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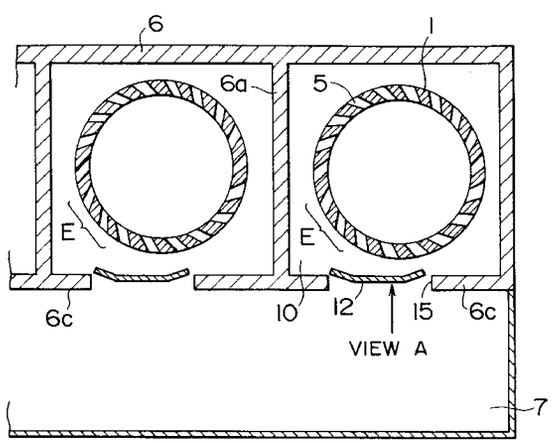
(54) Construction of scavenging air chamber for diesel engine.

(57) In a two-cycle diesel engine, a control plate (12) is installed near the scavenging air inlet (15) for connecting a scavenging trunk (7) to a scavenging air chamber (10) to make the flow of scavenging air uniform in the circumferential direction in the scavenging air chamber (10), by which the distribution of the scavenging air is made uniform in the circumferential direction of the cylinder liner (1) in the scavenging air chamber (10), and the eccentricity of swirl in the cylinder is eliminated, thereby the scavenging efficiency being improved.

FIG. 2(a)



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FIELD OF THE INVENTION AND RELATED ART STATEMENT

The present invention relates to a construction of scavenging air chamber for two-cycle diesel engine used mainly as a marine main engine.

Figs.14 through 17 show a construction of scavenging air chamber for two-cycle diesel engine of prior art.

Fig.14 is a schematic view showing the flow of scavenging air in a sectional view including the cylinder axis of two-cycle diesel engine. Fig.15 is a sectional view of a scavenging air chamber for a conventional two-cycle diesel engine, the view being perpendicular to the cylinder axis. Fig.16 is a sectional view showing the flow of scavenging air in the above-mentioned conventional diesel engine. Fig.17 is a sectional view corresponding to Fig.16, showing another example.

In Fig.14, reference numeral 1 denotes a cylinder liner, 2 denotes an exhaust valve, 3 denotes a piston, 4 denotes a flow of scavenging air, and 5 denotes a scavenging port. To give a swirling flow to the scavenging air during the scavenging stroke, a plurality of scavenging ports, which have a suitable twisting angle, are arranged in the circumferential direction. If the flow rate of air flowing through the scavenging ports 5 is uniform in the circumferential direction, the inflow velocity is also uniform in the circumferential direction, so that the swirl axis in the cylinder is nearly equal to the axis of cylinder liner as shown in the figure.

In Fig.15 which is a sectional view perpendicular to the cylinder liner axis, reference numeral 1 denotes the cylinder liner, 5 denotes the scavenging port, 6 denotes a cylinder jacket, 7 denotes a scavenging trunk, 10 denotes a scavenging air chamber, and 8 denotes a scavenging air inlet connecting the scavenging air chamber to the scavenging trunk.

In Fig.16, the scavenging ports 5 are arranged uniformly in the circumferential direction, and are formed so as to incline toward one direction of scavenging air flow 9 from the scavenging trunk 7 to the scavenging air chamber 10 as shown in the figure. Reference numeral 11 is the center of swirl.

The construction shown in Fig.17 is different from that shown in Fig.16 in that a passage 6b for scavenging air is made in a wall 6a partitioning the scavenging air chamber 10.

With the conventional construction of scavenging air chamber for diesel engine as shown in Fig.16, there occurs an imbalance of inflow velocity at the scavenging ports 5 facing the flowing direction of scavenging air indicated by symbol E in the figure and at the scavenging ports 5 not facing the flowing direction indicated by symbol F because only one flow passage (scavenging air inlet 8) is arranged to let the scavenging air flow from the scavenging trunk 7 to the scavenging air chamber 10 in the cylinder jacket 6. That is to say, the inflow velocity of the scavenging air at the scavenging port 5 at the E portion is higher than that of the scavenging air at the scavenging port 5 at the F portion. As a result, the swirl center 11 is shifted toward the F position as shown in Fig.16 by being pushed by the scavenging air which flows through the scavenging ports 5 at the E portion and has a higher inflow velocity. Therefore, the scavenging efficiency is decreased, by which the engine performance is deteriorated.

With the construction shown in Fig.17, the scavenging air flows from the scavenging air chamber 10 of adjacent cylinder through the passage 6b in the wall 6a depending on the ignition sequence by the pumping action due to the up-and-down movement of the piston 3 in the adjacent cylinder, or the scavenging air is sucked out to the adjacent cylinder side, thereby an imbalance of inflow velocity occurring as with the case of Fig. 16. In this case too, therefore, the scavenging efficiency is decreased, by which the engine performance is deteriorated.

OBJECT AND SUMMARY OF THE INVENTION

The main object of the present invention is to solve the problems with the conventional construction and provide a construction of scavenging air chamber for diesel engine which improves the engine performance by eliminating the eccentricity of swirl center in the cylinder and by smoothly performing the exhaust gas changing action due to scavenging.

To attain the above object, according to the present invention, a control plate for providing an inflow velocity of scavenging air flowing through the scavenging port which is uniform in the circumferential direction of the cylinder liner is installed near the scavenging air inlet communicating the scavenging air chamber for each cylinder with the scavenging trunk.

According to the present invention, the scavenging air flowing from the scavenging trunk to the scavenging air chamber is modulated by the control plate because of the control plate installed near the scavenging air inlet for connecting the scavenging air chamber for each cylinder to the scavenging trunk. Therefore, unlike the conventional construction, the scavenging air does not flow directly into the scavenging ports of cylinder liner from the scavenging trunk at the E portion, so that the eccentricity of swirl center in the cylinder liner caused by the difference in inflow velocity between the E portion and the F portion is eliminated, by which the scavenging efficiency and the engine performance are improved.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings,

Fig.1 is a longitudinal sectional view of a con-

struction for scavenging in a two-cycle diesel engine,

Fig.2 shows a first embodiment of the present invention, (a) being a sectional view perpendicular to the cylinder axis, and (b) being a view in the direction of arrow A in Fig.2(a),

Fig.3 shows a second embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively,

Fig.4 shows a third embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively,

Fig.5 shows a fourth embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively,

Fig.6 shows a fifth embodiment of the present invention, (b) corresponding to Fig.2(b),

Fig.7 shows a sixth embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively,

Fig.8 shows a seventh embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively,

Fig.9 shows a eighth embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively,

Fig.10 shows a ninth embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively,

Fig.11 shows a tenth embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively,

Fig.12 shows a eleventh embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively, and (c) being a view in the direction of arrow B in Fig.12(a),

Fig.13 shows a twelfth embodiment of the present invention, (a) and (b) corresponding to Fig.2(a) and Fig.2(b), respectively, and (c) and (d) being front views of control plate,

Fig.14 is a schematic sectional view including a cylinder axis, showing a conventional example,

Fig.15 is a sectional view corresponding to Fig.2(a), showing a conventional example,

Fig.16 is a sectional view corresponding to Fig.2(a), showing a conventional example, and

Fig.17 is a sectional view corresponding to Fig.2(a), showing a conventional example.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Preferred embodiments of the present invention will be described with reference to Figs.1 through 13.

In the figures, reference numeral 1 denotes a cylinder liner, 3 denotes a piston, 5 denotes a large number of scavenging ports disposed at equal intervals in the circumferential direction at the lower part of the cylinder liner, 6 is a cylinder jacket, 7 is a scavenging trunk, and 10 is a scavenging air chamber (piston underside chamber).

Reference numeral 12 denotes a control plate installed at a scavenging air inlet 15 which connects the scavenging trunk 7 to the scavenging air chamber 10 for each cylinder.

Fig.2 shows a first embodiment of the present invention. View (a) is a sectional view perpendicular to the cylinder axis, and (b) is a view seen in the A direction in view (a) (like views are shown in the subsequent figures).

In the figure, reference numeral 7 denotes the scavenging trunk, 15 denotes the scavenging air inlet which connects the scavenging trunk 7 to the scavenging air chamber 10 for each cylinder, and 12 denotes the control plate installed at the scavenging air inlet 15.

The control plate 12 has a height such as to cover the total height of the scavenging port in a projected plane in the direction of cylinder axis as shown in Fig.2(a) and (b).

In the first embodiment shown in Fig.2, the scavenging air, which is introduced into the scavenging trunk from a supercharger (not shown), flows into the scavenging air chamber 10 through the upper and lower ends of the control plate 12 and the gap between the control plate 12 and the scavenging air inlet 15. Then, the scavenging air is diffused in the scavenging air chamber 10 along the outer periphery of the cylinder liner 1, and flows into the cylinder through the scavenging ports when the scavenging ports are opened.

The control plate 12 installed at the scavenging air inlet 15 inhibits a concentrated flow of scavenging air to the E portion in the figure, which provides uniform flow of scavenging air to each scavenging port 5. Therefore, unlike the conventional construction, the eccentricity of swirl center is eliminated, by which high scavenging efficiency is maintained without the decrease in scavenging efficiency.

Fig.3 shows the second embodiment of the present invention. In this embodiment, the control plate 12 is inclined at an angle θ with respect to the plate surface of a wall 6c on the scavenging trunk side to further increase the modulation effect.

The other configuration is the same as that of the first embodiment.

Fig.4 shows the third embodiment of the present invention, in which the control plate 12 is installed to a bracket 20 fixed to the wall 6c of the scavenging air chamber 10 on the scavenging trunk side at the position of the scavenging air inlet 15 in such a manner that the control plate 12 can be turned around a pin 21, and the free end of the control plate is locked temporarily to a bracket 22. To open the control plate 12, the free end is unlocked and the control plate 12 is turned around the pin 21 as indicated by the dash-

and-dot line in Fig.4(a).

As shown in Fig.4(b), the control plate 12 has a height extending a certain distance from the total height of the scavenging port 5 upward and downward, so that the direction of the scavenging air to the scavenging port 5 can be changed.

Fig.5 shows the fourth embodiment of the present invention.

In this embodiment, the control plate 12 disposed at the scavenging air inlet 15 is inclined at an angle of θ with respect to the wall 6c, and is installed to the bracket 20, by which the modulation effect of the control plate 12 is further increased.

The other constitution is the same as that of the third embodiment (Fig.4).

Fig.6 shows the fifth embodiment of the present invention.

In this embodiment, the height of the control plate 12 is defined so that nearly an upper half of scavenging port 5 is exposed.

Although not illustrated, the control plate 12 may be positioned so that nearly a lower half of scavenging port 5 is exposed. The other constitution is the same as that of the first embodiment.

Fig.7 shows the sixth embodiment of the present invention. In this embodiment, the control plate 12 is fixed to a transverse beam 12d by means of supports 12b having a straight, elongated hole 12a each and bolts 12c. By loosening bolts 12c and moving the supports 12b in the direction of arrow 12e, the distance G between the control plate 12 and the scavenging port 5 can be adjusted, by which the modulation effect can be easily controlled.

Fig.8 shows the seventh embodiment of the present invention. In this embodiment, the adjacent scavenging air reservoirs 10 communicate with each other by means of a communicating passage 6e in a wall 6a. In such configuration, the control plate 12 arranged as in the third embodiment has a modulation effect. However, the modulation effect is low because of the flow of scavenging air occurring between the adjacent scavenging air reservoirs 10 by the pumping action due to the reciprocating movement of the piston. For this reason, control plates 12f and 12g are arranged in the communicating passage 6e to enhance the modulation effect.

In this case, the ignition intervals of adjacent cylinders differ depending on the ignition sequence, thus the flow of scavenging air being different for each cylinder. Therefore, the control plates 12f and 12g of the same shape are installed and the distance, angle, area, and the like of the control plates 12f and 12g may be varied for each cylinder. Alternatively, the presence of the control plates 12f and 12g may be varied for each cylinder.

Fig.9 shows the eighth embodiment of the present invention. In this embodiment, the control plate 12h is formed integrally with the cylinder jacket 6 at the scavenging air inlet 15.

Fig.10 shows the ninth embodiment of the present invention. In this embodiment, the control plate 12 is fixed to a transverse beam 12d by means of support 12i having an arcuate, elongated hole 12j and a bolt 12c. By loosening the bolt 12c and moving the support 12i in the direction of arrow 12k, the angle between the control plate 12 and the scavenging port 5 can be adjusted, by which the modulation effect can be easily controlled.

Fig.11 shows the tenth embodiment of the present invention. In this embodiment, the control plate is arranged as in the ninth embodiment (Fig.10) and a part 12m of the control plate 12 is moved by a hinge 12n independently, by which only the angle between the part 12m of the control plate 12 and the scavenging port 5 can be controlled.

Fig.12 shows the eleventh embodiment of the present invention. In this embodiment, the control plate 12 is fixed to a transverse beam 12d by means of supports 12p having a straight, elongated hole 12a each and bolts 12r. By loosening bolts 12r and moving the supports 12p in the direction of arrow 12s (refer to Fig.12(c)), the height of control plate 12 with respect to the scavenging port 5 or the degree of exposure of scavenging port 5 in the aforesaid fifth embodiment (Fig.6) can be adjusted, by which the modulation effect can be easily controlled.

Fig.13 shows the twelfth embodiment of the present invention. In this embodiment, the control plate 12 comprises a plurality of plates 12t, 12u, and 12v, and each plate is fixed to a transverse beam 12d by means of bolts 12w. The control plate 12t is arranged adjacently to the control plate 12u, so that the area of the control plate 12 can be adjusted by attaching/detaching the control plate 12t (refer to Fig.13(c)). The control plate 12v is arranged so as to partially overlap with the control plate u. Therefore, the area of the control plate 12 can be adjusted by loosening bolts 12w and changing the overlap (refer to Fig.13(d)).

Since the present invention is constituted as described above, the direction of flow of scavenging air, which flows into the scavenging air chamber for each cylinder, can be changed by the control plate, which eliminates direct flow of scavenging air into the scavenging port.

In particular, since the opening of the scavenging air inlet below the control plate 12, which is open to the scavenging trunk is large, the scavenging air flows mainly through the opening below the control plate 12, so that an upward flow occurs in the scavenging air through the scavenging port and the inflow velocity of scavenging air flowing into the cylinder through each scavenging port is made uniform in the circumferential direction. As a result, the swirl center in the cylinder agrees approximately with the cylinder axis, thereby the eccentricity of swirl being eliminat-

ed. Therefore, the change of exhaust gas to fresh air by scavenging is performed smoothly, so that the improvement in engine performance can be expected.

The blowing-through of fresh air is reduced by the throttling action of control plate, so that the temperature of exhaust gas is increased and the efficiency of exhaust turbosupercharger is improved, thereby the overall engine performance being enhanced.

Claims

(1) In a two-cycle diesel engine in which the remaining gas in a cylinder is exhausted through an exhaust valve installed at the upper portion of the cylinder by scavenging air introduced through a large number of scavenging ports disposed along the circumferential direction at the lower portion of a cylinder liner,

a construction of scavenging air chamber for diesel engine in which a control plate is installed near a scavenging air inlet for connecting said scavenging air chamber for each cylinder to which said scavenging ports face to a scavenging trunk in order to make the inflow velocity of scavenging air, which flows into said scavenging port, uniform in the circumferential direction of cylinder liner.

(2) A construction of scavenging air chamber for diesel engine according to claim (1) wherein said control plate is installed so as to rotate around a support pin mounted on a wall of said scavenging air chamber.

(3) A construction of scavenging air chamber for diesel engine according to claim (1) wherein said control plate is installed so that its plate surface is substantially in parallel to the plate surface of said wall on the scavenging trunk side.

(4) A construction of scavenging air chamber for diesel engine according to claim (1) wherein said control plate is installed so that its plate surface is inclined at a certain angle with respect to the plate surface of said wall on the scavenging trunk side.

(5) A construction of scavenging air chamber for diesel engine according to claim (1) wherein said control plate is installed so that a part of said scavenging port is exposed in a projected plane in the direction of cylinder axis.

(6) In a two-cycle diesel engine in which the remaining gas in a cylinder is exhausted through an exhaust valve installed at the upper portion of the cylinder by scavenging air introduced through a large number of scavenging ports disposed along the circumferential direction at the lower portion of a cylinder liner,

a construction of scavenging air chamber for diesel engine in which a communicating passage is disposed in a wall to connect scavenging air reservoirs for each cylinder to which said scavenging ports face to each other and a control plate is installed near said communicating passage and a scavenging air inlet for connecting said scavenging air chamber to a scavenging trunk in order to make the inflow velocity of scavenging air, which flows into said scavenging port, uniform in the circumferential direction of cylinder liner.

(7) A construction of scavenging air chamber for diesel engine according to claim (1) wherein an adjusting mechanism is provided which adjusts the distance at right angles to the cylinder axis between said control plate and said cylinder liner.

(8) A construction of scavenging air chamber for diesel engine according to claim (1) wherein said control plate is installed integrally with said wall.

(9) A construction of scavenging air chamber for diesel engine according to claim (4) wherein an adjusting mechanism is provided which adjusts the inclination angle of said control plate.

(10) A construction of scavenging air chamber for diesel engine according to claim (1) wherein said control plate is mounted via an adjusting mechanism which moves said control plate in the direction of the cylinder axis.

(11) A construction of scavenging air chamber for diesel engine according to claim (1) wherein said control plate is constructed by combining a plurality of detachable plates.

FIG. 1

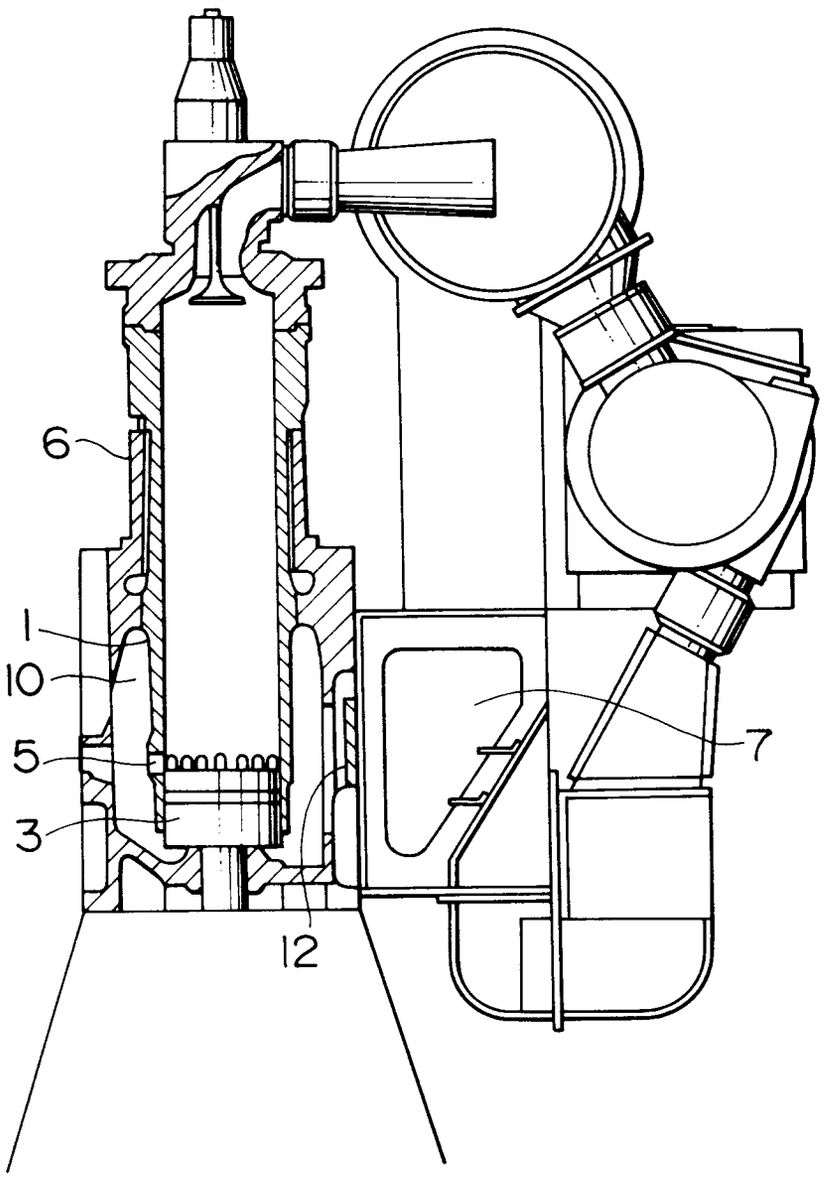


FIG. 2(a)

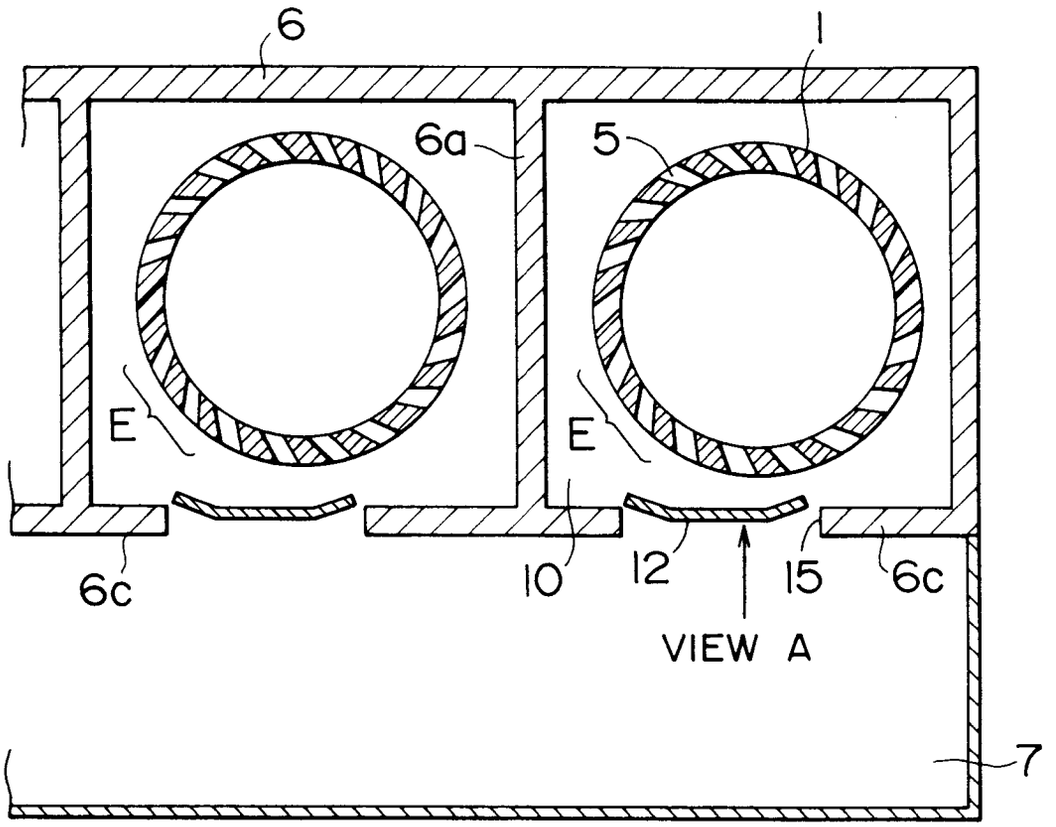

6
1
6a
5
E
E
6c
10
12
15
6c
VIEW A
7

FIG. 2(b)

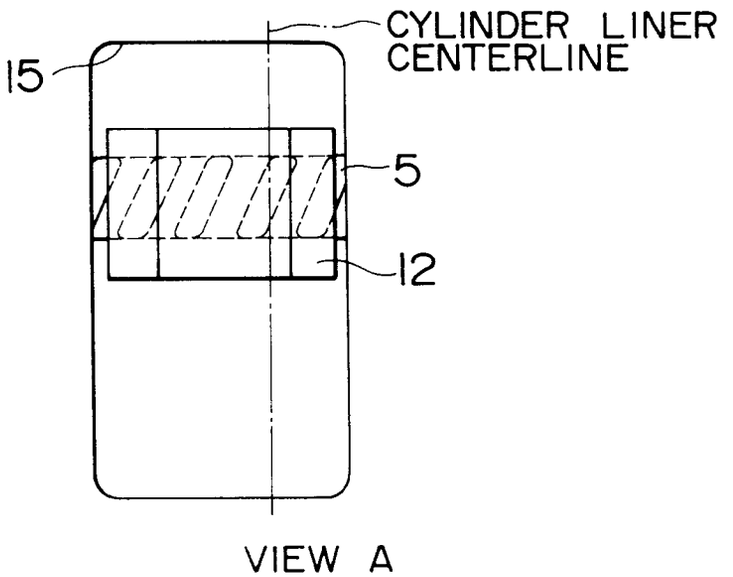

CYLINDER LINER CENTERLINE
15
5
12
VIEW A

FIG. 3(a)

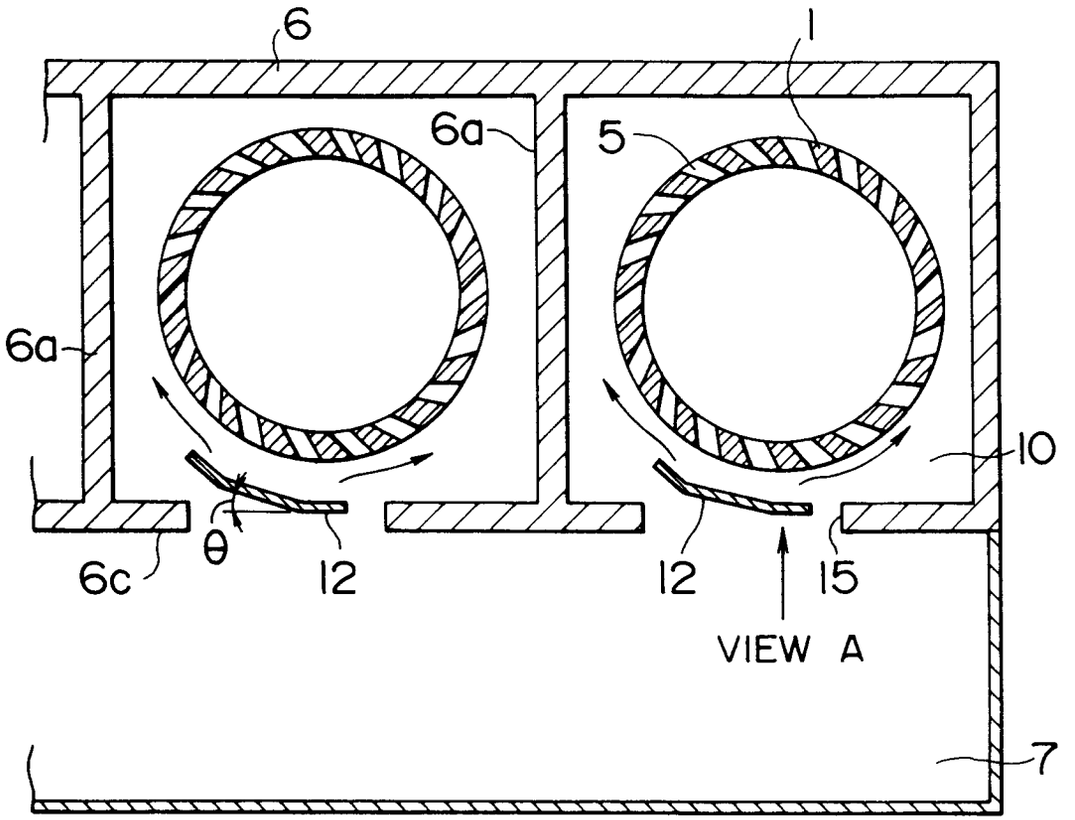

6
1
6a
5
6a
10
θ
6c
12
12
15
VIEW A
7

FIG. 3(b)

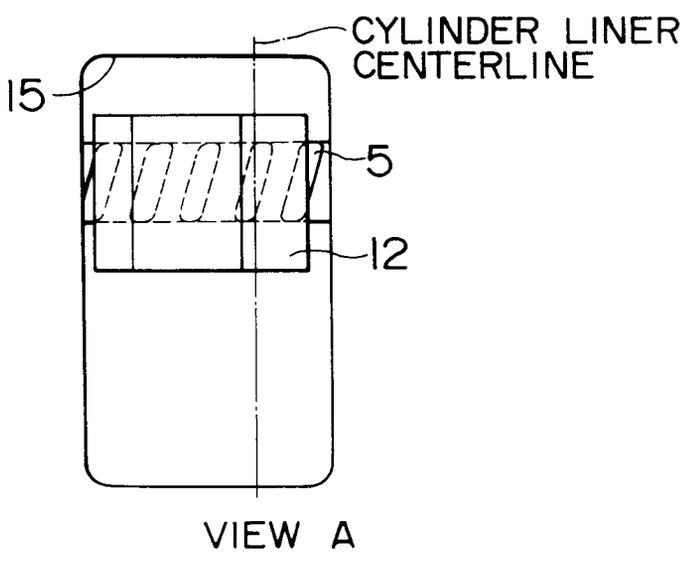

CYLINDER LINER
CENTERLINE
15
5
12
VIEW A

FIG. 4(a)

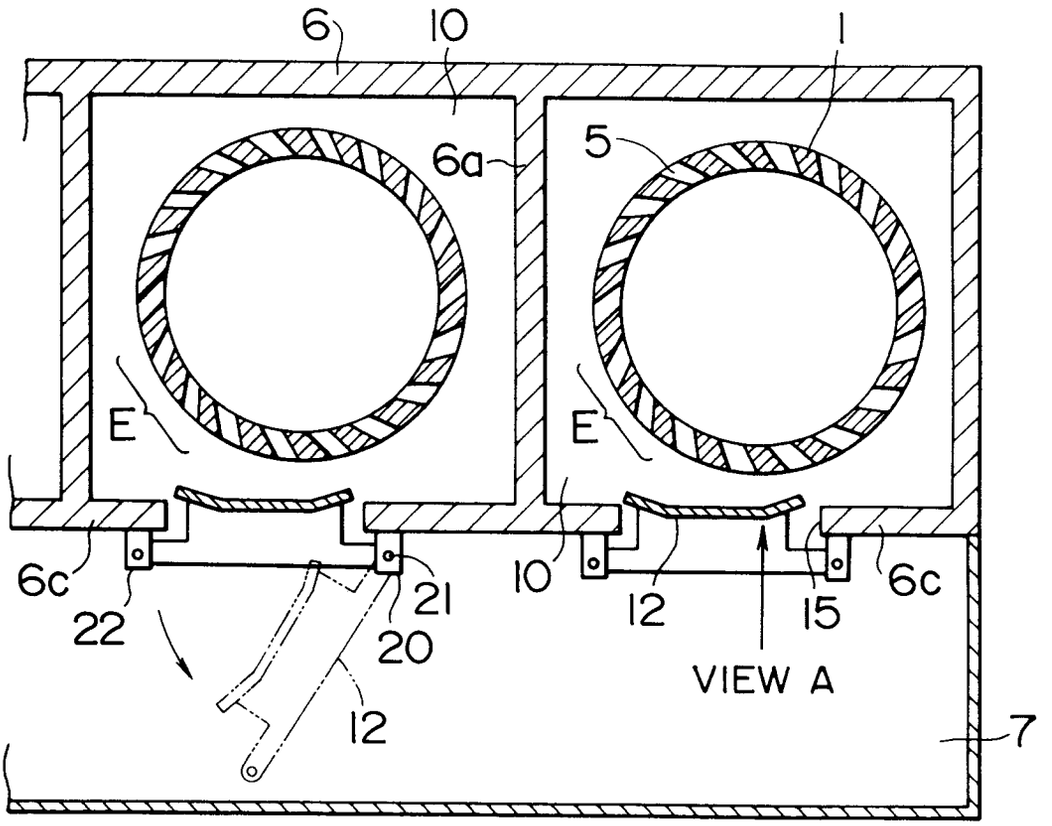
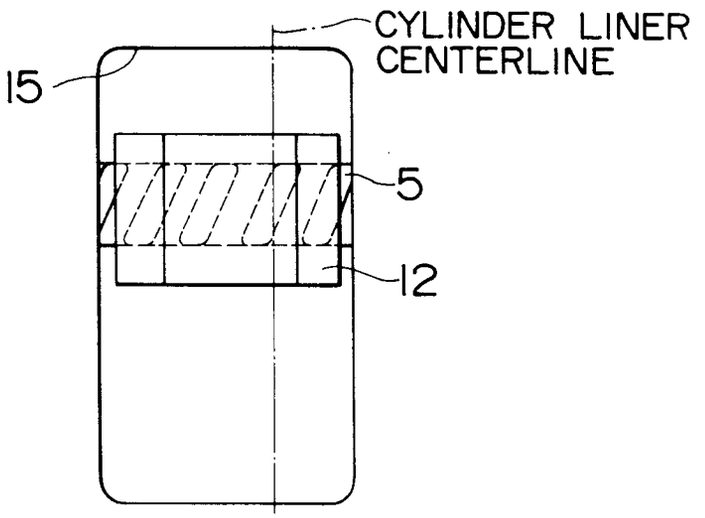


FIG. 4(b)



VIEW A

FIG. 5(a)

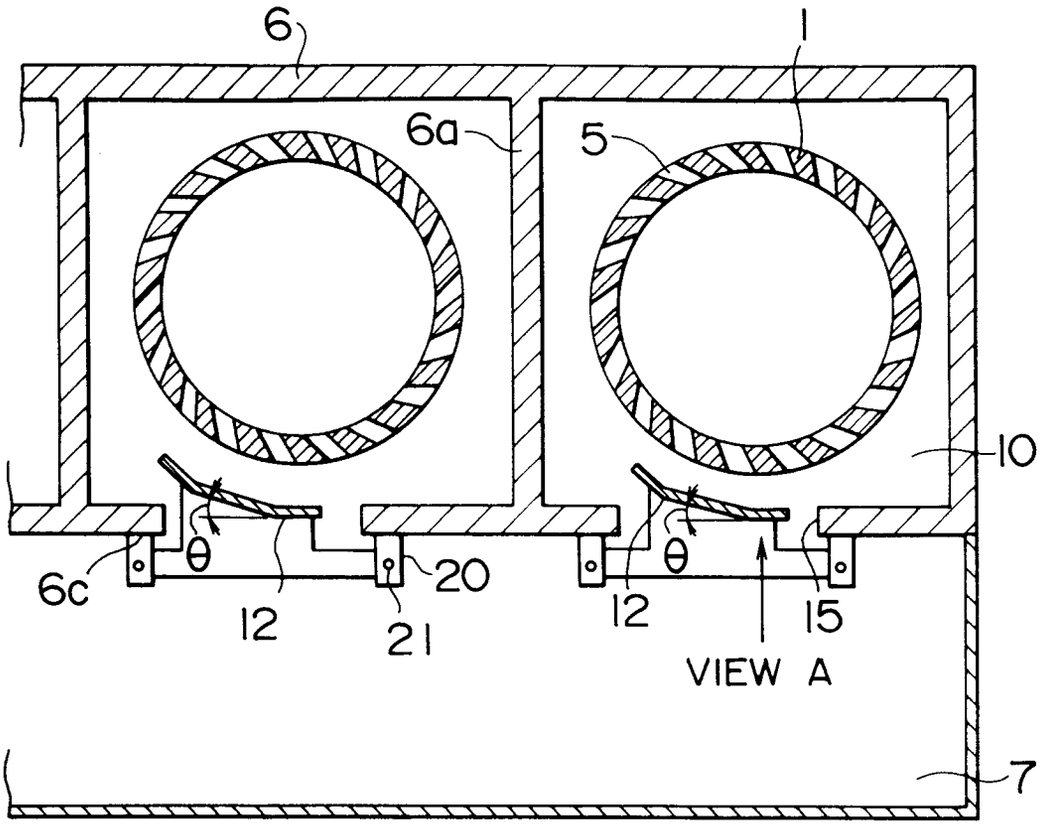
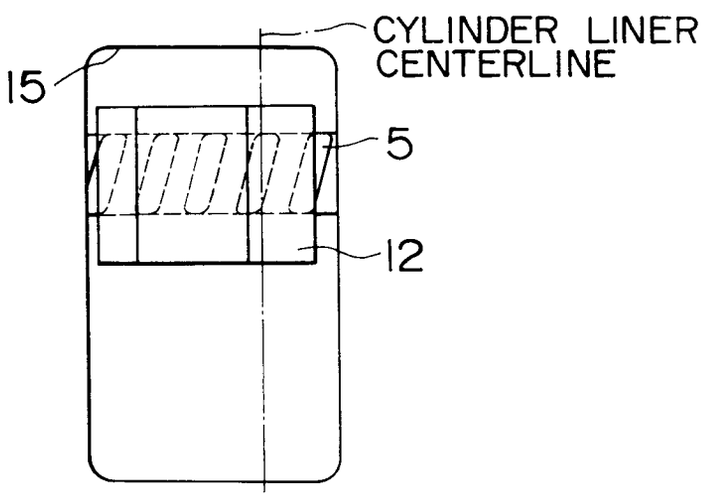


FIG. 5(b)



VIEW A

FIG. 6

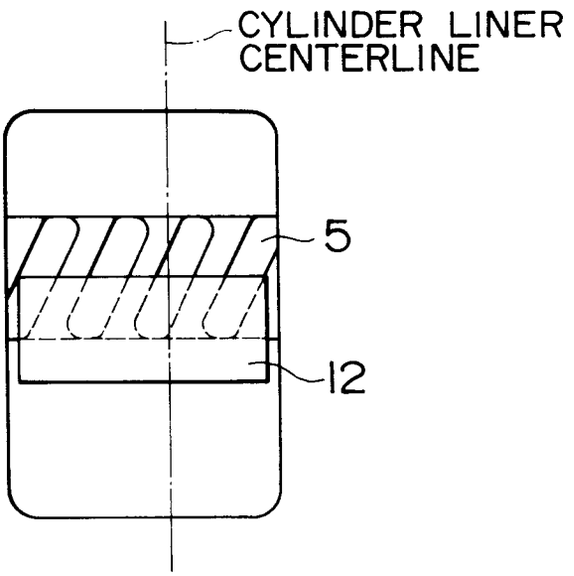


FIG. 7(a)

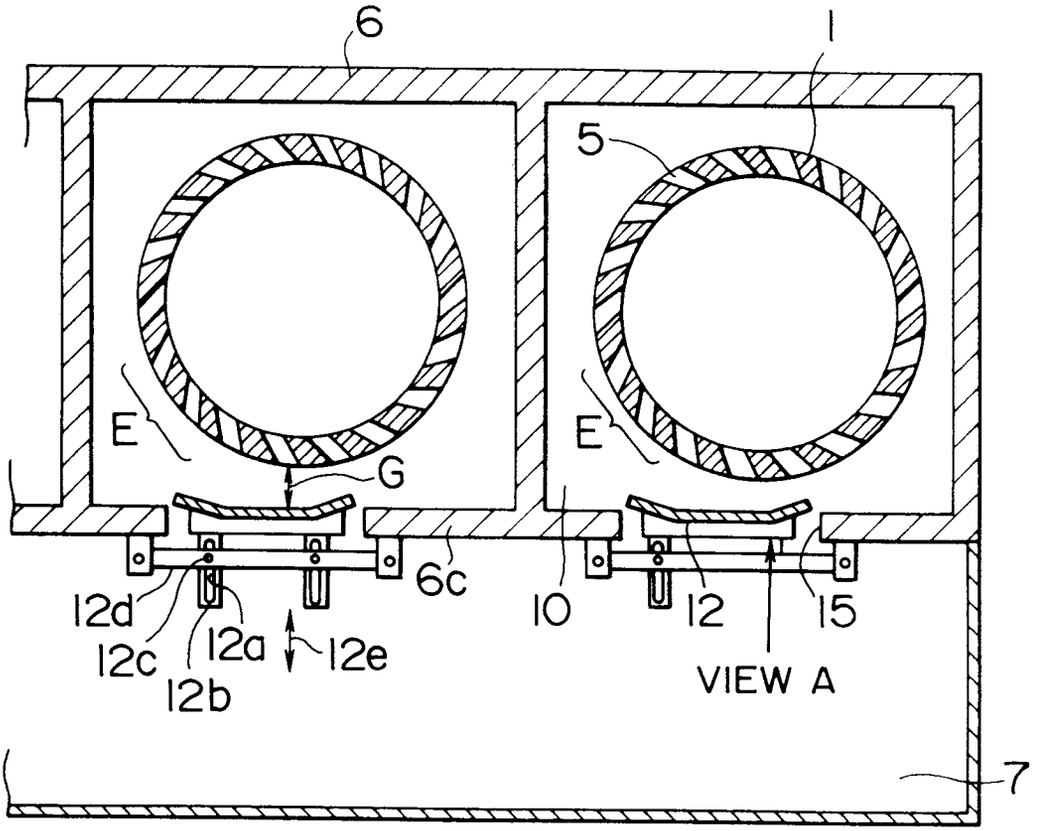

6
1
5
E
E
G
6c
10
12
15
12d
12c
12a
12e
12b
VIEW A
7

FIG. 7(b)

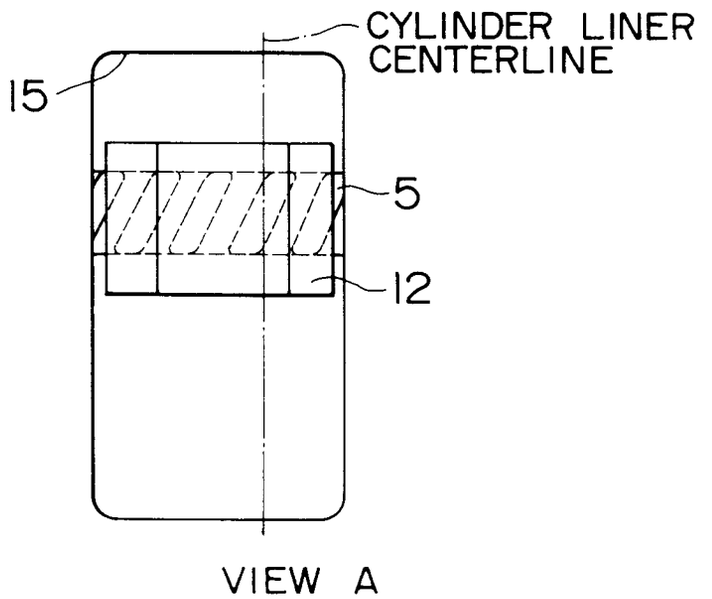

CYLINDER LINER
CENTERLINE
15
5
12
VIEW A

FIG. 8(a)

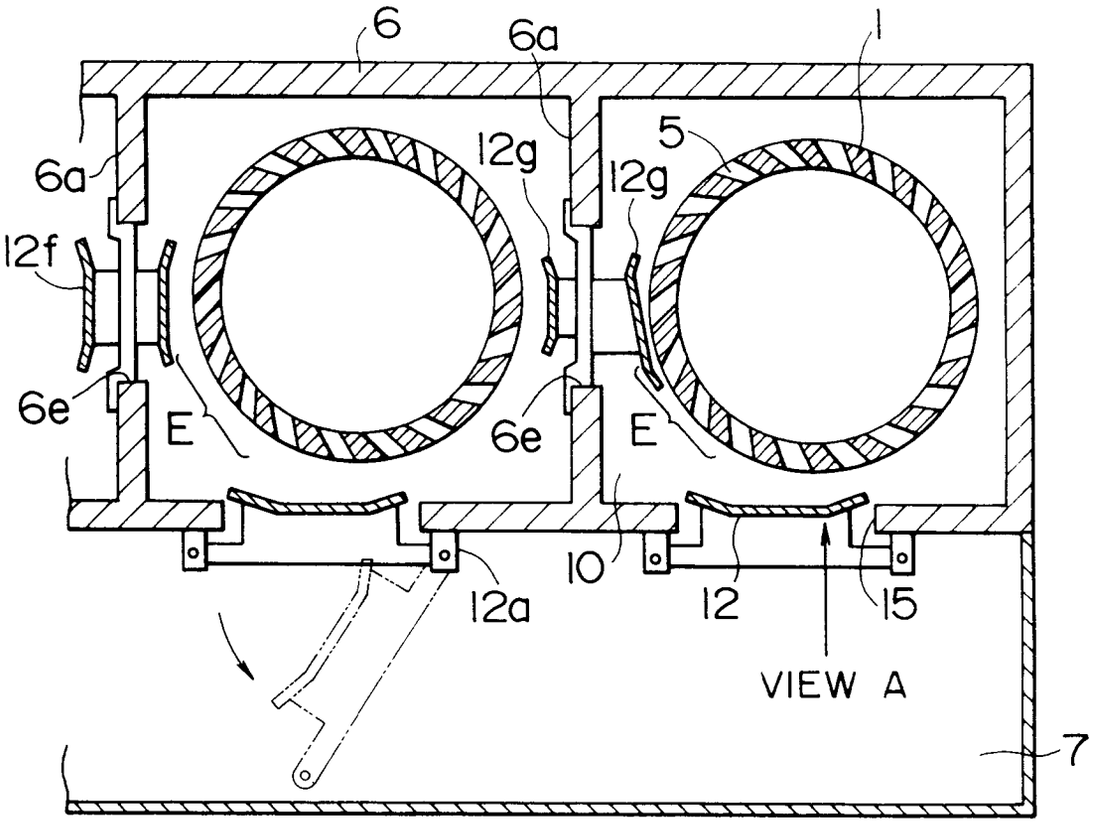
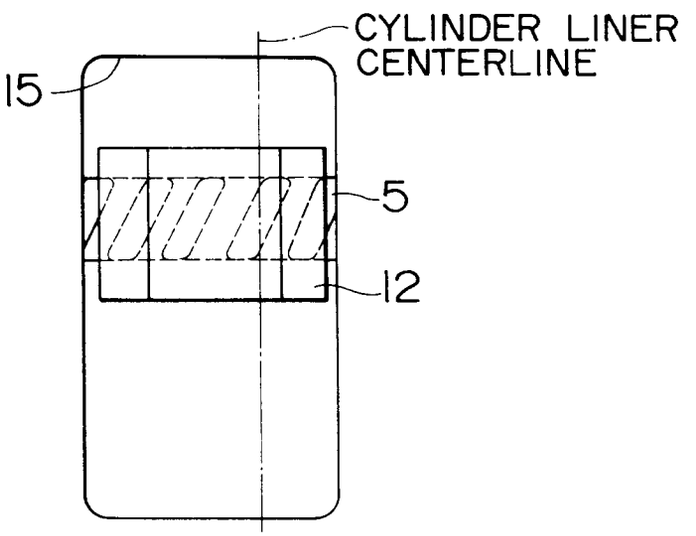


FIG. 8(b)



VIEW A

FIG. 9(a)

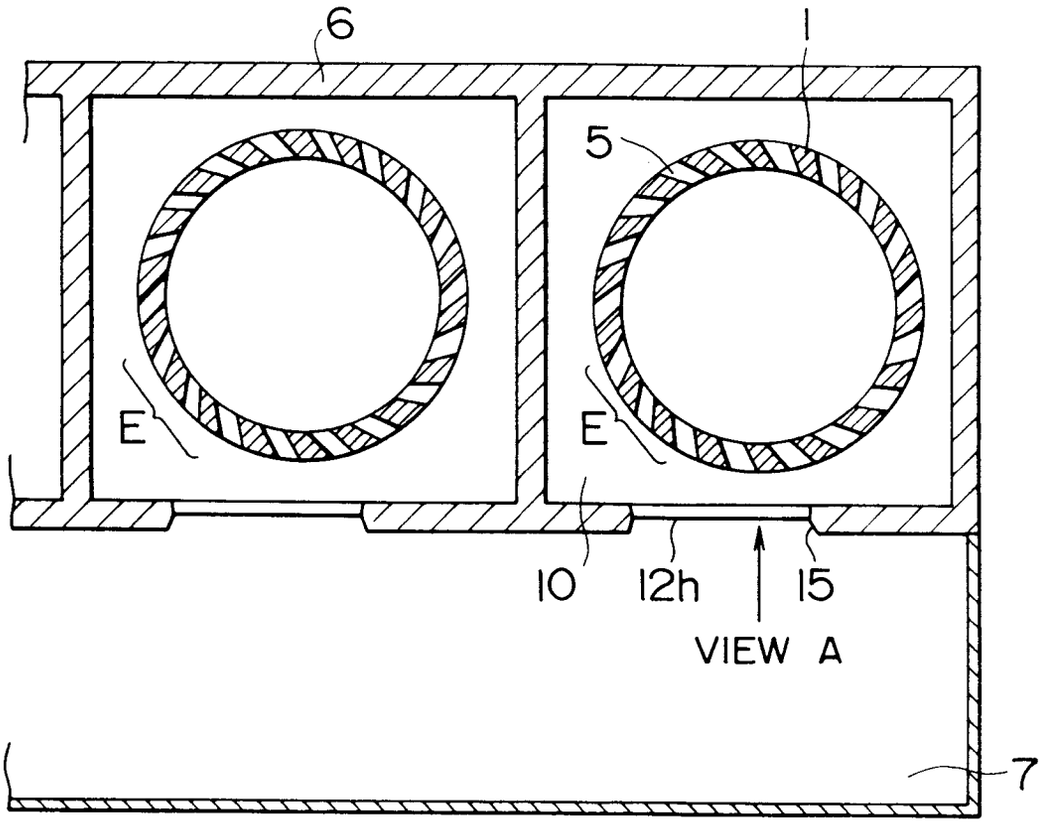
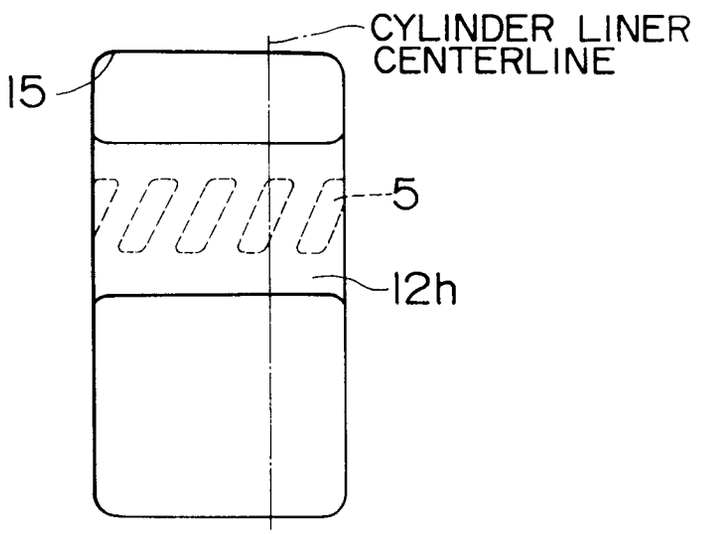


FIG. 9(b)



VIEW A

FIG. 10(a)

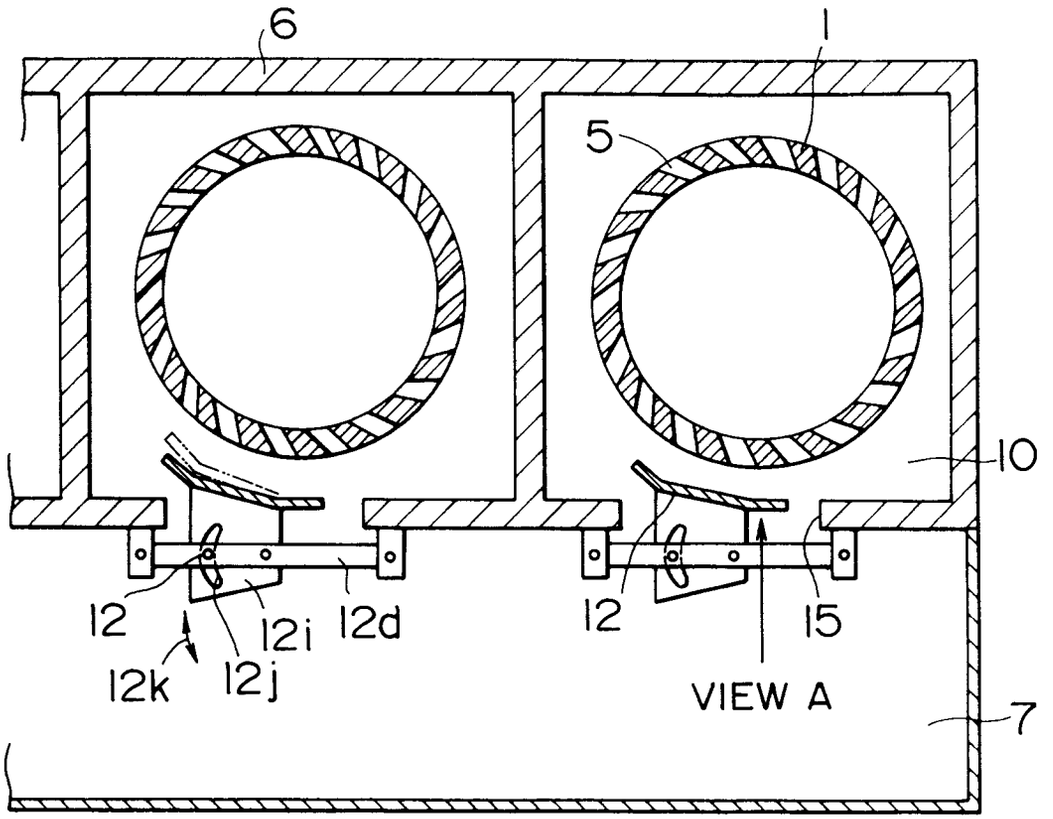
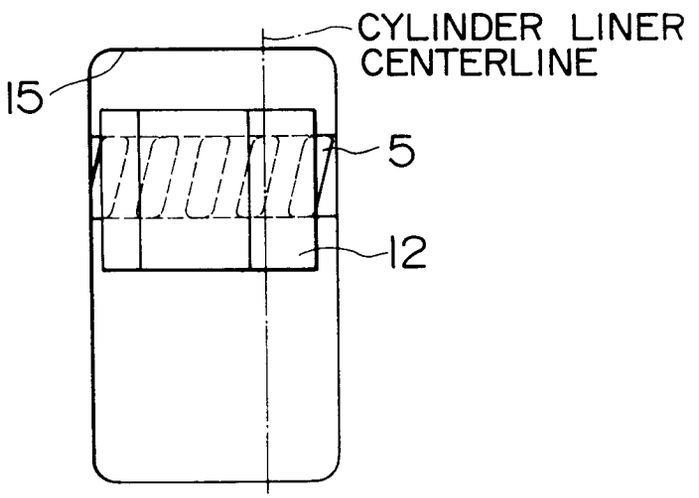


FIG. 10(b)



VIEW A

FIG. 11(a)

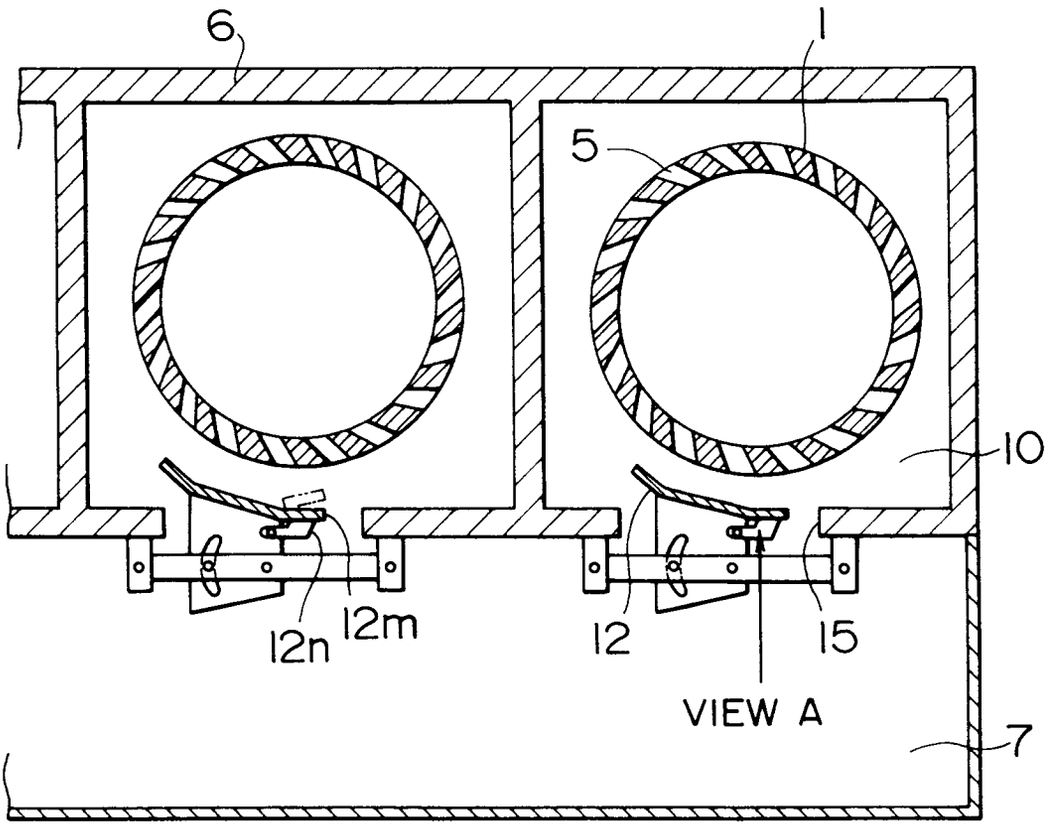


FIG. 11(b)

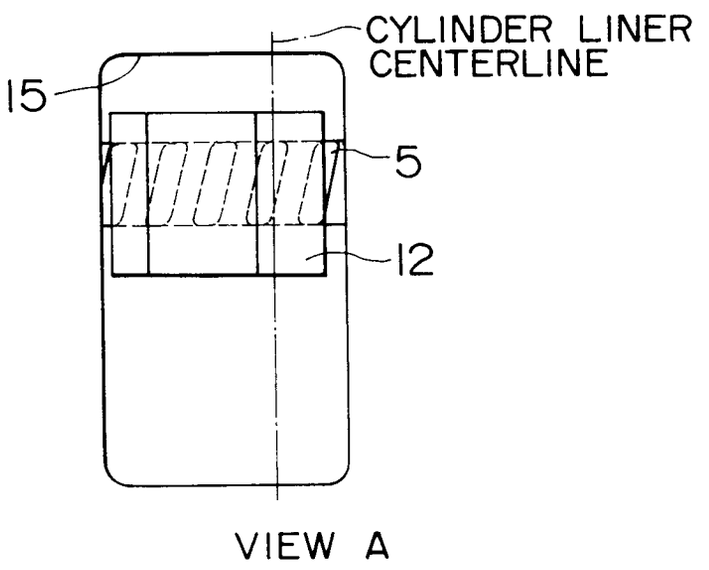


FIG. 12(a)

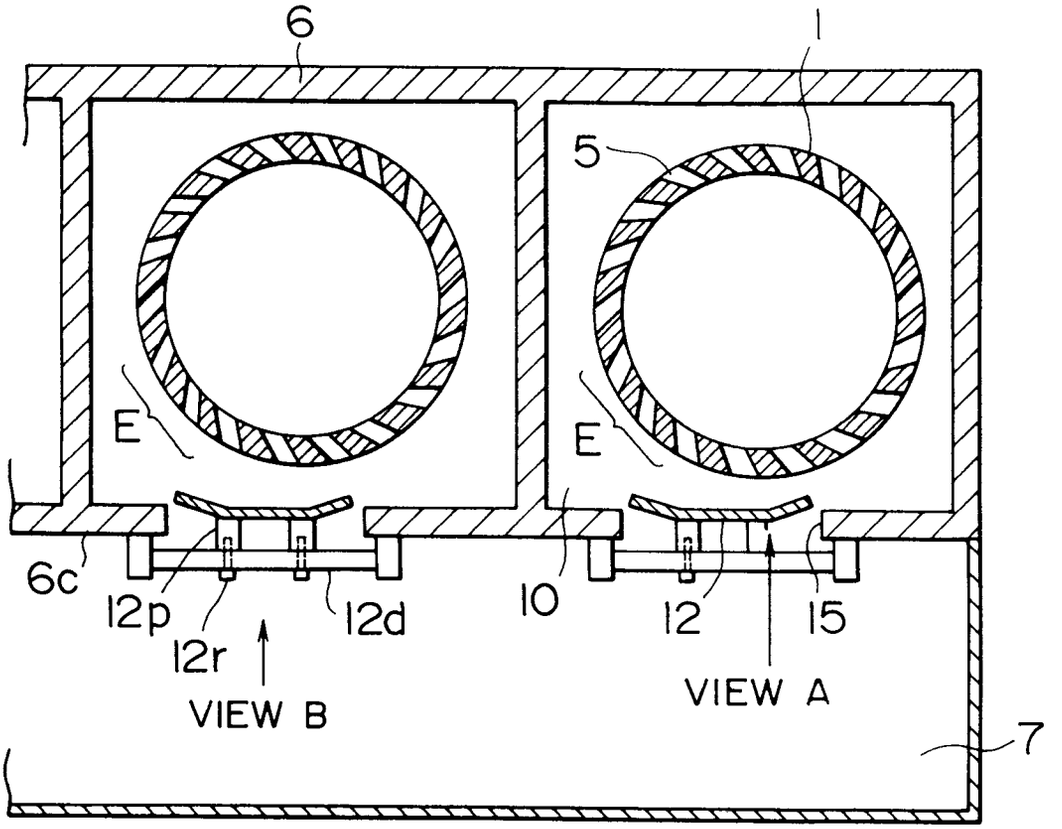
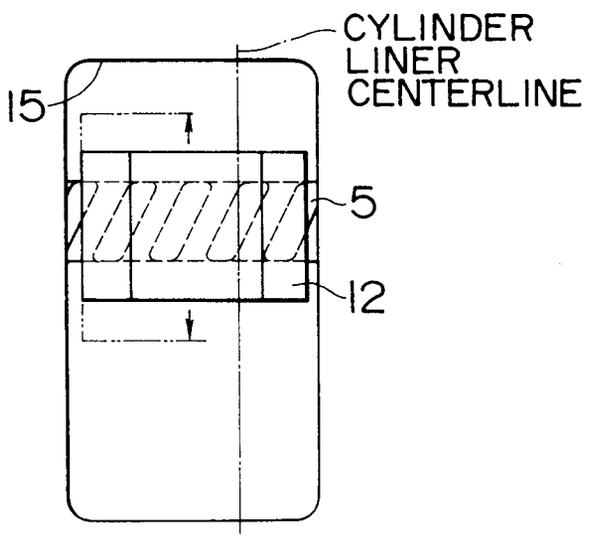
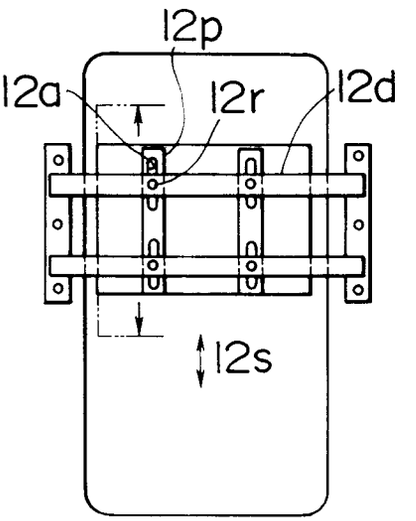


FIG. 12(b)



VIEW A

FIG. 12(c)



VIEW B

FIG. 13(a)

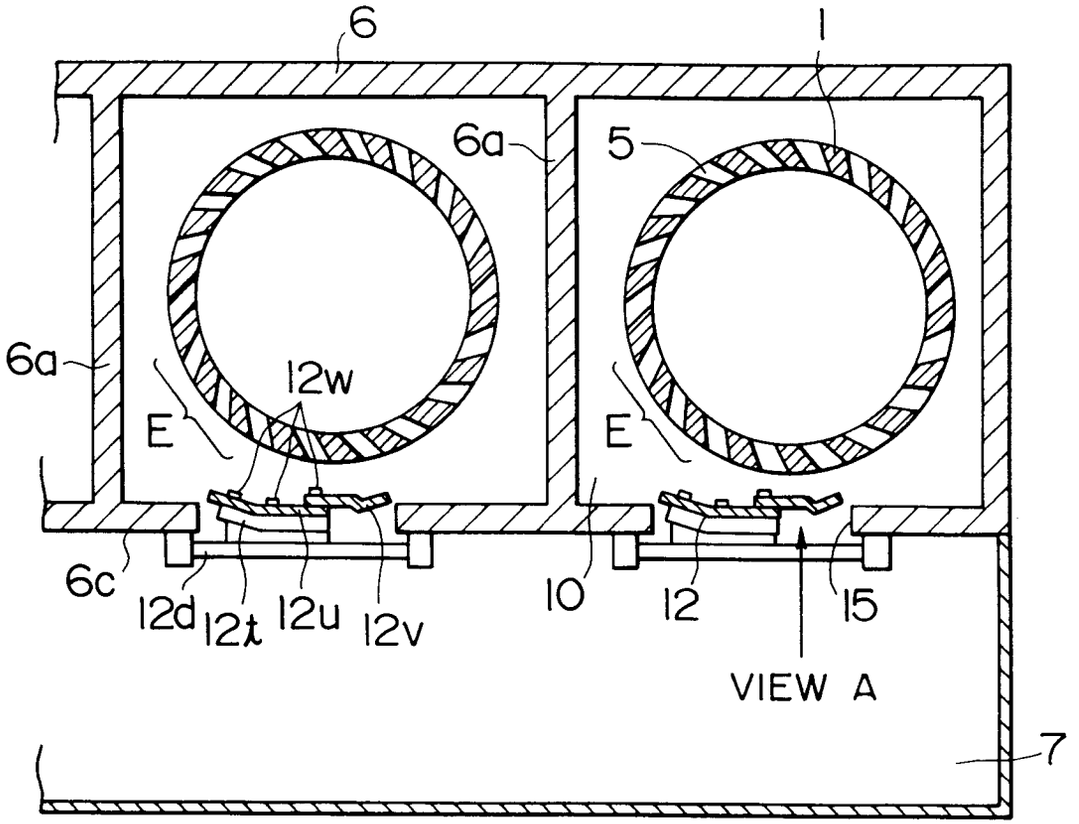


FIG. 13(b)

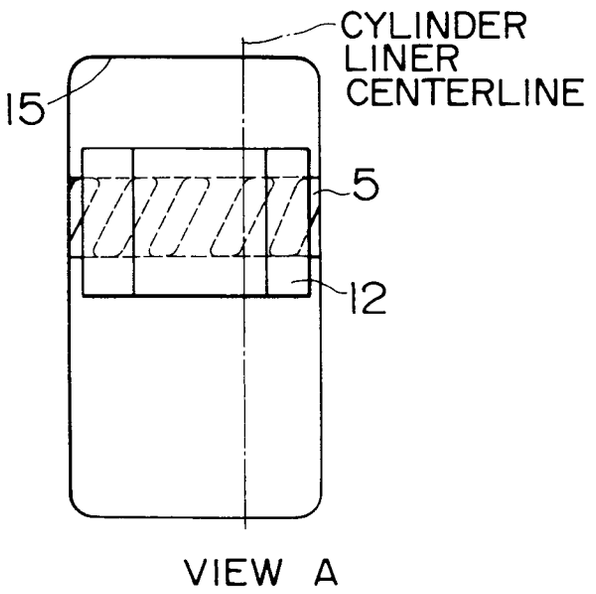


FIG. 13(c)

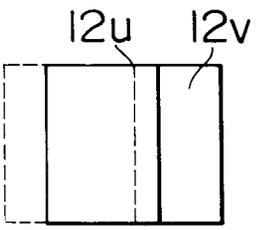


FIG. 13(d)

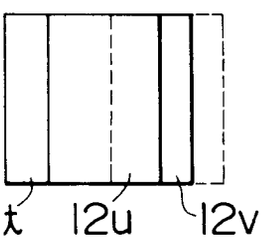


FIG. 14

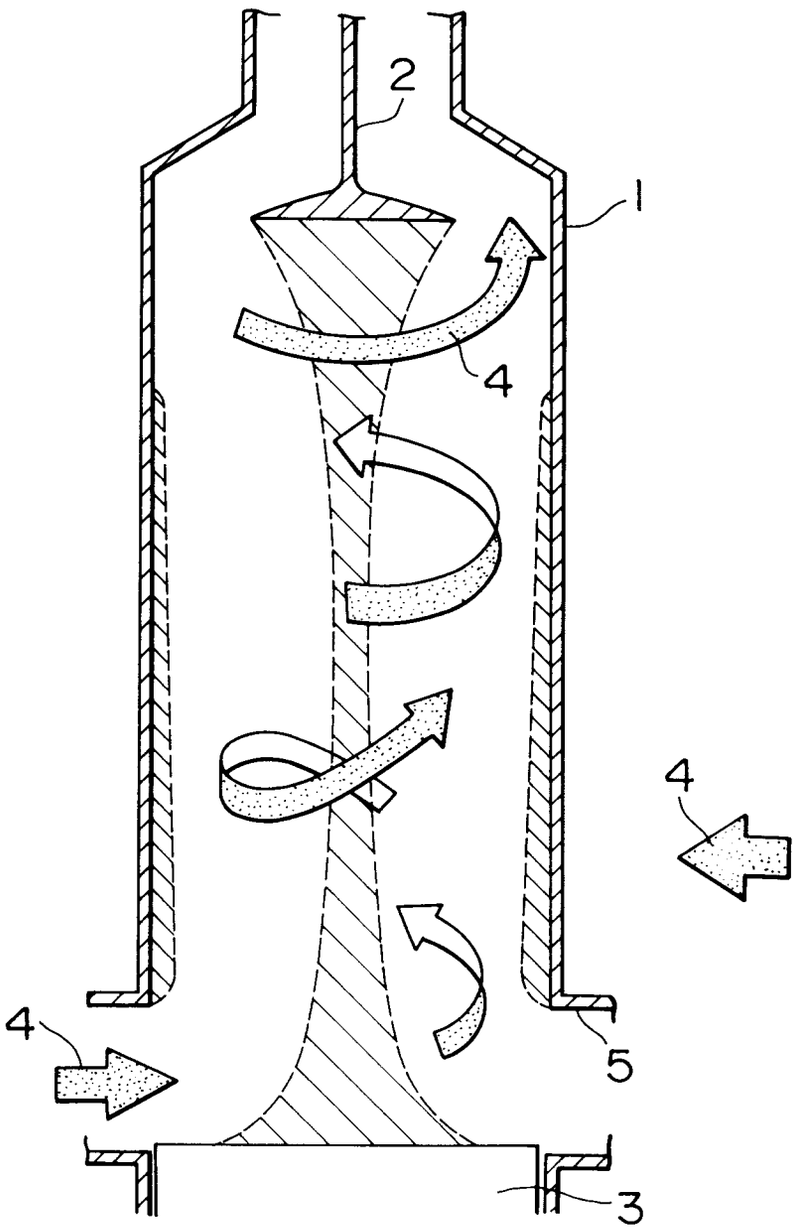


FIG. 15

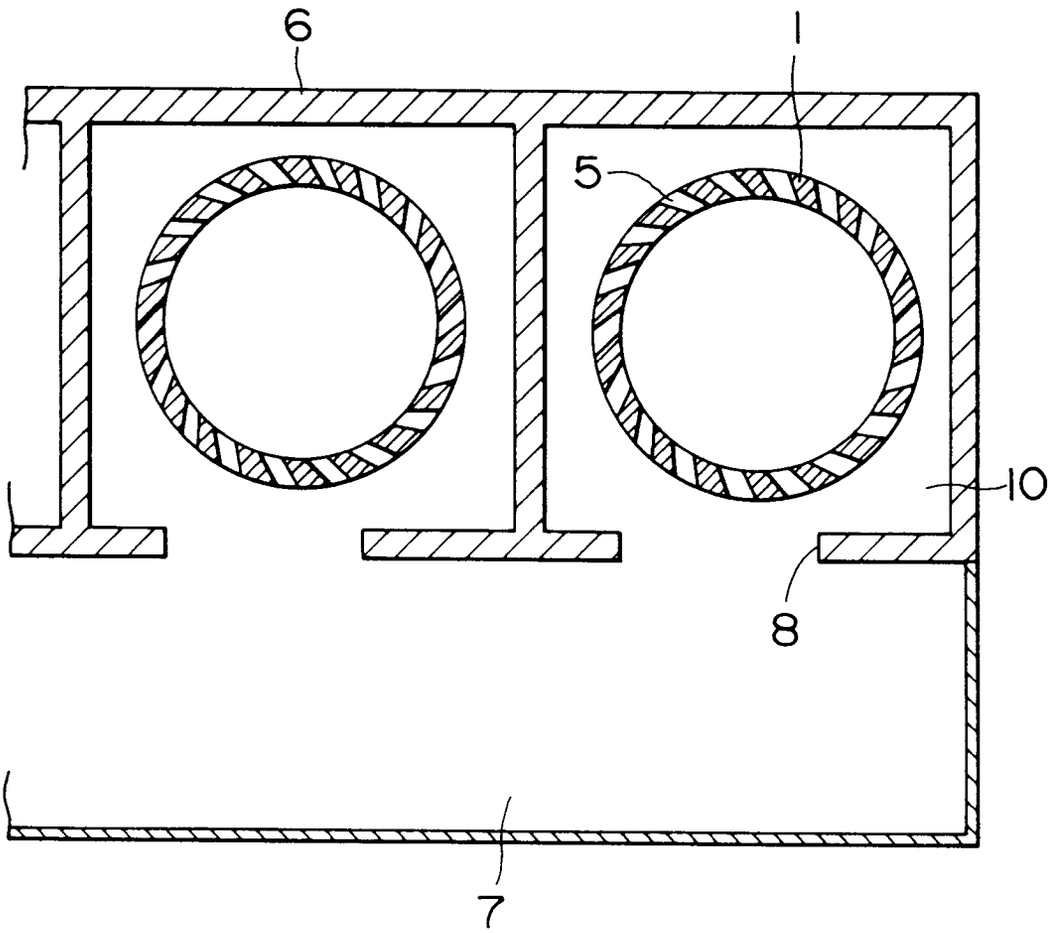


FIG. 16

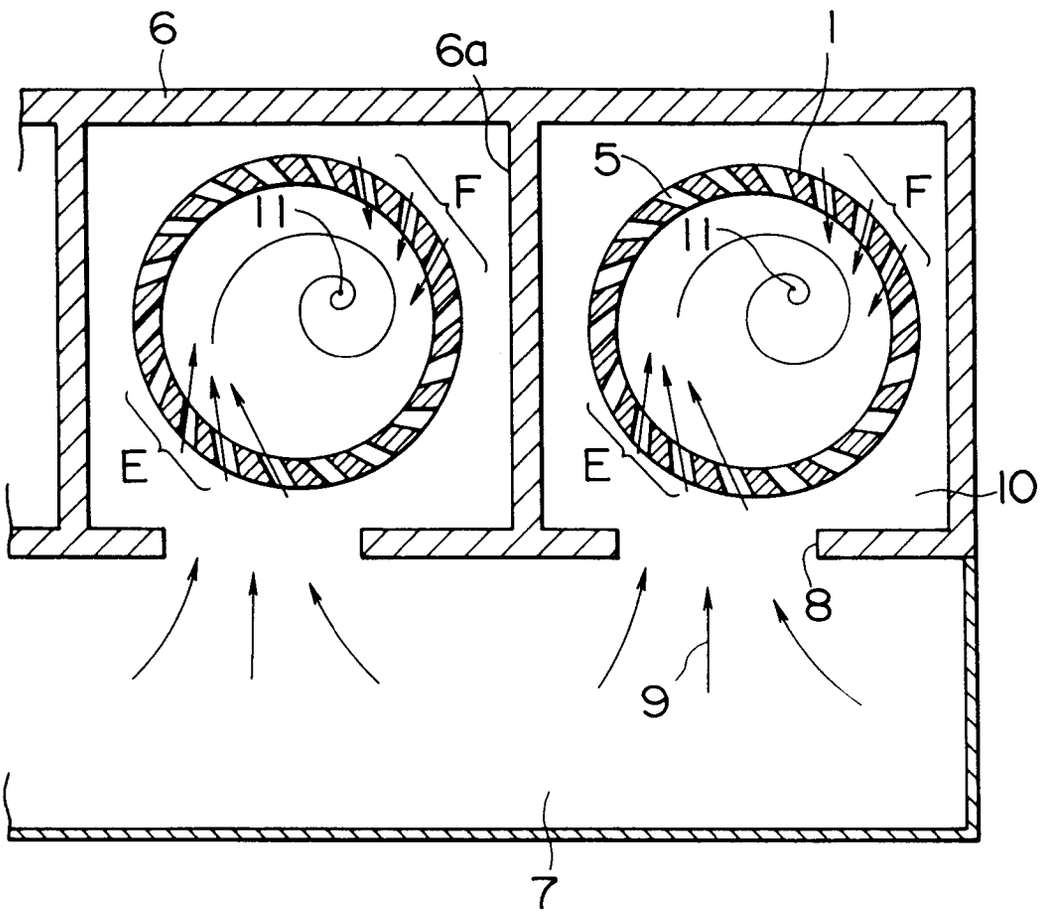
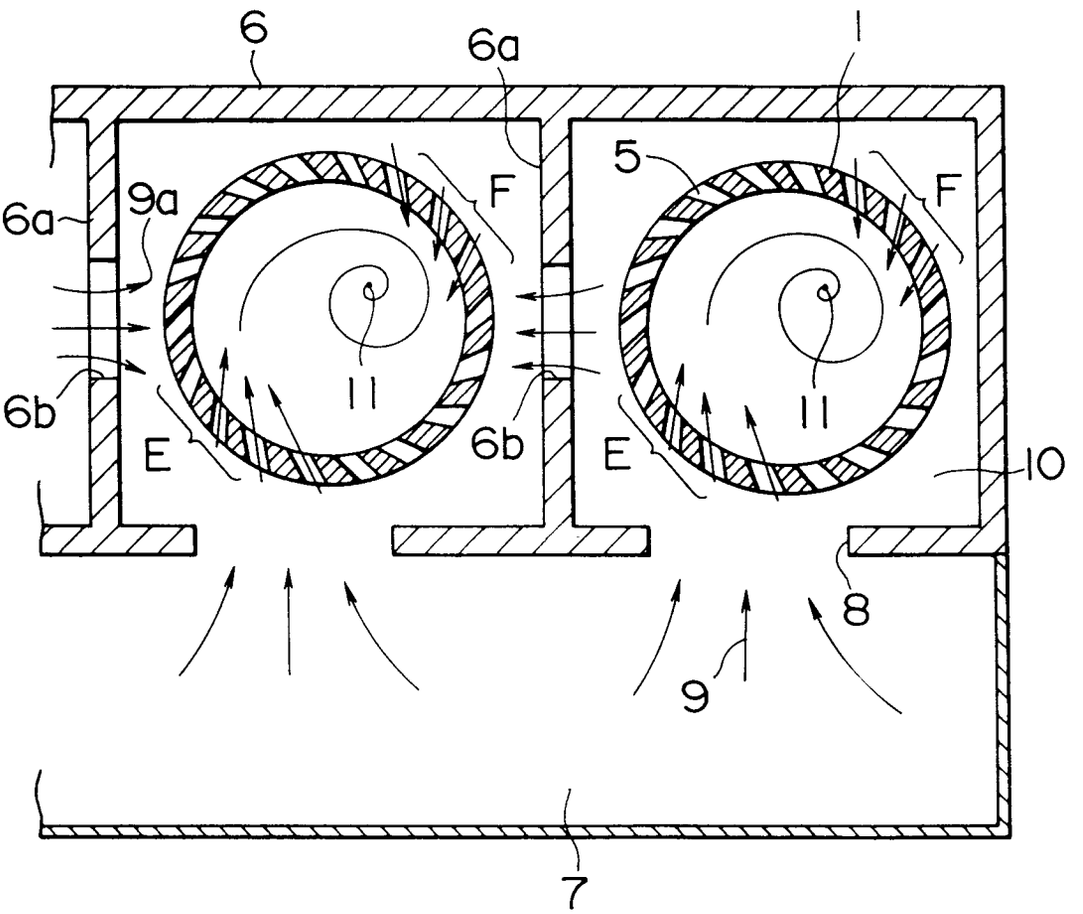


FIG. 17



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 61 0014

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	CH-A-174 162 (ATTESLANDER) 1 April 1935 * page 1, left column, line 1 - line 4 * * page 2, left column, line 8 - line 14 * * page 2, right column, line 5 - line 24 * * page 3, right column, line 31 - page 4, left column, line 11 * * page 4, left column, line 32 - line 44; figures 1,6 *	1-5	F02B25/04
A	US-A-2 228 832 (LIEBERHERR) 14 January 1941 * page 1, line 33 - line 46 * * page 1, line 46 - line 55; figures 3,4 *	1-5,8	
A	EP-A-0 204 687 (AVL) 10 December 1986 * column 1, line 1 - line 11 * * column 1, line 34 - line 48 * * column 2, line 1 - line 21 * * column 4, line 16 - line 33 * * column 4, line 40 - line 45 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	UA-A-2 090 149 (POLLISTER) 17 August 1937 * page 1, left column, line 48 - right column, line 2; figures 2,3 *	5	F02B
A	US-A-1 972 805 (VANNI) 4 September 1934 * page 1, line 102 - line 109; figures 1,4,7 *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 MAY 1993	JORIS J.C.

CATEGORY OF CITED DOCUMENTS

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