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Valve apparatus of enclosed reciprocating compressor

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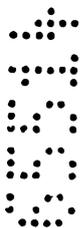
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ABSTRACT OF THE DISCLOSURE

The present invention relates a valve apparatus of an enclosed reciprocating compressor having a discharge valve, a stopper valve and a keeper member for further stabilizing movement of the discharge valve improving performances and reducing noise the apparatus including; the stopper valve formed with a bend unit obliquely bent at a predetermined angle so that the discharge valve can be controlled in its opened height to thereby by closed, and vibrating phenomenon transmitted to a valve movem unit of a discharge valve caused by discharge of the compressed high-pressurized gas cannot be transfer to a valve fixing unit to thereby be point-contacted.



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COMPLETE SPECIFICATION
STANDARD PATENT

Applicant(s):

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Invention Title:

**VALVE APPARATUS OF ENCLOSED
RECIPROCATING COMPRESSOR**



The following statement is a full description of this invention, including the best method of performing it known to me/us:

VALVE APPARATUS OF ENCLOSED RECIPROCATING COMPRESSOR

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a valve apparatus of an enclosed reciprocating compressor by which shape of a stopper valve disposed in a cylinder head can be changed to stabilize movement of a discharge valve.

DESCRIPTION OF THE PRIOR ART

A conventional enclosed reciprocating compressor includes, as illustrated in Figure 1, driving means 20 having a rotor 21 and a stator 22 disposed at an upper side in an upper and a lower case 10 and 11, a crank axis 40 having an eccentric unit 41 disposed at an inner lower side of the rotor 21 through the medium of a bearing 30 and an oil pickup tube 50 disposed at a lower end of the eccentric unit 41 for being eccentrically moved by turning effect of a crank shaft 40 and for picking up oil (o) stored at a lower side in a lower case 11 to thereby supply the oil to the eccentric unit 41 and a spiral groove 42 formed at the crank shaft 40.

The eccentric unit 41 of the crank shaft 40 is disposed with a connecting rod 60 for receiving an eccentric movement according to the turning effect of the crank shaft 40 to thereby convert the movement to horizontal reciprocating movement.

The connecting rod 60 is disposed at a tip end thereof with a piston 80 for moving horizontally and reciprocally in a cylinder block 70 mounted at one side in the lower case 11.

The cylinder block 70 is arranged at one side thereof with a cylinder head 90 having suction and discharge chambers 91 and 92 for high pressurized gas to be sucked in and discharged therethrough.

Furthermore, the suction chamber 91 is provided at one side thereof with a silencer 100 for attenuating noise generated in the course of mixed gas being sucked in, and is arranged at the other side thereof with a capillary tube 110 for supplying the oil (o) stored at a lower side in the lower case 11 to the suction chamber 91 when a piston 80 is horizontally and reciprocating moved in the cylinder block 70.

Meanwhile, as illustrated in Figures 2 and 3 a valve plate 120 having a suction inlet 121 is disposed between the cylinder block 70 and the cylinder head 90.

A suction valve 130 is disposed between the cylinder block 70 and the valve plate 120 for being opened by pressure generated by the high pressurized gas sucked from the suction chamber 91 to the cylinder block 70 when the piston 80 is moved to a bottom dead center.

Gaskets 140 are respectively provided between the cylinder head 90 and the valve plate 120 and between the cylinder block 70 and the suction valve 130.

At this time, the valve plate 120 is concavely formed at an upper center area thereof with a first accommodation unit 122 for accommodating a Keeper member 170 to accurately place a discharge valve 150 and a stopper valve 160 at a predetermined position.

The first accommodation unit 122 is centrally formed with the charge valve 150 for being opened by pressure generated by the high-pressurized gas discharged from the cylinder block 70 to the discharged chamber 92 when the piston 80 is moved to an upper dead point, and is also concavely formed with a second accommodation unit 123 for accommodating the stopper valve 160 so that the discharge valve 150 thereof can be restricted in area of closing and opening.

The second accommodation unit 123 is centrally arranged with a discharge hole 124 for discharging the high pressurized gas from the cylinder block 70 to the discharge chamber 92.

In other words, the second accommodation unit 123 is formed at one end thereof with a support groove 123a for accommodating respective valve fixing units 151 and 161 formed at tip ends of the discharge valve movement units 152 and 162 disposed at the other tip ends to vertically move to the left and right directions without being swayed.

The second accommodation unit 123 is also formed at the other end thereof with a support space 123b having a discharge hole 124 at a central portion thereof in order to allow the high-pressurized gas to be discharged from the cylinder block 70 to the discharge chamber 92 and to allow the valve movement unit 152 at the discharge valve

150 to be opened and closed while being smoothly and vertically moved.

At this time, the stopper valve 160 is formed with a bend unit 163 between the valve fixing unit 161 and the valve movement unit 162 bent at a predetermined angle so as to limit an opened degree of the discharge valve 150 and to alleviate trembling of the discharge valve 150.

The bend unit 163 serves to press straightly on an upper surface of the discharge valve 150 by way of a line contact so that the valve movement unit 162 can maintain a horizontal state as illustrated in Figure 5.

The stopper valve 160 thus constructed serves to press the valve fixing unit 161 and the valve movement unit 162 by way of the keeper member 170 mounted thereon when same is assembled to the first accommodation unit 122 of the valve plate 120, so that the bend unit 163 line-contacts a space between the valve fixing units 151 and the valve movement unit 152, and the line-contact area is detached by a margin of "S" from the support groove 123a of the second accommodation unit 123 at the valve plate 120, as illustrated in Figure 4.

At this time, when the high-pressurized gas compressed through the discharge hole 124 of the valve plate 120 is discharged, the discharge valve 150 is caused to open by pressure of discharged high-pressurized gas, which is in turn discharged to the discharge chamber 92 of the cylinder head 90.

The stopper valve 160 serves to limit the opened degree of the discharge valve 150 and press down the discharge valve 150 in a state where the bend unit 163 line-contacts the upper surface of the discharge valve 150, being separated at as much distance as "S", so that, when the pressurized gas is discharged through the discharge hole 124 of the valve plate 120, the discharge valve 150 is alleviated in vibration thereof.

However, there is a problem in the valve apparatus of enclosed reciprocating compressor thus constructed, in that, structure thereof is such made that the bend unit 163 of the stopper valve is straightened out but in bent form to cause a pointed area of the bend unit 163 to line-contact the support groove 123a formed at the second accommodation unit 123 of the valve plate 120 at a position distanced as much as "S" spacing from a staired unit of the support space 123b as illustrated in Figure 4, thereby resulting in the valve movement unit 152 at the discharge valve 150 to vibrate when the compressed high-pressurized gas is discharged through the discharge hole 124 of the valve plate 120 and subsequently having the vibration of the valve movement 152 to be delivered to the valve fixing unit 151 for generation of vibration mode, realization of irregular movement of the discharge valve 150 and providing causes of decreased performances and increased noises.

SUMMARY OF THE INVENTION

Accordingly, the present invention is provided to solve the aforementioned problems and it is an object of the present invention to provide a valve apparatus of enclosed reciprocating compressor by which a contact characteristic between the stopper valve and

discharge valve is such that a point-contact therebetween is realized obliquely to further stabilize the movement of the discharge valve, improve performances and to reduce the noise therefrom.

In accordance with the object of the present invention, there is provided a valve apparatus of an enclosed reciprocating compressor having a discharge valve, a stopper valve and a Keeper member for opening and closing a discharge hole of a valve plate, the apparatus comprising:

The stopper valve is formed with a bend unit obliquely bent at a predetermined angle so that the discharge valve can be controlled in its opened height to thereby be closed, and vibrating phenomenon transmitted to a valve movement unit of a discharge valve caused by discharge of the compressed high-pressurized gas cannot be transferred to a valve fixing unit to thereby be point-contacted.

BRIEF DESCRIPTION OF THE DRAWINGS

For fuller understanding of the nature and objects of the invention, reference should be made to the following detailed description taken in conjunction with the accompanying drawings in which:

Figure 1 is a sectional view of a conventional enclosed compressor;

Figure 2 is an exploded perspective view for illustrating a conventional cylinder head;

Figure 3 is an assembled sectional view for illustrating the conventional cylinder head;

Figure 4 is an enlarged schematic drawing of "A" part in Figure 3;

Figure 5 is a sectional view taken along line "B-B" in Figure 3;

Figure 6 is an explicated perspective view for illustrating a cylinder head according to the present invention;

Figure 7 is an assembled sectional view for illustrating the cylinder head according to the present invention;

Figure 8 is an enlarged schematic drawing of "C" part according to the present invention;

Figure 9 is a sectional view taken along line D-D in Figure 7 ; and

Figure 10 is a sectional view taken along line E-E in Figure 7.

DETAILED DESCRIPTION OF THE INVENTION

Now, the preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings.

Throughout the drawings, like reference numerals and symbols as in Figure 1 through 5, are to be used for like parts or portions and redundant descriptions thereof are to be omitted.

As illustrated in Figures 6 and 7, a valve plate 120 having a suction hole 121 is disposed between a cylinder block 70 and a cylinder head 90, and a suction valve 130 is disposed between the cylinder block 70 and the valve plate 120 so as to be opened and closed by pressure generated by high-pressurized gas sucked from the suction chamber 91 to the cylinder block 70 when the piston 80 is moved to a bottom dead center, and gaskets 140 are respectively disposed between the cylinder head 90 and the valve plate 120 and the cylinder block 70 and the suction valve 130 to thereby prevent the high-pressurized gas from being leaked.

At this time, the valve plate 120 is concavely formed at an upper central surface thereof with a first accommodation unit 122 for accommodating a keeper member 170 so as to place the discharge valve 150 and the stopper valve 200 at a predetermined position.

The first accommodation unit 122 is concavely formed at a central portion thereof with a second accommodation unit 123 for accommodating a discharge valve 150 for being opened and closed by pressure generated by the high-pressurized gas discharged from the cylinder block 70 to the discharge chamber 92 when the piston is moved to an upper dead point and at the same time for accommodating a stopper valve 200 for controlling an opening and closing domain of the discharge valve 150.

The second accommodation unit 123 is centrally formed with a



discharge hole 124 for the high-pressurized gas to be discharged from the cylinder block 70 to the discharge chamber 92.

In other words, the second accommodating unit 123 is formed at one end thereof with a support groove 123a for accommodating valve fixing units 151 and 201 respectively formed at one end of the discharge valve 150 and the stopper valve 200 to allow valve movement units 152 and 202 to vertically move without being swayed to the left and to the right directions, and is formed at the other end thereof with a support space 123b centrally having a discharge hole 124 so that the high-pressurized gas can be discharged from the cylinder block 70 to the discharge chamber 92 and the valve movement unit 152 at the discharge valve 150 can be smoothly and vertically moved to thereby be opened and closed.

At this time, there are formed at the stopper valve 200 a valve fixing unit 201 and a valve movement unit 202 bent at a predetermined slant angle for limiting an opened height of the discharge valve 150 and closing same, and for preventing the vibration transmitted to the valve movement unit 152 at the discharge valve 150 from being transmitted to the valve fixing unit 151 by discharge of compressed high-pressurized gas and instead for alleviating same, and a bend unit 203 is disposed therebetween.

The bend unit 203 serves to press obliquely an upper surface of the discharge valve 150 by way of point-contact to thereby be positioned at a predetermined slant angle (L) at an intermediate side of the valve movement unit 202, as illustrated in Figure 9 and the valve movement unit 202 is positioned at a tip side thereof at a predetermined slant angle (L') by being in contact with part of the

Keeper member 170 as illustrated in Figure 10.

Furthermore the bend unit 203 of the stopper valve 200 is so structured as to be positioned at a staired unit of the support groove 123a and the support space 123b formed at the second accommodation unit 123 of the valve plate 120 while maintaining a predetermined point contact space (P) as illustrated in Figure 8 in the course of being mounted at an upper surface of the discharge valve 150 in order to prevent the trembling motion transmitted to the valve movement unit 152 of the discharge valve 150 by the pressure generated by the discharge of compressed high-pressurized gas from being transmitted to the valve fixing unit 151.

Next, operational effect of the present invention thus constructed will be described.

When the power is received and applied to a stator 22 of driving means 20, magnetic force is formed at a space between the stator 22 and a rotor 21, which is in turn rotated.

A crank shaft 40 is rotated by turing effect of the rotor 21 by being supportively fixed through the medium of a bearing 30 and serves to eccentrically rotate an eccentric unit 41 formed at a lower end of the crank shaft 40 and at the same time, eccentricly rotate an oil pickup tube 50 mounted at a lower end of the eccentric unit 41.

At this time, when the oil pickup tube 50 is eccentrically rotated, the oil (O) restored in a lower side case 11 is picked up by surface tension generated by a slant angle of the oil pickup tube

50 along the oil pickup tube 50 and some small portion of the oil (0) is infused into a contact surface of a connecting rod 60 and the eccentric unit 41 through an oil passage (not shown) leading to a periphery of the eccentric unit 41 to thereby reduce a frictional resistance, and another small portion of the oil (0) is infused into a contact space between the piston 80 and the cylinder block 70 through an oil passage (not shown) formed at the connecting rod 60 and the piston 80, thereby reducing a frictional resistance.

Futhermore, the oil (0) raised and picked up along a spiral groove 42 of the crank shaft 40 connected to the oil passage of an eccentric unit 30c and evenly dispersed on the peripheral surface of the crank shaft 40 is infused into a contact space in a bushing (not shown) fitted to be rotatively contacted to an upper and a lower end respectively against an inner diameter of the bearing 30, to thereby reduce a frictional resistance.

Meanwhile, when the eccentric unit 41 is eccentrically rotated, the connecting rod 60 connected to the eccentric unit 41 in turn performs a horizontal reciprocating motion, and the piston 80 disposed at a tip end thereof is driven to continuously move between an upper dead center and a bottom dead center in the cylinder block 70.

In other words, when the piston 80 is moved from the upper dead center to the bottom dead center, vacuum state is maintained in the cylinder block 70 to thereby open the suction valve 130, so that mixed gas in the suction chamber 91 at the cylinder head is sucked into the cylinder block 70 through a suction hole 121 of the valve plate 120 and the oil (0) is infused into the suction chamber 91, by

way of vacuum suction force, and at the same time, is pulverized to thereafter be sucked into the cylinder block 70 with the mixed gas.

Furthermore, when the bottom dead center is moved to the upper dead center, the mixed gas in the cylinder block is compressed and at the same time, the discharge valve is opened by compressin force therof so that the high-pressurized gas in the cylinder block 70 is discharged into the discharge chamber 92 at the cylinder head 90 through the discharge hole 124 of the valve plate 120.

In other words, when the discharge valve 150 is opened by the high-pressurized gas discharged through the discharge hole 124 of the valve plate 120, the valve movement unit 152 of the discharge valve 150 hits the valve movement unit 202 of the stopper valve 200 to thereby be restricted in opened degree and to guide a discharge of the high-pressurized gas.

When the discharge of the high-pressurized gas finished, the discharge valve 150 is closed by resilient force of the bend unit 203 formed at the stopper valve 200 and by restoring force of the discharge valve 150, thereby closing the discharge hole 124 of the valve plate 120.

At this time, a surface contact space "P" illustrated in Figure 8 is positioned at a staired unit between the support groove 123a and the support space 123b formed at the second accommodation unit 123 of the valve plate 120 when the bend unit of the stopper valve 200 surface-contacts an upper surface of the discharge valve 150, and serves to perform a spring contact role between the valve movement unit 152 of the discharge valve 150, and the valve fixing

unit 151, and play a role of damping for alleviating the vibration of the discharge valve 150, together with the staired unit of the valve plate 120.

The slant angles L and L' illustrated in Figures 9 and 10 first contact a slant start point of the stopper valve 120 the moment the discharge valve 150 is opened and contact a slant end point for a few seconds after the discharge valve 150 is opened, so that contact period between the discharge valve 150 and the stopper valve 200 can be lengthened and the trembling phenomenon of the valve movement at the discharge valve 150 can be reduced and at the same time transmission of vibration mode to the valve fixing unit 151 can be attenuated.

Accordingly, surface contact space 9 in Figure 8 serves to press the valve fixing unit 151 of the discharge valve 150 to allow same to be tightly adhered to the support groove 123a of the valve plate 120 to thereby attenuate generation of trembling phenomenon transmitted to the valve fixing unit 151 by the vibration mode of the valve movement 152 at the discharge valve 150.

The slant angles L and L' illustrated in Figures 9 and 10 serve to lengthen the contact period between the discharge valve 150 and the stopper valve 200 can be lengthened generation of trembling phenomenon transmitted to the valve fixing unit 151 by the vibration mode of the valve movement unit 152 at the discharge valve 150, so that valve movement can be stabilized, irregular movement generated by valve vibration can be eliminated to thereby improve performances and to reduce noise.

As apparent from the foregoing there is an advantage in the valve apparatus of an enclosed reciprocating compressor according to the present invention, in that a bend unit is obliquely and slantly formed between valve fixing unit and a valve movement unit of a stopper valve to thereby make the bend unit thereof tight press a valve fixing unit of discharge valve to a staired unit of a valve plate, so that generation of trembling phenomenon transmitted to a valve fixing unit by vibration mode occurring at a valve movement unit of a discharge valve can be attenuated, valve movement can be further stabilized, performances can be improved and noise can be reduced.

Throughout the specification and claims, the words "comprise", "comprises" and "comprising" are used in a non-exclusive sense.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A valve apparatus adapted for use in a reciprocating compressor which pressurizes gas, the valve apparatus comprising:

a valve plate having a gas discharge opening for discharging pressurized gas, and a discharge valve; the discharge valve including a fixing portion and a movement portion normally assuming a closed position covering the discharge opening; the movement portion being flexible rearwardly relative to the fixing portion to an open position uncovering the discharge opening in response to a force of pressurized gas; and

a stopper disposed behind the discharge valve for limiting an opening angle of the movement portion in its open position; the stopper including a first portion disposed behind the fixing portion of the discharge valve, and a second portion disposed behind the movement portion of the discharge valve and being bent relative to the first portion to define a corner engaging the discharge valve; the corner extending obliquely relative to a longitudinal axis of the discharge valve as the stopper and discharge valve are viewed in a direction parallel to the discharge opening, wherein the second portion is slanted at an inclination relative to a plane of the fixing portion of the discharge valve as viewed in a direction parallel to the longitudinal axis of the discharge valve.

2. The valve apparatus according to claim 1, wherein a section of the valve plate disposed in front of the movement portion is spaced forwardly of a section of the valve plate disposed in front of the fixing portion, those sections forming a step therebetween, the corner of the stopper intersecting the corner as the stopper is viewed in said direction.



3. The valve apparatus according to claim 1, further including a keeper disposed behind the stopper for maintaining the first portion of the stopper in contact with the fixing portion of the discharge valve.

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4. A valve apparatus substantially as herein described with reference to Figures 6 to 10.

Dated this 19th day of October 2000

10 SAMSUNG KWANG-JU ELECTRONICS CO., LTD.

By their Patent Attorneys

GRIFFITH HACK

Fellows Institute of Patent and
Trade Mark Attorneys of Australia

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FIG. 1
(PRIOR ART)

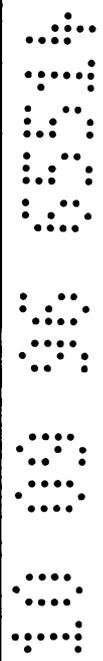
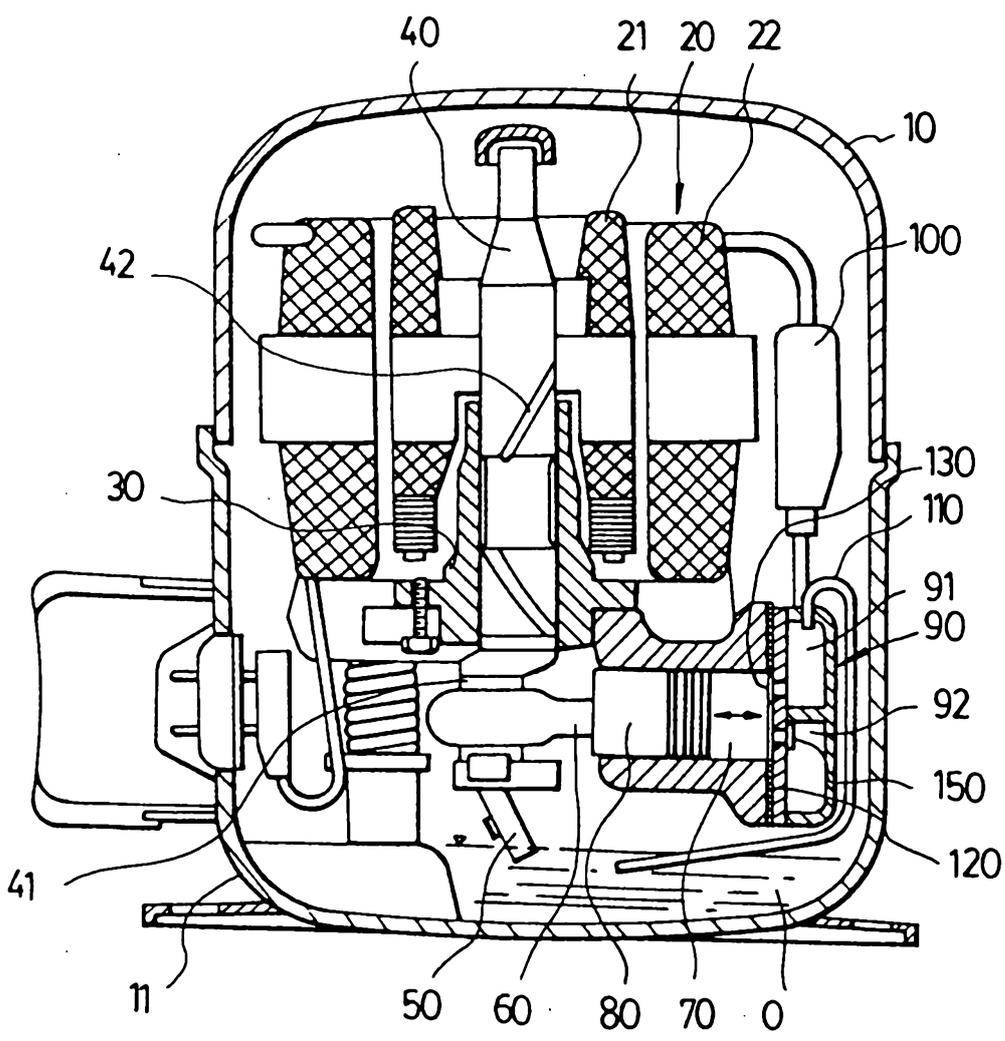


FIG. 2
(PRIOR ART)

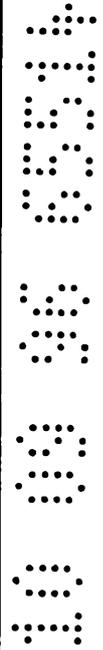
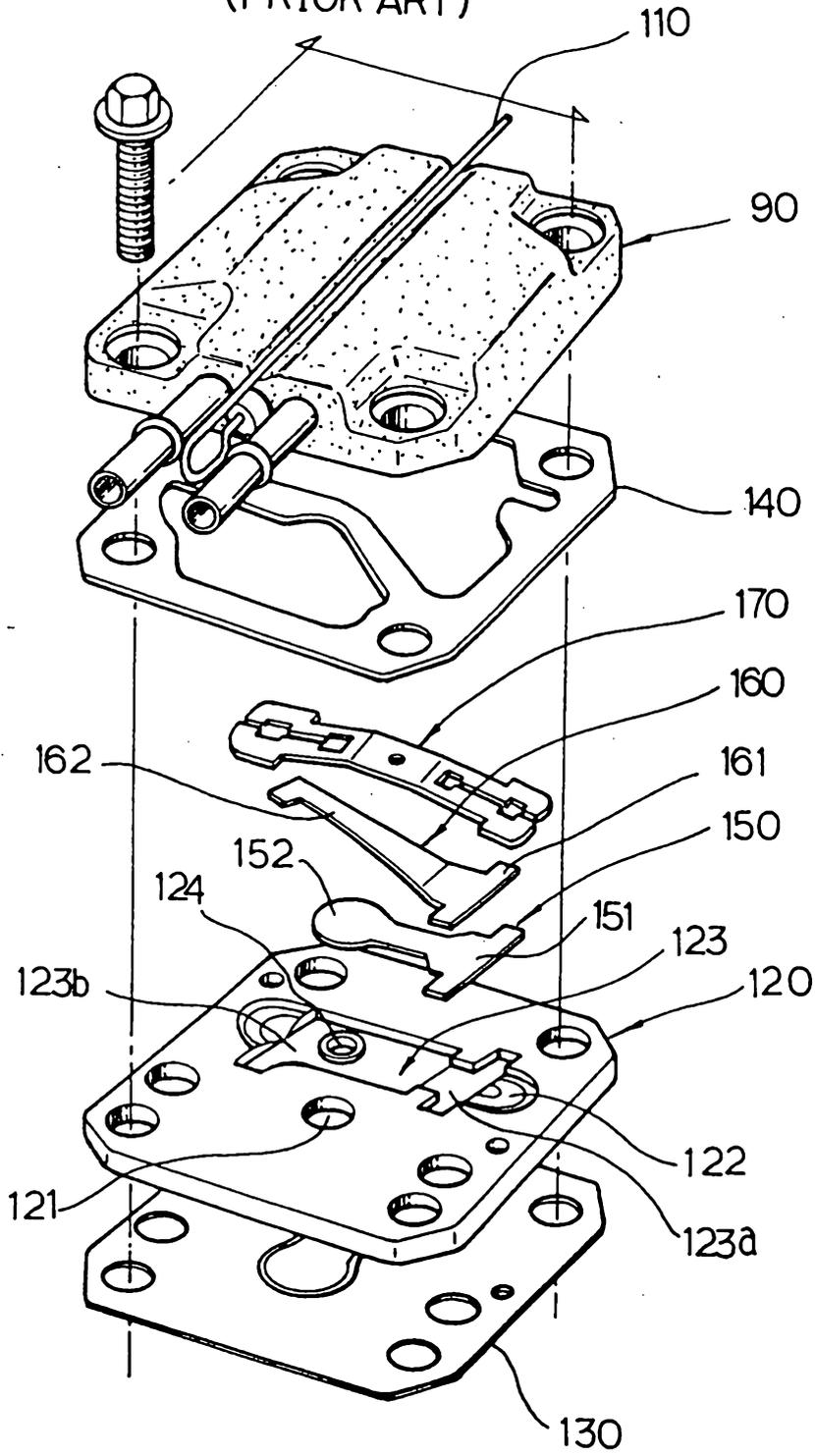


FIG.3

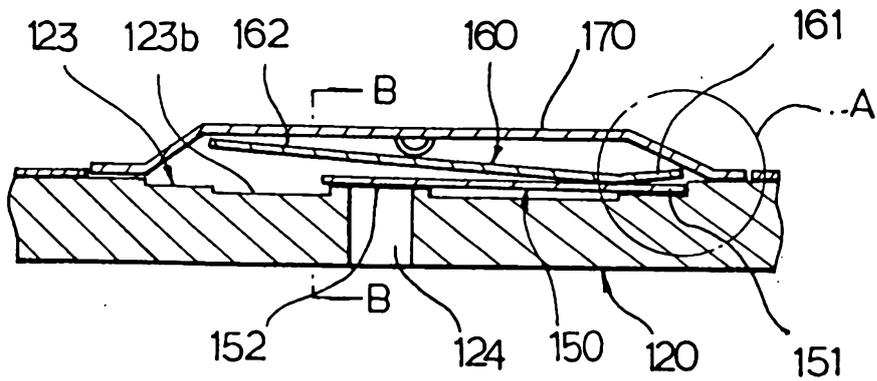


FIG.4

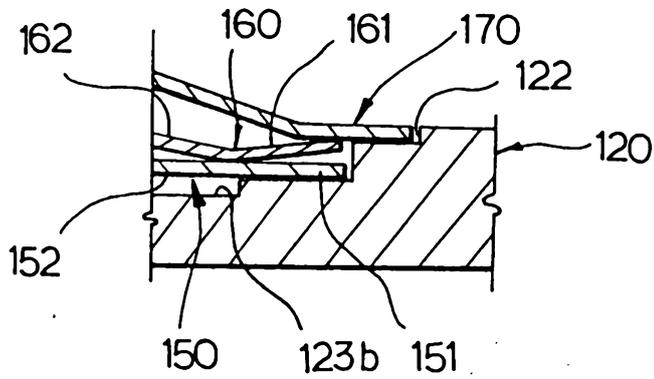


FIG.5

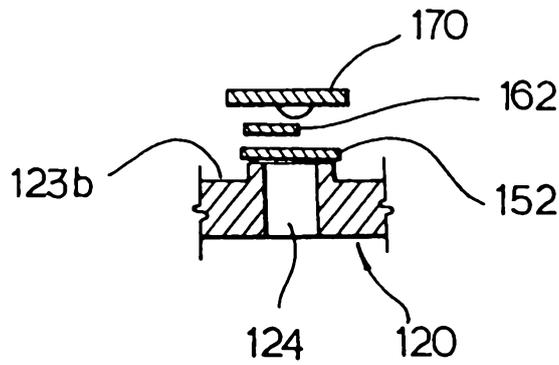


FIG.6

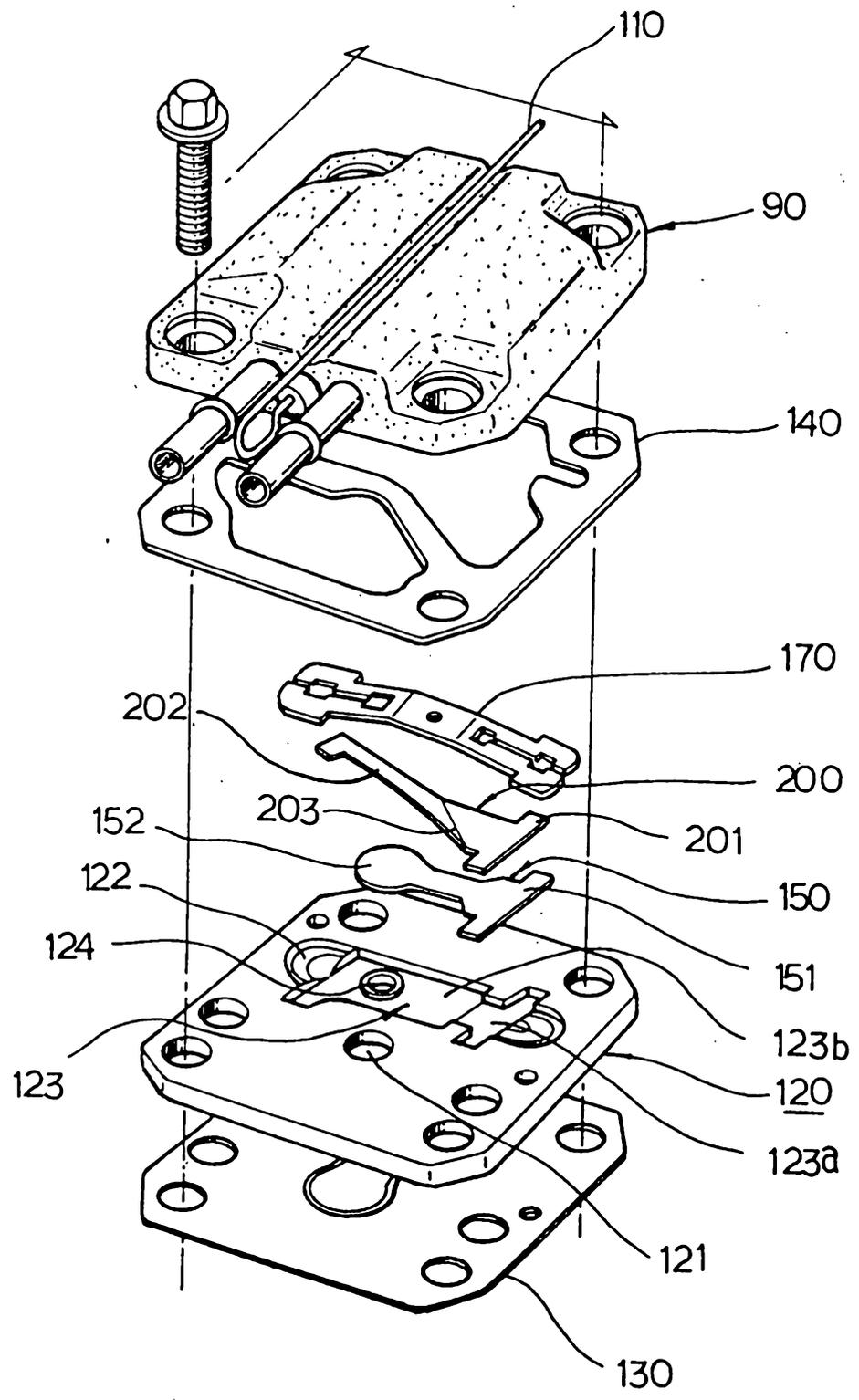


FIG. 7

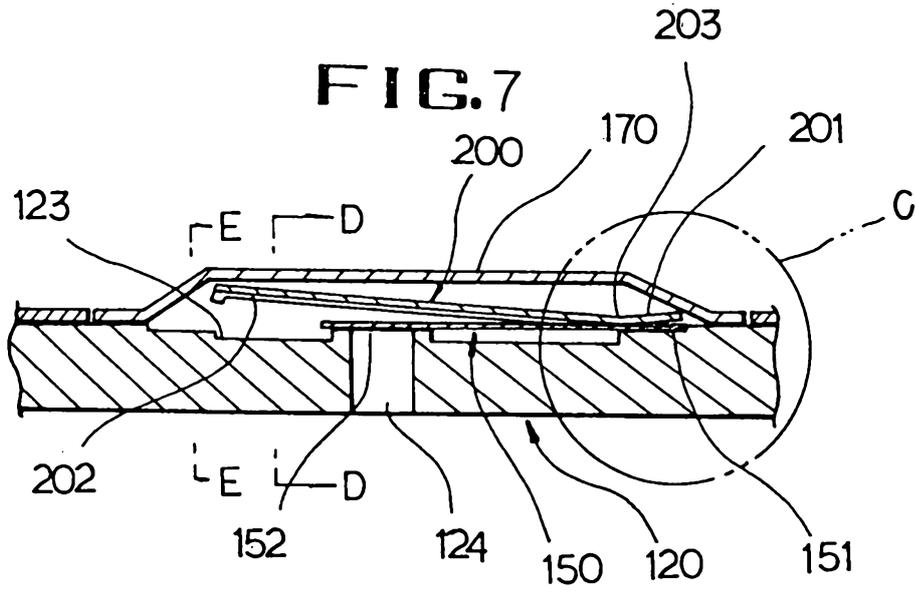


FIG. 8

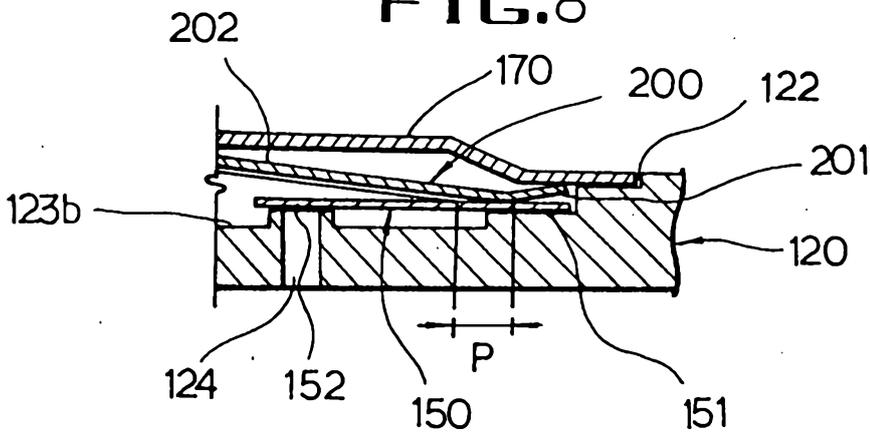


FIG. 9

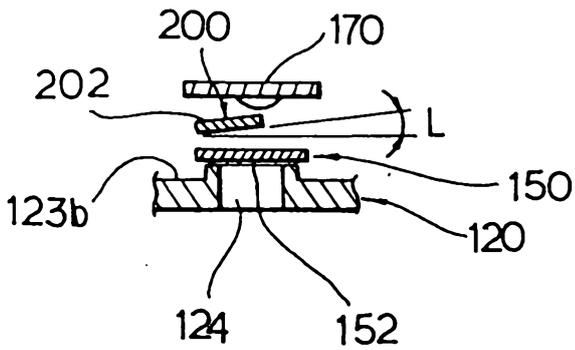


FIG. 10

