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I. C. JENNINGS
SUMP OR BILGE PUMP

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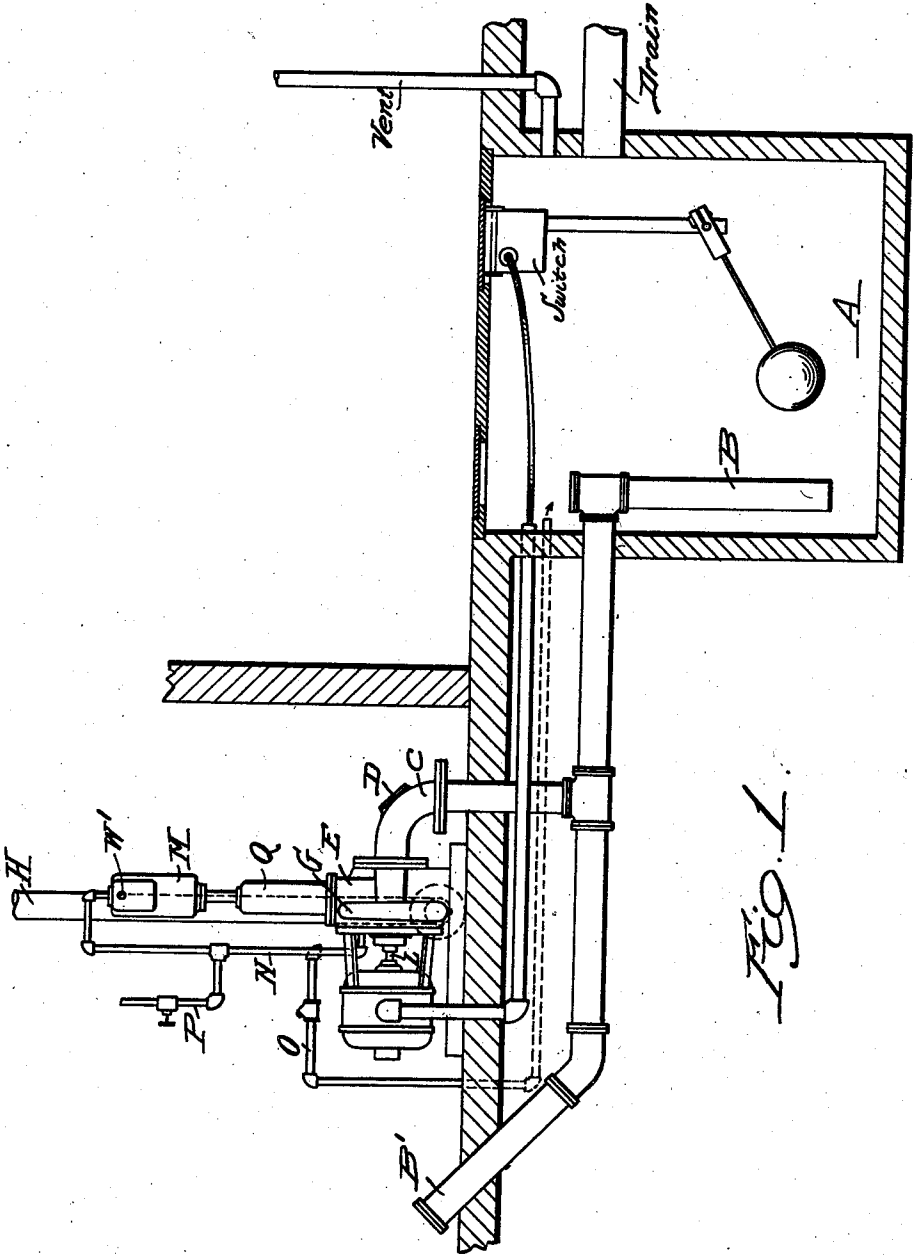


Fig. 1

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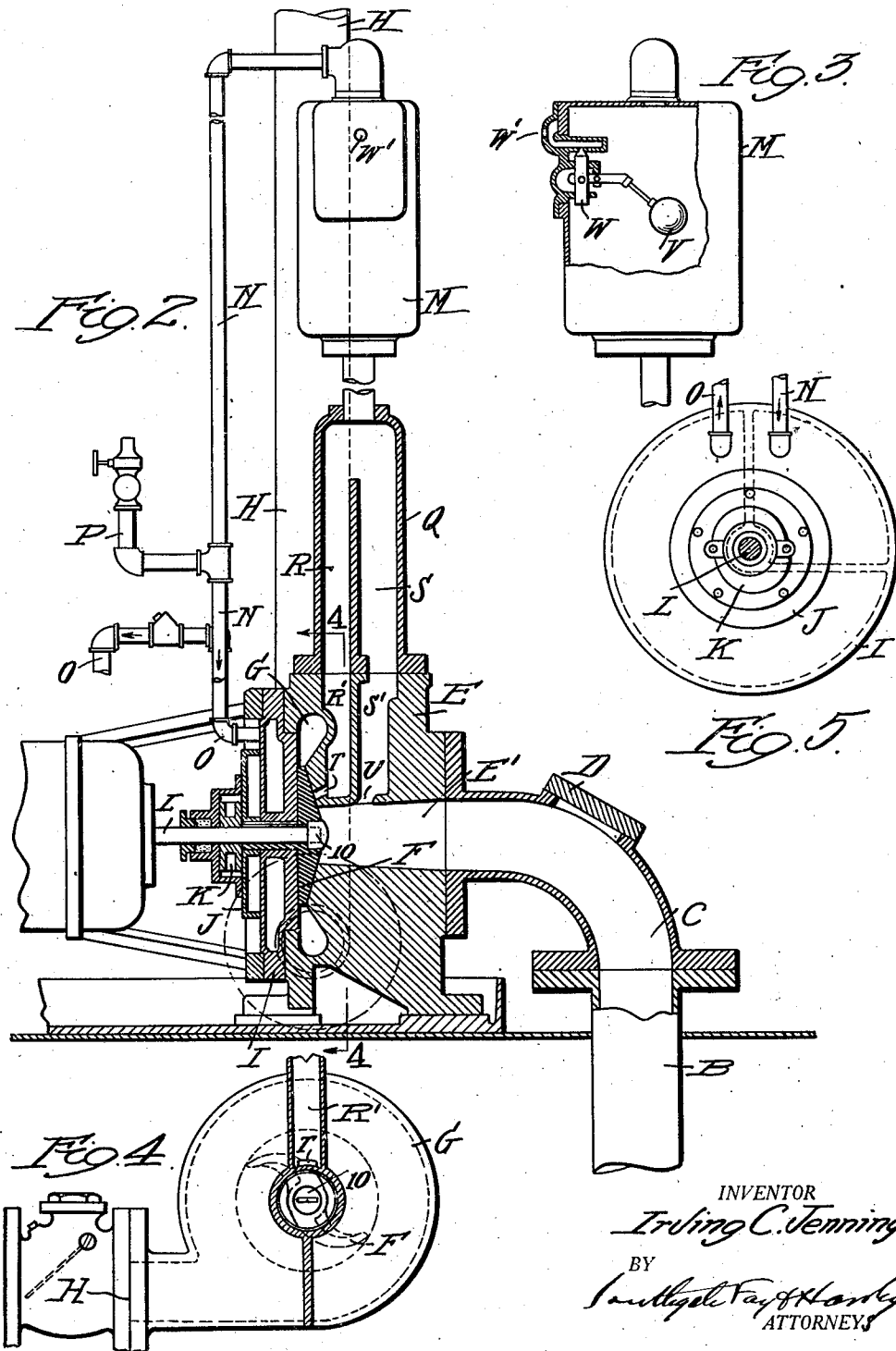
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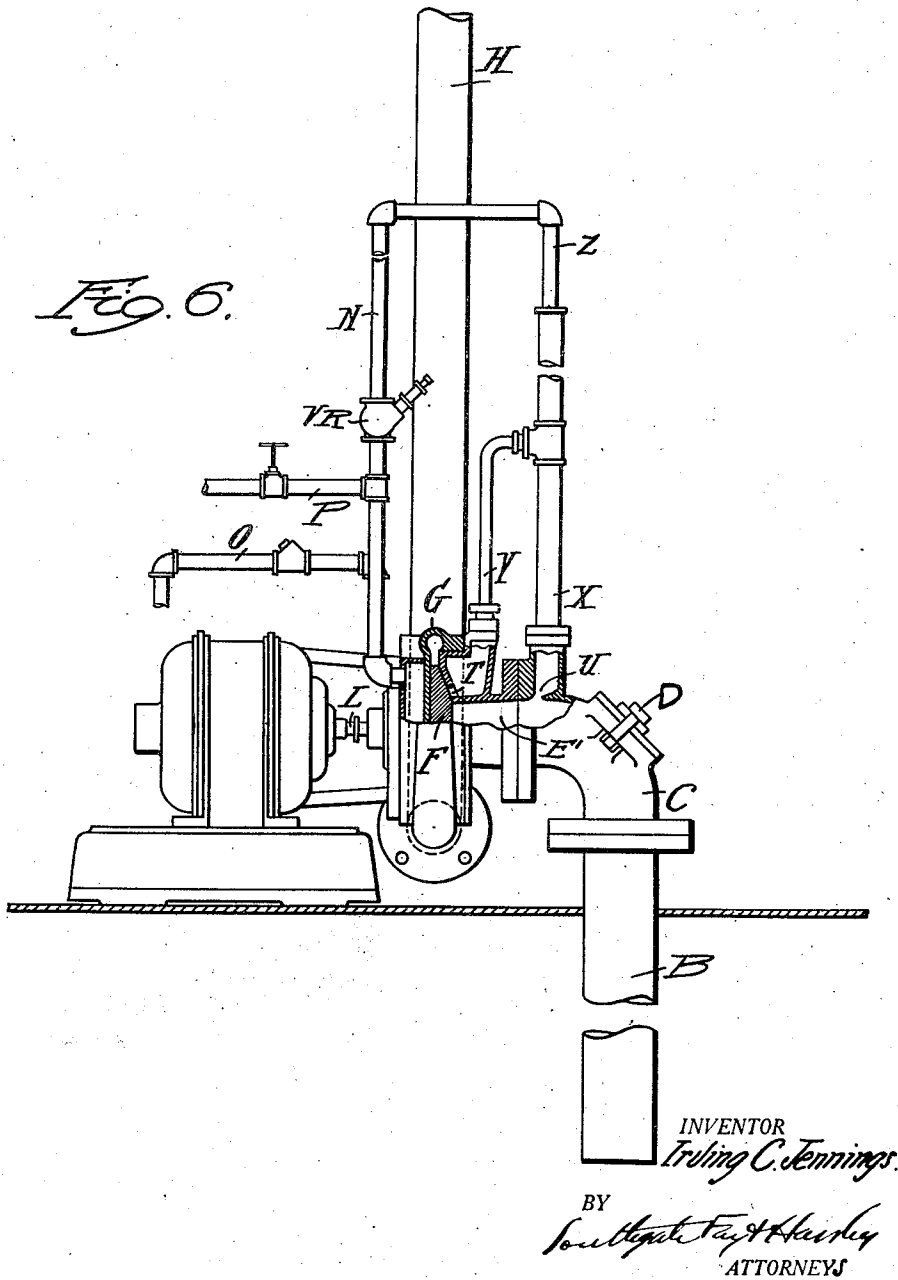
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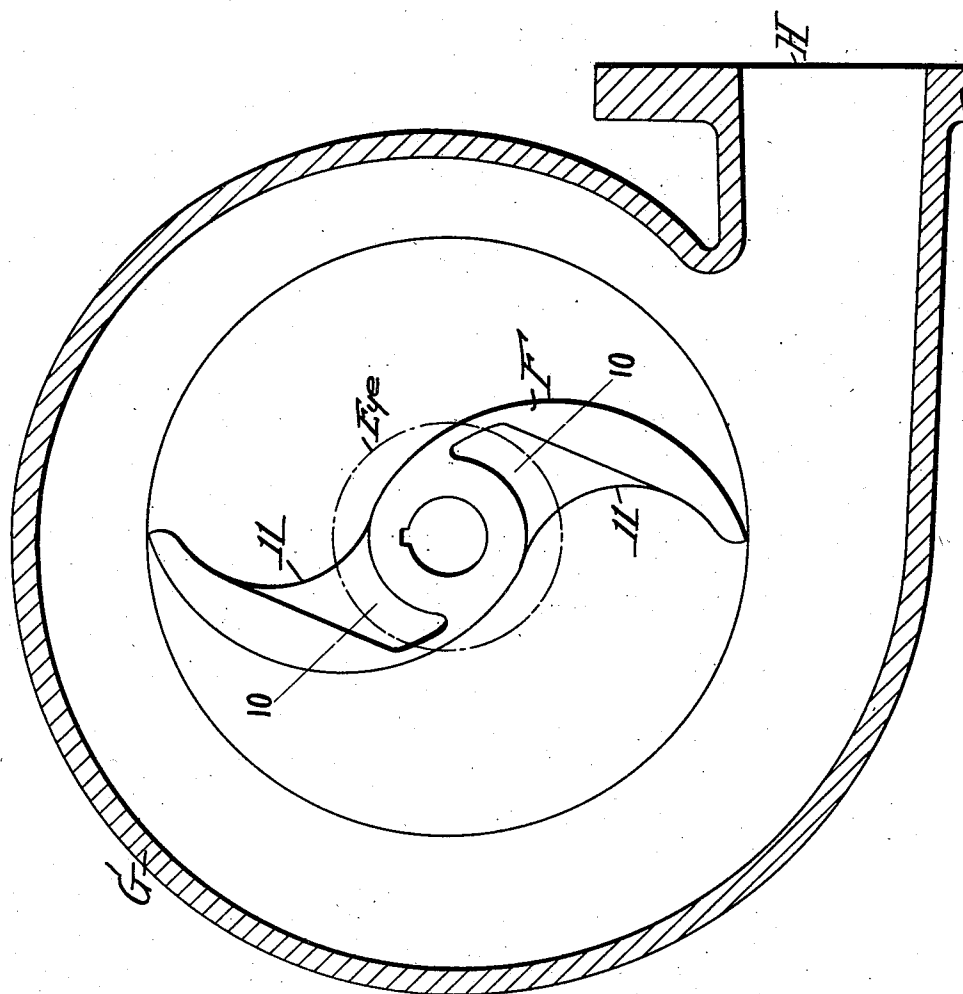


FIG. 7

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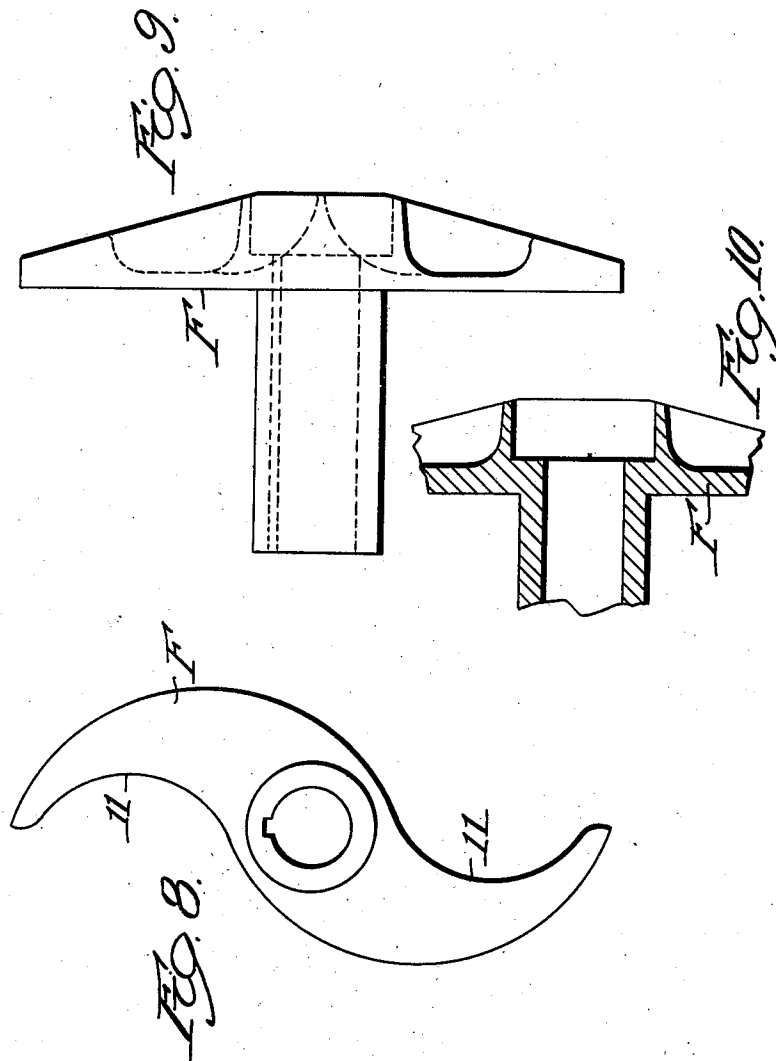
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5 Sheets-Sheet 5



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SUMP OR BILGE PUMP

Application filed September 6, 1927. Serial No. 217,670.

The object of this invention is to provide a new and improved sump or bilge pump, by which seepage or drainage water can be removed from a low point or sump and discharged at a higher point, as into a sewer. The structure has been particularly designed for use in buildings, where it is necessary to lift seepage or other water or sewage up into a sewer at a high level.

10 The usual apparatus for doing this work consists of a centrifugal pump arranged on a vertical shaft submerged in the sump, and driven by a motor vertically arranged on top of the sump. This usual structure has the disadvantages that it is hard to get at the pump for the purposes of cleaning and repair, and that it is difficult to maintain the pump in good working order due to the fact that the bearings of the pump are submerged in the liquid. The motor also has to be set over the sump and usually is in the way.

One main design of my present invention is to provide a pump for this purpose which can be arranged on a horizontal axis and at a distance from the sump. As a pump of this character is operated intermittently, and as a centrifugal pump in starting cannot operate to lift, it is necessary to provide a device by which the centrifugal pump will start in operation. To effect this starting, I arrange an air pump in connection with the centrifugal.

15 In using a combined centrifugal and air pump of this character, I have found difficulty in effecting a quick starting of the centrifugal and in keeping the centrifugal smoothly in action, as more or less air will come along with the water from time to time. A further purpose of the invention, therefore, is to provide an improved connection between the air pump and the centrifugal so that this objection will be overcome.

45 The invention further comprehends certain improvements in the structure of the impeller or rotor of the centrifugal pump hereinafter described.

The invention is shown in detail in the 50 accompanying five sheets of drawings.

In said drawings, Figure 1 is a diagrammatic view illustrating how my apparatus can be installed horizontally above and away from the sump.

Figure 2 is a partial sectional elevation 55 on an enlarged scale, of the pumping apparatus.

Figure 3 is a sectional elevation through the water and air separator tank.

Figure 4 is a sectional view on the line 60 4—4 of Figure 2, illustrating the inlet connection, and the air vents for the centrifugal pump.

Figure 5 is an end elevation of the port plate and air head illustrating the connections. 65

Figure 6 is a view similar to Figure 2, illustrating a modification of the air connections to the pump.

Figure 7 is a cross-sectional view on an 70 enlarged scale of the centrifugal pump.

Figure 8 is a rear elevation of the impeller.

Figure 9 is a side elevation thereof, and

Figure 10 is a sectional view taken on the 75 line 10—10 of Figure 7.

The improvements will be best understood by a detailed description of the parts. Referring to the drawings, and in detail, A designates the sump or well into which the seepage and sewage may flow and into which the drains are connected. This sump is usually provided with an air ventilating pipe or vent. An electric switch is arranged in the sump and is controlled by a float. The contents of the sump are removed through a 85 pipe B, which projects down near the bottom of the sump and which extends horizontally to the pumping apparatus. This pipe may be provided with an extension or cleanout B', through which a rod or cleaning tool can be inserted. This pipe B is joined to elbow C, Fig. 2, which is bolted or connected to one side of the pump casing. This elbow C is provided with a cleanout D. 90 E designates the pump casing, which has a central passage E'. F represents the impeller or centrifugal pump, which is arranged on the same axis as the inlet passage E'. The volute G of the pump is formed 100

in the pump casing around the centrifugal impeller F, and an outlet pipe H is connected therewith and carried to the desired point of discharge. An air head I is fitted into the pump casing. A port plate J is secured to this air head I, and a rotary air pump K is secured to the port plate. This rotary air pump can be made of any desired form and preferably the well-known Nash air pump such as is shown in Patent No. 1,297,692 dated March 18, 1919, is employed. The centrifugal impeller F and the rotor of the air pump are arranged on a common shaft L, which is driven by an electric motor secured by a bracket to the air head I. The air pump is connected by a pipe N to exhaust air and gas from an air and water separator tank M, and to discharge the same through a pipe O which may be run to waste. A water pipe P may be connected to the inlet of the air pump at any desired point, as through the inlet pipe N, so that the air pump can be primed with water.

It is not necessary to describe the operation of the air pump in detail as the same is well known and understood from the patent before referred to. The separator tank M is secured on top of a manifold Q, which is secured on top of the pump casing. This manifold has two passages, R and S, which connect together at the top and which communicate with passages R' and S' in the water pump casing E. The passage R' is provided with a hole or orifice T, which communicates with the interior of the water pump or volute at a point outside the inlet eye to the impeller, which is formed by the central inlet passage E' and within the diameter of the impeller. The passage S' communicates with the central inlet or water supply E' through a restricted opening U. The passages R and S and R' and S' thus form a circulating connection between the hole T and the opening U. The operation of the parts thus far described is substantially as follows:

When the level of the water or sewerage in the sump reaches a predetermined height, the float operates the electric switch and starts the motor in operation. This will cause the rotary air pump to exhaust air from the pipe B through elbow C, through the orifice T, and the restricted opening U. When the air is exhausted from the pipe B and the elbow C, atmospheric pressure will force water from the sump to the rotating impeller of the centrifugal pump. As the water gradually rises in the horizontal inlet connection E' to the water pump, the air continues to be drawn by the air pump through the restricted opening U and the orifice T until the horizontal inlet to the water pump is nearly filled. At this point the air still contained in the centrifugal

water pump can pass out through the orifice T without having to travel back against the direction of flow of the water, as would be the case if the opening U were the only means available for the air to escape. The water and air in the centrifugal pump are mixed together due to the turning of the impeller of the centrifugal pump. The water entering the centrifugal pump, entrains air with it, which has to be eliminated. The impeller of the centrifugal pump causes this water and air to whirl around in the pump casing and as the water is heavier than the air, it displaces the air towards the center of the centrifugal pump, where it will escape through the orifice T. When the centrifugal pump is completely filled with water, it will pump efficiently, drawing water up through the passage E'. Any additional air which may be drawn up with the water due to leaky connections, or air dissolved in the water, will be forced to the center of the centrifugal and pass out through the passage orifice T. The centrifugal pump is therefore always kept in efficient operation. The orifice T being slightly outside of the opening or eye E' connecting to the centrifugal pump forms, in effect, a small centrifugal pump; water being drawn from the central passage E', discharged through the opening T, up through the passage R' and R, and returning through the passage S and S', and the opening U.

Any air discharged up through the opening T, with this water, passes out of the water at the top of the passages R and S and escapes into the separating tank M. If the opening U were not present, this flow would not occur and the passages R' and R might remain full of water, preventing the air accumulating in the centrifugal pump from passing up through the orifice T. By causing circulation as described above, this air is eliminated rapidly and the centrifugal pump is kept operating efficiently.

The separating tank M is provided with a float V which controls a valve W, controlling a passage to the atmosphere. If the water should rise in the separating tank M to a level sufficient to operate the float, this valve W opens to the atmosphere at W', and the vacuum created by the air pump is broken, which prevents the water rising above the level at which the float is set. This will prevent water drawn from the sump from passing over into the air pump. This is very desirable, because the water drawn from the sump may contain grit or solids which would interfere with the action of the air pump.

Another arrangement of parts which can be employed is shown in Figure 6. In this arrangement, the motor is secured on a base and the pump casing is carried by a frame or bracket extending from the motor. In this arrangement, the restricted opening U is ar-

5 ranged in the elbow C, and a pipe X is secured
to the top of the elbow to communicate with
this restricted opening. The orifice T is con-
nected by a pipe Y to the pipe X, so that the
two pipes X and Y perform the functions of
the passages R and S in the manifold of the
apparatus first described. The pipe X is
carried up to a suitable height Z before it is
connected to the exhaust pipe N extending to
the air pump. The height of the pipe X
above its connection with the pipe Y will be
determined by the high and low water level
in the sump, the height of the pipe X from its
connection with the pipe Y being made a little
greater than the difference between these
levels.

A vacuum relief valve VR is arranged at
any convenient point in the pipe line ZN.
This relief valve is set to operate at a vacuum
corresponding with the pressure of the height
of water from the upper level of the water
line in the sump to a point a little below the
top of the pipe Z, so that it will open and pre-
vent the water rising high enough in the pipe
Z to pass over into the air pump. This vacuum
relief valve thus performs the function of the
float V and valve W of the device first de-
scribed.

It is usual in sump pumps to employ a
strainer. This strainer rapidly fills with dirt
and rubbish and has to be cleaned out fre-
quently. By providing an impeller of open
construction as shown, capable of handling
dirt and rubbish, and by arranging the pipe
B and elbow C slightly larger than the intake
of the water pump, any material which cannot
be handled by the dirt handling impeller will
lodge at the entrance to the water pump and
can be readily removed through the opening
covered by the cleanout plate D. As only
very large particles will be caught in this
manner, the pipe C will not have to be cleaned
out except in very rare instances.

The improved construction of the impeller
will now be described and to follow this de-
scription, reference should be had to Figures
7, 8, and 9. The impeller F is two-bladed and
unwebbed as shown in Figure 7. The im-
peller is secured on the end of the shaft L by
means of a key, and is held in place by a
rounded nut 10, Figure 2, threaded on the end
of the shaft L. This provides a smooth face
or surface on the receiving face or side of the
impeller so that extraneous matter coming in
with the sump water will not catch thereon.
The faces of the two blades or wings of the
impeller on the side thereof towards the inlet
passage E', are gouged or cut out as at 11—11.
It will be noticed that these gouges or reduc-
tions in the stock of the impeller extend out
beyond the eye or inside diameter of the in-
let passage E'. The bearing faces of the im-
peller at the right side thereof are the areas
outside of the eye, as can be understood by
reference to Figure 7, where the eye is shown

in dotted lines. The opposed bearing faces
of the impeller on the left hand side thereof
are indicated in Figure 8; these faces being
the sections of the impeller beyond the cir-
cumference of the inlet or eye which is shown
in dotted lines. It will be noted that the faces
on the right side of the impeller are less in
area than the faces on the left side. The pres-
sure generated in the volute will work down
between these impeller faces and the casing
and as the pressure area is greater on the left
hand side of the impeller than on the right
hand side thereof, the resultant axial pressure
will act to push the impeller to the right, as il-
lustrated in the construction shown in Figure
5, and this will act to keep the rotor of the
air pump K in tight engagement with the
port plate J.

It will be noticed that the gouges or cut out
sections in the impeller extend inside of the
area of the inlet eye or the central passage
E'. This permits a larger inlet to the interior
of the impeller blades.

It also will be noticed that the construction
of the impeller is such that there is very little
opportunity for rubbish or waste to catch
thereon.

The details and arrangement herein shown
and described may be greatly varied by a
skilled mechanic without departing from the
scope of my invention as expressed in the
claims.

Having thus fully described my invention,
what I claim and desire to secure by Letters
Patent is:—

1. A centrifugal water pump comprising
an impeller, a casing forming a volute for
the impeller, a central inlet passage through
the casing forming the inlet eye to the im-
peller, a continuously open hole or orifice
in the casing communicating with the volute
at a point outside the inlet eye and within
the diameter of the impeller, and a circu-
lating connection from said orifice around
to the inlet passage.

2. A centrifugal water pump comprising
an impeller, a casing forming a volute for
the impeller, a central inlet passage through
the casing forming the inlet eye to the im-
peller, a hole or orifice in the casing com-
municating with the volute at a point outside
the inlet eye and within the diameter of the
impeller, an elevated circulating connection
extending from said hole up and then back
to the inlet passage, and having an air es-
cape opening at a high point, the impeller
co-acting with said hole or orifice to form in
effect a small centrifugal pump for pumping
a small stream of water out through said
orifice and back to the inlet passage to carry
along and exhaust any air coming in through
the inlet water so as to prevent the pump
becoming air-bound thereby.

3. A centrifugal water pump comprising
an impeller, a casing forming a volute for

the impeller, a central inlet passage through the casing forming the inlet eye to the impeller, a hole or orifice in the casing communicating with the volute at a point outside the inlet eye, and within the diameter of the impeller, an opening into the inlet passage, and means for exhausting air through said hole and said opening.

4. A centrifugal water pump comprising an impeller, a casing forming a volute for the impeller, a central inlet passage through the casing forming the inlet eye to the impeller, a hole or orifice in the casing communicating with the volute at a point outside the inlet eye, means for exhausting air through this orifice, an opening into said inlet, the hole and said opening being connected at a level above the inlet to allow a circulation of water through said hole into said opening back into the inlet, and means for exhausting air from the connection between said hole and opening.

5. A centrifugal water pump comprising an impeller, a casing forming a volute for the impeller, a central inlet passage through the casing forming the inlet eye to the impeller, a hole or orifice in the casing communicating with the volute at a point outside the inlet eye, and within the diameter of the impeller, an opening into said inlet, a connection between said hole and said opening extending to a substantial height above the inlet, and means for exhausting air from the top of said connection.

6. A centrifugal water pump comprising an impeller, a casing forming a volute for the impeller, a central inlet passage through the casing forming the inlet eye to the impeller, a hole or orifice in the casing communicating with the volute at a point outside the inlet eye, an opening into the inlet, a circulating connection between said hole and opening carried up to a substantial height above the central inlet passage, an air pump for exhausting air from said connection, and means for preventing the water from passing over to the air pump.

7. A centrifugal water pump comprising an impeller, a casing forming a volute for the impeller, a central inlet passage through the casing forming the inlet eye to the impeller, a hole or orifice in the casing communicating with the volute at a point outside the inlet eye, and opening into the central inlet passage, a connection between said hole and said opening extending to a substantial height above the inlet, a separator tank connected to the top of said connection, an air suction pump connected to said separator tank, and a float in said separator tank controlling an opening to the atmosphere.

8. A centrifugal water pump comprising an impeller, a casing forming a volute for the impeller, a central inlet passage through the casing forming the inlet eye to the im-

PELLER, a hole or orifice in the casing communicating with the volute at a point outside the inlet eye, an opening into the central inlet passage, a manifold secured on said casing and having passages communicating with said hole and said opening so as to form a circulating passage between the same, a separating tank secured on top of the manifold and having a float controlling a connection to the atmosphere, and a suction air pump connected to the impeller of the water pump to exhaust air from said separating tank.

9. A centrifugal water pump comprising an impeller, a casing forming a volute for the impeller, a central inlet passage through the casing forming the inlet eye to the impeller, a hole or orifice in the casing communicating with the volute at a point outside the inlet eye, an opening into the central inlet passage, a manifold secured to the top of the casing and having passages communicating with said hole and with said opening and forming a circulating connection between the same, a separating tank on top of the manifold, a float controlled valve therein communicating with the atmosphere, and a rotary air pump employing liquid for its pumping medium having its rotor connected to turn with the impeller of the water wheel.

10. A centrifugal water pump having an unwebbed bladed impeller, provided with a smooth surface on its receiving side, the wings or blades of which are gouged or cut out on the side thereof towards the inlet passage so as to form reductions in the stock of the impeller, said gouges extending out beyond the eye or inside diameter of the inlet passage to the impeller and arranged so that the bearing faces of the impeller blades are less in area than the other side of the impeller.

11. A pumping apparatus comprising a centrifugal water pump having an impeller, the wings or blades of which are gouged or cut out on the side thereof towards the inlet passage, and a rotary air pump connected to the water pump to start and keep the same in operation, the air pump employing liquid for its pumping medium and having a rotor bearing laterally on a port plate, the rotor being connected to and turning with the impeller, the gouges in the blades of the impeller making the impeller faces less in area on one side than on the other, the parts being arranged so that the resultant axial pressure will act to keep the rotor of the air pump in engagement with its port plate.

In testimony whereof I have hereunto affixed my signature.

IRVING C. JENNINGS.