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(54) Exhaust catalyst mounting structure for motorcycles

(57) The invention realizes an arrangement of an exhaust catalyst in which respective shapes of the exhaust catalyst and a muffler are determined so as to avoid interference with respect to each other.

In the invention, a front exhaust pipe 25 and a rear exhaust pipe 26 extending from a front cylinder 23 and a rear cylinder 24 of an engine 10 of a V-shape in the fore-and-aft direction are collected at a collective pipe 27

below the engine 10, and the rear end portion thereof is connected to a cylindrical catalyst pipe 40 disposed at a position overlapped with a rear wheel 9 in side view. A cylindrical exhaust catalyst 41 is stored in the catalyst pipe 40. The catalyst pipe 40 is connected to the collective pipe 27 of small diameter via a front tapered connecting pipe 42, and is connected to a muffler 28 having a substantially inverted triangular cross section with a larger diameter via a rear tapered connecting pipe 43.

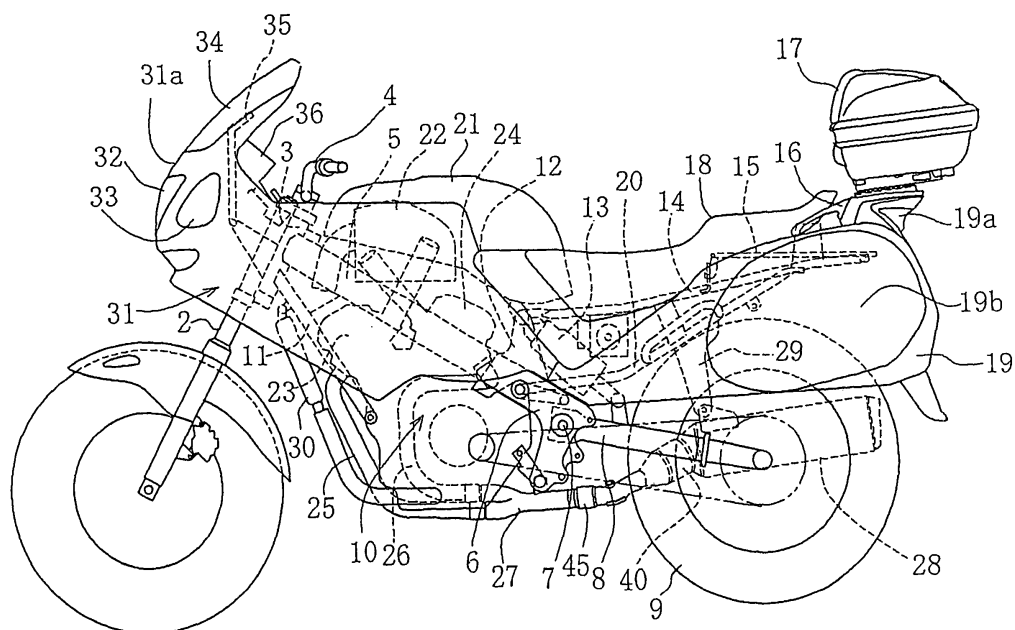


FIG. 1

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Description

[0001] The present invention relates to a mounting structure of an exhaust catalyst in an exhaust system of a motorcycle.

[0002] In an motorcycle, there is a type having a structure such that a plurality of exhaust pipes extending from a multi-cylinder engine are collected at a position below the engine, a rear end thereof is connected to a muffler via a joint pipe, a main catalyst is disposed in a sound absorbing chamber in the muffler, and a preheat pipe-shaped catalyst is disposed in the joint pipe (see JP-A-10-103046).

[0003] In the case where a catalyst is provided in a sound absorbing chamber as in the example disclosed, since the shape of the catalyst and the shape of the sound absorbing chamber depend on each other, flexibility in design is lowered. Also, when the catalyst is provided on an exhaust pipe section which is connected to a muffler, since an exhaust pipe passes through a lower portion of a vehicle body, employment of a catalyst having a large capacity in order to improve the efficiency of exhaust emission purification is difficult in view of securement of a minimum ground clearance.

[0004] In order to solve the above-described problems, an exhaust catalyst mounting structure of a motorcycle according to Claim 1 of the invention, characterized in that, in an exhaust system in a motorcycle in which an exhaust pipe extending from an engine to a muffler at a rear of a vehicle body and an exhaust catalyst is provided in an exhaust channel, a catalyst storage section of the exhaust catalyst is disposed at a connecting portion between the muffler and the exhaust pipe.

[0005] In Claim 1 described above, the invention according to Claim 2 is characterized in that the catalyst storage section is formed into a cylindrical shape, the catalyst of a cylindrical shape is stored therein, and portions connecting the catalyst storage section with respect to the exhaust pipes and the muffler are formed into tapered and enlarged shape.

[0006] In Claim 2 described above, the invention according to Claim 3 is characterized in that the catalyst storage section is smaller than the muffler in diameter, and the catalyst storage section is disposed at a position overlapped with a rear wheel in side view.

[0007] In Claim 1 described above, the invention according to Claim 4 is characterized in that a plurality of the exhaust pipes are provided and a preheat catalyst is disposed in a collective exhaust pipe unit in which the plurality of the exhaust pipes are collected at a front portion of the vehicle body.

[0008] In Claim 4 described above, the invention according to Claim 5 is characterized in that the preheat catalyst is disposed below a pivot portion for pivotally supporting a front end of a rear swing arm which supports the rear wheel.

[0009] In Claim 1 described above, the invention according to Claim 6 is characterized in that the muffler is

formed into a non-cylindrical shape.

[0010] According to Claim 1 of the invention, the catalyst can be disposed without depending on the shape of the muffler. The shape of the muffler can also be determined freely without depending on the catalyst. Therefore, the shape of the catalyst and the shape of the sound absorbing chamber can be determined freely without depending on each other, and hence flexibility in design is increased.

[0011] According to Claim 2 of the invention, since the catalyst storage section and the catalyst can be formed into a simple cylindrical shape, and hence manufacture and structure can be simplified. Also, since the portions connecting the catalyst storage section with respect to the exhaust pipes and the muffler are formed into tapered and enlarged shape, smooth flow of exhaust air is achieved.

[0012] According to Claim 3 of the invention, the exhaust system including the catalyst storage section can be disposed inside the vehicle body by arranging the catalyst storage section, which is smaller than the muffler in diameter, at a position overlapping with the rear wheel in side view, and hence a relatively large bank angle can be secured.

[0013] According to Claim 4 of the invention, by the provision of the relatively small preheat catalyst in the collective exhaust pipe unit, the minimum ground clearance of the vehicle can be secured sufficiently, the efficiency of exhaust emission purification of the exhaust catalyst can be increased.

[0014] According to Claim 5 of the invention, since the preheat catalyst is disposed below the pivot portion which pivotally supports the front end of the rear swing arm which supports the rear wheel, the preheat catalyst can be disposed at a preferable position of the vehicle body where interference with the rear swing arm can be avoided.

[0015] According to Claim 6 of the invention, flexibility of the layout, such as to form the muffler into a non-cylindrical shape to achieve slimming of the vehicle body or to increase in the bank angle, can be increased.

Fig. 1 is a side view of a motorcycle to which the invention of the present application is applied.

Fig. 2 is a side view of a portion of an exhaust system. Fig. 3 is a plan view of the portion of the exhaust system.

Fig. 4 is a plan view of a portion including a catalyst pipe and a muffler.

Fig. 5 is a partly broken side view of the same portion. Fig. 6 is a cross-sectional view taken along a line 6-6 in Fig. 4.

Fig. 7 is a drawing showing a shape of a rear end portion of the muffler.

Fig. 8 is a cross-sectional view taken along a line 8-8 in Fig. 5.

[0016] Referring now to drawings, an embodiment will

be described. Fig. 1 is a left side view of a vehicle body of a motorcycle to which the invention of the present application is applied. A pair of left and right front forks 2 supporting a front wheel 1 at a lower ends thereof are connected at upper ends to a head pipe 3 so as to be steerable by a handle 4.

[0017] The head pipe 3 is mounted to front ends of main frames 5. A pair of the left and right main frames 5 extend from the head pipe 3 so as to open rearward, and pivot plates 6 are mounted respectively to rear ends thereof. A pair of the left and right pivot plates 6 are formed substantially into L-shape in side view, and support both ends of a pivot shaft 7 which is provided laterally therebetween.

[0018] A front end of a rear swing arm 8 is swingably supported by the pivot shaft 7. A rear wheel 9 is supported at rear end of the rear swing arm 8. A water-cooled four-cycle engine 10 of V-shape in fore-and-aft direction is disposed under the main frame 5. The engine 10 is supported by the main frame 5, the pivot plates 6, and a down tube 11 which extends obliquely downward and rearward from the head pipe 3.

[0019] A pair of left and right stays 12 projecting upward are integrally provided at the respective front end portions of the left and right pivot plates 6, and a rear cushion 13, which constitutes a rear wheel suspension, is connected between the stay 12 and the front upper surface of the rear swing arm 8. Front ends of upper seat rails 14 are mounted to the upper portions of the respective stays 12. A pair of the left and right upper seat rails 14 extend obliquely upward and rearward, respectively, and rear end portions of reinforcing pipe members 15 which extend substantially horizontally are connected to the rear ends thereof.

[0020] Grab rails 16 are disposed above the reinforcing pipe members 15, and a trunk box 17 is supported on rearward extensions of the grab rails 16. A two-seater seat 18 is disposed in front of the grab rails 16, and is supported on the upper seat rails 14. A rear cover 19 is supported below the seat 18. Reference numeral 19a designates a tail lamp, and reference numeral 19b designates a side trunk with a relatively large capacity.

[0021] A pair of left and right lower seat rails 20 are provided below the upper seat rails 14, and respective front ends thereof are connected to the rear portion of the engine 10, and rear ends thereof are connected to the rear ends of the upper seat rails 14. The upper seat rails 14 and the lower seat rails 20 constitute a seat rail.

[0022] A fuel tank 21 is disposed in front of the seat 18 and above the engine 10, and is supported above the main frames 5 and the pivot plates 6. An air cleaner 22 is integrated inside the front portion of the fuel tank 21, and supplies to a front cylinder 23 and a rear cylinder 24 of the engine 10.

[0023] A front exhaust pipe 25 and a rear exhaust pipe 26 extend from respective exhaust ports of the front cylinder 23 and the rear cylinder 24, and collected at a position below the engine 10 to constitute a collective pipe

27 and is further connected to a muffler 28 at the rear. The collective pipe 27 is supported by the lower ends of the pivot plates 6, and the muffler 28 is disposed on the side of the rear wheel 9 and is supported by a stay 29 extending downward from the lower seat rail 20. A radiator 30 is supported by the down tube 11 at the front of the front cylinder 23 for water-cooling the front cylinder 23 and the rear cylinder 24.

[0024] The front portion of the vehicle body is covered by a front cowl 31, and a front end portion 31a covers a head light 32 at the front of the head pipe 3. Front wipers 33 are provided on side surfaces of the front end portion 31a. A wind screen 34 is arranged on top of the front end portion 31a, and is supported by the head pipe 3 via a wind screen supporting stay 35. Reference numeral 36 designates an instrument.

[0025] Fig. 2 and Fig. 3 are a plan view and a side view of a portion of an exhaust system from the collective pipe 27 to the muffler 28. In these drawings, disposed between the collective pipe 27 and the muffler 28 is a catalyst pipe 40. The catalyst pipe 40 has a cylindrical shape, and a publicly known exhaust catalyst 41 having also a cylindrical shape is stored therein. The exhaust catalyst 41 has a relatively large capacity to an extent which can be sufficient for purifying exhaust air.

[0026] The outer diameter of the catalyst pipe 40 is a size between the collective pipe 27 and the muffler 28, and between a front end of the catalyst pipe 40 and a rear end of the collective pipe 27, and between a rear end of the catalyst pipe 40 and a front end of the muffler 28 are connected by front and rear tapered connecting pipes 42, 43. As in this embodiment, a diameter when the muffler 28 has a non-cylindrical shape indicates a diameter of a circumscribing circle which can include the entire muffler 28 or a diameter of a circle similar thereto.

[0027] The respective tapered connecting pipes 42, 43 are opened toward the rear (downstream of exhaust air). The front portion of the collective pipe 27 is bifurcated, which constitutes branches 44a, 44b which are connected to the front exhaust pipe 25 and the rear exhaust pipe 26. The rear portion of the collective pipe 27 is provided with a heat tube 45, and a preheat catalyst 46 is provided therein. The heat tube 45 is positioned below the pivot shaft 7 (see Fig. 2).

[0028] The preheat catalyst 46 is heated by exhaust air collected into the heat tube 45, and increases exhaust temperature on the downstream side to preheat to activate a catalytic action in the exhaust catalyst 41 sufficiently. Therefore, when compared with the exhaust catalyst 41, the preheat catalyst 46 must only have relatively small capacity, and has a simple cylindrical shape. Reference numerals 47 to 49 in the drawing designate supporting stays.

[0029] Fig. 4 is an enlarged plan view of a portion including the catalyst pipe 40 and the muffler 28, and Fig. 5 is a side view of the same showing an interior of the muffler 28 as a sound absorber. As shown in Fig. 4, the muffler 28 is disposed in substantially parallel with a cent-

er of the vehicle body, and the catalyst pipe 40, the front tapered connecting pipe 42, and the rear tapered connecting pipe 43 are bent inwardly of the vehicle body so that the front portions thereof are directed toward the center of the vehicle body. The supporting stay 49 is provided on a front upper surface of the muffler 28 so as to be shifted toward the center of the vehicle body.

[0030] As shown in Fig. 5, the interior of the muffler 28 is partitioned into three sound absorbing chambers 50-52 in the fore-and-aft direction, and as shown in the drawing with arrows, exhaust air flows from the first sound absorbing chamber 50 through a first connecting pipe 53 and returns into the third sound absorbing chamber 52, then flows through a second connecting pipe 54 and enters into the second sound absorbing chamber 51, and then is discharged from the second sound absorbing chamber 51 via a third connecting pipe 55 to the atmosphere. A rear end portion of the third connecting pipe 55 passes through an end cap 56 and opened toward the atmosphere.

[0031] The muffler 28 has a double walled pipe structure, and an inner pipe 57 has an air-ventilating structure such as punched metal or the like, and communicates with a clearance 59 defined between the inner pipe 57 and an outer pipe 58. The clearance 59 is filled with sound absorbing material such as glass wool.

[0032] Fig. 6 is a cross-sectional view taken along a line 6-6 in Fig. 4. The rear end portion of the catalyst pipe 40 has a double walled pipe structure including the rear tapered connecting pipe 43 and the catalyst pipe 40 with the inner side of the rear tapered connecting pipe 43 projected rearward. The rear end portion of the exhaust catalyst 41 stored in the catalyst pipe 40 is partly inserted into the first sound absorbing chamber 50.

[0033] Fig. 7 is a drawing showing the shape of the rear end portion of the muffler 28 when viewed in the direction indicated by an arrow 7 in Fig. 5, and Fig. 8 is a cross-sectional view taken along a line 8-8 in Fig. 5. As shown in these drawings, the muffler 28 has a non-cylindrical shape, in this embodiment, has a substantially inverted triangular shape, and an inner surface 60 out of three surfaces which constitute the side surface thereof assumes a substantially flat surface extending in substantially parallel with the vertical direction and opposes the side surface of the rear wheel 9.

[0034] An upper surface 61 also assumes a substantially horizontal flat surface. An outer surface 62 is an inclined surface, and a rear end thereof is inclined toward the center of the vehicle body. Therefore, the cross-sectional shape of the muffler 28 is such that the upper portion is enlarged portion being increased in width outwardly of the vehicle body and the lower end has the narrowest width.

[0035] As shown in Fig. 8, the third sound absorbing chamber 52 (the same in other sound absorbing chambers) is a substantially inverted triangular shape, and only the first connecting pipe 53 is disposed in the lower portion thereof, which is the narrowest portion, and the sec-

ond connecting pipe 54 and the third connecting pipe 55 are disposed in the wider upper portion in juxtaposed arrangement.

[0036] As shown in Fig. 7, since the rear end portion of the third communicating pipe 55 opens to the center of the end cap 56, the third communicating pipe 55 is inclined obliquely downward toward the rear as shown in Fig. 5, so as to be directed toward the center of the vehicle body.

[0037] Subsequently, the operation of the invention will be described. As shown in Fig. 1 to Fig. 3, since the catalyst pipe 40 is disposed at the connecting portion between the muffler 28 and the collective pipe 27, exhaust air passed through the front exhaust pipe 25 and the rear exhaust pipe 26 passes below the engine 10, is collected at the collective pipe 27, purified sufficiently by the exhaust catalyst 41 of a relatively large capacity in the catalyst pipe 40, enters into the muffler 28, and is discharged into the atmosphere.

[0038] At this time, although the sound absorbing chamber in the muffler 28 assumes a substantially inverted triangular shape, since the catalyst pipe 40 is located outside the muffler 28, it can be formed into a simple cylindrical shape without depending on the shape of the sound absorbing chamber. In contrast, the shape of the muffler 28 does not depend on the shape of the exhaust catalyst 41. Therefore, the catalyst pipe 40 and the muffler 28 are designed into any shape, respectively. The preheat catalyst 46 in the collective pipe 27 is also the same. Therefore, flexibility in design increases.

[0039] In addition, since the catalyst pipe 40 is connected to the collective pipe 27 via the front tapered connecting pipe 42, and to the muffler 28 via the rear tapered connecting pipe 43, the collective pipe 27, the catalyst pipe 40, and the muffler 28 having different diameters can be connected so as to gradually increase in diameter toward the downstream of exhaust air, and a smooth flow of exhaust air is achieved.

[0040] Since the catalyst pipe 40 is smaller than the muffler 28 in diameter, it can be arranged near the center of the vehicle body without interference with the rear wheel 9 by arranging the same so as to be overlapped with the rear wheel 9 in side view. In this manner, a relatively large bank angle can be secured by reducing the amount of outward projection of the exhaust system including the catalyst storage section by arranging the same inside the vehicle body.

[0041] Since the muffler 28 is formed substantially into an inverted triangular shape, and the inner surface 60 assumes the flat surface extending substantially in parallel with the vertical surface, the muffler 28 can be arranged at a position closer to the side surface of the rear wheel 9. Also, since the outer side surface 62 assumes the inclined surface opened upward and outward, the bank angle can be increased as well. By forming the muffler 28 into a non-cylindrical shape as described above, flexibility of the layout such that one or both of slimming of the vehicle body and securement of the bank angle

can be achieved simultaneously can be increased.

[0042] In addition, since the heat tube 45 is provided at the rear portion of the collective pipe 27, and the preheat catalyst 46 is stored therein, exhaust air can be preheated at the heat tube 45 section, whereby catalytic action by the exhaust catalyst 41 can be activated, and the efficiency of exhaust emission purification can be increased.

[0043] In addition, since the heat tube 45 is substantially positioned immediately below the pivot shaft 7, it can be arranged near the center of swinging movement of the rear swing arm 8, whereby the preheat catalyst 46 can be positioned at a preferable position in the vehicle body where interference of the rear swing arm 8 is avoided.

[0044] In addition, since the relatively small preheat catalyst 46 is sufficient, even when the heat tube 45 is provided at the rear portion of the collective pipe 27 at a small ground clearance, arrangement with sufficient ground clearance is achieved.

[0045] The non-cylindrical shape of the muffler 28 is not limited to the substantially triangular cross section, but may be various shapes such as an oval shape. The shapes of the exhaust catalyst 41 and the preheat catalyst 46 are not limited to the circular shape, and may be a non-circular shape. The type of the engine is not limited, and the arrangement structure of the exhaust catalyst in the present application can be applied to an exhaust system having one single exhaust pipe with a single cylinder.

[0046] The invention realizes an arrangement of an exhaust catalyst in which respective shapes of the exhaust catalyst and a muffler are determined so as to avoid interference with respect to each other.

[0047] In the invention, a front exhaust pipe 25 and a rear exhaust pipe 26 extending from a front cylinder 23 and a rear cylinder 24 of an engine 10 of a V-shape in the fore-and-aft direction are collected at a collective pipe 27 below the engine 10, and the rear end portion thereof is connected to a cylindrical catalyst pipe 40 disposed at a position overlapped with a rear wheel 9 in side view. A cylindrical exhaust catalyst 41 is stored in the catalyst pipe 40. The catalyst pipe 40 is connected to the collective pipe 27 of small diameter via a front tapered connecting pipe 42, and is connected to a muffler 28 having a substantially inverted triangular cross section with a larger diameter via a rear tapered connecting pipe 43.

muffler (28) and the exhaust pipe (25, 26, 27).

2. The exhaust catalyst mounting structure for a motorcycle according to claim 1, **characterized in that** the catalyst storage section (40) is formed into a cylindrical shape, the catalyst (41) of a cylindrical shape is stored therein, and portions (42, 43) connecting the catalyst storage section (40) with respect to the exhaust pipes (25, 26, 27) and the muffler (41) are formed into tapered and enlarged shape.
3. The exhaust catalyst mounting structure for a motorcycle according to claim 1, **characterized in that** the catalyst storage section (40) is smaller than the muffler (41) in diameter, and the catalyst storage section (40) is disposed at a position overlapped with a rear wheel (9) in side view.
4. The exhaust catalyst mounting structure for a motorcycle according to claim 1, **characterized in that** a plurality of the exhaust pipes (25, 26) are provided and a preheat catalyst (46) is disposed in a collective exhaust pipe unit (27) in which the plurality of the exhaust pipes (25, 26) are **collected at a front portion of the vehicle body**.
5. The exhaust catalyst mounting structure for a motorcycle according to claim 4, **characterized in that** the preheat catalyst (46) is disposed below a pivot portion (7) for pivotally supporting a front end of a rear swing arm (8) which supports the rear wheel.
6. The exhaust catalyst mounting structure for a motorcycle according to claim 1, **characterized in that** the muffler (28) is formed into a non-cylindrical shape.

Claims

1. In an exhaust system in a motorcycle in which an exhaust pipe (25, 26, 27) extending from an engine (10) to a muffler (28) at a rear of a vehicle body and an exhaust catalyst (41) is provided in an exhaust channel, an exhaust catalyst mounting structure for a motorcycle **characterized in that** a catalyst storage section (40) of the exhaust catalyst (41) is disposed at a connecting portion (42, 43) between the

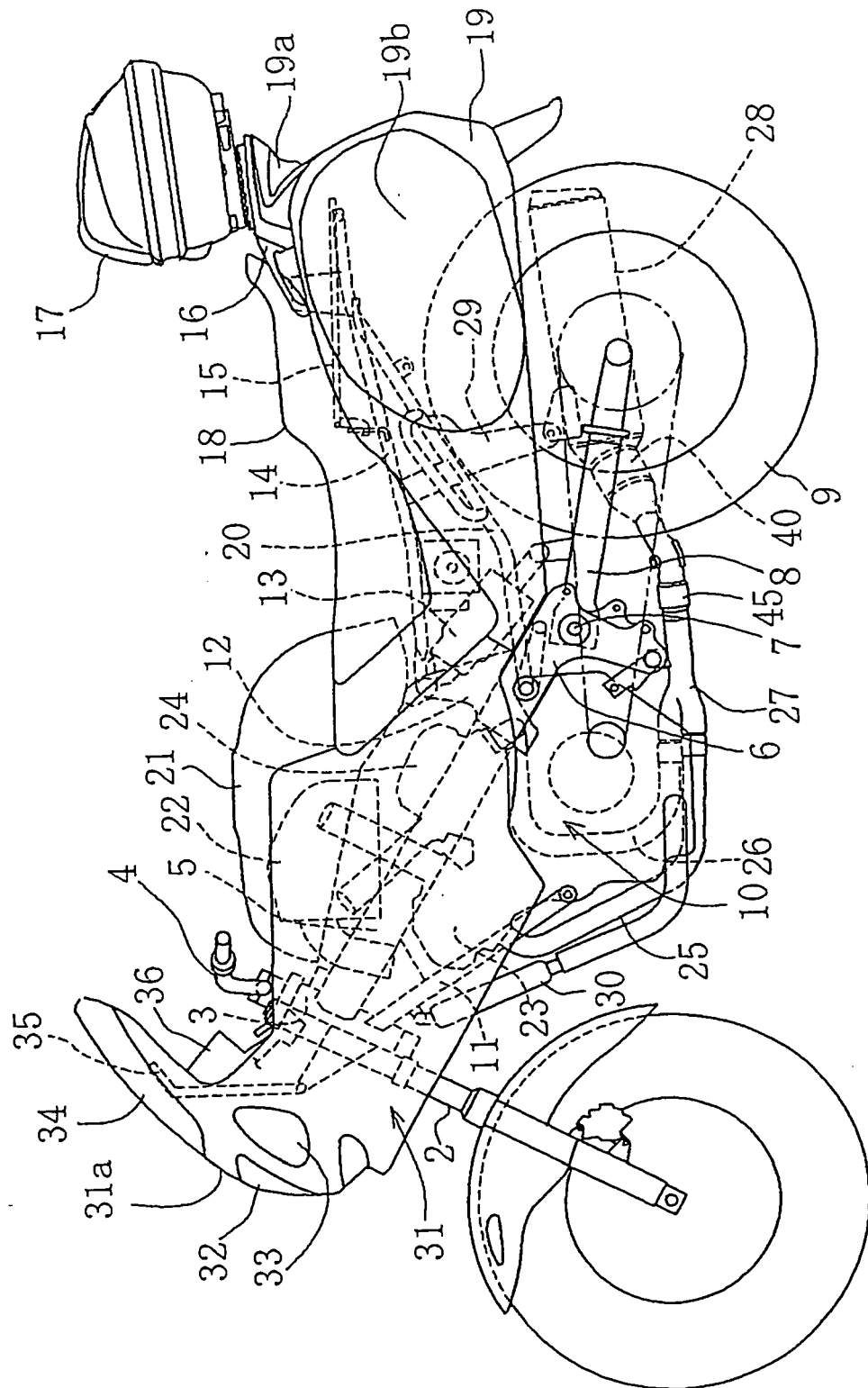
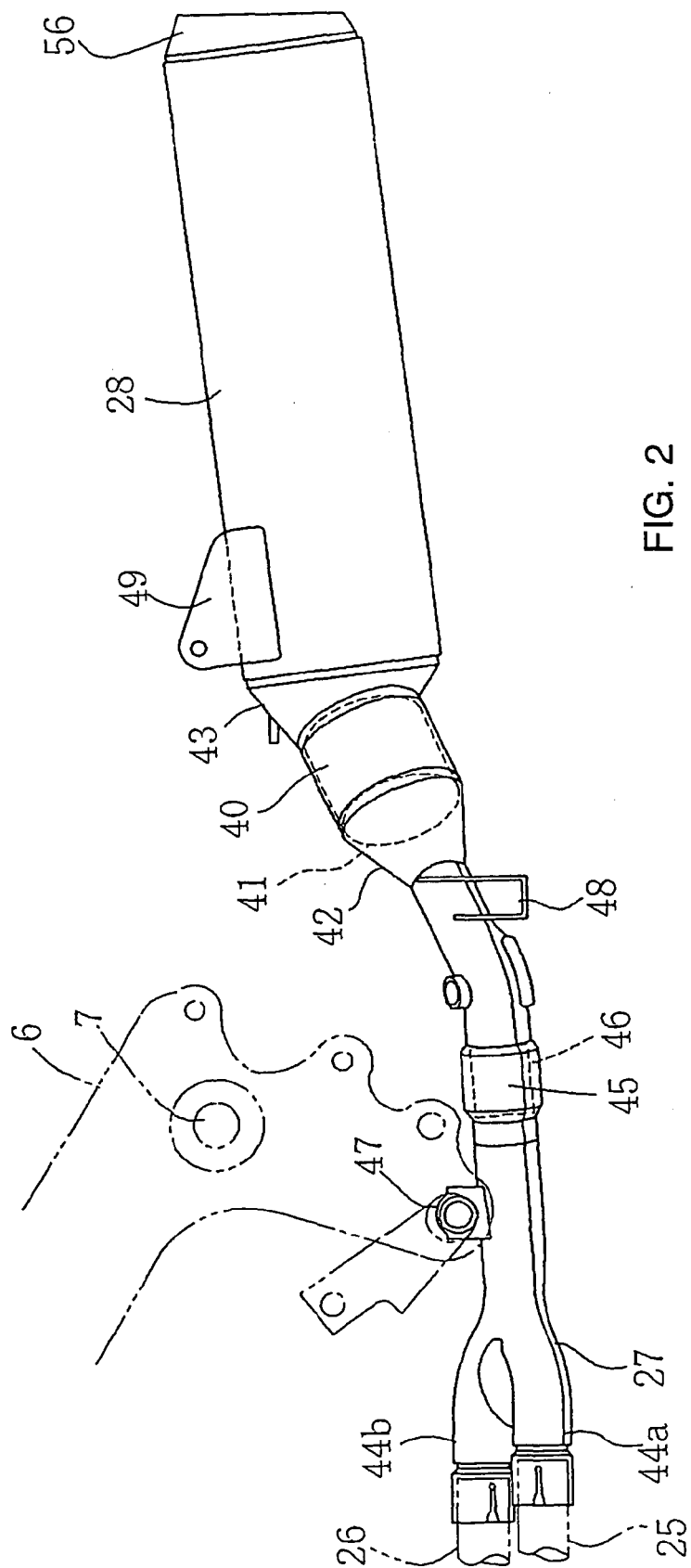


FIG. 1



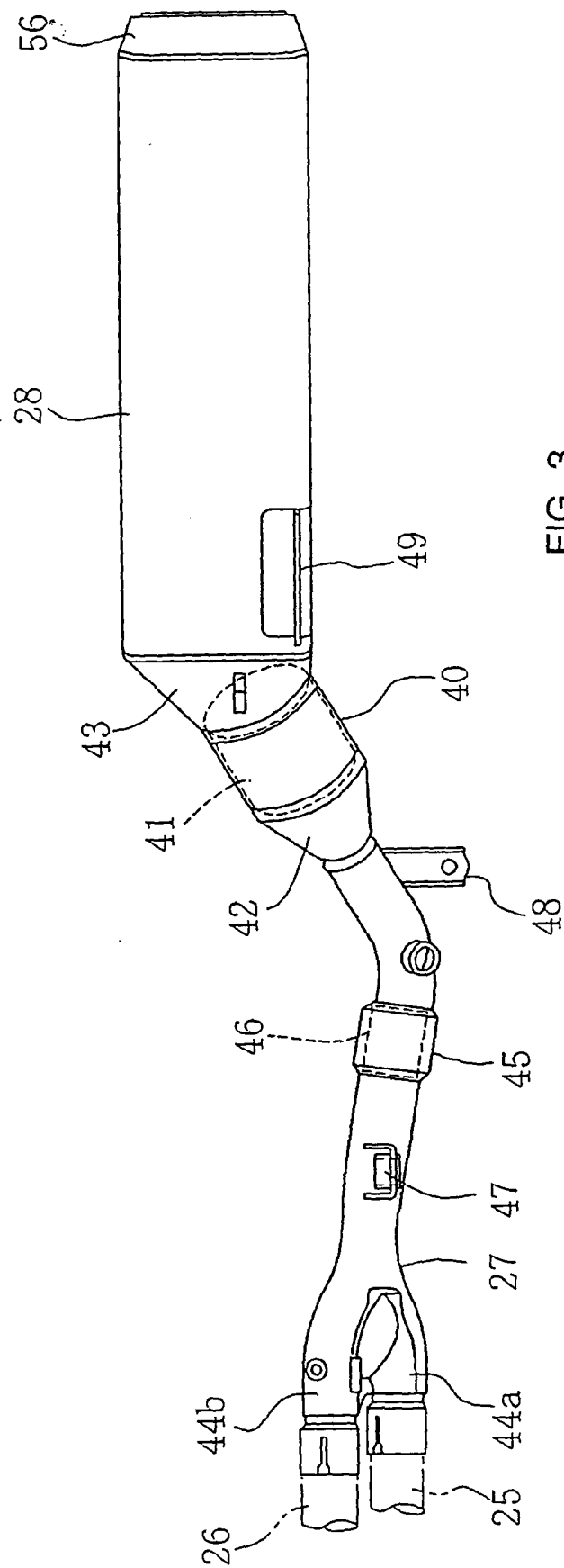


FIG. 3

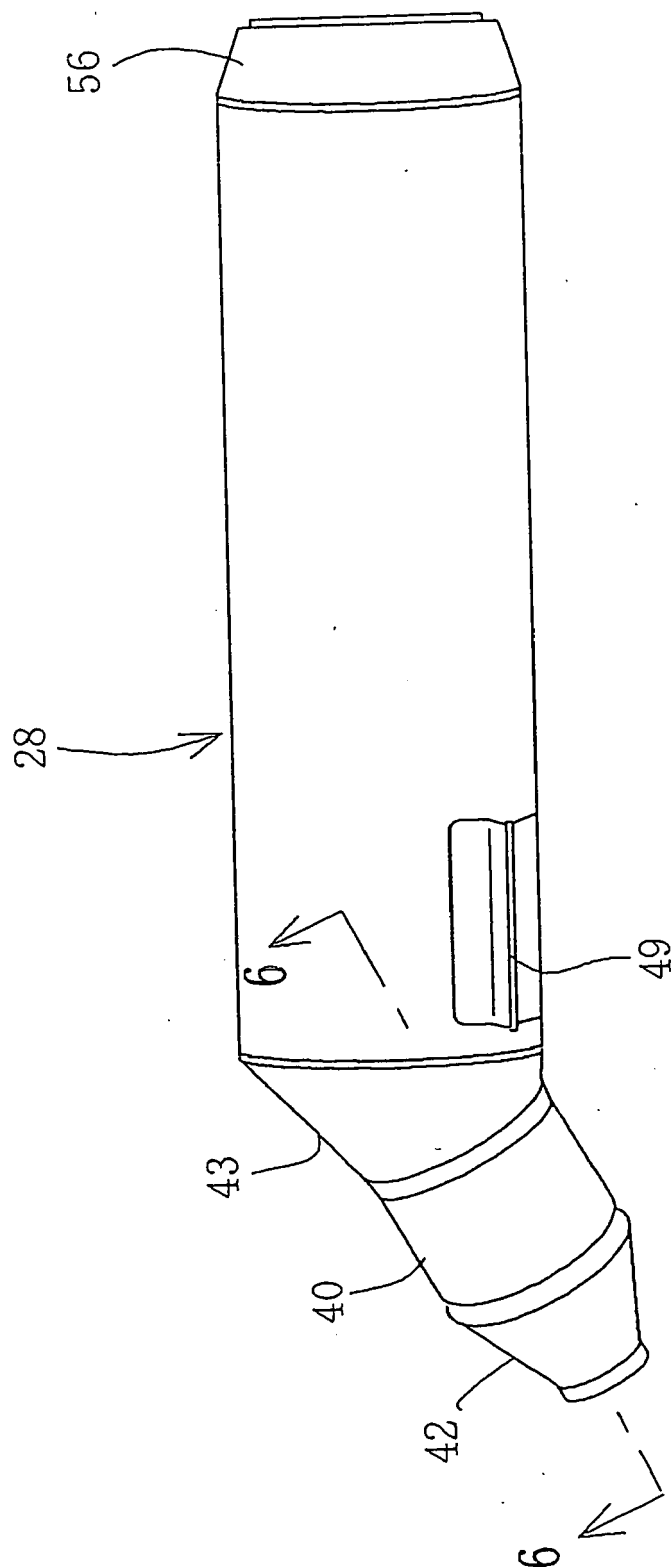


FIG. 4

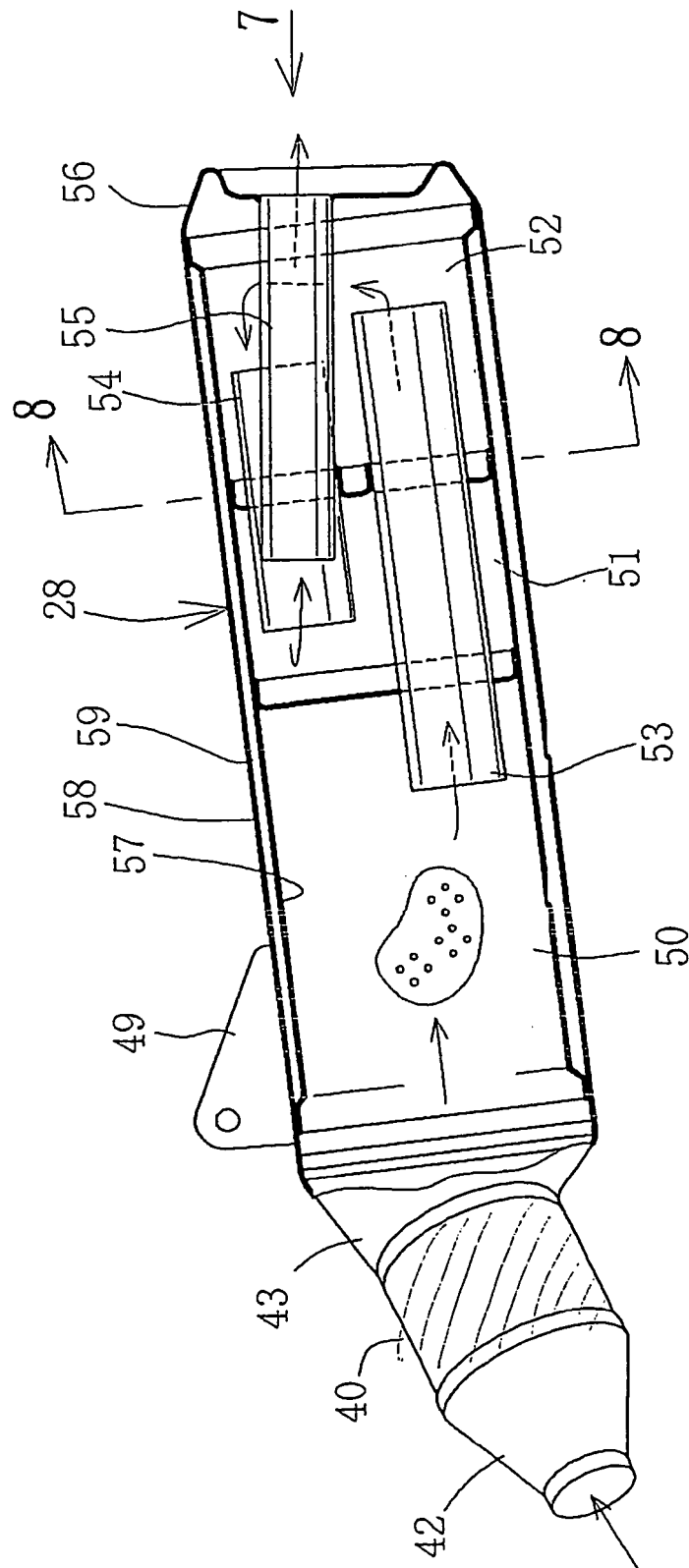


FIG. 5

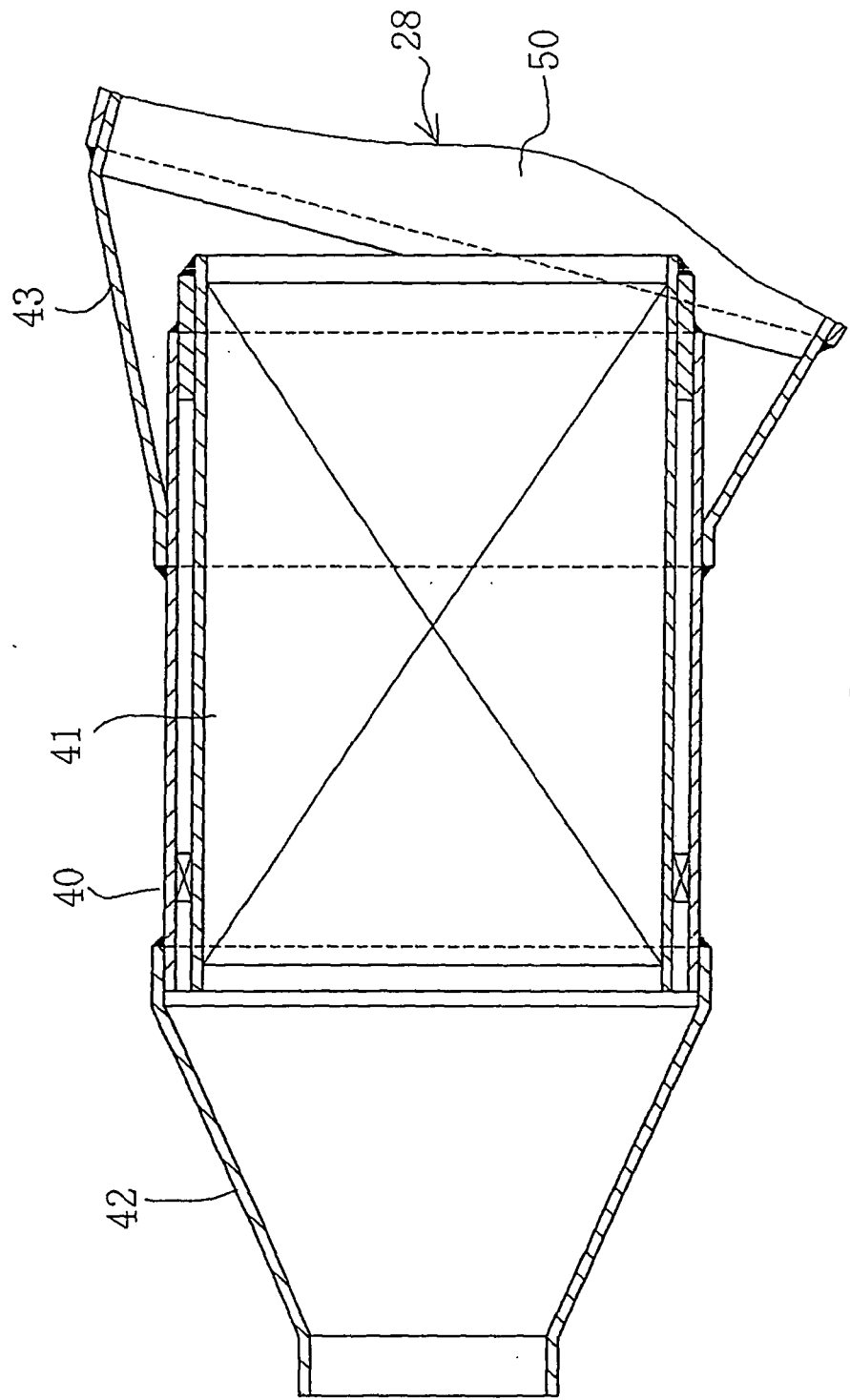


FIG. 6

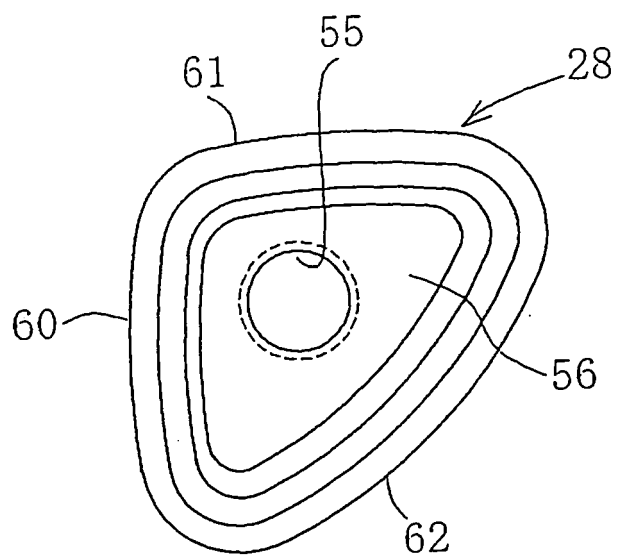


FIG. 7

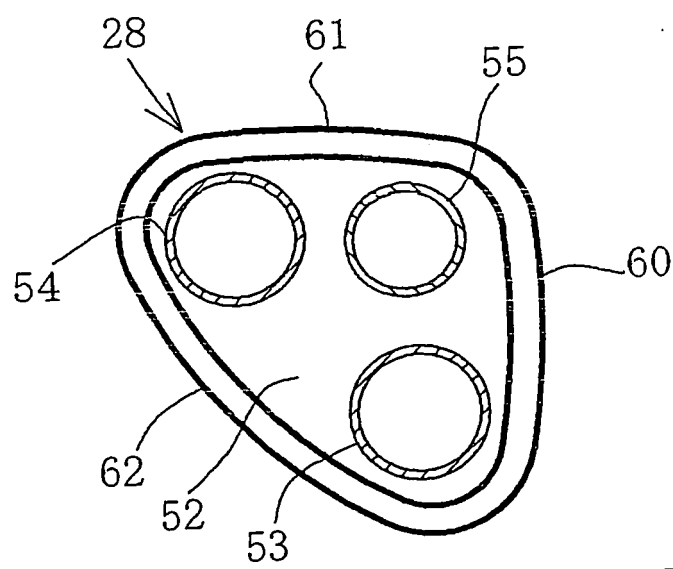


FIG. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 05 01 7996

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	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 01, 31 January 1997 (1997-01-31) & JP 08 246860 A (SUZUKI MOTOR CORP), 24 September 1996 (1996-09-24) * abstract *	1	F01N3/28 F01N7/18
A	----- PATENT ABSTRACTS OF JAPAN vol. 1997, no. 01, 31 January 1997 (1997-01-31) & JP 08 246861 A (SUZUKI MOTOR CORP), 24 September 1996 (1996-09-24) * abstract *	1	
A	----- DE 44 31 484 A1 (FA. J. EBERSPAECHER, 73730 ESSLINGEN, DE) 14 March 1996 (1996-03-14) * abstract *	1	
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 September 2005	Examiner Tatus, W
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 01 7996

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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26-09-2005

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