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(54) **Title**: PICKING DEVICE FOR HANGING FRUIT, IN PARTICULAR OLIVES

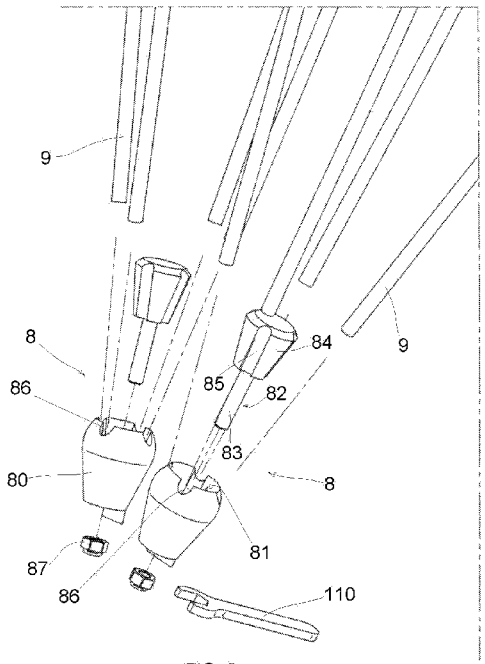

FIG. 6

(57) **Abstract**: Picking device for hanging fruit, in particular olives A picking device for hanging fruit, in particular olives, is disclosed, comprising a head (1), a pair of racks (8) with prongs (9), an actuation mechanism arranged inside the head and adapted to move the racks (8) with alternate motion. Each rack (8) comprises a support (80) provided with a tapered axial hole (86) with increasing diameter from down up and an insert (82) with tapered body (84) that is coupled inside the axial hole (86) of the support with conical coupling. The lower part of the prongs (9) is compressed between the external surface of the body (84) of the insert and the internal surface of the support (80), in such a way that the prongs (9) have a divergent configuration relative to the axis of the support (80) from down up.

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Description

Picking device for hanging fruit, in particular olives.

The present patent application for industrial invention relates to a picking device for hanging fruit, in particular olives, commonly defined as beater.

As it is known, a beater comprises a couple of opposite racks that are pneumatically controlled to move with alternate motion and cause the detachment of fruit from trees. Said racks are mounted on the head of an internal rod that telescopically slides inside an external rod adapted to be held by the user.

The beaters according to the prior art are impaired by some drawbacks.

The racks comprise prongs mounted on linear supports that radially extend outwards with respect to the axis of the telescopic rods. Consequently this type of racks is very cumbersome and tends to get stuck in the branches of thick-crowned trees.

An actuation mechanism is generally used to actuate said racks in alternate motion, comprising a reduction gear box. This involves high complexity and weight of the actuation mechanism mounted at the head of the upper telescopic rod.

Consequently, in order to support the actuation device, the two telescopic rods must have a large diameter and high thickness. For instance, the external rod has a diameter of about 35 mm and thickness higher than 1.5 mm. Said dimensions of the telescopic rods further increase the weight of the beater, which is generally higher than 2.5 Kg. Evidently, the large diameter of the external telescopic rod and the high weight of the entire beater device contribute to reducing maneuverability.

Moreover, it must be considered that the high weight of the racks and the high friction of the gear boxes contribute to high power dissipation of the electric motor. Generally, the electric motor absorbs a current higher than 10 amp/hour.

Accordingly the beater must be provided with cumbersome batteries that impair maneuverability further. Moreover, the life of the batteries is very limited, being approximately four hours for an ordinary 40 amp/hour battery, making it impossible to use the beater for harvesting works that require several hours, unless very expensive lithium batteries are used.

EP 1 051 900 discloses a beater provided with two racks with opposite series of prongs, wherein the prongs of a series are staggered with respect to the prongs of the opposite series.

The purpose of the present invention is to eliminate the drawbacks of the prior art by disclosing a picking device for hanging fruit that is easy to handle, not too cumbersome, light, efficient, versatile and easy to use.

This purpose has been achieved according to the present invention, with the characteristics illustrated in the attached independent claim 1.

Advantageous embodiments are disclosed in the dependent claims.

The picking device for hanging fruit, in particular olives, according to the invention comprises:

- a head,
- a pair of racks provided with prongs,
- an actuation mechanism provided inside the head and adapted to move the racks with alternate motion.

Each rack comprises:

- a support provided with a tapered axial hole with increasing diameter from down up, and
- an insert provided with tapered body with increasing diameter from down up, adapted to be coupled inside said axial hole of the shank with conical coupling.

In view of the above, the lower part of the prongs is compressed between the external surface of the body of the insert and the internal surface of the shank, in such a way that the prongs have a divergent configuration relative to the axis of the shank from down up.

The advantages of the invention are evident. In fact, this particular configuration of the racks allows for using the device also in thick-crowned trees.

Moreover, the particular configuration of the racks allows for obtaining a very compact actuation mechanism of the racks that can be contained inside the head of the device.

In this way, the head can act as handle, regardless of the fact that it is mounted on a telescopic rod system.

Further characteristics of the invention will become clearer from the detailed description below, which refers to a merely illustrative, not limiting, embodiment, as shown in the enclosed figures, wherein:

Fig. 1 is a perspective view of the picking device for hanging fruit according to the invention;

Fig. 2 is a perspective view of the head of the device of Fig. 1;

Fig. 3 is an exploded view of the head of Fig. 2;

Fig. 4 is a partially sectional view of the head of Fig. 2;

Fig. 5 is a perspective view of the head of Fig. 2 with upper lid removed;

Fig. 6 is an exploded view of the racks of the head of Fig. 2; and

Fig. 7 is an axial sectional view of a rack of the head of Fig. 2.

Referring to the aforementioned figures, the picking device for hanging fruit according to the invention is disclosed, which is globally referred to with numeral (100).

With reference to Fig. 1, the device (100) comprises a telescopic rod system (101) comprising an external rod (102) and an internal rod (not visible in the drawing) that slides telescopically inside the external rod (102).

A head (1) is mounted at the upper end of the internal rod, containing suitable actuation means designed to actuate two racks (8) with alternate motion in order to knock down the hanging fruit.

The device (100) is provided with suitable power supply means (108) to power the actuation means mounted in the head (1). The power supply means (109) can be contained in a backpack (103) provided with shoulder straps in order to be carried by the user.

A cable or tube (104) connects the power supply means (108) with the actuation means mounted inside the head (1). The cable or tube (104) passes inside the telescopic rod system (101).

A handle (105) is mounted at the lower end of the external rod (102), provided with a button (106) connected to a switch in order to power the actuation means.

The device (100) is also provided with a second power cable or tube (107) to connect the power supply means (108) directly to the actuation means inside the head (1) without the need for the telescopic rod system (101). In such a case the user can only use the head (1), for instance to knock down the fruit on low-stemmed trees. Consequently, also the head (1) is provided with a button (B) connected to a switch to power the actuation means.

Referring to Figs. 2 and 3, the head (1) has a basically cylindrical body (10) with diameter of approximately 40 mm and length of approximately 160 mm. Advantageously the body (10) of the head has an ergonomic shape in order to act as handle and be used independently from the telescopic rod system.

The body (10) is internally empty and is provided with an axial housing (11) to receive an actuation means (2) designed to drive into rotation an output shaft (21) arranged axially in the upper part of the head (1).

Advantageously, the actuation means (2) comprises an electric motor (2) connected to an epicycloidal reduction gear (20) that drives into rotation the output shaft (21). In this case the power supply means (108) are batteries, such as for example an ordinary 40 or 50 amp/hour battery normally used to power portable tools, such as drills or similar. Advantageously, a lithium battery with reduced weight can be used and disposed in the user's belt.

The epicycloidal reduction gear (20) guarantees a reduction of the revolution speed of the output shaft (21) with maximum efficiency and minimum volume in radial direction.

The actuation means (2) can also be a hydraulic or pneumatic motor; in this case the power supply means (108) comprise a pump or compressor.

The actuation means (2) can also be an internal combustion motor; in such a case, the power supply means (108) comprise a fuel tank.

The output shaft (21) is coupled on the rotor of the reduction gear (20) by means of a key (22) and a Seeger (23).

A radial housing (12) is obtained in the lower part of the body (109) to receive the switch button (B) provided with electrical contacts for connection to the electric motor (2).

The body (10) is provided in lower position with a connection (13) with expandable wings to connect to the upper end of the internal rod of the telescopic system (101). A threaded ring (14) is tightened on the connection (13) to firmly lock the head (1) on the rod of the telescopic system. In this way the head (1), which is the actual tool, is interchangeable independently from the telescopic rods.

An electrical connector (15) is arranged in the lower part of the body (10) to be electrically connected to the motor. The electrical connector (15) can removably receive a complementary connector provided in the upper end of the telescopic system and in the supplementary electrical cable (107).

The body (10) of the head is provided with a collar (16) with higher diameter in the upper end. A flange (4) is mounted on the collar (16) by means of screw means (40).

The flange (4) comprises:

- a central hole (41),
- two peripheral circular housings (42, 42') arranged in diametrally opposite positions, and
- two peripheral slots (43, 43') in close position.

In particular, the housing (42) and the slot (43) are obtained at a lower level than the housing (42') and the slot (43').

The slots (43, 43') create a labyrinth to prevent the entrance of dust.

A pin (5) has an eccentric hole (50) that receives the output shaft (21) of the reduction gear, so that the pin (5) can pass through the central hole (41) of the flange (4). A locking ring (25) is mounted in the upper end of the output shaft (21) above the eccentric pin (5).

Also referring to Figs. 4 and 5, two connecting rods (6, 6') are mounted on the flange (4). Each connecting rod (6, 6') comprises:

- a connecting rod head (60) that forms a U-shaped arched housing (66),
- a pivoting pin (61) arranged on the connecting rod head (60) in such a way to protrude in upper and lower position with respect to the connecting rod head,
- an arm (62) that protrudes radially from the connecting rod head (60) and ends in a connecting rod foot (63) provided with a fixing hole (64).

The foot (63) of each connecting rod (6) is arranged on a downward inclined plane with respect to the plane of the arm (62) and head (60). It must be considered that the arm (62) and head (60) of the rod are designed to be arranged according to a horizontal plane.

The two connecting rods (6, 6') are positioned on the flange (4) with the arched housings (66) in opposite position around the pin (5) with eccentric hole (50).

Two ball bearings (7, 7') are arranged around the pin (5) so that the internal rings of the bearings are in contact with the pin (5); whereas the external rings of the bearings are in contact with the arched housings (66) of the connecting rods (6, 6').

It must be noted that the heads (60) of the rods (7, 7') are supported by the flange (4) on different height levels in order to avoid mutual inference.

Two lower friction rings (R) are arranged in the circular housings (42, 42') of the flange (4) and the lower end of the pins (61) of each connecting rod is arranged inside the friction rings (R) so that the lower friction rings (R) rub on the lower surface of the connecting rod head (60).

Likewise, two upper friction rings (R) are arranged around the upper end of the pins (61) of each connecting rod, so that the upper friction rings (R) rub the upper surface of the connecting rod head (60). The upper friction rings (R) are housed in corresponding housings (not shown) obtained in a lid (17) that is closed on the flange (4) by means of screw means (18).

The friction rings (R) are made of a material with low coefficient of friction, such as Teflon.

It must be noted that the provision of the two ball bearings (7, 7') and four friction rings (R) minimize the sliding friction and rolling friction to which the two connecting rods (6, 6') and the pin (5) with eccentric hole are subject.

This particular configuration of the actuation mechanism minimizes volume, weight and friction. Therefore, the entire actuation mechanism can be inserted in the head-handle (1) without excessively increasing the weight of the beater. Moreover, in case of electrical motor (2), the motor absorbs a current of about 3 amp/hour. Consequently, the batteries (108) can be ordinary 40 or 50 amp/hour batteries, with life longer than 13 hours.

The feet (63) of the connecting rods (6, 6') radially protrude outwards from the flange (4) and from the circular lid (17). In this way, two racks (8) can be mounted on the feet (63) of the two connecting rods (6, 6').

Referring to Figs. 6 and 7, each rack (8) comprises a support (80) shaped as a shank, with basically truncated-conical or tapered shape with increasing diameter from down up.

The shank (80) is internally empty and is provided with an axial hole or channel (81) with truncated conical shape that crosses the shank (80). A support insert (82) is inserted in the hole (81) of the shank (80), comprising a truncated-conical body (84) with increasing diameter from down up, which is coupled with the hole (81) of the shank with conical coupling.

The body (84) of the insert has a threaded stem (83) that protrudes axially downwards and comes out from the lower end of the shank (80).

As shown in Fig. 5, the lower part of the stem (83) is inserted in the fixing hole (64) of the connecting rod foot and is tightened by means of a nut (87), using an ordinary tool, such as a wrench (110) (Fig. 6).

The body (84) of the insert is provided on the external surface with four longitudinal grooves (85) that are spaced by 90°. The longitudinal grooves (85) have a cross-sectional profile with semicircle shape to receive the prongs (9). The prongs (9) are cylindrical rods with approximately 320 mm length and 5 mm diameter, made of a sturdy, light material, such as carbon fiber.

Suitably, also the internal surface of each shank (80) is provided with four longitudinal grooves (86) in register with the longitudinal grooves (85) of the

body of the insert. In this way the prongs (9) are compressed between the grooves (85) of the insert and the grooves (86) of the shank and are given a configuration according to the corners of an overturned pyramid with square base.

Although the drawings show four prongs (9) mounted on each shank (80) it appears evident that a different number of prongs (9) can be provided.

The mounting and dismounting of the prongs (9) is extremely simple and rapid, it being simply necessary to tighten or loosen one bolt to fix or remove all prongs of a rack at the same time.

It must be considered that the special configuration of the racks (8) and of the actuation mechanism contained in the handle (1) have a limited weight. Therefore, also the dimensions and weight of the telescopic rod system (101) are minimized (Fig. 1). In particular, the external rod (102) has a diameter lower than 35 mm, preferably 30 mm, and thickness lower than 1.5 mm, preferably 1 mm.

Both rods are made of aluminum and advantageously the internal rod has a polyurethane foam core to absorb vibrations and reduce bending. In this way the entire beater has a weight lower than 2 Kg, preferably 1.6 Kg.

Numerous variations and modifications can be made to the present embodiment of the invention by an expert of the art, while still falling within the scope of the invention as claimed in the enclosed claims.

Claims

1) Picking device for hanging fruit, in particular olives, comprising:

- a head (1),

- a pair of racks (8) provided with prongs (9),

- an actuation mechanism provided inside the head and adapted to move the racks (8) with alternate motion,

characterized in that

each rack (8) comprises:

- a support (80) provided with tapered axial hole (86) with increasing diameter from down up, and

- an insert (82) provided with tapered body (84) with increasing diameter from down up adapted to be coupled inside said axial hole (86) of the support with conical coupling,

wherein

the lower part of the prongs (9) is compressed between the external surface of the body of the insert and the internal surface of the support (80), in such a way that the prongs (9) have a divergent configuration relative to the axis of the support (80) from down up.

2) Device as claimed in claim 1, characterized in that the external surface of the body (84) of the insert and the internal surface of the support (80) are provided with longitudinal grooves (85, 86) to receive the lower part of the prongs (9).

3) Device as claimed in claim 1 or 2, characterized in that said insert (82) comprises a threaded stem (83) axially protruding downwards from said tapered body (84) of the insert to be tightened by means of a nut (87) to an actuation means (6, 6') of said rack.

4) Device as claimed in claim 3, characterized in that said actuation means of each rack (8) comprises a connecting rod (6, 6') comprising:

- a connecting-rod head (60) connected to actuation means, and

- a connecting-rod foot (63) provided with a hole (64) crossed by the threaded stem (83) of the insert of the rack.

5) Device as claimed in claim 4, characterized in that said actuation mechanism comprises:

- actuation means (2, 20) that drive an output shaft (21) into rotation, and
- a pin (5) provided with eccentric hole (50) that receives the output shaft (21), in which the heads (60) of each connecting-rod (6, 6') are arranged around the pin (5) with eccentric hole (50).

6) Device as claimed in claim 5, characterized in that said actuation means comprise an electric motor (2) connected to an epicycloidal reduction gear (20).

7) Device as claimed in claim 5 or 6, characterized in that said actuation mechanism comprises two ball bearings (7, 7') mounted between the pin (5) with eccentric hole and the heads (60) of the connecting-rods (6).

8) Device as claimed in any one of claims 5 to 7, characterized in that the head (1) of the device has a cylindrical shape of an ergonomic handle inside which the actuation means (2, 22) are axially arranged and the head (1) is provided with an upper flange (4) that receives the heads (60) of the two connecting-rods (6, 6') and a lid (17) that closes on the flange (4).

9) Device as claimed in claim 8, characterized in that the head (60) of each connecting-rod (6) is provided with a pin (61) that extends from the flange (4) to the lid (17) and around the pin (61) of each connecting-rod two friction rings (R) are situated between the flange (4) and the head of the connecting-rod and between the head of the connecting-rod and the lid (17).

10) Device as claimed in any one of the preceding claims, characterized in that the head (1) of the device is provided with switch button (B) and electrical connector (15) to receive the connector of a power cord (107).

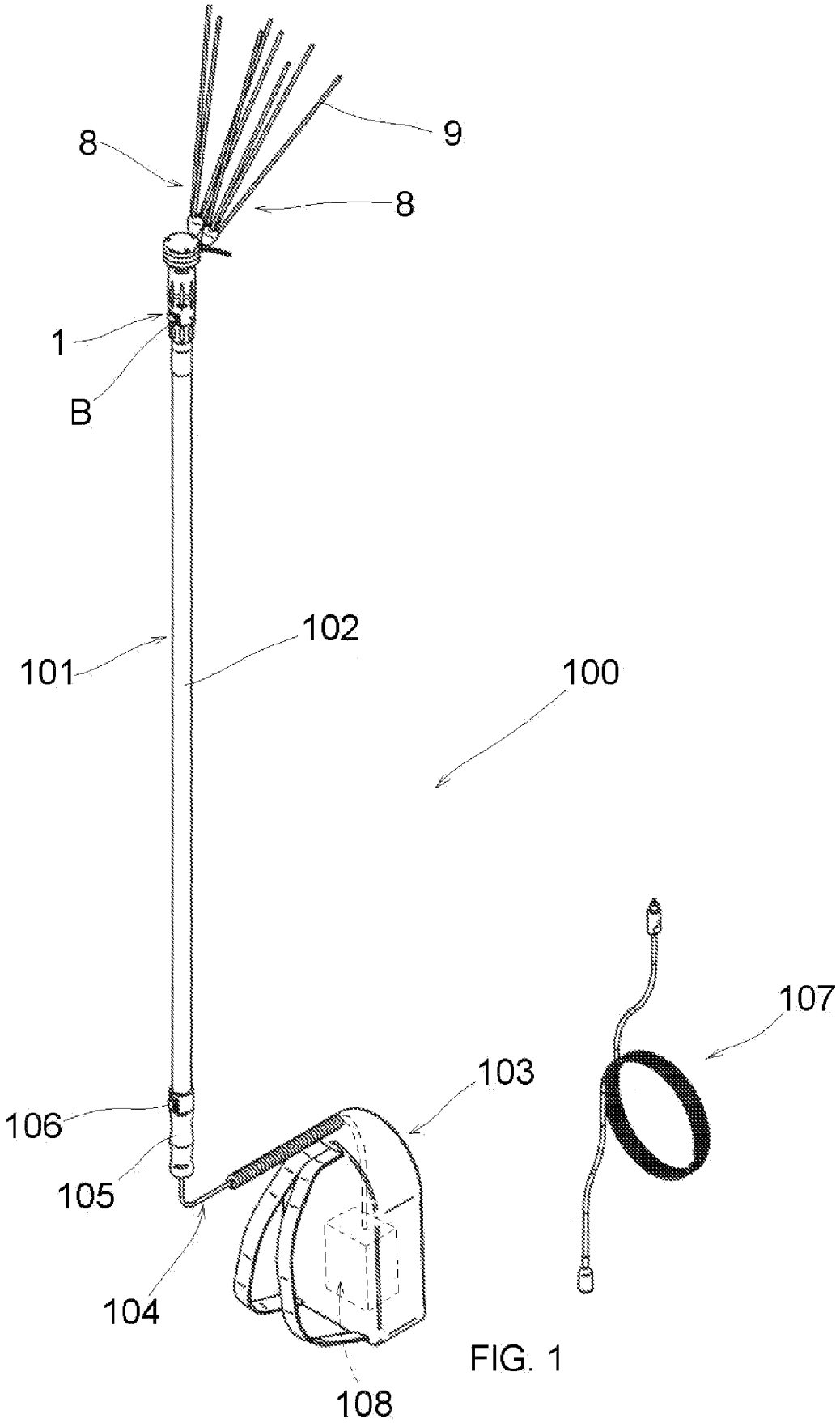

FIG. 1

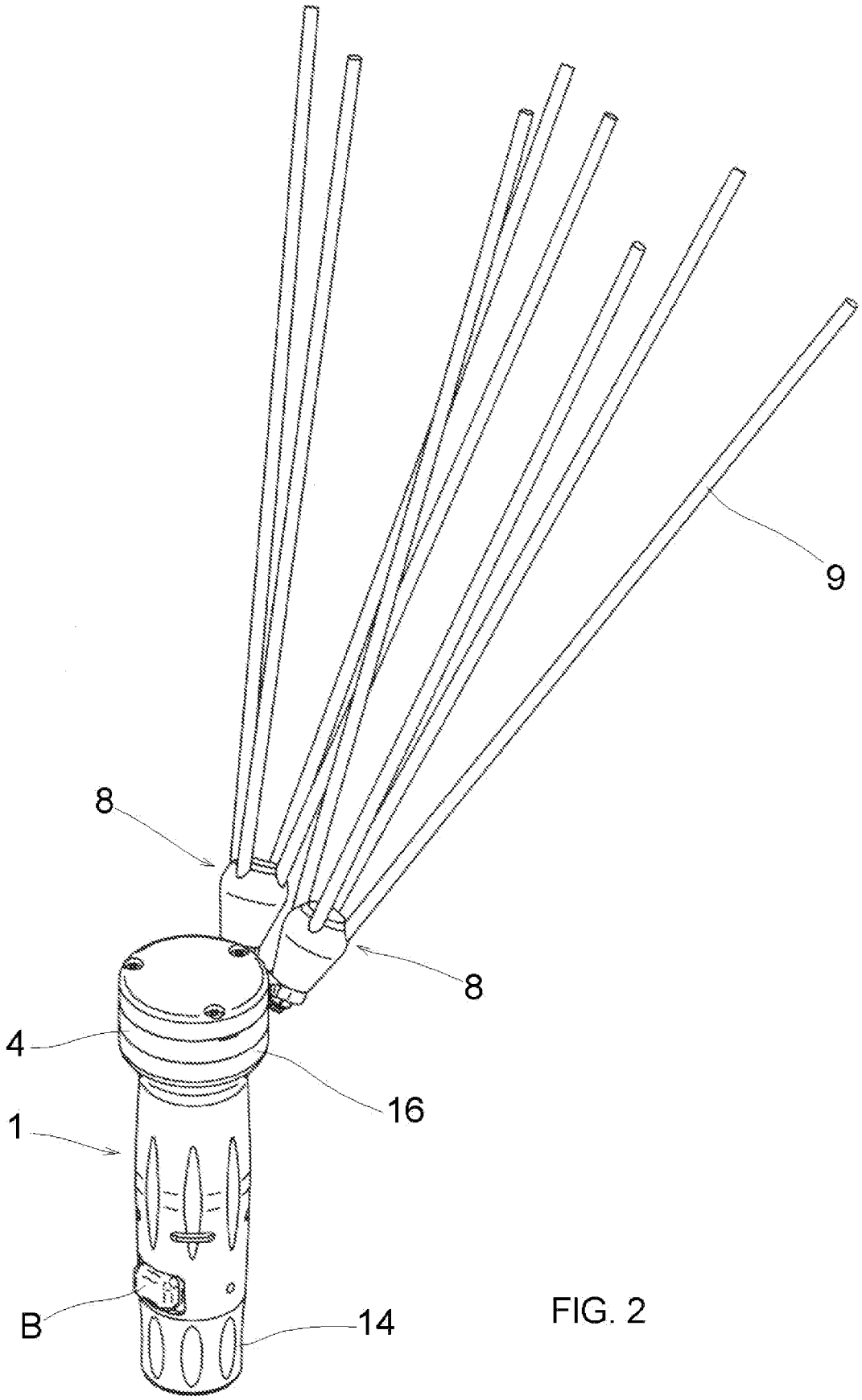

FIG. 2

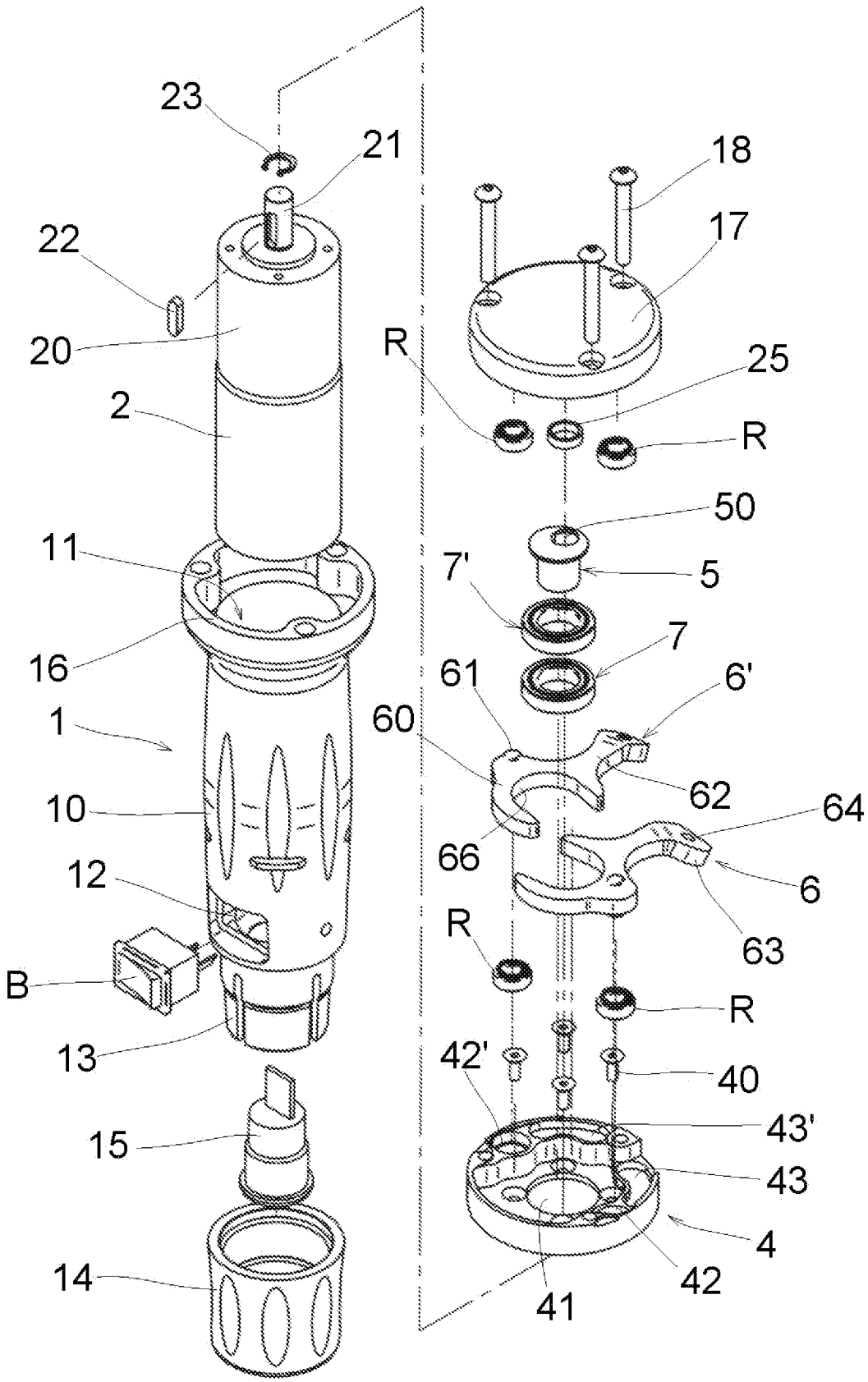
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FIG. 3

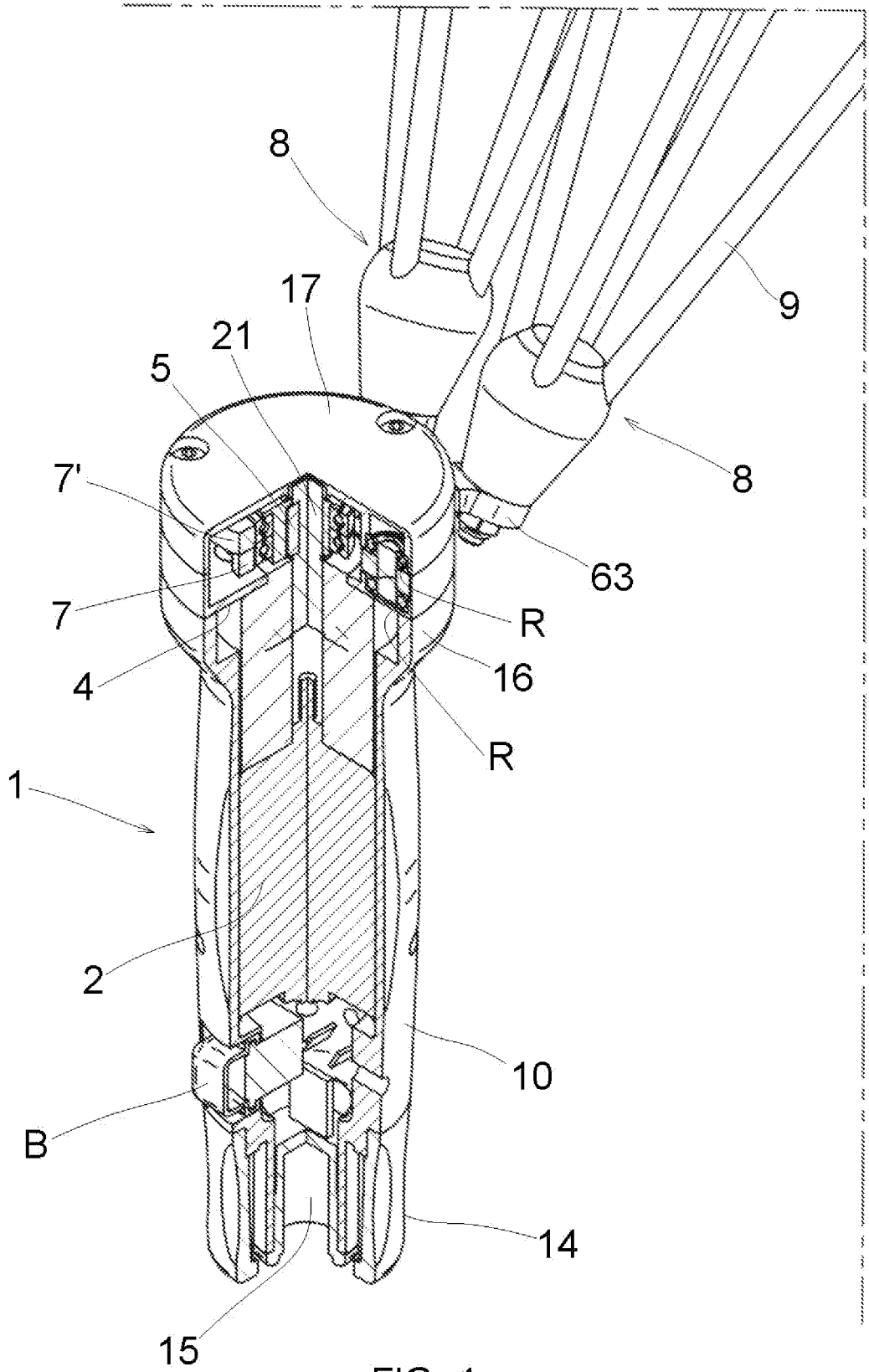

FIG. 4

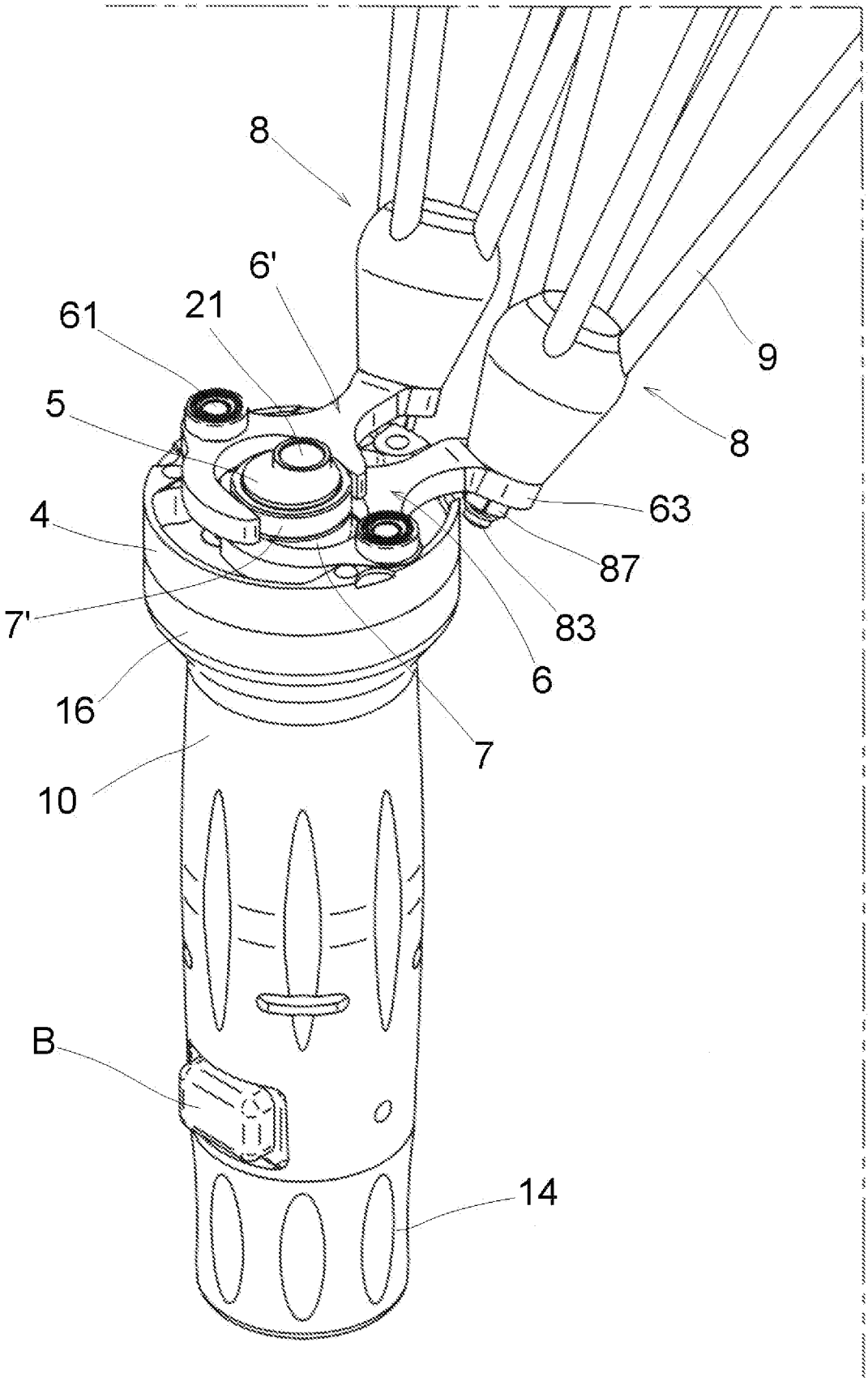

FIG. 5

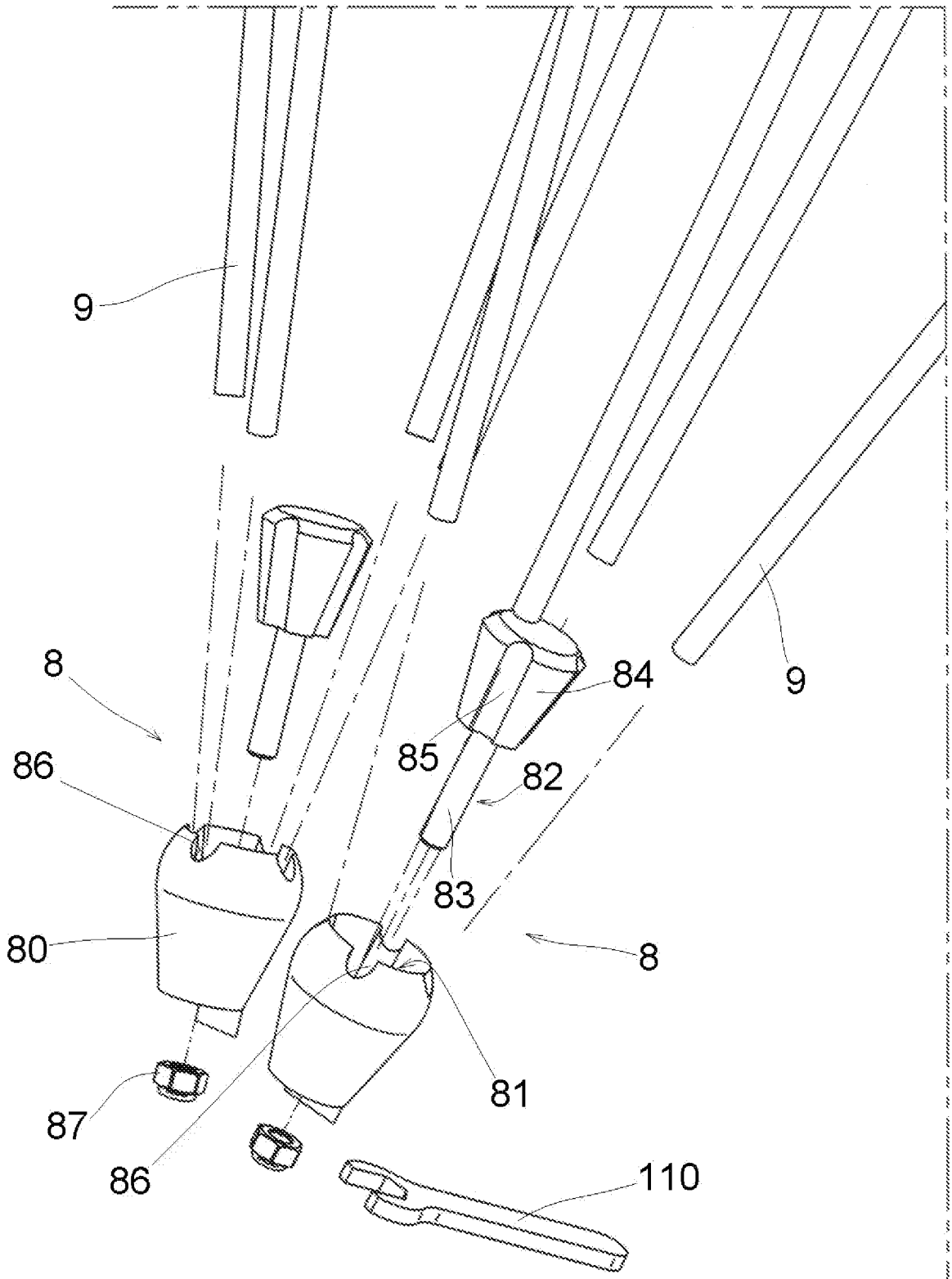

FIG. 6

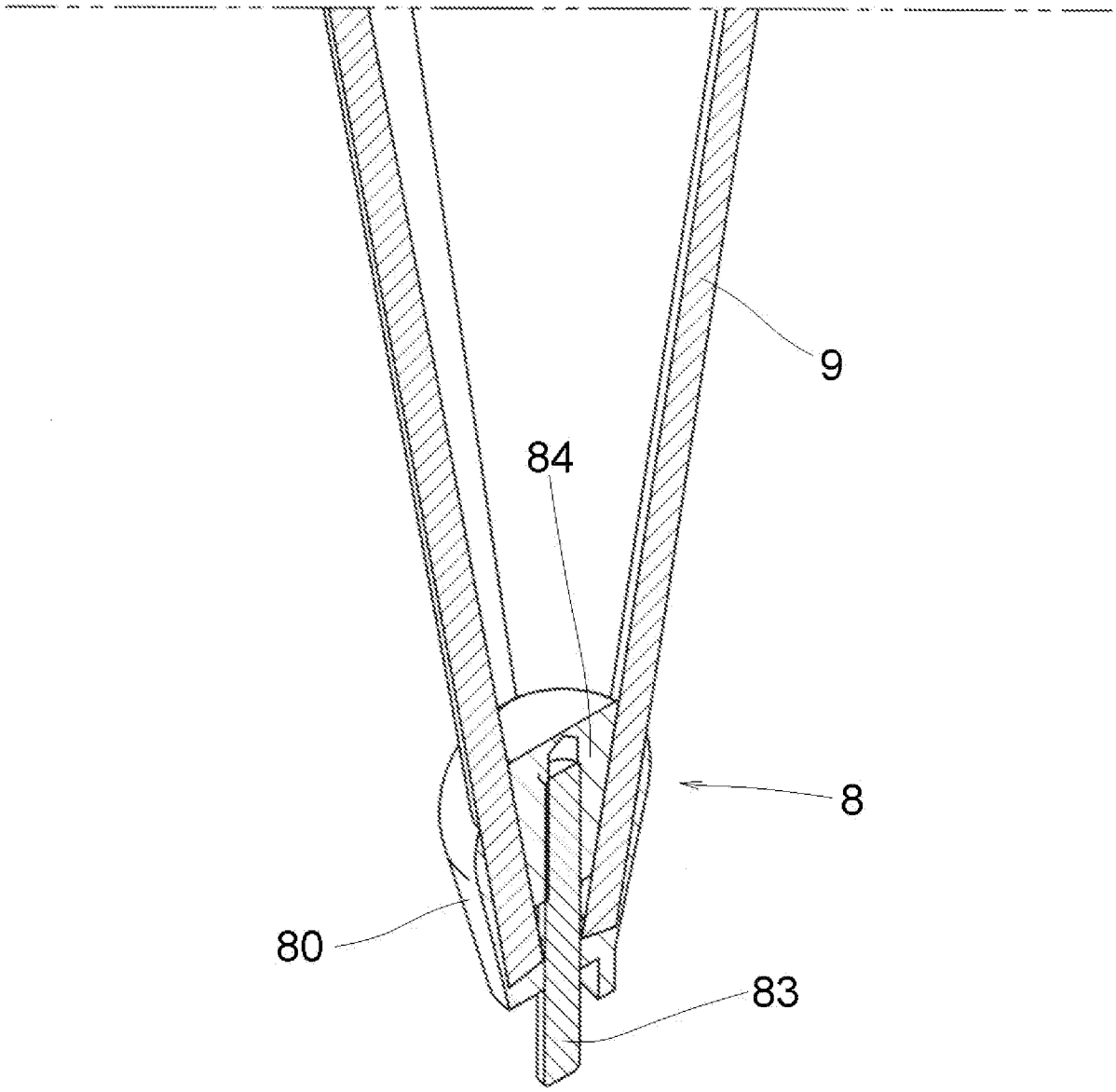

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/068890

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01D46/26
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 051 900 A1 (ZANON S N C DI ZANON FRANCO E [IT] ZANON S R L [IT]) 15 November 2000 (2000-11-15) cited in the application the whole document -----	1-10
A	EP 1 175 823 A1 (PATERLINI REMO [IT]) 30 January 2002 (2002-01-30) the whole document -----	1
A	EP 1 795 064 A1 (CAMPAGNOLA S R L [IT]) 13 June 2007 (2007-06-13) * abstract -----	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 February 2011	25/02/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Espeel, Els

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2010/068890

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