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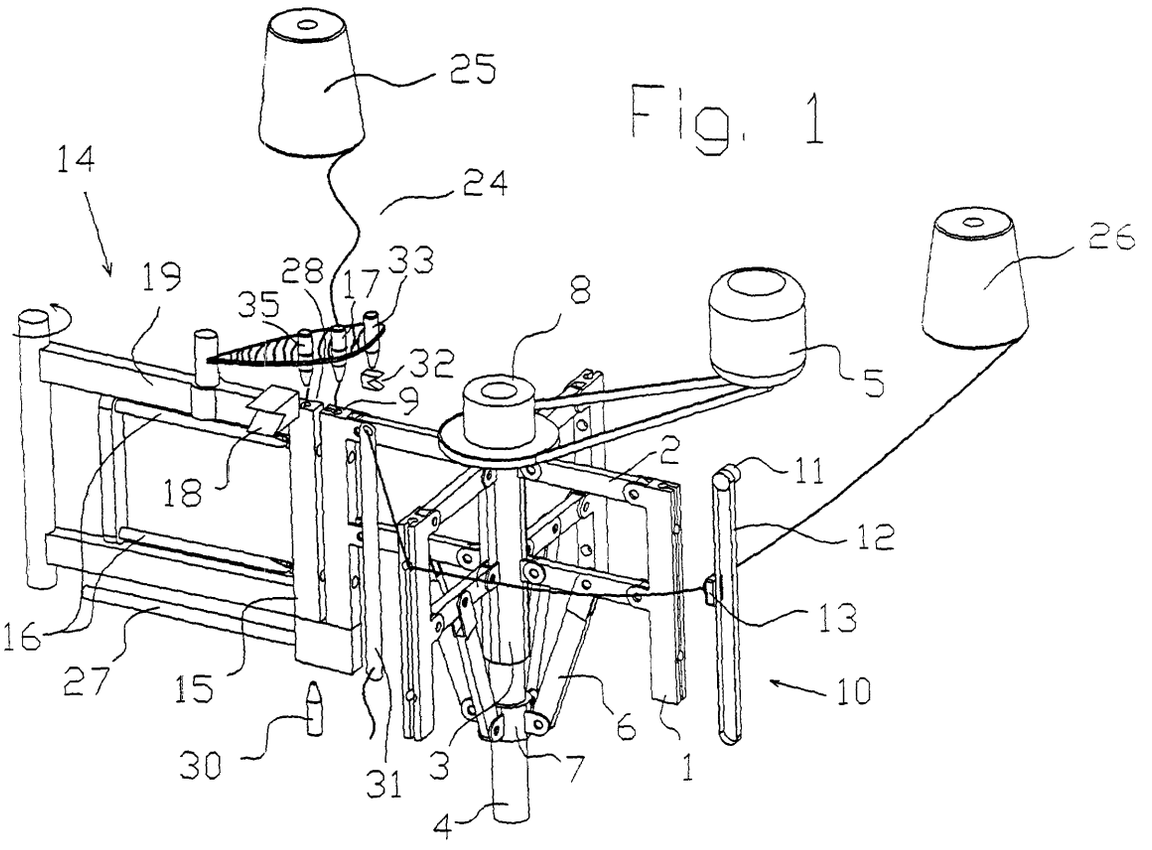
(54) Procedure and machine for winding and tying skeins

(57) **"PROCEDURE AND MACHINE FOR WINDING AND TYING SKEINS"**, of the type used in the textile industry, for transferring to subsequent processes such as dyeing, mercerising, etc., in which, starting with a conventional bobbin, the machine is threaded and the yarn wound in the form of a skein (23) on a winding device (2) made up of three or more retractable blades (1) on which the yarn is distributed with the help of a thread guide (13) with alternating linear movement (10); following completion of the winding of the skein (23), it is tied in one or more places by means of an automatic tying device, with the start and finish-ends of the skein (23) being incorporated into one of the knots.

Fig. 1



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Description

DESCRIPTION OF THE INVENTION

[0001] The objective of this invention, as expressed in the statement to this descriptive report, consists of a **"PROCEDURE AND MACHINE FOR WINDING AND TYING SKEINS",** of the type used in the textile industry for converting traditional bobbins into skeins, before being transferred to the dyeing, mercerising, etc., stages.

[0002] There are already machines for winding yarn into skeins on the market.

[0003] This type of machine is very common in the textile industry because it produces tension-free yarn in the form of skeins which is the best arrangement for yarn in terms of permeability for the colouring baths that are used in dyeing and similar processes.

[0004] These machines, which are fed from a battery of bobbins, are made up of horizontally positioned blades which are connected by articulated joints to arms which, in turn, are connected by articulated joints to a central revolving shaft.

[0005] The rotation of the unit causes the simultaneous winding of a given number of skeins, which are distributed along the length of the blades.

[0006] The winding of the yarn of the skeins is kept in order by a thread-guide mechanism with alternating linear motion, which establishes a certain order and layout in the crossing of the yarn to create a pattern resembling a bees' nest, which affords regular permeability in colouring baths or other similar treatment processes. These thread-guide mechanisms are made up of mechanical parts, such as cams, eccentrics and connecting rods, which, from the revolving motion of the blades, generate the appropriate reciprocating movement.

[0007] The bees' nest pattern of crosses also makes the skeins more resistant to untidiness during subsequent processes (steaming, dyeing, centrifuging, drying, etc.) and the transfers between them. In addition, it ensures that the subsequent skein-to-cone winding is carried out with as few tangles and breakages as possible.

[0008] This type of configuration is limited in that it does not allow more than one pattern of weaving or crossing of the yarn by the machinery. To change the weaving pattern, it is necessary to readjust all the mobile elements or replace the eccentrics and cams that determine the trajectory of the movements.

[0009] An example of this type of machine is described in patent US 1526756.

[0010] Once the winding process on the blades has been completed, the machine stops rotating and the process of tying each of the skeins is carried out. The tying is done either manually or using a conventional automatic tying machine which moves along a rail from one skein to the next.

[0011] With a separate yarn, which we will call the "tying yarn", the skein is tied in one or more places, for example, three. One of the knots is tied in a special way to bring together the four ends: the two of the skein itself, corresponding to the start and end of the skein; and the two of the tying yarn (start and end). In this way, both the start and end of the skein can easily be found for subsequent winding. The other two knots are tied in the same way but without the incorporation of the start and end of the skein.

[0012] Existing automatic tying devices operate on a given number of skeins, for example, twenty-four, with the blades in a horizontal position. These skeins are arranged along the blades, next to each other, leaving small areas of space between them which are used by the tying mechanism to access the inner faces of the skeins in order to tie the skeins up. These conditions substantially limit the ways in which the job can be performed, increasing the complexity of the tying device and its components, to the extent that a large number of machines rely on manual intervention for this step.

[0013] In existing automatic tying devices, the movement of the device is parallel to the blades, starting at the first skein where the first knot is tied, then moving to the next skein and so forth until it reaches the last skein.

[0014] When the first set of knots have been tied, the blades are rotated a third of a full circle (because the number of knots to be tied per skein is three) for the second series of knots to be tied. Then the blades are rotated again by the same amount in order for the final series of knots to be tied.

[0015] Clearly, the performance of the machine is seriously reduced by the tying process regardless of whether this is done manually or automatically.

[0016] In general, known automatic tying mechanisms have movable arms and parts operated by cams or pistons which, as mentioned earlier, are inserted into the free spaces between the skeins to gain access to their inner faces to be able to tie the skeins up. The complexity and restriction of movement of the movable arms, combined with the complexity of the process itself, lead frequently to technical problems and breakdowns in the automatic tying device. This further reduces the performance of the machine.

[0017] To reduce costs, these machines have long blade shafts for winding a large number of skeins at the same time.

[0018] Once the tying of the skeins has been carried out, the mechanism for retracting the blades is operated in order to free the skeins and allow them to be extracted and transferred to other treatment processes (steaming, dyeing, softening, centrifuging, drying, reeling, etc.).

[0019] For this operation, it is necessary to dismantle the side of the machine, which is the only exit for the skeins, in a manual operation. The structure of these machines is clearly designed to facilitate this process, but even so, it continues to be a slow and fiddly operation.

[0020] When the skeins have been extracted, an operator closes the side of the machine again and manu-

ally rethreads the system for the next set of skeins.

[0021] As the process of threading and closing the machine is manual, in order to facilitate a more economically viable performance, the machines are designed to accommodate the highest number of skeins possible. This involves yet another limitation consisting of the enormous proportions that a machine of this type must acquire to maximise its yield.

[0022] The new machine has a radically different approach to that of traditional machines, consisting of preparing the skeins one by one in a fully automatic way, without the need for manual intervention during the threading, winding, tying or extraction of the skeins. Thus, the processes of tying manually, opening the machine and extracting the skeins, closing the machine and rethreading are eliminated.

[0023] As a result, the new machine enables a batch of 24 skeins to be prepared in less time than that needed by a conventional 24-skein machine, with the advantage of not requiring any manual intervention for the unloading, rethreading or restarting of the new batch of skeins.

[0024] The new machine has short blades which wind one skein at a time. As a result, there is open space on each side of the skein which means that the inner face of the skein can be accessed easily, safely and without the limitations in space characteristic of skein machines seen in the market up until now.

[0025] The short length of the blades also provides the possibility of a higher winding speed than conventional machines, for reasons of dynamic equilibrium and inertia.

[0026] The lateral accessibility of the skeins on both sides at the same time paves the way for a totally innovative system of automatic skein tying that is much more simple than the existing devices on the market.

[0027] The blades are made up of three or more articulated parallelograms which are connected to a motor-driven central tubular element in whose interior is a threaded shaft.

[0028] One of the collapsible arms of each of the parallelograms making up the blades is connected at the middle to an articulated bar which, in turn, is connected at the other end to a second tubular element which moves around the aforementioned threaded shaft. However, unlike the first tubular element, the second tubular element is physically threaded to the shaft.

[0029] At the same end of the central tubular element as the operation of the motor is a lock with two positions: one where the threaded shaft is locked to the set of parallelograms making up the blades, resulting in it rotating rhythmically with them; and the other where the threaded shaft is locked to the chassis of the machine and, therefore, instead of turning rhythmically with the parallelograms, it moves at an angle to them. Thus, in the latter case, the second tubular element, which is connected to the parallelograms and threaded to the shaft, moves with the rotation of the blades, going up or down the screw-thread of the shaft depending on the direction of rotation.

[0030] As the second tubular element moves up or down the threaded shaft, the bars connected to the parallelograms will open or close them rhythmically.

[0031] This mechanism is what allows the diameter of the skein to be chosen at the start and the skein to be unloaded at the end.

[0032] The aforementioned locking device may consist of an electromagnetic clutch or any other system that is appropriate.

[0033] Opposite the set of blades is an innovative thread-guide mechanism, with alternating linear motion, made up of a step-by-step motor which moves a belt to which a thread-guide head is connected. The motor is controlled by automaton or PLC which synchronises it with the motor that operates the blades and follows the length and cross pattern programme that has been selected. In this way, it is not necessary to interfere with or modify the mechanisms of the machine in order to change the cross pattern of the yarn; all you have to do is select the required programme from a control unit.

[0034] The tying mechanism, which is capable of tying up the skein transversally, is located on the other side of the machine. The tying yarn comes from a different bobbin to the bobbin used in the winding of the skein.

[0035] This tying mechanism is comprised essentially of a head which, when in operation, comes face-to-face with a blade of the unit of parallelograms; a minimum of one needle which is capable of going through both the head and the blade when these parts are facing each other; various pneumatic impulsion devices; various pneumatic suction devices; a clamp and a conventional knotter.

[0036] The entire tying device is mounted on an adjustable support which, starting from a stand-by position, moves the head and needles towards the blades so that they come face to face, but leaving room for the diameter of the skein for which the machine has been programmed.

[0037] The mechanism for tying up all the ends of the skeins works in the following way:

[0038] Before starting the machine for the first time, the start-end of the yarn of the skein must be threaded manually. Taking the yarn from the feed cone, it is passed through the thread guide with the alternating linear motion and inserted manually into a threading tube.

[0039] The threading tube is similar in length to the blades and is supported by at least one of them.

[0040] Having satisfied this pre-requisite, the winding of the skein can begin.

[0041] After winding, the set of blades stops rotating, leaving the blade with the threading tube facing the section of the machine containing the tying device.

[0042] While the blades are stopping rotating, the thread-guide head moves towards the end where the start-end of the skein was threaded, until it is beyond the path of the skein, where it forms a separate loop of yarn on the blades, which serves as the end of the skein.

[0043] At this point, the tying device moves a pneumatically operated clamp, one of whose functions is to trap the separate loop of yarn.

[0044] Next, the support carrying the tying device rotates around a shaft, which is parallel to the revolving shaft of the blades, until the tying head is facing the blade that was moved earlier towards the section of the machine containing the tying device.

[0045] On the way, the clamp traps the separate loop of yarn and positions itself at the end of the threading tube. A pneumatic suction/blower device, which is connected to the clamp, acts by sucking the start-end of the yarn of the skein which was deposited earlier in the threading tube. At this point, both the start-end and finish-end of the skein have been picked up.

[0046] We should point out that, like the tying head, the blades have transversal holes, as well as an open longitudinal hole in the form of a channel throughout the length of the blade. When the tying head and blade come face to face, the open lengths of the longitudinal holes are also facing each other.

[0047] This is immediately followed by the penetration of the needles which, first of all, go through the transversal holes of the tying head, then the skein, which is between the tying head and the blade, and, finally, through the transversal holes of the blade. At the end of these needles is an open hole, in the form of a semi-open clamp, which lines up with the longitudinal hole of the blade.

[0048] Next, the pneumatic impulsion device of the tying yarn, which is currently situated at the end of the blade, forces the tying yarn through the longitudinal hole of the blade. Thus, the tying yarn passes through the blade and the holes of the needles, and is collected at the other end by a pneumatic suction device which stops operating when enough yarn has been collected to go back through the tying head longitudinally.

[0049] Next, the needles rotate approximately 120° and retreat to their initial position, taking with them the tying yarn, which has been caught in two notches, making a type of hook, etched into the sides of the hole of the needles. Thus, each needle constitutes a loop, which is now aligned with the longitudinal hole of the tying head.

[0050] Then, a second pneumatic impulsion device releases another jet of air, pushing the tying yarn through the longitudinal hole of the tying head, going through the loops and emerging at the other end, where it is picked up by another pneumatic suction device.

[0051] At this point all four yarns are on the same side of the blade, and this is when the base supporting the following elements:

- clamp + automatic suction/ blower device
- pneumatic impulsion device of the tying yarn
- pneumatic suction device,

turns, pulling with it the four yarns, which are picked up in a conventional knotter.

[0052] This device acts on the four yarns (start/finish of the skein and start/finish of the tying yarn), tying a knot with all of them and cutting them.

[0053] The base supporting the three aforementioned elements rotates again to position the clamp with the yarn of the feed cone above the threading tube. The suction/blower device connected to the clamp blows just as the clamp releases the yarn, thereby successfully blowing the yarn through the tube. The base supporting the three elements turns again until it has retreated.

[0054] In this operation, the finish-end of the old skein is connected once again to the blade, forming the start-end of a new skein; thus, conveniently rethreading the system.

[0055] If desired, before the start and finish-ends of the skein are tied, other knots may be tied using the tying yarn only, distributing them along the skein to ensure that the skein is fully secured. To do this, the blades must be rotated by an angle determined by the programmed number of knots per skein, as a result of which, one by one, the blades will be brought face-to-face with the tying head.

[0056] After completing the tying of the skein, the next step is the retraction of the parallelograms of the winding device, by operating the locking mechanism and changing the direction of rotation of the motor.

[0057] In this way, the skein is released and, if the device of the machine is vertical or inclined, falls towards a skein collector. If the device of the machine is horizontal or not sufficiently inclined to make use of the force of gravity, the skein will have to be removed from the blades manually or mechanically.

[0058] Clearly the new skein winding machine may be used in a vertical, horizontal or inclined position, but those operations that use the force of gravity for extracting the skeins will have an added advantage. In any case, the vertical position is the most advantageous because of the size of the machine and simplicity of its operation.

[0059] The use of a thread-guide device controlled by automaton or PLC means that the device can be used to run a diverse range of programmes, each with the thread-guide head covering a specific distance.

[0060] The aforementioned programme allows different distances to be chosen, which may be constant or with automatic decrements, depending on the thickness of the skein, the latter being highly recommended for fine yarns.

[0061] It also provides for the so-called progressive distances, which are very useful for thick yarns.

[0062] It also allows variable crossing patterns depending on the development of the thickness of the skein.

[0063] The innovative thread-guide device may be substituted for any other already on the market of lower capability.

DESCRIPTION OF THE DIAGRAMS

[0064] To illustrate everything explained so far, a page of drawings is attached to this descriptive report, forming an integral part of it, representing the invention in a simplified and schematic way. These drawings are intended to be purely illustrative and are not an exhaustive representation of the practical possibilities of the invention.

[0065] In these diagrams, figure 1 represents an overall schematic view in perspective of the device.

[0066] Figure 2 is a schematic aerial view of the device.

[0067] Figure 3 is a schematic elevation view of the device.

[0068] Figure 4 represents a schematic cross-sectional elevation view of the winding device.

[0069] Figure 5 is an aerial outline of the blades.

[0070] Figure 6 represents three elevation views of the tying device of the machine showing the advance, rotation and retreat of the needles for tying the yarn on the skein.

[0071] Figure 7 is a view of the tying effected by the needles with the tying yarn.

[0072] Figure 8 is an elevation view of a needle.

[0073] Figure 9 is an aerial view of a needle.

[0074] Figure 10 is a detailed view of the tip of the needle with the open hole in the form of a semi-open clamp.

DESCRIPTION OF A PRACTICAL EXAMPLE

[0075] The new machine consists of a set of blades (1) made up of four articulated parallelograms (2) which are connected to a central tubular element (3) in whose interior is a threaded shaft (4). The central tubular element is operated by a motor (5).

[0076] One of the collapsible arms of each of the parallelograms making up the blades is connected at the middle to an articulated bar (6). Connected to the other end of the articulated bar is a second tubular element (7) which moves around the threaded shaft (4). However, unlike the first tubular element, the second tubular element is physically threaded to the aforementioned shaft (4).

[0077] At the same end of the central tubular element as the operation of the motor is a locking element (8) with two positions: one where the threaded shaft (4) is locked to the set of parallelograms making up the blades (1); and the other where the threaded shaft (4) is locked to the chassis of the machine.

[0078] At the side of one of the blades is a threading tube (31) which lies parallel to the longitudinal axis of the blades and is similar in length.

[0079] Opposite the set of blades is an innovative thread-guide mechanism (10), with alternating linear motion, made up of a step-by-step motor (11) which moves a belt (12) to which a thread-guide head (13) is connected.

[0080] The tying mechanism (14), which is capable of tying up the skein (23) transversally, is located on the other side of the machine. The tying yarn (24) comes from a different bobbin (25) to the bobbins (26) used in the winding of the skein (23).

[0081] The tying mechanism (14) comprises a tying head (15), two needles (16), a pneumatic suction/blower device of the tying yarn (17), and a knotter (18).

[0082] The needles (16) have a hole (20) close to the tip and the hole is directly connected to the tip by means of a channel (21). On the sides of the holes (20) are notches in the form of hooks (22).

[0083] The entire tying unit is mounted on an adjustable support (19).

[0084] The tying mechanism works in the following way:

[0085] Before starting the machine for the first time, the start-end of the yarn of the skein (23) must be threaded manually. Taking the yarn from the feed cone (26), it is passed through the thread-guide head (13) with alternating linear motion directly to the threading tube (31) through which it is inserted.

[0086] After the skein (23) has been wound, the set of blades (1) stops rotating, leaving the blade with the threading tube facing the section of the machine containing the tying unit (14).

[0087] While the blades (1) are stopping rotating, the thread-guide head (13) moves towards the end where the start-end of the skein was threaded, until it is beyond the path of the skein (23), where it forms a separate loop of yarn on the blades (1), which serves as the end of the skein (23).

[0088] At this point, the tying device moves the pneumatically operated clamp (32), whose function is to trap the separate loop of yarn.

[0089] Next, the adjustable support carrying the tying unit (19) turns around a revolving shaft, which is parallel to the revolving shaft of the blades, until the tying head (15) is facing the blade (1) that was moved earlier towards the section of the machine containing the tying device.

[0090] On the way, the clamp (32) traps the separate loop of yarn and positions itself at the end of the threading tube (31). The pneumatic suction/blower device (33), which is connected to the clamp, acts by sucking the start-end of the yarn of the skein (25a), which was deposited earlier in the threading tube (31). Now, both the start and finish-ends of the skein (25a and 25b) have been picked up.

[0091] We should point out that, like the tying head (15), the blades (1) have transversal holes (34), as well as longitudinal holes (9 and 28) open in the form of channels throughout their lengths. When the tying head (15) and blade (1) are facing each other, the open lengths of the longitudinal holes (9 and 28) are also facing each other.

[0092] The next step is the penetration of the needles (16) which go through the tying head (15) first, then the

skein (23), which is between the head (15) and the blade (1), and, finally, the blade (1), through the transversal holes (34). At one end of these needles (16) is an open hole (20), forming a type of semi-open clamp (21), which lines up with the longitudinal hole (9) of the blade (1).

[0093] Later, the pneumatic impulsion device (17) of the tying yarn, which is now situated at the end of the blade (1), forces the tying yarn (24) through the longitudinal hole (9) of the blade (1). Thus, the tying yarn (24) passes through the blade (1) and the holes (20) of the needles (16), and is gathered at the other end by a pneumatic suction device (27). When the section of yarn is long enough for going back through the tying head (15) longitudinally, the suction device stops.

[0094] Next, the needles (16) rotate approximately 120° and retreat to their initial position, carrying with them the tying yarn (24) which has been caught in the two notches (22), in a form of hook, etched into the sides of the holes (20) of the needles (16). Thus, each needle (16) constitutes a loop (29), which is now aligned with the longitudinal hole of the tying head (15).

[0095] Then, a second pneumatic impulsion device (30) releases another jet of air, pushing the tying yarn (24) through the longitudinal hole (28) of the tying head (15), passing through the loops and coming out at the other end, where it is gathered by another pneumatic suction device (35).

[0096] At this point, all four yarns are on the same side of the blade (1) and this is when the base supporting the following elements:

- clamp (32) + automatic suction/blower device (33)
- pneumatic impulsion device of the tying yarn (17)
- pneumatic suction device (35),

turns, pulling with it the four yarns which are picked up by a conventional knotter (18).

[0097] This device acts on the four yarns (start/finish of the skein (25a and 25b) and start/finish of the tying yarn (24a and 24b)), tying a knot with all of them and cutting them.

[0098] The base supporting the three aforementioned elements rotates again to position the clamp with the yarn from the feed cone above the threading tube (31). The suction/blower device (33) connected to the clamp (32) blows just as the clamp releases the yarn, successfully inserting the yarn through the tube (31). The base supporting the three elements turns again until it has retreated.

[0099] In this operation, the finish-end of the old skein (23) is connected once again to the blade, forming the start-end of a new skein (23); thus, conveniently rethreading the system.

[0100] After completing the tying of the skein, the next step is the withdrawal of the tying head (15) and the retraction of the parallelograms of the winding device (2), by operating the locking device (8) and changing the direction of rotation of the motor (5).

[0101] Thus, the skein is free to be removed, falling if the machine is in a vertical or inclined position.

[0102] Having established the concept behind the invention, the note of claims is drafted next, thus establishing the inventions that are the subject of the claims.

Claims

1. **"PROCEDURE FOR THE WINDING AND TYING OF SKEINS",** of the type used in the textile industry, for transferring to other processes such as dyeing, mercerising, etc., in which, starting with a conventional bobbin, the machine is threaded and the yarn is wound in the form of a skein on a winding device made up of three or more retractile blades on which the yarn is distributed with the help of a thread guide with alternating linear motion; following the winding of the skein, the skein is tied one or more times by means of an automatic tying device, with the start and finish-ends of the skein being incorporated into one of the knots; **characterised** essentially by the fact that, in the first phase of starting up the system, an operation which only needs to be carried out once at the start, the yarn from the feed cone is taken and inserted manually into a threading tube, having previously passed it through the thread guide with alternating linear motion, after which the winding of the skein begins.

2. "**PROCEDURE**", as per the claim above, **characterised by** the fact that, after the winding of the skein, the thread-guide device moves towards the end where the start-end of the skein was threaded, until it is situated beyond the path of the skein, where it forms a separate loop of yarn on the blades, which serves as the end of the skein.

3. "**PROCEDURE**", as per the claims above, **characterised by** the fact that, as the separate loop of yarn of the end of the skein is being formed, the set of blades stops rotating, leaving the blade with the threading tube facing the part of the machine containing the tying device.

4. "**PROCEDURE**", as per the claims above, **characterised by** the fact that, immediately after, the tying device rotates until the tying head of this device is facing the blade that was moved earlier towards the section of the machine containing the tying device.

5. "**PROCEDURE**", as per the claims above, **characterised by** the fact that, during the movement of the tying device, a clamp connected to it traps the separate loop of yarn and positions itself at the end of the threading tube.

6. "**PROCEDURE**", as per the claims above, **charac-**

terised by the fact that, after the clamp has positioned itself at the end of the threading tube, a pneumatic suction/blower device next to the clamp is activated, sucking the start-end of the yarn of the skein, which was deposited earlier in the threading tube; thus bringing together to the same point the start and finish-ends of the skein.

7. "**PROCEDURE**", as per the claims above, **characterised by** the fact that, with the tying head and blade facing each other, needles are inserted through both elements, passing through the skein which is positioned between the blade and the head.

8. "**PROCEDURE**", as per the claims above, **characterised by** the fact that, with the tying head and blade facing each other and the needles inserted in these elements, the tying yarn is passed longitudinally through the blade and the tip of the needles, continuing its path through a tube and stopping when there is enough yarn in the tube to pass through the tying head longitudinally.

9. "**PROCEDURE**", as per the claims above, **characterised by** the fact that, when the tying yarn has stopped, the needles retreat, pulling with them the tying yarn and, in doing so, creating two loops in the tying head.

10. "**PROCEDURE**", as per the claims above, **characterised by** the fact that, after the formation of the loops, the section of yarn contained in the tube is passed through the tying head, going through the two loops and emerging at the upper part of the tying head, where it joins the yarn that entered the blade and the start and finish-ends of the skein.

11. "**PROCEDURE**", as per the claims above, **characterised by** the fact that the start and finish ends of the skein and tying yarns, which are all at the same side of the blade, are pulled and gathered in a conventional knotter which makes a knot with all of them and cuts them.

12. "**PROCEDURE**", as per the claims above, **characterised by** the fact that, after the knot is made, the suction/blower device connected to the clamp is activated, blowing at the same time as the clamp releases the yarn which, moved by the air, is inserted into the threading tube; thus, leaving what will constitute the start yarn of the next skein threaded.

13. "PROCEDURE", as per the claims above, **characterised by** the fact that, before the tying of the knot incorporating the start and finish-ends of the skein, other knots may be tied using just the tying yarn, distributing them along the skein to secure it better.

14. "**PROCEDURE**", as per the claims above, **characterised by** the fact that, having tied the skein, the next step is to withdraw the device in order to release the skein, which is extracted either by gravity or mechanical or manual means.

15. **"MACHINE FOR WINDING AND TYING SKEINS",** of the type consisting of three or more retractable blades on which yarn is distributed by means of a thread guide with alternating lateral motion, **characterised** essentially by the fact that the blades (1) are made up of articulated parallelograms (2) which are connected to a central tubular element (3) which has a threaded shaft (4) in its interior but is not threaded to it.

16. "**MACHINE**", as per claim 16, **characterised by** the fact that the central tubular element is operated by a motor (5).

17. "**MACHINE**", as per claim 16 and subsequent claims, **characterised by** the fact that one of the collapsible arms of each of the parallelograms making up the blades is connected at the middle to an articulated bar (6) which, in turn, is connected at the other end to a second tubular element (7) which moves over the threaded shaft (4) to which it is physically threaded.

18. "**MACHINE**", as per claim 16 and subsequent claims, **characterised by** the fact that, on the same side of the central tubular element as the operation of the motor, there is a locking element (8) with two positions: one in which the threaded shaft (4) is locked to the set of parallelograms making up the blades (1); and the other in which the threaded shaft (4) is locked to the chassis of the machine.

19. "**MACHINE**", as per claim 16 and subsequent claims, **characterised by** the fact that, opposite the set of blades, there is a thread-guide mechanism with alternating linear motion (10) made up of a step-by-step motor (11) which moves a belt (12) to which a thread-guide head (13) is connected.

20. "**MACHINE**", as per claim 16 and subsequent claims, **characterised by** the fact that, in another section of the machine, there is a tying mechanism (14) made up of a tying head (15), a minimum of one needle (16), a pneumatic impulsion and suction device of the tying yarn (17) and a knotter (18).

21. "**MACHINE**", as per claim 16 and subsequent claims, **characterised by** the fact that the needles (16) have a hole (20) close to the tip to which the hole is connected by means of a channel (21); and has notches in the form of hooks (22) on the sides of the holes (20).

22. "**MACHINE**", as per claim 16 and subsequent claims, **characterised by** the fact that the entire tying mechanism (14) is mounted on a support (19) which rotates on a shaft that is parallel to the revolving shaft of the blades and can move backwards and forwards in a perpendicular direction to this shaft.

Fig. 1

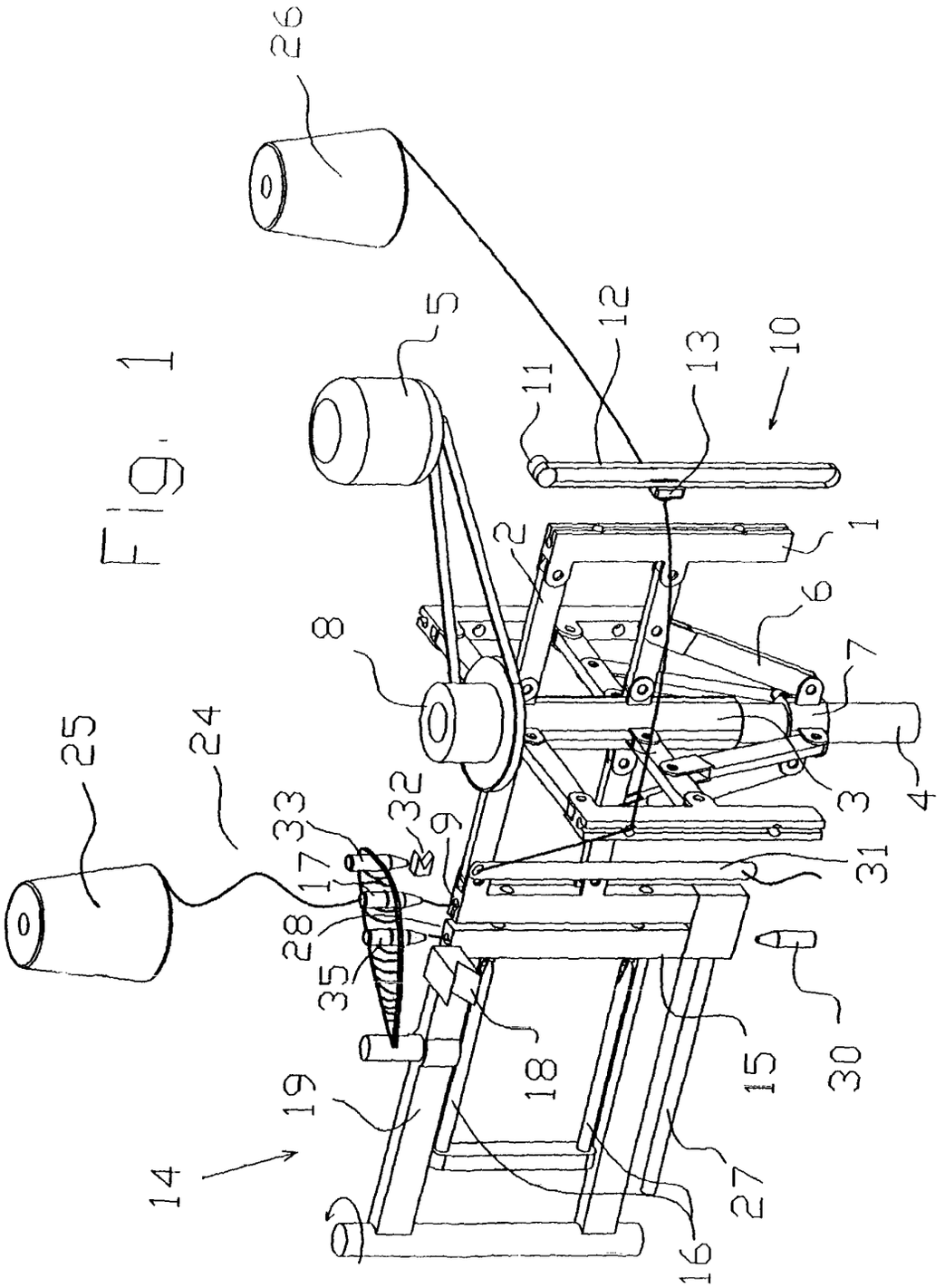

Fig. 2

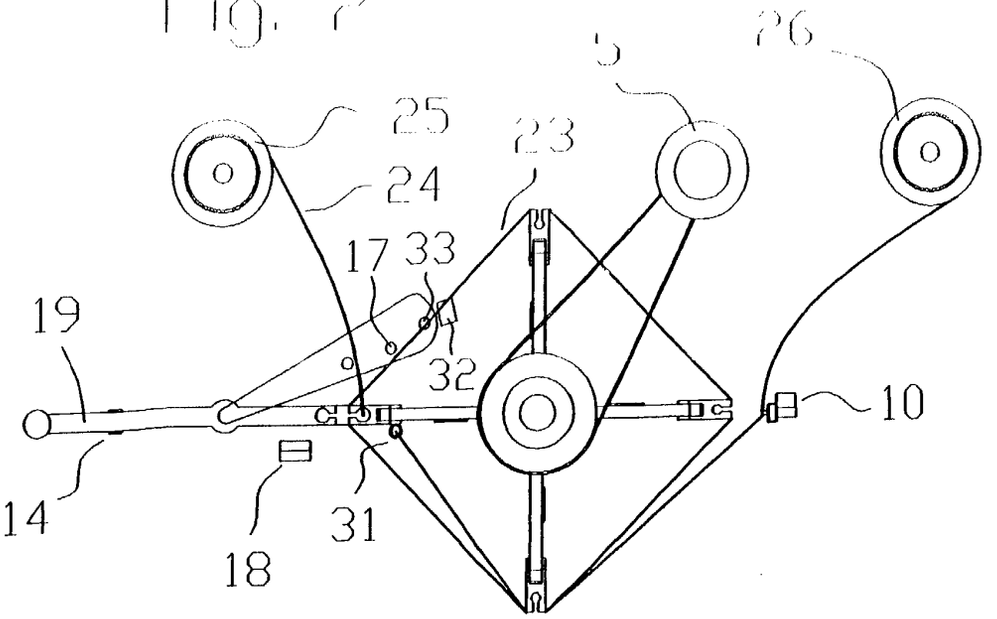
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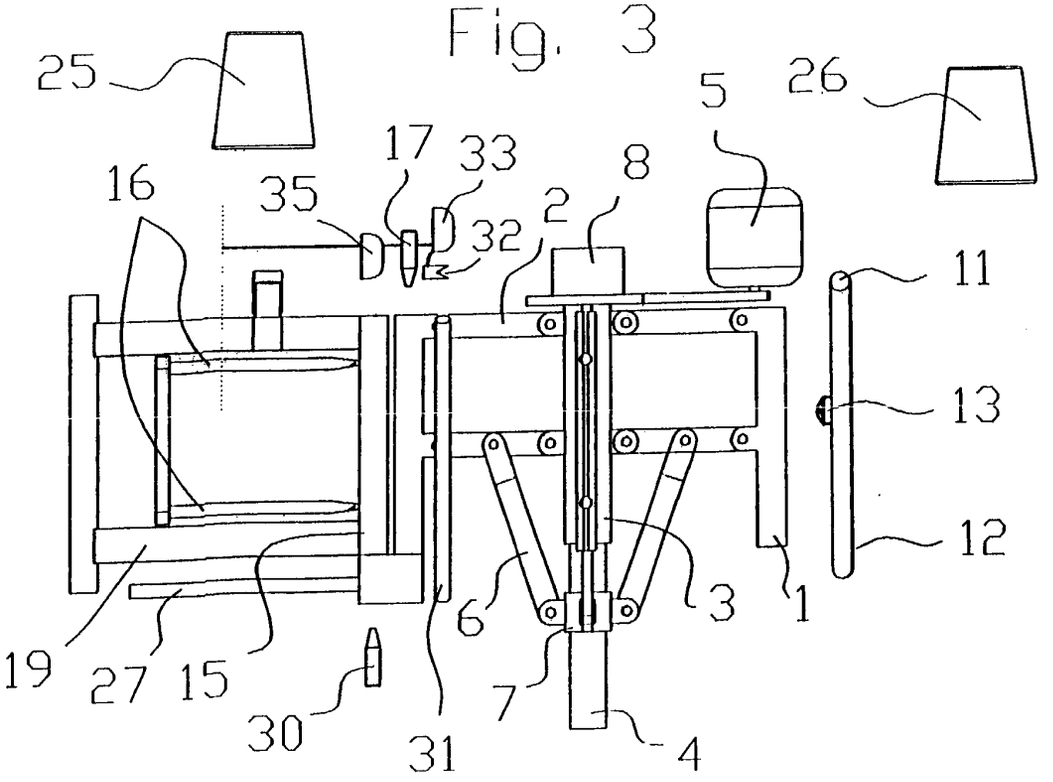
Fig. 3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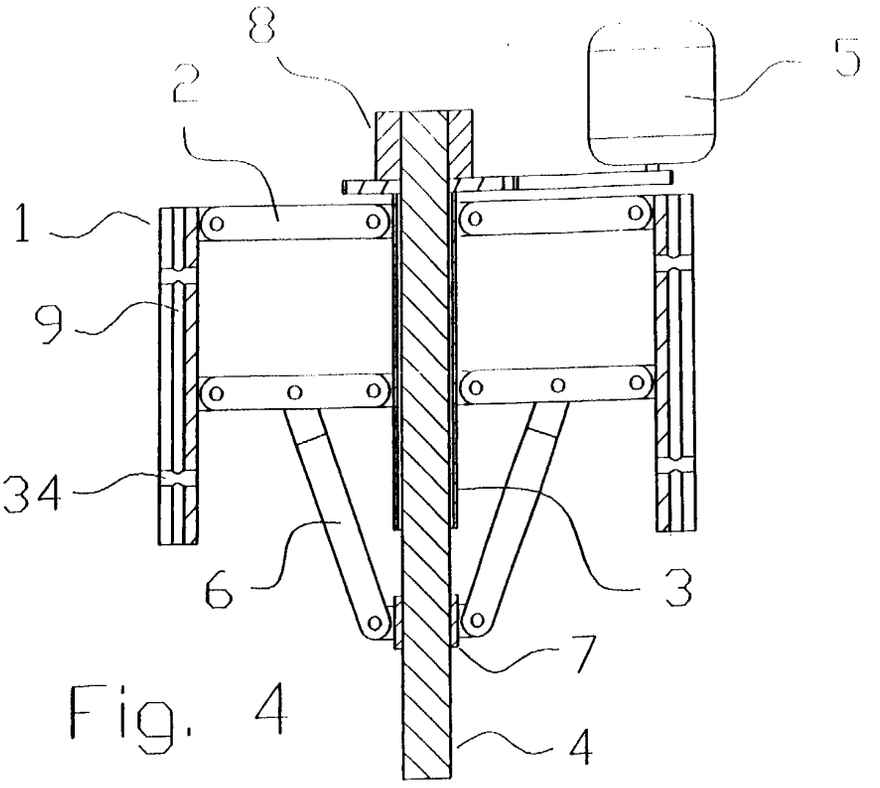


Fig. 4

Fig. 5

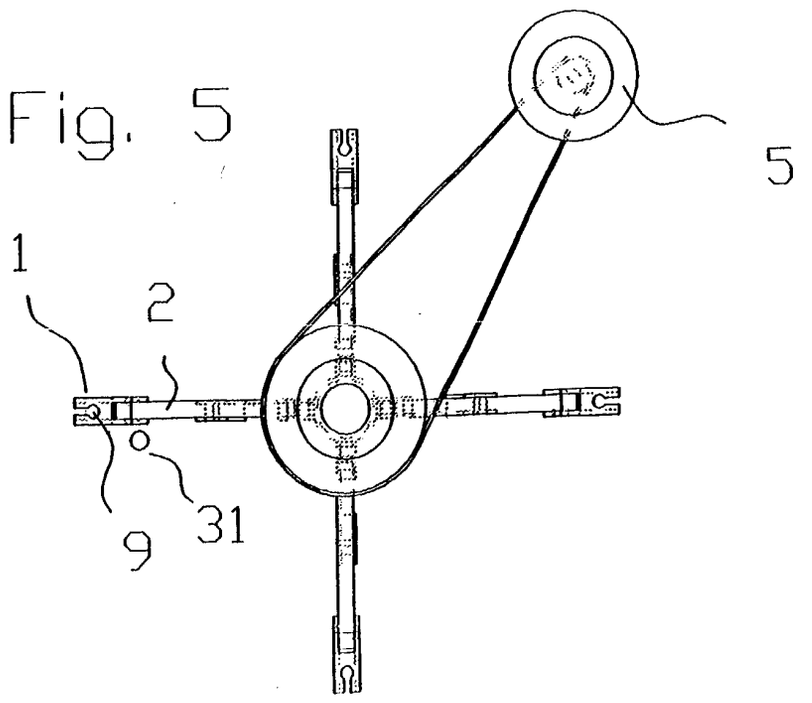
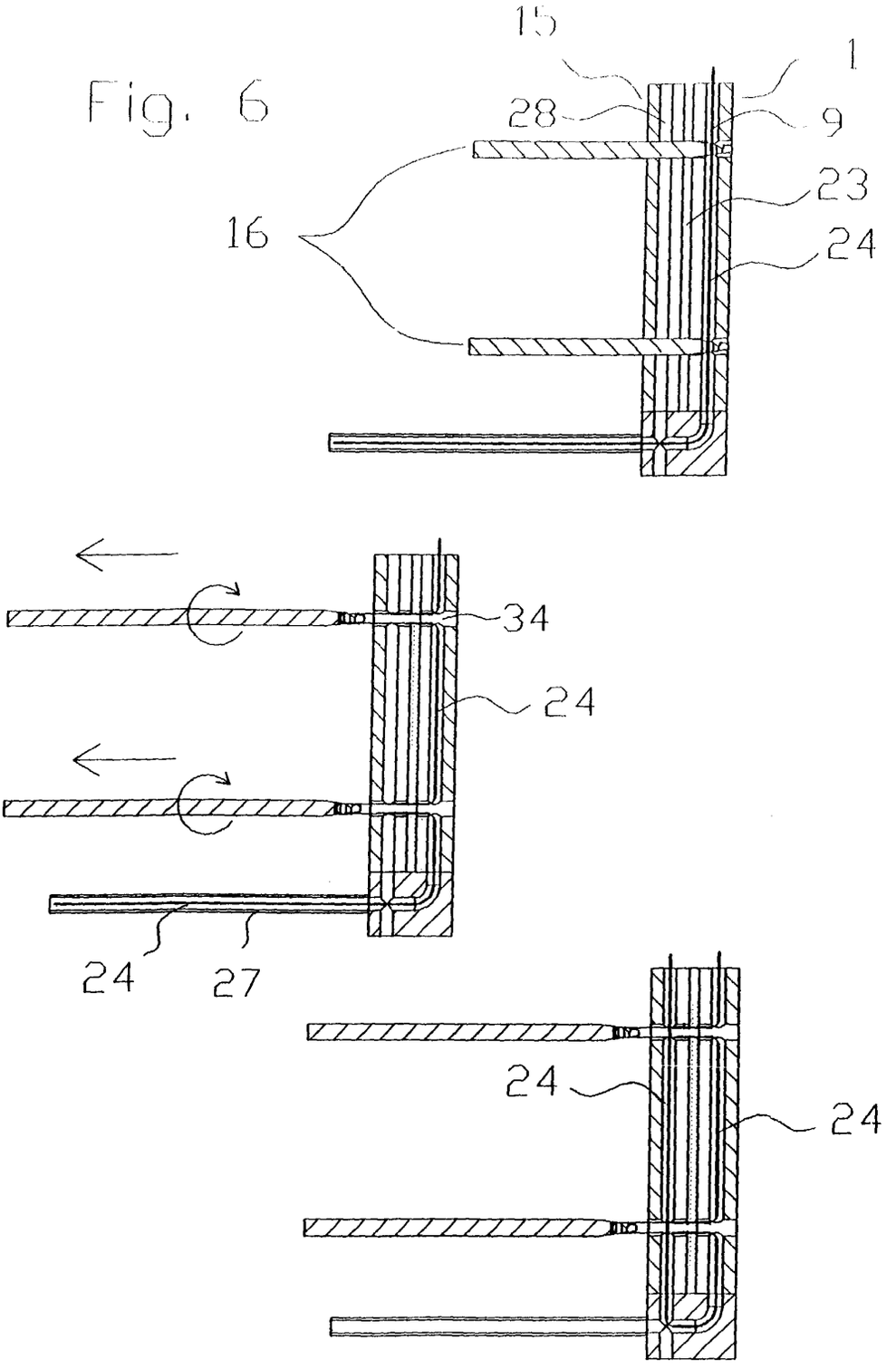


Fig. 6



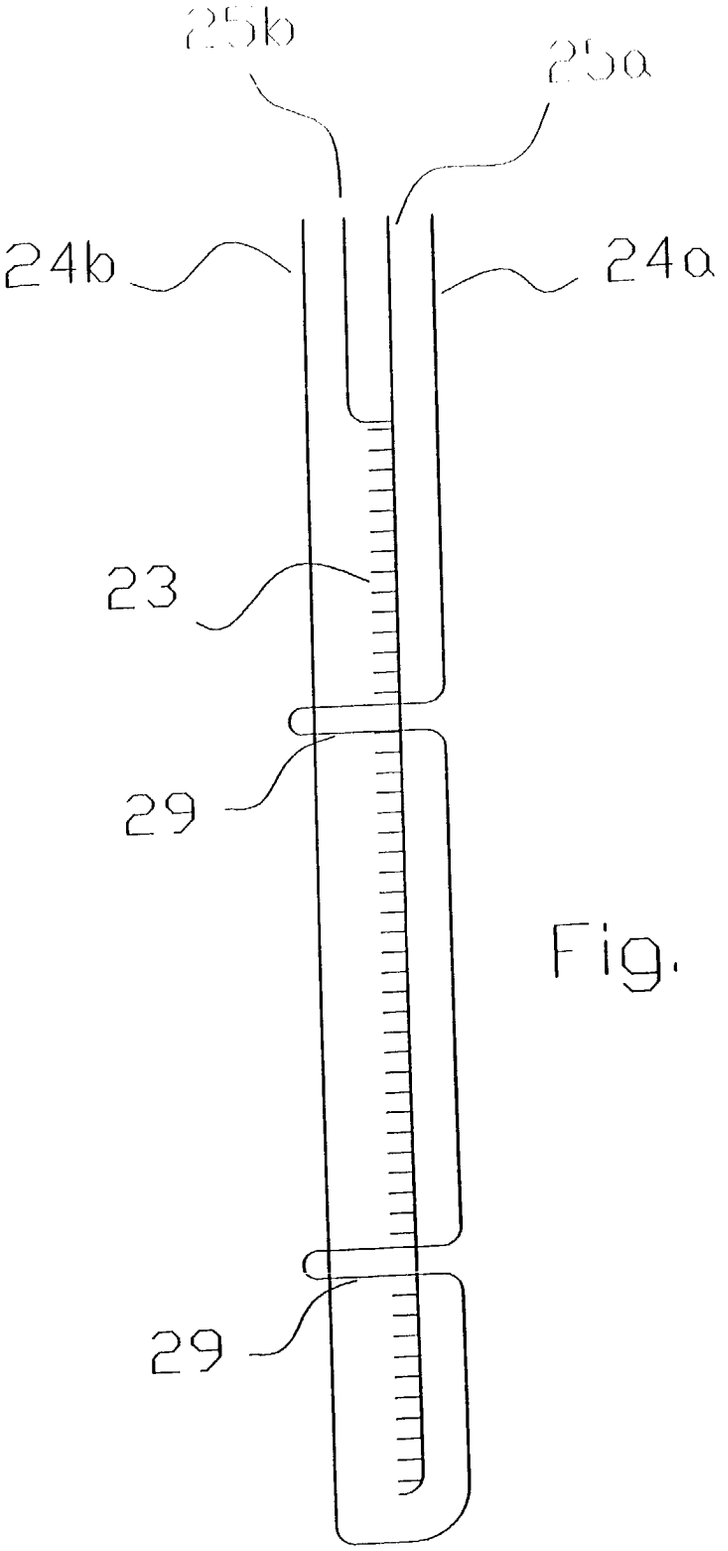


Fig. 7

Fig. 8

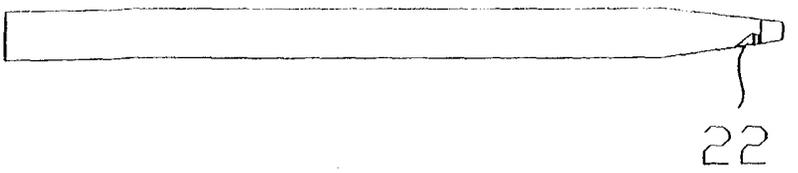


Fig. 9

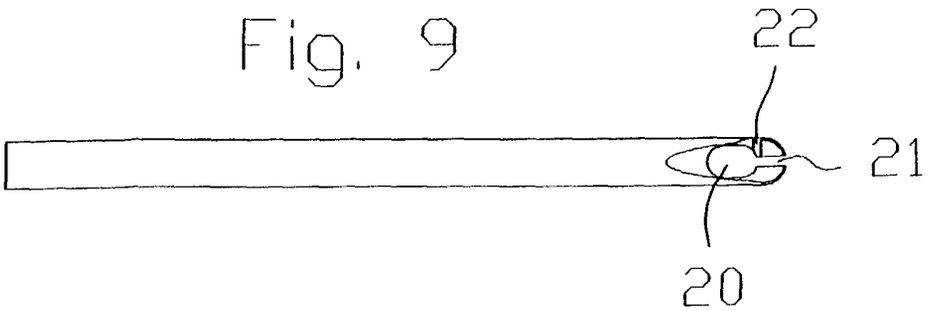


Fig. 10