United States Patent [19]

Akins, Sr.

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[45] **Jan. 29, 1974**

[54] **SUBMERSIBLE PUMP**

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[21] Appl. No.: **269,836**

[52] **U.S. Cl.** **417/88,** 417/89, 417/91

[51] **Int. Cl.** **F04b 23/04**

[58] **Field of Search** 417/87, 88, 91, 89, 90, 376, 417/244, 54

[56] **References Cited**

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Primary Examiner—William L. Freeh
Assistant Examiner—Richard E. Gluck
Attorney, Agent, or Firm—Schroeder, Siegfried, Ryan and Vidas

[57] **ABSTRACT**

This invention relates to a submersible pump which combines a pneumatic motor with an elongated cylindrical pump body having a vane type structure therein driven by the motor. The outlet of the pump receives a portion of the supply air bled off at the intake side of the motor and directed to the outlet of the pump to provide a jet action increasing pumping efficiency. The exhaust air from the motor is also directed to the outlet side of the pump to further assist the pump by providing an air pressure source to the water column moved by the pump.

4 Claims, 4 Drawing Figures

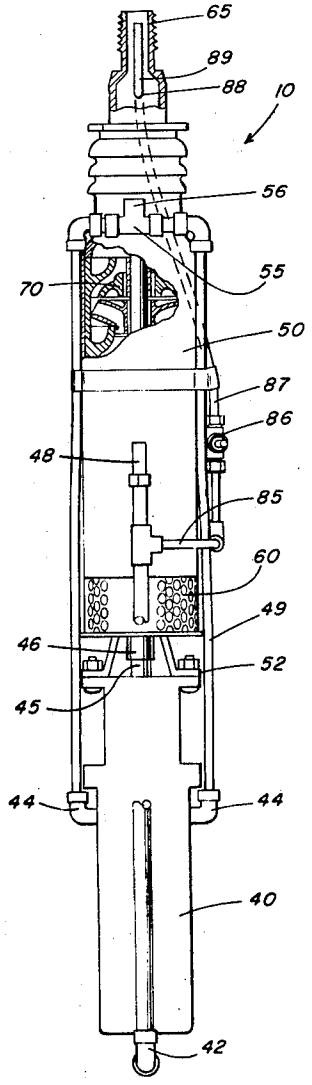


FIG. 1.

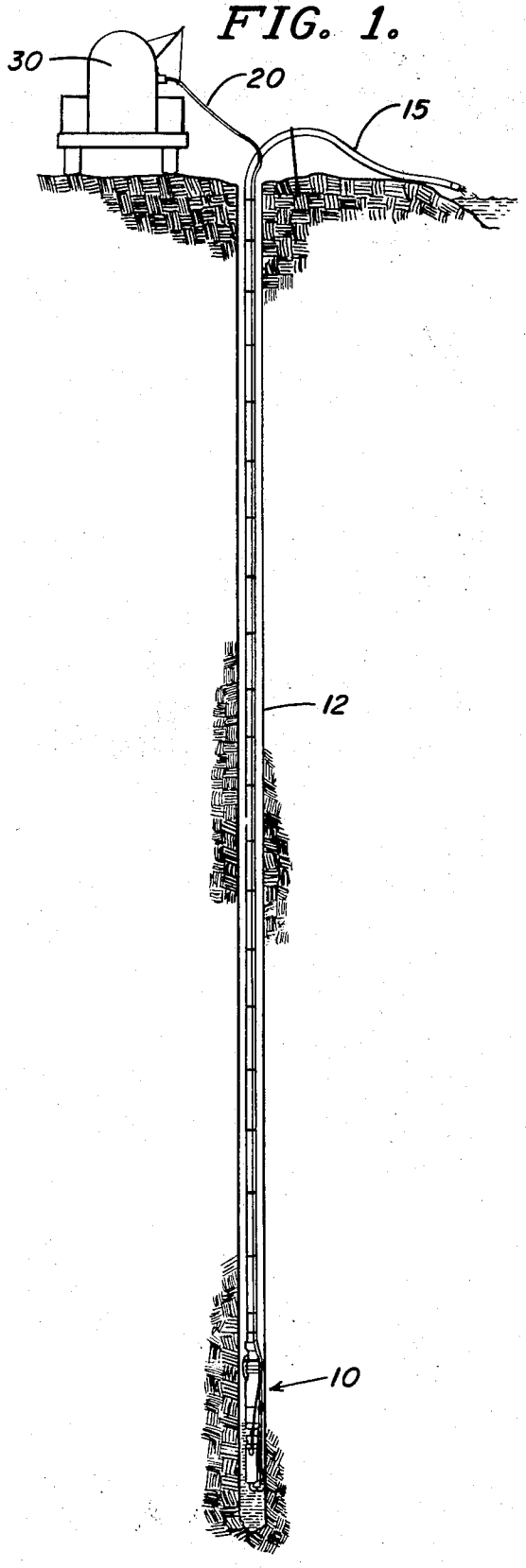


FIG. 2.

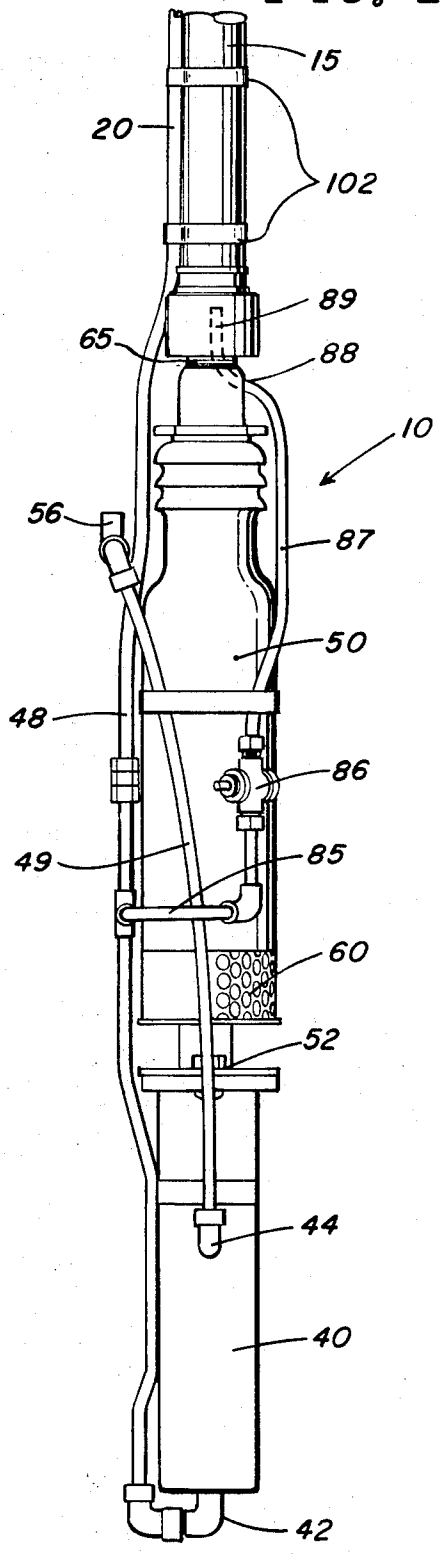


FIG. 3.

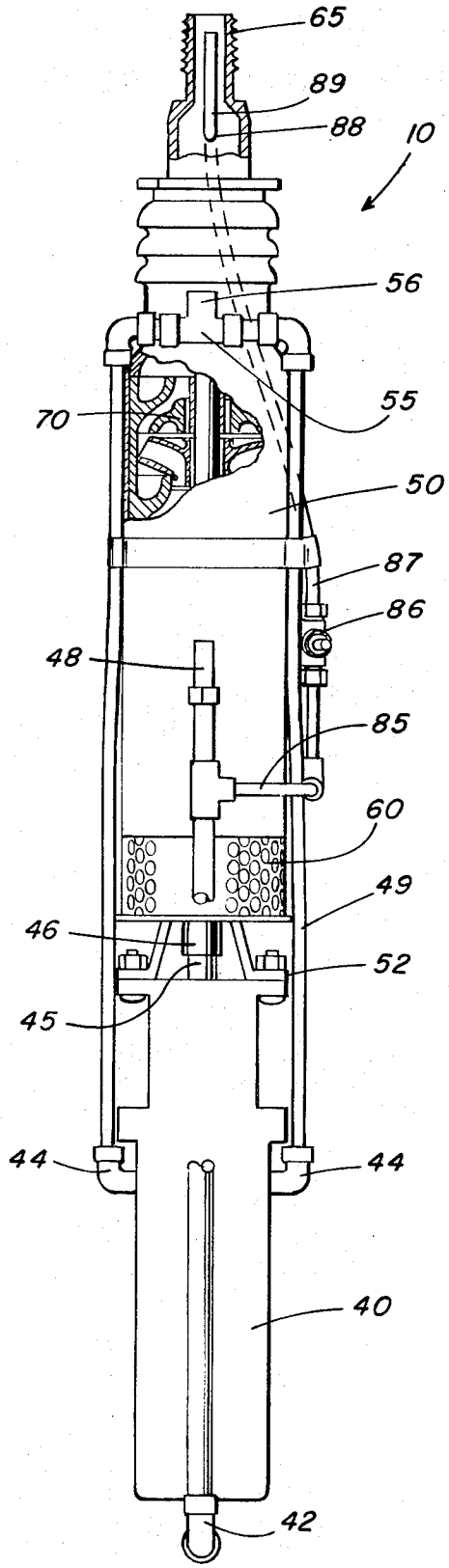
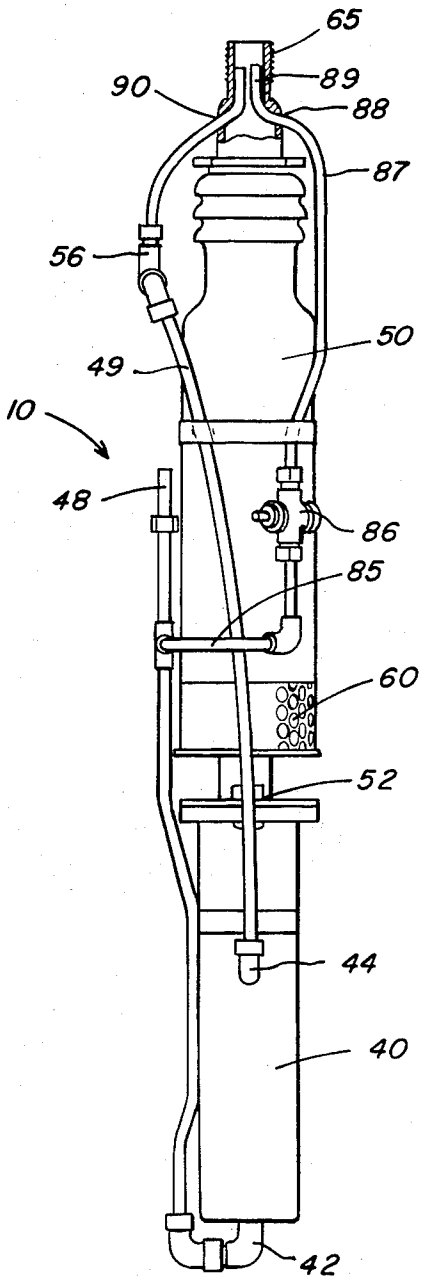

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FIG. 4.


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SUBMERSIBLE PUMP

My invention relates to motor driven pumping apparatus and more particularly to an improved submersible pump particularly adapted for use in the pumping of drill holes.

Submersible pumps are known and in use. They have taken a variety of forms or shapes and have used fluid as well as electric motive means for driving the same. Generally, prior designs have not been applicable to applications in which the pump is inserted and removed from a pumping area with each application or usage, nor have they been of such a compact nature as to permit ready insertion into a confined space, such as a drill hole, for the purpose of removing water or moisture from the same. Similarly, the prior designs were not built sufficiently rugged in construction to withstand such usage and were incapable of a lift efficiency which would enable them to raise fluids in a relatively short period of time and to a desired height to enable the water or fluid to be removed therefrom. Further, the insertion and removal of such pumps required the use of special tools and inserting and lifting apparatus.

In the present invention, an improved submersible pump is provided which combines a pneumatic motor as the power source with a pump of the spiral vane type adapted to provide a lifting force to enable it to work at significant head levels for the purpose of removing water from drill holes. In the improved design, the cylindrical body of the pump and motor are substantially identical in diametrical dimension to provide an elongated structure of uniform circumference and with an external air line connected thereto to permit powering of the motor and usage of the exhaust air as well as some of the inlet air to improve the pumping efficiency and provide a greater pumping head. In the improved submersible pump design, the air power line and the water discharge line are combined to provide the means by which the pump is raised and lowered into drill holes and provide a structure which is relatively maintenance free and shock proof.

It is therefore an object of this invention to provide an improved submersible pump with increased pumping efficiency.

Another object of this invention is to provide an improved submersible pump which is rugged in design and capable of continuous insertion and removal into and from drill holes without the application of special tools.

A further object of this invention is to provide in a submersible pump an arrangement by means of which a portion of the motive air supply is directed to the discharge exit of the pump to provide a jet assist to the pumping action thereof and increase the efficiency of operation of the same.

A still further object of this invention is to provide an improved submersible pump having an elongated cylindrical profile particularly adapted for use in the pumping of drill holes for the purpose of removing water therefrom preparatory to blasting operations.

Another object of this invention is to provide an improved submersible pump which is easily positioned and removed from drill holes to pump water out of the same and remove water therefrom.

A still further object of this invention is to provide an improved submersible pump which is non-hazardous in operation.

A further object of this invention is to provide a submersible pump design which is easy to use and maintain.

These and other objects of this invention will become apparent from a reading of the attached description together with the drawings wherein:

FIG. **1** is a schematic view of a drill hole showing the application of the improved submersible pump thereto with the exhaust and power sources connected thereto;

FIG. **2** is a front elevational view of the pump;

FIG. **3** is a side elevational view of the submersible pump of FIG. **2** with parts broken away; and

FIG. **4** is an elevational view of an alternative embodiment of the pump connections of FIGS. **1, 2** and **3.**

My improved submersible pump is shown schematically at **10** in the principal application of the same. FIG. **1** is a schematic or diagrammatic showing of a drill hole or shaft **12** positioned in the earth from which it is normally desired to remove water or other moisture before usage can be made of the same. Normally, in drilling of blast holes or drill holes, if they are left unattended for a period of days before usage, surface water or seepage may fill or partially fill the hole making it incapable for usage, particularly where explosives are to be used therein and the explosives are of the water soluble type. Thus, it is necessary to remove the moisture from the hole before effective usage such as blasting may be made of the same. As shown schematically in FIG. **1,** the improved submersible pump is lowered into the drill hole by means of a water evacuating hose **15** and an air hose **20** clamped together and connected to the submersible pump. Sufficient length of the hose is provided so that the water discharge hose or evacuating hose **15** may have the free extremity of the same positioned away from the surface of the hole after pumping operation so that water discharged therefrom will not seep back into the hole. As shown schematically in FIG. **1,** a block **30** indicating an air compressor **30,** provides an air supply which is directed to the air line **30** powering the submersible pump as will be hereinafter described.

In FIGS. **2** and **3,** the improved submersible pump is shown as comprised of a pneumatic motor section **40** and a pump section **50** coupled together by means of a coupling means **52** to provide a generally elongated cylindrical outline. Each of the members or the motor and the pump having a cylindrical body of substantially the same diametrical dimension. The internal details of the pump and motor form no part of the present invention and are shown only schematically herein to indicate the operation of the structure. The pneumatic motor may be of any make but for simplicity and application should have a generally elongated cylindrical body with a uniform exterior with an inlet port **42** and at least one outlet port **44** by means of which air may be directed through the motor body. The output shaft **45** will be connected to the inlet shaft **46** of the pump to drive the same. I have found that a pneumatic motor manufactured by Gardner-Denver Company of South Gardner Expressway, Quincy, Illinois 62301 identified by Type Number MA3G is suitable for this purpose. This motor is powered from the air supply line indicated at **20** which extends from the compressor on the surface and is preferably made of a flexible or rubber material. A suitable metal tube **48** is connected to the inlet port **42** and clamped to the body of the pump and

motor to provide a generally smooth exterior outline for the submersible pump without significantly increasing the overall dimensional size of the same. The pump similarly may be of any make and I have found that a series UT pump manufactured by Gould Pumps, Inc. of Seneca Falls, New York is suitable for this purpose. Thus in FIGS. 2 and 3, the pump body which has the generally cylindrical casing of the approximately same diametrical dimension as that of the motor will provide a generally elongated cylindrical outline or profile for the submersible pump readily adapted for insertion into blast holes. The outlet ports of the motor 44 are connected by means of metal tubing 49 to a T shaped outlet member 55 having an outlet nozzle or port 56 above the end of the pump for the purpose of discharging the motor air at this point. The pump has an inlet area 60 which is suitably screened adjacent the drive shaft 46 and the coupling to the motor shaft 45. The opposite end of the cylindrical body of the pump has a nozzle section 65 through which fluid pumped from the pump will be ejected. This is coupled to the rubber discharge hose 15 leading to the surface of the ground. Internally the drive shaft of the pump with the impellers 70 mounted thereon, as will be seen in FIG. 3, is suitably journaled within the casing.

In the preferred embodiment of the pump design, the inlet air line 48 or the tubing thereto has a branch passage 85 leading therefrom and through a restriction 86 in the form of an adjustable valve with a passage continuing through conduit 87 and through the wall of the discharge end 65 of the pump, as indicated at 88, to provide a tubular section 89 within the discharge section of the pump from which supply air will be exhausted for the purpose of providing a jet air stream assisting the outlet of the pump and reducing the pressure on the side to improve the efficiency of the same. The valve or restriction is adjustable to proportion the amount of air taken from the air line to the motor so that the ideal motor operation and pumping efficiency can be obtained. This jet assist by means of the supply air increases the efficiency of the pump and its lifting ability by providing an air column as the water is being lifted to increase the lift height and discharge capacity of the pump.

In the alternate embodiment shown in FIG. 4, the same components of motor 40 and pump body 50 are employed with the coupling between the motor and pump for the driving relationship therefrom. In addition, the air inlet line 48 to the motor includes the bypass 85 by means of which airflow is directed into the discharge extremity 65 of the pump to provide the jet assist therefrom. The inlet air is also directed through the port 42 of the motor and the outlets 44 of the motor are connected in a branch common and into the discharge extremity 65 of the pump as indicated at 90. Thus, discharge air from the motor will assist the air bled through the conduits 85, 86 and 87 in increasing the pumping efficiency by utilizing the air coming from the motor for the purpose of providing additional air force and jet action to the water stream leaving the pump to reduce the pressure on the discharge side of the pump and increase the lifting efficiency of the same.

In each of the emobdiments, the discharge hose 15 and the air hose 20 are clamped by suitable clamping means, such as is indicated by tapes or clamps 100 along the extent of the same to provide a flexible and coilable suspension means of high tensile strength by means of which the submersible pump body may be raised or lowered into a drill hole for the purpose of application of the same. The improved construction of the metallic tubes for the air supply and discharge air supply along the extent of the body will be held in close proximity thereto by means of clamps 102 to enable the pipes to present a minimum of projection beyond the cylindrical surface of the pump and motor bodies to provide a profile for an elongated body structure readily insertable and removable from a drill hole. The intake to the pump while being positioned at the upper end of the motor will effectively remove most of the moisture from the drill hole since the motor body will be displacing the same. With this improved submersible pump, the drill hole or equivalent structure may be substantially evacuated of all fluid, such as water, and prepared for a blasting operation by the insertion of a sock or other protective surface to provide a moisture protective area between the soluble type explosives and the water surface.

In considering this invention it should be remembered that the present disclosure is illustrative only and the scope of the invention should be determined by the appended claims.

I claim:

1. A submersible pump comprising in combination:

a. a pneumatic motor having an elongated cylindrical body with an inlet port at one extremity and an output shaft and outlet ports at the other extremity,

b. a pump having a cylindrical body with a drive shaft and and inlet port at one extremity and an outlet port at the other extremity,

c. means coupling the cylindrical bodies of the motor and the pump and connecting the output shaft of the motor in driving relationship with the drive shaft of the pump, said cylindrical bodies of said motor and pump being substantially of the same diametrical dimension to provide an elongated submersible pump structure adapted to be inserted into drill holes with the fluid inlet to the pump being positioned above the motor,

d. an air supply pipe connecting the inlet port of the motor to provide an air supply to the motor to rotate its output shaft,

e. a discharge pipe connected to the outlet port of the pump and adapted to remove fluid pumped by said pump with operation of said motor, and

f. a bypass connection including a restriction connecting the air supply pipe to the outlet port of the pump to provide a jet assist to the operation of the pump, the air supply pipe and the dishcarge pipe being mechanically coupled together above the outlet port of the pump and being made of a flexible material to provide the means for raising and lowering the submersible pump into drill holes,

g. and additional connection means connecting the outlet ports of the motor to the discharge pipe of the pump to provide an additional jet assist to fluid discharged at the outlet of the pump said additional connection means located external of said pump cylindrical body.

2. The submersible pump of claim 1 in which the restriction is an adjustable valve for proportioning the airflow from the inlet air source between the inlet of the motor and the outlet of the pump.

3. The submersible pump of claim 2 in which a portion the air supply pipe is positioned adjacent the cylindrical bodies of the pump and motor leading to the inlet port of the motor, said portion being made of a rigid material and clamped to the cylindrical bodies to closely align with the physical outline of the cylindrical bodies of the submersible pump.

4. The submersible pump of claim 3 in which the bypass connection is made of a rigid material and is clamped external to the body of the cylindrical pump and in contact therewith.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,788,771 Dated January 29, 1974

Inventor(s) Herbert Akins, Sr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 40, "30" should be changed to-"20"-

Column 4, line 53, "dishcarge" should read -- discharge -- .

Signed and sealed this 6th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.