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71 Applicant: SAVIO S.p.A.
Via Udine 105
I-33170 Pordenone(IT)

72 Inventor: Sartoni, Sandro
Via Pendini 1/A
I-40026 Imola Bologna(IT)
Inventor: Verlicchi, Giovanni
Via Casoni 13
I-40026 Imola Bologna(IT)

74 Representative: De Carli, Erberto et al
ING. BARZANO' & ZANARDO MILANO S.p.A.
Via Borgonuovo, 10
I-20121 Milano(IT)

54 Method and device for engaging the yarn with and joining it to the silver in a ring spinning machine.

57 The present invention relates to a method for automatically bringing yarn which has broken in a spindle of a ring spinning machine into engagement with and rejoining it to the textile fibre sliver passing through the last pair of drafting rollers, and a device for implementing the method.

With the method of the present invention the yarn end from the package is made to engage the textile fibre and passing through the last pair of drafting rollers, by the action of a mobile arm the terminal part of which comprises a scissor element overlying a gripper element, said mobile arm guiding the yarn end into a position resting against the side of the presser roller, which then drags said yarn end round until it is trapped below the line of contact between the presser roller and the drafting roller, to enable the yarn to be engaged with the textile fibre sliver and thus effect the rejoining of the yarn to the sliver.

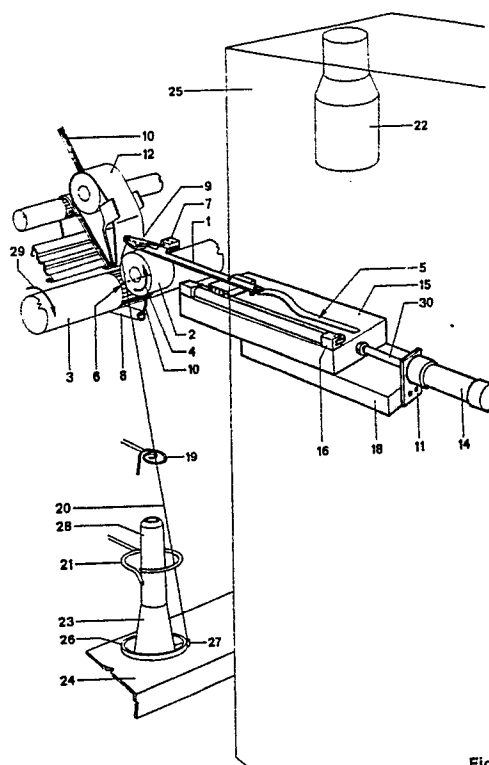


Fig. 2

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METHOD AND DEVICE FOR ENGAGING THE YARN WITH AND JOINING IT TO THE SLIVER IN A RING SPINNING MACHINE

This invention relates to a device for engaging the yarn with and joining it to the sliver in a ring spinning machine, the device to be used in combination with known means for sensing the presence of a broken yarn, for halting the package on which the breakage has occurred, for seeking the broken yarn end on the package and for seizing said end by suitable means, as described in other patents of the present applicant.

Said sliver can be of any composition or structure, and in the ensuing description and claims will be simply called sliver or textile fibre sliver, the terms being synonymous.

It is well known that during spinning, for various reasons the yarn winding onto packages can break one or more times, and in order to enable the spinning process to proceed the broken yarn end must be sought and the yarn rejoined to the textile fibre sliver which continues to emerge from the last pair of drafting rollers of the spinning machine. Because of the nature of continuous spinning machines said breakage always occurs in the section between the exit of the two drafting rollers and the upper layer of yarn wound on the corresponding package.

The bringing together of the broken yarns before application of the carriage-mounted apparatus for rejoining such broken yarns in continuous ring spinning machines has always been done manually by the personnel who watch the machines for this particular purpose. The labour cost involved in overseeing the spinning has been a considerable factor in the calculation of the cost of the yarn produced. Completely automatic equipment is therefore installed which, by patrolling the working faces of the controlled machines, ascertains whether the yarn is present or not in each of the spinning spindles, then halts if it discovers that a yarn is lacking, and in such a case rejoins the end of the broken yarn to the textile fibre sliver leaving the drafting rollers.

Having done this, it continues its watching movement along one or more machines.

Said equipment has operated satisfactorily, although certain of its operating units could well be improved. It would also be advantageous to simplify its overall working method by incorporating new operating principles designed to give improved reliability and versatility in applying the equipment to the great variety of types of textile materials and their different manufacturing speeds.

According to the present invention, the automatic yarn rejoining equipment is improved by it now embracing a new method and a new device

for engaging the broken yarn end with and rejoining it to the sliver. The known methods and devices for joining the yarn to the sliver implement said operation mechanically, by engaging the yarn and sliver at the exit of the last pair of drafting rollers.

Said methods are of poor reliability in that they sometimes result in an unsuccessful joint. This is because a transverse positioning error can arise in the joining device, which therefore does not make contact with the drafting roller with the result that the textile fibre sliver and the yarn do not join due to lack of contact. Said positioning error can also be of longitudinal type, ie the joining member can properly touch the drafting roller but the sliver and yarn may not face each other but instead be mutually offset. This can happen either because of an error in the positioning of the joining device relative to the drafting roller, or because of the necessarily displaced position of the sliver following the sliver shift action.

The sliver shift action is an alternating rightwards and leftwards movement of the fibre sliver trajectory in order not to generate localized wear of the belts and rollers of the drafting unit.

The present applicant has proposed in European patent application 88202729.5 a method for automatically rejoining the yarn to the sliver which is implemented pneumatically by the sucking action of a suction tube during which said yarn and said sliver are engaged and rejoined, to restart the spinning process.

Said method has resulted in a substantial improvement in reliability and quality in the rejoining of the yarn to the sliver. Nevertheless, sometimes, and only if working with very thin yarns, the method produces a joint which is not always reliable and of optimum quality in that the sliver leaving the drafting unit is composed of a small number of fibres which within the air stream inside the suction tube have to be engaged with and twisted together with the yarn, the twists of which, rising up from the spindle, have to be able to restrain and retain said few fibres, which instead tend to be dragged away by the action of the suction air stream. It is apparent that when very thin yarns are concerned, it is necessary to control the suction effect very precisely, this not being easy.

The method and the device for implementing the present invention solve the aforesaid problems by a solution which makes it impossible for the yarn and fibre sliver leaving the drafting unit not to encounter each other, and with which no difficulty arises if very thin yarns are concerned. A further

advantage of the device over the known art is its extreme constructional simplicity, which results in very reliable operation. These and further advantages are all attained by the method of the present invention, which enables the yarn end, picked up from the package under formation, to be led between a scissor element and between a gripper element, the one overlying the other, said elements being fixed to the terminal part of a mobile arm which is guided in its movement by a cam track supported by a mobile slide unit pertaining to a carriage-mounted unit; and which also enables the gripper element to be activated to retain the yarn and, immediately afterwards, the scissor element to be activated to cut the yarn; and which further enables the yarn end retained by the gripper element to be moved to rest against the side of the presser roller in a zone proximate to the line of contact between the two last rollers of the drafting unit; and which further enables the yarn end to be retained for a very short time against said side to enable the presser roller to drag said yarn end round below the line of contact, so making it possible for the yarn to engage the textile fibre sliver; and which further enables the yarn end to be released by opening the gripper element to enable said yarn end, already engaged with the textile fibre sliver below the line of contact, to twist about the textile fibres leaving the pair of drafting rollers, to thus rejoin the yarn to the sliver.

The device used for the practical implementation of the method of the present invention comprises a mobile slide unit associated integrally with a carriage-mounted unit provided with a mobile arm, the end part of which comprises a scissor element overlying a gripper element, which mobile arm, after gripping and cutting the yarn end picked up from the package under formation, guides the yarn by means of a cam track into contact with the side of the presser roller of the last pair of drafting rollers.

The invention is described in detail hereinafter with reference to the embodiment shown diagrammatically in the figures of the accompanying drawings, together with clarification of further details and characteristics, it being understood however that the invention can be implemented in the form of other embodiments.

In the accompanying drawings:

Figure 1 is a schematic isometric perspective view of the device for engaging the yarn with and rejoining it to the sliver, the figure showing the package under formation and representing the moment in which the yarn end, picked up from the package under formation and retained by the suction cap, is positioned frontally between a scissor element and between a gripper element which form the terminal part of a mobile arm supported by a

mobile slide unit, this latter being advantageously housed in a carriage-mounted unit;

Figure 2 is a schematic isometric perspective view of the device for engaging the yarn with and rejoining it to the sliver, the figure representing the moment in which the yarn end has been brought into contact with the side of the presser roller and is retained in this position by the gripper element located in the terminal part of the mobile arm. This is the moment which precedes the dragging of said end by the presser roller, which drags the yarn until it has been trapped below the contact line between said presser roller and the underlying drafting roller. In the figures, equal elements carry equal reference numerals. Furthermore, for overall clarity those parts not necessary for the understanding of the invention are omitted from the figures, or are indicated in an overall manner as they are known.

In said accompanying figures:

2 is the presser roller lying on the drafting roller 3. Said presser and drafting rollers represent the last pair of the drafting unit 12; 10 is the textile fibre sliver which passes through the drafting unit 12 to emerge from the pair of rollers 2 and 3 and be conveyed, in the case of a yarn breakage, into the suction tube 8; 9 are the gripper and scissor elements, one above the other, said elements being fixed to the terminal part of a mobile arm 1; 7 is a pneumatic or electromagnetic actuator or any actuator of the known art for simultaneously operating the gripper and scissor elements 9; 6 represents the line of contact between the presser roller 2 and the underlying drafting roller 3; 29 is an arrow indicating the direction of rotation of the drafting roller 3, which in relation to the presser roller direction of rotation indicated by the arrow 4 is such as to cause the textile fibre sliver 10 to emerge from the drafting unit 12; 16 is an actuator of cable type, ie without a rod, which translationally moves the arm 1. Said actuator is operated pneumatically or by any other drive source; 18 is the support for the mobile slide 15; 14 is the actuator which moves the mobile slide 15 by means of the rod 30; 11 is the plate for connecting the actuator 14 to the support 18; 5 is the suitably contoured cam track for guiding the mobile arm 1 into a position such that the end of the yarn 20 rests against the side of the presser roller 2; 22 is the cap which by suction retains the yarn end picked up from the package 23 under formation; 25 is a schematic line representation of the carriage-mounted unit which travels along the spinning machine face, said unit advantageously housing the entire device of the present invention; 20 is the yarn end picked up by known means from the package 23 under formation; 27 is the traveller which during the spinning process rotates along the ring 26, which is

supported by and fixed on the bench 24; 21 is the antiballoon yarn guide or balloon control ring; 19 is the yarn guide lying below the drafting unit; 28 is the support tube for the yarn which is wound to form the package 23.

The following description of operation, which refers to the stated figures, relates mainly to that which is new, and therefore examines only the device of the present invention for engaging the yarn with and rejoining it to the sliver, in which respect it should be noted that for its operation additional devices are required but which are not included in the description.

It is known to associate the ring spinning machine with a carriage for automatically rejoining the yarns which break during the operation of the spinning spindles. Said carriage is mobile along the spinning face or faces on runways comprising one or more rails of any shape, which cooperate with suitable rolling means. During spinning the carriage, for the purpose of yarn rejoining, moves continuously to-and-fro along the front of the line of spindles to carry out a forward and backward patrolling action.

During this patrolling action the carriage ascertains by sensor means of the known art whether the yarn is present or absent in each spinning spindle. When it senses the absence of one of the yarns, it halts the carriage at the spindle where the broken yarn is located and starts the mechanisms for initiating the rejoining operation. At the moment of breakage of the yarn 20, the textile fibre sliver 10 from the drafting rollers 2 and 3 is sucked into the suction tube 8 and retained until rejoining has taken place. The broken yarn end is then sought within the upper layers of the package 23 and a sufficient length of it is automatically unwound, as described in other patents of the present applicant.

Said end is withdrawn and raised along a predetermined path, and retained by the suction cap 22.

During the yarn seeking, withdrawal and transfer stages, the spindle on which the package 23 under formation is mounted does not rotate, and is kept at rest by suitable means.

The yarn end 20 is therefore retained by the suction cap 22, along its path it having been inserted into the various elements present between the package and said cap using conventional means and operating methods well known to the expert of the art.

Along said path, the yarn end is also positioned frontally between the scissor and gripper elements 9 fixed to the terminal part of a mobile arm 1.

The aforesaid stages are followed by the commencement of the operation for engaging the yarn end 20 with the textile fibre sliver 10 and its rejoining thereto.

The actual engagement operation according to the present invention is implemented simply by the use of a mobile arm which performs the function of gripping and thus locking the yarn end and moving it against the side of the presser roller.

To begin the engagement operation, the actuator 7 is operated to operate the gripper and scissor elements 9, one above the other, in order to lock and cut the yarn end 20. The yarn portion which is cut away between the mobile arm 1 and the suction cap 22 is sucked in by this latter and thus removed.

To better clarify the operation of the elements 9, it should be noted that the gripper element grips the yarn just before the scissor element cuts it.

The thus retained yarn end 20 is moved against the side of the presser roller 2 by the simultaneous or successive or partially superimposed operation of the actuators 14 and 16.

The mobile arm 1 is guided by the cam track 5 so as to position the yarn end 20 against the side of the presser roller 2.

This contact is made under a certain pressure and is effected in that side portion proximate to the contact line 6. By virtue of the pressure involved in this contact and the direction of rotation as indicated by the arrow 4, the yarn end 20 is immediately dragged round by the presser roller 2, which drags it into a trapped position below the contact line 6, so making it possible for the yarn to be brought into contact with the textile fibre sliver 10. The gripper element 9 is opened after the yarn has been dragged below the the contact line 6.

Simultaneously or substantially simultaneously with the contact between the yarn end 20 and the side of the drafting roller 2, the locking device which kept the spindle of the package 23 at rest is released.

This latter then rotates to impart twist to the yarn 20 in the manner well known to the expert of the art.

At the moment in which the yarn and sliver engage each other below the contact line 6, said yarn and sliver mutually interfere and become secured to each other as the sliver fibres are seized and wrapped by the end of the yarn, this latter being under strong twist by virtue of the rotation of the traveller 27.

The spinning process then restarts.

From tests carried out by the applicant, it has been found that the rejoining method of the present invention gives perfectly repeatable and reliable results throughout the entire range of yarns, including the thinnest yarns produced by manufacturers. When the rejoining operation has been carried out the mobile slide unit 15 and the arm 1 are returned to their initial position, to thus enable spinning to proceed in a regular manner and the carriage-

mounted unit 25 to again patrol backwards and forwards, this latter representing the support and handling unit for the device of the present invention. The described embodiments are given by way of non-limiting example only. It is apparent that modifications can be made by experts of the art to the details of the device, but without leaving the general idea of the method of the present invention.

guides the yarn by means of a cam track to rest against the side of the presser roller of the last pair of drafting rollers.

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Claims

1. A method for engaging the yarn with and rejoining it to the sliver in a ring spinning machine, in which for each spinning spindle there emerges a textile fibre sliver from the last pair of drafting rollers, in the case of yarn breakage the textile fibre sliver being deviated from its normal path towards the mouth of a fixed suction tube by the action of an air stream, said method being characterised by:

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- leading the yarn end, picked up from the package under formation, to between a scissor element and between a gripper element, the one overlying the other, said elements being fixed to the terminal part of a mobile arm which is guided in its movement by a cam track supported by a mobile slide unit integrally associated with a carriage-mounted unit mobile along the spinning face;

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- activating the gripper element to retain the yarn and, immediately afterwards, activating the scissor element to cut the yarn;

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- translationally moving the yarn end retained by the gripper element so that it bears against the side of the upper presser roller in a zone proximate to the line of contact between the two last rollers of the drafting unit;

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- retaining the yarn end for a very short time against said side to enable the upper presser roller to drag said yarn end round until it is trapped below the line of contact, so making it possible for the yarn to engage the textile fibre sliver, this latter having been dragged to the exit of said drafting rollers;

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- abandoning the yarn end by opening the gripper element to enable said yarn end, already engaged with the textile fibre sliver below the line of contact, to twist about the textile fibres leaving the pair of drafting rollers, to thus rejoin the yarn to the sliver.

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2. A device for implementing the method claimed in claim 1, characterised by comprising a mobile slide unit associated integrally with a carriage-mounted unit provided with a mobile arm, the terminal part of which comprises a scissor element overlying a gripper element, which mobile arm, after firstly gripping and cutting the yarn end picked up from the package under formation,

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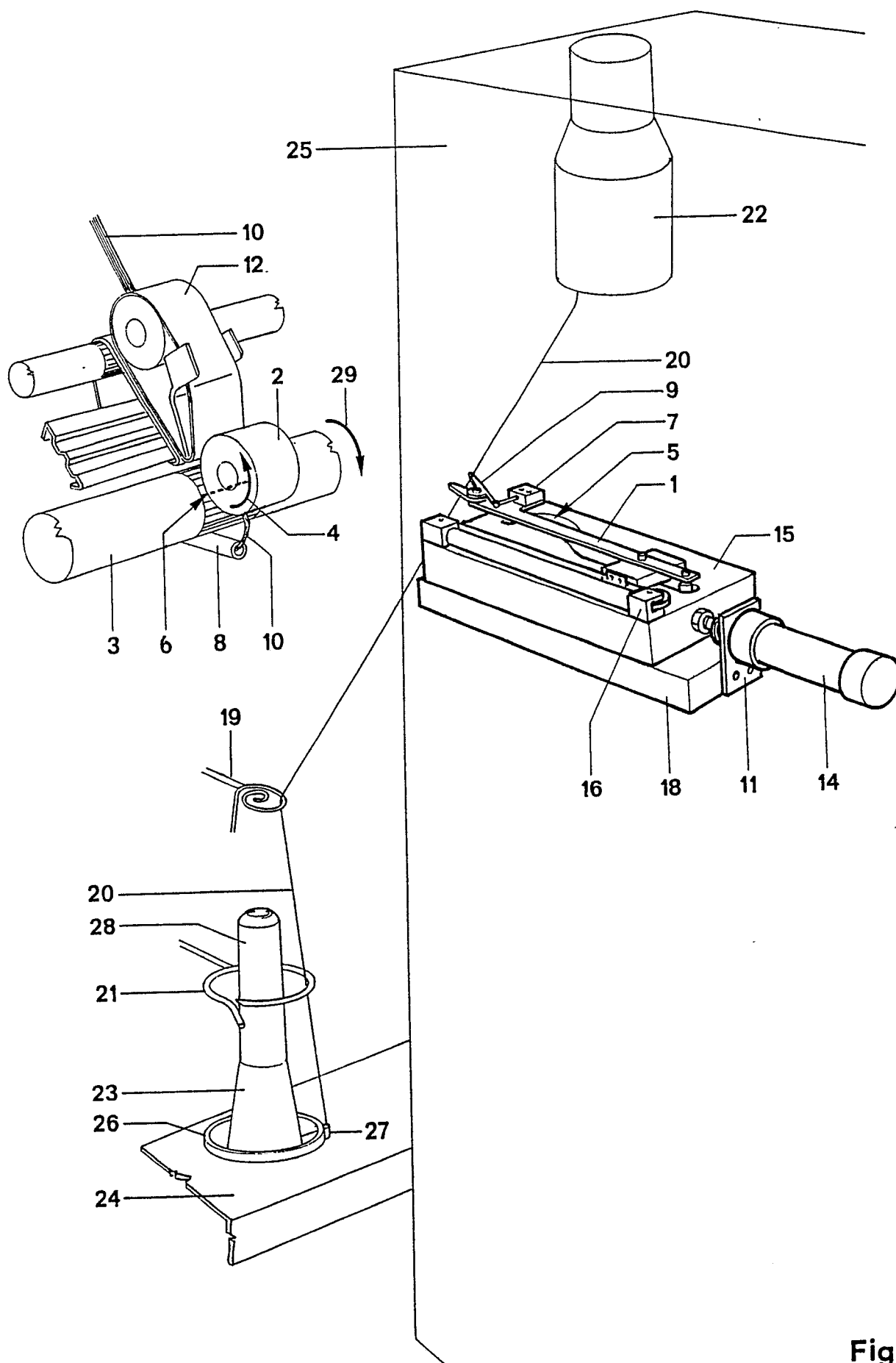


Fig.1

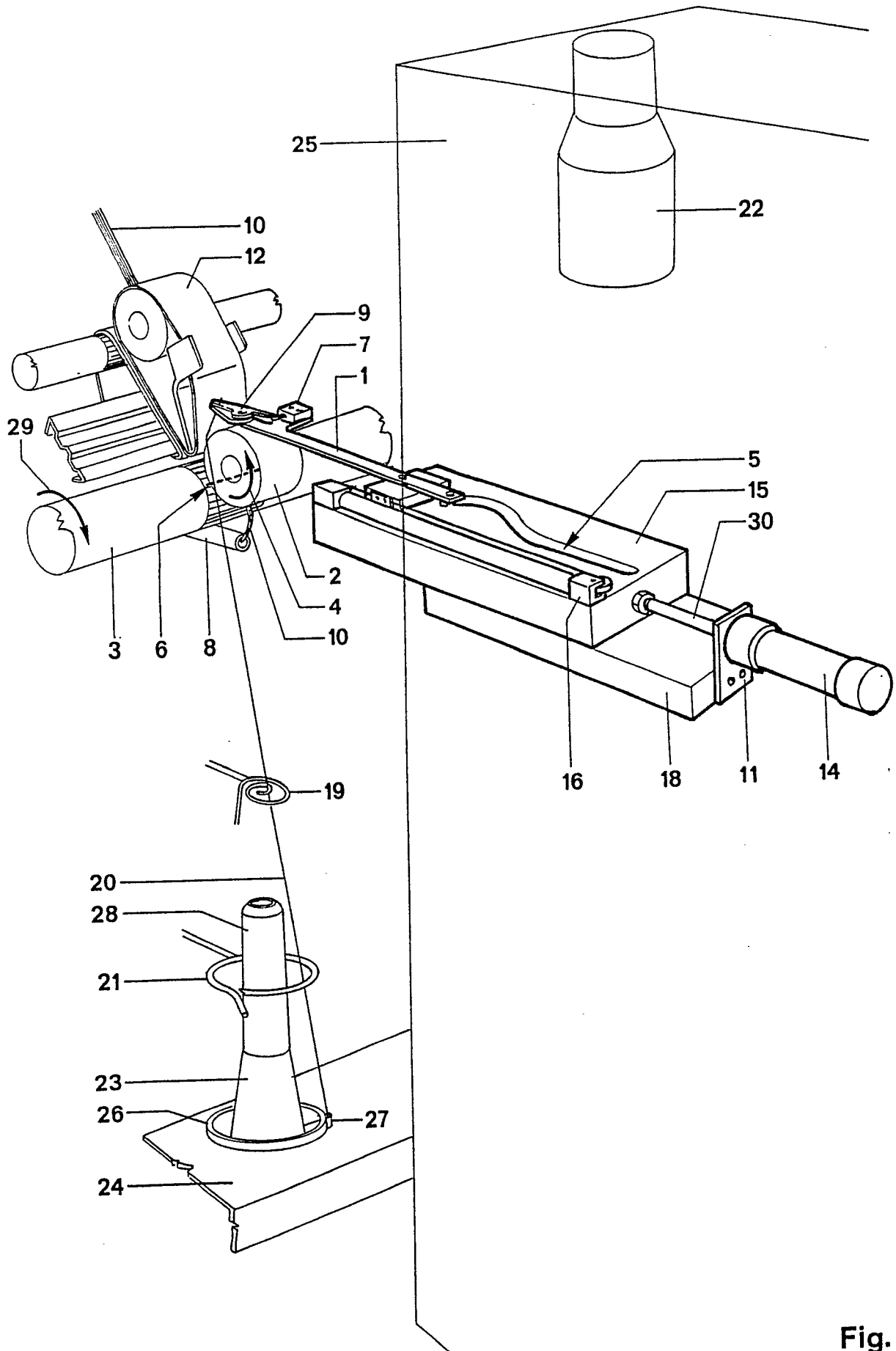


Fig. 2