(19) Europäisches Patentamt
European Patent Office
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(11) **EP 3 950 551 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.02.2022 Bulletin 2022/06

(21) Application number: **21187905.1**

(22) Date of filing: **27.07.2021**

(51) International Patent Classification (IPC):
B65H 57/22 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B65H 57/22; B65H 2701/31

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **07.08.2020 IT 202000019660**

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(54) DEVICE AND METHOD FOR CONTROLLING A BALLOON, WINDING UNIT COMPRISING SAID DEVICE

(57) A device (12) for controlling a balloon during the unwinding of a yarn (14) from a bobbin (16) in a winding unit (18), comprising: a first substantially tubular containment element (20), having a longitudinal axis (x) and a through opening (22) adapted for the passage of the yarn (14) leaving said bobbin (16); and a support (24) adapted to support said first containment element (20), and adapted to be fixed to a structure of a winding unit (18). The first containment element (20) comprises a first containment component (120) and a second containment component (220). The support (24) comprises a first arm (124) and a second arm (224) on which the first containment component (120) and the second containment component (220) are respectively positioned. The device (12) comprises drive means (26) suitable for driving the arms (124, 224), and consequently the containment components (120, 220), between two positions: a first position, in which the containment components (120, 220) are spaced apart from each other, and a second position, in which the containment components (120, 220) are closer together with respect to the first position. The device (12) comprises a second static containment element (50), provided downstream from said first containment element (20). The second containment element (50) is provided with a second through opening (52) comprising a base portion (54) in use facing toward the first containment element (20), having a substantially rectangular cross section relative to the longitudinal axis (x).

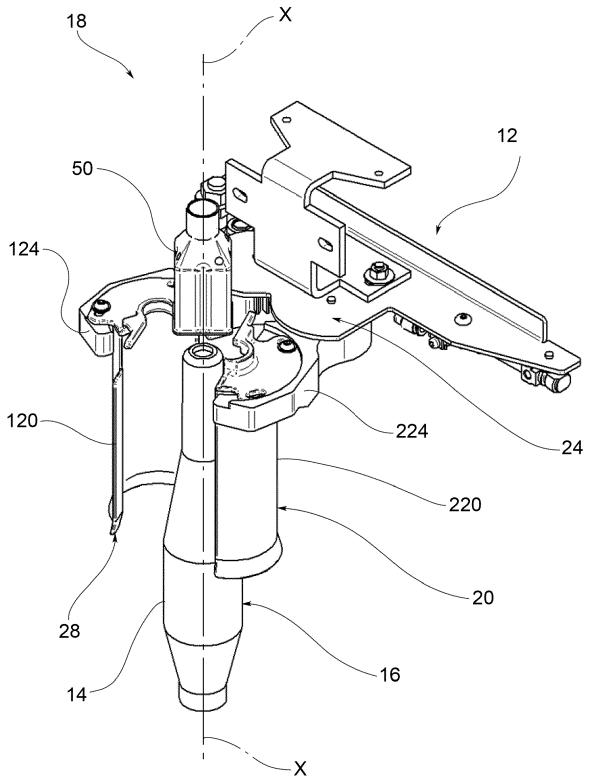

FIG.2

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Description

FIELD OF APPLICATION

[0001] The present invention relates to a device for controlling a balloon during the unwinding of a bobbin, a winding unit provided with such a device, and a method for controlling a balloon during the unwinding of a bobbin.

STATE OF THE ART

[0002] As is known, industrial-type winding machines comprise a plurality of winding units that are independent of each other and controlled by a programmable control unit.

[0003] The winding unit is used for winding a yarn on a support, generally cone-shaped, to create a spindle that will be used in weaving, knitting, or other subsequent processing. The yarn is wound on the support with a predetermined type of winding to optimize the subsequent unwinding of the yarn from the spindle during the weaving stage.

[0004] In this discussion the term "thread" or "monofilament" or "continuous thread" means a single filament or continuous strand (for example in the case of silk, artificial, or synthetic fibers), while the term "yarn" means the set of fibrils of variable length that are parallelized and joined by twisting. In the following, either term will be used indistinctly, it being understood that the applications of the present invention are not limited to one or the other type.

[0005] The yarn is wound on the spindle preferably with a cylinder in contact with said spindle and rotating about an axis substantially parallel to that of the spindle. The cylinder is provided with a predetermined geometry of seats that are engaged by the yarn and guide it during its winding onto the spindle.

[0006] It is self-evident that high winding speeds of the yarn onto the spindle correspond to high unwinding speeds of the bobbins that supply the yarn.

[0007] One of the main results of increasing the unwinding speed of the bobbin, is the increase in the tension due to unwinding, which in some cases may cause the yarn to break, and which in any case is detrimental to the yarn because the defectiveness may increase the specific pressures in the contact points of the thread.

[0008] The yarn in the vicinity of the bobbin forms a so-called balloon: as it unwinds from the bobbin, it becomes wider with respect to the shape of the yarn wound on the bobbin, and this widening extends for a certain height above the bobbin, up to the cylindrical connection point placed above the tube. The more the unwinding speed increases, the more the diameter of the balloon increases until it collapses and slides onto the tube, thus losing its characteristic shape. Essentially, as the speed increases, the centrifugal force is not sufficient to overcome the other forces involved (Coriolis force in primis but also aerodynamic resistance force), and the balloon closes up on the tube.

[0009] In addition, as the bobbin is emptied, there is a further increase in tension due to the lowering of the pick-up point of the thread from the bobbin and a consequent increase in height of the balloon and the possible collapse thereof.

[0010] The correlation between the balloon diameter and the tension due to unwinding is well known; in particular, it is known that as the unwinding speed of the bobbin increases, the balloon diameter increases and consequently so does the unwinding tension. Moreover, in the event that the balloon collapses, the tension is further raised by the friction generated between the thread and tube. Such friction, inter alia, may deteriorate the yarn.

[0011] The prior art has tried to solve this problem by attempting to confine the diameter of the balloon, passing the yarn inside a containment element that is part of a system called a balloon breaker, substantially cylindrical in shape, coaxial with respect to the bobbin, and positioned near the upper end of the bobbin.

[0012] As the bobbin is emptied, the pickup point of the yarn from the bobbin is lowered, increasing the height of the balloon, and thus increasing its maximum diameter until it collapses. This increase in height causes the containment effect to be lost, significantly reducing the effectiveness of such systems.

[0013] For this reason, the known types of balloon breakers provide additional functions, such as a downward shift of the containment element as the amount of yarn remaining on the bobbin decreases.

[0014] This solution is particularly favored because it allows an optimal distance to be maintained between the yarn still wrapped on the bobbin and the containment element, thus allowing an optimal confinement of the balloon inside the containment element.

[0015] However, the system is technically complex and expensive since each winding machine may comprise dozens of winding units and thus dozens of such devices.

[0016] In effect, the movement is carried out through a motor connected to a screw element parallel to the direction of movement of the containment element, using for the movement a so-called screw-nut coupling.

[0017] The device also comprises sensors, for example optical sensors, which are adapted to detect the height of the portion of the bobbin covered by yarn and transmit this information to a programmable control unit, which consequently commands the motor to lower the containment element.

[0018] Therefore, as mentioned above, the solutions proposed by the prior art, although widely used and functional, are not free from drawbacks.

[0019] First, the system is very complex because it requires continuous monitoring of the winding state of the yarn on the bobbin in order to continuously move the containment element.

[0020] Further, as stated above, it is an expensive system because it envisages the use of a motor, means to

transform a rotational motion into a translational motion of the containment element, and sensors to evaluate the amount of yarn wound on the bobbin.

[0021] Thus, it is obvious that the cost of incorporating these devices into all the winding units has a major impact on the final cost of the winder.

[0022] These systems further provide for the system to rise whenever there is a breakage to allow the thread to be picked up freely from the bobbin with the appropriate nozzles or even to provide additional means for retaining the thread.

[0023] Moreover, the reduction in tension that is achieved may, with some yarns, worsen the hairiness of the yarn due to the friction that is generated.

DISCLOSURE OF THE INVENTION

[0024] There is therefore a need to at least partially resolve the disadvantages and limitations mentioned with reference to the prior art.

[0025] Thus, there is a need to provide a device for controlling the tension of the balloon that allows the unwinding tension to be better managed and the production speed to be increased without adding hairiness to the thread. Such a device should have a simpler structure than the devices of the prior art and thus be easily and inexpensively implemented in a winding unit.

[0026] Moreover, always with a view to simplifying the structure of the device, there is a need for a system that does not require the use of additional sensors to establish the winding state of the yarn on the bobbin.

[0027] Also, there is a need for a device for controlling the balloon that is more effective than the devices of the prior art.

[0028] These requirements are at least partially met by a device for controlling a balloon according to claim 1, a winding unit comprising said device according to claim 16, and a method for controlling the balloon according to claim 17.

DESCRIPTION OF THE DRAWINGS

[0029] Further features and advantages of the present invention will become more apparent from the following detailed description of preferred, non-limiting embodiments thereof, wherein:

- Fig. 1 shows schematically a front view of a device for controlling a balloon according to the present invention;
- Fig. 2 shows schematically a perspective view of a device for controlling a balloon according to the present invention;
- Fig. 3 shows schematically a perspective view of a device for controlling a balloon according to the present invention;
- Fig. 4A, 4B, and 4C show schematically three possible unwinding steps according to an embodiment of a method for unwinding a yarn from a bobbin according to the present invention;
- Fig. 5 shows schematically a front view in cross section of a portion of a device for controlling a balloon according to the present invention;
- Fig. 6 shows schematically a front view of a device for controlling a balloon according to the present invention;
- Fig. 7 shows schematically a front view in cross section of a component of a device for controlling a balloon according to the present invention;
- Fig. 8 shows schematically a perspective view of a component of a device for controlling a balloon according to the present invention;
- Fig. 9 shows schematically a plan view from above of a portion of a device for controlling a balloon according to the present invention;
- Fig. 10 shows schematically a plan view from below of a portion of a device for controlling a balloon according to the present invention; and
- Fig. 11 shows schematically a front view of a portion of a device for controlling a balloon according to the present invention.

[0030] Elements or parts of elements common to the embodiments described hereinafter will be indicated with the same numerical references.

DETAILED DESCRIPTION

[0031] In Fig. 1 the general numerical reference 12 is used to indicate a device for controlling a balloon during the unwinding of a yarn 14 from a bobbin 16 in a winding unit 18.

[0032] The device 12 comprises:

- a first substantially tubular containment element 20 having a longitudinal axis x and a through opening 22 adapted for the passage of the yarn 14 leaving the bobbin 16; and
- a support 24 adapted to support the first containment element 20, and adapted to be fixed to a structure of a winding unit 18.

[0033] As shown in the figures, the first containment element 20 comprises a first containment component 120 and a second containment component 220. Further, the support 24 comprises a first arm 124 and a second arm 224 on which the first containment component 120 and the second containment component 220 are respectively positioned.

[0034] The device 12 comprises drive means 26 adapted to move the arms 124, 224, and consequently the containment components 120, 220, between two positions: a first position wherein the containment components 120, 220 are spaced apart from each other, and a second position wherein the containment components 120, 220 are closer together with respect to the first po-

sition.

[0035] According to a possible embodiment, in the second position the containment components 120, 220 may be in contact with each other.

[0036] In other words, in the first position, the containment components 120, 220 may be spaced apart so as not to interact substantially with the balloon that develops during the unwinding of the yarn 14 from the bobbin 16.

[0037] Whereas, in the second position, the containment components 120, 220 may be closer together, and possibly in contact with each other, so as to interact substantially with the balloon that develops during the unwinding of the yarn 14 from the bobbin 16.

[0038] According to a possible embodiment, one or more intermediate positions may be provided between the first position and the second position of the containment components 120, 220 so as to allow for a containment of the balloon depending on the size of said balloon.

[0039] According to a possible embodiment, in the second position, the through opening 22 may be substantially cylindrical with an outward flaring 28 at the input portion of the yarn 14.

[0040] In effect, as shown for example in Fig. 1 or 2 the containment components 120, 220 may have a widening, and therefore an increase in the diameter of the through opening 22, at the input portion of the yarn 14.

[0041] According to a possible embodiment, the through opening 22 may have a narrowing 29 at a position opposite the input of the yarn of the through opening 22.

[0042] According to a possible embodiment, which may be seen for example in Fig. 3, the first arm 124 and the second arm 224 may rotate in opposite directions about respective rotation axes y, z spaced apart from each other and substantially parallel to said axis x.

[0043] The first arm 124 and the second arm 224 may be provided with cogwheels 126, 226, integral with their respective arms, which mesh with each other and are adapted to rotate about their respective axes y, z, so that the rotation of one arm causes the rotation of the other arm and are therefore synchronous.

[0044] One such embodiment is shown, for example, in Fig. 9, wherein the cogwheels 126, 226 are shown, which may also be incomplete and provided only at one portion of the circumference of the cogwheel.

[0045] According to a possible alternative embodiment, the drive means may comprise alternative systems to the cogwheels 126, 226 such as an articulated, quadrilateral kinematic motion or a crank mechanism.

[0046] According to a possible embodiment, the drive means 26 may comprise a linear actuator 260 connected to one of the arms 224 at a lever 128 arranged on the arm 224, whereby a linear movement of one operating end of the linear actuator 260 causes a rotation of the arm 224, and consequently of the other arm 124.

[0047] The linear actuator may, for example, be a pneumatic actuator, or an electric actuator, in a way known per se to the person skilled in the art.

[0048] According to alternative embodiments, the arms 124, 224 may be driven in different technical ways, such as through the use of rotary actuators or the like. Also in this case, the actuators used may, for example, be pneumatic or electric.

[0049] More specifically, it is also possible to envisage two actuators being provided, one for each arm. In this case, the arms may also be without the coupling with cogwheels.

[0050] According to an alternative embodiment, the drive means 26 may be adapted to move the containment components 120, 220 in a straight direction. For example, a linear actuator shared by both the containment components 120, 220 or a linear actuator for each linear element may be provided.

[0051] Moreover, the drive means may be suitable for achieving asynchronous movement of the containment components 120, 220.

[0052] In a further alternative embodiment, the linear actuator may, for example, be directly keyed to one of the containment components and, by means of a mechanical transmission, may also move the other containment component.

[0053] The device 12 comprises a second static containment element 50 arranged downstream from the first containment element 20, comprising a second through opening 52 arranged with a base portion 54 in use facing toward the first containment element 20, having a substantially rectangular cross section with respect to the longitudinal axis x.

[0054] Advantageously, the second containment element 50 may be arranged on the same support 24 as the first containment element 20.

[0055] According to a possible embodiment, the base portion 54 of the second through opening 52 may have a substantially square cross section. More specifically, it may have a substantially square cross section with a side dimension of between 20 mm and 30 mm, preferably between 24 mm and 28 mm, and even more preferably around 26 mm. Further, the height of the base portion 54 of the second through opening 52, according to a longitudinal direction perpendicular to the cross section of the second through opening 52, may be between 30 mm and 45 mm, and preferably between 35 mm and 40 mm.

[0056] According to a possible embodiment, the substantially rectangular or square cross section may comprise inward protrusions located at the midpoint of each side making up the rectangular or square cross section.

[0057] The second through opening 52 may comprise a central portion 56 having a substantially truncated pyramid shape with a larger base at the base portion 54 opposite the input section of the yarn in the second containment element 50.

[0058] According to a possible embodiment, the truncated pyramid-shaped central portion 56 comprises a smaller base having a substantially circular shape opposite the larger base. The second through opening 52 may further comprise a substantially cylindrical end portion 58.

[0059] In other words, according to a possible embodiment, the yarn 14, during an unwinding stage of a bobbin, may pass within the first containment element 20 and subsequently, within the second containment element, in particular within the base portion 54, the central portion 56, and the end portion 58.

[0060] As shown in Fig. 10, the sides of the cross section of the second containment element 50 may, for example, be joined together so that there are no internal edges.

[0061] In effect, precisely because of the rectangular or square cross section, the continuity of the balloon is interrupted during its formation (Fig. 4A). More specifically, the continuous rubbing and bumping of the yarn on the sides of the containment element delays the formation of the balloon and thus the increase in the longitudinal tension component of the yarn.

[0062] Once the amount of yarn in the bobbin decreases, the balloon tends to form, in a lower position than before.

[0063] In effect, it was seen that in the first part of the unwinding of the bobbin (Fig. 4A), the containment of the balloon is less effective than the continuous breakage through the second containment element 50. In this way it is possible to contain the tensions because the height of the balloon is contained.

[0064] Once the bobbin begins to empty, for example, about halfway through the bobbin, the second containment element 50 loses effectiveness as the balloon height, and consequently the yarn tension, increases.

[0065] The height causes the thread to slide on the tip of the tube, thus losing contact with the inner surfaces of the second containment element 50 (Fig. 4B).

[0066] At this point, the first containment element 20 closes in the second position.

[0067] The method for controlling a balloon through a device 12 essentially comprises:

a. a step in which an operating parameter is measured during the unwinding of a yarn 14 from a bobbin 16;

b. a step in which the operating parameter is compared with predefined values of the operating parameter, for example in a programmable control unit (not shown in the accompanying figures); and

c. based on the comparison in step c, the containment element 20 is actuated so that the first containment component 120 and the second containment component 220 move from the first position to the second position, or to an intermediate position, if present.

[0068] According to an embodiment, the operating parameter used may be a percentage of the yarn unwound from the bobbin.

[0069] According to a possible alternative embodiment, the operating parameter may, for example, be the yarn tension, measured downstream of the device 12.

[0070] Thus, actuation of the containment element 20 from the first position to the second position, or to an intermediate position, if present, may occur when a specified value of the yarn tension measured downstream of the device is exceeded.

[0071] Further, to prevent tension spikes from compromising an effective actuation of the first containment element, the actuation of the containment element from the first position to the second position, or to an intermediate position, if present, may be performed when a specified tension value is exceeded a predetermined number of times, or for a predetermined length of time.

[0072] In this way, it is possible to prevent a temporary disturbance in the system from compromising the winding.

[0073] For example, it is possible to use the thread tension adjustment system that is already installed on the winders. In effect, the thread tensioning system normally works between a minimum and a maximum value which correspond respectively to a maximum and a minimum winding tension, and it is possible to make use of said system to adjust the winding speed, as well as the actuation of the first containment element.

[0074] Specifically, the thread tension adjustment system may be used so that the first containment element is actuated when the thread tensioner operates near the minimum value (corresponding to a high winding tension), or when a specified value is exceeded a predetermined number of times, or for a predetermined length of time.

[0075] As for the adjustment of the distance between the device 12 and the bobbin, this depends on the unwinding parameters as will be obvious to the person skilled in art. More specifically, the distance between the device and the tube of the bobbin may be adjusted according to, for example, the behavior of the balloon at certain unwinding speeds, and the yarn count.

[0076] For example, the distance between the second containment element and the tube of the bobbin may be about 10-30 mm, whereas the distance between the first containment element and the second containment element may be about 4-12 mm.

[0077] According to one possible embodiment, the distance between the end of the tube of the bobbin and the narrowing 29 of the first containment element may be between 4 and 12 mm.

[0078] According to one possible embodiment, the through opening 22 may have a diameter of about 26-42 mm. The narrowing 29 may be approximately 22-40 mm in diameter.

[0079] In the attached figures, only a portion of the winding unit is shown, since the other components are known per se to the person skilled in the art.

[0080] The advantages of the method according to the present invention are therefore now also apparent.

[0081] First, a device and method for controlling a balloon have been provided that allow for more efficient control than devices of the prior art.

[0082] In particular, unlike the devices of the prior art, the control of the balloon occurs indirectly, through the measurement of the tension of the yarn during the step of unwinding from the bobbin.

[0083] In other words, no dedicated optical sensors or the like are used to determine the degree of filling of the bobbin or the balloon status.

[0084] Advantageously, the first containment element 120 and the second containment element 220 close just above where the yarn detaches from the winding of the coils. Doing so generates a controlled tension sufficient to avoid rubbing against the tube, but not so high as to unwind several coils at once or, worse, so as to break the yarn.

[0085] Thus, the main advantages that may be achieved are a stabilization and reduction of the unwinding tension, the fluctuations of which may stress the yarn during said unwinding. In this way it is possible to increase the unwinding speed in the final step, even by 30-40%.

[0086] The result is an increase in productivity, since traditional winding systems, conversely, impose a decrease in winding speed.

[0087] Moreover, the effect whereby several coils come off the bobbin at the same time is consistently reduced, and the number of yarn breakages is reduced.

[0088] A person skilled in the art may make modifications to the embodiments described above or substitute described elements with equivalent elements, in order to satisfy particular requirements, without departing from the scope of the accompanying claims.

Claims

1. Device (12) for controlling a balloon during the unwinding of a yarn (14) from a bobbin (16) in a winding unit (18) comprising:

   - a first containment element (20) substantially tubular, having a longitudinal axis (x) and a through opening (22) adapted to the passage of the yarn (14) coming out of said bobbin (16);
   - a support (24) adapted to support said first containment element (20), and adapted to be fixed to a structure of a winding unit (18);
   wherein said first containment element (20) comprises a first containment component (120) and a second containment component (220);
   wherein said support (24) comprises a first arm (124) and a second arm (224) on which said first containment component (120) and said second containment component (220) are respectively positioned;
   wherein said device (12) comprises drive means (26) adapted to move said arms (124, 224) and consequently said containment components (120, 220), between two positions: a first position in which said containment components (120, 220) are spaced apart, and a second position in which said containment components (120, 220) are closer together with respect to the first position; and
   wherein said device (12) comprises a second static containment element (50), arranged downstream of said first containment element (20), said second containment element (50) being arranged with a second through opening (52) comprising a base portion (54) facing, in use, said first containment element (20), having a substantially rectangular cross-section with respect to said longitudinal axis (x).

2. Device (12) for the control of a balloon according to the preceding claim, **characterised in that** in said second position said containment components (120, 220) are in contact with each other.

3. Device (12) for the control of a balloon according to any of the preceding claims, **characterised in that** said containment components (120, 220) have a widening, and therefore an increase in the diameter of the through opening (22) at the yarn input portion (14).

4. Device (12) for the control of a balloon according to any of the preceding claims, **characterized in that** said first arm (124) and said second arm (224) rotate in opposite directions, around respective axes of rotation (y, z) spaced apart, and substantially parallel to said axis (x).

5. Device (12) for the control of a balloon according to the preceding claim, **characterized in that** said first arm (124) and said second arm (224) are provided with a cogwheel (126, 226) integral with the respective arms, which mesh with each other and are adapted to rotate around said respective axes (y, z), so that the rotation of said first arm (124) and said second arm (224) is synchronous.

6. Device (12) for the control of a balloon according to the preceding claim, **characterized in that** said drive means (26) comprise a linear actuator (260) connected to one of said arms (124), said linear actuator (260) being connected to a lever (128), provided on said arm (124), so that a linear movement of one operating end of said linear actuator (260) causes a rotation of said arm (124) .

7. Device (12) for the control of a balloon according to any of the preceding claims, **characterised in that** said drive means (26) comprise an electric type actuator for the movement of said containment components (120, 220) .

8. Device (12) for the control of a balloon according to any of the preceding claims, **characterised in that** said base portion (54) of said second through opening (52) has a substantially square cross-section.

9. Device for the control of a balloon according to the preceding claim, **characterised in that** the side of said substantially square cross section of said second through-opening (52) has a dimension between 20 mm and 30 mm, preferably between 24 mm and 28 mm, and even more preferably around 26 mm.

10. Device for controlling a balloon according to any of the preceding claims, **characterised in that** said base portion (54) of said second through-hole (52) has a height, in a longitudinal direction perpendicular to the cross-section of said through-hole, between 30 mm and 45 mm, preferably between 35 mm and 40 mm.

11. Device for the control of a balloon according to any of the preceding claims, **characterized in that** said second through opening (52) comprises a central portion (56) substantially in the shape of a truncated pyramid having a larger base at said base portion (54), in the opposite position to the input section of the yarn into the second containment element (50).

12. Device (12) for the control of a balloon according to the preceding claim, **characterised in that** said central, truncated pyramid portion (56) comprises a smaller base with a substantially circular shape, opposite the larger base.

13. Device according to any of the preceding claims, **characterised in that** said second through opening (52) comprises a final portion (58) which is substantially cylindrical.

14. Device according to any of the preceding claims, **characterized in that** it comprises a programmable control unit suitable for comparing a measured operating parameter value with a reference value, and on the basis of such comparison, operating the containment element (20) accordingly so that said first containment component (120) and said second containment component (220) move from the first position to the second position, or to an intermediate position if present.

15. Winding unit (18) comprising a device (12) for controlling a balloon during the unwinding of a yarn (14) from a bobbin (16) according to any of the preceding claims.

16. Method for controlling a balloon by means of a device (12) according to any of the claims 1-14, **characterized in that** it comprises:

a. a step in which an operating parameter is measured during the unwinding of a yarn (14) from a bobbin (16);
b. a step in which said operating parameter is compared with predetermined values of said operating parameter; and
c. based on the comparison in step c, said containment element (20) being operated in such a way that said first containment component (120) and said second containment component (220) move from the first position to the second position, or to an intermediate position if present.

17. Method for controlling a balloon according to the preceding claim, **characterized in that** said operating parameter is the yarn tension, measured downstream of the device (12).

18. Method for controlling a balloon according to any of the claims 16-17, **characterised in that** said actuation of said containment element from the first position to the second position, or to an intermediate position if present, occurs when a certain value of the yarn tension measured downstream of the device is exceeded.

19. Method for controlling a balloon according to any of the claims 16-18, **characterised in that** said actuation of said containment element from the first position to the second position, or to an intermediate position if present, occurs when a specified yarn tension value is exceeded for a predetermined number of times, or for a predetermined length of time.

20. Method for controlling a balloon according to claim 16, **characterised in that** said actuation of said containment element from the first position to the second position, or to an intermediate position if present, occurs when a percentage of unwound yarn is exceeded.

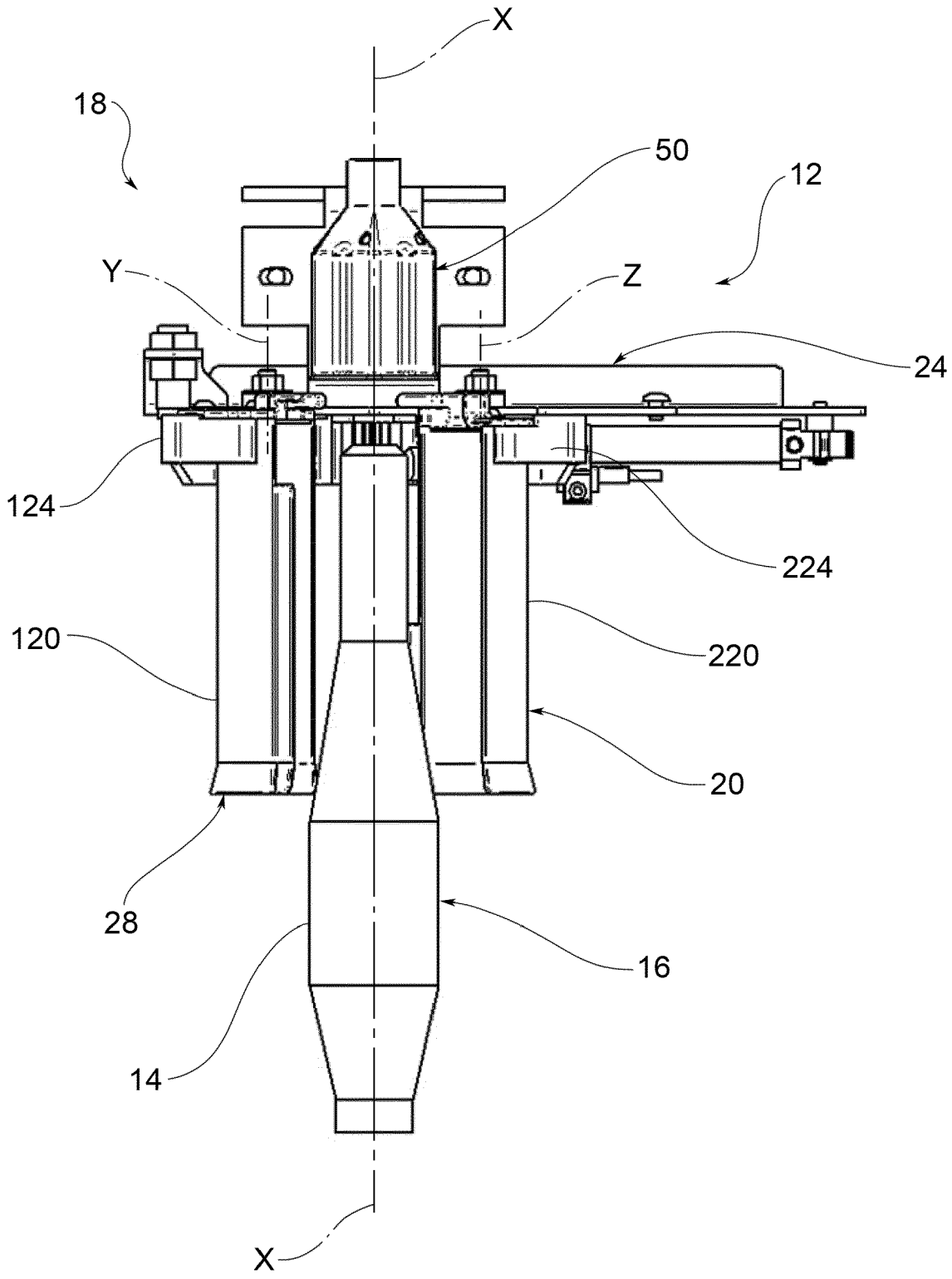

FIG.1

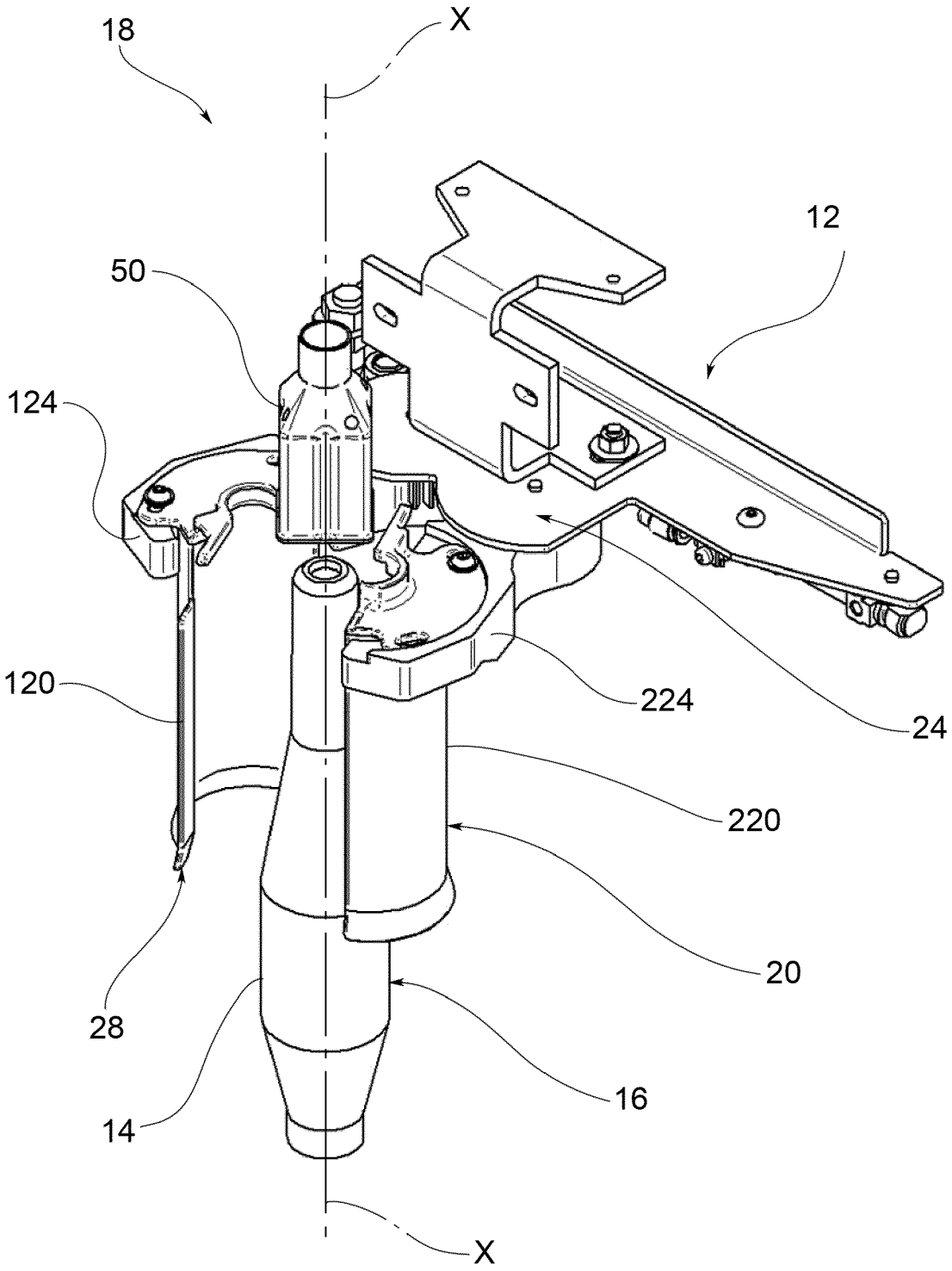

FIG.2

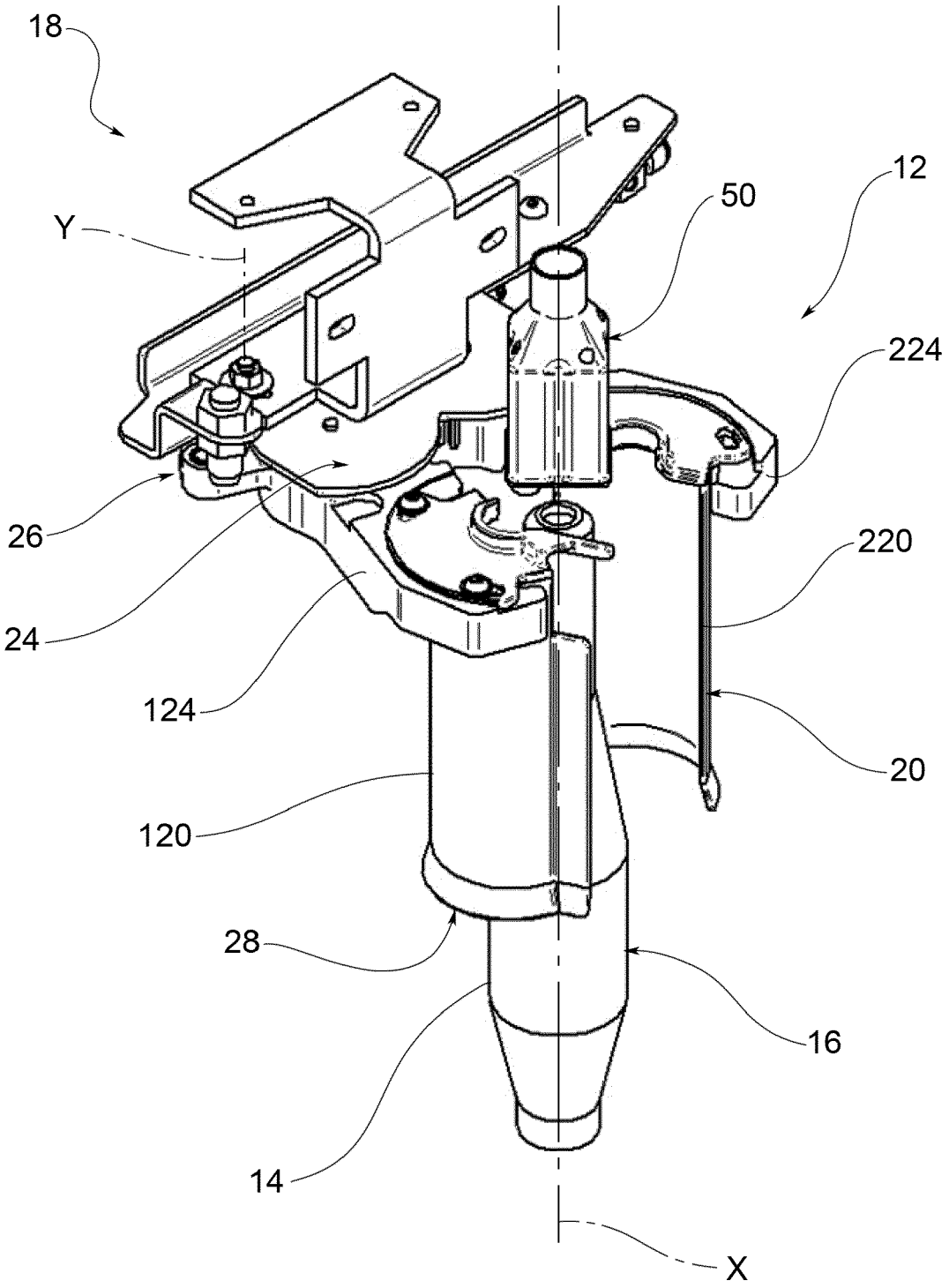

FIG.3

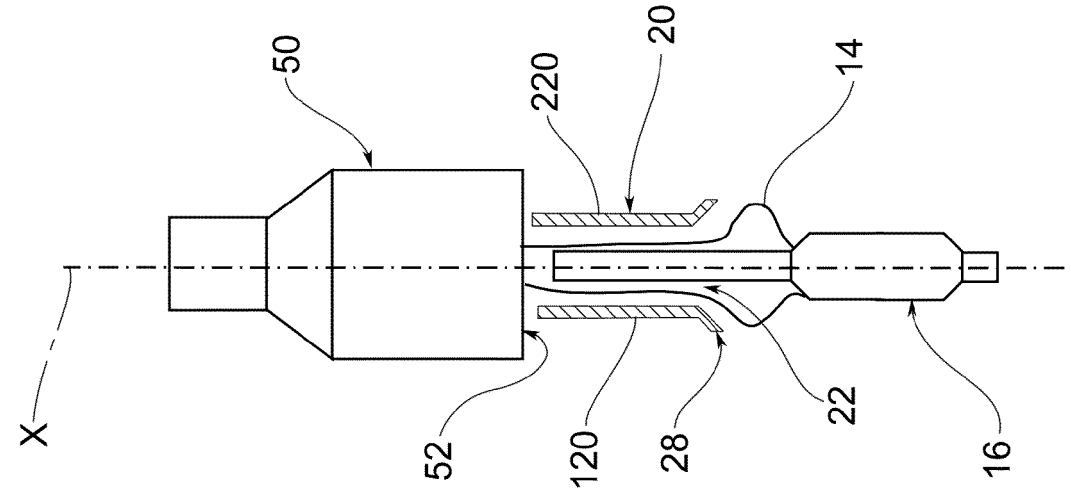

FIG.4c

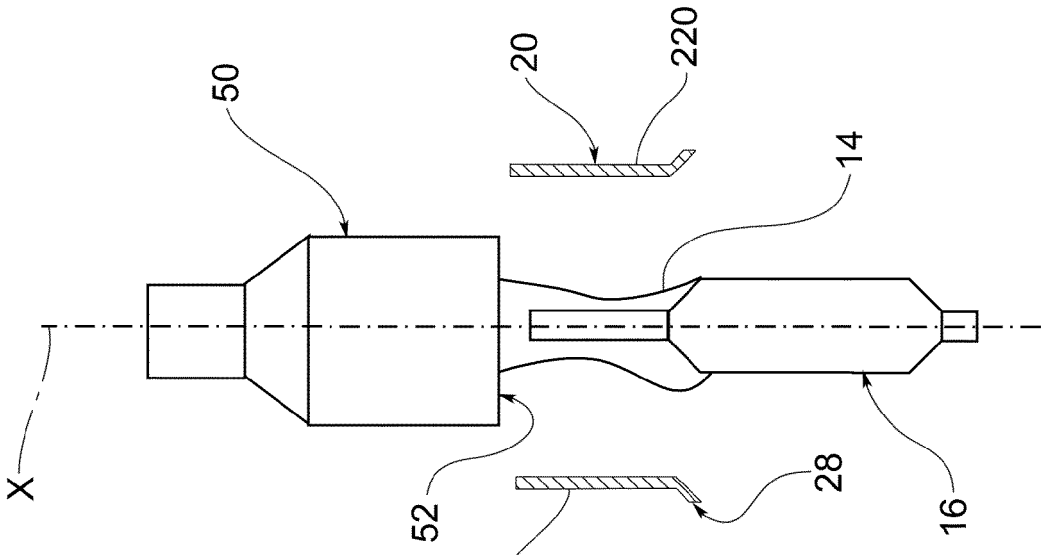

FIG.4b

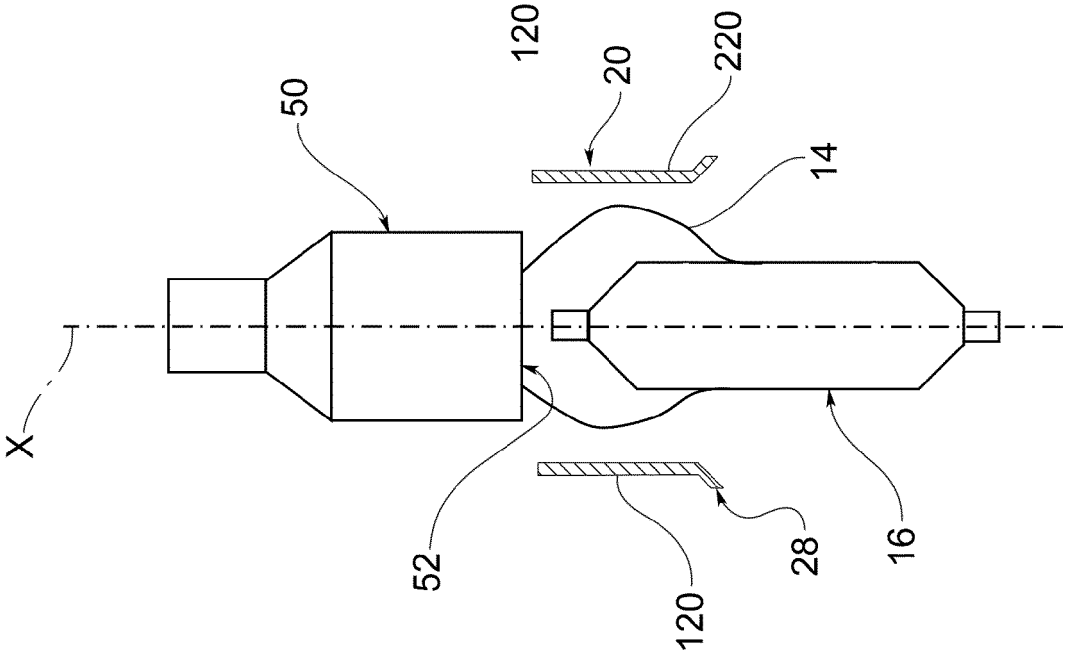

FIG.4a

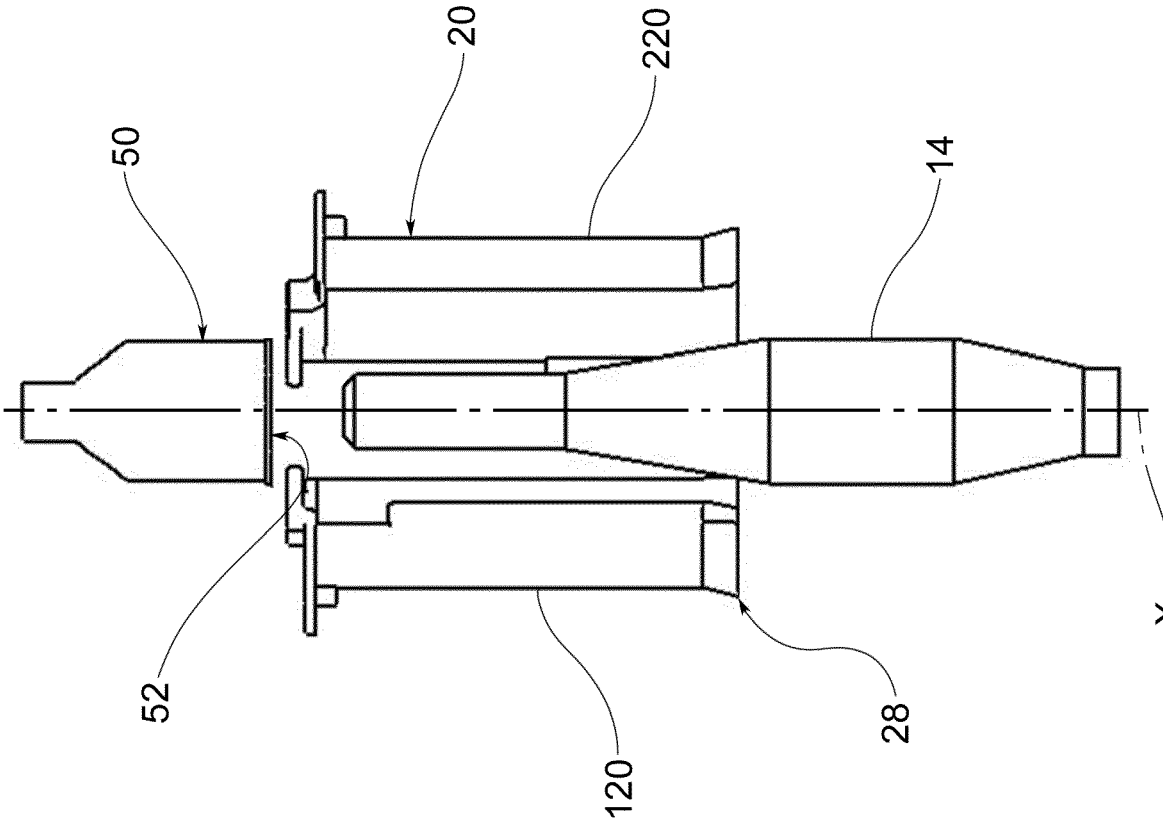

FIG.6

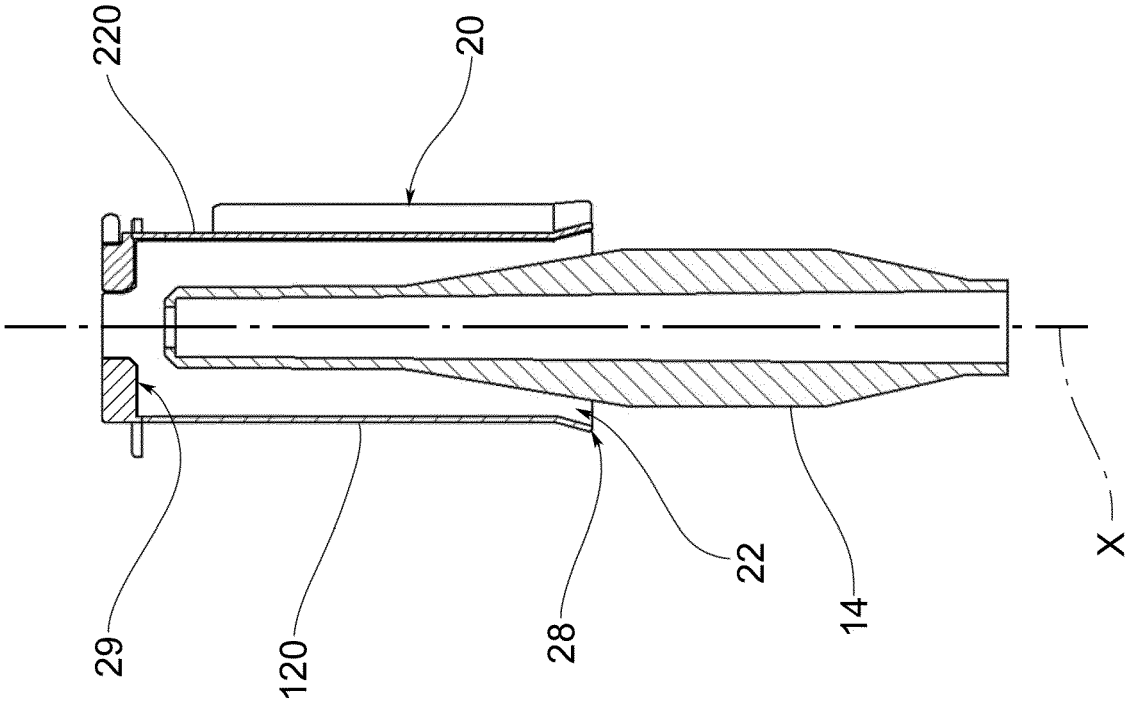

FIG.5

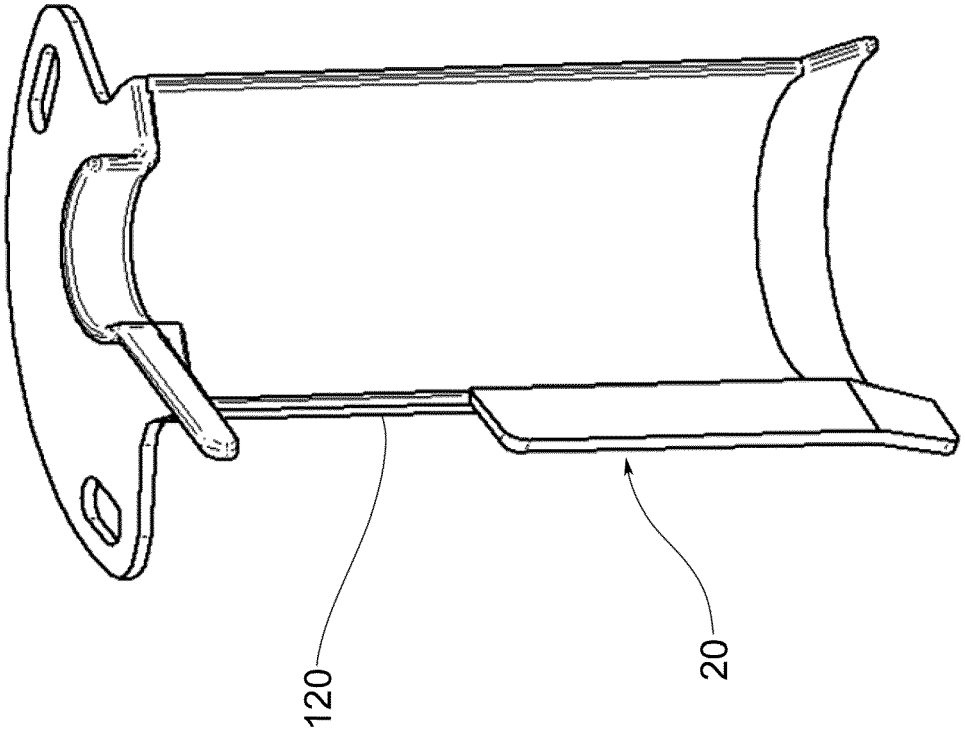

FIG.8

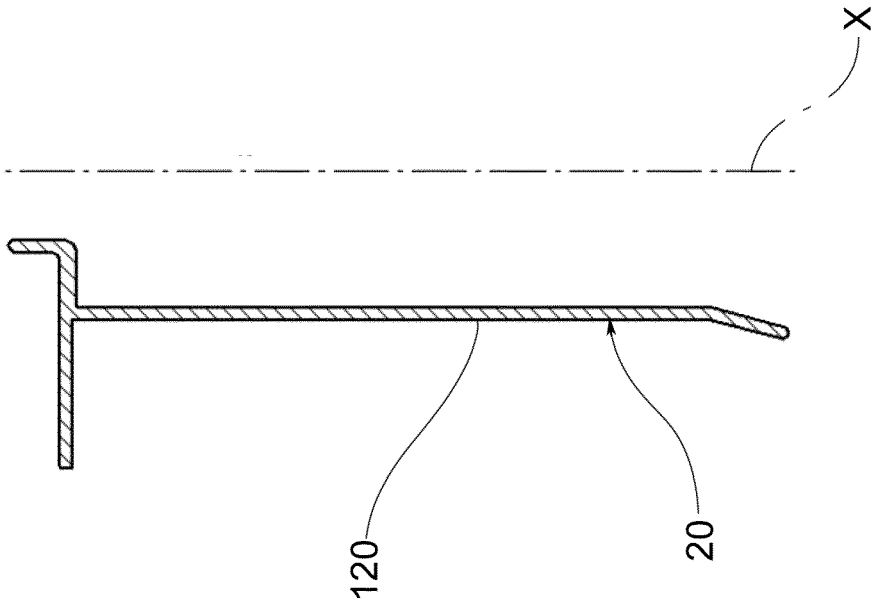

FIG.7

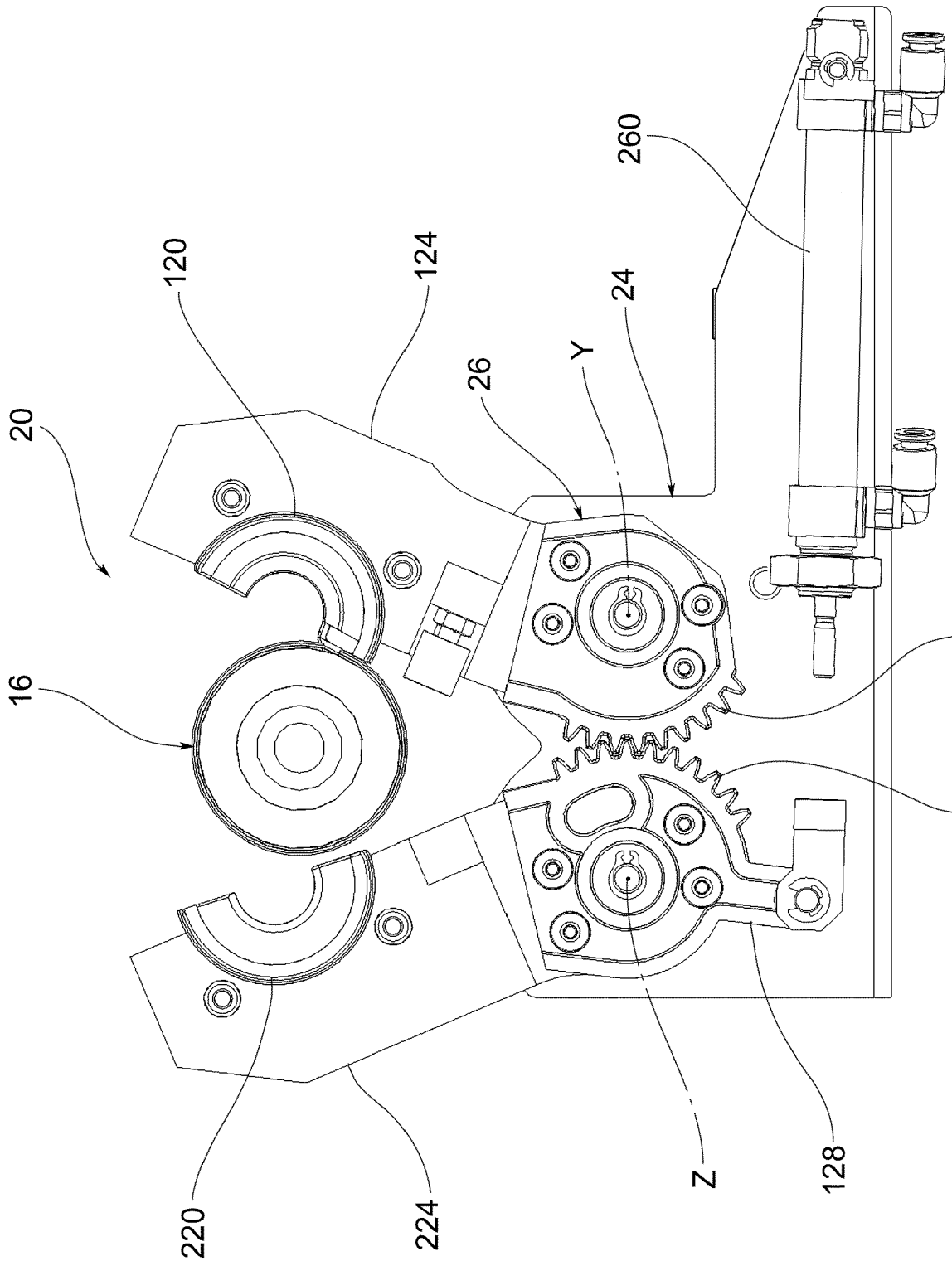

FIG.9

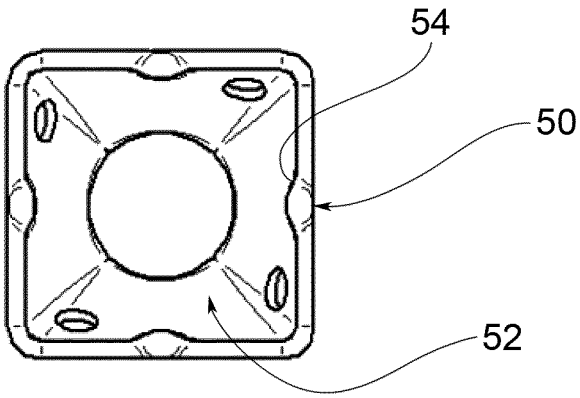

FIG.10

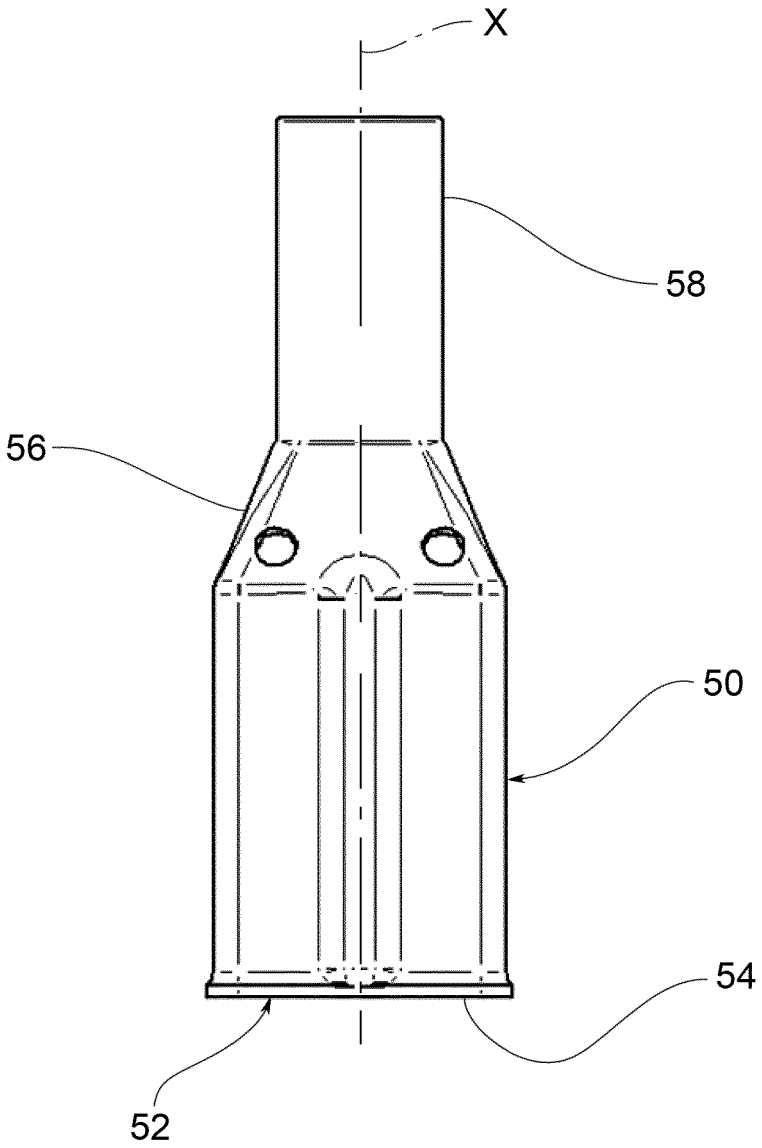

FIG.11

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EUROPEAN SEARCH REPORT

Application Number
EP 21 18 7905

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 4 673 138 A (ICHIBA YOSHIYUKI [JP]) 16 June 1987 (1987-06-16) * column 4, line 46 - line 59 * * figures 10,11 *	1-13,15 14,16-20	INV. B65H57/22
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			TECHNICAL FIELDS SEARCHED (IPC)
			B65H

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 December 2021	Guisan, Thierry

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