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(71) Applicant *(for all designated States except US)*: **C. JEPSEN CONSULTING APS** [DK/DK]; Egelykke 16, DK-6400 Sønderborg (DK).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **JEPSEN, Christian** [DK/DK]; Egelykke 16, DK-6400 Sønderborg (DK).

(74) Agents: **HERTLING, Peter** et al.; Inspicos A/S, P.O. Box 45, Kogle Allé 2, DK-2970 Hørsholm (DK).

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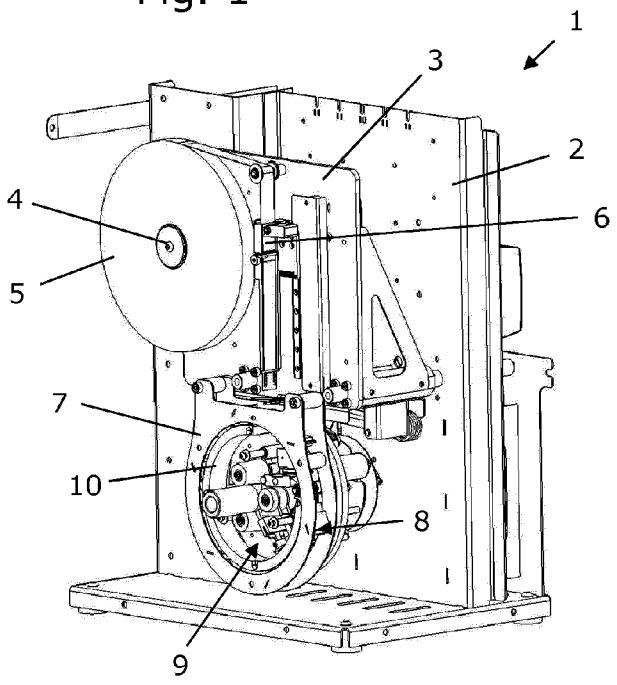
(54) Title: AN APPARATUS FOR WINDING TAPE ON A PIPE STUB

Fig. 1



(57) Abstract: The invention provides an apparatus and a method for winding tape on a pipe stub, particularly for Teflon pack tape on valves of pressure bottles etc. The apparatus comprises storage for a tape roll and a drum being rotatable about the pipe stub to wind the tape onto the pipe stub. To enable winding of tape without being bound by the size of the tape roll, the drum comprises an outer surface onto which the tape is winded for subsequent winding onto the pipe stub after the de-coiled tape is separated from the tape roll.

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AN APPARATUS FOR WINDING TAPE ON A PIPE STUB

INTRODUCTION

The invention relates to an apparatus for winding tape on a pipe stub, e.g on a pipe stub of a valve or similar fitting of a system for gas under pressure.

Particularly, the invention relates to an apparatus with storage for a tape roll and a system for winding the tape onto an outer surface of the pipe stub.

BACKGROUND OF THE INVENTION

Piping systems are an important part of almost all homes, buildings and technical installations for plumbing, gas and other utilities. Pipes constructed of metal or PVC plastic are intended to withstand extreme temperatures and changes in pressure. For this reason, the pipe threads require sealing in order to reinforce the system and ensure proper function. PTFE tape is one of the most effective and commonly used methods of providing an airtight seal. Particularly with respect to gas under pressure, e.g. oxygen etc, there are strict regulation specifying how and where to apply thread seal tape.

The process is typically carried out by hand and includes a few distinct steps. In a first step, the thread seal tape is wrapped tightly around the male pipe thread. In a subsequent step, the tape is pressed firmly against the pipe stub to make the tape conform to the threaded surface. Subsequently, the male and female pipes are fitted. PTFE tape is applicable on both PVC plastic pipe threads and galvanized metal piping, and on solid brass stubs of valves etc.

Due to the severe danger involved with gas leakage, particularly in case of inflammable gases, it is important that the thread seal tape is winded very precisely on the pipe stub. Accordingly, it is typically an expensive, laborious task to apply the thread tape.

DESCRIPTION OF THE INVENTION

It is an object of the invention to provide automatic means for applying tape to pipe stubs and particular to provide a relatively compact apparatus and to provide an apparatus which is capable of applying tape from a roll of tape, even from a tape roll of large size.

According to a first aspect, the invention provides an apparatus with:

— a drum being rotatable about a space formed within a radial outer surface of the drum;

— a seat for the pipe stub in the space;

— a tape arrest in the space; and

— a guide;

The guide forms a passage for a free end of tape from the tape roll in the storage through a slot in the drum to the space where the tape arrest can press the free end of the tape against an outer surface of the pipe stub such that rotation of the drum causes de-coiling of tape from the tape roll and winding of the de-coiled tape around an outer surface of the pipe stub and around the outer surface of the drum simultaneously.

Since the de-coiled tape is winded both around an outer surface of the pipe stub and around the outer surface of the drum, the tape can be de-coiled and winded onto the pipe stub without the need to rotate the tape roll around the pipe stub. This enables a very compact design and/or use of tape rolls of large size.

The outer surface of the drum may be circular and the seat may be located centrally with respect to the outer surface. This will provide a very constant binding pressure as the distance between the surface of the pipe stub and the surface of the drum is constant.

The apparatus may further comprise power driven means and a control system operable to effectuate a winding sequence in which:

a) winding tape is guided from the storage via the guide to the tape arrest;

b) the tape arrest is moved to a position where it presses the free end of the tape against the outer surface of the pipe stub;

c) the drum is rotated to de-coil tape from the tape roll while winding the de-coiled tape onto both the outer surface of the pipe stub and outer surface of the drum;

d) the de-coiled tape is separated from the tape roll; and

e) the drum is rotated to un-wind the de-coiled tape from the outer surface of the drum and wind it onto the outer surface of the pipe stub.

To provide automatic actuation of the apparatus and thus to improve the speed and ease by which the apparatus is operated, the seat may comprise a switch for initiating the winding sequence. The switch may be a mechanical or magnetic switch, or a switch which in any similar way recognises that a pipe stub is pressed against the seat whereby the winding sequence may start.

50-75 percent of the de-coiled tape may advantageously be winded onto the outer surface of the drum prior to the separation of the de-coiled tape from the tape roll. This amount will be sufficient for a complete pipe stub under normal conditions. For this purpose, the outer surface of the drum may e.g. have a diameter being in the range of 3-15, such as 5-10 such as 7 times the diameter of the pipe stub or times the diameter of an average size pipe stub for which the apparatus is designed.

The apparatus may further comprise a tape retention gripper located in the space and adapted to releasably grip the tape to provide increased tension in the tape during winding onto the pipe stub. By use of the retention gripper, it may be ensured that a very low counter force is provided as long as the tape is only winded up to 1-2 turns around the pipe stub, and as soon as the tape is winded sufficiently around the pipe stub to ensure resistance against sliding between the tape and the outer surface of the pipe stub, the retention gripper may close and thus increase the binding force due to the resistance against sliding between the tape and the retention gripper.

The apparatus may further comprise at least one contact roll adapted to revolve about the pipe stub and to press the tape against the outer surface of the pipe stub. Preferably, the contact roll forms the tape arrest such that the tape is simply arrested by the contact roll pressing the tape against the outer surface of the pipe stub.

The apparatus may further comprise a guiding arm movable from a position where a lower termination thereof is outside the space to a position where the lower termination is in the space for supporting positioning of the tape against the outer surface of the pipe stub. The guiding arm may particularly have a rigid structure such that it becomes capable of maintaining the tape in a stretched configuration and in a predetermined orientation or direction at which the tape approaches the pipe stub.

Additionally, the aforementioned sequence a-e may contain further steps, e.g. a step of moving the guiding arm into the space and out of the space. This step forms part of the

aforementioned step a. Or e.g. a step of closing a retention gripper e.g. after step c). Or the step of opening the retention gripper e.g. after step e), the step of moving the storage part and the winding part inwardly and outwardly relative to a frame (will be described later) to form a specific winding pattern e.g. simultaneously with steps c) and e), and finally, the sequence may comprise the step of moving a brush to a position where it is pressed against the outer surface of the pipe stub to press the tape firmly against that surface.

The lower termination may have a compliant shape which is influenced by gravity. As an example, the lower termination may comprise one or several small pieces of metallic chain which hangs freely from a lower surface of a rigid arm forming the remaining part of the guiding arm. The electrical conductivity of the metal chains may facilitate adherence of the tape onto the chains by means of electrical charge or static electricity. In that way, the free tip of the tape may be positioned very exactly at the outer surface of the pipe stub when the chains hang in a position very close to the pipe stub or in a position where the chains touch the pipe stub. In this position, the tape arrest, e.g. in form of the mentioned roll or rolls may move to a position where the tape is squeezed between the roll and the outer surface of the pipe stub. Additionally, the roll or rolls may move axially, i.e. in the direction of the rotation axis of the rotor.

To enable winding of the tape in a specific pattern onto the pipe stub, the apparatus may comprise a frame to which the storage and the drum are movably affixed. This means that the storage and the drum can move back and fourth in a direction being parallel to the longitudinal centreline of the pipe stub – i.e. parallel to the centre line around which the winding takes place. In that way, the tape can be winded from the tip of the pipe stub and upwards along the shaft of the pipe stub, and optionally back again towards the tip by movement of the storage and the drum relative to the frame.

If the pipe arrest is constituted by at least one and preferably three pressure rolls, each pressure-roll may be movable between a position where the roll does not touch the pipe stub and a position where it presses against the outer surface of the pipe stub. Initially, when the pipe stub is inserted into the machine, the pressure rolls are in a position radially remote from the pipe stub, and when the pipe stub is in the apparatus, the rolls are moved radially towards the stub to press the tape against the outer surface thereof. The rolls are also movable in a direction perpendicular to the radial direction, namely in the direction of the axis around which they revolve. This freedom enables the rolls to move relative to the rotor and thus to stay in a fixed position relative to the pipe stub when the rotor moves back and fourth to perform a specific winding pattern of the tape onto the pipe stub.

In practise, it may be problematic to ensure that the tape adheres to the pipe stub and not to the pressure rolls. For this purpose, each roll may comprise features for preventing the tape from sticking onto the roll. Such means may be provided e.g. by at least one groove and a separator plate which extends out from each groove. The separator plate could be movable relative to the roll such that the separator plate can ensures separation of the tape from the roll during rotation of the roll against the outer surface of the pipe stub.

Surprisingly, it has been discovered that the tape becomes more reluctant to adhere to the pipe stub and thereby less reluctant to adhere to the pressure rolls if the pipe stub has a temperature which is higher than that of the pressure rolls. Therefore, it may be an advantage to provide a heating structure adapted to increase the temperature of the surface of the pipe stub, preferably to a temperature above that of the pressure rolls.

In a second aspect, the invention provides an apparatus by which adherence of the tape onto the pressure roll is prevented. Accordingly, the invention also provides an apparatus for winding tape on a pipe stub, the apparatus comprising:

- a storage for a tape roll;
- a drum being rotatable about a space formed within a radial outer surface of the drum;
- a seat for the pipe stub in the space;
- a tape arrest in the space; and
- a guide;

the guide forming a passage for a free end of tape from the tape roll in the storage through a slot in the drum to the space where the tape arrest can press the free end of the tape against an outer surface of the pipe stub, wherein the tape arrest is constituted by at least one pressure-roll adapted to roll against an outer surface of the pipe stub and thereby press the tape against the outer surface of the pipe stub.

The pressure roll and the means for preventing adherence of tape onto the roll may be equal to that described relative to the first aspect of the invention, i.e. the roll may comprise a groove with a separator plate, or the apparatus may comprise heating means for pre-heating of the pipe stub.

In a third aspect, the invention provides a method of winding tape on a pipe stub, the method comprising:

- guiding a free end of tape from a tape roll through a passage which extends through a slot in an outer surface of a drum,
- pressing the free end of the tape against an outer surface of the pipe stub which is located within the outer surface of the drum;
- rotating the drum to cause de-coiling of tape from the tape roll and winding of the de-coiled tape around an outer surface of the pipe stub and around the outer surface of the drum simultaneously.

The method may further comprise the step of separating the free end of the tape from the tape roll when the de-coiled tape has been winded around the outer surface of the pipe stub and drum.

Additionally, the method according to the third aspect of the invention may follow the features of the apparatus according to the first and second aspects and the method contain any step necessary in order for the apparatus to perform as described relative to the first aspect.

LIST OF DRAWINGS

Embodiments of the invention will now be described in further details with reference to the drawings in which:

Fig. 1 illustrates an apparatus according to the invention;

Figs. 2 and 3 illustrate exploded views of the apparatus in Fig. 1;

Fig. 4 illustrates a rotor with a drum for an apparatus according to the invention;

Fig. 5 illustrates a front view with the guiding arm in the space before the rolls grip the free end of the tape;

Fig. 6 illustrates a front view with the guiding arm in the space after the rolls have gripped the free end of the tape;

Fig. 7 illustrates a front view with the guiding arm out of the space after the rolls have gripped the free end of the tape;

Fig. 8 illustrates the shape of the de-coiled portion of the tape when it is winded onto the pipe stub and outer surface of the drum;

Fig. 9 illustrates the drive mechanism for the guiding arm;

Figs. 10 and 11 illustrate the compliant termination of the guiding arm influenced by gravity to hang vertically downwards;

Fig. 12 illustrates a retention gripper in a closed configuration;

Figs. 13-14 illustrate enlarged views of one of the rolls for contact with the pipe stub;

Fig. 15 illustrates a loading and pre-heating station for the apparatus according to the invention; and

Figs. 16-18 illustrate a pattern in which the tape is typically winded.

DETAILED DESCRIPTION OF EMBODIMENTS

It should be understood that the detailed description and specific examples, while indicating embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

Fig. 1 illustrates an apparatus 1 for winding tape on a pipe stub. The apparatus comprises three main components, namely a machine frame 2, a storage part 3 which forms storage 4 for a tape roll 5 and a part 6 of a guide for the free end from the tape roll to the pipe stub. The apparatus further comprises a winding part which includes a drum 7 being rotatable about a space 8 formed within a radial outer surface 9 of the drum 7. The drum 7 is fixed to the rotor 10 which can rotate relative to the frame 2 and relative to the storage part 2. The rotor rotates with the seat 11 forming a centre axis for the rotation, c.f. Fig. 2 such that the pipe stub 12 becomes located centrally within the rotating rotor. Herein, the rotor 10 forms the mentioned winding part 5.

Fig. 2 illustrates the apparatus in an exploded view where the storage part 3 and the winding part 5 disassembled from the frame 2. To form a specific winding pattern, the storage part 3 and the winding part 5 move inwardly and outwardly relative to the frame 2 and thus relative to the seat 11 which forms part of the frame 2.

Fig. 3 illustrates the storage part 2 and winding part 5 without the frame 2 and in a partly exploded view. In this view, the pipe stub 12 is clearly seen. The pipe stub 12 is pressed against a seat (not shown) in the space 8. The seat comprises a switch which activates a winding sequence. The rotor 10 includes a tape retention gripper 13 located in the space and adapted to releasably grip the tape to provide increased tension in the tape during winding onto the pipe stub. The tape retention gripper is illustrated in further details in Fig. 10.

The rotor 10 further comprises a set of contact rolls including three soft rubber rolls 14 adapted to revolve about the pipe stub and to press the tape against the outer surface of the pipe stub when the rotor 10 rotates. The contact rolls form the tape arrest and they are disclosed more clearly in Figs. 5 and 6.

The storage part 3 comprises a guiding arm 17 which can slide vertically between a position where a lower termination 18 of the guiding arm is outside the space 8 and a position where it has entered into the space by vertical downwards movement of the arm. The arm supports positioning of the tape against the outer surface of the pipe stub by bringing the free end 19 of the tape in direct contact with the pipe stub. In this position (not shown in Fig. 3), the contact rolls move radially inwards and presses the free end of the tape against the outer surface of the pipe stub.

The lower termination 18 is made from two short pieces of a chain hanging freely from a lower surface of the guiding arm 17. The chains are hanging freely influenced by gravity. Since the lower termination is of an electrically conductive material, the static electricity nearly always being present in the winding tape, will draw the winding tape onto the termination 18 and the guiding arm will thereby be able to position the free end of the tape directly onto the pipe stub.

Fig 4 illustrates the rotor 10 seen from another angle.

Fig. 5 illustrates the contact rolls 14 in a position being remote from the pipe stub 12. The guiding arm 17 is in the vertical bottom position with the lower termination 18 and the free end 19 in the space. In this position, the contact rolls 14 move radially inwards as illustrated in Fig. 6 until the free end 19 is squeezed between outer surfaces of the pipe stub 12 and the

roll 14. At this point, the guiding arm 17 returns vertically to the top position in which the lower termination 18 is outside the space 8, c.f. Fig. 7.

Rotation of the rotor 10 and thereby rotation of the drum 7 and of the rolls 14 relative to the pipe stub 12 will, at this point, cause de-coiling of tape from the tape roll and winding of the de-coiled tape both around the outer surface of the pipe stub 12 and around the outer surface 9 of the drum 7 simultaneously.

Initially, i.e. after approximately 90 degrees turning of the rotor 10 anti-clockwise relative to the pipe stub 12, the tape 20 will be plan against the top surface 21 of the retention gripper 13. When the tape has been coiled approximately 1-2 turns about the pipe stub, the retention gripper closes and the friction increases whereby the tightness of the tape onto the thread of the pipe stub increases.

Figs. 5 and 6 also illustrate the brush 15 which is movable by use of a solenoid 16 in a radial direction towards the pipe stub. When the brush is moved onto the surface of the pipe stub, continued rotation of the rotor onto which the brush is mounted, will make the brush press the tape firmly to the outer surface of the pipe stub and thus increase the binding quality.

Fig. 8 illustrates the shape of the de-coiled tape piece 22 which has an inner winding portion 23 winded about the pipe stub, and an outer winding portion 24 winded about the outer surface 9 of the drum.

Due to the outer winding portion 24, an amount of tape has been accumulated on the rotor, and the de-coiled tape can therefore be separated by from the tape roll in the storage part 3 and the continued winding operation carried out by the winding part is therefore independent on the tape roll. Accordingly, a scissor 25, c.f. Fig. 7, located between the storage part 3 and the winding part 10, 11 is operated to cut the de-coiled piece of tape 22 off from the tape roll.

Fig. 9 illustrates an enlarged view of a top part of the guiding arm 17 which is movable in a vertical direction to bring the opposite termination 18 into and out of the space 8, respectively, and thereby to guide the tape 20 to the pipe stub 12. At the top end 26, the guiding arm 17 comprises a connection 27 connecting the arm 17 with an endless belt 28 which is motorised to bring the guiding arm into the vertically directed motion into and out of the space 8. the connection 27 is hinged such that it can move relative to the top end 26. This provides the feature that tape will be movable only in one direction from the tape roll towards the pipe stub. In this way, movement of the guiding arm in the vertical direction de-coils tape from the tape roll.

Figs. 10 and 11 illustrate the termination 18 of the guiding arm 17 seen from the front (Fig. 10) and from the side (Fig. 11). The termination is constituted by two pieces of a metal chain which hangs freely downwards influenced by gravity. Due to the electrically conductive properties, the tape 20 will stick closely to the side of the metal chains under influence of static electricity, and the chains will therefore effectively ensure that the free end of the tape 20 is straightened out which enables the free end to be squeezed between the outer surface of the roll 14 and the outer surface of the pipe stub 12.

Fig. 12 illustrates a cross section of the retention gripper 13. The gripper comprises a base plate 29 forming a top surface 21 and a gripping element 30 hinged to the base plate 29 by the hinge component 31. The gripping element 30 comprises a compression plate 32 and for adjustment of pressure, a spring loaded screw 33 which enables adjustment of the pressure of the compression plate 32 onto the top surface 21 of the base plate 29 when the gripping element is in the illustrated closed position. Fig. 7 illustrates the gripping element with the gripping element 30 in the opposite open position ready to receive the tape 20 on the top surface upon rotation of the rotor 10 relative to the pipe stub 12. When the tape 20 is received on top surface 21, the gripping element closes and thereby provides a grip around the tape. As a result of this grip, the tape will be pulled through the retention gripper 13 on its way from the tape roll 5 to the pipe stub 12, and the retention gripper 13 will provide a certain degree of friction which can be adjusted by rotation of the screw 33. The friction will control how tight the tape 20 is winded onto the pipe stub 12.

Figs. 13 and 14 illustrate enlarged views of one of the rolls 14. As it is indicated in Fig. 13, the roll 14 comprises grooves 34, 35, and a separator plate 36, 37 for each groove, ensures separation of the tape from the roll. The separator plate is more clearly seen in Fig. 14 illustrating section perpendicular to the axial direction of the roll 14 and located in the middle of the groove 36, c.f. Fig. 13.

The separator plates are identical and Fig. 14 illustrates one of the plates 36 seen from the side. The plate comprises a plate element 38 and a wire hook 39 which is suspended over the inner part of the roll 14 in the bottom 40 of the groove 34. When the roll 14 rolls on the shaft 41, the weight of the plate element 38 brings the plate element to a lower most orientation by gravity, and the outwards portion 42 of the wire hook 39 effectively lifts off tape which may bind to the outer surface of the roll 14 thereby effectively preventing the tape to wind onto the rolls rather than onto the pipe stub.

Fig. 15 illustrates a combined loading and heating station 43 including a plurality of supports 44 for a valve or similar item with a pipe stub to be winded with pack tape. The heating station includes a heater 45 which heats the pipe stubs and thereby increases the ability of

the tape to bond onto the outer surface of the pipe stub. The table 46, onto which the supports 44 are mounted, can rotate to bring the valves to a position within the rotor 10 one by one.

The apparatus comprises the following motors for effecting movement of the mentioned elements:

The apparatus has seven degrees of freedom, five being actuated by step-motors and two being actuated by solenoid motors. The motors are controlled by a control system (not illustrated) which is constituted by a PLC, type Siemens S7-1200 PLC with pulse output for the step-motors. All electric components of the apparatus are based on 24 Vdc which is established by use of an integrated power supply adapted for 110-240Vac input. The PLC ensures the cycle of:

a) Moving the guiding arm into the space thereby guiding winding tape from the storage via the guide to the outer surface of the pipe stub 12;

b) Moving the rolls 14 radially inwardly until the rolls press against the outer surface of the pipe stub 12;

c) Moving the guiding arm out of the space

d) Rotating the rotor 10 and thus the drum a first rotation sequence to de-coil tape from the tape roll 5 while winding the de-coiled tape onto both the outer surface of the pipe stub and outer surface 9 of the drum 7;

e) Moving the storage part 3 and the winding part 5 move inwardly and/or outwardly relative to the frame 2 and thus relative to the seat 11 which forms part of the frame 2 to form a specific winding pattern (This step takes place simultaneous with step d);

f) Separating the de-coiled tape 22 from the tape roll 5 by operation of the scissor 25;

g) Closing the retention gripper 13 by rotation of the gripping element 30 relative to the base plate 29. This will increase the friction and thus tighten the tape around the pipe stub;

h) Rotating the rotor 10 and thus the drum 7 a second rotation sequence to unwind the de-coiled tape from the outer surface 9 of the drum 7 and wind it onto the outer surface of the pipe stub 12;

i) Moving the storage part 3 and the winding part 5 move inwardly and/or outwardly relative to the frame 2 and thus relative to the seat 11 which forms part of the frame 2 to form a specific winding pattern (This step takes place simultaneous with step h);

j) Moving the brush radially inwardly to press the tape firmly against the outer surface of the pipe stub;

k) Moving the rolls 14 radially outwardly to release the pressure of the rolls against the outer surface of the pipe stub 12;

l) Opening the retention gripper 13 by rotation of the gripping element 30 relative to the base plate 29;

The five step-motors control movement as follows, c.f. the above sequence description:

Step motor 1: Sequences: a, c

Step motor 2: Sequences: b, k

Step motor 3: Sequences: d, h

Step motor 4: Sequences: e, i

Step motor 5: Sequences: f

The two solenoid motors control movement as follows, c.f. the above sequence description:

Solenoid motor 1: Sequence: g, l

Solenoid motor 2: Sequence: j

The PLC receives user input via a keyboard. The user may input date which specifies the pattern in which the tape is winded onto the pipe stub. This pattern is determined by the

movement of the winding part 5 relative to the frame 2 and thus relative to the seat 11 and pipe stub 12.

Figs. 16, 17, and 18 illustrate a winding sequence and the pattern which is typically desired. Fig. 16 illustrates the free end 47 of the tape being arrested against the outer surface of the pipe stub 12. The roll 14 which is used for this purpose is not illustrated. The free end 47 is held against the tip 48 of the pipe stub. From this location the tape is winded downwards along the shaft 49 of the pipe stub 12 until it reaches a lower most location 50. At this point, the tape is winded backwards towards the tip 48 where the winding is stopped with the termination 51 of the tape.

CLAIM

1. An apparatus (1) for winding tape on a pipe stub (12), the apparatus comprising:

— a storage for a tape roll (5);

— a drum (7) being rotatable about a space (8) formed within a radial outer surface of the drum (7);

— a seat (11) for the pipe stub (12) in the space;

— a tape arrest (14) in the space; and

— a guide;

the guide forming a passage for a free end of tape from the tape roll in the storage through a slot in the drum to the space where the tape arrest can press the free end (47) of the tape against an outer surface (48, 49) of the pipe stub such that rotation of the drum causes de-coiling of tape from the tape roll (5) and winding of the de-coiled tape around an outer surface of the pipe stub (12) and around the outer surface of the drum (7) simultaneously thereby accumulating an amount of tape on the outer surface of the drum (7) for subsequent winding onto the pipe stub (12).

2. An apparatus according to claim 1, wherein the outer surface of the drum is circular and the seat is located centrally within respect to the outer surface.

3. An apparatus according to claim 1 or 2, further comprising power driven means and a control system operable to effectuate a winding sequence in which:

— winding tape is guided from the storage via the guide to the tape arrest;

— the tape arrest is moved to a position where it presses the free end of the tape against the outer surface of the pipe stub;

— the drum is rotated to de-coil tape from the tape roll while winding the de-coiled tape onto both the outer surface of the pipe stub and outer surface of the drum;

— the de-coiled tape is separated from the tape roll; and

— the drum is rotated to un-wind the de-coiled tape from the outer surface of the drum and wind it onto the outer surface of the pipe stub.

4. An apparatus according to claim 3, wherein the seat comprises a switch for initiating the winding sequence.

5. An apparatus according to any of the preceding claims, wherein at least 50 percent of the de-coiled tape is winded onto the outer surface of the drum prior to the separation of the de-coiled tape from the tape roll.

6. An apparatus according to any of the preceding claims, further comprising a tape retention gripper located in the space and adapted to releasably grip the tape to provide increased tension in the tape during winding onto the pipe stub.

7. An apparatus according to any of the preceding claims, further comprising at least one contact roll adapted to revolve about the pipe stub and to press the tape against the outer surface of the pipe stub.

8. An apparatus according to any of the preceding claims, further comprising a guiding arm movable from a position where a lower termination thereof is outside the space to a position where the lower termination is in the space for supporting positioning of the tape against the outer surface of the pipe stub.

9. An apparatus according to claim 8, wherein the lower termination has a compliant shape which is influenced by gravity.

10. An apparatus according to claim 9, wherein the lower termination is of an electrically conductive material.

11. An apparatus according to any of the preceding claims, comprising a frame to which the storage and the drum are movably fixed.

12. An apparatus according to any of the preceding claims, wherein the tape arrest is constituted by at least one pressure-roll adapted to roll against an outer surface of the pipe stub and thereby press the tape against the outer surface of the pipe stub.

13. An apparatus according to claim 12, wherein each pressure-roll is movable between a position where the roll does not touch the pipe stub and a position where it presses against the outer surface of the pipe stub.

14. An apparatus according to claim 12 or 13, where each roll comprises at least one groove and a separator plate which extends out from each groove, where the roll and separator plate is movable relative to each other such that the separator plate can ensures separation of the tape from the roll during rotation of the roll against the outer surface of the pipe stub.

15. An apparatus according to any of the preceding claims, further comprising a heating structure adapted to increase the temperature of the surface of the pipe stub.

16. An apparatus for winding tape on a pipe stub, the apparatus comprising:

- a storage for a tape roll;
- a drum being rotatable about a space formed within a radial outer surface of the drum;
- a seat for the pipe stub in the space;
- a tape arrest in the space; and
- a guide;

the guide forming a passage for a free end of tape from the tape roll in the storage through a slot in the drum to the space where the tape arrest can press the free end of the tape against an outer surface of the pipe stub, wherein the tape arrest is constituted by at least one pressure-roll adapted to roll against an outer surface of the pipe stub and thereby press the tape against the outer surface of the pipe stub.

17. An apparatus according to claim 16, wherein each pressure-roll is movable between a position where the roll does not touch the pipe stub and a position where it presses against the outer surface of the pipe stub.

18. An apparatus according to claim 16 or 17, where each roll comprises at least one groove and a separator plate which extends out from each groove, where the roll and separator plate

is movable relative to each other such that the separator plate can ensures separation of the tape from the roll during rotation of the roll against the outer surface of the pipe stub.

19. A method of winding tape on a pipe stub, the method comprising:

— guiding a free end of tape from a tape roll through a passage which extends through a slot in an outer surface of a drum,

— pressing the free end of the tape against an outer surface of the pipe stub which is located within the outer surface of the drum;

— rotating the drum to cause de-coiling of tape from the tape roll and winding of the de-coiled tape around an outer surface of the pipe stub and around the outer surface of the drum simultaneously.

20. A method according to claim 19, further comprising the step of separating the free end of the tape from the tape roll when the de-coiled tape has been winded around the outer surface of the pipe stub and drum.

21. A method according to claim 20, wherein at least 50 percent of the de-coiled tape is winded onto the outer surface of the drum before the free end is separated from the tape roll.

22. A method according to claims 20 or 21, further comprising the step of un-winding the de-coiled tape from the outer surface of the drum and winding the tape onto the outer surface of the pipe stub by rotation of the drum after the free end has been separated from the tape roll.

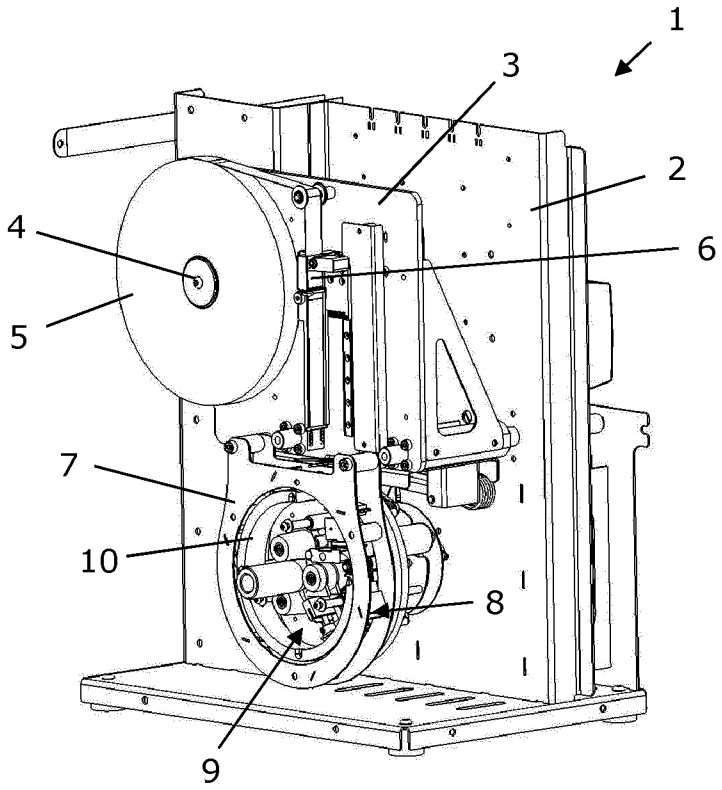

Fig. 1

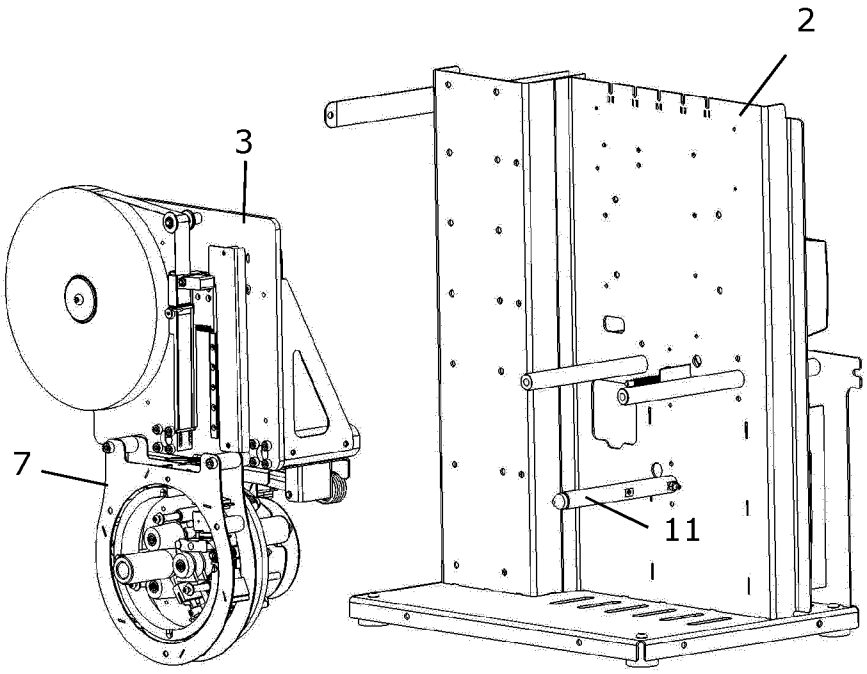

Fig. 2

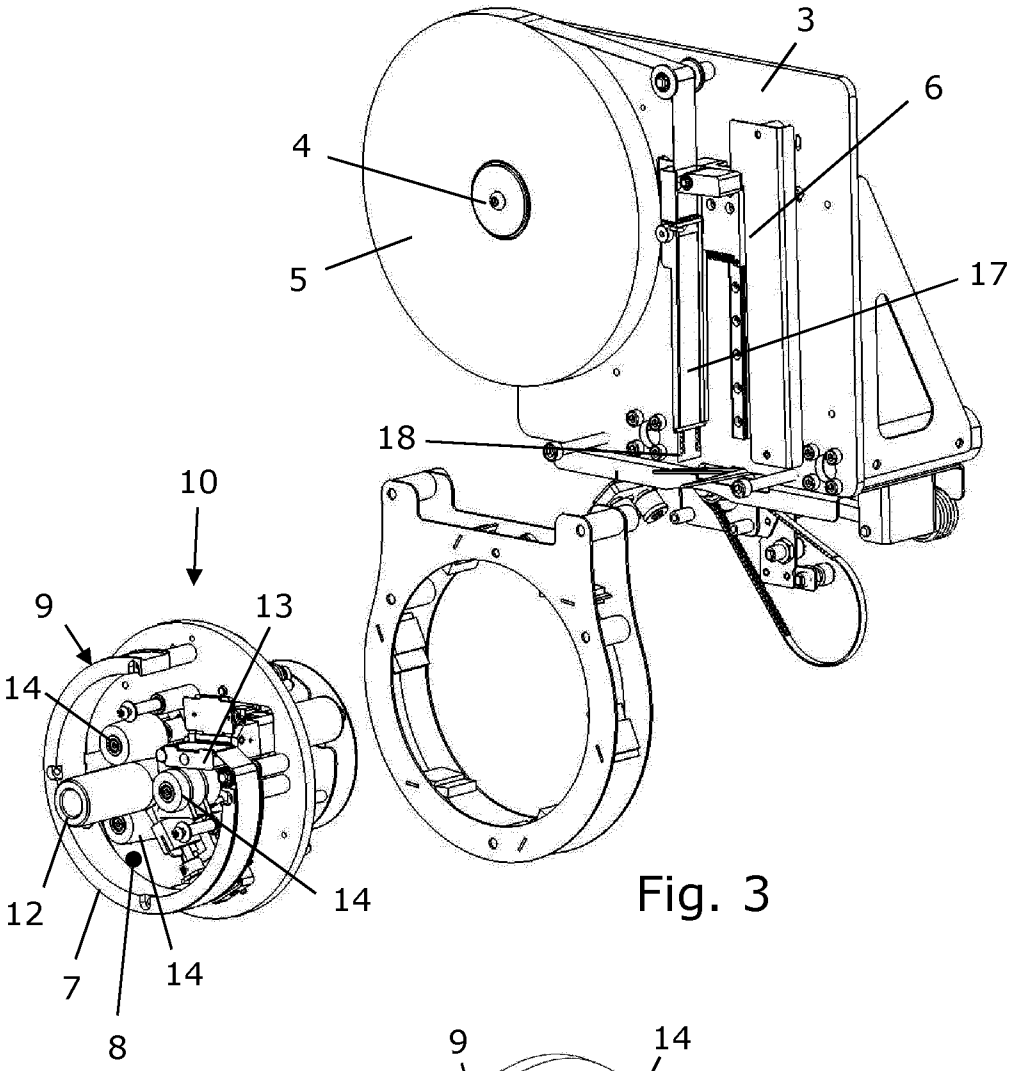

Fig. 3

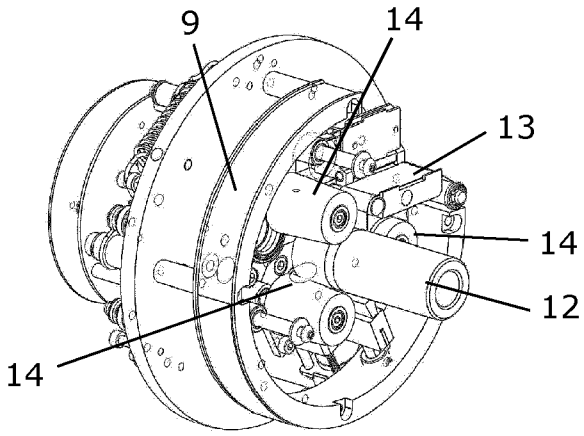

Fig. 4

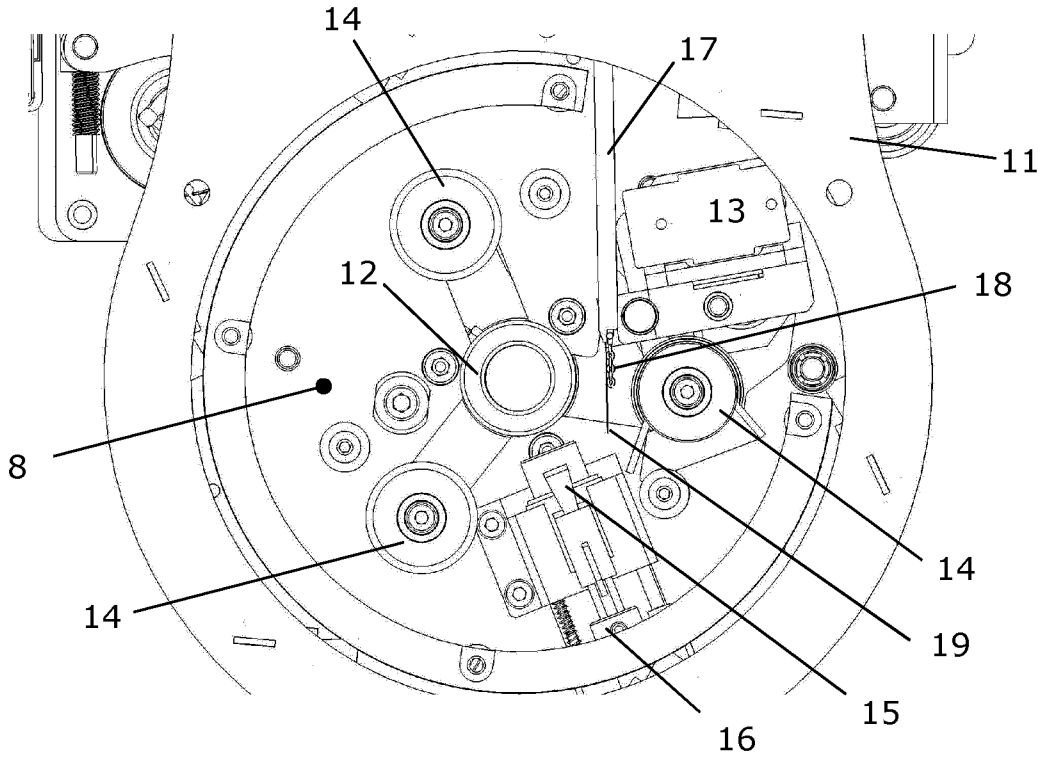

Fig. 5

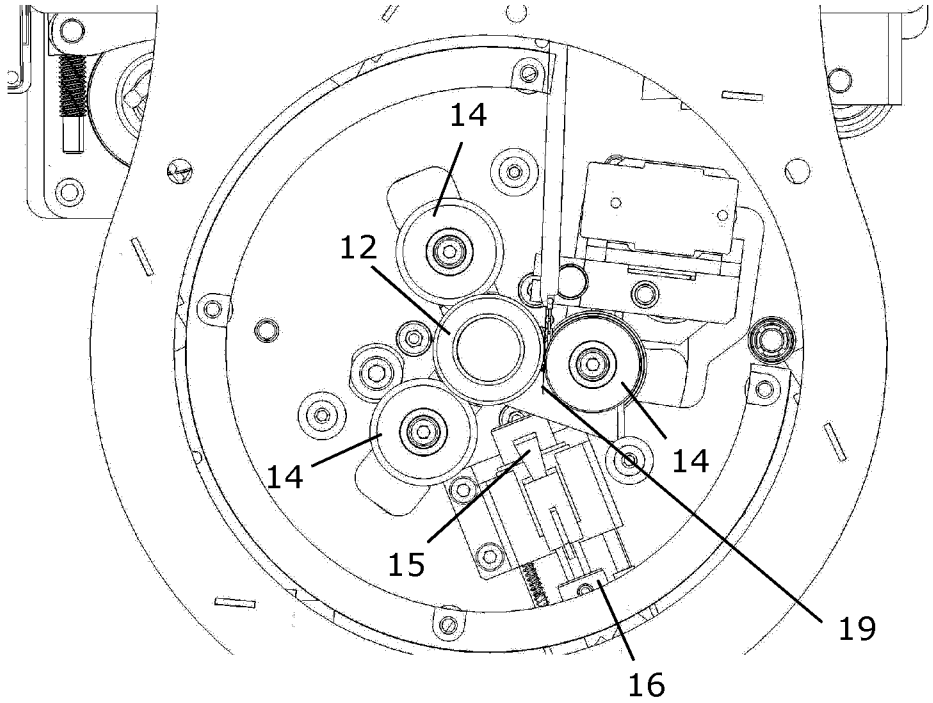

Fig. 6

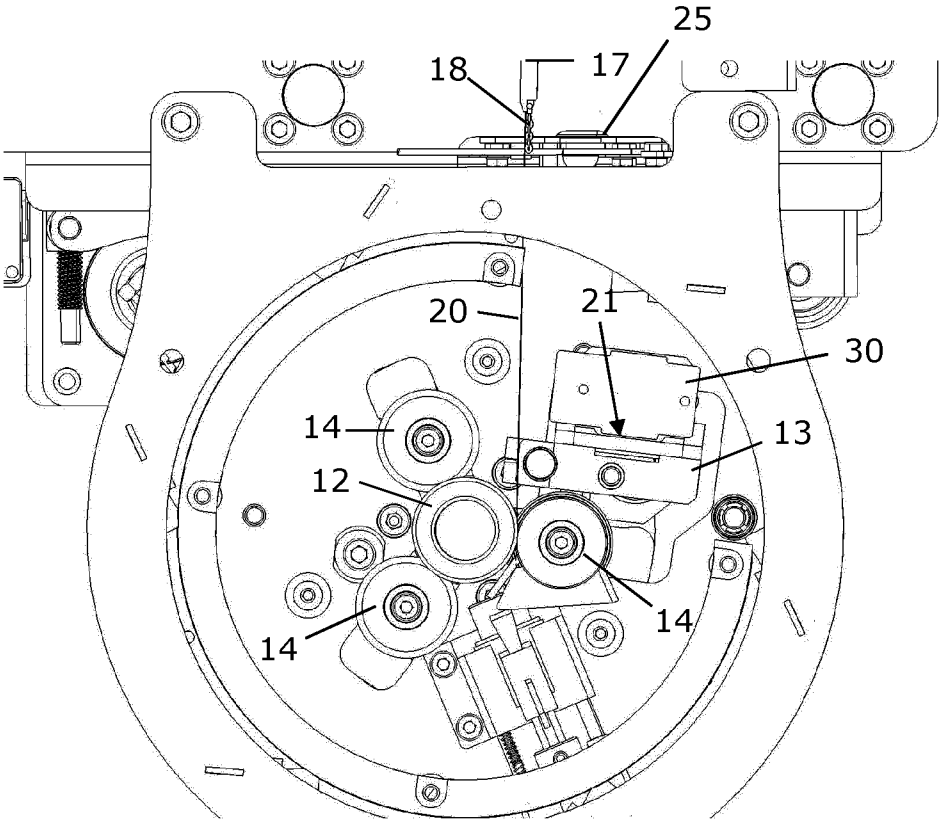

Fig. 7

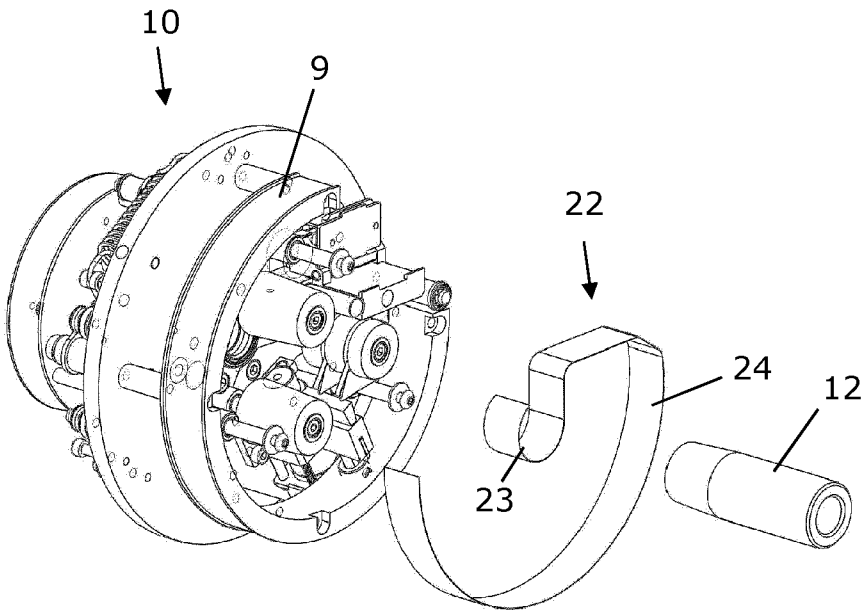

Fig. 8

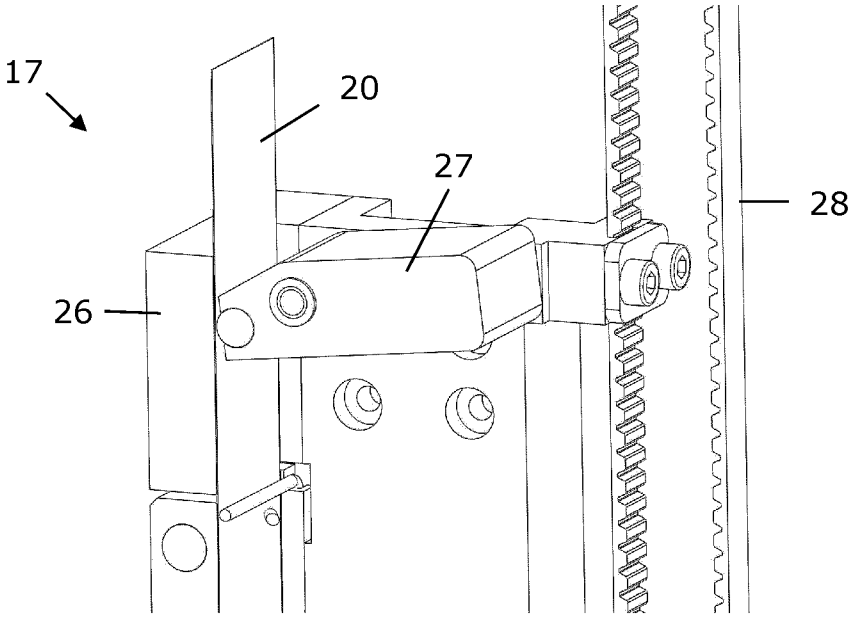

Fig. 9

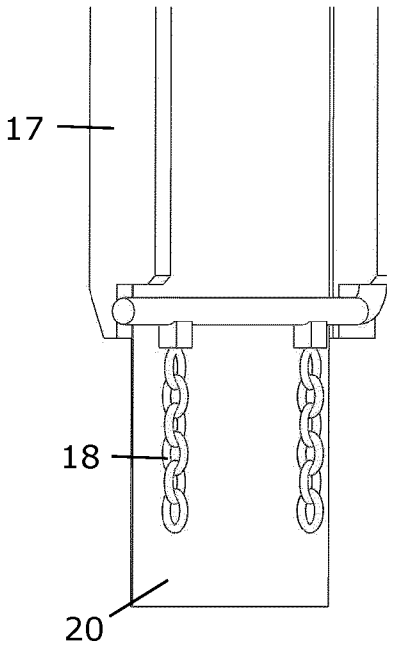

Fig. 10

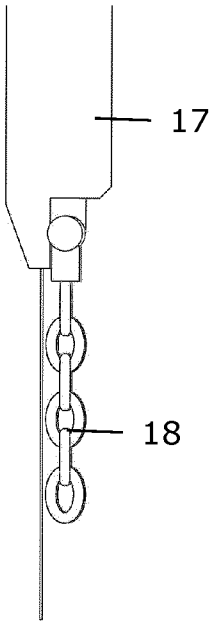

Fig. 11

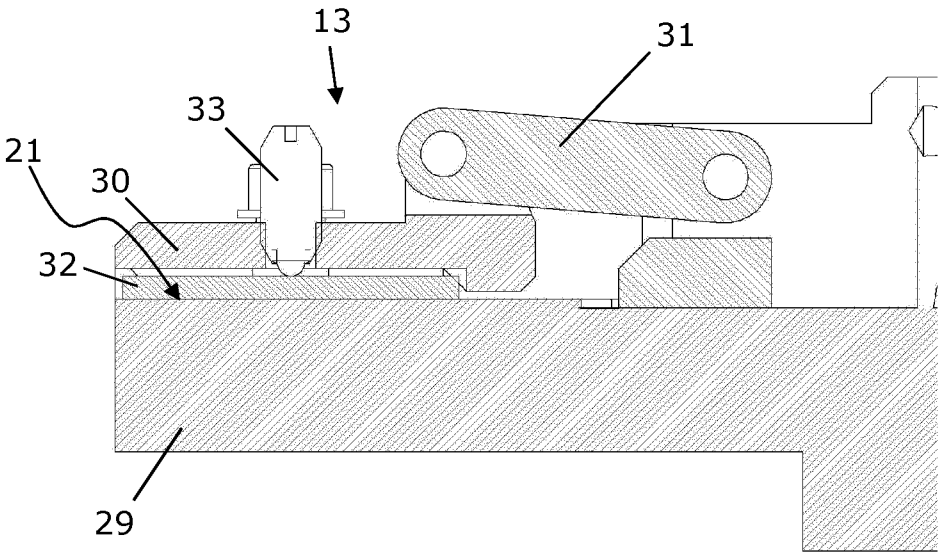

Fig. 12

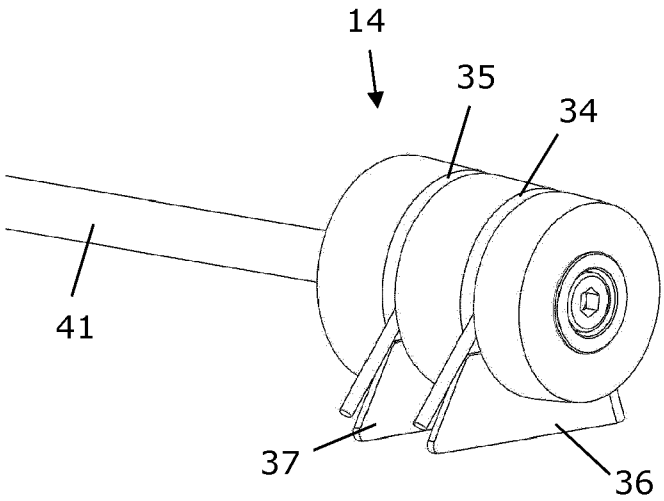

Fig. 13

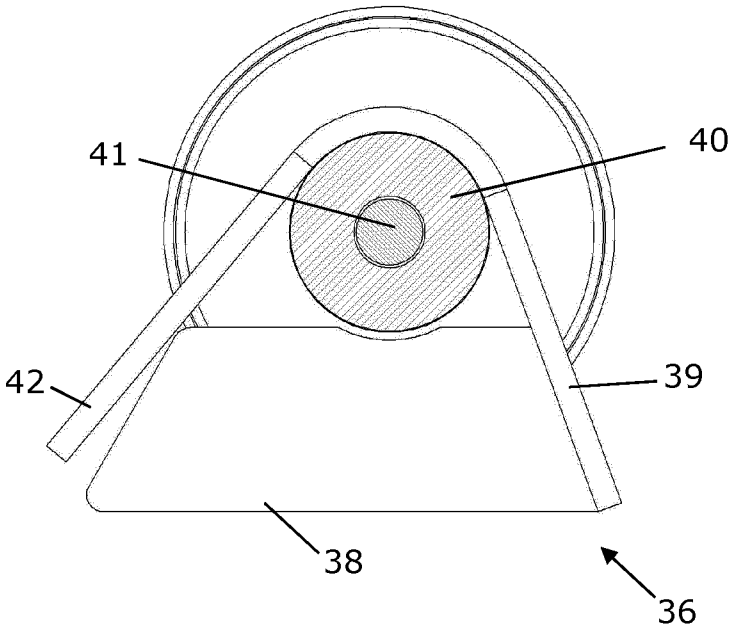

Fig. 14

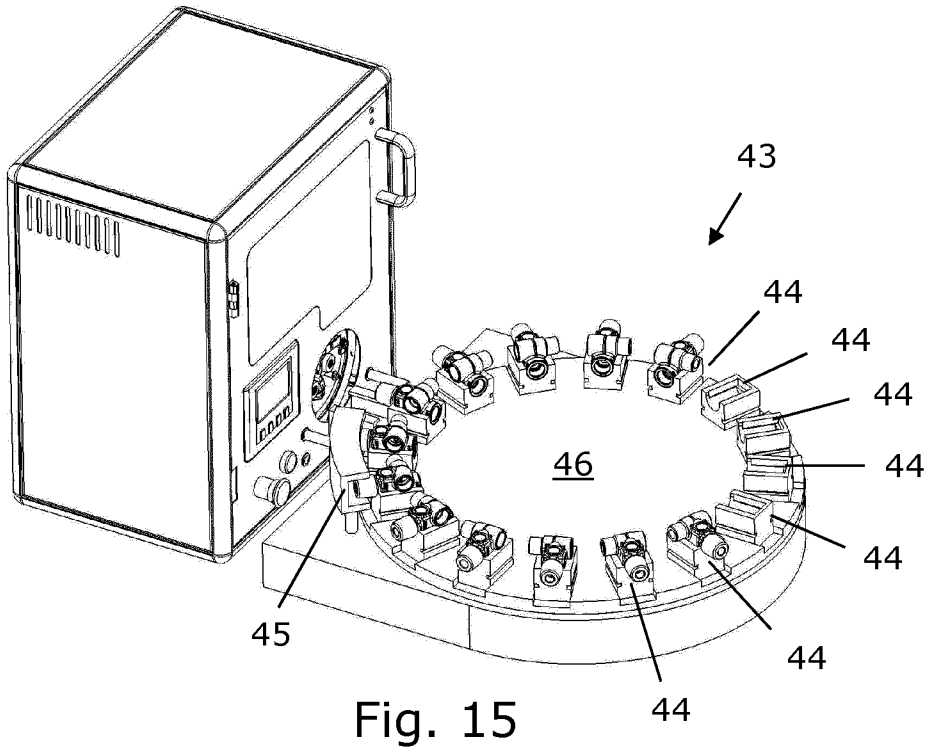

Fig. 15

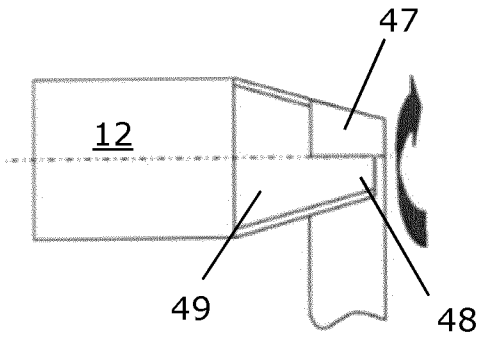

Fig. 16

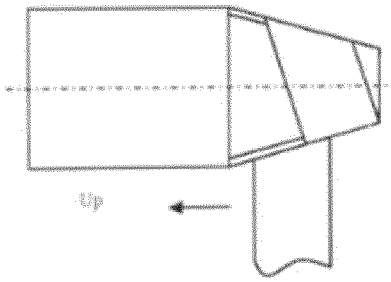

Fig. 17

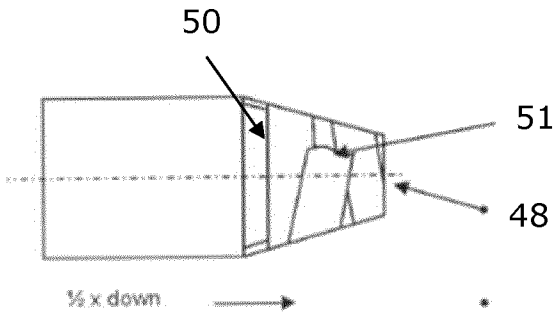

Fig. 18