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(54) Floor cleaning machine

(57) A floor cleaning machine (1) comprising a chassis (2) which can travel over the floor along a travel direction and supports, on its side directed toward the floor, means for cleaning the floor and, to the rear with respect to the floor cleaning means along the travel direction of the chassis (2), a floor wiper (4) which can move, with respect to the chassis, along a path which is substantially transverse to the travel direction of the chassis; the chassis is provided with steering means (5) which can be operated to change its travel direction; the machine (1) further comprises actuation means which act on the floor wiper (4) to move the floor wiper along the path following an intervention performed on the steering means (5) to change the travel direction of the chassis (2).

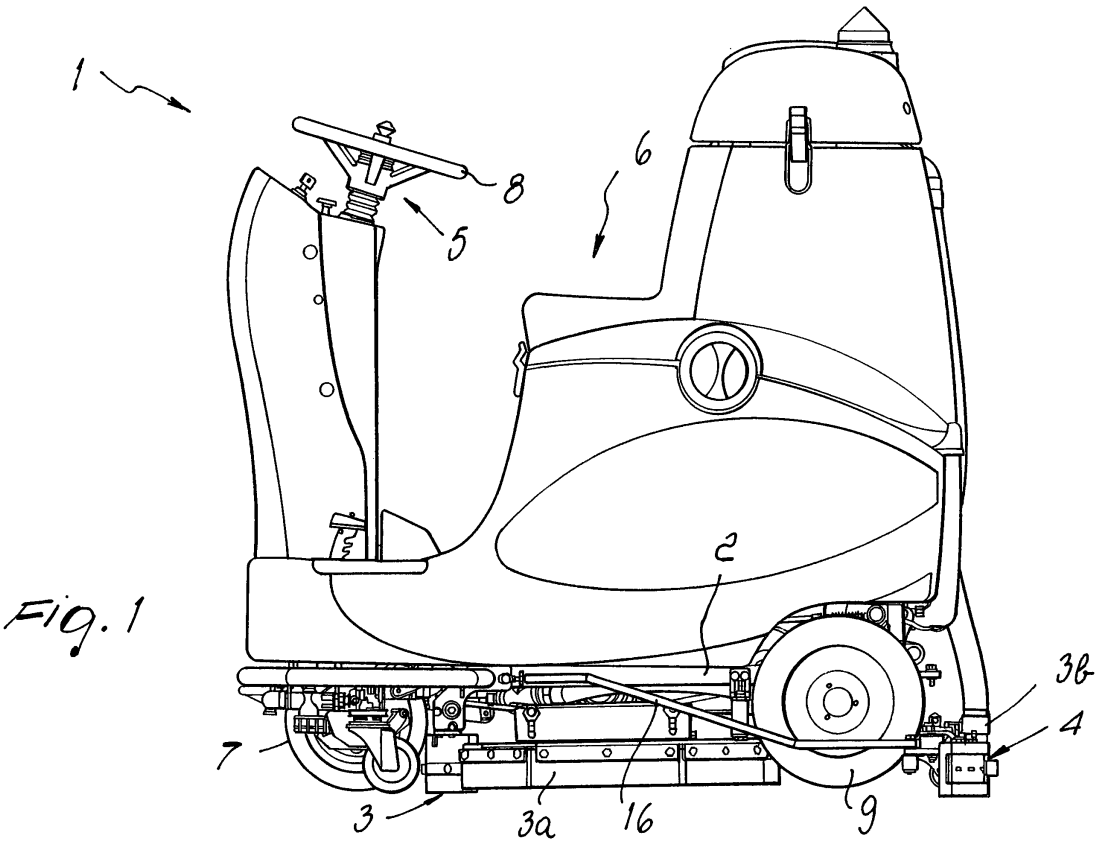

Fig. 1

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Description

[0001] The present invention relates to a floor cleaning machine.

[0002] As is known, floor cleaning and drying machines for industrial or professional use are constituted substantially by a chassis which can move on the floor and supports floor cleaning means, constituted typically by at least one brush which can be actuated so as to rotate, by a device for dispensing a washing liquid, and by a suction device which draws the washing liquid and the dirt, partially drying the floor.

[0003] To the rear of the cleaning means, along the direction of travel of the chassis along the floor, there is usually a floor wiper, constituted by an elongated body which is arranged substantially transversely to the direction of travel of the machine and supports a strip of flexible material, such as rubber or the like, which is kept elastically in contact with the floor in order to allow, as the machine travels, to collect the washing liquid and the dirt removed by the action of the brush, which can thus be removed easily by the suction device, so as to leave the floor dry and clean.

[0004] In some known solutions, the floor wiper is fixed to the machine chassis and typically has a considerable length, which increases its lateral footprint, so that if the machine chassis steers, regions which are wet because they are not affected by the action of the floor wiper are not left on the floor.

[0005] In other known solutions, in order to avoid leaving dirty liquid residues on the floor if the machine chassis steers, the floor wiper is mounted so that it can rotate freely about an axis which is substantially perpendicular to the floor, so that when the machine steers the floor wiper automatically arranges itself laterally with respect to the machine chassis due to its friction against the floor.

[0006] However, even this solution, while allowing to reduce significantly the lateral space occupation of the floor wiper, has not turned out to be fully satisfactory, since the movements performed by the floor wiper in case of machine steering are often limited in extent, and therefore wet regions at the turns of the machine still tend to remain on the floor.

[0007] Moreover, with this solution the floor wiper, in case of steering, tends to arrange itself proximate to the side of the chassis that is directed toward the inside of the turn made by the machine, with the consequence however of leaving wet the region of the floor that lies on the opposite side.

[0008] The aim of the present invention is to solve the drawbacks noted above by providing a floor cleaning machine which is devised particularly for use in the industrial field and can perform deep cleaning of the floor without leaving residues of dirty liquid on the floor if the machine steers.

[0009] Within this aim, an object of the present invention is to provide a floor cleaning machine which has a very simple structure and is easy to use.

[0010] Another object of the invention is to provide a floor cleaning machine which is capable of offering great assurances of reliability and safety in use.

[0011] Still another object of the invention is to provide a floor cleaning machine which can be obtained easily starting from commonly commercially available elements and materials and is further competitive from an economical standpoint.

[0012] This aim and these and other objects which will become better apparent hereinafter are achieved by a floor cleaning machine according to the invention, as defined in claim 1.

[0013] Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the machine according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a side elevation view of the machine according to the invention;

Figure 2 is an elevated perspective view of the machine according to the invention with some parts omitted and other parts shown in phantom lines for the sake of simplicity;

Figure 3 is a partial perspective view of the machine according to the invention, with parts omitted for greater clarity;

Figure 4 is a partial perspective view of the rear part of the machine according to the invention, with some elements omitted for the sake of simplicity and illustrating the floor wiper in the central position;

Figure 5 is a perspective view of the floor wiper of the machine according to the invention, shifted laterally with respect to the position shown in Figure 3;

Figure 6 is a perspective view of the front portion of the machine, with portions shown in phantom lines and other portions omitted, to show a steerable wheel which is arranged so as to allow the machine to turn in one direction;

Figure 7 is a perspective view of the steerable wheel of Figure 5, arranged for turning in the opposite direction;

Figure 8 is a schematic top plan view of the machine according to the invention, during a turn.

[0014] With reference to the figures cited above, the machine according to the invention, generally designated by the reference numeral 1, comprises a chassis 2 which can move along the floor in a travel direction and supports, in a downward region, floor cleaning means 3, which can comprise for example a nozzle, not shown, for dispensing a washing liquid, at least one brush 3a which has a vertical or horizontal axis and can be actuated so as to rotate about its own axis by motor means which are supported by the chassis 2 and are not shown for the sake of simplicity, and a suction port 3b, which can be connected to a known type of suction device and allows

to pick up the washing liquid and the dirt removed by the brush 3a.

[0015] To the rear of the floor cleaning means 3 along the travel direction of the chassis 2, there is a floor wiper 4 which lies transversely to the travel direction of the machine.

[0016] In particular, the floor wiper 4 is mounted on the chassis 2 so that it can move along a path 4a which lies substantially transversely to the advancement direction of the chassis 2.

[0017] Moreover, the chassis 2 is provided with steering means 5 which can be maneuvered by the user to change the direction of travel of the chassis 2.

[0018] As shown, the steering means 5 are arranged for example at a driver's seat 6, which is preferably provided in a front region of the chassis 2, and conveniently comprise at least one steerable wheel 7, which is supported by the chassis 2 so that it can rotate about its own axis and about a steering axis which is substantially perpendicular to the floor.

[0019] Conveniently, the steerable wheel 7 can rotate about the steering axis by means of a steering element which can be maneuvered and is constituted for example by a steering wheel 8, which is connected to the steerable wheel 7 in a per se known manner.

[0020] Preferably, the output shaft of a driving motor 7a, for example of the electric type, is functionally connected by way of transmission means to the axle of the steerable wheel 7; such motor is advantageously mounted monolithically with respect to the steerable wheel 7 in its rotation about the steering axis.

[0021] It should be noted that two rear wheels 9 also are conveniently connected to the chassis 2.

[0022] The peculiarity of the invention consists in that it provides actuation means 10 which act on the floor wiper 4 to move it along the path 4a following an intervention performed by the user on the steering means 5 to vary the travel direction of the chassis 2.

[0023] Advantageously, the actuation means 10 are adapted to move the floor wiper 4 along the path 4a in the opposite direction with respect to the center of curvature 100 of the turn made by the chassis 2. In this manner, the floor wiper 4 is capable of drying the floor correctly in a region which is external to the turn made by the machine.

[0024] Conveniently, the actuation means 10 can be activated by way of the steering means 5 and are advantageously provided by providing kinematic connection means which are capable of producing a mechanical connection between the steering means 5 and the floor wiper 4.

[0025] Conveniently, such kinematic connection means comprise at least one actuation rod 11, which is functionally connected, at a first end 11 a to the steering means 5 and is connected kinematically, at a second end 11b, to the floor wiper 4.

[0026] With reference to the example shown in the figures, the actuation rod 11 lies substantially parallel to the longitudinal extension of the chassis 2 and can perform a translational motion, in one direction or the other, along its own axis with respect to the chassis 2 in order to move in one direction or the other the floor wiper 4 along the path 4a in response to an intervention of the user on the steering means 5.

[0027] Advantageously, first elastic return means 12 act on the actuation rod 11 and are adapted to contrast the axial translational motion of the actuation rod 11 at least in one direction.

[0028] In particular, the first elastic return means 12 are constituted for example by a helical spring 13, which is arranged around the actuation rod 11, between an annular shoulder 14, which is rigidly coupled to the actuation rod 11, and an eye 15, which is fixed to the chassis 2 and slidingly supports the actuation rod 11.

[0029] Conveniently, the floor wiper 4 is connected to the chassis 2 by way of a pair of linkages 16, which lie substantially parallel to each other and are articulated, at one of their ends, to the chassis 2 and, at their other end, to a respective end portion of the floor wiper 4.

[0030] Advantageously, the actuation means 10 of the floor wiper 4 comprise at least one actuation arm 17, which is pivoted to the chassis 2 about an oscillation axis which is substantially perpendicular to the floor and is functionally connected, with one of its end portions, to the floor wiper 4.

[0031] In particular, the actuation arm 17 is capable of performing on command, following an intervention performed on the steering means 5, an angular movement about its own oscillation axis in the same direction as the turn imparted to the chassis 2 by the steering means 5 and more precisely as the direction of rotation actuated to the steerable wheel 7 about its own steering axis, to steer the chassis 2.

[0032] The actuation arm 17 engages conveniently between the prongs of a fork-like element 18, which is connected to a central region of the floor wiper 4 so that it can rotate about a pivoting axis which is substantially parallel to the oscillation axis of the actuation arm 17, in order to allow the movement of the floor wiper 4 along the path 4a when the actuation arm 17 rotates about its own oscillation axis.

[0033] As shown in particular in Figures 6 and 7, the steerable wheel 7 is adapted to act on the first end 11 a of the actuation rod 11 to produce a translational motion of the actuation rod 11 along its own axis following a rotation performed by the steerable wheel 7 about its own steering axis.

[0034] Preferably, the actuation rod 11 is provided, at its first end 11a, with an engagement head 19, which protrudes with respect to the axis of the actuation rod 11 toward the steerable wheel 7 and is provided conveniently with a gliding wheel 19a.

[0035] Conveniently, on the steerable wheel 7 there are abutment means which are designed to engage the first end 11a of the actuation rod 11 and more particularly its engagement head 19 so as to push axially on the

actuation rod 11 in one direction or the other depending on the direction of rotation imparted to the steerable wheel 7 about its own steering axis when the chassis 2 is steered.

[0036] In particular, such abutment means are provided by providing a structure 20 which is connected monolithically to the steerable wheel 7 in its rotation about the steering axis and substantially defines, in points which are diametrically opposite with respect to the axis of the steerable wheel 7 and on opposite sides with respect to its steering axis, two abutment surfaces 21 which are directed toward each other and can engage selectively against the engagement head 19 of the actuation rod 11 depending on the direction of rotation imparted to the steerable wheel 7, about the steering axis.

[0037] In greater detail, the structure 20 has an elongated plate 22 which lies substantially at right angles to the axis of the steerable wheel 7 and to its steering axis and has two folded end portions 22a, 22b, which protrude with respect to the plane of arrangement of the remaining portion of the elongated plate 22 in the opposite direction with respect to the steerable wheel 7 and define, with their mutually facing faces, the abutment surfaces 21. Conveniently, the folded end portions 22a, 22b are inclined and mutually converge toward the steerable wheel 7.

[0038] It should be noted that the engagement of the abutment means against the engagement head 19 of the actuation rod 11 can occur for example after exceeding a preset angle of rotation of the steerable wheel 7 with respect to its non-steered position which allows the chassis 2 to travel in a straight line, so as to exclude the intervention of the actuation means 10 on the floor wiper 4 in case of turns of the chassis 2 with a limited steering angle.

[0039] At its second end 11b, the actuation rod 11 is advantageously connected to lever means which act on the actuation arm 17 to produce, following an axial translational motion of the actuation rod 11 produced by a rotation about the steering axis of the steerable wheel 7, an angular movement of the actuation arm 17 about its own oscillation axis in the same direction as the rotation performed by the steerable wheel 7 about its own steering axis.

[0040] Conveniently, such lever means comprise a first lever 23, which is pivoted, at one of its ends, to the second end 11b of the actuation rod 11 and, at the other end, to the chassis 2, and a second L-shaped lever 24, which is pivoted, with an intermediate region, to the chassis 2 about an articulation axis which is substantially perpendicular to the floor. The second lever 24 can rotate about its own articulation axis in contrast with second return means, which are connected between the second lever 24 and the chassis 2 and are constituted for example by a torsion spring 25 which is arranged on the pivot of the second lever 24.

[0041] In particular, the second lever 24 is pivoted with one side 24a of the L-shape to an end of a linkage 26, which is articulated, at its other end, to an intermediate portion of the first lever 23 and is conveniently adjustable in length by means of threaded elements.

[0042] The other side 24b of the second lever 24 advantageously has a fork-shaped free end 27 which straddles the actuation arm 17 in order to engage it rigidly in the rotation of the second lever 24 about its articulation axis.

[0043] Operation of the floor cleaning machine according to the invention is as follows.

[0044] With the steerable wheel 7 in the non-steered position, the floor wiper 4 is in a substantially centered position with respect to the rear part of the chassis 2, as shown in Figure 3.

[0045] When rotation in one direction of the steerable wheel 7 about its own steering axis is actuated by operating the steering wheel 8 to correspondingly turn the chassis 2 and thus change the travel direction of the machine, one of the folded end portions 22a, 22b engages the engagement head 19 of the actuation rod 11 so that the steerable wheel 7, in its rotation about the steering axis, can push the actuation rod 11, causing an axial translational motion thereof.

[0046] As a consequence of this fact, the first lever 23 performs a rotation about its own fulcrum, which is connected to the chassis 2, so as to actuate, by way of the linkage 26, the second lever 24 so that it rotates about its own articulation axis, overcoming the action of the torsion spring 25.

[0047] The second lever 24, thus actuated, in turn causes an angular movement of the actuation arm 17 about its own oscillation axis, in the same direction of rotation as the steerable wheel 7, consequently achieving a movement of the floor wiper along the path 4a, in the opposite direction with respect to the center of curvature of the turn performed by the chassis 2.

[0048] Once the steerable wheel 7 has been returned to the non-steered position, the action of the torsion spring 25 on the second lever 24 allows to return the actuation arm 17 automatically to its initial position and consequently return the floor wiper 4 to its centered position.

[0049] In practice it has been found that the invention fully achieves the intended aim and in particular the fact is stressed that thanks to the actuation means of the floor wiper it is possible to ensure the correct movement of the floor wiper and therefore perfect cleaning of the floor when the machine turns.

[0050] The individual characteristics described with reference to general teachings or particular embodiments may all be present in other embodiments or replace characteristics in these other embodiments.

[0051] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0052] In practice, the materials used, as well as the contingent shapes and dimensions, may be any according to requirements.

[0053] All the details may further be replaced with other technically equivalent elements.

[0054] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A floor cleaning machine comprising a chassis which can travel over the floor along a travel direction and supports, on its side directed toward the floor, means for cleaning the floor and, to the rear with respect to said floor cleaning means along the travel direction of said chassis, a floor wiper which can move, with respect to said chassis, along a path which is substantially transverse to the travel direction of said chassis, said chassis being provided with steering means which can be operated to change its travel direction, **characterized in that** it comprises actuation means which act on said floor wiper to move said floor wiper along said path following an intervention performed on said steering means to change the travel direction of said chassis.

2. The machine according to claim 1, **characterized in that** said actuation means are adapted to impart to said floor wiper a movement along said path in the opposite direction with respect to the center of curvature of the turn performed by said chassis following an intervention on said steering means.

3. The machine according to one or more of the preceding claims, **characterized in that** said actuation means can be activated by way of said steering means.

4. The machine according to one or more of the preceding claims, **characterized in that** said actuation means comprise kinematic connection means, which are adapted to connect said steering means to said floor wiper.

5. The machine according to one or more of the preceding claims, **characterized in that** said kinematic connection means comprise at least one actuation rod which is functionally connected, at a first end, to said steering means and is connected kinematically, at a second end, to said floor wiper, said at least one actuation rod being able to perform a translational motion in either direction along its own axis with respect to said chassis in order to produce a movement, in either direction, of said floor wiper along said path in response to an intervention on said steering means to vary the advancement direction of said chassis.

6. The machine according to one or more of the preceding claims, **characterized in that** it comprises first elastic return means which contrast, at least in one direction, the axial translational motion of said at least one actuation rod.

7. The machine according to one or more of the preceding claims, **characterized in that** said floor wiper is connected to said chassis by way of a pair of linkages which are substantially mutually parallel and are articulated, at one of their ends, to said chassis and, at their other end, to a respective end portion of said floor wiper.

8. The machine according to one or more of the preceding claims, **characterized in that** said actuation means comprise at least one actuation arm which is mounted so that it can oscillate on said chassis about an oscillation axis which is substantially perpendicular to the floor and is functionally connected, with one of its end portions, to said floor wiper, said actuation arm being angularly movable on command, about said oscillation axis, following an intervention performed on said steering means in the same direction as the steering imparted to said chassis by said steering means.

9. The machine according to one or more of the preceding claims, **characterized in that** said steering means comprise at least one steerable wheel, which is mounted on said chassis so that it can rotate about a steering axis which is substantially perpendicular to the floor, and can be actuated so as to rotate by means of an actuatable steering element, said at least one steerable wheel being adapted to act on said first end of said at least one actuation rod in order to produce a translational motion of said at least one actuation rod along its own axis following a rotation of said at least one steerable wheel about said steering axis.

10. The machine according to one or more of the preceding claims, **characterized in that** said at least one actuation rod is connected, at said second end thereof, to lever means which act on said actuation arm to produce, following an axial translational motion of said at least one actuation rod achieved by way of a rotation of said at least one steerable wheel about said steering axis, an angular movement of said actuation arm about its own oscillation axis in the same direction as the rotation of said at least one steerable wheel.

11. The machine according to one or more of the preceding claims, **characterized in that** said lever

means comprise a first lever which is pivoted, at one of its ends, to said second end of said at least one actuation rod and, at the other end, to said chassis, and a second L-shaped lever which is pivoted with an intermediate region to said chassis, in contrast with second return means, and has one side of its L-shape pivoted to an end of a linkage which is articulated, at its other end, to an intermediate portion of said first lever, and the other side of the L-shape with a fork-shaped free end which engages said actuation arm.

12. The machine according to one or more of the preceding claims, **characterized in that** said at least one steerable wheel has abutment means, which are designed to engage said first end of at least one actuation rod to apply an axial thrust to said at least one actuation rod in one direction or the other depending on the direction of rotation about said steering axis imparted to said at least one steerable wheel to turn said chassis.

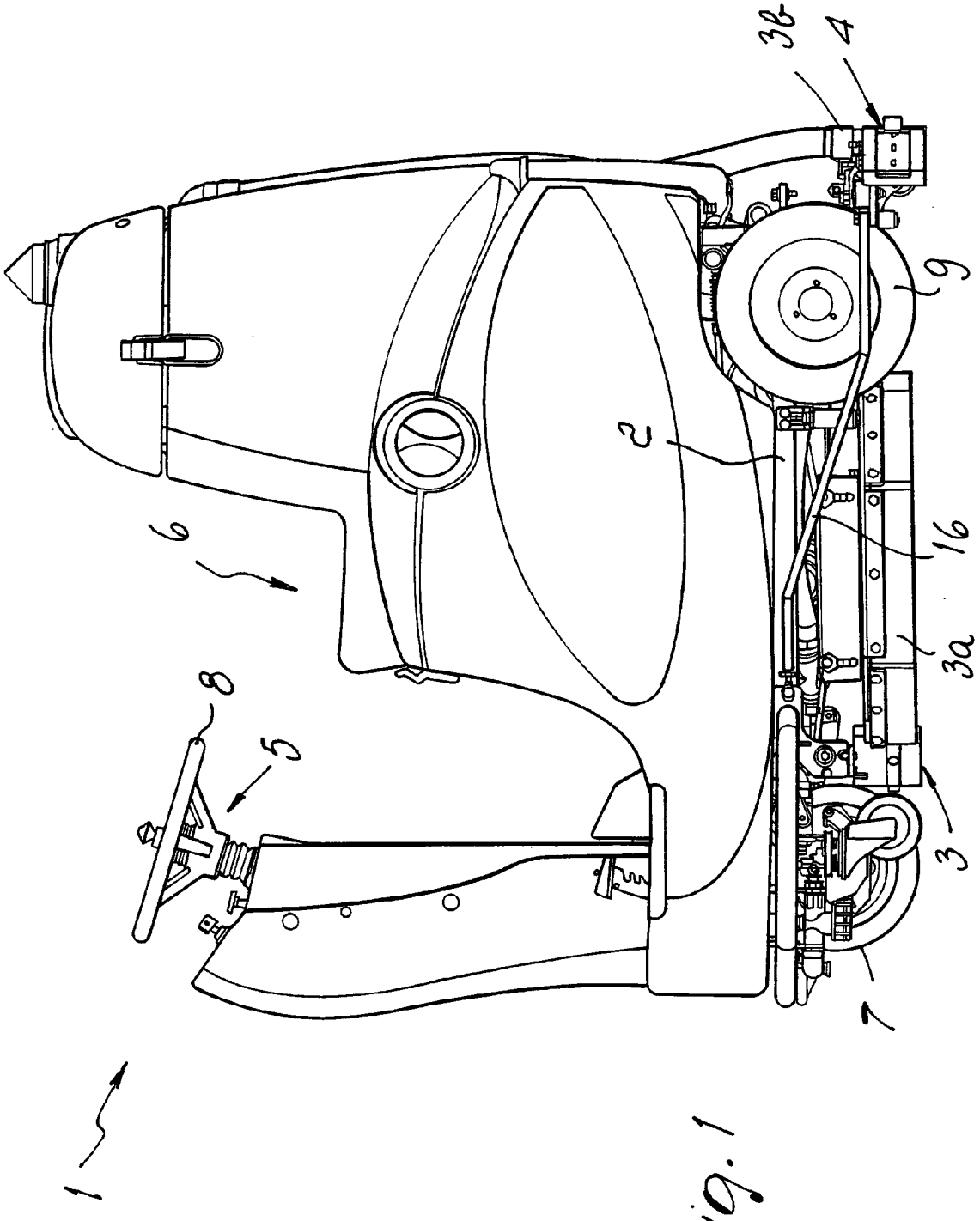

Fig. 1

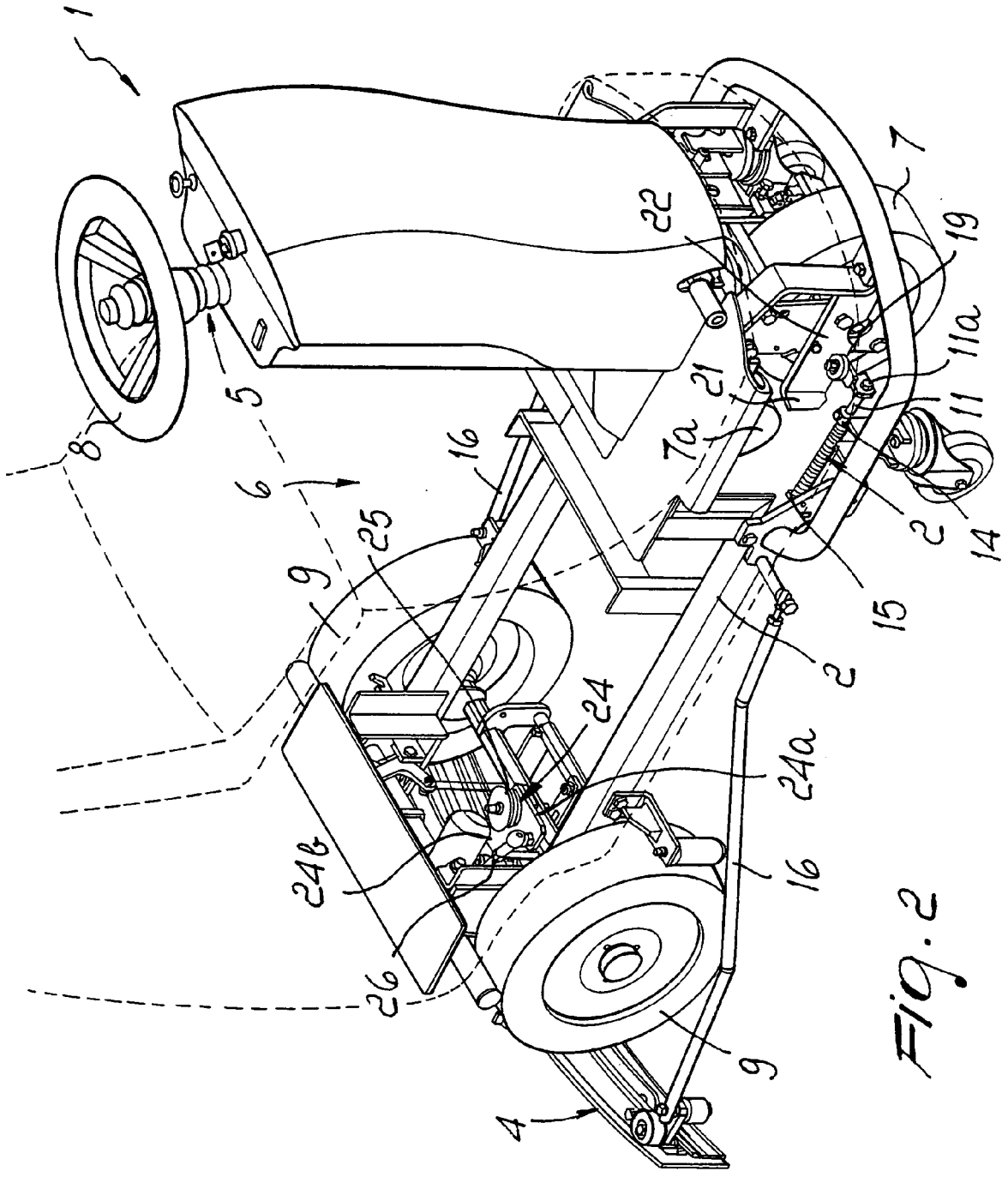

Fig. 2

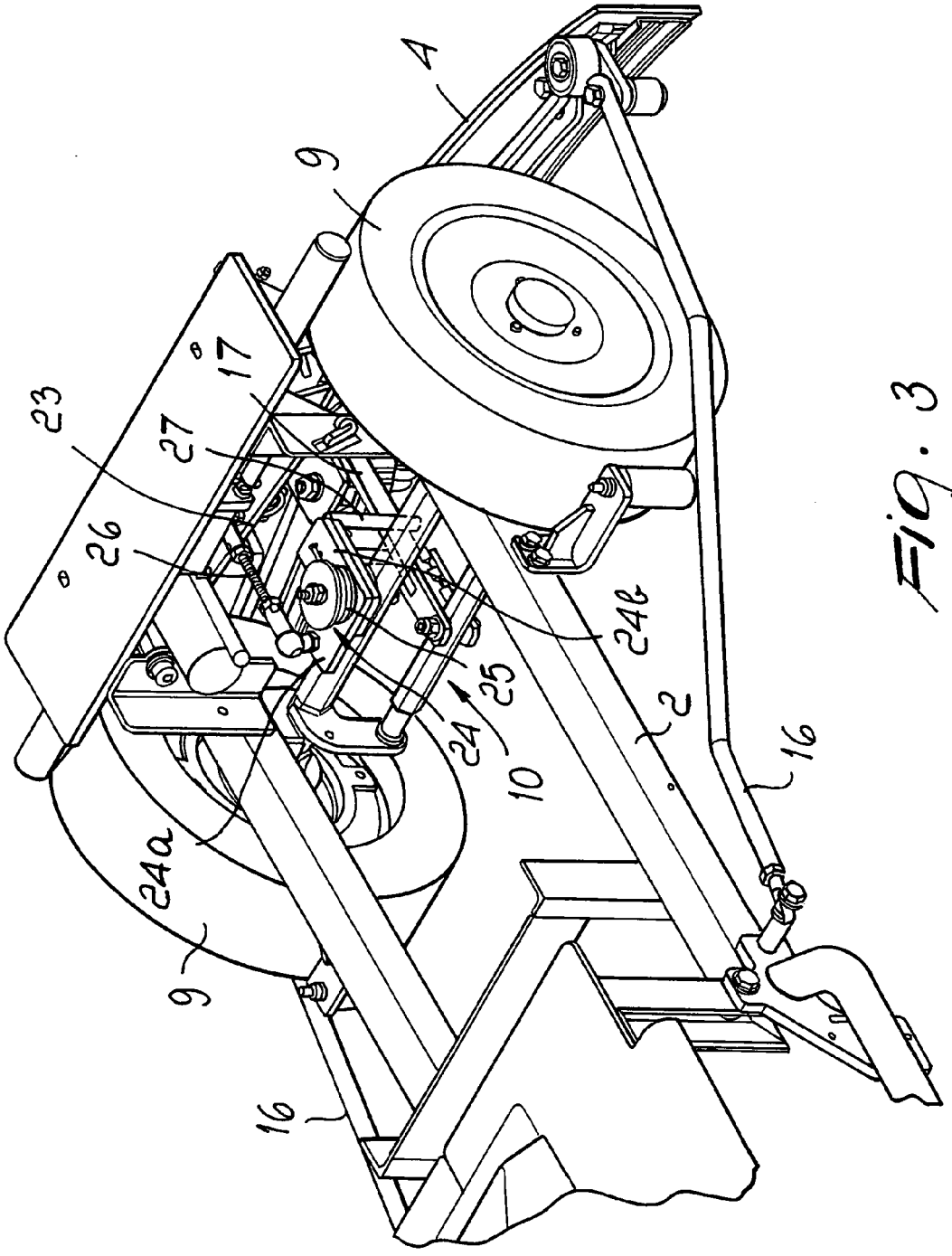

Fig. 3

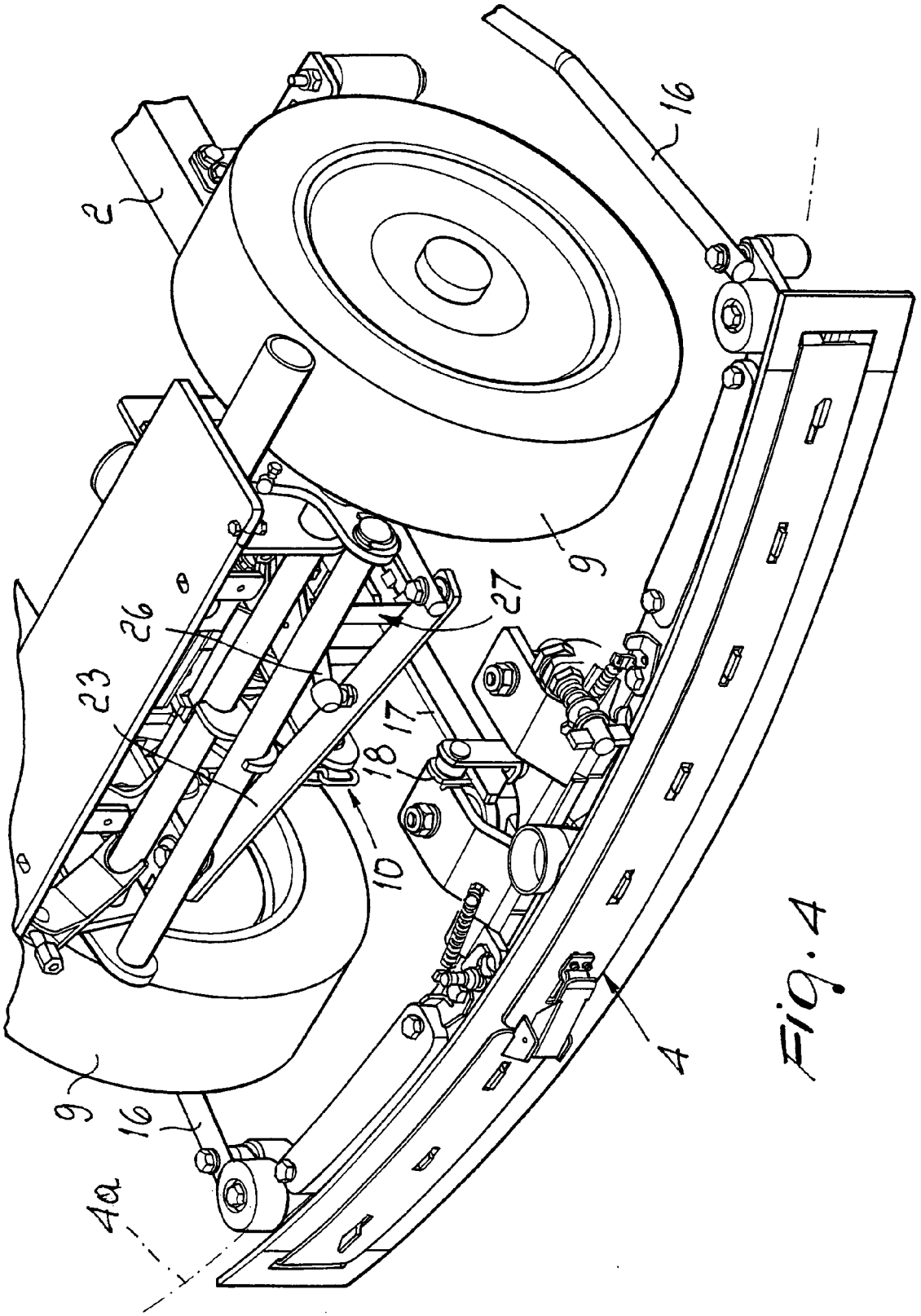

Fig. 4

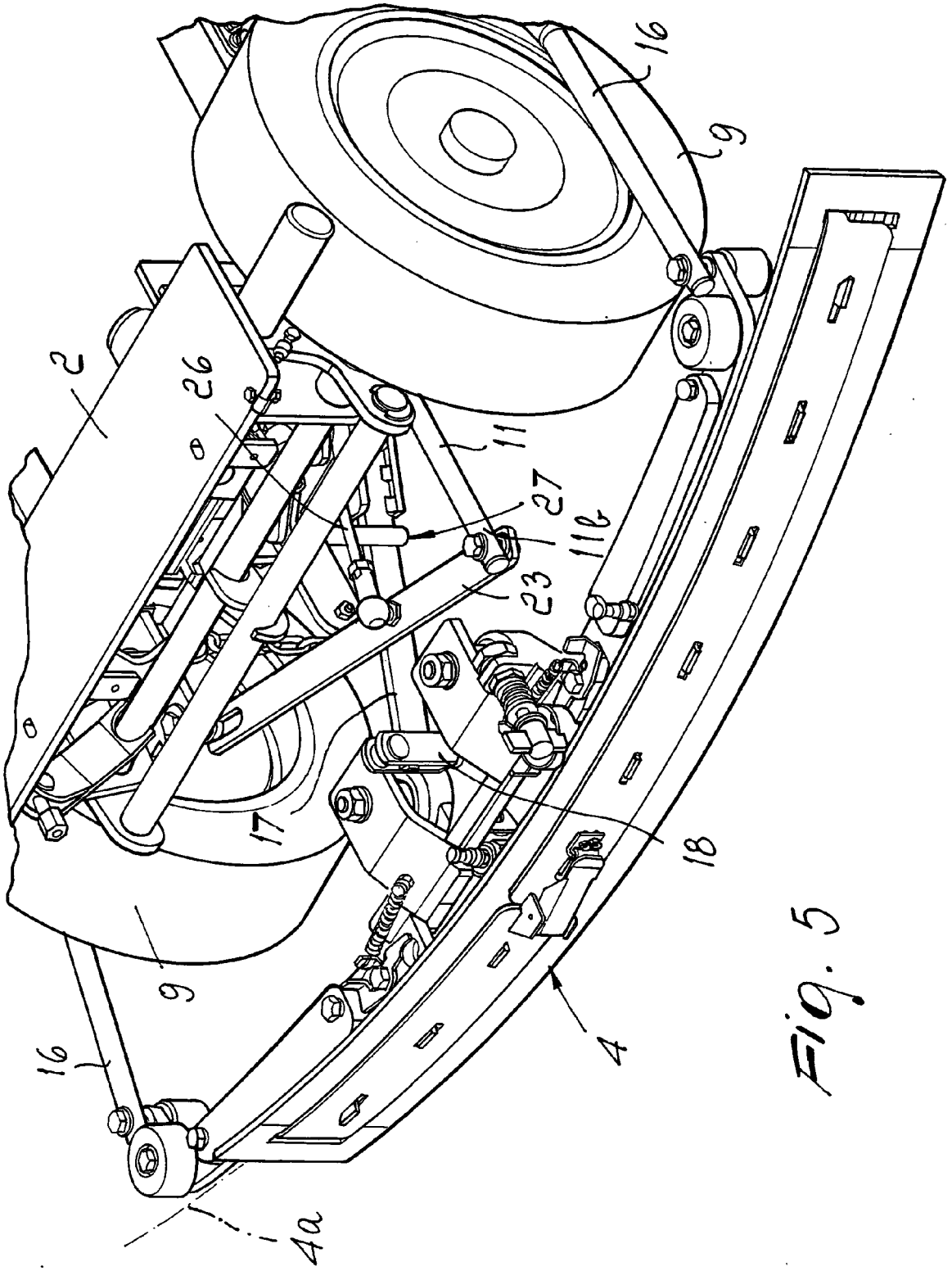

Fig. 5

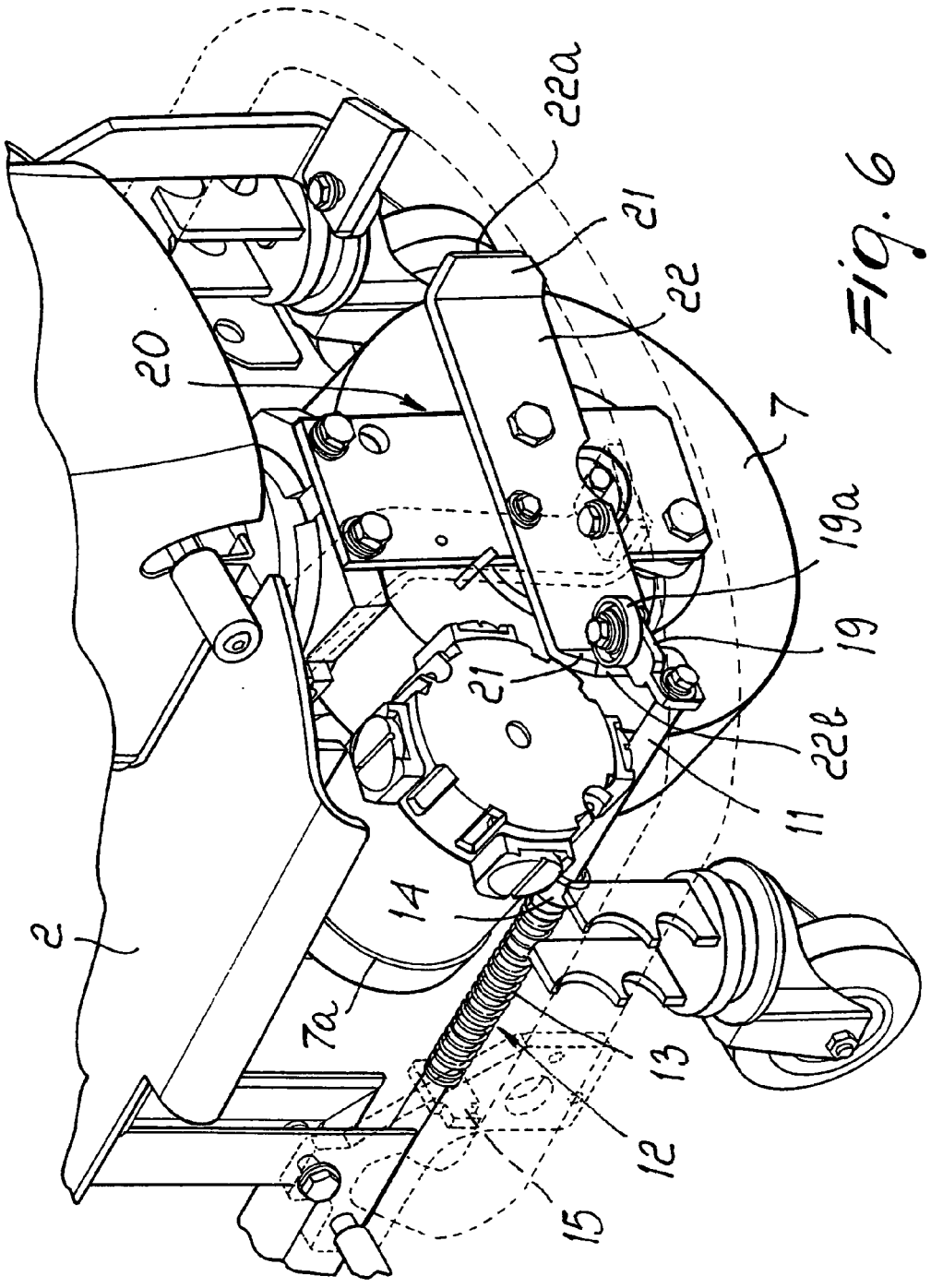

Fig. 6

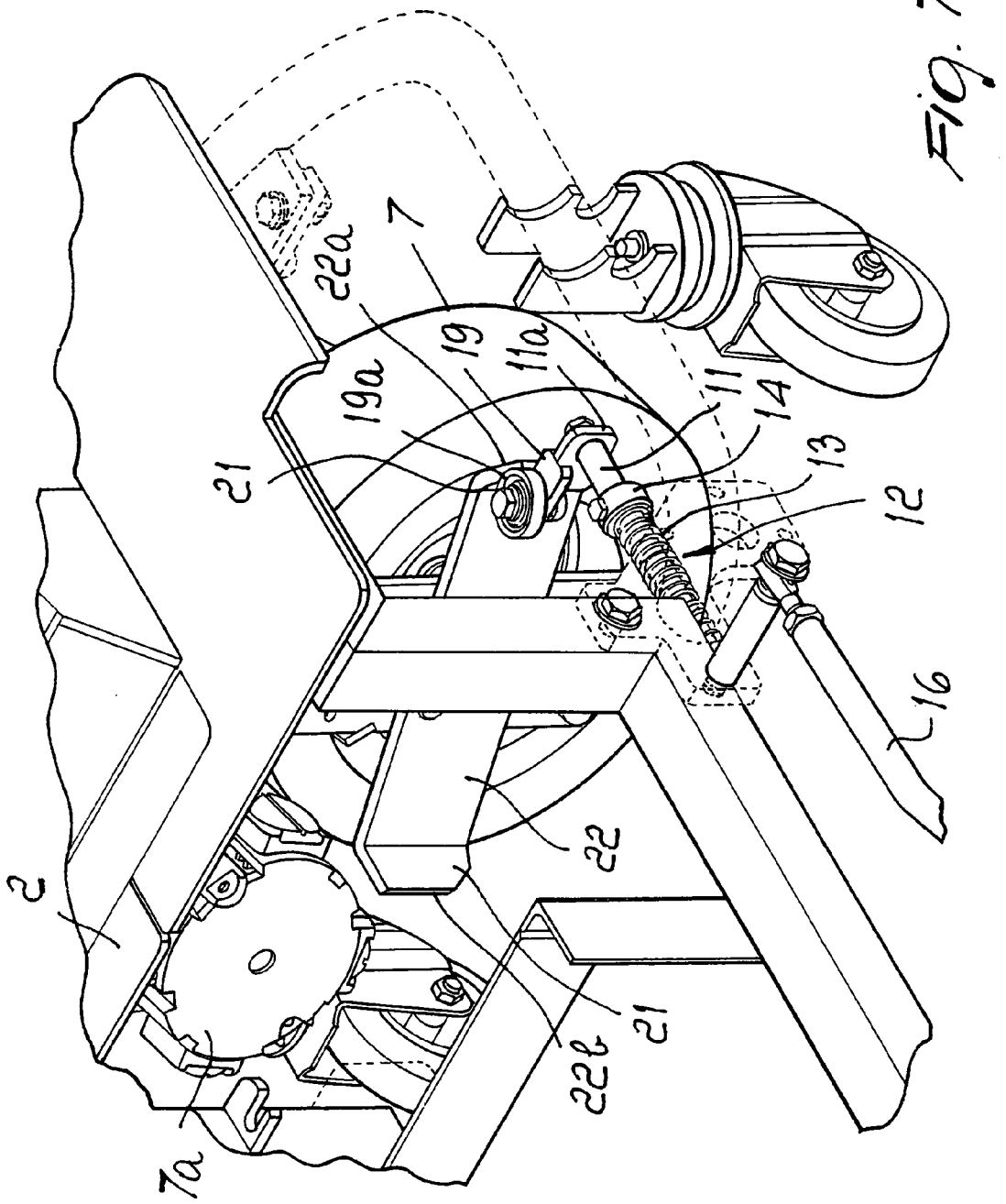

Fig. 7

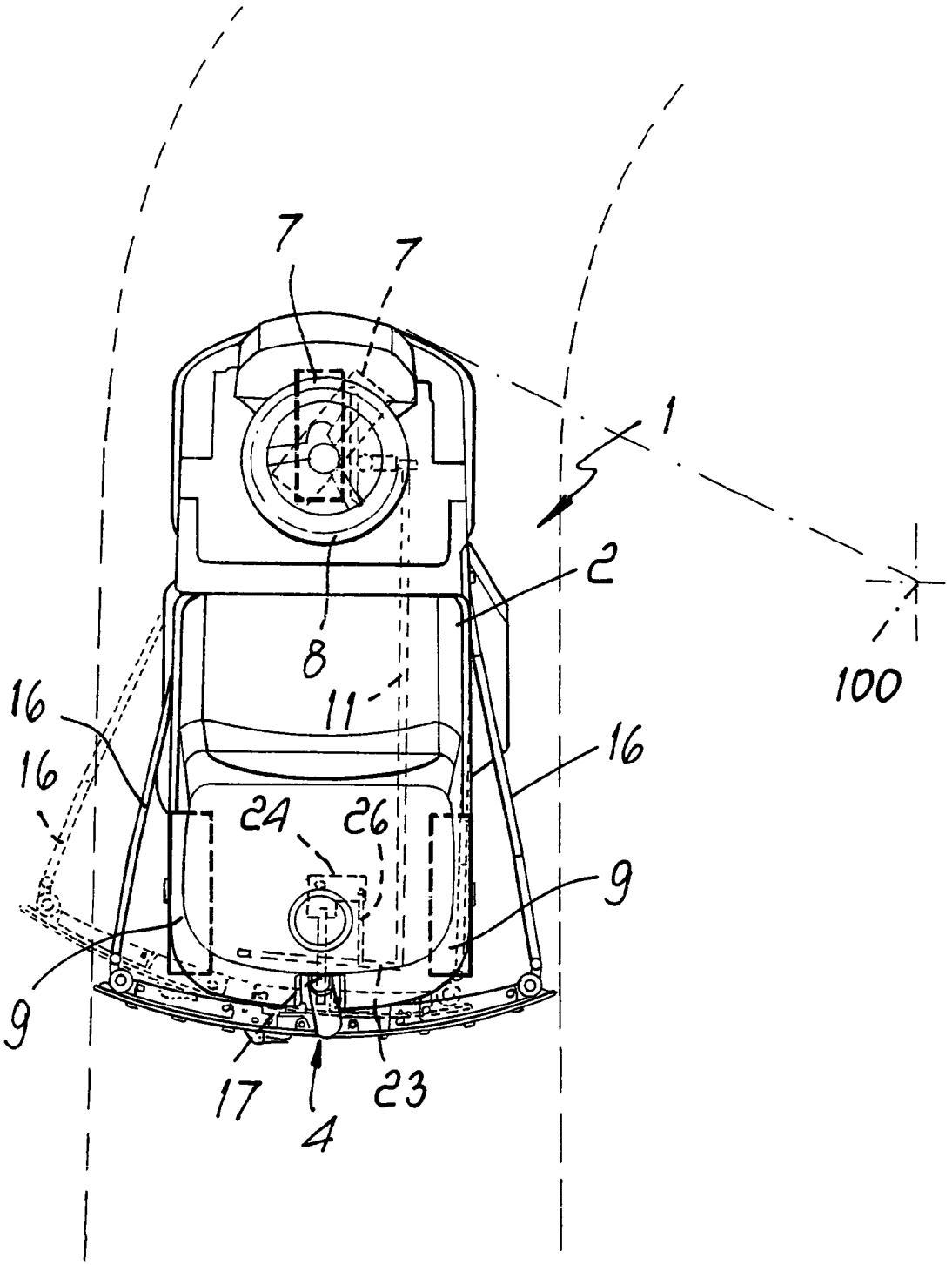

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5500

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 January 2008	Clarke, Alister

CATEGORY OF CITED DOCUMENTS

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