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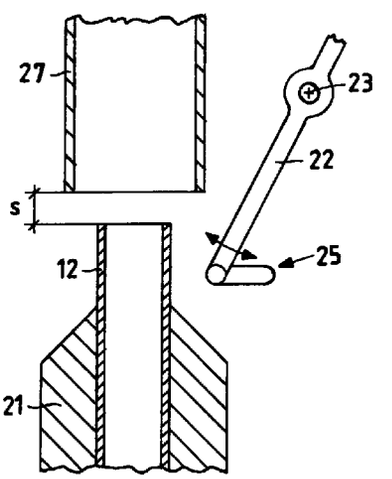
(54) Balloon controlling device and process for the unwinding of yarn from the feeding spool of an automatic spooler

(57) Device and process for containing and controlling the balloon while unwinding the feeding spools in automatic spoolers, in which a balloon containing cross-bar is kept close to the upper part of the spooling tube but not in contact with the same: in this manner, the yarn of the balloon is at every turn forced by the bar to re-approach its tube and be contained by the same. The yarn is then passed to a second containing element set above the spool.

Fig.2A



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Description

[0001] This invention refers to a device and a process for unwinding the yarn from the feeding spools of spinning machines, in particular in automatic spoolers for controlling the so-called balloon.

[0002] In order to better evidence both the technical problems faced and solved by this invention and its advantages with respect to the known technology, brief reference is made to the fundamental features of the spooling process is given. The basic features of the spooling unit are illustrated in Figure 1. 1 indicates the unwinding spool from which the yarn 2 is picked up. The yarn 2 passes through the yarn guiding elements 3, the yarn-presence sensor 4 and the yarn-stretcher 5, which generally consists of two small facing dishes squeezing the unwinding yarn between each other. The path further includes a splicer 6, which receives the ends of the yarn to be spliced by aspirating nozzles, not shown for the sake of simplicity, whenever the yarn is interrupted by a rupture or by the action of the comb 7 set immediately downstream of the splicer. The spooled yarn is collected in the reel 8, actuated to a rotating motion by the roller 9 and held by the reel supporting arm 10.

[0003] The driving action by the roller 9 occurs at a pre-established and substantially constant speed, as the dimension of the growing reel changes; it attracts the yarn 2, unwinding it at a high rotating speed from the spool 1 held firm on a positioning pin 11.

[0004] The invention is described here for exemplifying and non-limiting purposes with reference to its main application to the processing of spools in spoolers and specifically in a reeling phase, as the device and process according to this invention may find advantageous applications for a high-speed unwinding of the yarn from a spool even in some textile technology operations differing from those of a reeling operation.

[0005] A considerable technical problem is encountered while unwinding the spools in the spooler. It must in fact be taken into account that in the spoolers of the latest design the unwinding speeds are in the order of 25 m/sec and higher. The underlying spool 1 is set on a positioning pin 11 and rests on its base.

[0006] The overlying reel 8 recalls the yarn from the spool positioned in the underlying reeling unit, and the yarn is wound-up in spiraling fashion on its tube 12 to shape the spool unwinds from the same at a whirling speed in the order of 15,000 rpm. Under these conditions the unwinding yarn assumes, under the effect of the centrifugal force on the yarn itself, a curved trajectory and swells out toward the outside, thus forming the so-called "balloon" 13 around the spool itself and generating considerable centrifugal stresses which translate to strains which may even exceed the strength of the yarn and cause its rupturing. They further tend to deviate the spool 1 from its proper vertical position. These centrifugal forces turn out to directly depend on the maximum radial size of such a balloon, whose dimensions must therefore be controlled and contained. It is further observed that the unwinding force of the yarn proceeds in an increasing manner from the beginning to the end of the spool, depending on the greater length of the free portion of the yarn generating the balloon 13.

[0007] A certain margin of tolerance between the internal dimensions of the spooling tube 12 and the external dimensions of its positioning pin 11 is necessary to ensure the loading of the spool on the same by a free-falling action. In the spoolers providing for a transfer of the spools on a mobile dish, this positioning pin is set in the upper part of the transport dish. In this case the spool's positioning precision with respect to the reeling unit is also influenced by the further margin of tolerance of the positioning precision of the dish in the reeling unit during the unwinding process. These margins may cause a misalignment of the spool with respect to its specified position and cause some unsymmetrical strains in the balloon's rotation, thus further aggravating the difficulties.

[0008] In the known prior art, a number of highly elaborate and complex technical solutions have been proposed. According to the Italian patent no. 1.263.217, corresponding to the US-patent 5.377.923, the control of the spool's balloon during the unwinding phase is entrusted to two cylindrical tubular elements coaxial with the spool, through which the unwinding yarn is passed; during the unwinding process the first organ remains fixed immediately above the spool, while the second tubular organ, of a diameter greater than that of the tube and smaller than that of the spool, follows the evolution of the unwinding process by lowering itself and thereby evenly following the level of the flared portion of the spool from which the yarn unwinds, while gradually lowering itself from the top to the bottom.

[0009] According to the Italian patent application RM9400093, corresponding to the US-patent 5.553.799, the balloon is controlled by a tubular element in the shape of an upside-down funnel which is gradually lowered, while keeping its conical portion positioned around the flared portion of the unwinding spool.

[0010] However, these solutions are complex and expensive, also because an automatic spooler contains dozens of reeling units needing to be individually equipped with such balloon controlling devices, as well as with instruments and actuators to induce each reeling unit to follow the evolution of the unwinding of the yarn from the spool, while considerably complicating the operations of substituting the feeding spools and splicing the yarn downstream of the combs removing imperfections from the yarn. The operation of such devices according to the known technology may also be compromised if the spool is not axially positioned with precision in relation to them.

[0011] This invention therefore refers to a device and a controlling process for the balloon during the unwinding of the spool. The scope of this invention is to achieve a simplified control of the balloon, without any of the

drawbacks and complications of the similar devices known at the state of the art.

[0012] In the most general concept of the device, this invention is defined in the first claim.

[0013] The characteristics and advantages of the balloon controlling device according to this invention will become more evident from the description of a few typical embodiments in the Figures numbered from 2 to 4 for exemplifying and non-limiting purposes.

[0014] This invention achieves the control of the balloon by two organs contacted by the yarn in its unwinding motion. One of them consists in a lever oscillating around a rotating pin. It is illustrated in the figures according to one of its preferred embodiments in the shape of an L, but could also perform its function in configurations equivalent or different from those shown in a simplified manner in Figure 2, for instance in the shape of a T or Y. Figure 2A illustrates a side view of the reeling unit, which shows the unwinding spool where the yarn forms the winding 21 on the tube 12, and where the L-shaped lever 22 is hinged with its upper longitudinal arm on a pin 23 so as to rotate around an axis 24. Figure 2B illustrates another side view, and the Figure 2C a ground view of the same. The lower cross-arm 25 of the L-shaped lever constituted by a bar set across the tube is designed to contact the unwinding yarn and preferably built from a small metallic bar having a smooth and rounded cross-section. According to another preferred embodiment of the invention, the bar is at its end designed to face the tube 12 and to contact the yarn shaped in a broken line (25a, 25b, 25c, 25d) coherent with the curvature of the tube surface and designed to force the yarn of the balloon to approach the tube 12.

[0015] A second controlling organ for the balloon is set-up Just above the top of the tube 12. It consists in an annular or tubular element 27, within which the yarn of the rotating balloon is forced to pass while sliding over its surfaces and thus reducing its rotating speed. In its simplest version it may be made of a ring or a metallic bar ringlet, as already known in the art to define the tip of the balloon. According to a preferred embodiment of the invention, the element 27 is built in a tubular shape and with a cross-section configured with radial changes, or by alternating sections of different curvature or concave and convex elements so as to thereby exert a high braking action in regard to the balloon's circulating motion. In order to achieve the best containing and braking effects on the rotation of the balloon during the spool unwinding operation, this second element 27 is preferably placed at an axial distance s of 10-60 mm from the tip of the tube 12. The Figures 3A, B illustrate a few forms of the transversal cross-section of the tubular element 27 according to the invention.

[0016] This second tubular element for controlling the balloon may be constructed with a continuous lateral wall, as illustrated in Figure 3A, or be equipped with a longitudinal slit 28 to insert the yarn, as shown in Figure 3B, depending on the process of starting-up and resuming the reeling operation adopted to build the spooling machine.

[0017] The first element with an L-shaped lever is equipped with a positioning device in relation to the lower arm 25 of the L-shaped lever with respect to the tip of the tube 12, a typical embodiment of which will be described below.

[0018] In order to better evidence the characteristics and advantages of the invention, we are herewith describing the process of controlling and containing the balloon, while utilizing the elements of the device described up to this point, with reference to the Figures 2.

[0019] In the most general meaning of the process, this invention is described in claim 8.

[0020] According to this invention, during the unwinding phase the lower part 25 of the L-shaped lever of the balloon controlling device is kept as close as possible but not in contact with the upper part of the tube 12, at a distance d of less than 10 mm and preferably between 1 and 2 mm, at the point of minimum distance between the tube 12 and the bar 25. In the embodiment according to Figures 2, the bar 25 constituting the lower arm of the L-shaped lever is shown in a configuration following the broken line 25a, b, c, d, according to one of its preferred embodiments aimed at enhancing the contacting effect between the yarn and the bar 25. This precision approach to the tube must be achieved independently of its more or less exact position and of the precision of its diameter, in a repetitive manner for all reeling stations and for each of them at every change of the spool, and even, according to a preferred embodiment, at each splicing cycle. The possible shortage in the diameter of the tube and/or of the true positioning of the spool 1 with respect to its exact position may reach 2-3 mm and more; this change to a greater or lesser value is already highly significant for the purposes of controlling the balloon.

[0021] At every change of the spool or at any splicing cycle the L-shaped lever is rotated to a retracted position, so as not to interfere with these operations. Before restarting the unwinding process, the L-shaped lever is rotated until it rests on the tube of the spool, in its upper part and preferably within 10-20 mm from its tip. After contacting the tube, it is therefore withdrawn by a very small, pre-established distance, which would preferably, as already described above, be within a range of 1-2 mm. The contact with the tube, independently of the precision of its diameter or position, allows establishing a precise reference point for this distance. Shortly before the L-shaped lever assumes this detached yet very close position to the tip of the tube, the unwinding of the spool is started or re-started, both to achieve the reeling of the yarn and to form the upper reel. According to this invention, it is surprising that with this setup the balloon 13 of the yarn 2 unwinding from the spool 1 swells up to a very limited extent, because at every turn around the spool the yarn of the balloon is forced to re-

approach its tube due to the constraint represented by the broken-line bar 25 of the L-shaped, balloon-rupturing lever; the balloon is thereby kept from swelling up - generally known as "blowing up" - as would on the contrary occur in the absence of such a constraint, which would not allow it the time to blow up and attain the configuration of a balloon that it would otherwise spontaneously assume. The tension of the balloon's yarn as a result of the centrifugal force is thereby drastically reduced, even during the unwinding of the final portion of the spool with the greatest free length of yarn which generates the balloon 13.

[0022] Downstream of the bar 25 of the L-shaped balloon-bursting lever the yarn encounters a second controlling organ of the balloon constituted by the annular or tubular element 31 which exerts both a second radial containment action of the balloon and a braking action on its rotating speed, which acts along the yarn on the spool and toward the tip of the tube.

[0023] The Figures 4 show a typical embodiment of the approaching and detaching device of the L-shaped lever in a direction to the tip of the tube. For simplicity, the figures show the lower part 25 of the L-shaped lever in a rectilinear configuration. This device allows the sensing of the true position of the L-shaped balloon-bursting lever in an operating position during the unwinding process.

[0024] In Figure 4A the device 30 is shown in a position ready for a spool change, with the L-shaped lever 22 in a retracted position with respect to the tube 12. It consists of an actuator and in the embodiment shown of an electromagnet 31, governed by the control cables 32, which retracts the cursor 33 to its interior when excited. A transversal dish 34 is rigidly coupled to the bar of the cursor 33; it acts as a stop at one end of a compression spring 35 affixed to the body of the magnet, while the other end, whenever the magnet is not excited, extends and retracts the cursor 33 to its outermost position shown in Figure 4A. The dish 34 is also connected with the traction spring 36 which hooks up with the other end to the lever 22, in its part opposite to the arm 25, so as to rotate around the axis 24 of the rotating pin 23.

[0025] An adjusting plate 37 is mounted around the same axis 24 and on the same pin 23. This plate is forced to rotate together with the lever 22, both by the presence of two pegs 40 and 41 constituting the end-stops of the relative rotation between the lever 22 and the plate 37, and by the pressure spring 43 resting on one side on the lever 22 and on the other side on a projection 42 of the plate 37.

[0026] In the configuration shown in Figure 4A the actuating magnet 31 is not excited, the spring 35 is extended and projects the cursor 33 toward the lever 22, causing the latter to rotate in a counterclockwise direction. This lever 22 compresses the spring 43 and also causes the plate 37 to rotate in a counterclockwise direction toward the indicated position.

[0027] Figure 4B shows the device 30 in a position to contact the tube of the spool, with the L-shaped lever 22 advanced to its utmost extent, so as to touch the tube 12 using the bar 25. In the configuration shown in Figure 4B, the actuating magnet 31 is excited; it retracts the cursor, compresses the spring 35, and by retrieving the cursor 33 tensions the spring 36 and pulls the lever 22 to the right, so as to rotate it in a clockwise direction. The lever 22 rests on the peg 40 and also causes the plate 37 to rotate in a clockwise direction to the indicated position. The rotation in a clockwise direction stops when the arm 25 comes to rest on the tip of the tube 12. This configuration attains a position in which it zeroes the distance between the tube 12 and arm 25, thus creating a true and useful reference point, despite the fact that the spool - or better said the tip of its tube - is in an imprecise position which does not fit its precise location.

[0028] Figure 4C shows the device 30 in a position to make contact with the tube of the spool, with the L-shaped lever 22 held in its most extended position, so as to touch the tube 12 while using the bar 25. The zeroing position is fixed by blocking the adjusting plate 37 in a corner, thus preventing it, up to the next unblocking step, from rotating again around the pin 23. This blockage occurs by using an actuator, and in the embodiment shown, by using an electromagnet 44 governed by the control cables 45, which if excited projects a cursor 45 to the outside which engages and blocks the plate 37 using its extremity 47.

[0029] Figure 4D shows the device 30 in an operating position ready for unwinding the yarn, while holding the arm 25 of the L-shaped lever retracted at a distance d from the tube 12. In the configuration shown in Figure 4D the excitation of the actuating magnet 31 is discontinued, the spring 35 extends and projects the cursor 33 toward the lever 22, thereby pushing it so as to rotate in a counterclockwise direction. This lever 22 compresses the spring 43, while rotating counterclockwise by an angle α up to the point of resting the lever 22 on the peg 41 in the indicated position. After this rotation the arm 25 finds itself at the distance d and cannot move further, because the actuator 44 blocks the plate 37 and its peg 41 prevents the L-shaped lever 22 from moving further.

[0030] It can easily be seen that adjusting the distance d corresponds to adjusting the rotating angle of the lever 22 between the pegs 40 and 41, or by their angular distance α with respect to the pin 23.

[0031] In summary, the approaching and detaching device of the L-shaped lever to the tip of the tube consists in an actuator 31 designed to axially move the cursor 33 between an extracted and retracted position, and to rotate the L-shaped lever in a counterclockwise and clockwise direction, respectively, around its pin 23, combined with an adjusting plate 37 which rotates with respect to the same pin 23 together with the L-shaped lever 22. This adjusting plate 37 is further equipped with the blocking actuator 44, which acts in a zeroing posi-

tion, and by the end-stops 40, 41 which allow the L-shaped lever 22 to rotate with respect to the plate 37 by the angle α, depending on the push of the actuator 31.

[0032] As an example, the plate 37 can be fitted with a row of perforations for the positioning of the pegs 40 and 41, at variable angular apertures with respect to the rotating axis 24 of the pin 23. This embodiment is in a simplified manner described in Figure 4E, which refers to the plate 37 and shows the perforations 50 a-d and 51 a-d in which the pegs 40 and 41 can be respectively inserted, while gradually restricting the aperture angle α with respect to the axis 24, by advancing from the index a to the index d. The distance d is correspondingly reduced by adjusting.

[0033] When the unwinding stops and an operation must be performed at the reeling station, such as the changing of a spool or the splicing of a yarn cycle, it suffices to unblock the actuating magnet 44 by shutting off its excitation to cause the compression spring 35 to complete its extension of the cursor 33, until the end-stop configuration of Figure 4A is attained.

[0034] Based on a further embodiment of this invention, the oscillating lever 22 may be assigned - during the unwinding operation of the spool - to perform the further function of a so-called "curling prevention", according to the European patent no. 275.596 by the same Applicant. For this purpose, the release of the lever 22 to touch the tip 12 of the tube can be obtained according to the configuration in Figure 4C, by holding the plate 37 blocked by the actuator 44 and activating the excitation of the magnetic actuator 31, which retracts the cursor 33. This actuation is accompanied by a connection - for example through the control unit of the machine to the sensor 4, which triggers the excitation of the magnet 31, as soon as it no longer receives a signal sensing the presence of the yarn 2 moving in its interior. The approaching of the bar 25 to the tube 12 within short periods of time allows blocking the ascending end of the yarn between the bar and the tube, thus preventing it from curling up and allowing it to be easily caught by the service nozzle while avoiding any needless waste of yarn during the re-splicing phase.

[0035] It can easily be seen that the balloon's controlling device according to the invention need not follow the course of the unwinding from the spool by displacing it in an axial direction; once it is set in position, it does not require any axial shifting during the unwinding process but remains fixed, nor any monitoring of the level from which the yarn is unwinding. The device according to the invention allows the machine to accept the processing of spools wound on tubes of various diameter, without the need to change any parts of the machine, as occurs on the contrary when using the devices of a known technology. The approaching and positioning actuators of the balloon-bursting lever are of an on-off type and do not require any sensing instruments, as the device mechanically zeroes itself to create its own reference in the contact position.

Claims

1. Device for containing and controlling the balloon while unwinding the feeding spools in spinning machines and in particular in automatic spoolers, said device consisting of two elements interacting with each other, characterized in that the first element consists of an oscillating lever hinged on a pin (23) formed by an upper longitudinal arm (22) and a lower cross-arm (25) designed to contact the unwinding yarn, where said lever is equipped with devices (30) to move its cross-arm (25) in a radial direction with respect to the tip of the tube (12), and by a second element set above the tip of the tube (12) and consisting in an annular or tubular element (27) within which the yarn of the rotating balloon passes while sliding over its walls and decreasing its rotating speed.

2. Device for containing and controlling the balloon according to claim 1, characterized in that the first element consists of an oscillating L-shaped lever.

3. Device for containing and controlling the balloon according to claims 1 or 2, characterized in that the cross-bar (25) is configured according to a broken line (25a, b, c, and d).

4. Device for containing and controlling the balloon according to claim 1, characterized in that the second element (27) for controlling and containing the balloon is placed at an axial distance (s) of 10-60 mm from the tip of the tube (12).

5. Device for containing and controlling the balloon according to claim 1, characterized in that the second element (27) for controlling and containing the balloon is constructed in a tubular form and with a cross-section configured with radial changes, so as to exert a high braking action with respect to the balloon's circulating motion.

6. Device for containing and controlling the balloon according to claim 4, characterized in that the second element (27) is built by alternating sections of different curvature, or by alternating concave and convex elements.

7. Device for containing and controlling the balloon according to claim 1, characterized in that the devices (30) for moving its transversal arm (25) are susceptible to cause said arm to alternatively assume a retracted non-interfering position in which said arm comes to rest on the upper part of the tube (12) of the spool, and a retracted position at a very short and pre-established distance from the tube (12).

8. Device for containing and controlling the balloon according to claim 7, characterized in that the devices (30) for moving its cross-arm (25) consist in an actuator (31) to move a cursor (33) in an axial direction between an extended and a ratracted position, so as to cause the lever (22) to rotate in a respectively counterclockwise and clockwise direction around a pin (23), and in an adjusting plate (37) rotating with respect to the same pin (23) together with the lever (22), where said adjusting plate (37) is equipped with blocking devices (44) in a zeroing position and with end-stops (40, 41) allowing the lever (22) to rotate with respect to the plate (37) by an angle α depending on the push of the actuator (31).

9. Device for containing and controlling the balloon according to claim 8, characterized in that the actuator (31) retracting the cursor (33) is accompanied by a connection to the sensor (4) of the yarn, thereby allowing the oscillating lever (22) to also perform a curling-prevention function during the spool unwinding operation.

10. Device for containing and controlling the balloon while unwinding the feeding spools in spinning machines, and in particular in automatic spoolers while using the device according to one or several of the foregoing claims, characterized in that the lower part (25) of the lever (22) of the balloon controlling device is during the unwinding phase kept close to the upper part of the tube (12), as close as possible but not in contact with the same, at a distance d below 10 mm and preferably between 1 and 2 mm, at the point of the minimum distance between the tube (12) and the bar (25).

11. Process for containing and controlling the balloon according to claim 10, characterized in that at every change of the spool or at every splicing cycle the lever (22) is rotated to a retracted position so as not to interfere with these operations, that prior to restarting the unwinding operation the lever (22) is rotated to the point of resting with the arm (25) on the upper part of the tube (12) of the spool (1) and preferably at a distance of 10-20 mm from its summit, that after contacting the tube (12) it is retracted to the distance pre-established for the unwinding operation, and that shortly before the lever (22) assumes this position of being detached and very close to the tip of the tube the spool's unwinding operation is started or restarted to reel up its yarn (2) and to form the upper reel (8).

12. Process for containing and controlling the balloon according to claim 10, characterized in that during the unwinding operation of the spool the sensor (4), when it no longer senses the signal of a presence of the yarn (2), causes the excitation of the actuator (31), thus inducing the bar (25) to approach the tube (12) and block the ascending end of the yarn between the bar and the tube.

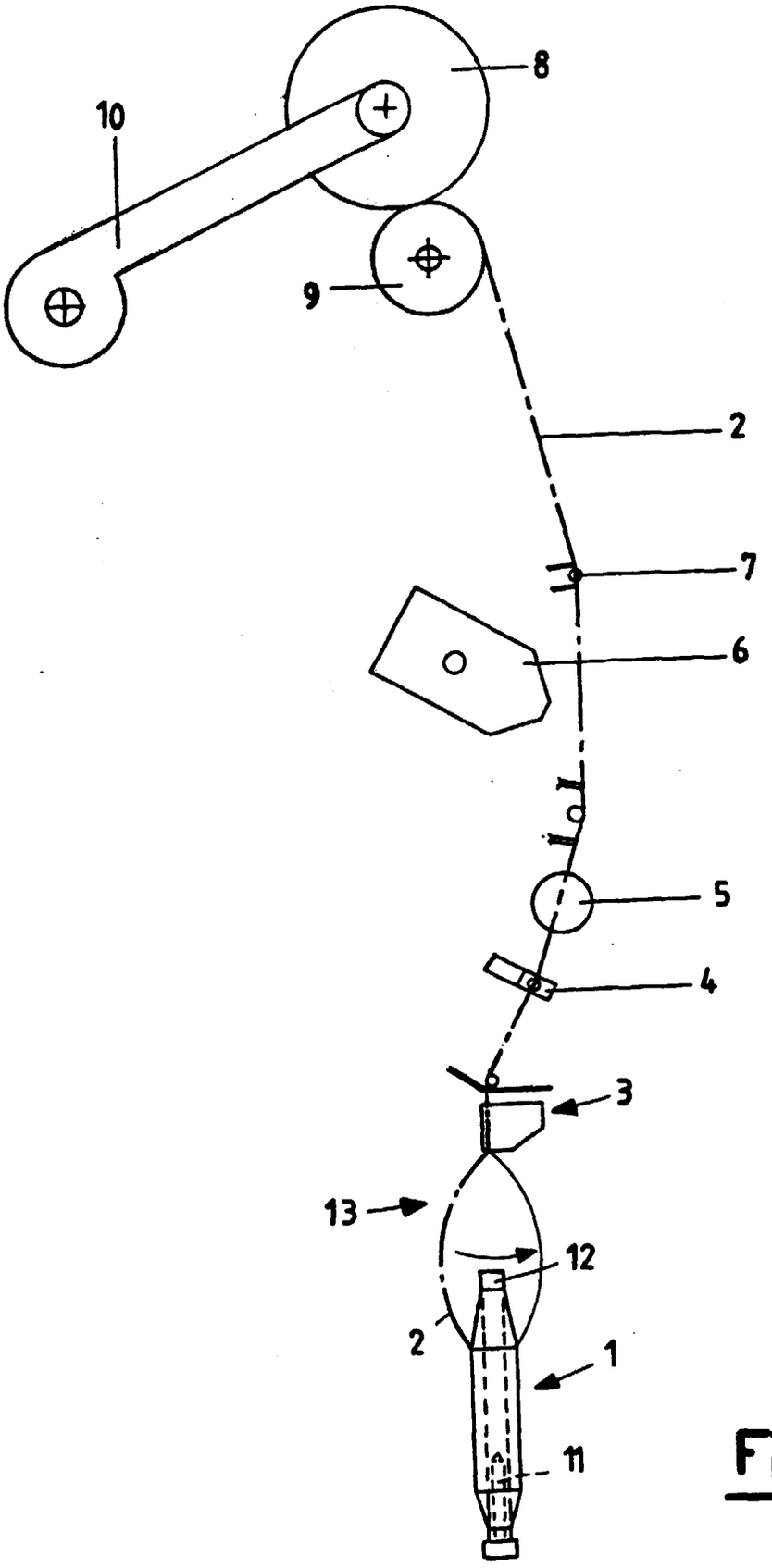


Fig.1

Fig.2A

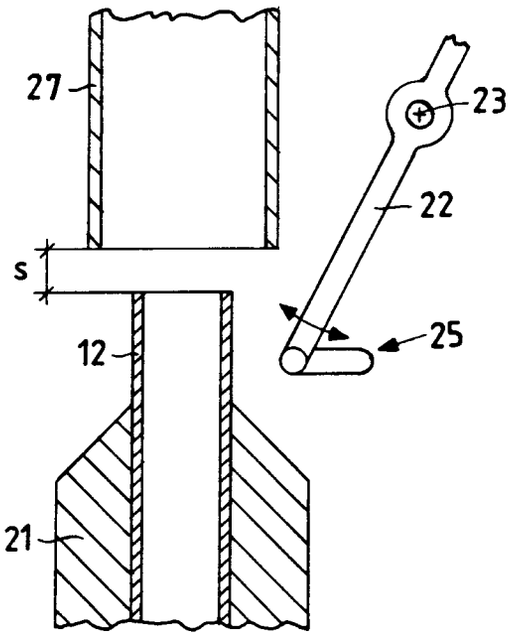
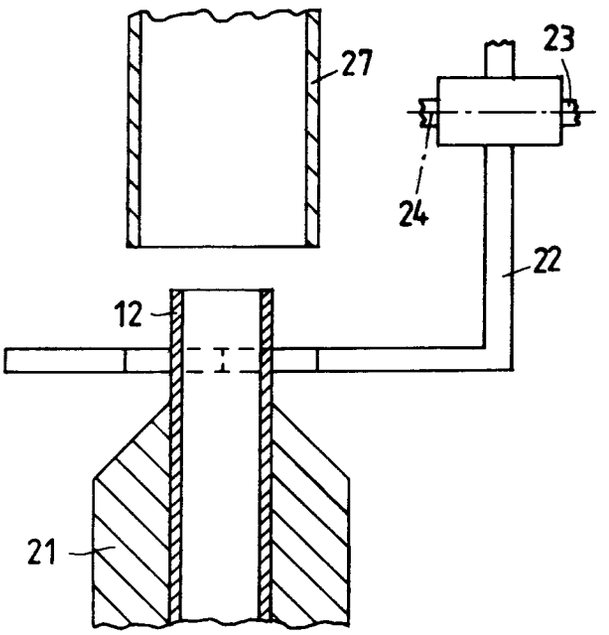


Fig.2B



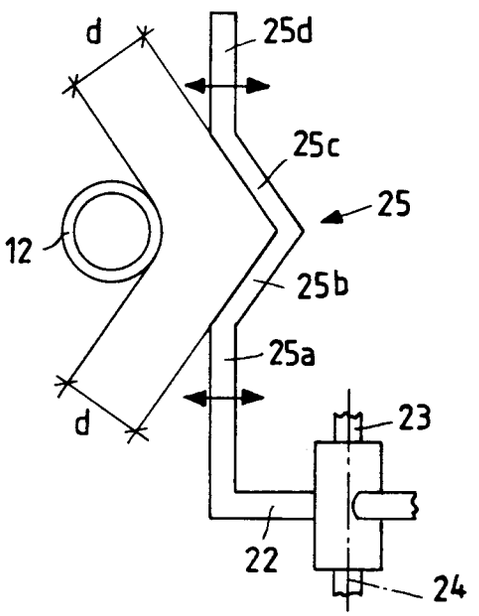


Fig.2C

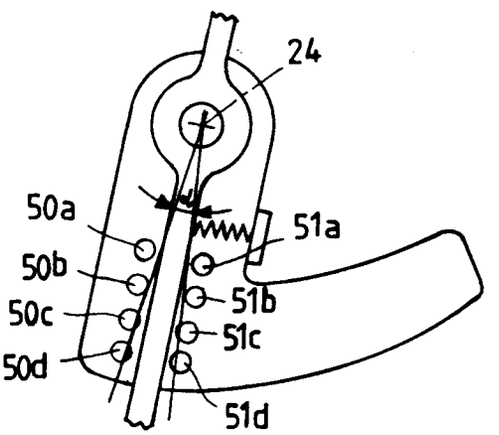


Fig.4E

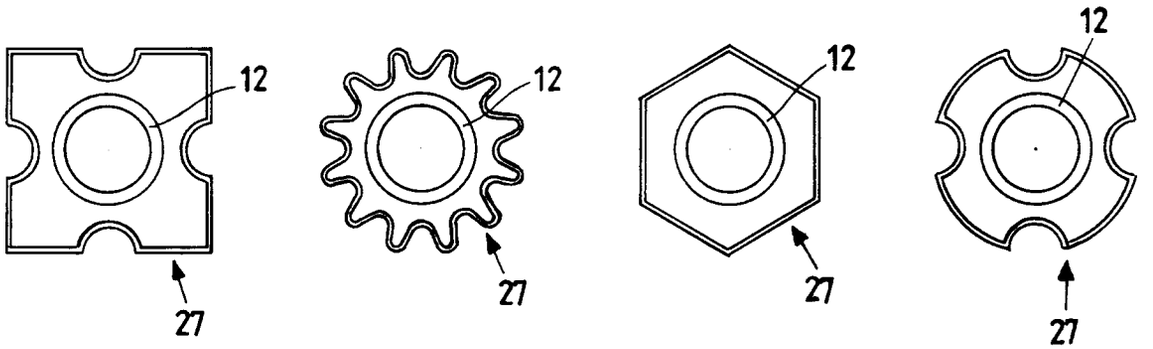


Fig.3A

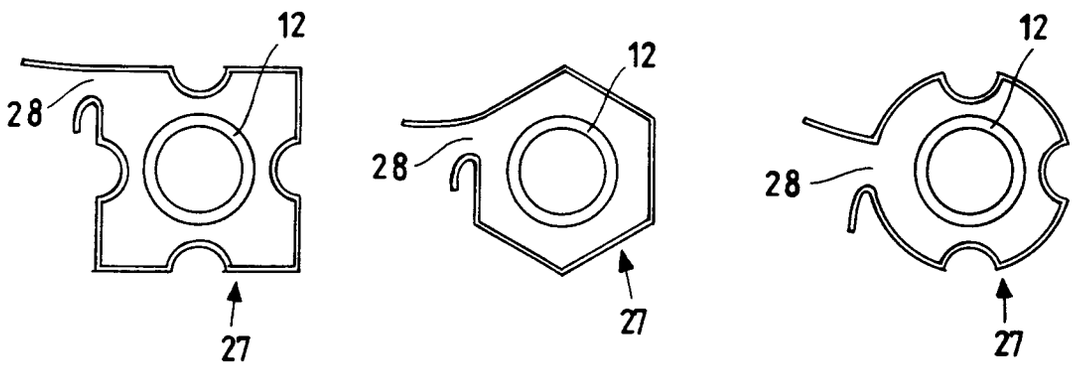


Fig.3B

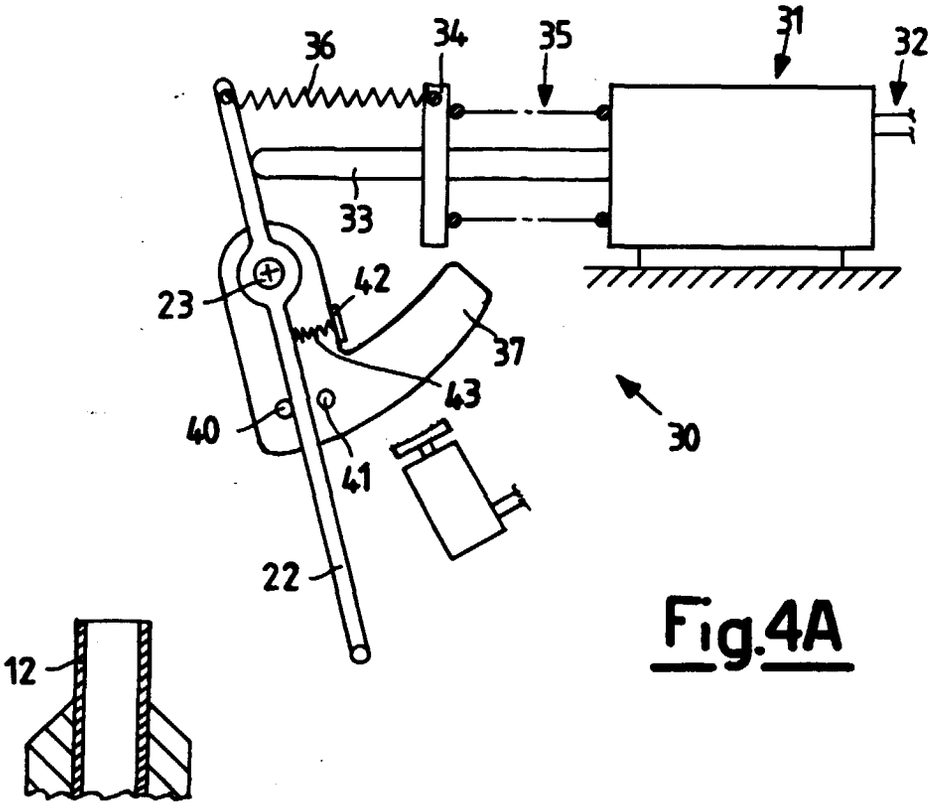

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Fig.4A

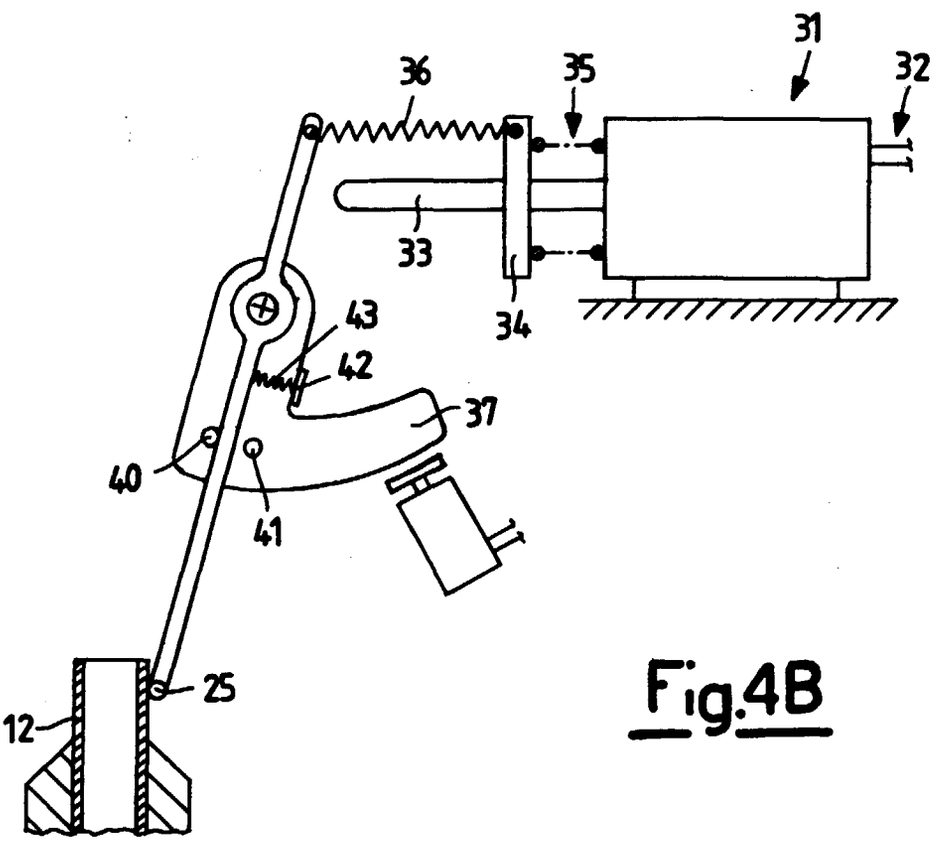
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Fig.4B

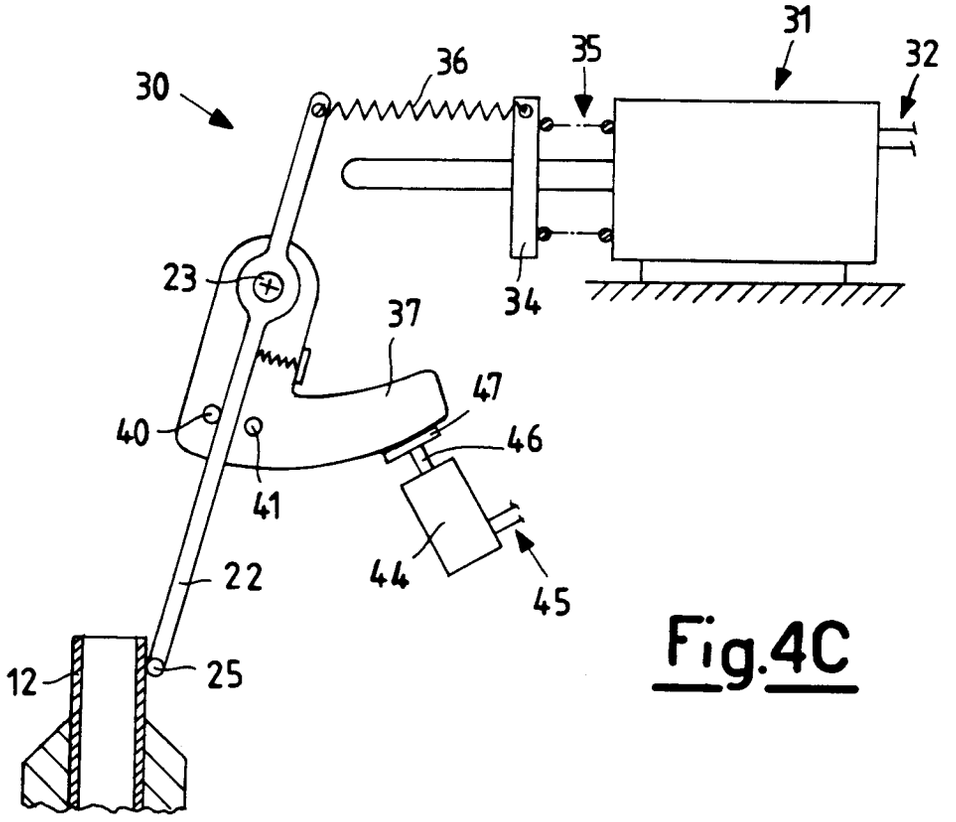
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Fig.4C

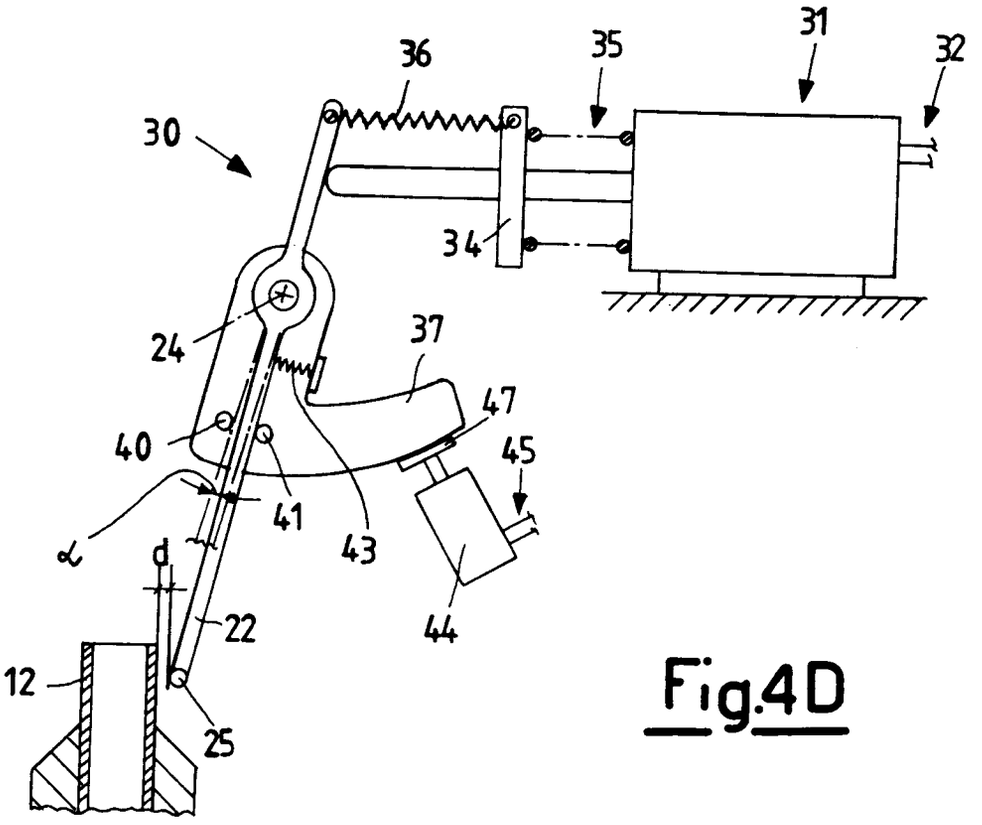
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Fig.4D