

March 23, 1943.

F. J. GRAY

2,314,698

MEANS FOR SUPPLYING AIR TO SUBMERGED SUBMARINES

Filed July 22, 1940

3 Sheets-Sheet 1

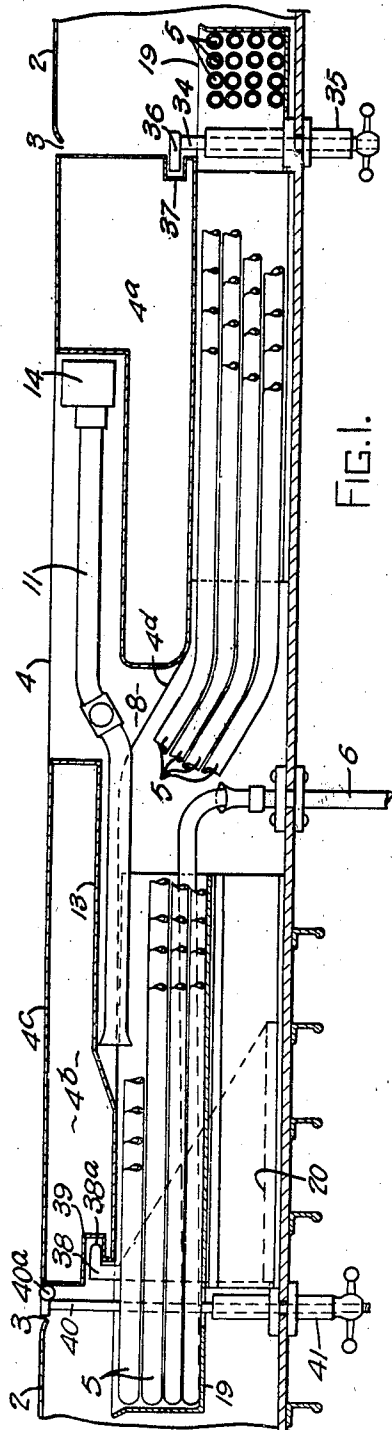


FIG. 1.

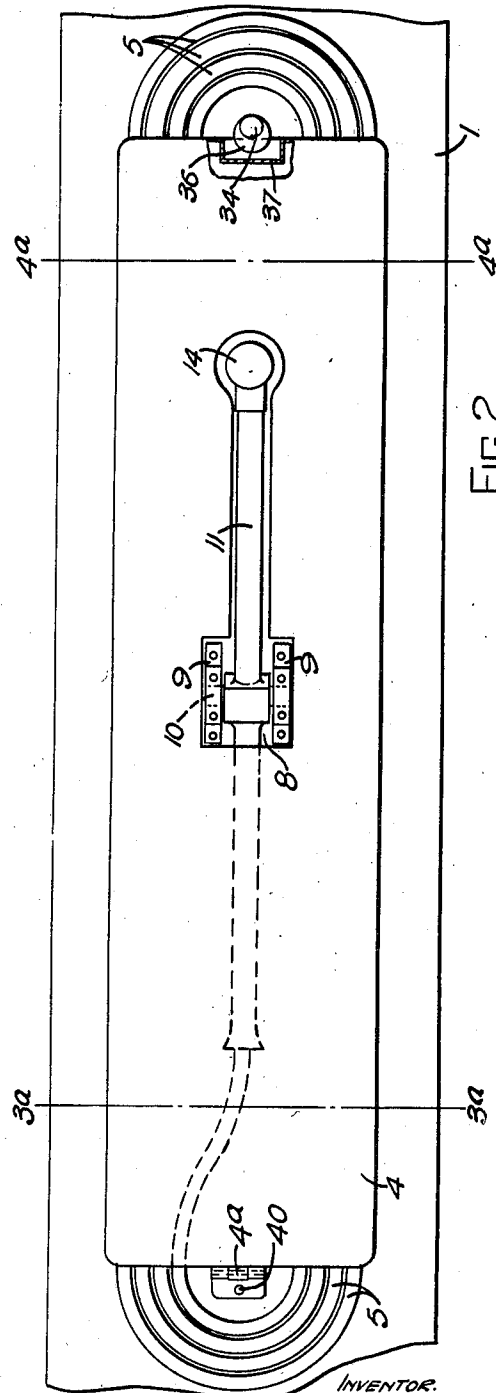


FIG. 2.

INVENTOR.
FREDERICK JAMES GRAY
PER *Rayner H. H.*
ATTORNEYS.

March 23, 1943.

F. J. GRAY

2,314,698

MEANS FOR SUPPLYING AIR TO SUBMERGED SUBMARINES

Filed July 22, 1940

3 Sheets-Sheet 2

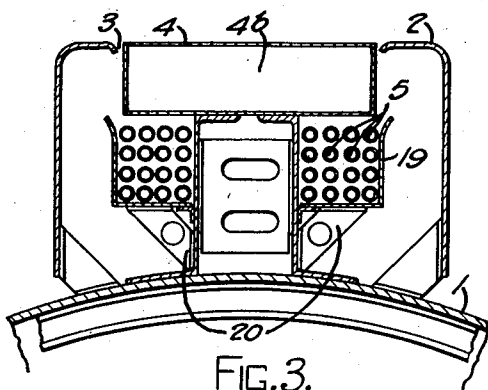


FIG. 3.

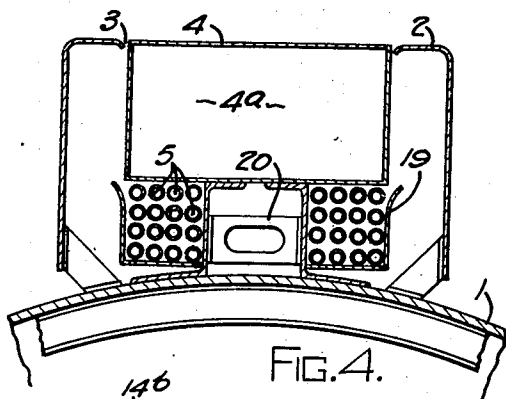


FIG. 4.

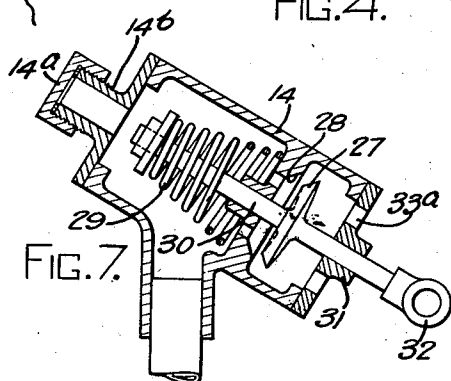


FIG. 7.

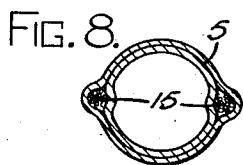


FIG. 8.

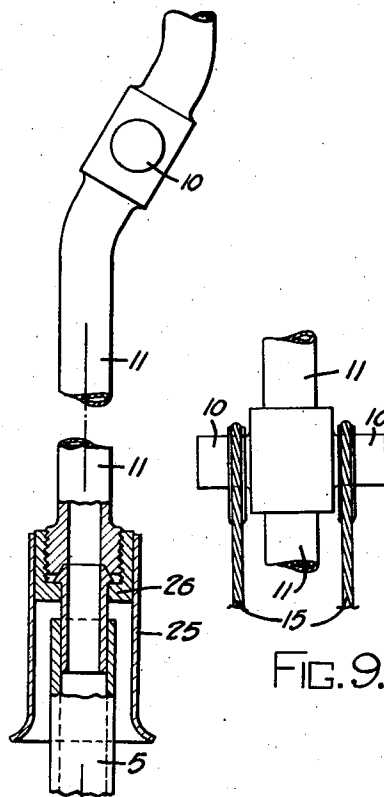


FIG. 9.

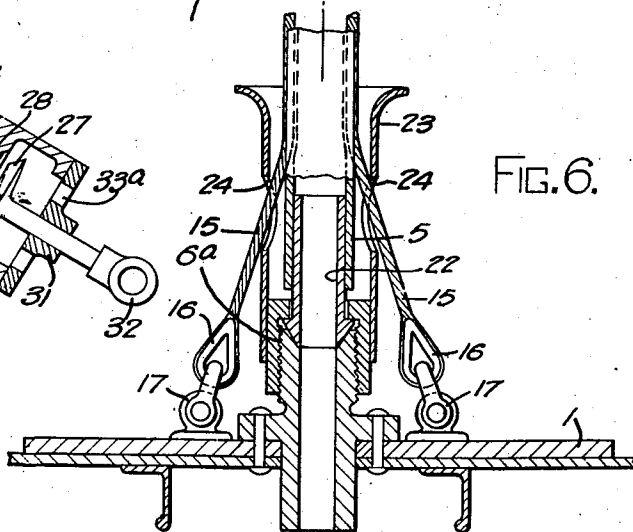


FIG. 6.

INVENTOR
FREDERICK JAMES GRAY.
PER *Rayner & Co.*
ATTORNEYS.

March 23, 1943.

F. J. GRAY

2,314,698

MEANS FOR SUPPLYING AIR TO SUBMERGED SUBMARINES

Filed July 22, 1940

3 Sheets-Sheet 3

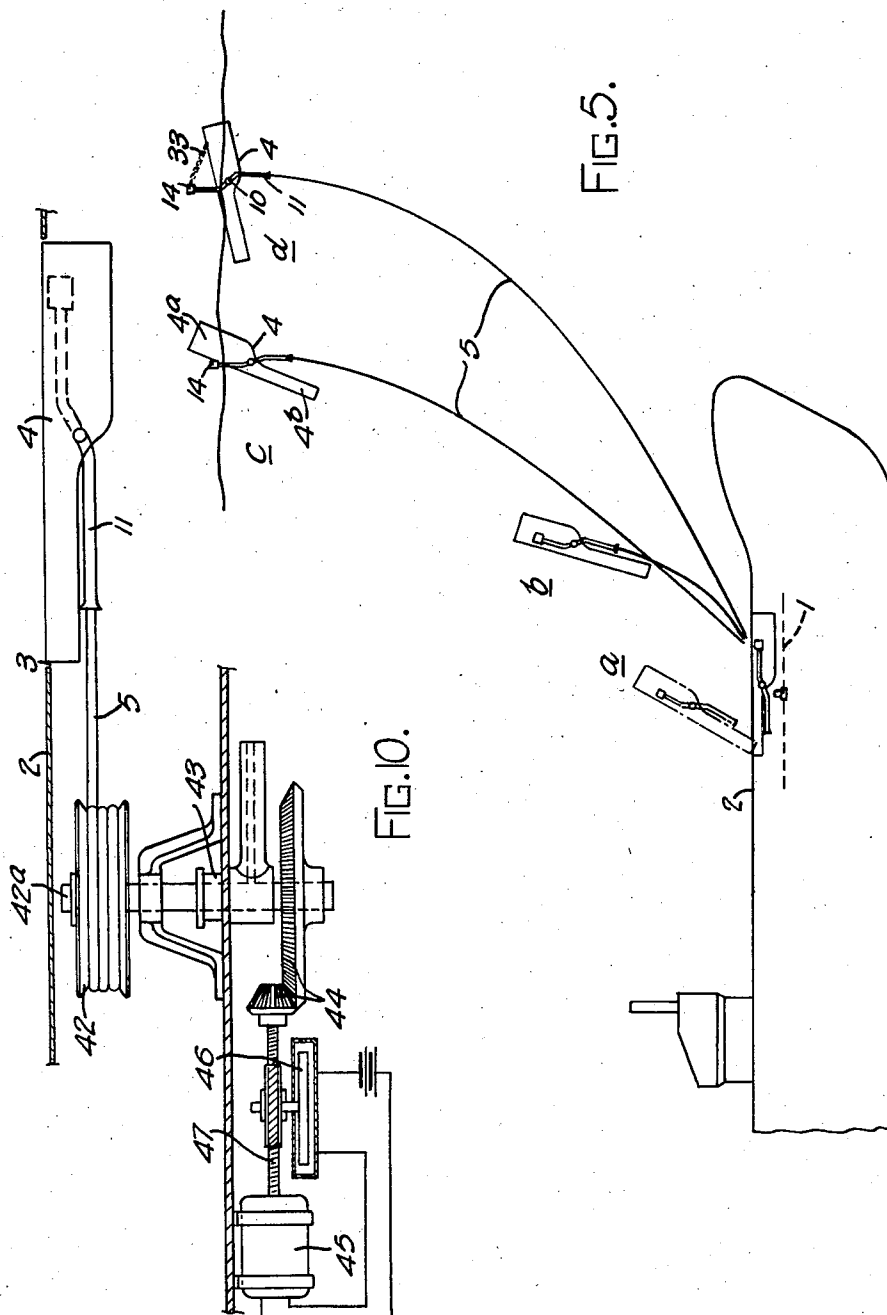


FIG. 5.

FIG. 10.

INVENTOR

FREDERICK JAMES GRAY.

PER

Raymond M. H.
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,314,698

MEANS FOR SUPPLYING AIR TO
SUBMERGED SUBMARINES

Frederick James Gray, Cheltenham, England

Application July 22, 1940, Serial No. 346,747
In Great Britain August 11, 1939

6 Claims. (Cl. 114—16.4)

This invention relates to means for supplying air to submerged submarines, and has for its chief object to provide apparatus which can be adapted to existing submarines or form part of the equipment of future submarines, which will enable an air supply conduit to be readily released by the occupants of the submerged vessel so as to communicate with the submarine and the air above sea level. Another object of this invention is to combine with an emergency air supply device means for indicating the location of a submerged submarine and also if desired for affording a means of communication with the crew of the submarine.

According to this invention an emergency air supply device comprises a float connected by a flexible conduit to the submarine and adapted normally to lie close to the submarine shell but having such configuration that when released from the submerged submarine it rises with one buoyant part trailing in relation to another buoyant part, such buoyant parts upon reaching water level being brought by their buoyancy to substantially level positions and thereby by such change in position operating means to connect the conduit to the air above sea level.

In order that this invention may be clearly understood and readily carried into effect drawings are appended hereto illustrating an embodiment thereof and wherein:

Fig. 1 is a broken sectional elevation showing the emergency air supply appliance stowed away in a compartment of the deck or upper part of the submarine.

Fig. 2 is a plan view of Fig. 1.

Fig. 3 is a section on the line 3a 3a of Fig. 2.

Fig. 4 is a section on the line 4a 4a of Fig. 2.

Fig. 5 is a diagrammatic view showing various stages in the ascent of the buoyant member.

Fig. 6 is a part sectional broken elevation view showing the connection of the flexible conduit to the submarine.

Fig. 7 is a detail sectional elevation of a valve forming part of means to automatically connect the tube interior to atmosphere when the float is supported at water level.

Fig. 8 is a cross section of the tube showing stiffening cables incorporated therewith.

Fig. 9 is a detail elevation view showing a suitable manner of anchoring the stiffening cables to the end of the conduit remote from the submarine, and

Fig. 10 is a somewhat diagrammatic elevation view of a modified means for drawing in and re-

leasing the flexible conduit for normal conditions of the craft.

Referring to the drawings the submarine shell is indicated by the reference numeral 1 and the deck or other convenient superstructure by the reference numeral 2, this upper deck or superstructure being formed with an opening 3 to receive a float 4 adapted to be freed to rise to the sea level and draw with it the emergency air supply pipe 5 secured to an air tube 6 depending into the interior of the submarine. The said float is so shaped that the buoyancy of one end 4a is considerably greater than at the other end 4b so that when the float is released from a submerged position the former end will be above the latter end until the float reaches sea level when it will assume a normal floating position. The preferred configuration of float is of an outline which will afford a side 4c which will fit flush against a convenient part of the upper structure of the submarine, e. g. the deck 2 whilst affording the minimum protuberance, and also if desired presenting a substantially streamline surface externally, e. g. bowed in cross and longitudinal section at its upper side. However, for normal purposes the float may as shown, be a rectilinear body with a flat (normally upper) side 4c.

The more buoyant end 4a of the float is deeper (see Fig. 1) than the other end 4b, an inclined face 4d joining the lower sides of these two parts at about mid-way between the ends of the float. In this inclined face is an opening 8 extending through the top face 4c of the float, such opening containing bearings 9 in which swivels a spigot 10 forming the axis of oscillation of a metal tube 11 normally nested at one end in a channel 12 in the top of the more buoyant end 4a of the float, and at its other end in a channel 13 in the lower side of the shallower end 4b of the float. The spigot 10 is located about mid-way between the ends of this tube 11, and the end of this tube which is accommodated in the lower channel 13 receives one end of the air supply pipe 5, whilst the other end of such tube carries a valve housing 14 for the purpose of normally sealing the tube 11 and for admitting air at the appropriate time.

The air supply pipe 5 is strengthened by a pair of cables 15 which are suitably embedded in the pipe 5 during its manufacture and at one end are anchored by eyes 16 to shackles 17 fixed to the shell 1 of the submarine. The other ends of these two cables can be secured by eyes 18 to the spigot 10 of the tube 11. The air supply pipe 5 is sufficiently flexible for coiling in a suitable

manner in the space between the float 4 and the shell 1 as shown in Figs. 1 and 2, and part of this air supply pipe can be nested in a trough 19 supported on suitable frame members 20, thus compensating for the difference in the space between the shallow end of the float and the top end of the float in relation to the shell 1.

The air tube 6 which depends into the interior of the submarine can be threaded as at 6a to receive a sleeve nut 21 which firmly clamps in position a union member 22 secured in the lower end of the pipe 5. Surrounding this lower end of the pipe 5 is a cup 23 with a flared upper end to obviate excessive bending or abrasion of the pipe at its anchored end, and this cup 23 is provided with apertures 24 for the ends of cables 15. The upper end of the pipe 5 is similarly protected by an inverted cup 25 which is also disposed about a nut 26 threaded onto the appropriate end of the oscillating tube 11.

The said valve housing 14 can accommodate any convenient form of valve which will open automatically when the float is above sea level, and a convenient form of valve comprises the spring loaded conical valve 27 shown in Fig. 7, this valve normally engaging a seating 28 in the housing 14 by reason of the action of a coiled compression spring 29 disposed about the valve stem 30, this stem sliding through a suitable packed guide 31, and carrying at its outer end an eye 32 to which is anchored a chain or other suitable member 33 also anchored to a convenient part of the float 4. The length of this chain is such that when the tube 11 moves to a substantially vertical position when the float is at sea level, the tension is such as to pull the valve off its seating and thereby admit air at atmospheric pressure to the pipe 5. The valve housing is provided with any suitable arrangement of air inlets 33a.

The float 4 is held in the opening 3 on the submarine deck by any suitable quick release means, and the quick release means may comprise a vertical spindle 34 supported in suitable packed bearings 35 in the shell 1 and carrying at its upper end a wedge or cam member 36 normally tightly engaged in a recess 37 in the deeper end of the float 4. The other end of the float 4 is held in position by means of an abutment 38 engaging in a stepped recess 39 in the shallow end of the float, this abutment 38 being in the form of a horizontal finger with an arcuate free edge 38a about which the lower side of the recess 39 can rock when the more buoyant end 4a of the float starts to rise.

In addition to the locking cam 36 means is provided in juxtaposition to the finger 38 to prevent upward swinging of the float until required by the occupants of the submarine. This additional locking means comprises a roller 40a carried by the upper end of a splined feed screw 40 which is traversed axially by any suitable feed nut device 41 inside the submarine. Normally, the roller 40 abuts against the upper corner of the float, but if it is traversed downwardly so that it becomes located opposite the recess 39 the float will be free to ascend when the locking cam 36 is released.

Instead of coiling the pipe 5 in the manner shown in Figs. 1 and 2, it may be wound upon a drum 42 supported by a shaft 42a passed through suitable packed bearings 43 in the shell 1 and driven by any convenient train of gear wheels 44 from a motor 45. Such an arrangement might obviate the necessity of the retaining or locking

devices 36, 38 and 40 or at least some of them, as the tension on the air supply pipe 5 when wound fully home can retain the float 4 in position.

The operation of the device is quite simple because once the operator has released the float it will ascend by reason of its own buoyancy with the larger volume area 4a uppermost, this being illustrated in Fig. 5 which shows at a the float about to be released from the submarine and swinging about the finger 38, and at b the float is ascending and drawing the pipe 5 with it until it reaches the position c at sea level, whereupon the float will automatically assume a substantially horizontal position as indicated at d and the valve carrying pipe 11 will remain perpendicular resulting in the tension on the chain 33 opening the valve 27, so that air atmospheric pressure is now being supplied to the interior of the submarine. An inlet 14b for a pump line is closed by cap 14a.

The valve housing 14 can be suitably shielded against flooding or easy ingress of sea water, any suitable arrangement of hood and baffles being provided for such purpose.

In addition to carrying a flexible conduit to the surface the float can carry a telephone wire, and also the said pipe or other movable element on the float can carry a suitable signal.

I claim:

1. An emergency air supply device for use with submarines comprising a hollow body forming a float, an opening through the float at a point between its ends, a tube pivoted in said opening to the float so that one end of the tube extends along the upper side of one end of the float and the other end extends along the lower side of the float, a valve housing on the upper end part of the tube, a valve in said housing, spring means normally closing said valve, means connecting the valve to the float body to open the valve when the said tube pivots in one direction, an air supply pipe connected to the tube at the end remote from the valve housing, the said float and pipe being adapted to be located close to the deck of the submarine, and means operable from within the submarine to release the float.

2. An emergency air supply device for use with submarines comprising a float, a tube pivoted to the float so as to be free to oscillate relatively to the float, a valve housing on such tube accommodating a valve normally closed, means to open such valve automatically by relative movement of said tube and float when the float reaches sea level, an air supply pipe connecting said tube to the interior of the submarine, the said float and pipe being adapted to be normally located close to the deck or top of the submarine, one part of the float being more buoyant than another part so that as the float ascends one part trails below the other, but when reaching sea level, the two parts move to substantially level positions to produce said relative movement, and means operable from within the submarine to release the float.

3. An emergency air supply device for use with submarines, comprising a float adapted to be held close to the submarine deck or top, one end of said float being more buoyant than the other so that when freed from the submarine the latter end will trail behind the former until sea level is reached whereupon both ends will establish normal floating level, an air inlet tube, an opening in such float between its relatively buoyant ends, a pivotal support in said opening connect-

ing said tube to said float with one end of the tube extending along a normally upper side of the float and the other end extending along the normally lower side of the float, a normally closed air inlet valve carried by the former end of the tube, a flexible air supply pipe connected at one end to the other end of the tube and at its other end to the interior of the submarine so that when the float reaches sea level the tension on the pipe and the establishment of normal sea level of the float will produce relative movement of the float and said valve carrying tube, and means transmitting said movement to said valve to open the valve.

4. An emergency air supply device for use with submarines comprising a float normally held close to the submarine but adapted to be released to float to sea level and having a greater buoyancy at one end than at an opposite end, a tube, means relatively oscillatably connecting said tube to the float, a valve housing on said tube accommodating a valve normally closed, a flexible air supply pipe connecting one end of said tube to the interior of the submarine means connecting said valve to said float so as to open such valve automatically by relative movement of said tube and float and the tension of said pipe when the float reaches sea level due to the less buoyant end of the float floating up from an ascending trailing position to a position substantially level with the other end of the float, abutments on the said ends of the float, co-operating float securing abutments carried by the submarine and engaging the float abutments, means operable from within the submarine to separate the abutments at the more buoyant end of the float, and a further abutment engaging and translatively movable relatively to the lesser buoyant end of the float and to the beforesaid abutments at such end and operable from within the submarine to draw it from an operative position to free for separation the said co-operating engaging abutments at the trailing end of the float and on the submarine, whereby the more buoyant end of the

float is released first and the flexible pipe carrying end of the said tube and other end of the float trail relative to the more buoyant end when ascending in the water.

5. An emergency air supply device for use with submarines comprising a float with one end having a greater buoyant volume than the other end, a relatively oscillatable air admission tube carried pivotally by the float and normally extending lengthwise close to and from one of said ends to the other end of said float, a flexible air supply pipe connecting the end of the tube at the less buoyant end of the float to the interior of the submarine, a valve housing on said tube, a normally closed air inlet valve in said housing, means connecting said valve to the float so as to open such valve automatically by relative movement of said tube and float due to the ascent of the lesser buoyant end of the float relative to the other end when the float reaches sea level and the tension on the said air supply pipe, the said float and pipe being adapted to be normally located close to the deck or top of the submarine, and means operable from within the submarine to release the float.

6. An emergency air supply device for use with submarines comprising a float with one end more buoyant than an opposite end, an air admission tube pivoted to the float between its ends and the ends of the float, a valve housing on said tube on one side of the pivot, a flexible air supply pipe connected to an end of the tube remote from said housing and to the interior of the submarine, an air inlet to the tube provided in said housing, a valve normally closing said inlet, means yieldingly opposing opening of said valve, and means operatively connecting the valve to the float to effect opening of the valve when the said tube moves to a substantially perpendicular position in relation to the float due to the tension on said pipe and the levelling of the float ends when the float reaches sea level.

FREDERICK JAMES GRAY.