

(19)



Europäisches Patentamt
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Office européen des brevets



(11)

EP 0 738 651 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
23.01.2002 Bulletin 2002/04

(51) Int Cl.7: **B62D 51/00, B66F 9/075**

(21) Application number: **96106023.3**

(22) Date of filing: **17.04.1996**

(54) **Body structure of industrial device**

Aufbaustruktur eines Gabelhubwagens

Structure de caisse d'un chariot de manutention

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **19.04.1995 JP 9373795**

(43) Date of publication of application:
23.10.1996 Bulletin 1996/43

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- **PATENT ABSTRACTS OF JAPAN vol. 006, no. 256 (M-179), 15 December 1982 & JP 57 151473 A (NISSAN JIDOSHA KK), 18 September 1982,**
- **PATENT ABSTRACTS OF JAPAN vol. 017, no. 304 (M-1427), 10 June 1993 & JP 05 024555 A (NISSAN MOTOR CO LTD), 2 February 1993,**

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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION:

[0001] The present invention relates to a body structure of industrial vehicle such as a fork lift, and more particularly relates to a body structure suitable for a rear wheel drive, battery-operated, three-wheeled fork lift.

DESCRIPTION OF THE RELATED ART:

[0002] Fig. 5 schematically shows a body structure of a conventional rear wheel drive, battery-operated, -three-wheeled fork lift. The illustrated fork lift has a drive unit 34 of the type vertically placing a drive motor 33 for driving a rear wheel, the drive unit 34 being attached to the rear side of a frame 31 together with a power steering oil motor 35 and controller 36. A large quantity of strengthening material such as a thick steel plate 37 or rib is welded with the rear side of the frame 31 to secure a required strength for attaching such mechanical hardware as the drive unit 34 and controller 36.

[0003] Further, a counterweight 32 is mounted on the rear end portion of the frame 31, the counterweight 32 having a horizontal section in the form of a substantially U-shape so as to surround mechanical hardware and strengthening material for supporting them. Such body structure is disclosed, for example, in Japanese Patent Laid-Open No. 62-36299 and Japanese Patent Laid-Open No. 5-24555.

[0004] In the above described conventional fork lift, since the drive unit 34, oil motor 35, controller 36 etc. are attached to the frame 31, it is necessary, when mounting the counterweight 32, to provide a predetermined gap between an inner surface of the counterweight 32 and the mechanical hardware and steel plate or the like for supporting them so as not to cause an interference thereof. Since, however, the counterweight in general is formed as a cast product, the production precision thereof is poor. For this reason, the gap for avoiding an interference tends to be set larger than that actually needed considering a margin of safety.

[0005] On the other hand, one of the characteristics of a three-wheeled, rear wheel drive fork lift is its compactness and capability of making a small turn. In order to fully use this characteristic, it is necessary to reduce the overall length of the vehicle as much as possible. For this reason, a rearward extension from the outer surface of the counterweight must be avoided. As described, the counterweight in the conventional three-wheeled, rear wheel drive fork lift has a constraint on its extension with respect to both the inner surface side and the outer surface side thereof. It has thus been very difficult to clear such constraint to obtain a required weight. Further, since a large quantity of strengthening material

such as a thick steel plate or rib is welded with the rear portion of the frame, material cost and processing cost are increased to result in a problem of high cost.

[0006] EP-A-0 231 642 shows a rear frame assembly for an industrial vehicle attachable to a main frame assembly thereof. The rear frame assembly carries a steerable rear wheel. A counterweight assembly 30 is adapted to be fixed on the rear frame and contains control elements arranged on a mounting plate. The counterweight is fixed to the rear frame afterwards.

[0007] From DE-U-93 19 187 a particular arrangement for the drive transmission between a drive motor and steerable driven rear wheel of an industrial vehicle is known. This particular arrangement uses an elastic support for the driving gear so that a backlash in the gear can be avoided.

SUMMARY OF THE INVENTION

[0008] In view of the above described problems, it is an object of the present invention to provide a body structure of industrial vehicle capable of facilitating setting of the weight of a counterweight and at the same time suitable for achieving simplification of a rear portion of its frame.

[0009] This object is solved with a body structure according to claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 is a schematic perspective view showing a counterweight and mechanical hardware attached thereto used in the body structure of a rear wheel drive, battery-operated, three-wheeled fork lift according to an embodiment of the present invention, Fig. 2 illustrates the attaching relation between the counterweight and drive unit in the embodiment, Fig. 3 is a top view showing the layout of an upper side portion of the counterweight in the embodiment,

Fig. 4 is a horizontal sectional view showing the layout of a lower side portion of the counterweight in the embodiment, and

Fig. 5 schematically illustrates the body structure of a conventional three-wheeled, fork lift.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] An embodiment of the present invention will now be described in detail by way of the drawings. Referring to Fig. 1, a counterweight 1 formed as a cast product includes a rear portion 2 constituting a rear end portion of the vehicle and left and right side portions 3 monolithically extended frontward from the rear portion 2 to constitute the two side portions of the rear end of

the vehicle. The counterweight 1 is to be mounted on a rear end portion of the frame (not shown) of a fork lift.

[0012] The rear portion 2 of the counterweight 1 is formed into a substantially arch-like shape with the front surface side thereof being formed as a concave of the arch. The outer surface (rear surface) thereof is provided as a curved surface having a curvature approximated to the minimum turning clearance radius of the vehicle. A unit attaching portion 4 for attaching a drive unit 11 is formed on the inner surface side of the rear portion 2. The unit attaching portion 4 is formed into the form of a plate extended substantially horizontally in a direction toward the front with having a required thickness substantially at the mid height on the inner surface of the rear portion 2, the front end edge thereof reaching near the end surface of the side portions 3 and a substantially circular attaching hole vertically penetrating through substantially the center portion thereof.

[0013] As shown in Fig. 2, the drive unit 11 to be attached to the unit attaching portion 4 includes: a gear case 12; a tire 13 rotatably attached to the gear case 12 around the horizontal axial line thereof; a drive motor 14 serving as a driving unit assembled in its vertical position with an upper portion of the gear case 12; an array of gears (not shown) contained in the gear case 12 and transmitting the driving force of the drive motor 14 to the tire 13; and a substantially ring-like turning base 15 for rotatably supporting an upper end portion of the gear case 12 around a vertical axis thereof through a bearing (not shown).

[0014] Of the drive unit 11, the members except the drive motor 14 are attached to a lower surface of the unit attaching portion 4 of the counterweight 1. That is, the unit attaching portion 4 has an attaching surface formed by the lower surface of the peripheral edge of the attaching hole 5, and the turning base 15 is detachably/reattachably tighten to the attaching surface with its upper surface abutting thereagainst by means of a plurality of bolts 16 which are inserted from the upper surface side of the unit attaching portion 4. It should be noted that the attaching surface of the unit attaching portion 4 is processed into a horizontal plane, and the bolt holes to be formed on the attaching portion 4 are assured with their horizontal aspect by means of spot facing.

[0015] On the other hand, the drive motor 14 is placed on an upper end surface of the gear case 12 through the attaching hole 5 from the top of the unit attaching portion 4, and a peripheral edge portion of an attaching flange 17 thereof is fixed detachably/reattachably to the upper end surface of the gear case 12 by means of a suitable number of fixing bolts 18. That is, the drive motor 14 of the drive unit 11 is so constructed that it is detached/attached from the top of the unit attaching portion 4. In this manner, of the drive unit 11, only the turning base 15 is fixed to the counterweight 1 and the remaining members are provided as capable of a horizontal rotation for the purpose of steering.

[0016] In this manner, the gear case 12 of the drive

unit 11 is attached from the lower surface side of the unit attaching portion 4 and the drive motor 14 is attached to the gear case 12 from the upper surface side of the unit attaching portion 4 through the attaching hole 5. Thereby, rational assembling of the drive unit 11 can be realized.

[0017] To secure an attaching space for the fixing bolt 16 of the turning base 15 in the present embodiment, the portions corresponding to the bolt attaching positions of the inner peripheral edge of the attaching hole 5 are extended inwardly as shown in Fig. 3 to form protuberances 5a. Further, in order to secure an attaching space of the fixing bolt 18 of the drive motor 14, protuberances 17a are formed by outwardly extending the portions of the peripheral edge of the attaching flange 17 corresponding to the bolt attaching positions.

[0018] A predetermined gap is required between the end surface of the hole side protuberance 5a and the end surface of the flange side protuberance 17a in order to avoid interference of the protuberances 5a, 17a with each other in the rotating direction of the drive unit 11. In this case, since dimensional precision of the counterweight 1 formed as a cast product is poor, the end surface of the hole side protuberance 5a is processed after the forming of the counterweight 1 to secure the required gap therefrom to the flange side protuberance 17a.

[0019] As a result of forming the protuberances 5a on the inner periphery of the attaching hole 5 and forming the protuberances 17a on the outer periphery of the attaching flange 17, recesses 5b, 17b are formed respectively between the neighboring hole side protuberances 5a and between the neighboring flange side protuberances 17a. Accordingly, when the drive motor 14 is to be detached or attached, the detaching/attaching operation may be readily performed by positioning in the peripheral direction as shown in Fig. 3 so that the protuberances 5a, 17a pass each other through the recesses 17b, 5b on their respective opposite side.

[0020] As shown in Fig. 4, a substantially block-like motor attaching portion 6 for attaching an oil motor 19 for effecting power steering is formed on a lower side of the inner surface of one side portion 3 of the counterweight 1. The motor attaching portion 6 is processed so that a vertical front surface thereof is provided as an attaching surface 6a. The oil motor 19 with its axis placed along a vertical direction is detachably and attachably fixed to the attaching surface 6a at a base plate 20 thereof by means of fixing bolt 21. A steering chain 24 is then extended over a driving sprocket 22 on the motor shaft and a large-diameter follower rail 23 formed on the outer periphery of an upper portion of the gear case 12. It should be noted that a laterally extended opening 8 is formed on the rear portion 2 of the counterweight 1 at a position suitable for the maintenance of the steering chain 24. The opening is usually closed by a cover 9 which may be removed and reattached.

[0021] Further, as shown in Fig. 3, controller attaching portions 7 for attaching a controller 25 are formed on an

upper portion of the front end surface of the left and right side portions 3 of the counterweight 1. The controller attaching portion 7 is processed so as to provide an attaching surface 7a by its vertical front surface. A base plate 26 of the controller 25 disposed in a manner extended left and right over the attaching surfaces 7a is detachably and attachably fixed thereto by means of fixing bolts 27.

[0022] As described above, in the present embodiment, the counterweight 1 is used as a rear frame by assembling such mechanical hardware as the drive unit 11, oil motor 19 and controller 25 with the counterweight 1. Thereby, the rear portion of the frame in the fork lift requires no strengthening members and their welding such as a thick steel plate for attaching mechanical hardware and ribs for reinforcing the same which have been required in the conventional construction. Thus, the rear portion of the frame is simplified in construction and a reduction in cost is achieved.

[0023] Further, when mounting the counterweight 1 onto the rear portion of a frame, the conventional type where the mechanical hardware are mounted on the frame side requires a gap to be provided in order to avoid interference with the mechanical hardware and strengthening members for attaching them. Since, however, the above described gap need not be considered when employing the construction where the mechanical hardware are attached to the counterweight 1 as in the present embodiment, the constraint with respect to space is eliminated and at the same time it becomes possible to set the shape of the inner surface of the counterweight 1 at will whereby weight adjustment may be readily performed.

[0024] In particular, since the counterweight 1 may be designed as a single unit including the drive unit 11, oil motor 19 and controller 25 to be attached thereto, the space efficiency thereof is improved so that a required weight may be readily obtained within a limited vehicle dimension (overall length and vehicle width).

[0025] In addition, a rational positioning of the drive unit 11, oil motor 19 and controller 25 becomes possible by respectively providing the unit attaching portion 4 on a substantially center portion of the front surface of the rear portion 2 of the counterweight 1, the motor attaching portion 6 on a lower portion of the inner surface of one of the side portions 3 and the controller attaching portions 7 on an upper portion of the front surface of the left and right side portions 3.

[0026] Provided herein is a battery-operated, three-wheeled fork lift using a counterweight as its rear frame, thereby making weight setting of the counterweight easier and at the same time suitably achieving a simplification of the rear portion of the frame. A unit attaching portion 4 extended substantially horizontally in a direction toward the front is formed on a front surface of a rear portion 2 of the counterweight 1 to be mounted on a rear end portion of the frame, and a drive unit 11 for driving a rear wheel is attached thereto. Further, controller at-

taching portions 7 are formed on an upper part of front surface of two side portions 3 of the counterweight 1, and a controller 25 is attached thereto. Furthermore, a motor attaching portion 6 extended inwardly to provide an attaching surface by its front surface is formed on an inner surface of one of the side portions 3 of the counterweight 1, and an oil motor 19 for power steering is attached thereto.

Claims

1. A body structure of an industrial vehicle having a drive unit (11) for driving a rear wheel (13) and a counterweight (1) provided at the rear of a frame of the body,
characterized in that

said counterweight (1) forms a rear frame of the body, and is mounted on the rear end portion of the frame of the body, and
said counterweight (1) comprises a unit attaching portion (4) to which said rear wheel (13) and said drive unit (11) are fixed.

2. The body structure as claimed in claim 1 wherein said counterweight includes a rear portion (2) constituting a rear end portion of the vehicle and a pair of left and right side portions (3) monolithically extended frontward from the rear portion to constitute two side portions of the rear end of the vehicle, said unit attaching portion being extended substantially horizontally frontward in the manner of a plate from the front surface of said rear portion.
3. The body structure as claimed in claim 1 or 2 wherein said body structure further comprises: a substantially circular attaching hole (5) penetrating through in a vertical direction formed on said unit attaching portion; a ring-like turning base (15) attached to a lower surface of a peripheral edge of the attaching hole; a gear case (12) of said drive unit fixed to said turning base at a lower surface side of said unit attaching portion; a drive motor (14) of said drive unit disposed on an upper surface side of said unit attaching portion and fixed to an upper end surface of said gear case through said attaching hole.
4. The body structure as claimed in claim 3 wherein said turning base is fixed by means of bolts (16) to a plurality of protuberances (5a) formed in such a manner as to extend inward on an inner peripheral edge of the attaching hole of said unit attaching portion, and said drive motor is fixed to the upper end surface of said gear case by putting bolts (18) through a plurality of protuberances (17a) formed in such a manner as to extend outward on an outer peripheral edge of an attaching flange (17) on the

outer peripheral portion thereof.

5. The body structure as claimed in one of claims 1 to 4 wherein an oil motor (19) for power steering and a controller (25) are fixed to said counterweight. 5
6. The body structure as claimed in claim 5 wherein said counterweight includes: an attaching portion (7) for said controller on a front end surface of said pair of side portions; and an attaching portion (6) for said oil motor extended inwardly of said counterweight on an inner surface of one of the side portions to provide an attaching surface by a front surface thereof. 10
7. The body structure as claimed in one of claims 2 to 6 wherein said rear portion has a substantially arch-like horizontal shape having a front surface side thereof formed in a concave surface, and the outer surface thereof is a curved surface having a curvature close to that of the minimum turning clearance radius of the vehicle. 15 20

Patentansprüche

1. Karosseriestruktur eines Industriefahrzeugs mit einer Antriebseinheit (11) für ein Antreiben eines Hinterrades (13) und einem Gegengewicht (1) das hinten an einem Rahmen der Karosserie vorgesehen ist, **dadurch gekennzeichnet, dass**

das Gegengewicht (1) einen Hinterrahmen der Karosserie ausbildet und an dem hinteren Endabschnitt des Rahmens der Karosserie montiert ist, und

das Gegengewicht (1) einen Einheitenanbringabschnitt (4) aufweist, an dem das Hinterrad (13) und die Antriebseinheit (11) befestigt sind. 35

2. Karosseriestruktur gemäß Anspruch 1, wobei das Gegengewicht einen Hinterabschnitt (2) hat, der einen hinteren Endabschnitt des Fahrzeugs bildet, und ein paar linker und rechter Abschnitte (3) hat, die monolithisch nach vorn von dem hinteren Abschnitt erweitert sind, um zwei Seitenabschnitte des hinteren Endes Fahrzeugs zu bilden, wobei ein Einheitenanbringabschnitt im Wesentlichen horizontal nach vorn plattenförmig von der Vorderfläche des hinteren Abschnitts erweitert ist. 40

3. Karosseriestruktur gemäß Anspruch 1 oder 2, wobei die Karosseriestruktur des weiteren folgendes aufweist: ein im Wesentlichen kreisförmiges Anbringloch (5), das durchdringend in einer vertikalen Richtung an dem Einheitenanbringabschnitt ausgebildet ist; eine ringförmige Wendebasis (15), die an

eine untere Fläche eines Umfangsrandes des Anbringlochs angebracht ist; ein Getriebegehäuse (12) der Antriebseinheit, das an der Wendebasis an einer unteren Flächenseite des Einheitenanbringabschnitts befestigt ist; einen Antriebsmotor (14) der Antriebseinheit, der an einer oberen Flächenseite des Einheitenanbringabschnitts angeordnet und an eine obere Endfläche des Getriebegehäuses über das Anbringloch befestigt ist.

4. Karosseriestruktur gemäß Anspruch 3, wobei die Wendebasis mittels Schrauben (16) an einer Vielzahl von Vorsprüngen (5a) befestigt ist, die auf eine derartige Weise ausgebildet sind, dass sie sich an einem inneren Umfangsrand des Anbringlochs des Einheitenanbringabschnitts erstrecken, und wobei der Antriebsmotor an der oberen Endfläche des Getriebegehäuses durch Setzschrauben (18) durch eine Vielzahl von Vorsprüngen (17a) befestigt ist, die auf eine derartige Weise ausgebildet sind, dass sie sich an dem äußeren Umfangsrand eines Anbringflansches (17) an seinem äußeren Umfangsabschnitt erstrecken. 15

5. Karosseriestruktur gemäß einem der Ansprüche 1 bis 4, wobei ein Ölmotor (19) für eine Servolenkung und ein Regler (25) an dem Gegengewicht befestigt sind. 25

6. Karosseriestruktur gemäß Anspruch 5, wobei das Gegengewicht folgendes aufweist: einen Anbringabschnitt (7) für den Regler an einer Vorderendfläche des paars der Seitenabschnitte; und einen Anbringabschnitt (6) für den Ölmotor, der nach innen von dem Gegengewicht an einer Innenfläche des einen der Seitenabschnitte erweitert ist, um eine Anbringfläche durch eine Vorderfläche davon vorzusehen. 30

7. Karosseriestruktur gemäß einem der Ansprüche 2 bis 6, wobei der Hinterabschnitt eine im Wesentlichen bogenförmigen horizontale Gestalt hat, wobei eine Vorderflächenseite davon als eine konkave Fläche ausgebildet ist, und wobei die Außenfläche davon eine gekrümmte Fläche ist, die eine Krümmung hat, die derjenigen des minimalen Wendestandsradius des Fahrzeugs nah ist. 35 40

Revendications

1. Structure de carrosserie pour un véhicule industriel comportant une unité d'entraînement (11) pour entraîner une roue arrière (13) et un contrepoids (1) prévu à l'arrière d'un cadre de la carrosserie, 45 50

caractérisée en ce que,

ledit contrepoids (1) forme un cadre arrière de la carrosserie et est monté sur la partie d'extrémité arrière du cadre de la carrosserie, et ledit contrepoids (1) comprend une partie de fixation d'unité (4) à laquelle ladite roue arrière (13) et ladite unité d'entraînement (11) sont fixées.

2. Structure de carrosserie selon la revendication 1, dans laquelle ledit contrepoids comprend une partie arrière (2) constituant une partie d'extrémité arrière du véhicule et deux parties latérales gauche et droite (3) s'étendant d'une seule pièce vers l'avant à partir de la partie arrière afin de constituer deux parties latérales de l'extrémité arrière du véhicule, ladite partie de fixation d'unité s'étendant sensiblement horizontalement vers l'avant à la manière d'une plaque à partir de ladite surface avant de ladite partie arrière. 10
3. Structure de carrosserie selon la revendication 1 ou 2, dans laquelle ladite structure de carrosserie comprend, de plus : un trou de fixation sensiblement circulaire (5) traversant dans une direction verticale formé sur ladite partie de fixation d'unité ; une base tournante en forme de bague (15) fixée à une surface inférieure d'un bord périphérique du trou de fixation ; un carter d'engrenages (12) de ladite unité d'entraînement fixé à la ladite base tournante au niveau d'un côté de surface inférieure de ladite partie de fixation d'unité ; un moteur d'entraînement (14) de ladite unité d'entraînement disposé sur un côté de surface supérieure de ladite partie de fixation d'unité et fixé à une surface d'extrémité supérieure dudit carter d'engrenages par l'intermédiaire dudit trou de fixation. 20 25 30 35
4. Structure de carrosserie selon la revendication 3, dans laquelle ladite base tournante est fixée au moyen de boulons (16) à une pluralité de saillies (5a) formées de telle manière qu'elles s'étendent vers l'intérieur sur un bord périphérique intérieur du trou de fixation de ladite partie de fixation d'unité, et ledit moteur d'entraînement est fixé à la surface d'extrémité supérieure dudit carter d'engrenages en faisant passer des boulons (18) à travers une pluralité de saillies (17a) formées de telle manière qu'elles s'étendent vers l'extérieur sur un bord périphérique extérieur d'une bride de fixation (17) sur la partie périphérique extérieure de celle-ci. 40 45 50
5. Structure de carrosserie selon l'une quelconque des revendications 1 à 4, dans laquelle un moteur hydraulique (19) pour une direction assistée et un contrôleur (25) sont fixés audit contrepoids. 55
6. Structure de carrosserie selon la revendication 5, dans laquelle ledit contrepoids comprend : une par-

tie de fixation (7) pour ledit contrôleur sur une surface d'extrémité avant desdites deux parties latérales ; et une partie de fixation (6) pour ledit moteur hydraulique s'étendant vers l'intérieur dudit contrepoids sur une surface intérieure de l'une des parties latérales afin de fournir une surface de fixation par une surface avant de celle-ci.

7. Structure de carrosserie selon l'une des revendications 2 à 6, dans laquelle ladite partie arrière présente une forme horizontale sensiblement en forme d'arche ayant son côté de surface avant configuré en une surface concave, et sa surface extérieure est une surface incurvée ayant une courbure proche de celle du rayon d'encombrement en virage minimum du véhicule.

FIG. 1

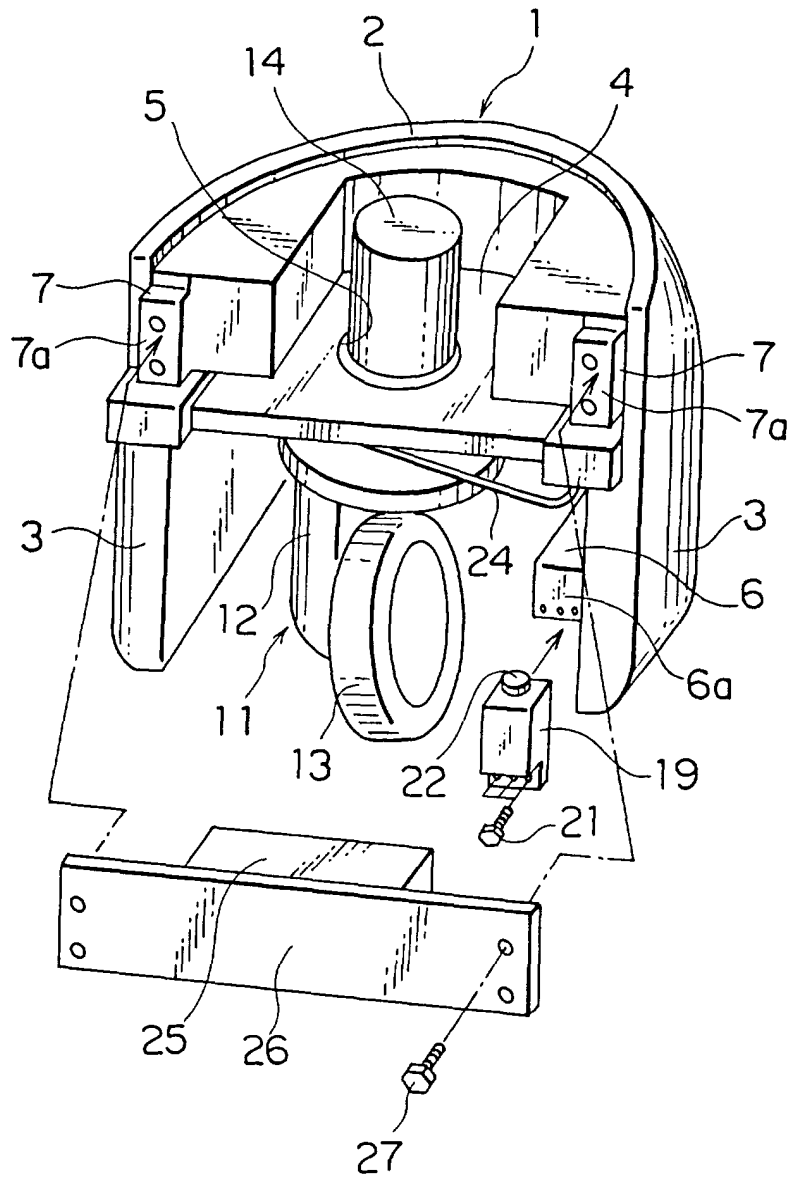


FIG. 2

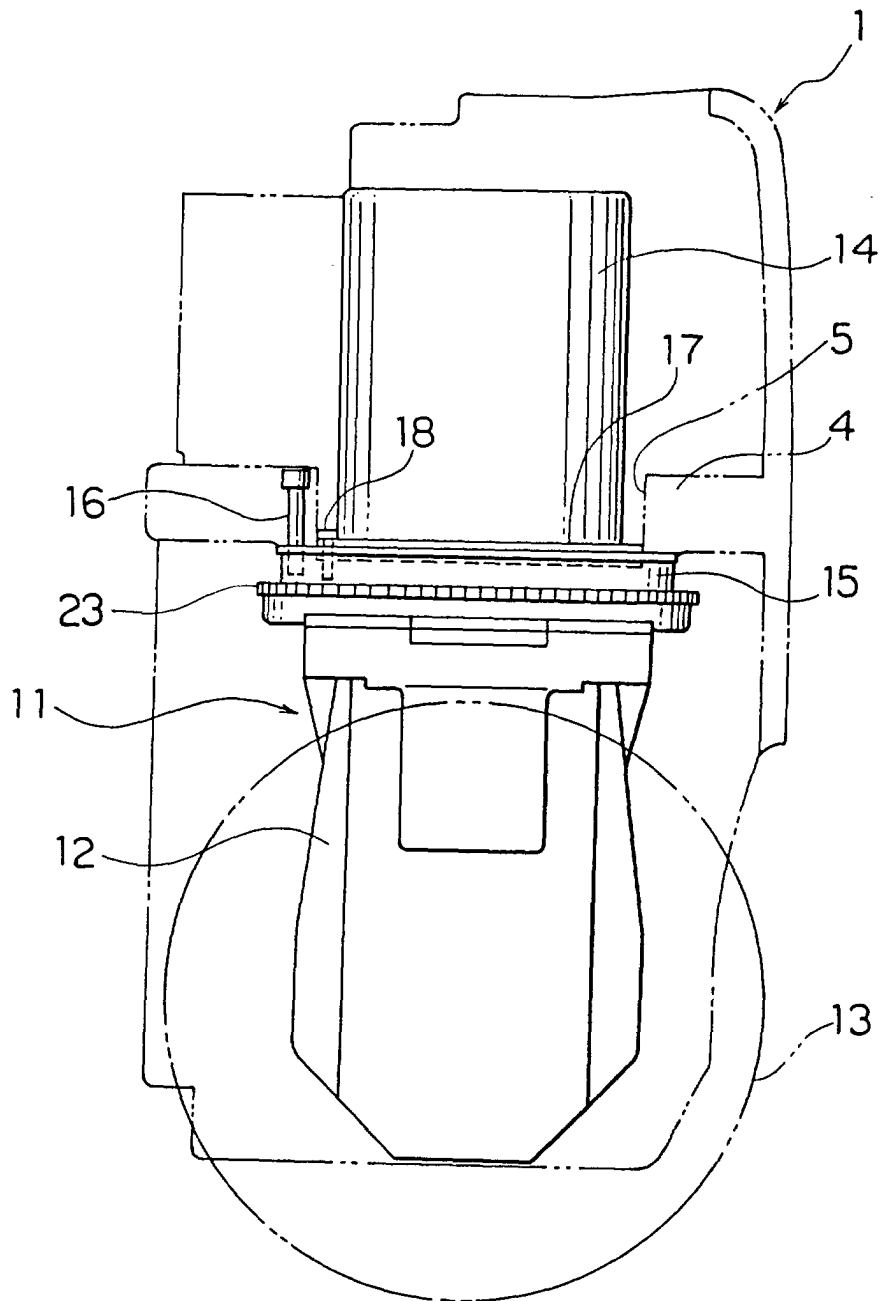


FIG. 3

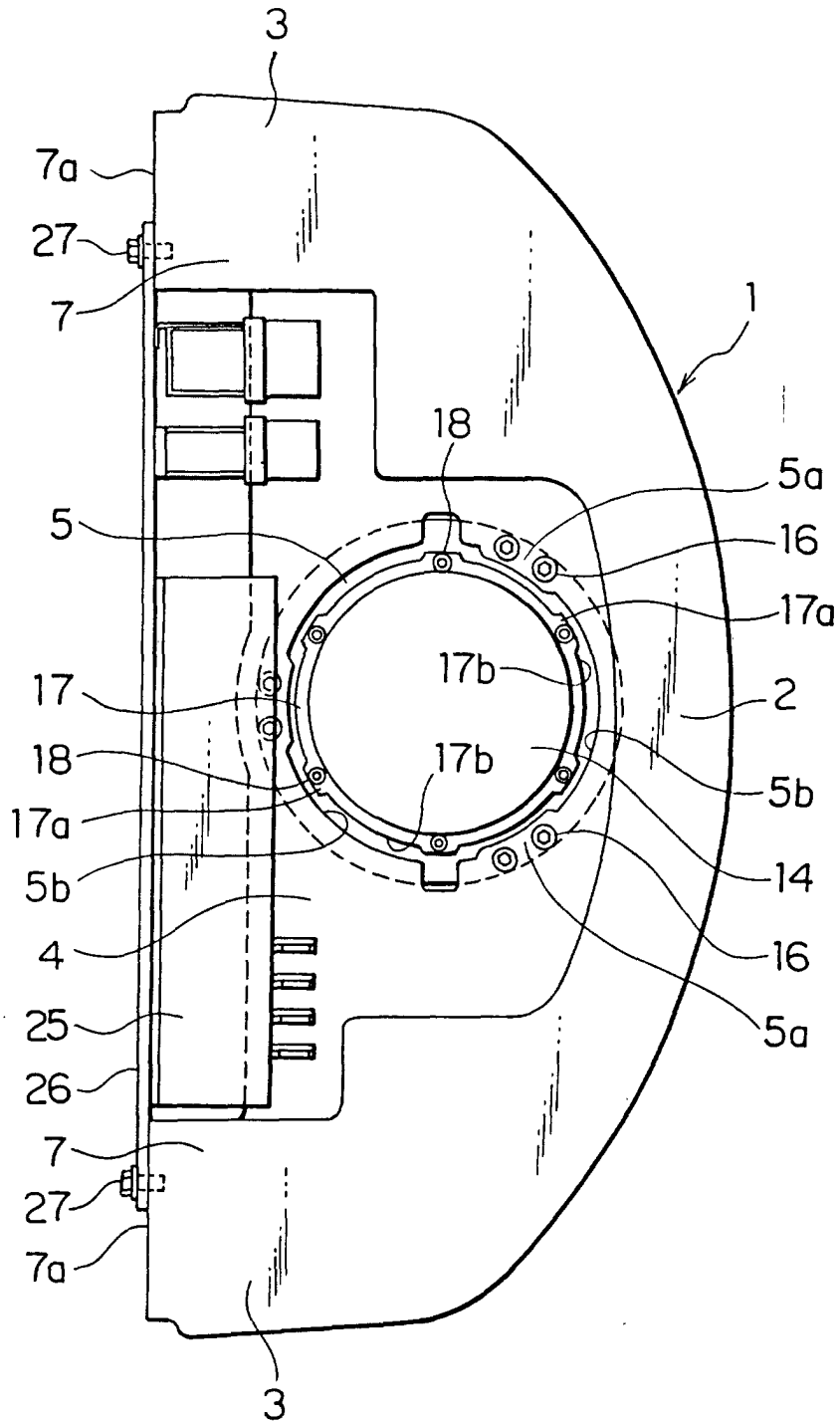


FIG. 4

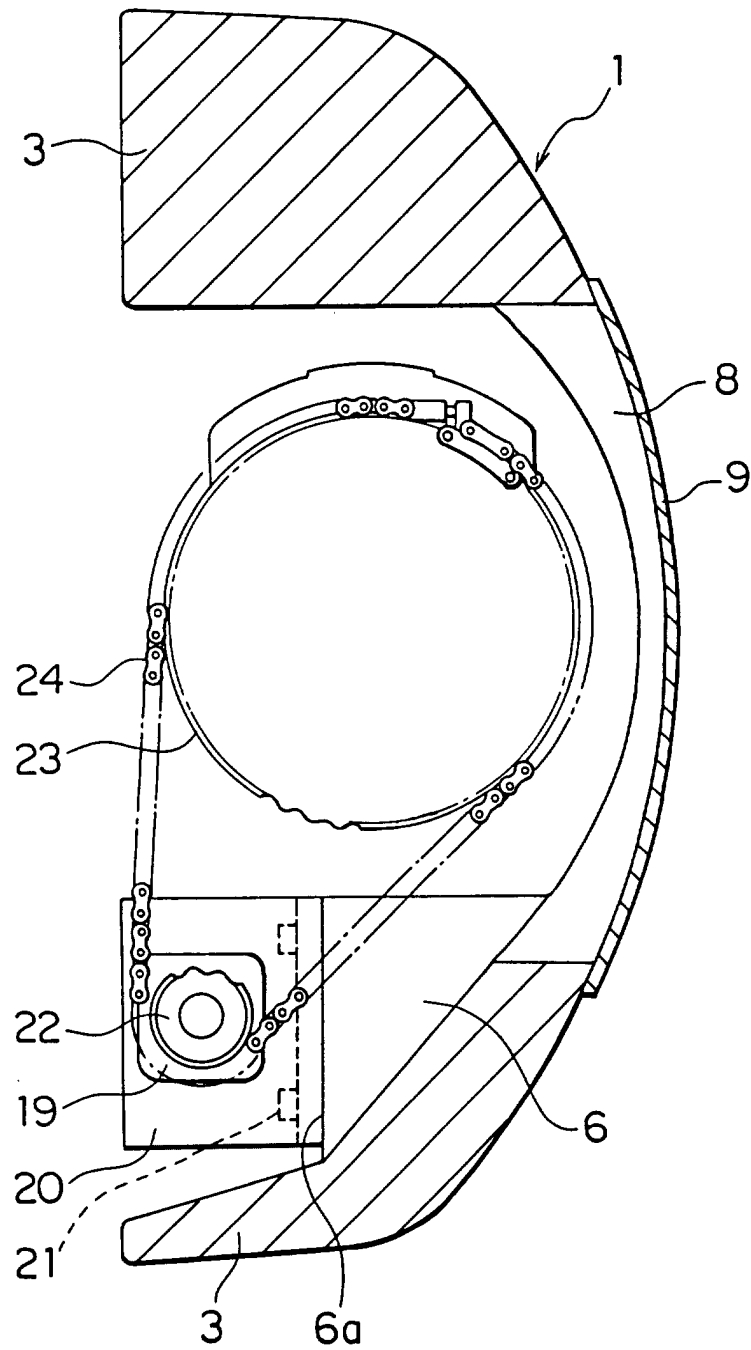


FIG. 5

