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(54) **Title:** TOWING APPARATUS FOR AGRICULTURAL MACHINES, OF THE TYPE OF BALERS, ROUND BALERS AND THE LIKE

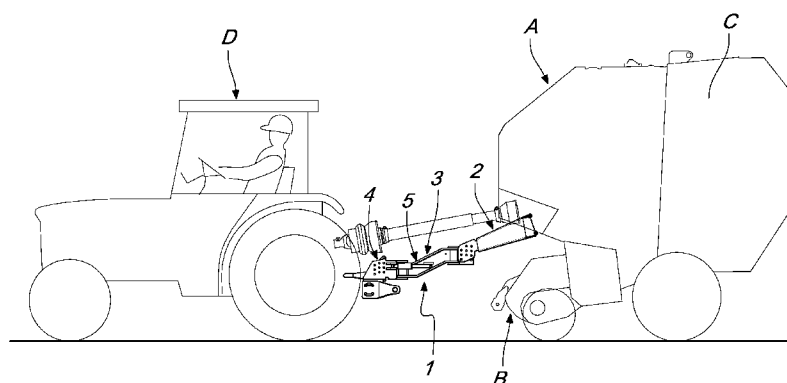


Fig. 4

(57) **Abstract:** A towing apparatus for agricultural machines of the type of balers, round balers and the like, which comprise at least one device for gathering previously-cut agricultural products, of the type of grass, wheat, maize, hay, forage, and the like, and a chamber (C) for the accommodation and compression of the agricultural products, which are received from the gathering device (B), for the formation of a bale. The towing apparatus comprises at least one first member (2), which can be coupled to the agricultural machine (A) and is associated with a second member (3); the second member (3) is in turn associated with a third member (4), which can be coupled to a tractor (D) for towing the agricultural machine (A). Either or both of the first member (2) and the second member (3) is controlled by at least one respective actuator (5), for the movement of the agricultural machine (A) at least partially independently of the advancement of the tractor (D).



TOWING APPARATUS FOR AGRICULTURAL MACHINES, OF THE  
TYPE OF BALERS, ROUND BALERS AND THE LIKE

The present invention relates to a towing apparatus for agricultural machines, of the type of balers, round balers and the like.

5 As is known, in the agricultural sector there is often the necessity to gather previously-cut products from the ground, such as grass, wheat, maize, hay, forage, and the like, in order to be able to subsequently compress them into bales of various shapes and sizes.

The bales can in fact be easily transported and stored (or more  
10 generally, enable a simpler management of the agricultural products that make them up, as a function of the specific purposes for which they are destined).

In order to form the bales, the use is frequent of agricultural machines, called "balers" or "forage presses", which are first of all provided  
15 with a pick-up apparatus, which is capable of picking up the agricultural products that the machine progressively encounters during its advancement.

At the rear of the above mentioned apparatus, such machines are further provided with a chamber for the compression of the agricultural products (which are received from the pick-up apparatus), so as to be able to  
20 carry out the formation of the bale.

Among the various different types of machines that are covered by the above mentioned category, a role of undoubted importance is occupied by "round balers", which produce cylindrical bales.

Although sometimes the pick-up apparatus, the chamber and the drive  
25 unit all form part of the same vehicle, and thus move on the ground supported by the same chassis, usually round balers are substantially constituted by a an operating unit (provided with the pick-up apparatus and the chamber) that has to be towed by an independent tractor, which in turn is driven by a driver.

30 The coupling between the tractor and the operating unit is thus

obtained by way of a towing device, which according to methods that are now widely consolidated comprises a towbar arranged according to the direction of travel, which extends at the front of the operating unit and is typically rigidly coupled thereto. At its free end the towbar is provided with  
5 means of fixed rotatable engagement with the tractor, and, in the latter case, such means usually comprise a ring-shaped element, called "towing eye", which can accommodate, rotatably, a pin that is rigidly coupled to the rear portion of the tractor.

However, such implementation solutions are not devoid of drawbacks.  
10 It should in fact be observed that, after harvesting, usually the agricultural products are gathered along ordered rows (called "windrows"), which are distributed along the agricultural ground, and which thus define the path along which the agricultural machine has to be progressively moved.

Moreover, for various reasons the windrows sometimes do not have a  
15 regular and linear progression (or constant width), and/or the agricultural products are not evenly distributed along them.

In such circumstances, the driver of the tractor is forced to perform continual detours and/or complex maneuvers, in order to "follow" the irregularities of the windrow and prevent the bale formation chamber from  
20 being fed in a patchy and uneven manner over time, since this would result in the production of bales that are in turn incomplete or uneven.

Moreover, for the driver it is not always possible or in any case practical to perform the necessary maneuvers and in any case it seems clear that the need to perform continual detours and course adjustments is wholly  
25 inconvenient and results in an increase in the time necessary to complete the gathering, with consequent unwelcome decrease in productivity.

The aim of the present invention is to solve the above mentioned problems by providing a towing apparatus for balers, round balers, and similar agricultural machines, that ensures the optimal formation of the bale,  
30 even in the event of uneven distribution on the ground of the agricultural

products to be picked up and compressed.

Within this aim, an object of the invention is to provide a towing apparatus that ensures the optimal formation of the bale, without requiring constant corrections to the course of the tractor, in order to follow any  
5 irregularities of the windrow.

Another object of the invention is to provide a towing apparatus that ensures the optimal formation of the bale, without requiring the driver to constantly check the distribution of the agricultural products on the ground, in order to make the necessary corrections.

10 Another object of the invention is to provide a versatile towing apparatus, that can be effectively coupled to tractors of different types and/or destined for different markets, in compliance with local regulations governing the sector.

Another object of the invention is to provide a towing apparatus that  
15 ensures a high reliability of operation.

Another object of the invention is to provide a towing apparatus that can be easily implemented using elements and materials that are readily available on the market.

Another object of the invention is to provide a towing apparatus that  
20 is low cost and safely applied.

This aim and these objects are achieved by a towing apparatus for agricultural machines of the type of balers, round balers and the like, which comprise at least one device for gathering previously-cut agricultural products, of the type of grass, wheat, maize, hay, forage, and the like, and a  
25 chamber for the accommodation and compression of the agricultural products, which are received from the gathering device, for the formation of a bale, characterized in that it comprises at least one first member, which can be coupled to the agricultural machine and is associated with a second member, said second member being in turn associated with a third member,  
30 which can be coupled to a tractor for towing the agricultural machine, either

or both of said first member and said second member being controlled by at least one respective actuator, for the movement of the agricultural machine at least partially independently of the advancement of the tractor.

Further characteristics and advantages of the invention will become better apparent from the description of a preferred, but not exclusive, embodiment of the towing apparatus according to the invention, which is illustrated by way of non-limiting example in the accompanying drawings wherein:

Figure 1 is a perspective view of the towing apparatus according to the invention;

Figure 2 is a side view of the towing apparatus in Figure 1;

Figure 3 is a view from above of the towing apparatus in Figure 1;

Figure 4 is a schematic side view of the towing of an agricultural machine by a tractor, by way of the apparatus in Figure 1;

Figure 5 is a schematic side view of the towing of an agricultural machine, using a different mounting arrangement, by a tractor, by way of the apparatus in Figure 1;

Figures 6 to 8 are schematic views from above of the towing of an agricultural machine by a tractor by way of the apparatus according to the invention, and show the operation thereof.

With reference to the figures, the reference numeral 1 generally designates a towing apparatus for agricultural machines A of the type of balers, round balers and the like: as is known, the machines A comprise first of all at least one device B for gathering previously-cut agricultural products, of the type of grass, wheat, maize, hay, forage, and the like.

Furthermore, the agricultural machine A comprises a chamber C for the accommodation and compression of the agricultural products, which are received from the gathering device B, in order to thus be capable of forming a bale (which is usually, but not exclusively, cylindrical).

In more detail therefore, in the preferred application the apparatus 1 is

intended for the towing of machines A of the substantially known type described above, for the purpose of moving them along a piece of agricultural land and first of all gathering the above mentioned agricultural products, which usually have already been cut and are on the ground, piled  
5 so as to form one or more ordered rows, called windrows.

The gathering device B picks up the agricultural products, usually by way of a plurality of torsion springs that are made to rotate about a horizontal axis by a shaft facing the ground, and, with the aid of adapted cowlings, feeds those agricultural products into the chamber C, in which  
10 they are compressed according to conventional methods until the desired bale is formed.

Although in the preferred application, which is repeatedly referred to in the present discussion, the agricultural machine A is of the type of a rotobaler and the like, adapted to the formation of a usually cylindrical bale A, it  
15 should be noted however that the possibility is not ruled out of adopting the apparatus 1 according to the invention for towing other types of agricultural presses, or even for other agricultural machines A, while remaining within the scope of protection claimed herein.

According to the invention, the towing apparatus 1 comprises first of  
20 all at least one first member 2, which can be coupled to the agricultural machine A and is associated with a second member 3. Furthermore, the second member 3 is in turn associated with a third member 4; the latter can be coupled to a tractor D (which is also for example conventional), when it is desired to perform the towing of the agricultural machine A.

25 In addition, either or both of the first member 2 and the second member 3 is controlled by at least one respective actuator 5, in order to move the agricultural machine A at least partially independently of the advancement of the tractor D and so be able to follow the irregularities of distribution of the agricultural products, while maintaining a constant  
30 advancement direction E for the tractor D (and thus achieving, from this

point onward, the set aim).

In particular, the first member 2, which can be coupled rigidly to the agricultural machine A (according to methods that will be explained in the following pages for the purposes of non-limiting example), is pivoted at the  
5 opposite end to the second member 3 about a first substantially vertical rotation axis F.

In the embodiment illustrated in the accompanying figures, it is furthermore the second member 3 that is controlled by the actuator 5, which in turn is connected at the opposite end to the third member 4.

10 The third member 4, which can be coupled rigidly to the tractor D according to methods that will also be explained in the following pages for the purposes of non-limiting example, is pivoted to the second member 3 about a second substantially vertical rotation axis G (and thus parallel to the first axis F).

15 Even more specifically, and as can be seen clearly from Figures 1, 2 and 3, in the preferred embodiment the actuator 5 is constituted substantially by a hydraulic cylinder, which comprises first of all a substantially cylindrical jacket 6, which is articulated with one of its ends to at least one contoured tab 7, protruding from the third member 4. Furthermore, the  
20 cylinder comprises a piston 8, which is at least partially slideable within the jacket 6 and is articulated, with its free end, to a contoured crest 9 protruding from the second member 3.

The sliding of the piston 8 in the jacket 6, which can be driven according to the methods that will for example be described below,  
25 determines the rotation of the second member 3 about the second axis G and, consequently, the rotation about the first axis F of the first member 2, and, with the latter, of the agricultural machine A.

It should still be noted however that the possibility is not ruled out of using one or more actuators 5 of different type, for the movement of the  
30 second member 3 (or of the first member 2), while remaining within the

scope of protection claimed herein.

Conveniently, the towing apparatus 1 according to the invention comprises automatic means of control and management of the actuator 5 (or of the actuators 5, in embodiments that have two or more thereof), in order  
5 to be able to automatically activate it, and thus obtain, as a consequence, the automatic movement of the agricultural machine A independently of the advancement direction E of the tractor D.

In particular, in the preferred embodiment, the automatic means of control and management comprise at least one detection sensor, direct or  
10 indirect, of the pressure, which can be arranged in the chamber C of the agricultural machine A.

Furthermore, the automatic means comprise an electronic unit for driving the actuator 5, which is associated with the sensor (or sensors), and which can be arranged on board the tractor D or on board the agricultural  
15 machine A, according to specific requirements.

Thanks to such components, it is thus possible to automatically activate the actuator 5 (in order to move the agricultural machine A) in the presence of irregularities in the bale formation process, in that such irregularities, as is known, can be detected by way of monitoring the  
20 progression of the pressure value inside the chamber C, such monitoring being performed by the sensor (or sensors).

In more detail, as a function of the information acquired by way of the sensor (or sensors), the control unit (a controller or a PLC for example) can act on hydraulic valves that are connected to the hydraulic cylinder (or  
25 hydraulic cylinders).

It should be noted that the sensors can be selected from any type, and be adapted to detect the pressure value in one or more conveniently selected points of the chamber C (the value being directly correlated to the progressive filling of the chamber C with the agricultural products).

30 For example, although the possibility is not ruled out of adopting

sensors capable of detecting the pressure directly, each sensor can be a potentiometer, capable of monitoring the pressure, and thus the filling of the chamber C, by way of the measurement of the movement or of the oscillation (depending, as noted, on the pressure value) of a respective  
5 reference plate, which is conveniently arranged in the chamber C.

The possibility is not ruled out moreover of identifying other values to monitor, during the bale formation process, for the purposes in any case of making available to the electronic unit the data necessary to promptly identify anomalies in the bale being progressively formed, and thus enable  
10 the unit (conveniently programmed and/or provided with adapted software) to promptly intervene, by driving the actuator 5 and thus the movement of the agricultural machine A.

In an embodiment of significant practical interest, shown in the accompanying figures for the purposes of non-limiting example of the  
15 application of the invention, the first member 2 comprises a first fork 10, which defines a first rotatable accommodation seat for a first pivot 11 that is arranged according to the first rotation axis F and is coupled to the second member 3.

With further reference to the embodiment shown in the accompanying  
20 figures, the first fork 10 of the first member 2 is rigidly fixed, according to a configuration selected from a plurality of different configurations (which can be obtained according to the methods that will be explained in the paragraphs below), to a supporting bracket 12 for a pair of contoured bars  
13.

25 As schematically shown for example in Figures 6, 7 and 8, (and according to methods that are also conventional), in turn the contoured bars 13 can be rigidly anchored to the agricultural machine A so as to obtain the coupling between the towing apparatus 1 according to the invention and the agricultural machine A.

30 In order to obtain the possibility of rigid fixing according to a

plurality of different configurations, as previously mentioned, the supporting bracket 12 and the first fork 10 have a plurality of respective slots 14: thus, at least some selected such slots 14 can be mutually aligned (in the mounting step) in order to be able to insert first fixing elements  
5 therein, of the type of nails, rivets, screws, and the like.

So assuming, for example, that the supporting bracket 12 and the bars 13 (which are fixed to the agricultural machine A) are kept immobile, in the mounting step it is possible to make the first fork 10 slide with respect to the bracket 12, while still being able to arrive at the mutual alignment between  
10 at least some slots 14, and thus, consequently, the rigid fixing of the bracket 12 to the first fork 10 according to a configuration selected from a plurality of different configurations.

In the embodiment shown for the purposes of non-limiting example in the accompanying figures, the third member 4 comprises a second fork 15,  
15 which defines a second rotatable accommodation seat for a second pivot 16 that is arranged along the second rotation axis G and is coupled to the second member 3.

Even more specifically, the second fork 15 is fixed to a pair of contoured plates 17, which can be rigidly anchored to the tractor D  
20 (according to methods that will be explained in the paragraphs below), so as to obtain the coupling between the tractor D and the towing apparatus 1 according to the invention.

Advantageously, the plates 17 support, according to an arrangement selected from a plurality of different arrangements, a rigid support 18 of a  
25 towing eye 19, which can be coupled rotatably to a fixed pin that is integral with the tractor D.

More specifically, the plates 17 and the support 18 have a plurality of respective holes 20: in a substantially similar fashion as that for the first fork 10 and the bracket 12, at least some selected such holes 20 can be  
30 mutually aligned, in order to insert second fixing elements therein, of the

type of nails, rivets, screws, and the like.

So again, in the mounting step it is possible to move the support 18 with respect to the plates 17 (or vice versa), until the mutual alignment is reached of at least some holes 20, and thus, consequently, the rigid coupling  
5 is obtained between the towing eye 19 and the plates 17, and the second fork 15, according to a mutual arrangement selected from a plurality of different mutual arrangements.

The holes 20 and the slots 14 thus make it possible to obtain repeated course corrections, corresponding to mutual deployments of the three  
10 members 2, 3 and 4, and thus offer a first possibility of adapting the apparatus 1 according to the invention to the specific dimensions of the machine A and of the tractor D that is to tow it.

The coupling between the third member 4 and the tractor D is finally completed by S-shaped metal sheets 21: each sheet 21 is in fact welded to a  
15 respective plate 17 and, at the opposite end, defines an orifice 22 that can be aligned with a respective slit that is provided on a corresponding beam H that protrudes from the rear of the tractor D, so as to allow the insertion of a locking element.

Conveniently, in the preferred embodiment, one of the plates 17  
20 defines a pair of protruding tabs 7, mutually parallel, which rotatably support the jacket 6 of the hydraulic cylinder.

With further reference to the preferred, non-limiting embodiment of the application of the invention, the second member 3 is constituted substantially by a profiled element that defines, at its mutually opposite end  
25 portions 3a, 3b, the first pivot 11 and the second pivot 16.

Even more specifically, the profiled element is substantially made up of the two above mentioned end portions 3a, 3b, mutually parallel, and of an intermediate portion 3c, inclined (and in any case aligned, in the longitudinal direction, with the two end portions 3a, 3b).

30 Thus, thanks to the non-rectilinear progression thus defined for the

profiled element that constitutes the second member 3, it is possible to rotatably couple the second member 3 to the first member 2 according to at least two different mounting options (which are clearly shown in Figures 4 and 5).

5 In the first mounting option (Figure 4), which is obtainable by conveniently orienting the profiled element, the first pivot 11 is arranged at a higher vertical height with respect to the second pivot 16, and consequently with respect to the towing eye 19, and it is thus possible to use the towing apparatus 1 according to the invention in order to tow  
10 agricultural machines A by way of tractors D that have the fixed pin (and more generally the towing elements) at a low height from the ground.

Vice versa, in the second mounting option (Figure 5), which is obtained starting from the first by rotating, ideally through 180°, the profiled element about the advancement direction E, the first pivot 11 is  
15 arranged at a lower vertical height with respect to the second pivot 16, and consequently with respect to the towing eye 19. In the second mounting option it is thus possible to use the towing apparatus 1 according to the invention in order to tow agricultural machines A by way of tractors D which have the fixed pin (and more generally the towing elements) at a high  
20 distance from the ground.

It should be noted that in a first implementation of the concepts explained above, the towing apparatus 1 can be sold with two different second members 3, each one of which is provided with a respective protruding crest 9 and can be coupled rotatably with a same first member 2  
25 and a same third member 4. Thus, each second member 3 can as needed provide a respective mounting option, of the two described above.

Preferably, in order to keep down costs and simplify logistics management, the (same) second member 3 defines two protruding crests 9, which, as can be seen from the accompanying figures, are arranged at the  
30 mutually opposite sides of the intermediate portion 3c.

Thus, in each one of the at least two mounting options described above, the free end of the piston 8 can be articulated to a respective protruding crest 9 of the (same) second member 3.

It should be noted that the two mounting options described in the foregoing paragraphs (and illustrated in Figures 4 and 5) do not exhaust the possible mounting options of the apparatus 1, while remaining within the scope of protection claimed herein.

Firstly in fact, the members 2, 3 and 4 (and optionally the actuator 5) are mutually coupled in a different manner to that outlined above, so as to obtain further mounting arrangements.

Furthermore, the possibility is not ruled out of providing second members 3 (and/or optionally first members 2 and third members 4) of different shapes and dimensions, for the express purpose of ensuring, in the assembly step, the possibility to choose further mounting options.

Moreover, as has previously been seen, each one of the two mounting options described in detail corresponds on its own in effect to innumerable modes of mutual fixing between the supporting bracket 12 and the first fork 10 (thanks to the slots 14), as with between the plates 17 and the support 18 (thanks to the holes 20), and this, on the basis of just the two mounting options shown, makes it possible to obtain a virtually infinite number of configurations.

Operation of the towing apparatus according to the invention is the following.

During normal agricultural activities, and according to substantially conventional methods, the machine A can be towed by the tractor D in order to be moved along a piece of agricultural land: the tractor D follows a rectilinear course, usually defined by the windrows that were provided previously, and behind it the gathering device B picks up the agricultural products, to feed to the chamber C and progressively form the bale.

Thus, for as long as the process of formation occurs properly, the

members 2, 3 and 4 are substantially aligned along the advancement direction E (as in Figure 6) and the agricultural machine A, towed by the tractor D, continues in turn along the advancement direction E.

When the control unit detects anomalies in the bale formation process (according to the methods described previously), owing to, as has been seen, an uneven distribution of the agricultural products on the ground, it activates the actuator 5.

The sliding of the piston 8 within the jacket 6 thus determines the rotation, about the second axis G, of the second member 3 with respect to the third member 4 (which is integral with the tractor D and thus, in fact, fixed) and, consequently, the rotation of the first member 2 with respect to the second member 3 about the first axis F.

As a consequence, the agricultural machine A is forced to perform a translational motion at right angles to the advancement direction E (proportionally to the extent, variable at will, of the rotation imposed on the second member 3 by the piston 8), thus bringing itself for example into one of the two positions illustrated in Figures 7 and 8 (which correspond to the rotations in the two directions of the second member 3, which in turn depend on the sliding of the piston 8 in the two opposite directions).

Thus, the towing apparatus 1 ensures the correct formation of the bale under all operating conditions, in that it enables the machine A to follow the irregularities of formation of the windrow and/or move toward the region of the ground on which the agricultural products are piled the most, without requiring any course correction of the tractor D, which can thus freely proceed in its rectilinear motion along the advancement direction E.

Thanks to the towing apparatus 1, the feeding of the chamber C can thus still occur with sufficient evenness, even when, by contrast, the distribution of the agricultural products is not uniform (a situation that, as has been seen, with conventional agricultural machines results in an inadequate filling of the chamber and the formation of uneven bales).

Moreover, such result is obtained entirely automatically (thanks to the sensors and to the control unit), without requiring any intervention of the driver or other operator, who can in fact ignore the distribution of the agricultural products on the ground.

5 Obviously, the possibility is not excluded of providing towing apparatuses 1 according to the invention in which control of the actuator 5 is entrusted (exclusively, or as an alternative to the control unit) to the driver (or other human operator), where the specific requirements make it preferable.

10 It should furthermore be noted that the towing apparatus 1 is undoubtedly versatile, thanks to the numerous possibilities (described previously) for adjustment and adaptation of the three members 2, 3 and 4, to the specific dimensions of the machine A and of the tractor D, and to the specific requirements (and to the regulations).

15 In fact, it has been seen that the holes 20 and the slots 14 make it possible to modify the mutual arrangements of the three members 2, 3 and 4 at will, thus adapting the encumbrances, and in general the dimensions and the distances between centers, to the specific requirements.

Furthermore, the various mounting options that can be obtained make  
20 it possible to adapt the towing apparatus 1 according to the invention to the different operating conditions under which the agricultural machines A and the tractors D must operate in each instance, in relation in particular to the vertical height at which to perform the coupling between the various components involved in the towing and more generally in relation to the  
25 different tow hook systems that various national regulations impose.

In practice it has been found that the towing apparatus according to the invention fully achieves the set aim and objects in that the use of a first member, which can be coupled to an agricultural machine and is associated with a second member, which in turn is associated with a third member that  
30 can be coupled to a tractor, for towing the agricultural machine, with either

or both of the first member and the second member being controlled by at least one respective actuator, makes it possible to move the agricultural machine at least partially independently of the advancement of the tractor and therefore ensures the optimal formation of the bale, even in the event of  
5 uneven distribution on the ground of the agricultural products to be picked up and compressed.

The invention, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims. Moreover, all the details may be substituted by other,  
10 technically equivalent elements.

In the embodiments illustrated, individual characteristics shown in relation to specific examples may in reality be substituted with other, different characteristics, existing in other embodiments.

In practice, the materials employed, as well as the dimensions, may be  
15 any according to requirements and to the state of the art.

The disclosures in EPA No. 14425131.1 from which this application claims priority are incorporated herein by reference.

Where the technical features mentioned in any claim are followed by reference numerals and/or signs, those reference numerals and/or signs have  
20 been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference numerals and/or signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference numerals and/or signs.

CLAIMS

1. A towing apparatus for agricultural machines (A) of the type of balers, round balers and the like, which comprise at least one device (B) for gathering previously-cut agricultural products, of the type of grass, wheat, maize, hay, forage, and the like, and a chamber (C) for the accommodation and compression of the agricultural products, which are received from the gathering device (B), for the formation of a bale, characterized in that it comprises at least one first member (2), which can be coupled to the agricultural machine (A) and is associated with a second member (3), said second member (3) being in turn associated with a third member (4), which can be coupled to a tractor (D) for towing the agricultural machine (A), either or both of said first member (2) and said second member (3) being controlled by at least one respective actuator (5), for the movement of the agricultural machine (A) at least partially independently of the advancement of the tractor (D).

2. The towing apparatus according to claim 1, characterized in that said first member (2), which can be coupled rigidly to the agricultural machine (A), is at the opposite end pivoted to said second member (3) about a first substantially vertical rotation axis (F), said second member (3) being controlled by said at least one actuator (5), which is connected at the opposite end to said third member (4), said third member (4), which can be coupled rigidly to the tractor (D), being pivoted to said second member (3) about a second substantially vertical rotation axis (G).

3. The towing apparatus according to claim 2, characterized in that said at least one actuator (5) is constituted substantially by a hydraulic cylinder, comprising a substantially cylindrical jacket (6), articulated with one of its ends to at least one contoured tab (7) protruding from said third member (4), and a piston (8), at least partially able to slide within said jacket (6) and articulated, with its free end, to a contoured crest (9) protruding from said second member (3).

4. The towing apparatus according to one or more of the preceding claims, characterized in that it comprises automatic means of control and management of said at least one actuator (5), for its automatic activation, and the consequent automatic movement of the agricultural machine (A) independently of the advancement direction (E) of the tractor (D).

5. The towing apparatus according to claim 4, characterized in that said automatic means of control and management comprise at least one detection sensor, direct or indirect, of the pressure, which can be arranged in the chamber (C) of the agricultural machine (A), and an electronic unit for driving said actuator (5), which is associated with said at least one sensor, for the automatic activation of said actuator (5) in the presence of irregularities in the bale formation process, which are detectable by way of monitoring the progression of the pressure value inside the chamber (C), said monitoring being performed by said at least one sensor.

6. The towing apparatus according to one or more of the preceding claims, characterized in that said first member (2) comprises a first fork (10), which defines a first rotatable accommodation seat for a first pivot (11) that is arranged according to said first rotation axis (F) and coupled to said second member (3).

7. The towing apparatus according to claim 6, characterized in that said first fork (10) of said first member (2) is rigidly fixed, according to a configuration selected from a plurality of different configurations, to a supporting bracket (12) for a pair of contoured bars (13), which can be rigidly anchored to the agricultural machine (A).

8. The towing apparatus according to claim 7, characterized in that said supporting bracket (12) and said first fork (10) have a plurality of respective slots (14), at least some selected said slots (14) being mutually alignable for the insertion of first fixing elements, of the type of nails, rivets, screws, and the like, and, consequently, the rigid fixing of said bracket (12) to said first fork (10) according to a configuration selected from a plurality

of different configurations.

9. The towing apparatus according to one or more of the preceding claims, characterized in that said third member (4) comprises a second fork (15), which defines a second rotatable accommodation seat for a second pivot (16) that is arranged along said second rotation axis (G) and coupled to said second member (3).

10. The towing apparatus according to claim 9, characterized in that said second fork (15) is fixed to a pair of contoured plates (17) that can be rigidly anchored to the tractor (D), said plates (17) supporting, according to an arrangement selected from a plurality of different arrangements, a rigid support (18) of a towing eye (19) that can be rotatably coupled to a fixed pin, which is integral with the tractor (D).

11. The towing apparatus according to claim 10, characterized in that said plates (17) and said support (18) have a plurality of respective holes (20), at least some selected said holes (20) being mutually alignable, for the insertion of second fixing elements, of the type of nails, rivets, screws, and the like, and, consequently, the rigid coupling between said towing eye (19) and said plates (17), and said second fork (15), according to a mutual arrangement selected from a plurality of different mutual arrangements.

12. The towing apparatus according to claim 10, characterized in that one of said plates (17) defines a pair of said protruding tabs (7), mutually parallel, for the rotatable support of said jacket (6) of said hydraulic cylinder.

13. The towing apparatus according to one or more of the preceding claims, characterized in that said second member (3) is constituted substantially by a profiled element that defines, at its mutually opposite end portions (3a, 3b), said first pivot (11) and said second pivot (16).

14. The towing apparatus according to claim 13, characterized in that said profiled element is substantially composed of said two end portions (3a, 3b), mutually parallel, and of an intermediate portion (3c), inclined, for the

possibility of rotatable coupling of said second member (3) to said first member (2) according to at least one first mounting option, in which said first pivot (11) is arranged at a higher vertical height with respect to said second pivot (16), and consequently with respect to said towing eye (19),  
5 and a second mounting option, in which said first pivot (11) is arranged at a lower vertical height with respect to said second pivot (16), and consequently with respect to said towing eye (19).

15. The towing apparatus according to claim 14, characterized in that said second member (2) defines two of said protruding crests (9), which are  
10 arranged at the mutually opposite sides of said intermediate portion (3c), in each one of said at least two mounting options said free end of said piston (8) being articulated to a respective protruding crest (9).

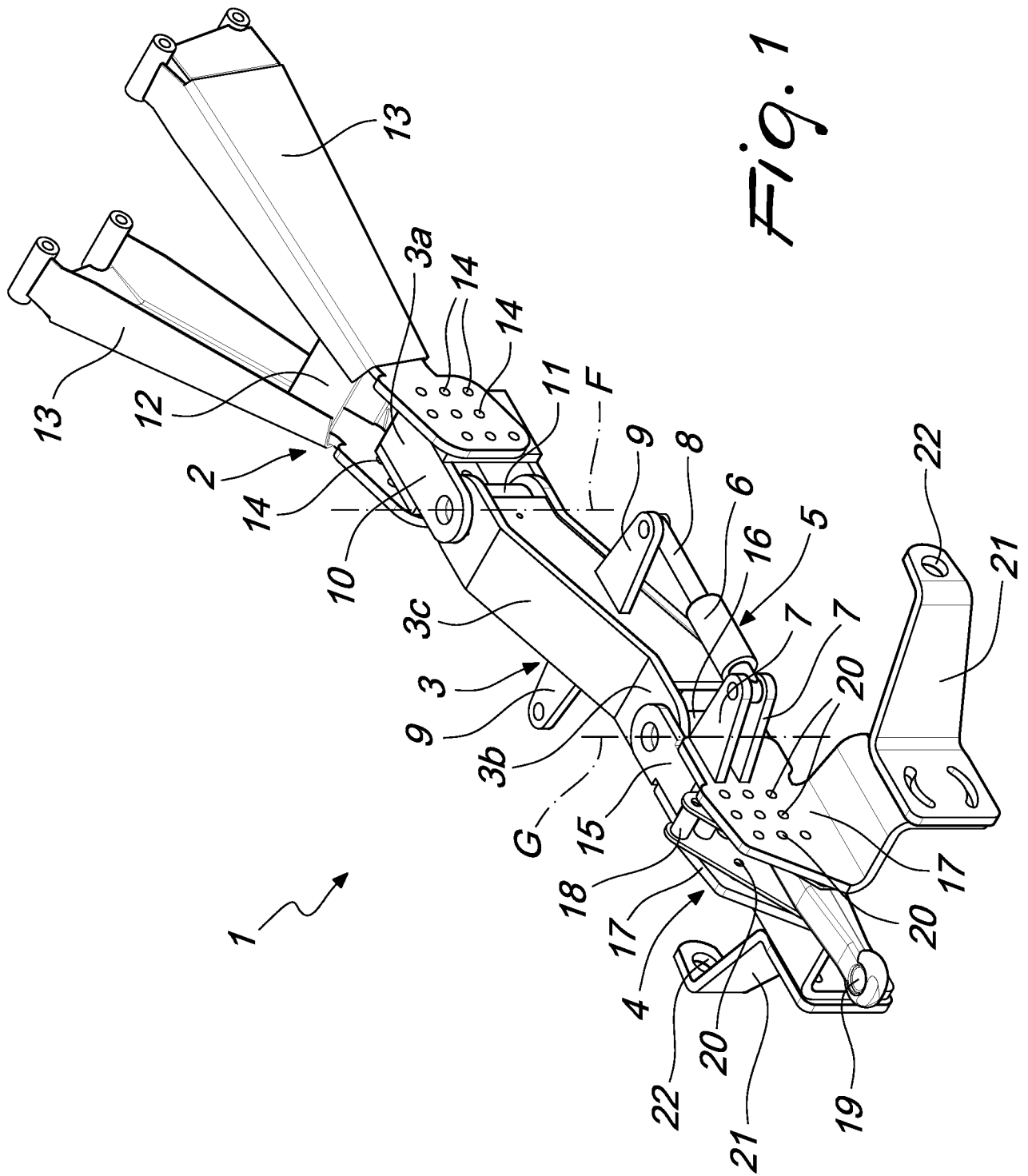
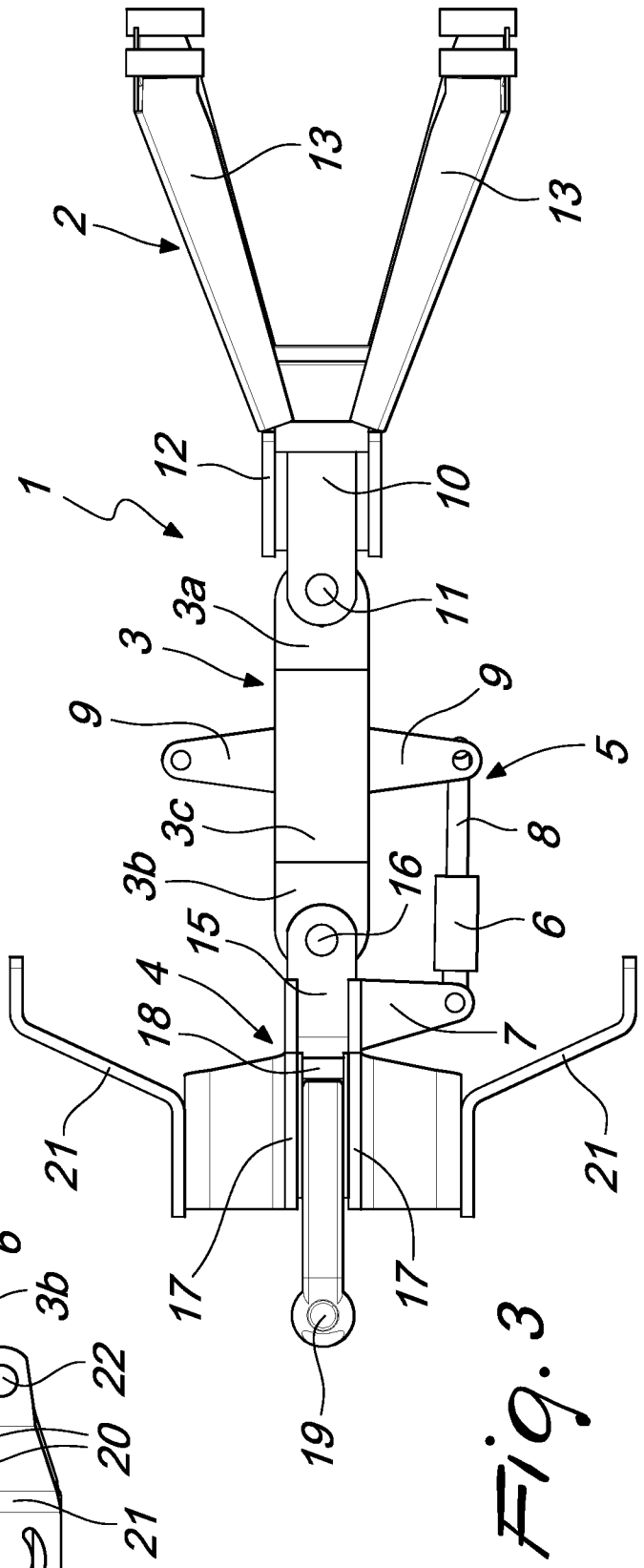
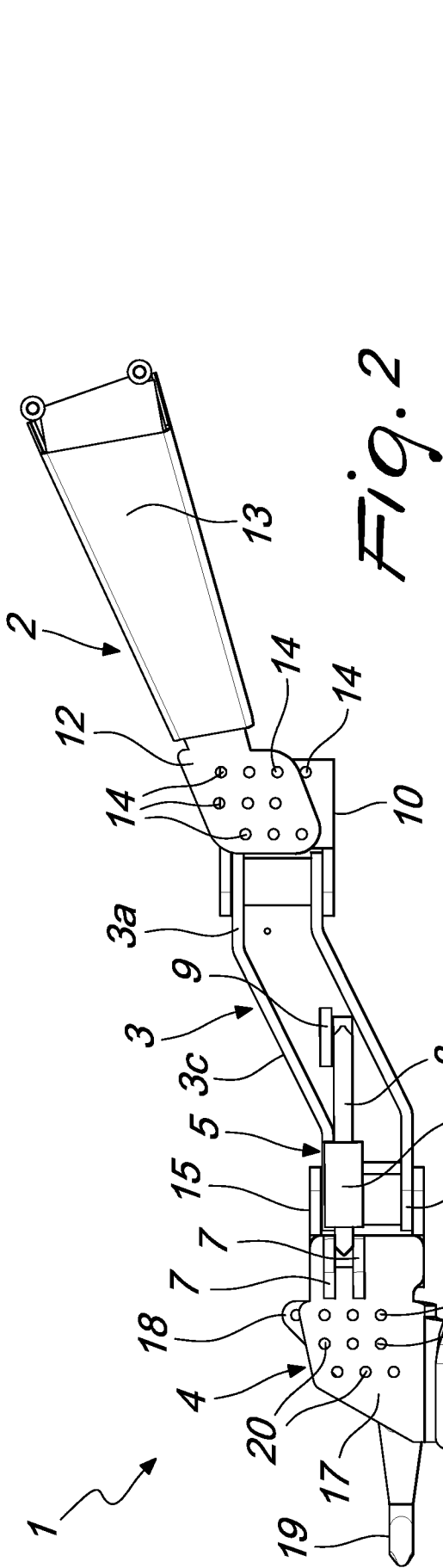


Fig. 1



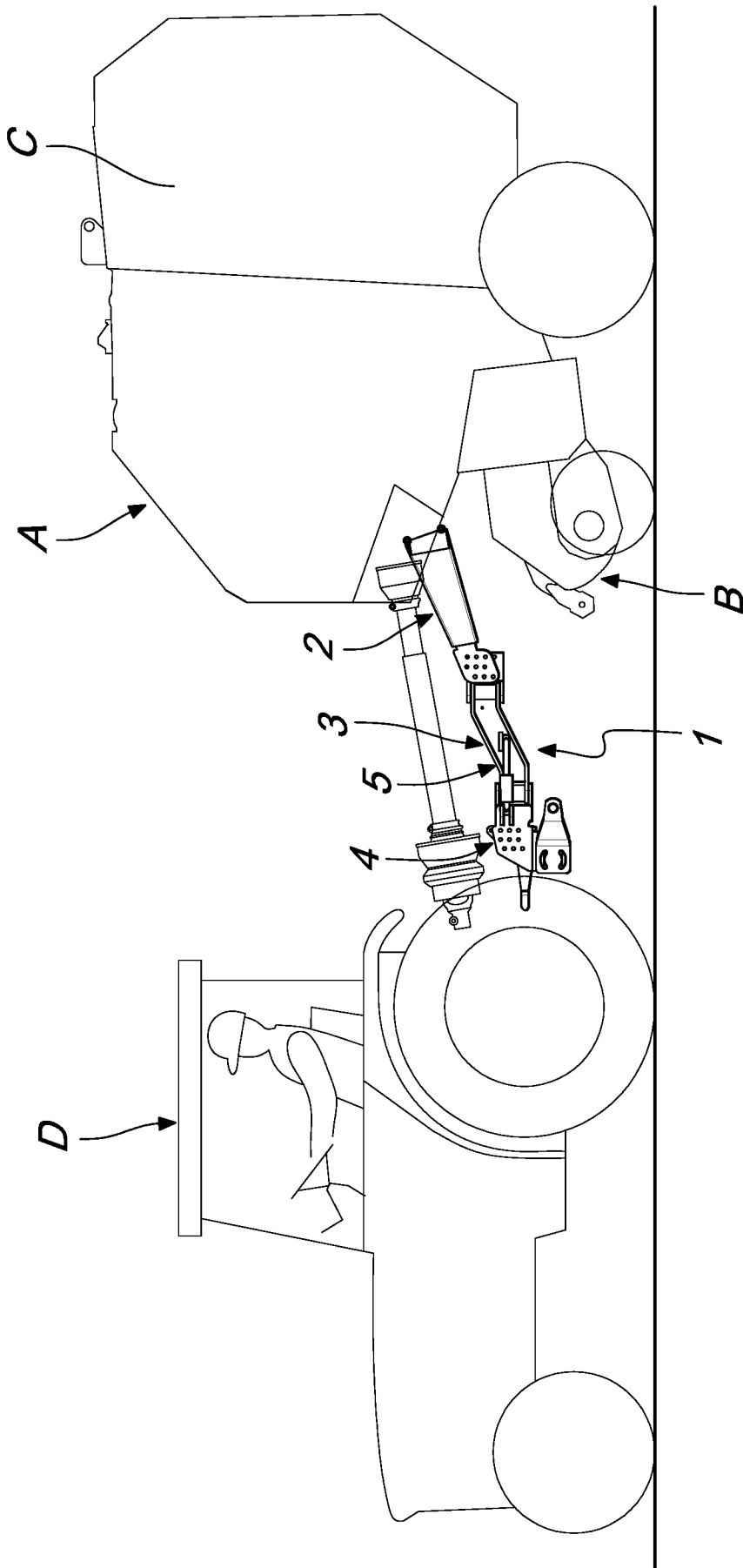


Fig. 4

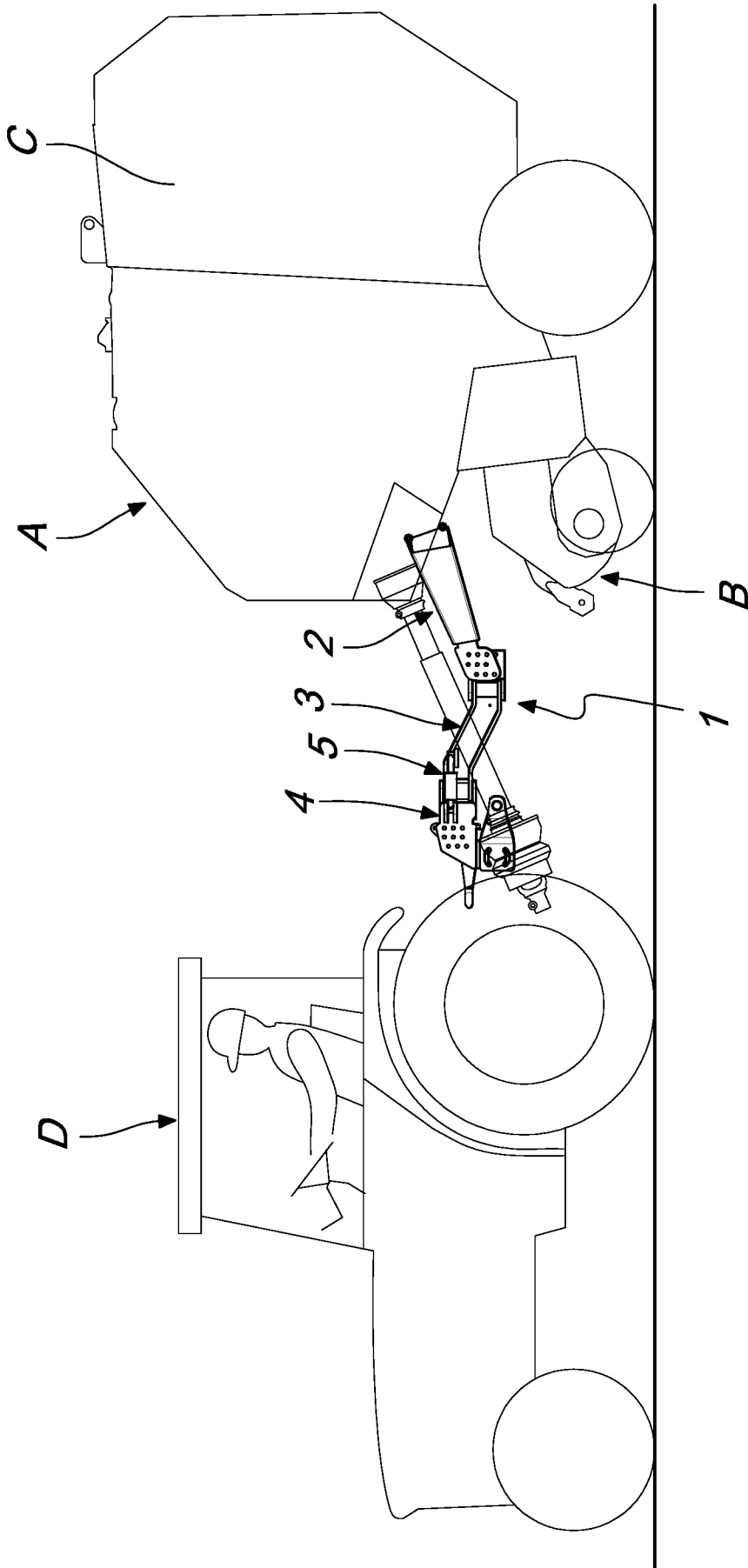


Fig. 5

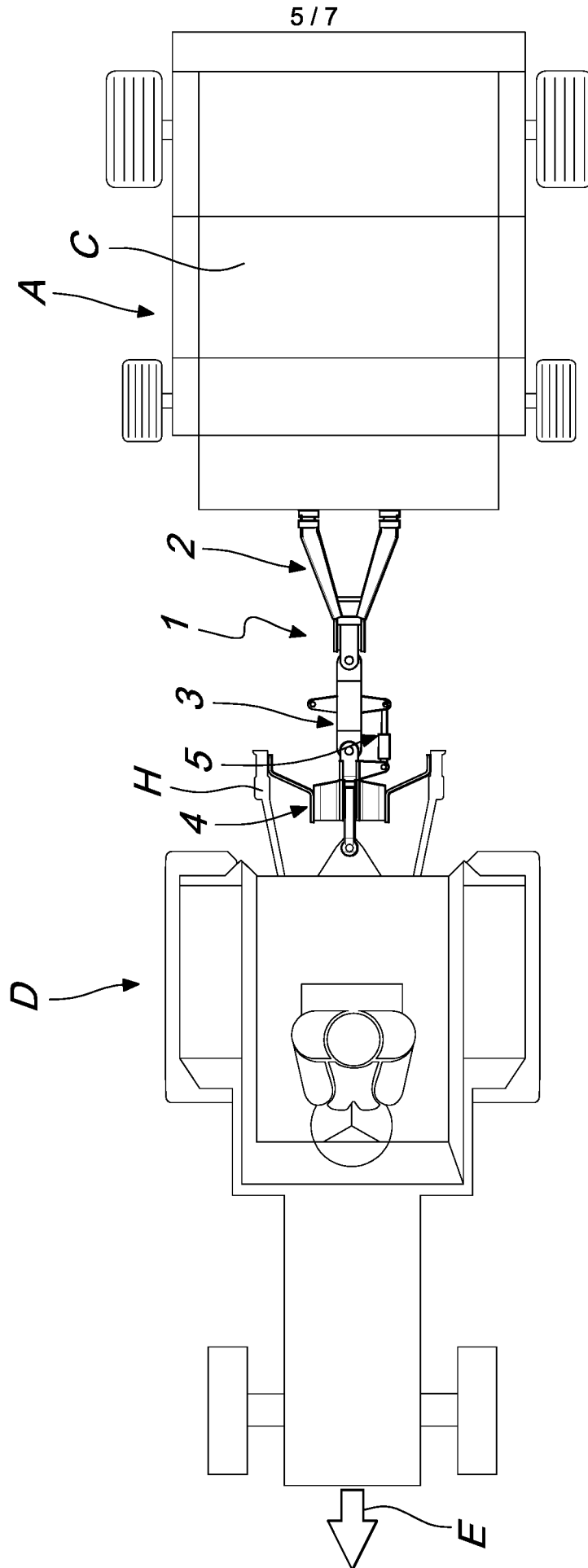


Fig. 6

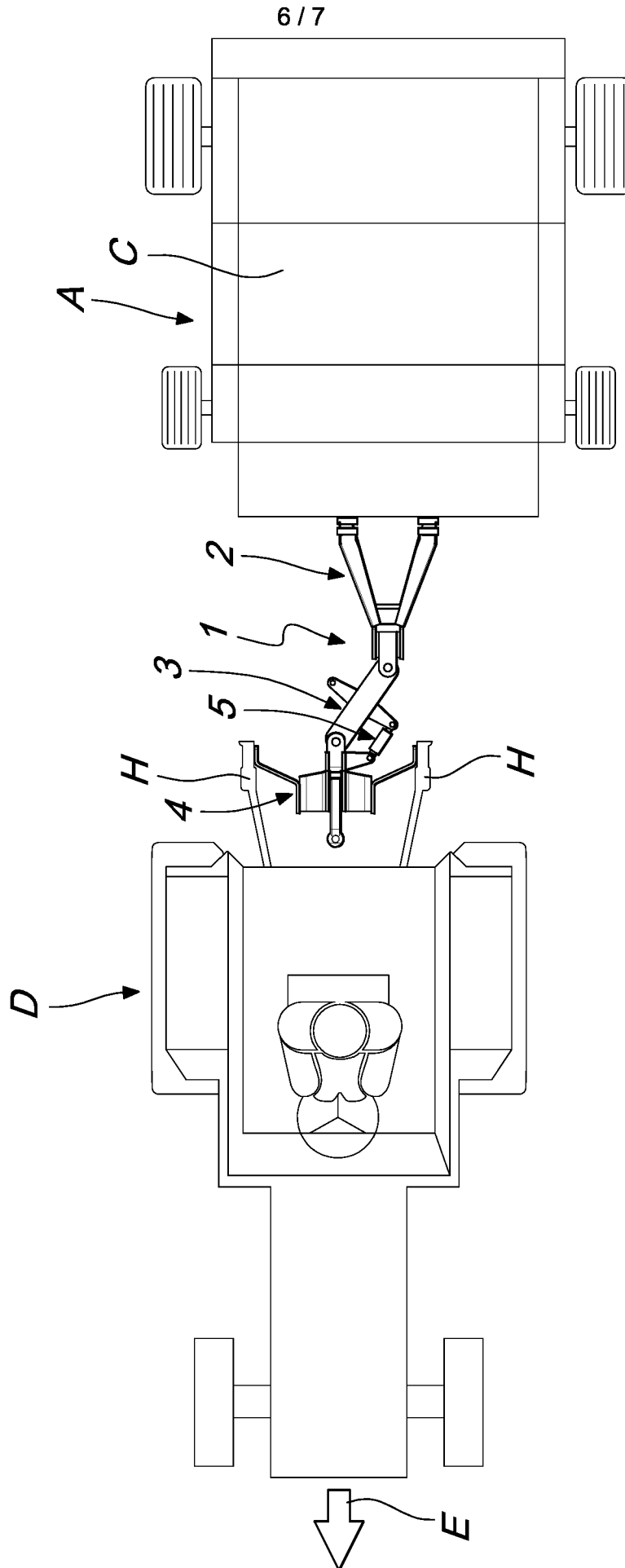


Fig. 7

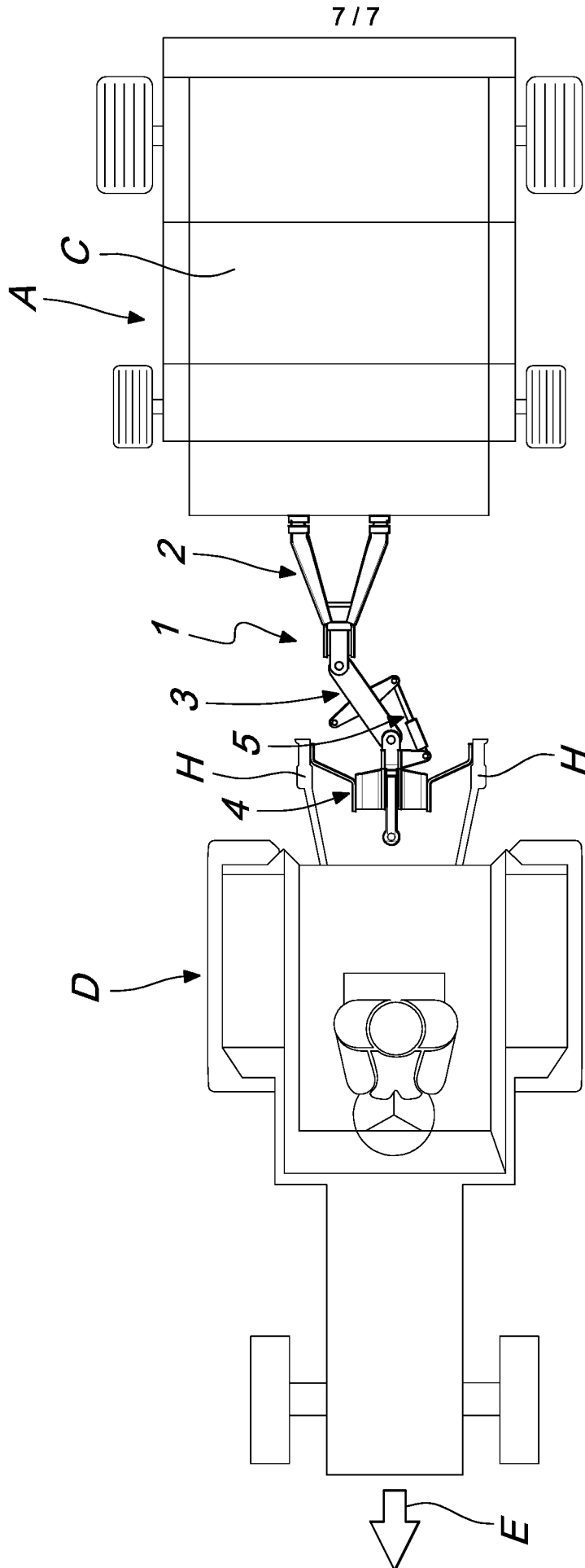


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2015/073601

A. CLASSIFICATION OF SUBJECT MATTER  
INV. A01B59/043 A01F15/08  
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)  
A01B A01F

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, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 514 463 A1 (DEERE & CO [US]) 16 March 2005 (2005-03-16) abstract; figure 2	1-15
X	WO 2012/041743 A1 (DEERE & CO [DE]; KORMANN GEORG [DE]; VOLLMAR UWE [DE]) 5 April 2012 (2012-04-05) claims 1-9; figure 1	1-15
X	EP 0 948 882 A1 (DEERE & CO [US]) 13 October 1999 (1999-10-13) claim 4	1-15
A	DE 10 2009 047585 A1 (DEERE & CO [US]) 9 June 2011 (2011-06-09) figure 2	1-15

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "O" document referring to an oral disclosure, use, exhibition or other means
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- "&" document member of the same patent family

Date of the actual completion of the international search <b>9 February 2016</b>	Date of mailing of the international search report <b>23/02/2016</b>
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer <b>Van Woensel, Gerry</b>
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Information on patent family members

International application No PCT/EP2015/073601
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