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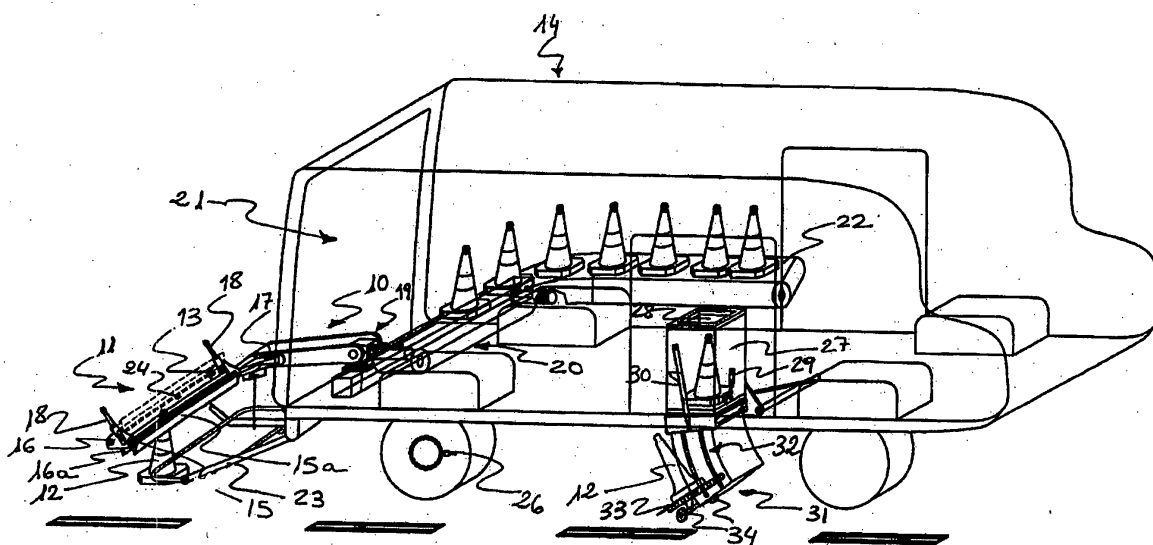
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(54) **SYSTEM FOR HANDLING CONES ON A ROAD**

(57) The system, which is installed on a vehicle (14), incorporates a robotic arm (10) with a gripping device for seizing and releasing cones (12), a detection system (13) for detecting cones (12), driving means for driving the arm (10) between a pick-up position for picking up the cone (12) and an unloading position for unloading the cone (12) in a storage area and means for positioning cones (12) at a regular distance on said road. The grip-

ping device comprises an elongated member (11) projecting in a cantilevered manner from a side of the vehicle (14) provided to face said cones (12) when the vehicle (14) moves backwards. The elongated member (11) incorporates a fixed half-clamp (15) and a mobile half-clamp (16), which can be moved closer to/away from said fixed half-clamp (15) to seize and hold an upper end of the cone (12) therebetween.



**Fig. 1**

**Description**Technical Field

**[0001]** The present invention relates generally to a system for handling demarcation or sign cones of a road, and particularly to a system installed in a vehicle for automatically picking up and/or positioning cones on a traffic circulation road.

State of the Prior Art

**[0002]** Various systems for picking up and positioning cones on a road are known in the state of the art.

**[0003]** In particular, patent EP-B1-0501106 relates to an apparatus and to a method for positioning and picking up cones on a road. The apparatus described in this patent comprises means for ascending and descending the cones, means for correcting the posture of the cones, sensors and gripping means in the form of a clamp for picking up and placing cones on the road. The cones are picked up with the vehicle moving backwards, when such cones are in their upright position, gripping them by their body. In relation to the position of the cones, it is carried out with the vehicle moving in the travel direction.

**[0004]** In addition, patent EP-B1-1112411 describes an apparatus for automatically picking up cones from the surface of a road with a vehicle optionally moving forwards or backwards. This apparatus is assembled adjacent to a side of the vehicle and comprises a lifting arm operated by maneuvering means between an ascending position and a descending position. The mentioned lifting arm has gripping means configured to grip a cone by its base when the cone is not in its upright position, i.e., it is lying down on the road. These gripping means are activated by a sensor which detects the presence of the cone in a position relative to the apparatus.

**[0005]** Patent application WO-A1-2005071167 describes an apparatus and a method for picking up cones where the apparatus comprises a lifting arm provided with gripping means designed to pick up the cone by being introduced at least partially inside the walls of the cone through its base. A sensor detects if the gripping means are positioned inside the mentioned cone. Furthermore, the gripping means are provided with an adjoining surface where the side of the cone can rest, so the cone is placed in a predetermined position with respect to the gripping means to be maneuvered safely and precisely. The apparatus also comprises means for overturning the cones and means for positioning them so that it is easier to pick them up by their lower part. Likewise, the mentioned apparatus can comprise means for putting an overturned cone upright if necessary.

**[0006]** The present invention proposes an alternative system to the described systems for automatically picking up and positioning cones on a road with a gripping device which is different to those set forth above, which allows covering a wider surface area in which to place

the cone for it to be picked up.

Disclosure of the Invention

**[0007]** The present invention relates to a system for automatically or semi-automatically handling cones on a road, installed in a vehicle, of the type comprising:

- a robotic arm with a gripping device, at a distal end, for seizing and releasing the cone;
- a detection system for detecting the presence of a cone on the road and activating the gripping device after its detection;
- driving means for driving the robotic arm between a pick-up position for picking up the cone on the road and an unloading position for unloading the cone in a storage area inside the vehicle; and
- means for positioning cones at a regular distance on the road.

**[0008]** According to the present invention the mentioned gripping device further comprises:

- an elongated member, extending in a cantilevered manner transversely to the road, covering a wide section thereof, projecting perpendicularly from a side of the vehicle through a rear opening thereof, provided to face the cones when the vehicle moves backwards.

**[0009]** This elongated member, projecting perpendicularly to the longitudinal direction of the vehicle, is formed by:

- a fixed half-clamp located in a pick-up position, at a height, in relation to the ground, slightly lower than the measurement of the cone in a vertical position; and
- a mobile half-clamp, which can be moved closer to and away from the fixed half-clamp by driving means for driving between a rest position, in which the mobile half-clamp is located at a height above the cone, and an active position in which it moves until facing the fixed half-clamp, seizing and holding the upper end of the cone therebetween like a clamp.

**[0010]** The distal end of the robotic arm further comprises height regulation and verification means with respect to the ground of the arm, which means allow maintaining the mentioned elongated member at a uniform height from the ground during the process for picking up the cones.

**[0011]** In addition, in a preferred embodiment of the present invention, the fixed half-clamp and the mobile half-clamp are formed by two substantially parallel arms having associated therewith respective profiles with a triangular section, acting as a clamp jaw. The fact of using two elongated bars allows covering, by sweeping, a larg-

er transverse area in which to locate the cone for it to be picked up, since it is possible to seize it provided that it is in its upright position, within the area located between both ends of these bars.

**[0012]** The mentioned movement of the mobile half-clamp closer to and away from the fixed half-clamp is carried out by means of a linear movement combined with a rotational movement with respect to a longitudinal axis of the mobile half-clamp such that in the active position, the two jaws point towards the ground when they seize the end of the cone by clamping and in the rest position, the jaw of the mobile half-clamp is oriented in a direction opposite to the ground.

**[0013]** Thus, the mobile half-clamp is linearly guided for its movement between said rest position and said active position, this mobile half-clamp having fixed thereto, in a preferred embodiment of the present invention, a pinion coaxial with the longitudinal axis thereof and meshed with a fixed rack arranged parallel to the direction of the linear movement. In relation to the driving means, they are formed by linear actuators linked to each of the ends of the mobile half-clamp and arranged to perform the linear movement with the collaboration of the mentioned pinion rack and thus cause said rotational movement of the mobile half-clamp.

**[0014]** In relation to the robotic arm, it likewise comprises, at a proximal end thereof, a rotational drive unit suitable for, once the cone is seized by the fixed half-clamp and the mobile half-clamp, performing a first rotation of the robotic arm on a substantially horizontal axis, from the pick-up position to an intermediate position between the pick-up position and the unloading position, and a second rotation from the mentioned intermediate position to an unloading position.

**[0015]** The mentioned rotational drive unit of the robotic arm is installed on a linear movement unit, transverse to the longitudinal direction of the vehicle, which comprises driving means suitable for moving the robotic arm in the mentioned intermediate position, after having performed the first rotation, linearly closer to the unloading area, the fixed half-clamp and the mobile half-clamp thus being in a suitable position for being able to be introduced inside the vehicle through the rear opening thereof. After this lineal movement of the robotic arm, the second rotation thereof is performed, depositing the cone on a conveyor belt comprising leading means which lead the cone to the mentioned storage area.

**[0016]** The gripping device further comprises an element acting as a concealable stop located, in its extended position, at a height close to the base of the cone to support part of the body of the cone and thus prevent it from overturning when the first rotation is performed. This concealable stop comprises a strip associated with a frame secured to the chassis of the vehicle.

**[0017]** In relation to the mentioned detection system, it consists of an optical detection system generating an optical barrier in front of the fixed half-clamp.

**[0018]** The system for handling cones object of the

present invention likewise incorporates an element demarcating a safety area inside which the cones to be picked up are positioned, which element comprises a frame, flush with the ground, open towards the area of contact with the cones.

**[0019]** In addition, the mentioned means for positioning cones on the road comprise:

- an angular detection device associated with a wheel of the vehicle for detecting, when the vehicle moves forwards, the distance traveled by the vehicle for the purpose of carrying out said positioning of the cones at a regular distance from one another;
- a loading hopper, where the hollow cones are introduced through an inlet opening, stacked one on top of the another and fitted;
- a locking automatism associated with an unloading automatism for unloading cones, arranged in the outlet opening of the loading hopper, configured to drop the cones one by one;
- an unloading hopper, extending below the outlet opening of the loading hopper, the mentioned unloading hopper comprising side guiding grooves for guiding a conveyor carriage for cones which moves up and down controlled by linear actuators; and
- an unloading ramp, supported with wheels of support on the ground, connected to said carriage at the lower end thereof, the unloading ramp comprising a series of freely rotating rollers with axes aligned in one and the same plane which allow smoothly depositing the cone on the road, preventing it from overturning.

#### Brief Description of the Drawings

**[0020]** The previous and other advantages and features will be more fully understood from the following detailed description of an embodiment with reference to the attached drawings, in which:

Figure 1 schematically illustrates a vehicle in which the system for handling cones object of the present invention is installed;

Figure 2 is an enlarged partial view of Figure 1 to show with greater detail the robotic arm in a pick-up position for picking up the cones and the gripping device seizing a cone;

Figure 3 is a perspective view of the gripping device in the proximity of a cone;

Figure 4 is a perspective view of the gripping device in the moment in which the cone is supported on the fixed half-clamp and the mobile half-clamp is moving towards the fixed half-clamp to seize the cone therebetween;

Figure 5 is a side elevational view of the gripping device with the two jaws of the half-clamps seizing the upper end of the cone;

Figure 6 illustrates in detail the mechanism of rotational and linear movement of the mobile half-clamp;

and

Figure 7 shows an enlarged partial view of Figure 1 which illustrates with greater detail the system for positioning cones on the road.

#### Detailed Description of an Embodiment

**[0021]** Figure 1 shows a system for handling cones on a road, installed in a vehicle, the mentioned system comprising:

- a robotic arm 10 with a gripping device, at a distal end, for seizing and releasing said cone 12;
- a detection system 13 for detecting the presence of a cone 12 on the road, preparing and activating the gripping device after its detection;
- driving means for driving the arm 10 between a pick-up position for picking up the cone 12 on said road, and an unloading position for unloading the cone 12 in a storage area inside the vehicle 14; and
- means for positioning cones 12 at a regular distance on the road;

**[0022]** Figure 2 illustrates with greater detail the mentioned gripping device, formed by an elongated member 11, extending in a cantilevered manner, projecting perpendicularly from a side of the vehicle 14, transversely to the road, on the right or left side of the vehicle, through a rear opening 21 thereof, and which is provided to face the cones 12 when the vehicle 14 moves backwards. The mentioned elongated member 11 incorporates a fixed half-clamp 15 located in a pick-up position, at a height, in relation to the ground, slightly lower than that of the cone 12 in a vertical position, and a mobile half-clamp 16, which can be moved closer to and away from the fixed half-clamp 15 by driving means for driving between a rest position, in which the mobile half-clamp 16 is located at a height above the cone 12, and an active position in which it moves until facing the fixed half-clamp 15, seizing the upper end of the cone 12 therebetween.

**[0023]** The fixed half-clamp 15 and the mobile half-clamp 16 are two substantially parallel arms having associated therewith respective profiles or strips with a triangular section, acting as a clamp jaw 15a, 16a.

**[0024]** The mentioned movement of the mobile half-clamp 16 closer to and away from the fixed half-clamp 15 is carried out by means of a linear movement combined with a rotational movement with respect to a longitudinal axis of the mobile half-clamp 16 such that in the active position, the two jaws 15a, 16a point towards the ground when they seize the end of the cone 12 (Figures 5 and 6), whereas in the rest position the jaw 16a is oriented in a direction opposite to the ground (Figure 3).

**[0025]** Figure 3 also shows that the distal end of the robotic arm 10, in a pick-up position for picking up cones 12, incorporates height regulation and verification means 17. Likewise, in the embodiment shown, the detection system 13 is an optical detection system generating an

optical barrier 24 in front of the fixed half-clamp 15.

**[0026]** Figure 4 illustrates the gripping device in the moment in which the cone 12 has already gone through the optical barrier 24 and is supported in the fixed half-clamp 15. The jaw 16a associated with the mobile half-clamp 16 is moving closer to the fixed half-clamp 15 by means of the rotational and linear movement explained above, to trap the cone 12 between both jaws 15a, 16a. Figure 5 shows the gripping device once it has seized the cone 12.

**[0027]** In relation to Figure 6, it shows the mechanism of rotational and linear movement which, for the embodiment shown, is performed by means of a pinion 36 fixed to the mobile half-clamp 16 and coaxial with the longitudinal axis thereof, meshed with a rack 37 arranged parallel to the direction of the linear movement, and linear actuators 18 linked to each of the ends of the mobile half-clamp 16 and arranged to perform the linear movement and thus cause the rotational movement. Figure 6 shows with a dotted line the mobile half-clamp 16 in a rest position, the direction of rotation and movement performed by such half-clamp to reach its active position being shown with an arrow.

**[0028]** In addition, the robotic arm 10 comprises, at a proximal end, a rotational drive unit 19 suitable for, once the cone is seized by the fixed half-clamp 15 and the mobile half-clamp 16, performing a first rotation of the robotic arm 10 on a substantially horizontal axis, from the mentioned pick-up position to an intermediate position between the pick-up position and the unloading position, and a second rotation from the intermediate position to the unloading position. The rotational drive unit 19 is installed, as illustrated in Figure 1, on a linear movement unit 20, transverse to the longitudinal direction of the vehicle 14, this linear movement unit 20 comprising driving means suitable for moving the robotic arm 10 in the intermediate position, after having performed the first rotation, linearly closer to the unloading area, the fixed half-clamp 15 and the mobile half-clamp 16 thus being in a suitable position for being able to be introduced inside the vehicle 14 through the rear opening 21 thereof. The system likewise comprises a conveyor belt 22 inside the vehicle 14, which in turn comprises leading means for leading the cone 12 to the storage area.

**[0029]** According to what is illustrated in Figures 1 and 2, the gripping device also comprises a concealable stop 23 located, in its extended position, at a height close to the base of the cone 12, to support part of the body of the cone 12 and thus prevent it from overturning when the mentioned first rotation is performed. This concealable stop 23 is formed by a strip associated with a frame.

**[0030]** Figures 1 and 7 illustrate the mentioned means for positioning the cones 12 on the road, which comprise:

- an angular detection device 26 associated with a wheel of the vehicle 14 for detecting, when the vehicle 14 moves forwards, the distance traveled by the vehicle 14 for the purpose of carrying out said

positioning of the cones 12 at a regular distance from one another;

- a loading hopper 27, where the hollow cones 12 stacked by fitting are introduced through an inlet opening 28;
- a locking automatism 29 associated with an unloading automatism for unloading cones 12 which comprises a linear actuator 30, arranged in the outlet opening of the loading hopper 27, configured to drop the cones 12 one by one;
- an unloading hopper 31, extending below the outlet opening of the loading hopper, the unloading hopper 31 comprising guiding grooves 32 for guiding a conveyor carriage 35 for cones 12 which moves up and down; and
- an unloading ramp 33, supported with wheels 34 of support on the ground, connected to the unloading hopper 31 at the lower end thereof, the unloading ramp 33 comprising a series of freely rotating rollers with axes aligned in one and the same plane which allow smoothly depositing the cone 12 on the road, preventing it from overturning.

**[0031]** A person skilled in the art could introduce changes and modifications in the embodiments described without departing from the scope of the invention as it is defined in the attached claims.

## Claims

1. A system for handling cones on a road, installed in a vehicle (14), of the type incorporating:

- a robotic arm (10) with a gripping device, at a distal end, for seizing and releasing said cone (12);
- a detection system (13) for detecting the presence of a cone (12) on the road and activating said gripping device after said detection;
- driving means for driving said arm (10) between a pick-up position for picking up the cone (12) on said road and an unloading position for unloading the cone (12) in a storage area inside said vehicle (14); and
- means for positioning cones (12) at a regular distance on said road;

**characterized in that** said gripping device comprises:

- an elongated member (11), extending in a cantilevered manner, projecting from a side of said vehicle (14) provided to face said cones (12) when the vehicle (14) moves backwards, said elongated member (11) incorporating:

- a fixed half-clamp (15) located in a pick-up position, at a height, in relation to the ground, slightly lower than the measure-

ment of the cone (12) in a vertical position; and

- a mobile half-clamp (16), which can be moved closer to and away from said fixed half-clamp (15) by driving means for driving between a rest position, in which said mobile half-clamp (16) is located at a height above the cone (12), and an active position in which it moves until facing said fixed half-clamp (15), seizing and holding the upper end of the cone (12) therebetween.

2. The system according to claim 1, **characterized in that** said distal end incorporates height regulation and verification means (17) for regulating and verifying the height with respect to the ground of said arm (10) in a pick-up position for picking up cones (12).

3. The system according to claim 1, **characterized in that** said fixed half-clamp (15) and said mobile half-clamp (16) comprise two substantially parallel arms having associated therewith respective profiles with a triangular section, acting as a clamp jaw (15a), (16a).

4. The system according to claim 1, **characterized in that** said elongated member (11) projects perpendicularly with respect to the longitudinal direction of the vehicle (14) on the right or left side of the vehicle.

5. The system according to claim 1, **characterized in that** said movement of the mobile half-clamp (16) closer to and away from the fixed half-clamp (15) is carried out by means of a linear movement combined with a rotational movement with respect to a longitudinal axis of said mobile half-clamp (16) such that in said active position, the two jaws (15a, 16a) point towards the ground when they seize the end of the cone (12) by clamping and in said rest position the jaw (16a) of the mobile half-clamp (16) is oriented in a direction opposite to the ground.

6. The system according to claim 5, **characterized in that** said mobile half-clamp (16) is linearly guided for its movement between said rest position and said active position, said mobile half-clamp (16) having fixed thereto a pinion (36) coaxial with said longitudinal axis thereof and meshed with a fixed rack (37) arranged parallel to the direction of the linear movement, the mentioned driving means being formed by linear actuators (18) linked to each of the ends of the mobile half-clamp (16) and arranged to perform the linear movement with the collaboration of the mentioned pinion (36) and the mentioned fixed rack (37) and thus cause said rotational and lifting movement of the mobile half-clamp (16).

7. The system according to claim 1, **characterized in that** said robotic arm (10) comprises, at a proximal end, a rotational drive unit (19) suitable for, once said cone is seized by the fixed half-clamp (15) and the mobile half-clamp (16), performing a first rotation of said robotic arm (10) on a substantially horizontal axis, from said pick-up position to an intermediate position between said pick-up position and said unloading position, and a second rotation from said intermediate position to said unloading position.
8. The system according to claim 7, **characterized in that** said rotational drive unit (19) is installed on a linear movement unit (20), transverse to said longitudinal direction of the vehicle (14), said linear movement unit (20) comprising driving means suitable for moving said robotic arm (10) in said intermediate position, after having performed said first rotation, linearly closer to said unloading area, said fixed half-clamp (15) and said mobile half-clamp (16) thus being in a suitable position for being able to be introduced inside said vehicle (14) through said rear opening (21).
9. The system according to claim 7, **characterized in that** it comprises a conveyor belt (22) inside the vehicle (14) on which the cone (12) is deposited after said second rotation, said conveyor belt (22) comprising leading means for leading the cone (12) to said storage area.
10. The system according to claim 7, **characterized in that** said gripping device further comprises an element acting as a concealable stop (23) located, in its extended position, at a height close to the base of the cone (12) to support part of the body of the cone (12) and thus prevent it from overturning when the cone is gripped.
11. The system according to claim 10, **characterized in that** said concealable stop (23) comprises a strip associated with an arch secured to the chassis of the vehicle.
12. The system according to claim 1, **characterized in that** said detection system (13) is an optical detection system generating an optical barrier (24) in front of said fixed half-clamp (15).
13. The system according to claim 1, **characterized in that** said means for positioning cones (12) on said road, on both sides of the vehicle, comprise:
- an angular detection device (26) associated with a wheel of said vehicle (14) for detecting, when said vehicle (14) moves forwards, the distance traveled by the vehicle (14) for the purpose of carrying out said positioning of the cones (12)
- at said regular distance from one another;
- a loading hopper (27), where the hollow cones (12) stacked by fitting are introduced through an inlet opening (28);
  - a locking automatism (29) associated with an unloading automatism for unloading cones (12) which comprises a linear actuator (30), arranged in the outlet opening of said loading hopper (27), configured to drop the cones (12) one by one;
  - an unloading hopper (31), extending below said outlet opening of the loading hopper (27), said unloading hopper (31) comprising side guiding grooves (32) for guiding a conveyor carriage (35) for cones (12), said conveyor carriage (35) being controlled by said linear actuator (30); and
  - an unloading ramp (33).
14. The system according to claim 13, **characterized in that** said unloading ramp is supported with wheels (34) for support on the ground, connected to said conveyor carriage (35) at the lower end thereof, said unloading ramp (33) comprising a series of freely rotating rollers with axes aligned in one and the same plane which allow smoothly depositing the cone (12) on the road, preventing it from overturning.
15. The system, according to claim 1, **characterized in that** said elongated member (11) projects through a rear opening (21) of the vehicle, extending transversely to the road.

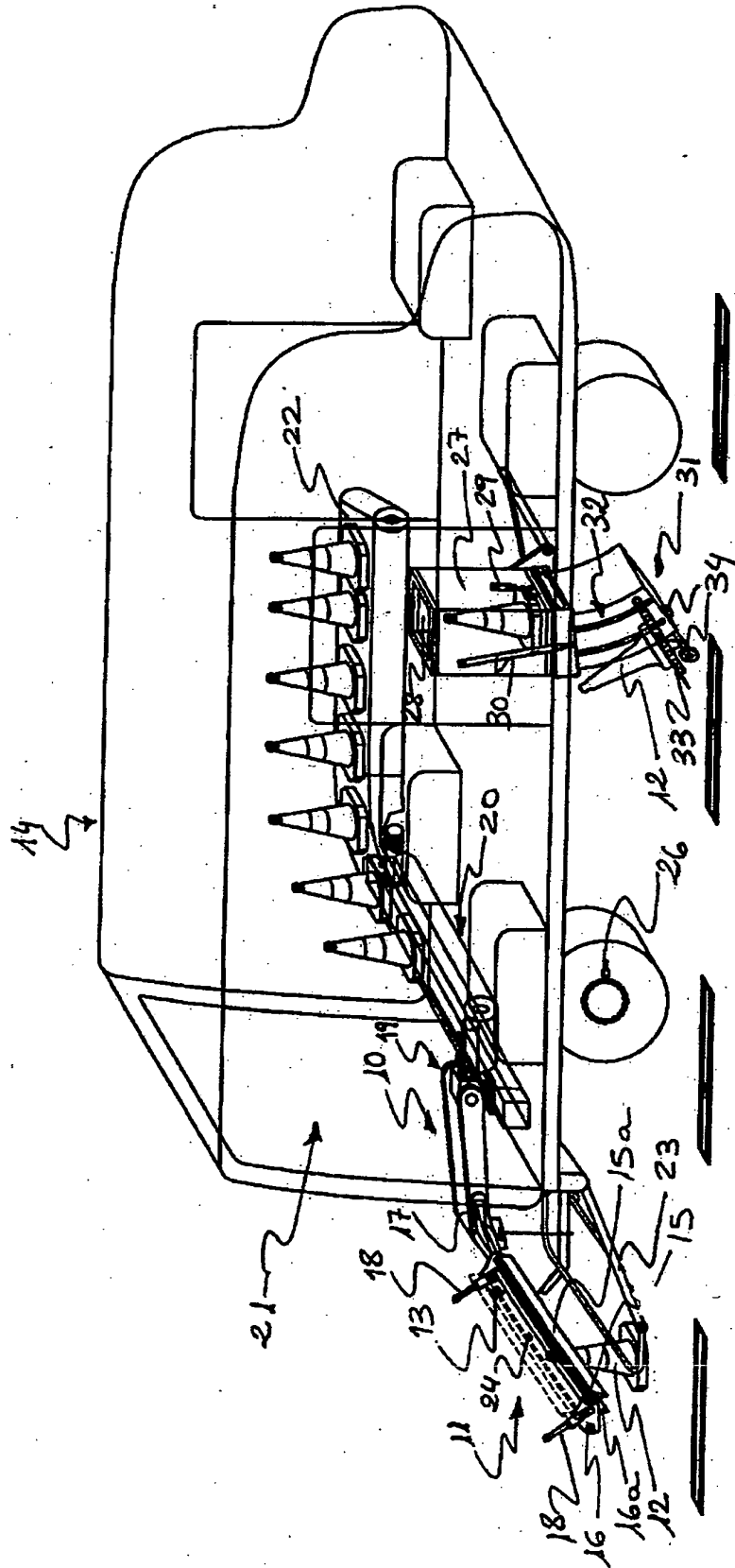
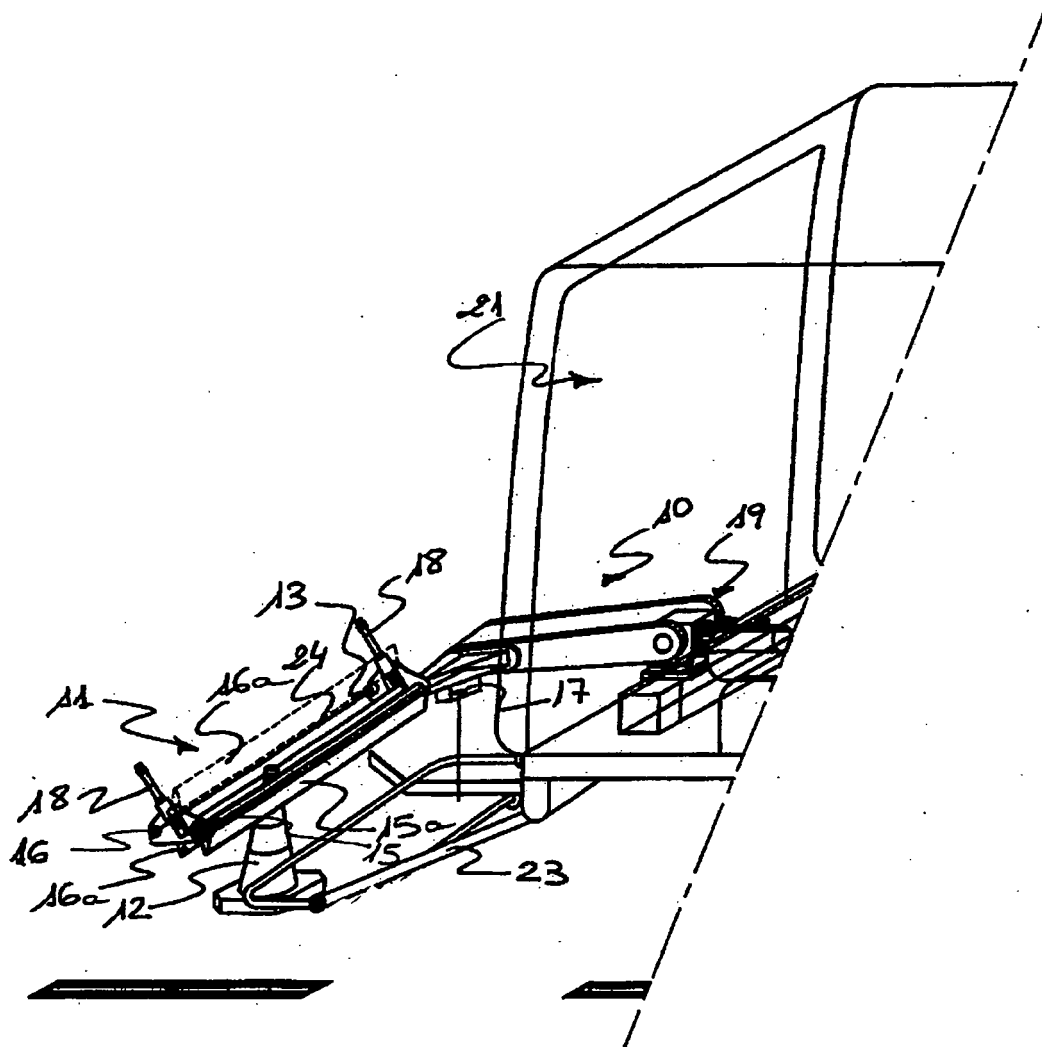


Fig. 1



**Fig.2**

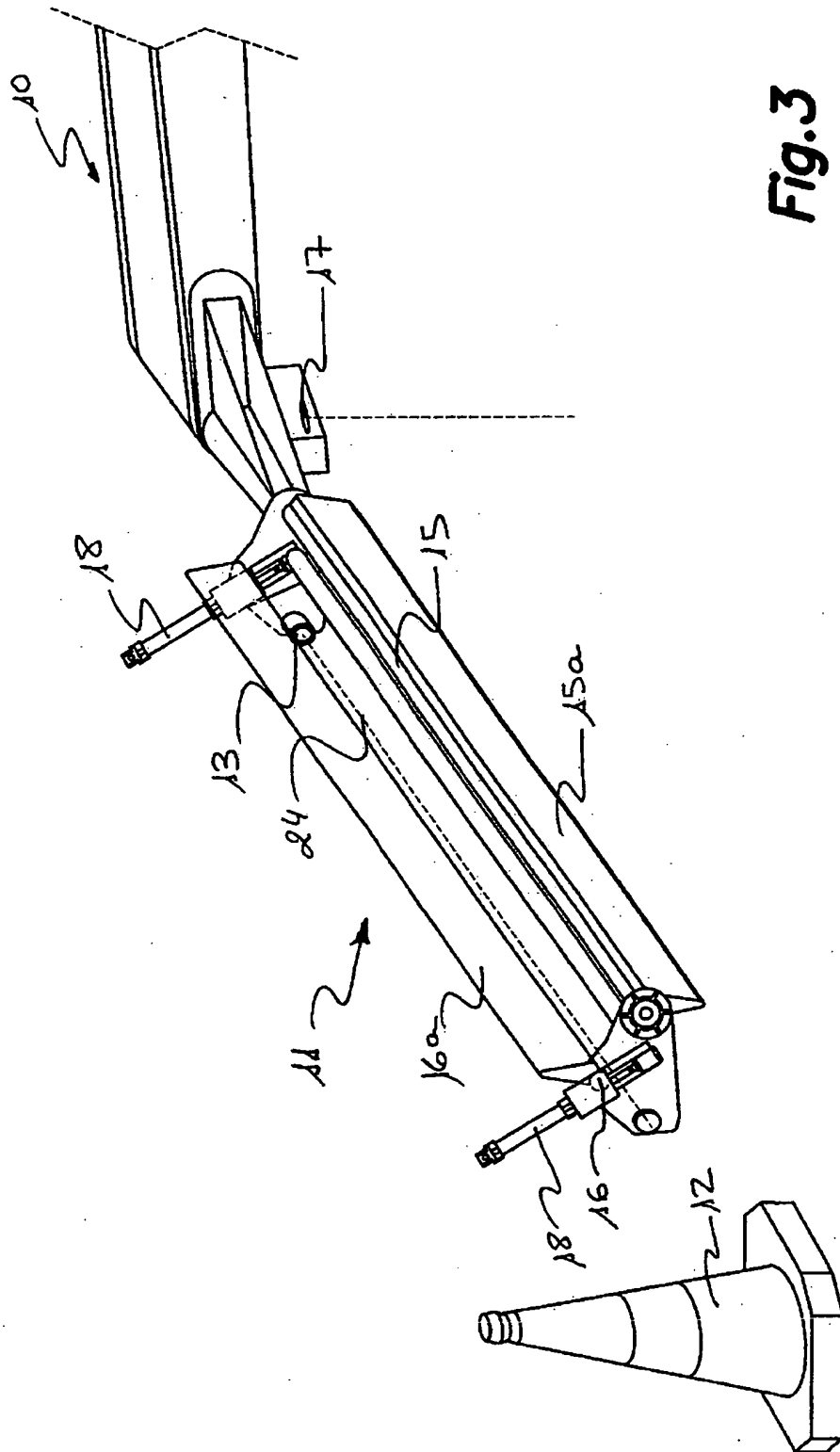


Fig.3

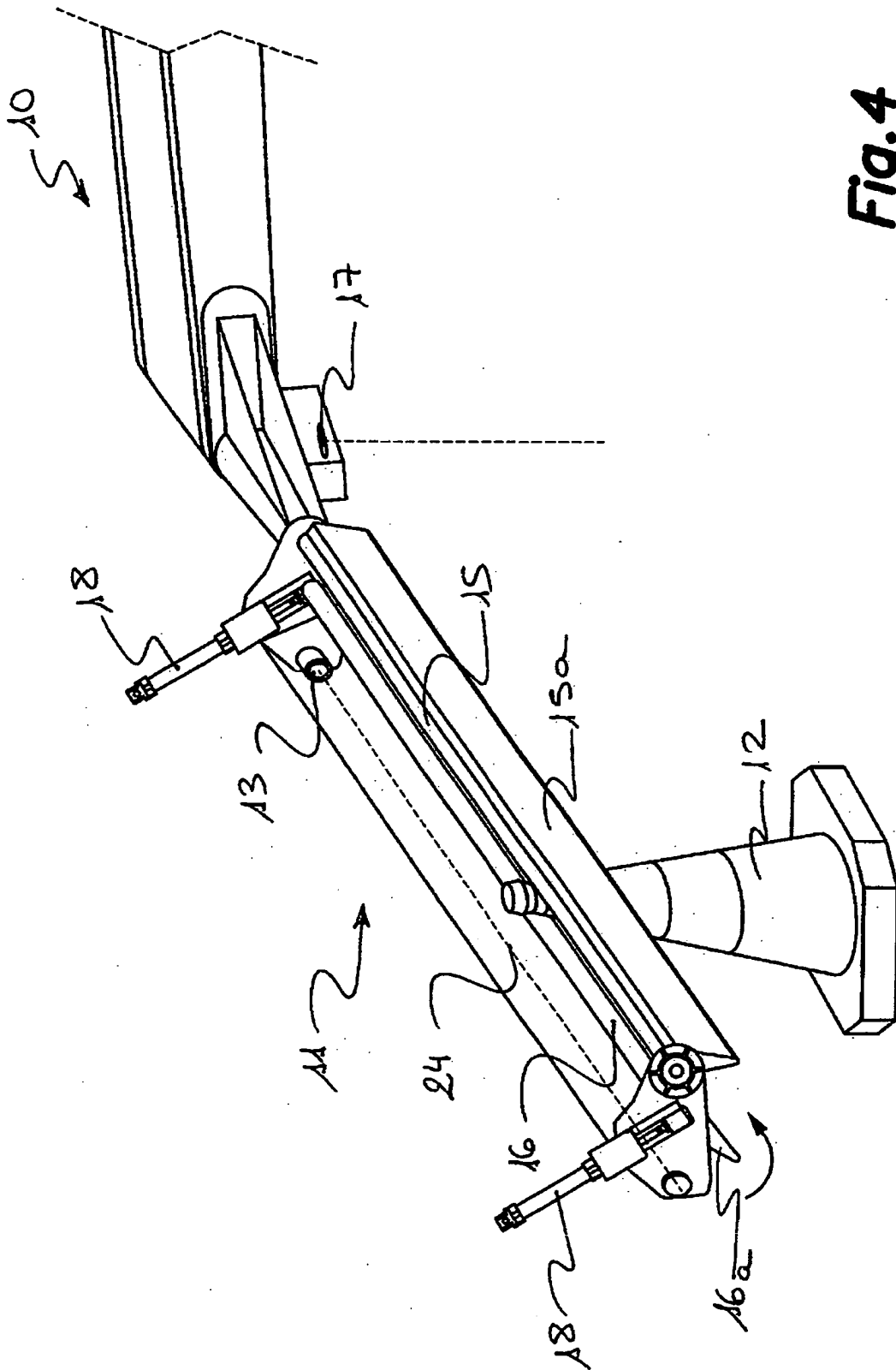
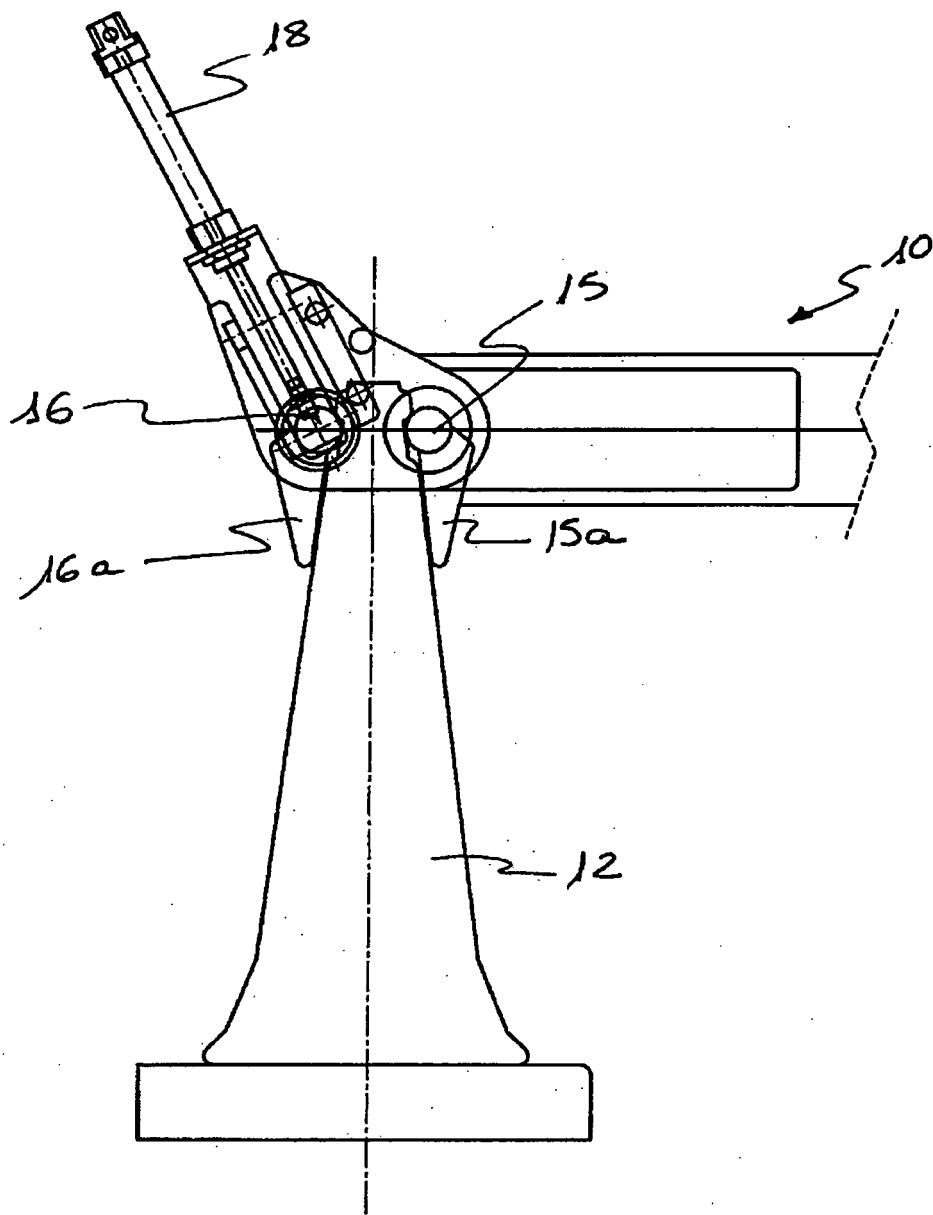
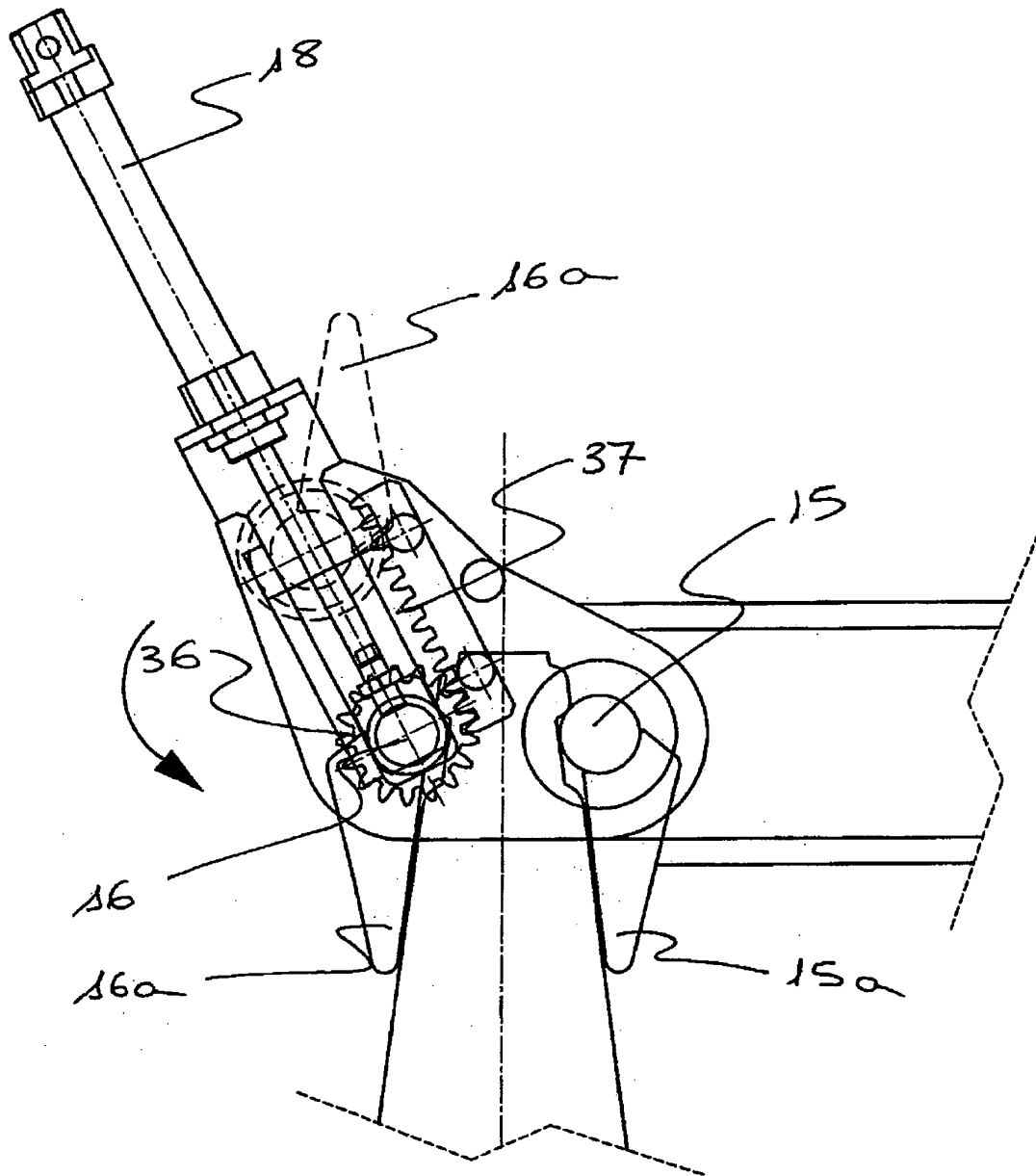


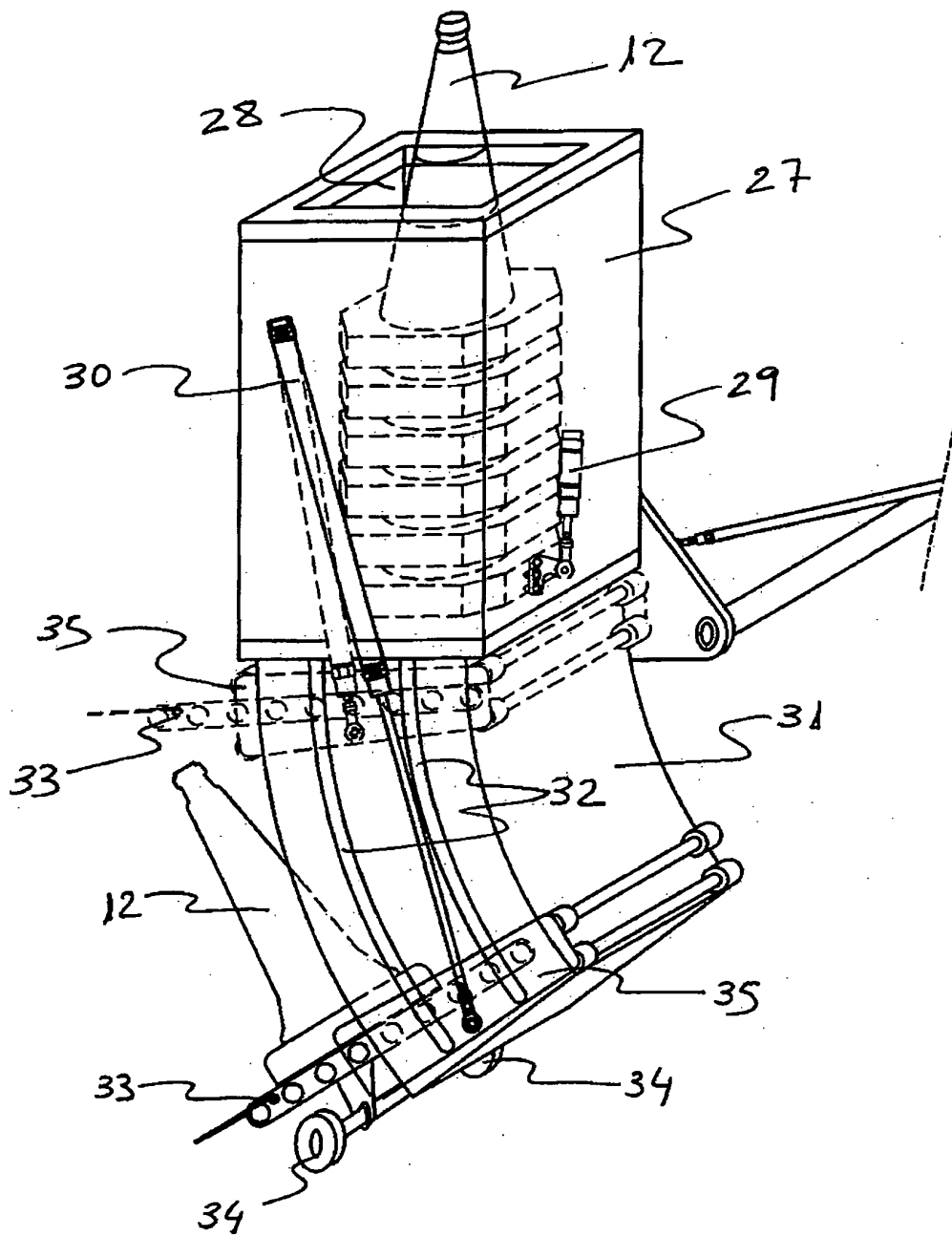
Fig. 4



**Fig.5**



**Fig.6**



**Fig. 7**

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/ ES 2010/070097

## A. CLASSIFICATION OF SUBJECT MATTER

**E01F 9/014** (2006.01)

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)

E01F

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)

INVENES,EPODOC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages         | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------|-----------------------|
| A         | US 6056498 A (VELINSKY et al.) 02.05.2000, column 2, line 58 - column 7, line 25; figures. | 1-15                  |
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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

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

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