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(54) **Method and device for doffing bobbins from a spinning machine and breaking the yarn.**

(57) Method for the automatic removal of a full bobbins (S) from a spindle (1) and for breaking the underwinding and binding yarns (FS, FL), wherein : the tube (T) on which the bobbin (S) to be removed is wound is gripped by a gripping device (11) close to the lower rim (TB) of the tube thus pinching the underwinding and binding yarns (FS, FL) against the tube (T), and the bobbin (S) is removed breaking the underwinding and binding yarns (FS, FL) between the underwinding area on the spindle (1) and the point at which they are pinched against the tube (T).

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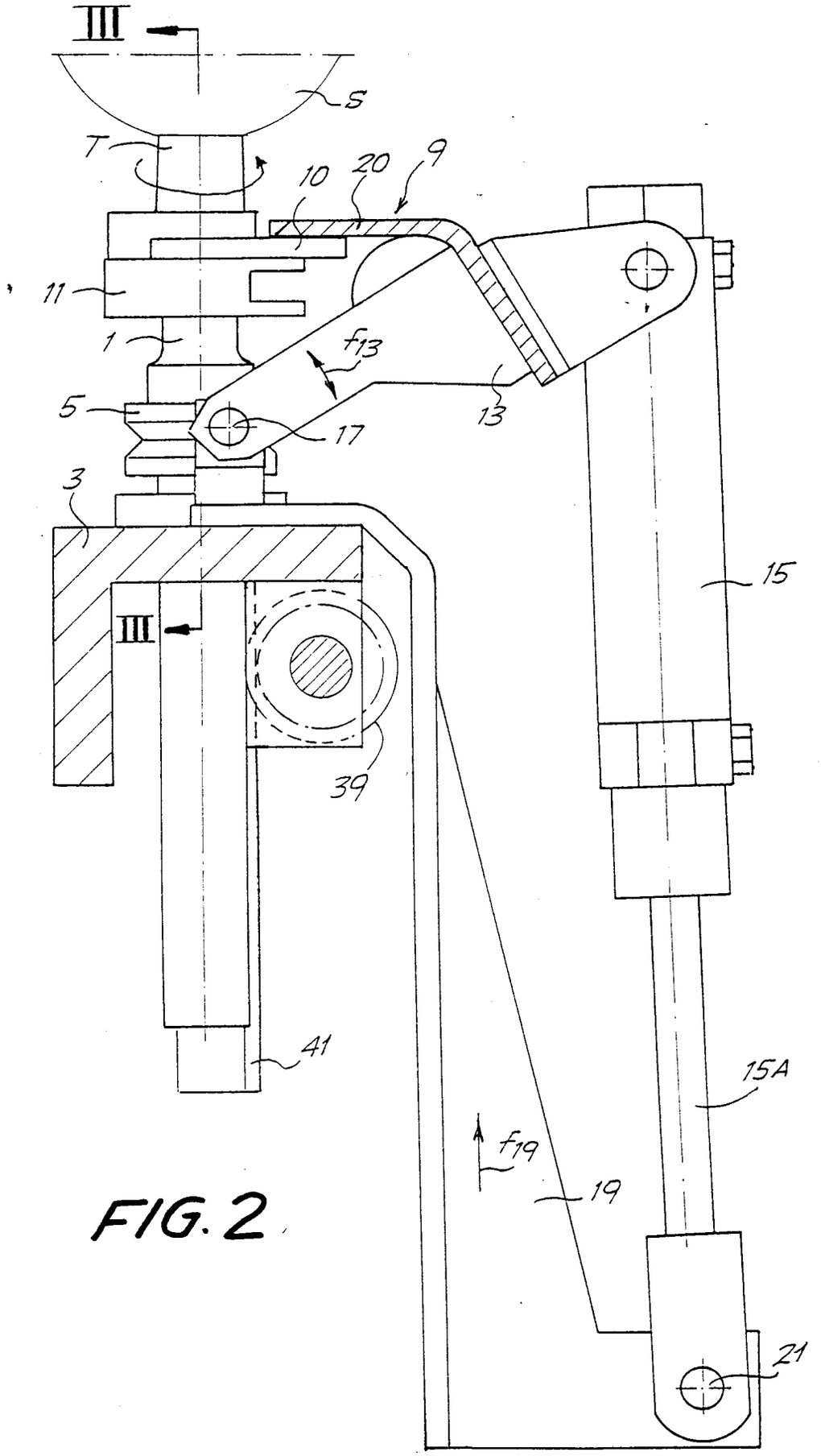


FIG. 2

The present invention refers to a method for removing bobbins from a spinning machine and breaking the yarn. The invention refers also to a device for doffing bobbins from a spinning machine.

With spinning machines, such as intermittent, or self-acting spinning machines and continuous, or ring type spinning machines, the slubbing coming from a feed pirn or bobbin is unwound and fed to the working units where it is drawn and twisted, and then rewound onto a tube or some similar item for holding yarn. The bobbin is formed around a tube which is generally conical in shape and is fitted over and grip a rotating drive spindle. When a bobbin is full, in other words when a sufficient quantity of yarn has been wound around it, the bobbin must be removed and replaced with an empty tube, in order to form a new bobbin. This can be carried out manually or by automatic systems that doff full bobbins and replace them with empty tubes. When full bobbins are doffed from spindles, sufficient force must be applied to disengage the bobbin from the spindle or, more precisely, the tube on which the bobbin has been formed. This force must be sufficient to disengage the tube from the spindle and to break the underwinding yarn (attaching the bobbin to the spindle), and break the binding yarn on the tube (that attaching the tube to the spindle), so as to be able to wind a new bobbin. The underwinding yarn is the yarn that, once winding is completed, is taken from the bobbin to the underwinding area on the spindle. The underwinding operation allows the bobbin to be removed from the spindle whilst keeping the yarn in position between the drawing assembly and the spindle. Before doffing the bobbin the yarn is wound around the spindle a few times in the underwinding area. When the bobbin is subsequently removed from the spindle and the yarn breaks, the end of the yarn stays wound around the spindle so that winding can then start on a fresh tube. When winding begins on the new tube, the yarn attached to the underwinding area is taken to the new tube so that winding of a new bobbin can begin.

When a full bobbin must be doffed, there are thus two yarns attaching the bobbin to the spindle that require breaking so that the full bobbin can be removed and replaced by an empty tube. In winding of some types of textile materials, circumstances may occur, under which breaking of the two yarns becomes difficult. The greatest difficulty is encountered when highly elastic yarns must be broken, whose extensibility is too high and causes problems for traditional bobbin doffing devices. In other words, the underwinding and binding yarns require stretching for a distance greater than the machine is capable of before they break. This occurs, for example, with self-acting spinning machines because the automatic doffing systems they are fitted with for doffing bobbins from their spindles cannot move for a sufficient distance as they are obstructed by other parts of the spinning machine (such as the faller and counterfaller shafts) that prevent movement beyond the top of the spindle.

There are also difficulties when spinning yarn with a high breaking strength, as when full bobbins are being doffed from spindles, the yarns, instead of breaking, tend to unwind from the bobbins (the first yarn coils wound around the new tube and/or the last yarn coils wound around the full bobbin with a possible rotation of the bobbin). If this occurs, bobbins are removed from spindles without breaking the underwinding yarn and/or the binding yarn.

The object of the present invention is thus a method of doffing bobbins that overcomes the above mentioned drawbacks, and allows bobbins to be doffed and their underwinding and binding yarns to be broken even when the yarn being spun is very elastic and/or has a high breaking strength.

In substance, the method according to the invention is characterized in that: the tube on which the bobbin is formed is gripped by a gripping device near the bottom edge of the tube, thus pinching the underwinding and binding yarns against the tube; and that the bobbin is doffed causing the underwinding and binding yarns to break between the spindle underwinding area and the tube pinch point.

In the method according to the invention, before removing a full bobbin by taking the tube off its respective spindle, the gripping device grips the two underwinding and binding yarns at a point very close to the underwinding area on the spindle. Therefore, the length of the underwinding and binding yarns being pulled (and stretched) to cause breaking thereof is extremely limited. Consequently, the total stretching distance before the yarns break is kept within the limits compatible with the movements of the devices for doffing the bobbins and loading the tubes. Moreover, by breaking the yarns in this way, the yarns do not unwind from the full bobbins being removed.

A second object of the invention is a device for doffing bobbins from a spinning machine, for performing the above described method.

In substance, the device according to the invention is characterized by a gripping and extracting means comprising a pliers-shaped or similar gripping device for gripping the tube in correspondence of the lower edge thereof and pinching the underwinding and binding yarns between said gripping device and the tube, said means being capable of moving in a direction that is approximately parallel to the axis of the spindle, so as to remove the tube and its relevant bobbin from the spindle.

In practice, the gripping device is designed to have alternately an inactive position, where the gripping device is clear of its respective spindle, and an active position, where the gripping device grips the tube on the spindle. To this end, the gripping device is capable of moving towards the spindle, so that,

when the gripping device touches the tube, the active surfaces of the gripping device close around the tube on the spindle. This approaching movement can be a translation movement, or, in a particularly advantageous embodiment, the gripping device can be mounted in an oscillating fashion and an actuator controls the oscillation of the gripping device from its clear position to its operating position where it grips the tube.

In order to make this device particularly simple and reliable, in one possible embodiment the gripping device comprises two jaws that are held in their open position by an elastic means. These jaws are directly closed by the approach of the jaws to the tube. However, the possibility of using some form of drive system for closing these jaws is not excluded.

When a full bobbin is extracted from the spindle and doffed, a fresh tube has to be inserted and fitted on the spindle so that winding of a new bobbin can take place. This operation can also present certain difficulties. Currently, particularly on self-acting spinning machines, tube fitting systems are used that comprise a spring loaded device that "shoots" a tube onto the spindle. When the device is tripped, a tube is violently pushed against the spindle in a co-axial direction so that it is fitted onto the spindle. A device of this type is described, for example, in EP-A-O 299 934. As tubes can be deformed or of not precisely the same shape, these tube fitting systems cannot fit all tubes onto the spindles of a machine in precisely the same position.

In an improved embodiment of the method and device according to the invention, the problems inherent with traditional tube fitting systems, including those mentioned above, are also solved.

In substance, in an improved embodiment of the method according to the invention, the same means that grips and removes the bobbins is used to grip a tube that has been placed onto the spindle without the use of force and pull it downward until the tube is locked on the spindle by interference. In this way, the empty tube is safely and reliably fitted onto the spindle.

Correspondingly, a specific configuration for the gripping device is also provided, this configuration enabling the latter to be used not only for doffing the bobbin and break the underwinding and binding yarns, but also for fitting a fresh tube. To this end, the two jaws that form the gripping device can have an internal projecting ridge that divides the active surface of the jaws into an upper and a lower part, which are designed to cooperate respectively with the lower edge of the tube for extracting the bobbin and with an intermediate portion of the tube for forcing the empty tube onto the spindle, after it has been inserted thereon without interference. Advantageously, one, or both of the upper and lower parts of the jaws can be conically shaped with a suitable aperture so as to cooperate with the tube.

Other advantageous embodiments of the invention are set out in the attached dependent claims.

The invention is further explained in the description that follows with reference to the attached drawing which shows some practical non-limiting examples of the invention. In the drawing:

Fig. 1 is a schematic side view of the underwinding area of a spindle with a bobbin fitted over it and the device according to the invention in an inactive position;

Fig. 2 is similar to Fig. 1, with the device according to the invention in its active position;

Fig. 3 is a local cross-section according to line III-III in Fig. 2;

Figs. 4 and 5 are plan views of the pliers according to the invention in open and closed positions, respectively, and only the jaws are shown in Fig. 5;

Figs. 5A and 5B are schematic views of the forces exerted on the pliers when a tube is being removed from the spindle;

Fig. 6 is a view along the line VI-VI in Fig. 5;

Fig. 7 is a view of an empty tube being fitted over the spindle;

Fig. 8 is a plan view of a modified form of the pliers; and

Figs. 9 and 10 are views of a further embodiment of the device according to the invention with a different type of gripping device.

Figs. 1 and 2 schematically show the lower part of a spindle (1) mounted on a spindle line (3). The spindle shown is typical of those found on self-acting, or intermittent type spinning machines. In any case, as will become clear from that which follows, the same device can be fitted to any textile machine that winds yarn around a tube. There is a pulley (5) returning a drive belt (7) (see Fig. 3) that is circular in section and drives the spindle (1). On the spindle (1), there is a tube (T) that is fitted and forced over the spindle and is rotated by the spindle. A yarn bobbin (S) is formed around the tube.

To the spindle (1) there is combined a spool-remover (indicated in its entirety by 9) comprising a plate (10) on which a pair of pliers (11) described in greater detail later on is mounted. The spool-remover is mounted on a rocker-arm (13) that is jointed at one end to a cylinder-piston actuator (15), and at the other end to a support (17, 19). The assembly formed by the spool-remover (9), rocker-arm (13), actuator (15), and support (17, 19) is mounted on a bar (20), hereinafter called the spool-remover bar. When the actuator (15) is operated, the piston rod (15A) of which is hinged (in 21) to the spool-remover support (19), the rocker-arm (13) is caused to oscillate in the directions shown by the arrow (f13). Figs. 1 and 2 show the limit positions of the rocker-arm (13), and thus the spool-remover (9), as driven by the actuator (15). In Fig. 1, the rocker-

arm (13) is in its lower position and the spool-remover (9) is in its inactive position with the plier (11) clear of the spindle (1). In Fig. 2, the rocker-arm (13) has been driven to its upper position so that the spool-remover (9) is placed in its active position, i.e. with the pliers (11) engaging the tube (T).

In the part of the description that follows, reference is made to a single spindle and its spool-remover, however it is evident that the device illustrated extends for a certain length along the spindle line, and each spindle has an identically placed spool-remover. The spool-removers are mounted on bar (20), along the length of which a suitable number of actuators controlling the movement of the bar itself are mounted.

As shown in detail in Figs. 3 to 6, the pliers (11) are composed of a pair of jaws (25) attached via a hinge (27) to the plate (10), and held in an open position by a spring (29) whose ends are attached to two pins (31) housed in two cavities (33) in the jaws (25). When the spool-remover (9) is in its inactive position as shown in Fig. 1, due to the action of the spring (29) the jaws (25) of the pliers (11) are in the open position shown in Fig. 4. When the spool-remover (9) is moved by the oscillation of the rocker-arm (13) towards its active position as shown in Fig. 2, the jaws (25) approach the tube (T) until they close around it in the position shown in Fig. 3. The jaws (25) are closed by the action of the jaws themselves being pressed against the external surface of the tube (T).

As shown in Fig. 3, when closed, the jaws (25) grip the tube (T), on which the bobbin (S) is formed, around the flared lower rim (TB) of the tube. In this fashion, the underwinding yarn (FS) and the binding yarn (FL) that are positioned between the bobbin (S) and the underwinding area on the spindle (1) are pinched between the lower rim (TB) of the tube (T) and the internal surface of the jaws (25). Advantageously, as shown in Figs. 3 and 6, the jaws (25) have a conical tube gripping surface (35) that ends in a ring-shaped raised ridge (37).

When the bobbin (S) is to be doffed, the spool-remover (9) is moved into the position shown in Fig. 2, and the jaws (25) of the plier (11) grip the lower rim (TB) of the tube (T) thereby pinching the underwinding (FS) and binding yarns (FL). At this point, the spool-remover support (19) and the bar (20) are raised in the direction shown by the arrow (f19), remove the tube from the spindle (1), and release the bobbin (S) to means for holding or collecting it, that are not shown as they are of a known type. A rack and pinion system (39, 41) can be used to raise the spool-remover bar, or a system that uses an actuator with a hydraulic piston or other suitable means, possibly similar to those used on traditional spool-removers. One example of a system for collecting full bobbins is described in the previously mentioned EP-A-O 299 934.

The yarns (FS and FL) are also broken during this operation. As they are pinched around the lower rim of the tube and therefore close to the underwinding area of the spindle (1), the breakage takes place within an extremely limited free length of yarn. This means that the total stretching distance before the yarns break is far less than that of normal bobbin doffing devices, where the underwinding and binding yarns are free from the underwinding area to the point where they are attached to the bobbin. The pinching action of the pliers (11) also prevents any of the coils wound around the bobbin from unwinding. The subsequent release of bobbins to means for collecting it occurs in the traditional manner.

Figs. 3, 4, 5, 5A, and 5B show the operation of the pliers whilst removing the tube in detail. The tube is fitted over the spindle (1) with interference, thus a degree of force (V) must be applied in order to remove it from the spindle. When removing the tube, the pliers touch the rim (TB) of the tube (T) with a certain degree of play so that the pliers can be positioned without an excessive amount of force being used. The position of the pliers in respect of the tube before removal begins is shown in Fig. 5A, i.e. before the closed pliers begin moving upwards: the tube (T) is in contact with the jaws (25) and rests laterally thereon. The contact reaction forces between the tube and the jaws (25) are shown at (F1) and (F2). These reaction forces are balanced by the reactions (R) and (H) of the hinges attaching the jaws (25) to the plate (10). When the spool removal bar (20) is in its closed position, the axes about which the jaws (25) on each pair of pliers rotate (in other words the axes of the hinges (27)) are aligned with the axis of the respective spindle (1). When the spool-remover begins moving upward in the direction shown by the arrow (f19), the play between the tube and the jaws (25) is recovered, and the tube is completely gripped between the two jaws (25), as shown in Fig. 5B. In this configuration, the system is balanced by the reactions (F) and (R) that are on the same axis and pass through the centres of rotation of the jaws and the spindle (1) axis. In this position when the bobbins are removed and the yarns broken, there are no excess stresses on the spool-remover bar (20), and the system can be kept in stable equilibrium whatever the degree of stress. In Fig. 3, the contact forces on the conical surfaces (35) of the jaws (25) that are required to overcome the resistance (V) of the bobbin to being removed are shown. These contact forces can be resolved in components (V1), (V2) (vertical stresses) and (W1), (W2) (horizontal stresses). The contact actions on the conical surfaces (35) of the jaws (25) cause the jaws to rotate until they completely grip the tube (T), as shown in Fig. 5B.

The above descibed pliers (11) are also designed to be capable of fitting an empty tube over the spindle (1). To this end, there is a ring-shaped projecting ridge (37) and a second conical surface (43) below it. Tubes are fitted in the following way (see Fig. 7): The tube is

loosely placed over the spindle (1) either by hand or using an automatic system of a known type. The pliers (11) of the spool-remover (9) are in their inactive position and the spool-remover support (19) is raised. The tube (T) is fully fitted by the pliers (11) moving from their inactive position, as shown in Fig. 7 by a solid line, to their active position, as shown in Fig. 7 by a dotted line, where the aforementioned pliers grip an intermediate part of the tube. The spool-remover support (19) then lowers in the direction shown by the arrow (f19') thus pushing the tube (T) downwards over the spindle (1). During this operation, the tube (T) cooperates with the lower conical surface (43) of the jaws (25) of the pliers (11). The forcing degree is thus uniform, and this ensures that all the tubes in a spindle line, on a self-acting spinning machine for instance, are fitted in a uniform fashion.

During fitting, horizontal and vertical contact forces are also applied, this time in correspondence with the ring-shaped ridge (37). By resolving these forces in vertical and horizontal components, the vertical components are directly transmitted to the plate (10) and thus the bar (20), whilst the horizontal forces are balanced as they pass through the axes about which the jaws (25) rotate, as shown in Fig. 5B for the tube removing operation. By adjusting the position of the spool-remover bar (20) so that the axes about which the jaws (25) rotate are aligned with the centre of the spindle (1), the jaws (25) can be fairly stably balanced against rotation. When this balance against the rotation of the jaws (25) can no longer be maintained, the jaws themselves begin rotating causing the pliers to open, which tends to cause the bar (20) to oscillate towards the direction of opening. The degree of opening can be controlled by the force exerted by the actuator (15), and can occur when a certain value of force (V) is reached, i.e. a certain degree of the force with which the tube is fitted over the spindle.

Fig. 8 shows a modified form of construction of the pliers on the spool-remover (109). In this case, the pliers (111) have two jaws (125) pivoted on pins (127) inserted in respective slots (127A). The jaws are held in an open position by a spring (129). There are two tailpieces (126) on the jaws that are positioned close to each other and are used to close the jaws, and there is an oval shaped piece (128) between them that is attached at (130) to the spool-remover. A small crank (132) is fixed to the oval shaped piece (128) and rotates about the same pivot (130), and is also attached at (134) to a control rod (136). When the rod (136) moves in the direction shown by the arrow (f136), the oval shaped piece (128) is caused to rotate and thus close the jaws (125). Therefore, in this configuration, active means are required in order to close the pliers. There can be several control rods (136) along a spindle line, each of which is jointed to a number of small cranks (132) that each close the pliers on a respective spindle. As the tubes gripped by the jaws may not all be precisely the same, or may not be in precisely the same position on their respective spindles, the jaws (125) of the various pliers driven by the same control rod (136) must be able to adapt during closure to different diameters of tubes. This is achieved by the spring (129) and the slots (127A).

When doffing bobbins from the spindles, the two jaws of the pliers (111) are only used to grip the tube, and the necessary upward force is provided by the edge (110) of the support bar striking against the lower rim of the tube. When tubes are to be fitted over the spindles, the support bar holding the pliers (111) is lowered so that the jaws (125) of the various pliers (111) are held in an open position around their respective spindles. The tubes are then loosely fitted over the spindles and the control rod (136) then causes the jaws (125) to close around the tubes, and the bar is lowered parallel to the spindle axes thus fitting the tubes over the spindles.

Figs. 9 and 10 show a modified gripping device that can be used as an alternative to the previously described pliers. This gripping device is constructed with a pair of rollers (201) mounted on a bar (203), corresponding to bar (20). The rollers (201) are basically cylindrical, but each has a toroid shaped section (205) designed to be capable of gripping a tube (T). These rollers (201) are mounted in an oscillating fashion on two axes (A-A) that are eccentric in respect of the axes of the rollers, and are connected to a spring (207).

The oscillation of the rollers allows a space to be created between them into which a tube can be housed. The bar (203) can oscillate in the same way as the bar (20) in the previously described example. When the tubes are being fitted over the spindles, the bar (203) lowers and the tube (T) is gripped and fitted over the spindle. The friction action of the tube on the eccentric rollers (201) causes them to rotate on their respective rotation axes (A-A), thus causing them to grip the tube. When the bobbins are being removed, the bar (203) is placed beneath the base of the tube and forms a rest for removing the tube and pinching the yarns to be broken. At this stage, the rotation of the eccentric rollers is limited by slots on the bar (203). The space between the rollers is less than the diameter of the tube to be removed.

It is to be understood that the figures show but one example of the invention purely as a practical demonstration, and the forms and features of the invention may be changed and still remain within the concept on which the invention is based. The reference numbers in the Claims are for the sole purpose of making the Claims themselves easier to relate to the description and attached figures, and do not limit the protection afforded by the Claims.

Claims

1. Method for the automatic removal of a bobbin (S) from a spindle (1) and for breaking the underwinding and binding yarns (FS, FL), characterized in: that the tube (T) on which the bobbin (S) is wound to be removed is gripped by a gripping device (11; 111; 201) close to its lower rim (TB), thus pinching the underwinding and binding yarns (FS, FL) on the tube (T); and that the bobbin (S) is removed breaking the underwinding and binding yarns (FS, FL) between the underwinding area on the spindle (1) and the point at which they are pinched on the tube (T).

2. Method as in Claim 1, wherein the same gripping device (11; 111; 201) is used to grip a new tube to be fitted over the spindle in an intermediate position along the tube, locking by interference of the tube onto the spindle being obtained by pushing said tube over the spindle by means of said gripping device.

3. Device for the automatic removal of a bobbin (S) and for breaking the underwinding and binding yarns (FS, FL), and in particular for carrying out the method according to Claim 1, characterized by a removing means (9; 109) comprising a gripping device (11; 111; 201) designed to grip the tube (T) close to its lower rim (TB) and pinch the underwinding and binding yarns (FS, FL) between the said gripping device (11; 111; 201) and the tube (T); this removing means (9; 109) having a movement approximately parallel to the spindle (1) so as to remove the tube (T) and its bobbin (S) from the spindle (1).

4. Device as in Claim 3, characterized in that the aforementioned gripping device (11; 111; 201) is designed to alternately occupy an inactive position where it is clear of the spindle (1), and an active position where the gripping device grips the tube (T) fitted on the spindle (1).

5. Device as in Claim 3 or 4, characterized by a support (19) to which the gripping device (11; 111; 201) is attached in an oscillating fashion, an actuator (15) being provided for controlling the oscillating movement of the gripping device (11; 111; 201) between its inactive and active positions.

6. Device as in one or more of Claims 3 to 5, characterized in that the gripping device (11; 111) includes a pair of jaws (25 or 125) with a conical internal surface (35) designed to grip the lower rim (TB) of a tube (T); the wider end of this conical surface being towards the top of the spindle (1).

7. Device as in one or more of Claims 3 to 6, characterized in that the gripping device (11; 111) includes a pair of jaws (25; 125) with a conical internal surface (43) designed to grip an intermediate part of a tube (T) in order to fit it over the spindle; the wider end of this conical surface being towards the base of the spindle (1).

8. Device as in one or more of Claims 3 to 7, characterized in that the gripping device (11; 111) includes a pair of jaws (25; 125) with an internal projecting ridge (37) that divides the jaws into an area (35) for gripping the lower rim of a tube (T), and an area (43) for gripping an intermediate part of a tube (T).

9. Device as in one or more of Claims 3 to 8, characterized in that the gripping device (11) includes a pair of jaws (25) that are held in an open position by an elastic means (29); these jaws (25) being closed directly by the approach of the jaws to a tube (T).

10. Device as in one or more of Claims 3 to 9, characterized in that the gripping device (111) has a pair of jaws (125) that are connected to elastic means (129), and includes a drive means (128, 132, 136) that closes the jaws (125).

11. Device as in one or more of Claims 3 to 5, characterized in that the gripping device includes a pair of rollers (201) that are eccentrically mounted on a bar (203) and have surfaces (205) designed to grip a tube.

12. A spinning machine including at least one spindle on which a tube is fitted for forming a bobbin, and at least one device for doffing the bobbin, characterized in that it includes a device as in one or more of Claims 3 to 11.

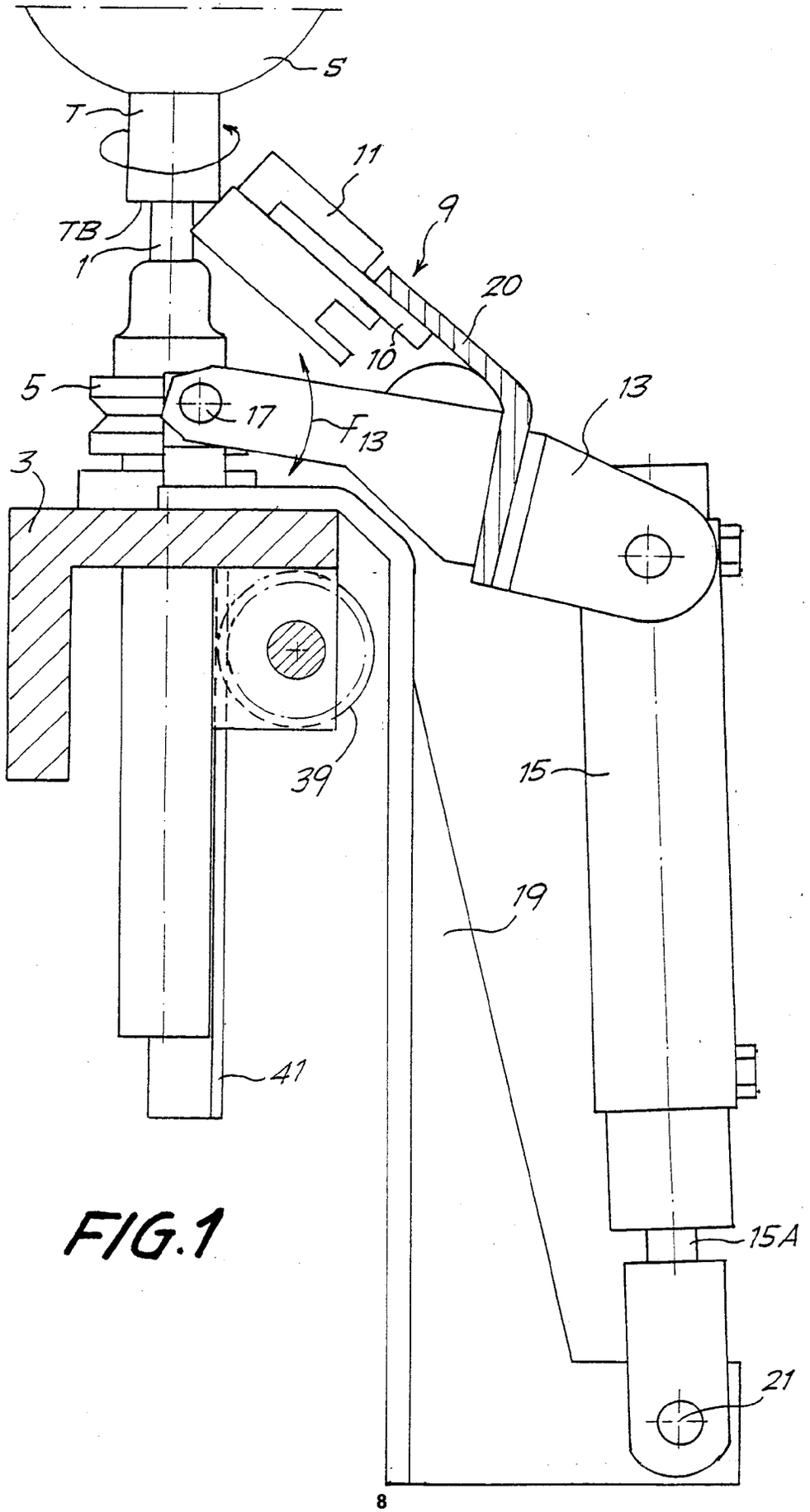


FIG.1

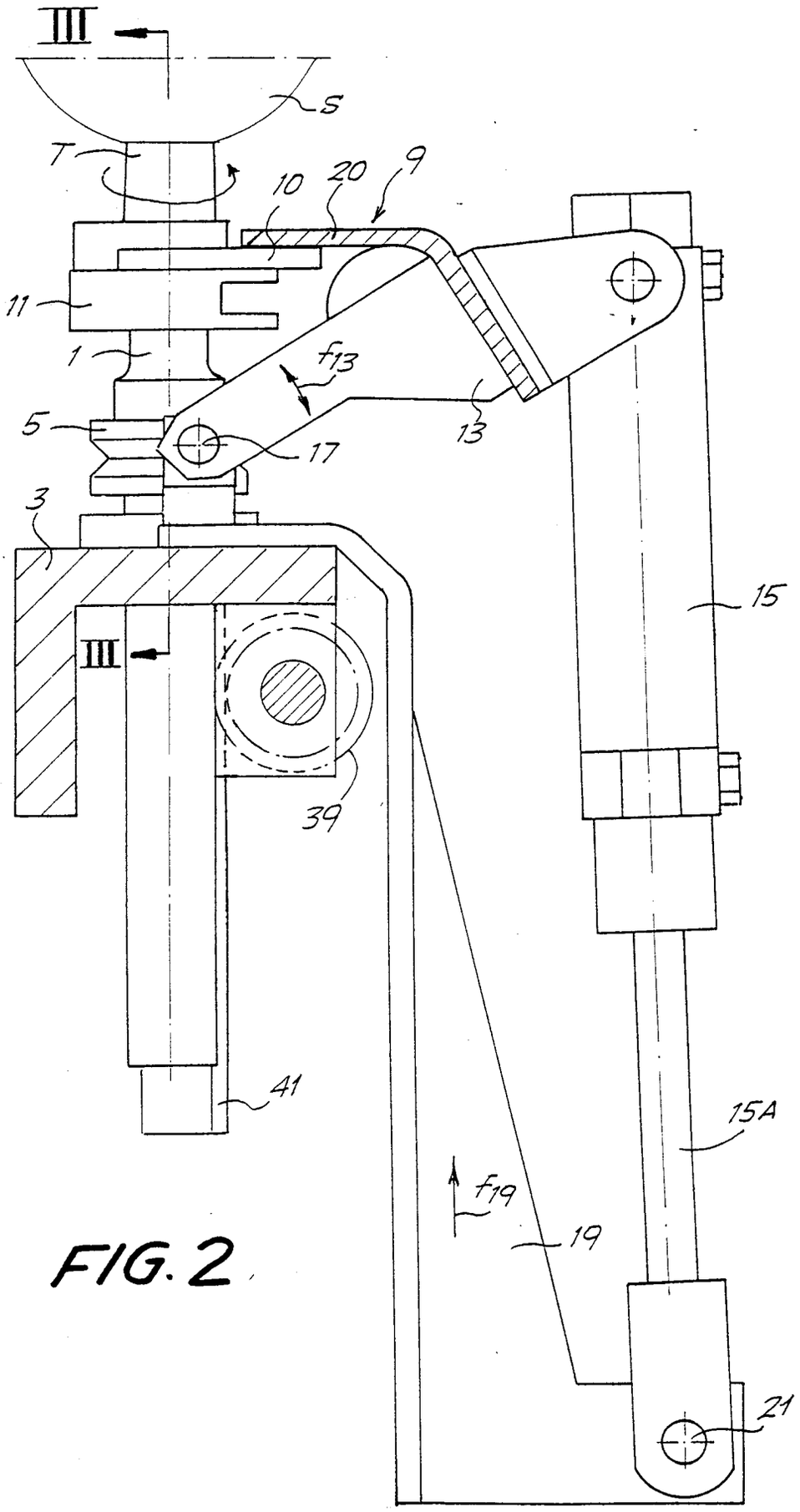


FIG. 2

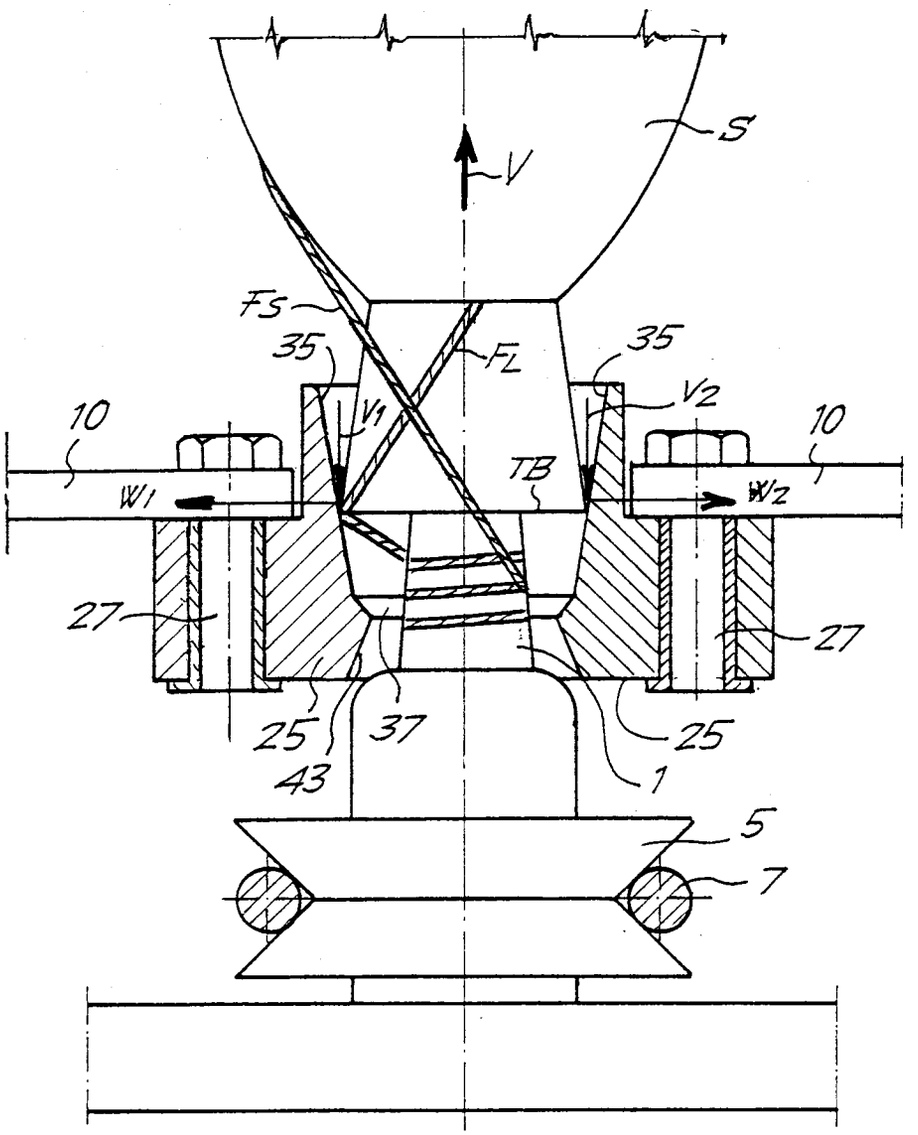
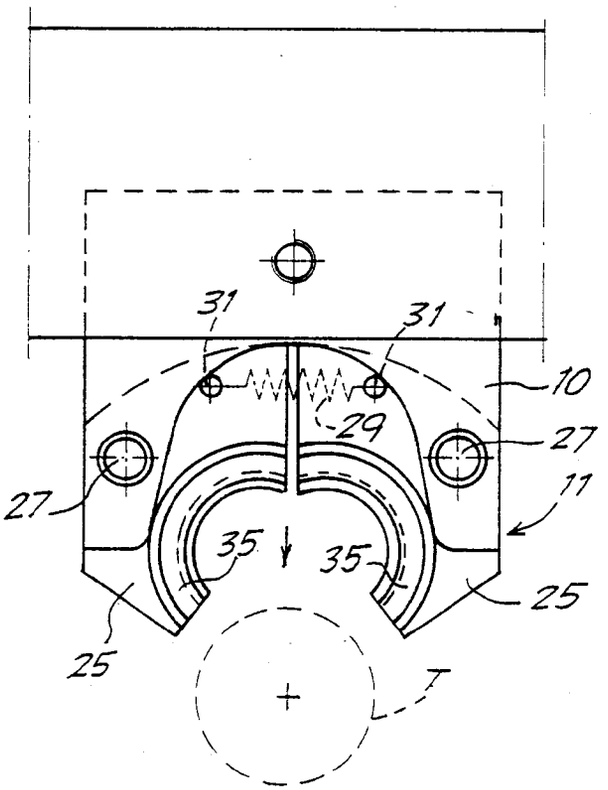


FIG. 3

FIG. 4



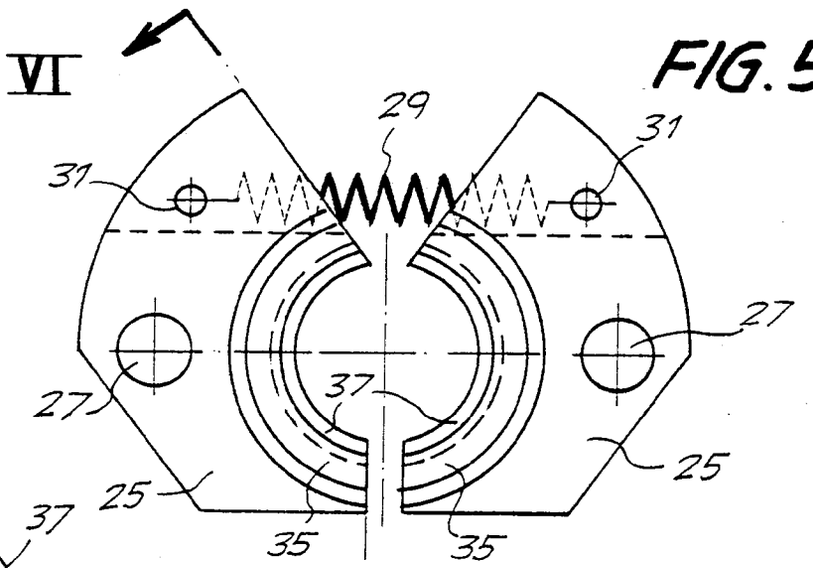


FIG. 5

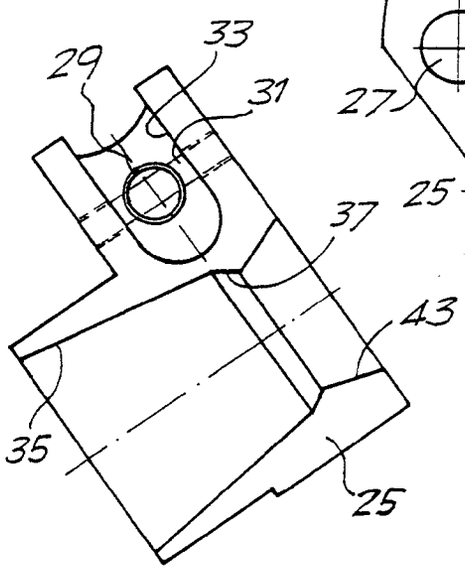


FIG. 6

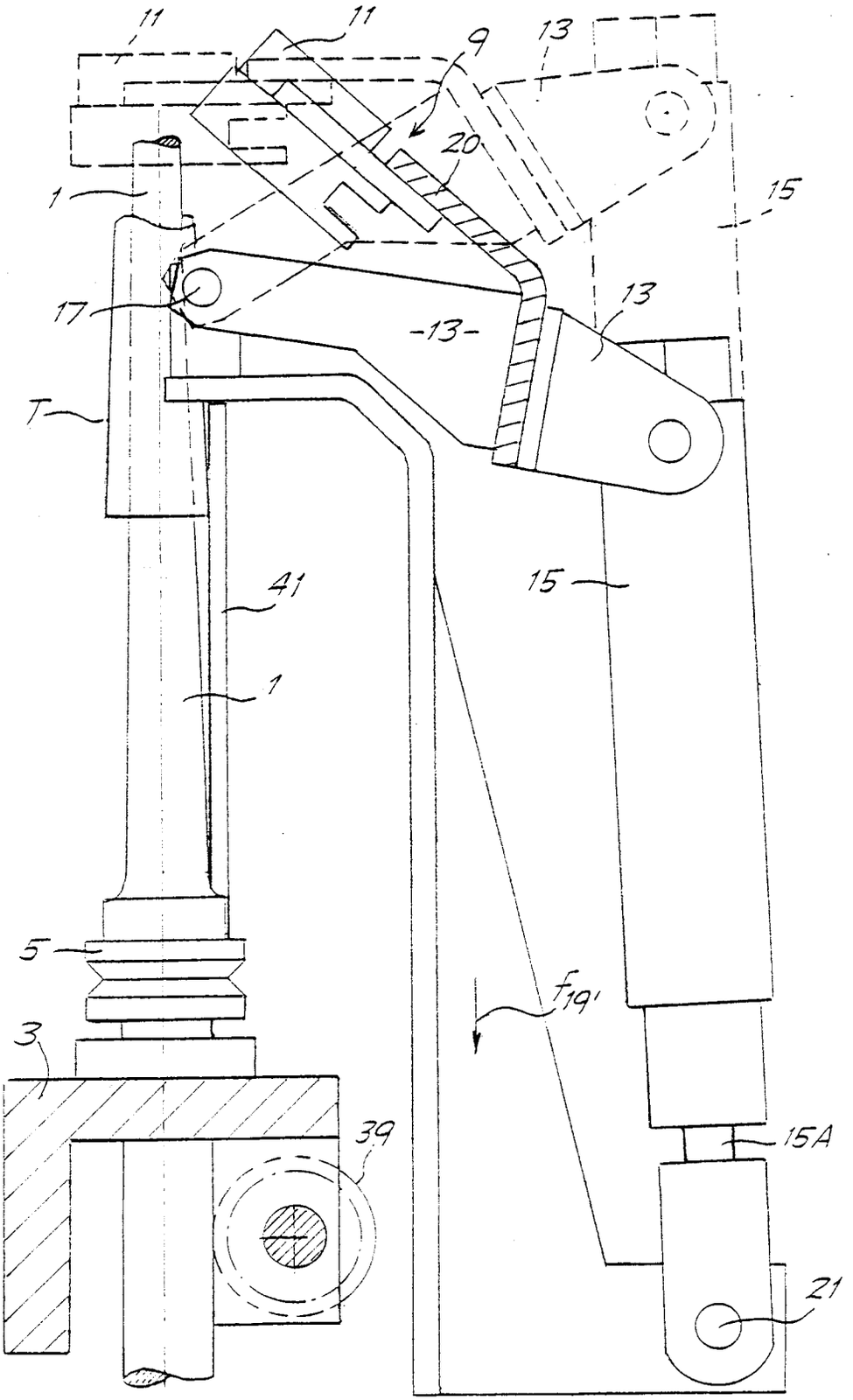


FIG. 7

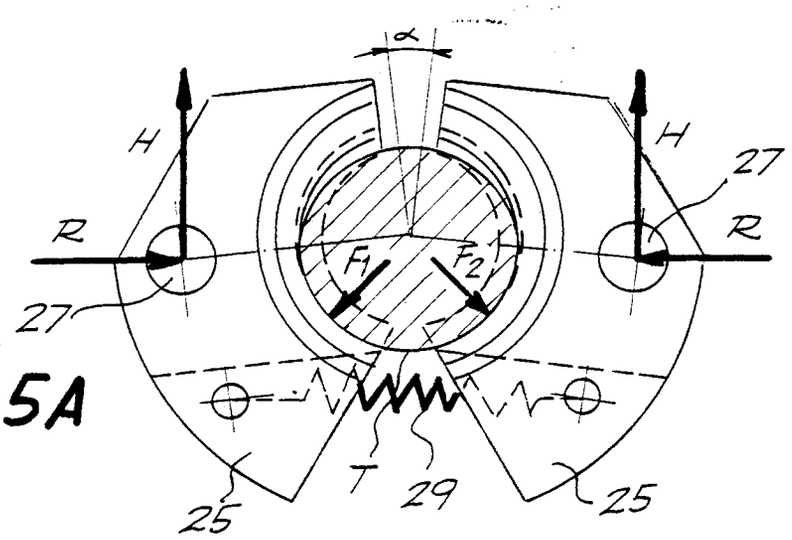
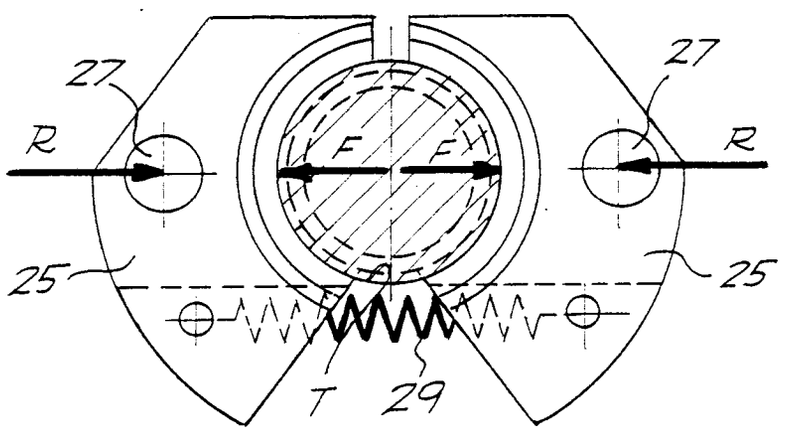


FIG. 5A

FIG. 5B



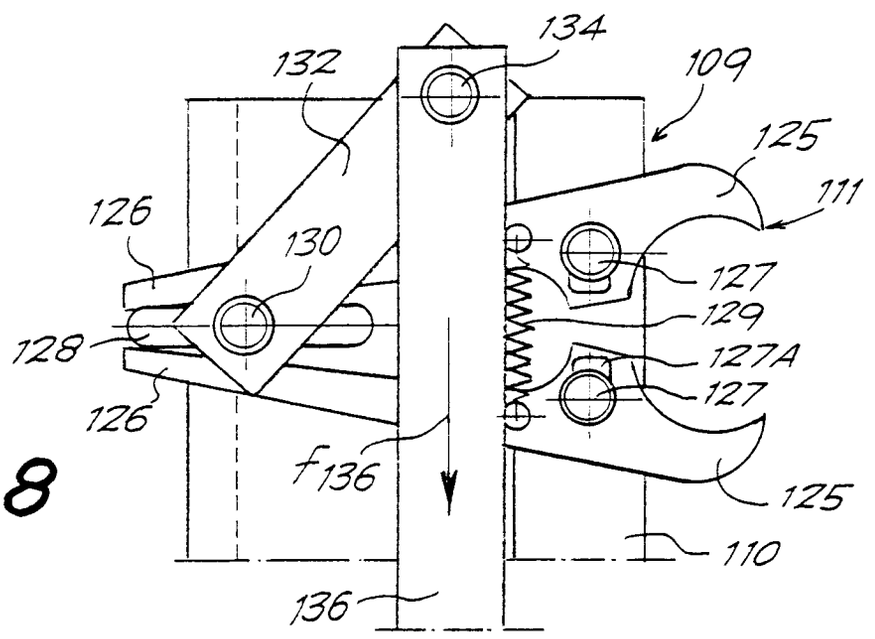


FIG. 8

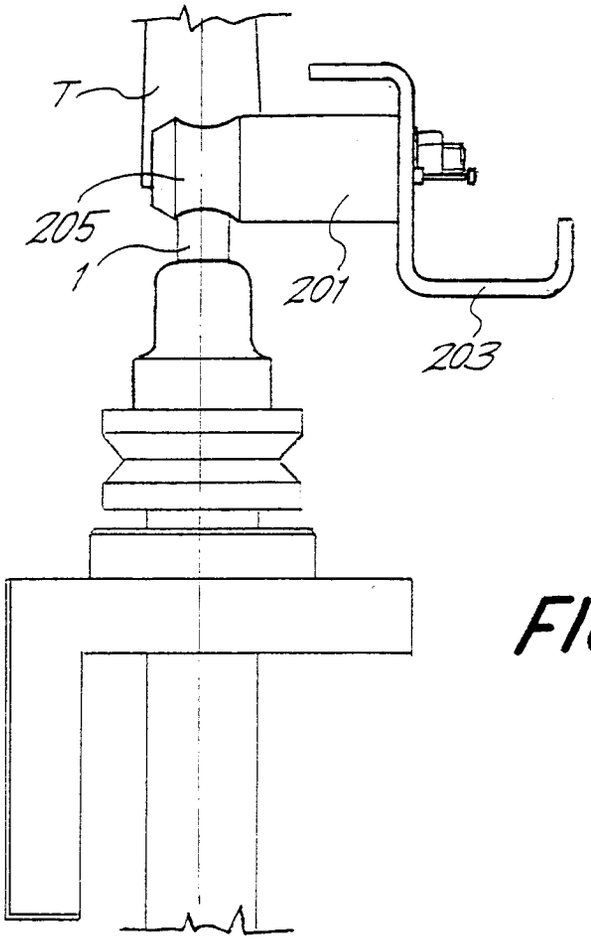
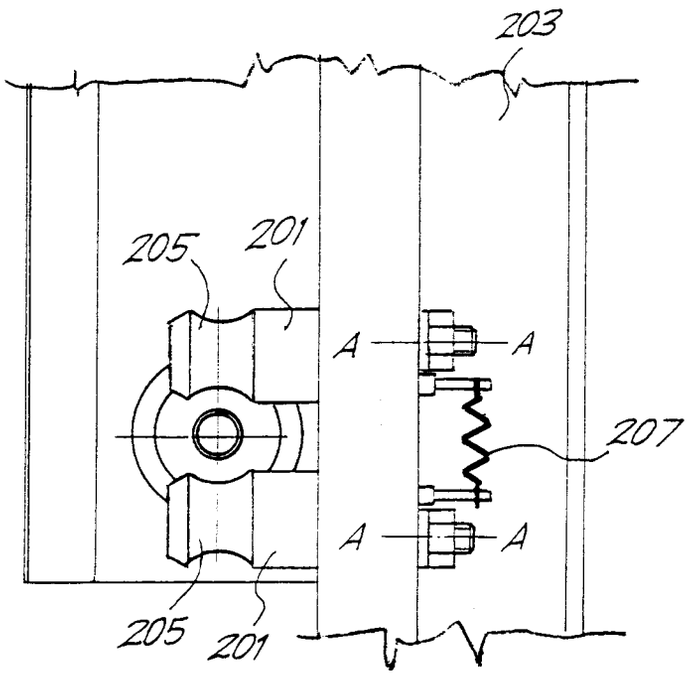


FIG. 9

FIG. 10



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EUROPEAN SEARCH REPORT

Application Number

EP 91 83 0308

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.5)
A,D	EP-A-0 299 934 (S. BIGAGLI & C. SPA) * column 7, line 38 - line 56; figures 19,20 *	1,3,12	D01H9/16 D01H9/04
A	PATENT ABSTRACTS OF JAPAN vol. 7, no. 177 (M-233)(1322) 5 August 1983 & JP-A-58 078 965 (OOSAKA KIKOU K.K.) 12 May 1983 * the whole document *	1,3,12	
A	EP-A-0 201 942 (S.BIGAGLI & C. SPA) * page 6, line 4 - line 15; claims 1,2 *	1-12	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D01H
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	04 NOVEMBER 1991	TAMME H.-M.N.

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