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(54) **Title:** OPEN-TYPE CIRCULAR KNITTING MACHINE FOR KNITWEAR WITH TAKE-DOWN AND/OR COLLECTING GROUP OF THE FABRIC

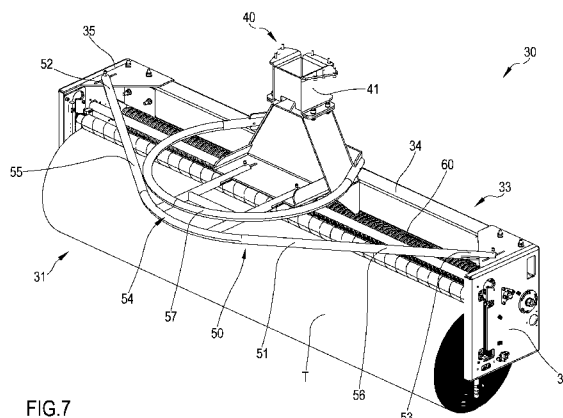


FIG. 7

(57) **Abstract:** A circular knitting machine for knitwear (1), of an "open" type and configured for producing fabric (T) and collecting it in an open configuration, i.e. in a single layer, comprising a base frame (2) constituting the bearing structure of the machine and provided with a support upper ring or element (3), with a lower base or cross-base (4), and with at least two support legs (5, 6) interposed between, and connecting, in at least two distinct and laterally distanced positions, the upper ring and the lower base, such that the upper ring (3) is vertically superposed on, and distanced from, the lower base (4), and in that between them a collecting space (S) is vertically defined. The machine comprises a knitting head (H) mounted to the upper ring (3) and provided with at least a rotating needle-bearing organ (0), being in a form of a needle cylinder or a needle plate, with a plurality of needles movably mounted to the needle-bearing organ, and with command means for selectively activating the plurality of needles for enabling production of a fabric. The machine comprises a take-down and/or collecting group (30) movably housed in the collecting space (S) and able to open and stretch the fabric produced by the machine, winding it in a single layer and continuously on at least a collecting roller (31). The whole take-down and/or collecting group is rotatably mounted hanging to the base frame (2) or to the needle-bearing organ (0), such as to be vertically suspended in the collecting space (S).

“Open-type Circular Knitting Machine for Knitwear with take-down and/or collecting group of the fabric”

The present invention relates to a circular knitting machine for knitwear, of the type known as “open” and provided with a base-frame having a reduced size. More in detail, the invention
5 relates to a base-frame for a circular knitting machine of the open type. Further, the present invention relates to a circular knitting machine of the open type, provided with take-down and/or collecting group of the fabric produced by the machine. The invention further relates to a take-down and/or collecting group destined to be mounted in an open-type circular knitting machine. Additionally, the invention concerns a tensioning roller for a take-down and/or collecting group for
10 circular knitting machines of the open type.

The present invention relates to the technical sector of circular knitting machines for knitwear belonging to a type known in the sector by the term OPEN. This type comprises circular knitting machines equipped with at least a needle-bearing organ, a cam device for commanding the movement of the needles and especially a take-down and collecting group able to collect the
15 fabric produced by the machine in a single layer, typically by winding it on a roller. The single-layer fabric coming from the needle-bearing organ and collected by the take-down and collecting group can be obtained by means of cutting and opening-out of a tubular fabric (should - as in the majority of cases – the machine continuously produce a tubular fabric) or, alternatively it can be directly produced “openly”, i.e. as a single continuous layer of fabric (having a determined width).
20 In other words, the take-down and collecting group collects (by winding it on a roller) a single-layer fabric and not a cylindrically-developing tubular fabric: the single-layer fabric has a continuous-strip conformation of a special width and can be obtained by opening out a tubular conformation, by means of a continuous cut performed parallel to the longitudinal development direction of the fabric produced, or coming from the machine already opened-out, in a single
25 layer: this has given rise to the term “open”, used for identifying the type of machine.

Open-type knitting machines can sometimes comprise a group which only collects, i.e. is lacking the take-down function. This is true, for example of those machines in which the take-down is performed directly at the needle-bed of the needles; in this case, the fabric produced by the needle-bearing organ falls into the collecting group, which winds it on a roller, typically by means
30 of a winder. In any case, an open-type machine is definable as a circular knitting machine in which the fabric produced is collected “open”, i.e. as a single layer, and is wound on a collecting roller.

The circular knitting machines of the present invention, in its various aspects, can be of a single needle-bed type (with a single needle cylinder) or the double needle-bed type (having a needle

cylinder and a needle plate).

The claims of the present invention, where indicating an "open-type" knitting machine, thus identify, specifically, a knitting machine having the above-described characteristics for open machines, which characteristics identify and define this type clearly and univocally in the reference sector, and are clearly comprehensible for an expert in the field. The terminology used
5 in the claims should therefore be correctly interpreted in the light of the data relating to the technical sector of reference. In particular, the characteristic according to which the machine of the present invention is of the open type is to be understood as a precise technical characteristic, which constitutes a limitation and should not be interpreted as a mere example of knitting
10 machine, among the many types in existence, on which to incorporate the further technical characteristics set down in the claims.

In the sector of knitting machines for knitwear, circular knitting machines of the "open" type are known. These machines are provided with a special base-frame which constitutes the bearing structure thereof and which supports and houses all the machine components, in particular the
15 knitting head (comprising the needle-bearing organ, a plurality of needles and command means of the needles) and the take-down and collecting group. The base-frame further enables stably resting the machine in the designated workplace.

Open-type machines typically exhibit a needle-bearing organ, i.e. a needle cylinder or a needle plate, having a diameter of the order of 30-40 inches, but other example exist having a smaller
20 diameter, for example 24 inches. Beyond 40 inches diameter the knitting machine assumes excessive dimensions, which make realization and transfer difficult.

As shown above, the open circular machines typically produce a tubular fabric which is opened by means of a longitudinal cut performed by a cutter, and then opened and stretched-out so as to be wound - in a single layer - on a collecting roller. Consequently the lateral dimension of the
25 opened fabric collected on the roller, below the cylinder, is double with respect to the diameter assumed by the "flattened" and uncut tubular product (i.e. closed to form two layers of fabric joined at the sides). The opening of the fabric thus leads to a considerable increase in the encumbrance of the machine below the cylinder, i.e. in the area housing the take-down and/or collecting group. This area must be free of structural elements which can interfere with the
30 structure and the movement of the take-down and/or collecting group, which is dimensioned such as to collect the open fabric stretched out to a whole width thereof. From this derives the fact that the base-frame of the open knitting machines of known type exhibits a considerable encumbrance.

Open circular knitting machines belonging to the prior art all exhibit a three-legged base-frame,

arranged circumferentially about the take-down and/or collecting group and superiorly supporting a support ring on which the knitting head and the needle cylinder are mounted. The three legs are typically angularly equidistant, i.e. they present angles of 120° from one another. Typically one of the three arms constitutes the main leg, which is larger with respect to the other two "lateral" legs and houses the control means of the machine. This base-frame structure enables stably supporting the whole machine, considering the large weight of the structure, the large dimension and the presence of organs in motion. The known structures are designed to prevent overturning of the machine and to limit vibratory phenomena.

The three-legged base-frame structure of known type exhibits a series of drawbacks. Firstly it is clear that the circular arrangement of the three legs determines a large encumbrance of the machine both in terms of width and length, i.e. considering two encumbrance directions perpendicular to one another – in plan view - of the knitting machine. Typically the length of the machine is defined along the axis of the collecting roller of the fabric, passing through the main leg, while the width is defined as the maximum lateral extension of the two lateral legs. Overall, the encumbrance of the machine can be schematically represented as a rectangle having as sides the above-mentioned length and width, and is a function of the dimension and arrangement of the three legs; the structure of the known base-frames exhibits large dimensions in both length and width.

The large weight of the base-frames of the known machines is a very significant problem in the sector of open knitting machines, as the maximum dimensions for realising a machine are limited to the need to make the machine transportable by means of standard transport means (and not exceptional transport) and easily at a modest cost. In more detail, rigid standards exist for the transport of goods, which disallow exceeding specific dimensions in terms of length and width. These standards are linked to the dimensions of containers for goods transport and the dimensions of the transport means (such as lorries, trains and juggernauts), especially the width of these containers and means (which typically cannot exceed 230-240 cm).

Therefore in machines of known type, with three-legged base-frames, the need not to exceed these limits is translated into the difficulty of realizing machines able to produce fabrics having a width of more than a certain limit, as the width of the fabric collected corresponds to the dimensions of the take-down and/or collecting group, and even more greatly the external dimensions of the base-frame which houses the group. This is extremely disadvantageous, as it would be desirable to be able to produce and "openly" collect fabrics with an even greater width.

A further drawback of the known machines, due to the three-legged conformation of the base-frame, consists in the poor accessibility of the knitting head and the needle-bearing organ. This

causes a reduction in the productivity of the machine, since the structure makes intervention of an operator difficult, for example in a case of breakage of a thread or a needle. In the same way, the mounting and maintenance of the organs of the machine can be long and difficult due to the presence of the legs of the base-frame.

5 To remedy the drawbacks determined by the three-legged base-frame, the present Applicant has in the past realised a circular knitting machine of the open type having a three-legged base-frame arranged with non-constant angles between them, i.e. not by 120° . In this solution, each of the two lateral legs forms, with the main leg (arranged along the longitudinal axis of the machine) an angle of greater than 120° , for example 135° , while between the two lateral legs the angle is less
10 than 120° , for example 90° . In other words, it is as though the two lateral legs had been rotated backwards, reducing the angle comprised between them. In this way it has been possible to reduce, by a limited amount, the width of the machine, while increasing the length. This has been advantageous as the increase in the length does not in itself constitute a problem, since the transport dimensions are mainly limited in width, while they are plentiful in terms of length.

15 A further known solution, which attempted to remedy the problems of three-legged encumbrance, is described in patent EP1253230. This patent illustrates a three-legged base-frame, of which a fixed main leg (arranged along the longitudinal axis of the machine) and two symmetrical lateral legs with respect to the longitudinal axis and able to pass between a transport configuration and a work configuration. The lateral legs can vary the radial extension thereof (with respect to the
20 central axis of the machine) so as to be neared to the central support ring in the transport configuration (which thus exhibits a smaller width size) and more greatly distanced therefrom in the work configuration. The variation of the radial extension is obtained by means of a pair of horizontal rods (or "extensions") for each lateral leg, which connect the upper and lower ends of each leg to the support leg and at the base of the base frame when the lateral legs are in the
25 working configuration, while they are removed - by mounting the lateral legs directly to the support ring and the base of the base-frame - when the legs are in the transport configuration. Note that, in the working configuration, the radial distancing of the lateral legs of the central support ring, obtained by means of the extensions, enables a free space to be offered below the cylinder which enables housing and functioning of the take-down and collecting group; in this way
30 the machine can operate correctly. On the contrary, the transport configuration can be used only for this purpose: the lateral walls are in fact mounted in a neared position to the cylinder (such as to reduce the encumbrance in width and facilitate the transport), and occupy the space destined to the rotation of the take-down and collecting organs.

The Applicant has found, however, that even the base-frames for open-type knitting machines of

the modified type, with legs arranged at non-constant angles or with demountable legs as described in patent no. EP1253230, are however not able to fully overcome the drawbacks and are improvable in various ways. In particular, the known solutions are able only partially to limit the encumbrance in terms of width of open knitting machines; this means the relevant transport
5 problems persist. Further, the problems linked to the poor accessibility of the knitting head and the needle-bearing organ, fundamental for a rapid intervention on the machine, are only mitigated and not solved.

Further, the solutions offers – in particular the base-frame described in patent no. EP1253230 – exhibit a structure that is difficult to realise and/or requires complex operations of configuring the
10 machine for transport and functioning thereof.

Circular knitting machines of the open type typically comprise a device, known in the sector as a take-down and collecting group, which collects the fabric produced by the knitting machine on a collecting layer in a single layer. The take-down and collecting group can further be used to “stretch” the fabric coming from the needle-bearing organ, guaranteeing its descent as the fabric
15 is produced at the needle position; in some machines, the take-down of the fabric takes place directly in proximity of the needle-bearing organ and the group is used only for collecting the fabric (already tensioned).

In the open machines which produce a tubular fabric (i.e. do not produce a fabric directly “opened-out”), the take-down and/or collecting group comprises cutting organs able to
20 longitudinally cut the tubular fabric produced by the needle-bearing organ in such a way as to make it “open” and therefore windable in a single layer on the collecting roller.

The take-down and collecting group can comprise further organs, such as flattening means of a tubular fabric, opening-out means for opening the fabric following the cut, traction roller for controlled advancing of the fabric in the pathway thereof towards the collecting roller, as well as
25 actuators and synchronizing means of the movements of the various organs.

The take-down and collecting group is typically mounted to the machine below the needle-bearing organ (in a collecting space specially destined to the group) and is able to rotate solidly with the needle-bearing organ so as to follow the production of fabric and collect the fabric in a roll or in superposed folded layers.

Examples of take-down and collecting groups for knitting machines of an open type are illustrated
30 in patent documents EP 0456576, EP 0696658 and WO 00/50678. In greater detail, the take-down and collecting groups exhibit a frame support all the organs of the group and arranged in the machine inferiorly of the knitting head. The whole frame rotates solidly with the needle-bearing organ, and is further rested on the lower base of the machine by support means

(comprising for example a bearing) which bear the weight and at the same time enable the rotation; the support means in the lower part can be activated (for example by a motor) in order to determine the rotation of the whole frame.

The Applicant has found that the known-type open knitting machines, in particular the take-down and collecting groups of these machines, exhibit drawbacks and are improvable in various ways. Firstly, the known take-down groups exhibit a weight and encumbrance of large dimensions. Further, the inserting thereof into the machine requires connecting and movement means that are complex and expensive, due in particular to the need to support the whole load of the take-down and collecting group in rotation and to synchronise the movement with respect to the needle-bearing organ.

These problems increase when considering that open-type knitting machines typically exhibit needle-bearing organs having a large diameter, which require complex take-down and collecting groups which are also large.

The take-down and collecting groups of known type typically internally exhibit at least a stretcher roller, or tensioning roller, which intercepts the fabric upstream of the collecting roller and is configured to open it progressively, in a direction of the width thereof, so that the fabric reaches the collecting roller in the most open and stretched configuration thereof, over the whole width thereof. Examples of stretcher roller having this aim are illustrated in patent documents EP 0534917 and WO 00/50678: the rollers exhibit two grooved portions extending helically in opposite directions from the centre towards the two ends of the rollers.

The Applicant has however found that the known stretcher rollers exhibit some limitations and drawbacks.

Further, the stretcher rollers of known type are not able to create effectively a complete stretching-out of the fabric before it reaches the collecting roller; this leads to accumulation on the collecting roller of fabric exhibiting folds, creases and/or undesired superposing, which can damage the fabric and compromise the quality thereof, complicating the subsequent finishing or packing operations or performed on the fabric, or can require further operations of adjusting the fabric on the collecting roller.

Further, the stretcher rollers of known type do not enable the entity and size of the stretching performed on the fabric to be modified; nor can different levels of stretching be set towards the ends of the roller, on different portions of fabric passing on the stretcher roller.

Also, the known-type stretcher rollers are characterised by a complex structure and high manufacturing and maintenance costs.

Further, as known stretcher rollers have limited efficiency in the lateral stretching of the fabric,

they have an influence on the performance of the whole take-down and collecting group; this typically requires the use of a plurality of stretcher rollers, or large-dimensioned stretcher rollers, with the effect of increasing the complexity and/or the dimensions and/or the cost of realizing the take-down and collecting group.

5 The limitations in performance of the stretcher rollers of known type lead to reducing the efficiency of the whole dimensioning and collecting group in stretching the external edges of the fabric, which tend to curl up or roll on themselves in the longitudinal direction, forming on each side a roll resembling a cigarette shape.

10 The Applicant has also found that in the known take-down and collecting groups the various elements cooperating with the fabric from the needle-bearing organ to the collecting roller, i.e. opening-out means, stretcher rollers, tensioning rollers and traction rollers, are reciprocally arranged in a way that is not optimal, generating de-alignments and/or creases in the fabric, in particular rolls on the lateral edges of the fabric, and determining a non-uniform winding on the collecting roller.

15 In this situation the aim underpinning the present invention, in the various aspects and/or embodiments thereof, is to provide a circular knitting machine for knitwear of the open type, a take-down and/or collecting group for circular knitting machines of the open type, and a stretcher roller for a take-down and/or collecting group for circular knitting machines of the open type which are able to obviate one or more of the above-mentioned drawbacks.

20 A further aim of the present invention is to provide a circular knitting machine of the open type characterised by a base-frame having a smaller size with respect to the known solutions, in particular a smaller width.

A further aim of the present invention is to provide a circular knitting machine of the open type able to be transported easily.

25 A further aim of the present invention is to provide a circular knitting machine of the open type able to realize and collect open fabrics having a large width, in particular greater than a maximum width obtainable with the known machines, while conserving the possibility of being transported using transport means of standard type.

A further aim of the present invention is to provide a circular knitting machine of the open type
30 characterised by a high degree of accessibility to the knitting head and the needle cylinder.

A further aim of the present invention is to provide a circular knitting machine of the open type characterised by a greater productivity with respect to the known machines.

A further aim of the present invention is to provide a circular knitting machine for knitwear of an open type characterised by a simple and rational structure.

A further aim of the present invention is to provide a circular knitting machine of an open type characterised by a great facility of manufacturing and/or mounting and/or setting-up and/or maintenance.

5 A further aim of the present invention is to provide a circular knitting machine of an open type provided with a take-down and/or collecting group and characterised by a simple and rational structure.

A further aim of the present invention is to provide a circular knitting machine for knitwear of an open type in which the take-down and/or collecting group is both supported and set in rotation effectively.

10 A further aim of the present invention is to provide a circular knitting machine for knitwear of an open type in which the take-down and/or collecting group is rotatably mounted in the machine in an innovative way.

A further aim of the present invention is to provide a take-down and/or collecting group for circular knitting machines of open type which is able to prevent formation of dealignment and/or
15 creases in the collected fabric, and in particular to prevent rolling the lateral edges of the fabric.

A further aim of the present invention is to provide a take-down and/or collecting group for circular knitting machines of open type which is able to realize a uniform and flat winding of the fabric on the collecting roller.

20 A further aim of the present invention is to provide a tensioning roller for a take-down and/or collecting group for circular knitting machines of an open type that can open and stretch the fabric efficiently.

A further aim of the present invention is to provide a stretching roller for a take-down and/or collecting group for circular knitting machines of an open type which can reduce the space needed internally of the take-down and/or collecting group in order to perform an effective
25 stretching of the fabric before it is wound on the collecting roller.

A further aim of the present invention is to provide a stretcher roller for a take-down and/or collecting group for circular knitting machines of an open type which is versatile and adaptable to various fabric requirements and different types and dimensions of fabric.

30 A further aim of the present invention is to provide a tensioning roller for a take-down and/or collecting group for circular knitting machines of an open type which is simple and/or economical to manufacture.

These aims and others besides, which will more fully emerge during the course of the following description, are substantially attained by a circular knitting machine for knitwear of an open type, a take-down and/or collecting group for circular knitting machines of the open type, and a

stretcher roller for a take-down and/or collecting group for circular knitting machines of the open type according to one or more of the accompanying claims, each of which taken alone (without the relative dependencies) or in any combination with the other claims, as well as according to the following aspects and/or embodiments, variously combined, including with the above-mentioned claims.

In a first aspect, the invention relates to a circular knitting machine of an open type, configured for producing fabric and collecting it openly, i.e. in a single layer.

In an aspect the knitting machine comprises a base-frame constituting the bearing structure of the machine.

In an aspect the knitting machine comprises a knitting head mounted to said base-frame and provided with at least a needle-bearing organ, being in a form of a needle cylinder or a needle plate, with a plurality of needles movably mounted to said at least a needle-bearing organ, and with command means for selectively activating said plurality of needles for enabling production of a fabric.

In an aspect the base-frame comprises:

- a support upper ring or element, on which said knitting head is mounted such that said needle-bearing organ can rotate about a substantially-vertical central axis;
- a lower base, or cross-base, destined to be at least partially rested on the ground;
- two and only two support legs interposed between, and connecting, in two distinct and laterally distanced positions, said upper ring and said lower base, such that said upper ring is vertically superposed on, and distanced from, said lower base, and in that between them a collecting space is vertically defined, free of elements of said base frame and destined to movably house a take-down and/or collecting group of said fabric produced by the knitting machine, said two legs being arranged in correspondence of two respective sides of said upper ring and of said lower base, or cross-base, in such a way as to laterally delimit said collecting space.

In an aspect the needle-bearing organ, preferably a needle-bearing cylinder, has a larger diameter of 24 inches, and/or greater than 26 inches and/or greater than 30 inches and/or greater than 36 inches and/or greater than 40 inches.

In a further independent aspect thereof, the invention relates to a circular knitting machine for knitwear, of an open type and configured for producing fabric and collecting it openly, i.e. as a single layer, the machine comprising:

- a base frame constituting the bearing structure of the machine and comprising a support upper ring or element, a lower base, or cross-base, and at least two support legs interposed between, and connecting, in at least two distinct and laterally distanced positions, said upper ring and said

lower base, such that said upper ring is vertically superposed on, and distanced from, said lower base, and in that between them a collecting space is vertically defined, free of elements of said base frame and destined to movably house a take-down and/or collecting group of said fabric produced by the knitting machine;

- 5 - a knitting head mountable to said upper ring and provided with at least a rotating needle-bearing organ, being in a form of a needle cylinder or a needle plate, with a plurality of needles movably mounted to said at least a needle-bearing organ, and with command means for selectively activating said plurality of needles for enabling production of a fabric;
- a take-down and/or collecting group movably housed in said collecting space and configured and predisposed at least to open and stretch, or even possibly tension from said needle-bearing organ, the fabric produced by the machine, winding it in a single layer and continuously on at least a collecting roller.

In an aspect, preferably according to the preceding aspect, the whole take-down and/or collecting group is rotatably mounted hanging to said base frame or to said needle-bearing organ such as to be vertically suspended in said collecting space.

In an aspect the needle-bearing organ is a needle-bearing cylinder or a needle-bearing plate.

In an aspect the knitting machine is of a single-needle bed type comprising a single needle-bearing organ, or of a double-needle bed type, comprising two needle-bearing organs, respectively a needle cylinder and a needle plate.

20 In a further independent aspect, the invention relates to a stretcher roller, or tensioning roller, for a take-down and/or collecting group of a circular knitting machine for open-type knitwear, configured for producing fabric and collecting in in an open configuration, i.e. as a single layer, the stretcher roller being destined to be mounted to a frame of the take-down and/or collecting group in an intermediate position between a needle-bearing organ of the knitting machine and a collecting roller for the fabric and arranged with a longitudinal axis thereof substantially parallel to the rotation axis of the collecting roller.

25 In an aspect the stretcher roller is configured such as to interact with the fabric advancing towards the collecting roller in such a way that the fabric passes over at least a portion of the stretcher roller, about it and in contact therewith, and being configured such as to stretch the fabric towards two opposite lateral ends of the stretcher roller.

30 In an aspect the stretcher roller comprises a rod, mountable to the frame and exhibiting the respective longitudinal axis, and a plurality of sectors rotatably mounted to the rod so as to be able to rotate on the rod, each sector independently of the other sectors, about a respective rotation axis.

In an aspect each sector develops on a respective plane of development inclined transversally, and not perpendicularly, with respect to the longitudinal axis of the rod of the stretcher roller.

In an aspect, the respective rotation axis of each sector is perpendicular to the respective development plane.

5 In a further independent aspect, the invention relates to a take-down and/or collecting group for circular knitting machine of an open type, configured such as to produce fabric and collect in openly, i.e. as a single layer, the take-down and/or collecting group being movably housable in a collecting space of the knitting machine and configured and predisposed at least such as to open and stretch, possibly drawing the fabric produced by the needle-bearing organ from a needle-
10 bearing organ of the knitting machine, and winding the fabric in a single layer and continuously on at least a collecting roller.

In an aspect, the take-down and/or collecting group comprises a support frame mountable to a base of the knitting machine and configured such as to rotate solidly with the needle-bearing organ.

15 In a further aspect, the take-down and/or collecting group comprises means for opening out the fabric coming directly as a single layer from the needle-bearing organ or obtained by cutting a tubular fabric produced by the needle-bearing organ, the opening-out means comprising at least an opening-out bar mounted, preferably fixedly, to the frame and structure so as to cause an opening-out, by means of a progressive distancing, of two lateral edges of the fabric, the fabric
20 passing onto the opening-out bar in a descent of the fabric into the collecting space towards a collecting roller and extending in width on the opening-out bar as a single layer of fabric.

In an aspect, the take-down and/or collecting group comprises at least a collecting roller rotatably mounted to the frame and destined to receive the fabric from the opening-out means and collect it thereon in a single layer and continuously, the collecting roller being able to rotate about a
25 respective rotation axis.

In an aspect, the take-down and/or collecting group comprises at least a return roller operatively interposed between the opening-out means of the open fabric and the collecting roller along an advancing pathway of the fabric, the return roller being configured to receive the fabric from the opening-out means and to send it in a single layer towards the collecting roller, the return roller
30 being able to rotate about a respective rotation axis.

In an aspect, the take-down and/or collecting group comprises at least a stretcher roller, or tensioning roller, mounted to the frame in an operatively intermediate position between the opening-out means and the collecting roller and arranged with a longitudinal axis thereof substantially parallel to the rotation of the collecting roller, the stretcher roller being configured

such as to interact with the fabric advancing towards the collecting roller in such a way as to stretch it flat, widening it towards two lateral ends of the stretcher roller.

In an aspect, the return roller has a respective rotation axis lying on a first vertical plane, the collecting roller has a respective rotation thereof lying on a second vertical plane and the

5 tensioning roller has a longitudinal axis thereof lying on a third vertical plane.

In an aspect, the at least a tensioning roller is positioned in the take-down and/or collecting group in such a way that the distance between the third plane and the first plane is at least equal to the distance between the second plane and the first plane and the second and third planes are in a same semi-space defined by the first plane.

10 Each of the above-mentioned aspects of the invention can be taken alone or in combination with any one of the claims or the other described aspects.

Further characteristics and advantages will more fully emerge from the detailed description that follows of some embodiment, among which other preferred embodiments, by way of non-exclusive examples, of a circular knitting machine for "open" type knitwear, according to the

15 present invention, a take-down and/or collecting group for open type circular knitting machines according to the present invention, and a stretcher roller for take-down and/or collecting group for open type circular knitting machines according to the present invention. The description will be set down in the following with reference to the accompanying figures of the drawings, provided only by way of non-limiting example, in which:

- 20 - figure 1 is a perspective view of a possibly embodiment of a circular knitting machine for open-type knitwear according to the present invention;
- figure 2 is a plan view from above of the machine of figure 1;
- figure 3 is a lateral view of the machine of figure 1;
- figure 4 is an exploded view of the machine of figure 1;
- 25 - figure 5 is a perspective view of the machine of figure 1, complete with closing cages in a closed configuration;
- figure 6 illustrates a further perspective view of the machine of figure 5, wherein the cages mounted to a side of the machine are shown in an open configuration;
- figure 7 illustrates a perspective view of a possible embodiment of a take-down and/or collecting
- 30 group for open-type circular knitting machines according to the present invention, comprising - by way of example - a fabric produced by the knitting and collected by the group;
- figure 8 is a plan view, from above, of the group of figure 7;
- figure 9 is a front view of the group of figure 7;
- figure 10 is a lateral view of the group of figure 7;

- figure 11 is a view in transversal section of the group of figure 7, sectioned along plane XI-XI and with some parts removed;
- figure 12 is an exploded perspective view of the group of figure 7;
- figure 13 is a schematic view of a possible embodiment of a take-down and/or collecting group for open-type circular knitting machines according to the present invention, seen laterally;
- figure 14 is a schematic illustration of a further embodiment of a take-down and/or collecting group for open-type circular knitting machines according to the present invention, viewed laterally;
- figure 15 is a perspective view of a possible embodiment of a stretcher roller for a take-down and/or collecting group for open-type knitting machines, according to the present invention;
- figure 15a is a frontal view in larger scale of a portion of the tensioning roller of figure 15;
- figure 16 is a perspective view of a further possible embodiment of an open-type circular knitting machine of the present invention, complete with a take-down and/or collecting group;
- figure 17 is a perspective view from below of the open-type knitting machine of figure 16;
- figure 18 is a perspective view in larger-scale of a detail of the circular knitting machine of figure 16;
- figure 19 is a perspective view from below of a further possible embodiment of an open-type circular knitting machine according to the present invention, complete with a further embodiment of the take-down and/or collecting group;
- figure 20 is a further perspective view of the open-type circular knitting machine of figure 19;
- figure 21 is a perspective view from above and in a larger scale of a detail of the circular knitting machine of figure 19.

With reference to the figures of the drawings, 1 denotes in its entirety a circular knitting machine for knitwear of the open type, according to the present invention, while numeral 30 denotes a take-down and collecting group for a knitting machine of the open type, according to the present invention; numeral 60 denotes a stretcher roller, for take-down and collecting groups for open knitting machines, according to the present invention. In general, the same reference numeral is used for identical or similar elements, possibly in variant embodiments thereof.

A first embodiment of a knitting machine according to the present invention is shown in figures 1-6. The circular knitting machine 1 comprises a base-frame 2, constituting the bearing structure of the machine, and a knitting head mounted on the base-frame and provided with at least a needle-bearing organ O, a plurality of needles mounted mobile to the needle-bearing organ, and command means able to selectively activate the plurality of needles to enable production of a fabric T. The needle-bearing organ O can be a needle cylinder (as schematically shown in figures

16-21) or a needle plate. The needles of the needle-bearing organ are not shown in detail, being of the conventional type and well known in the reference technical sector.

The base-frame 2 comprises a ring or upper support element 3, on which the knitting head is mounted such that the needle-bearing organ O can rotate about a substantially-vertical central axis A, and comprises a lower base, or cross-base 4, destined to be at least partially rested on the ground. The base-frame further comprises two and two only support legs 5 and 6.

The two legs 5 and 6 are interposed between, and connect, in two distinct and laterally-distanced positions, the upper ring 3 the lower base 4, such that said upper ring is vertically superposed on, and distanced from, the lower base, and in that between them a collecting space S is vertically defined, free of elements of said base frame and destined to movably house a take-down and/or collecting group 30 of said fabric produced by the knitting machine.

The two legs are at two respective sides of said upper ring and said lower base, or cross-base, in such a way as to laterally delimit said collecting space S. The upper support element 3 is preferably ring-shaped, but can take on different shapes, as long as the shapes are suitable for the aim of supporting the knitting and can be laterally supported by the base legs.

The knitting machine 1 is preferably configured such as to collect the fabric from a single collecting organ, by means of a take-down and/or collecting group mounted mobile to the base-frame, as will be more fully described in the following. The upper support ring 3 is preferably coaxial to the central axis A. The two legs 5 and 6 preferably have a substantially vertical development and are structured such as to stably support the upper ring, preventing overturning of the machine in any working configuration. The two legs are preferably aligned along said longitudinal plane P and the central axis A of the needle-bearing organ is parallel to, and preferably lying one, the longitudinal plane P. The longitudinal plane P is preferably substantially vertical. The two legs 5 and 6 are preferably aligned along the longitudinal plane P in such a way as to form there-between two equal angles of 180° between them (see in particular figure 2). The knitting machine preferably exhibits an overall length, defined as an encumbrance along said longitudinal plane (P), externally delimited by the two legs 5, 6, and exhibits an overall width, defined as an encumbrance of the machine in a perpendicular direction to the longitudinal plane P: the overall length and width define the maximum encumbrance of the knitting machine.

A first leg 5 of the two legs preferably extends vertically between a lower end 5a, connected and mounted to a first mounting portion 4a of the cross-base 4, and a respective upper end 5b, connected and mounted to the upper ring 3. A second leg 6 of the two legs preferably extends vertically between a respective lower end 6a, connected and mounted to a second mounting portion 4b of the cross-base, opposite the first mounting portion 4a, and a respective upper end

6b, connected and mounted to the upper ring in an opposite position with respect to the first leg. The first leg 5 and the second leg 6 are preferably substantially identical, and in particular exhibit a same height between the lower end and the upper end thereof. The lower ends 5a and 6a of the two legs are preferably perpendicular to the cross-base 4. The cross-base preferably comprises a central portion 4c, extending between the first 4a and the second mounting portion 4b and centrally crossed by the central axis A of the needle-bearing organ O.

The cross-base 4 preferably further comprises one or due lateral portions 7a, 7b solidly constrained and coplanar to the central portion 4c and extending from opposite sides of the central portion in the two opposite half-planes with respect to the longitudinal plane P of the knitting machine.

The needle-bearing organ O preferably has a diameter of greater than 24 inches and/or greater than 26 inches and/or greater than 30 inches and/or greater than 36 inches and/or greater than 40 inches.

The base-frame 2 preferably exhibits an overall closed-polygonal structure, developing on the longitudinal plane P, the polygon preferably having a rectangular shape with four sides, of which an upper side constituted by the upper ring 3, a lower side constituted by the cross-base 4 and two lateral sides constituted by the two support legs 5 and 6.

The base-frame 2 preferably exhibits a portal structure, the portal being superiorly delimited by the support ring 3, inferiorly by the cross-base 4 and laterally by the two support legs 5 and 6, such as to define an open passage in a transversal and perpendicular direction to the longitudinal plane P and delimited along the longitudinal plane by the two support legs 5 and 6, the passage housing the take-down and/or collecting group 30.

The above-mentioned overall width of the base-frame of the knitting machine is less than 230cm.

The two legs 5 and 6 preferably exhibit a width, in a perpendicular direction to the longitudinal plane L, which is smaller than 100 cm and/or smaller than 75 cm and/or smaller than 50 cm and/or smaller than 25cm. The two legs preferably exhibit a width, in a perpendicular direction to the longitudinal plane, of greater than 10cm and/or greater than 15cm and/or greater than 20cm. The two legs preferably extend laterally symmetrically in the two half-planes defined by the longitudinal plane P. The cross-base 4 preferably has a lateral extension in one or both half-planes identified by the longitudinal plane P, at least equal to the width of the two legs. In a case where the lateral extension is equal to the width of the legs, the cross-base exhibits only the central portion 4c and is lacking the lateral portions 7a and 7b. The cross-base 4 preferably has a lateral extension, in one or both the two half-planes identified by the longitudinal plane P, that is substantially equal to the lateral extension of the needle-bearing organ O, i.e. to the diameter of

the needle-bearing organ. In this case the respect plan encumbrances of the needle-bearing organ O and the cross-base 4 are substantially the same.

The cross-base 4 preferably has a lateral extension, in one or both of the two half-planes identified by the longitudinal plane P, that is substantially equal to the lateral extension of the upper ring. In this case the respective encumbrances in plan view of the upper ring 3 and the cross-base are substantially the same.

The cross-base 4 preferably extends laterally beyond the lateral width of the two legs, in one or both the two half-planes identified by the longitudinal plane P, at least by 10 cm and/or 20 cm and/or 40 cm and/or 60 cm and/or 80 cm and/or 100 cm. The cross-base 4 preferably has a respective overall width, in a perpendicular direction to the longitudinal plane P, of greater than 50 cm and/or greater than 100 cm and/or greater than 150 cm and/or greater than 200 cm.

The lateral encumbrance of the cross-base 4 is preferably symmetrical with respect to the longitudinal plane P.

The respective width of the cross-base 4 is preferably defined as an overall lateral encumbrance of the two lateral portions 7a and 7b of the cross-base. The needle-bearing organ is preferably mounted coaxially on the upper ring 3, the ring exhibiting a central hole through which the fabric T produced by the machine progressively descends into the collecting space S. Each of the two legs 5 and 6 preferably comprises a respective vertically-developing upright 11, 12, inferiorly exhibiting the lower edge of the leg 5a and 6a, and a respective horizontally-developing cross-piece 13 and 14, terminating with the upper end of the leg 5b and 6b; each cross-piece 13 and 14 is solidly joined, at an opposite end with respect to the upper ring, to a top of the respective upright in such a way that the leg takes on an angular conformation, i.e. an L-shape.

Each of the two cross-pieces 13 and 14 is preferably able to laterally distance the upright 11 or 12 of the respective leg with respect to the upper ring 3 such as to increase the extension of the collecting space S in the direction of the longitudinal plane P. The two cross-pieces are positioned above the collecting space S and the two uprights are positioned at sides of the collecting space S. The upper ring 3 is preferably mounted to the two legs 5 and 6, still more preferably is mounted superiorly of the cross-pieces of the two legs (as can be seen in the figures).

Figure 4 is an exploded view of a possible embodiment of the base-frame 2, in which the various elements composing it can be seen. For each of the two legs 5 and 6, the respective upright 11, 12 and the respective cross-piece 13, 14 have been illustrated, realized in this case by means of a cutting and bending metal sheets. Each leg is obtained by means of assembling the respective cross-piece on the respective upright, so as to form a single body. Each leg is assembled in its

parts during the step of realization of the base-frame, and the connection between the upright and the cross-piece is of an unremovable type. Further, each leg – once assembled and fixed to the upper ring and the lower cross-base – maintains a single configuration internally of the base-frame, both during transport and during functioning of the machine.

5 The two legs 5 and 6 preferably have a section, in a horizontal plane, that is polygonal and preferably rectangular.

The base-frame 2 preferably comprises an additional seal ring 8, mounted to the upper ends of the two legs 5 and 6 in a lower position with respect to the upper ring and preferably coaxially thereto.

10 The additional ring 8 preferably exhibits a central hole through which the fabric T, produced by the machine and coming from the needle-bearing organ O, progressively descends into the collecting space S. The additional ring 8 is preferably mounted inferiorly of the two cross-pieces 13 and 14 of the two legs 5 and 6. The base-frame 2 preferably comprises one or more stiffening plates 19a and 19b, preferably exhibiting an angular conformation, each interposed between and
15 connecting the lower end of a respective leg with the respective mounting portion of the cross-base, so as to stiffen and stabilize the base-frame. The needle-bearing organ is preferably a needle cylinder or a needle plate. Preferably the base-frame 2, and even more preferably the whole knitting machine 1, is substantially symmetrical with respect to the longitudinal plane P. The two legs 5 and 6 and the cross-base 4 are preferably dimensioned and structured so as to
20 determine a maximum encumbrance of the knitting machine such as to enable transport, with the base-frame assembled, by the use of transport means of standard dimensions, for example containers or juggernaut lorries.

As shown for example in figures 5 and 6, the base-frame preferably comprises at least a closing cage of the collecting space S, movably mounted to at least one of the two legs and configured
25 such as to laterally close the collecting space with respect to the longitudinal plane P.

The cage is preferably positioned laterally of the collecting space beyond the lateral extension of the cross-base.

The at least a cage is preferably movably mounted to the base-frame at least between a closed configuration (figure 5), in which it prevents access to the collecting space, and an open
30 configuration (figure 6), in which it allows access to the collecting space transversally with respect to the longitudinal plane P. In an aspect the at least a cage is rotatably mounted to at least one of the two legs 5 or 6 in such a way as to pass by means of a rotation between the closed configuration and the open configuration. The knitting machine can comprise two cages, preferably identical to one another, arranged on opposite sides of the base-frame with respect to

the longitudinal plane P and configured such as to close the collecting space in the two half-planes defined by the longitudinal plane P, each of the two cages being arranged externally of the cross-base. As shown by way of example in figures 5 and 6, the knitting machine 1 advantageously comprises two pairs of cages 15 and 16, 17 and 18, preferably identical to one another. Each pair of cages is arranged on a respective side of the base-frame 2 with respect to the longitudinal plane P and is configured such as to close the collecting space in one of the half-planes defined by the longitudinal plane. Each of the two pairs of cages is arranged externally of the cross-base. Each of the two pairs of cages comprises a first cage (15 or 17), rotatably mounted to one of the legs of the base-frame and configured such as substantially to close half of the collecting space in the respective half-plane with respect to the longitudinal plane, and a second cage (16 or 18), rotatably mounted to the other leg of the base-frame and configured such as to close the other half of collecting space in which the first cage is mounted. In each of the two pairs of cages, the first and the second cage are rotatably mounted to the two legs of the base-frame such as to open in opposite directions, such as to enable access to the collecting space from the respective side of the base-frame, and to close, going into contact with one another.

The cages enable safe functioning of the knitting machine: in fact, the take-down and/or collecting group works by rotating in the collecting space, and it is therefore necessary to make the collecting space inaccessible during the functioning of the machine, so as to avoid accidental contacts with moving organs. On the contrary, the cages must also allow access to the inside of the collecting space for the operations of configuration and maintenance of the machine and for the loading/unloading of the collecting roller for fabric; this is why the cages are openable singly or selectively, manually or automatically.

The cross-base 4, as shown by way of example in the figures, has a polygonal shape (in plan view) and is realized by assembling (by means of screws, welding or other fastening means) a group of bars or longitudinal members and plates. The cross-base can comprise one or more rest feet (preferably adjustable in height) for the correct positioning of the base-frame on a flooring.

The knitting machine 1 typically comprises control means, not described in greater detail as of known type, configured such as to manage the functioning of the whole machine. The control means are preferably associated to one of the two legs (for example contained internally of one or both the two legs).

There follows a description of an embodiment of a knitting machine according to a further aspect of the present invention, with particular reference to figures 7-12 and 16-21.

The open circular knitting machine 1 for knitwear comprises a base-frame 2 of the above-

described type, i.e. with an upper support element or ring 3, a lower base or cross-base 4, at least two support legs 5 and 6 and a collecting space S (defined vertically between the upper ring and the cross-base and horizontally between the legs) lacking elements of the base-frame. The collecting space movably houses a take-down and/or collecting group 30 of the fabric T produced by the knitting machine. The knitting machine 1 comprises a knitting head H mounted to the upper support ring and provided with at least a rotating needle-bearing organ O, in the form of a needle cylinder or a needle plate, of a plurality of needles movably mounted to the needle-bearing organ, and command means (not illustrated as of known type, for example command cams) able to selectively activate the plurality of needles and enable a fabric T to be produced.

The knitting machine 1 further comprises a take-down and/or collecting group 30, movably housed in the collecting space S and configured at least so as to open and stretch, or even possibly pull the fabric produced by the machine from the needle-bearing organ O and wind it in a single layer and continuously on at least a collecting roller 31.

In this particular aspect of the present invention, the whole take-down and/or collecting group 30 is rotatably mounted hung to the base-frame 2 or the needle-bearing organ O, so as to be vertically suspended internally of the collecting space S (as shown in figures 16-21).

Note that this aspect of the invention relates to a knitting machine having any base-frame, with two, three or more legs (for example a base-frame belonging to the prior art); in this sense the figures show the take-down and/or collecting group 20 hung in a machine having a two-legged base-frame merely by way of example.

The knitting head H is mounted on the upper support ring 3 so that the needle-bearing organ O can rotate about a substantially vertical central axis A. The take-down and/or collecting group 30 is hung to the base-frame or the needle-bearing organ such as to rotate solidly or in an angularly coordinated manner with the needle-bearing organ O.

In this embodiment too, the needle-bearing organ, preferably a needle cylinder, preferably has a diameter of more than 24 inches and/or greater than 26 inches and/or greater than 30 inches and/or greater than 36 inches and/or greater than 40 inches.

The take-down and/or collecting group 30 is lacking support organs connecting the group to lower and/or lateral portions of the base-frame; in particular it is lacking in support organs connecting the take-down and/or collecting group to the lower base, or cross-base, of the base-frame and/or the legs of the base-frame.

In figures 7-12 show, for example, that the take-down and/or collecting group 30 preferably comprises a support frame 33 housing collecting means of the fabric produced by the machine and possibly take-down means of the fabric produced by the machine: the support frame 33

superiorly comprises mounting means 40 fixable to the base-frame 2 or the needle-bearing organ O and configured and dimensioned to suspendingly support the whole load of the take-down and/or collecting group.

The term "load" comprises the weight of the take-down and/or collecting group 30 and the weight of the fabric T collected on at least a collecting roller 31, and also comprise the stresses determined by the rotation of the take-down and/or collecting group and transmitted to the base-frame or the needle-bearing organ.

The mounting means 40 are preferably arranged exclusively in an upper position in the frame 33 and are not present inferiorly and/or laterally to the frame.

The take-down and/or collecting group 30 is entirely hung to the base-frame and the whole weight, as defined above, is internally supported by the base-frame, or the take-down and/or collecting group 30 is entirely hung to the needle-bearing organ and the whole weight is entirely supported by the needle-bearing organ.

As shown by way of example in figures 16-18, the mounting means 40 preferably comprise at least a mounting bracket 41 directly connecting the frame 33 of the take-down and/or collecting group to the needle-bearing organ O, so as to make the take-down and/or collecting group solid with the needle-bearing organ; the mounting bracket supports the whole weight of the take-down and/or collecting group and, at the same time, acts as a transmission organ of the motion of the needle-bearing organ to the take-down and/or collecting group, so that the rotations of the needle-bearing organ and the take-down and/or collecting group occur synchronously and coaxially, i.e. to a determined angular rotation of the needle-bearing organ about the central axis corresponds a same angular rotation of the take-down and/or collecting organ about the axis.

The at least a mounting bracket 41 is preferably fixed to a single continuous sector of the needle-bearing organ O, the sector having an angular extension comprised between 10° and 180° and/or comprised between 20° and 150° and/or comprised between 30° and 120° and/or comprised between 45° and 90° with respect to the central axis A.

In a further embodiment (not shown) the mounting means comprise a pair of mounting brackets connecting the frame of the take-down and/or collecting group directly to the needle-bearing organ in two distinct and separate positions, preferably diametrically opposite one another, of the needle-bearing organ.

In a further embodiment, independent of the preceding embodiments and shown by way of example in figures 19-21, the base-frame 2 comprises a guide holding ring 8, mounted to the legs in a lower position with respect to the upper ring 3 and coaxial thereto; the guide holding ring 8 exhibits a central hole through which the fabric T, produced by the machine and coming from

the needle-bearing organ O, progressively descends into the collecting space S. The guide holding ring 8 comprises an external ring 8a fixed to and solidly constrained to the base-frame and an internal ring 8b coaxial to the external ring and rotatably mounted thereto. The external ring 8a and the internal ring 8b of the guide holding ring 8 preferably together realize a fifth wheel or bearing, preferably of the revolving type.

The mounting means 40 preferably comprise fixing organs 45 directly connecting the frame 33 of the take-down and/or collecting group 30 to the internal ring 8b of the holding ring 8, such as to make the take-down and/or collecting group 30 solid with the internal ring. In this case the fixing organs 45 at least partially support the above-mentioned load of the take-down and/or collecting group.

With reference to the embodiment shown by way of example in figures 19-21, the mounting means 40 preferably comprise a respective drive transmission organ 42 connecting the needle-bearing organ O to the frame 33 of the take-down and/or collecting group, so that the rotations of the needle-bearing organ, of the take-down and/or collecting group and the internal ring happen synchronously and coaxially, i.e. to a determined angular rotation of the needle-bearing organ about the central axis A corresponds a same angular rotation of the take-down and/or collecting group 30 and the internal ring about the axis.

The fixing organs 45 are preferably configured to support the whole load of the take-down and/or collecting group 30, and the transmission organ 42 is configured to transmit the rotation of the needle-bearing organ to the take-down and/or collecting group and to the internal ring without support the load. In this latter case, as shown by way of example in figures 19 and 20, the transmission organ comprises a bracket – or rod – fixed to the needle-bearing organ and a drawing pin fixed to the internal ring 8b of the holding ring 8: the drawing pin is engaged in a seating at the base-frame of the bracket such that, during the rotation of the needle-bearing organ, the bracket draws the pin and with it the whole internal ring 8a of the holding ring, to which in turn the frame of the take-down and/or collecting group is fixed; by doing this the rotation of the needle-bearing organ is transferred correspondingly to the take-down and/or collecting group. Note that the bracket-drawing pin coupling serves only to transmit the rotation, synchronously, from the needle-bearing organ to the take-down and/or collecting group, while the load is entirely supported by the fixing organs 45 (directly connecting the frame 33 to the internal ring 8b of the holding ring 8).

In an alternative aspect to the previous one, the fixing organs 45 are configured such as to support a fraction of the load of the take-down and/or collecting group, and the transmission organ 42 is configured to transmit the rotation of the needle-bearing organ to the take-down

and/or collecting group and to the internal ring and at the same time support the remaining fraction of the load not supported by the fixing organs.

The fraction supported by the fixing organs is preferably greater than 80% of the load, and/or greater than 60% of the load, and/or greater than 40% of the load, and/or correspondingly the remaining fraction supported by the transmission organ is respectively lower than 20% of the load, and/or lower than 40% of the load, and/or lower than 60% of the load.

The frame 33 preferably comprises a beam 34, positioned substantially horizontally in the collecting space S, and a pair of lateral support plates 35 and 36, fixed to two opposite sides of the beam 34 and facing one another. The lateral plates 35 and 36 are preferably substantially vertically positioned. The beam 34 and the lateral plates 35 and 36 preferably support the collecting means of the fabric produced by the machine and/or the tensioning means of the fabric produced by the machine.

The beam 34 preferably extends longitudinally, below the needle-bearing organ O, substantially symmetrically with respect to the central axis A of the needle-bearing organ and parallel to the central axis.

The fixing organs 45 preferably comprise one or more screws 46, or one or more weld seams or equivalent means, fixing the beam of the frame directly to the internal ring 8b of the upper ring 8 of the base-frame 2.

The fixing organs can preferably comprise a respective mounting bracket of the frame to the internal ring of the holding ring.

The take-down and/or collecting group 30 preferably exhibits an overall empty weight, i.e. with the collecting roller 31 without fabric produced by the machine, in the order or, or substantially equivalent to, the weight of a maximum quantity of fabric windable on the collecting roller 31, and/or exhibits an overall empty weight comprised between 90% and 110%, or between 80% and 120%, or between 70% and 130%, or between 50% and 150%, or between 20% and 200%, of the weight of a maximum quantity of fabric windable to the collecting roller 31. In this embodiment too of the circular knitting machine, the needle-bearing organ can be a needle cylinder or a needle plate, and the knitting machine can be of the single-bed type (comprising a single needle-bearing organ) or the double-bed type (comprising two needle-bearing organs, respective a needle cylinder and a needle plate).

As shown in figures 7-21, the take-down and/or collecting group 30 preferably comprises the collecting roller 31, rotatably mounted to the frame 33 such as to be able to rotate about a respective substantially-horizontal rotation axis; as described above, the collecting roller 31 is destined to collect, windingly thereon and in a single continuous layer, a fabric T produced by the

knitting machine. The collecting roller 31 extends between two longitudinal ends at which it is rotatably mounted to the lateral plates 35 and 36. The rotation axis of the collecting roller 31 is preferably orientated parallel to the longitudinal development of the beam 34 of the frame 33.

In a possible embodiment, the take-down and/or collecting group can comprise substantially
5 flattening means 95 of the fabric T coming from the knitting machine, when the fabric is produced by the knitting head in the form of a closed tubular knitwear form.

The flattening means 95 preferably comprise a pair of rods 96 or rollers arranged substantially horizontally in the collecting space S below the needle-bearing organ O or superiorly of the collecting roller 31, the pair of rods or rollers being arranged transversally, preferably
10 perpendicularly, to the rotation axis of the collecting roller.

The bars 96 or rollers are preferably flanked to one another such as to define a substantially straight passage for the tubular fabric T, the passage determining a substantial flattening of the tubular fabric in closure along a diameter thereof.

In a possible embodiment (not illustrated), the take-down and/or collecting group can comprise
15 cutting means arranged downstream of the flattening means and able to longitudinally cut, along a preferably vertical generatrix, the tubular fabric produced by the knitting machine such as to be able to open it subsequently and wind it in a single layer on the collecting roller.

The take-down and/or collecting group 30 preferably comprises opening-out means 50 of the fabric in arrival directly as a single layer from the needle-bearing organ or obtained by cutting a
20 tubular fabric produced by the needle-bearing organ. The opening-out means 50 comprise at least an opening-out rod 51 mounted, preferably fixed, to the frame and structured to determine an opening, via progressively distancing, of two lateral edges of the fabric, the fabric passing on the opening-out rod 51 in the descent thereof into the collecting space S towards the collecting roller 31 and extending in width on the opening-out rod as a single layer of fabric.

The opening-out bar 51 preferably extends longitudinally between two respective ends 52 and 53, each mounted on a respective lateral plate of the frame, and extends laterally from a front side of the beam 34 of the frame 33. The opening-out bar preferably exhibits a curved conformation and emerges progressively from the two respective ends distancingly from the beam, such as to exhibit a central portion 54, or point, having a maximum distance from the
25 beam and able to guide the descent of a central portion of the fabric in a single layer.

The opening-out rod 51 is preferably substantially symmetrical with respect to a vertical plane passing through the central axis of the needle-bearing organ and perpendicular to the axis of rotation of the collecting roller.

The opening-out rod 51 preferably has an overall rounded V-shaped conformation, i.e. it exhibits

a curved central portion 54, or an arc of circumference, and two straight portions 55 and 56 branching, in opposite directions, from two sides of the central portion and each terminating on the respective lateral plate 35 and 36 of the frame 33. The opening-out rod 51 is preferably arranged, in the take-down and/or collecting group 30, substantially horizontally. The central
5 portion 54, or point, is preferably fixed by one or more central bars, to the frame. The opening-out rod 51 is preferably mounted on the frame 33 in such a way that the lateral extension thereof can be adjusted with respect to the beam, in particular the maximum distance of the central portion, or point, can be adjusted with respect to the beam 34 of the frame.

The take-down and/or collecting group 30 preferably further comprises a guide ring 57 mounted,
10 preferably fixedly, to the frame 33 in an upper position to the opening-out rod 51, the guide ring being structured such as to guide the descent of the fabric T produced by the knitting machine, coming directly as a single layer from the needle-bearing organ or obtained by means of cutting a tubular fabric produced by the needle-bearing organ O.

The guide ring 57 is preferably provided with a hole internally of which the fabric descends,
15 preferably sliding on the inside of the guide ring. The guide ring enables eliminating the tensions present in the fabric at the outlet from the needle-bearing organ, which tend to roll up or spiral, which is undesired, the material about the central axis of the machine; in this way the fabric reaches to cutting means (if present) and the opening-out means without internal tensions and vertically with respect to the needle-bearing organ.

20 The guide ring 57 preferably extends laterally from the front side of the beam with respect to which the opening-out bar 51 extends, the guide ring being superposed on the opening-out bar 57.

The guide ring 57 is preferably arranged substantially horizontal in the take-down and/or collecting group 30.

25 The guide ring is preferably distanced superiorly from the opening-out bar 57 by a distance comprised between 1cm and 100cm and/or comprised between 5cm and 50cm and/or comprised between 10cm and 30cm.

The opening-out bar 51 and the guide ring 57 are preferably positioned in the take-down and/or collecting group 30 such that the fabric T coming from the needle-bearing organ descends
30 internally of the guide ring, crossing the hole of the guide ring, and inferiorly of the guide ring before passing externally of the opening-out rod and proceeding in the descent thereof towards the collecting roller.

The guide ring 57 preferably has a substantially circular conformation and is fixed to the frame 33 such as to be substantially coaxial to the needle-bearing organ O. The guide ring 57 is preferably

fixed at a central portion of the beam 33.

Some embodiments of a take-down and/or collecting group are now described, for open circular knitting machines according to further aspects of the present invention, with particular reference to the schematic representations of figures 13 and 14.

5 Consider that the various embodiments of a take-down and/or collecting group of the present invention, while illustrated in combination with a base-frame according to the present invention, are independent of the circular knitting machines shown by way of example in the figures and can be used with any circular knitting machine of the open type, even of known type and/or in replacement for take-down and/or collecting groups of known type.

10 Further note that the expression "take-down and/or collecting group" identifies this group with reference to circular knitting machines of the open type, characterised in that it produces an "open" fabric, in a single layer, and collects it wound on a collecting roller (thus preventing the free descent or free collecting of the fabric below the needle-bearing organ). In this sense, the take-down and/or collecting group certainly deals with the collection of the fabric, at the basis of
15 the functioning of open machines, while the operation of take-down the fabric from the needle-bearing organ is optional (though widely used in open machines which produced tubular fabric cut longitudinally so as to opened out to form a single layer) as this operation in open-type machines can be deputed to the take-down and/or collecting group (which in this case becomes a "take-down and collecting group") or performed directly on the needle-bearing organ (in this
20 case the take-down and/or collecting group becomes a collecting group, which receives a fabric that is already tensioned and collects it.

The take-down and/or collecting group 30 for open-type circular knitting machines comprises opening-out means 50 of the fabric T in open conformation, coming directly as a single layer from the needle-bearing organ or obtained by means of cutting a tubular fabric produced by the
25 needle-bearing organ. The opening-out means comprise at least an opening-out rod 51 mounted preferably fixed to the frame 33 and structured to determine an opening by progressive distancing of two lateral edges of the fabric, the fabric passing on the opening-out rod in the descent of the fabric towards a collecting roller 31 and extending in width on the opening-out rod as a single layer of fabric. The take-down and/or collecting means comprise at least a collecting
30 roller 31 rotatably mounted to the frame and destined to receive the fabric from the opening-out means and collect it wound thereon in a single continuous layer, the collecting roller being able to rotate about a respective axis of rotation.

The take-down and/or collecting group 30 further comprises at least a relay roller 70 operatively interposed between the opening-out means of the fabric and the collecting roller along an

advancing pathway of the fabric, the relay roller receives the fabric from the opening-out means and sends it in a single layer towards the collecting roller. The relay roller is able to rotate about a respective rotation axis, along which it longitudinally stretches.

The take-down and/or collecting group 30 further comprises at least a stretcher roller 60, or
5 tensioning roller, mounted to the frame in an operatively intermediate position between the opening-out means 50 and the collecting roller and arranged with a respective longitudinal axis L substantially parallel to the rotation axis of the collecting roller. The stretcher roller 60 is configured so as to interact with the fabric T advancing towards the collecting roller in such a way as to tension it flat, widening it between two lateral ends 61, 62 of the stretcher roller.

10 As shown by way of example in figures 13 and 14, the relay roller 70 has a respective rotation axis lying on a first vertical plane 71, the collecting roller 31 has a respective rotation axis lying on a second vertical plane 72 and the stretcher roller 60 has a longitudinal axis L thereof lying on a third vertical plane 73.

The stretcher roller 60 is positioned in the take-down and/or collecting group in such a way that
15 the distance between the third plane and the first plane is at least equal to the distance between the second plane 72 and the first plane 71 and that the second 72 and third 73 plane are in the same semi-space defined by the first plane 71.

The distance between the third plane 73 and the first plane 71 is preferably exactly equal to the distance between the second plane 72 and the first plane 71. In other words, the stretcher roller
20 60 is vertically aligned with the collecting roller 31 (as shown in figure 13, with the stretcher roller 60 represented in a continuous line below the collecting roller).

The stretcher roller 60 is preferably positioned inferiorly of the collecting roller 31.

As shown in figures 13 and 14, the first vertical plane and/or the second vertical plane and/or the third vertical plane are parallel to a central axis of the needle-bearing organ O.

25 In an alternative embodiment, the stretcher roller 60 is positioned in the take-down and/or collecting group 30 in such a way that the distance between the third plane 73 and the first plane 71 is greater than the distance between the second plane 72 and the first plane 71. In other words, the stretcher roller 60 is located in the take-down and/or collecting group 30 in an advanced position with respect to the collecting roller 31, i.e. on an opposite side of the collecting
30 roller with respect to the relay roller 70. This embodiment is shown in figure 13, with the stretcher roller 60 in a broken line below the collecting roller (and advanced with respect thereto).

The stretcher roller 60 is positioned in the take-down and/or collecting group at a lateral distance, i.e. on a perpendicular plane to a central axis of the needle-bearing organ, from the relay roller greater than the respective lateral distance of the collecting roller from the relay roller.

The respective rotation axis of the collecting roller 31 from the relay roller, the respective rotation axis of the collecting roller 31, the respective rotation axis of the relay roller 70 and the longitudinal axis L of the stretcher roller 60 are preferably parallel to one another, preferably horizontal.

5 The take-down and/or collecting group can preferably comprise means for rolling 80 the fabric onto the collecting roller 31, configured such as to enable advancing of the fabric T in arrival from the needle-bearing organ O and for winding the fabric continuously and uniformly on the collecting roller 31.

10 The means for rolling 80 the fabric preferably comprise at least a traction roller 81 movably mounted to the frame in such a way as to be in contact with the collecting roller 31 in a contact line C crossed by the fabric, the traction roller 81 being configured to rotate in such a way as to impress a corresponding rotation to the collecting roller and determine the continuous winding of the fabric on the collecting roller.

15 The traction roller 81 is preferably positioned in the take-down and/or collecting group aligned vertically with the collecting roller and preferably inferiorly thereof.

The at least a stretcher roller 60 is positioned in the take-down and/or collecting group aligned vertically with the traction roller and preferably inferiorly thereof.

20 The traction roller 81 is preferably rotatable about a respective rotation axis lying on a fourth vertical plane. The stretcher roller 60 is positioned in the take-down and/or collecting group in such a way that the distance between the third plane 73 and the first plane 71 is at least equal to the distance between the fourth plane and the first plane 71.

25 The traction roller 81 is preferably positioned in the take-down and/or collecting group at a lateral distance, i.e. on a perpendicular plane to a central axis of the needle-bearing organ, by the relay roller 70 at least equal to the respective lateral distance of the traction roller from the relay roller, and/or wherein the third plane and the fourth plane coincide with one another.

The at least a stretcher roller 60 is preferably positioned in the take-down and/or collecting group such that a distance between the third plane 73 and the first plane 71 is greater than a distance between the fourth plane and the first plane.

30 The at least a stretcher roller 60 is preferably located in the take-down and/or collecting group in an advanced position with respect to the traction roller, i.e. on an opposite side of the traction roller with respect to the relay roller 70.

The at least a stretcher roller is preferably positioned in the take-down and/or collecting group at a lateral distance, i.e. on a plane that is perpendicular to a central axis of the needle-bearing organ, from the relay roller that is greater than the lateral distance of the traction roller from the

relay roller.

As shown by way of example in figure 14, the means for rolling 80 the fabric preferably comprise a first 81 and a second traction roller 82 both acting, on a respective contact line C, on the collecting roller such as to impress thereon a rotation and determine a continuous winding of the fabric on the collecting roller, the fabric crossing in series both the contact lines C defined by the first and the second traction roller.

The at least a stretcher roller is interposed between the first traction roller 81 and the second traction roller 82.

The at least a stretcher roller 60 is located in the take-down and/or collecting group in an intermediate position between the first traction roller 81 and the second traction roller 82.

The at least a stretcher roller 60 is preferably positioned in the take-down and/or collecting group at a lateral distance, i.e. on a plane that is perpendicular to a central axis of the needle-bearing organ, from the relay roller that is greater than the respective lateral distance of the first traction roller from the relay roller and less than the respective lateral distance of the second traction roller from the relay roller.

The relay roller 70 can preferably also be a stretcher roller, the take-down and/or collecting group in this case exhibiting two stretcher rollers 60.

The take-down and/or collecting group 30 can comprise a stretcher roller 60 (or two stretcher rollers, in the case in which the relay roller also has the function of a stretcher roller) of conventional type, i.e. one or two stretcher rollers according to a further aspect of the present invention, which will be described in the following.

In the described embodiment of the take-down and/or collecting group shown in figures 7-12, the stretcher roller 60 also performs the function of a relay roller; in fact (see in particular figures 7, 8, 1 and 11); the stretcher roller 60 is positioned downstream of the opening-out means and in a retracted position with respect to the collecting roller, the stretcher roller being able to receive, from the opening-out means, the opened-out fabric and send it in the form of a single (and flat) layer towards the collecting roller.

The take-down and/or collecting group of the present invention can preferably additionally comprise pulling means 90 in a downwards direction of the fabric T produced continuously by the needle-bearing organ O, the pulling means determining a tensioned descent of the fabric into the collecting space S. The pulling means 90 preferably comprise one or more pulling rollers, in series to one another, acting on the fabric to force advancement thereof towards the collecting roller 31. In figure 13 and 14 three pulling rollers 91, 92, 93 are shown by way of example, located in series to one another and crossed in sequence by the fabric T.

The take-down and/or collecting group of the present invention can preferably additionally comprise cutting means (not illustrated, for example of known type) arranged downstream of the flattening means 95 (described above) and able to longitudinally cut, along a preferably vertical generatrix, the tubular fabric T produced by the knitting machine in such a way as to be able successively to open it out and wind it in a single layer on the collecting roller 31.

The take-down and/or collecting group can comprise, according to needs, actuators (for example electric motors or pneumatic actuations) which enable rotation of the various organs of the group, such as stretcher roller, relay rollers, pulling roller, traction rollers and/or collecting rollers. For example, the take-down and/or collecting group can comprise respective actuators acting on the collecting roller (or traction rollers) so as to set it in rotation and determine the winding of the fabric thereon.

With particular reference to figures 15 and 15a, there follows a description of a stretcher roller according to a further aspect of the present invention, independent of the preceding aspects, destined to be used in a take-down and/or collecting group for circular knitting machines of the open type.

The stretcher roller 60, or tensioning roller, is destined to be mounted to a frame 33 of a take-down and/or collecting group 30 in an intermediate position between the needle-bearing organ O of the knitting machine and the collecting roller 31 for the fabric and arranged with a respective longitudinal axis L substantially parallel to the rotation axis of the collecting roller 31.

The stretcher roller 60 is configured such as to interact with the fabric T advancing towards the collecting roller 31 in such a way that the fabric passes over at least a portion of the stretcher roller, about it and in contact therewith, and is configured such as to stretch the fabric towards two opposite lateral ends 61, 62 of the stretcher roller.

The stretcher roller is configured to open progressively, in a width-wise direction, the fabric that is passing on the stretcher roller, such that the fabric reaches the collecting roller 31 open and stretched uniformly over a whole length thereof. Additionally, the stretcher roller is configured so as to oppose the tendency of the portions of fabric closed to the two external edges of the fabric to roll up longitudinally, i.e. in the sliding direction of the fabric. The stretcher roller 60 comprises a rod 63, mountable to the frame and exhibiting the longitudinal axis L, and a plurality of sectors 65 rotatably mounted to the rod 63 so as to be able to rotate on the rod, each sector independently of the other sectors, about a respective rotation axis 66a. Each sector 65 develops on a respective plane of development 66 inclined transversally, and not perpendicularly, with respect to the longitudinal axis L of the rod of the stretcher roller 63.

In other words, each sector is arranged non-perpendicularly to the rod, and rotates about a

rotation axis thereof that is inclined with respect to the longitudinal axis L of the rod 63. Additionally, the respective rotation axis of each sector 65 is perpendicular to the respective development plane 66, and each sector 65 rotates, about the rotation axis thereof, while staying in the respective development plane 66.

5 Each sector 65 is preferably mounted rotatably to the rod 63 in such a way as to be able to freely rotate idle on the rod, about the rotation axis thereof. In other words, the sectors 65 are preferably not activated by an actuator, and are free to rotate – in both rotation directions - about the rotation axis 66a thereof. Each sector is rotated by the fabric T in contact therewith, by effect of the advancing of the fabric towards the collecting roller 31. In other words, the rotation of each
10 sector occurs by effect of the drawing of the advancing fabric thereon.

The rotation velocity of each sector 65 is preferably equal, at all points thereof in contact with the fabric T, to the advancement velocity of the fabric.

As shown in figure 15, the plurality of sectors 65 preferably comprises a first group 68 of sectors and a second group 69 of sectors, the first group of sectors exhibiting sectors 65 having
15 respective planes of development 66 all with a same first inclination α with respect to the longitudinal axis of the rod of the stretcher roller, and the second group 69 of sectors exhibiting sectors 65 having respective planes of development 66 all having a same second inclination with respect to the longitudinal axis L of the rod of the stretcher roller.

The first group 68 of sectors preferably extends from a central portion 64 of the rod of the
20 stretcher roller towards a first end 61 of the stretcher roller and the second group 69 of sectors extends from the central portion of the rod towards a second end 62 of the stretcher roller, opposite the first end 61.

The first inclination α and the second inclination are preferably specular, or opposite, with respect to a perpendicular axis to the longitudinal axis L, or with respect to the central portion 64 of the
25 rod.

Each sector 65 of the first group 68 of sectors is preferably configured such as to exert, on the portion of the fabric in contact there-with, a stretching force towards the first end 61 of the stretcher roller, and each sector 65 of the second group 69 of sectors is configured such as to exert, on the respective portion of the fabric T in contact therewith, a stretching force towards the
30 second end 62 of the stretcher roller, such that overall the fabric T opens or stretches completely in width between the first 61 and the second end 62 of the stretcher roller.

The first inclination of the plane of development 66 of the sectors 65 of the first group 68 of sectors is preferably equal to an angle, with respect to the longitudinal axis of the rod, of less than 89° and/or less than 87° , and/or less than 85° and/or less than 80° , and is greater than 50°

and/or greater than 60° and/or greater than 70° .

The second inclination is preferably specular, with respect to a perpendicular axis to the longitudinal axis, to the first inclination, and is equal to the angle of the first inclination.

5 The sum of the value of the smaller angle formed by the planes of development 66 of the sectors of the first group 68 of sectors with the longitudinal axis of the stretcher roller 60, and the value of the greater angle formed by the planes of development 66 of the sectors of the second group 69 of sectors with the longitudinal axis of the stretcher roller is preferably substantially 180° .

10 The algebraic sum of the value of the smaller angle formed by the development planes 66 of the sectors 65 of the first group 68 of sectors with the longitudinal axis L of the stretcher roller, and the value of the respective smaller angle formed by the development planes 66 and the sectors 65 of the second group 69 of sectors with the longitudinal axis L of the stretcher roller is preferably 0° , i.e. the value of the smaller angles formed by the development planes of the first group of sectors with the longitudinal axis L and the value of the smaller angles formed by the development planes of the second group of sectors with the longitudinal axis L are equal to one
15 another and opposite.

Likewise, each sector 65 preferably has the rotation axis thereof inclined by an angle, with respect to the longitudinal axis of the rod, greater than 1° and/or greater than 3° and/or greater than 5° and/or greater than 10° and less than 40° and/or less than 30° and/or less than 20° .

20 The stretcher roller 60 is preferably mounted in the take-down and/or collecting group 30 such that the fabric T, in the advancing thereof about the stretcher roller 60, is wound limitedly to a portion of contact of the external surface of the stretcher roller, the contact portion being continuous and extending over a determined angle, less than a full revolution, from an attachment line, at which the fabric starts to contact the stretcher roller, to a detachment line, at which the fabric detaches from the stretcher roller and proceeds in a pathway thereof towards the
25 collecting roller 31. The contact portion varies instantly on each sector and remains constant in the space with respect to the rod of the stretcher roller 60.

The stretcher roller 60 is preferably mounted in the take-down and/or collecting group such that the contact portion on which the fabric T is wound to the stretcher roller corresponds to respective portions of the sectors of the first group 68 of sectors 65 able to move, during the
30 rotation of the sectors, the overlying fabric towards the first end of the stretcher roller, and corresponds to respective portions of the sectors 65 of the second group 69 of sectors able to move, during the rotation of the sectors, the overlying fabric towards the second end 62 of the stretcher roller.

The stretcher roller 60 is preferably mounted in take-down and/or collecting group 30 in such a

way that the portions of the sectors of the first group 68 of sectors corresponding to the contact portion are facing towards the first end 61 of the stretcher roller, and the portions of the sectors of the second group 69 of sectors corresponding to the contact portion are facing towards the second end 62 of the stretcher roller, such that the fabric T, in the pathway thereof along the contact portion of the stretcher roller, is open and stretched laterally towards the two ends of the stretcher roller from the sectors of the first 68 and second group 69 of sectors.

Each sector 65 of the stretcher roller 60 preferably laterally stretches the fabric in contact therewith, in the advancing thereof between the attachment line and the detachment line, by a quantity, along the longitudinal axis L of the roller, proportional to both the inclination of the respective development plane of the sector with respect to the longitudinal axis L of the rod, and to the angular and surface extension of the contact portion between the attachment line and the detachment line.

The rod 63 is preferably fixed to the frame 33 of the take-down and/or collecting group 30 in such a way that the fabric T, between the attachment line to the stretcher roller and the detachment line, is drawn progressively towards the first end 61 of the stretcher roller in the portion thereof in contact with the sectors of the first group 68 of sectors, and is progressively drawn towards the second end 62 of the stretcher roller in the portion thereof in contact with the sectors of the second group 69 of sectors.

The stretcher roller 60 is preferably configured such as to be mountable to the frame of the take-down and/or support group, keeping the longitudinal axis L of the rod fixed and varying the angular position of the rod, such as to modify the angular position of the sectors 65 of the roller with respect to the attachment line and the detachment line of the fabric T. In this way it is possible to vary the effect of the sectors on the fabric, increasing or reducing the lateral stretching performed by the sectors.

In an alternative embodiment (not illustrated), the stretcher roller 60 is mounted to the frame 33 of the take-down and/or collecting group such that the sectors 65 exert a force facing towards the central portion 64 of the rod 63 and determine a narrowing of the fabric T, i.e. a reduction in the width or closure, in the passage thereof on the roller.

As shown in figures 15 and 15a, each of the sectors has a disc, wheel or roller conformation, in particular having a circular section.

Each sector 65 preferably has an external sector that is substantially annular. All the sectors 65 of the first group 68 of sectors are identical to one another and all the sectors 65 of the second group 69 of sectors are identical to one another. Still more preferably, as shown by way of example in the figures, all the sectors 65 of the stretcher roller 60 are identical to one another,

possibly with only a variation of the relative inclination with respect to which they are mounted on the rod 63. The sectors 65 are preferably realized by moulding, for example of plastic material.

The sectors 65 are preferably configured such as to prevent sliding of the fabric T on the external surface, such that the fabric, in the advancing thereof between the attachment line and the detached line, does not slide or run on the sectors, but is constantly in contact with the external surface of the sectors and stretched thereby towards the ends 61 and 62 of the stretcher roller.

The sectors 65 preferably exhibit the external surface thereof clad in rubber or another material suitable for increasing the grip of the fabric on the sectors and the tensioning exerted by the sectors of the fabric.

Each sector 65 is preferably mounted to the rod by means of a respective plain bearing, the sector being rotatable about the bearing and the sector being internally solidly constrained to the rod of the stretcher roller. The rod preferably has a polygonal section (preferably not circular) and the bearing of each sector has a central hole that is complementarily-shaped to the rod section, such as to prevent rotation of the bearing on the rod and/or guide the insertion of the sectors on the rod with the correct inclination.

The plain bearing is preferably a bushing or the plain bearing is a bushing or bearing made of a self-lubricating techno-polymer, having a low friction coefficient with metals and metal alloys.

The respective sectors 65 of the first 68 and second 69 group of sectors are laterally flanked to one another and preferably substantially in contact. The stretcher roller can possibly exhibit the sectors 65 only at one or more longitudinal portions, between the first 61 and the second 62 end of the roller, in which a stretching is to be performed width-wise of the fabric T in advancement towards the collecting roller 31.

In the take-down and/or collecting group, the stretcher roller is preferably arranged transversally (preferably perpendicularly) to the advancement direction of the fabric T in a point in which the fabric contacts the stretcher roller 60 and starts to advance about the roller 60. The stretcher roller 60 is preferably mounted to the frame 33 of the take-down and/or collecting group 30 in an intermediate position between the opening-out means 50 and the collecting roller 31.

Observe that the above-described stretcher roller, object of the present invention, can be advantageously used internally of a take-down group according to the present invention, for example the take-down group as in figure 7, or a take-down group as described with reference to figures 13 or 14, or a take-down group such as described with reference to figures 16-18 or 19-21. In general, the stretcher roller 60 of the present invention can be used with any circular knitting machine of the open type, both according to the present invention and of known type, including in replacement of stretcher rollers already present in the machine.

The invention as it is conceived is susceptible to numerous modifications and variants, all falling within the scope of the inventive concept, and the components mentioned can be replaced by other technically-equivalent elements. The invention provides important advantages. Primarily the invention enables some of the drawbacks of the prior art to be obviated.

5 Further, the two-legged base-frame enables obtaining a circular knitting machine of the open type that exhibits a smaller overall size with respect to the known solutions, in particular a smaller width.

Further, the open-type knitting machine with the two-legged base-frame enables facilitating the transport of the machine itself and in particular transporting the machine with the whole base-frame already mounted, including using transport means of a standard type.

A further advantage of the open-type knitting machine with the two-legged base-frame relates to the greater accessibility of the machine, and in particular the possibility of accessing the collecting space and approaching the knitting head and the needle-bearing organ.

15 A further advantage of the open-type knitting machine with the two-legged base-frame relates to the possibility of rapidly and easily carrying out the loading and unloading operations of the fabric produced and collected by the take-down and/or collecting group.

A further advantage of the open-type knitting machine with the two-legged base-frame relates to the possibility of increasing the width of the fabric produceable by the machine (or the pulling thereof) by increasing the longitudinal dimension of the machine without increasing the transversal encumbrance thereof; in other words the machine can be significantly longitudinally

20 lengthened without this leading to a considerable broadening in a transversal direction.

The open-type knitting machine with the two-legged base-frame is further characterised by a simple and rational structure, and enables simplifying the operations of realization, mounting, set-up and maintenance of the actual machine.

25 Further, the open-type knitting machine with two-legged base-frame enables increasing the productivity with respect to the known machines.

The present invention further provides various embodiments of the take-down and/or collecting groups able to provide numerous advantages. Primarily, a take-down and/or collecting group of the present invention is characterised by a simple, compact and rational structure and enables

30 mounting to the base-frame of the machine to be done effectively both from the point of view of the support of the loads and from the point of view of the synchronization of the rotation with respect to the needle-bearing organ.

Further, a take-down and/or collecting group of the present invention is able to open and stretch the fabric effectively and uniformly, preventing formation of creases and rolling of the edges of

the collected fabric.

The present invention further provides a stretcher roller that in turn offers numerous advantages.

Firstly, the stretcher roller of the present invention enables completely opening and stretching out the fabric effectively in a plane configuration, preventing and avoiding formation of creases and
5 folds along the whole width of the fabric. Further, the stretcher roller enables making the stretching of the fabric uniform before it reaches the collecting roller, leading to an advantageous effect of stretching the fabric out.

Further, the stretcher roller obviates the problem of rolling-up of the lateral sides of the fabric, and especially lamented problem in the technical sector of open-type knitting machines.

10 Also, the stretcher roller enables reducing the space required, internally of the take-down and/or collecting group, for performing an effective stretching-out of the fabric before it is wound on the collecting roller; this is translated into a general compacting of the whole take-down and collecting group.

A further advantage of the stretcher roller of the present invention is its modularity, given by the
15 realisation thereof using a plurality of distinct sectors mountable independently. This modularity increases the versatility of the stretcher roller, which is translated into a greater adaptability of the various types of fabric to be treated and the various dimensions. The versatility relates to both the choice of the portions of fabric (in width) to be stretched, and to the entity of the lateral stretch imposed on the fabric. In addition, the structure of the stretcher roller (in particular the modularity
20 thereof) makes it simple to realize and means that it is characterised by an overall cost that is modest with respect to the performance and quality provided.

CLAIMS

1. A circular knitting machine for knitwear (1), of an "open" type and configured for producing fabric (T) and collecting it in an open configuration, i.e. in a single layer, the machine comprising:
- a base frame (2) constituting the bearing structure of the machine and comprising a support upper ring or element (3), a lower base, or cross-base (4), and at least two support legs (5, 6) interposed between, and connecting, in at least two distinct and laterally distanced positions, said upper ring and said lower base, such that said upper ring (3) is vertically superposed on, and distanced from, said lower base (4), and in that between them a collecting space (S) is vertically defined, free of elements of said base frame and destined to movably house a take-down and/or collecting group of said fabric (T) produced by the knitting machine;
 - a knitting head (H) mountable to said upper ring (3) and provided with at least a rotating needle-bearing organ (O), being in a form of a needle cylinder or a needle plate, with a plurality of needles movably mounted to said at least a needle-bearing organ, and with command means for selectively activating said plurality of needles for enabling production of a fabric;
 - a take-down and/or collecting group (30) movably housed in said collecting space (S) and configured and predisposed at least to open and stretch, or even possibly to take-down from said needle-bearing organ, the fabric produced by the machine, winding it in a single layer and continuously on at least a collecting roller (31);
- wherein the whole take-down and/or collecting group is rotatably mounted hanging to said base frame (2) or to said needle-bearing organ (O) such as to be vertically suspended in said collecting space (S).
2. The knitting machine (1) of the preceding claim, wherein said knitting head (H) is mounted on said upper support ring (3) in such a way that said needle-bearing organ (O) can rotate about a substantially-vertical central axis (A), and wherein the take-down and/or collecting group (30) is hung to said base frame or to said needle-bearing organ such as to rotate solidly, or in an angularly coordinated way, with the needle-bearing organ (O), and/or wherein said needle-bearing organ, preferably a needle cylinder, has a diameter of greater than 24 inches and/or greater than 26 inches and/or greater than 30 inches and/or greater than 36 inches and/or greater than 40 inches.
3. The knitting machine (1) of claim 1 or 2, wherein said take-down and/or collecting group (30) is free of support organs connecting and/or centring the group to lower and/or lateral portions of the base frame, in particular is free of support organs connecting the take-down and/or collecting group to said lower base, or cross-base (4), of the base frame and/or to said legs (5, 6) of the base frame.

4. The knitting machine (1) of any one of the preceding claims, wherein said take-down and/or collecting group comprises a support frame (33) housing collecting means of the fabric produced by the machine and possibly take-down means of the fabric produced by the machine, said support frame (33) superiorly comprising mounting means (40) fixable to said base frame (2) or to said needle-bearing organ (O) and configured and dimensioned for suspendingly supporting the whole load of said take-down and/or collecting group, where said load comprises the weight of the take-down and/or collecting group and of the fabric (T) collected on said at least a collecting roller (31), and comprises the stresses determined by rotation of the take-down and/or collecting group and transmitted to said base frame or to said needle-bearing organ, and/or wherein said mounting means (40) are arranged exclusively in an upper position in said frame (33) and are not present inferiorly and/or laterally to said frame, and/or wherein the take-down and/or collecting group (30) is entirely hung to said base frame (2) and said whole load is entirely supported by said base frame or wherein the take-down and/or collecting group is entirely hung to said needle-bearing organ (O) and said whole load is entirely supported by said needle-bearing organ.

5. The knitting machine (1) of any one of the preceding claims, wherein said mounting means (40) comprise at least a mounting bracket (41) directly connecting said frame (33) of the take-down and/or collecting group to said needle-bearing organ (O), in such a way as to make the take-down and/or collecting group solid with the needle-bearing organ, said at least a mounting bracket supporting the whole above-mentioned load of the take-down and/or collecting group, and at the same time acting as a drive transmission organ from the needle-bearing organ to the take-down and/or collecting group, in such a way that the rotations of the needle-bearing organ and the take-down and/or collecting occur synchronously and coaxially, i.e. to a determined angular rotation of the needle-bearing organ about said central axis (A) corresponds a same angular rotation of the take-down and/or collecting group about the same axis, and/or wherein said at least a mounting bracket (41) is fixed to a single continuous sector of the needle-bearing organ, said sector having an angular extension comprised between 10° and 180° and/or comprised between 20° and 150° and/or comprised between 30° and 120° and/or comprised between 45° and 90° with respect to said central axis.

6. The knitting machine (1) of any one of claims from 1 to 4, wherein said base frame comprises a holding ring (8), mounted to said two legs (5, 6) in a lower position with respect to said upper ring (3) and coaxial therewith, said holding ring (8) exhibiting a central hole through which the fabric (T), produced by the machine and coming from the needle-bearing organ, progressively descends into said collecting space (S), said holding ring (8) comprising an external ring (8a)

fixed to, and solidly constrained to, said base frame (2), and an internal ring (8b) coaxial to said external ring and rotatably mounted thereto, and/or wherein said external ring (8a) and said internal ring (8b) of the holding ring overall realize a fifth wheel or bearing, preferably of a revolving type.

5 7. The knitting machine (1) of the preceding claim, wherein said mounting means (40) comprise fixing organs (45) directly connecting said frame (33) of the take-down and/or collecting group to said internal ring (8b) of the holding ring (8), such as to make the take-down and/or collecting group solid with the internal ring, said fixing organs at least partially supporting said load of the take-down and/or collecting group, and/or wherein the mounting means (40) further comprise a
10 respective drive transmission organ (42) connecting the needle-bearing organ (O) to the frame (33) of the take-down and/or collecting group or to the internal ring (8b) of the holding ring (8), such that the rotations of the needle-bearing organ (O), of the take-down and/or collecting group (O) and of the internal ring (8b) occur synchronously and coaxially, i.e. to a determined angular rotation of the needle-bearing organ about said central axis corresponds an angular rotation of
15 the take-down and/or collecting group and the ring about the same axis.

8. The knitting machine (1) of any one of the preceding claims, wherein said fixing organs (45) are configured for supporting the whole load of the take-down and/or collecting group, and said transmission organ (42) is configured for transmitting the rotation of the needle-bearing organ to the take-down and/or collecting group and to the internal ring without supporting the above said
20 load, and/or wherein, alternatively, said fixing organs (45) are configured for supporting a fraction of the load of the take-down and/or collecting group, and the transmission organ is configured for transmitting the rotation of the needle-bearing organ to the take-down and/or collecting group and to the internal ring and, at the same time, for supporting the remaining fraction of the above said load not supported by said fixing organ, and/or wherein said fraction supported by the fixing
25 organ (45) is greater than 80% of said load, and/or greater than 60% of said load, and/or greater than 40% of said load, and/or wherein correspondingly said remaining fraction supported by the transmission organ (42) is respectively lower than 20% of said load, and/or lower than 40% of said load, and/or lower than 60% of said load.

9. The knitting machine (1) of any one of the preceding claims, wherein said frame (33)
30 comprises a beam (34), positioned substantially horizontally in said collecting space, and a pair of lateral support plates (35, 36), fixed to two opposite sides of said beam and facing one another, said lateral plates being positioned substantially vertically, said beam (34) and said lateral plates (35, 36) supporting said collecting means of the textile produced by the machine and/or the take-down means of the fabric produced by the machine, and/or wherein said beam

extends longitudinally, below the needle-bearing organ, substantially symmetrically with respect to said central axis (A) of the needle-bearing organ (O) and parallel to the central axis, and/or wherein said fixing organs (45) comprise one or more screws (46), or one or more weld beads or equivalent means, fixing said beam (34) of the frame directly to said internal ring (8b) of the upper ring (8) of the base frame (2), and/or wherein said fixing organs (45) can comprise a
5 respective mounting bracket of the frame to said internal ring (8b) of the holding ring.

10. The knitting machine (1) of any one of the preceding claims, wherein said take-down and/or collecting group (30) exhibits an overall empty weight, i.e. with said collecting roller free of the fabric (T) produced by the machine, in the order of, or substantially equivalent to, the weight of a
10 maximum quantity of fabric windable about said collecting roller, and/or exhibits an overall empty weight comprised between 90% and 110%, or between 80% and 120%, or between 70% and 130%, or between 50% and 150%, or between 20% and 200%, of the weight of a maximum quantity of fabric windable on said collecting roller, and/or wherein said needle-bearing organ (O) is a needle cylinder or a needle plate, and/or wherein the knitting machine is of a single-needle
15 bed type, comprising a single needle-bearing organ, or of a double-needle bed type, comprising two needle-bearing organs, respectively a needle cylinder and a needle plate.

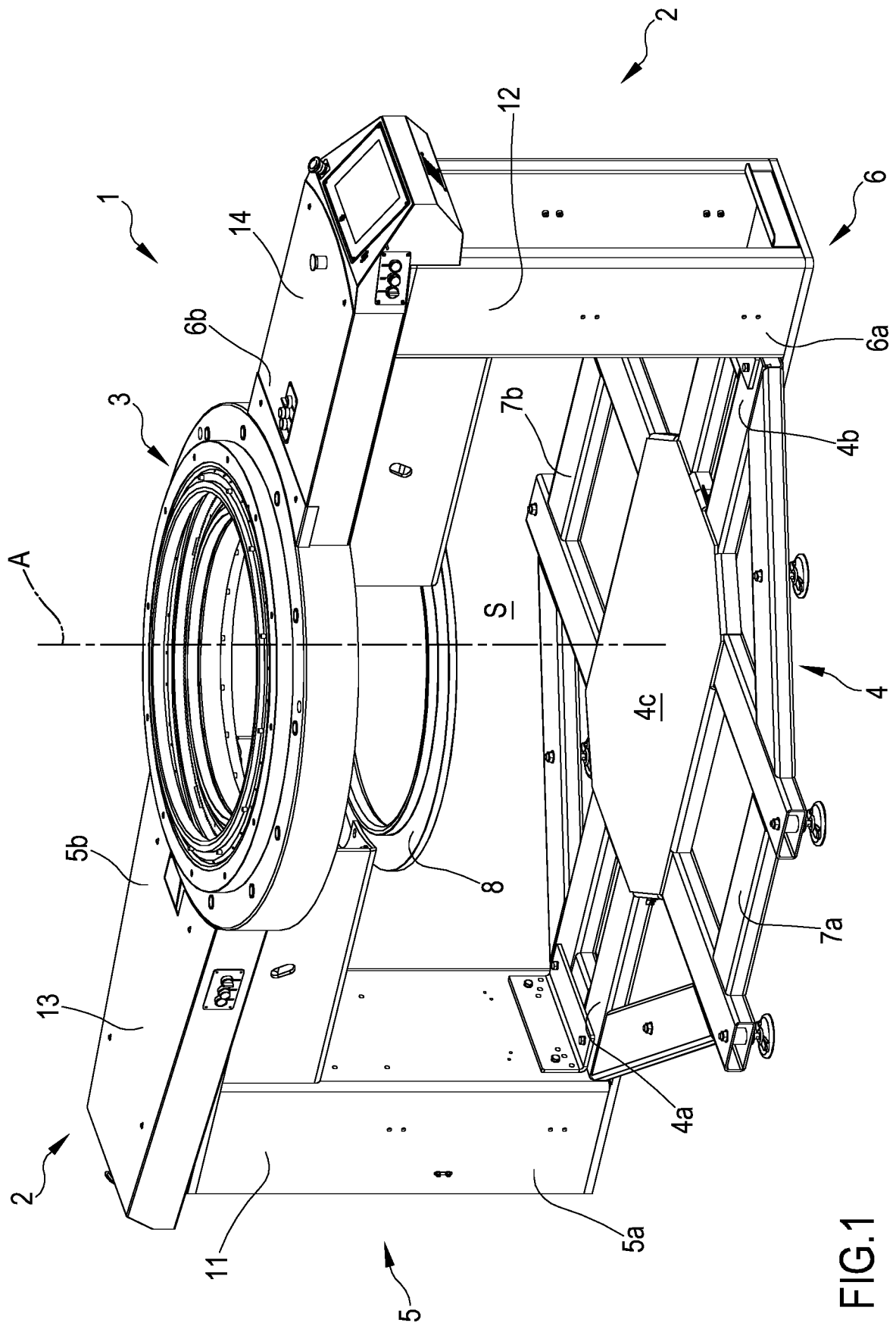


FIG.2

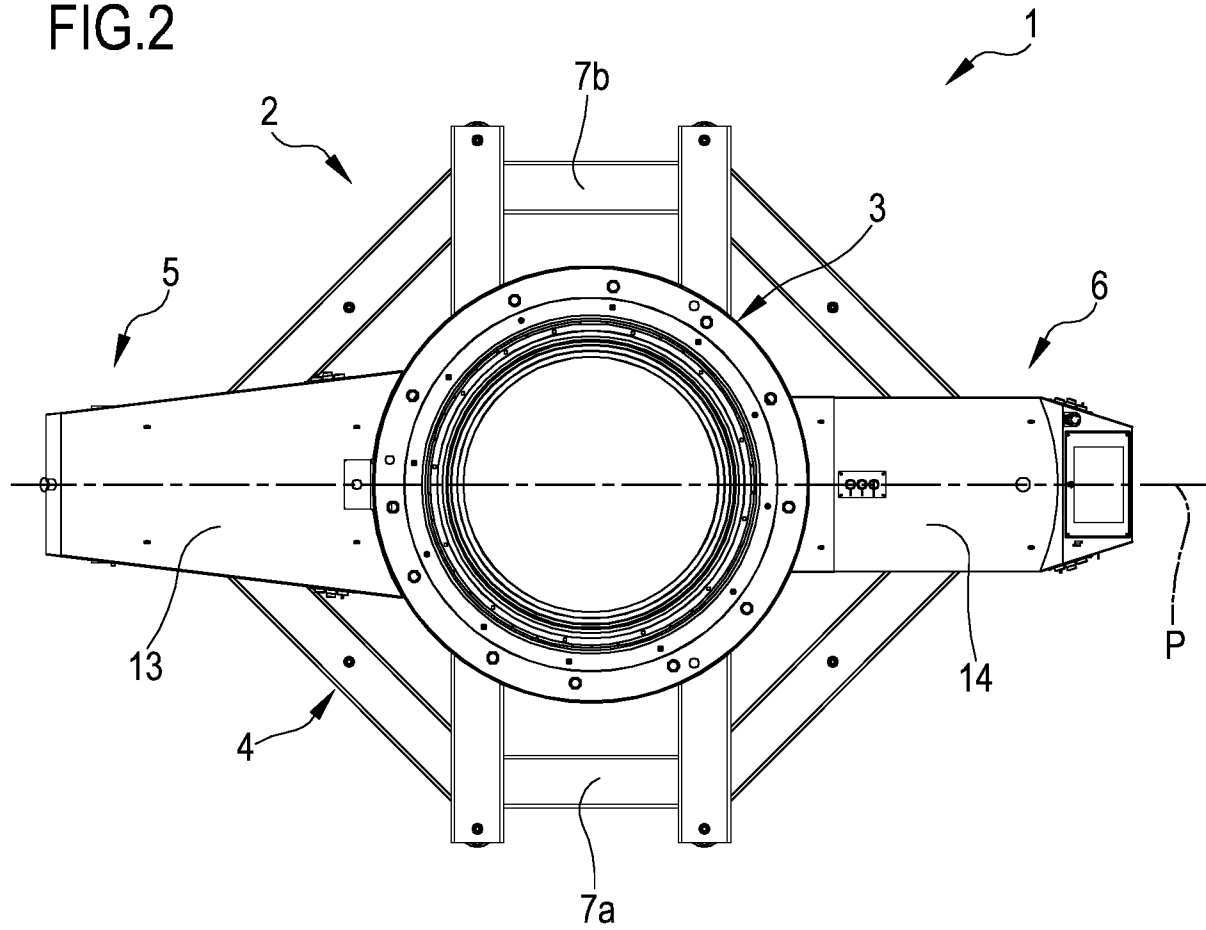
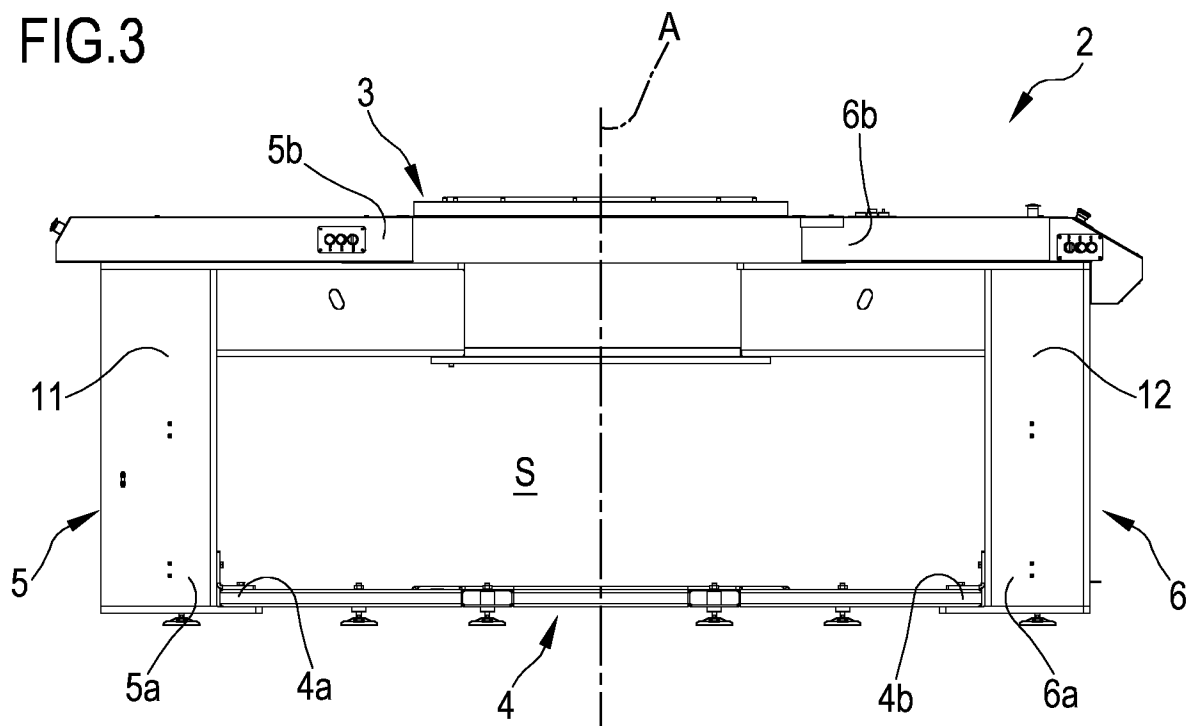


FIG.3



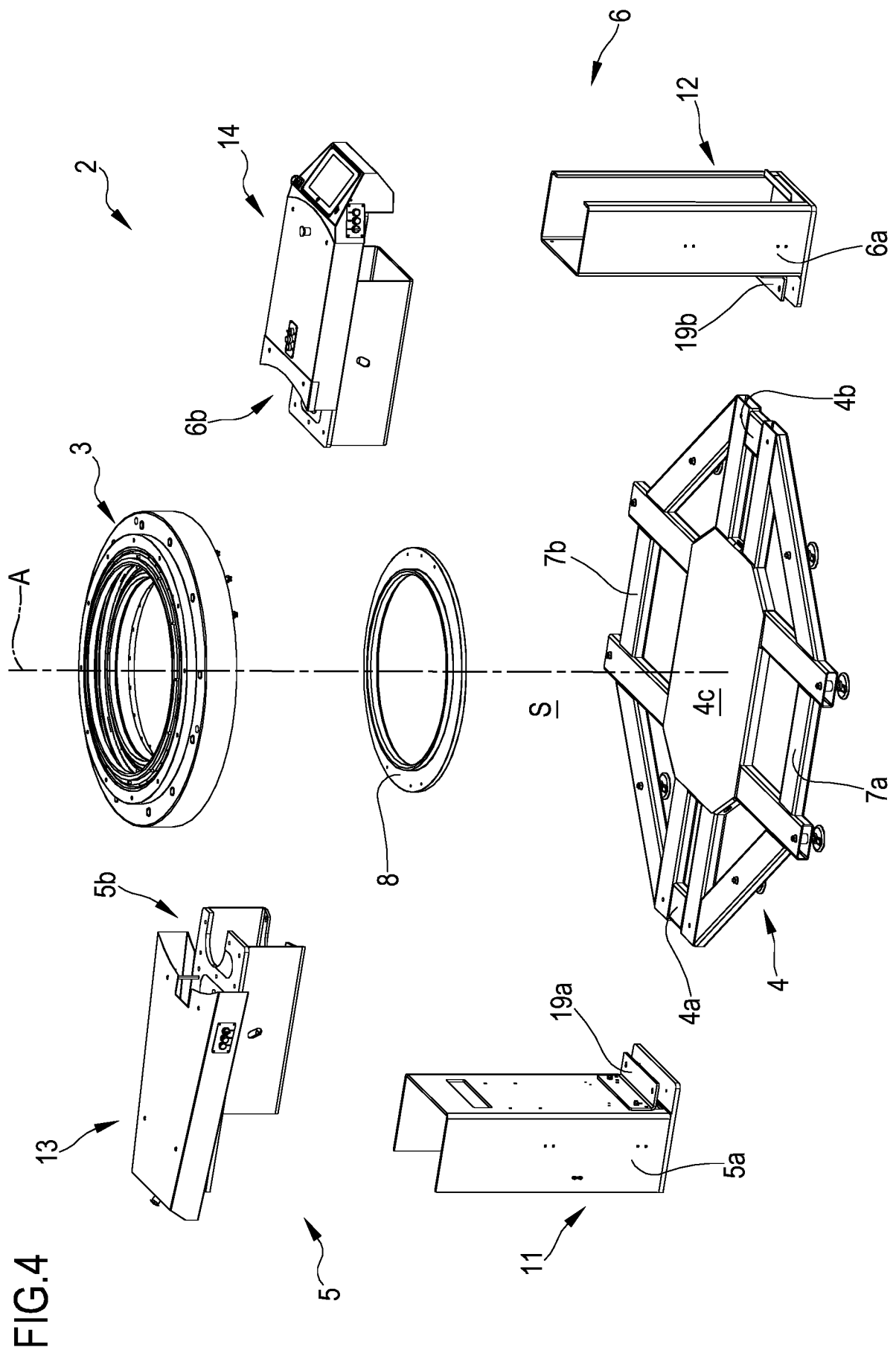


FIG.5

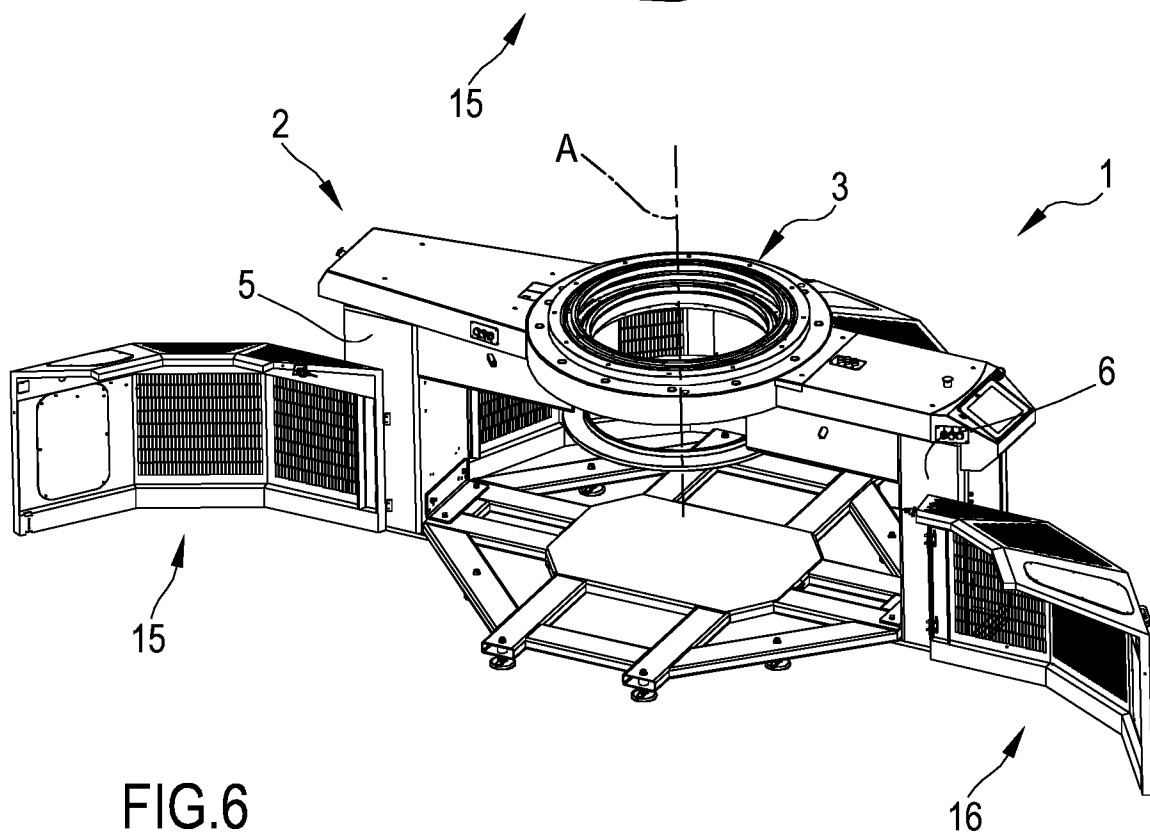
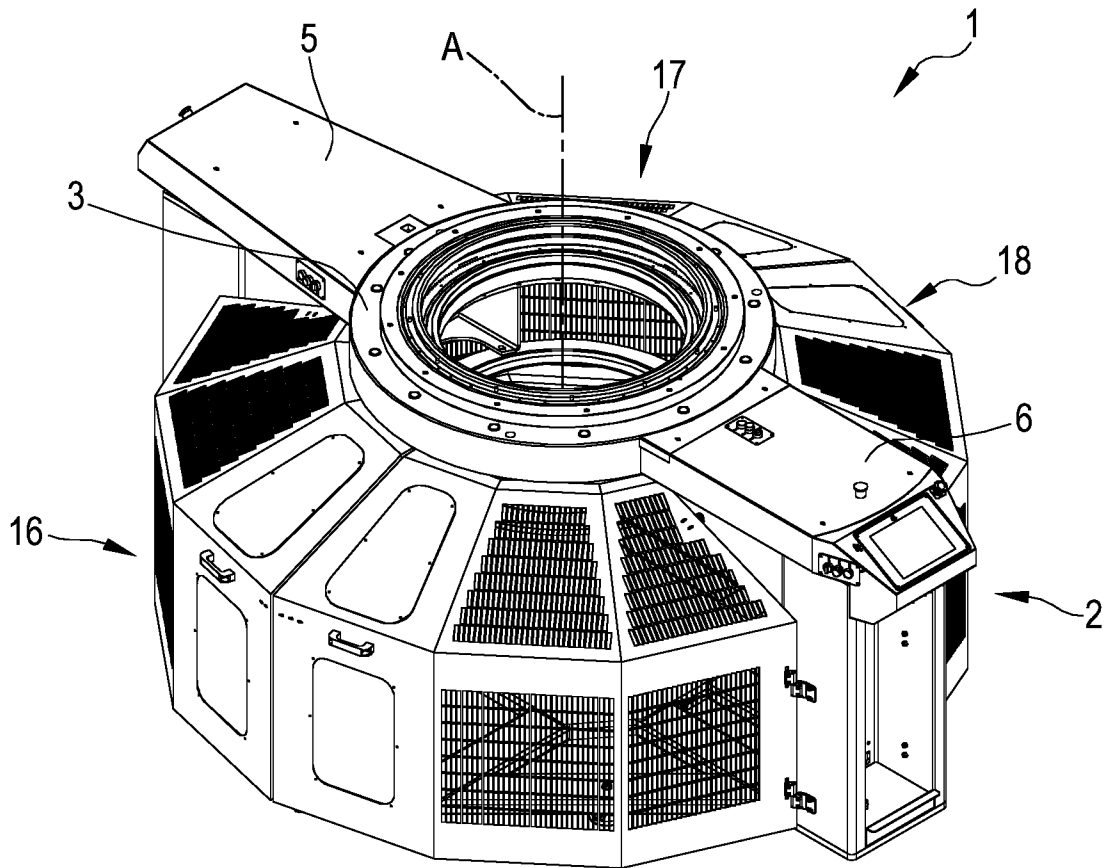


FIG.6

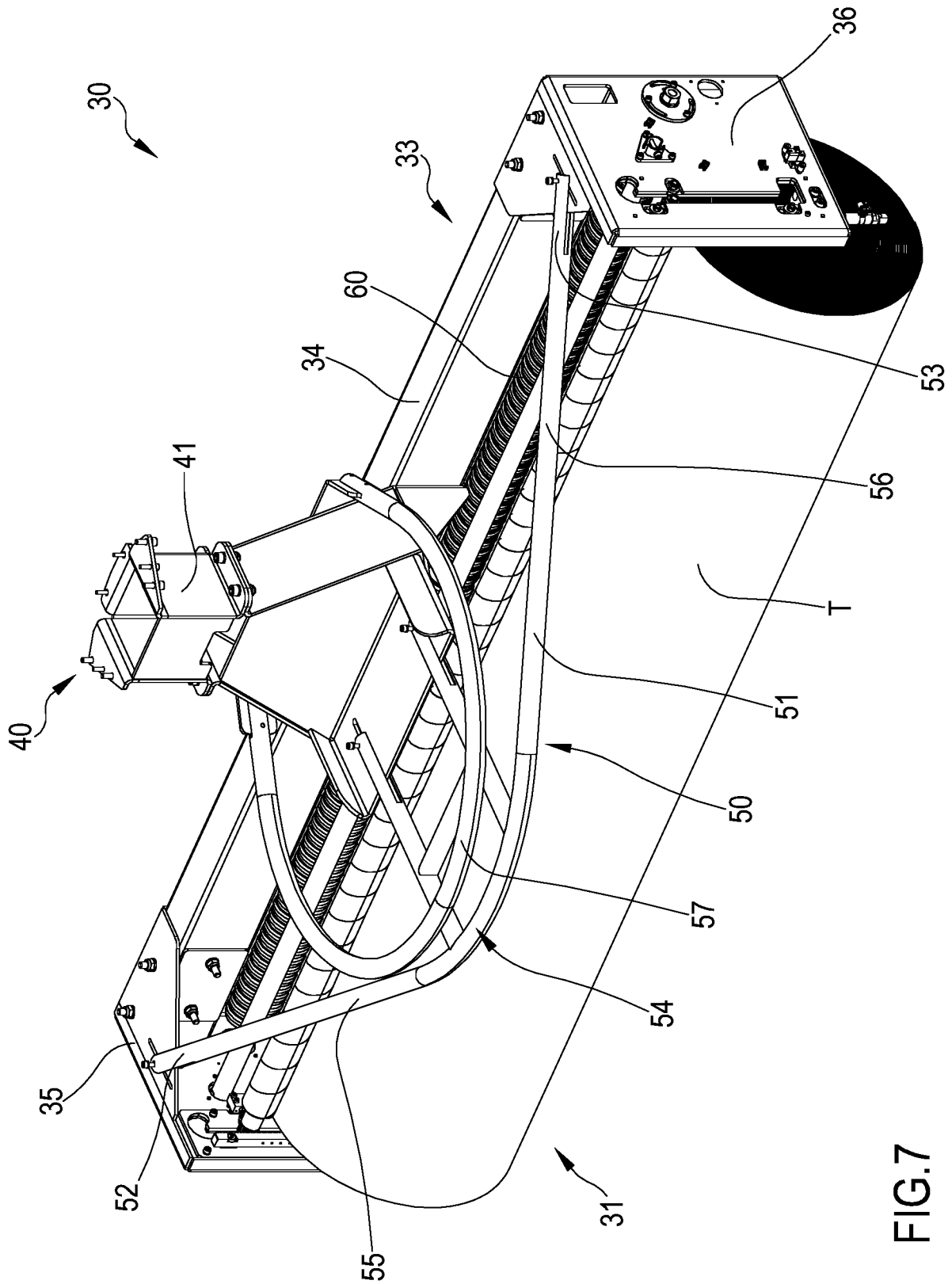


FIG. 7

FIG.8

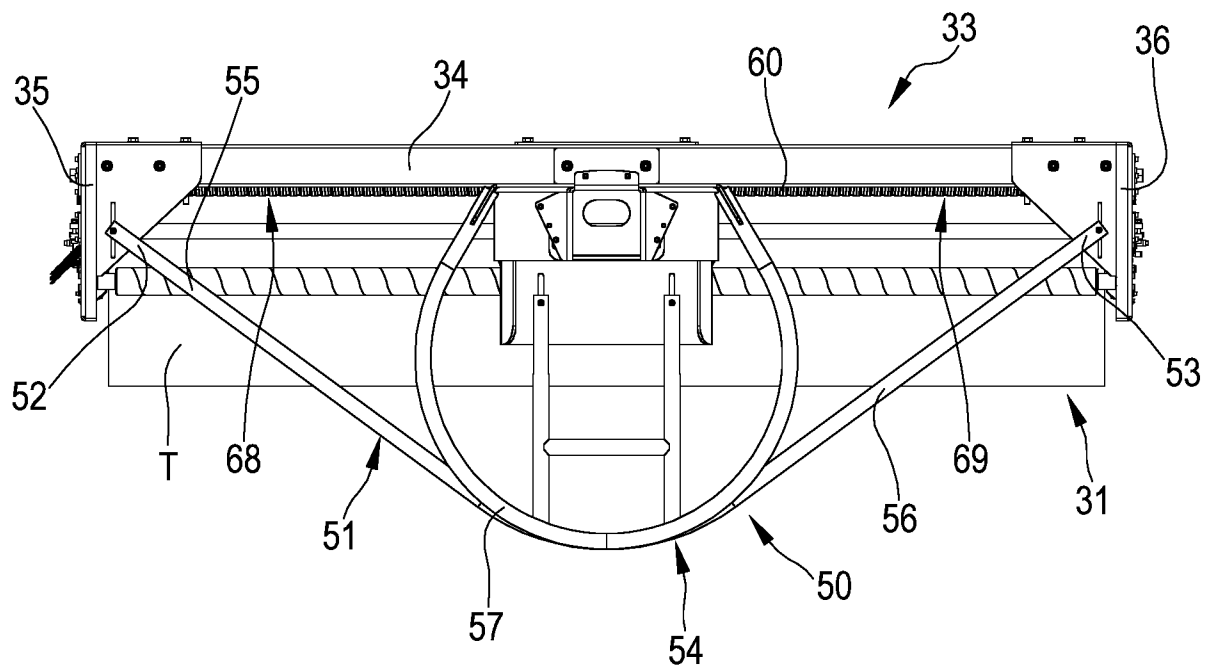
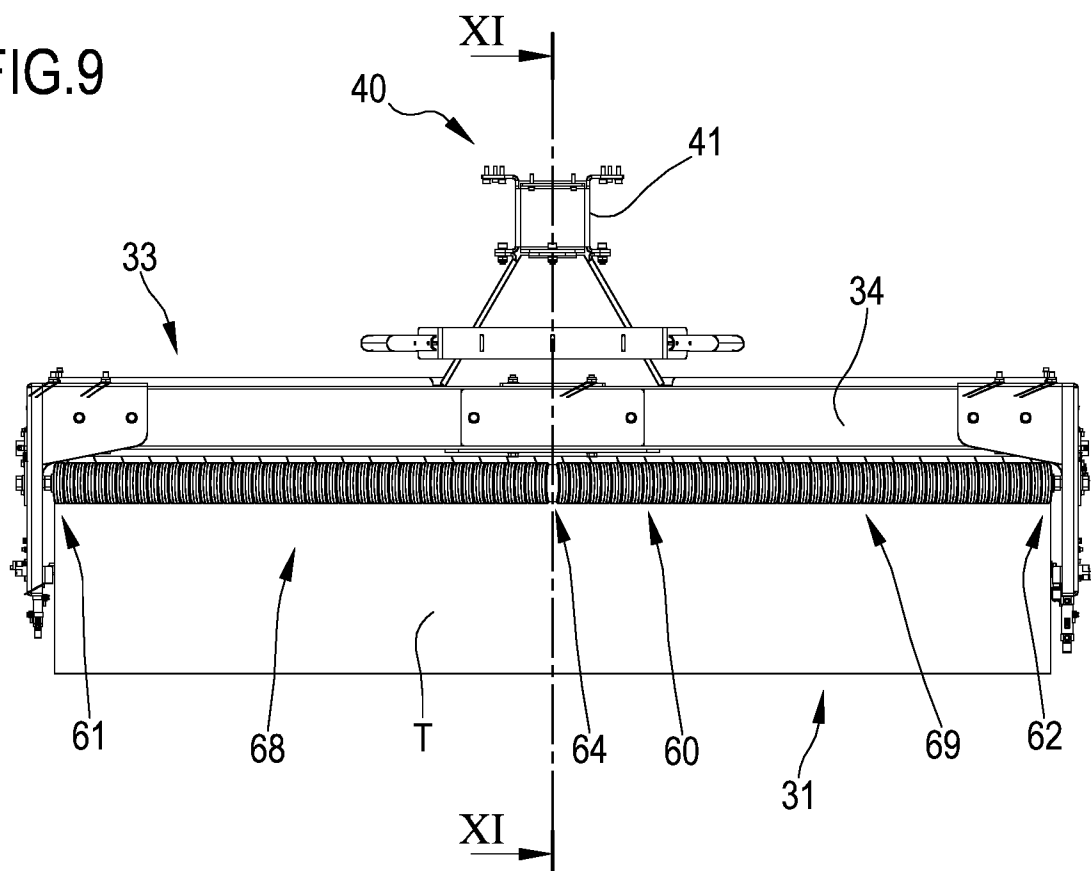


FIG.9



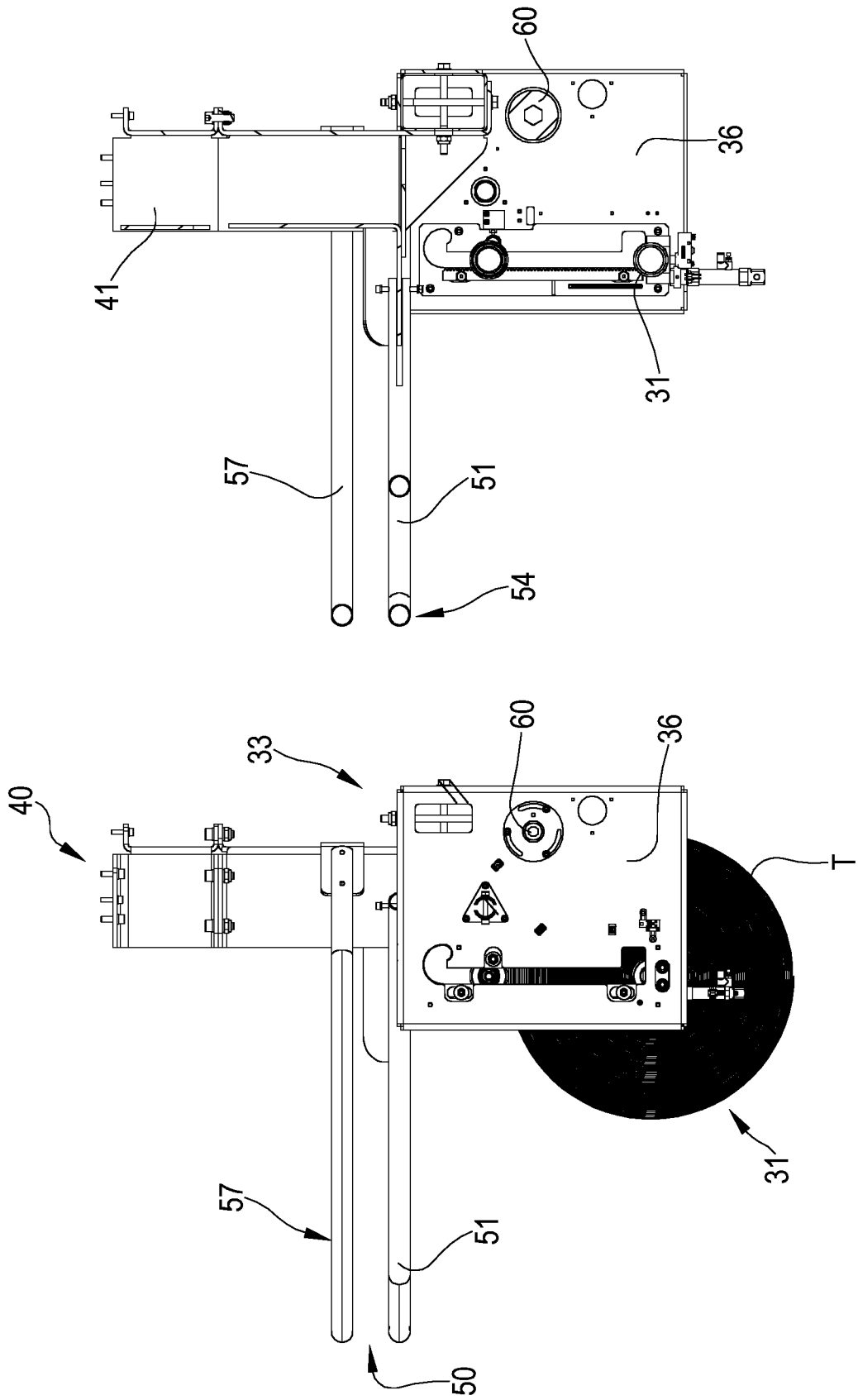


FIG.11

FIG.10

FIG.12

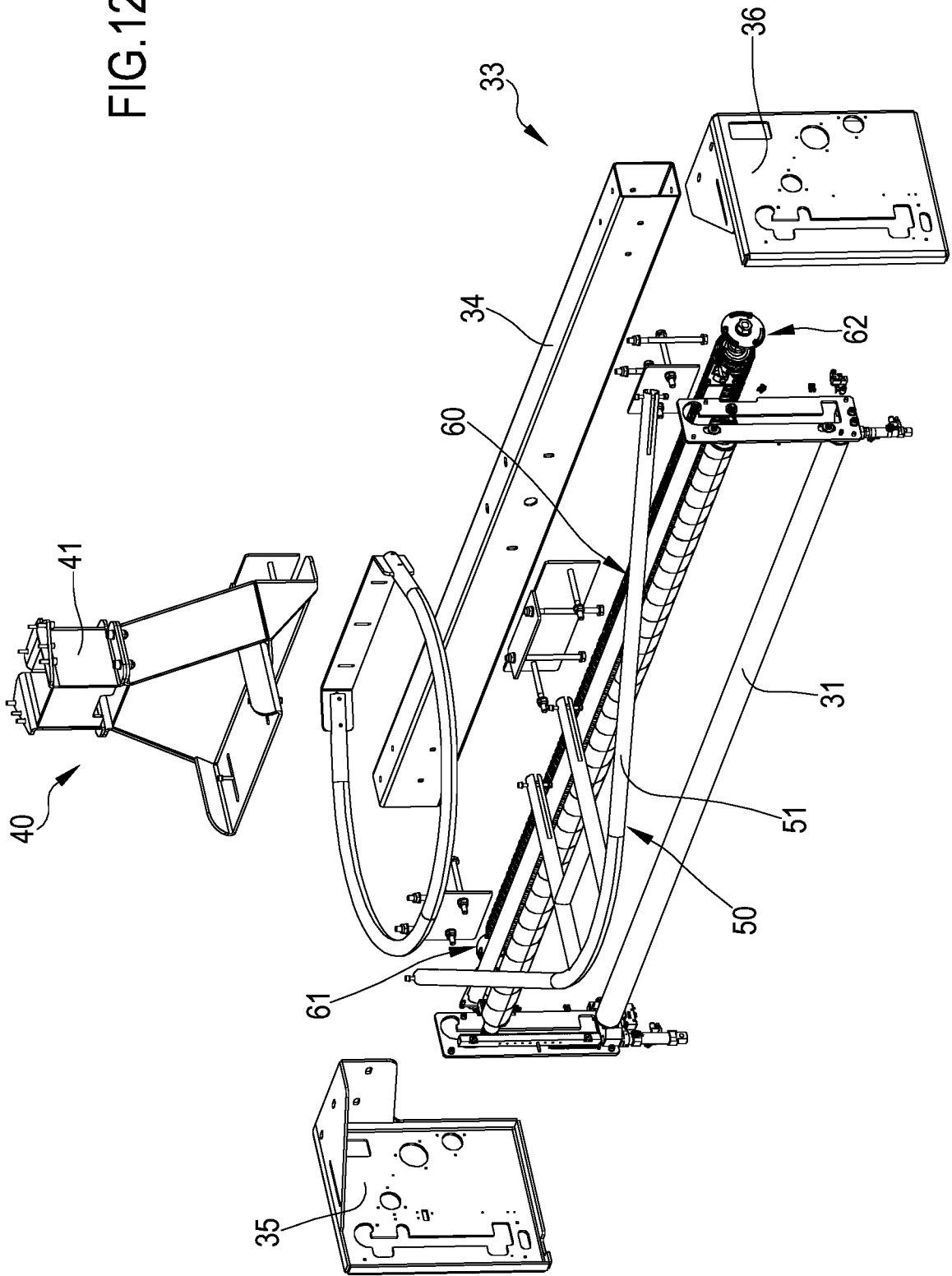


FIG.13

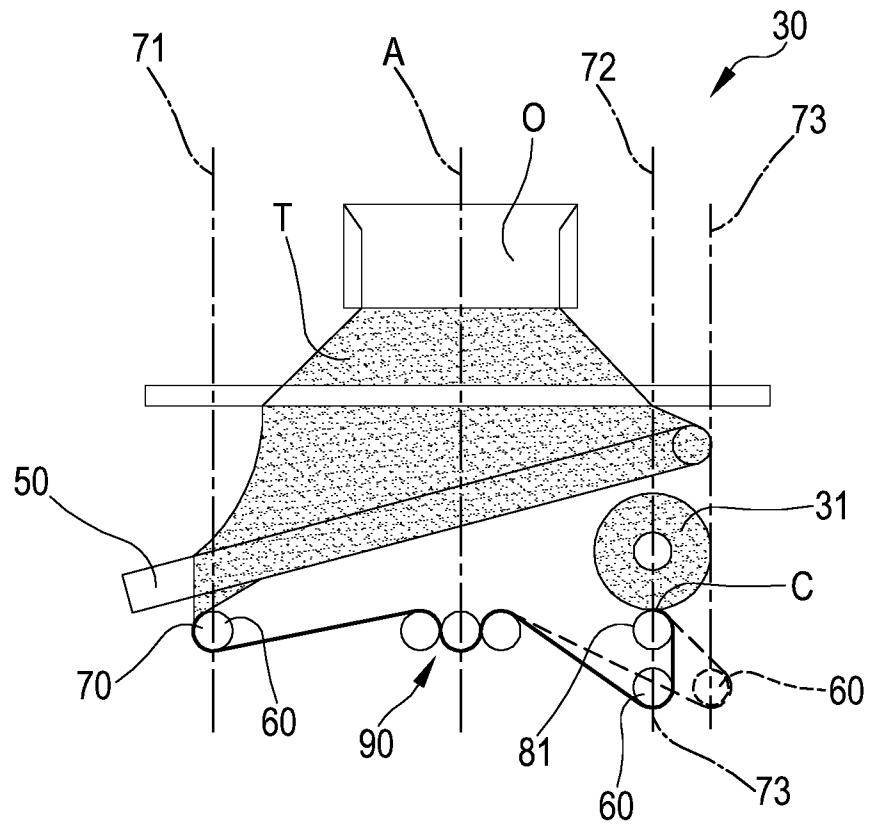
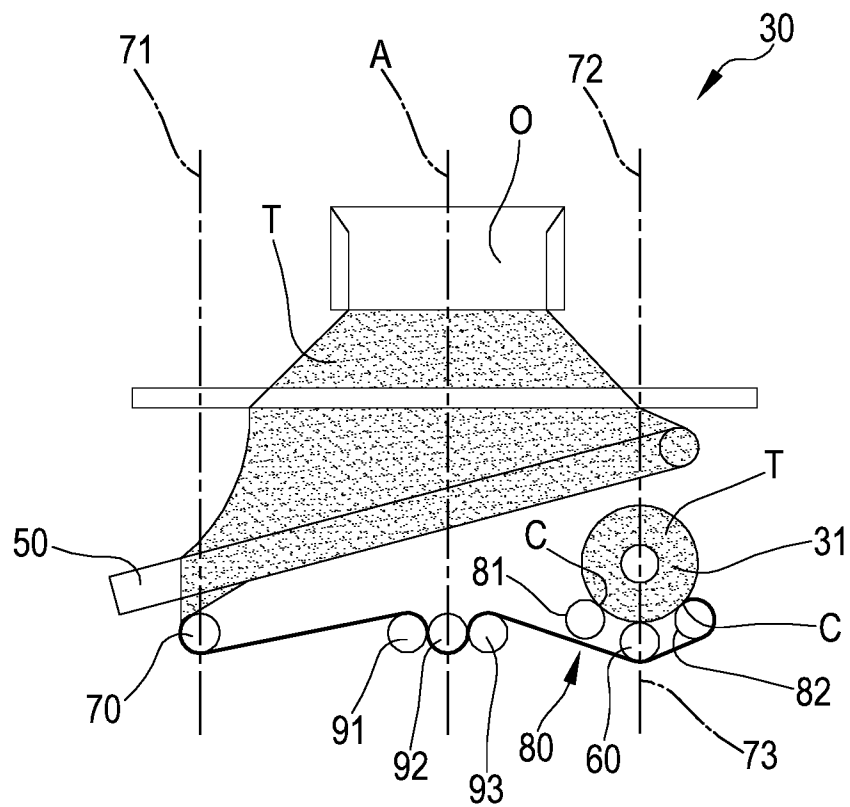


FIG.14



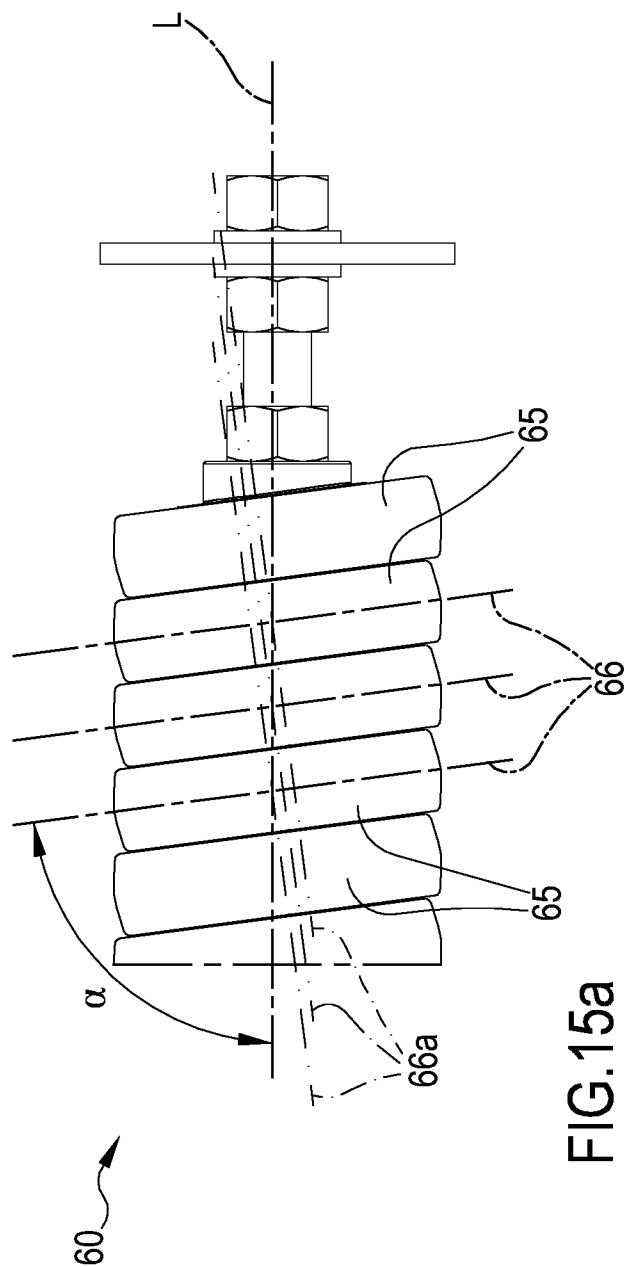
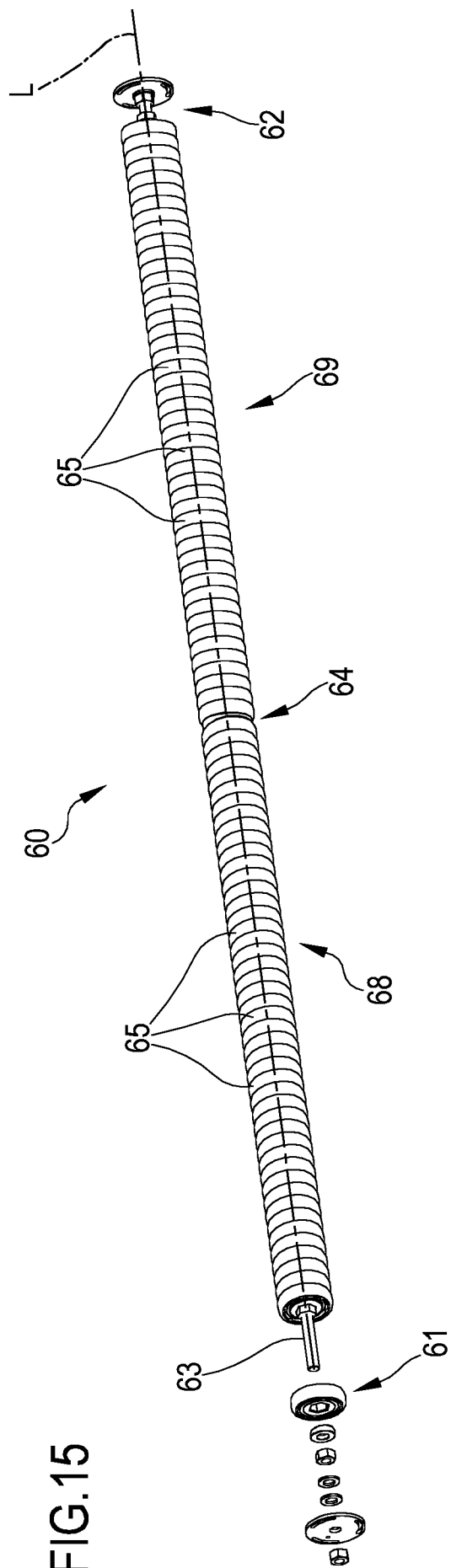


FIG. 15a

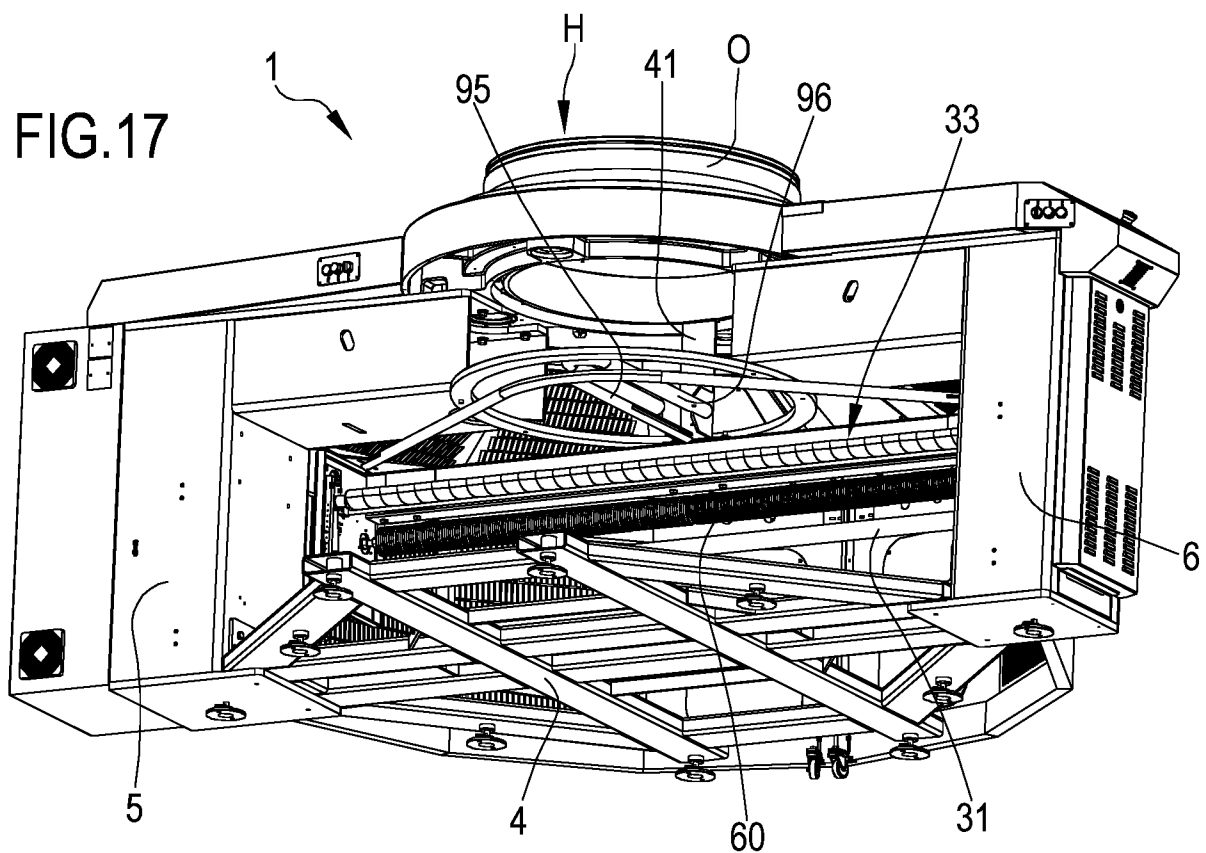
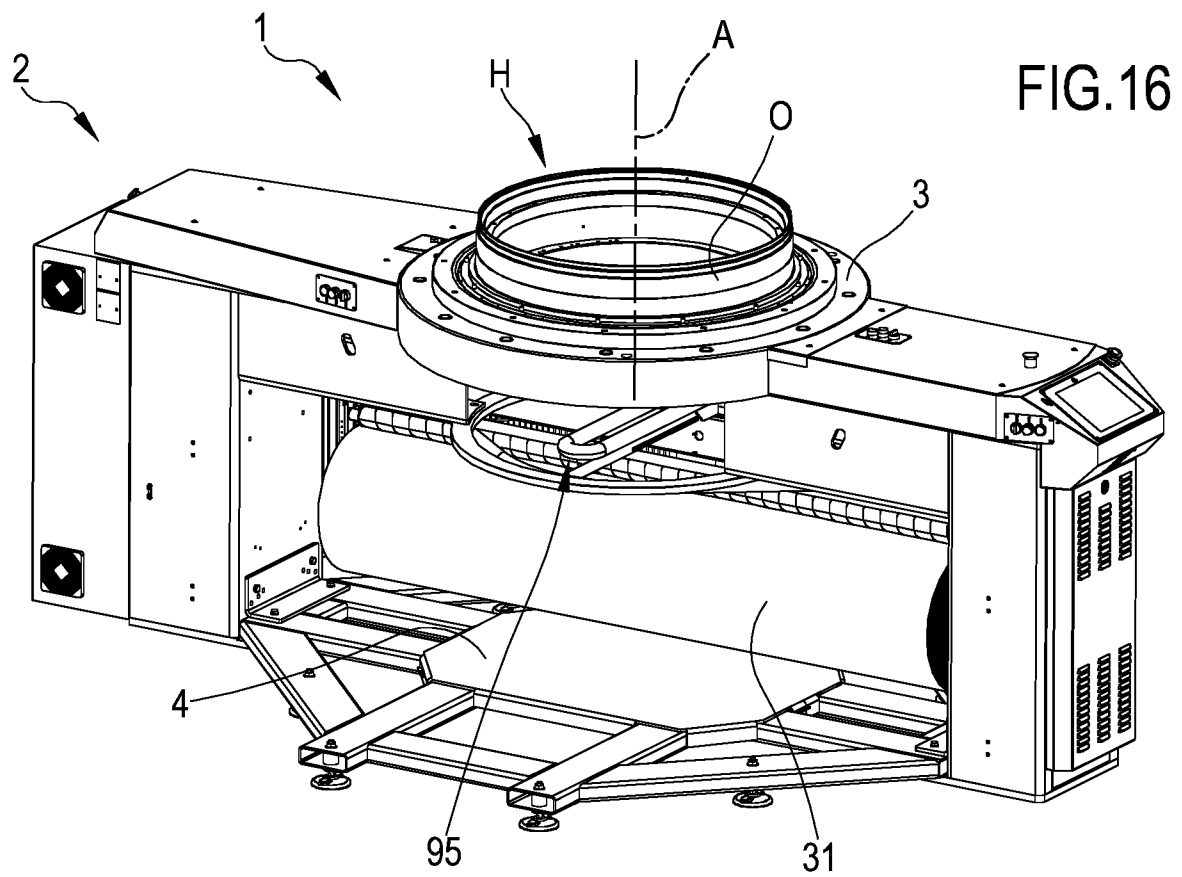


FIG.18

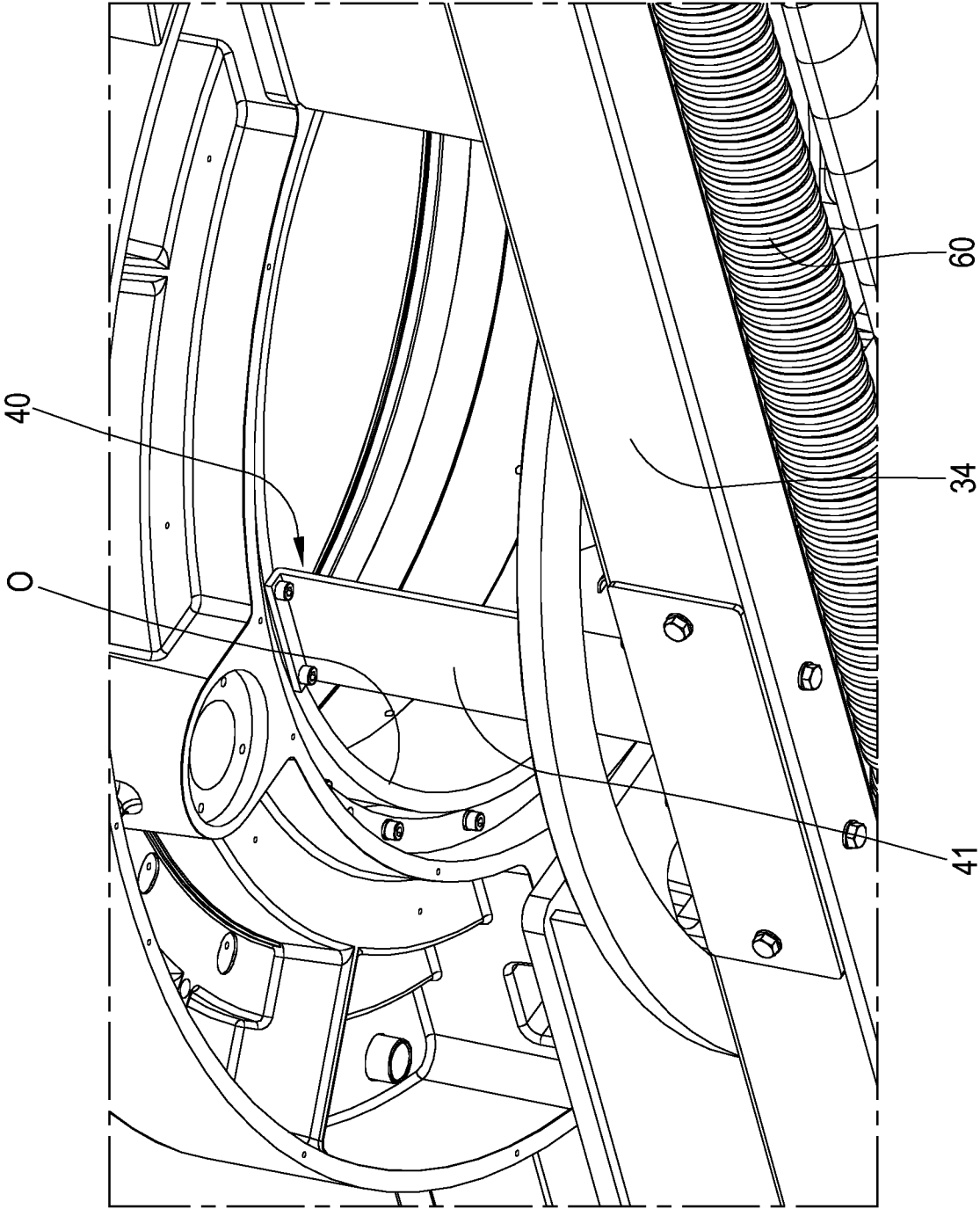


FIG.19

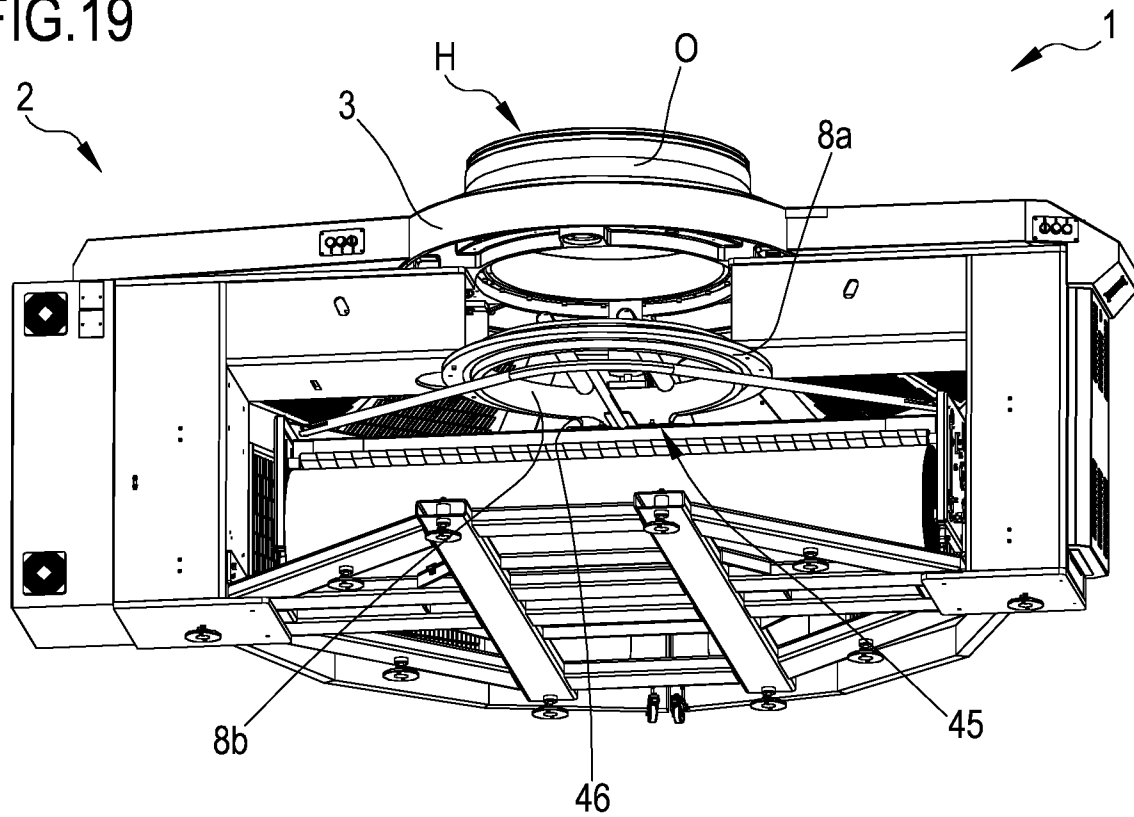
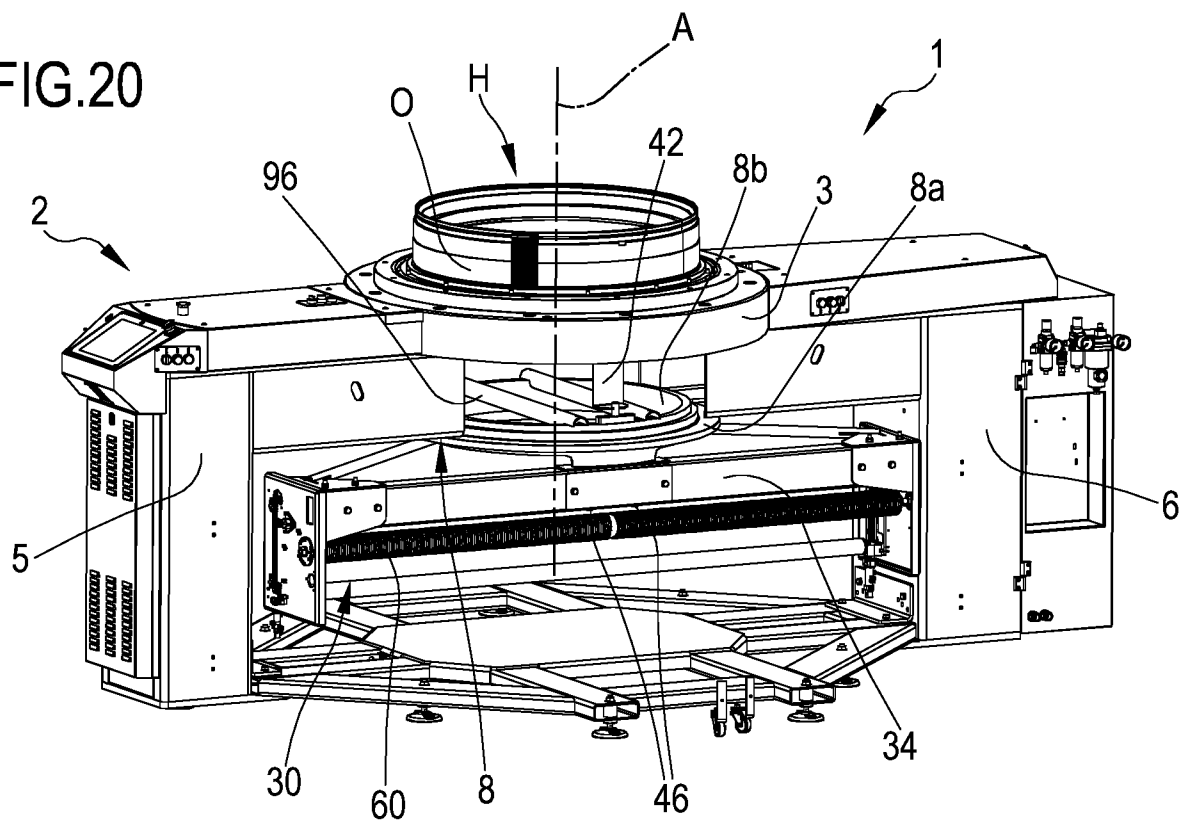


FIG.20



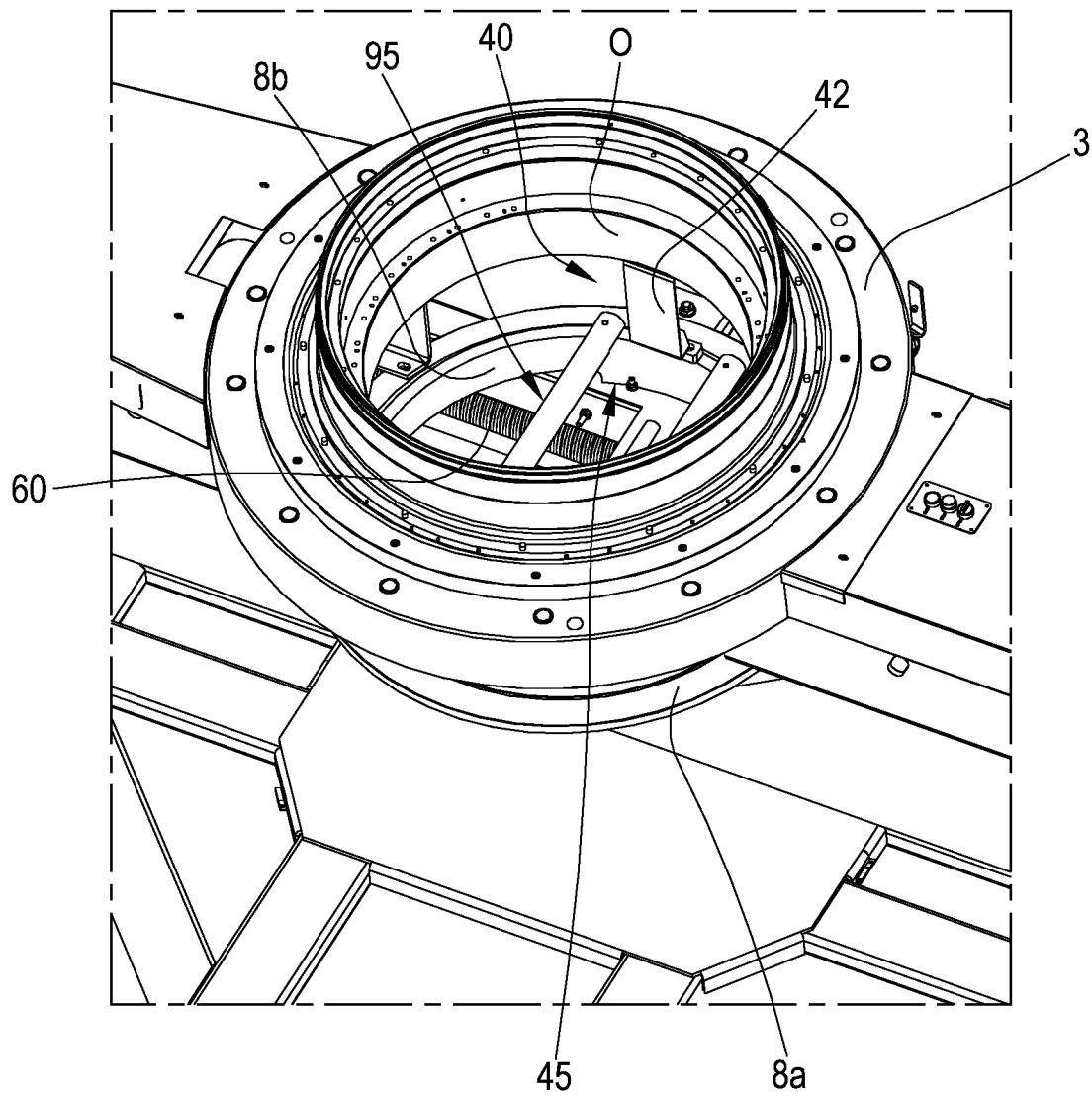


FIG.21

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/061528

A. CLASSIFICATION OF SUBJECT MATTER

INV. D04B15/88 D04B35/34
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

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)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 00/50678 A1 (VIGNONI SRL [IT]; LONATI TIBERIO [IT]) 31 August 2000 (2000-08-31) cited in the application page 1, lines 6-27; figures 1,2 page 6, line 17 - page 7, line 7 -----	1-10
A	WO 2005/100659 A1 (VIGNONI SRL [IT]; LONATI TIBERIO [IT]) 27 October 2005 (2005-10-27) page 1, line 4 - page 2, line 8; figures 1,2,3 page 8, line 7 - page 9, line 11 page 15, line 9 - page 16, line 21 ----- -/--	1-10



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

23 July 2014

Date of mailing of the international search report

31/07/2014

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Wendl, Helen

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2014/061528

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 4 765 157 A (OKADA TOSHIHIKO [JP]) 23 August 1988 (1988-08-23) column 3, lines 39-65; figure 1 column 1, lines 7-9 -----	1-10

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Information on patent family members

International application No

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