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

(11) EP 1 031 710 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
30.08.2000 Bulletin 2000/35

(51) Int. Cl.[7]: **F01N 7/04**, F01N 7/08, F01N 1/08

(21) Application number: **00102775.4**

(22) Date of filing: **10.02.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **25.02.1999 JP 4863799**

(71) Applicant:
HONDA GIKEN KOGYO KABUSHIKI KAISHA
Minato-ku Tokyo (JP)

(72) Inventors:
- **Furukawa, Kazuaki,**
  K.K. Honda Gijutsu Kenkyusho
  Wako-shi, Saitama (JP)
- **Amino, Hideo,**
  c/o K.K. Honda Gijutsu Kenkyusho
  Wako-shi, Saitama (JP)

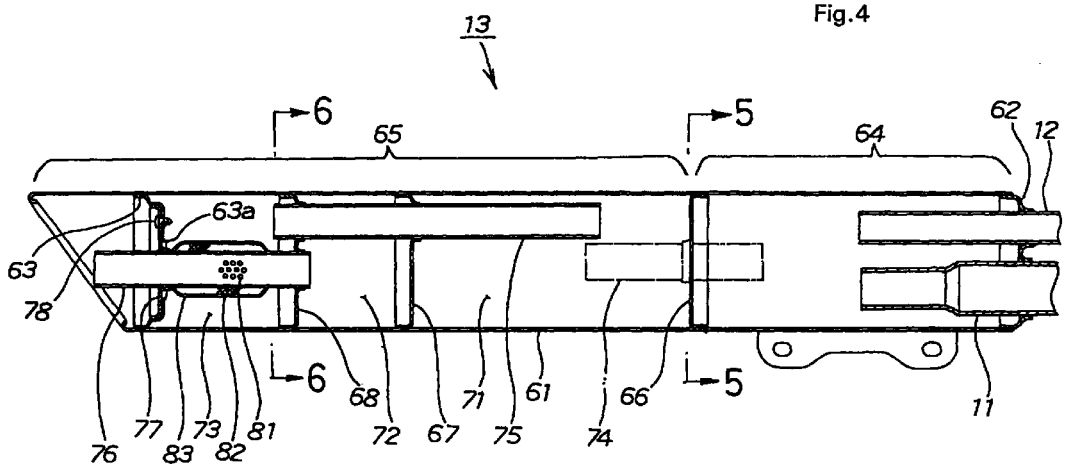
(74) Representative:
Liska, Horst, Dr. et al
Postfach 860 820
81635 München (DE)

(54) Exhaust assembly structure

(57) An exhaust chamber(64) is integrally provided with a muffler (65), and when a plurality of exhaust pipes (11,12) have different lengths, the exhaust pipe (11), which is longer, is set to have a larger diameter so that the exhaust pipes (11,12)have substantially equal exhaust resistance.

Exhaust pipes (11,12) can be set in a substantially linear arrangement so that exhaust resistance of the respective exhaust pipes (11,12) can be reduced. Also, as a longer exhaust pipe (11) is set to have a larger diameter, exhaust resistance for the respective exhaust pipes (11,12)can be set substantially equal. Therefore, fuel adjustment of the carburetors for fuel supply to the respective cylinders can be readily achieved, and, in combination with the substantially linear arrangement of the exhaust pipes (11,12),engine output performance can be improved.

Fig.4



EP 1 031 710 A1

Description

[0001] The present invention relates to an exhaust assembly structure capable of improving output performance and extending the life thereof.

[0002] As for an engine exhaust assembly structure, Japanese Patent Publication No. Hei 5-61449 "Motorcycle Exhaust assembly", for example, is known.

[0003] In the above art, exhaust pipes 2, 5 extending backward from a V-type engine 1, shown in Fig. 1 of the publication, are connected via respective connection pipes 4, 6 with an exhaust combining box 3, which is provided behind and below the engine 1 and at the middle part of the vehicle body in front of the rear wheel 7, as shown in Fig. 2 of the same publication. A lower muffler 8 is communicated via an exhaust inlet 12 to the exhaust combining box 3, which is also connected via a connection pipe 13 with an upper muffler 11.

[0004] With the above art, the communication pipes 4, 6 must be significantly bent in order to have them connected to the exhaust combining box 3 provided at the middle of the vehicle body. Also, the connection pipe 13 extending from the exhaust combining pipe 3 to the upper muffler 11 is also bent significantly. Therefore, exhaust resistances of the exhaust assemblies extending from the exhaust pipes 2, 5 to the respective mufflers 8, 11 become large, which makes it difficult to improve output performance.

[0005] In view of this, the object of the present invention is to provide an exhaust assembly structure for reducing exhaust resistance to improve output performance.

[0006] In order to achieve the above object, according to claim 1, there is provided an exhaust assembly structure in which exhaust pipes are extended backward from the respective cylinders of a multi-cylinder engine mounted to a motorcycle, the respective leading ends of these exhaust pipes are connected to an exhaust chamber for collecting exhaust gas, and the exhaust chamber is connected to a muffler, wherein the exhaust chamber is integrally formed with the muffler, and when the plurality of exhaust pipes are different in length, a longer exhaust pipe is set to have a larger diameter so that exhaust resistances in the respective exhaust pipes are set substantially equal.

[0007] The exhaust chamber is integrally provided with the muffler so that the plurality of exhaust pipes are provided in an arrangement closer to a straight line. Also, a longer exhaust pipe is set to have a larger diameter so that exhaust resistances of the respective exhaust pipes are set substantially equal.

[0008] According to claim 2, the engine is a V-type engine.

[0009] An exhaust pipe connected to the front cylinder of the front and rear cylinders of a V-type engine, which has a longer pipe length, is set to have a larger diameter so that it has substantially equal exhaust resistance to that of the exhaust pipe connected to the rear cylinder.

[0010] According to claim 3, the V-type engine has a 90° V-angle.

[0011] By setting a 90° V-angle, engine vibration is reduced whereby vibration to be propagated to the exhaust assembly is reduced to extend the life of the exhaust assembly.

[0012] A preferred embodiment of the present invention will be described based on the accompanying drawings.

[0013] Figs. 1 to 9 illustrate a preferred embodiment of the present invention, in which:

Fig. 1 is a side view of a motorcycle employing an exhaust assembly structure according to the present invention.

Fig. 2 is an enlarged side view of a supporting section of an exhaust assembly structure according to the present invention.

Fig. 3 is a perspective view showing a supporting section of an exhaust assembly structure according to the present invention.

Fig. 4 is a cross sectional view showing a combined muffler of an exhaust assembly structure according to the present invention.

Fig. 5 is a cross sectional view of Fig. 4 along the line 5-5.

Fig. 6 is a cross sectional view of Fig. 4 along the line 6-6.

Fig. 7 is a diagram for explaining of an exhaust assembly structure according to the present invention.

Fig. 8 is a first assembly diagram for explaining an assembly procedure for a combined muffler according to the present invention.

Fig. 9 is a second assembly diagram for explaining an assembly procedure for a combined muffler according to the present invention.

[0014] Note that the drawings should be viewed in the direction of the reference numerals.

[0015] Fig. 1 is a side view of a motorcycle employing an exhaust assembly structure according to the present invention. The motorcycle 1 comprises a vehicle frame 2, a head pipe 3 provided at the front end of the vehicle frame 2, a front fork 5 and a front wheel 6 to be operated using a handlebar 4, the front fork 5 being rotatably provided to the head pipe 3, the front wheel 6 being provided below the front fork 5, a fuel tank 7 provided behind the head pipe 3, an engine 8 provided below the fuel tank 7, exhaust pipes 11, 12 extending backward from the respective cylinders of the engine 8, a combined muffler 13 connected to the rear ends of the exhaust pipes 11, 12, and a transmission 14 integrally provided to the engine 8.

[0016] Also, the motorcycle 1 comprises a swing arm 15 swingably installed below the middle part of the vehicle frame 1, a rear wheel 17 provided at the rear

end of the swing arm 15 and to be driven by a chain (not shown) wound around an output axis of the transmission 14, seats 21, 22 provided behind the fuel tank 7, and rear suspension units 23, 23 (one on the other side being not shown) bridging between the vehicle frame 1 and the swing arm 15. Note that 8a indicates a front cylinder of the engine 8, which is connected to the leading end of the exhaust pipe 11; 8b indicates a rear cylinder of the engine 8, which is connected to the rear end of the exhaust pipe 12; 25 indicates a front fender; 26 indicates a headlamp; 27 indicates a speedometer; 28 indicates a mirror; 31 indicates a radiator; 32a indicates a front carburetor for fuel supply to the front cylinder 8a; 32b indicates a rear carburetor for fuel supply to the rear cylinder 8b; 34 indicates a rear step; and 35 indicates a rear fender.

[0017] The exhaust pipes 11, 12 and the combined muffler 13 together constitute the exhaust assembly 37.

[0018] The combined muffler 13 is provided, at its front end, with an exhaust chamber (to be described later) integrally formed thereon, which is connected to the exhaust pipes 11, 12.

[0019] The above motorcycle 1 is an American style vehicle suitable for a long drive, in which the seat 21 is set low, the handlebar 4 has a wide width and is set high so that the driver can sit in a comfortable posture, and the caster angle (an angle inclined with respect to a vertical straight line of the center line of a steering stem (not shown), and being substantially equal to the backward inclining angle of the front fork 5) is set large to achieve improved straight driving capability.

[0020] Also, the engine 8 is a V-type twin engine having a V-angle set at 90° to reduce engine vibration.

[0021] Fig. 2 is an enlarged side view showing a supporting section of an exhaust assembly structure according to the present invention. The motorcycle 1 comprises a bracket 41, welded below the middle part of the vehicle body frame 2, for supporting the exhaust assembly 37, and a stay 47 having a wide end 42 attached to the bracket 41 by means of bolts 43, 43, and a narrow end 44 attached to the lower bracket 45 of the combined muffler 13 by means of bolts 46, 46. Note that 51 indicates a heat shielding cover provided to the exhaust pipe 12 and 52 indicates a cover of the combined section.

[0022] Fig. 3 is a perspective view showing a supporting section of an exhaust assembly structure of the present invention, indicating that the stay 47 is attached by means of bolts 43, 43 to the bracket 41 welded to the vehicle frame 2.

[0023] The stay 47 is formed having one wide end 42, or the root, and gradually becoming thinner toward another section 44 thereof so that, when the combined muffler 13 (see Fig. 2) is attached to the leading end thereof, vertical stresses occurring in the respective sections thereof are substantially equal. Note that 53, 53 indicate bolt insertion slots where the bolts 43, 43 are inserted, 54, 54 indicate bolt insertion slots where the bolts 46, 46 (see Fig. 2) are inserted, and nuts (not shown) for receiving the bolts 46, 46 are provided at the rear side thereof.

[0024] Fig. 4 is a cross sectional view showing a combined muffler of an exhaust assembly structure according to the present invention. The combined muffler 13 has a front cap 62 provided at the front end of the large diameter tube section 61, and a rear cap 63 provided at the rear end of the large diameter tube section 61. Inside of the large diameter tube section 61 is partitioned by a dividing wall 66 into an exhaust chamber section 64 for combining the exhaust gas, which is connected to the exhaust tubes 11, 12, and a silencer section 65 for reducing exhaust noise.

[0025] The exhaust chamber section 64 serves to combine and expand high pressured exhaust gas to thereby reduce the pressure thereof to suppress interference and pulsation of the exhaust gas, propagated from the front and rear cylinders 8a, 8b (see Fig. 1) to improve exhaust efficiency.

[0026] In the silencer section 65, the space between the separation wall 66 and the rear cap 63 in the large diameter tube section 61 is separated by two separation walls 67, 68 to thereby form a first chamber 71, a second chamber 72, and a third chamber 73.

[0027] The separation wall 66 is provided with a communication tube 74 which communicates between the exhaust chamber section 64 and the first chamber 71 of the silencer section 65.

[0028] The separation walls 67, 68 are provided with a communication tube 75, which communicates between the first chamber 71 and the third chamber 73 of the silencer section 65. A communication tube 76 which communicates between the second chamber 72 of the silencer section 65 and the outside of the combined muffler 13 is inserted in the separation wall 68.

[0029] The rear cap 63 is fixedly secured by the flange 77, which is attached to the communication tube 76, by means of a screw 78. Note that 63a indicates an opening formed on the rear cap 63.

[0030] The communication tube 76 has holes 81 formed therein, and is surrounded, around the holes 81, by a swollen part 83 filled with glass wool 82 for noise reduction.

[0031] Fig. 5 is a cross section view of Fig. 4 along the line 5-5, showing the separation wall 66 viewed from the rear side thereof.

[0032] The separation wall 66 has a water-draining notch 85 at the lower part thereof, through which the water collected inside the exhaust chamber 64 (see Fig. 4) drains to the outside.

[0033] Fig. 6 is a cross sectional view of Fig. 4 along the line 6-6, showing the separation wall 68 viewed from the rear side thereof.

[0034] The separation wall 68 has openings 86, 87 for communicating between the second chamber 72 (see Fig. 4) and the third chamber 73 (see Fig. 4), and a water-draining notch 88. Note that 68a indicates a

through hole formed on the separation wall 68.

[0035] The rear cap 63 and the separation wall 67, shown in Fig. 4, also have a water-draining notch or slot (not shown) at the lower parts thereof.

[0036] Fig. 7(a), (b) are diagrams for explaining an exhaust pipe of an exhaust assembly structure according to the present invention, (a) being a side view, (b) being a plan view.

[0037] In (a), the exhaust pipe 11 extends downward from a connection section 11a with the front cylinder 8a (see Fig. 1), and then toward the rear of the motorcycle 1 (see Fig. 1) until connection with the combined muffler 13.

[0038] The exhaust pipe 12 slantingly extends downward and backward from the connection section 12a with the rear cylinder 8b (see Fig. 1), and then backward until connection with the combined muffler 13.

[0039] In (b), the exhaust pipe 11 extends sideward from the connection section 11a, and then backward.

[0040] The exhaust pipe 12 slantingly extends backward and sideward from the connection section 12a, and then backward.

[0041] By providing an exhaust chamber 64 (see Fig. 4) at the front part of the combined muffler 13, in other words, by providing an exhaust chamber 64 integrally with the silencer section 65 as a muffler (see Fig. 4), the exhaust pipes 11, 12 can be installed in a substantially linear arrangement except for parts in the vicinity of the connection sections 11a, 12a.

[0042] Also, although the exhaust pipe 11, which is connected to the front cylinder 8a, has a longer length than the exhaust pipe 12, which is connected to the rear cylinder 8b, the exhaust pipe 11 is set to have a larger inner diameter D1 than the inner diameter D2 of the exhaust pipe 12, which means that exhaust resistance in parts from the respective connection sections 11a, 12a of the exhaust pipes 11,12 to the respective trailing ends of the combined muffler 13 can be made substantially consistent.

[0043] With the above, fuel adjustment of the front and rear carburetors 32a, 32b, or an air fuel ratio, can be readily set at a predetermined value, and the air fuel ratios of the carburetors 32a, 32b can be readily matched. Further, the above arrangement, in combination with the exhaust pipes 11, 12 installed in a substantially linear arrangement, can improve output performance of the engine 8.

[0044] As the V-angle of the above V-type engine 8 is 90°, engine vibration is small. This can reduce vibration propagating to the exhaust assembly 37 (see Fig. 1) to thereby extend the life of the exhaust assembly 37.

[0045] Operation of the above described combined muffler 13 will next be described.

[0046] In Fig. 4, as the exhaust gas passing through the respective exhaust pipes 11, 12 has high pressure, and they pulsate, the high and low pressure timings thereof are different between the exhaust pipes 11 and 12.

[0047] When such exhaust gas flows into the exhaust chamber 64, the volume of the exhaust gas is expanded, with the exhaust gas speed being reduced. Therefore, interference between the exhaust gas from the exhaust pipe 11 and that from the exhaust pipe 12 due to the difference in the high and low pressure timings is suppressed, which improves exhaust efficiency and output performance.

[0048] Thereafter, the exhaust gas in the exhaust chamber section 64 flows into the first chamber 71 of the silencer 65 through the communication pipe 74, to the third chamber 73 through the communication pipe 75, to the second chamber 72 through the openings 86, 87 (see Fig. 6) on the separation wall 68, and finally to the outside of the combined muffler 13 through the communication pipe 76.

[0049] On the other hand, exhaust noise is attenuated while passing from the exhaust chamber section 64 through the communication pipe 74, the first chamber 71, the communication pipe 75, the third chamber 73, the openings 86, 87, the second chamber 72, and the communication pipe 76, and then absorbed in the communication pipe 76 by the swollen part 83 filled with glass wool 82.

[0050] Assembly procedure for the above described combined muffler 13 will next be described.

[0051] Fig. 8 is a first assembly diagram for explaining an assembly procedure for a combined muffler according to the present invention.

[0052] In (a), the rear cap 63 is inserted into the large diameter tube section 61 from the front side thereof, and fixed to the rear part thereof.

[0053] In (b), an assembly of the separation walls 67, 68, and the communication pipe 75 is inserted into the large diameter pipe 61 from the front part thereof, and secured at the predetermined middle position ① thereof.

[0054] In (c), an assembly of the separation wall 66 and the communication pipe 74 is inserted into the large diameter pipe 61 from the front end thereof, and secured at the predetermined middle position ② thereof.

[0055] Figs. 9(a), (b) are second assembly diagrams for explaining an assembly procedure for a combined muffler according to the present invention.

[0056] In (a), after the process of Fig. 8(c), an assembly of the communication pipe 76, the flange 77, and the swollen part 83 is inserted from the opening 63a on the rear cap 63, and the leading end of the communication pipe 76 is inserted into the throughout hole 68a on the separation wall 68.

[0057] In (b), an assembly of the communication pipe 76, the flange 77, and the swollen part 83 is fixed to the rear cap 63 by means of a screw 78. Also, the front cap 62 is fixed to the front end of the large diameter pipe 61, and the exhaust pipes 11, 12 are secured to the front cap 62.

[0058] As described above referring to Figs. 8 and 9, when the separation wall 66 is installed inside the large diameter pipe 61, and the front cap 62 is also installed, the exhaust chamber section 64 can be readily formed. As a result, the numbers of parts and welding points are reduced, compared to a conventional method in which they are provided separately from a muffler. This enables significant reduction of the number of assembly steps, and productivity improvement.

[0059] Note that the V-type engine 8 according to the present invention is not limited to a twin type, and may be four-cylinder type or a six-cylinder type.

[0060] The present invention provides the following effects due to the above structure.

[0061] In an exhaust assembly structure according to claim 1, as an exhaust chamber is integrally provided with the muffler, the exhaust pipes can be installed in a substantially linear arrangement, as a result of which exhaust resistance in the respective exhaust pipes can be reduced.

[0062] Further, as the longer exhaust pipe is set to have a larger diameter, resistances in the respective exhaust pipes can be set substantially equal. With this arrangement, fuel adjustments for the respective carburetors for fuel supply to the respective cylinders can be readily made, and, in combination with the exhaust pipes installed in a substantially linear arrangement, engine output performance can be improved.

[0063] With an exhaust pipe structure according to claim 2, as a V-type engine is employed, exhaust resistance in the exhaust pipe connecting to the front cylinder can be set substantially equal to that in the exhaust pipe connecting to the rear cylinder by making the former have a larger diameter. As a result, engine output performance can be improved.

[0064] With an exhaust pipe structure according to claim 3, as the V-type engine is set to have a 90° V-angle, an engine with small vibration can reduce vibration propagating to the exhaust assembly. As a result, the life of the exhaust assembly can be prolonged.

[0065] An exhaust chamber 64 is integrally provided with a muffler 65, and when a plurality of exhaust pipes 11, 12 have different lengths, the exhaust pipe 11, which is longer, is set to have a larger diameter so that the exhaust pipes 11, 12 have substantially equal exhaust resistance.

[0066] Exhaust pipes can be set in a substantially linear arrangement so that exhaust resistance of the respective exhaust pipes can be reduced. Also, as a longer exhaust pipe is set to have a larger diameter, exhaust resistance for the respective exhaust pipes can be set substantially equal. Therefore, fuel adjustment of the carburetors for fuel supply to the respective cylinders can be readily achieved, and, in combination with the substantially linear arrangement of the exhaust pipes, engine output performance can be improved.

Claims

1. An exhaust assembly structure in which exhaust pipes (11,12) are extended backward from the respective cylinders (8a,8b) of a multi-cylinder engine (8) mounted to a motorcycle(1), the respective leading ends of these exhaust pipes(11,12)are connected to an exhaust chamber(64) for collecting exhaust gas, and the exhaust chamber (64) is connected to a muffler (65), wherein the exhaust chamber(64) is integrally formed with the muffler (65), and when the plurality of exhaust pipes(11,12) are different in length, a longer exhaust pipe (11) is set to have a larger diameter (D1) so that exhaust resistance in the respective exhaust pipes (11,12) are set substantially equal.

2. An exhaust assembly structure according to claim 1, wherein the engine (8) is a V-type engine.

3. An exhaust assembly structure according to claim 2, wherein the V-type engine(8) has a V-angle of 90°.

Fig.1

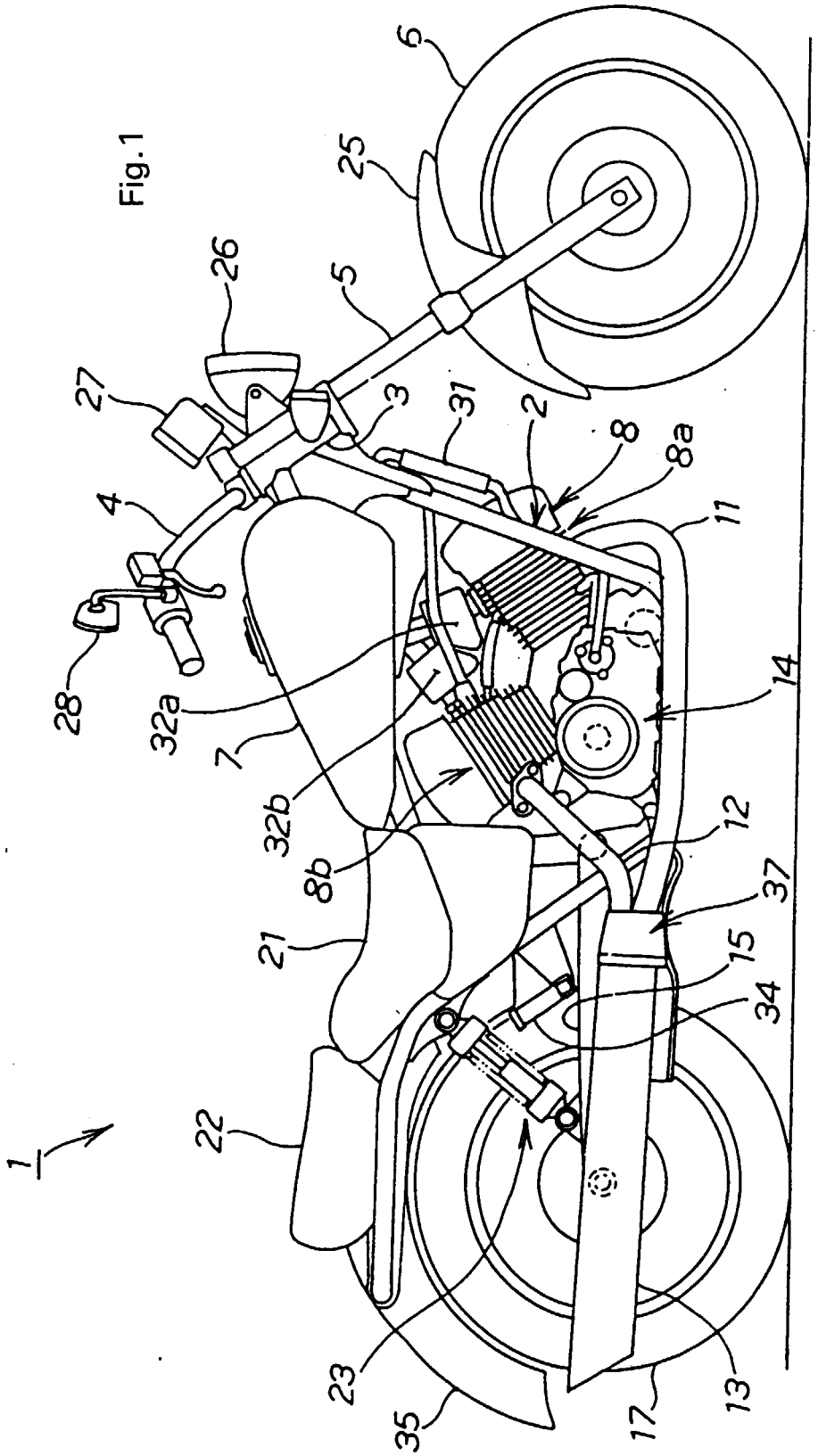

1
2
3
4
5
6
7
8
8a
8b
11
12
13
14
15
17
21
22
23
25
26
27
28
31
32a
32b
34
35
37

Fig.2

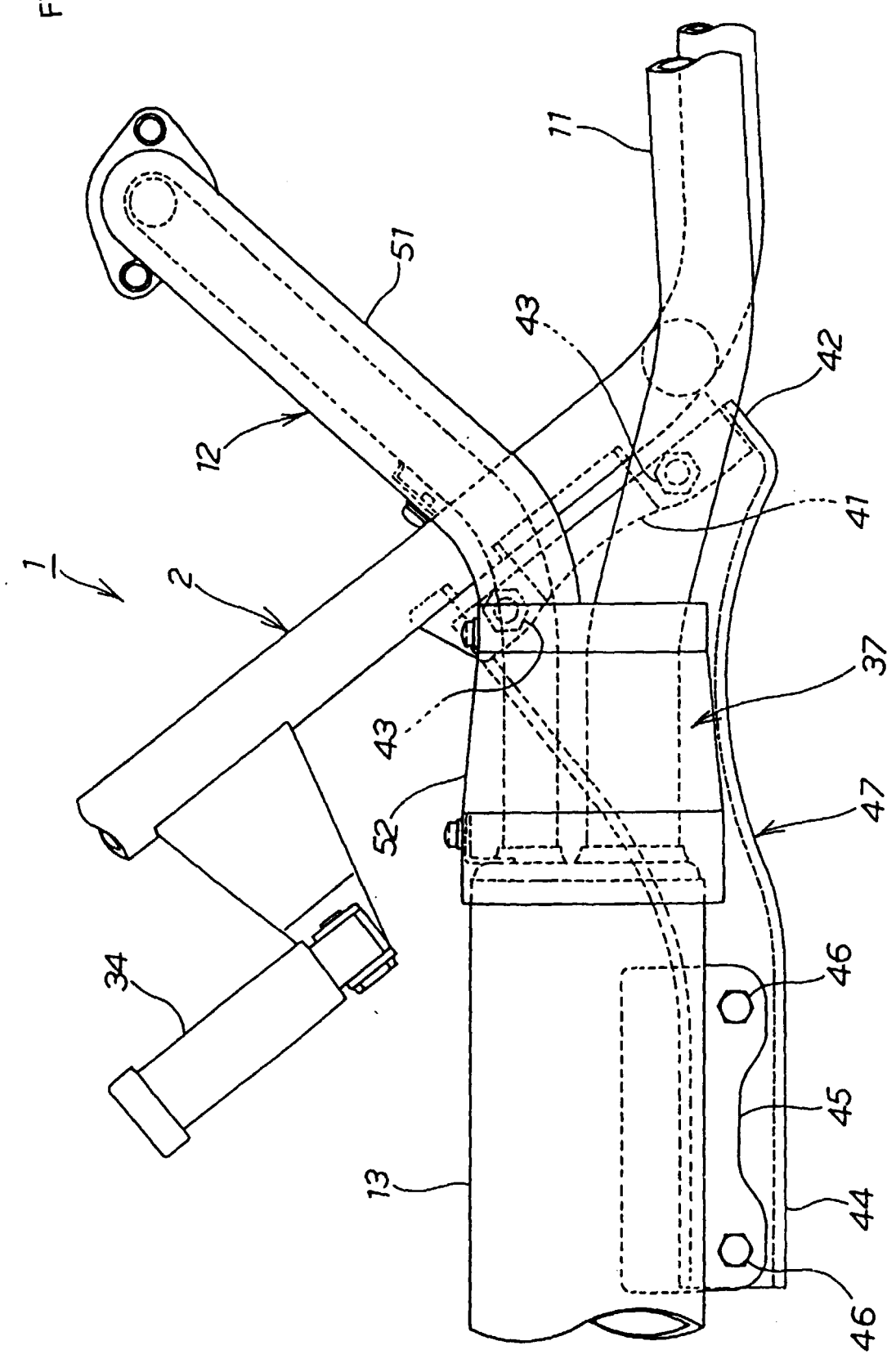


Fig.3

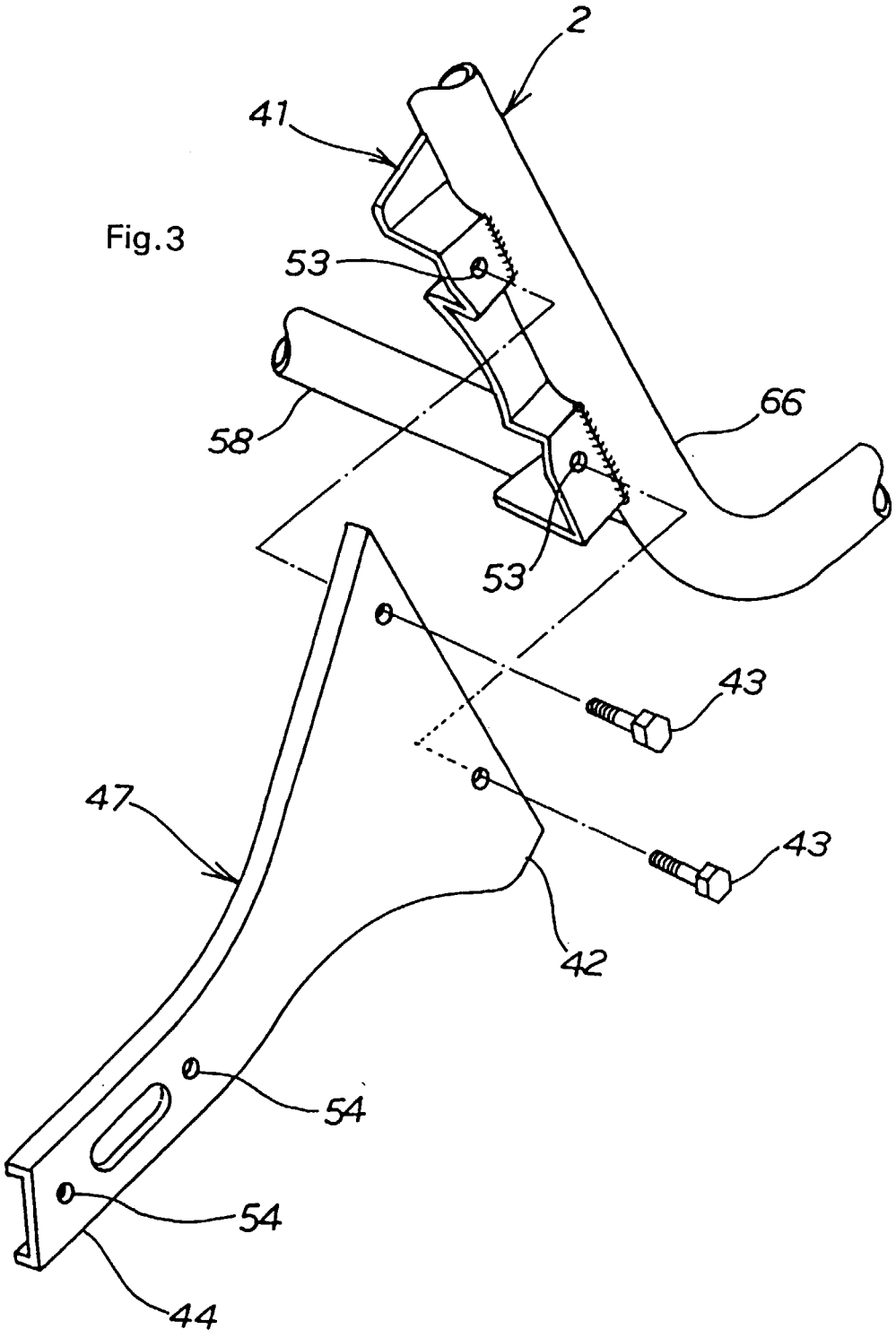


Fig.4

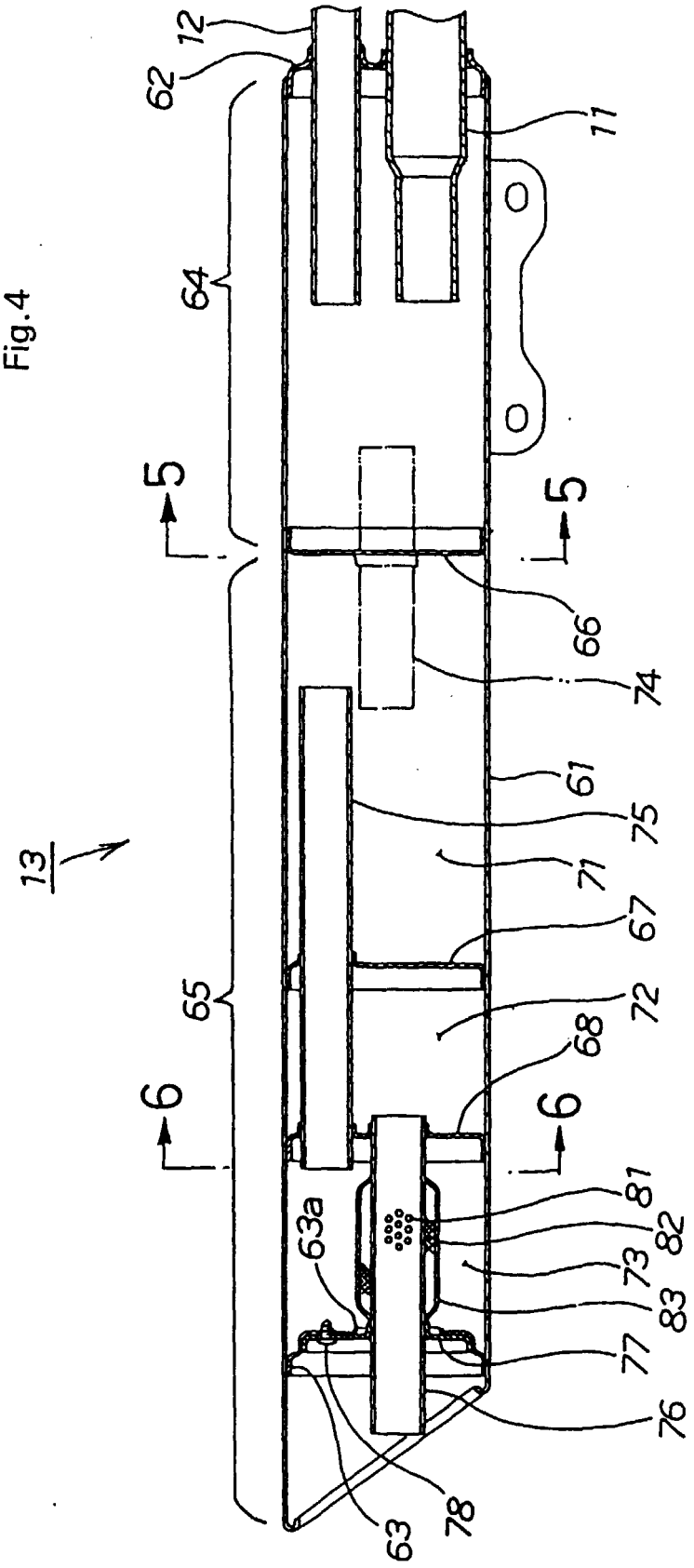

12
62
11
64
5
5
66
74
61
75
71
67
13
65
72
68
6
6
81
63a
82
73
83
77
76
78
63

Fig.5

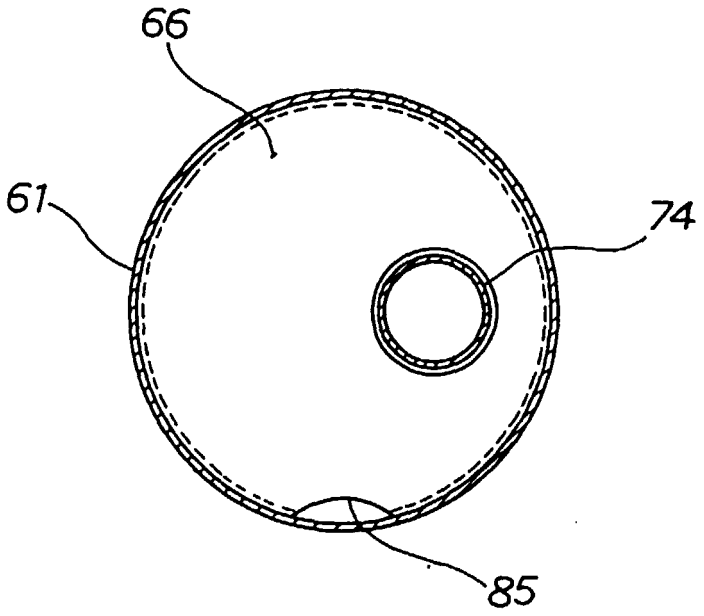
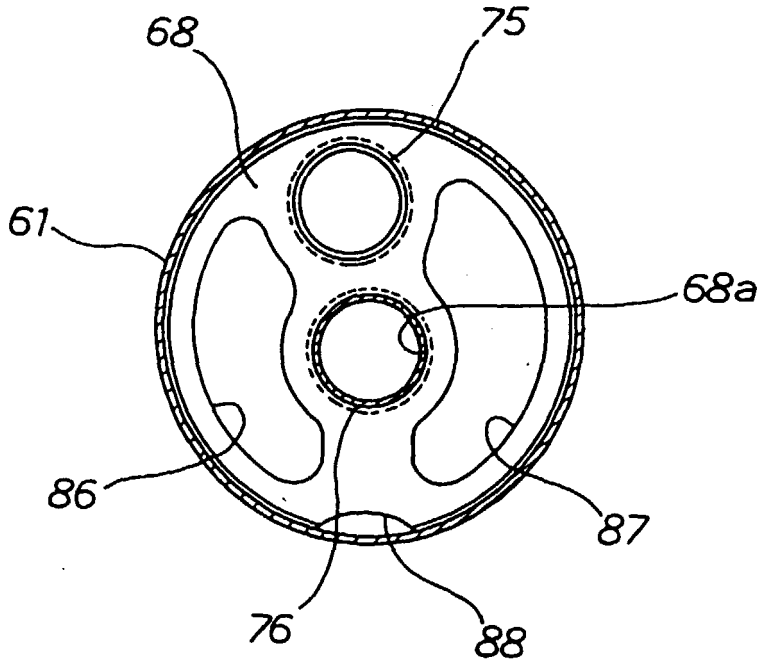


Fig.6



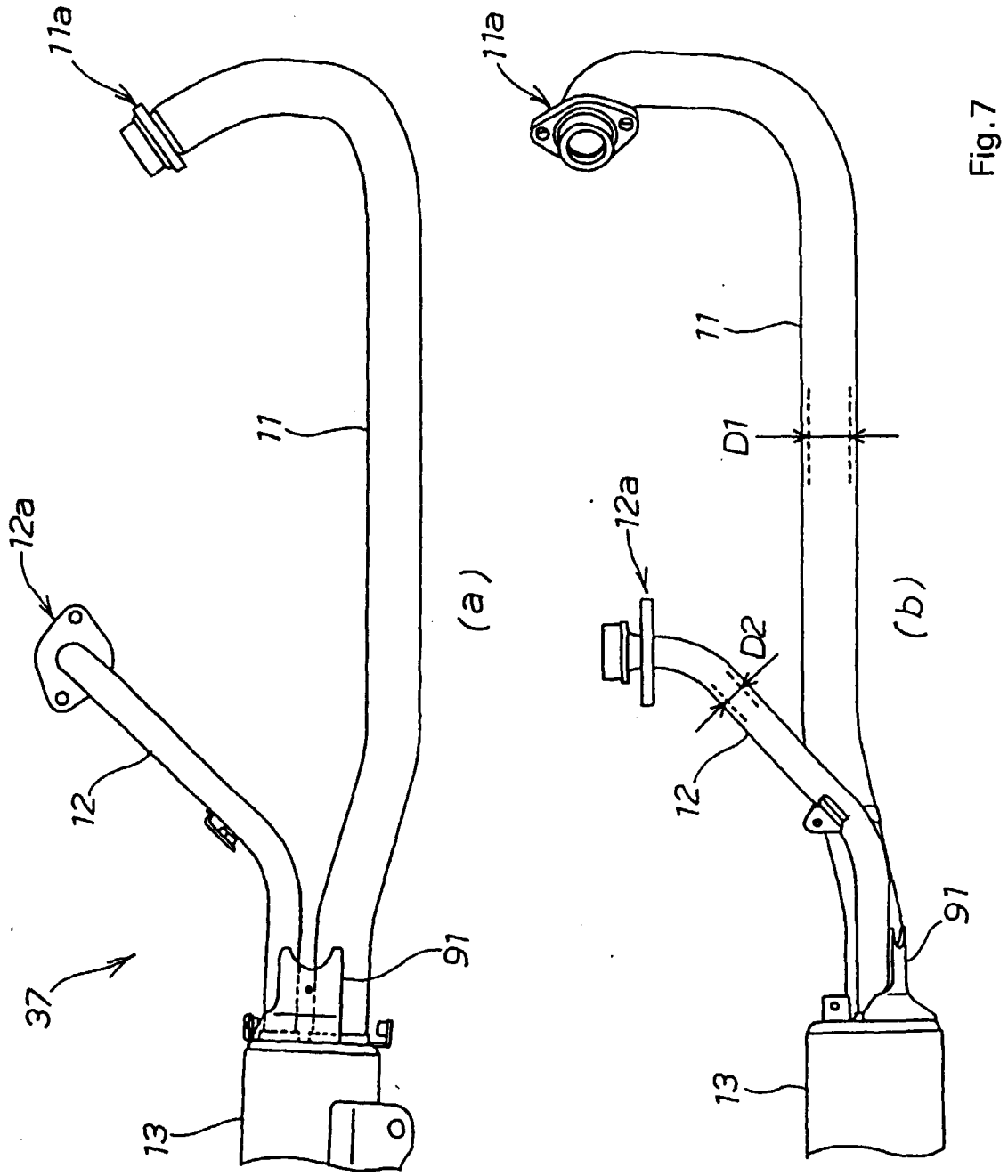


Fig.7

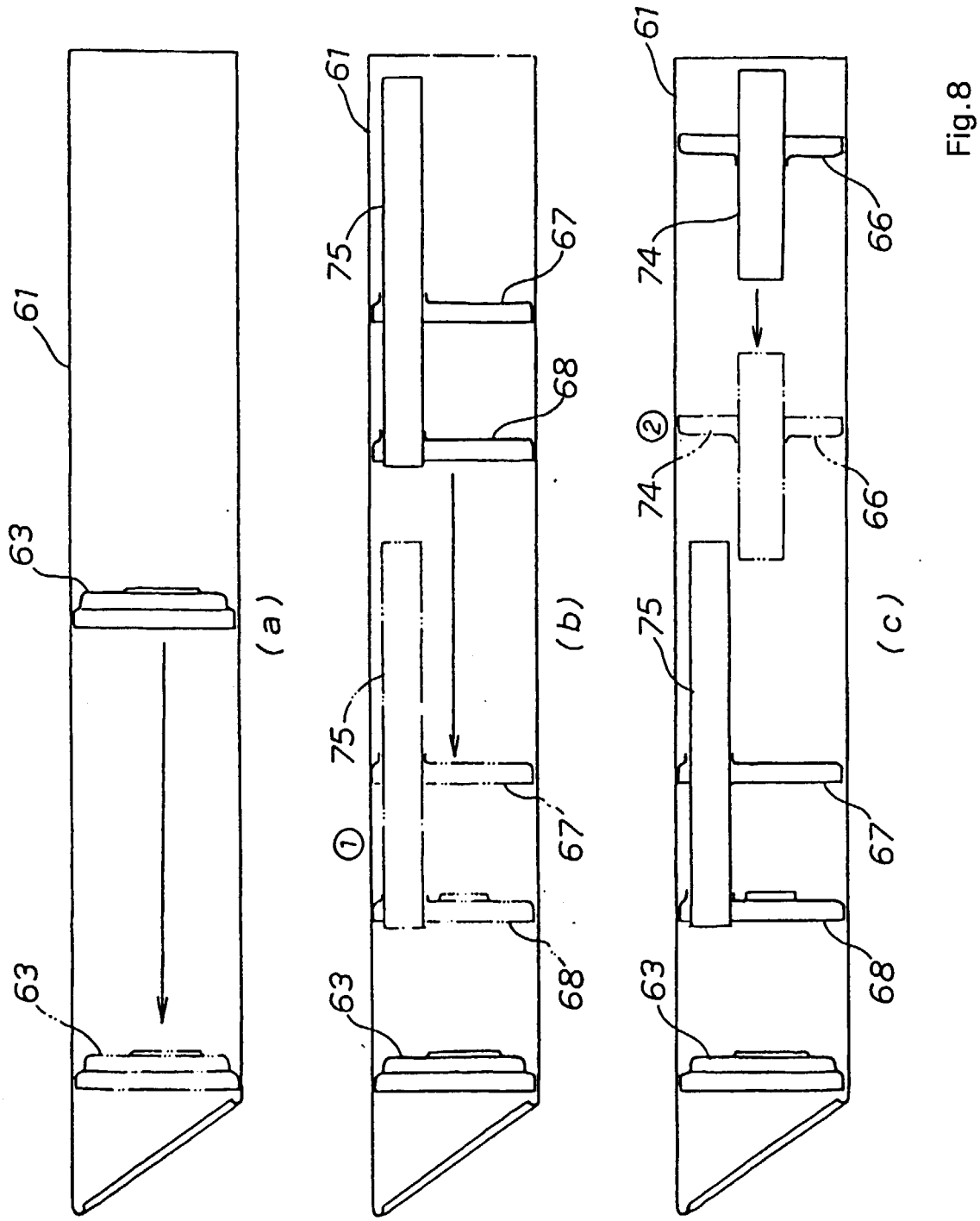


Fig.8

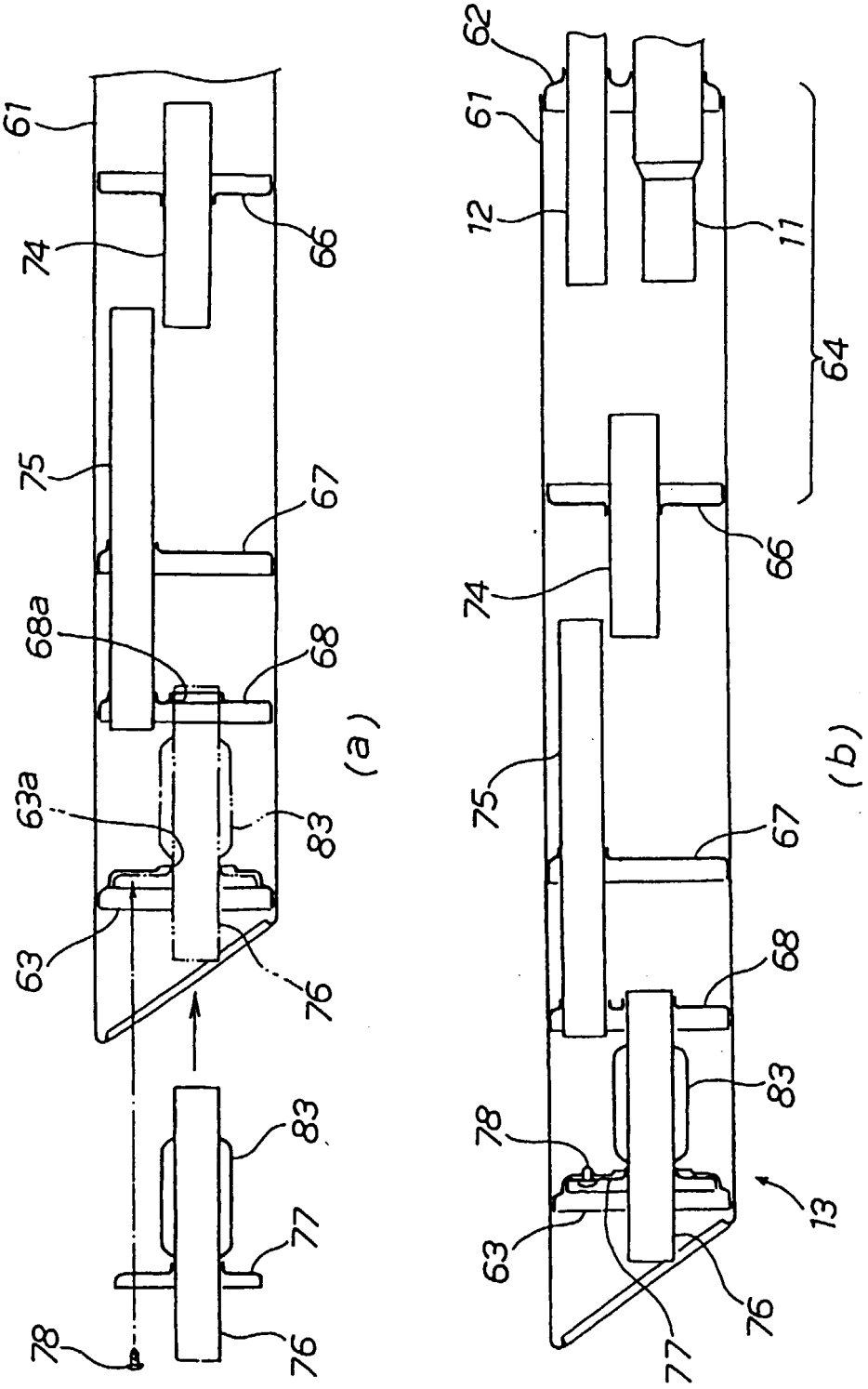


Fig.9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 10 2775

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.7)
X	US 4 800 719 A (CAMPBELL MONTY A) 31 January 1989 (1989-01-31) * column 4, line 45 - column 5, line 7; figures 4,5 *	1	F01N7/04 F01N7/08 F01N1/08
A	US 4 359 865 A (NAKAO YASUO ET AL) 23 November 1982 (1982-11-23) * column 1, line 62 - column 2, line 54; claim 1; figures 1,3 *	1-3	
A	US 4 903 483 A (ATSUUMI MAMORU ET AL) 27 February 1990 (1990-02-27) * column 4, line 42 - column 4, line 68; figures 2,2 *	1-3	
A	EP 0 500 105 A (YAMAHA MOTOR CO LTD) 26 August 1992 (1992-08-26) * column 3, line 30 - column 3, line 32 * * column 4, line 41 - column 5, line 1 * * column 7, line 4 - column 7, line 6; figure 7 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F01N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	20 April 2000	Tatus, W

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 10 2775

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-04-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4800719 A	31-01-1989	US 4953352 A	04-09-1990
US 4359865 A	23-11-1982	JP 1457393 C	09-09-1988
		JP 56034919 A	07-04-1981
		JP 63001442 B	12-01-1988
US 4903483 A	27-02-1990	JP 1211618 A	24-08-1989
		JP 1211623 A	24-08-1989
		JP 2654957 B	17-09-1997
EP 0500105 A	26-08-1992	JP 2966554 B	25-10-1999
		JP 4266579 A	22-09-1992
		DE 69213780 D	24-10-1996
		DE 69213780 T	30-01-1997
		US 5271477 A	21-12-1993
		JP 5124561 A	21-05-1993
		US 5360081 A	01-11-1994
		US 5271480 A	21-12-1993

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82