(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 806 503 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
11.03.2009 Bulletin 2009/11

(51) Int Cl.:
F04B 39/04 *(2006.01)* ***F04B 39/12*** *(2006.01)*

(21) Application number: **07000101.1**

(22) Date of filing: **04.01.2007**

(54) Booster-type gas compressor

Boosterähnlicher Gaskompressor

Compresseur à gaz de type survolteur

(84) Designated Contracting States:
BE

(30) Priority: **10.01.2006 JP 2006002211**

(43) Date of publication of application:
11.07.2007 Bulletin 2007/28

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EP 1 806 503 B1

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a booster-type gas compressor in which a compressed gas is further compressed by a reciprocating piston.

[0002] As shown in Fig. 4, a suction valve 23 is provided at one side of a top wall 22 of a cylinder 21 and a discharge valve 24 is provided at the other side of the top wall 22. Above the suction valve 23 and the discharge valve 24, there are a suction chamber 26 having an inlet 25 and a discharge chamber 28 having an outlet 27 respectively. Under the cylinder 21, a crank shaft 31 integrally formed with a driving shaft 30 in a crank case 29 is provided. The driving shaft 30 is driven by an electric motor 34 in a motor case 33 mounted to a side wall 29a of the crank case 29 so that a gas may pass through. A piston 39 is moved up and down in a cylinder 21 via a piston rod 35 by the crank shaft 31 formed with the driving shaft 30 to compress a gas such as N_2 introduced in a compressing chamber above the piston 36 via the suction valve 23 and to discharge it from the discharge valve 24 and outlet 27.

[0003] In such a reciprocating-piston-type gas compressor, with reciprocating motion of the piston 36, a compressed gas in the compressing chamber above the piston 36 in the cylinder 21 partially leaks through around the piston 36 into the crank case 29.

[0004] The compressed gas in the crank case 29 Is partially discharged from an air hole 38 of the crank case 29 to produce loss of energy. Leak of a toxic gas causes air pollution.

[0005] Furthermore, in case that such a reciprocating-piston-type gas compressor comprises a booster-type gas compressor sucking a compressed gas and compressing it to higher pressure, in a suction step of restarting or unloading operation, the compressing chamber becomes decompression condition in which a atmospheric pressure gas from an air hole 38 of the crank case 29 flows through around the piston 36 to the compressing chamber above the piston 36 and is mixed in a gas from the suction hole 25 to render density lowered.

[0006] To cool the electric motor 34, a ventilating hole 39 is formed in the electric motor case 33 or a fan is mounted to the driving shaft 30 to achieve forcing cooling. Thus, the electric motor 34 cannot be completely sealed to render noise leaked or dusts, and solid ingredients in external air are likely to remain in the electric motor 34 or motor case 33.

[0007] Furthermore, in such a booster-type gas compressor, atmospheric pressure remains in the crank case 29. So, owing to pressure difference above and under the piston 36, torque variation in one rotation becomes greater to increase an electric current of the electric motor 34 directly mounted to the crank case 29 to speed up damages on the outer circumferential surface of the piston 36, a piston ring, the driving shaft 30, bearings 41,42 of the crank shaft 31 and a seal of a sliding portion.

[0008] DE -A1-3536618 discloses a lifting-piston compressor according to the preamble of claim 1 which is intended in particular as a booster compressor for compressed-gas installations. The piston of the compressor is connected via a push-rod to a crank shaft which rotates in a crank housing using a drive arrangement. The crank housing interior is drawn off via at least one further compression stage in order to perform a pressure-relief action of the crank housing interior, and the outlet side of the further compression stage is connected to the inlet of the lifting piston compressor. As a result, the gases of the further compression stage emerging at the outlet are guided back again to the inlet of the booster-type compressor.

[0009] JP-A-05157050 relates to a control valve for controlling a flow rate of a return gas in a piston-type compressor so as to keep in the crank case a pressure higher than the atmospheric pressure.

[0010] EP-A-1116883 discloses a swash-plate compressor driven by an electric motor. The refrigerant is drawn from an intake port to the suction chamber and discharged into an intermediate pressure chamber. From there the refrigerant is partly bypassed into the crank chamber and then circulated into the motor chamber for cooling of the electric motor.

SUMMARY OF THE INVENTION

[0011] An object of the present invention is to provide a booster-type gas compressor comprising a reciprocating piston, pressure difference being reduced between a compressing chamber above the piston and a crank case under the piston thereby preventing wear of each part and unsmoothness of the operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The features and advantages of the invention will become more apparent from the following description with respect to embodiments as shown in accompanying drawings wherein:

Fig. 1 is a vertical sectional view of the first embodiment of a booster-type gas compressor according to the present invention;
Fig. 2 is a vertical sectional view of the second embodiment of a booster-type gas compressor according to the present invention;
Fig. 3 is a vertical sectional view of the third embodiment of a booster-type gas compressor according to the present invention; and
Fig. 4 is a vertical sectional view of a known booster-type gas compressor

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0013] Fig. 1 shows the first embodiment of a booster-type gas compressor according to the present invention.

[0014] The basic structure of the booster-type gas compressor is not so different from that in Fig. 4. The same numerals are allotted to the same members. Its description is omitted and only differences are described.

[0015] In Fig. 1, there is no air hole 38 communicating external air and a compressed-gas introducing hole 11 is formed in an electric motor case 36 instead of a ventilating hole.

[0016] A compressed-gas feeding path 37 is connected to a compressed-gas introducing hole 11 via a bypath conduit 14 comprising a check valve 12 that closes towards the compressed-gas feeding path 37 and opens in an opposite direction and a pressurre regulator 13 such as a pressure-regulating valve or a pressure reducing valve.

[0017] By opening a valve (not shown), a compressed gas is fed into a suction chamber 26 and partially introduced into the crank case 29 via the bypath conduit 14 comprising the check valve 12 and the pressure regulator 13, the compressed-gas introducing hole 11. a motor case 33 and a communicating hole 32 to let the inside of the crank case 29 compressed to more than atmospheric pressure.

[0018] The compressed gas in the compressed-gas feeding path 37 is partially fed into the crank case 29, so that gas pressure in the crank case 29 becomes more than atmospheric pressure different from a known device.

[0019] Thus, difference in pressure between a compressing chamber above a piston 36 in a cylinder 21 and the inside of the crank case 29 becomes smaller than that in a known device, thereby preventing sliding of the piston 36 from lacking smoothness and preventing each of the bearings 41,42 and preventing a seal from reducing their lives or producing looseness caused by unequal force.

[0020] By the pressure regulator 13, pressure of a compressed gas in the crank case 29 is regulated, so that pressure difference from a compression chamber above the piston 37 is regulated as soon as possible thereby achieving stable performance.

[0021] As shown in Fig. 2, a pressure regulator 15 may be directly joined to the crank case. The pressure regulator 15 may be a reserve tank comprising a pressure-regulating valve and a check valve thereby achieving similar advantage to that in Fig. 1.

[0022] In Fig. 3, a compressed-gas feeding path 37 is connected to a compressed-gas introducing hole 11 of a motor case 33 via a bypath conduit 14 comprising a check valve 12 that closes towards the compressed-gas feeding path 37 and opens in an opposite direction. A pressure regulator 13 is provided on the compressed-gas feeding path 37 between the bypath conduit 14 and a suction valve 23 thereby achieving similar advantage to that in Fig. 1.

[0023] The foregoing merely relates to embodiments of the invention. Various changes and modifications may be made by a person skilled in the art without departing from the scope of claims.

Claims

1. A booster-type gas compressor comprising:

a crank case (29);
a crank shaft (31) in the crank case (29);
a driving shaft (3) integrally connected to the crank shaft (31);
a cylinder (21);
a piston (36) in the cylinder (21);
a piston rod (35) joined to the piston (36) at an upper end and to the crank shaft (31) at a lower end; and
a compressed-gas flow path (37) that feeds a compressed gas into a compressing chamber above the piston (36) to further compress the compressed gas, **characterized in that**:

a motor case (33) is provided communicating with the crank case (29),
an electric motor (34) is joined to the driving shaft (3) to drive the driving shaft (30) in the motor case (33);
and **in that**:

the compressed-gas flow path (37) is connected to a hole (11) of the motor case (33) via a bypath conduit (14) to allow the compressed gas to flow into the crank case (29) via the motor case (33) to keep pressure in the crank case (29) to more than atmospheric pressure, while the electric motor (34) in the motor case (33) is cooled by the compressed gas flowing through the motor case (33).

2. A compressor of claim 1, wherein the motor case (33) communicates with the crank case (29) via a communicating hole (32) through a wall between the motor case (33) and the crank case (29) to allow the compressed gas to flow from the motor case (33) to the crank case (29).

3. A compressor of claim 1, further comprising a pressure regulator (13) at the bypath conduit (14).

4. A compressor of claim 3, further comprising another pressure regulator (15) on the crank case (29).

5. A compressor of claim 1, further comprising a pressure regulator (13) at the compressed-gas flow path (37) between the bypath conduit (14) and the cylinder (21).

Patentansprüche

1. Ein Gasverdichter vom Typ Boosterpumpe umfassend:

ein Kurbelgehäuse (29);
eine Kurbelwelle (31) innerhalb des Kurbelgehäuses (29);
eine Antriebswelle (3), die mit der Kurbelwelle (31) zusammengebaut verbunden ist;
ein Zylinder (21);
ein Kolben (36) in dem Zylinder (21);
eine Kolbenstange (35), die an ihrem oberen Ende mit dem Kolben (36) und
an ihrem unteren Ende mit der Kurbelwelle (31) verbunden ist; und
einen Strömungsweg für Druckgas (37), der Druckgas in eine Verdichtungskammer oberhalb des Kolbens (36) einspeist, um das Druckgas weiter zu verdichten,
dadurch gekennzeichnet,
dass ein Motorgehäuse (33) vorhanden ist, das in einer kommunizierenden Verbindung mit dem,Kurbelgehäuse (29) steht,
ein Elektromotor (34), der mit der Antriebswelle (3) verbunden ist, um die Antriebswelle (30) im Motorgehäuse (33) anzutreiben;
und **dadurch**, dass,
der Strömungsweg für das Druckgas (37) über eine Umgehungsleitung (14) mit einer Öffnung (11) des Motorgehäuses verbunden ist, um dem Druckgas zu ermöglichen, über das Motorgehäuse (33) in das Kurbelgehäuse (29) zu strömen, um den Druck im Kurbelgehäuse (29) oberhalb des Atmosphärendruckes zu halten, wobei der Elektromotor (34) in dem Motorgehäuse (33) durch die Strömung des Druckgases durch das Motorgehäuse (33) gekühlt wird.

2. Ein Gasverdichter nach Anspruch 1, wobei das Motorgehäuse (33) über eine kommunizierende Öffnung (32), die durch eine Wand zwischen dem Motorgehäuse (33) und dem Kurbelgehäuse (29) verläuft, in kommunizierender Verbindung mit dem Kurbelgehäuse (29) steht, um dem Druckgas zu ermöglichen, von dem Motorgehäuse (33) zu dem Kurbelgehäuse (29) zu strömen.

3. Ein Gasverdichter gemäß Anspruch 1, weiterhin umfassend einen Druckregler (13) an der Umgehungsleitung (14).

4. Ein Gasverdichter nach Anspruch 3, weiterhin umfassend einen anderen Druckregler (15) an dem Kurbelgehäuse (29).

5. Ein Gasverdichter nach Anspruch 1, weiterhin umfassend einen Druckregler (13) an dem Strömungsweg (37) für das Druckgas zwischen der Umgehungsleitung (14) und dem Zylinder (21).

Revendications

1. Compresseur à gaz de type surpresseur, comprenant :

un carter de vilebrequin (29) ;
un vilebrequin (31) dans le carter de vilebrequin (29) ;
un arbre d'entraînement (3) relié d'un seul tenant au vilebrequin (31) ;
un cylindre (21) ;
un piston (36) dans le cylindre (21) ;
une tige de piston (35) jointe au piston (36) à une extrémité supérieure et au vilebrequin (31) à une extrémité inférieure ; et
un passage d'écoulement de gaz comprimé (37) qui distribue un gaz comprimé dans une chambre de compression au-dessus du piston (36) pour comprimer davantage le gaz comprimé,
caractérisé en ce que :

un carter de moteur (33) est prévu communiquant avec le carter de vilebrequin (29),
un moteur électrique (34) est joint à l'arbre d'entraînement (3) pour entraîner l'arbre d'entraînement (30) dans le carter de moteur (33) ;
et **en ce que** :

le passage d'écoulement de gaz comprimé (37) est raccordé à un orifice (11) du carter de moteur (33) par l'intermédiaire d'un conduit de dérivation (14) pour permettre au gaz comprimé de s'écouler dans le carter de vilebrequin (29) par l'intermédiaire du carter de moteur (33) pour maintenir la pression dans le carter de vilebrequin (29) à une pression supérieure à la pression atmosphérique, tandis que le moteur électrique (34) dans le carter de moteur (33) est refroidi par le gaz comprimé s'écoulant à travers le carter de moteur (33).

2. Compresseur selon la revendication 1, dans lequel le carter de moteur (33) communique avec le carter de vilebrequin (29) par l'intermédiaire d'un orifice de

communication (32) à travers une paroi entre le carter de moteur (33) et le carter de vilebrequin (29) pour permettre au gaz comprimé de s'écouler du carter de moteur (33) au carter de vilebrequin (29).

3. Compresseur selon la revendication 1, comprenant en outre un régulateur de pression (13) au niveau du conduit de dérivation (14).

4. Compresseur selon la revendication 3, comprenant en outre un autre régulateur de pression (15) sur le carter de vilebrequin (29).

5. Compresseur selon la revendication 1, comprenant en outre un régulateur de pression (13) au niveau du passage d'écoulement de gaz comprimé (37) entre le conduit de dérivation (14) et le cylindre (21).

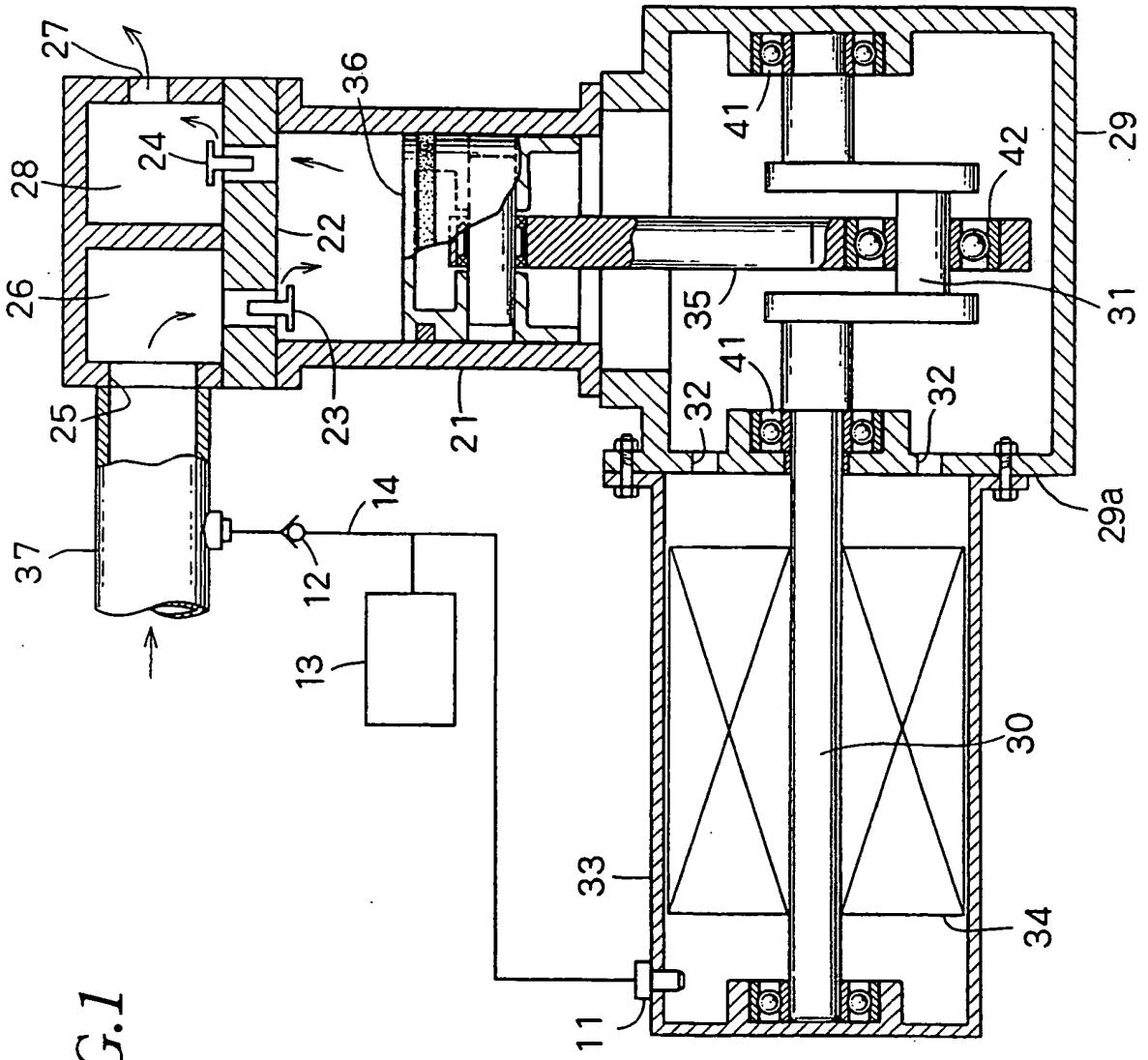
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FIG.1

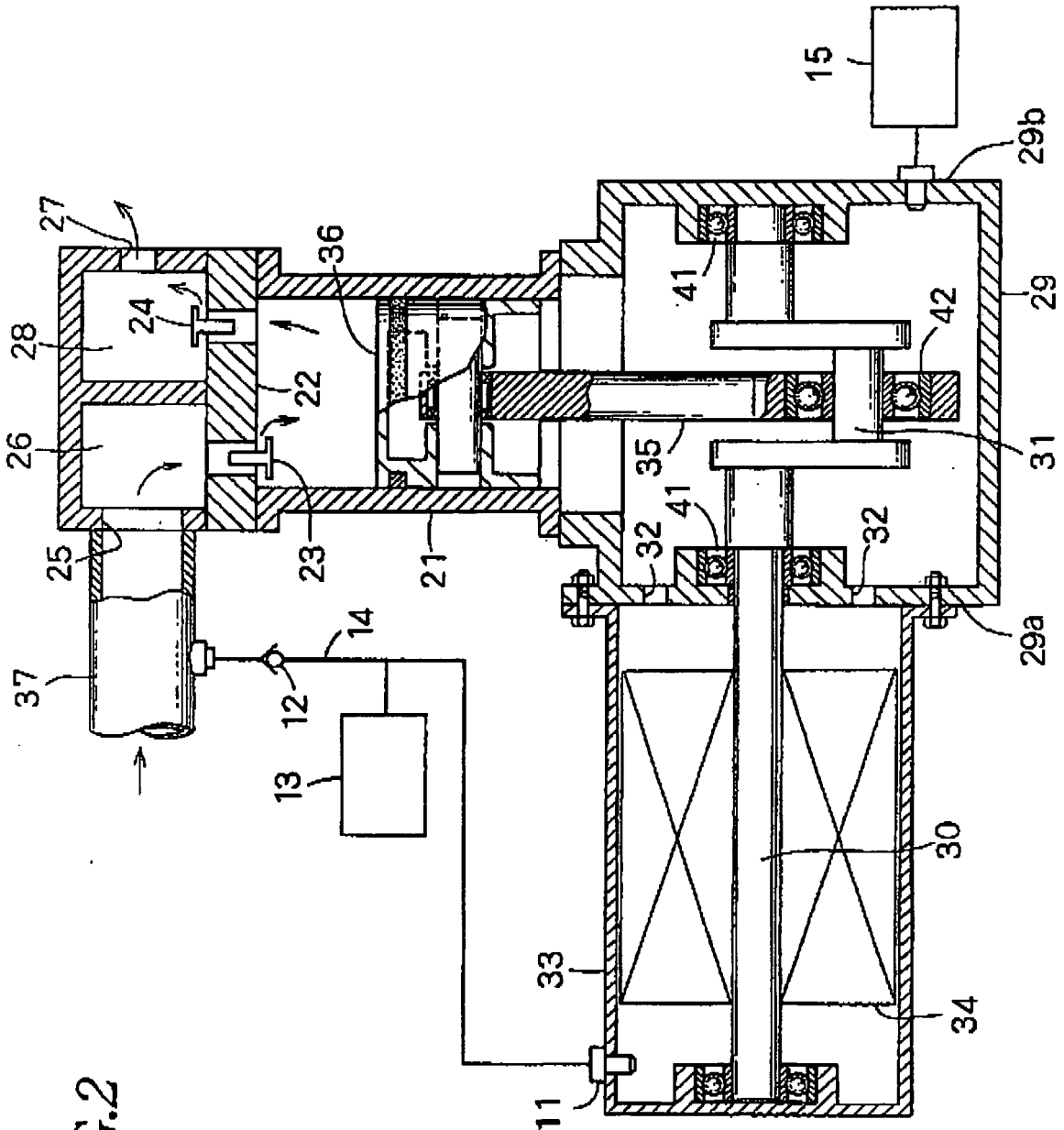
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FIG.2

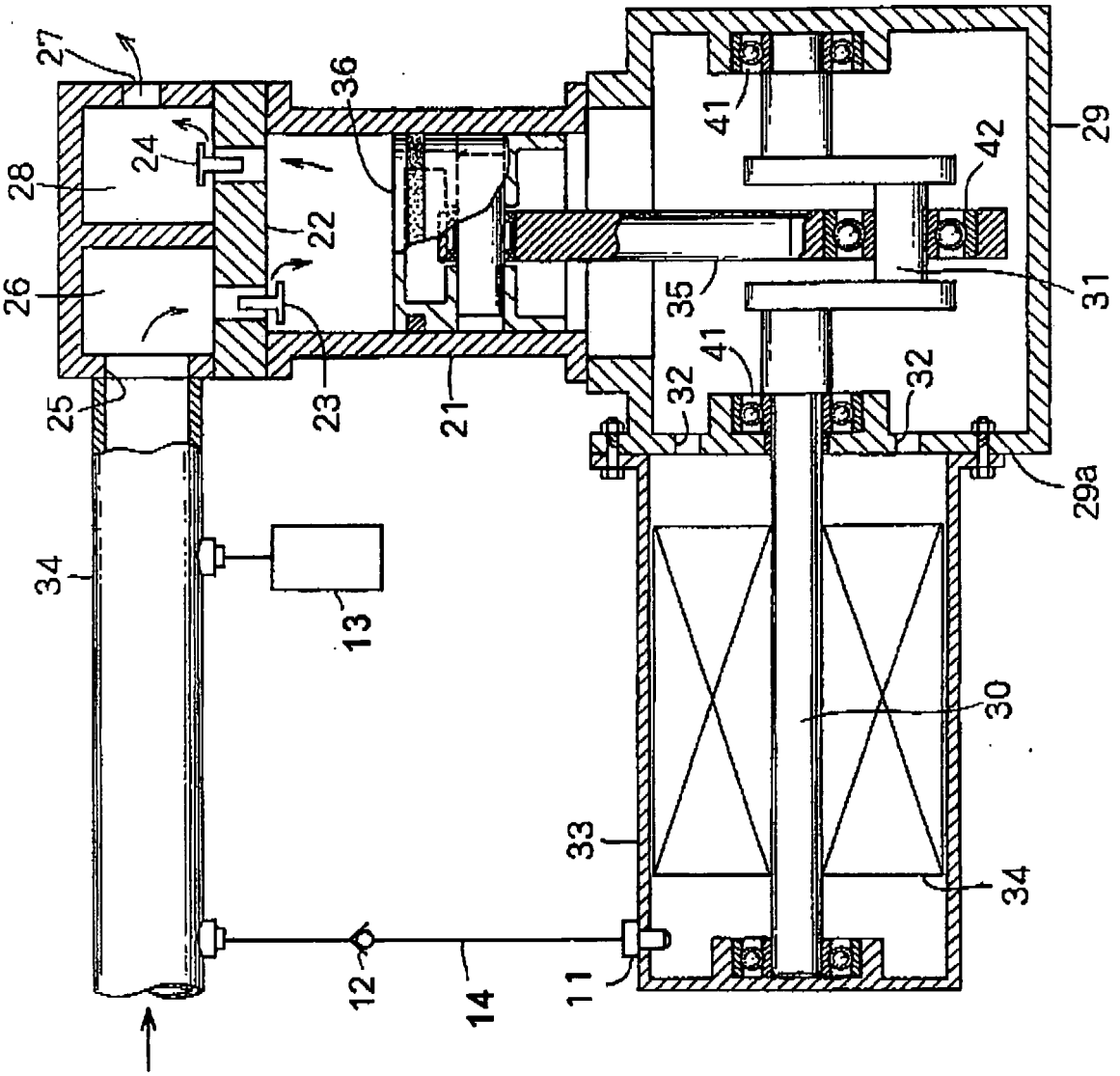
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FIG.3

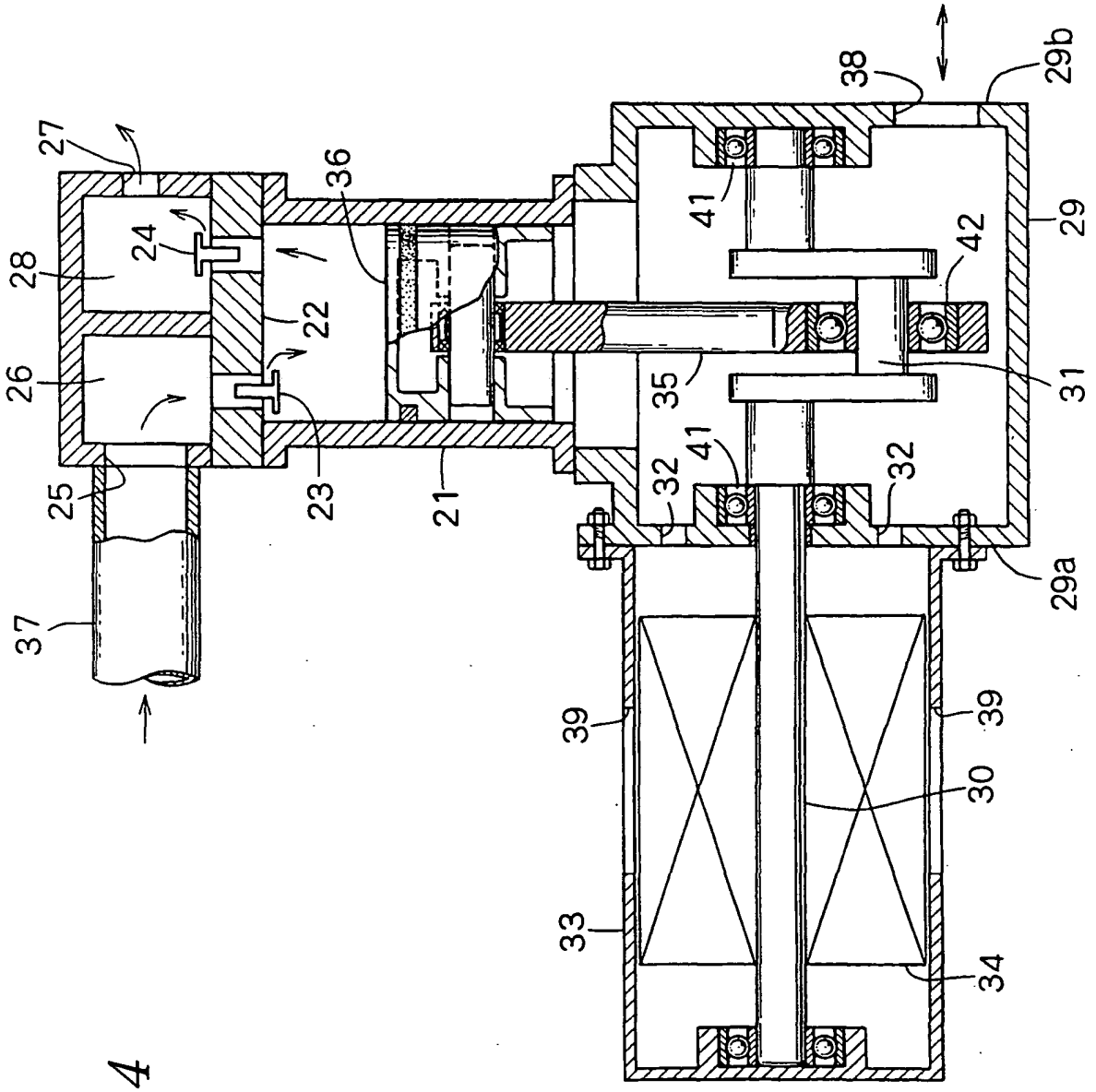
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FIG.4

REFERENCES CITED IN THE DESCRIPTION

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- JP 05157050 A **[0009]**
- EP 1116883 A **[0010]**