

(19)



(11)

EP 2 614 183 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

13.05.2015 Bulletin 2015/20

(51) Int Cl.:

D21F 5/10 (2006.01)

(86) International application number:

PCT/SE2011/051054

(21) Application number: **11823845.0**

(22) Date of filing: **01.09.2011**

(87) International publication number:

WO 2012/033444 (15.03.2012 Gazette 2012/11)

(54) **STEAM-HEATED DRYING CYLINDER**

DAMPFBEHEIZTER TROCKENZYLINDER

CYLINDRE DE SÉCHAGE CHAUFFÉ PAR VAPEUR

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **09.11.2010 US 411636 P**

08.09.2010 SE 1000912

(43) Date of publication of application:

17.07.2013 Bulletin 2013/29

(73) Proprietor: **Valmet Aktiebolag**

851 94 Sundsvall (SE)

(72) Inventor: **ÅNERUD, Johnny**

SE-654 64 Karlstad (SE)

(74) Representative: **Hynell, Magnus et al**

Hynell Patenttjänst AB

Patron Carls väg 2

683 40 Hagfors/Uddeholm (SE)

(56) References cited:

EP-A1- 2 017 517 DE-A1- 2 757 579

US-A- 3 368 288 US-A- 4 476 637

US-A- 4 476 637 US-A- 5 537 756

US-A- 5 537 756

EP 2 614 183 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to steam-heated drying cylinder of a paper machine, the drying cylinder having a jacket, which on its inside has circumferential grooves for collecting condensate that is formed as a result of heat transfer through the jacket to the outside thereof. The drying cylinder has a device for positioning a drain pipe of a draining system which is arranged in the steam-heated drying cylinder. The draining system comprises an outlet means, which discharges on the outside of the drying cylinder, and a plurality of drain pipes which are arranged in a plurality of axial groups and connected to the outlet means, said draining system being adapted to remove the condensate from said grooves of the drying cylinder to the outside thereof via said plurality of drain pipes and outlet means, said device for positioning a drain pipe comprising a first pipe positioner which is disposed within an end portion of the drain pipe located closest to the jacket, said pipe positioner comprising a supporting body which is designed for resting on the top surfaces of two ridges located adjacent to each other, and a locking device for fixing the drain pipe to the pipe positioner, wherein the pipe positioner is provided with a first through hole for receiving the drain pipe, and a second hole for receiving the locking device, said second hole opening into the first hole.

[0002] A known positioning device has a pipe positioner with a transverse supporting body for abutting against two adjacent ridges, delimiting the jacket groove, and a carrying body which projects perpendicularly from the supporting body to be received in the groove. At its lower end portion, the carrying body is provided with a smooth through hole for receiving the drain pipe. A threaded hole extends from the top side of the supporting body downward therethrough and further through the carrying body all the way to the said smooth hole. A locking device, comprising a threaded rod, is screwed into the threaded hole for abutting against the drain pipe and locking it in the desired position for the drain pipe, said position being locked by means of a locking nut carried by the threaded rod. The known pipe positioner, thus having a T-shape, is made for use in a groove of a particular depth. A different groove depth thus requires a T-shaped pipe positioner whose carrying body is shorter or longer in dependence on said groove depth, which is a problem particularly with respect to the stock-keeping of several sets of pipe positioners, where each set has its own, particular dimension.

[0003] US patent No. 4476637 discloses a steam heated dryer drum for drying of a web in a paper machine. The dryer drum disclosed in that document has a shell with an inner surface that is grooved to create a series of collection channels for condensate which forms during operation and the grooves are separated by ribs. Within the shell, there are axially extending collectors and from the walls of each collector, small tubes extend in a tangential direction with respect to the shell. These tubes

lead from the grooves to the interior of the collector. At the free end of each tube is secured a small guide plate that may have a T-shaped form. This guide plate is a tube positioning element and has a central lug with a hole therethrough into which projects the tube. The lug has one laterally extending arm or a pair of laterally extending arms which rest on adjacent ribs. In this way, the free open end of each tube is held a predetermined distance from the bottom surface of the groove.

[0004] The object of the present invention is to achieve an improved positioning device for drain pipes which eliminates the above-mentioned problems, and which enables it to be used for all drying cylinder regardless of the depth of the grooves on the inside of the jacket. Thereby, the stock-keeping is reduced to only one set of the pipe positioner in question.

[0005] The positioning device according to the invention is characterized in that said second hole opens into the first through hole and that a portion of the locking device that is located in the supporting body is provided with a third through hole adapted to interact with and be aligned with the first hole of the supporting body, so that the drain pipe extends through both the supporting body and the locking device, wherein the locking device is adapted to enclose the drain pipe and be brought to a locked position in interaction with the supporting body, in which locked position the drain pipe, the supporting body and the locking device are fixed to each other.

[0006] The invention will be described more closely with reference to the drawings.

Fig. 1 is an end view of portions of a drying cylinder whose end wall has been removed, and shows two out of several positioning devices according to the invention of a draining system for condensate.

Fig. 2 shows the positioning devices in cross-section.

Fig. 3 shows one of the positioning devices, comprising a drain pipe and first and second pipe positioners, before mounting onto a collecting pipe of the draining system.

Fig. 4 shows the second pipe positioner in cross-section.

Fig. 5 shows the first pipe positioner in cross-section.

Figs. 6 and 7 show the first pipe positioner with its different parts separated.

Fig. 8 is a cross-section of the second pipe positioner before mounting according to Fig. 3.

Fig. 9 is a cross-section of the jacket of the drying cylinder, along the line XI-XI in Fig. 3, and shows the drain pipe and the first pipe positioner.

[0007] Figs. 1 and 2 show an interior section of a steam-heated drying cylinder 1, which is installed in a drying section of a paper machine for manufacturing a paper web. The drying cylinder has a jacket 2, which has an outside, on which the paper web is dried, and an inside that is provided with a plurality of endless, circumferential grooves 3, evenly distributed in an axial direction, whose centres coincide with the centre axis of the drying cylinder 1. Suitably, the grooves 3 have a round, concave bottom surface 4. The grooves 3 define ridges 5 between them, wherein the top surfaces 30 of the ridges 5 and the bottom surfaces 4 and lateral walls of the grooves 3 together form an inner jacket surface for heat transfer. Such internally grooved drying cylinders 1 are used, *inter alia*, in the drying section of a tissue paper machine for manufacturing tissue paper, and then have a relatively large diameter which can vary from one machine to another. Furthermore, the drying cylinder 1 has a hollow central hub and two opposite axle journals, which are connected to the central hub to extend out through the opposite lateral end walls of the drying cylinder 1. The drying cylinder 1 is rotatably journaled by means of the axle journals, which thus define the axis of rotation of the drying cylinder 1.

[0008] The energy for drying the paper web is supplied in the form of steam to the interior space of the drying cylinder 1. The steam condenses on the inner jacket surface, and the heat is conducted through the jacket 2 to its outside, with which the paper web is in contact. During operation, condensate in the form of a film is accumulated on the bottom surface of each groove 3, said condensate film primarily determining the transition resistance from steam to jacket. An efficient heat flow requires that the grooves 3 are kept as free as possible from condensate. A special draining system for condensate, comprising a plurality of elongated drain pipes 6 which commonly are called suction pipes and are arranged in a plurality of evenly distributed groups around the inside of the jacket 2, is used for draining each groove 3 from condensate as efficiently as possible. Furthermore, the draining system comprises an outlet means which comprises, in order, a plurality of axially arranged collecting pipes 7, a stand pipe from each collecting pipe 7, a common centre connection for the stand pipes through said central hub and through one of the axle journals to the outside of the drying cylinder 1 for further transport. Accordingly, the number of collecting pipes 7 corresponds to the number of said groups. The collecting pipes 7 are arranged eccentrically and axially relative to the centre axis of the drying cylinder 1.

[0009] Each drain pipe 6 has an end portion 9 having an open end 10, with which the space 11 of the groove 3 stands in open communication, and an end portion 12 having an open end 13 that opens into the collecting pipe 7, see Fig. 2. During operation, the opening 10 of the end portion 9 should be disposed at a predetermined distance from the bottom surface 4 of the groove 3, as is evident from Figs. 1 and 9.

[0010] Each drain pipe 6 is provided with a device for positioning the drain pipe 6 relative to the inside of the jacket 2, and more precisely relative to the bottom surface 4 of the groove 3, in order to maintain said predetermined distance.

[0011] The positioning device comprises a first pipe positioner or pipe position adjuster 40, which is disposed in said end portion 9 of the drain pipe 6 that is located closest to the jacket 2. The first pipe positioner 40 comprises a supporting body 41, which is designed for resting on the top surfaces 30 of two successive ridges 5 to extend in a direction transversely across the groove 3 located therebetween. The supporting body 41 is delimited by two end surfaces 42, 43 facing away from each other, two lateral surfaces 44, 45 facing away from each other, an upper surface 46 and a lower surface 47, said lateral surfaces 44, 45 and upper and lower surfaces 46, 47 extending between said end surfaces 42, 43. Preferably, at least the lower surface 47 is curved as shown, e.g. circular-cylindrically. A first imaginary plane extends through the end surfaces 42, 43 and the upper and lower surfaces 46, 47. A second imaginary plane extends through the two end surfaces 42, 43 and the two lateral surfaces 44, 45 and intersects the said first plane at right angles. The planes may define centre planes of the supporting body 41, but one of the planes, or both, may be located slightly to the side of said centre plane.

[0012] A first through hole 48 extends between the lateral surfaces 44, 45 and has a diameter that is slightly larger than the diameter of the drain pipe 6 for receiving the drain pipe 6 therein with a sliding fit, so that the supporting body 41 can be displaced along the drain pipe 6 to a desired position relative to the end 10 of the end portion 9 of the drain pipe 6, or alternatively said fulcrum of the drain pipe 6. The first hole 48 has a centre axis that coincides with said second plane. Furthermore, a second through hole 49 is adapted to extend between the upper surface 46 and the lower, curved surface 47, said second hole 49 having a larger diameter than the first hole 48. The second hole 49 has a centre axis that coincides with said first plane. The centre axes of the two holes 48, 49 intersect each other at right angles, and their common intersection point coincides with the intersection point of the two said planes.

[0013] The first pipe positioner 40 further comprises a multi-functional, elongated pin 50, which comprises a central portion 51 that is designed to be received in the said second hole 49 with a sliding fit, wherein the portion 51 thus has diameter that is slightly smaller than the diameter of the second hole 49. The said portion is provided with a diametrical through hole 52, which has the same diameter as the first, smaller hole 48 of the supporting body 41 to thereby be aligned with the last-mentioned hole 48, so that the drain pipe 6 can be inserted into the smaller hole 48 of the supporting body 41 from one end and further through the hole 52 of the pin portion, and then further through the smaller hole 48 of the supporting body 4 and out through its other end. In that way, a unit

is produced which is slidable along the drain pipe 6 to be displaced and set to the desired position, when a predetermined distance between the bottom 4 of the groove 3 and the open end 10 of the drain pipe 6 has been reached. Furthermore, the pin 50 comprises a lower guiding and supporting portion 53, which extends from the lower surface 47 to be received in the groove 3 with the purpose of guiding and supporting the pipe positioner 40 in the groove, so that the drain pipe 6 is maintained in the correct, aligned position.

[0014] The length of the guiding and supporting portion 53 is smaller than the depth of the groove 3. The first pipe positioner 40 further comprises a locking device 54 for locking the three structural members 6, 41, 50 to each other. Such a locking device 54 can be designed and arranged in a plurality of different ways. In the shown embodiment, it comprises a nut 55 and an upper, threaded portion 56 of the pin 50, projecting from the upper surface 46 of the supporting body 41, onto which threaded portion the nut 55 is screwed, to finally abut against the upper surface 46 of the supporting body 41 and be tightened so that the supporting body 41, the drain pipe 6 and the pin 50 are locked to each other. If a position adjustment has to be made, the nut 55 needs to be loosened one or a few turns until the engagement is released, so that the first pipe positioner 40 can be displaced along the drain pipe in the desired direction. The first pipe positioner 40 according to the invention enables it to be used for all drying cylinders 1 regardless of the depth of the grooves 3 on the inside of the jacket 2. In order to reduce the weight of the supporting body 41, it can be provided with recesses, on both sides of the hole 49 and extending downward a suitable distance in a direction from the upper surface 46, e.g. half of the distance down to the lower surface.

[0015] The device further comprises a second pipe positioner or pipe position adjuster 14, which is disposed in the end portion 12. The second pipe positioner 14 comprises a mounting device 15, see Figs. 3 and 4, for mounting the drain pipe 6 onto the collecting pipe 7, and a lockable connection 16 that connects the drain pipe 6 to the mounting device 15. In the shown preferred embodiment, said connection 16 is a lockable joint connection which, in an unlocked condition, articulately connects the drain pipe 6 to the mounting device 15. The joint connection 16 forms a fulcrum for pivoting of the drain pipe in at least one vertical plane, i.e. a plane coinciding with the centre plane of the groove 3 that intersects the centre axis of the drying cylinder 1 at right angles. The degree of said pivoting is made in dependence on the diameter of the drying cylinder 1 and the depth of the groove 3, so that an open end of the drain pipe 6 comes to be located at a predetermined distance from the bottom surface 4 of the groove 3. Thereby, the joint connection 16 comprises an inner joint body 17, see Fig. 3, which is permanently mounted, e.g. by means of welding, onto the drain pipe 6 at a predetermined distance from said open end 10 of the said end portion 9 of the drain pipe 6. The inner joint

body 17 is designed with a curved, outer joint surface 18, which comprises surface portions 19, 20 at least facing forward and backward, as seen in the longitudinal direction of the drain pipe 6 and in a direction toward the collecting pipe 7. Furthermore, the joint connection 16 comprises an outer joint body 21, consisting of a first portion 22 and a second portion 23, see Figs. 3 and 4, which are detachably connected to each other and which together enclose the inner joint body 17. Each joint body portion 22, 23 is provided with an inner joint surface 24 and 25, respectively, see Fig. 4, which has the same shape and same radius as the joint surface 18 of the inner joint body 17. The two joint body portions 22, 23 are adapted to be joined into a unit, i.e. into said outer joint body 21, wherein their curved, inner joint surfaces 24 facing each other are adapted to interact with the curved joint surface 18 of the inner joint body 17 to produce in a first, initial position, a slidable interaction between the joint surfaces 18, 24, 25 facing each other, in which initial position the drain pipe 6 has a possibility to pivot about said fulcrum, which is thus defined by the joint surfaces 18, 24, 25, as has been described above. If continuing the forced bringing together of the two joint body portions 22, 23 in a direction toward each other, the friction between the joint surfaces 18, 24, 25 facing each other increases, until a completely locked condition of the joint connection 16 is achieved, whereby the drain pipe 6 becomes fixed against pivoting about said fulcrum. Suitably, the mounting device 15 and the joint body portion 22 located closest to the joint body 17 are made in one piece, as is evident from Figs. 3 and 4. The mounting device 15 and the outer joint body 21 have axially through-going centre holes 31, 32, see Fig. 4, which have a larger diameter than the drain pipe 6 to thereby enable said pivoting of the drain pipe 6.

[0016] In the shown preferred embodiment of the lockable joint connection 16, it is constituted of a ball joint, wherein the said curved joint surfaces 18, 24, 25 are spherical, whereby the draining means becomes pivotable in all directions. The mounting device 15 for mounting the drain pipe 6 onto the collecting pipe 7 comprises an externally threaded sleeve for screwing into an internally threaded hole 26 in a wall of the collecting pipe 7, said threaded hole connecting to the interior of the collecting pipe 7. The centre axis of the hole 26 is directed toward the region of the groove 3, where the drain pipe 6 is to suck condensate. It will be appreciated that all mounting holes 26 of the collecting pipe 7 have their centre axes aligned in the same way toward their corresponding regions, which thus will be located on, and intersected by, a common axial line. A screw depth stop 27 is formed at the transition to the ball joint 16. The first joint member portion 22 is cylindrical and has an external thread. In the shown embodiment, this first joint body portion 22 and said sleeve 15 are designed in one piece, wherein said screw stop 27 is formed by a radial, circumferential surface at the transition therebetween in that the first joint body portion 22 has a larger diameter than the sleeve 15. The second joint body portion 23 has the shape of a

nut, having an internal thread and a diameter at this thread portion which are adapted to the outer diameter of the first joint body portion 22 and its thread, so that the nut 23 can be screwed onto the first joint body portion 22 for the formation of screw connection while enclosing the inner spherical joint body 17. The side of the nut 23 facing away from the thread portion has a wall 28 that is provided with a centre hole 29, through which the drain pipe 6 extends and which also allows that a small portion of the inner, spherical joint body 17 can project therefrom to thereby enable that the drain pipe 6 can be pivoted in the desired way, when the ball joint is in a loosened state. The reference numeral 36 designates a securing plate, which is carried by the sleeve 15 and is foldable down over the nut 23 so that it is locked against being loosened, as is evident from Figs. 1-4.

[0017] Hitherto, a device with a second pipe positioner has been used where the end portion of the drain pipe facing toward the outlet means, and more precisely toward a collecting pipe, is provided with an external thread for screwing the drain pipe into the mounting device, which has a corresponding internal thread. Furthermore, the threaded portion of the drain pipe carries a locking nut, which is adapted to be brought into locking abutment against the mounting device, when the position of the drain pipe relative to the bottom surface of the groove has been decided. The position of the drain pipe relative to the bottom surface of the groove is thus set and adjusted by a rotation of the drain pipe about its axis so that it is screwed into or out of the mounting device. A disadvantage of the known device is that the length of the drain pipe is adapted to a particular drying cylinder and its diameter. Therefore, a range of drain pipes has to be provided for each size of drying cylinder, with respect to their diameters. Another disadvantage is that the mounting of the drain pipe is inconvenient and time-consuming in that it has to be performed directly inside the drying cylinder, and, furthermore, in that the adjustment of the drain pipes has to be done one by one without being able to utilize the settings of a previous, already mounted drain pipe.

[0018] The second pipe positioner 14, included in a preferred embodiment of the device according to the invention, enables one and the same length of the drain pipe 6 to be used for drying cylinders 1 having different diameters in that the second pipe positioner 14 is pivoted relative to the mounting axis 33, see Fig. 3, which is defined by the mounting device 15 that is fixed to the collecting pipe 7, so that the centre axis 34 of the drain pipe 6, see Fig. 3, forms an obtuse angle with the mounting axis 33, wherein the centre axis 34 thus may extend downward, as is shown in Fig. 3, or upward relative to the fixed mounting axis 33. In both cases, the centre axis 34 forms an acute angle α , see Fig. 3, with its tangent 35 in the intersection point with the bottom surface 4 of the groove 3 (or with the outside of the jacket 2). The mounting of the drain pipes 6 can be performed in a faster, simpler and more convenient way in that it is only necessary to mount a first drain pipe 6 onto the collecting

pipe 7, and thereby to set a desired angle, which is fixed by the nut 23 of the ball joint 16, whereafter the mounting device 15 is once again detached from the collecting pipe 7 to be used as a template for setting the corresponding angle of the other drain pipes 6 of the collecting pipe 7, which operation consequently can be carried out outside of the drying cylinder 1, whereafter the thus pre-positioned drain pipes 6 with associated devices can be mounted onto the collecting pipe 7 inside the drying cylinder 1. If an adjustment of an angle has to be made, this is a simple operation of loosening the nut 23 of the ball joint 16 to enable pivoting of the drain pipe 6 up or down depending on the degree of required adjustment. In the above-mentioned operations, the correct angle has been achieved when the open end 10 of the drain pipe 6 facing toward the jacket 2 is located at a predetermined distance from the bottom surface 4 of the groove 3. This distance is normally 3-5 mm. This distance is made permanent by means of the first pipe positioner 40, which is already pre-positioned on the drain pipe 6, but which can be readjusted if necessary. Furthermore, the first pipe positioner 40 is necessary for absorbing the centrifugal forces acting on the drain pipe 6 during operation, and which otherwise would press the end portion 9 of the drain pipe 6 inward in a direction toward the bottom surface 4 of the groove 3.

[0019] In the described embodiment having a ball joint 16, the fulcrum of the drain pipe 6 is thus defined by the centre point of the spherical joint surface 18 of the ball joint 16. In an alternative embodiment of the joint connection 16, the joint surface is cylindrical, defining a horizontal centre axis, which thus constitutes the fulcrum of the drain pipe 6.

[0020] The first pipe positioner, of course, can be used in combination with any type of the second pipe positioner, e.g. the known design which has been described above, where the end portion of the drain pipe facing toward the outlet means, and more precisely toward a collecting pipe, is provided with an external thread for screwing the drain pipe into the mounting device, which has a corresponding internal thread, or the new design, described more closely above, having a pivotable mounting of the drain pipe, which is preferred due to its many advantages over the said known design.

Claims

1. A steam-heated drying cylinder (1) of a paper machine, the steam-heated drying cylinder having a jacket (2), which on its inside has circumferential grooves (3) for collecting condensate that is formed as a result of heat transfer through the jacket (2) to the outside thereof, the grooves (3) defining ridges (5) between them wherein top surfaces (30) of the ridges (5) and bottom surfaces (4) and lateral walls of the grooves (3) together form an inner jacket surface for heat transfer, the steam-heated drying cyl-

- inder (1) further comprising a device for positioning a drain pipe (6) of a draining system which is arranged in the steam-heated drying cylinder (1), said draining system comprising an outlet means, which discharges on the outside of the drying cylinder (1), and a plurality of drain pipes (6) which are arranged in a plurality of axial groups and connected to the outlet means, said draining system being adapted to remove the condensate from said grooves (3) of the drying cylinder (1) to the outside thereof via said plurality of drain pipes (6) and outlet means, said device for positioning a drain pipe (6) comprising a first pipe positioner (40) which is disposed within an end portion (9) of the drain pipe (6) located closest to the jacket (2), said first pipe positioner (40) comprising a supporting body (41) which is designed for resting on the top surfaces (30) of two ridges (5) located adjacent to each other, and a locking device (54) for fixing the drain pipe (6) to the first pipe positioner (40), wherein the first pipe positioner is provided with a first through hole (48) for receiving the drain pipe (6), and a second hole (49) for receiving the locking device (54), the first through (48) being disposed in the supporting body (41), **characterised in that** said second hole (49) opens into the first through hole (48) and that a portion (51) of the locking device (54) that is located in the supporting body (41) is provided with a third through hole (52) adapted to interact with and be aligned with the first through (48) of the supporting body (41), so that the drain pipe (6) extends through both the supporting body (41) and the locking device (54), wherein the locking device (54) is adapted to enclose the drain pipe (6) and be brought to a locked position in interaction with the supporting body (41), in which locked position the drain pipe (6), the supporting body (41) and the locking device (54) are fixed to each other.
2. The steam-heated drying cylinder (1) according to claim 1, **characterized in that** the second hole (49) for the locking device (54) intersects the first hole (48) and is through-going, and that the locking device (54) comprises a lower, free guiding and supporting portion (53) which is adapted to project from the supporting body (41) to be freely received in the jacket groove (3).
 3. The steam-heated drying cylinder (1) according to any one of the claims 1 and **characterized in that** it comprises a second pipe positioner (14) which is disposed in an end portion (12) of the drain pipe (6) located closest to said outlet means, said pipe positioner (14) comprising a mounting device (15) for mounting the drain pipe (6) onto the outlet means, and a lockable connection (16) that connects the drain pipe (6) to the mounting device (15), that said lockable connection (16) is a joint connection, which defines a fulcrum for pivoting of the drain pipe (6) in at least one vertical plane to enable positioning of the drain pipe (6) relative to the bottom surface (4) of the groove (3).
 4. The steam-heated drying cylinder (1) according to claim 3, **characterized in that** the degree of said pivoting is made in dependence on the diameter of the drying cylinder (1) and the depth of the groove (3), so that an open end (10) of the drain pipe (6) comes to be located at a predetermined distance from the bottom surface (4) of the groove (3).
 5. The steam-heated drying cylinder (1) according to claim 3 or 4, **characterized in that** the joint connection (16) comprises an inner joint body (17) which is fixedly arranged on the drain pipe (6) at a predetermined distance from the open end (13) of the end portion (12) located closest to said outlet means, and which is designed with a curved joint surface (18), and an outer joint body (21) that consists of a first body portion (22) and a second body portion (23), which are detachably connected to each other and which together are adapted to enclose the inner joint body (17), said joint body portions (22, 23) having inner joint surfaces (24, 25), which are adapted to the joint surface (18) of the inner joint body (17) for slidable interaction during said pivoting of the drain pipe (6) and for locking frictional interaction in each set position of the drain pipe (6).
 6. The steam-heated drying cylinder (1) according to claim 5, **characterized in that** the mounting device (15) and the first body portion (22) of the outer joint body (21) located closest thereto are made in one piece.
 7. The stream-heated drying cylinder (1) according to claim 5 or 6, **characterized in that** the mounting device (15) and the outer joint body (21) have axially through-going centre holes, which have a larger diameter than the drain pipe (6) to thereby enable said pivoting of the drain pipe (6).
 8. The steam-heated drying cylinder (1) according to any one of the claims 3-7, **characterized in that** the lockable joint connection (16) is a ball joint with spherical joint surfaces (18, 24, 25).
- ## Patentansprüche
1. Dampfbeheizter Trockenzylinder (1) einer Papiermaschine, wobei der dampfbeheizte Trockenzylinder einen Mantel (2) hat, der an seiner Innenseite umlaufende Nuten (3) zum Aufnehmen von infolge von Wärmeübertragung durch den Mantel (2) zu dessen Außenseite gebildetem Kondensat hat, wobei die Nuten (3) zwischen einander Rippen (5) be-

grenzen, wobei obere Flächen (30) der Rippen (5) und Gründe (4), und Seitenwände der Nuten (3) zusammen eine innere Mantelfläche zur Wärmeübertragung bilden, der dampfbeheizte Trockenzylinder (1) weist ferner eine Vorrichtung zum Positionieren einer in dem dampfbeheizten Trockenzylinder (1) angeordneten Ablaufleitung (6) eines Ablaufsystems auf, wobei das Ablaufsystem eine außerhalb des Trockenzylinders (1) mündende Austrittseinrichtung, sowie eine Vielzahl von Ablaufleitungen (6) aufweist, die in einer Vielzahl von Axialgruppen angeordnet und mit der Austrittseinrichtung verbunden sind, wobei das Ablaufsystem angepasst ist, das Kondensat aus den Nuten (3) des Trockenzylinders (1) zu dessen Außenseite über die Vielzahl von Ablaufleitungen (6) und die Austrittseinrichtung zu beiseitigen, wobei die Vorrichtung zum Positionieren einer Ablaufleitung (6) einen ersten Leitungspositionierer (40) aufweist, der in einem Endabschnitt (9) der Ablaufleitung (6) angeordnet ist, der am nächsten zu dem Mantel (2) angeordnet ist, wobei der erste Leitungspositionierer (40) einen Haltekörper (41), der zum Aufliegen auf den oberen Flächen (30) zweier benachbart angeordneter Rippen konstruiert ist, sowie eine Verriegelungsvorrichtung (54) zum Befestigen der Ablaufleitung (6) an dem ersten Leitungspositionierer (40) aufweist, wobei der erste Leitungspositionierer mit einem ersten Durchgangsloch (48) zum Aufnehmen der Ablaufleitung (6), sowie einem zweiten Loch (49) zum Aufnehmen der Verriegelungsvorrichtung (54) versehen ist, wobei das erste Durchgangsloch (48) in dem Haltekörper (41) angeordnet ist, **dadurch gekennzeichnet, dass** das zweite Loch (49) in das erste Durchgangsloch (48) öffnet, und dass ein Abschnitt (51) der Verriegelungsvorrichtung (54), der in dem Haltekörper (41) angeordnet ist, mit einem dritten Durchgangsloch (52) versehen ist, das angepasst ist, mit dem ersten Durchgangsloch (48) des Haltekörpers (41) zusammenzuwirken und zu fluchten, sodass sich die Ablaufleitung (6) sowohl durch den Haltekörper (41) als auch die Verriegelungsvorrichtung (54) erstreckt, wobei die Verriegelungsvorrichtung (54) angepasst ist, die Ablaufleitung (6) zu umschließen und in eine verriegelte Position im Zusammenwirken mit dem Haltekörper (41) gebracht zu werden, wobei die Ablaufleitung (6), der Haltekörper (41) und die Verriegelungsvorrichtung (54) in der verriegelten Position aneinander befestigt sind.

2. Dampfbeheizter Trockenzylinder (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** das zweite Loch (49) für die Verriegelungsvorrichtung (54) das erste Loch (48) kreuzt und durchgehend ist, und dass die Verriegelungsvorrichtung (54) einen unteren, freigeführten und gehaltenen Abschnitt (53) aufweist, der angepasst ist, aus dem Haltekörper (41) vorzustehen, um in die Mantelnut (3) frei aufgenommen zu

werden.

3. Dampfbeheizter Trockenzylinder (1) nach einem der Ansprüche 1 und 2, **dadurch gekennzeichnet, dass** er einen zweiten Leitungspositionierer (14) aufweist, der in einem Endabschnitt (12) der Ablaufleitung (6) angeordnet ist, der am nächsten zu der Austrittseinrichtung angeordnet ist, wobei der Leitungspositionierer (14) eine Montagevorrichtung (15) zum Montieren der Ablaufleitung (6) auf der Austrittseinrichtung, sowie eine verriegelbare Verbindung (16) aufweist, die die Ablaufleitung (6) mit der Montagevorrichtung (15) verbindet, dass die verriegelbare Verbindung (16) eine Gelenkverbindung ist, die einen Gelenkpunkt zum Schwenken der Ablaufleitung (6) in mindestens einer senkrechten Ebene festlegt, um eine Positionierung der Ablaufleitung (6) relativ zu dem Grund (4) der Nut (3) zu ermöglichen.
4. Dampfbeheizter Trockenzylinder (1) nach Anspruch 3, **dadurch gekennzeichnet, dass** das Schwenkmaß abhängig von dem Durchmesser des Trockenzylinders (1) und der Tiefe der Nut (3) gemacht ist, sodass ein offenes Ende (10) der Ablaufleitung (6) mit einem festgelegten Abstand von dem Grund (4) der Nut (3) angeordnet werden kann.
5. Dampfbeheizter Trockenzylinder (1) nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** die Gelenkverbindung (16) einen inneren Gelenkkörper (17), der an der Ablaufleitung (6) mit einem festgelegten Abstand von dem offenen Ende (13) des am nächsten zu der Austrittseinrichtung angeordneten Endabschnitts (12) fest angeordnet ist und mit einer gekrümmten Gelenkoberfläche (18) konstruiert ist, sowie einen äußeren Gelenkkörper (21) aufweist, der aus einem ersten Abschnitt (22) und einem zweiten Abschnitt (23) besteht, die miteinander lösbar verbunden sind und die zusammen angepasst sind, den inneren Gelenkkörper (17) einzuschließen, wobei die Gelenkkörperabschnitte (22, 23) innere Gelenkoberflächen (24, 25) haben, die der Gelenkoberfläche (18) des inneren Gelenkkörpers (17) zum gleitenden Zusammenwirken während des Schwenkens der Ablaufleitung (6) und zum verriegelnden, reibenden Zusammenwirken in jeder festgelegten Position der Ablaufleitung (6) angepasst sind.
6. Dampfbeheizter Trockenzylinder (1) nach Anspruch 5, **dadurch gekennzeichnet, dass** die Montagevorrichtung (15) und der dieser am nächsten angeordnete erste Körperabschnitt (22) des äußeren Gelenkkörpers (21) einstückig gemacht sind.
7. Dampfbeheizter Trockenzylinder (1) nach Anspruch 5 oder 6, **dadurch gekennzeichnet, dass** die Mon-

tagevorrichtung (15) und der äußere Gelenkkörper (21) axial durchgehende Mittellöcher haben, die einen größeren Durchmesser als die Ablaufleitung (6) haben, um dadurch das Schwenken der Ablaufleitung (6) zu ermöglichen.

8. Dampfbeheizter Trockenzylinder (1) nach einem der Ansprüche 3 bis 7, **dadurch gekennzeichnet, dass** die verriegelbare Gelenkverbindung (16) ein Kugelenk mit kugelförmigen Gelenkoberflächen (18, 24, 25) ist.

Revendications

1. Cylindre de séchage chauffé à la vapeur (1) d'une machine à papier, le cylindre de séchage chauffé à la vapeur présentant une chemise (2), dont l'intérieur présente des rainures circulaires (3) destinées à recueillir un condensat qui est formé en raison d'un transfert de chaleur à travers la chemise (2) vers l'extérieur de celle-ci, les rainures (3) définissant entre elles des arêtes (5), dans lequel les surfaces supérieures (30) des arêtes (5) et les surfaces inférieures (4) et les parois latérales des rainures (3) forment ensemble une surface de chemise intérieure de transfert de la chaleur, le cylindre de séchage chauffé à la vapeur (1) comprenant en outre un dispositif destiné à positionner un tuyau de drainage (6) d'un système de drainage qui est agencé dans le cylindre de séchage chauffé à la vapeur (1), ledit système de drainage comprenant des moyens de sortie, qui évacuent vers l'extérieur du cylindre de séchage (1), et une pluralité de tuyaux de drainage (6) qui sont agencés en une pluralité de groupes axiaux et qui sont connectés aux moyens de sortie, ledit système de drainage étant adapté de façon à éliminer le condensat en provenance desdites rainures (3) du cylindre de séchage (1) à l'extérieur de celui-ci par l'intermédiaire de ladite pluralité de tuyaux de drainage (6) et des moyens de sortie, ledit dispositif destiné à positionner un tuyau de drainage (6) comprenant un premier dispositif de positionnement de tuyau (40) qui est disposé à l'intérieur d'une partie d'extrémité (9) du tuyau de drainage (6) qui se situe le plus près de la chemise (2), ledit premier dispositif de positionnement de tuyau (40) comprenant un corps de support (41) qui est conçu de façon à reposer sur les surfaces supérieures (30) de deux arêtes (5) situées adjacentes l'une à l'autre, et un dispositif de verrouillage (54) destiné à fixer le tuyau de drainage (6) au premier dispositif de positionnement de tuyau (40), dans lequel le premier dispositif de positionnement de tuyau est doté d'un premier trou traversant (48) destiné à recevoir le tuyau de drainage (6), et d'un deuxième trou (49) destiné à recevoir le dispositif de verrouillage (54), le premier trou traversant (48) étant disposé dans le corps de support (41),

caractérisé en ce que ledit deuxième trou traversant (49) s'ouvre dans le premier trou traversant (48) et **en ce qu'**une partie (51) du dispositif de verrouillage (54) qui se situe dans le corps de support (41) est dotée d'un troisième trou traversant (52) adapté de façon à interagir et être aligné avec le premier trou traversant (48) du corps de support (41), de telle sorte que le tuyau de drainage (6) s'étende à travers le corps de support (41) et le dispositif de verrouillage (54), dans lequel le dispositif de verrouillage (54) est adapté de façon à enfermer le tuyau de drainage (6) et à être placé dans une position verrouillée en interaction avec le corps de support (41), position verrouillée dans laquelle le tuyau de drainage (6), le corps de support (41) et le dispositif de verrouillage (54) sont fixés les uns aux autres.

2. Cylindre de séchage chauffé à la vapeur (1) selon la revendication 1, **caractérisé en ce que** le deuxième trou (49) pour le dispositif de verrouillage (54) coupe le premier trou (48) et est traversant, et **en ce que** le dispositif de verrouillage (54) comprend une partie guidage et support inférieure libre (53) qui est adaptée de façon à faire saillie à partir du corps de support (41) de façon à être reçue de manière libre dans la rainure de chemise (3).
3. Cylindre de séchage chauffé à la vapeur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il comprend un second dispositif de positionnement de tuyau (14) qui est disposé dans une partie d'extrémité (12) du tuyau de drainage (6) qui se situe le plus près desdits moyens de sortie, ledit dispositif de positionnement de tuyau (14) comprenant un dispositif de support (15) destiné à supporter le tuyau de drainage (6) sur les moyens de sortie, et une connexion qui peut être verrouillée (16) qui connecte le tuyau de drainage (6) au dispositif de support (15), **en ce que** ladite connexion qui peut être verrouillée (16) est une connexion de raccordement, qui définit un point d'appui destiné à un pivotement du tuyau de drainage (6) dans un plan vertical au moins de façon à permettre le positionnement du tuyau de drainage (6) par rapport à la surface inférieure (4) de la rainure (3).
4. Cylindre de séchage chauffé à la vapeur (1) selon la revendication 3, **caractérisé en ce que** le degré dudit pivotement dépend du diamètre du cylindre de séchage (1) et de la profondeur de la rainure (3), de telle sorte qu'une extrémité ouverte (10) du tuyau de drainage (6) se situe à une distance prédéterminée à partir de la surface inférieure (4) de la rainure (3).
5. Cylindre de séchage chauffé à la vapeur (1) selon la revendication 3 ou la revendication 4, **caractérisé en ce que** la connexion de raccordement (16) comprend un corps de raccordement intérieur (17) qui

est agencé de manière fixe sur le tuyau de drainage (6) à une distance prédéterminée à partir de l'extrémité ouverte (13) de la partie d'extrémité (12) qui se situe le plus près desdits moyens de sortie, et qui est conçu avec une surface de raccordement incurvée (18), et un corps de raccordement extérieur (21) qui se compose d'une première partie de corps (22) et d'une seconde partie de corps (23), qui sont connectées l'une à l'autre de manière détachable et qui sont adaptées toutes deux de façon à enfermer le corps de raccordement intérieur (17), lesdites parties de corps de raccordement (22, 23) présentant des surfaces de raccordement intérieures (24, 25), qui sont adaptées à la surface de raccordement (18) du corps de raccordement intérieur (17) pour une interaction coulissante au cours dudit pivotement du tuyau de drainage (6) et pour une interaction à friction de verrouillage dans chaque position fixée du tuyau de drainage (6).

6. Cylindre de séchage chauffé à la vapeur (1) selon la revendication 5, **caractérisé en ce que** le dispositif de support (15) et la première partie de corps (22) du corps de raccordement extérieur (21) qui se situe le plus près de celui-ci, sont réalisés d'une seule pièce.
7. Cylindre de séchage chauffé à la vapeur (1) selon les revendications 5 ou 6, **caractérisé en ce que** le dispositif de support (15) et le corps de raccordement extérieur (21) présentent des trous centraux traversants de manière axiale, qui présentent un diamètre plus grand que celui du tuyau de drainage (6) de façon à permettre de ce fait le pivotement dudit tuyau de drainage (6).
8. Cylindre de séchage chauffé à la vapeur (1) selon l'une quelconque des revendications 3 à 7, **caractérisé en ce que** la connexion de raccordement qui peut être verrouillée (16) est une articulation à rotule qui présente des surfaces de raccordement sphériques (18, 24, 25).

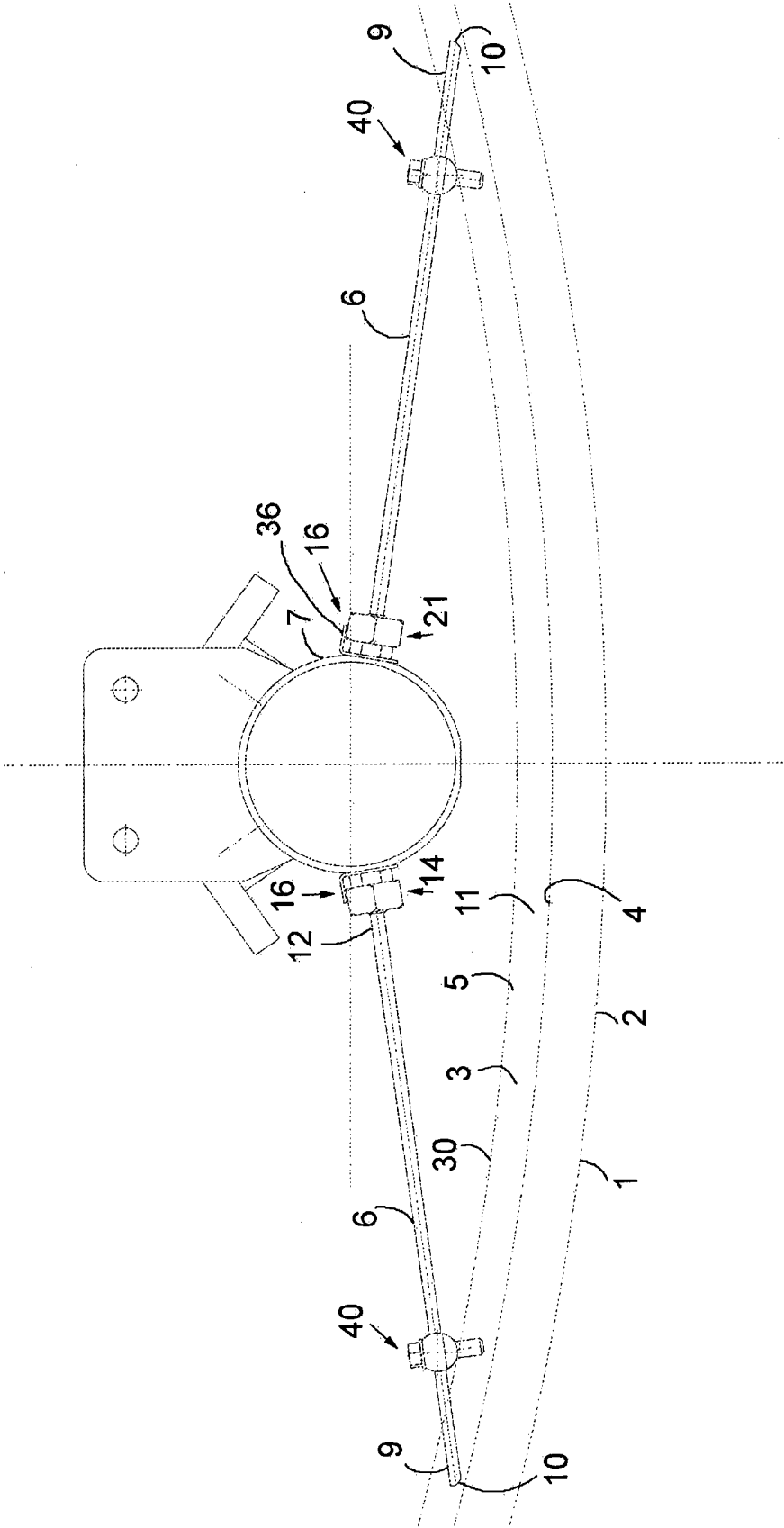


Fig. 1

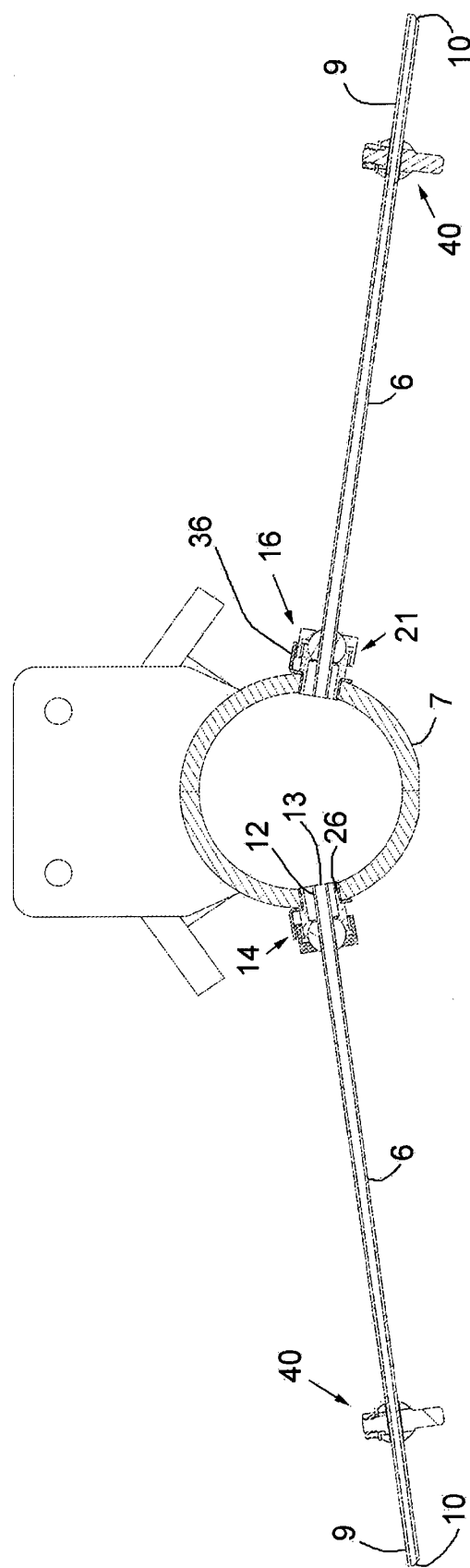


Fig. 2

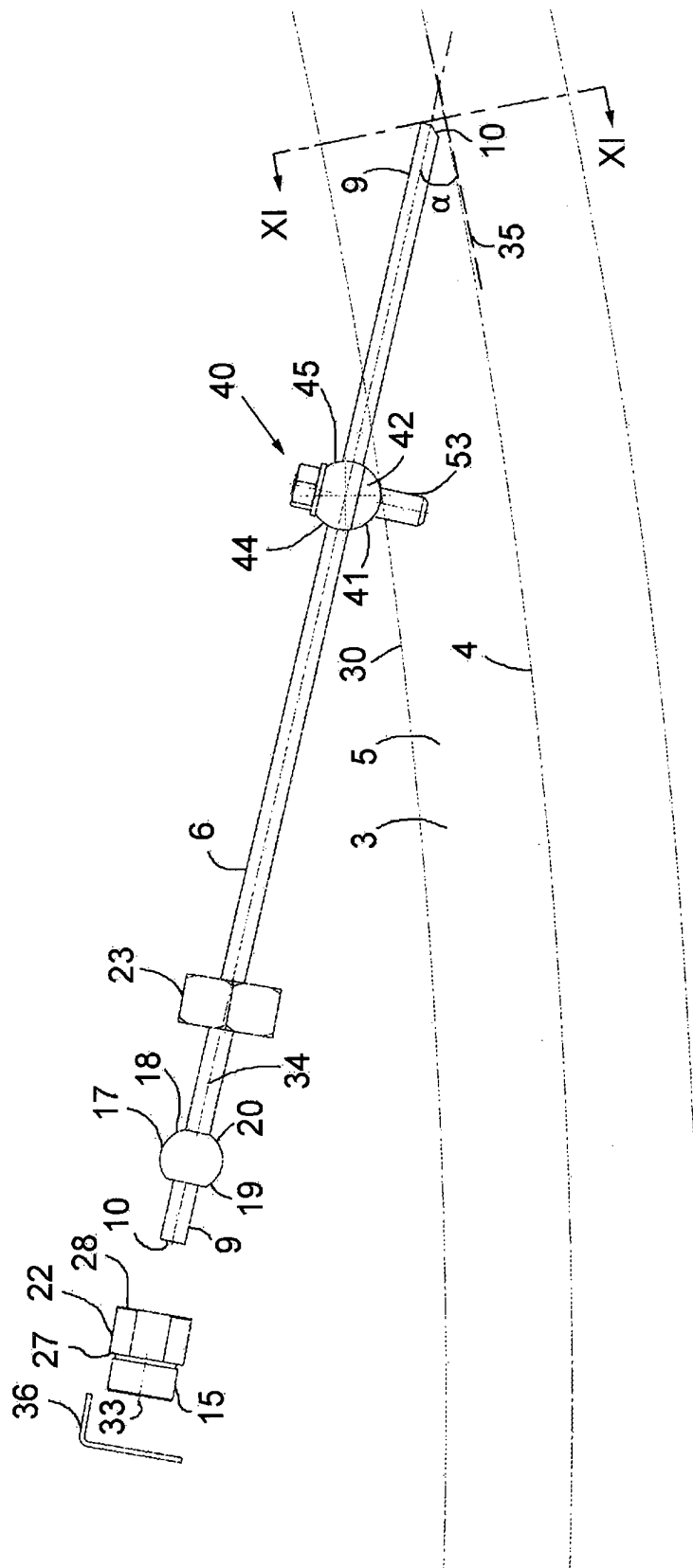


Fig. 3

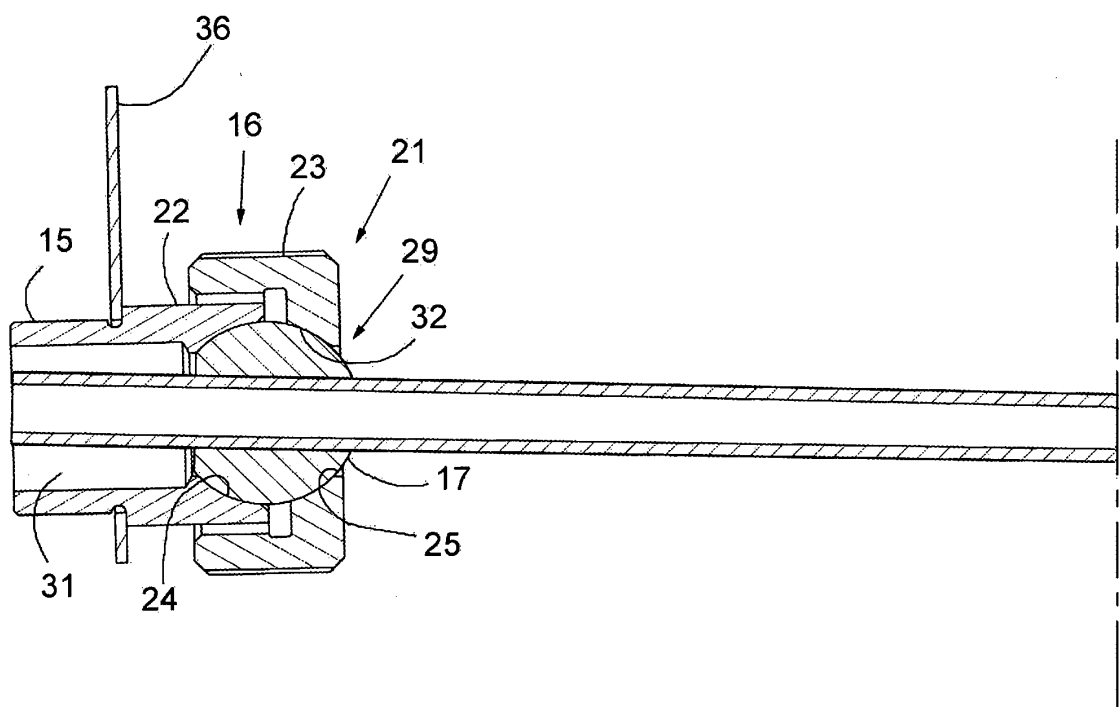


Fig. 4

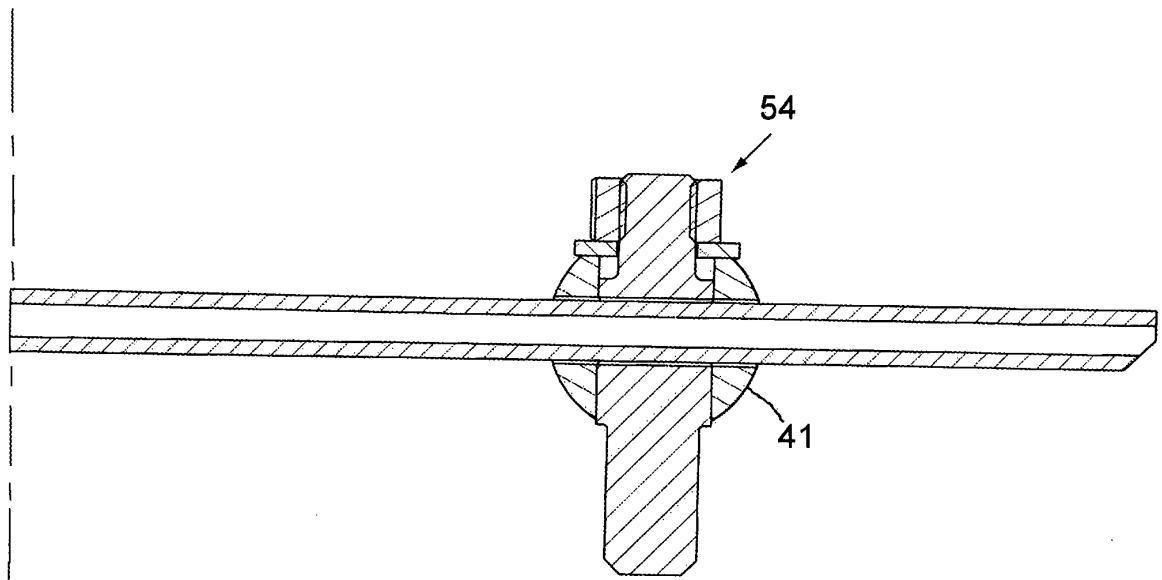


Fig. 5

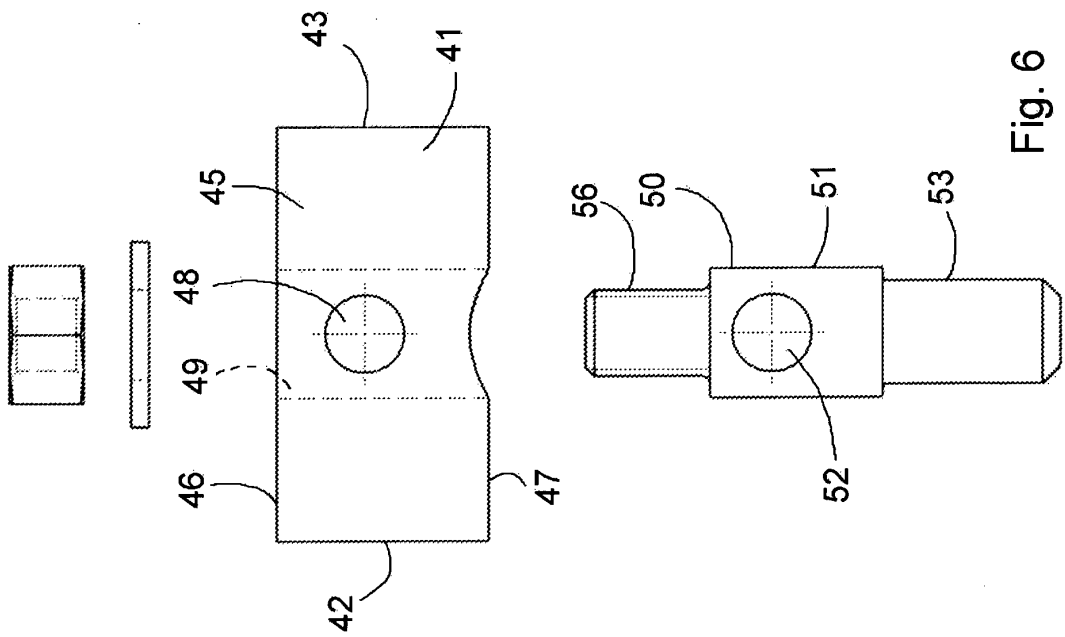


Fig. 6

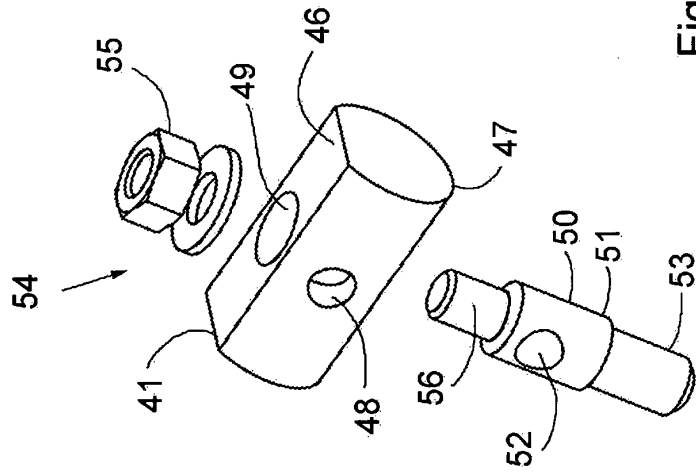


Fig. 7

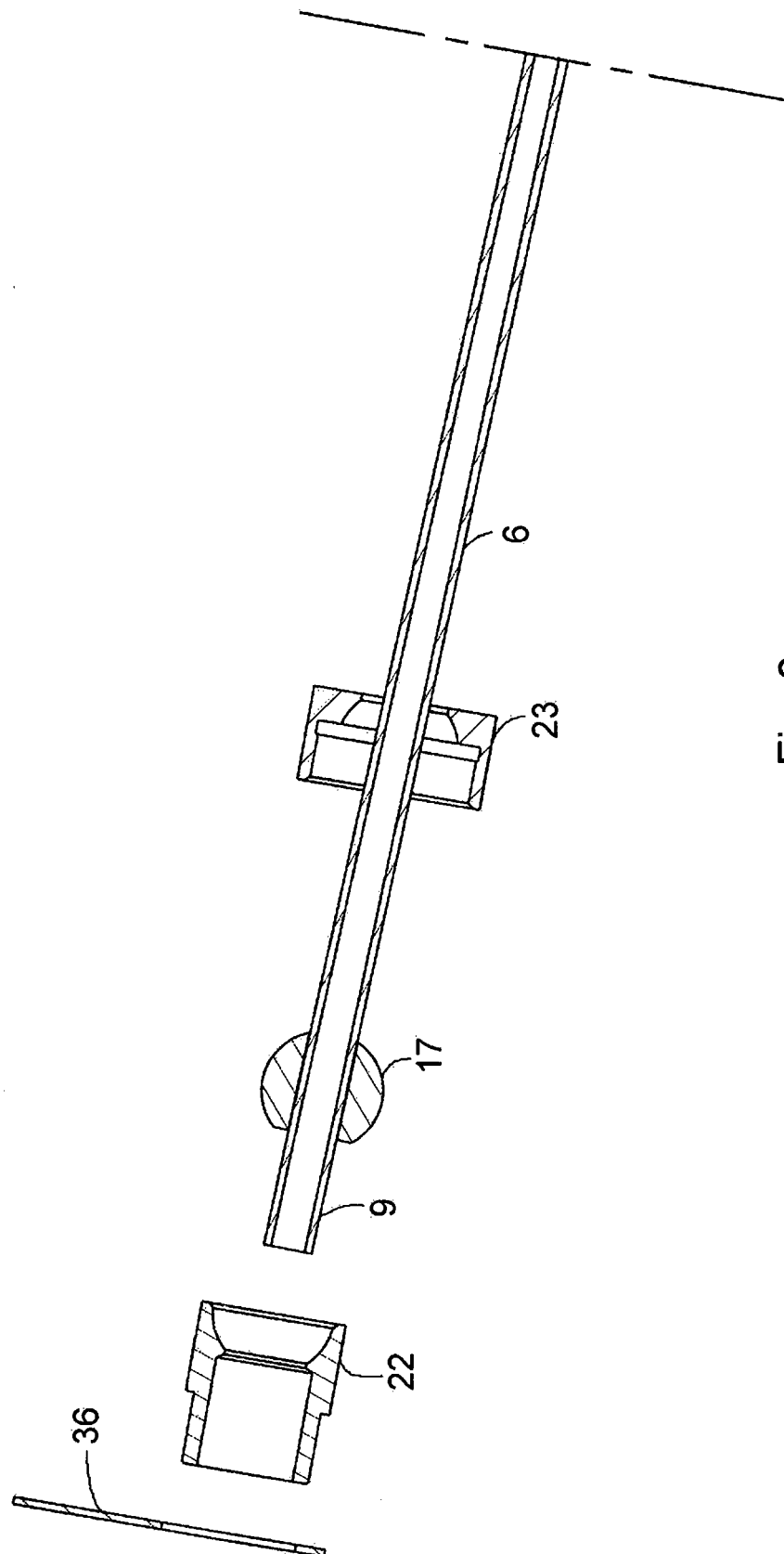


Fig. 8

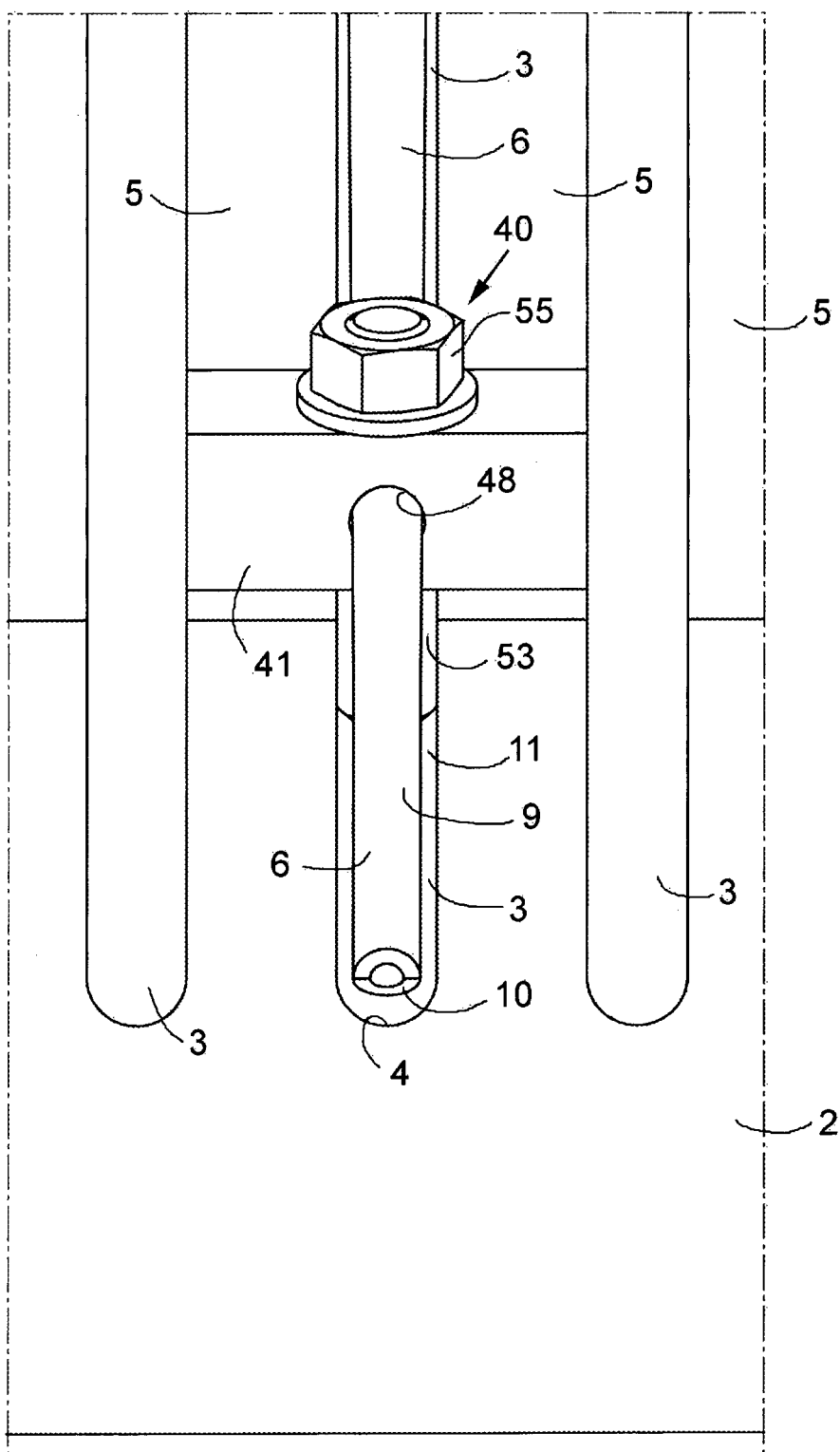


Fig. 9

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4476637 A [0003]