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(54) Device for seeking a broken yarn end on a forming package.

(57) The invention relates to a device for seeking and withdrawing a broken yarn end on a forming package (7) by means of a number of blowing nozzles (1) located along a line geometrically similar to a helical arc which embraces the package formation cone. The device also allows a yarn portion of determined length to be sucked by a suction cap (3) which tapers upperly into a suction duct (6), the axis of which has a straightened length substantially equal to the length of yarn which needs to be unwound and sucked from the package to enable the subsequent rejoining operation to take place for the automatic reinstatement of the spinning process.

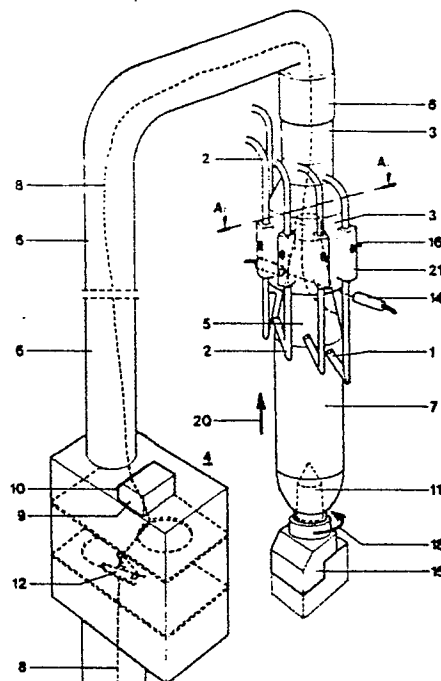


Fig. 1

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DEVICE FOR SEEKING A BROKEN YARN END ON A FORMING PACKAGE

This invention relates to a device for seeking and withdrawing a broken yarn end on a forming package in order to unwind a yarn length sufficient to allow the rejoining operation to take place for automatically reinstating the spinning process in a continuous ring spinning machine.

In textile manufacturing operations for various production purposes it is necessary to seek and release the end of a fixed yarn in windings which overall form a yarn package.

This is necessary for example in ring spinning machines in which when the yarn breaks and has to be rejoined it is necessary to seek and withdraw the broken yarn end to automatically reinstate the spinning process.

The automatic carriage apparatus for rejoining broken yarns in ring spinning machines has been the object of particular attention by the present applicant as the various patents filed thereby on this subject indicate.

The desire of the present applicant to attain greater perfection in the devices which operate during the automatic yarn rejoining stages of continuous spinning machines and his experience obtained in textile manufacturing applications have resulted in an improved practical application of said devices for automatically rejoining yarn with the purpose of reinstating the spinning process. One of the improvements towards which the device of the present invention tends is in the seeking and withdrawal of a broken yarn end on a forming package, from which a length is unwound sufficient to complete the rejoining cycle with maximum reliability and speed of implementation, and avoiding any need for unproductive repetition of the operation.

In a ring spinning machine for natural or synthetic fibres, during the rejoining of broken yarns it is necessary to bring an actual yarn into contact with a fascicle of textile fibres which has no consistency until the twist of the ring binds the individual fibres together. As the fascicle of textile fibres cannot itself be withdrawn from the feed zone at the exit of the drafting rollers because it would undergo certain breakage, it is absolutely necessary to use the yarn already collected on the forming package and unwind a part of it to be able to reach the zone for its joining to the fascicle of textile fibres close to the exit of the reed rollers.

It is therefore necessary to find the broken yarn end and withdraw it by unwinding a length of it from the package which is at least sufficient to cover the distance between the package and the fascicle of textile fibres fed by the feed rollers.

Devices are already known in the art for dis-

engaging and releasing the broken yarn lying on the surface of the package under formation.

Said known devices either do not ensure perfect preparation of the yarn under all conditions, or require a considerable use of blown air, or comprise blowing nozzles or sucker elements mounted in a fixed position and therefore unable to be operationally adapted to the variable position of the formation cone on whose surface the broken yarn end to be withdrawn is retained. It is apparent that in this latter case the separation action of the blower nozzles or sucker elements extends only partly over the surface of the formation cone, or in the limit not at all, with the result that the yarn withdrawal device does not operate effectively.

Other devices of the known art include blower and/or sucker elements aided by blades of various materials which rub against the package surface, ie against the wound yarn layers, in an attempt to release the broken yarn end.

However the contact pressure of these devices often results in damage to the yarn at several points along the wound surface layers to create portions of reduced strength which exert negative influence during the subsequent transformation passages towards the finished product. The aforesaid known devices, especially in the case of yarn which easily felts, have therefore been found unable to sufficiently release the end of a yarn fixed on the package formation cone.

The object of the present invention is to provide a device by which the broken yarn end adhering to the surface of the package formation cone is reliably released and at the same time a yarn portion of sufficient length is unwound to complete the rejoining cycle by which the spinning operation can go to completion. A further advantage of the device compared with the known art is its constructional simplicity which allows the necessary adjustments to be easily made as the geometrical parameters of the forming package vary and as the type of yarn being wound varies.

These and further advantages are all attained by the device of the present invention which comprises: - a series of blowing nozzles disposed substantially in a helical arc about the package formation cone;

- a suction cap which is located above the air jets produced by said nozzles and gradually tapers from the bottom upwards to connect into a suction duct having a straightened length substantially equal to the length of yarn required to be unwound and sucked from the package for the subsequent rejoining operation needed to automatically reinstate the spinning process;

- a block into which said suction duct opens and which has a first zone for sensing the yarn by means of a yarn-sensing light barrier or electric field and a second zone controlled by the first for shearing the end of the sucked yarn;
- two opposing frontal optical sensors which produce a barrier light beam for sensing the presence of the package formation cone in order to position it along the helical arc of the blowing nozzles.

The device also comprises a control mechanism arranged both to vertically move the package support peg upwards or downwards and to intermittently rotate said support peg to subject the entire surface of the formation cone to the action of the air jets from the blowing nozzles.

A further interesting improvement contained in the device of the invention is that the control source for rotating the peg and thus the bobbin provides two rotary movements: firstly a slow rotation for seeking the end of the yarn and extricating it from the wound layers of the formation cone, and then a sufficiently rapid rotation to release into the suction duct the yarn length required for rejoining, this rapidity resulting not only in a reduction in the cycle time but also preventing the yarn fibrillating substantially under the action of the air stream.

Further according to the invention, the pipes of the blowing nozzles are coupled to guide supports, these latter fixed to the outer surface of the suction cap, said coupling allowing the pipes both to slide vertically and to rotate angularly to be able to perfectly adjust the operating directions of the air jets blowing against the zone in which the broken yarn end is to be found, on the basis of the dimensions of the package formation cone and the type of yarn wound.

According to one embodiment, the control mechanism located at the base of the package support is able to generate an oscillatory reciprocating motion of limited amplitude straddling the position which the formation cone has assumed, this being done while the package is being rotated about its axis and in the opposite direction to the yarn winding.

The invention is described hereinafter on the basis of the embodiment shown diagrammatically on the figures of the accompanying drawings which schematically illustrate the characteristics of the invention, all the accompanying drawings and the description thereof corresponding to a preferred embodiment to make its implementation more understandable, however all constructional modifications included within the expounded general idea are to be deemed as falling within its scope of protection. In the accompanying drawings:

Figure 1 is a diagrammatic isometric perspective view showing both the device for seeking and withdrawing a broken yarn end and the package under formation, at the moment in which the package formation cone has already been positioned along the helical arc of the blowing nozzles and the yarn end has already been conveyed through the suction duct to the sensing and cutting block;

Figure 2 is a cross-sectional view from above, taken on the line A-A of Figure 1, showing a part of the device of the present invention.

In the figures identical elements carry the same reference numerals. Again, for reasons of overall clarity, those parts not necessary for understanding the invention are omitted from the figures or are shown only generically as they are of known type. In said accompanying figures:

1 is one of the blowing nozzles which operate by blowing jets of air onto the surface of the formation cone; 2 is the position-adjustable pipe of the blowing nozzles; 3 is the suction cap under which the upper end of the package 7 is located. Said cap tapers upperly to engage the suction duct 6; 4 is the block containing the sensing members for the yarn 8 and the cutting element 12. This block is the source of an air stream for conveying the end of the yarn 8 through the photo-electric or inductive sensor 9 and into the gap between the cutting blades of the scissor elements 12; 5 is the package formation cone on the surface of which the broken yarn end is retained; 6 is the suction duct, which is of length substantially equal to the length of yarn to be unwound and sucked from the package, and connects the suction cap 3 to the block 4; 7 is the package under formation, on the cone 5 of which the broken yarn end is sought; 8 is the yarn sucked from the package 7 and unwound by a length sufficient to allow the sucked yarn to be sensed by a light barrier 10; 11 is the peg which holds the forming package 7; 12 are the scissor elements for removing the excess yarn so that the portion of sucked yarn 8 is of a suitable length for rejoining as required for reinstatement of the spinning process; 14 are the two optical sensors, one emitting and one receiving, disposed facing each other to form an optical light curtain which when interrupted by the formation cone 5 halts the upward movement of the forming package 7 to position it correctly under the suction cap 3; 15 is a control mechanism block of the known art able to move the support peg 11 for the package 7 vertically upwards and downwards and also able to rotate said peg 11 in the opposite direction to that in which the yarn is being wound so as to disengage and release the broken yarn end reliably and rapidly. Said mechanism is also able to generate,

pneumatically or electrically, a reciprocating oscillatory movement of limited amplitude about the position established by the optical sensors 14 to enable the formation cone 5 to be struck by the air jets more effectively; 16 is the locking screw for the pipe 2 which when slackened allows exact positioning of the blowing nozzle 1 such that the air jet strikes the formation cone with high efficiency and in collaboration with the other nozzles; 18 is the direction of rotation of the support peg 11 and thus of the package 7, this direction being advantageously the opposite of that in which the yarn 8 is wound onto the forming package 7; 20 is the arrow indicating the vertical raising of the package 7 until its formation cone interrupts the light beam extending between the optical sensors 14; 21 is the guide support for the pipe 2 and is fixed to the outer surface of the suction cap 3.

The following description of operation given with reference to the said figures relates firstly to that which is new and therefore takes into consideration only the device of the present invention which seeks and withdraws the broken yarn end on a forming package as required for the subsequent rejoining of the yarn to the roving, it being understood that additional devices are required for the other operating stages prior and subsequent to the search for the broken yarn and that these do not form part of the description.

It is known to associate a ring spinning machine with a carriage apparatus for automatically rejoining yarns which break during the operation of the spinning spindles. The carriage houses the various devices required for the various operational stages involved in rejoining, and therefore also houses the device of the present invention.

Said carriage is mobile along the spinning face on runways comprising one or more rails of any shape, cooperating with suitable rolling means such as wheels, rollers or equivalent means. During the operation of the spinning machine, the yarn rejoining carriage is driven to and fro to patrol along the spindles. As it patrols, the carriage apparatus checks by sensor means of the known art whether the yarn is present or not in each spinning spindle.

When it detects the lack of one of the forming yarns it halts the carriage at the spindle where the yarn has been found to be broken and starts the mechanism for initiating the rejoining procedure. This procedure involves stopping the spindle and extracting the forming package 7 from the spindle line and locating it on the peg 11 inside the carriage apparatus in a position suitable for seeking and withdrawing the broken yarn end. The peg 11 together with the block 15 of the control mechanism are located in a lower waiting position. When the package 7 has been mounted on the peg 11 the control mechanism 15 is operated to vertically

raise the forming package 7 in the direction of the arrow 20 until its formation cone 5 intercepts and obscures the light beam or optical curtain between the facing sensors 14. When the light beam is intercepted the blowing nozzles 1 are activated and at substantially the same time the control mechanism 15 effects the rotation 18 and suction is applied to the cap 3 and duct 8, this latter being connected to a vacuum pump or similar member, or to any air suction main. The rotation 18 of the package 7 enables its entire frusto-conical surface 5 to be effectively exposed to the air jets leaving the nozzles 1, which by virtue of their overall helical arc arrangement create an air current of ascending vortex type. This latter is channeled along the entire surface of the suction cap 3 at a velocity which increases both because of the effect of the suction zone and because of the effect of the upward taper of the frusto-conical section of the cap 3 which is connected at its top to the suction duct 6. In addition to the rotation 18 the control mechanism 15 generates a reciprocating oscillatory motion of limited amplitude about the position assumed by the package 7 under the suction cap 3 to attain even greater efficiency in disengaging and releasing the broken yarn end.

Said rotation 18 of the package 7 is advantageously of increasing intensity, ie initially it comprises a few slow rotations necessary to give the blowing nozzles 1 time to disentangle the broken yarn end from the formation cone 5 followed a moment after by a rotation sufficiently rapid to drag along the suction duct the length necessary for passing the yarn 8 through the light barrier 10 and through the scissor elements 12.

The presence of the yarn excites the photoelectric barrier 10, which simultaneously deactivates the blowing nozzles 1, the control mechanism 15 and, simultaneously or immediately afterwards, the scissor elements 12.

The aforesaid stages could in fact at least partly overlap in time. Immediately following the cutting of the yarn 8 by the scissor elements 12 the package 7 begins to descend by the action of the control mechanism 15. On termination of its descent, the other operational stages follow in accordance with a programmed cycle under the action of various known devices, to complete the automatic rejoining of the yarn withdrawn by the device of the invention to the fascicle of textile fibres leaving the drafting rollers, in order to reinstate the spinning process on the spindle at which the yarn had accidentally broken. The described embodiment has been given by way of non-limiting example only. It is apparent that modifications and additions can be made by experts of the art to the details of the device, but without leaving the general idea of the present invention.

Claims

1. A device for seeking and withdrawing a broken yarn end on a forming package and drawing off by suction a determined yarn length required to allow the rejoining operation to take place for automatically reinstating the spinning process in a continuous ring spinning machine, characterised in that said device comprises:

- a series of blowing nozzles located along a line geometrically similar to a helical arc embracing the package formation cone; 10
- a suction cap with its lower profile located above the blown air jets produced by said nozzles;
- a suction duct having a straightened length substantially equal to the length of yarn required to be unwound and sucked from the package for the subsequent rejoining operation for the purpose of automatically reinstating the spinning process; 15
- a block having a first zone for sensing the yarn by means of a sensing light barrier or electric field and a second zone controlled by the first for shearing the end of the sucked yarn; said block being connected to the cap by the suction duct; 20
- two opposing frontal optical sensors which produce a barrier light beam for sensing the presence of the package formation cone in order to position it along the helical arc of the blowing nozzles. 25

2. A device as claimed in claim 1, characterised by further comprising a control mechanism arranged both to vertically move the package support peg upwards or downwards and to intermittently rotate said support peg to subject the entire surface of the formation cone to the action of the air jets from the blowing nozzles. 30 35

3. A device as claimed in claim 1, characterised in that the pipes of the blowing nozzles are coupled to guide supports, these latter fixed to the outer surface of the suction cap, said coupling allowing the pipes both to slide axially and to rotate angularly to be able to perfectly adjust in a simple manner the operating directions of the air jets blowing against the zone in which the broken yarn end is to be found, on the basis of the shape and dimensions of the package formation cone and the type of yarn wound. 40 45

4. A device as claimed in claim 2, characterised in that the control mechanism located at the base of the package support is able to generate an oscillatory reciprocating motion of limited amplitude straddling the position which the formation cone has assumed by the action of the optical sensors, this being done while the package is being rotated about its axis, and in the opposite direction to the yarn winding direction. 50 55

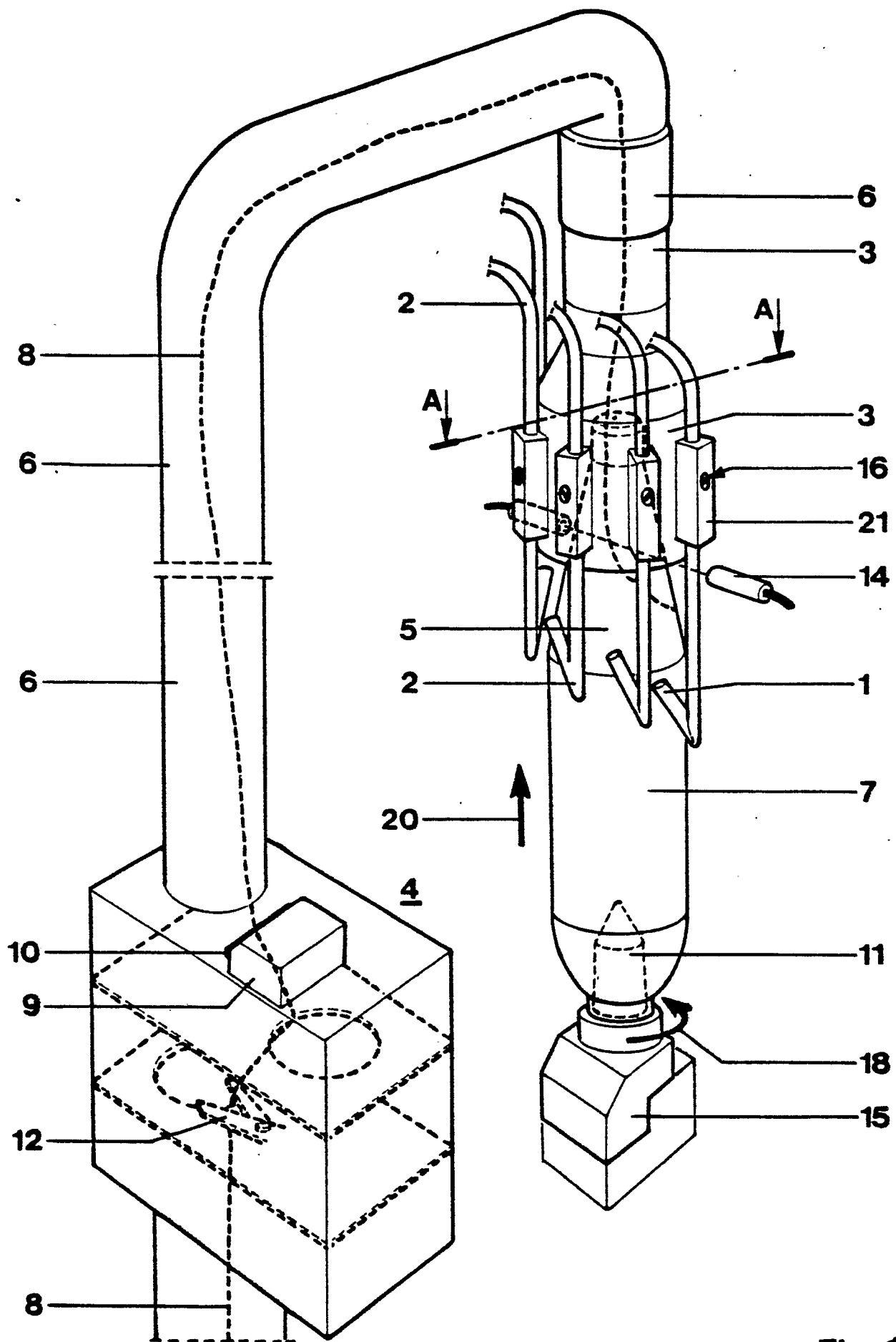


Fig. 1

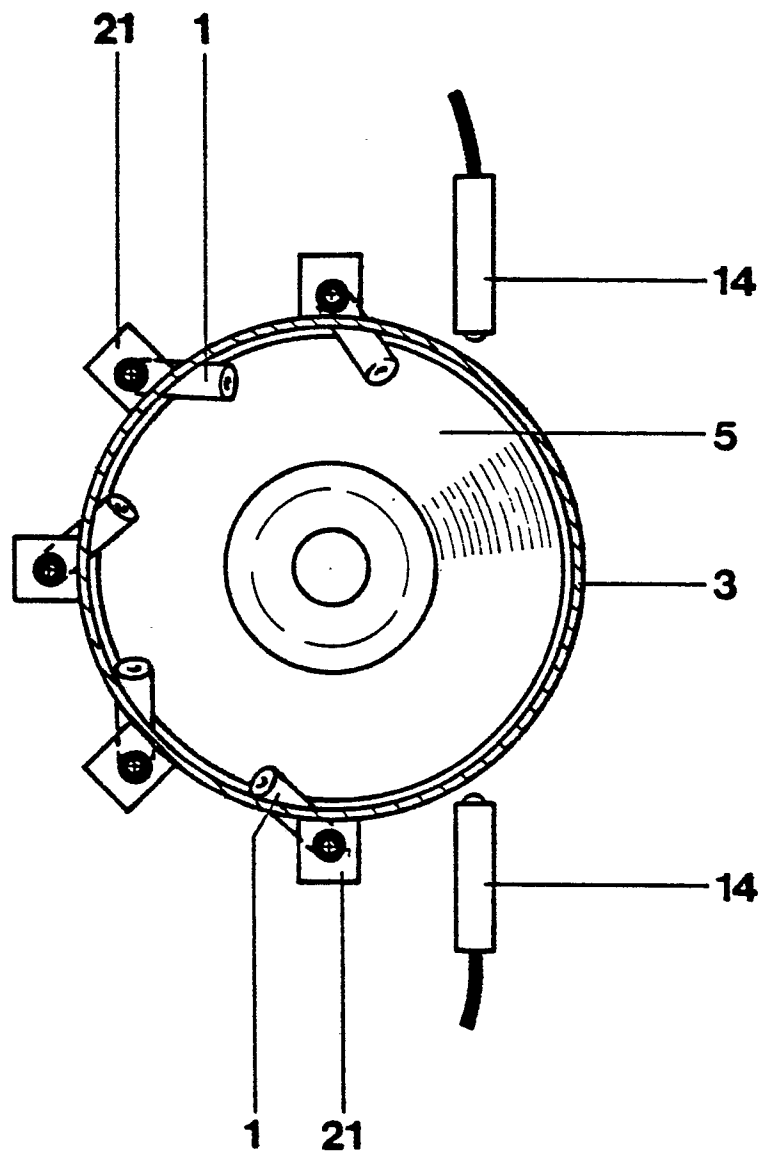


Fig. 2



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EUROPEAN SEARCH REPORT

Application Number

EP 88 20 2694

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	FR-A-2216208 (HEBERLEIN HISPANO S.A.) * claims 1, 2; figures 1, 4 * ----	1	D01H15/00 B65H67/08
A	DE-A-3013174 (ZINSER TEXTILMASCHINEN GMBH) * page 5, line 16 - page 6, line 2; figure 1 * ----	1	
A	DE-A-3314278 (ZINSER TEXTILMASCHINEN GMBH) * claim 1; figures 1, 2 * ----	1	
A	DE-A-3316108 (ZINSER TEXTILMASCHINEN GMBH) * claim 1; figures 1-3 * ----	1	
A	CH-A-554803 (ZINSER TEXTILMASCHINEN GMBH) * claim 1; figure 1 * ----	1	
A	FR-A-2523101 (MURATA KIKAI K.K.) * page 13, line 23 - page 14, line 21; figure 10 * ----	1	
A	EP-A-219095 (KURASHIKI BOSEKI K.K.) * claim 1; figure 3 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			D01H B65H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 APRIL 1989	Examiner HOEFER W.D.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document			