

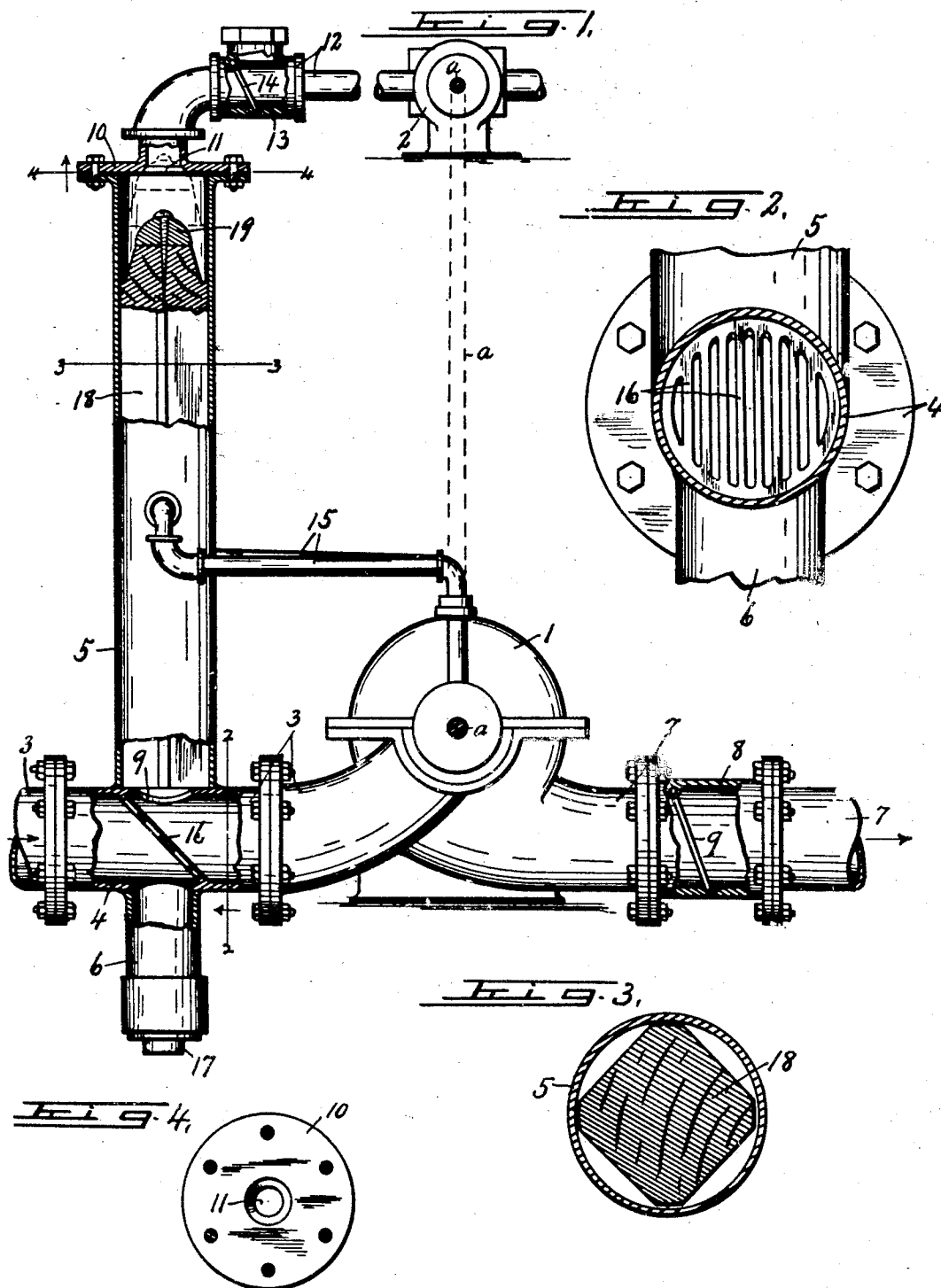
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HYDRAULIC PUMPING APPARATUS

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HYDRAULIC PUMPING APPARATUS

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This invention relates to apparatus involving the use of a centrifugal pump for removing water from marshes and other repositories preparatory to trenching and other excavations required for the construction of sewers, water mains, foundations for superstructures and other structural work and refers more particularly to means for maintaining a maximum efficiency of the pump under widely varying conditions of the work to be performed.

For example, in some cases it may be expedient or desirable to sink an indefinite number of well points into the water repositories along the line of the proposed excavations by jetting or otherwise and to connect these well points by a suction pipe which, in turn, is operatively connected to the suction side of a high powered centrifugal pump having its delivery side connected to an outlet pipe leading to any proximal or remote place where the water is to be discharged away from the place of removal.

In other cases, it may be necessary or desirable to use the apparatus to remove more or less shallow surface water commonly known as "open pumping" as distinguished from the "well point" work, and the broad object of this present invention is to render the apparatus equally efficient in both cases.

The main object, however, is to provide simple and efficient means for automatically removing and excluding air from said pump while the latter is in operation so that the latter may maintain a maximum working efficiency under abnormal as well as under normal conditions, without recourse to admitting outside air to the interior of the connections between the vacuum and centrifugal pump.

I have found that this latter object may be most successfully carried out by the usual or conventional type of rotary vacuum pump of suitable capacity providing it is properly connected to the intake of the water pump.

One of the objects, therefore, is to make these connections in such manner that the action of the vacuum pump may automatically and effectively prevent the accumulation of

any appreciable quantity of air within the centrifugal pump while the latter is in operation.

A further object is to provide means for preventing the passage of water from the intake of the centrifugal pump to the vacuum pump.

A further object is to provide means for preventing the transmission of any suction or partial vacuum produced by the centrifugal pump to the vacuum pump and thereby to avoid any possibility of drawing the priming water from the vacuum pump into the centrifugal pump.

Another object is to provide the intake of the centrifugal pump with a suitable baffle screen or grid for preventing the passage therethrough of chips and other objects which might be detrimental to the operation of the pump.

A further object is to provide the intake of said pump with a suitable sump adjacent to and cooperating with the screen for receiving and temporarily retaining such objects as might impair the operation of the pump.

Other objects and uses relating to specific parts of the apparatus will be brought out in the following description.

In the drawing:

Figure 1 is an elevation, partly in section and partly diagrammatic, showing the connections between the centrifugal pump and vacuum pump for carrying out the objects stated.

Figure 2 is an enlarged transverse vertical sectional view taken in the plane of line 2—2, Figure 1.

Figure 3 is an enlarged horizontal sectional view taken in the plane of line 3—3, Figure 1.

Figure 4 is a horizontal sectional view taken in the plane of line 4—4, Figure 1, showing more particularly the port controlled by the float valve.

In order that the invention may be clearly understood I have shown a conventional form of centrifugal pump —1— of relatively large capacity and a vacuum pump —2— which may also be of the conventional rotary type such, for example, as what is commonly

known as the Nash pump having a capacity sufficient to prevent the accumulation of any excess quantity of air in the centrifugal pump which might reduce its efficiency.

The impellers of both pumps may be driven by any suitable motor such, for example, as an electric motor, not shown, having its armature shaft *a*— connected to the impeller of the pump —1— and preferably extended, as shown, by dotted lines in Figure 1, for connection with the impeller of the vacuum pump —2— so that the impellers of both pumps may be coaxial and, if desired may, together with the motor, be mounted in more or less close proximity upon a suitable supporting frame or base, not shown.

An intake pipe —3— leading from any source of water supply is connected to the suction side of the pump —1— and includes therein a T-section —4— having an upwardly extending branch or stand pipe —5— and a downwardly extending sump chamber —6—, as shown in Figure 1 for purposes presently described.

An outlet pipe or conduit —7— is connected to the pressure side of the pump —1— and includes therein a valve chamber —8— containing a check valve —9— which is arranged to permit the outflow of water through the pipe —7— and to prevent the back-flow of water or air to the pump.

The stand pipe —5— constitutes a float chamber having its lower end permanently secured directly to the top wall of the T-section —4— for communication with the interior thereof through an opening —9'—, Figure 1, said stand pipe being extended upwardly from the section —4— a predetermined distance above the level of the pump —1— and is provided at its upper end with a cap section —10— which is bolted or otherwise secured thereto and has a central suction port and valve seat —11—.

This port —11— is connected by a pipe or conduit —12— to the suction side of the vacuum pump —2— which serves to maintain a sufficient vacuum or suction in the pump —1— for priming purposes at all times during the operation thereof, it being understood that this constant priming condition is necessary to obtain a maximum efficiency of the pump.

The vacuum pump —2— may be primed in any suitable manner and at such times as may be required to increase its working efficiency.

The pipe connection —12— is provided with a valve section —13— containing a check valve —14— which is arranged to permit the flow of air from the centrifugal pump —1— through the stand pipe —5— to the vacuum pump —2— and to prevent the back-flow of air or water from the vacuum pump into the stand pipe.

The intermediate portion of the stand pipe

—5— is connected by relatively small pipes —15— to the top portions of the suction shoulders of the centrifugal pump case to allow any air which may pass through the conduits —3— and —4— into said pump to be withdrawn through the pipes —15— into the stand pipe —5— and thence outwardly through the vacuum pump and thereby to avoid trapping of the air within the centrifugal pump.

The T-section —4— is provided with a screen or grid —16— extending diagonally across the interior thereof from top to bottom and from side to side so as to extend across the upper end of the sump chamber —6— and across the lower side of the port —9— to prevent the passage of sticks and other objects through the conduit —3— to the pump —1— which might impair or otherwise reduce the efficiency of said pump.

That is, the grid or screen —16— extends from the lower side of the T-section —4— at the inner side of the sump —6— upwardly and outwardly across the interior of the T-section to the upper side of said —T— at the outer side of the opening —9— so that any objects entering the outer end of the —T— which might interfere with the operation of the pump if allowed to pass thereto are deflected downwardly into the sump chamber —6— which is provided at its lower end with a removable cap or plug —17— to permit accumulations of refuse to be removed therefrom from time to time as may be required.

A float —18—, preferably of wood, or equivalent material of appreciably less specific gravity than water, is movable vertically within the stand pipe —5— by the accumulations of water therein and is provided at its upper end with a substantially semi-spherical tip or valve member —19— of rubber or equivalent material capable of automatically seating in the lower end of the port —11— to close the same when the float —18— is elevated by an excess quantity of water in the stand pipe —5—.

This float operated valve —19— constitutes the automatic means for preventing the passage of water from the suction conduit —3— into the vacuum pump. The check valve —14— constitutes the means for preventing the backflow of air or other fluid from the vacuum pump —2— into the stand pipe —18— and pump —1—.

The float —18— is preferably angular or square in cross section and is preferably beveled at the corners to fit more or less loosely within said stand pipe for guiding the float in its vertical movement and at the same time affording sufficient space between the sides of the float and walls of the stand pipe to permit the free passage of water and air there-through.

The float —18— extends the major portion of the length of the stand pipe —5— and nor-

5 mally rests at its lower end upon the top of the T —4— with its upper end in normally spaced relation to the valve seat —11—, the height of the stand pipe and float together
 10 with the weight of the float being arranged so that when the water in the stand pipe rises to approximately two-thirds of the height of the float due to the suction of the vacuum pump, said float will be buoyed upwardly to
 15 close the valve —19— against the seat —11— aided by the suction of the vacuum pump and thereby to effectively prevent passage of water from the stand pipe to the vacuum pump —2—.

Operation

15 As previously stated, the pumps —1— and —2— may be initially primed in any suitable manner to render them effective and when in operation the pump —1— will draw the water
 20 through the pipe —3— and grid —16— into said pump and discharge the same outwardly through the discharge pipe —7—, the check valve —9— being opened by the water pressure.

25 As the simultaneous operation of the pumps —1— and —2— continues the vacuum pump —2— will withdraw the air from the pump —1— through the conduits —3— and —15— for priming purposes and at the same
 30 time a part of the water drawn into the conduit —3— may rise in the stand pipe —5—.

35 In case the water in the standpipe should rise above a predetermined level below the port —11— it will raise the float —18— and its valve —19— and cause the latter to close the port and thereby to prevent any possibility of the passage of this excess water from the stand pipe into the vacuum pump —2—.

40 The pipes —15— are connected to the intermediate portions of the stand pipe —5— preferably above the top of the pump and allows the air to be withdrawn therethrough from the higher parts of the pump —1— by
 45 the suction of the vacuum pump —2—.

50 When the water level in the stand pipe rises sufficiently to close the valve —19—, aided by the suction of the vacuum pump, communication between the stand pipe and vacuum pump will be temporarily cut off and any air entering the stand pipe through the suction pipe —4— will pass to the highest point of the stand pipe and will be trapped therein.

55 As the trapped air accumulates in the upper portion of the stand-pipe it will gradually depress the water level therein (in this instance to about the level of the top of the pump —1—) until the float is permitted to
 60 descend by its own gravity for opening the valve —19— and allowing the trapped air to be again withdrawn by the vacuum pump, these operations being repeated whenever excess quantities of water and air are drawn
 65 into the stand pipe.

When the pump —1— is working under full head the conditions previously described will maintain the float —18— in a more or less balanced position between the ports —9— and —11— so as to assure the exhaustion of
 70 the air from the pump —1— and the suction pipe —3— for continuous priming purposes.

In case the apparatus is used in what is commonly known as open pumping which would allow more or less air to enter the
 75 intake pipe of the pump —1— this excess air is instantly withdrawn from the pump by the vacuum pump —2— so as to keep the pump —1— in a constantly primed condition.

Although I have shown and described a
 80 specific construction of pumping apparatus it is obvious that various changes may be made in the structural details without departing from the spirit of this invention.

What I claim is:

85 1. In a pumping system, a centrifugal hydraulic pump having an intake conduit and a discharge conduit, the intake conduit being provided with a sump, and a baffle screen within the intake conduit between the sump
 90 and pump, said intake conduit having alined openings in its lower and upper sides, the sump being connected to the lower opening, and an air exhaust device connected to the upper opening.

95 2. In a pumping system, a centrifugal hydraulic pump having an intake conduit and an exhaust conduit, the intake conduit being provided with a sump, and a baffle screen within the intake conduit between the sump
 100 and pump, said intake conduit having alined openings in its lower and upper sides, the sump being connected to the lower opening, a stand-pipe having its lower end connected to the upper opening for receiving liquid and
 105 air from the intake conduit and its upper end provided with a port, a self-opening float-valve adapted to be closed and opened by the rise and fall of liquid in the stand-pipe above a predetermined level, a vacuum pump connected to said port, and means for operating
 110 both pumps in unison.

3. In a pumping system a centrifugal hydraulic pump having an intake conduit and a discharge conduit, the intake conduit being
 115 provided with a sump, and having alined openings in its upper and lower sides, a baffle screen extending diagonally across the interior of the intake conduit from the outer side of the upper opening to the inner side of
 120 the lower opening, the sump being connected to the lower opening, and an air exhaust device connected to the upper opening.

4. The combination with a hydraulic pump having an intake conduit and an outlet conduit, the intake conduit having an opening in its upper side, an upright tube having its lower end secured directly to the intake conduit around said opening for receiving liquid therefrom and its upper end provided with a
 125 130

suction port, a float reciprocally movable axially of and within said tube as the liquid therein rises and falls and having its upper end provided a suction pump operatively
5 connected to said port with a valve controlling said port, for maintaining constant suction therein irrespective of the position of the float, and a screen extending across said opening and adjacent portion of the interior
10 of the intake conduit to prevent the passage of chips, stones and the like into the hydraulic pump and tube.

In witness whereof I have hereunto set my hand this 20th day of November, 1928.

THOMAS F. MOORE.

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