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(54) **Device and process for finishing the bobbins of a ring spinning frames before transferring them to the automatic winding**

(57) Device and process for preparing, during the doffing step, the bobbins (25) produced in a ring spinning frame, unloading them with the yarn tail already inside their tube by means of the previous winding of their terminal part on the top (35) of the spinning spindle (26), then at its base, and then proceeding to the doffing.

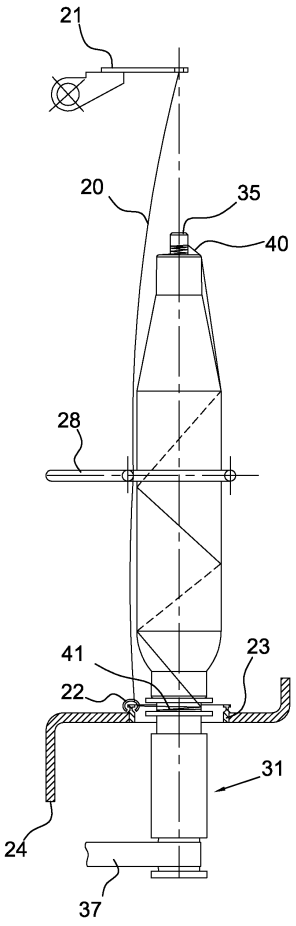

Fig. 3

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Description

[0001] The present invention refers to a device and a process for the preparation of bobbins to feed to the winding stage.

[0002] In industrial practice, the yarn production technique is widely prevalent that includes a first stage of ring spinning which produces bobbin yarn, followed by a second winding stage in which the yarn is unwound from its bobbin, cleaned of its defects and rewound in a package, which contains a much greater yarn quantity and which corresponds to a considerable number of processed bobbins. The winding processing is much faster than the spinning, and thus a small quantity of spinning stations or units, on the order of several dozens, is capable of completing the production of a great number of ring spinning units, on the order of several thousand.

[0003] The transfer between the two processing steps of the bobbins replete with yarn, from the spinning frame to the winder, and the transfer of the emptied tubes from the winder to the spinning frame, occurs in the so-called "yarn-winders" by directly and individually transferring the bobbins between the two processing stages. In the most recently ideated automatic winders, widely prevalent is the technique of moving the bobbins and the tubes by using peg supports, to be placed on conveyor belts or similar movement members that serve to individually bring said bobbins and tubes.

[0004] Still generally, in the yarn-winders, a spinning frame is coupled to a winder having hourly winding capacity that considerably exceeds the spinning capacity of the spinning frame, so to complete, with a certain margin, the entire spinning production without dead times.

[0005] Generally, in the prior art the bobbins which come from the spinning frame have the terminal part of their yarn wound a specific number of turns around the package of the bobbin or its base. Still according to the prior art, the preparation of the bobbin is carried out on the winder, before being fed to one of the winding stations which compose the automatic winder, with a processing which is carried out in several steps. The terminal part of the yarn on the bobbin must be drawn, freeing it from the base of the tube and unwinding it from the outer surface of the bobbin for a certain length. The yarn is then cut to length and inserted in the upper end of its tube, from which the winding station - at the start of the unwinding of every new bobbin fed thereto - can draw it, join it with the terminal yarn tail of the preceding bobbin, available on the package, and then restart the winding until the package being processed is completed. Still generally speaking, such preparation is requested both for the new bobbins coming from the spinning frame and for the few bobbins not completely unwound, if they had significant residual yarn still wound thereon that is worth recovering.

[0006] The preparation stations of the bobbins in the context of the winder thus require a certain time interval for every bobbin to be prepared, and thus they limit the winding capacity. Especially for the winders constituted by many winding units, they require a plurality of preparation stations for each winder; this is particularly the case for the yarn-winders which must wait every time for the doffing of the bobbins from the spinning frame connected thereto in order to restart the processing. The multiplication of the preparation units of the bobbins situated on each winder significantly increases their overall length, the transport circuits and consequently machine costs.

[0007] The present invention is aimed for the preparation of the bobbins already in the final step of the ring spinning, before being sent to the winding stage which is connected to the spinning frame.

[0008] The invention is herein described with reference to a typical embodiment thereof in a ring spinning station.

[0009] The present invention, in its most general meaning as bobbin preparation device, is defined in the first claim. Its preferred variants or embodiments are defined in the dependent claims 2-8.

[0010] The present invention, in its bobbin preparation process meaning before bobbin doffing and winder transfer, is defined in claim 9. Its preferred embodiments or variants are defined in the dependent claims 10-13. The latter claims regard the application of the invention in a yarn-winder.

[0011] The characteristics and advantages of the preparation device and process of the bobbins of the present invention is more evident from the exemplifying and non-limiting description of a typical embodiment thereof, illustrated in figure 1 regarding the device according to the invention.

[0012] In figures 2-4, the steps are illustrated of the bobbin preparation process, completed before the doffing according to the present invention, including:

Figure 2 shows the winding of the terminal yarn tail of the bobbin on the top of the bobbin carrier spindle,
Figure 3 shows the subsequent binding of the terminal yarn tail of the bobbin on the base of the bobbin carrier spindle,
Figure 4 shows the final step of the doffing of the bobbin from its bobbin carrier spindle,
Figure 5 shows the bobbin carrier spindle with the new tube 26 and the yarn tail of the upper side available for a new bobbin,
Figure 6 shows possible variants of the upper end of the bobbin carrier spindle.

[0013] For an improved comprehension of the problems and technical solutions connected with the ring spinning, the conventional scheme is described overall of a spinning unit with reference to figure 1, keeping in mind that every spinning frame is composed of a plurality of spinning stations aligned along its faces. Every spinning face is composed of hundreds of such stations, which commonly derive their driving from motors which actuate along longitudinal axes, and their functions from dispens-

er units which distribute them along the machine.

[0014] The sliver 1 comes from a package hung above the spinning station, not indicated in the figure for the sake of simplicity, and is first brought forward to the drafting unit 2. This generally consists of a plurality of driving members of the sliver at increasing linear speeds; such driving members gradually refine such sliver by making the fibres which compose it slide between them. In figure 1, the drafting group is depicted, as an example, with an initial pair of belts 3 and 4, of which the lower belt 3 is driven into movement by a knurled segment 5 of a longitudinal bar 6, in common with the adjacent spinning stations and rotating in accordance with the arrow a).

[0015] The path of the lower belts 3 is approximately triangular and determined by a common terminal bar 7 which is longitudinally extended. The upper belt 4 is idle and is driven in movement in accordance with the arrow b) by the lower belt 3, on which it is pressed by an overlying support, not indicated in the figure for the sake of simplicity. The path of the upper belt 4 is also approximately triangular and determined by a roller 8 and by a fixed terminal bar 9.

[0016] Downstream of the belts 3 and 4, a pair of drafting rollers 11,12 is placed, which impart the final drafting to the sliver, since they are provided with a linear speed greater than that of the preceding belts 3,4. The lower roller is composed of a grooved segment 11 of a longitudinal bar 13, shared with the adjacent spinning stations and rotating in accordance with the arrow c). The upper counter-roller 12 is idle and it too is pressed by a overhanging support means (not shown in the drawings), against the roller segment 11, which drives it in rotation in accordance with the arrow d), with the refined sliver interposed between them, and which gives rise to the yarn 20.

[0017] The yarn 20 first passes into the fixed thread guides 21, typically in pig's tail form, and from here into the rotating small ring 22, which rotates on a fixed ring 23 borne by a ring-carrier platform 24, shared with the adjacent spinning units, continuously moved in accordance with the arrow e) in two directions, so to continuously raise and lower all the fixed rings 23 of the single spinning units and to distribute the yarn winding on every bobbin 25 wound on its tube 26. The tube 26 is fit on the underlying rotating spindle 30, which is driven into rotation at high speeds, currently in the range of 10,000-20,000 rev/min. In general, such driving is carried out with longitudinal drive belts which slide engaged on the lower part 31 of the bobbin carrier spindle 30, shown in the subsequent figures 2-4.

[0018] With every rotation of the spindle 30, i.e. of the bobbin 25, the yarn released by the drafting group is drawn so to be wound on the bobbin 25. Substantially, a twisting turn of the yarn 20 is generated, which drives in rotation the rotating small ring 22, although with a slight delay due to its friction with the guide ring 23. If the spindle rotates N turns / minute and the cylinders 11,12 release L meters / minute of drafted sliver, except for shortening due to twisting, the twists T applied to a meter of produced yarn result equal to N/L.

[0019] The yarn 20 rotates in a whirling manner around the bobbin, forming the so-called "balloon" due to the centrifugal force. The balloon causes a significant stress on the yarn 20, and can be limited with a containment ring 28, in general of greater diameter than the size of the bobbin 25. The balloon containment ring 28 is firmly mounted on a platform thereof capable of vertical travel movements, which however maintain it above the level of the platform 24.

[0020] The twisting of the yarn is caused by the rotation of the bobbin 25 and is spread, together with the related stresses, rising up to the point at which the sliver of the yarn 20 is released by the final draft drums 11,12.

[0021] In order to wound the yarn thus twisted on the bobbin 25 in a regular manner, as it progressively forms, it is necessary to distribute it on the bobbin at different heights, continuously changing the level of the rotating small ring 22 borne by the ring-carrier platform 24, continuously moved by in accordance with the arrow e) in two directions, and modulating the deposition so as to continuously raise mid-point of the arrow e) travel. The deposition of the yarn 20 on the bobbin 25 generally starts in the lower part of the bobbin and grows upward in overlapped layers with conical progression, obtained with a series of slow, ascending movements of the ring-carrier platform 24 followed by sudden and slightly shorter descending movements. The object of such bobbin winding method is essentially that of giving a tapered shape to the bobbin, so that the bobbin results compact, so that it does not break up during its unwinding, and so that the yarn is unwound, substantially unwinding layer-by-layer from its upper conical part.

[0022] According to the present invention, the bobbin carrier spindle 30 is made with the following modes. It comprises:

- a lower cylindrical part 31, which always remains below the travel level of the ring-carrier platform 24 and which receives the rotation driving motion from a belt 37,
- a base part 32 on which the tube 26 abuts, shaped with a ring nut on which the yarn tail can be constrained,
- a cylindrical part 33 above the ring nut 32 of lesser diameter than the inner tube diameter 26, and of greater length with respect to said tube 26, such that its terminal part 35 - once the tube 26 is fit on the bobbin carrier spindle 30 - significantly projects from the top of the tube 26 and allows binding the yarn thereon, for example by winding it with a plurality of mutually overlapping coils.

[0023] The length of the part projecting from the terminal part 35 can be limited in the range of 8-15 mm, which is sufficient for the purpose of winding and holding yarn coils during the lifting of the completed bobbin. Along

such section, its cylindrical surface can be made with variants for modifying the adhesion of the wound yarn, shown in figure 6.

[0024] The ring-carrier platform 24 is provided with actuation which allows lifting until it brings the yarn 20 to be bound on the terminal part 35 of the bobbin carrier spindle 30.

[0025] As an example, the preparation of the bobbin is carried out as follows. The spinning process on the ring spinning frame is governed by a governing and controlling unit, which detects the achievement of the quantity of yarn in meters produced in bobbins 25 on every spinning frame unit. Such unit starts the bobbin completion process, before proceeding with the doffing of the completed bobbins 25 and their substitution with a new tube 26, on which a new bobbin will have to be wound, operating in parallel over all the spinning units which compose the ring spinning frame.

[0026] The spinning frame is provided with a doffing device that is capable of being to lifted so to simultaneously grasp all the completed bobbins 25 over all the spinning units, with a series of individual clamps which are brought to take the bobbins, to lift themselves, taking the bobbins from the bobbin carrier spindles 30 on which they are fit, and then to be lowered so to deposit them on the individual supports which constitute the transport system of the yarn-winder. The same device then provides for taking the empty tubes 26 and fitting them on the bobbin carrier spindles freed from the bobbins 25 in the preceding operation.

[0027] The first preparation stage of the completed bobbins 25 is shown in figure 2: the ring-carrier platform 24 is lifted to a maximum level in order to bring the rotating small ring 22 to deposit a winding 40 of yarn 20 on the upper terminal part 35 of the bobbin carrier spindle 30. In order to attain the object of temporarily binding the yarn 20 on said part 35, a small number of coils of the winding 40 will suffice. The length of such winding will then be available so to be inserted inside the tube 26 of the doffed bobbin.

[0028] As shown in figure 3, the bobbin is finished with the normal binding to the base of the tube 26. For such purpose, the ring-carrier platform 24 is lowered to a minimum level, in order to bring the rotating small ring 22 to deposit a winding 41 of yarn 20 on the ring nut of the part 32 on which the bobbin is abutted. In order to achieve the object of firmly binding the yarn tail 20 on said part 32, a number of coils of the winding 41 will suffice, in the range of 5-10. All the bobbin carrier spindles 30 are stopped and the spinning is interrupted, beginning the actual doffing operation.

[0029] As shown in figure 4, the ring-carrier platform 24 is then locked in the lowest position. The clamp 45 is brought to grasp the upper part of the tube of the bobbin 25 and to lift itself, taking the bobbin 25 off from the bobbin carrier spindle 30. In general, the clamp 45 is composed of a rigid cylindrical ring 46, having an annular chamber 47 at its interior that can be inflated with compressed air. The clamp 45 can thus be provided for engaging the body of yarn wound on the completed bobbin 25 or the upper part of its tube 26 free from the wound yarn. In both cases, the transverse size of the annular chamber 47 is determined such that, with non-inflated chamber, it can be easily inserted or taken off the body of the completed bobbin 25 or from its tube 26. The re-inflating with compressed air of the chamber 47 locks the bobbin 25 and allows lifting it and moving it by exerting the necessary forces, while the release of the compressed air allows freeing it after movement.

[0030] In figure 4, the clamp 45 has locked the upper part of the bobbin 25 and it has been raised to an intermediate point of its lifting travel so to remove the bobbin 25 from the bobbin carrier spindle 30. The thread guide 21 is lifted so to prevent interferences with the doffing.

[0031] The yarn 20 is held on one side of the bobbin 25 clamped by the clamp 45, and on the other side it is bound to the ring nut of the part 32 of the bobbin carrier spindle 30. Due to the lifting pull exerted by the clamp 45, the yarn 20 is broken in an intermediate point between clamp and ring nut. The bobbin 25 is removed from the bobbin carrier spindle 30 and the yarn winding 40 on its terminal part 35 is freed, falling inside the tube 26, the start of the bobbin unwinding thus remaining available at the start of its winding. The bobbin 25 doffed from its bobbin carrier spindle 30 is then deposited on one of the peg support pins which act as a carrier of the full bobbins and the empty tubes.

[0032] According to an improved embodiment of the present invention, the clamp 45 operates on the top of the tube 26 - as shown in figure 4 - and is provided with a blowing nozzle (not shown in the figure for the sake of simplicity). At the time of the release of the tube of the bobbin doffed on its peg by deflating the membrane 47, such blowing nozzle injects an air jet inside the tube, making the entire yarn tail of the winding 40 enter inside.

[0033] In figure 5, the bobbin carrier spindle 30 is shown which has received the new tube 26 for starting the production of the new bobbin. The yarn tail coming from the drafting group 2 passes through the small ring 22 and is bound to the ring nut 32. From here, the yarn tail of the winding 41 can be retaken, for once again starting the spinning on the changed tube.

[0034] In figure 6, several of the embodiments of the terminal part 35 of the bobbin carrier spindle 30 are shown. The variant A shows the cylindrical terminal part 35 machined with opening 51 slightly hollow in order to determine the deposition level of the winding 40. The variant B shows the cylindrical terminal part 35 made rougher in its peripheral part 52, for example machined with knurling, in order to favour the adhesion of the yarn 20 coils at the desired level. The variant C shows the cylindrical terminal part 35 of modifiable length. It can be made removable or substitutable with respect to the underlying cylindrical part 33. For example, the part 35 is mounted with a thread 55 or with an equivalent mechanical connection. Alternatively, the same terminal part 35

can be raised or lowered with respect to the underlying part 33, by screwing it or unscrewing it from its thread 55, possibly inserting thicknesses of collar form.

[0035] The variant C allows adapting the ring spinning frame to processing with tubes 26 of different length, in order to produce yarn batches wound on bobbins 25 that are larger or smaller. In such situation, terminal parts 35 of suitable length can be prepared on the bobbin carrier spindles 30 in the ring spinning units, such parts 35 making the projection level of said terminal part consistent with the length of the new tubes to be used.

[0036] During the doffing process, the plurality of the bobbins 25 - with their terminal yarn end inserted in the tube - is then delivered to the transport circuit for their sending to the winder.

[0037] Compared to the bobbin preparation systems available in the prior art, the preparation process and device of the bobbin still situated on the spinning frame according to the present invention offers considerably advantages. At the least the following advantages of the invention merit a brief mention below.

[0038] With respect to the technical solutions currently in use which operate on the winder, the winder is thus fed with new, already-ready bobbins which can immediately used without delay. The small part of rejected bobbins and those not completed by the spinning units can be prepared in an out-of-production-line transport branch, without affecting the normal winding process, by an auxiliary preparation unit which does not have to respect restricted time limits and can work with the best yield and maximum reliability.

[0039] The substantial elimination of the line preparation units of the bobbins on each winder simplifies its operation and substantially reduces the overall length of the machine, of its transport circuits and consequently reduces the machine costs. The preparation of the completed bobbins already on the spinning frame requires a slight modification which does not substantially increased the machine costs, requiring instead a different use of the members that are already available.

Claims

1. Device for the preparation, in the ring spinning units, of full bobbins with their terminal yarn tail already inserted inside their tube before being sent to the automatic winding, the ring spinning units which compose the spinning frame comprising means (2) for the automatic drafting of a feed sliver (1) of the spinning units, in order to give rise to a yarn (20) passing through a small ring (22) which rotates on a fixed ring (23) borne by a ring-carrier platform (24), the yarn (20) in turn being wound in a bobbin (25) on a tube (26) thereof, fit on an underlying bobbin carrier spindle (30), the spinning frame moreover comprising a doffing device which grasps the completed bobbins (25) with individual clamps (45), **characterised in that** said bobbin carrier spindle has a cylindrical part (33) for fitting the tube (26) thereon, setting it atop a base (32), the part (33) having a greater length than said tube, such that its terminal part (35), once the tube (26) is fit on the bobbin carrier spindle (30), significantly projects from the top of the tube (26) and allows binding the yarn (20) thereon.

2. Device for the preparation of the bobbins according to claim 1, **characterised in that** the yarn (20) is bound by winding it with a plurality of coils, for an available length of yarn tail so to be inserted inside the tube (26) of the doffed bobbin.

3. Device for the preparation of the bobbins according to claim 1, **characterised in that** the length of the projecting part of the terminal part (35) is in the range of 8-15 mm.

4. Device for the preparation of the bobbins according to claim 2, **characterised in that** the terminal cylindrical part (35) is machined with a hollow opening (51) in order to determine the deposition level of the yarn (20) coils winding.

5. Device for the preparation of the bobbins according to claim 2, **characterised in that** the terminal cylindrical part (35) is machined in order to make it rougher in its peripheral part (52), so to favour the adhesion of the yarn (20) coils at the desired level.

6. Device for the preparation of the bobbins according to claim 2, **characterised in that** the terminal cylindrical part (35) is removable and substitutable with respect to the underlying part (33).

7. Device for the preparation of the bobbins according to claim 2, **characterised in that** the terminal part (35) is raised or lowered with respect to the underlying part (33), by screwing it or unscrewing it from a connection thread (55).

8. Device for the preparation of the bobbins according to claim 1, **characterised in that** the spinning frame is equipped with clamps (45) provided with a blowing nozzle for injecting an air jet inside the tube (26) upon the release of the clamps themselves.

9. Process for the preparation, already in the spinning units of a ring spinning frame, of full bobbins with their terminal yarn tail inserted inside their tube before being sent to the automatic winding, the spinning frame comprising a common ring-carrier platform (24) which supports, for all the units composing a face thereof, a small ring (22) which rotates on a fixed ring (23), which winds yarn (20) in a bobbin (25) on a tube (26) thereof, fit on an underlying bobbin carrier spindle (30), and moreover comprising a doff-

ing device which grasps the completed bobbins (25) with individual clamps (45), **characterised in that** said bobbin carrier spindle has a terminal part (35) which projects from the top of the tube (26), to which height the ring-carrier platform (24) is first raised so to bring the rotating small ring (22) to deposit a winding (40) of yarn (20) on the upper terminal part (35) of the bobbin carrier spindle (30), the ring-carrier platform then being lowered so to bind the yarn tail of the yarn (20) by winding it on a lower part (32) of the bobbin carrier spindle (30) with a winding (41), and that the clamp (45) is then brought to grasp the bobbin (25) and to lift itself, taking the bobbin from the bobbin carrier spindle (30), thus freeing the yarn winding (40) on the terminal part (35) so it can fall inside the tube (26).

10. Process for the bobbin preparation according to claim 9, **characterised in that** the number of coils of the winding (40) on the terminal part (35) is in the range of 5-10.

11. Process for the bobbin preparation according to claim 9, **characterised in that,** at the time of the release of the tube of the bobbin doffed on its peg, the clamp (45) injects an air jet inside the tube (26), making the entire yarn tail of the winding (40) yarn enter inside the tube (26).

12. Process for the bobbin preparation according to claim 9, **characterised in that** the clamp (45) engages the body of yarn wound on the completed bobbin (25).

13. Process for the bobbin preparation according to claim 9, **characterised in that** the clamp (45) engages the upper part of the tube (26) free of the wound yarn.

14. Yarn-winder according to claim 1, constituted by a ring spinning frame and by an automatic winder connected by a peg transport system, **characterised in that** the bobbins (25) completed on the ring spinning frame are doffed by the spinning frame and transferred to the peg transport system with their terminal yarn tail already inserted inside their tube (26).

15. Yarn-winding process in a yarn-winder constituted by a ring spinning frame and by an automatic winder connected by a peg transport system, **characterised in that** the bobbins (25) completed on the ring spinning frame are doffed by the spinning frame and transferred to the peg transport system with their terminal yarn tail already inserted inside their tube (26).

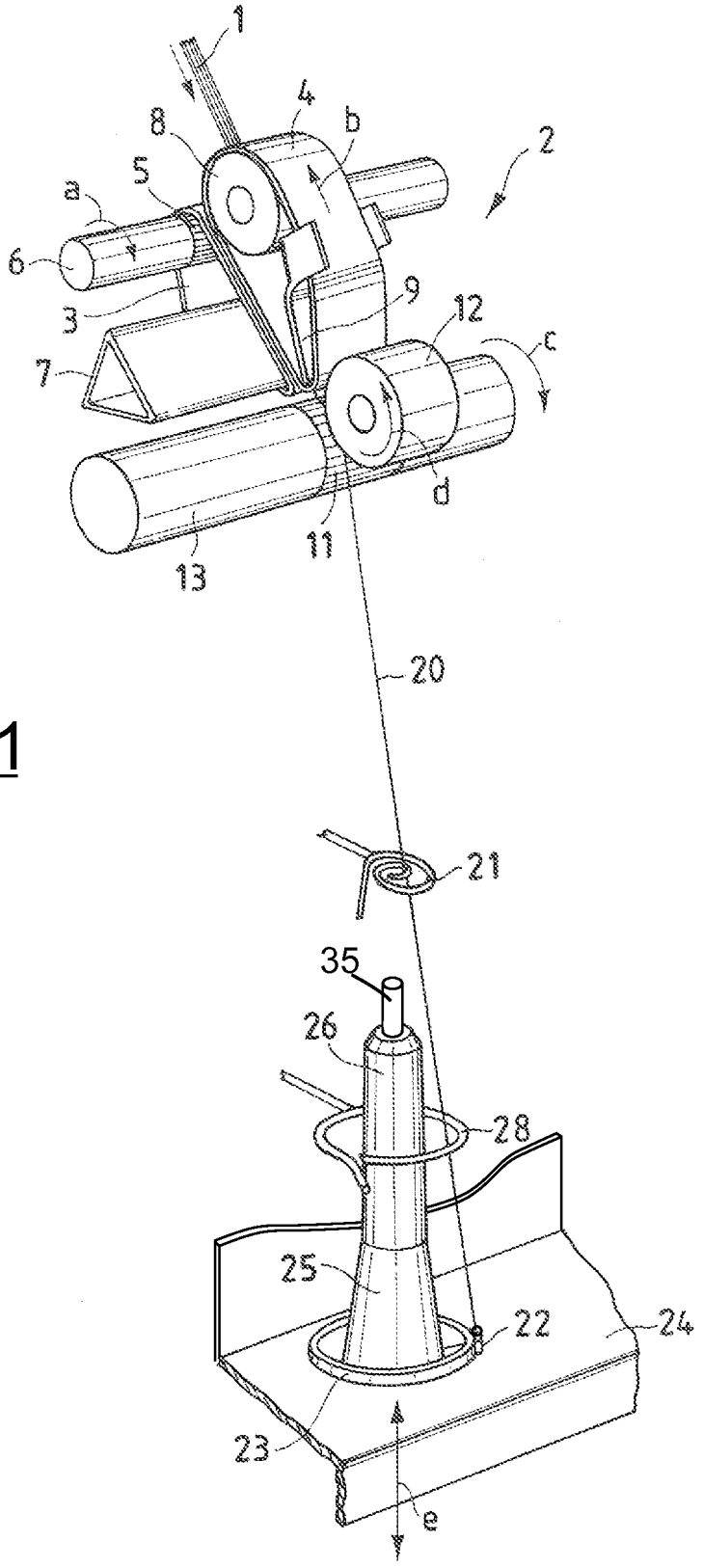

Fig. 1

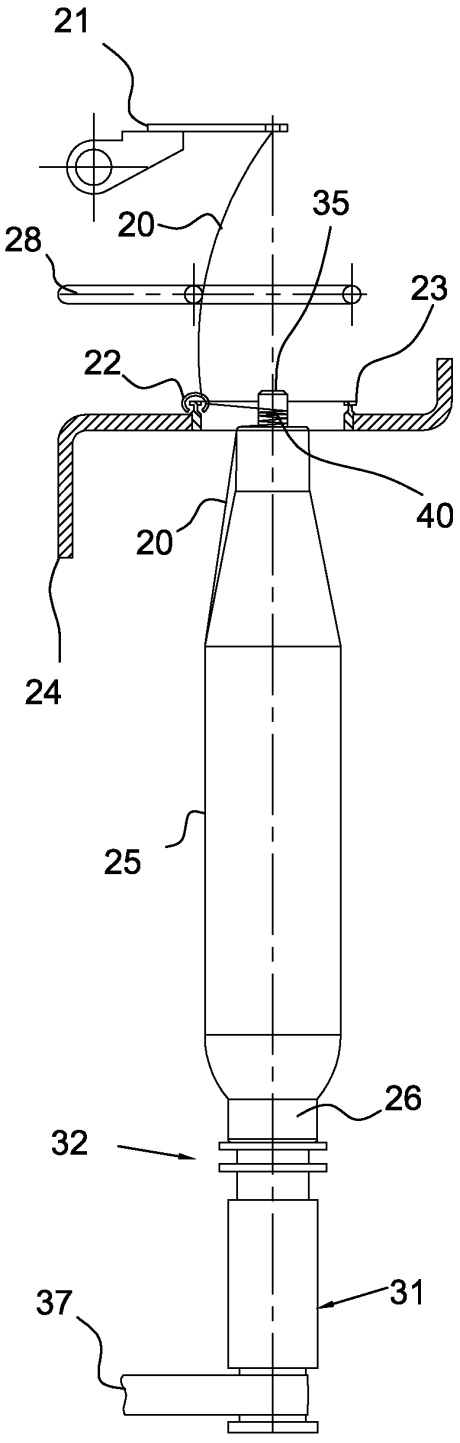

Fig. 2

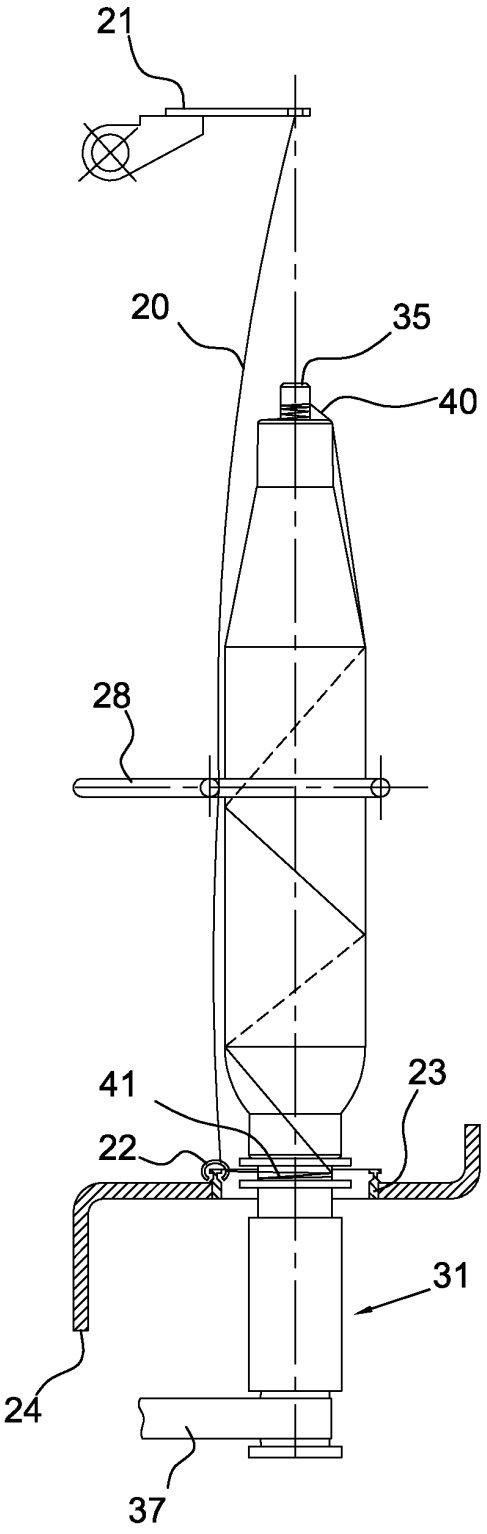

Fig. 3

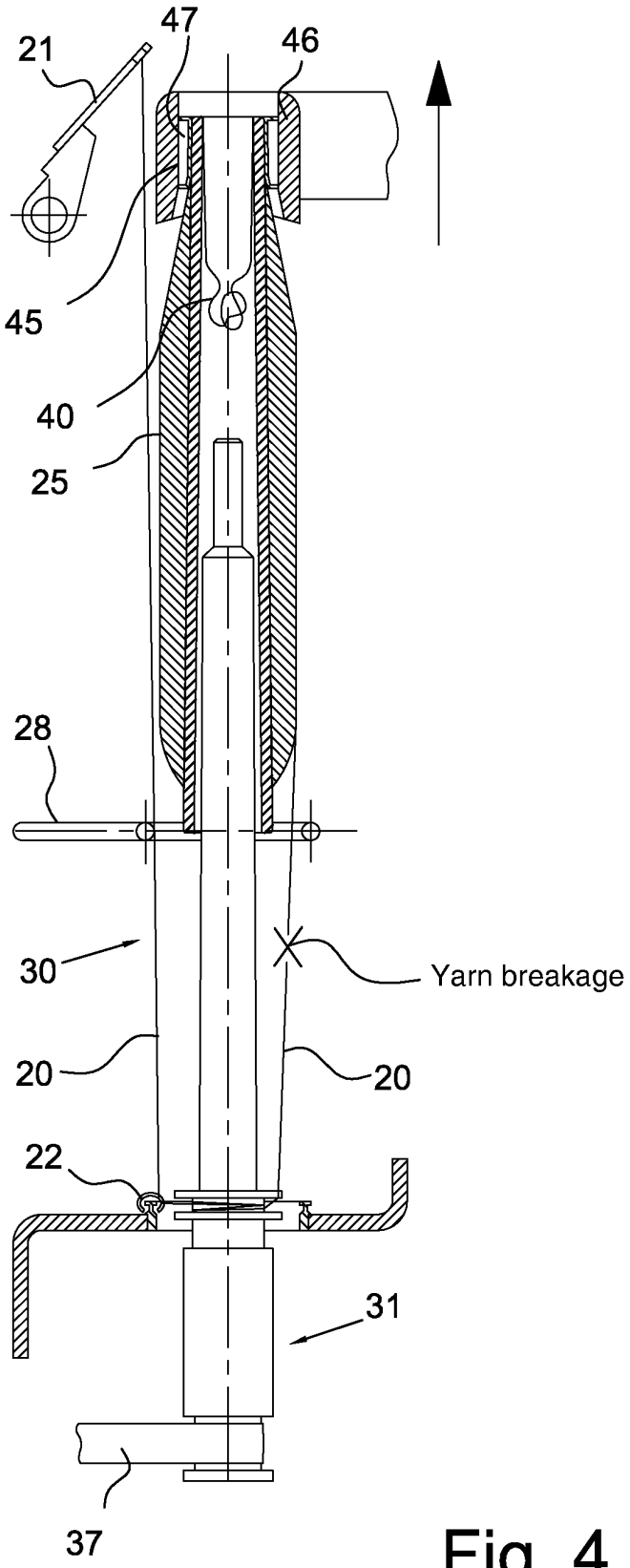

Fig. 4

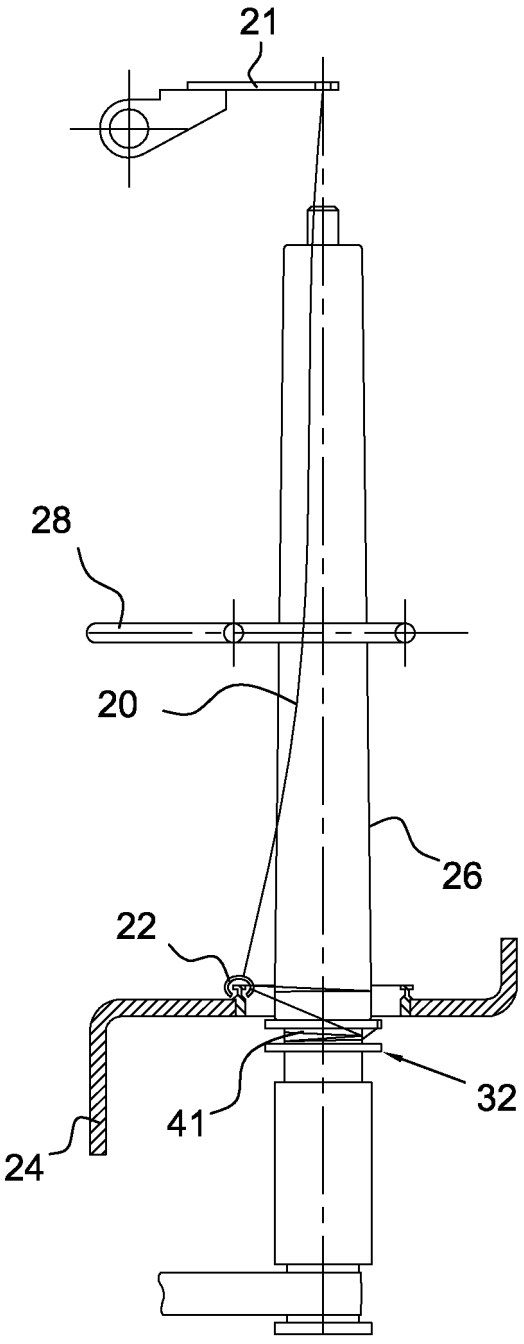

Fig. 5

Fig. 6