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(54) Pump.

(57) A centrifugal pump having an impeller (38) which is associated with a motor and a drive shaft (16,14) and that is enclosed within a housing (28). The housing (28) is mounted in surrounding, spaced and non-contacting relationship, with respect to the impeller (38) and drive shaft (14) contains fluid inlet (26,26') through which fluids are directed by the impeller (28) to an outlet from the housing (28). Also provided is a pump which operates from remote locations.

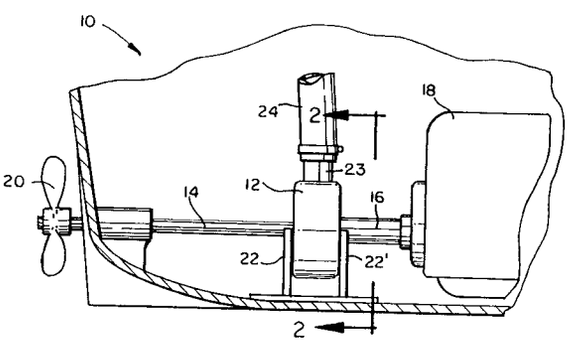

FIG. 1

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Field of the Invention

This invention is generally directed to centrifugal pumps having rotatably driven impellers mounted within a housing so as to create a fluid flow through such housing between an inlet and an outlet therein. More particularly, the invention provides a centrifugal pump which includes an impeller that couples an engine to a drive shaft and is rotatably disposed within the housing. Opposing fluid inlets are created between the sides of the housing and the drive shaft from which fluids are directed to a fluid outlet also formed in the housing. There is additionally provided a pump, such as a bilge pump, which operates from remote areas.

Background of the Invention

U.S. Pat. No. 4,688,987 to Ericson et al discloses a centrifugal pump having a split impeller which is mounted directly to an existing drive shaft. The inner surfaces of the hub portions of the split impeller are knurled or otherwise provided with ridges as to bite or lock the hub against the drive shaft when the two portions of the impeller are joined together.

This prior centrifugal pump is particularly adapted for use in the engine compartment or hull of a marine vessel wherein the impellers is attached for rotation with the drive shaft, such as a propeller drive shaft, and wherein the pump housing is mounted so as to be in a surrounding and spaced relationship to the impeller blades and drive shaft. The impeller is freely rotatable in order to pump fumes or fluids through annular intake openings between the drive shaft and pump housing and deliver the same through an outlet formed in the pump housing.

It is an object of this invention to provide a self priming centrifugal pumping apparatus which couples an engine and a drive shaft in an environment wherein hazardous gases or fumes may be encountered and wherein the pump is structured so that the gas or fluid impeller is not journaled or directly mounted to the pump housing. In this manner, no heat is generated during the rotation of the impeller by friction between the impeller and the housing as is the case in a pump in which the impeller is directly carried by the pump housing.

It is also an object of the present invention to provide a centrifugal pump apparatus which is coupled between the engine and the drive shaft to provide a pumping apparatus which does not require the lubrication and maintenance associated with conventional centrifugal pumps.

It is another object of the invention to provide an improved self priming pump for removing liquid from a vessel or container that is operated from nearby or remote areas.

Summary of the Invention

According to the present invention there is provided a self priming centrifugal pump apparatus for use in an atmosphere subject to the build-up of hazardous gases or other fluids.

The apparatus comprises a drive shaft, an engine or motor for driving said drive shaft, a housing having front and rear walls, a peripheral side walls and, fluid inlet openings which surround the power source and provides equal pressure from both sides on an impeller. Mounting means is provided for securing the housing so as to be in a fixed, spaced and non-contacting relationship around the drive shaft. An impeller means which is sloped on two sides forms a coupling of the motor with the drive shaft within and in spaced relationship with the housing. The slope expedites movement of the liquid outward to the vanes. Accordingly, the impeller and housing cooperate to discharge hazardous fluids in response to the rotation of the drive shaft without any substantial generation of heat due to friction.

According to one embodiment of the invention, the housing comprises front, rear and side wall portions at least, a pair of opposing fluid inlet openings in said front and rear walls of said housing providing equal pressure from both sides on the impeller means, each of said fluid inlet openings being of a greater dimension than said first cross sectional dimension of the drive shaft. The housing is provided with at least two sections which are divided along lines which intersect with the fluid inlet openings. Means is provided for selectively uniting the sections so as to enclose a portion of the length of the drive shaft therebetween and through each of the fluid inlet openings.

The drive shaft according to this embodiment extends through fluid inlet openings in spaced non-contacting relationship to the housing so that fluids entering the housing under equal pressure, passes around the drive shaft, along the sloped impeller to the impeller blades that propel the fluid outlet opening.

Preferably, the discharge opening is formed in the side wall of the housing and includes a nozzle means for creating a channel which extends outwardly of the housing generally tangentially with respect to the side wall portions.

Accordingly, to another embodiment, the housing defines a generally cylindrical chamber and the blade means of the impeller means substantially extends between the front and rear walls of the housing and outwardly into proximate relationship with the side wall portions thereof. The walls of the housing include portions extending outwardly beyond the walls, with spacer means extending from the outwardly extending portions of the rear walls so as to space the housing from adjacent walls of the enclosure.

The sloped impeller is formed within the housing by the coupling of the motor to the drive shaft. The impeller may be formed by the coupling of the motor to the drive shaft or it can be in the form of a blade means which couples to the motor and to the drive shaft.

The pump may be used by itself to carry a liquid from a vessel or container or can be used in combination with the drive shaft of a propeller for a boat to remove fumes.

According to another embodiment of the invention, there is provided a fluid immersible self priming discharge pump for removing a fluid such as water from a container or vessel. The discharge pump comprises a hydraulic motor, a housing associated with the motor having at least two opposing fluid inlet openings which create substantially equal pressure on opposing sides of the impeller. A drive shaft is within the housing and operatively connected for rotation by the motor. An impeller means is associated with the drive shaft and rotatable within the housing so as to draw fluid under equal pressure into the housing through the inlet openings and pass it along the sloped surface so as to discharge the fluid through the outlet openings by means of the impeller blades. A hose or nozzle is associated with the outlet opening to carry the discharge fluid away. The means for activating the motor can be in the form of a hydraulic pump which is located at a separate area, for example, outside of the vessel or container or on another boat.

Brief Description of The Drawings

Fig. 1 illustrate the mounting of the pump of the invention with the propeller drive shaft and transom of an inboard motor;

Fig. 2 is an enlarged front plan view of the pump housing taken along lines 2-2 of Fig 1;

Fig. 3 is a side view of the sloped impeller taken along lines 3-3 of Fig. 2;

Fig. 4 is a cross-sectional view taken along lines 4-4 of Fig 3, and

Fig. 5 illustrates the pump of the invention with a hydraulic motor and a fluid removal hose.

Description of the Preferred Embodiment

A more complete understanding of the invention will be had by referring to the following description and claims of a preferred embodiment, taken in conjunction with the accompanying drawings, wherein like reference members refer to similar parts throughout the several views.

With continued reference to the drawings, the centrifugal pump 10 of the present invention is shown as it is mounted in relationship to a propeller drive shaft 14 within the hull of an inboard motorboat 10. The drive shaft 14 is shown in Fig. 1 as extending from the propeller 20 though a transom, to the motor or engine 18. A suitable bearing or stuffing box 22,22′ is mounted so as to rotatably support the drive shaft 14 and pump 12. It should be noted that although the centrifugal pump 12 is being described for use with the propeller drive shaft of a conventional inboard motorboat 10, the pump 12 could be used in other environments. In addition, although only a single pump 12 is shown in the preferred embodiment, there may be occasions when two or more pumps would be used in the same environment such as a boat having twin screws driven by a pair parallel drive shafts.

As shown in Figs 2 and 3, the pump 12 is essentially constructed of an impeller 38, comprising a bladed member 38A which forms a coupling with the end coupler 16A of the engine 18 and the end coupler 38 of the drive shaft 14, and a housing 28. The pump housing 28 can be integral or split and composed of upper and lower sections, a circular or semicircular sidewall, a front wall and generally rectangular rear wall as found in U.S. Pat. No. 4,688,987. Openings 26, 26′ are provided in the upper corners of the rear wall of the upper section and through the lower corners of the rear wall of the lower section through which mounting bolts 34 may be selectively extended.

In order to create the desired suction and discharge at the inlet and discharge areas 23 of the housing, the impeller blades 32 are constructed to substantially extend outwardly to a point in close proximity with the inner surfaces of the sidewalls. Additionally, the width of the blades 32 is substantially equal to but slightly less than the distance between the front and rear walls. The design of the impeller 38 and pump housing 28 is such that upon rotation of the drive shaft 14, the impeller 38 will simultaneously be rotated to thereby draw air, fumes, liquids or other fluids inwardly through the opposing inlets 26, 26′. Thereafter, the fluids more along the sloped surface of the impeller 38 and are discharged under pressure through the passageway in the outlet nozzle 23 and through the exhaust hose 24 or similar conduit to a point remote from the pump.

When the engine is activated to rotate the drive shaft, the impeller rotates within the pump housing thereby drawing fluids including liquids and gases through the inlet ports and thereafter discharging the fluids under pressure through the outlet nozzle.

Therefore, the centrifugal pump of the present invention will automatically function to discharge any hazardous gaseous or fluid buildup or generated due to friction and thus the pump is safe for use in environments where ignitable or combustible fluids or gases are encountered.

Although the impeller member 38A is shown in Fig. 3 as being a separate and single intermediate bladed member 38A having a series of steps 31 which

are in mating engagement with the end member 14A of the drive shaft 14 on one side and the steps 31A of the end member 16A of the shaft 16 of the engine 18, the bladed impeller member 38A can also be integral with either end member 14A or end member 16A. Therefore, there can be a coupling to both sides of the impeller 38 within the housing or one side.

Fig. 4 shows the sloped coupled impeller 38 which is held together by bolts 34 or any other fastening member. The slope expedites movement of the liquid from the center of the impeller to the blades 32 where it is rapidly discharged through the outlet. A 30 to 45° slope on the impeller 38 is generally suitable for moving the liquid to the blades 32.

In Fig. 5 there is illustrated a fluid immersible pump 60 which can be used as a bilge pump that can be operated from a remove area, for example, another boat which provides a source of power. Pump 60 comprises a pump housing 61 in which an impeller 67 is mounted for rotation by a drive shaft 67. The drive shaft 68 is operatively connected to a hydraulic motor 62 that it is operated by a hydraulic pump (not shown) through hydraulic lines 65,65′.

The housing 61 is provided with two or more fluid intake openings 63, 63′ and a discharge opening 71 to which there is attached a discharge hose or nozzle 64. The water enters so that there is equal pressure from both sides on the impeller 67 whereby the pump is self priming.

Similar to the housing shown in Fig. 3, the housing comprises front, rear and side wall portions. Fluid openings 63′ are provided on one side of the impeller 67 and a fluid opening 63 is provided on the other side of the impeller 67 so as to create equal pressure and to be self priming.

The discharge opening 71 can be tangential as shown in Fig. 2, but advantageously it is horizontally aligned with the impeller 67 as seen in Fig. 5. Optionally, the housing 61 may have a stand such as foot 70 and 70′. Also, the interior of the housing 61 may contain a screen 72 to prevent intake of large objects which may damage the impeller 67. Also, optionally, a knife assembly 69 may be mounted on the drive shaft 63 to shred or break large particles or unwanted obstructions which are drawn into the pump 60.

In operation, the motor 62 rotates the impeller 67 which draws a fluid, for example, water, through the inlets 63, 63′ and into pump 60 that it is carried outwardly along the sloped impeller surface and propelled by the impeller blades through the discharge hose 64. The hydraulic lines 65 and 65′ may be connected to a hydraulic pump on a vessel which is remote from the area of operation.

The construction of the impeller of the bilge pump may be in accordance with the impeller shown in Fig. 1 or as described in the aforementioned patent No. 4,688,987, which is herein incorporated by reference.

A typical pump having a water discharge capacity to 15 gallons per second is provided with an 8 inch impeller having a 30° slope, a housing with a diameter of about 10½ inches, a width of about 3¾ inches. The NPT discharge is about 3 inches and the solid handling capacity is to about ⅞ inch. No seals are required.

In the larger sized remote pumps where there is a discharge opening of about 10 inches and an intake opening of about 10 inches, the sloped impeller is about 26 inches in diameter and is provided with impeller blades or paddles of about 5 inches in width.

As a result of the slope there is a greater volume of fluid at the end of the impeller blades to be discharged. The sloped impeller also causes a reduction in unusable vacumm and increase blade strength.

The pump of the invention does not require great precision in manufacture therefore it can be formed from metals such as aluminum, bronze, etc., or rigid plastics such as RYTON.

Although the foregoing invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it will be obvious that certain changes and modifications may be practiced within the scope of the appended claims.

Claims

1. A self priming centrifugal pump apparatus for use in an atmosphere subject to the build up of hazardous gases or other fluids comprising a drive shaft, a motor means for driving said drive shaft, a housing having front and rear walls, peripheral side walls, a discharge outlet opening, and mounting means for securing said housing so as to be in a fixed, spaced and non-contacting relationship around the drive shaft, sloped impeller means within and in spaced relationship with said housing formed by a coupling of said motor means to the drive shaft , said impeller means having outwardly extending blades at its end, and inlet means about the drive shaft so that fluid moves outwardly along the slope to the blades, whereby the impeller means and housing cooperate to discharge fluids through said outlet opening in response to the rotation of the drive shaft without any substantial generation of heat due to friction and the inlet means permits entry of the fluids so that there is equal pressure on both sides of the impeller means.

2. The centrifugal pump apparatus of claim 1 wherein said housing comprises front, rear and side wall portions, a pair of aligned fluid inlet openings in said front and rear walls of said housing, each of said fluid inlet openings being of a greater dimension than said first cross sectional dimension of

the drive shaft.

3. The centrifugal pump apparatus of claim 2 wherein said drive shaft extends through said fluid inlet openings in spaced non-contacting relationship to said housing so that fluids entering said housing passes around said drive shaft substantially equally on both sides of the impeller means, across the sloped surface of the impeller means and through said outlet opening, and the centrifugal pump apparatus of claim 2 in which said discharge opening is formed in said side wall of said housing and includes a nozzle means for creating a channel which extends outwardly of said housing generally tangentially with respect to said side wall portions.

4. The centrifugal pump apparatus of claim 1 in which said housing defines a generally cylindrical chamber, said impeller means has blade means substantially extending between said front and rear walls of said housing and outwardly into proximate relationship with said side wall portions thereof said rear walls of said housing include portions extending outwardly beyond said walls, and spacer means extending from said outwardly extending portions of said rear walls so as to space said housing from adjacent walls of the enclosure.

5. The centrifugal pump apparatus of claim 1 wherein said drive shaft is coupled to one side of said impeller means side, said motor means is coupled on the other side of said impeller means within said housing, and said drive shaft is provided with propeller means.

6. The centrifugal pump apparatus of claim 1 wherein said impeller means has a slope on both sides of about 30 to 45 degrees.

7. A fluid immersible discharge pump comprising a hydraulic motor, a housing associated with said motor, said housing having fluid inlet openings and a fluid discharge opening, a drive shaft within said housing operatively connected for rotation by said motor, an impeller means associated with said drive shaft and rotatable within said housing so as to draw fluid into said housing through said inlet openings, said impeller means having blades along its outward edge for discharging fluid through said discharge opening, said inlet openings being on both sides of said impeller means and creating substantially equal pressure on both sides of said impeller means, and means separate from said motor for activating said motor when said housing is immersed in a fluid.

8. The immersible pump of claim 7 wherein said impeller means is sloped on both sides about 30 to 45 degrees.

9. The immersible pump of claim 7 wherein said housing comprises front, rear and side wall portions, a pair of fluid openings in said front and rear walls of said housing, so as to create equal pressure and to be self priming.

10. The immersible pump of claim 7 wherein said impeller couples said motor with said drive shaft.

11. The immersible pump of claim 7 wherein said discharge opening includes nozzle means, and said motor is connected through hydraulic lines to a hydraulic pump.

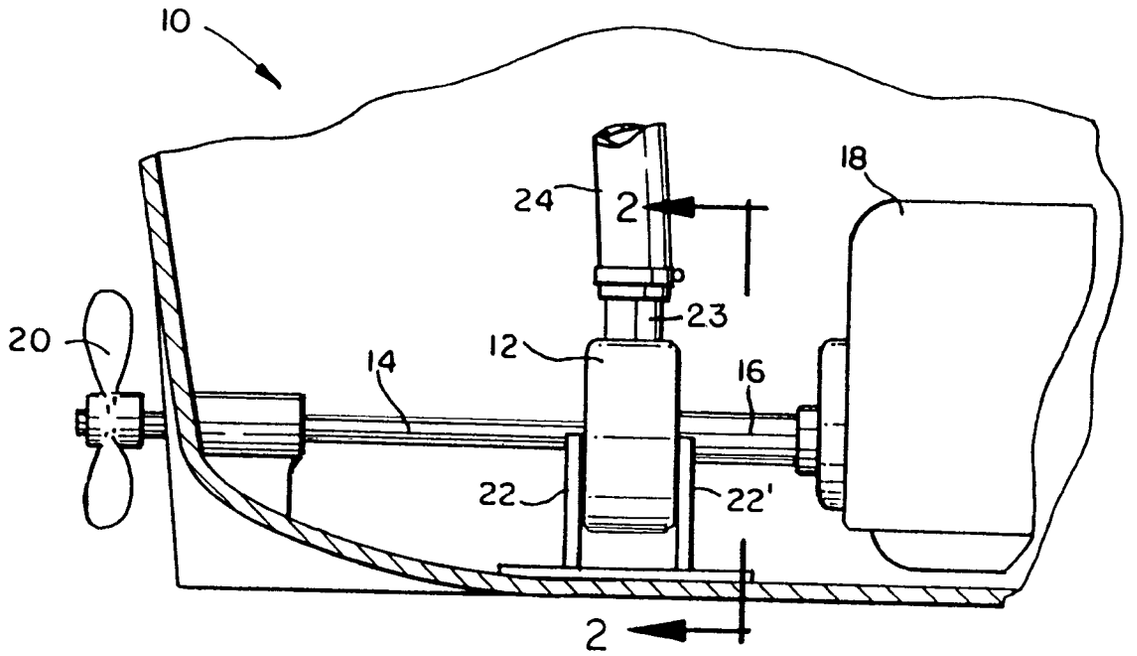

FIG. 1

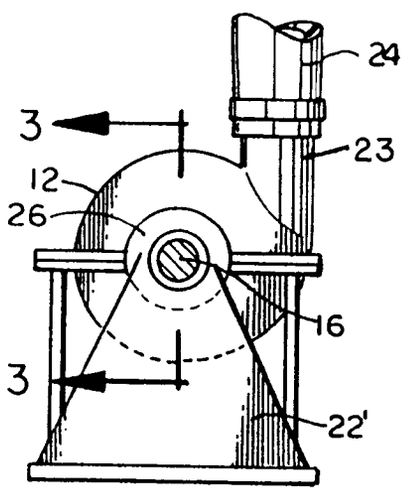

FIG. 2

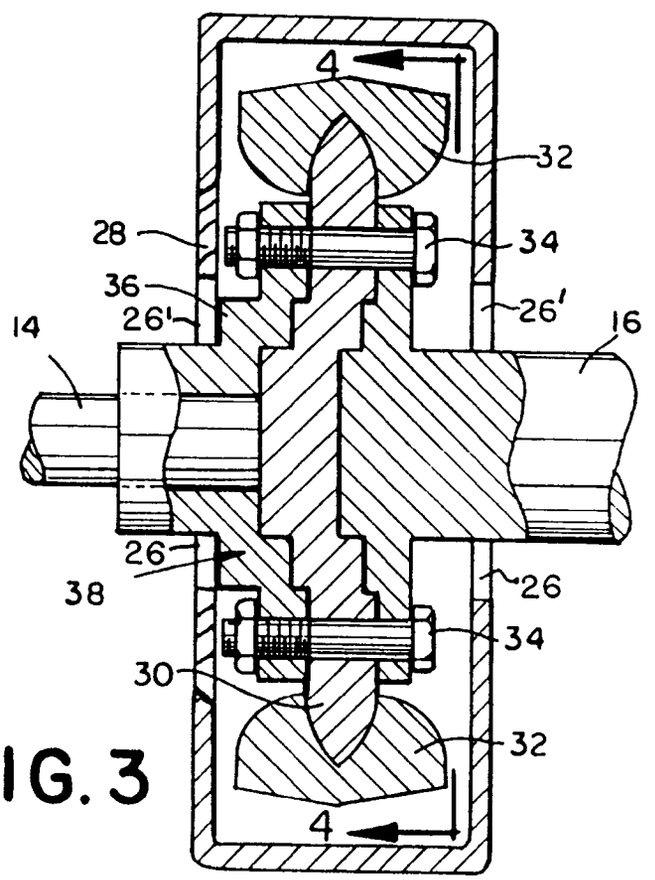

FIG. 3

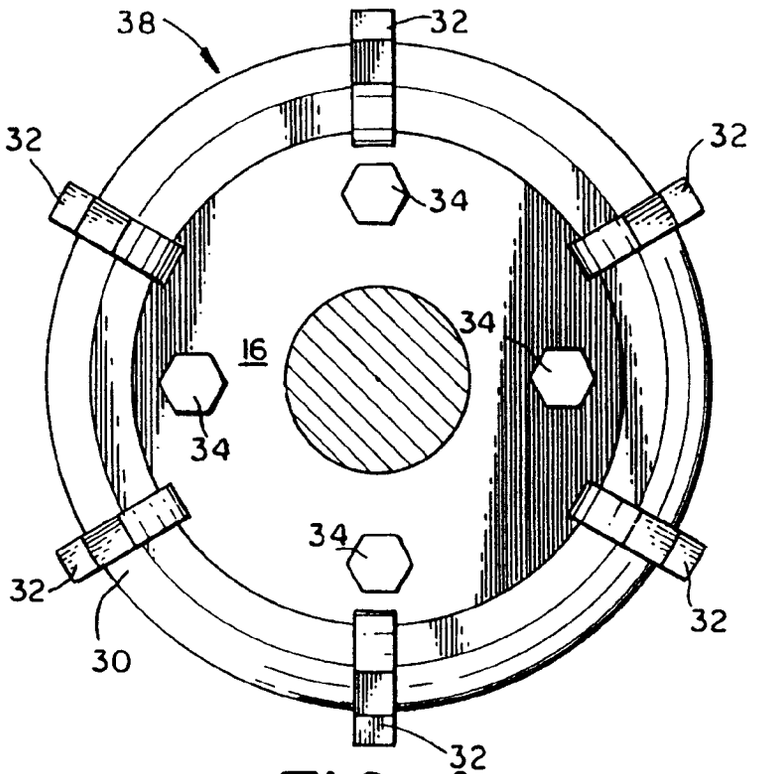
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FIG. 4

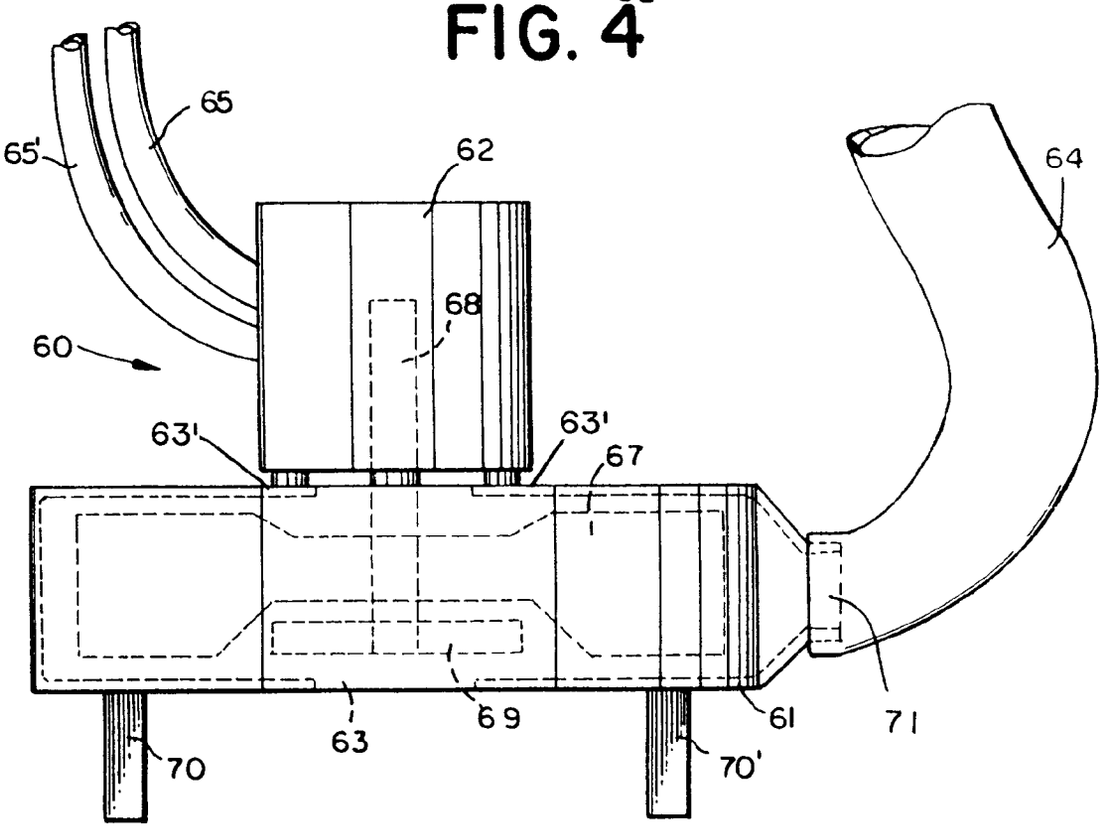
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FIG. 5