United States Patent [19]

Brazier

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[54] **BAILING DEVICES**

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[52] **U.S. Cl.** **114/185**

[51] **Int. Cl.**[2] **B63B 13/00**

[58] **Field of Search** ..... 114/183 R, 183 A, 184, 114/185

[56] **References Cited**

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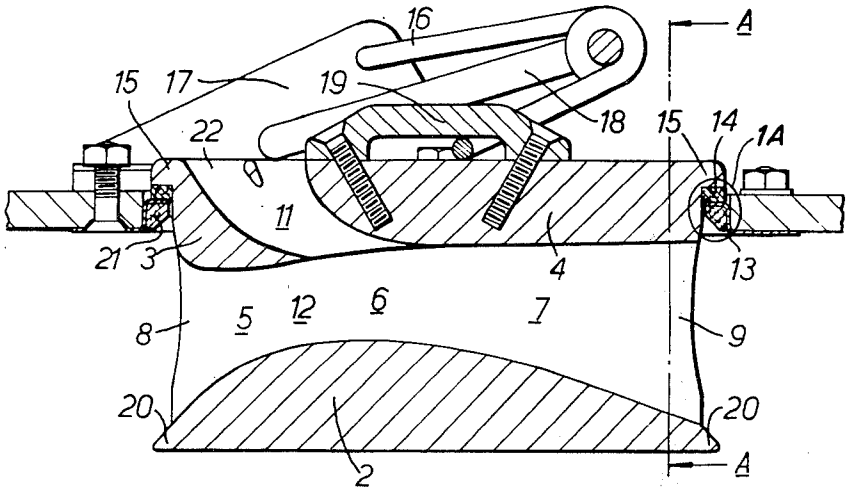
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[57] **ABSTRACT**

A bailing device for a dinghy comprises a duct having a convergent inlet section, a divergent outlet section, and a low pressure zone. A passage extends between the low pressure zone and the interior of the hull of the dinghy. The device projects downwardly from the hull with the axis of the duct extending fore and aft of the hull. Flow of water thru the duct during movement of the dinghy creates a pressure drop in the low pressure zone whereby water is drawn thru the passage from the hull.

1 Claim, 4 Drawing Figures



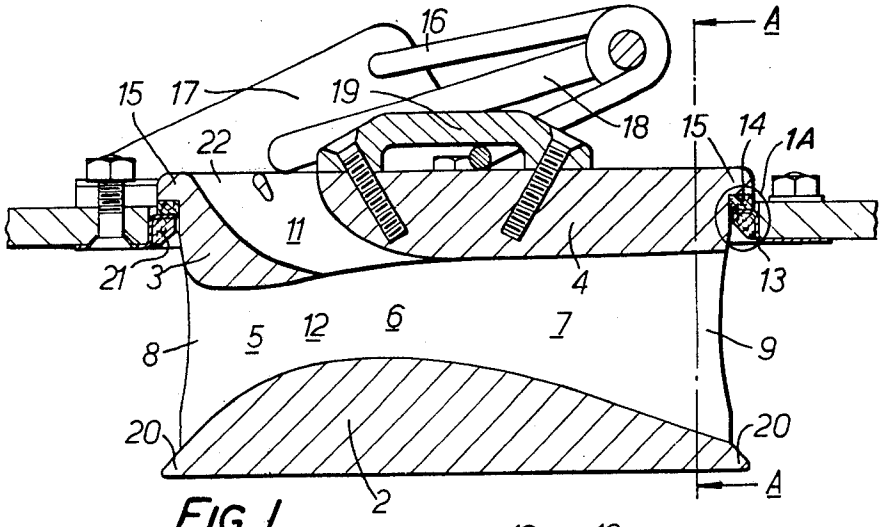


FIG. 1.

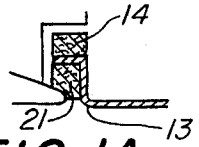


FIG. 1A.

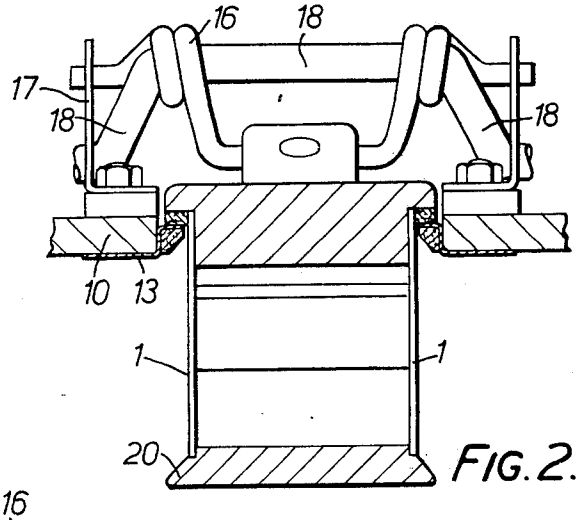


FIG. 2.

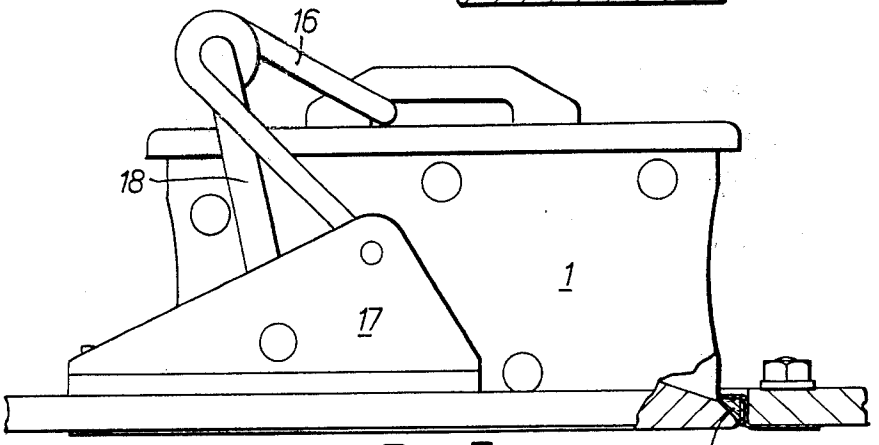


FIG. 3.

BAILING DEVICES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to pumping devices and more particularly to bailing devices for use with sailing dinghies and other small vessels.

2. Description of the Prior Art

One previously proposed bailing device for use with dinghies, particularly racing dinghies, comprises a rearwardly inclined flap depending from the hull of the dinghy with a passage extending from the trailing edge of the flap to the interior of the hull. During movement of the dinghy, the pressure-drop created as the water flows along the surface of the flap causes water to be withdrawn from the interior of the hull through the passage. As will be apparent, the bailing device will only operate in this manner when the pressure-drop (expressed as a head of water) across the flap is in excess of the draught of the dinghy, that is when the speed of the dinghy exceeds a predetermined minimum speed. In the previously proposed device, this minimum speed is relatively high. Further, the flap exerts a relatively high drag.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a bailing device for a dinghy or other vessel comprising a duct having a convergent inlet section and a divergent outlet section, means for mounting the duct on the hull of the vessel such that the duct lies in the water, with the axis of the duct lying fore and aft of the hull, and means defining a passage arranged to extend between the interior of the hull and a low pressure zone within the duct.

Further according to the present invention, there is provided a vessel having a bailing device mounted on its hull, the bailing device comprising a duct extending longitudinally of the hull, the duct having a convergent inlet section, a divergent outlet section, and a throat section between the inlet and outlet sections, the inlet section being located in front of the outlet section in the normal direction of movement of the vessel, and a passage extending between the interior of the hull and the interior of the duct at or adjacent the throat section.

BRIEF DESCRIPTION OF THE DRAWING

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings in which:

FIG. **1** is a longitudinal section of a bailing device in accordance with the invention, the device being shown in its normal operating position;

FIG. **1A** is a view taken from FIG. **1.**

FIG. **2** is a section taken on line AA of FIG. **1**; and

FIG. **3** is a side elevation showing the device in its retracted position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in the drawings, the bailing device comprises a rectangular-sectioned duct defined by a pair of opposed, parallel side walls or plates **1**, and a bottom member **2**. A member **3** is mounted in the front end portion of the duct between the side plates **1**; the shape

of the lower face of member **3** is such that the passage defined between member **3**, member **2** and the side plates **1** is a convergent flow passage. The lower edge of the member **3** in the direction at right angles to the side plates, is parallel to, and spaced from, the bottom member **2.** Although as described above, the duct is of rectangular section, it can alternatively be of axisymmetrical form.

A member **4** is mounted within the duct behind the member **3** and has a convex leading edge portion which is spaced from the rear surface of the member **3**, and a plane under surface which faces the upper surface of the member **2** and which is inclined with respect to the member **2.**

The member **3** and the member **4** define together with the lower portions of the side plates **1** and the bottom member **2**, a passage having a convergent section **5**, a mixing section **6**, and a divergent section **7.** As can be seen from FIG. **1**, the convergent section **5** lies beneath the curved portion of the member **3**, the mixing section **6** lies beneath the convex leading edge portion of the member **4**, and the divergent section **7** lies beneath the inclined under surface of the member **4.** The passage has an inlet **8** and an outlet **9.** The members **2,3** and **4** can be formed from a plastics material and the other components of the device can be formed from stainless steel. The bailing device is mounted on the hull **10** of a dinghy such that the passage lies beneath the underside of the hull with the inlet **8** and the outlet **9** lying respectively fore and aft along the longitudinal axis of the hull **10.** A passage **11** which provides communication between the mixing section **6** and the interior of the hull **10** is defined between the member **3** and the leading edge portion of the member **4.** Preferably, in the operating position of the device the bottom member **2** is inclined downwardly relatively to the axis of the hull, in a rearwards direction by a relatively small angle, for example up to about 5°. During forwards movement of the dinghy, water enters the inlet **8** and is accelerated in the convergent section **5;** this flow of water will be termed the "primary" flow. The acceleration causes a decrease in the fluid pressure so that the pressure in the section adjacent the trailing edge portion of the member **3** which constitutes a throat section **12** is less than the pressure at the inlet **8.** If the pressure of water within the hull is less than that at the throat section **12,** the water within the hull will be drawn from the hull through the passage **11**; this flow of water will be termed the "secondary flow". The secondary flow is mixed with the primary flow in the mixing section **6** and the combined flow passes through the divergent section **7**; the combined flow is decelerated which results in recovery of the pressure, the flow being discharged through the outlet **9.**

The flow area at the throat section **12** determines the pressure at the throat section **12** and hence the suction pressure. As the area at the throat section **12** is decreased, the acceleration of the primary flow is increased and the pressure at the throat section **12** is decreased. However, with increasing flow velocities and a decreasing distance between the member **3** and the bottom member **2,** the friction losses increase. As a result, there is an optimum ratio between the area of the throat section **12** and the area of the inlet **8,** the ratio being between about 0.3 and 0.5. With this optimum ratio, the bailing device is effective at relatively low speeds or with a dinghy of considerable draught.

As will be apparent however, it is also desirable that the volumetric pumping capacity of the bailing device be relatively high. This characteristic is influenced by the shape of the mixing section **6** and of the passage **11.** For this purpose the passage **11** should be relatively large and should discharge the secondary flow in a direction parallel to the primary flow for which purpose the downstream end portion of the passage **11** extends parallel to the axis of the duct. This arrangement results in flow losses which increase the suction pressure. The device shown in FIG. **1** is a compromise between the two requirements.

The mixing of the primary and secondary flows occurs in the mixing section **6** in which the low velocity secondary flow is accelerated by the high velocity primary flow issuing from the throat section **12.** The mixing section should be of such a length that the secondary flow has been accelerated at least to some degree before entering the divergent section **7.** The mixing section can, however, be omitted if it is necessary to reduce the axial length of the device.

The divergent section **7** is, in effect, a conventional diffuser. Generally the angle of divergence should be less than about 20° since otherwise the flow will spearate from the walls of the passage and the required pressure recovery will not be achieved.

The difference between the pressure at the inlet **8** and the throat section **12** is termed the "suction head". As the pressure at the throat section **12** decreases the suction head increased.

In the bailing device, the suction head is proportional to the square of the velocity of the dinghy. Therefore, for a dinghy of given draught there is a minimum speed at which the device can operate. Below this speed the pressure at the throat section **12** is greater than the pressure at the inlet portion **22** of the passage **11,** in this event water will tend to flow into the hull **10.** To prevent such return flow, a non-return valve can be fitted in the passage **11.** A suitable non-return valve can comprise a deformable sleeve supported at its upstream end portion, the downstream end portion of the sleeve being free and opening during flow from the inlet section **22** to the throat section **12;** the downstream end portion of the sleeve closes upon flow in the reverse direction (whereby to prevent such flow). However due to the good low speed characteristics of the device, a non-return valve is not essential and has not been shown.

The device can be permanently mounted on the underside of the hull or can be retractable to enable the dinghy to be launched from a sandy or other shore. A retractable mounting will now be described.

In the operating or open position, the duct defined by the side plates **1** and the bottom member **2** projects through an aperture in a flange **13** which is mounted on the hull **10.** A neoprene or other gasket **14** makes a seal between the flange **13** and a lip **15** which extends around the top portion of the assembly formed by the member **3** and **4.** The device is held in this operating position by a lever **16** which is pivotal between two stop positions. This lever **16** pivots in side brackets **17** and presses on the top of member **4.** A downwards force on the lever **16** is maintained by a spring **18** which may be of rubber shockcord or other material.

To retract the device the lever **16** is pulled upwards and anti-clockwise from one stop position. This has two effects. The lever **16** exerts an upward force on a member **19** which is attached to the top of the device, so pulling the device upwards through the aperture in the flange **13.** Rotation of the lever **16** also initially extends the spring **18** so increasing its tension. When the device is about half way up the spring **18** exerts an anti-clockwise force on the lever **16** so causing the lever to rotate rapidly anti-clockwise into its other stop position so fully retracting the device. In this retracted position a lip **20** which extends around the lower member **2** seals on a neoprene or other gasket **21** which is bonded to the flange **13.** The lever **16** can then be rotated anti-clockwise by hand to the position shown in FIG. **3.** This 'locks' the device in the retracted position and exerts a compression force between the lip **20** and the gasket **21** sufficient to ensure a leak free joint. In the locked position the device can only be lowered to the operating position by rotating the lever **16** clockwise. Once started, however, the device 'springs' to the down or operating position. One advantage of the spring loaded lever **16** is that the device is either in the retracted or the operating position. It will not stay in an intermediate position where water can leak into the dinghy.

In its normal operating position as shown in FIGS. **1** and **2,** the axis of the primary flow passage extends generally parallel to the plane of the flange **13** and hull **10** and thus to the general direction of movement of the dinghy; the pressure difference between the inlet **8** and the outlet **9** is very small in this position. This pressure difference is determined by the disturbance to the external flow around the device. Due to this small pressure difference the drag exerted by the device is low.

In a modified form of the device (not shown) the bottom plate is omitted and the convergent-divergent passage is formed by two hollow, shaped, side members which extend vertically downwards. The secondary flow enters via a vertical slot in each side member, the slots being located at the throat section of the passage. A flow passage extends from the interior of the hull to the inside of the side member.

The omission of the bottom plate does not adversely affect the performance of the device to any significant degree and will be advantageous in situations where fouling is likely to occur due to accumulations of weeds and other matter in the water. In this case when the device is withdrawn into the hull so that the lower edges are flush with the underside of the hull, weeds or other matter which has collected on the device will be pushed from the device.

The bailing device particularly described is more effective at low speeds than the aforesaid previously proposed bailing device. The minimum operating speed of the device for a dinghy of draught 4 inches is about 1½ knots compared with about 3 knots for the previously proposed device and the device has negligible drag in its normal operating position; at speed of 5 knots this represents a reduction in drag of about 15 lb. force.

What is claimed is:

1. In a bailing device for a vessel,

a duct assembly defining a duct having a convergent inlet section, a divergent outlet section, and an intermediate low pressure zone, said duct assembly being located within an aperture in the underside of the hull of the vessel,

a mounting assembly mounting the duct assembly for movement between an operative position in which the duct is located outwardly of the hull with the axis of the duct lying fore and aft of the hull and an

inoperative position in which the duct is retracted within the hull, said mounting assembly comprising

mounting means secured in the interior of the hull, and

manually operable pivotal lever means linked to the mounting means and the duct assembly, said lever means being located in the interior of the hull and being pivotal from a first stop position in which the duct assembly is in its operative position and a second stop position in which the duct assembly is in its inoperative position, movement of the lever means between its stop positions serving to move the duct assembly between its operative and inoperative positions rectilinearly in a direction transverse to the axis of the duct assembly, and

passage means defined within the duct assembly and extending between the low pressure zone and the interior of the hull.

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