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Description

[0001] The present invention relates to a winding machine for winding yarn on a tube to form a package. In the textile industry, winding machines are widely used for collecting yarn by causing a take-up tube to rotate on a spindle of a package-holder arm and draw the yarn from a feeding bobbin. The package is thus formed by pulling and winding the yarn on its surface. The package is driven caused to rotate by an underlying motor-driven cylinder on which the package rests. The yarn is wound at a substantially constant linear speed, irrespective of the growing size of the package being formed, only as a function of the speed of rotation of the driving cylinder.

[0002] In order to clarify both the technical problems underlying and solved by the present invention and its characteristics and advantages with respect to the prior art, a winding machine is described first. As known, winding machines consist of a plurality of winding workstations aligned along the front of the machine and equipped with commonly used control and service apparatuses.

[0003] Figure 1 shows a front view of a winding machine (or winder) with its main parts. A feeding bobbin 1 is unwound by picking up its yarn 2. The yarn 2 passes from the unwinding unit 3 that comprises a balloon breaker, yarn guide members 3, a yarn detector 4 and a yarn tensioner 5. This may comprise, for example, an adjustable deviator capable of rendering the path for the yarn more meandering to adjust its tension. Downstream of the tensioner 5 is an splicer 6, to which the ends of interrupted yarn needing to be spliced are taken by suction mouths 9 and 10, located on the sides of the feeding bobbin and the package, respectively. The uppermost working positions of the suction mouths are depicted in phantom line at 9' and 10'. In those positions, suction mouth 9 takes the yarn end on the feeding bobbin side to the splicer 6 and the suction mouth 10 takes the yarn end from the package. The suction mouths operate when the yarn is interrupted by breaking or by intervention of the yarn clearer 11 that is located downstream of the splicer 6. The yarn is collected in the package 12. The package rests upon and is caused to rotate by a driving cylinder or roller 13 supported by package-holder arm 14.

[0004] In general, the distribution of the yarn 2 on the package 12 is carried out by a traversing guide in order to form a package having a given wind ratio. In the diagram of Figure 1, the distribution of the yarn on the package is performed by the same driving cylinder 13. This cylinder is provided with traversing slots 17 which distribute the yarn 2 with an axial motion to and fro on the surface of the package 12, while the driving cylinder 13 transmits a driving torque required for winding the yarn. The number of helical traversing slots formed on the driving cylinder 13 varies depending on the count and the winding compactness of the package to form.

[0005] During its normal operation, each winding machine uses a large number of feeding bobbins to form packages of a much greater size. In general, a feeding

bobbin is unwound in a few minutes, while a package is completed in less than one hour. A system for moving the feeding bobbins is usually arranged at the bottom of the winder, feeding new bobbins to be unwound and removing the tubes of the finished bobbins, moving even thousands of pieces per hour. In the upper part of the winder, dozens of packages are formed each hour. The packages must be removed and replaced with new tubes in the package holder arms, each time restarting the winding machine. With automatic winding machines such interventions are performed by a doffing trolley equipped with special devices for each operation and movement required. With other types of winders, these operations are performed manually by the personnel.

[0006] Figure 2 shows a side view of the structure of a package holder arm 14, which performs a plurality of functions and movements.

[0007] Figure 2 shows a cross-sectional view of the package holder arm 14 as seen from the left. As already shown in Figure 1, the arm 14 may have a U-shaped structure, which forms two prongs at the ends 22, 23 of which two centers are supported. The right hand end of prong 23 carries the mobile center 26, with a device 27 which can be opened and closed to release the package or to receive a new tube 29 for the package 12. The end of prong 22 supports a fixed center 25. The package holder arm 14 can be raised and lowered, rotating about a pin 28 along an arc delimited by two stops, not shown for simplicity.

[0008] The opening and closing movements of the mobile center are generally carried out mechanically through opening mechanisms contrasted by springs which tend to close the centers.

[0009] The package-holder arm rests on the fixed structure 30 of the winding machine by means of actuator 31. By way of example, actuator 31 may comprise a pneumatic cylinder, supplied by a source 32 of pressurized air, which allows for controlled lifting and lowering of the package-holder arm. The actuator 31 has two ends, of which a lower end is connected to the fixed structure 30 and an upper end is connected to one of the two prongs 22, 23 of the package-holder arm. The ends of the actuator are provided with spherical joints to allow rotation of the pneumatic cylinder, as a result of the rotation of arm 14 about the pivot 28.

[0010] During the winding process, the package-holder arm is raised by the package as this grows. Through the actuator 31, a counterweight force can be applied to the arm so as to adjust the contact pressure of the package 12 on the driving cylinder 13, in order to determine the density of the package being formed, for example according to the patent publication EP 1 820 764, in the name of the same Applicant.

[0011] When the winding is stopped for splicing or doffing the yarn, the package must be raised, braked and stopped. To this end, the package holder arm is provided with a brake actuated by a pneumatic piston, not shown in the figure for simplicity.

[0012] When starting a package, the centers of the holder arm must be opened, provided with a new tube on which the yarn is to be wound. After the centers are closed on the new tube, the package holder arm is lowered to bring the new tube in contact with the driving cylinder 13, in order to draw the yarn from the feeding bobbin 1 and start a new package 12.

[0013] Once the package is finished, it must be raised, braked and removed by opening the centers of the package holder arm. A new tube is then fitted on the arm for taking the winding. This operation is currently known as doffing. It can be carried out manually by operators or, in the case of automatic winders, by a service trolley, which goes to the position of the winding machine to serve. Before starting the doffing step and stopping the package, the holder arm must be raised as high as possible to lift the package 12 above the cylinder 13, leaving plenty of room for doffing operations.

[0014] In general, the above movements and functions of the package holder arm - during winding, splicing, and doffing - are carried out by a plurality of devices controlled by a control unit of the winding machine and in cooperation with the doffing trolley.

[0015] A winding machine according to the preamble of claim 1 is disclosed in EP 0 846 640 A2. A linear actuator device is known from EP 1 847 720 A1.

[0016] The technical problem to which the present invention is addressed is to control angular movements of the package holder arm, throughout the various stages of the winding process, through a single device, thereby simplifying the control of the winding process.

[0017] The present invention provides a winding machine as defined in claim 1. Preferred embodiments are defined in the dependent claims.

Figure 1 is a front view of a yarn collecting unit in a winding machine, schematically showing the most important devices that take part in the process of forming a package, for the purpose of illustrating the problem underlying the invention.

Figure 2 is a schematic diagram of a package-holder arm according to an embodiment of the present invention.

The characteristics and advantages of the package-holder arm according to the present invention are more apparent from the description of a few preferred but not limiting embodiments, shown in Figures 3 to 4.

Figures 3A and 3B show a cross-sectional view of an embodiment of the lower part of a pneumatic cylinder actuator 31 according to an embodiment of the present invention. In Figure 3B the actuator is extended or raised more than in Figure 3A. As shown also in Figure 2, the actuator 31 may comprise a casing 39 defining a sliding cavity 40 having a mushroom-shaped lower end portion, i.e. with two coaxial cylindrical chambers 41, 42 of different diameters.

[0018] In this embodiment, the wider chamber 41 is above the narrower chamber 42. A piston 44 is slidably accommodated within the cavity 40. The size and shape of piston 44 is adapted or corresponding to chambers 41, 42. Piston 44 comprises two superimposed cylindrical portions 45, 46 having diameters corresponding to chambers 41, 42, respectively, defining an overall mushroom-like arrangement. The wider chamber 41 has a cross-sectional area corresponding to the cross-sectional area of the wider cylindrical portion 45 of the piston, and the narrower chamber 42 has a cross-sectional area corresponding to the cross-sectional area of the narrower cylindrical portion 46 of the piston 44.

[0019] In an embodiment, sealing gaskets 48 are fitted on the outer cylindrical surfaces of the two cylindrical portions 45, 46. In this example, the sealing gaskets 48 are O-rings arranged inside circumferential grooves 49.

[0020] When the lower, narrower cylindrical portion 46 of piston 44 penetrates the lower, narrower chamber 42, the two chambers 41 and 42 of cavity 40 are not directly communicating with one another. Conversely, when the lower cylindrical portion 46 is lifted out of chamber 42, the two chambers 41 and 42 are in fluid communication and are at the same pressure. Figure 3B shows the piston 44 in a raised position with chambers 41 and 42 communicating with one another.

[0021] In the exemplary embodiment of Figures 2, 3A and 3B, a pressurized air system 50 for the supply and outlet of pressurized air into and out of cavity 40 is located in the lower part of the pneumatic actuator 31. The air supply system 50 comprises a control valve 51, preferably a two-way valve or a three-way valve, connected to a source 32 of pressurized air or an equivalent pressurized operating fluid, for adjusting the pressure of the fluid supplied to the cavity 40. The valve 51 is actuated by a control unit (not shown) which controls operation of the entire winding machine. The valve 51 is associated with the pneumatic actuator 31. In figures 3A and 3B, the same reference number 51 is used to designate a connector through which fluid communication may be established between the valve 51 (Fig. 2) and the pneumatic actuator 31. The casing 39 forms a seat for connecting to the valve 51 and a bifurcated conduit for establishing fluid communication between the valve 51 and each of the two chambers 41, 42. A common conduit 52, communicating with the valve 51, bifurcates in two separate conduits 57, 56. The first conduit 57 connects the common conduit 52 with the wider chamber 41. The second conduit 56 connects the common conduit 52 with the narrower chamber 42. The two separate conduits 57 and 56 supply separately the two chambers 41 and 42.

[0022] According to an embodiment, all the conduits 52, 56, 57 are formed within the casing 39 of the pneumatic actuator 31.

[0023] According to an embodiment, the two separate conduits 56 and 57, that supply and discharge the two chambers 41 and 42, are provided with means 60 for causing different losses of pressure, or pressure drops,

in the fluid flowing in the two conduits 56, 57. The valve 51 supplies the common conduit 52, preferably through a choked nozzle 53, which generates a predetermined loss of pressure in common conduit 52 and in conduit 56.

[0024] As shown in Figures 3A-B, the first conduit 57 is provided with a choked nozzle 59, which generates a predetermined pressure drop in conduit 57. The pressure drop caused by the or choked nozzle 59 is considerably higher than the pressure drop determined by the choke nozzle 53.

[0025] In the exemplary embodiment of Figures 3A, 3B, the choked nozzle 59 is fitted in the conduit 57 where this conduit opens on the upper, wider chamber 41.

[0026] Operation of the package-holder arm may be as follow. During normal winding, the arm 14 raises slowly due to the growth of the package. The piston 44 is pulled upwards by the ball joint 34. The control valve 51 can deliver pressurized air at controlled pressure for counterbalancing and adjusting the contact pressure of the package 12 against the cylinder 13. The fluid flow is small. The choked nozzles 53 and 59 do not exert any significant action.

[0027] When the package-holder arm 14 has to be lifted, the valve 51 is opened by way of a control signal coming from the winding machine control unit. The open valve 51 supplies pressurized fluid at the maximum available pressure into the cavity 40, lifting the piston 44 (Figure 3B).

[0028] When the package-holder arm 14 is to be lowered, for example to bring the new tube 29 to rest against the driving cylinder 13, the valve 51 is opened by a control signal from the winding machine control unit. The valve is opened to discharge the pressure within the actuator 31 and let the fluid out of chambers 41 and 42. Due to its own weight, the package-holder arm 14 descends. At the beginning of the downward stroke, the piston 44 is in the position shown in Figure 3B. The nozzle 59, which is calibrated to provoke a high pressure loss within the conduit 57, does not hinder the outflow since the conduit 56 communicates with all the internal volume of the cavity 40. Therefore, in the initial phase of the descent, the package holder arm comes down relatively quickly. Then, when the piston 44 is lowered - as in Figure 3A - enough to introduce its lower cylindrical portion 46 into the lower chamber 42, the two chambers 41 and 42 are no longer communicating directly. The choked nozzle 59 prevents the fluid contained in chamber 41 from flowing out quickly. As a result, the piston 44 and the arm 14 are lowered slowly in the final part of the descent of piston 44. The chamber 41 therefore acts as a shock absorber to prevent the package-holder arm from impacting on the package abruptly. Consequently, damages to the both the actuating cylinder 13 and the tube retaining centers are prevented.

[0029] The choked nozzle 53 is advantageous in slowing down the first part of the descent of the piston 44 and the arm 14. In fact, should the arm drop too quickly in the first part of its descent, it would bounce back upwards as

soon as the narrower cylindrical portion 46 of the piston enters the narrower cylindrical chamber 42.

[0030] As an alternative to the choked nozzle 53, the conduit 52 or the conduit 56 could be made very narrow, so as to cause a predetermined pressure drop without the provision of the choked nozzle 53. In such an alternative embodiment, the same conduits 52 or 56 would act as means for causing a significant loss of pressure, or pressure drop, to the fluid flowing through them.

[0031] Experimental test have shown that good results in braking the descent of the package-holder arm can be attained with an embodiment with a narrower chamber 42 having a cross-sectional area in the range of 6-15% the area of the wider chamber 41, whereas the length of the narrower cylindrical portion 46 of the piston 44 is in the range of 10-30 mm. This length corresponds to the final part of the downward stroke of piston 44, which is dampened or braked before the package-holder arm reaches its resting position. Preferably, in order to obtain the shock absorbing effect, the nozzle 59 causing the greater pressure loss has a diameter in the range of about 0.1 and about 0.5 mm. The above sizes are not to be regarded as limiting values.

[0032] A control for lifting and lowering the package-holder arm 14 with the actuator 31 can include, by way of example - in winding machines of the manual type - a switch located on the assembly 27 which is actuated by the operator. With automatic models of winding machines equipped with a doffing trolley, the actuator 31 can be controlled remotely when the trolley reaches the winder to be serviced. The lifting and lowering of the package-holder arm therefore does not require any effort to the operator with manual winding machines, nor any physical contact between a trolley and an automatic winding machine.

[0033] Figures 4A and 4B show an alternative embodiment of the pneumatic cylinder actuator 31, which may be provided with an additional device 65 for raising the package on those occasions when the yarn-splicer 6 is to be activated. Figures 4A and 4B show operational conditions of the actuator 31 during winding and splicing of the yarn 2, respectively.

[0034] As already mentioned, the package-holder arm needs to be lifted for splicing the yarn. To allow this, the package must first be raised, stopped and, after the yarn has been spliced, rested back upon the driving cylinder. In these cases it suffices to lift the package-holder arm and raise the piston 44 only a few millimeters above the angular position that the arm 14 has reached as a result of the progressive growth of the package.

[0035] As shown in Figure 4A, the package-holder arm 14 is in its working position. Valve 51 is open, exerting its function of counterbalancing the arm. The additional device 65 is fitted, in this example, to the upper part of the actuator 31, on the outside of the casing 39. The additional device 65 includes a second, annular cylindrical chamber 70, defined internally by the casing 39 and externally by a second cylindrical casing 73. In this em-

bodiment, the top of annular chamber 70 is closed with a top cover 74. Sliding within the annular chamber 70 is a piston 71 having an annular shape and a size compatible with the chamber 70. Preferably, the annular piston 71 has cylindrical surfaces provided with gaskets 78, for example O-rings, forcedly fitted inside circumferential grooves 79. Since the stroke required to piston 44 for the so-called instant lifting is limited to a few millimeters, the height required for the chamber 70 may be slightly greater than the height of the annular piston 71.

[0036] According to an embodiment, a pressurized air on/off system 80 for the supply and outlet of pressurized air into and out of the annular chamber 70 is arranged on the lower side of annular piston 71. In this exemplary embodiment, air supply system 80 includes a three-way valve 81 connected to a source 82 of pressurized air or an equivalent compressed fluid. Valve 81 is actuated through the winding machine control unit (not shown) when the yarn must be spliced. The valve 81 supplies a conduit 83 which opens on the bottom of annular chamber 70. Advantageously, the pressurized air source 82 may coincide with the pressurized air source 32, which is already provided on the winding machine for other services.

[0037] In the embodiment of Figures 4A and 4B, a tapered surface 85 is formed at the top of the inner surface of annular piston 71. A plurality of balls 86 are arranged in the available space defined, at the upper end of the cylindrical casing 39, between the piston 44 and the tapered surface 85. The diameter of the balls 86 is of a size just less than that of the available space.

[0038] When pressurized air is let into annular chamber 70 against the lower face of annular piston 71 for opening the valve 81, the piston 71 is lifted. The tapered surface 85 locks the balls 86 pressing them against the piston 44, thereby clamping the piston 44 and dragging upwards until it abuts it rests against the top cover 74.

[0039] In an embodiment, a number of contrasting springs, not shown in the drawings for simplicity, are fitted between the upper face of annular piston 71 and the top cover 74 are. Those springs are loaded by the raising of piston 71. When the valve 81 is controlled to open, in order to discharge the pressure existing in annular chamber 70, the thrust of the contrast springs prevails and annular piston 71 descends, bringing the balls 86 down and releasing the piston 44. Thus, piston 44 returns to the previous level it was at before activation of the additional device 65, allowing the package to rest again upon driving cylinder 13.

[0040] With respect to prior art systems, the present invention offers significant advantages, amongst which at least the following should be mentioned. Control and actuation of the package-holder arm is always performed by a single pressurized air actuator, i.e. for exerting a counterbalancing action, for lifting the arm completely, as well as for causing the instant lifting of the arm to splice the yarn. The movement of the arm provides that the final part of its downward movement is slowed down so as to

dampen the contact between the tube, or the initial package, and the driving cylinder. A complete lifting of the package-holder arm for doffing operations is no longer required to operators or to the doffing trolley of automatic winders. The arm is lifted due to a control signal by the control unit of the winding machine at the beginning of the doffing step, thereby facilitating the work of the operators or simplifying the doffing trolley, since the arm will have been already raised.

[0041] According to a different embodiment (not shown), the actuator may have a reversed arrangement with respect to the embodiments shown in figures 3A-B and 4A-B. According to such an alternative, the narrower chamber 42 and the corresponding narrower cylindrical portion 46 of the piston may be at the top of the actuator, i.e. near the arm 14. Accordingly, also the supply system 50 would need to be inverted, as if figures 3A and 3B were tilted upside down.

Claims

1. A winding machine for winding yarn on a tube to form a package (12), the winding machine comprising:

- a fixed structure (30);
- a package holder arm (14) supporting a fixed center and a movable center, which centers can be opened and closed to release the package or to receive a new tube, said holder arm (14) being pivotally mounted to the fixed structure (30) for rotation about a pivot (28);
- an actuator (31) comprising a pneumatic cylinder, supplied by a source (32) of pressurized air, wherein the actuator (31) has a first end connected to the fixed structure (30) of the winding machine and a second end connected to the package holder arm (14), whereby actuation of the actuator causes the package holder arm (14) to be raised or lowered rotating about the pivot (28), and the actuator (31) is associated with a supplying system comprising a control valve (51) connectable to the source (32) of compressed air or an equivalent pressurized operation fluid, the actuator (31) comprising a casing (39) defining a cavity (40) for slidably accommodating a piston, and a piston (44) slidably accommodated within the cavity (40);

characterized in that

- the cavity (40) is so shaped as to form an end portion with a first, wider cylindrical chamber (41) and a second, narrower cylindrical chamber (42);
- the piston comprises two superimposed, respectively wider and narrower cylindrical portions (45, 46) having shapes and sizes corre-

- sponding to the cylindrical chambers (41, 42);
- the control valve (51) controls the pressure supplied to the cavity (40) as a result of control signals from a control unit which controls operation of the winding machine, and that the control valve (51) separately supplies and discharges the first (41) and second (42) chamber through two separate first (57) and second (56) conduits, and that at least the first conduit (57) comprises a means (59) for causing a first loss of pressure in the fluid flowing through the first conduit (57), whereby the first loss of pressure is greater than a second loss of pressure in the fluid flowing through the second conduit (56), and that
 - the cavity (40) is mushroom-shaped in its lower end portion, with the wider cylindrical chamber (41) arranged above the narrower cylindrical chamber (42).
2. A winding machine according to claim 1, **characterized by** further comprising a means (53) for causing a second loss of pressure in the fluid flowing through the second conduit (56), and that the means (59) for causing the first pressure loss in the first conduit (57) are capable of causing a greater pressure loss than the means (53) for causing the second pressure loss in the second conduit (56).
 3. A winding machine according to claim 1 or 2, **characterized in that** the means (59, 53) for causing a pressure loss in the first (57) and/or second conduit (56) comprise at least one choked nozzle.
 4. A winding machine according to claim 3, **characterized in that** the means (53) for causing the second loss of pressure in the second conduit (56) comprise a choked nozzle (53) fitted in a conduit (52) which bifurcates forming the first conduit (57) and the second conduit (56).
 5. A winding machine according to claim 1, **characterized in that** the a cross-sectional area of the narrower chamber (42) is in the range of 6-15% of the cross-sectional area of the wider chamber (41).
 6. A winding machine according to claim 5, **characterized in that** the narrower cylindrical portion (46) of the piston (44) has a length within the range of 10-30 mm.
 7. A winding machine according to claim 2, **characterized in that** the choked nozzle (59) for causing the first, greater pressure loss has a diameter in the range of 0.1 - 0.5 mm.
 8. A winding machine according to claim 1, **characterized in that** the upper part of the pneumatic actuator

(31) is provided with an additional device (65) for raising the package holder arm (14) when it is necessary to splice the yarn.

9. A winding machine according to claim 8, **characterized in that** the additional device (65) comprises an annular cylindrical chamber (70) arranged around the casing (39) of the chamber (40), the annular chamber (70) being closed with a top cover (74) and slidably accommodating an annular piston (71) having a shape and a size corresponding to the chamber (70) and allowing a stroke corresponding to the stroke required to the piston (44) for bringing about the said raising of the package holder arm, and wherein the an upper and inner portion of the annular piston (71) provides a tapered portion (85) for containing at an end of the cylindrical casing (39) between the piston (44) and the tapered portion (85), a plurality of balls (86) having a diameter slightly less than the available space so that, when the annular piston (71) raises, its conical tapered portion (85) locks the balls (86) and compresses the balls against the piston (44), clamping the piston (44) and dragging it upwards.
10. A winding machine according to claim 9, **characterized in that** on-off system (80) for applying pressurized air to and discharging pressurized air from the chamber (70) is provided at a lower side of the annular piston (71), the on-off system (80) comprising a three-way valve (81) connected to a source of pressurized air or an equivalent pressurized operation fluid, the three-way valve (81) being actuated by a control unit for controlling the winding machine when splicing the yarn.
11. A winding machine according to claim 1, **characterized in that** the casing (39) forms a seat for connecting to the valve (51) and a bifurcated conduit for establishing fluid communication between the valve and each of the two chambers (41, 42), the bifurcated conduit comprising a common conduit (52), communicating with the valve (51), which common conduit bifurcates forming said two separate first and second conduits (57, 56), wherein the first conduit (57) connects the common conduit (52) with the wider chamber (41) and the second conduit (56) connects the common conduit (52) with the narrower chamber (42).

Patentansprüche

1. Wickelmaschine zum Wickeln von Garn auf ein Rohr, um einen Wickelkörper (12) zu bilden, wobei die Wickelmaschine umfasst:
 - eine feststehende Struktur (30);

- einen Wickelkörper-Halterarm (14), der ein feststehendes Zentrum und ein bewegliches Zentrum stützt bzw. trägt, wobei die Zentren geöffnet und geschlossen werden können, um den Wickelkörper zu lösen oder um ein neues Rohr aufzunehmen, wobei der Halterarm (14) zur Rotation um einen Zapfen (28) schwenkbar an der feststehenden Struktur (30) montiert ist;

- einen Betätiger (31), der einen pneumatischen Zylinder umfasst, der von einer Quelle (32) unter Druck stehender Luft versorgt wird, wobei der Betätiger (31) ein erstes Ende, das mit der feststehenden Struktur (30) der Wickelmaschine verbunden ist, und ein zweites Ende hat, das mit dem Wickelkörper-Halterarm (14) verbunden ist, wobei das Betätigen des Betätigers den Wickelkörper-Halterarm (14) dazu veranlasst, angehoben oder gesenkt zu werden, während er um den Zapfen (28) rotiert, und der Betätiger (31) mit einem Versorgungssystem in Verbindung steht, das ein Steuer- bzw. Regelventil (51), das mit der Quelle (32) unter Druck stehender Luft oder eines gleichwertigen unter Druck stehenden Betriebsfluids verbindbar ist, und wobei der Betätiger (31) ein Gehäuse (39), das einen Hohlraum (40) zur gleitenden Aufnahme eines Zapfens definiert, sowie einen Zapfen (44), der innerhalb des Hohlraums (40) gleitend aufgenommen ist, umfasst;

dadurch gekennzeichnet, dass

- der Hohlraum (40) derart geformt ist, dass mit einer ersten, breiteren zylindrischen Kammer (41) und einer zweiten, schmaleren zylindrischen Kammer (42) ein Endabschnitt gebildet ist;

- der Zapfen zwei übereinander lagernde, breitere bzw. schmalere zylindrische Abschnitte (45, 46) umfasst, deren Formen und Abmessungen den zylindrischen Kammern (41, 42) entsprechen;

- das Steuer- bzw. Regelventil (51) den Druck, mit dem der Hohlraum (40) versorgt wird, steuert bzw. regelt als Ergebnis von Steuer- bzw. Regelsignalen einer Steuer- bzw. Regeleinheit, die den Betrieb der Wickelmaschine steuert bzw. regelt, und dass das Steuer- bzw. Regelventil (51) die erste (41) und die zweite (42) Kammer durch zwei separate erste (57) und zweite (56) Leitungen separat versorgt und entleert, und dass zumindest die erste Leitung (57) ein Mittel (59) umfasst zum Verursachen eines ersten Verlusts von Druck in dem durch die erste Leitung (57) fließenden Fluid, wobei der erste Verlust von Druck größer ist als ein zweiter Verlust von Druck in dem durch die zweite Leitung (56) fließenden Fluid, und dass

- der Hohlraum (40) in seinem unteren Endabschnitt eine Pilzform aufweist, wobei die breitere zylindrische Kammer (41) oberhalb der schmaleren zylindrischen Kammer (42) angeordnet ist.

2. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** sie ferner ein Mittel (53) umfasst zum Veranlassen eines zweiten Verlusts von Druck in dem durch die zweite Leitung (56) fließenden Fluid, und dass die Mittel (59) zum Veranlassen des ersten Verlusts von Druck in der ersten Leitung (57) dazu imstande sind, einen größeren Verlust von Druck zu veranlassen als die Mittel (53) zum Veranlassen des zweiten Verlusts von Druck in der zweiten Leitung (56).

3. Wickelmaschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Mittel (59, 53) zum Veranlassen eines Verlusts von Druck in der ersten (57) und/oder zweiten Leitung (56) zumindest eine Drosseldüse umfassen.

4. Wickelmaschine nach Anspruch 3, **dadurch gekennzeichnet, dass** die Mittel (53) zum Veranlassen des zweiten Verlusts von Druck in der zweiten Leitung (56) eine Drosseldüse (53) umfassen, die in eine Leitung (52) eingepasst ist, die sich verzweigt und dabei die erste Leitung (57) und die zweite Leitung (56) bildet.

5. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** der ein Querschnittsbereich der schmaleren Kammer (42) im Bereich von 6-15% des Querschnittsbereichs der breiteren Kammer (41) liegt.

6. Wickelmaschine nach Anspruch 5, **dadurch gekennzeichnet, dass** der schmalere zylindrische Abschnitt (46) des Zapfens (44) eine Länge innerhalb des Bereichs von 10 - 30 mm aufweist.

7. Wickelmaschine nach Anspruch 2, **dadurch gekennzeichnet, dass** die Drosseldüse (59) zum Veranlassen des ersten, größeren Druckverlusts einen Durchmesser im Bereich von 0,1 - 0,5 mm aufweist.

8. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** der obere Teil des pneumatischen Betätigers (31) mit einer zusätzlichen Vorrichtung (65) versehen ist zum Anheben des Wickelkörper-Halterarms (14), wenn es nötig ist, den Garn zu spleißen.

9. Wickelmaschine nach Anspruch 8, **dadurch gekennzeichnet, dass** die zusätzliche Vorrichtung (65) eine ringförmige zylindrische Kammer (70) umfasst, die um das Gehäuse (39) der Kammer (40)

herum angeordnet ist, wobei die ringförmige Kammer (70) mit einer oberen Abdeckung (74) verschlossen ist und einen ringförmigen Zapfen (71) gleitend aufnimmt, der eine der Kammer (70) entsprechende Form und Abmessung aufweist und einen dem vom Zapfen (44) benötigten Hub zum Auslösen des Anhebens des Wickelkörper-Halterarms entsprechenden Hub ermöglicht, und wobei der ein oberer und unterer Abschnitt des ringförmigen Zapfens (71) einen abgeschrägten Abschnitt (85) vorsieht zur Aufnahme, an einem Ende des zylindrischen Gehäuses (39) zwischen dem Zapfen (44) und dem abgeschrägten Abschnitt (85), einer Mehrzahl von Bällen (86), deren Durchmesser geringfügig geringer ist als der verfügbare Raum, sodass, wenn sich der ringförmige Zapfen (71) anhebt, sein konischer abgeschrägter Abschnitt (85) die Bälle (86) verriegelt und die Bälle gegen den Zapfen (44) drückt, wodurch der Zapfen (44) festgeklemt und nach oben gezogen wird.

10. Wickelmaschine nach Anspruch 9, **dadurch gekennzeichnet, dass** An-Aus-System (80) zum Einbringen von unter Druck stehender Luft in die und zum Ablassen der unter Druck stehenden Luft aus der Kammer (70) an einer unteren Seite des ringförmigen Zapfens (71) vorgesehen ist, wobei das An-Aus-System (80) ein Drei-Wege-Ventil (81) umfasst, das mit einer Quelle unter Druck stehender Luft oder eines gleichwertigen unter Druck stehenden Betriebsfluids verbunden ist, wobei das Drei-Wege-Ventil (81) betätigt wird durch eine Steuer- bzw. Regelungseinheit zum Steuern bzw. Regeln der Wickelmaschine, wenn der Garn gespleißt wird.
11. Wickelmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** das Gehäuse (39) einen Sitz zum Verbinden mit dem Ventil (51) und eine verzweigte Leitung zum Aufbau einer fluiden Kommunikation zwischen dem Ventil und jeder der beiden Kammern (41, 42) bildet, wobei die verzweigte Leitung eine gemeinsame Leitung (52) umfasst, die mit dem Ventil (51) kommuniziert, und wobei die gemeinsame Leitung sich verzweigt und dabei die beiden separaten ersten und zweiten Leitungen (57, 56) bildet, und wobei die erste Leitung (57) die gemeinsame Leitung (52) mit der breiteren Kammer (41) und die zweite Leitung (56) die gemeinsame Leitung (52) mit der schmaleren Kammer (42) verbindet.

Revendications

1. Machine d'enroulement destinée à enrouler du fil sur un tube afin de former un paquet (12), laquelle machine d'enroulement comprend :

- une structure fixe (30) ;
- un bras de maintien du paquet (14) portant un centre fixe et un centre mobile, lesquels centres peuvent être ouverts et fermés afin de libérer le paquet ou de recevoir un nouveau tube, ledit bras de maintien (14) étant monté de façon pivotante sur la structure fixe (30) en vue de sa rotation autour d'un pivot (28) ;
- un actionneur (31) comprenant un vérin cylindrique alimenté par une source (32) d'air comprimé, lequel actionneur (31) possède une première extrémité reliée à la structure fixe (30) de la machine d'enroulement et une seconde extrémité reliée au bras de maintien du paquet (14), de sorte que l'actionnement de l'actionneur fait monter ou descendre le bras de maintien du paquet (14) en tournant autour du pivot (28), et l'actionneur (31) est associé à un système d'alimentation comprenant une vanne de commande (51) qui peut être reliée à la source (32) d'air comprimé ou à un fluide de fonctionnement sous pression équivalent, l'actionneur (31) comprenant un corps (39) qui définit une cavité (40) pouvant recevoir un piston de façon coulissante et un piston (44) reçu de façon coulissante dans la cavité (40) ;

caractérisée en ce que

- la cavité (40) est conformée de manière à former une partie d'extrémité avec une première chambre cylindrique (41) plus large et une seconde chambre cylindrique (42) plus étroite ;
- le piston comprend deux parties cylindriques (45, 46) superposées, respectivement plus large et plus étroite, dont les formes et les tailles correspondent aux chambres cylindriques (41, 42) ;
- la vanne de commande (51) contrôle la pression fournie à la cavité (40) à la suite de signaux de commande d'une unité de commande qui commande le fonctionnement de la machine d'enroulement, et **en ce que** la vanne de commande (51) alimente et évacue séparément la première chambre (41) et la seconde (42) via une première conduite (57) et une seconde conduite (56) séparées, et **en ce que** la première conduite (57) au moins comprend un moyen (59) pour provoquer une première baisse de pression dans le fluide circulant dans la première conduite (57), de telle sorte que la première baisse de pression soit plus importante qu'une seconde baisse de pression dans le fluide circulant dans la seconde conduite (56), et **en ce que**
- la cavité (40) est en forme de champignon dans sa partie d'extrémité inférieure, la chambre cylindrique plus large (41) étant disposée au-des-

sus de la chambre cylindrique plus étroite (42).

2. Machine d'enroulement selon la revendication 1, **caractérisée en ce qu'elle** comprend en outre un moyen (53) pour provoquer une seconde baisse de pression dans le fluide circulant dans la seconde conduite (56) et **en ce que** les moyens (59) pour provoquer la première baisse de pression dans la première conduite (57) sont capables de provoquer une baisse de pression plus importante que les moyens (53) pour provoquer la seconde baisse de pression dans la seconde conduite (56). 5
3. Machine d'enroulement selon la revendication 1 ou 2, **caractérisée en ce que** le moyen (59, 53) pour provoquer une baisse de pression dans la première conduite (57) et/ou la seconde (56) comprend au moins une buse étranglée. 10
4. Machine d'enroulement selon la revendication 3, **caractérisée en ce que** le moyen (53) pour provoquer la seconde baisse de pression dans la seconde conduite (56) comprend une buse étranglée (53) montée dans une conduite (52) qui bifurque en formant la première conduite (57) et la seconde conduite (56). 15
5. Machine d'enroulement selon la revendication 1, **caractérisée en ce que** l'aire de section de la chambre plus étroite (42) représente entre 6 % et 15 % de l'aire de section de la chambre plus large (41). 20
6. Machine d'enroulement selon la revendication 5, **caractérisée en ce que** la partie cylindrique plus étroite (46) du piston (44) a une longueur comprise entre 10 et 30 mm. 25
7. Machine d'enroulement selon la revendication 2, **caractérisée en ce que** la buse étranglée (59) pour provoquer la première baisse de pression plus importante a un diamètre compris entre 0,1 et 0,5 mm. 30
8. Machine d'enroulement selon la revendication 1, **caractérisée en ce que** la partie supérieure de l'actionneur pneumatique (31) est munie d'un dispositif supplémentaire (65) pour lever le bras de maintien du paquet (14) lorsqu'il est nécessaire d'épisser le fil. 35
9. Machine d'enroulement selon la revendication 8, **caractérisée en ce que** le dispositif supplémentaire (65) comprend une chambre cylindrique annulaire (70) disposée autour du corps (39) de la chambre (40), laquelle chambre annulaire (70) est fermée par un couvercle supérieur (74) et reçoit de façon coulissante un piston annulaire (71) dont la forme et la taille correspondent à la chambre (70) et permet une course correspondant à la course nécessaire pour que le piston (44) provoque le mouvement ascendant du bras de maintien du paquet, et une partie 40

supérieure et intérieure du piston annulaire (71) qui crée une partie conique (85) pour contenir à une extrémité du corps (39) cylindrique, entre le piston (44) et la partie conique (85), plusieurs billes (86) dont le diamètre est légèrement inférieur à l'espace disponible, de sorte que lorsque le piston annulaire (71) monte, sa partie conique (85) bloque les billes (86) et les presse contre le piston (44) en serrant ainsi le piston (44) et en le tirant vers le haut.

10. Machine d'enroulement selon la revendication 9, **caractérisée en ce qu'un** système d'activation et désactivation (80) destiné à amener de l'air comprimé et à l'évacuer de la chambre (70) est prévu sur un côté inférieur du piston annulaire (71), lequel système d'activation et désactivation (80) comprend une vanne à trois voies (81) reliée à une source d'air comprimé ou d'un fluide de fonctionnement sous pression équivalent, la vanne à trois voies (81) étant actionnée par une unité de commande qui commande la machine d'enroulement lors de l'épissure du fil. 45
11. Machine d'enroulement selon la revendication 1, **caractérisée en ce que** le corps (39) forme un siège en vue de la liaison à la vanne (51) et à une conduite bifurquée afin d'établir une communication de fluide entre la vanne et chacune des deux chambres (41, 42), la conduite bifurquée comprenant une conduite commune (52) qui communique avec la vanne (51), laquelle conduite commune bifurque en formant lesdites première et seconde conduites (57, 56) séparées, la première conduite (57) reliant la conduite commune (52) à la chambre plus large (41) et la seconde conduite (56) reliant la conduite commune (52) à la chambre plus étroite (42). 50

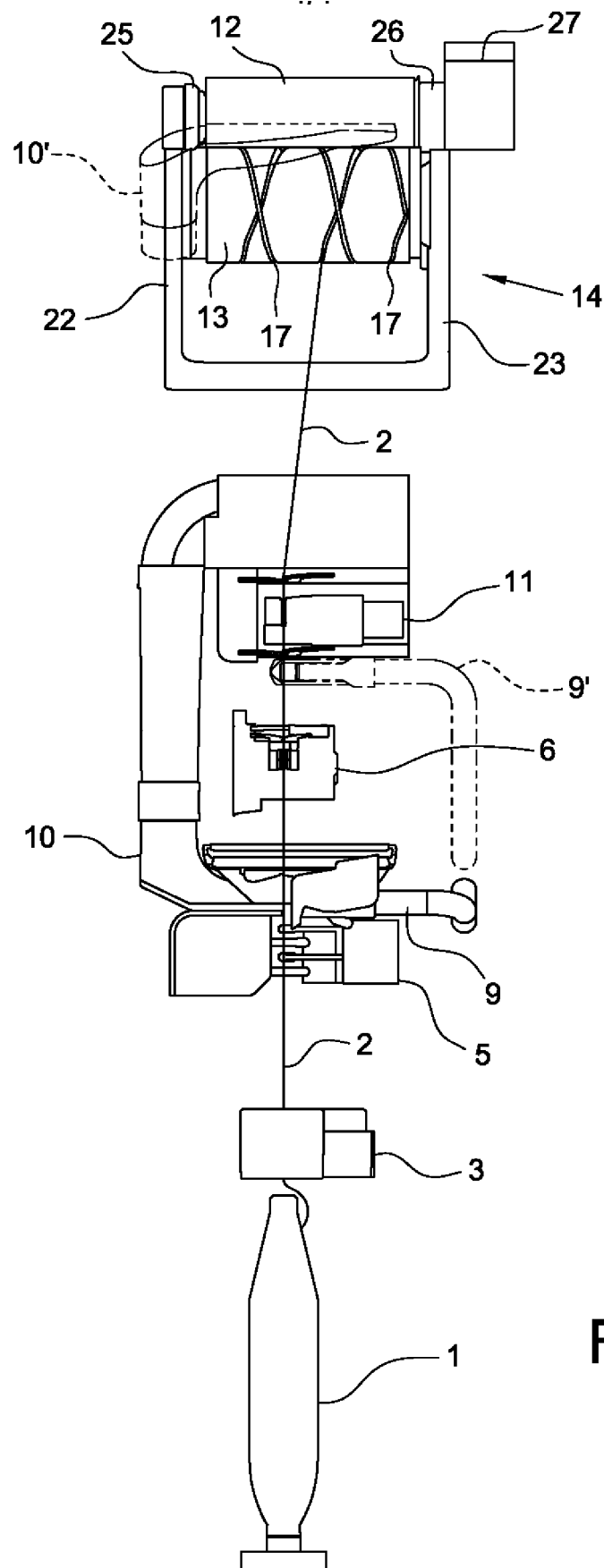


Fig. 1

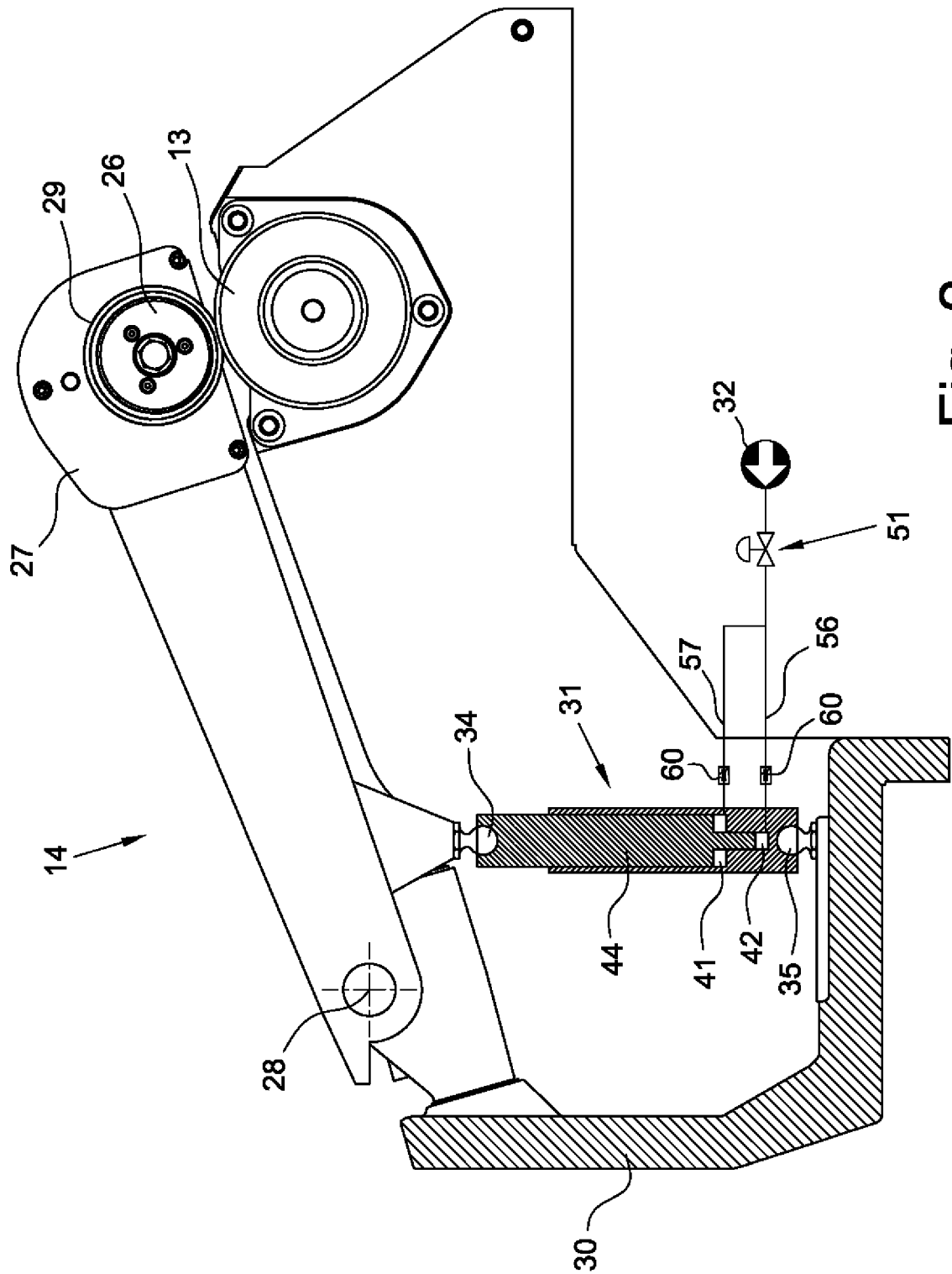


Fig. 2

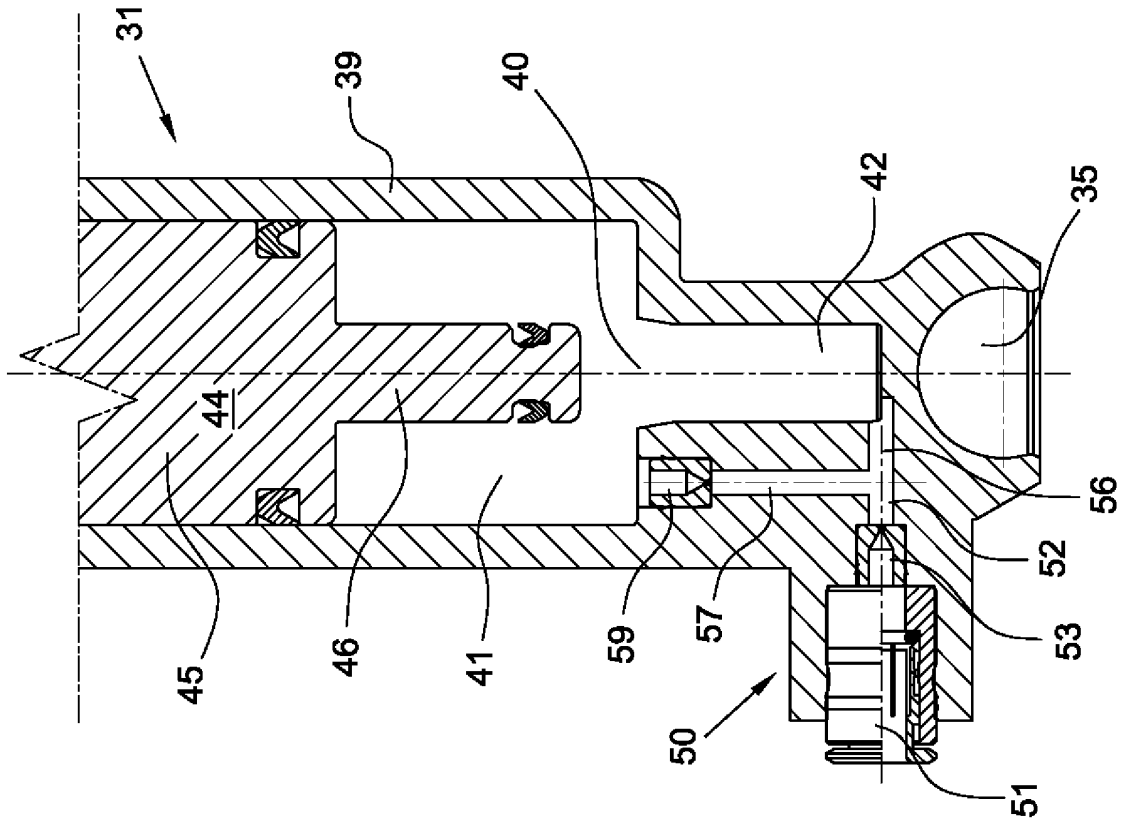


Fig. 3B

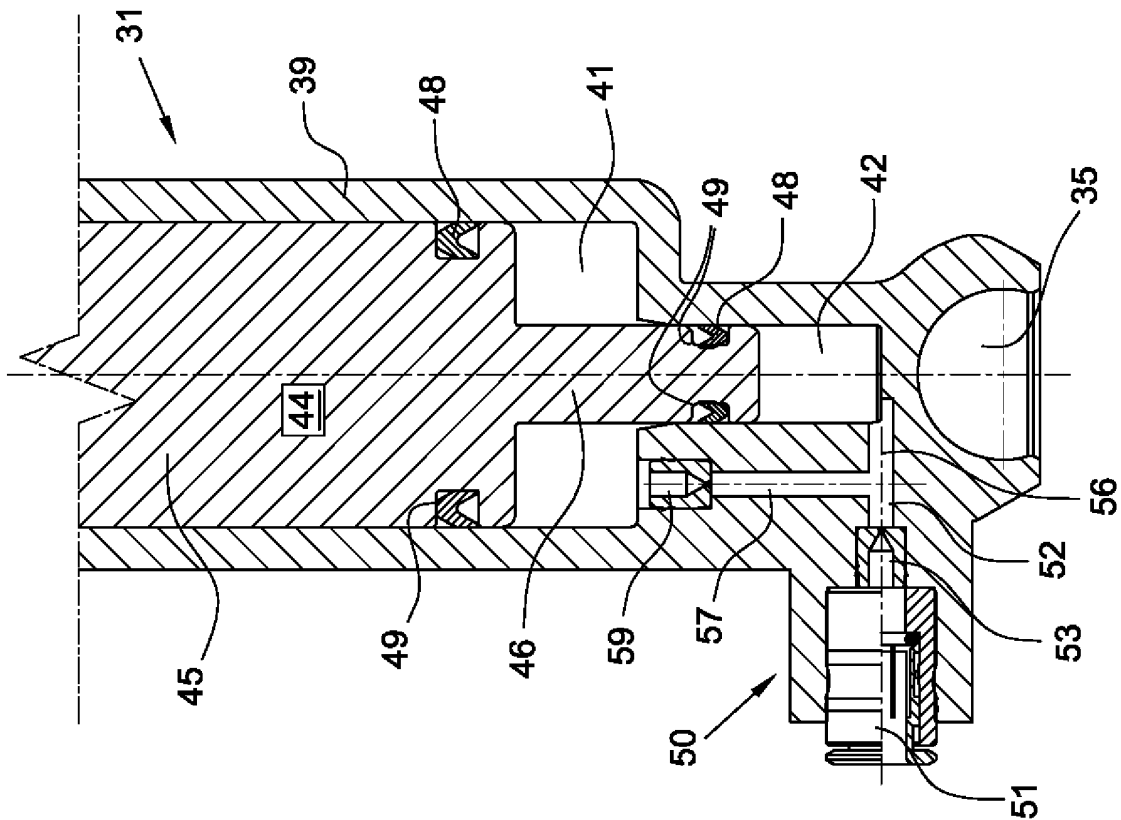


Fig. 3A

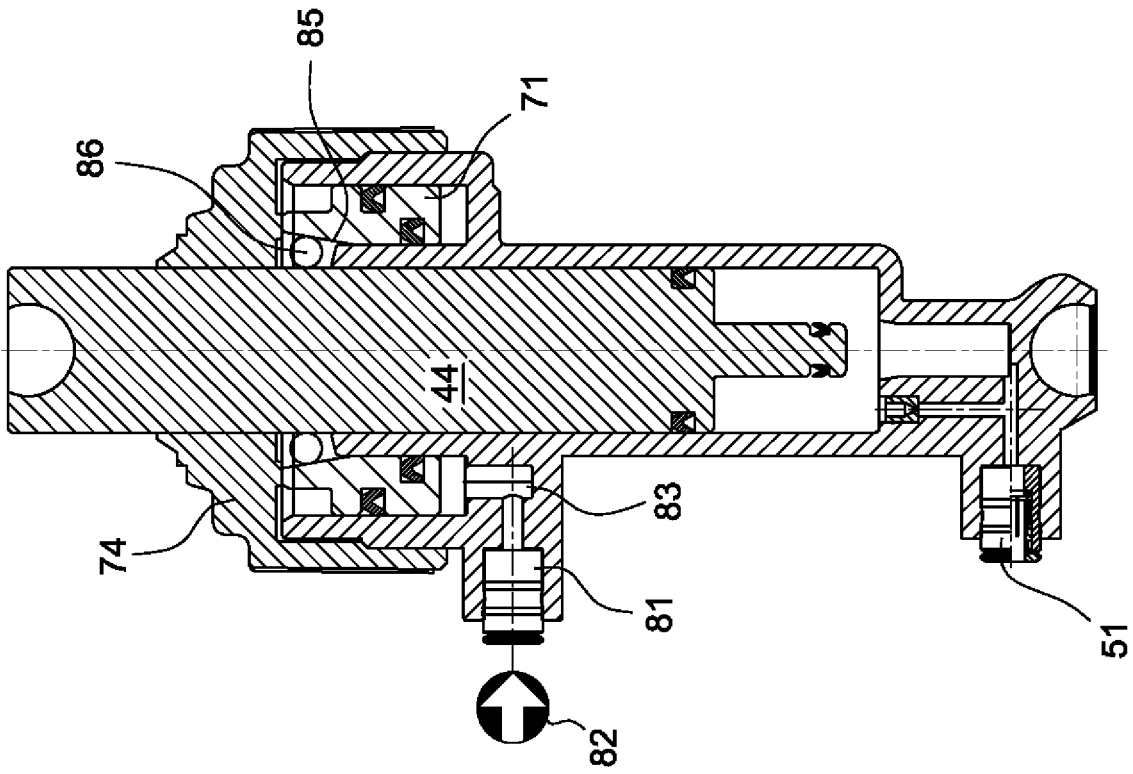


Fig. 4B

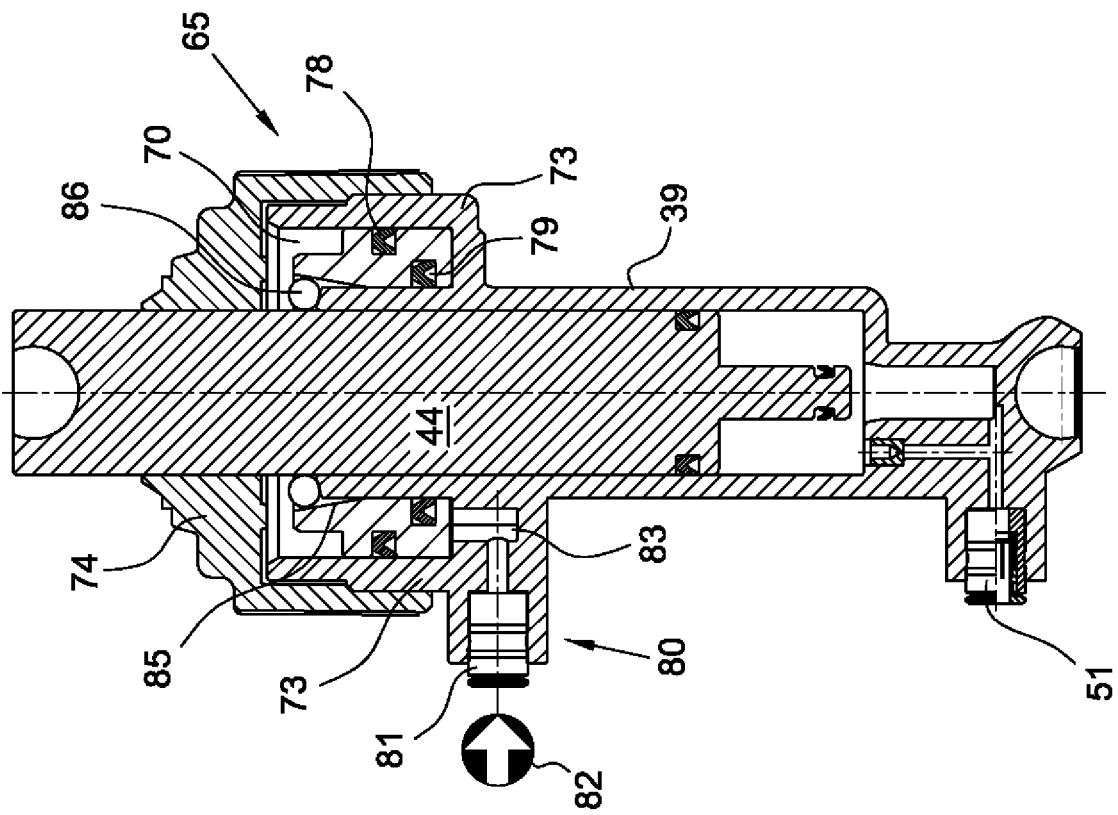


Fig. 4A

REFERENCES CITED IN THE DESCRIPTION

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