

(19) **DANMARK**



Patent- og
Varemærkestyrelsen

(10) **DK/EP 2599376 T3**

(12) Oversættelse af
europæisk patentskrift

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- (51) Int.Cl.: **A 01 D 78/10 (2006.01)** **A 01 D 78/12 (2006.01)** **A 01 D 80/00 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2016-02-01**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2015-10-21**
- (86) Europæisk ansøgning nr.: **12193159.6**
- (86) Europæisk indleveringsdag: **2012-11-19**
- (87) Den europæiske ansøgnings publiceringsdag: **2013-06-05**
- (30) Prioritet: **2011-11-30 FR 1160945**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **Højbjergningsmaskine**
- (56) Fremdragne publikationer:
EP-A1- 0 403 409
DE-A1-102004 036 671
FR-A1- 2 386 248
FR-A1- 2 910 233

Description

The present invention relates to a haymaking machine including at least one rotor fitted with arms carrying work tools. On known haymaking machines of this type, during the work the said arms rotate around an axis during each revolution of the said rotor by means of a mechanism that includes a stationary control cam located inside the said rotor. The said arms then move the said work tools from a position in which they rake products lying on the ground to a position in which they deposit the collected products and vice versa. The said arms are usually of a substantial length so as to collect and move a large quantity of products. However, due to regulations concerning the width and height of the machine during transport, in general at least one of the said arms is divided into a first section carrying the said work tools and a second section connected to the said rotor, and the said sections can be connected to each other using a hitching device.

In a first machine of the type previously described, known from the document DE 10 2004 036 671 A1, the hitching device can enable the said first and second sections to slide relative to each other. The said sections can therefore be slipped into one another for work and separated from each other for transport. Alternatively, in a second machine known from the document EP 0 403 409 A1, the said hitching device can enable the said sections to pivot relative to each other for transport. The said arm is therefore shorter in length.

On these two known machines, for work, the said first and second sections are connected to each other and the said hitching device allows a torque to be transmitted from one to the other around the said axis. In this way, the rotational drive of the said second section by the said mechanism located inside the said rotor is transmitted to the said first section so that the said work tools are moved as previously described. In a known manner, the said hitching device includes a stop means and a tension means. The said stop means cooperates with the said tension means. During work, the said tension means is brought into an operating position in which it exerts on the said stop means a force directed from one to the other of the said first and second sections. The result is that in the said operating position, the said first section is, at least in one direction substantially parallel to

the said axis, stationary relative to the said second section. The said stop means includes at least two support parts, a first support part connected to the said first section and a second support part connected to the said second section. Thus, during one revolution of the said rotor, the said second section, subject in particular to centrifugal acceleration, cannot move relative to the said first section at least along the said axis.

However, on the known machines, the said hitching device transmits the said torque around the said axis from one to the other of the said sections, but maintains a rotational clearance around the said axis between the said sections. A first case is the one known from the document DE 10 2004 036 671 A1, in which the said hitching device includes a sliding connection that allows, for example by means of grooves, to fit one of the said first and second sections into the other. In this case, the said rotational clearance is, on one hand, required so that the user can easily hitch the said sections to each other and, on the other hand, a consequence of the manufacturing tolerances of the said sections, the said tolerances not allowing a sliding connection to be obtained without the said rotational clearance. In a second case known from the document EP 0 403 409 A1, in which the said hitching device makes it possible for the said sections to be pivoted relative to each other, a joint is provided between the said sections and is not without clearance.

The said rotational clearance allows the said sections to slightly turn relative to each other around the said axis between two end positions. However, during work and each revolution of the said rotor, the said cam dictates to the said second section a stage of positive angular speed-up followed by a stage of negative angular speed-up. The said first section undergoes the said speed-ups but, due to its own inertia, reacts with a slight delay. The result is that as the sometimes positive and sometimes negative speed-ups occur, the said rotational clearance is recovered in the direction of now one now the other of the said end positions. Afterwards impacts will occur that are in particular a source of unpleasant noise for the user. These impacts also speed-up wear on the machine, in particular because they lead to matting of the surfaces of the said sliding connection or the said joint. Ultimately, the said rotational clearance increases with the duration of

use of the machine. Neither the stop means nor the tension means fitted to known machines allow this rotational clearance to be recovered.

The aim of the present invention is to propose a haymaking machine that does not present the aforementioned drawbacks.

5 To this end, an important feature of the invention resides in the fact that the said first support part has at least one first support surface that is tilted relative to the said axis, that the said second support part has at least one second support surface that is tilted relative to the said axis and that, in the said operating position, the said force maintains in contact the said at least one first support surface against
10 the said at least one second support surface so that, in the said operating position, the immobilisation of the said first section relative to the said second section along the said axis simultaneously causes an immobilisation of the said first section relative to the said second section around the said axis.

Thus, when the user places the said tension means in the said operating
15 position, he immobilises in a single movement the said first section relative to the said second section both along the said axis and around the said axis. The hitching device according to the invention therefore enables the recovery of the said rotational clearance between the said sections at the same time as the latter are axially abutting each other, and therefore enables perfect transmission of the
20 torque to be achieved. Whether the said hitching device includes a pivoting connection between the said first and second sections or a sliding connection between the latter, in both cases the said connections can be achieved with normal manufacturing tolerances. The latter therefore enable the said rotational clearance to exist although, during work, this is recovered and is therefore in no way a
25 hindrance. Furthermore, the aforementioned impacts are avoided, which increases both the usability and lifespan of the machine. Advantageously, the said tension means includes an adjustment means making it possible to adjust the said force. Thus, the user can act on the said adjustment means at any time so that the said force is sufficient to ensure the immobilisation of the said first and second sections
30 between each other both along the said axis and around the said axis.

Other features and advantages of the invention will become clear from the following description, along with references to the attached drawings that depict,

as a non-limited example, several embodiments of the pick-up device according to the invention.

On these drawings:

- 5 - figure 1 shows a top view of a haymaking machine according to the invention, including at least one rotor fitted with arms;
- figure 2 shows a detailed perspective view of an arm according to a first embodiment variant, in the said operating position;
- figure 3 shows a detailed perspective view of an arm according to the first embodiment variant, in an unlocked position;
- 10 - figure 4 shows a detailed perspective view of an arm according to a second embodiment variant, in the said operating position;
- figure 5 shows a detailed perspective view of an arm according to the second embodiment variant, in an unlocked position;
- figure 6 shows a detailed view of an arm according to a third embodiment variant, in the said operating position;
- 15 - figure 7 shows a detailed perspective view of an arm according to the third embodiment variant, in an unlocked position;
- figure 8 shows a detailed perspective view of an arm according to a fourth embodiment variant, in the said operating position;
- 20 - figure 9 shows a detailed perspective view of an arm according to the fourth embodiment variant, in an unlocked position;
- figure 10 shows a detailed partial cross-section view of an arm according to a fifth embodiment variant, in the said operating position;
- figure 11 shows a detailed perspective view of an arm according to the fifth embodiment variant, in an unlocked position;
- 25 - figure 12 shows a detailed perspective view of an arm according to a sixth embodiment variant, in an unlocked position;
- figure 13 shows a detailed cross-section view of an arm according to the first embodiment variant;
- 30 - figure 14 shows a detailed perspective view of an arm according to a seventh embodiment variant;

- figure 15 shows a detailed perspective view of an arm according to an eighth embodiment variant, in the said operating position;
- figure 16 shows a detailed perspective view of an arm according to the eighth embodiment variant, in an unlocked position;
- 5 - figure 17 shows a detailed perspective view of an arm according to a ninth embodiment variant, in an unlocked position.

As shown in Figure 1, the machine according to the invention is a windrower for plants lying on the soil. It comprises a support structure (1) made up of a central beam (2) that has a hitching device (3) at its front end to hitch it to
10 a tractor, not shown, making it possible to move the machine in a direction of advance (A). The said central beam (2) has a crossbar (4) at its rear end fitted with wheels (5 and 6) that roll over the soil. On each side of the said central beam (2), by means of a substantially horizontal axis (7, 8), an arm (9, 10) carrying a raking wheel (11, 12) is articulated. In the example shown, the said arms (9, 10) and the
15 said corresponding raking wheels (11, 12) are offset in the direction of advance (A). The plants windrowed by the raking wheel (11) furthest forward can be picked up by the raking wheel (12) furthest to the rear to form a single windrow of greater volume.

The said central beam (2) could have only one arm and one raking wheel. It
20 could also have no arm and only one raking wheel supported directly by the said central beam (2). The said central beam (2) could also comprise, on each side, two arms of different lengths, each one supporting a raking wheel. In this case, the machine would have four raking wheels, which would enable a greater working width to be achieved.

25 The said raking wheels (11 and 12) are substantially identical. Each one includes a casing (13) in which a support axis (14) which is substantially vertical in work position is fastened. Underneath the said casing (13), a rotor (15) is arranged with arms (16) that extend outwards and are fitted with work tools (17) such as forks. The said rotor (15) is mounted on the said support axis (14) so that
30 it can turn on the latter. The said arms (16) are guided in bearings rigidly fastened to the said rotor (15) so that they can substantially pivot around their respective geometric longitudinal axes. Inside the said rotor (15), is provided an immobile

control cam that is fastened to the said support axis (14). Each arm (16) includes at its end located in the said rotor (15) a lever with a roller that is guided in the said cam. In this way, the said arms (16) are controlled so that their work tools (17) collect the plants on the forward part of their path in particular and deposit
5 them in the form of a windrow in the lateral part of their path.

Inside the said casing (13) of each raking wheel (11, 12), are housed means for driving the said rotor (15) in rotation on the said support axis (14). The said means are made up of a gear ring rigidly fastened to the upper part of the said rotor (15) and a drive pinion that engages with the said ring. The said pinion is
10 linked to a shaft that protrudes outside the said casing (13). On the said shaft, a transmission shaft (18, 19) is connected, which can be made of several parts and is driven by the power take-off shaft of the tractor. The rotational drive of the said rotor (15) of each raking wheel (11, 12) could also be performed by means of a hydraulic or electric engine.

15 The said arm (9, 10) on each raking wheel (11, 12) is equipped with a hydraulic jack (20, 21) that makes it possible to pivot it around the said articulation axis (7, 8). Each hydraulic jack (20, 21) is articulated with one of its ends on the said central beam (2) and with its other end on the said corresponding arm (9, 10). Each hydraulic jack (20, 21) can be a double-acting jack so that it can
20 be controlled during lengthening and shortening and makes it possible to move the said corresponding arm (9, 10) between a transport position and a work position. In the said transport position, each raking wheel (11, 12) extends in a substantially vertical or near-vertical plane, so that the bulk of the machine is reduced in terms of its width. In the said work position, each raking wheel (11, 12) extends in a
25 substantially horizontal plane.

The said support axis (14) of each raking wheel (11, 12) is fitted at its lower end with a frame (22) with several support wheels (23) on the ground. The latter roll over the ground during the work and allow the said raking wheels (11, 12) to cope with uneven surfaces on the ground.

30 At least one of the said arms (16) comprises at least two sections, namely a first section (24) carrying the said work tools (17) and a second section (25) connected to the said rotor (15). Thus, the said first and second sections (24, 25)

can be moved in relation to each other so that the said raking wheel (12) is smaller in size in the said transport position than in the said work position, so that the total height of the machine during transport is reduced. If the machine only includes one raking wheel carried by the said central beam (2), the said first and second

5 sections can be moved in relation to each other so as to reduce the width of the machine for transport purposes. The said second section (25) is guided in the said bearings so that it can pivot around an axis (26) oriented in a longitudinal direction of the said second section (25). A hitching device (27) allows the said first and second sections (24, 25) to move in relation to each other and includes

10 means for connecting the said first and second sections (24, 25) to each other. The said means can in particular be achieved of a sliding connection (28) or a pivoting connection (29). An example of a sliding connection (28) is provided by the first production variant in figures 2 and 3. The said first section (24), tubular in shape, includes an end (30) that engages inside the said second section (25), the shape of

15 which is a hollow pipe with an internal diameter slightly larger than that of the said first section (24). An example of a pivoting connection (29) is provided by the eighth embodiment variant in figures 15 and 16. The said pivoting connection (29) is formed by a joint (31) that connects the said first and second sections (24, 25). The said joint (31) includes an axis of articulation (32) positioned outside the

20 said first and second sections (24, 25) and which extends in a direction perpendicular to the said axis (26).

The said hitching device (27) allows a torque to be transmitted from one to the other of the said first and second sections (24, 25) around the said axis (26). To this end, the said hitching device (27) includes a stop means (33) and a tension

25 means (34). The said stop means (33) allows the said first and second sections (24, 25) to be brought into contact with each other at least in a direction parallel to the said axis (26). The said tension means (34) can be placed in an operating position in which it exerts on the said stop means (33) a force directed from one to the other of the said first and second sections (24, 25). Thus, in the said operating

30 position, the said first section (24) is, at least in a direction parallel to the said axis (26), stationary relative to the said second section (25).

The said stop means (33) includes at least two support parts, namely one first support part (35) connected to the said first section (24) and one second support part (36) connected to the said second section (25). In the embodiment variants illustrated by the figures 2 to 7 and 10 to 14, the said first support part (35) is made of a sleeve (37) rigidly fastened to the said first section (24), for example by welding or being forced onto it. The said second support part (36) is made of the end (38) of the said second section (25) oriented in the direction of the said first section (24). In the embodiment variants shown in figures 15 to 17, the said first and second support parts (35, 36) each include an end (30, 38) of the said corresponding first or second section (24 or 25). In the fourth embodiment variant in figures 8 and 9, the said first section (24) includes a feather (39) that fits inside a slit (40) made in a small plate (41) rigidly fastened to the said second section (25). The said feather (39) includes a support plate (42) that comes into contact with the said small plate (41) when the said tension means (34) is placed in the said operating position. In this embodiment variant, the said first support part (35) includes at least the said small plate (41), while the said second support part (36) includes at least the said support plate (42).

In addition, the said first support part (35) includes at least one first support surface (43) that is tilted relative to the said axis (26) and the said second support part (36) includes at least one second support surface (44) that is tilted relative to the said axis (26). Thus, in the embodiment variants illustrated by figures 2, 3, 6, 7, 10, 11 and 14, the sleeve (37) rigidly fastened to the said first section (24) includes at least one point shaped element (45). This point (45) is fitted with at least one first support surface (43) around its periphery. The end (38) of the said second section (25), oriented in the direction of the said sleeve (37), has a cavity (46) cut into it so that it includes a second support surface (44) that can cooperate with the said first support surface (43). As shown in the figures, the said first and second support surfaces (43, 44) are tilted relative to the said axis (26). The fourth embodiment variant, shown in figures 8 and 9, differs from the previous variants in particular in that the said points (45) and cavities (46) are transferred to the said support plate (42) and the said small plate (41) respectively. In the second embodiment variant, shown in figures 4 and 5, the said first and second support

parts (35, 36) are bevelled so that they each have one single support surface (43 or 44) that is tilted relative to the said axis. In this embodiment variant, the angle formed by each support surface (43, 44) relative to the said axis (26) is identical for the two support surfaces (43 and 44) so that one cooperates with the other in the said operating position. In the eighth embodiment variant in figures 15 and 16, the end (30) of the said first section (24) includes at least one point shaped element (45) that cooperates with a cavity shape (46) cut into the said second section (25). In this embodiment variant, the said support surfaces (43, 44) have a fairly small width, which corresponds to the thickness of the material of the tube included in the said first and second sections (24, 25). Nevertheless, it would be possible for the end of the said tube to be solid, so that the said support surfaces (43, 44) have a thickness similar to that of the diameter of the said tube.

In figures 2, 4, 6, 8, 10 and 15, the embodiment variants previously described are shown in the said operating position. It is clearly evident that in this position, the said at least one first support surface (43) is kept in contact with the said at least one second support surface (44). This continued contact is achieved by the force exerted by the said tension means. The tilt of the said first and second support surfaces (43, 44) relative to the said axis (26) implies that, in the said operating position, the immobilisation of the said first section (24) relative to the said second section (25) along the said axis (26) simultaneously causes the immobilisation of the said first section (24) relative to the said second section (25) around the said axis (26). In figures 3, 5, 7, 9, 11, 12, 14, 16 and 17, the said tension means (34) is placed in an unlocked position and the said first and second sections (24, 25) can then be moved relative to each other. A rotational clearance can then exist between the said first and second sections (24, 25). Thus, in the eighth embodiment variant illustrated in figure 16, this results from the clearance that exists at the level of the said axis of articulation (32) of the said pivot connection (29). In the embodiment variants shown in figures 2 to 14, the said rotational clearance results from the fact that the said sliding connection (28) is in fact a sliding pivot connection formed of a smooth tube that engages inside another smooth tube. Nevertheless, such a sliding pivot connection can also be achieved with tubes that have any type of surface appearance, for example rough,

grooved or other. In the said operating position, the said rotational clearance is recovered, as the said first and second sections (24, 25) are immobilised around the said axis (26) at the same time as the latter are axially abutting each other.

Preferentially, the said first support part (35) includes at least one pair (47) of first support surfaces (43) that are tilted relative to the said axis (26) so that they form a V, the said second support part (36) includes at least one pair (48) of second support surfaces (44) that are tilted relative to the said axis (26) so that they form a V, and in the said operating position, the said at least one pair (47) of first support surfaces (43) cooperates with the said at least one pair (48) of second support surfaces (44). In the said operating position, the said first and second support surfaces (43, 44) extend along the said axis (26).

Advantageously, in this position and in a direction parallel to the said axis (26) and oriented either from the said first section (24) towards the said second section (25), or from the said second section (25) towards the said first section (24), at least one of the said first support surfaces (43) and at least one of the said second support surfaces (44) are directed in a plane (P) that passes through the said axis (26). The plane (P) is shown in perspective on figures 2 to 5 and in a plane view in figures 6 and 10, where it extends perpendicular to the plane of the views in question. The plane (P) can take different orientations depending on the embodiment variants in question; thus, in the fourth embodiment variant in figures 8 and 9, it corresponds substantially to the median plane of the said tension means (34). As shown in figures 2 to 5 and 6 and 10, the first support surfaces (43) are oriented, on one hand, from the said first section (24) towards the said second section (25) and, on the other hand, towards the said plane (P). The first support surfaces (43) cooperate with the second support surfaces (44) oriented in the same way. The said first respectively second support surfaces (43, 44) are also symmetrically distributed relative to the said plane (P). In the fourth embodiment variant shown in figures 8 and 9, the second support surfaces (44) are oriented, on one hand, from the said second section (25) towards the said first section (24) and, on the other hand, towards the said plane (P). In other embodiment variants not shown, it would be possible for the said pair (47) to include a first support surface (43) parallel to the said plane (P) and a first support surface (43) oriented in the

direction of the said plane (P). Alternatively, it would be conceivable for the said pair (47) to include first support surfaces (43) oriented in the direction of the said plane (P) and distributed asymmetrically relative to the said plane (P). In each of these cases, the said pair (48) of second support surfaces (44) would be designed
5 to cooperate with the said pair (47) of first support surfaces (43). In addition, the said first and second support surfaces (43, 44) can be flat, curved or even have several adjacent flat or curved facets. In the case of flat surfaces, the angle of the said V can vary between a strictly positive value and a value strictly below 180°.

An advantageous feature resulting from the sixth embodiment variant in
10 figure 12 consists of the said first support part (35) including several (49) of the said at least one pair (47) of first support surfaces (43), the said second support part (36) including several (50) of the said at least one pair (48) of second support surfaces (44), and for the said several elements (49, 50) to cooperate with each other. This feature has the advantage of increasing the total contact surface
15 between the said first and second support parts (35, 36). This means that for a given value of the torque to be transmitted between the said first and second sections (24, 25), the contact pressures exerted on the said first and second support surfaces (43, 44) are lower. Consequently, a higher torque can be transmitted and/or the wear on the said first and second support surfaces (43, 44), particularly
20 from matting, is reduced.

Preferentially, the said tension means (34) includes a tension element (51) that can be connected to one of the said first and second sections (24, 25). Therefore, the said tension element (51) can be rigidly fastened to one of the said first and second sections (24, 25). Alternatively, it can be designed to be
25 connected to one of the said first and second sections (24, 25) in the said operating position and to be detached therefrom for transport, so that during transport it does not remain in place on the said raking wheel (11 or 12).

Preferentially, the said tension element (51) includes an operating element (52) and a locking element (53, 53'); the said operating element (52) acts on the
30 said locking element (53, 53') and the said operating element (52) is connected in a non-removable way to the said locking element (53, 53'). An embodiment example of such a tension element (51) is a knuckle of the type (54) illustrated in

figures 2 and 3 or that (54') illustrated in figure 14. The knuckle (54, 54') is attached to the said first section (24) carrying the said work tools (17). Another embodiment example of a knuckle is shown in figures 15 and 16, where the knuckle (54) is attached to the said second section (25) linked to the said rotor (15). In these two embodiment examples, the knuckle (54, 54') includes an operating element (52) formed by a lever (55) and a locking element (53, 53') formed by a rod (56) or a U-bolt (57). The said lever (55) is articulated to the said first or second section (24 or 25). The said rod (56) or the said U-bolt (57) is connected to the said lever (55) by a non-removable joint (58). Advantageously, this feature provides the user with a tension element (51) that includes the operating element (52) required to place the said tension element (51) in and out of the said operating position. The user therefore does not need to use external means, such as tools, to operate the said tension element (51). In addition, significant ease of use results from the interaction between the said operating element (52) and the said locking element (53, 53').

The said tension means (34), including a tension element (51) that can be connected to one of the said first and second sections (24, 25), can in addition include a stop element (59) connected to the other of the said first and second sections (24, 25), and the said stop element (59) cooperates with the said tension element (51). Thus, as shown in particular in figures 2 to 5, the said stop element (59) can be formed by a hook. In figures 15 to 17, the said stop element (59) can be formed by a finger.

Preferentially, the said tension element (51) includes a knuckle (54, 54'). In the first embodiment variant in figures 2 and 3, the knuckle (54) includes a rod (56) with a curved end designed to cooperate with the said stop element (59). In the fourth embodiment variant shown in figures 8 and 9, the feather (39) has a hook-shaped end to which the rod (56) of the knuckle (54) can attach. In the seventh embodiment variant in figure 14, the knuckle (54') has a U-bolt (57) that can attach to the said stop element (59).

The said tension element (51) can also include a tension spring (60). This feature appears in the second embodiment variant shown in figures 4 and 5. In this embodiment variant, one end of the said tension spring (60) is connected, in a

detachable manner or otherwise, to a hook rigidly fastened to the said first section (24), while the other end cooperates with a hook rigidly fastened to the said second section (25) in order to place the said tension spring (60) in the said operating position, in which it is stretched.

5 The said tension element (51) can also include a pin running at right angles (61), embodiment examples of which are shown in figures 6 and 7, as well as 10 and 11. In figures 6 and 7, the said first section (24) includes a feather (39) that engages inside a slit (40) made in a small plate (41) rigidly fastened to the said second section (25). The said feather (39) includes an opening (62) that passes
10 through it in a direction perpendicular to the said axis (26). The said opening (62) includes a tilted surface (63). After having fitted the said first section (24) into the said second section (25) so that the points (45) cooperate with the cavities (46), the said pin running at right angles (61) is arranged in the said opening (62). When it is pushed in the direction of the said axis (26), it rests on one hand on the said
15 small plate (41) and on the other hand on the said tilted surface (63) and brings the said first and second sections (24, 25) closer to one another until their respective support surfaces (43, 44) are in contact with each other. The said force increases as the said pin running at right angles (61) is further inserted into the said opening (62). In the fifth embodiment variant shown in figures 10 and 11, the said first and
20 second sections (24, 25) include a through hole (64, 65) of a rectangular profile that extends perpendicular to the said axis (26). The hole (64) made in the said first section (24) has a tilted surface (66). In the said operating position, a pin running at right angles (61) engages inside the said holes (64, 65) and rests on them. Due to the aforementioned tilted surface (66), the said first and second
25 sections (24, 25) are axially brought closer together and placed under axial tension against each other.

Preferentially, the said tension means (34) can be operated without a tool. This is particularly the case when the said tension means (34) includes the said knuckle (54, 54').

30 Preferentially, the said tension means (34) includes an adjustment means (67) making it possible to adjust the said force. Indeed, when the machine is operating, wear can occur, in particular from matting, on the said at least one first

support surface (43) and at least one second support surface (44). This results in the said first and second sections (24, 25) axially moving towards each other and a decline in the said force exerted by the said tension means (34). In this case, the user can adjust the said adjustment means (67) so as to maintain the said force at a substantially constant value over time. In the first embodiment variant in figures 2 and 3, the knuckle (54) includes a threaded rod (56) with a curved end that is articulated to a lever (55). When the knuckle (54) moves closer to the said operating position, the threaded rod (56) is held by a nut (68) that rests on a ring (69). A more detailed illustration of the mechanism is provided in figure 13. In this figure, the knuckle (54) is shown in a solid line in the said operating position and in a dotted line in an unlocked position. A slight deformation of the said knuckle (54) is required so that it can be placed in the said operating position. To this end, the ring (69) should preferably be made from an elastic material. Alternatively, the curved end of the threaded rod (56) can be designed to accept this deformation. As shown in figure 14, the knuckle (54') does not include a threaded rod but a U-bolt (57) that is made from spring steel and is articulated to the lever (55). The shape of the said U-bolt (57) is designed so that it can deform when the knuckle (54') is moved into the said operating position.

The said adjustment means (67) preferably includes the said nut (68) that cooperates with the said threaded rod (56). This feature appears in particular in the first embodiment variant. By acting on the said nut (68), the said threaded rod (56) is moved so that in the said operating position it exerts a greater or lesser traction force on the said stop element (59).

Thus, as shown in figure 14, the said adjustment means (67) can include a flange (70) that can be moved on one of the said first and second sections (24, 25) along the said axis (26). Indeed, in this embodiment variant, the position of the U-bolt (57) relative to the lever (55) cannot be adjusted. As a result, the lever (55) is articulated to the said flange (70), which can be screwed in the desired position on the said first section (24) using a screw (71).

Other embodiments of the said adjustment means, not shown, remain possible. For example, the said adjustment means could make it possible to move

the said stop element along the said first or second section to which it is connected.

Preferably, the said force includes a component oriented along the said axis (26). This feature clearly emerges from figures 2, 4, 6, 8, 10 and 15. In the eighth embodiment variant in figures 15 and 16, the orientation of the said force changes as the said first and second sections (24, 25) are pivoted in each other's direction under the effect of the said tension means (34). Nevertheless, in the said operating position shown in figure 15, the said force is oriented along the said axis (26).

As already mentioned, the said hitching device (27) can include a pivot connection (29) that allows the said first section (24) to pivot relative to the said second section (25) in a direction substantially perpendicular to the said axis (26). This feature appears in the embodiments shown in figures 15 to 17. In particular, for transport, it makes it possible to fold the said first section (24) carrying the said work tools (17) onto the said second section (25) connected to the said rotor (15), so that the bulk of the said raking wheel (11, 12) is reduced.

In particular, it can be provided that the said pivot connection (29) connects the said first and second sections (24, 25) to each other inseparably. This feature appears in the eighth embodiment variant in figures 15 and 16.

Nevertheless, it can also be provided that the said pivot connection (29) allows the said first section (24) to be separated from the said second section (25) without tools. Thus, as shown in figure 17, the said first section (24) has a curved shape (72) that can fit into another curved shape (74) of the said second section (25) along a pivoting axis (73). After boxing, the said curved shapes (72, 74) create a hinge.

Alternatively, the said stop means (33) can include a sliding connection (28) allowing the said first section (24) to slide relative to the said second section (25) alongside the said axis (26). This feature appears in the embodiment variants shown in figures 2 to 14. In the second embodiment variant shown in figures 4 and 5, the said first and second support parts (35, 36) respectively have one single first support surface (43) and one single second support surface (44) that are tilted relative to the said axis (26). The result is that in the said operating position, the said force includes a first component oriented along the said axis (26) and a

second component oriented perpendicular to the said axis (26). In this embodiment variant, the said sliding connection (28) partially recovers the said second component, without which the said first and second support surfaces (43, 44) would slide along each other under the action of the said force.

5 An advantageous feature that emerges in particular from figures 2 to 5 provides that the said first section (24) includes a first end (30) directed towards the said rotor (15) and a first length (L1) extending from the said first end (30) in the direction of the said work tools (17), that the said first support part (35) is distant from the said first length (L1) relative to the said first end (30) and that the
10 said sliding connection (28) is formed by a fraction of the said first length (L1) engaging inside a length (L2) of the said second section (25).

 The advantageous feature described above preferably provides that the said second section (25) includes a second end (38) oriented towards the said work tools (17) and that the said second support part (36) forms the said second end
15 (38).

 Conversely, according to the fourth embodiment variant shown in figures 8 and 9, it is possible for the said second section (25) to include a second end (38) directed towards the said work tools (17) and a second length (L2') extending from the said second end (38) in the direction of the said rotor (15), that the said
20 first second part (36) is distant from the said second length (L2') of the said second end (38) and that the said sliding connection (28) is formed by a fraction of the said second length (L2') engaging inside a length (L1') of the said first section (24).

 In this case, it is advantageous for the said first section (24) to include a first
25 end (30) oriented towards the said rotor (15) and for the said first support part (35) to form the said first end (30).

 The previous description relates to a windrower for plants lying on the ground fitted with at least one raking wheel whose axis of rotation is preferably vertical in a work position. However, the invention can also relate to a tedder
30 fitted with, instead of the said at least one raking wheel, at least one tedder wheel whose axis of rotation is for example tilted in the direction of advance. More generally, the invention concerns any haymaking machine including at least one

rotor fitted with arms carrying work tools. Such a machine can be for example a windrower, a baler or a loader wagon fitted with a pick-up element with fingers and including a rotor according to the invention placed, for example, at one of the side ends of the said pick-up element. The axis of rotation of the said rotor can be
5 positioned in a vertical plane or a horizontal plane.

It is evident that the invention is not limited to the embodiments described above and shown in the attached figures. Modifications remain possible, particularly concerning the composition or number of the various elements or by substituting technical equivalents, without departing from the scope of protection.

PATENTKRAV

1. Højbjærtningsmaskine med mindst én rotor (15) forsynet med arme (16), der bærer på arbejdsredskaber (17), hvor mindst én af nævnte arme (16) omfatter mindst to dele, en første del (24) bærende på nævnte arbejdsredskaber (17) og en
5 anden del (25) forbundet med nævnte rotor (15), hvor nævnte første og anden del (24, 25) kan være indbyrdes forbundet ved hjælp af en sammenkoblingsanordning (27), der tillader at overføre et drejningsmoment fra nævnte ene til nævnte anden del (24, 25) omkring en akse (26) orienteret i nævnte anden dels (25) længderetning, hvor nævnte sammenkoblingsanordning (27) omfatter et stoporgan
10 (33) og et spændingsorgan (34), hvor nævnte spændingsorgan (34) kan placeres i en driftsstilling, hvor nævnte spændingsorgan (34) udøver en kraft, der er rettet fra nævnte første del (24) til nævnte anden del (25) på nævnte stoporgan (33), således at nævnte første del (24) er immobil i forhold til nævnte anden del (25) i nævnte driftsstilling og mindst i én retning parallel med nævnte akse (26), hvor nævnte
15 stoporgan (33) omfatter mindst to understøtningsdele, en første understøtningsdel (35) forbundet med nævnte første del (24) og en anden understøtningsdel (36) forbundet med nævnte anden del (25), **kendetegnet ved, at** nævnte første understøtningsdel (35) omfatter mindst én første støtteflade (43), der er skrå i forhold til nævnte akse (26), at nævnte anden understøtningsdel (36) omfatter
20 mindst én anden støtteflade (44), der er skrå i forhold til nævnte akse (26), og at nævnte kraft fastholder kontakten af nævnte mindst én første støtteflade (43) mod nævnte mindst én anden støtteflade (44) i nævnte driftsstilling, således at immobilisationen af nævnte første del (24) i forhold til nævnte anden del (25) langs med nævnte akse (26) i nævnte driftsstilling medfører samtidig en
25 immobilisation af nævnte første del (24) i forhold til nævnte anden del (25) omkring nævnte akse (26).

2. Højbjærtningsmaskine ifølge krav 1, **kendetegnet ved, at** nævnte første understøtningsdel (35) omfatter mindst ét par (47) første støtteflader (43), der er
30 skrå i forhold til nævnte akse (26) for således at danne et V, at nævnte anden understøtningsdel (36) omfatter mindst ét par (48) andre støtteflader (44), der er

skrå i forhold til nævnte akse (26) for således at danne et V, og at nævnte mindst ét par (47) første støtteflader (43) samvirker med nævnte mindst ét par (48) andre støtteflader (44) i nævnte driftsstilling.

- 5 3. Høbjærkningsmaskine ifølge krav 2, **kendetegnet ved, at** mindst én af nævnte første støtteflader (43) og mindst én af nævnte andre støtteflader (44) er rettet mod et plan (P), der går gennem nævnte akse (26), i nævnte driftsstilling og i en retning parallel med nævnte akse (26) og i en retning der går fra nævnte første del (24) mod nævnte anden del (25).
- 10 4. Høbjærkningsmaskine ifølge krav 2, **kendetegnet ved, at** mindst én af nævnte første støtteflader (43) og mindst én af nævnte andre støtteflader (44) er rettet mod et plan (P), der går gennem nævnte akse (26), i nævnte driftsstilling og i en retning parallel med nævnte akse (26) og i en retning der går fra nævnte anden del (25)
- 15 mod nævnte første del (24).
5. Høbjærkningsmaskine ifølge et hvilket som helst af kravene 2 til 4, **kendetegnet ved, at** nævnte første understøtningsdel (35) omfatter flere (49) af nævnte mindst ét par (47) første støtteflader (43), at nævnte anden
- 20 understøtningsdel (36) omfatter flere (50) af nævnte mindst ét par (48) andre støtteflader (44), at nævnte flere dele (49, 50) samvirker indbyrdes.
6. Høbjærkningsmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** nævnte spændingsorgan (34) omfatter et spændingselement
- 25 (51) der kan være forbundet med en af nævnte første og anden del (24, 25).
7. Høbjærkningsmaskine ifølge krav 6, **kendetegnet ved, at** nævnte spændingselement (51) omfatter et manøvreringsselement (52) og et låseelement (53, 53'), at nævnte manøvreringsselement (52) påvirker nævnte låseelement (53,
- 30 53'), og at nævnte manøvreringsselement (52) er forbundet med nævnte låseelement (53, 53') på en ikke demonterbar måde.

8. Højbjergningsmaskine ifølge krav 6 eller 7, **kendetegnet ved, at** nævnte spændingsorgan (34) omfatter et stopelement (59) forbundet med den anden af nævnte første og anden del (24, 25), og som samvirker med nævnte spændingselement (51).
- 5
9. Højbjergningsmaskine ifølge et hvilket som helst af kravene 6 til 8, **kendetegnet ved, at** nævnte spændingselement (51) omfatter et kugleled (54, 54').
10. Højbjergningsmaskine ifølge et hvilket som helst af kravene 6 til 8,
- 10 **kendetegnet ved, at** nævnte spændingselement (51) omfatter en trækfjeder (60).
11. Højbjergningsmaskine ifølge et hvilket som helst af kravene 6 til 8, **kendetegnet ved, at** nævnte spændingselement (51) omfatter en skrå tværkile (61).
- 15
12. Højbjergningsmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** nævnte spændingsorgan (34) kan manøvreres uden et redskab.
- 20 13. Højbjergningsmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** nævnte spændingsorgan (34) omfatter et reguleringsorgan (67), der gør det muligt at justere nævnte kraft.
14. Højbjergningsmaskine ifølge kravene 9 og 13, **kendetegnet ved, at** nævnte
- 25 reguleringsorgan (67) omfatter en møtrik (68), der samvirker med et gevindstykke (56).
15. Højbjergningsmaskine ifølge kravene 9 og 13, **kendetegnet ved, at** nævnte reguleringsorgan (67) omfatter en flange (70), der kan forskydes på en af nævnte
- 30 første og anden del (24, 25) langs nævnte akse (26).
16. Højbjergningsmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** nævnte kraft omfatter en komponent rettet langs nævnte akse (26).

17. Højbjergningsmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** nævnte sammenkoblingsanordning (27) omfatter en drejelig forbindelse (29), der gør det muligt for nævnte første del (24) at dreje i forhold til
5 nævnte anden del (25) i en retning, der er tilnærmelsesvis vinkelret på nævnte akse (26).
18. Højbjergningsmaskine ifølge krav 17, **kendetegnet ved, at** nævnte drejelige forbindelse (29) forbinder nævnte første og anden del (24, 25) indbyrdes på
10 uadskillelig vis.
19. Højbjergningsmaskine ifølge krav 17, **kendetegnet ved, at nævnte** drejelige forbindelse (29) tillader nævnte første del (24) at være adskilt fra nævnte anden del (25) uden et redskab.
- 15 20. Højbjergningsmaskine i henhold til et hvilket som helst af kravene 1 til 16, **kendetegnet ved, at** nævnte stoporgan (33) omfatter en glideforbindelse (28), der muliggør en glidning af nævnte første del (24) i forhold til nævnte anden del (25) langs nævnte akse (26).
- 20 21. Højbjergningsmaskine ifølge krav 20, **kendetegnet ved, at** nævnte første del (24) omfatter en første ende (30) rettet mod nævnte rotor (15) og en første længde (L1) der forløber fra nævnte første ende (30) i retning af nævnte arbejdsredskaber (17), at nævnte første understøtningsdel (35) er i en afstand fra nævnte første
25 længde (L1) i forhold til nævnte første ende (30), og at nævnte glideforbindelse (28) er dannet af en fraktion på nævnte første længde (L1), der går i indgreb med det indvendige af længden (L2) på nævnte anden del (25).
- 30 22. Højbjergningsmaskine ifølge krav 21, **kendetegnet ved, at** nævnte anden del (25) omfatter en anden ende (38) rettet mod nævnte arbejdsredskaber (17), og at nævnte anden understøtningsdel (36) danner nævnte anden ende (38).

23. Højbjærtningsmaskine ifølge krav 20, **kendetegnet ved, at** nævnte anden del (25) omfatter en anden ende (38) rettet mod nævnte arbejdsredskaber (17) og en anden længde (L2'), der forløber fra nævnte anden del (38) i retning af nævnte rotor (15), at nævnte anden understøtningsdel (36) er i en afstand fra nævnte anden
- 5 længde (L2') af nævnte anden ende (38), og at nævnte glideforbindelse (28) er dannet af en fraktion på nævnte anden længde (L2'), der går i indgreb indvendigt i en længde (L1') på nævnte første del (24).
24. Højbjærtningsmaskine ifølge krav 23, **kendetegnet ved, at** nævnte første del
- 10 (24) omfatter en første ende (30) rettet mod nævnte rotor (15), og at nævnte første understøtningsdel (35) danner nævnte første ende (30).

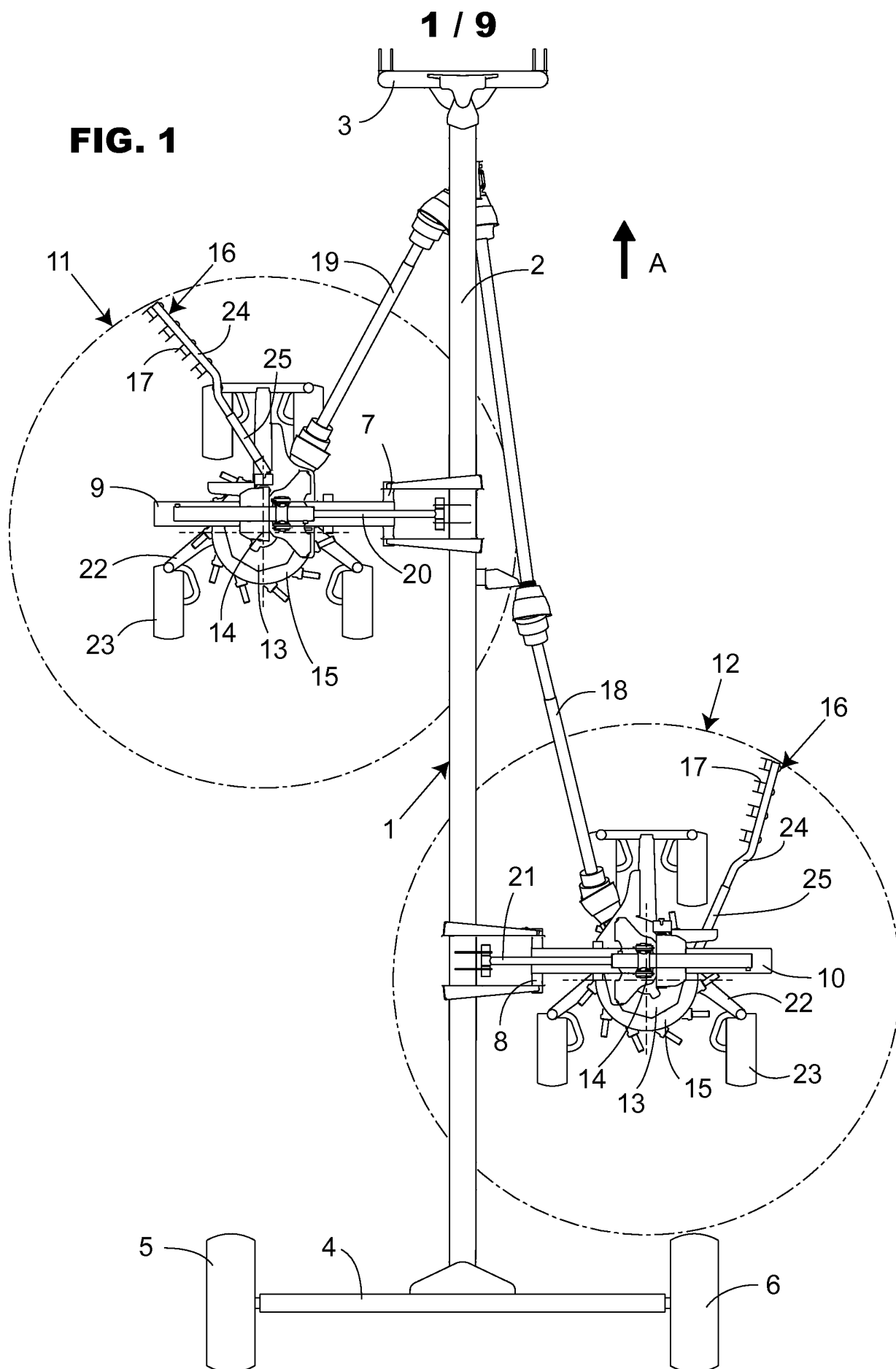


FIG. 2

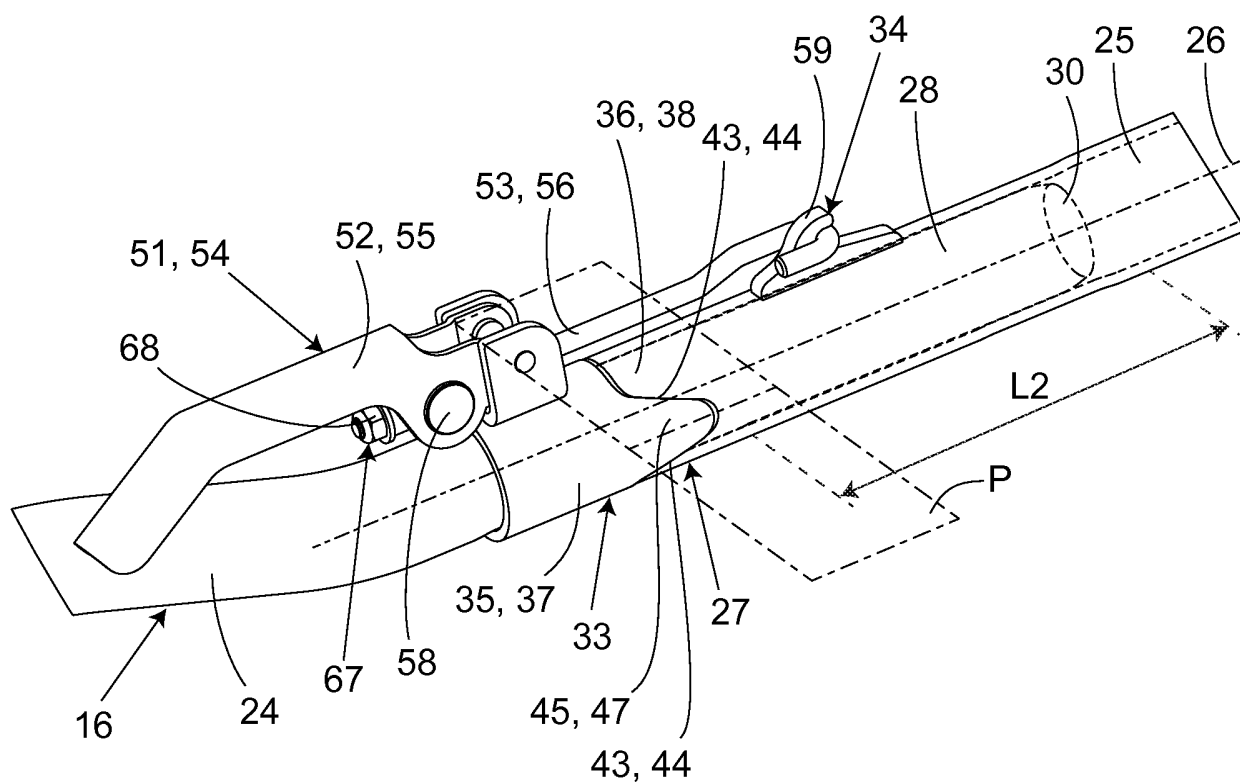
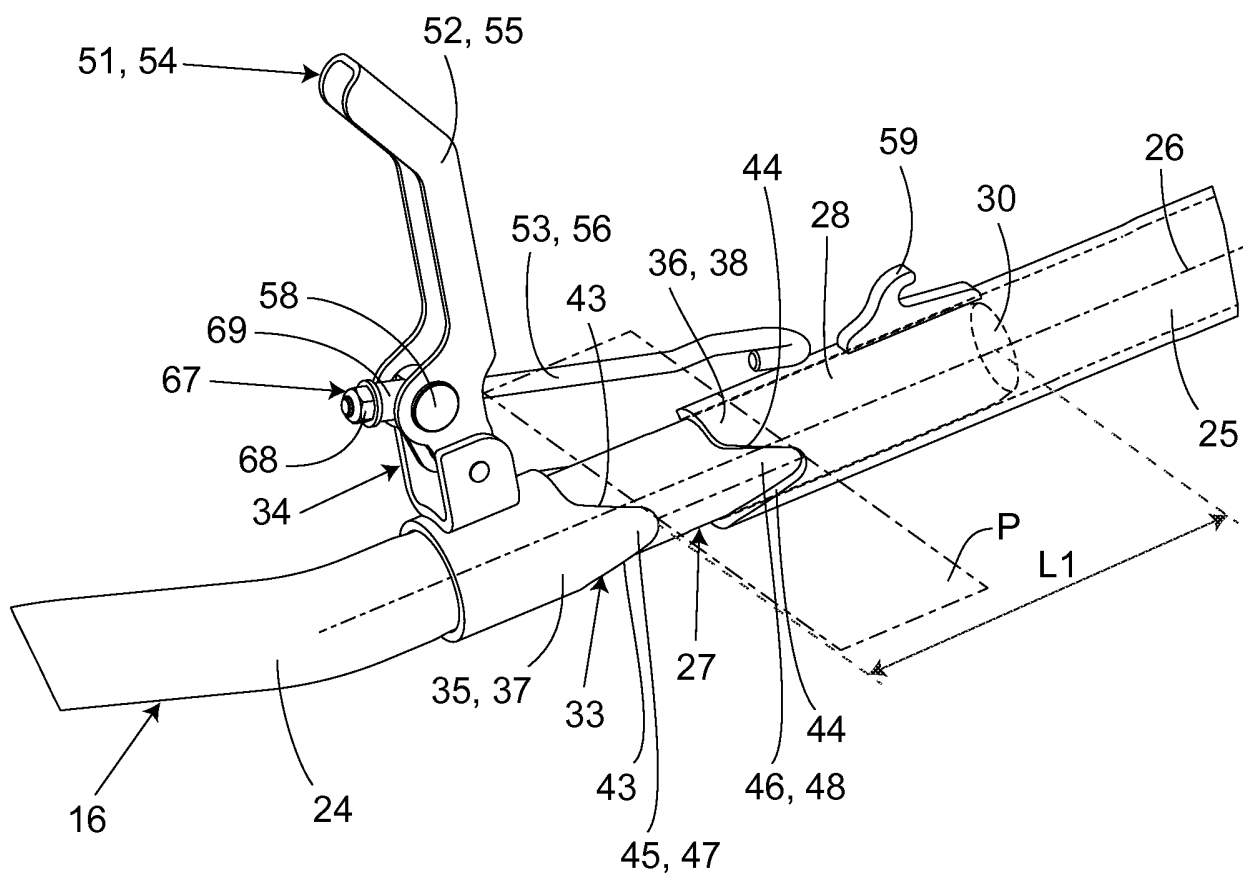
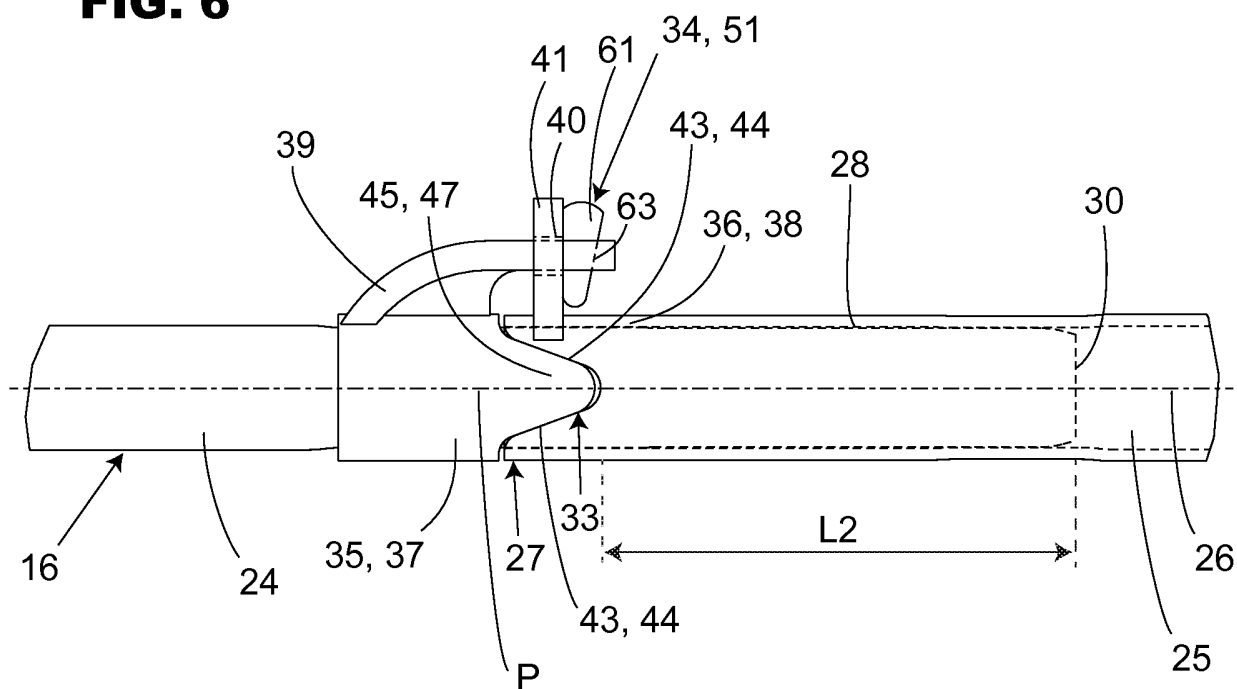
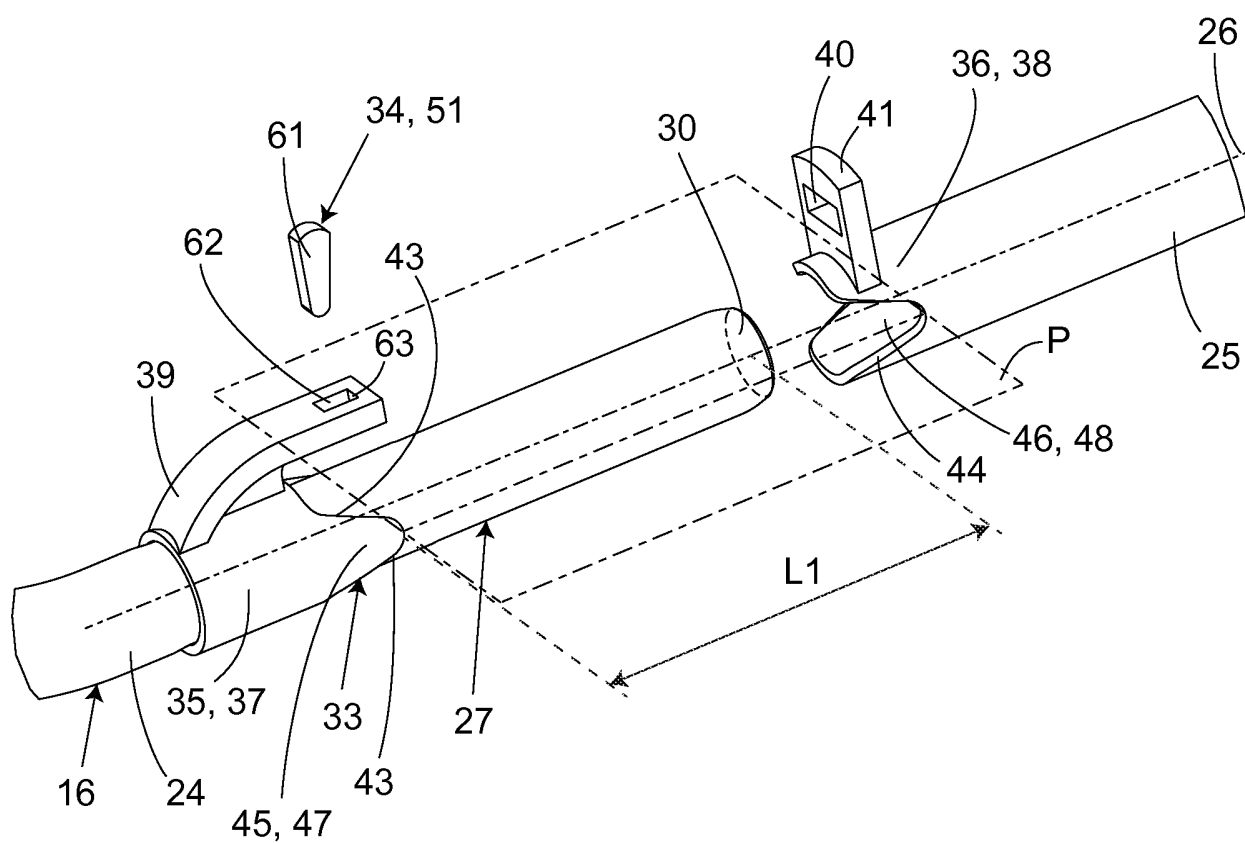


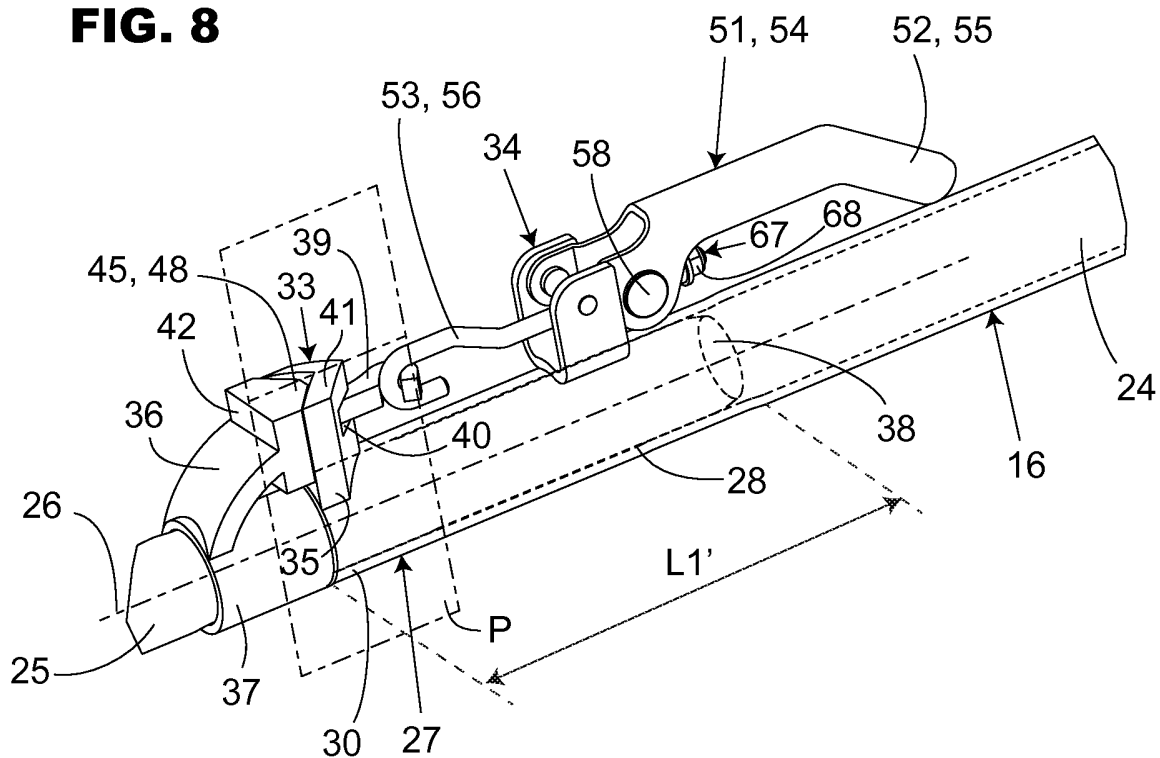
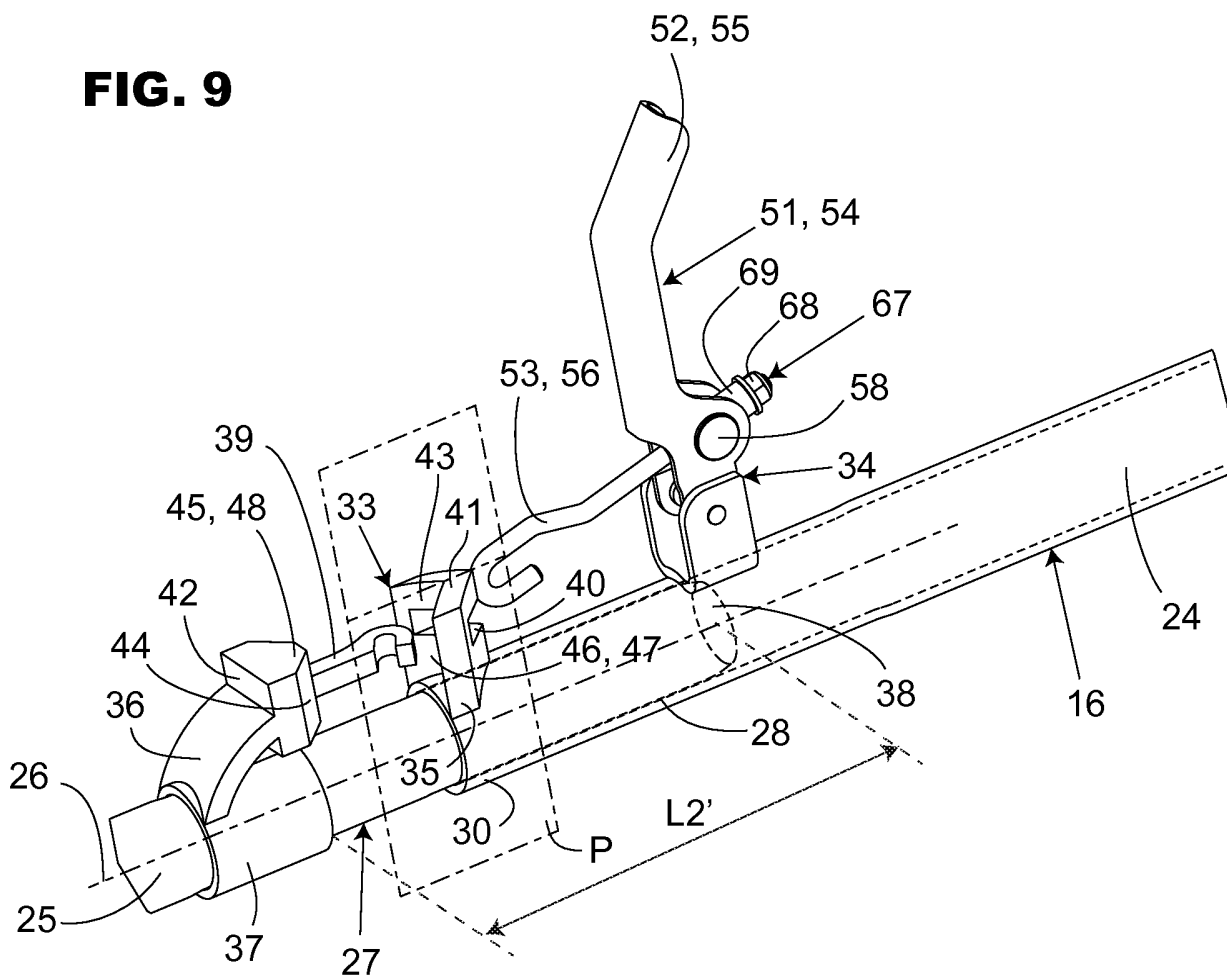
FIG. 3



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FIG. 6**FIG. 7**

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FIG. 8**FIG. 9**

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FIG. 10

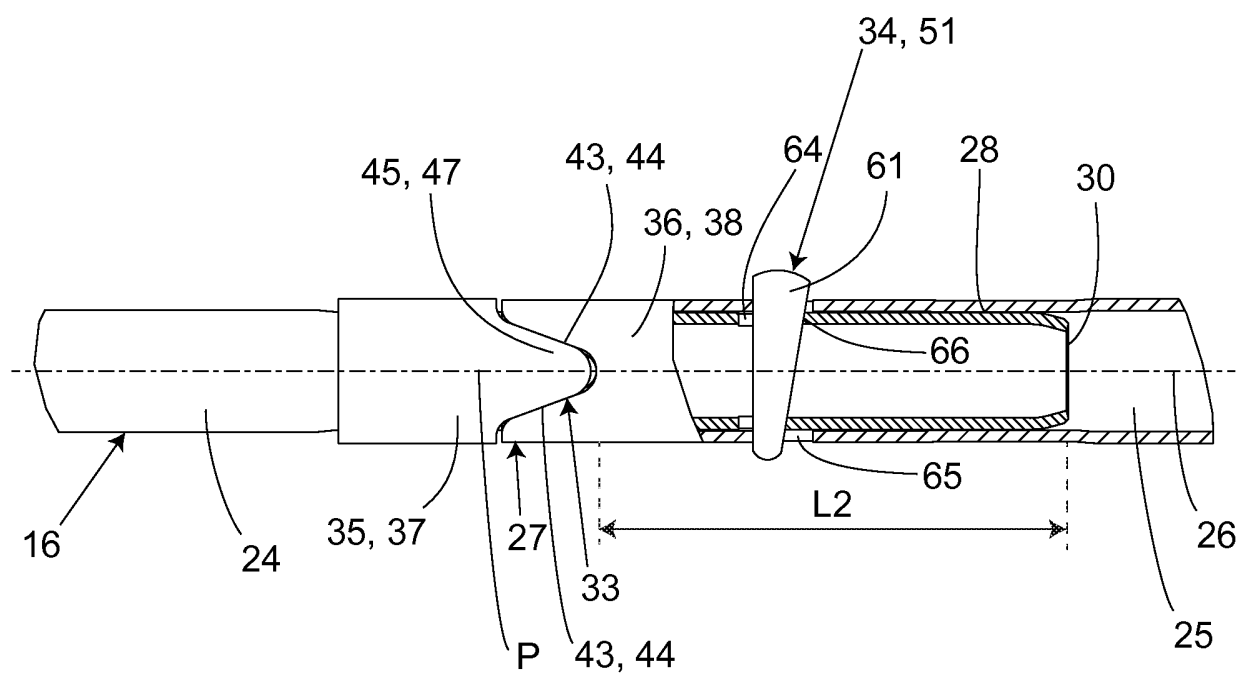


FIG. 11

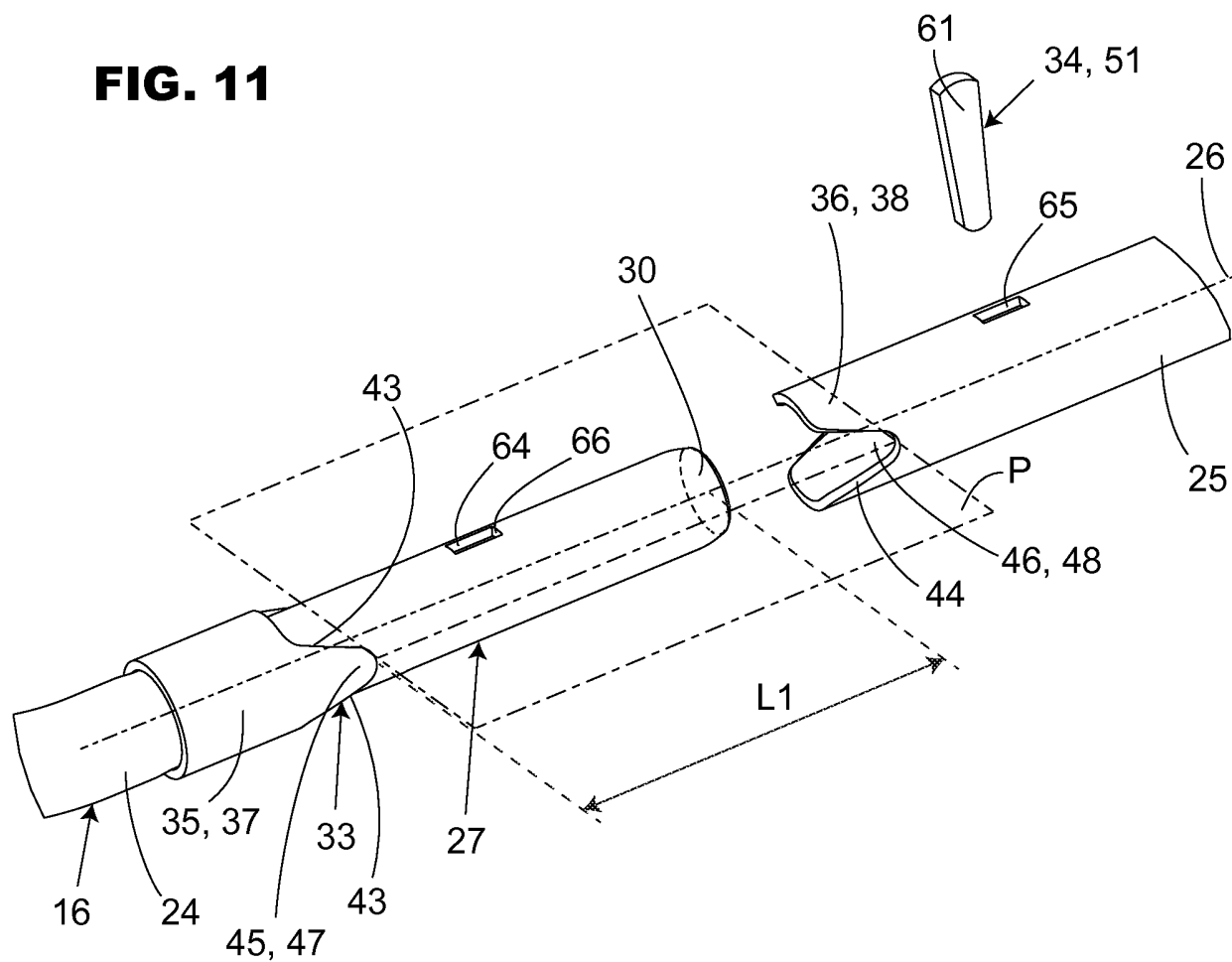


FIG. 12

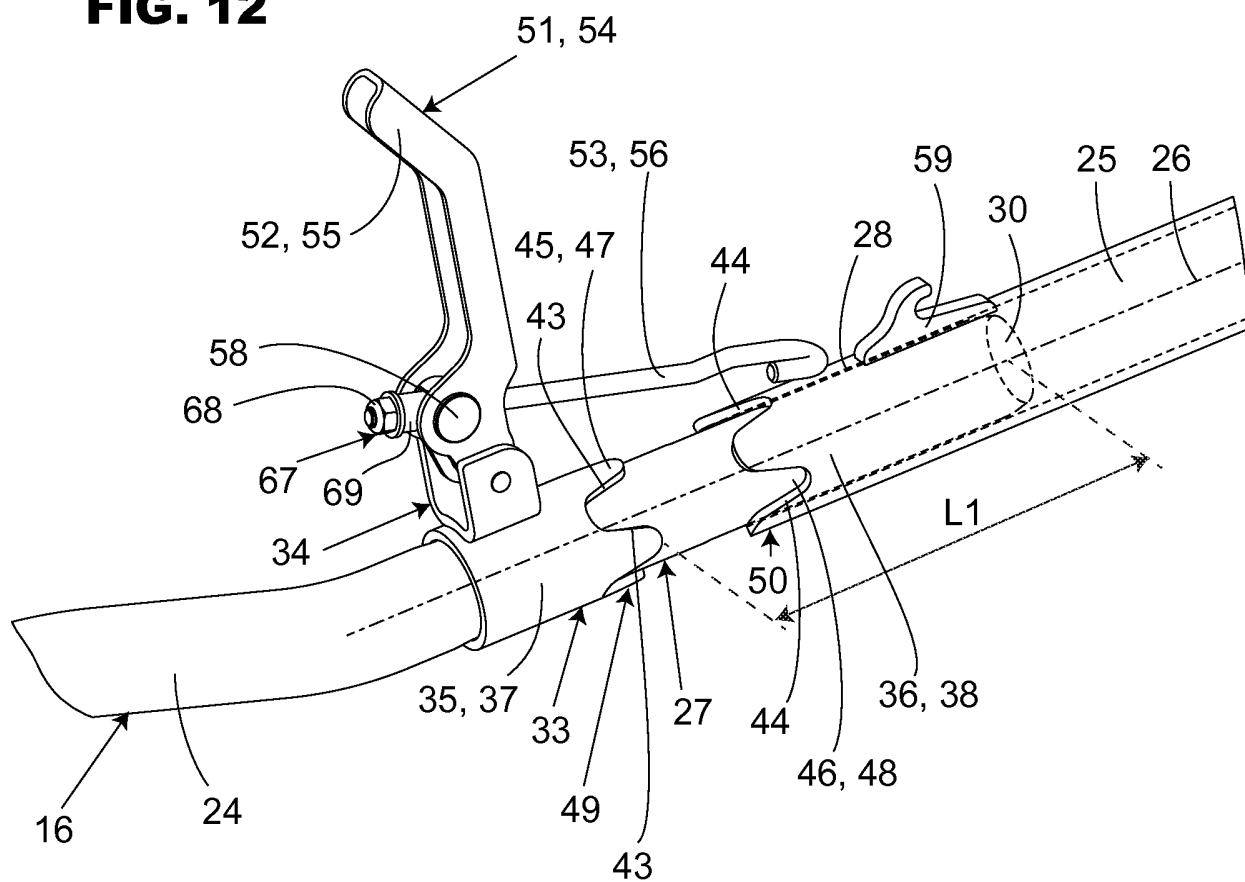
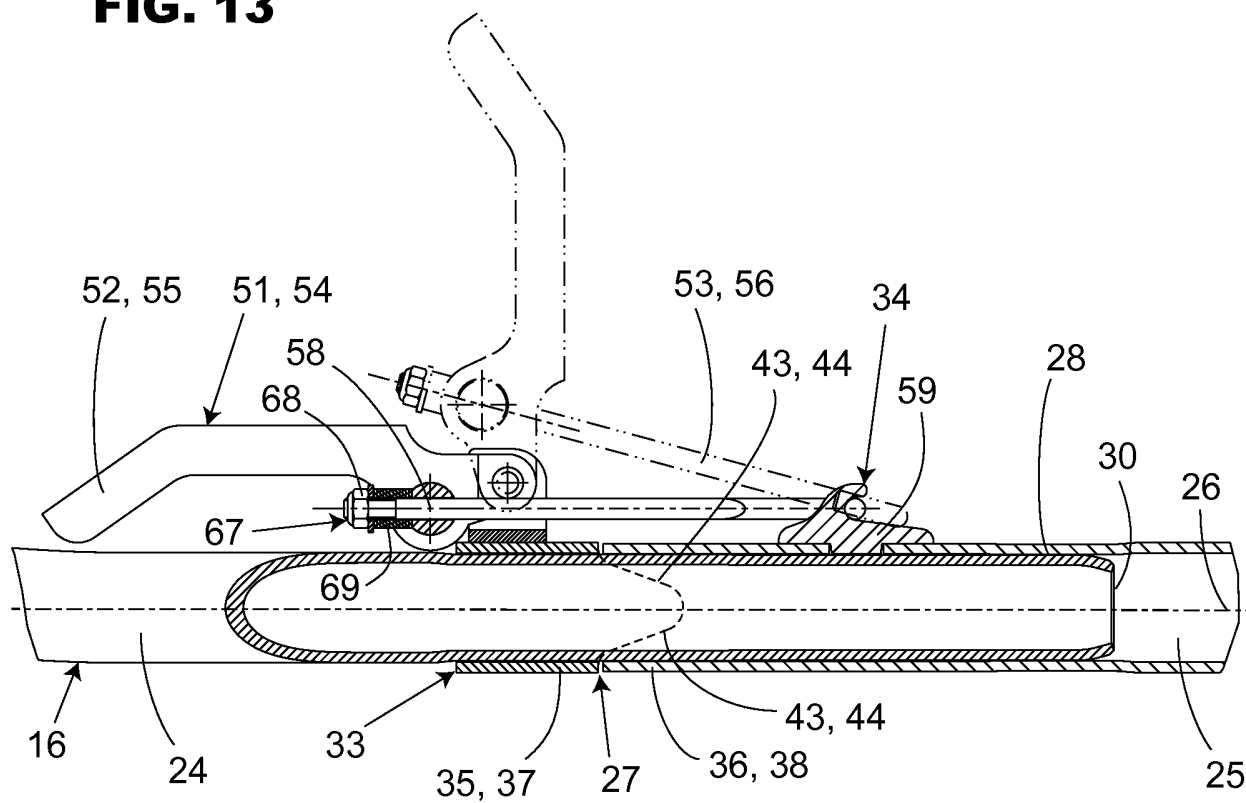
**FIG. 13**

FIG. 14

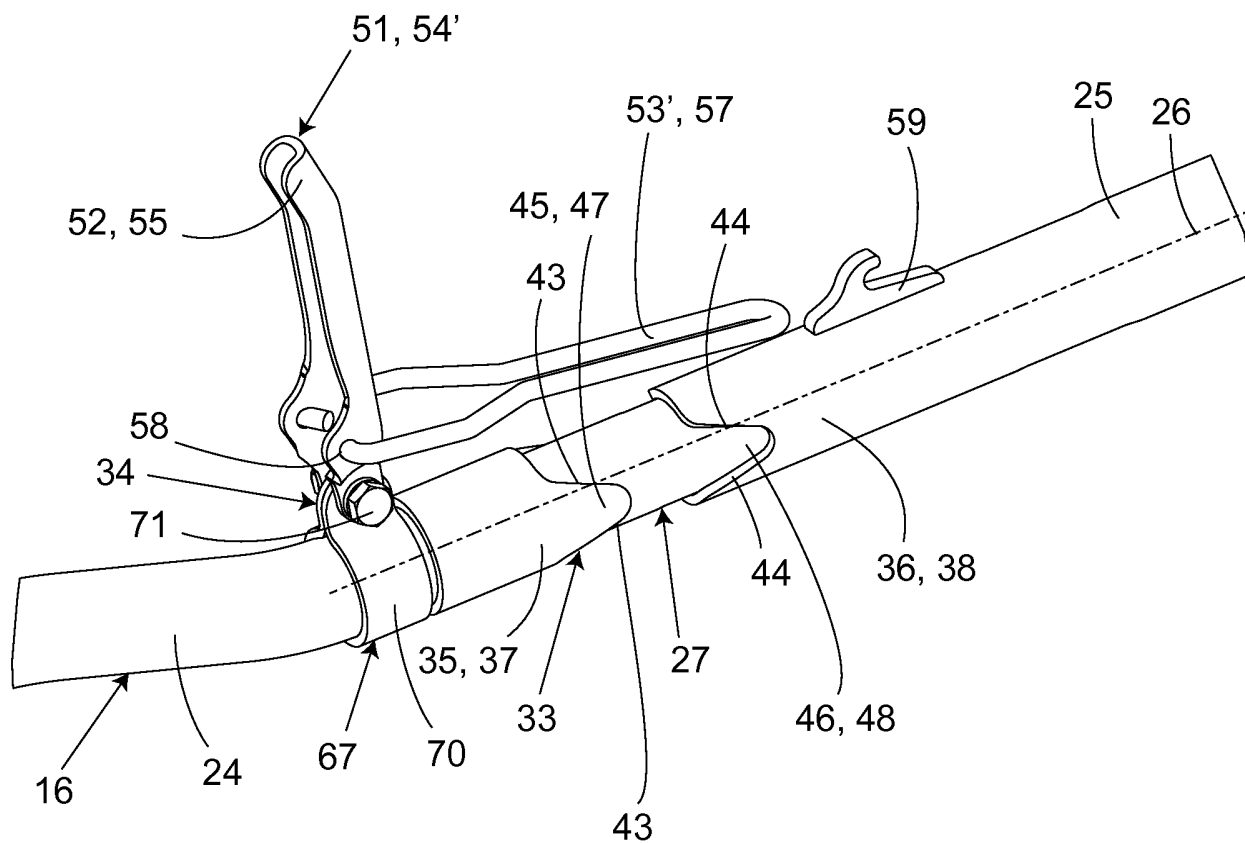
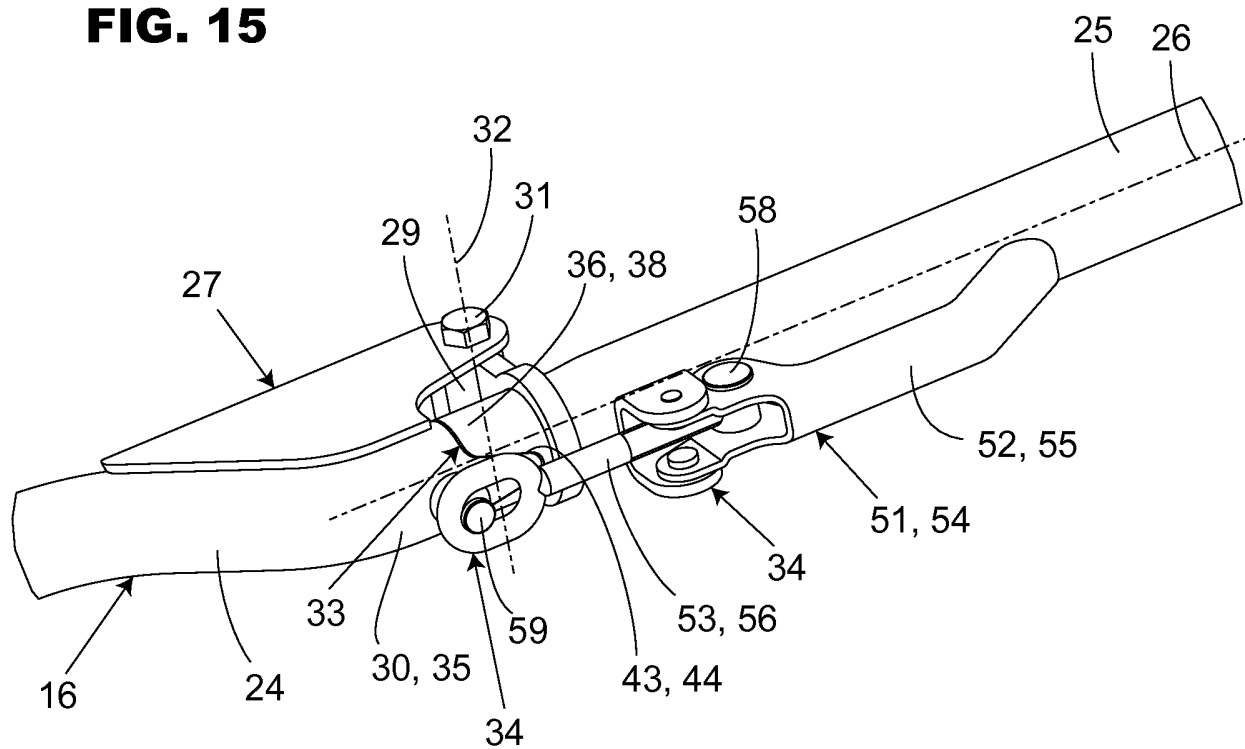
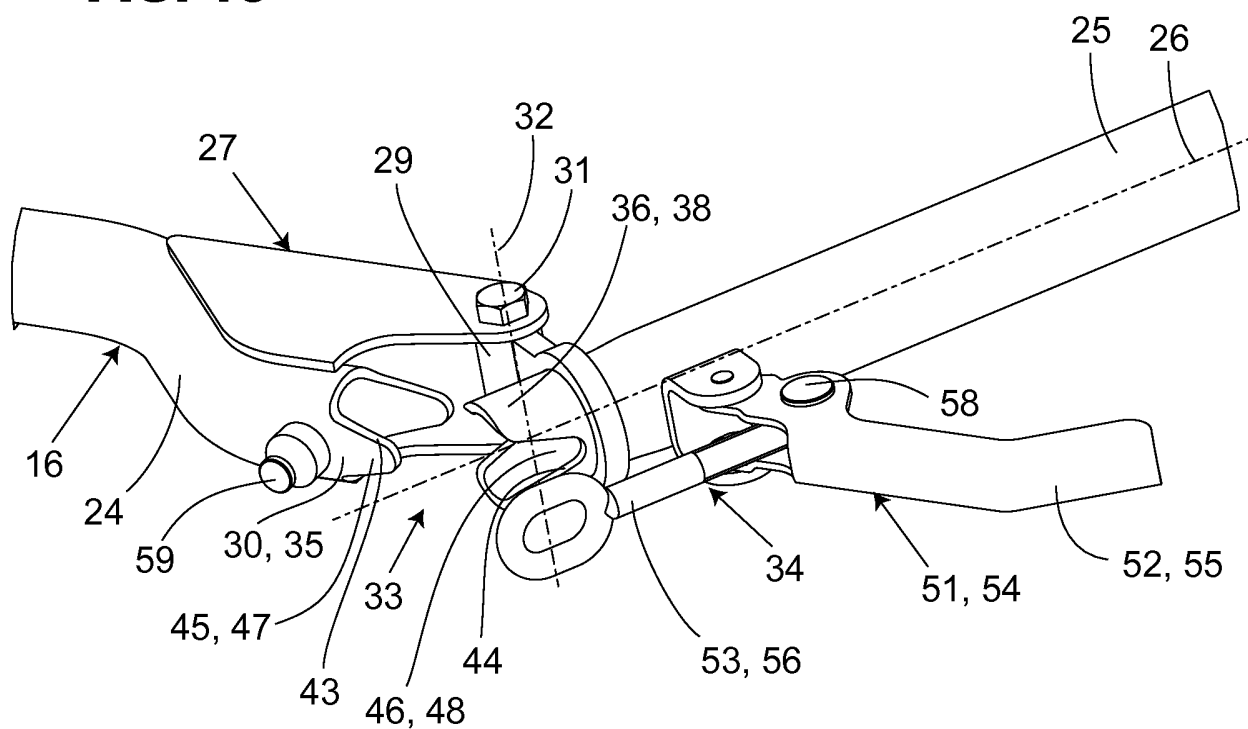
**FIG. 15**

FIG. 16**FIG. 17**