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(54) Portable engine unit.

(57) A portable engine unit is provided. The unit comprises an engine (1) including a clutch (41), a crankcase (47) enclosing a crank shaft (21), and engine cylinder enclosing a piston (97) and a piston rod (21), a carburetor (49), an air filter (67), a recoil starter (45) and a muffler (55). The engine comprises further a housing (3) for enclosing said engine (1), said housing (3) being dividable into two portions (15,17) along a vertical plane (19) including the axis of the output shaft (7). The engine unit further comprises means for isolating the housing (3) from vibrations caused by the engine (1) and the engine (1) is fitted via the vibration isolating means (69, 71, 73, 75) in the housing (3).

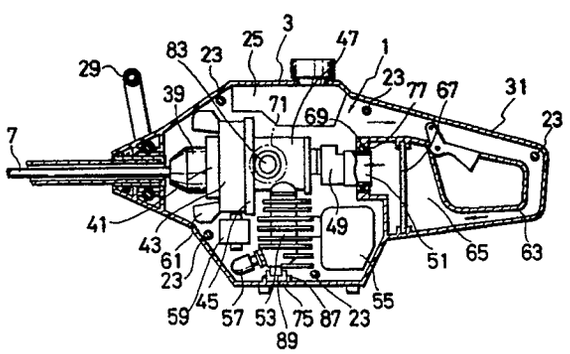

FIG.4

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PORTABLE ENGINE UNIT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a portable engine unit, and more particularly to a portable engine unit applicable for a weed cutter, snow blower, etc., and has a housing which is separated along a plane including the axis of rotation of an output shaft of the engine.

2. Description of the Prior Art

In a prior art portable engine unit, a housing which encloses an engine is divided along a plane orthogonal to the axis of rotation of an output shaft of the engine and provided with two cover casings which are fitted to the opposite sides of the housing. Further, in many prior art portable engine units, separate casings shall be provided for enclosing a cylinder, muffler, etc., of the engine.

Measures to cope with noise and vibration are not sufficiently realized in a prior art portable engine unit.

Concerning to vibration, a prior art portable engine is provided with a plurality of vibration isolators between the engine and a housing of the engine. The engine comprises a crankcase enclosing a cantilever crank arm, a recoil starter, a magnet wheel, and a centrifugal clutch comprising a clutch drum and a clutch shoe member. These components are arranged axially in series to constitute the engine. The vibration isolators are positioned around the engine gravity center which is usually located in front of the crankcase. In this arrangement, the gravity center of reciprocating parts such as a piston and a piston rod, which are main factors of vibration, are positioned out of an area surrounded by the vibration isolators. As a result, vibration is not effectively prevented.

As another measure to cope with vibration, the prior art portable engine is equipped with a vibration isolator joint between the centrifugal clutch and a torque transmission shaft which transmits torque generated by the engine through the clutch to a work tool such as a weed cutter. In order to house the vibration isolator joint and the clutch drum, a special casing is required that increases the manufacturing process and cost as well as the weight of engine.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a portable engine unit as described above having vibration isolators which are located to surround an area in which a gravity center of reciprocating parts such as a piston and a piston rod of the engine moves, thereby reducing the vibration of engine effectively.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects, features and advantages of the present invention will become apparent from the following descriptions of preferred embodiments taken in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective view showing a weed cutter to which an engine unit according to the present invention is applied;

Fig. 2 is a side view showing an engine housing of the weed cutter shown in Fig. 1;

Fig. 3 is a plan view showing the engine housing;

Fig. 4 is a view showing the cross section of the engine housing with an engine being exposed;

Fig. 5 is an enlarged cross-sectional side view showing the essential part of the housing and engine;

Fig. 6 is a cross-sectional plan view showing the essential part of the housing and engine;

Fig. 7 is a view showing the three-dimensional positions of vibration isolators disposed according to the present invention between the housing and the engine;

DETAILED DESCRIPTION OF THE EMBODIMENTS

Embodiments of the present invention will now be described with reference to accompanying drawings in which the present invention is applied for a weed cutter.

Figures 1 to 3 show the external view of the weed cutter. An engine 1 (Fig. 4) is enclosed in a housing 3 which is connected with a weed cutter 5 through a transmissicn shaft 7 disposed in a connection pipe 9. The weed cutter 5 comprises a rotary blade 11 and a bearing member 13 which supports the rotary blade 11 and incorporates bevel gears (not shown) to transmit torque from the transmission shaft 7 to the rotary blade 11. The housing 3 is made of synthetic resin and divided into a right housing 15 and a left housing 17 along a boundary plane 19 which includes the axis of

rotation of an output shaft (a crank shaft) 21 of the engine 1. The right and left housings 15 and 17 are fitted together with screws 23. A fuel tank 25 (Fig. 4) is provided at an upper part inside the housing 3. The housing 3 is also provided with a hook 27, a front handle 29, and a rear handle 31 comprising a right portion 33 and a left portion 35, all of which will be described later. In Fig. 2, a shoulder band 37 is hooked to the hook 27.

Since the housing 3 is separated into the right and left housings 15 and 17 along the plane 19 including the axis of rotation of crank shaft 21, the engine 1, fuel tank 25, etc., are fixed easily between the right and left housings 15 and 17. The number of components which constitute the housing 3 is only two (right and left housings 15 and 17) which is smaller in comparison with a prior art housing so that the engine unit according to the present invention may reduce the manufacturing and assembling process as well as cost.

Figure 4 shows the arrangement of engine 1, in which a vibration isolator joint 39, a clutch drum 41, a magnet wheel 43, a recoil starter 45, a crankcase 47, a carburetor 49, and a choke case 51 are disposed axially in series. The vibration isolator joint 39 is connected with the transmission shaft 7. An engine cylinder 53 is connected to the bottom of crankcase 47. A muffler 55 is connected to the rear of cylinder 53. An ignition plug 57 is attached to the cylinder 53 and actuated by an ignition coil 59 which is located in the vicinity of the circumference of magnet wheel 43 and generates electric power in response to magnets (not shown) embedded in the periphery of magnet wheel 43. The magnet wheel 43 is provided with a plurality of fins 61 for generating airflow. The torque of engine 1 is transmitted to the rotary blade 11 via the transmission shaft 7. An operator grips with his hands the front and rear handles 29 and 31 and cuts weeds with the rotary blade 11.

As shown in Fig. 4, the rear handle 31 is hollow, and the hollow portion forms a suction passage 63. An upper end of the passage 63 is open to the engine 1 to receive airflow generated by the fins 61. An lower end of the passage 63 communicates with a suction chamber 65. An air filter 67 is disposed to cross the suction chamber 65. Due to this, airflow generated by the fins 61 enters into the upper end of passage 63 and into the chamber 65, passes through the air filter 67, and is sucked into the carburetor 49. A suction noise generated by the carburetor 49 is reduced during its propagation through the long passage 63 toward the fins 61 side.

As shown in Fig. 4 and also in Fig. 6, the periphery of air filter 67 is entirely held by the inner side of housing 3. According to this arrangement, a separate casing for the air filter 67 is not required so that the constitution inside the housing 3 may become simpler, and the size of air filter 67 may be allowed to be larger.

As shown in Figs. 4 and 6, the engine 1 is supported by the housing 3 through vibration isolators 69, 71, 73, and 75. The rubber vibration isolator 69 is sealingly disposed between the periphery of choke case 51 and an inner wall of an opening 77 located at the front end of suction chamber 65. The rubber vibration isolators 71 and 73 are received in receiver portions 79 and 81 formed on the inner surface of the casing 3. The vibration isolators 71 and 73 receive projections 83 and 85 formed on the surface of crankcase 47. The rubber vibration isolator 75 is received in a receiver portion 87 formed on the inner surface of the casing 3. The vibration isolator 83 receives in turn a projection 89 formed on the bottom surface of cylinder 53.

Figure 5 shows further detail of the arrangement of engine 1. The crankcase 47 has a bearing portion 91 which supports the crank shaft 21 through bearings 93 and 95. A piston 97 is slidably enclosed in the cylinder 53 and connected through a piston rod 99 to a crank arm 101 which is fixed to the rear end of crank shaft 21. The carburetor 49 is connected to the rear of crankcase 47 through a reed valve 103 (Fig. 6). A centrifugal clutch 105 is disposed inside the clutch drum 41. Clutch shoes of the clutch 105 contact with the inner circumference of clutch drum 41 by centrifugal force applied on the clutch shoes due to the rotation of clutch 105. The clutch drum 41 may be made by synthetic resin, and may have a metallic friction ring fixed to the inner circumference thereof to contact with the clutch shoes of clutch 105. The clutch drum 41, centrifugal clutch 105, and magnet wheel 43 are fixed to the outer end of crank shaft 21 with a female screw cylinder 107. The transmission shaft 7 is supported inside the connection pipe 9 through a bearing 109 and a vibration isolator 111. A support cylinder 113 is held by the casing 3 at an front end thereof. One end of the connection pipe 9 is inserted into the support cylinder 113. The support cylinder 113 is provided with a notch 115 across which a fitting 117 is fixed. The fitting 117 is fastened by a bolt 119 to fix the connection pipe 9. A cap 121 is fitted such that it covers the fitting 117. The support cylinder 113 is provided with a projection 123 which engages with a notch 125 provided at the end of connection pipe 9 to prevent the rotation thereof.

The vibration isolator joint 39 which is one of features of the present invention will now be described with reference to Fig. 5. A boss 127 of the clutch drum 41 engages with the female screw cylinder 107 such that the clutch drum 41 is freely rotatable around the screw cylinder 107. An annular

member 131 is fixed to the clutch drum 41 of the centrifugal clutch 105. A vibration isolator 131 made of resilient material such as rubber is engaged removably into the annular member 131. A recess 133 formed on the periphery of vibration isolator 131 engages with a projection 135 formed on the inner surface of the annular member 129 to prevent the relative rotation between them. A metallic fitting cylinder 137 is fixed to the center of the vibration isolator 131. The fitting cylinder 137 is provided with a hole 139 having a rectangular cross section to receive a rectangular portion 141 located at one end of the transmission shaft 7.

According to the above arrangement, the torque of engine 1 is transmitted to the transmission shaft 7 through the centrifugal clutch 105, the clutch drum 41, and the vibration isolator joint 39 without propagating the vibration of engine to the transmission shaft 7 and connection pipe 9.

Figure 5 shows another feature of the present invention, in which an annular baffle 143 is fixed to the casing 3 to cover the front sides of the fins 61. The annular baffle 143 guides effectively airflow generated by the fins 61 toward the engine 1. There is further provided a guide plate 145 which is fixed to the housing 3 and extends in a space between the engine 1 and the housing 3 to separate the space. The guide plate 145 guides the airflow generated by the fins 61 effectively around the cylinder 53 to cool it. The annular baffle 143 may be fixed directly to the peripheries of the fins 61 instead of housing 3 such that it covers the front sides of the fins 61. According to the above arrangement, a part of airflow which tends to flow forward, hits the baffle 143 and is changed its flow direction to the engine 1 side and guided by the guide plate 145 to flow around the cylinder 53.

The recoil starter 45 will now be described with reference to Figs. 5 and 6. The recoil starter 45 is arranged around the bearing portion 91 with a proper gap between them. The recoil starter 45 has on its periphery a fitting portion 147 which engages with the housing 3 as well as having on its inner side face projections 149 which engage with the crankcase 47 to prevent the rotation of recoil starter 45. A reel 151 of the recoil starter 45 is rotated against the spring force of a spiral spring 153 by pulling a starter handle (not shown) fixed to an end of a starter string 155 which is wound around the reel 151. A pivotable nail 157 is arranged on the inner surface of the magnet wheel 43 and pushed by a spring 159 against a ratchet 161 provided on the outer surface of the reel 151. The reel 151 and the spiral spring 153 may solidly be made by synthetic resin.

According to the above arrangement, if the starter handle (not shown) is pulled to pull the starter string 155, the reel 151 is rotated to engage the ratchet 161 with the nail portion 157 to rotate the magnet wheel 43. Accordingly, the crank shaft 21 which is fixed to the magnet wheel 43 is rotated to start the engine 1. After that, the nail portion 157 is pushed away by the ratchet 161 to release the engagement between them, and this released state is maintained due to the centrifugal force. If the speed of engine 1 is increased to a predetermined value, the centrifugal clutch 105 is engaged with the clutch drum 41 to transmit torque to the transmission shaft 7 via the vibration isolator joint 39. Since a gap is provided between the bearing portion 91 of crankcase 47 and the recoil starter 45, the heat and vibration of crankcase 47 is not transferred to the recoil starter 45.

Figure 7 shows that the vibration isolators 69, 71, 73, and 75 shown in Figs. 4 and 6 are located such that the gravity center of the reciprocate portions of engine 1, i.e., the gravity center of the piston 97 and piston rod 99, moves always within a space defined by the positions of the vibration isolators 69, 71, 73, and 75. Due to this arrangement, vibration is effectively prevented.

Claims

1. A portable engine unit comprising:

an engine (1) including a clutch (41) a crankcase (47) enclosing a crank shaft (21), which is to be connected to an output shaft (7), an engine cylinder (53) having a piston (97) and a piston rod (21), a carburettor (40), an air filter (67), a recoil starter (45) and a muffler (55); and

a housing (3) for enclosing said engine (1), said housing (3) being dividable into two portions (15,17) along a vertical plane (19) including the axis of the output shaft (7),

characterized in that

the engine unit further comprises means (69, 71, 73, 75) for isolating the housing (3) from vibration caused by the engine (1) and the engine (1) is fitted via the vibration isolating means (69, 71, 73, 75) in the housing (3).

2. A portable engine unit as claimed in claim 1, wherein the vibration isolating means includes at least four members (69, 71, 73, 75), and reciprocating motion in the engine is performed with a polyhedral range defined by the at least four members (69, 71, 73, 75).

3. A portable engine unit as claimed in claim 1,

wherein two (71, 73) of the at least four members of vibration isolating means are provided on lateral opposite sides of the engine (1), one (75) is provided on the lower side of the engine, and another one (69) is provided on the rear side of the engine.

4. A portable engine unit as claimed in claim 1, wherein said clutch (41) comprises a clutch drum and a clutch shoe member which is connected with said crank shaft (21) and said engine unit comprising further a vibration isolator joint which comprises an annular member fixed on a side face of said clutch drum opposite to said crank case (21), said vibration isolator means (69, 71, 73, 75) being removably received in said annular member and a fitting member fixed to the center of said vibration isolator and on the output shaft (7) in and fixed to said fixing member.

5. A portable engine unit as claimed in claim 4, wherein said clutch drum being provided on one side face thereof opposite to said crankcase (47) with a plurality of projections, said vibration isolator having a plurality of holes which removably engage with said projections formed on said clutch drum, and said annular member not being provided in this case.

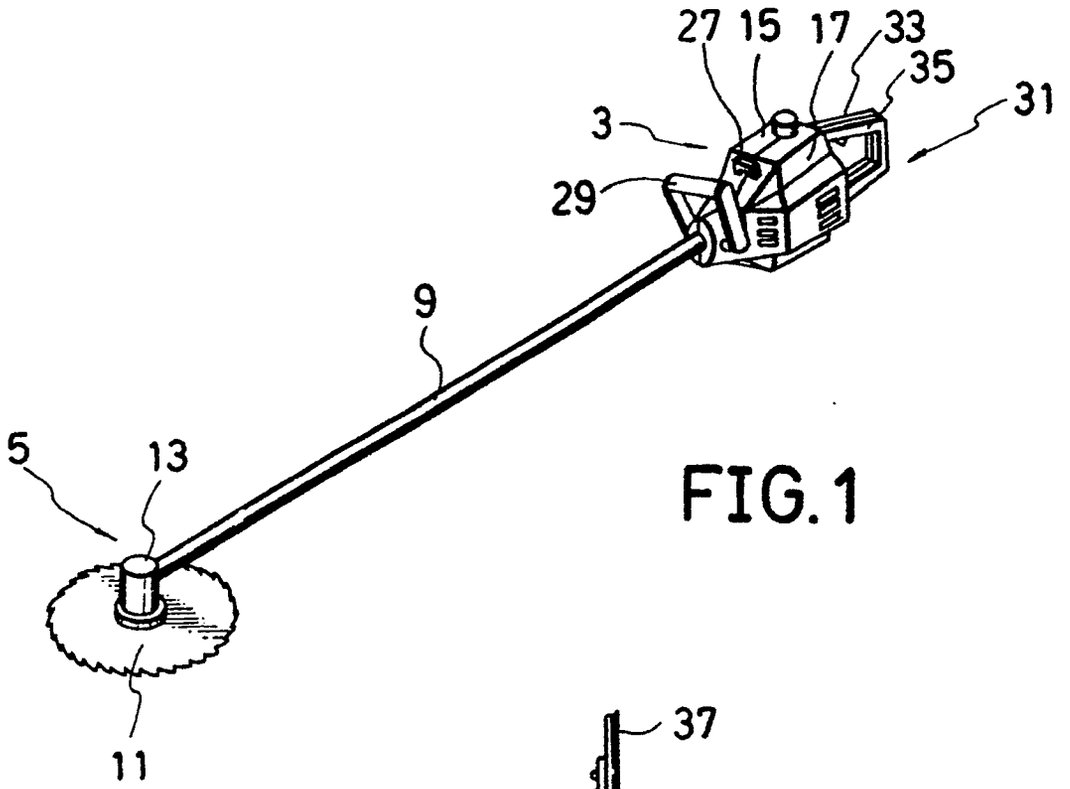

FIG.1

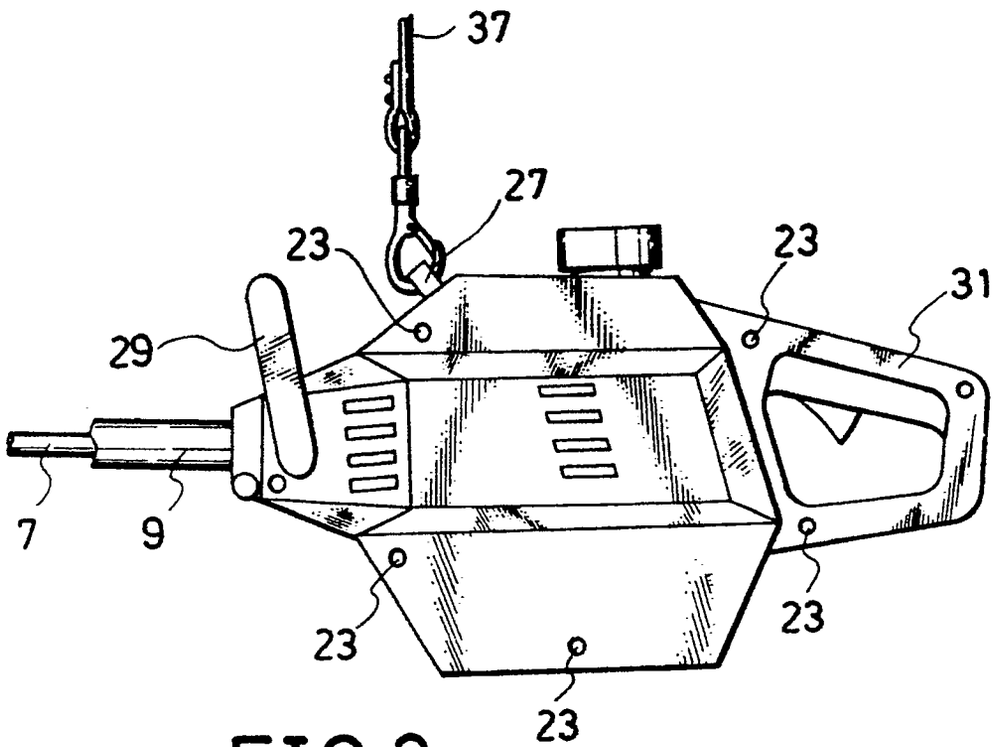

FIG.2

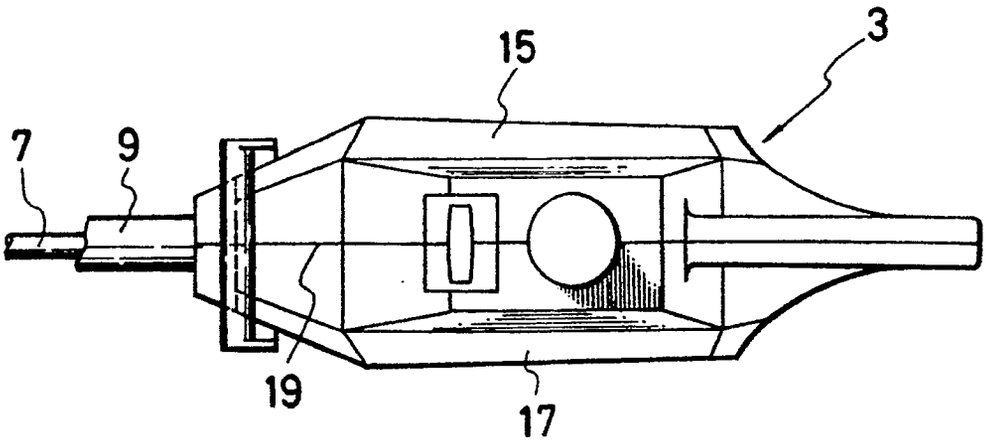
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FIG.3

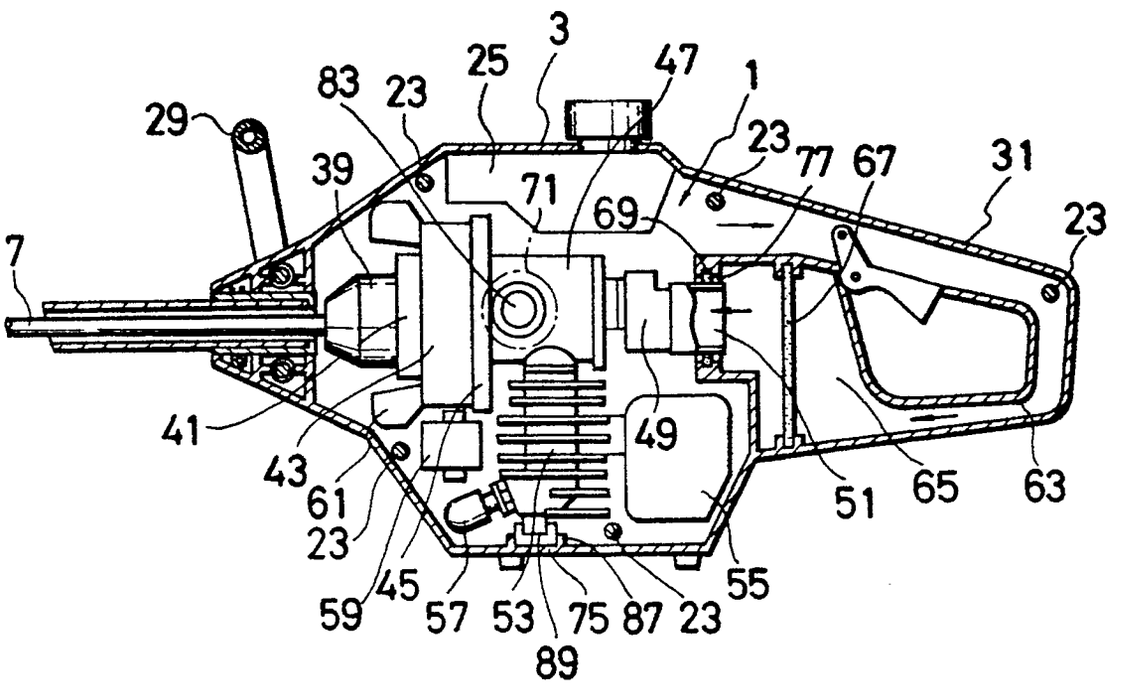
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FIG.4

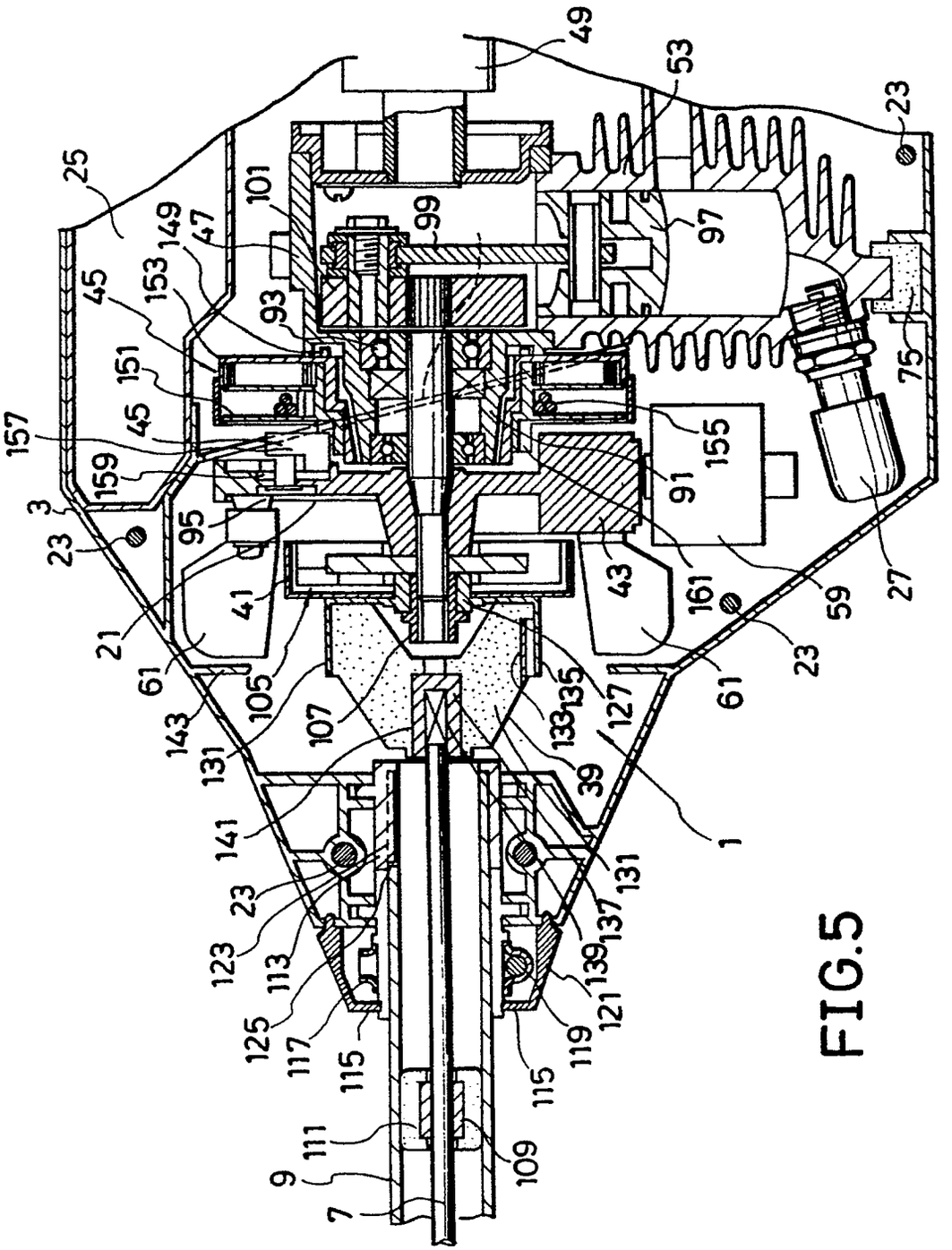
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FIG.5

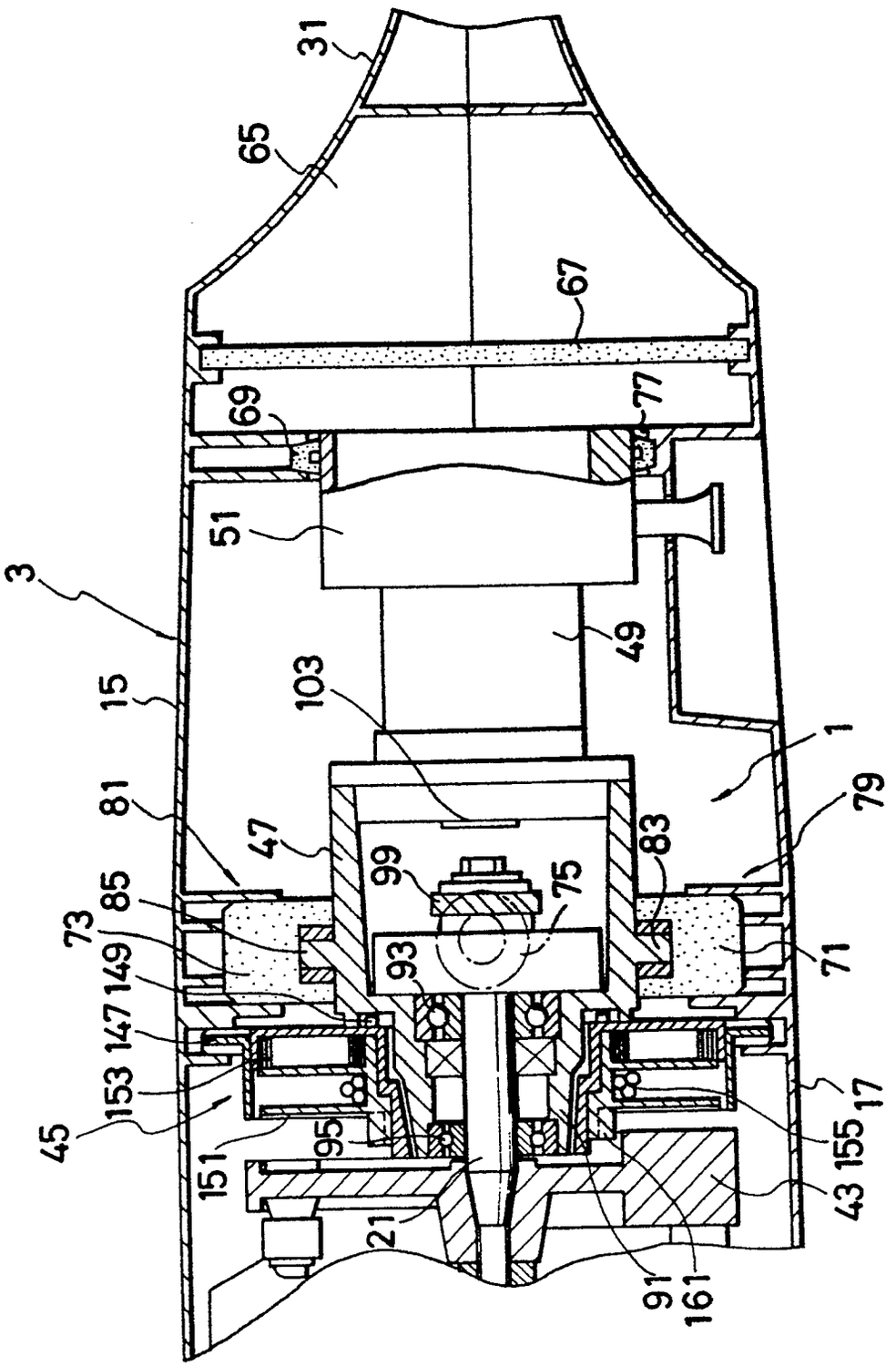
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FIG.6

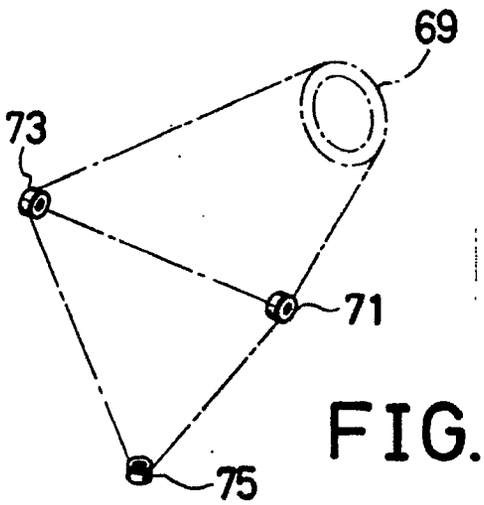

FIG.7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 12 5124

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	US-A-4 391 041 (PORTER-BENNETT) * column 3, line 22 - column 7, line 27; figures 1-7, 12, 13 *	1	F 02 B 63/02
A	GB-A-2 054 035 (BEAIRD-POULAN DIVISION OF EMERSON ELECTRIC) * page 2, line 124 - page 5, line 100; figures 1-5 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F 02 B
F 16 D

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
Berlin	08 March 91	NOVELLI B.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
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
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