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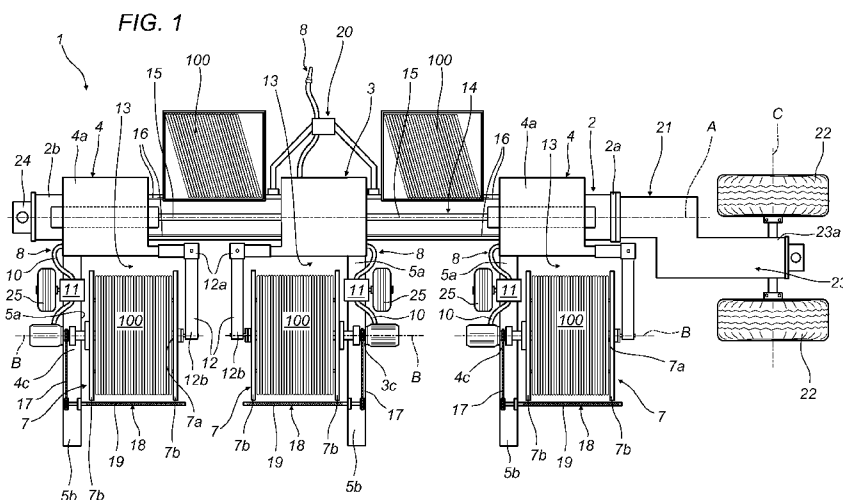
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(54) Title: DEVICE FOR WINDING DRIP IRRIGATION OR MICROIRRIGATION HOSES



(57) Abstract: A device for winding drip irrigation or microirrigation hoses comprises a frame (2) mainly extending along a respective main direction (A), a plurality of arms (3, 4) connected to the frame (2), which are transversally projected towards it and located in sequence along the main direction (A) and a plurality of rollers (7) for winding at least one hose (100), each rotatably connected to one of the arms (3, 4) to rotate around an axis of rotation (B) to roll up and unroll the hose (100).

DESCRIPTION
DEVICE FOR WINDING DRIP IRRIGATION OR MICROIRRIGATION
HOSES.

Technical field

This invention relates to a device for winding drip irrigation or microirrigation hoses.

This invention applies to the sector of farm equipment manufacturing and in particular, to the field of irrigation and intensive cultivations.

The term drip irrigation ("localized irrigation" or also "microirrigation") in this text means an irrigation method which slowly delivers water to plants, both by watering the ground surface surrounding the plant or directly at the root zone, through a system of hoses or pipelines which are generally microperforated to define a plurality of drippers. The aim is to minimize the use of water by delivering a limited and localized quantity of water to various points to wet small areas of soil in the vicinity of the plants, typically by using drippers or micro-sprayers. The delivery of the water may be constant or intermittent; in such a case, drip irrigation is referred to as "user controlled".

Background art

An advanced drip irrigation system envisages laying the microperforated hoses (also called in line drippers) underground so that the drippers may come in direct contact with the root apparatus and at the same time prevent the pipes, which would otherwise be arranged on the ground surface, from hindering the cultivation operations.

In this regard, the microperforated hoses in the prior art are wound (at the factory or on the field) into individual rolls and then unrolled individually when they are laid (typically by hand) on the fields, generally along a plurality of parallel irrigation rows.

As already mentioned, the hoses may be laid on the surface or underground; in this latter case, a preliminary step is envisaged of ditching

the ground to make the channel for housing the hose or pipe.

At the end of the season, the hoses are recuperated for storing in specific warehouses, thus allowing the field to be resodded.

To date, this operation is carried out manually or by whatever means that allow the hose to be rewound once it is freed from the ground.

Disadvantageously, these solutions are particularly inconvenient and costly, both in terms of time and of the physical effort required of the operator.

In effect, the operator must move along the row of the individual hose while rewinding the individual hose onto a specific roller, both to lay and to rewind the hose (moreover one at a time).

Furthermore, if the hose is laid underground, the operator (or the person on his behalf) must first dig the hose out of the ground, which requires significant effort.

Disclosure of the invention

The aim of this invention is to provide a device for winding drip irrigation hoses which overcomes the above mentioned disadvantages of the prior art.

More specifically, the aim of this invention is to provide a high-performance device for winding drip irrigation or microirrigation hoses that is easy to make and use.

Furthermore, the aim of this invention is to provide a device for winding drip irrigation hoses capable of simplifying and speeding up the operations of laying and winding the hoses.

These aims are fulfilled by the device for winding drip irrigation or microirrigation hoses as described in one or more of the appended claims.

Brief description of drawings

Described below by way of a non-limiting example is a preferred embodiment of a device for winding drip irrigation or microirrigation hoses,

as illustrated in the accompanying drawings, in which:

- figure 1 illustrates a schematic plan view of the device for winding drip irrigation or microirrigation hoses according to this invention;
- figure 2 shows a detail of figure 1, in an assembly configuration;
- figure 3 shows the device of figure 1 in an operating configuration;
- figure 4 shows the device for winding drip irrigation or microirrigation hoses in a pulling configuration;
- figures 5 shows a detailed perspective view of a detail of the device for winding drip irrigation hoses according to this invention.

Detailed description of preferred embodiments of the invention

With reference to the accompanying drawings, the numeral 1 denotes a device for winding drip irrigation hoses according to this invention.

It should be noticed, as already underlined, that the term "drip irrigation" in this text means an irrigation method which slowly delivers water to plants, both by watering the ground surface surrounding the plant or directly at the root zone, through a system of hoses or pipelines which are generally microperforated to define a plurality of drippers (or, if necessary, sprayers). Thus, this invention defines a winding device 1 designed to roll up and unroll hoses 100 for drip irrigation 100, preferably perforated (that is microperforated) along the respective extension by a plurality of irrigation holes 101 (which may be equidistant from each other or spaced in the most diverse ways) to facilitate the laying (unrolling) of it.

These hoses 100 are generally made of plastic material, such as for example, rubber, polypropylene or the like.

The hoses may also be of any length that is compatible with the operation of and the weight supported by the winding device 1.

The device 1 comprises a frame 2 mainly extending along a respective main direction "A", to which a plurality of arms 3, 4 are rigidly connected.

This frame 2 is preferably elongated in shape, extending between a first 2a and a second end 2b along the above mentioned main direction "A".

Preferably, the frame 2 is substantially straight in shape; however, it might alternatively be curved or be discontinuous in shape (shaped for example like a crankshaft).

The frame 2 also comprises means 20 for its attachment to a farm machine which are configured to allow the device 1 to be lifted and/or pulled.

These means may be of various types known to experts in the trade.

Preferably, the attachment means 20 are located in a central zone of the frame 2 to allow connection with the farm machine and advancing along a direction which is transversal (preferably orthogonal) to the main direction "A".

In the preferred embodiment, the attachment means 20 are shaped to allow the device 1 to be lifted.

Alternatively, the device 1 could be equipped with an independent drive system (therefore capable of generating power, for example with solar panels, etc.).

The arms 3, 4 transversally project towards the frame 2 and are located in sequence along the main direction "A".

More specifically, the arms 3 protrude from the frame 2 on the same side, so as to each face (and be spaced from) the next arm 3, 4.

Preferably, the arms 3, 4 are substantially parallel to each other.

In the preferred embodiment, each arm 3, 4 is equipped with a wheel 25 for resting on the ground, which is oriented so as to allow the device 1 to be transported orthogonally to the main direction "A" of the frame 2. Thus, these wheels 25 have an axis of rotation which is substantially parallel to the main direction "A".

More specifically, each arm 3, 4 has a first 5a and a second portion 5b, which are connected to each other and are inclined relative to each other to define an elbow 6.

In the embodiment illustrated, there are three arms 3, 4. However, the number of arms could alternatively be less (two) or more (four or more).

The device 1 also comprises a plurality of rollers 7 for winding at least one hose 100, each rotatably connected to one of the arms 3, 4 to rotate around an axis of rotation "B" to roll up and unroll the hose or pipe 100.

Preferably, the axis of rotation "B" is substantially parallel to the main direction "A".

It should be noticed that the roller 7 is connected to the respective arm 3, 4 by means of a rotatable shaft 9a, which defines the axis of rotation "B". Each shaft 9a is connected at an intermediate portion 3c, 4c of the respective arm 3, 4 (in particular, close to the elbow 6).

The rollers 7 comprise a middle core 7a extending parallel to the axis of rotation "B" and a pair of lateral shoulders 7b shaped to contain the hose 100.

In other words, the roller 7 defines a circumferential groove in which the hose 100 is wound.

In some embodiments, the roller 7 is made in one piece to facilitate its disassembly or assembly.

However, at least one of the lateral shoulders 7b can preferably be disconnected from the core 7a to allow the hose 100, which is already in a winding condition, to be replaced or inserted.

In some embodiments (not illustrated), the lateral shoulder is mobile between a closed position where it is abutted and restrained to the core, and an open position, where it is spaced from the core.

Preferably, the rollers 7 are made of lightweight material, such as for example plastic, aluminium or the like, so as to facilitate their replacement and handling.

It should be noticed that the roller 7 is connected to the respective arm 3, 4 by means of a rotatable shaft 9a.

Preferably, each shaft 9a is connected at an intermediate portion 3c, 4c of the respective arm 3, 4 (in particular, close to the elbow 6).

Preferably, the rollers 7 are connected to the respective arms 3, 4 by means of reversible connecting means 9 in order to allow the whole roller

to be replaced.

In the preferred embodiment, the reversible connecting means 9 are defined by a male/female coupling.

Preferably, the connection shaft 9a between arm 3, 4 and roller 7 can be inserted to slide in a respective groove 9b.

As illustrated, the shaft 9a is (rotatably) connected to the arm 3, 4 and extends along the axis of rotation "B", while the groove 9b is formed in the roller 7 (that is, in the core 7a).

Preferably, both the shaft 9a and the groove 9b are polygonal in shape so as to increase the stability of the coupling and the transmission of the rotating motion from the shaft 9a to the groove 9b.

Alternatively, the coupling between roller 7 and arm 3, 4 can be made in other known ways. In effect, this coupling depends on the possibility of using commercial rolls (rollers) or on the weight of the hose 100, and therefore different mechanical couplings may be required for transmitting motion (for example, cantilever). It should be noticed that the device 1 comprises drive transmission means 8 for transmitting motion from a central power unit (farm machine) to each of the rollers 7.

Thus, the drive transmission means 8 are associated with the rollers 7 to place them in rotation around the respective axis of rotation "B" so as to roll up or lay the hoses (therefore with the possibility of inverting rotation or also with the drive idling).

Thus, the drive transmission means 8 are connected to the shafts 9a of the reversible connecting means 9 in order to place them in rotation.

It should be noticed that these drive transmission means 8 may be engaged so as to place the rollers 7 in synchronized rotation, or disengaged, thus allowing the operator to freely decide which hose 100 to operate and how.

In detail, the drive transmission means 8 comprise a hydraulic system 10 associated with each arm 3, 4 for placing the respective roller 7 in rotation. It should be noticed that the actuator means 8 for these devices could also

comprise a pneumatic or electrical or other system.

More specifically, the hydraulic system 10 is configured to be associated with a hydraulic pump (not illustrated) of a farm machine 50.

Alternatively, in an embodiment not illustrated, means which are each directly controlled by a respective central power unit could also be assembled on the device 1.

Furthermore, the hydraulic system 10 comprises a plurality of means 11 for controlling the hydraulic flow 11 (valves) which can be controlled by an operator to independently activate the rotation of the individual rollers 7.

In the embodiment illustrated, each arm 3, 4 is equipped with respective control means 11.

The drive transmission means 8 also comprise a mechanical transmission assembly 17 which cooperates with the hydraulic system 10 for driving the shaft 9a of each roller 7 or other mobile parts of the device 1 (for example, the grooved bar 19 which will be described below).

In the embodiment illustrated, this mechanical transmission assembly 17 comprises a plurality of toothed wheels 17a and chains 17b or belts which cooperate with each other.

In an alternative embodiment, the drive transmission means only comprise the mechanical transmission assembly. In this embodiment, for example, the drive transmission means comprise at least one cardan shaft interposed between the central power unit (of the farm machine 50) and the frame 2.

Alternatively, according to a variant not illustrated, the device 1 could comprise respective independent actuator means, defined for example by electrical motors or the like.

Preferably, each arm 3, 4 is associated with an auxiliary arm 12 spaced from it and substantially parallel to define a fork 13 for housing and supporting the roller 7.

Thus, each auxiliary arm 12 comprises a first end 12a, which is proximal to the frame 2, and a second end 12b, which is distal from the frame 2.

Preferably, the auxiliary arm 12 is mobile relative to the frame 2, between a closed and an open configuration.

More specifically, the second end 12b of the auxiliary arm is mobile between a position close to the arm 3, 4 (in which it faces the elbow 6) and a position spaced from it.

For that purpose, the auxiliary arm 12 is hinged at the respective first end 12a to allow the rotation of the auxiliary arm 12 around an axis which is orthogonal to it, between the closed configuration (corresponding to the position close to the second end 12b) and the open configuration (corresponding to the position spaced from the second end 12b).

Advantageously, by opening the fork 13, the roller 7 is simple and fast to replace (Figure 2).

Preferably, at least one of the arms 3, 4 is slidably associated with the frame 2 to move relative to it along the main direction "A".

Thus, at least one of the arms is a mobile arm 4.

It should be noticed that the expression "mobile arm 4" as used below refers to the arms capable of translating along the main direction "A".

Preferably, the mobile arms 4 within the device are such in number as to allow the variation of each centre distance between two consecutive arms 3, 4.

In general, if the number "n" of arms 3, 4 is odd, it is sufficient for there to be at least "n-1" mobile arms 4.

If the number "n" of arms 3, 4 is even, it is preferable for there to be "n" mobile arms 4.

In the embodiment illustrated, there are two mobile arms 4 (out of a total of three arms 3, 4).

More specifically, the two end arms 4 are mobile approaching and proceeding away from a central arm 3.

Advantageously, this way it is possible to vary the distance between the rollers 7 as a function of the distance between two adjacent irrigation rows. Consequently, the device 1 is very versatile.

Each mobile arm 4 is associated with a shoe which slides along a guide 16.

Thus, each mobile arm 4 preferably comprises a base portion 4a (from which the first portion 5a extends) defining a sliding carriage along the frame 2 (that is along the guide 16 which is integral with the frame 2).

The mobile arm 4 may be manually driven or may be associated with specific drive means 14.

For example, the mobile shafts 4 may be connected to the frame 2 by means of idle couplings in order to allow the operator to move them manually.

The drive transmission means 8 however preferably comprise drive means 14 associated with the above mentioned mobile arms 4 (and in particular with the portions of base 4a or carriages) for adjusting the position of them along the main direction "A" of the frame 2.

Thus, the drive means 14 can be associated with the central power unit (that is with the farm machine 50 or with the respective means of the device) to drive the mobile arms 4 independently along the guide while adjusting their position.

Preferably, the drive means 14 are hydraulic, that is directly controlled by the hydraulic system 10 (or, when necessary, pneumatic or electrical or other).

More specifically, the drive means 14 comprise at least one hydraulic (or pneumatic) cylinder 15 which is operatively interposed between the frame 2 and at least one mobile arm 4 to drive it along the main direction "A".

Preferably, the drive means 14 comprise a plurality of hydraulic cylinders 15, each associated with a respective mobile arm 4.

In the embodiment illustrated, each hydraulic cylinder 15 is interposed between the respective mobile arm 4 (in particular, the base portion 4a) and the fixed adjacent arm 3 (and thus the frame 2).

The drive means 14 are also equipped with a control unit (not illustrated) which can be activated and controlled by the operator to vary the position

of the mobile arms 4a.

Alternatively, the drive means could be partly mechanical.

In a first alternative embodiment (not illustrated), the drive means comprise a lead screw extending along the main direction "A".

This lead screw is rotatably connected to the frame 2 to rotate around the respective axis of extension and each mobile arm 4 is associated with the lead screw by means of a respective nut.

In a second alternative embodiment (not illustrated), the drive means are at least partly defined by a transmission chain or belt system.

In both cases described above, the lead screw or the transmission chain system, or like the rollers 7, can be connected to the central power unit of the farm machine 50 (or by means of the central power unit(s) of the device 1 itself) to be placed in rotation.

It should be noticed that the drive means could also be independent, that is they could also be driven independently by a respective central power unit of the device 1, which could be motorized.

Preferably, the device also comprises at least one hose guide element 18 associated with each roller 7 and positioned in front of it in a position which is distal from the frame 2 relative to the axis of rotation "B" of the roller 7 to allow the hose 100 to be wound or unrolled properly.

This hose guide element 18 is configured to translate the hose 100 transversally to its winding direction to ensure the roll is even and prevent the hose 100 from being damaged.

In the embodiment illustrated, the hose guide element 18 is defined by a rotatable grooved bar 19 extending parallel to the axis of rotation "B" of the respective roller 7. Preferably, the grooved bar 19 is connected to the drive means 8 to rotate at the same time as the roller 7.

More specifically, the grooved bar 19 is connected to the shaft 9a for rotating the roller 7 (preferably by means of chain means).

The grooved bar 19 is equipped with a plurality of grooves or shoulders 19a for housing the hose 100 which is thus driven so as to roll it up in

layers (that is with alternating motion) between the two shoulders of the roller 7.

The device for guiding the hose or pipe can be constructionally of another type, for example with electronic activation or with hydraulic or electric servo-control.

To facilitate the transport of the device along public roads (city and suburban road network), the device 1 comprises one or more pulling means 21 equipped with at least one drive wheel 22 which rotates around a rolling axis "C" which is transversal to the main direction "A" of the frame 2.

In other words, the pulling means 21 allow the device 1 to be pulled along the advancing direction corresponding to the main direction of the frame 2, thus reducing the transversal space occupied on the road.

In the embodiment illustrated, the pulling means 21 comprise a longitudinal bar 23 for extending the frame 2, which is equipped, at a free end 23a of it, with a pair of drive wheels 22.

Thus, the longitudinal bar 23 extends starting from the first end 2a of the frame 2 and proceeding away from it.

In this embodiment, the pulling means 21 also comprise, located at the second end 2b of the frame 2, an element 24 for connecting with a farm machine 50.

It should be noticed that there could also be two longitudinal bars 23, located on opposite sides of the frame 2, to allow stable resting on the ground even when there is no farm machine.

Furthermore, the pulling means 21 could also be located at several points of the frame 2 (that is both at the ends 2a, 2b and in intermediate zones).

Moreover, the wheels can then also be mounted on the device with an offset "L" relative to the central axis "A" to better balance the structure.

Preferably, the longitudinal bar 23 is connected to the frame 2 in a removable manner, to allow the removal of it when the device is being used.

Alternatively, the longitudinal bar 23 could be mobile between a lowered operating position, where the wheels 22 rest on the soil, and a raised non-operating position, where the wheels do not hinder the movement of the device 1 which is transversal to the main direction "A".

Furthermore, to facilitate transport, the pulling means 21 could also be equipped with rotating modules configured to rotate/bend like a hinge (90°) relative to the frame 2. In this way, the length of the device 1 is significantly reduced. Lightweight devices could also be transported by the tractor by means of the middle hitch built in the middle part of the frame 2.

The device according to the embodiment illustrated in figure 4 could also have a connecting point on the side opposite to the one depicted in the figure, to allow better and easier driving of the device by the operator in special cases.

Furthermore, the device 1 in the embodiment illustrated comprises one or more compartments for housing one or more rolled hoses 100 (or rolls) waiting to be used.

The invention achieves the preset aims and brings important advantages.

The presence of a plurality of rollers located in sequence along the frame allows several hoses to be laid and wound, or rewound, with ease along the irrigation rows.

Furthermore, the possibility of driving the rollers towards and away from each other allows the device to be adapted to the needs of the operator as a function of the irrigation type and of the dimensions of the field.

The use of actuator means which can be selectively and independently activated gives the operator maximum freedom when using the device.

Furthermore, the reversible connection between each roller and the respective arm (or fork) allows the roll to be replaced with ease, without having to wind it in advance on the roller of the device.

Furthermore, the use of lightweight materials to make the rollers significantly reduces the driving effort required by the operator.

The presence of the pulling elements shaped to allow longitudinal pulling

(that is parallel to the main direction of the frame) is of particular usefulness and convenience during road transport.

It should be noticed that other connecting points are also possible for transporting the device, as already mentioned, or the device can have autonomous drive means.

By partly modifying the shape of the device, it can also be installed on other types of farm machines which can, for example, be used for seeding, thus allowing the hose to be laid out (on the ground or underground) at the same, in this case, at the same time as seeding.

CLAIMS

1. A device for winding drip irrigation or microirrigation hoses, characterized in that it comprises:

- a frame (2) mainly extending along a respective main direction (A);
- a plurality of arms (3, 4) rigidly connected to the frame (2), which are transversally projected towards it and located in sequence along the main direction (A);
- a plurality of rollers (7) for winding at least one hose (100), each rotatably connected to one of the arms (3, 4) to rotate around an axis of rotation (B) to roll up and unroll the hose (100).

2. A device according to claim 1, characterized in that it comprises drive transmission means (8), which are operatively interposed between a central power unit (50) and each of the rollers (7) to place them in rotation around the respective axis of rotation (B) so as to roll up or lay the hoses (100).

3. A device according to claim 1 or 2, characterized in that at least one of the arms (4) is slidingly mobile relative to the frame (2) to translate relative to it along the main direction (A).

4. A device according to claim 3, characterized in that it comprises means (14) for driving the at least one mobile arm (4) configured to translate it along a guide (16) while adjusting its position.

5. A device according to claim 4, characterized in that the drive transmission means (8) comprise a hydraulic system (10) configured to be associated with a farm machine (50) and associated with each arm (3, 4) to place the respective roller (7) in rotation; the drive means (14) comprising at least one hydraulic cylinder (15) associated with the

hydraulic system (10) and operatively interposed between the frame (2) and the at least one mobile arm (4) to drive it along the main direction (A).

6. A device according to any one of the preceding claims, characterized in that it comprises at least one microperforated drip irrigation or microirrigation hose (100) wound on each winding roller (7).

7. A device according to any one of the preceding claims, characterized in that it comprises at least one hose guide element (18) associated with each roller (7) and positioned in front of it in a position which is distal from the frame (2) relative to the axis of rotation (B) of the roller (7) to allow the hose (100) to be wound properly.

8. A device according to claim 7, characterized in that the hose guide element (18) is defined by a rotatable grooved bar (19), which extends parallel to the axis of rotation (B) of the roller (7) and is equipped with one or more shoulders (19a) configured to drive the hose (100) with alternating motion between the two shoulders (7b) of the roller (7) in order to roll it up in layers.

9. A device according to any one of the preceding claims, characterized in that it comprises means (20) for its attachment to a farm machine (50) and which are configured to allow lifting and/or pulling the device.

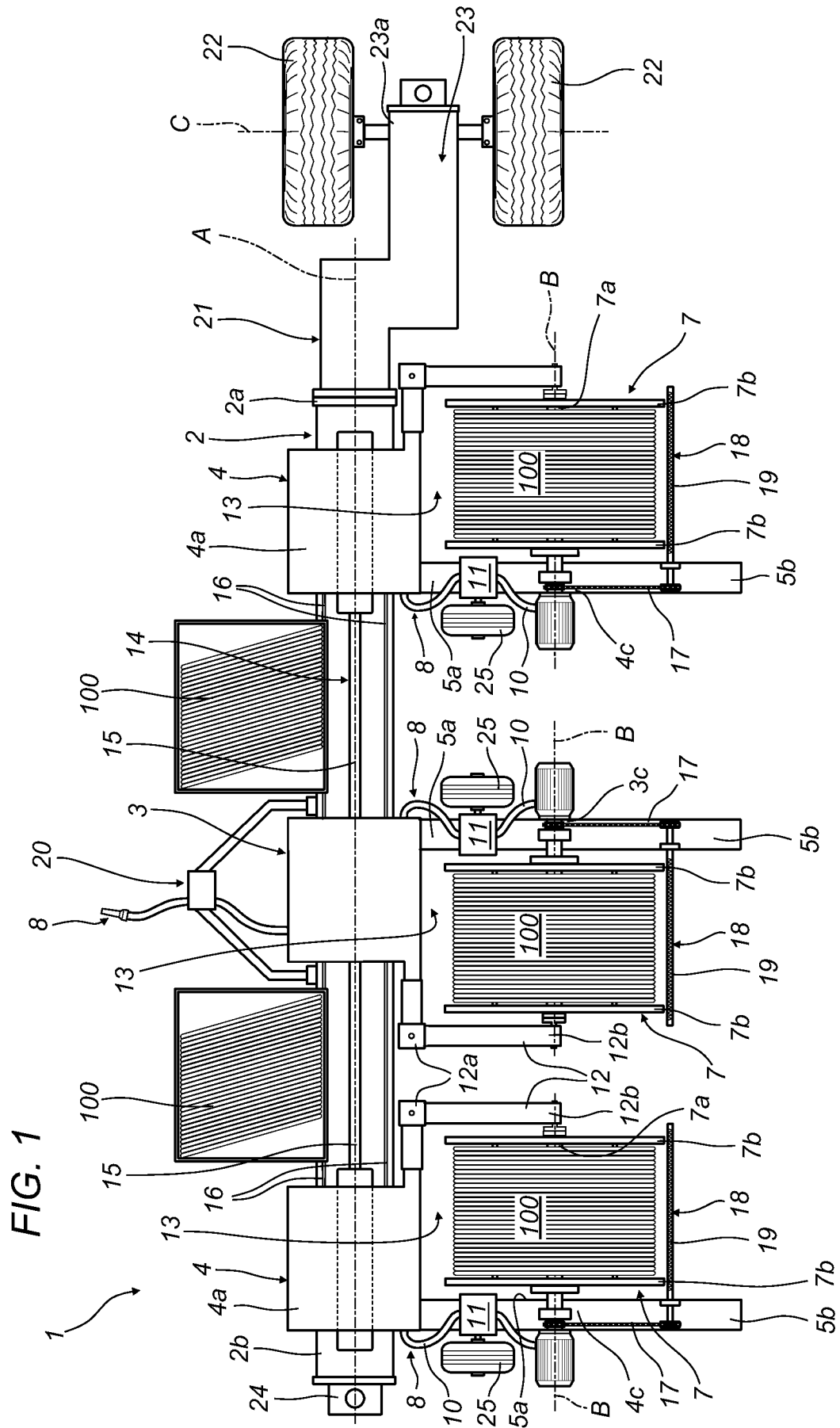
10. A device according to any one of the preceding claims, characterized in that it comprises one or more pulling means (21) equipped with at least one drive wheel (22) which rotates around a rolling axis (C) which is transversal to the main direction (A) of the frame (2).

11. A device according to claim 10, characterized in that the pulling element (21) comprises a longitudinal bar (23) for extending the frame (2)

and equipped, at a free end (23a) of it, with a pair of drive wheels (22).

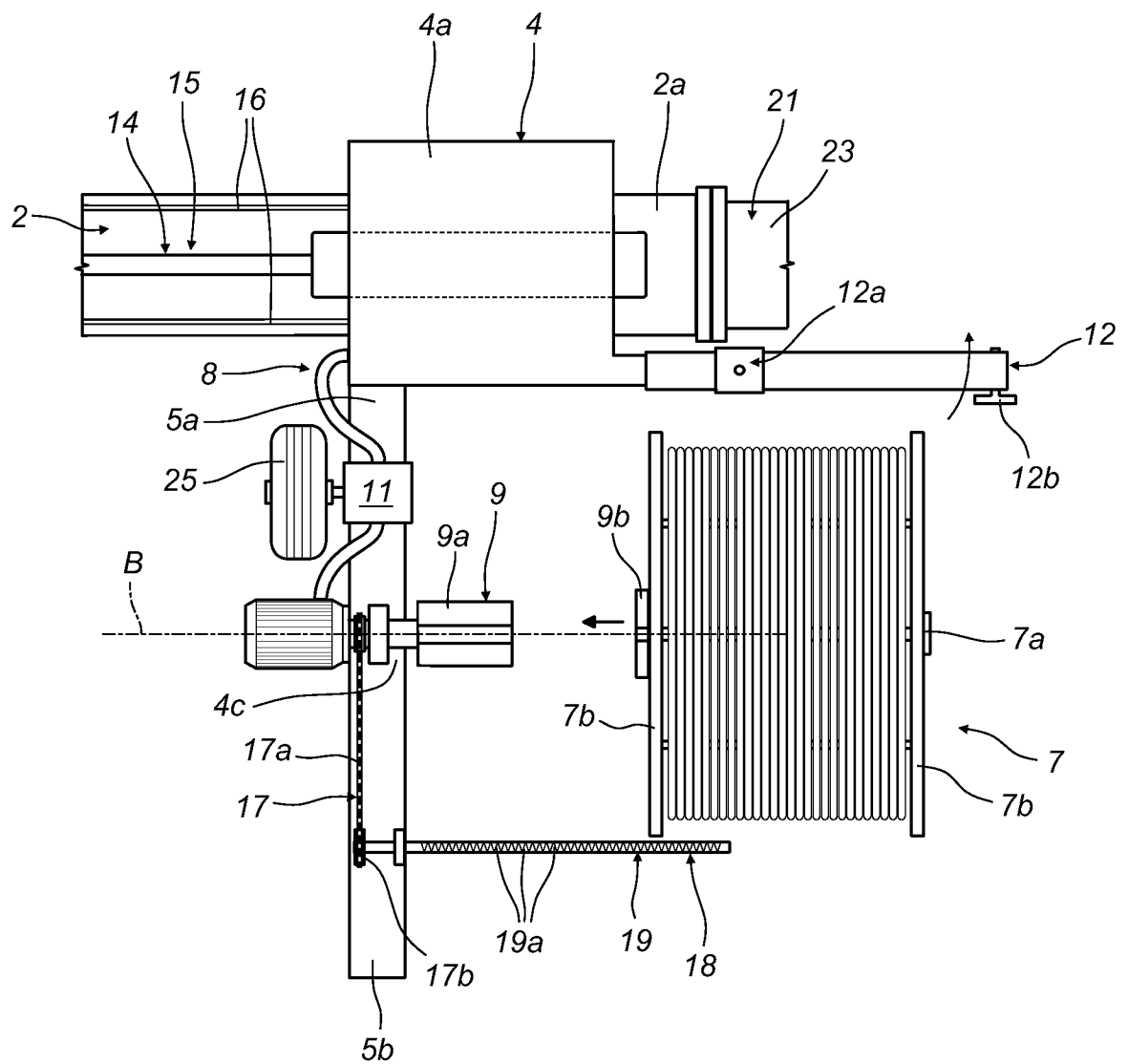
12. A device according to any one of the preceding claims, characterized in that each roller (7) is coupled to its respective arm (3, 4) by reversible connecting means (9).

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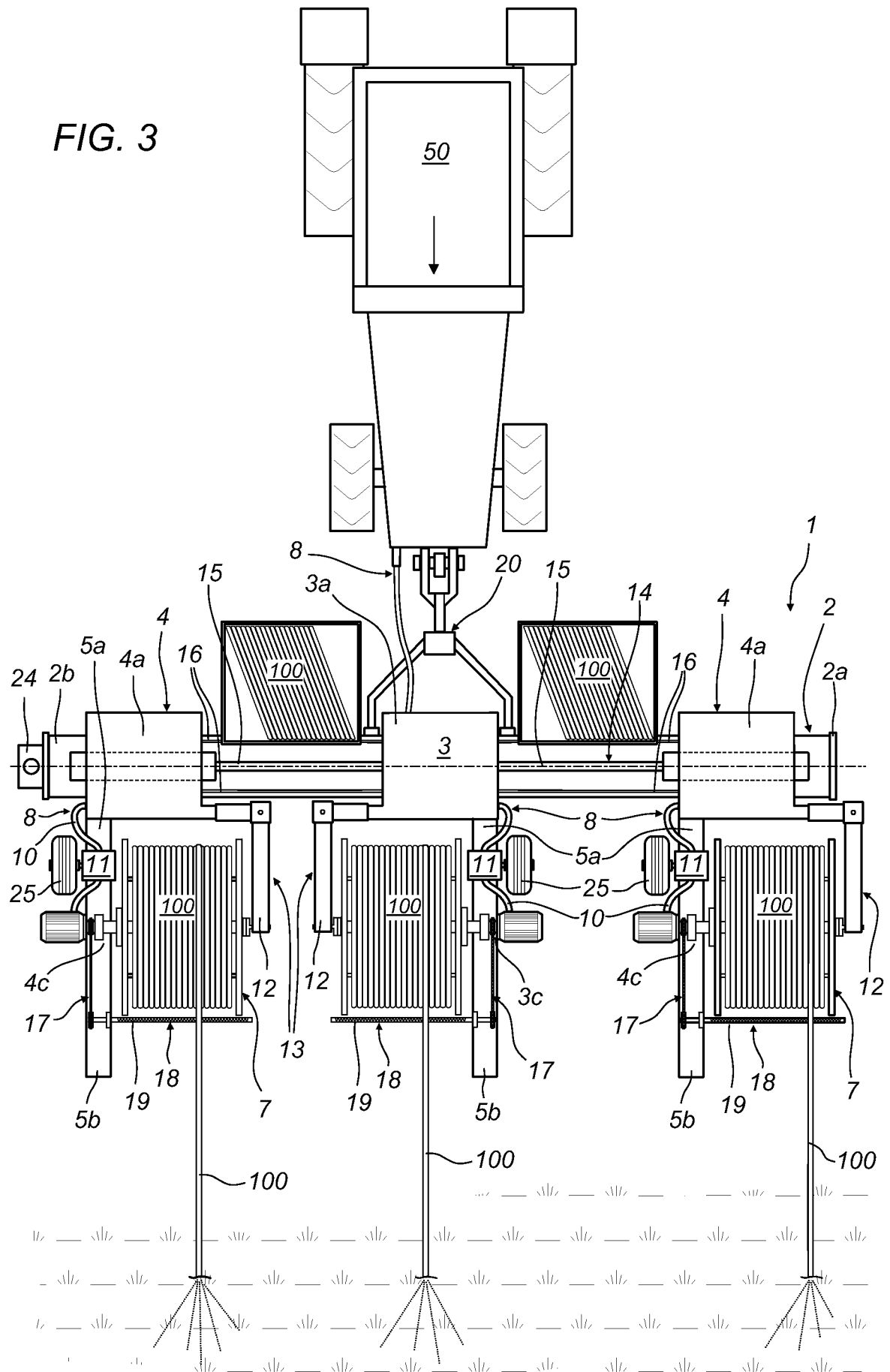
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FIG. 2

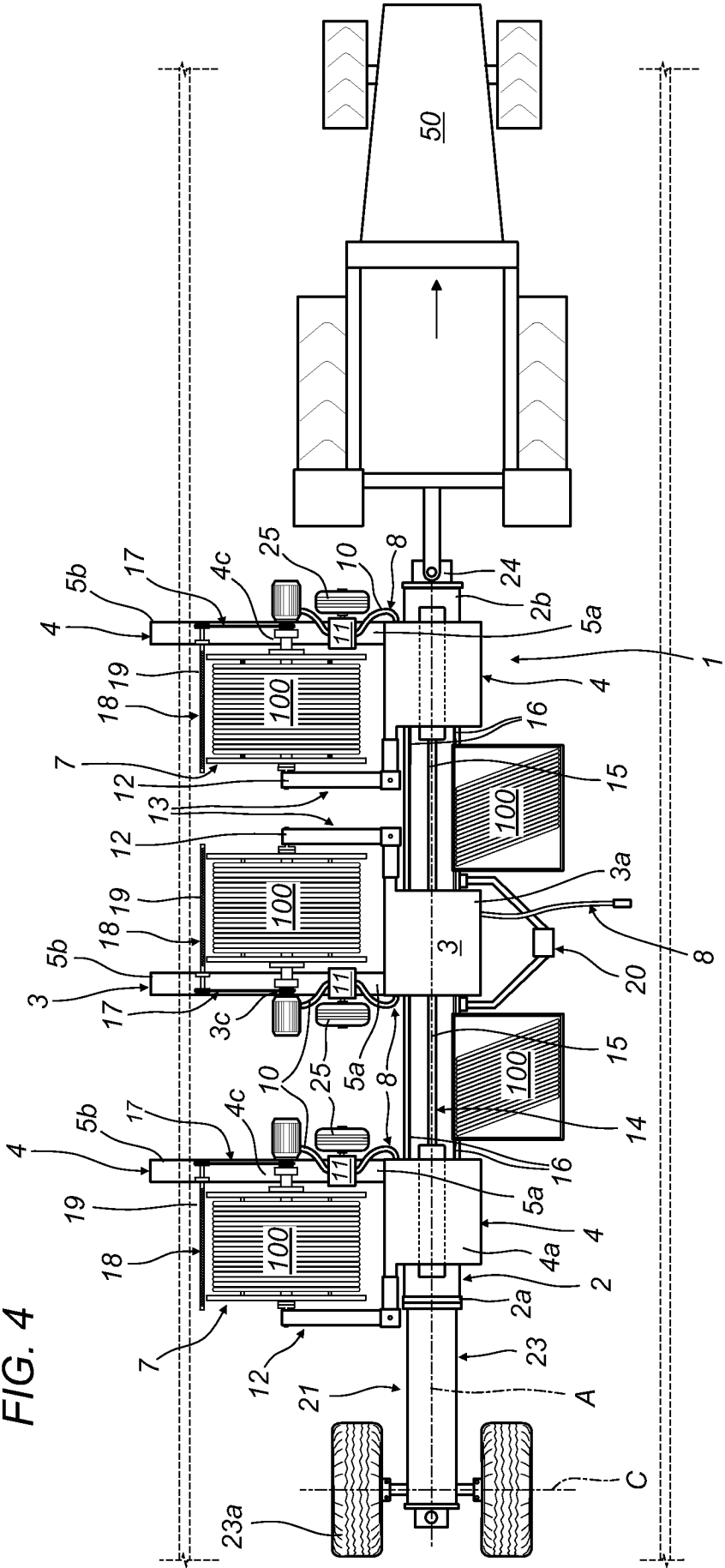


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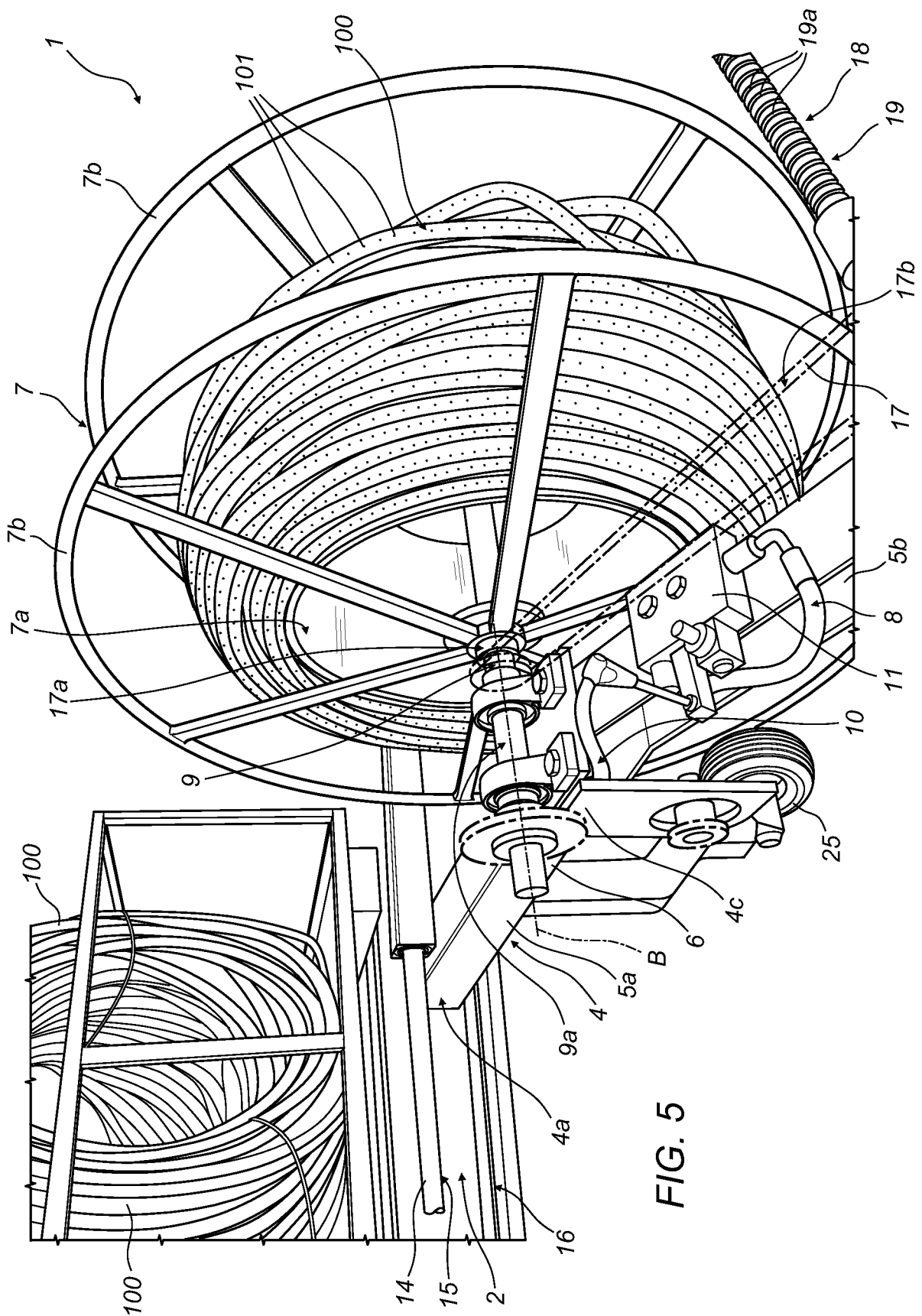
FIG. 3



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5/5



INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/055005

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01G25/09 A01B73/00
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)
A01G A01B B65H

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	FR 2 634 969 A1 (CHAGNAUD LUC [FR]; FERMIN EMILE [FR]) 9 February 1990 (1990-02-09) page 3, lines 23-25; figure 1	1,2,9 10-12 3-5,8
X Y	----- GR 2004 0100 277 A (BAKOULAS CHARALABOS) 24 February 2006 (2006-02-24) figure 1	1,6,9 10-12
X Y	----- US 4 586 677 A (NEVAREZ ENRIQUE F [US]) 6 May 1986 (1986-05-06) figures 1,9,14 column 4, line 14	1,2,6,7, 9 10-12
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☒ 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

4 November 2013

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INTERNATIONAL SEARCH REPORT

International application No

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