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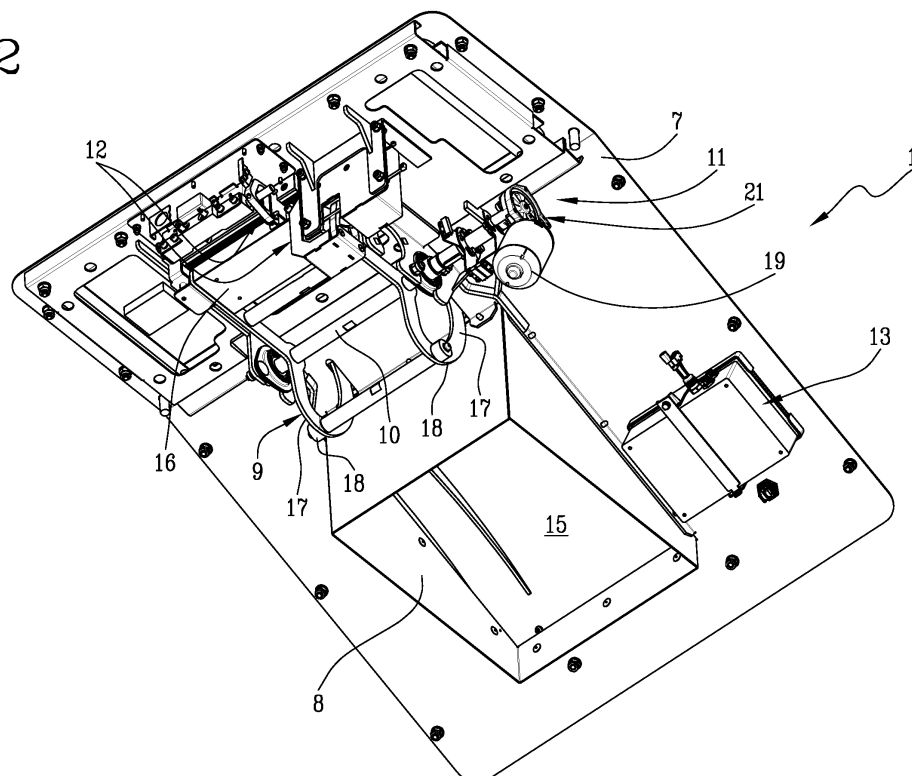
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(54) **WASTE CONTAINER CLOSING APPARATUS, AND CONTAINER EQUIPPED WITH SAID APPARATUS**

(57) A waste container closing apparatus comprises a cover structure (7) engageable to a waste container (2). A lid (9) integral with a drive shaft (10) is rotatably carried by the cover structure (7) around a horizontal hinge axis (X). A drive unit (11) carried by the cover structure (7) operates on the drive shaft (10) to move the lid (9) around the hinge axis (X), between a closed condition in which it

closes an underlying insertion inlet (8) that is fixed relative to the cover structure (7), and an open condition in which it opens the insertion inlet (8). The drive unit (11) is configured to move, relative to the drive shaft (10), a mass (M) hanging relative to the drive shaft itself, so as to impose a rotational moment on the lid (9) about the hinge axis (X).

Fig.2



Description

[0001] The present invention relates to a closing apparatus for waste containers. A waste container incorporating the aforesaid apparatus is also the subject matter of the invention.

[0002] As is known, waste collection in urban areas is normally carried out with the help of special containers, e.g., bins or other types, conveniently located throughout the urban area and accessible to citizens for waste disposal. The containers are periodically emptied into suitably equipped vehicles, which transport the waste to the respective treatment sites.

[0003] For the purpose of waste collection in urban environments, where separate collection is required, the containers are each conveniently configured for the user's disposal of a specific type of waste. To allow the control and monitoring of the waste disposal by users, solutions have been proposed that enable and possibly record the disposal of waste after identification of the user.

[0004] These solutions include a locking system that prevents the direct disposal of waste, making it possible only after unlocking a hatch or other access system by an electromechanical device. The electromechanical device is automatically activated following user identification, usually by means of an electronic interface by reading a code stored or storable on a badge or other type of optical, magnetic, RFID, and/or smartphone or similar support. There is also an increasing need to make it easier for both able-bodied users and disabled users, e.g., wheelchair users, to open the hatch.

[0005] Another need increasingly felt in the industry is the demand for devices that can operate efficiently without requiring a direct connection to an electrical power supply. These needs are typically addressed by using of autonomous battery power units, possibly rechargeable by means of photovoltaic panels. However, the use of these autonomous power units makes it important to minimise the energy consumption of the computer and automation equipment with which the containers are equipped as much as possible, and in particular the electromechanical locking systems used to lock and unlock the access opening.

[0006] In the state of the art, the need for manual operation of the lid or lever mechanisms adapted to open/close it also entails hygiene and sanitation issues, which can also be a deterrent to proper use of the containers by users.

[0007] The invention aims to meet one or more of the conflicting needs described above. More in particular, the aim of the invention is to provide a waste container which does not require direct intervention on the lid, handles or other mechanical levers to determine the opening and closing of the lid itself, so as to facilitate use also by disabled persons and/or when a normally able-bodied user is about to carry out a disposal with both hands engaged. Another aim is to limit possible hygiene and

health issues involved in the use of waste collection containers by the public.

[0008] A further aim is that the automated opening of the lid requires minimum energy, so that the device can be powered autonomously without requiring large-capacity batteries and/or large photovoltaic panels.

[0009] A further aim of the invention is to propose a system in which the automation of the opening and/or closing movement does not impair the safety of use with respect to the user, even if the user's hands or other parts of the body, or other objects, accidentally interfere with the opening and/or closing movements of the lid.

[0010] These aims and others, which will appear more clearly in the following disclosure, are essentially achieved by a waste container closing apparatus, comprising:

a cover structure rigidly engageable to a waste container;

a lid which is integral, at least rotationally, to a drive or transmission shaft rotatably engaged relative to the cover structure around a horizontal hinge axis;
a drive unit carried by the cover structure and operating on the drive shaft to move the lid around the hinge axis, between a closed condition in which it closes an insertion inlet that is fixed relative to the cover structure, and an open condition in which it opens the insertion inlet, preferably below. The drive unit is configured to move, relative to the drive shaft, a mass hanging relative thereto, so as to impose a rotational moment on the lid about the hinge axis.

[0011] In a further aspect, the invention relates to a waste container equipped with such a closing apparatus.

[0012] For the purposes of the present disclosure, the term "integral" referring to the constraint between the lid and the drive shaft is used to indicate that these two elements are rigidly constrained to each other at least rotationally, so that the rotation of one also corresponds to the rotation of the other. A rotational movement imposed by the drive unit is therefore transmitted to the lid through the drive shaft.

[0013] The applicant realised that the opening and closing movements of the lid can be conveniently achieved by inducing a mass connected to the lid to make controlled displacements towards one or the other of two opposite directions relative to the hinge axis of the lid itself. This expedient makes it possible to automate the opening and closing of the lid with less energy consumption, making it possible to use an autonomous power supply with smaller capacity and longer lasting batteries, or by using small, low-cost photovoltaic panels. The low kinetic energy transmitted also allows movements to be carried out with high safety, avoiding transmitting high impact forces onto objects, hands or other parts of the user's body that might accidentally interfere with the movement of the cover or other mechanical parts.

[0014] In at least one of the aforesaid aspects, one or

more of the following preferred features are also envisaged.

[0015] Preferably, the hanging mass and the lid are integrally constrained to each other rotationally.

[0016] Preferably, a rotational oscillation of the lid corresponds to a proportional rotational oscillation of the hanging mass, and vice versa. Preferably, the hanging mass and the lid form an oscillating assembly.

[0017] Preferably, the drive unit is configured to determine an unbalance of the oscillating assembly about the hinge axis.

[0018] Preferably, the oscillating assembly is in a condition of substantial stationary balance about the hinge axis.

[0019] Preferably, the hanging mass comprises a motor of the drive unit. Preferably the weight of the motor, and/or of the hanging mass, is supported by the drive shaft.

[0020] Preferably, the lid comprises a closing portion extending away from the hinge axis above said insertion inlet, and a counterweight arranged on the side opposite the lid with reference to the hinge axis.

[0021] Preferably, the closing portion and the counterweight are respectively balanced about the hinge axis.

[0022] The adoption of a lid provided with a counterweight such as to keep it in a condition of substantial balance about its hinge axis allows it to be opened and closed with a minimum expenditure of energy.

[0023] Preferably, the drive unit comprises:

a motor configured to drive an output shaft thereof in rotation;

a driven pinion rotationally fixed relative to the drive shaft;

a kinematic drive interconnecting the output shaft and the driven pinion.

[0024] Preferably, the motor results suspended in an oscillating manner relative to the drive shaft. Preferably, said kinematic drive comprises a worm gear coaxially carried by the output shaft and operatively engaged with a circumferential gear carried by the driven pinion.

[0025] Preferably, said kinematic drive further comprises an intermediate shaft carrying a transmission gear operatively engaged with the worm gear and a return pinion operatively engaged with the driven pinion.

[0026] Preferably, the intermediate shaft is rotatably carried by the support structure.

[0027] Preferably, the intermediate shaft is flanked parallel relative to the drive shaft.

[0028] Preferably, the drive shaft and intermediate shaft are kinematically connected to each other and mutually integral in rotation.

[0029] Preferably, the drive shaft and the intermediate shaft form a first and a second section of the same drive or transmission shaft.

[0030] Preferably, said hinge axis and intermediate axis form a first and second portion, flanked parallel to

each other, of the same hinge axis.

[0031] Preferably, the worm gear is fixed on an upper end of the output shaft, which in turn supports the motor.

[0032] Preferably, the motor is arranged lower relative to the worm screw and the drive shaft.

[0033] Preferably, the motor is arranged lower relative to the worm gear and the intermediate shaft.

[0034] Preferably, the motor is movable with respect to the drive shaft.

[0035] Preferably, the motor is oscillating around the hinge axis.

[0036] Preferably, the motor is oscillating around an intermediate axis parallel to the hinge axis.

[0037] Preferably, the intermediate shaft is coaxial to the intermediate axis. Further comprising sensor devices to stop the motor upon reaching a first and a second end-stroke condition, respectively.

[0038] Preferably, such sensor devices comprise a first proximity sensor and a second proximity sensor integral to the drive shaft at positions angularly spaced apart from each other around the hinge axis, and cooperating with a reference pointer integral to the motor.

[0039] Preferably, such sensor devices comprise a first proximity sensor and a second proximity sensor integral to the intermediate shaft at positions angularly spaced apart from each other around the intermediate axis, and cooperating with a reference pointer integral to the motor.

[0040] Preferably, a locking device is also provided for holding the lid in the closed position.

[0041] Preferably, the locking device can be deactivated to free the mobility of the lid towards the open condition following the identification of an authorised user.

[0042] Preferably, there is also a user identification unit configured to enable the unlocking of the lid from the closed condition following the entry of an identification code.

[0043] Preferably, the drive unit comprises one or more motion sensors configured to control the opening of the lid following the approach of a user. Preferably, the drive unit comprises:

a pump:

a first and a second containment chamber in fluid communication with said pump;

wherein said first and second containment chambers are mechanically interconnected to the lid on sides respectively opposite to the hinge axis.

[0044] Preferably, the hanging mass comprises a fluid configured to be transferred from the first to the second containment chamber and vice versa, by means of the pump.

[0045] Preferably, the pump is connected to said first and second containment chambers by means of flexible and/or extensible conduits.

[0046] Preferably, each of said first and second containment chambers transmits a momentum to the lid that

tends to make it rotate about the hinge axis, in the opposite direction to the momentum transmitted by the other containment chamber.

[0047] Preferably, each of said containment chambers is restrained as hanging relative to the lid by at least one respective hanging element.

[0048] Preferably, each of said containment chambers is made in the form of a movable tank.

[0049] Preferably, said pump is a peristaltic pump.

[0050] Preferably, said sensor devices comprise at least a first and a second level sensor associated with said first and second containment chambers, respectively, to stop the pump, each upon reaching a filling condition of the respective containment chamber.

[0051] Further features and advantages will better appear from the detailed description of a preferred, but not exclusive, embodiment of a waste container closing apparatus, and of a container equipped with said apparatus, in accordance with the present invention. Such a description will be set forth herein below with reference to the accompanying drawings, provided for merely indicative and therefore non-limiting purposes, in which:

- Figure 1 shows in perspective view a waste container equipped with a closing apparatus according to the present invention;
- Figure 1a shows a further example of a waste container, which can be equipped with the apparatus according to the invention;
- Figure 2 shows a perspective view from below of the closing apparatus, highlighting the internal components thereof;
- Figure 3 shows in perspective view, from a slightly different angle, an enlarged detail of Figure 2;
- Figure 4 schematically shows in side view some components of the apparatus of Figures 2 and 3 at rest in the closed condition;
- Figure 5 shows the apparatus of Figure 4 in the open condition;
- Figure 6 shows the apparatus of Figures 4 and 5 in a situation where the opening of the lid is obstructed;
- Figure 7 shows the apparatus of Figures 4 to 7 in a situation where the closing of the lid is obstructed;
- Figure 8 shows in perspective view from below an embodiment variant of the apparatus;
- Figure 9 shows in perspective view, from a slightly different angle, an enlarged detail of Figure 8;
- Figures 10 and 11 schematically show in side view a possible further embodiment variant of the apparatus.

[0052] With particular reference to Figures 1 and 1a, 1 overall indicates a waste container closing apparatus, in accordance with the present invention. Apparatus 1 is associated with a waste container 2 comprising a containment structure 3 which, in the example shown, has a substantially prismatic shape whose perimeter development is defined by side walls 4 rising away from the road

surface or other supporting surface, and circumscribing a containment chamber 5 closed at the top by the closing apparatus 1. Two or more waste containers 2 each designed to accommodate a specific type of waste (paper, plastic, glass, etc.) can be installed one after the other in mutual alignment, or placed close together within a dedicated separated waste collection area.

[0053] Containment chamber 5 of waste container 2 can accommodate at least one containment bin 5a, preferably removable by opening an access hatch 6 obtained in one of side walls 4. In a known manner, access hatch 6 can be fitted with a lock that can only be opened by authorised personnel in possession of a special key, for the purpose of performing periodic bin emptying operations and/or other maintenance operations.

[0054] In a possible embodiment variant, waste container 2 can be made in the form of a bell that can be emptied from the bottom as shown in Figure 1a, a side-loading bin, or another type of container having containment chamber 5 designed to directly accommodate the waste in the absence of internal bins. Closing apparatus 1 is also applicable to a column or turret typically associated with underground or semi-underground containers.

[0055] Closing apparatus 1 comprises a cover structure 7 engageable at the top of waste container 2. In the example shown, cover structure 7 is suitable to be fixed to the upper edges of containment structure 3. In the case of waste container 2 without an inner bin, cover structure 7 can be hinged above to one of the sides of containment structure 3, and can be opened by gravity following an overturning motion of waste container 2, in order to determine the emptying of the waste onto a waste collection vehicle.

[0056] In cover structure 7, an insertion inlet 8 is obtained which is provided with a lid 9, for introducing waste inside waste container 2. Lid 9 is integral with a drive shaft 10, rotatably engaged relative to cover structure 7 around a horizontal hinge axis X, on the side facing the inside of containment chamber 5.

[0057] Cover structure 7, also internally relative to containment chamber 5, carries a drive unit 11 which operates on drive shaft 10, to move lid 9 about hinge axis X between a closed condition, in which it closes underlying insertion inlet 8, and an open condition in which insertion inlet 8 is open and accessible from the outside for the purpose of waste disposal.

[0058] It may be envisaged that the activation of drive unit 11 for the purpose of moving lid 9 towards the open condition is enabled upon deactivation of an electromechanical locking device 12 (not shown in detail), configured to hold lid 9 itself in the closed condition. The operation of locking device 12 can be conveniently managed through a user identification unit 13 which enables the unlocking of lid 9 from the closed condition following the entry of an identification code assigned to the user. The identification code can be entered in various ways, e.g., by means of keyboard, touch-screen, reading a

magnetic card, RFID or wirelessly querying a smart-phone or remote memory unit.

[0059] The opening of lid 9 can be controlled by an electronic control unit following recognition of the identification code. Alternatively, in the presence or absence of locking device 12 and the user identification unit, the opening of lid 9 can occur by means of an activation button 14 of drive unit 11 and/or by means of sensors, e.g., TOF (Time of Flight) type motion sensors. Such sensors, not shown, detect the proximity of the user relative to waste container 2 and/or, for example, the approach of the hand to a predefined activation zone arranged on containment structure 3. It is also possible to envisage that the movement of lid 9 is controlled by means of a foot pedal upon a manual action exercised by the user directly on lid 9 itself or on a control lever.

[0060] In the embodiment shown in Figures 1 and from 2 to 11, lid 9 comprises a closing portion 15 extending away from hinge axis X above said insertion inlet 8, and at least one counterweight 16 arranged on the opposite side relative to lid 9 with reference to hinge axis X. Counterweight 16 is concealed within containment chamber 5. When lid 9 is in the closed condition, counterweight 16 is positioned in a juxtaposed relation relative to cover structure 7, on one side of the latter facing containment chamber 5 itself. A displacement of closing portion 15 towards the open condition corresponds to a lowering of counterweight 16 towards the inside of containment chamber 5.

[0061] A pair of "U"-shaped brackets 17 connects closing portion 15 to drive shaft 10, thus allowing a sufficient angular excursion of lid 9 around hinge axis X without interference against cover structure 7. A pair of stop buffers 18 carried by "U"-shaped brackets 17 lends itself to acting against cover structure 7 to stop the movement of lid 9 when the open condition is reached.

[0062] It can conveniently be envisaged that closing portion 15 and counterweight 16 of lid 9 are respectively balanced about hinge axis X, so as to minimise the force required to obtain the movement of lid 9 from the open and/or closed condition.

[0063] Drive unit 11 comprises a motor 19, preferably an electric motor, configured to rotatably drive an output shaft 20 thereof. A kinematic drive 21 connects output shaft 20 with a driven pinion 22 coaxial to drive shaft 10 of lid 9. In the example shown in Figures 2 to 7, kinematic drive 21 comprises a worm gear 23 coaxially carried by output shaft 20 of motor 19, and operatively engaged with a circumferential gear (not visible in the drawings) carried by driven pinion 22. This embodiment solution offers an efficient connection between motor 19 and drive shaft 10, with a reduced number of components for the benefit of structural and construction simplification.

[0064] In the embodiment variant shown in Figures 8 and 9, equal parts and/or parts having the same function have been indicated with the same numerical references used in Figures 2 to 7. In contrast to the embodiment example described above, in this embodiment variant

kinematic drive 21 further comprises an intermediate shaft 24b, flanked parallel relative to drive shaft 10 and carried by cover structure 7, rotating about an intermediate axis X1 thereof. Intermediate shaft 24 coaxially carries a transmission gear 25 operatively engaged with worm screw 23, and a return pinion 26 operatively engaged with driven pinion 22 keyed along drive shaft 10. This embodiment variant offers greater design freedom in the positioning of motor 19, and greater adaptability of the system to the geometric and dimensional features of cover structure 7.

[0065] In the embodiment solution of Figures 8 and 9, drive shaft 10 and intermediate shaft 24 are kinematically connected to each other to be mutually integral in rotation. Drive shaft 10 and intermediate shaft 24 can therefore be considered respectively as forming a first and a second section of a same drive or transmission shaft. As can be clearly seen from Figures 8 and 9, such first and second pieces identified by drive shaft 10 and intermediate shaft 24 are respectively parallel and/or axially offset from each other. Similarly, hinge axis X and intermediate axis X1 can be considered as forming, respectively, a first and a second portion, flanked parallel to each other, of the same hinge axis. It is also evident that transmission gear 25 in Figures 8 and 9 is structurally similar to and carries out the same function as driven pinion 22 in Figures 2 to 7, and is therefore comparable thereto.

[0066] In both embodiment solutions, worm gear 23 is fixed on an upper end of output shaft 20, which in turn supports motor 19. Motor 19 is in turn arranged lower relative to the same worm screw 23, drive shaft 10 and/or intermediate shaft 24. Therefore, motor 19 is hanging and oscillating relative to drive shaft 10, and moving with respect thereto, about hinge axis X (Figures 2-7) or about intermediate axis X1 (Figures 8 and 9).

[0067] Motor 19 thus constitutes a hanging mass M relative to drive shaft 10. In fact, in other words, the weight of motor 19 and of hanging mass M it represents, is supported by drive shaft 10. Motor 10 and/or hanging mass M, together with lid 9, form an oscillating assembly relative to hinge axis X. Due to the engagement of worm screw 23 with driven pinion 22 or with transmission gear 25, when motor 19 is stopped, such an oscillating assembly can rotate about hinge axis X, for example following a movement directly imposed on lid 9 towards the closed or open condition, while maintaining the mutual orientation between hanging mass M and lid 9 unchanged.

[0068] In the activation phases of motor 19, lid 9 and hanging mass M are instead induced to rotate with respect to each other about hinge axis X and/or about intermediate axis X1. In this circumstance, hanging mass M is induced to move relative to drive shaft 10, describing an arcuate path around hinge axis X (Figures 2-7) or intermediate axis X1 (Figures 8 and 9). The resulting unbalance of the oscillating assembly imposes on lid 9 a rotational momentum around hinge axis X, causing it to move towards the open condition or the closed condition.

[0069] By appropriately sizing and positioning counter-weight 16 and/or other hanging masses with respect to lid 9 and/or motor 19, the oscillating assembly can be conveniently configured to maintain, at rest, a condition of substantial stationary balance in which a centre of gravity G of hanging mass M lies in a vertical plane containing hinge axis X or intermediate axis X1, below the respective drive shaft 10 or intermediate shaft 24.

[0070] This thereby minimises the energy required to determine the movement of lid 9 towards the open or closed condition. A modest unbalance of the oscillating assembly can also be envisaged, for example to favour the opening of lid 9 from the closed condition, or in holding lid 9 in the open condition. The reduced energy expenditure makes it easy to power the device autonomously, for example with the aid of rechargeable batteries powered by one or more solar panels 30.

[0071] Drive unit 11 is also preferably associated with sensor devices 27, configured to stop motor 19 respectively upon reaching a first and a second end-stroke condition corresponding to the open condition and the closed condition of lid 9, respectively.

[0072] Sensor devices 27 can for example comprise one or more proximity sensors 28a, 28b and at least one reference pointer 29, respectively integral with respect to motor 19 and with respect to drive shaft 10 (Figures 2-7) or intermediate shaft 24 (Figures 8 and 9).

[0073] In the examples illustrated, reference pointer 29 is made in the form of a fixed magnet relative to motor 19 and arranged to selectively interact with a first proximity sensor 28a and a second proximity sensor 28b fixed to drive shaft 10 or to intermediate shaft 24, if any, at positions angularly spaced apart from each other around hinge axis X or intermediate axis X1. Figures 4 to 7 schematically show in side view different operating configurations that can be conveniently implemented by the apparatus in question. Such figures refer to the preferred solution depicted in Figures 2 and 3, but the operational concept remains essentially the same also for the embodiment variant in Figures 8 and 9.

[0074] In particular, Figures 4 and 5 show the execution of the automated opening of lid 9. Starting from the closed condition depicted in Figure 4, the identification of a user by means of the identification unit and/or a command imposed by means of the aforesaid activation button 14 and/or motion sensors, determines the activation of motor 19 after deactivation of locking device 12, if present. Worm screw 23 transmits a counter-clockwise rotation to driven pinion 22, with reference to the figures. In this circumstance, the weight of lid 9 and/or the inertia thereof may cause a resistant momentum about hinge axis X, which may induce a slight clockwise displacement of hanging mass M represented by motor 19 and a consequent displacement of centre of gravity G towards the left side of vertical plane P containing hinge axis X. However, centre of gravity G of hanging mass M tends to restore a balanced position aligned with the vertical plane, below hinge axis X, causing the lid to open with a counter-

clockwise rotation movement. The action of the end-stroke buffers against cover structure 7 stops the movement of lid 9 when the open position is reached. In this circumstance, motor 19 remains in operation and the action of worm screw 23 on driven pinion 22 forces the motor itself and centre of gravity G to move clockwise around hinge axis X, as shown in Figure 5. The rotation of motor 19 is stopped when reference pointer 29, rotating together with motor 19 around hinge axis X, reaches first proximity sensor 28a. In this situation, centre of gravity G is displaced to the left relative to vertical plane P and hanging mass M represented by motor 19 transmits, by gravity, a rotational momentum to driven pinion 22, which favours holding lid 9 in the open condition.

[0075] The subsequent return of lid 9 to the closed condition can, for example, be controlled automatically after a predetermined time from the opening, or following the distancing of the user from waste container 2, resulting in an actuation of motor 19 and the consequent movement of lid 9 in the opposite direction to that which caused the opening. When the closed condition is reached, the rotation of lid 9 is stopped against cover structure 7, restoring the situation depicted in Figure 4. The rotation of motor 19 can be conveniently stopped when reference pointer 29, rotating together with motor 19, reaches second proximity sensor 28b. In the example shown, when the closed condition is reached, centre of gravity G of hanging mass M is vertically aligned below hinge axis X, in vertical plane P. If necessary, however, by suitably adjusting the position of second proximity sensor 28b around hinge axis X or intermediate axis X1, it can be envisaged that in this situation centre of gravity G is shifted to the right-hand side of vertical plane P containing hinge axis X, so that hanging mass M represented by motor 19 transmits, by gravity, a rotational momentum to driven pinion 22, which favours the retention of lid 9 in the closed condition.

[0076] Figure 6 shows a situation in which the movement of lid 9 towards the closed condition is incidentally stopped, for example due to interference with a user's hand or another object interposed between closing portion 15 and cover structure 7. In this situation, the action of motor 19 can continue without transmitting excessive forces through closing portion 15. In fact, the interaction of worm screw 23 on driven pinion 22 forces motor 19 to move counter-clockwise around hinge axis X, until motor 19 itself stops when reference pointer 29 reaches second proximity sensor 28b. In this circumstance, centre of gravity G is displaced to the right relative to vertical plane P, generating a modest rotational momentum on the hinge shaft and lid 9, the magnitude of which is not such as to cause physical trauma or injury to the user, or damage mechanical parts.

[0077] Figure 7 shows a situation in which the movement of lid 9 towards the open condition is incidentally stopped, e.g., due to interference with a user's hand or another object. Also in this situation, the action of motor 19 can continue without transmitting excessive forces

through closing portion 15. In fact, the interaction of worm screw 23 on driven pinion 22 forces motor 19 to move clockwise around hinge axis X, until motor 19 itself stops when reference pointer 29 reaches first proximity sensor 28a. In this circumstance, centre of gravity G is displaced to the left relative to vertical plane P, generating a modest rotational momentum on the hinge shaft and lid 9, the magnitude of which is not such as to cause physical trauma or injury to the user, or damage mechanical parts.

[0078] The absence of direct mechanical constraints between motor 19 and cover structure 7 also makes it possible to perform the movement of lid 9 from the closed condition to the open condition, and vice versa, by manually acting on the control handle, after deactivating any locking devices present. It is therefore possible to determine the movement of lid 9 even in the absence of electrical power supply. The invention also makes it possible to bring the lid into an open condition voluntarily and quickly without affecting the operation in progress, and also to keep it deliberately open to carry out a disposal more slowly. It is also possible to enable the automated opening and closing of lid 9 only after the identification of disabled users or users with special needs, limiting the amount of energy required.

[0079] The embodiment examples described achieve the opening and closing of lid 9 by conveniently exploiting the displacement of the mass of electric motor 19 relative to the hinge shaft.

[0080] For the purposes of the present invention, it is also possible to implement the movement of lid 9 by moving counterweights and other different masses. As schematically shown in Figures 10 and 11, it may be envisaged, for example, that drive unit 11 comprises at least one peristaltic or other type of pump 31, preferably bi-directional, connected to containment chambers 32a, 32b, preferably made in the form of movable tanks. More in particular, a first movable tank 32a and a second movable tank 32b may be provided, connected to pump 31 by means of flexible and/or extensible conduits, respectively a first conduit 33a and a second conduit 33b. Movable tanks 32a, 32b, e.g., by means of cables, ropes, tie-rods and/or other hanging elements 34a, 34b, are also mechanically interconnected to lid 9, in a hanging relationship on mutually opposite sides relative to hinge axis X. Each movable tank 32a, 32b, transmits to lid 9 a momentum which tends to make it rotate about hinge axis X, in the opposite direction relative to the momentum transmitted by the other movable tank. Movable tanks 32a, 32b can be associated with respective level sensors 35a, 35b which carry out the function of aforesaid sensor devices 27, stopping pump 31, each upon reaching a filling condition of the respective movable tank 32a, 32b to which the open condition and the closed condition of lid 9 corresponds, respectively.

[0081] The driving of pump 31 in either direction, which can be achieved by means of a motor or a manually or foot-operated linkage, causes the transfer of a fluid mass M (e.g., oil, water possibly with antifreeze additive or

other) from one to the other of tanks 32a, 32b. An imbalance of the oscillating assembly relative to hinge axis X can thus be achieved, which causes lid 9 to move towards the open or closed condition.

[0082] The invention is also conveniently adaptable to different types of lids 9. For example, Figure 1a shows one of the further possible variants, adapted to implement a volumetric limitation of the material introduced at each delivery, in which lid 9 can comprise a pair of semi-cylindrical hooded drums, movable in opposite directions around hinge axis X, one of which defines closing portion 15. The drums can move simultaneously, or a drum and a horizontally hinged diaphragm can be provided which diverges, driven by the movement of the first drum, creating a volumetric limitation system. Cover structure 7 can be fixed at the top of one of side walls 4, as shown in Figure 1a.

Claims

1. Waste container closing apparatus, comprising:

a cover structure (7) rigidly engageable to a waste container (2);
a lid (9) integral with a drive shaft (10) rotatably engaged to the cover structure (7) around a horizontal hinge axis (X);
a drive unit (11) carried by the cover structure (7) and operating on the drive shaft (10) to move the lid (9) around the hinge axis (X), between a closed condition in which it closes an insertion inlet (8) that is fixed relative to the cover structure (7), and an open condition in which it opens the insertion inlet (8);
wherein the drive unit (11) is configured to move, relative to the drive shaft (10), a mass (M) hanging relative to the drive shaft itself, so as to impose a rotational moment on the lid (9) about the hinge axis (X).

2. Apparatus according to claim 1, wherein the hanging mass (M) and the lid (9) form an oscillating assembly, the drive unit (11) being configured to determine an unbalance of the oscillating assembly about the hinge axis (X)

3. Apparatus according to claim 2, wherein said oscillating assembly is in a condition of substantial stationary balance about the hinge axis (X).

4. Apparatus according to claim 1 or 2, wherein the hanging mass (M) comprises a motor (19) of the drive unit (11).

5. Apparatus according to one or more of the preceding claims, wherein the lid (9) comprises a closing portion (15) extending away from the hinge axis (X)

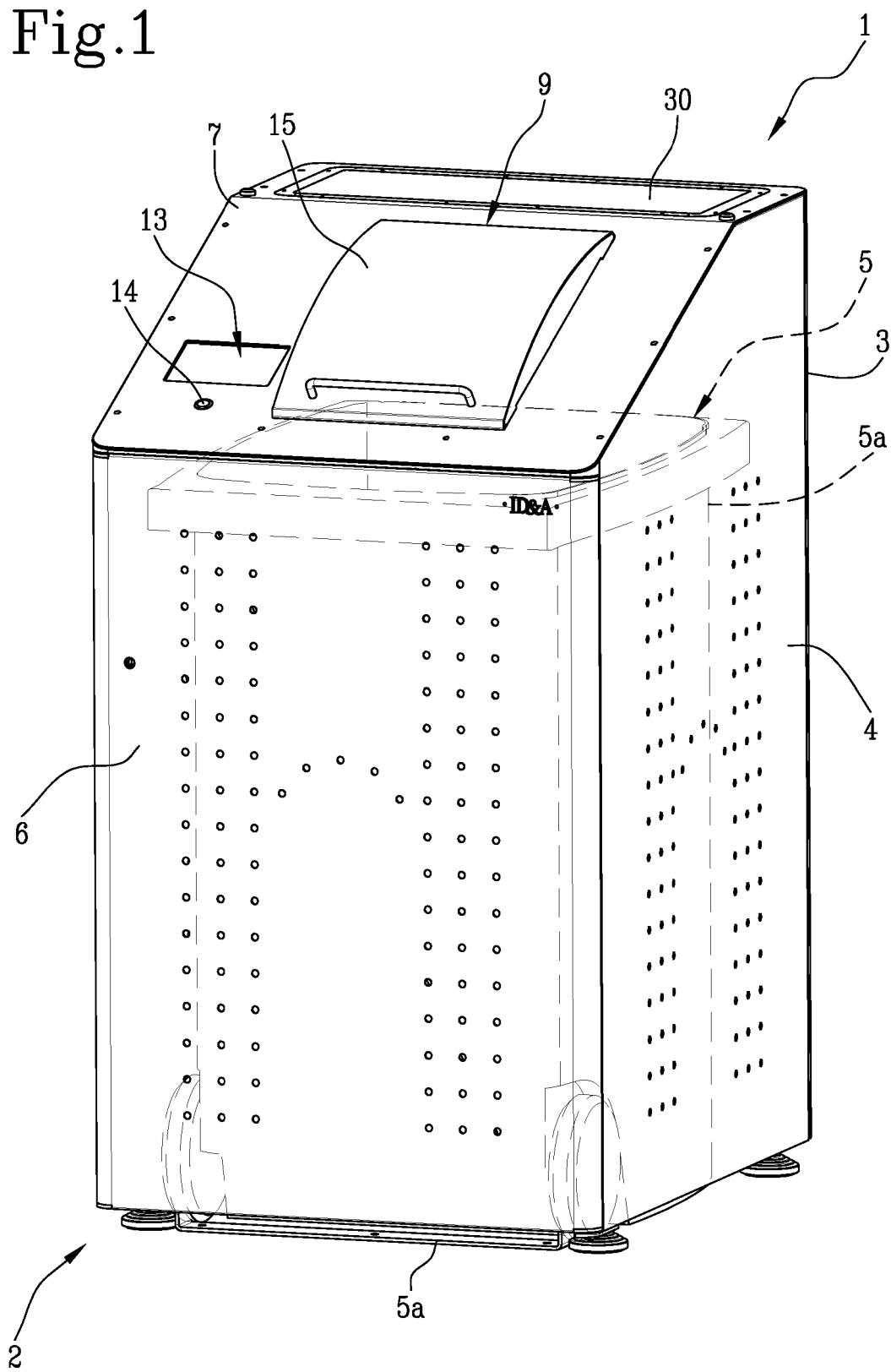
above said insertion inlet (8), and a counterweight (16) arranged on the side opposite the lid (9) with reference to the hinge axis (X).

6. Apparatus according to one or more of the preceding claims, wherein the drive unit (11) comprises:
 - a motor (19) configured to drive an output shaft (20) in rotation;
 - a driven pinion (22) rotationally fixed relative to the drive shaft (10);
 - a kinematic drive (21) interconnecting the output shaft (20) and the driven pinion (22); wherein the motor (19) is hanging and oscillating relative to the drive shaft (10).
7. Apparatus according to claim 6, wherein said kinematic drive (21) comprises a worm gear (23) coaxially carried by the output shaft (20) and operatively engaged with a circumferential gear carried by the driven pinion (22)
8. Apparatus according to claim 7, wherein said kinematic drive (21) further comprises an intermediate shaft (24) carrying a transmission gear (25) operatively engaged with the worm gear (23) and a return pinion (26) operatively engaged with the driven pinion (22).
9. Apparatus according to one or more of claims 4 to 8, wherein the motor (19) is hanging and oscillating relative to the drive shaft (10).
10. Apparatus according to one or more of claims 4 to 9, further comprising sensor devices (27) to stop the motor (19) upon reaching a first and a second end-stroke condition respectively, wherein said sensor devices (27) preferably comprise a first proximity sensor (28a) and a second proximity sensor (28b) integral to the drive shaft (10) or to the intermediate shaft (24), at positions angularly spaced apart from each other around the hinge axis (X), and cooperating with a reference pointer (29) integral to the motor (19).
11. Apparatus according to one or more of the preceding claims, wherein the drive unit (11) comprises: a pump (31):
 - a first and a second containment chamber (32a, 32b) in fluid communication with said pump (31); wherein said first and second containment chambers (32a, 32b) are mechanically interconnected to the lid (9) on sides respectively opposite to the hinge axis (X);
 - wherein the hanging mass (M) comprises a fluid configured to be transferred from the first to the

second containment chamber (32a, 32b), and vice versa, by means of the pump (31).

12. Apparatus according to claim 11, wherein each of said containment chambers (32a, 32b) is restrained as hanging relative to the lid (9).
13. Apparatus according to claim 11 or 12, wherein each of said first and second containment chambers (32a, 32b) transmits to the lid (9) a momentum that tends to make it rotate about the hinge axis (X), in the opposite direction to the momentum transmitted by the other containment chamber (32a, 32b).
14. Apparatus according to one or more of claims 11 to 13, wherein said sensor devices (27) comprise at least one first and one second level sensor (35a, 35b) respectively associated with said first and second containment chambers (32a, 32b), to stop the pump (31), each upon reaching a filling condition of the respective containment chamber (32a, 32b).
15. Waste container comprising a closing apparatus (1) according to one or more of the preceding claims.

Fig.1



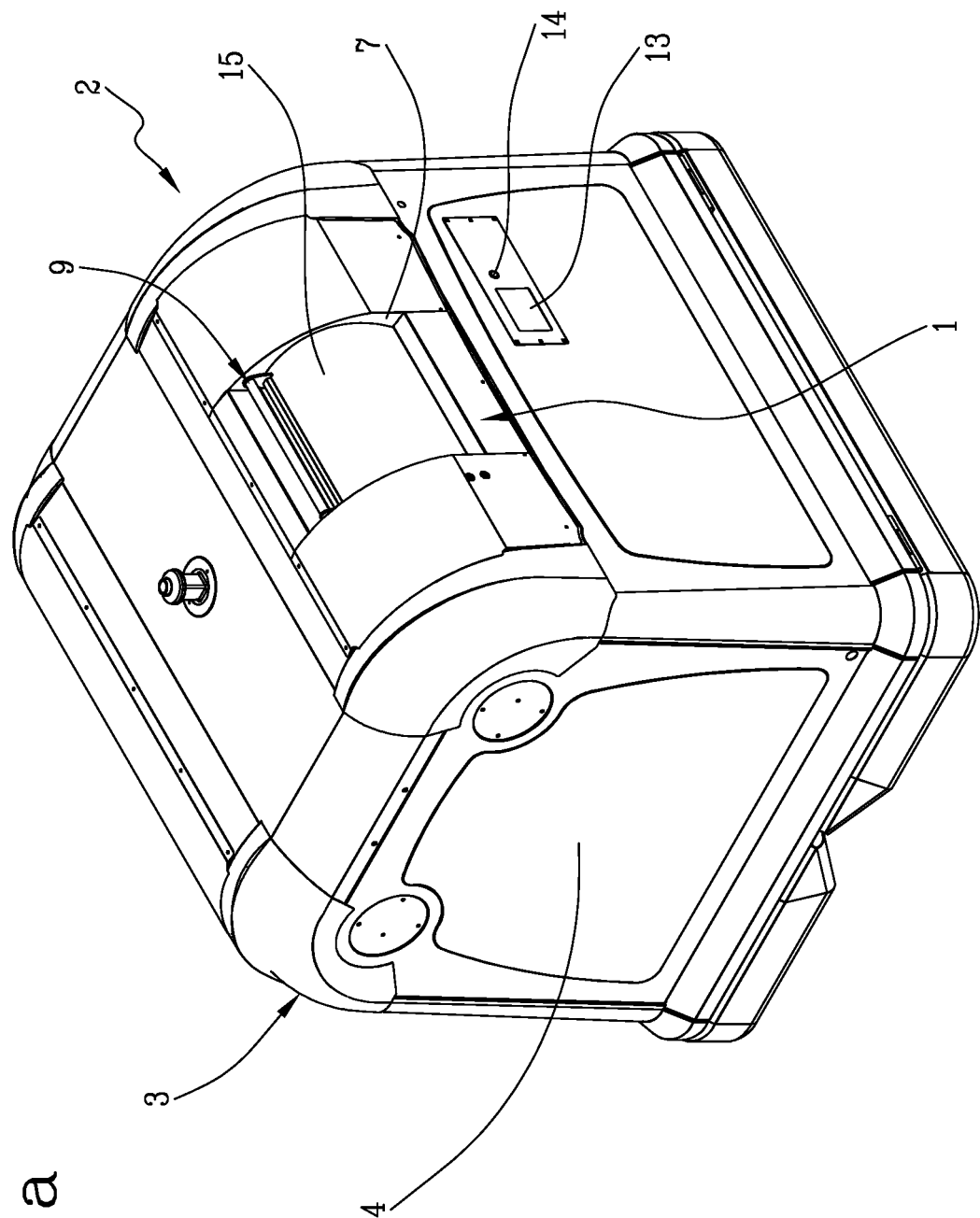


Fig.1a

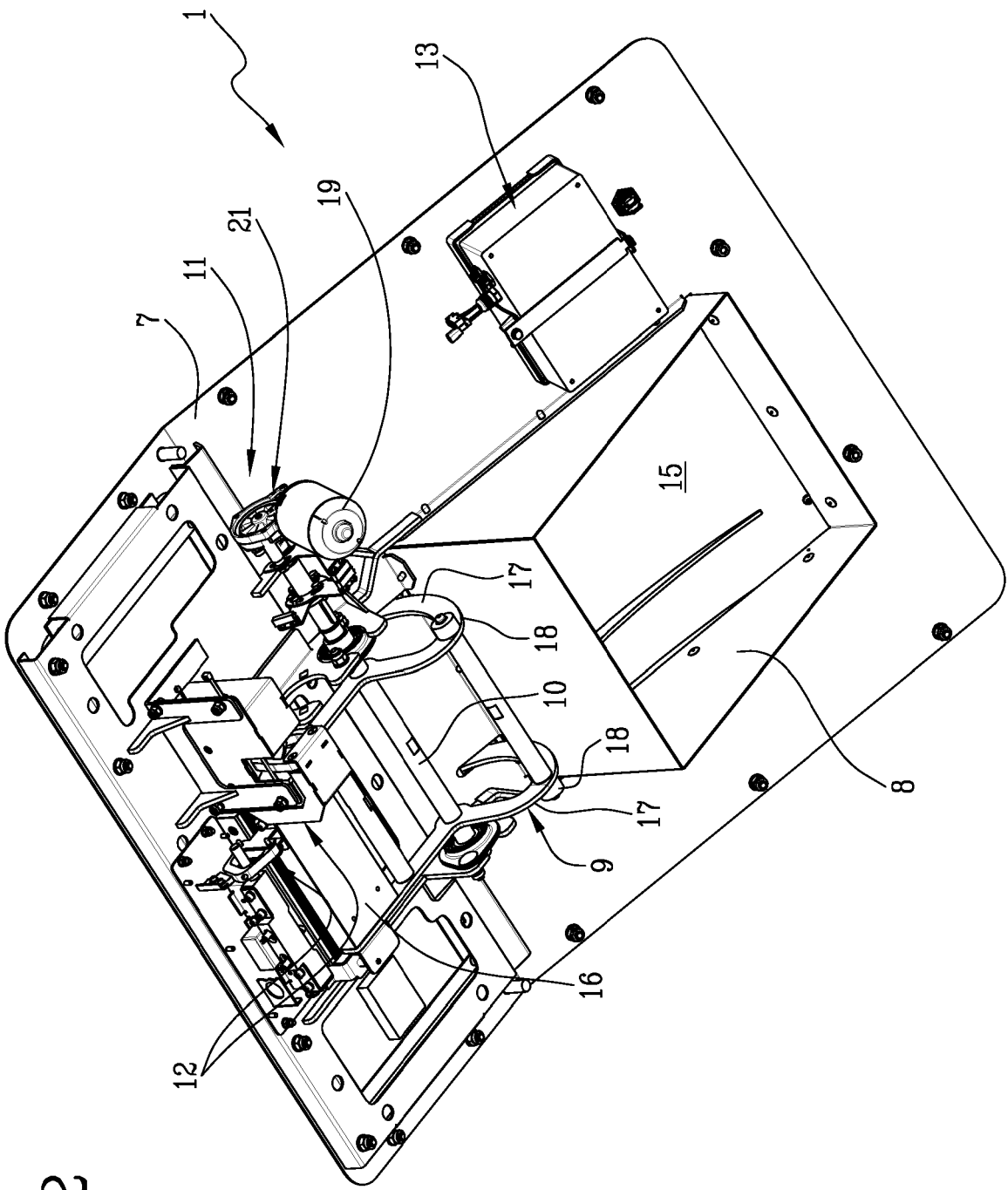


Fig.2

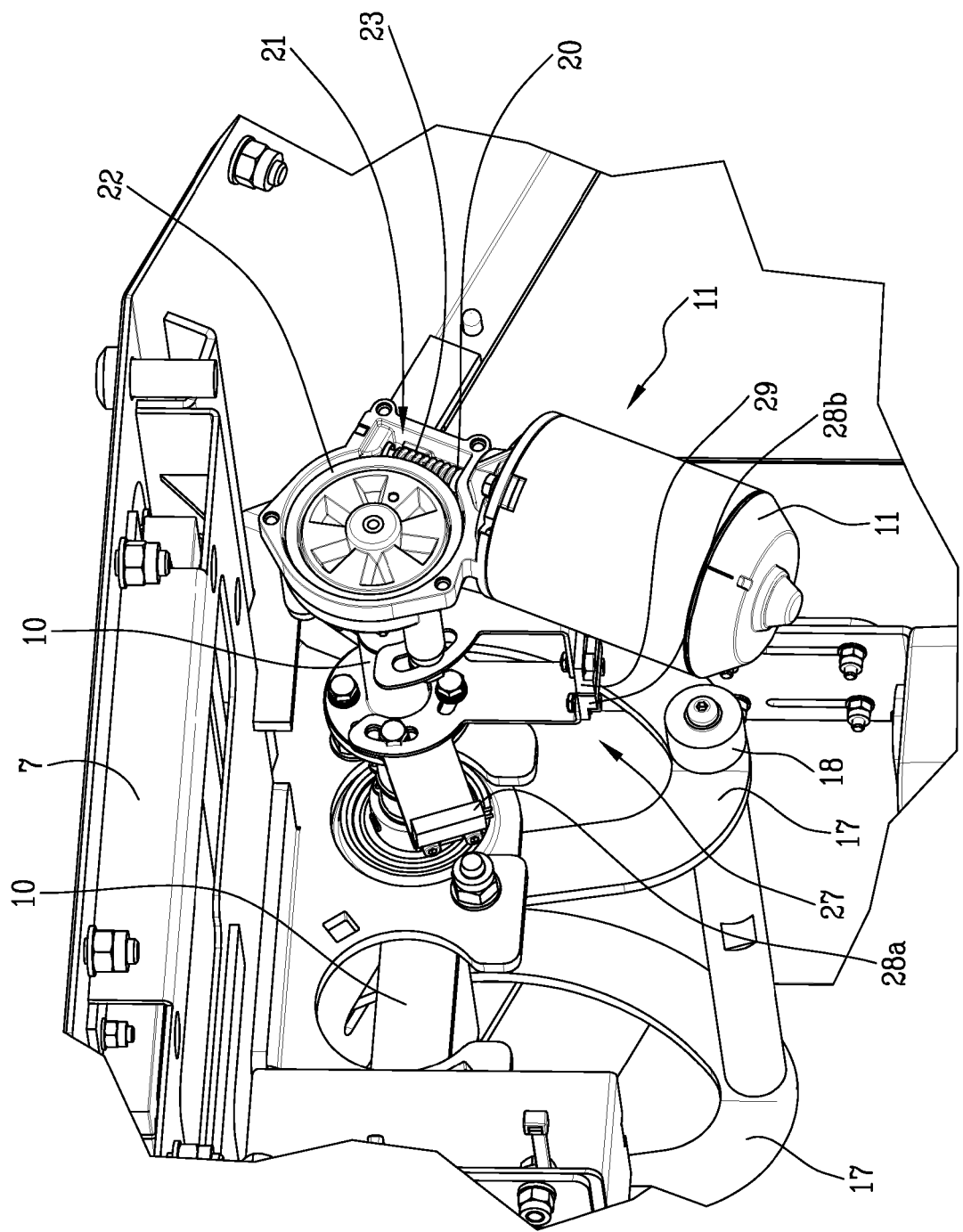


Fig.3

Fig.4

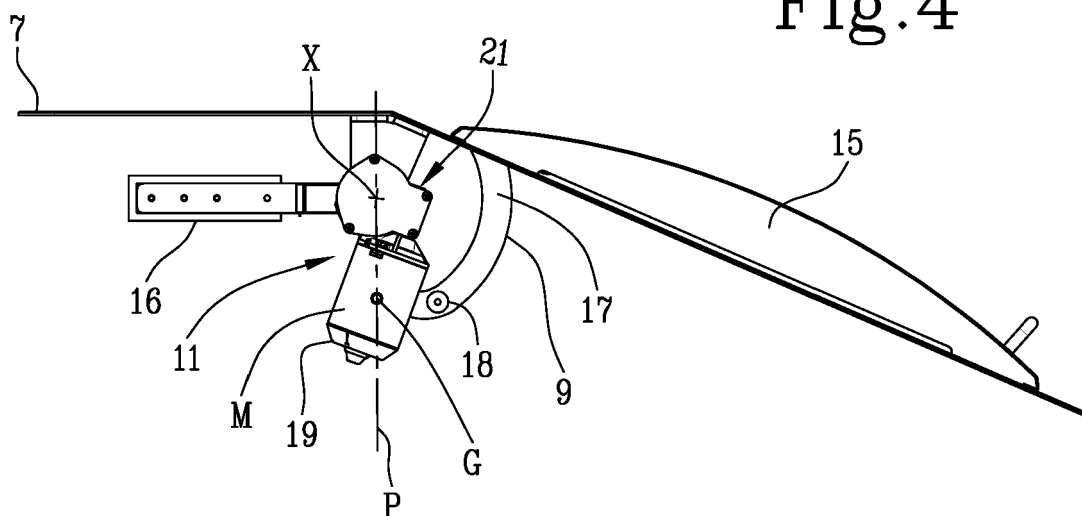


Fig.5

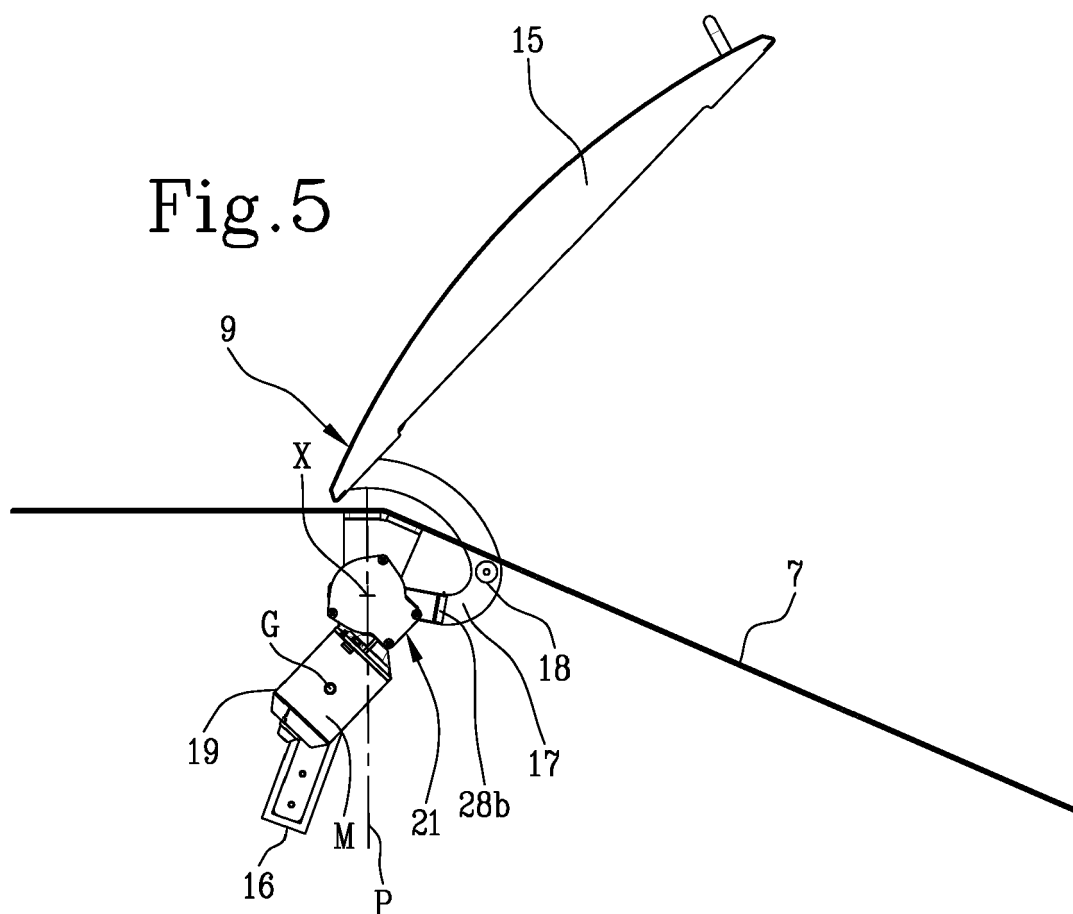


Fig.6

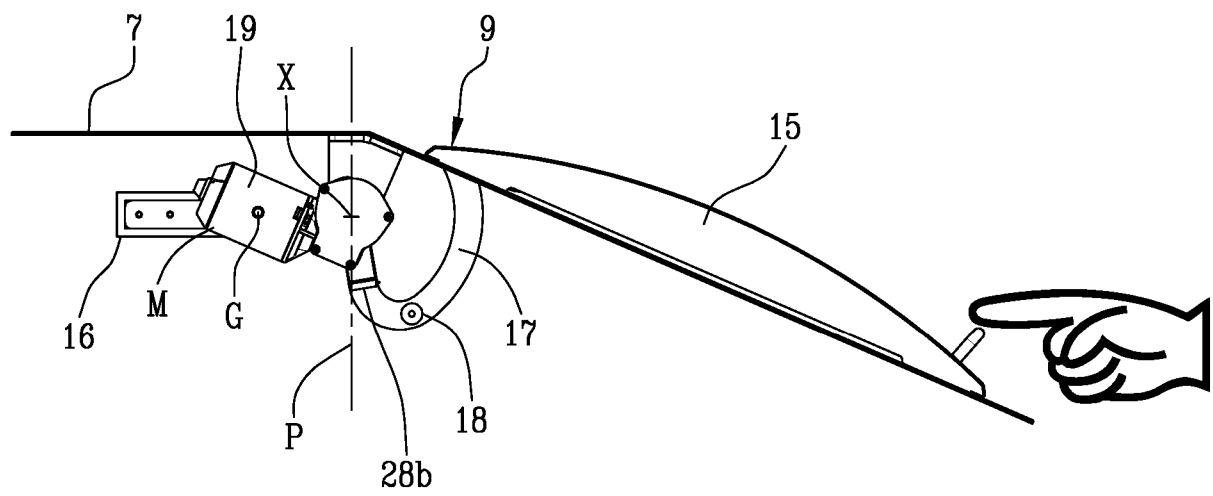


Fig.7

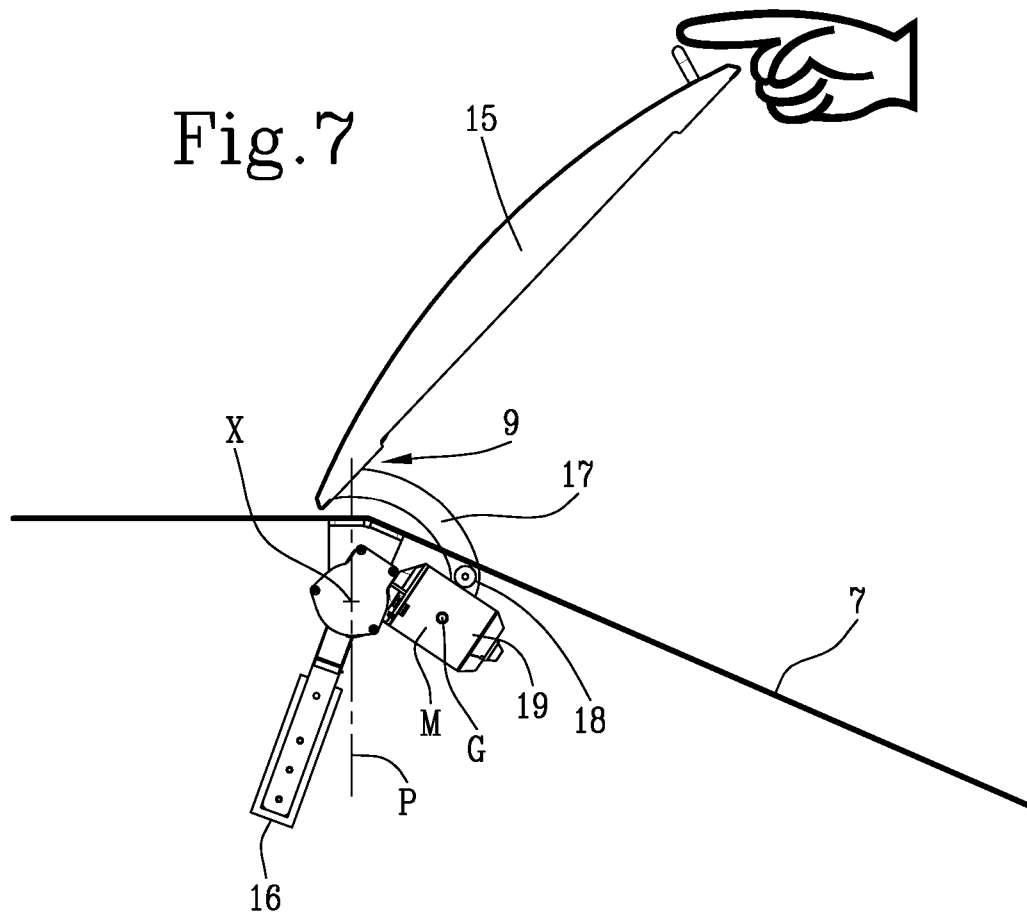
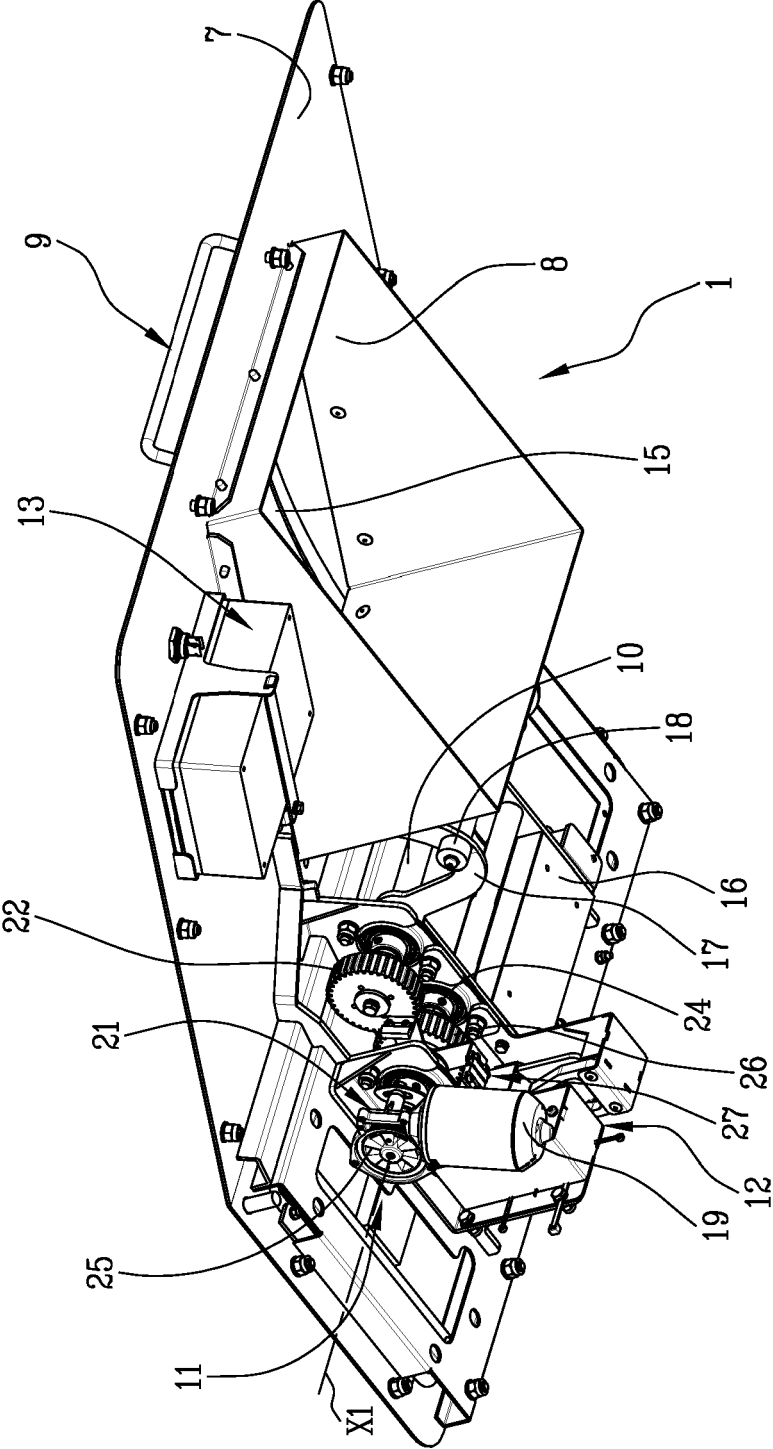
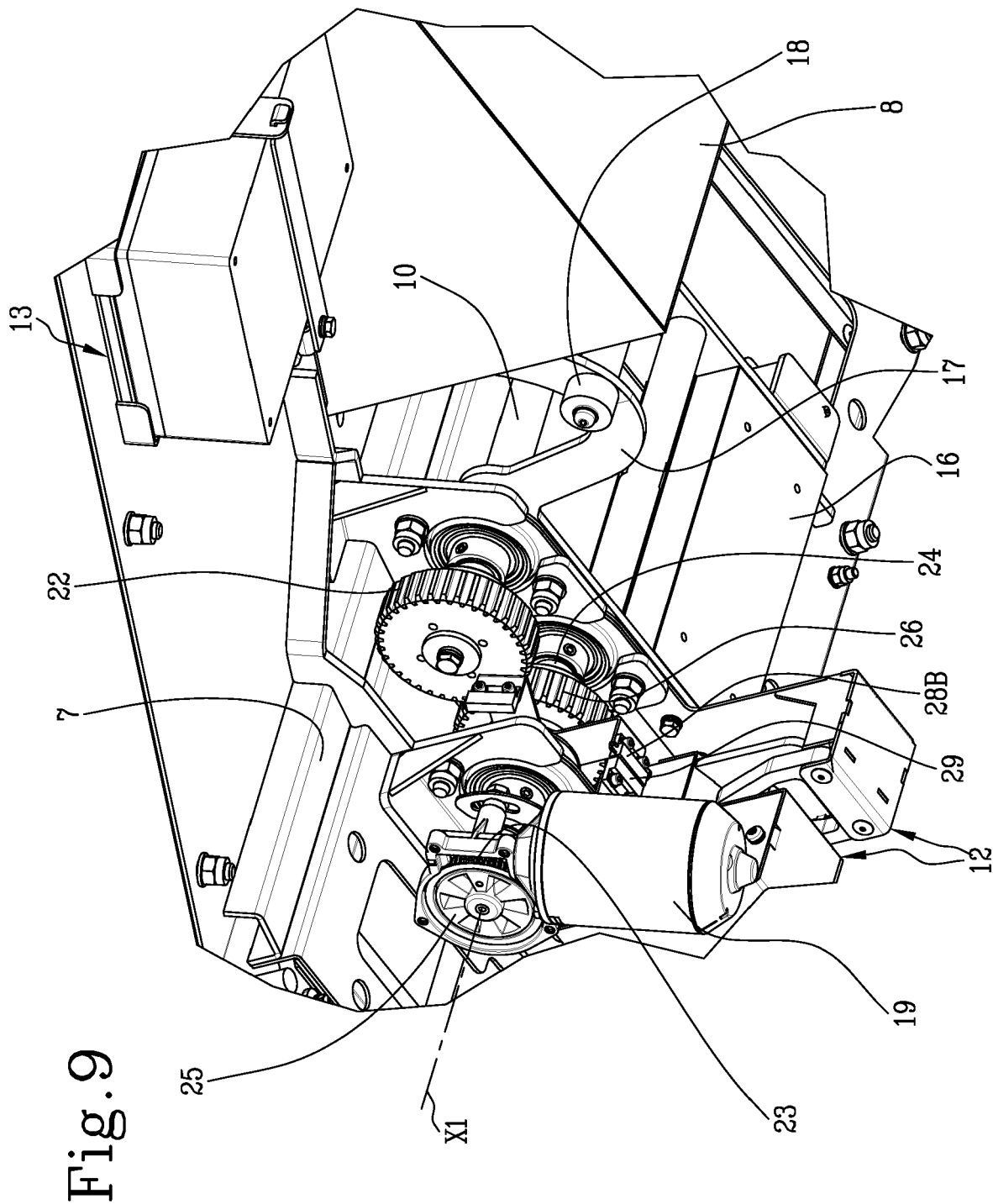
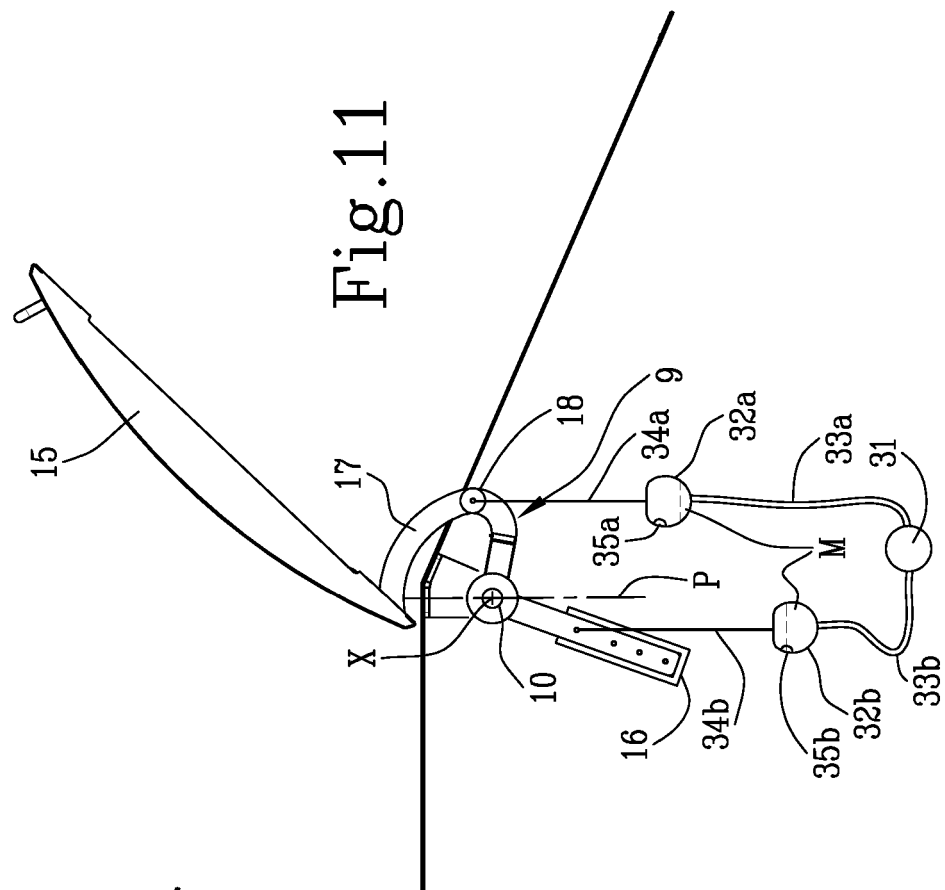
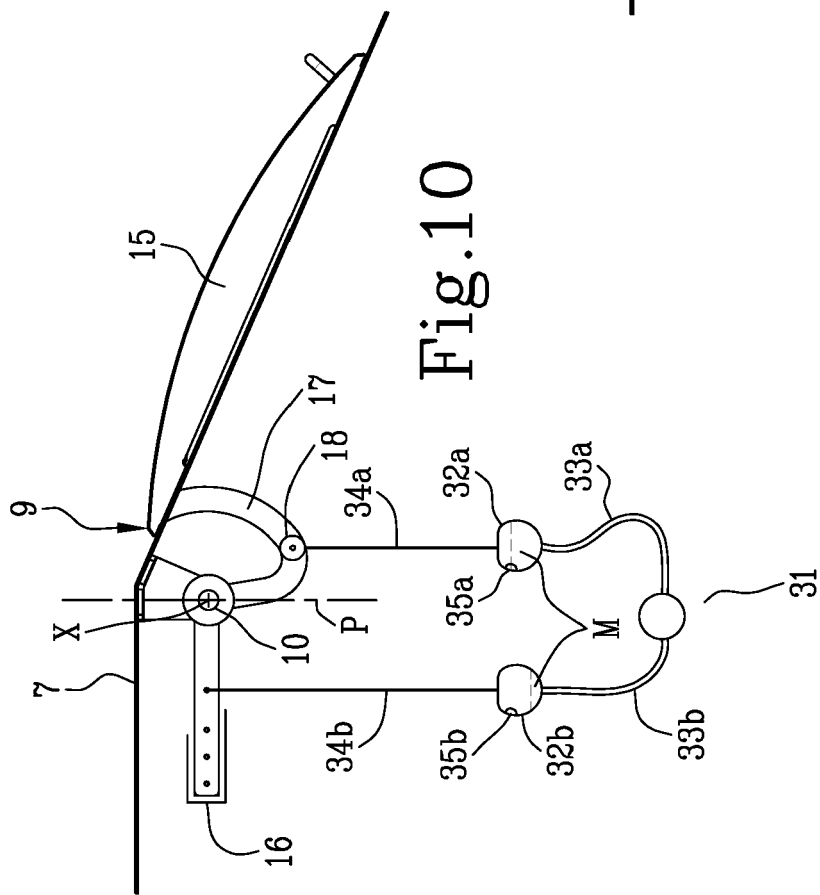


Fig.8









EUROPEAN SEARCH REPORT

Application Number

EP 24 20 3172

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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
The Hague		18 February 2025	Luepke, Erik
CATEGORY OF CITED DOCUMENTS			
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