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(54) **Apparatus for feeding fuel to a marine engine.**

(57) To avoid danger of fuel leakage into bilges of a vessel's hull, the fuel feed pipe (26) from the fuel supply to the vessel's engine cauburettor (40) is enclosed within a cylindrical casing (34) sealed at one end to a fitting on the carburettor. At its other end the casing is sealed to an aperture (32) in the hull, the feed pipe extending externally of the hull between the aperture and a container (16) enclosing the fuel supply. Alternatively the casing is sealed at its other end directly to the container. The carburettor may have an annular fuel feed chamber (52) with adjustable fuel orifices connected to the feed pipe through scroll valve means (56) linked to the carburettor throttle valve.

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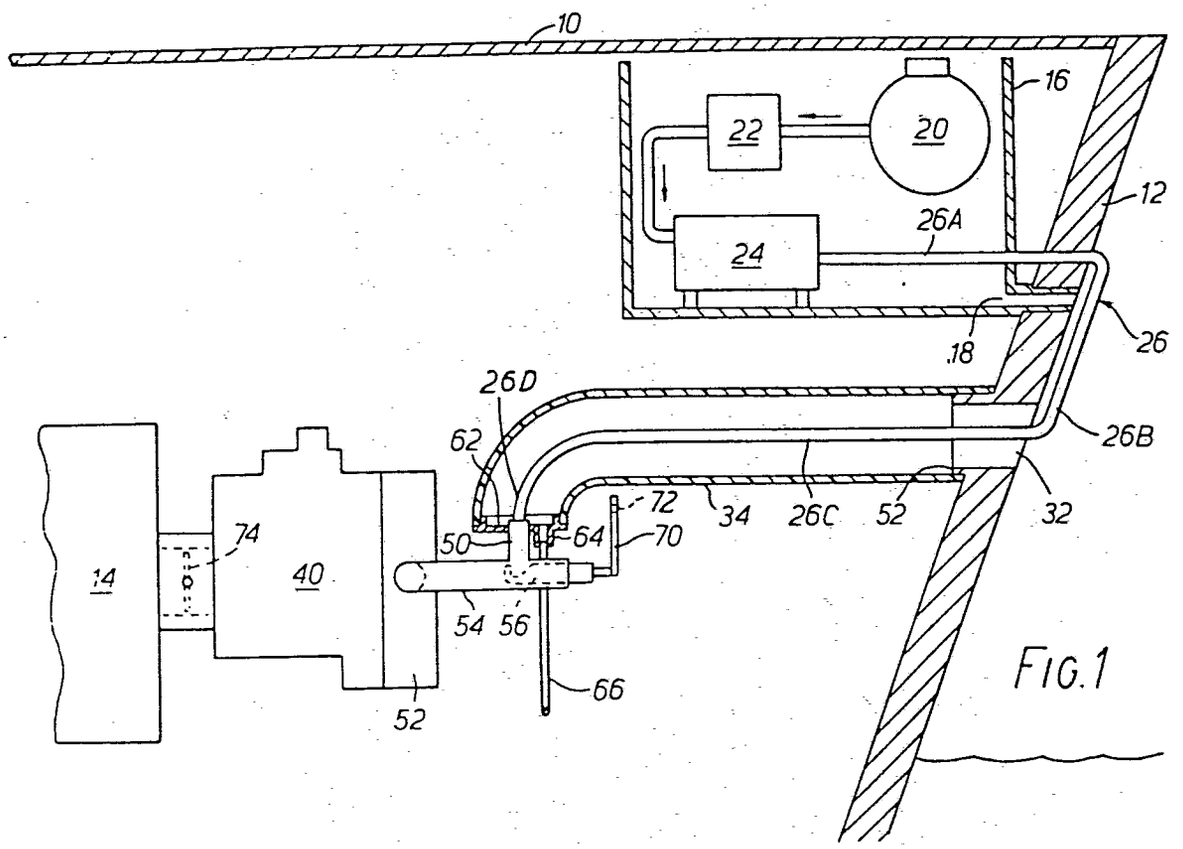
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FIG. 1

APPARATUS FOR FEEDING FUEL TO A MARINE ENGINE

This invention relates to apparatus for feeding fuel to an internal combustion marine engine.

There is a danger in vessels that fuel will collect in the bilges of the vessel if there is a slight leak. Such a collection of fuel, which may be gas or liquid, gives rise to a risk of explosion and if there is an explosion it may have disastrous consequences such as sinking the vessel or setting it on fire. An aim of the invention is to provide a reasonably inexpensive, yet safe and practical installation for feeding fuel to a marine engine, and for controlling the fuel feed.

According to the invention, there is provided apparatus for feeding fuel to marine engines which comprises a generally annular chamber having on its inner wall a series of peripherally-spaced orifices, a conduit connected to the annular chamber, a branch pipe secured to the conduit, and a helical rotary scroll valve member located in the conduit to obturate an adjustable proportion of the branch pipe opening dependent upon the rotational position of

the scroll valve member, and a radial lever connected to the valve member.

In accordance with one embodiment of the present invention there is provided apparatus for feeding fuel to a marine engine including a fuel feed pipe leading from a fuel storage container to a fuel intake of a carburettor, the pipe having one portion which is outside the hull of the vessel and a further portion which is inside the hull of the vessel, the apparatus also including a tubular gas or liquid-tight casing which surrounds the whole length of the said further portion of the feed pipe and extends to a fitting on the carburettor, the tubular casing at its end remote from the fitting being open to atmosphere.

With such an arrangement, the fitting is preferably constituted by the said branch pipe, the latter being directly connected to the said fuel feed pipe.

The radial lever may be operated in response to movement of the butterfly valve in the carburettor.

A drain pipe is preferably located between an inlet flange associated with the carburettor and the hull of the vessel above the waterline.

The invention may be applied to a horizontal air intake flow type carburettor, or to a downdraught carburettor.

The invention may be applied whether the fuel is liquid or gas; for example the fuel could be petrol, any liquid hydrocarbon fuel, or low pressure hydrocarbon gas.

The tubular casing may be at least partly of flexible material.

The invention will be better understood from the following non-limiting description of illustrative examples thereof, given with reference to the accompanying drawings in which:-

Figure 1 is a diagrammatic longitudinal section through a rear part of a vessel in which one example of apparatus according to the invention is installed;

Figure 2 is a perspective view of an annular chamber which forms part of the apparatus shown in Figure 1;

Figure 3 is a diagrammatic longitudinal cross-section through a rear part of a vessel in which a second example of apparatus according to the invention is installed;

Figures 4 and 5 are respectively front and side views of a flange included in the apparatus of Figure 3;

Figures 6 and 7 and 8 are views of one form of adaptor block, Figure 4 being a front view, Figure 5 being a side view, and Figure 6 being a partial cross section on the line A-A of Figure 4; and

Figure 9 is a side view of an example of the invention applied to a downdraught carburettor;

Figure 10 is a diagrammatic longitudinal cross-section through part of a vessel in which a fourth example of apparatus according to the invention is included;

Figures 11a and 11b are an axial vertical section and a front view of a flange included in the apparatus of Figure 1; and

Figure 12 is a rear view of a vessel embodying the example of the invention shown in Figure 10.

Referring to Figure 1, a marine vessel has a deck 10, a transom 12, and an internal combustion engine 14. The remainder of the vessel is conventional and so is not shown. A container 16 with an

open top has a drain hole 18 connected directly through the transom 12 to the outside. The illustrated vessel is intended to be propelled by LPG (liquefield petroleum gas) which is stored at high pressure and gasifies upon release of pressure. In the container 16 are a cylinder 20 of compressed LPG in liquid form, a fuel lock 22, and a liquid-to-gas converter 24. These are known items of equipment and therefore will not be described in detail. A gas feed pipe generally indicated at 26 extends from the converter 24 to a branch pipe 50. A first portion 26A of the pipe 26 passes through a wall of the container 16 and through the transom 12. A second portion 26B is outside the vessel. A third portion 26C passes through a hole 32 in the transom 12 and within a and through a tubular casing 34. A fourth portion 26D of the pipe 26 leads into the branch pipe 50.

The engine 14 is conventional and has a carburettor 40 of known design fixed thereto. An annular chamber 52 is secured to the carburettor 40 and has a conduit 54 projecting therefrom. This conduit serves as a valve body for a helical rotary scroll valve member 56 which obturates the whole of the orifice formed by the branch pipe 50 in the conduit 54 when in its closed position, and which, when rotated, progressively exposes more of this opening so allowing LPG to flow into the conduit 54 and thence into the hollow annular chamber 52. The latter is secured in a gas-tight manner to the carburettor 40 and the feed pipe 26D is secured in a gas-tight manner to the branch pipe 50. This coupling may for extra safety be located within the space enclosed by the tubular casing 34. The annular chamber has a series of peripherally spaced orifices 60, Figure 2, through which the fuel gas passes on its way to a combustion chamber of the engine 14. It may be bolted to the carburettor using bolt holes 61. The effective size of each of the orifices 60 is adjustable by means of an arcuate slide plate 160 located behind the wall 166 containing the orifices. The

slide plate 160 has a similar number of correspondingly sized and spaced orifices which can be brought into and out of strict register with the orifices 160 by sliding the slide plate. The slide plate is secured in any predetermined position by a screw 162 in the slide plate which extends through a slot 164 in the wall 166.

One end of the casing 34 is closed in a gas-tight manner by a flange 62, which has a small cup-shaped extension 64. The purpose of this cup-shaped extension is to collect any LPG which may have leaked within the casing 34 and conduct it away via a pipe 66 to the exterior of the vessel.

The valve member 56 has a boss on its outer end to which is securely fixed a radial lever 70. This has a hole 72 at its outer radial end to facilitate connection of a link or control cable (not shown) by which rotation of the lever about the axis of the scroll valve member 56, and hence rotation of the scroll valve member on be caused. The link or control cable referred to is attached to a suitable control mechanism so that when the carburettor butterfly valve 74 is opened the scroll valve member is rotated in an opening direction, and vice versa.

The tubular casing 34, which may be at least partly of a flexible material, for example a rubber or plastics bellows, is connected between the flange 62 and a flange 52 on the inner side of the transom and surrounding the hole 32. The connections are made at each end in such a way that LPG cannot leak therethrough. The flexible nature of the tubular casing 34 assists in ensuring that the integrity of these gas-tight connections is maintained even though there is relative vibration between the flange 62 (which vibrates with the engine) and the transom 12 of the vessel.

Referring now to Figures 3 - 8, a marine vessel has a deck 210, a transom 212, and an internal combustion engine 214. The remainder of the vessel is conventional and so is not shown. A container 216 with an open top and having a drain hole 218 connected directly through the transom 212 to the outside.

In the container 216 are a cylinder 220 of compressed LPG in liquid form, a fuel lock 222, and a liquid-to-gas converter 224. These are known items of equipment and therefore will not be described in detail. A gas feed pipe generally indicated at 226 extends from the converter 24 to an adaptor block 230. A first portion 226A of the pipe 226 passes through a wall of the container 216 and through the transom 212. A second portion 226B is outside the vessel. A third portion 226C passes through a hole 232 in the transom 212 and within and through a tubular casing 234. A fourth portion 226D of the pipe 226 passes through a flame trap 236 and the pipe 226 terminates at a suitable bore or fitting 230A (Fig. 6) in the adaptor block 230.

The engine 214 is conventional and has a carburettor 240 of known design fixed thereto. The adaptor block 230 is securely fixed, e.g. by bolts and suitable sealing washers, to the carburettor 240. The fixing is done in a gas-tight manner. The flame trap 236, which may also serve as an air cleaner, and which may consist of a casing or chamber having wire wool packing therein, is fixed in a gas-tight manner, to the adaptor block 230 in such a way that its interior is in communication with a central hole in the adaptor block, and, via said hole, with an air entry port of the carburettor 240. A flange member 250 is secured also in a gas-tight manner to another wall of the flame trap 236.

The tubular casing 234, which may be at least partly of a flexible material, for example a rubber or plastics bellows, is connected between the flange member 250 and a flange 252 on the inner side of the transom and surrounding the hole 232. The connections are made

at each end in such a way that LPG cannot leak therethrough. The flexible nature of the tubular casing 234 assists in ensuring that the integrity of these gas-tight connections is maintained even though there is relative vibration between the flange member (which vibrates with the engine) and the transom of the vessel.

The adaptor block 230 has a central hole 230E, Figure 6, and this serves as the air entry pathway for air sucked into the carburettor from outside the engine via holes in the flame trap 236. The gas feed pipe 226, surrounded over most of its length by the casing 234, is fixed to the fitting 230A of the block 230. From fitting 230A a bore 230B in the block extends to a fitting 230C. A rigid pipe 254 connects the fitting 230C with a fuel inlet port of the carburettor 240. The flange 252 is fixed in a gas-tight manner to the transom 212 and the casing 234. The adaptor block 230 has flanges 230F and holes 230G whereby it can be bolted to the carburettor 240. The block 230 may be made of aluminium alloy. The flange 252 and the flange member 250 could of course be replaced by other suitable fittings.

In a modified version of this embodiment of the invention, not illustrated, the separate adaptor block 230 and rigid pipe 254 are dispensed with, and the carburettor comprises a block containing its working parts and already provided with bores providing the passageway from the end of the fuel feed pipe to the fuel entry port of the carburettor.

It will be realised that the arrangements so far described offer the possibility of feeding fuel to the engine with improved safety in marine vessels without undue complexity or expense. Even if there should be a leak between the pipe 226D and the fitting 230A in the block 230, or from the pipe 26C in Figure 1, any escaping fuel cannot reach the bilges of the vessel but instead is conducted harmlessly to the exterior via the tubular casing 234 or via the pipe 66. Equally, any leak between or at the parts 20, 22, 24, 26A or their

counterparts in Figure 3 results in the fuel collecting in the bottom of the container from whence it passes harmlessly to the exterior via the drain hole 18 or 218. The supply of air to the carburettor is not impeded, and only relatively slight modification of a conventional vessel is needed.

In the embodiment of the invention illustrated in Figure 9, a downdraught carburettor 100 has an air intake at its top surface and carries thereon a flame trap 102, fixed for example by bolts 104. The air control butterfly is denoted by 105. A fuel inlet pipe 112 leads to a fuel control valve 108 and fuel flows therefrom into the body of the carburettor via a pipe 109. The engine inlet manifold is shown at 110. In accordance with this embodiment of the invention, the fuel feed pipe 112 is secured in a liquid- and gas-tight manner to the fuel control valve 108, using a flange 114 similar in essential function to the flange shown in Figure 3. A right angle bracket 116 is clamped between the flame trap 102 and the carburettor 100 and has a downwardly depending flange 118 with a hole through which passes a tubular casing 122. The tubular casing 122 is connected in a liquid- and gas-tight manner to the flange 114. The tubular casing 122 extends from the flange 114 to the transom (not shown in Fig. 9) of the vessel, in a similar way to the tubular casing 34 of Figure 1. The flange 114 (Figure 9) comprises a flat plate 130 having a cylindrical sleeve 132 extending therefrom. The end of the tubular casing 122 fits tightly around the sleeve 132. The plate 130 has a generally central hole 134 through which passes the pipe 112 which is thereupon directly connected and sealed to the valve 108. The flange 114 also has a smaller, offset hole 136 therein which extends to an aperture surrounded by a short external cylindrical sleeve 138. A drain pipe 140 is sealed to this sleeve 138 and extends, for example laterally of the vessel at a point above the waterline. With such an arrangement, any fuel which leaks from the fuel feed pipe 112 is prevented from descending into the bilges of the boat but instead passes to atmosphere through the drain pipe 140. In this

way, the likelihood of an explosion through escape of gas or liquid fuel is reduced virtually to zero.

Figure 10 depicts a vessel including apparatus according to the invention which is slightly modified compared to Figure 1 and 3. In Figures 1 and 10, like parts bear like reference numerals. The container 16 has a drain hole 300 leading to an exit hole 302 in the transom 12. The tubular casing 34 has a bend therein, and terminates in a flange 50 whose construction can readily be seen from Figures 11a and 11b. A drain pipe 304 leads from the flange 50 to the exterior of the hull of the vessel, above the waterline. With this arrangement, any leakage of fuel whether gas or liquid is conducted to the exterior either via the exit hole 302 or the drain pipe 304, and cannot enter the bilges of the vessel.

Figure 12 illustrates a vessel incorporating the example of the invention shown in Figure 10 seen looking forward. The vessel has a hull 10, a transom 12, a rudder 202, rudder pintles 204, an engine 14 (supported on structural members 14a), and a carburettor 40. A tubular casing 34 extends from a container 16 to a flange 50. The drain pipe 304 extends from the flange 50, laterally of the vessel, to an outlet 142 located above the waterline.

WHAT IS CLAIMED IS:-

1. Apparatus for feeding fuel to a marine engine comprising a generally annular chamber locatable between a fuel feed pipe and the engine carburettor, said chamber having an inner wall provided with a series of peripherally spaced orifices, a conduit connected to the annular chamber, a branch pipe secured to the conduit, and a helical rotary scroll valve member located in the conduit to obturate an adjustable proportion of the branch pipe opening dependent upon the rotational position of the scroll valve member, and a radial lever connected to the valve member.

2. Apparatus according to claim 1 wherein the radial lever is linked to a throttle valve in the carburettor for movement therewith.

3. Apparatus according to claim 1 or 2 wherein means are provided for adjustment of the effective area of said chamber orifices, said adjustment means comprising a slide plate having further orifices corresponding to said chamber orifices, and moveable to bring the chamber orifices and further orifices into and out of strict register, and means for clamping said slide plate in any predetermined position within its range of movement.

4. Apparatus according to any of claims 1-3 wherein said branch pipe is connected to a fuel feed line which is enclosed within a casing which is sealed at one end to a flange sealed around the branch pipe and is sealed at the other end, to an orifice extending through a vessel hull containing the marine engine.

5. Apparatus for feeding fuel to a marine engine of a vessel and including a fuel feed pipe leading from a fuel storage container to a fuel intake of a carburettor of said engine, said pipe having a portion which is external of the hull of the vessel and a portion which is internal of the hull of the vessel; and further including an elongated fluid-tight casing surrounding the said internal portion of said pipe and sealingly connected at one end to a fitting on said carburettor, the

other end of said casing being open to atmosphere externally of the vessel hull.

6. Apparatus according to claim 5 wherein said fitting is provided with a drain leading externally of the hull.

7. Apparatus according to claim 5 or 6 wherein said fitting is a flange mounted on a branch pipe of a conduit containing fuel feed valve means to said carburettor.

8. Apparatus according to claim 5, 6, or 7 wherein said fitting is a flange mounted on said carburettor.

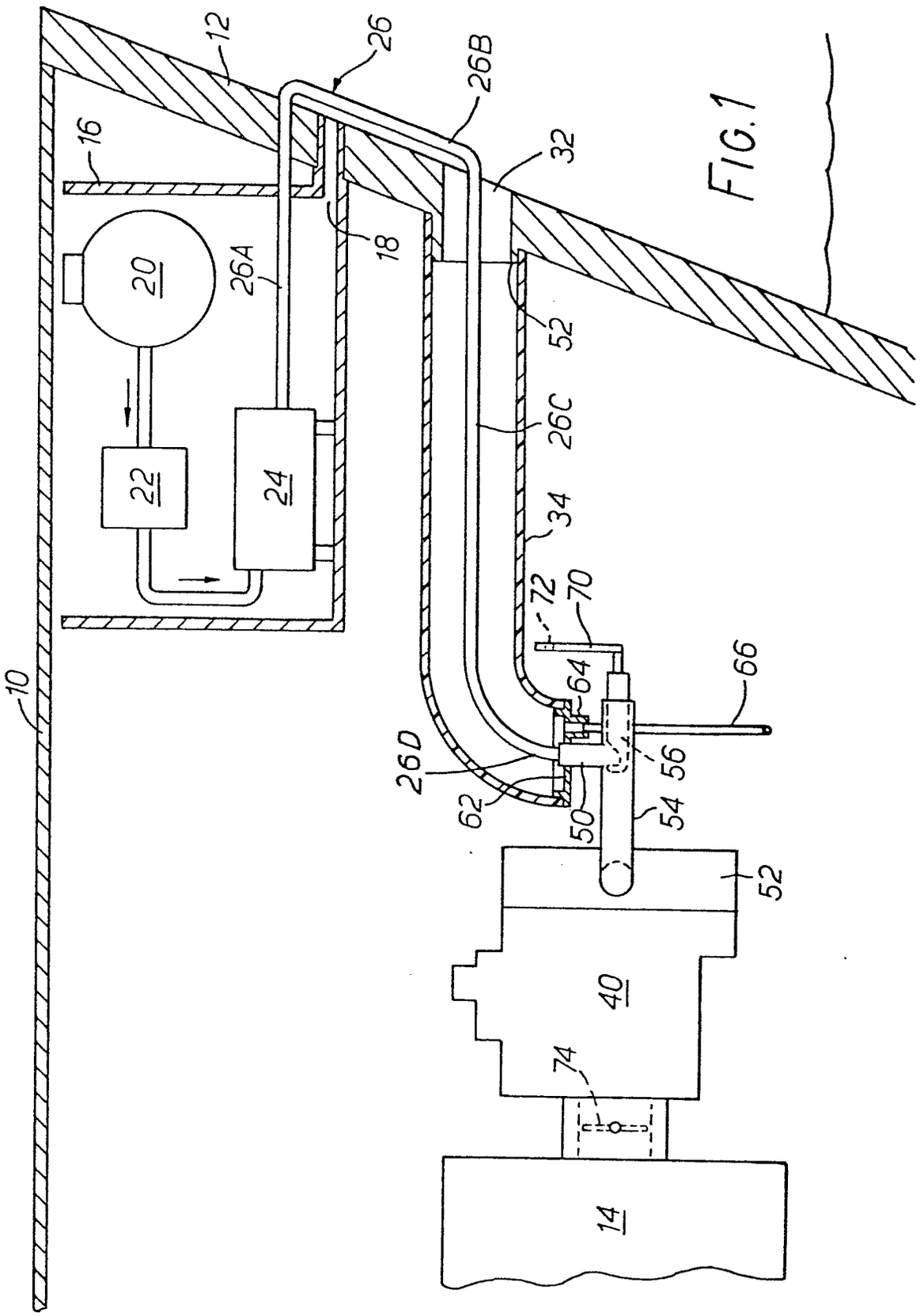
9. Apparatus according to claim 5, 6, or 7 wherein said fitting is a flange mounted on a flame trap on said carburettor.

10. Apparatus according to any of claims 5-9, wherein said fuel storage container is located within an outer container having a drain pipe extending to the exterior of the hull.

11. Apparatus for feeding fuel to a marine engine of a vessel and including a fuel feed pipe leading from a fuel storage container within an outer container to a fuel intake of a carburettor of said engine, and an elongated fluid-tight casing surrounding said feed pipe and having one end sealingly connected to a fitting on said carburettor and the other end sealingly connected to said outer container.

12. Apparatus according to claim 11 wherein drain pipes extend from said fitting and said outer container externally of the hull of said vessel.

13. Apparatus according to claim 11 or 12 wherein said fitting is secured to a flame trap of said carburettor.


12
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26B
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32
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26A
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FIG. 1

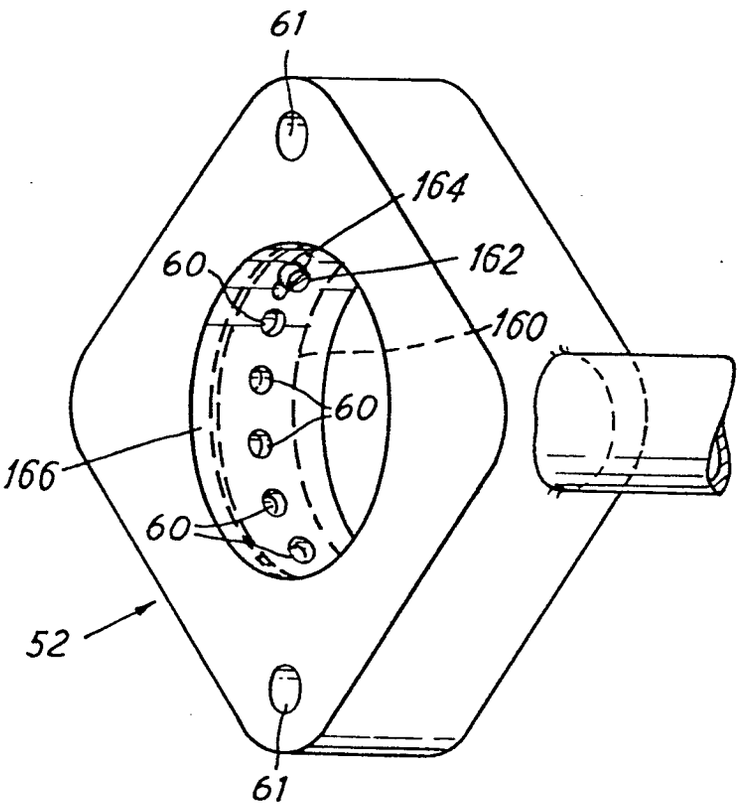

FIG. 2

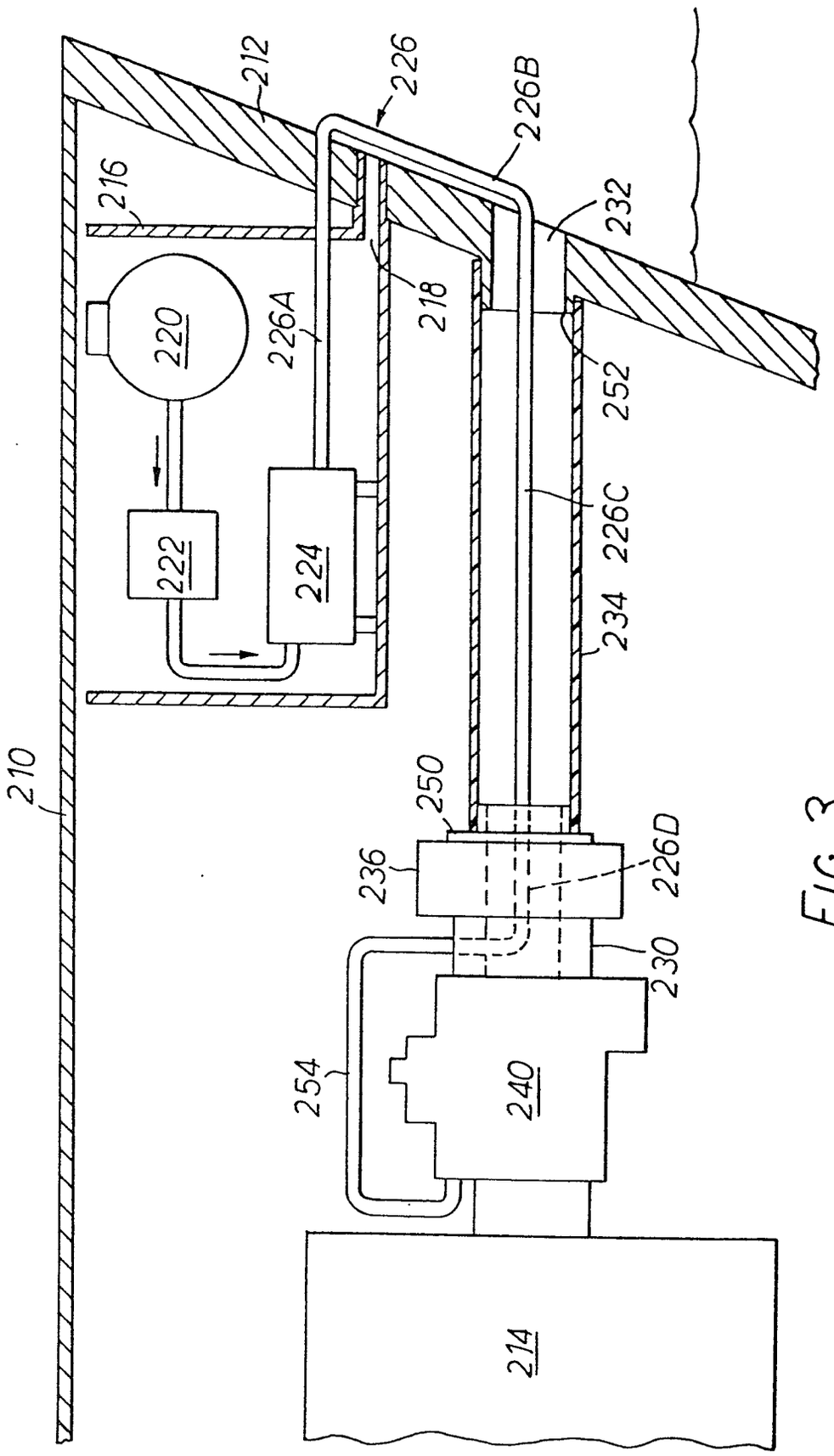
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FIG. 3

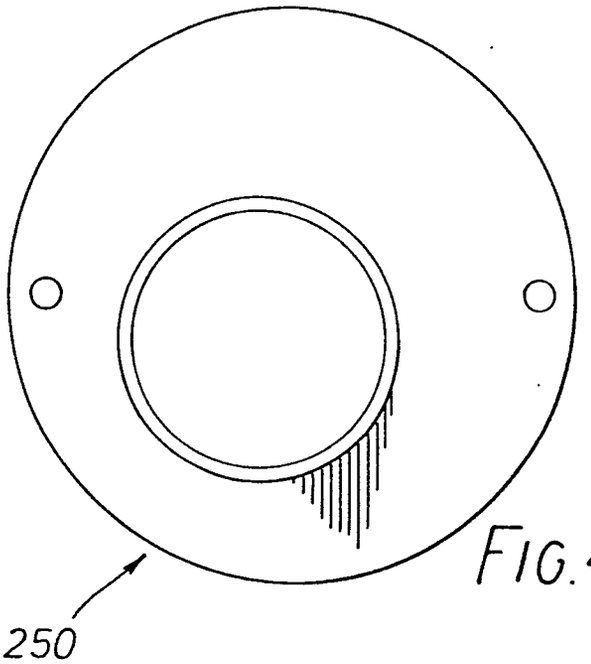


FIG.4

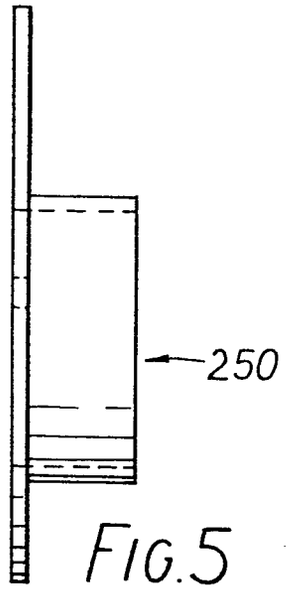


FIG.5

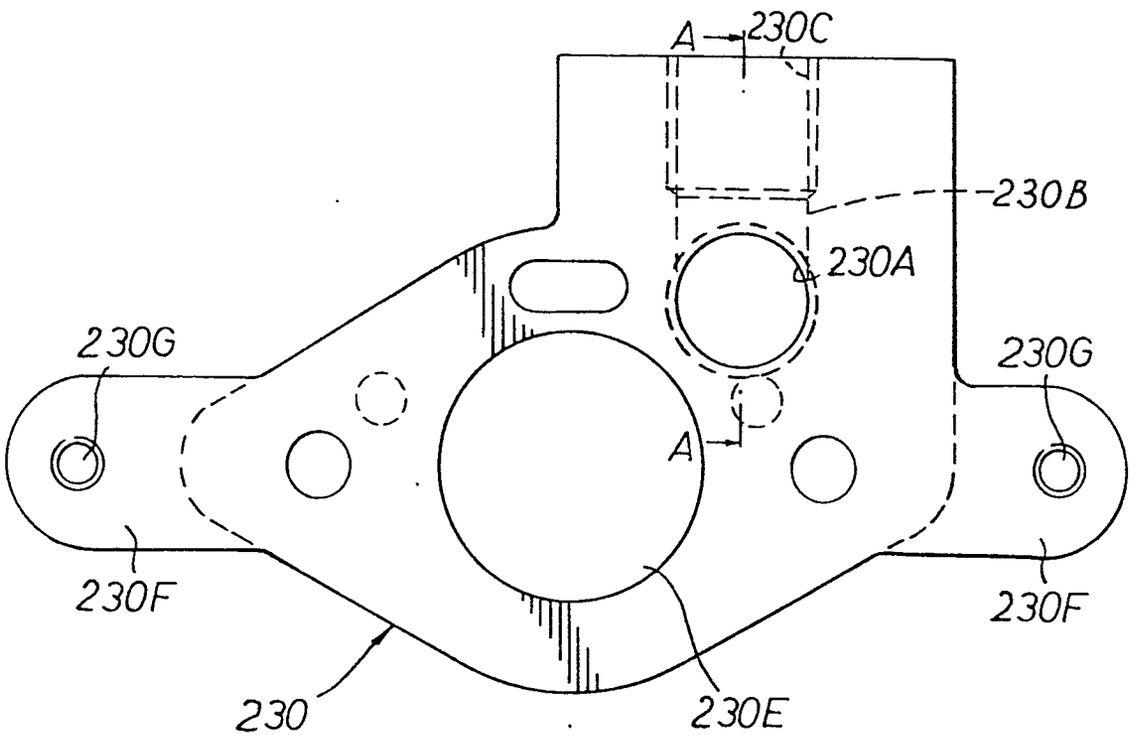


FIG.6

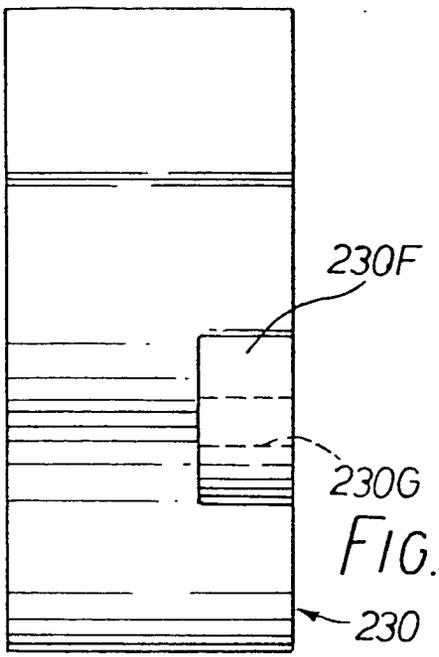


FIG. 7

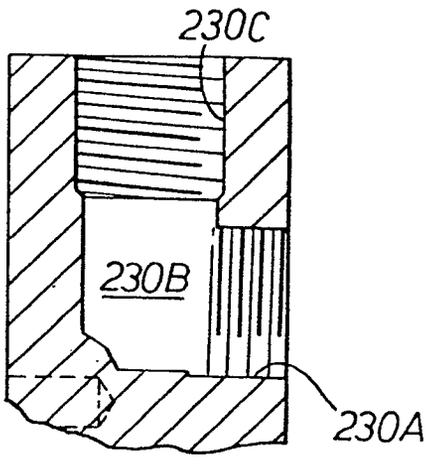


FIG. 8

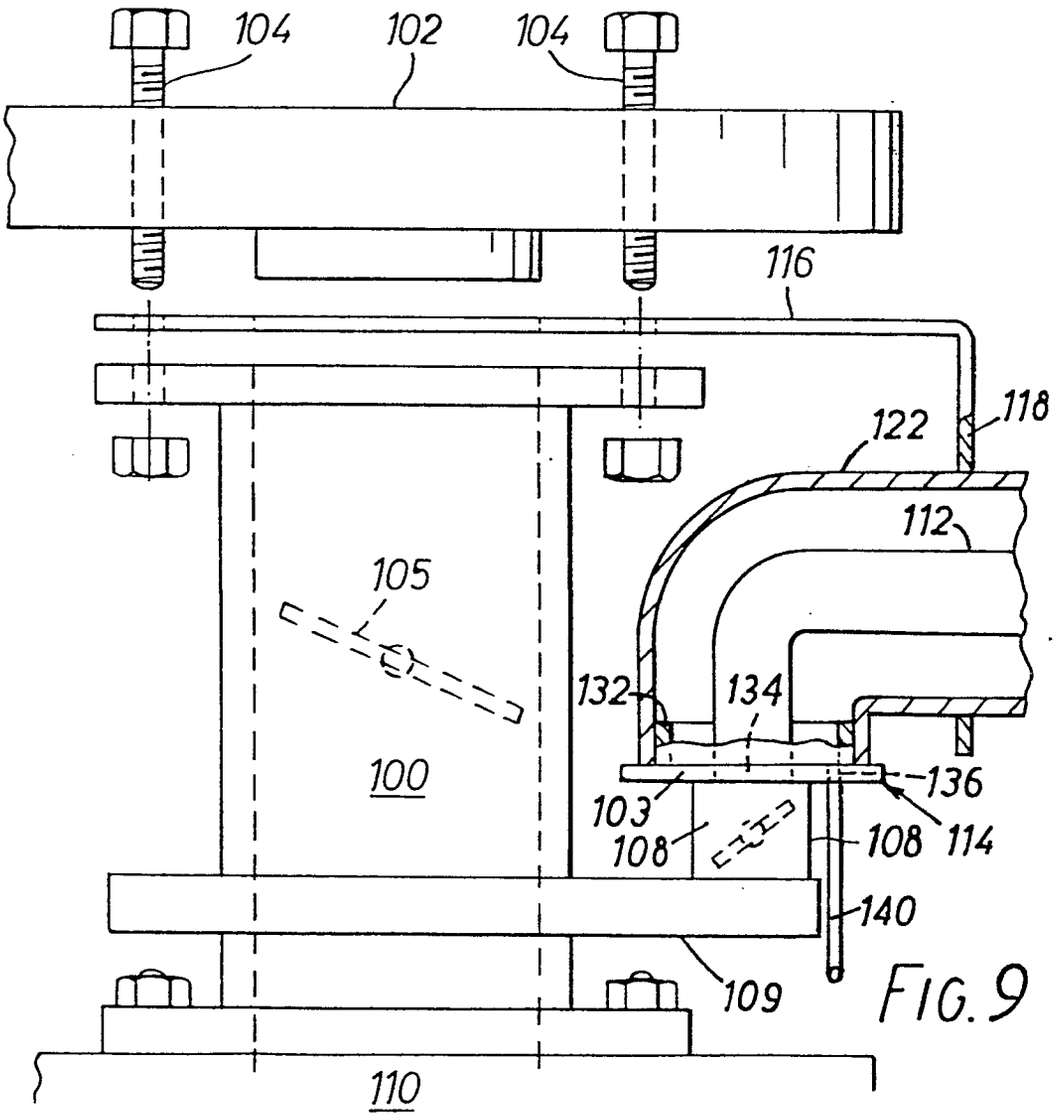


FIG. 9

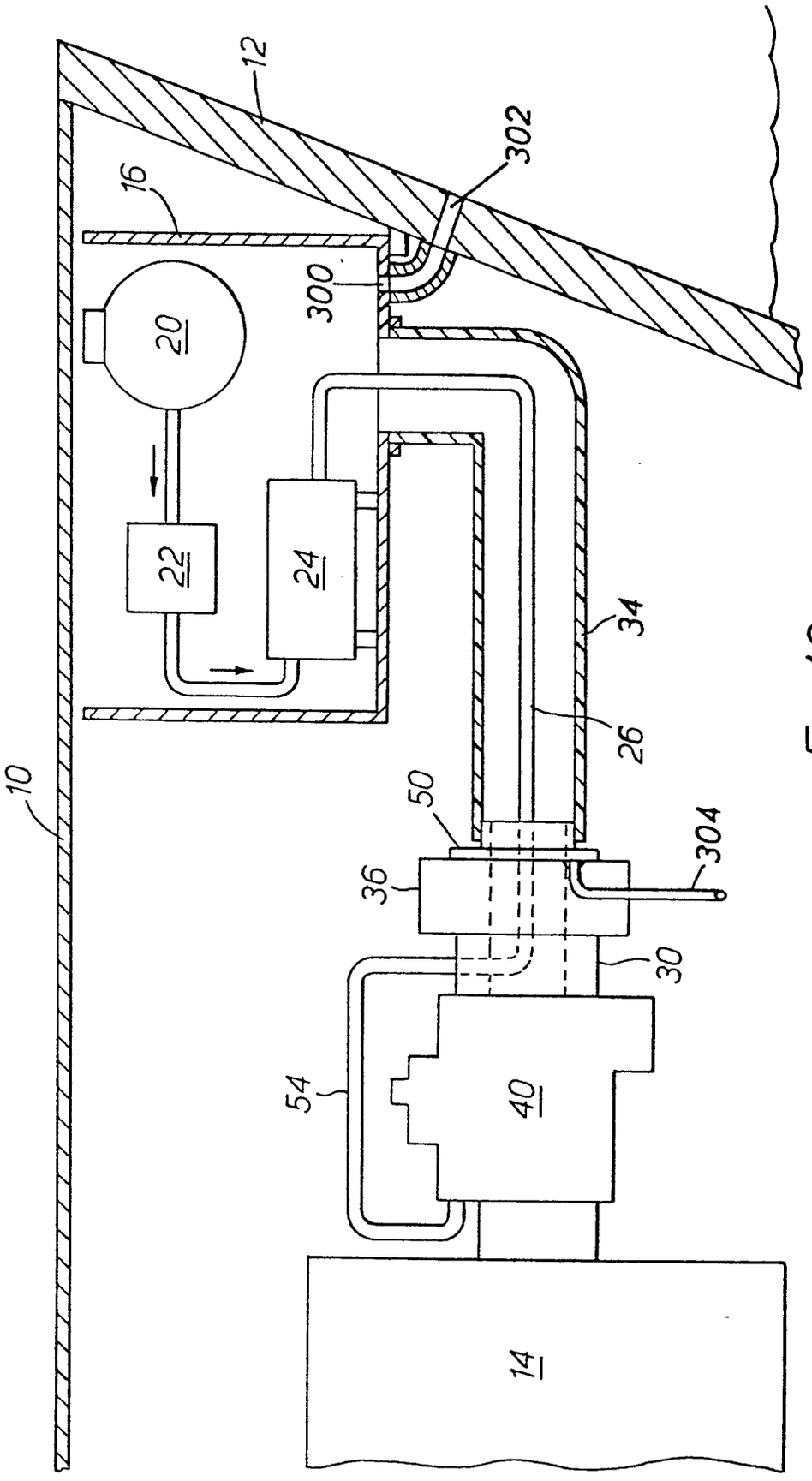


FIG.10

FIG. 11a

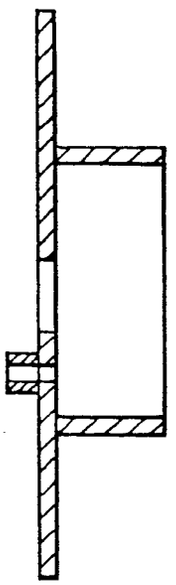


FIG. 11b

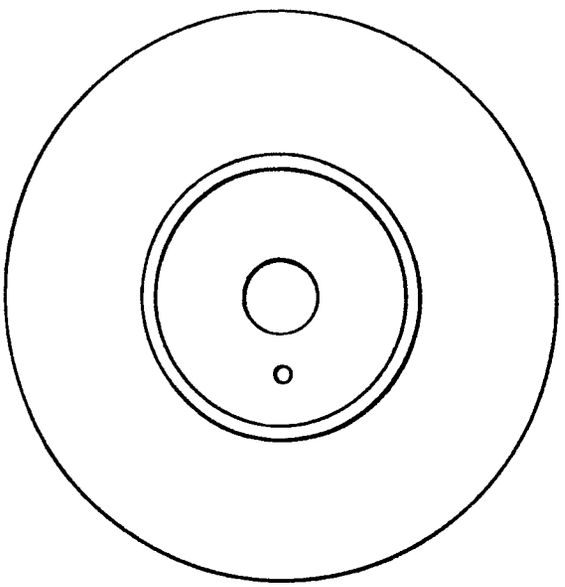
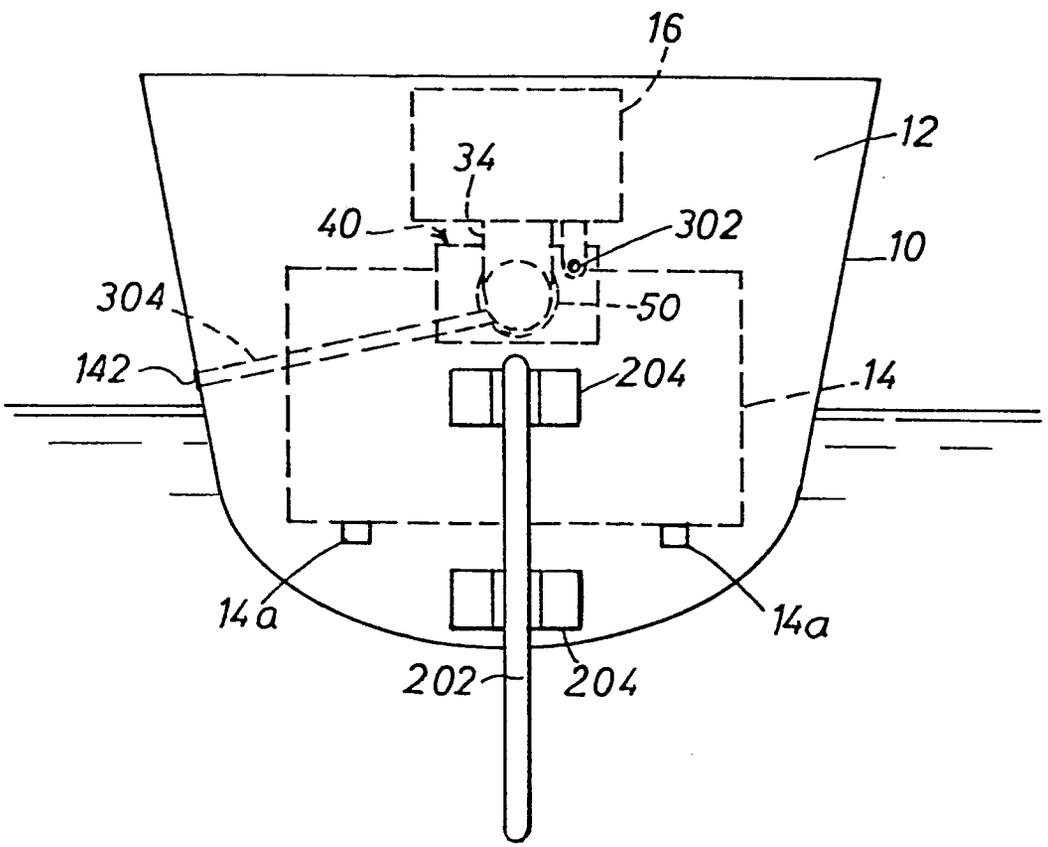


FIG. 12



European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 80 30 2508.9

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	US - A - 2 939 776 (H.W. McCLAIN) * column 1, line 40 to column 2, line 40 *	1
	FR - A - 2 091 212 (D. COSTRIN et al.) * fig. 5 *	2
	DE - C - 130 981 (WESTINGHOUSE MACHINE CO.) * page 1 to page 2, paragraph 1; fig. 1 *	3
A	DE - A - 2 260 531 (REGIE NATIONALE DES USINES RENAULT et al.) * fig. 1, 3 *	
A	DE - B - 1 201 252 (GARRETT CORP.) * fig. 1, 2 *	
A	DE - C - 725 393 (AEG) * whole document *	
A	DD - A - 103 719 (EDELEANU GMBH) * fig. 1 *	
A,P	US - A - 4 185 579 (N.F. ASHER) * abstract *	

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

F 02 B 77/08
F 02 M 37/00

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

A 62 C 3/00
B 63 H 21/00
F 01 B 25/00
F 02 B 77/00
F 02 M 21/00
F 02 M 37/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	16-01-1981	STÖCKLE