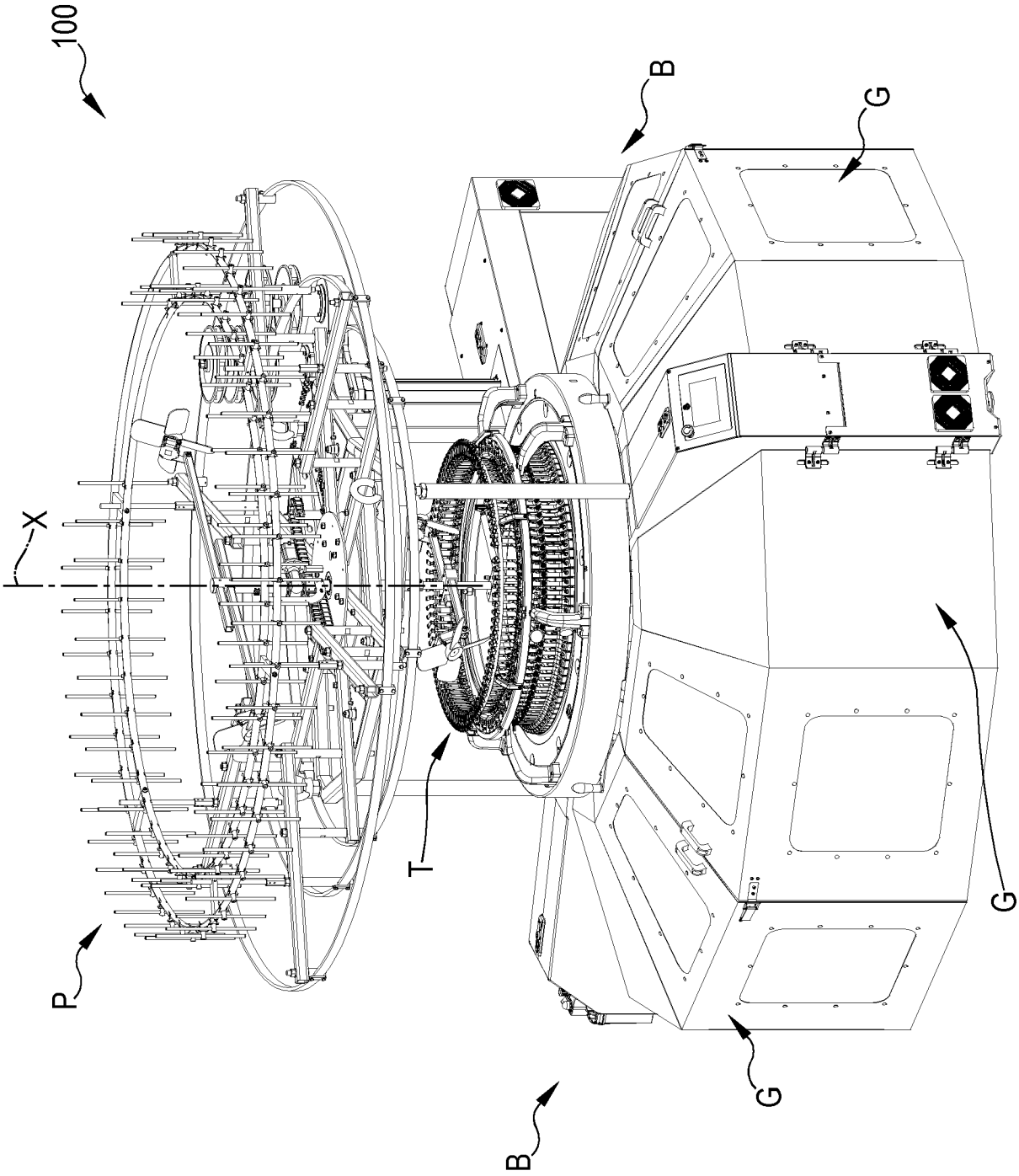


FIG.20

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2024/055495

A. CLASSIFICATION OF SUBJECT MATTER

INV. B65H23/195 D04B15/88 D04B35/10
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)
D04B B65H

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.
X	WO 2014/191868 A1 (SANTONI & C SPA [IT]) 4 December 2014 (2014-12-04) cited in the application	1-3,6,8, 9,11
A	p.11, l.19-21; p.29, l.6-11; claim 1; figures 1, 7	14,15

X	EP 2 261 407 A1 (PRECISION FUKUHARA WORKS LTD [JP]) 15 December 2010 (2010-12-15)	1-8, 10-13
A	paragraphs [0018], [0021], [0040]; claims 1-3; figures 1,2	14,15

☐ 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
7 August 2024	16/08/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Messai, Sonia

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Information on patent family members

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