United States Patent [19]

Winther

[11] **3,851,996**

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[54] **OUTBOARD MOTOR POWERED LOW LIFT PUMP**

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[52] **U.S. Cl.** **417/61,** 417/158, 417/364, 415/7, 415/121

[51] **Int. Cl.** **F04b 21/00,** F01d 25/28

[58] **Field of Search** ..... 415/7, 121, 182, 203, 207; 417/236, 89, 158, 364, 61; 115/12 A; 114/183

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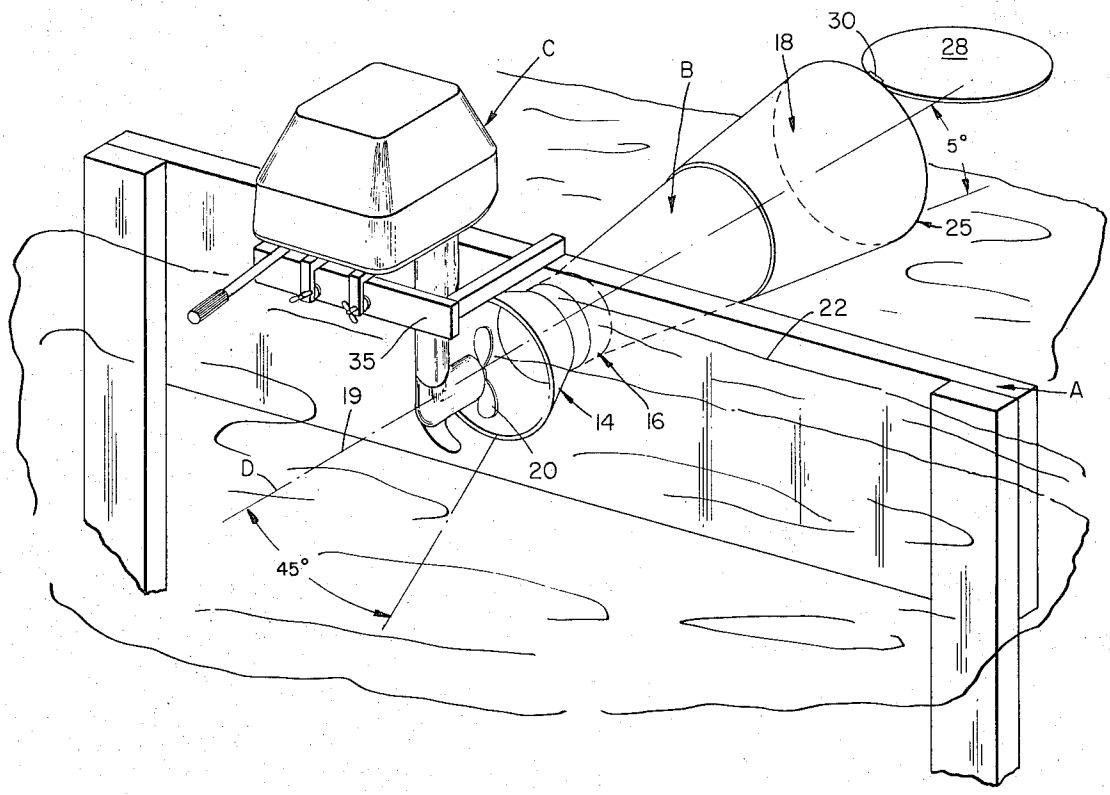
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Primary Examiner—Henry F. Raduazo
Attorney, Agent, or Firm—Townsend and Townsend

[57] **ABSTRACT**

An outboard motor powered low head high volume pump is disclosed. The outboard, mounted on the inlet side of the pump, discharges with its line of flow, directly into the acceleration chamber of a Venturi tube. The Venturi tube, typically mounted with its throat transpiercing a levy weir, has its deceleration chamber extending from the throat to the receiving body. In operation, the Venturi functions to accelerate the water impelled by the outboard motor through the throat of the Venturi to obtain a velocity head in excess of the static head at the discharge side of the pump. The deceleration tube of the pump serves to convert the velocity head largely to a static pressure head so that a high volume low discharge velocity head output of the pump results.

9 Claims, 5 Drawing Figures



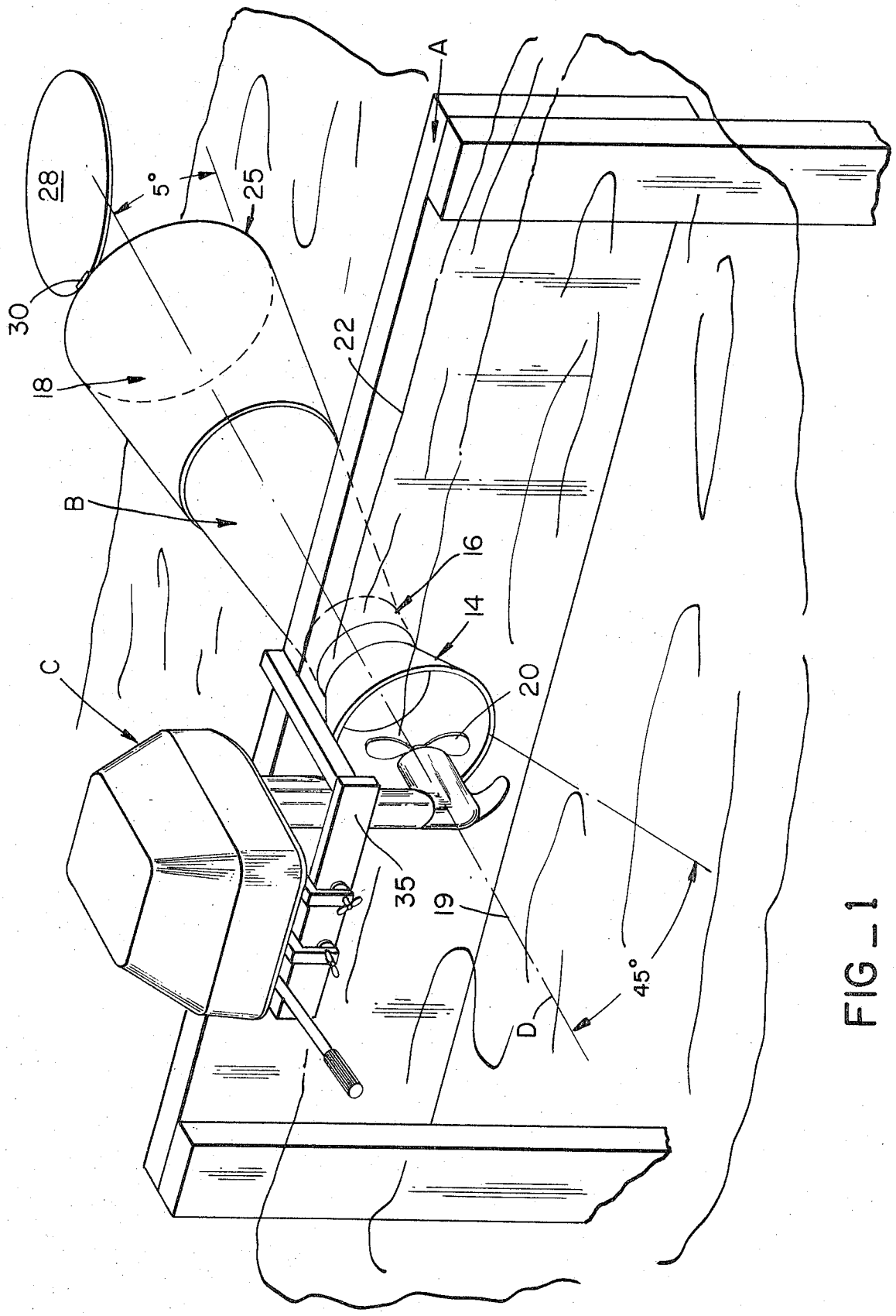


FIG_1

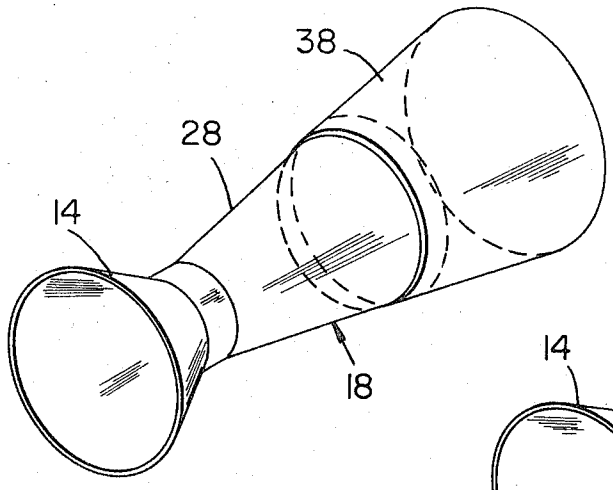


FIG _ 2

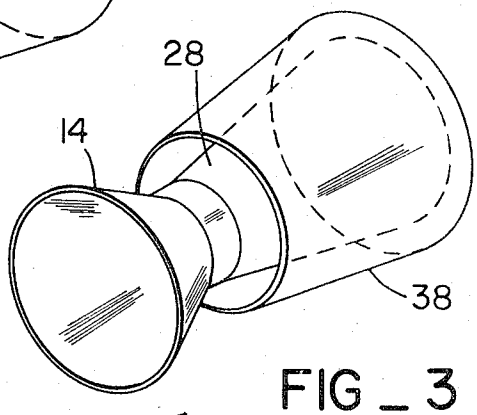


FIG _ 3

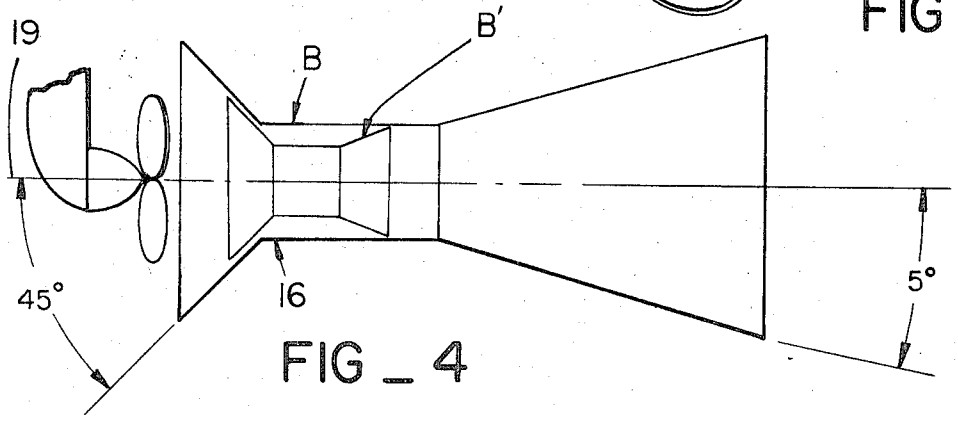


FIG _ 4

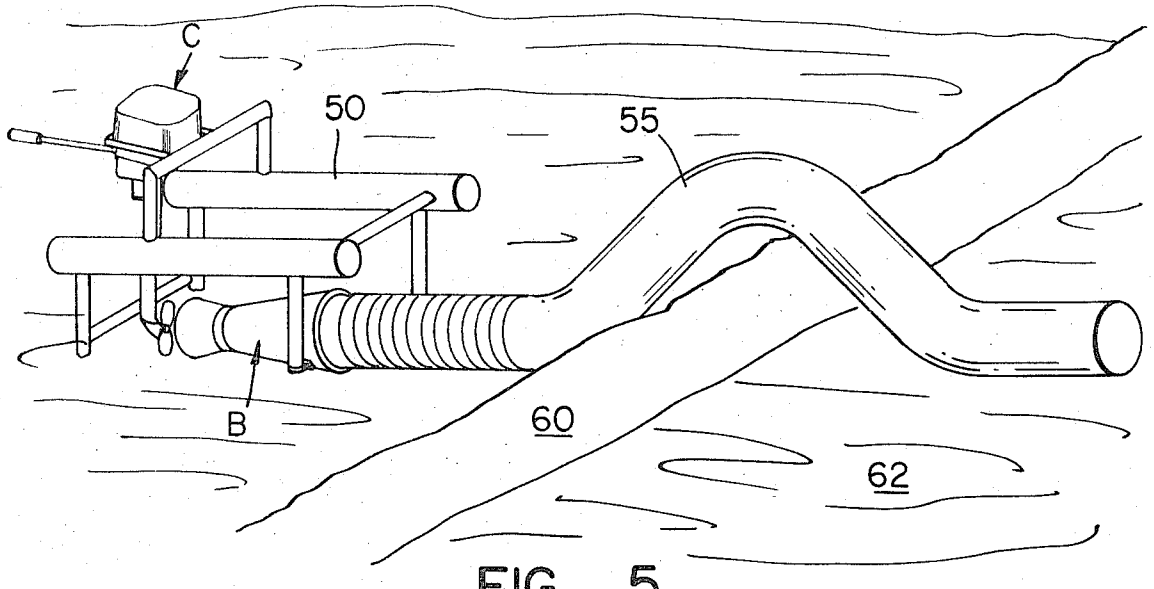


FIG _ 5

OUTBOARD MOTOR POWERED LOW LIFT PUMP

This invention relates to propeller pumps and more particularly to an outboard motor powered low lift high volume pump.

SUMMARY OF THE PRIOR ART

Propeller pumps are known. Typically, propeller pumps include a casing with the propeller located interior of the casing. As opposed to the present invention, these types of pumps have two disadvantages. First, there is no way a conventional outboard can be used to conveniently power such pumps. Second, with the propeller located interiorly of the housing, frictions between the propeller and casing adjacent the propeller results in undesired fluid turbulence. Low pump efficiency results.

Outboard motors have had pumps attached. These pumps, however, lose the efficiency for which outboard motors are designed. Specifically, the ability of an outboard motor to move large volumes of water is lost. Instead, the prior art has mounted conventional centrifugal pumps in place of the propeller with resultant high losses in pump efficiency. Examples of such prior art include Nielson U.S. Pat. Nos. 2,792,786 and 2,884,862 and Winkleman et al. U.S. Pat. Nos. 2,684,635 and 2,733,679.

Outboard motors have had connected to them acceleration chambers. These chambers provide an accelerated output for faster vessel propulsion. However, they result in a high velocity head which is not suitable for efficient pumping. Typically, the water is discharged at high velocity without conversion of the velocity into a high discharge static head. An example of such an outboard motor with an acceleration chamber is the Hall U.S. Pat. No. 3,389,558.

SUMMARY OF THE INVENTION

An outboard motor powered high volume low head pump is disclosed. The outboard motor, mounted on the inlet side of a pump, discharges with its line of flow directly into the acceleration chamber of a Venturi tube. The Venturi tube, typically mounted with its throat transpiercing a levy weir, has its acceleration chamber extending from the throat to the receiving body.

In operation, the Venturi functions to accelerate the water impelled by the outboard motor through the throat of the Venturi to attain a velocity head in excess of the static head of the discharge side of the pump. The decleration tube of the pump serves to convert this velocity head largely to a static pressure head so that a high volume, low discharge head output of the pump results.

OTHER OBJECTS AND ADVANTAGES OF THIS INVENTION

It is an object of this invention to use an outboard motor as a power source for a low head, high velocity pump.

An advantage of using an outboard motor is that a readily available cheap power source can be used for low head, high volume pumping.

A further advantage of this invention is that the pump is singularly adaptable for use with a levy or weir pump high volumes of water against low head.

Yet another advantage of utilizing an outboard motor is that the mounting of the motor with respect to the entrance of the Venturi where the pump has the greatest efficiency, can be readily accomplished.

Another object of this invention is to use a Venturi tube to convert the relatively high discharge velocity of water from an outboard motor into a small static head with accompanying low discharge velocity so that maximum pump efficiency results.

An advantage of utilizing an outboard motor in combination with a Venturi tube is to avoid velocity discharge losses due to high pump discharge velocities.

An additional advantage of this invention is that the Venturi tube can be constructed from extremely inexpensive material. For example, Venturi may be simply constructed from standard sheet metal.

Yet another advantage of utilizing a Venturi tube is that the Venturi section is typically collapsible. Resultant portability of the pump is greatly increased.

A further object of this invention is to disclose a low head, high volume pump which can have its inlet side mounted to a floating platform. According to this aspect of the invention, the pump and inlets are mounted to a float to vary in elevation with varying pump inlet water level.

An advantage of this embodiment of the invention is that the pump becomes adaptable to variation in inlet water level with resultant minimum loss of efficiency.

Other objects, features and advantages of this invention will be more apparent after referring to the attached specification and drawings in which:

FIG. 1 is a perspective view of an outboard motor mounted to a levy weir with the Venturi tube of this invention transpiercing the weir and extending from an acceleration chamber on the inlet side to a deceleration chamber on the outlet side;

FIG. 2 is a perspective of the Venturi of FIG. 1, the Venturi shown in the expanded position;

FIG. 3 is a perspective similar to FIG. 2 with the deceleration chamber collapsed for increased portability;

FIG. 4 is a side elevation section of the pump of this invention illustrating the insertion of a second and smaller Venturi tube interior of a first and larger Venturi tube to permit the pump of this invention to work against relatively higher heads; and,

FIG. 5 illustrates an embodiment of this invention wherein the pump is mounted to a float so that the pump inlet may vary in elevation as the inlet water level varies in elevation.

Referring to FIG. 1, a perspective view of a levy weir A is shown having the Venturi tube B mounted transpiercing the weir A.

In operation, outboard motor C impells water into and through the Venturi B. Water is pumped away from the outboard motor C through the Venturi B and thus through the barrier provided by weir A.

Regarding weir A, such weirs are typically part of levy and irrigation systems common to flat river areas. It should be realized that the pump here illustrated is ideal for such pumping. Typically, the pump operates against low head of less that 10 feet between the inlet and discharge side. Preferably, the pump operates in a difference of two to three feet between the inlet and discharge side of the pump.

The Venturi includes an acceleration chamber **14,** a throat **16,** and a deceleration chamber **18.**

Acceleration chamber **14** extends from the inlet side of the pump down to the throat **16.** This chamber is typically frustroconical in shape. The open and enlarged end of the frustrum extends toward the propeller **20** of motor E. The constricted end of the frustroconical acceleration chamber **14** terminates at throat **16.**

The acceleration chamber is typically symmetrical about an axis **19.** Preferably, its walls slope at an angle of 45° with respect to axis **19.**

It is preferred in operation, and indeed required, that the inlet of the acceleration chamber be completely submerged with respect to the water level **22** of the water being pumped. It is preferred that the inlet of the acceleration chamber at its upper portion be at least **10** inches under water to provide optimum pumping. Since this dimension is compatible with the immersion of most propellers on standard outboard motors, this requirement is easily met by the standard outboard motors.

The throat **16** of the Venturi is rigidly affixed to the weir structure. Conventional flange fastenings and the like, well known in the prior art, have been found suitable for this purpose.

The outlet or expansion chamber has an outlet area at the end **25** of deceleration inlet B which is four times the area of the throat **16** of the Venturi. Preferably, this chamber expands at an angle of 5° with respect to an axis **19.** Similar to acceleration chamber **14,** deceleration chamber **18** is frustroconical and extends from throat **16** to the discharge end **25.**

It is preferred that the Venturi B provide a straight line flow from the inlet to outlet. This is done so that fluid friction losses which would accompany a circuitous fluid path can be avoided. It should be noted by those skilled in the art that the pump hereshown differs radically from centrifugal pumps in this respect.

The deceleration chamber **18** is hereshown provided with a closure flap **28** hinged about a hinge **30.** Typically, when motor C ceases operation and water tends to backflow from the outlet end **25** of the Venturi towards the acceleration chamber **14,** flap **28** closes. This closure is caused by water in entraining flap **28** to close overlying opening **25** of the Venturi B.

As has been emphasized, outboard motor C is conventional. Typically, the motor is aligned so that the center line of thrust is coaxial with the axis **19** of the Venturi.

Typically, the diameter of the propeller **20** will be less than the diameter of the inlet to the acceleration chamber **14.** Moreover, the propeller **20** will typically be mounted some distance from the inlet to the acceleration chamber **14.** The reason for this is that water impelled by the propeller **20** of outboard motor **16** typically entrains other water with that water directly impelled by the propeller. It has been found, especially as to an engine attached to a static platform, that the water expands from the propeller outwardly in roughly a frustroconical volume. By the expedient of mounting acceleration chamber **14** to capture this outflowing frustroconical volume of water, efficient capture and thereafter acceleration of the outflow from the propeller **20** of outboard motor C can occur.

Mounting of the outboard motor is conventional. Any suitable bracket **35** which is capable of holding the outboard motor C disposed toward the Venturi B will be satisfactory.

It is desirable to include some flexibility in the mounting of the motor C. Both the depth of the propeller and acceleration chamber should be somewhat variable. For high discharge heads the propeller should be in close proximity to the acceleration chamber. For low discharge heads the propeller can be moved further away from the acceleration chamber.

It is preferred in any event that the impingement of water at the acceleration tube be of a uniform velocity. This produces maximum pump efficiency due to a minimum of turbulence.

Regarding the power of the outboard motor, utilizing a Venturi having a diameter of **13** inches at the throat with a 27-inch discharge with the preferred 45° angle on the acceleration tube **14** and the preferred 10° expansion angle on the deceleration chamber, the following flow characteristics can be produced:

6 cubic feet per second can be pumped through a 6-inch elevation head by a 1 horsepower motor;

8 cubic feet per second can be pumped through a 9-inch elevation head by a 3 horsepower motor;

10.5 cubic feet per second can be pumped through a 6-inch elevation head by a 5 horsepower motor;

13 cubic feet per second can be pumped through an 8-inch elevation head by a 5 horsepower motor;

13 cubic feet per second can be pumped through a 28-inch elevation head by a 10 horsepower motor; or,

16.5 cubic feet per second can be pumped through a 12-inch elevation head by a 10 horsepower motor.

Broadly, the maximum elevation head is dictated by the fluid flow velocity entering the expansion chamber. An approximation can be made that $V^2/64.4$ is approximately equal to the elevation head where V is the maximum uniform velocity of the entrance to the expansion chamber in feet per second, and the elevation head is expressed in terms of feet.

It can be seen that elevation heads in excess of 12 feet can be pumped, but the invention is of far greater value in heads of less than 12 feet.

Referring to FIGS. **2** and **3,** an advantage of this invention can be seen. Typically, the deceleration chamber **18** can be provided into a first section **28** and a second section **38,** each of these sections being frustroconical. By the expedient of making the contracted portion of the frustroconical deceleration chamber **38** of lesser diameter than the expanded portion of the deceleration chamber segment **28.** The overall chamber can be made to telescope. Thus in the expanded position, it will have the configuration shown in FIG. **2.** When transportation is desired and the deceleration chamber sections are collapsed one upon another, as shown in FIG. **8,** transportation of the respective chamber sections is enhanced.

Referring to FIG. **4,** another embodiment of this invention is illustrated. Typically, in pumping some volumes of water, the inlet to discharge differential will increase. With increasing elevation, increased velocity at the Venturi throat is required to oppose the correspondently increasing static discharge head.

Referring to FIG. **4,** a first Venturi B has a second Venturi B′ inserted concentrically thereof. As can be seen, the discharge **40** fits snugly within the throat **16** of the original Venturi. Thus, Venturi B′ can be concentrically inserted into the Venturi B. With such an

insertion, an increased acceleration and increased velocity to overcome an increased discharge head occurs on the outlet side of the pump. The size of the deceleration chamber is effectively increased.

Referring to FIG. 5, an alternate embodiment of this invention is disclosed. Broadly, a float 50 supports both the outboard motor C and a Venturi B. Typically, float 50 is maintained in a given spatial orientation on the surface of the water body being anchored in place by ground tackle not shown.

Venturi B has affixed thereto an outflow conduit 55. Conduit 55 is flexible and, with varying elevation of the float 50 with respect to levy 60, permits water to be pumped over the levy 60.

Once the basic pump is disclosed, the operation is believed obvious. Outboard motor C in combination with Venturi 50 causes water to be pumped into conduit 55. Dependent upon elevation changes, water flows from the body being pumped to the receiving body 62.

It should be appreciated that modifications can be made of the disclosed invention. For example, it is not required that the pumped body have an elevational head lower than the receiving body. The pump, according to this invention, can be used against no head, or alternately used to commence a siphon flow of large volume where the body being pumped has a higher elevation head than the receiving body. Moreover, although I have illustrated herein frustroconical Venturi tube acceleration and deceleration chambers, conventional parabolic longitudinally sectioned chambers can be used. Likewise, other modifications of the invention can be made.

I claim:

1. An outboard motor powered low head, high volume pump for pumping water from an inlet to an outlet comprising: a weir structure separating the inlet from the outlet; a Venturi tube transpiercing said weir structure, said Venturi tube having an acceleration chamber communicated to said inlet, a decleration tube communicated to said outlet and a throat section therebetween; and, an outboard motor having a water discharge means for mounting said outboard motor in front of said acceleration chamber of said Venturi tube with said water discharge directed into said acceleration chamber.

2. The invention of claim 1 and wherein said Venturi tube transpierces said levy structure at the throat of said Venturi tube.

3. The invention of claim 1 and wherein said Venturi tube is constructed symmetrically about an axis and acceleration chamber and said deceleration chamber are each frustoconical in shape.

4. The invention of claim 3 and wherein the side walls of said acceleration chamber are inclined at substantially a 45° angle with respect to said axis.

5. The invention of claim 3 and wherein the side walls of said deceleration chamber are inclined at substantially a 10° angle with respect to said axis.

6. An outboard motor powered low head, high volume pump from pumping water through a levy structure from an inlet side on one side of said levy structure to an outlet side on the other side of said levy structure, said pump comprising: a Venturi tube having an acceleration chamber, a deceleration chamber, and a throat section therebetween; means for mounting said Venturi tube to immerse said acceleration tube in said inlet and to communicate said deceleration tube to said outlet; an outboard motor having a water discharge; and, means for mounting said outboard motor in front of the acceleration chamber of said Venturi tube with said water discharge directed into said acceleration chamber.

7. The invention of claim 6 and wherein said means for mounting said Venturi tube to immerse said acceleration chamber in said inlet includes a float, means for dependingly suspending said Venturi tube from said float to immerse said acceleration chamber in said inlet and said means for mounting said outboard motor is mounted to and supported by said float.

8. The invention of claim 6 and wherein said deceleration chamber includes at least first and second frustroconical sections with the greatest diameter of one frustroconical section being larger than the smallest diameter of the other frustroconical section whereby said first and second frustroconical sections can telescope one upon another to reduce the length of said deceleration chamber.

9. An outboard motor powered low head, high volume pump for pumping water from an inlet water body at a first elevation to an outlet water body at a second and high elevation with a water-tight barrier separating said inlet and outlet water body, said pump comprising: a Venturi tube having an acceleration chamber, a deceleration chamber, and a throat therebetween; means for mounting said Venturi tube to immerse said acceleration chamber in said inlet water body; means communicating said deceleration chamber to said outlet water body; an outboard motor having a propeller for discharging water and a motor for driving said propeller to discharge said water; means for mounting said outboard motor with said propeller in front of said acceleration chamber of said Venturi tube with said water discharge directed into said acceleration chamber; and, said motor and propeller having sufficient water discharge power to accelerate water at the throat of said Venturi tube to a velocity at said throat which exceeds in velocity head the difference in static head between the lower elevation of said inlet and the higher elevation of said outlet.

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