Jan. 20, 1970 J. M. VALDESPINO 3,490,376

WELL POINT SYSTEM

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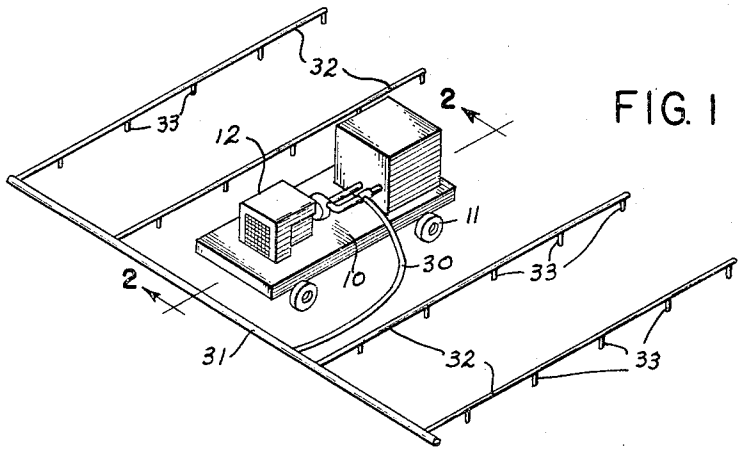


FIG. 1

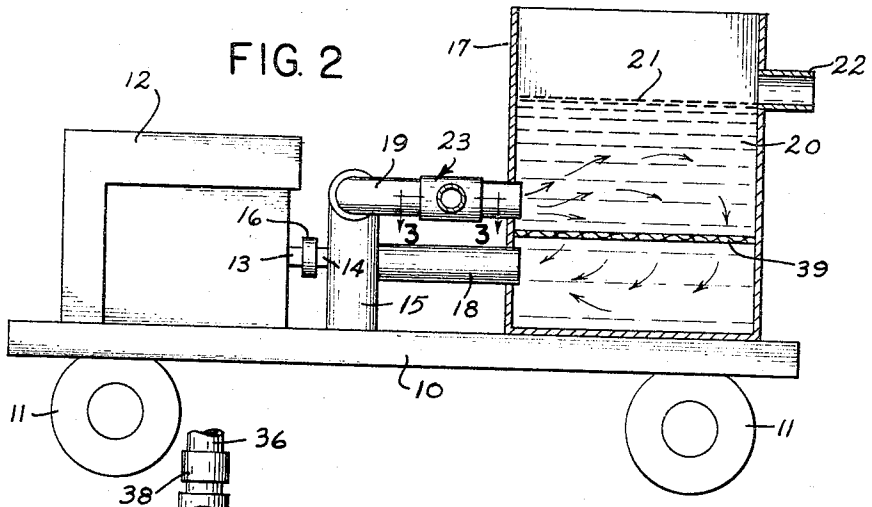


FIG. 2

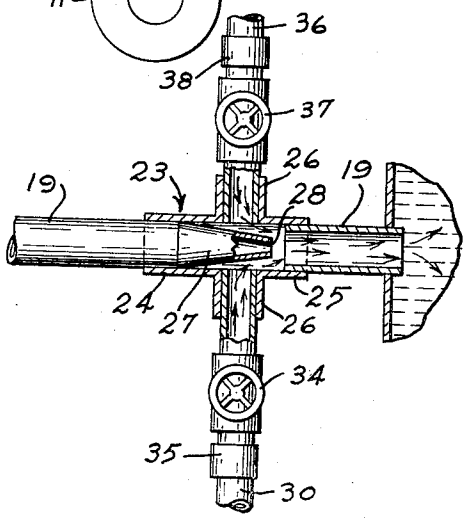


FIG. 3

INVENTOR
JOE M. VALDESPINO

BY A. Yates Dowell & A. Yates Dowell, Jr.
ATTORNEY

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FIG. 4

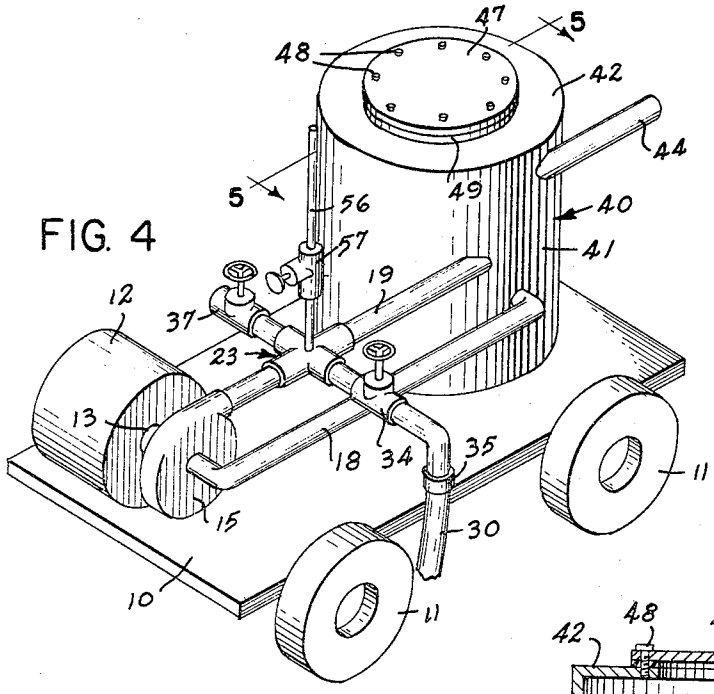


FIG. 5

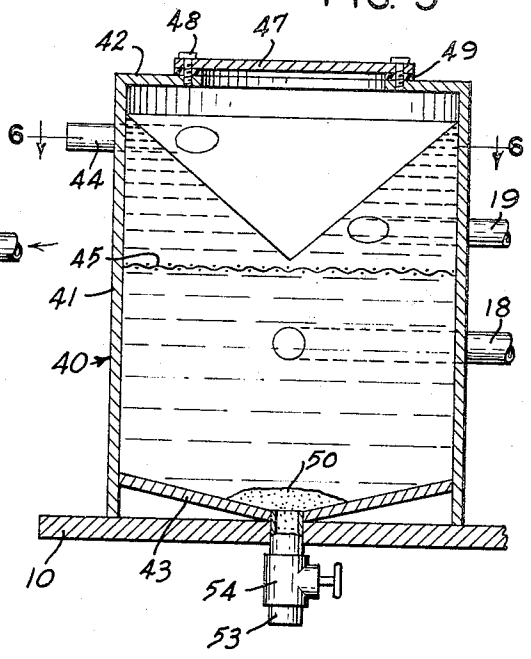


FIG. 6

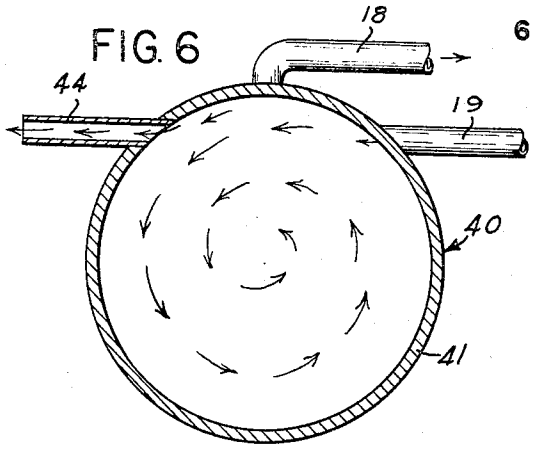
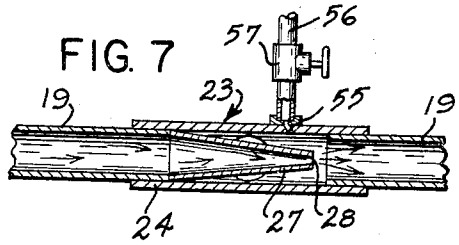


FIG. 7



INVENTOR
JOE M. VALDESPINO

BY A. J. Jakobsohn & A. J. Jakobsohn
ATTORNEYS

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WELL POINT SYSTEM

Joe M. Valdespino, 5023 Golf Club Parkway, Orlando, Fla. 32808

Continuation-in-part of abandoned application Ser. No. 661,258, Aug. 17, 1967. This application Dec. 30, 1968, Ser. No. 804,338
Int. Cl. F04b 23/04; F04f 5/00
U.S. Cl. 105—5 2 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for removing water from the earth, either above or below ground level, by constantly recirculating water under pressure through a venturi-type nozzle to create a suction on a line extending into a supply of water to be removed so that such water will be removed by such suction.

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 661,258 filed Aug. 17, 1967 and now abandoned.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates generally to pumps of various kinds and particularly to pumps operating in collaboration with reciprocating, centrifugal or rotary pneumatic displacement equipment which creates a vacuum to lift a column of water or other liquid.

Description of the prior art

In the past most well point systems have been provided with a motorized pump operating in conjunction with a separate vacuum means to remove the water from an area below the surface of the ground. It has been necessary to maintain a vacuum on these prior devices and the utilization of the pump alone has not proven effective when the water supply has been depleted in that loss of vacuum which occurs when the water is exhausted and the pump therefore will overheat.

SUMMARY OF THE INVENTION

Normally when a sewer, pipeline or other subsurface structure is to be constructed, it is necessary that all water and other liquid be removed from the area prior to the excavation so that construction can be performed without liquid being present. After the initial water has been removed, it is desirable to keep the dewatering system in operation during the term of construction to remove any seepage as it accumulates so that the earth will remain dry. In order to do this, applicant has provided a portable well point system including a plurality of well points extending downwardly into the earth a desired distance up to a depth of approximately 30 feet and such well points have their upper ends connected to a header. A motor driven centrifugal, high efficiency pump is located adjacent to the header and is provided with inlet and outlet pipes connected to a container or reservoir of water having a liquid level located above such pipes. A nozzle is located within a fitting in the outlet pipe to form a venturi which creates a vacuum on the header.

It is an object of the invention to provide a well point or dewatering system which eliminates vacuum pumps, belts, and pulleys and which generates and sustains a strong vacuum hydraulically so that the removal of water to a depth of approximately 30 feet is possible.

Another object of the invention is to provide a dewatering system which is simple and reliable in operation and which will continue to operate during the term of construction without attendance and without damage to the system.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective illustrating one application of the well point system of the present invention.

FIG. 2 is an enlarged section on the line 2—2 of FIG. 1.

FIG. 3 is an enlarged section on the line 3—3 of FIG. 2.

FIG. 4 is a perspective illustrating a modified form of the invention.

FIG. 5 is an enlarged section on the line 5—5 of FIG. 4.

FIG. 6 is a section on the line 6—6 of FIG. 5.

FIG. 7 is an enlarged detail section on the line 7—7 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With continued reference to the drawings, a platform **10** is provided which may have wheels **11** or other ground engaging support members. A source of power **12**, such as an electric motor or an internal combustion engine, is mounted on the platform **10** and has a drive shaft **13** connected to the driven shaft **14** of a centrifugal type, high efficiency pump **15** in any desired manner as by a coupling **16**. A container or reservoir **17** is mounted on the platform **10** in spaced relation to the pump **15** and is connected thereto by inlet and outlet lines or pipes **18** and **19**, respectively.

The reservoir **17** is substantially taller than the pump **15** and is adapted to contain water or other liquid **20** having a waterline **21** located above the inlet and outlet lines **18** and **19**. The waterline **21** is controlled by a discharge **22** located adjacent to the top of the reservoir and connected to a hose or pipe (not shown) for removing excess water from the area of the well point system. The inlet and outlet lines **18** and **19** provide communication between the reservoir and the pump so that when the pump is operated, water **20** will be withdrawn from the reservoir, circulated through the pump and back to the reservoir.

The outlet line **19** on the high pressure side of the pump **15** has a cross or other connection **23** having inlet and outlet portions **24** and **25** and one or more side openings **26**. A nozzle **27** having a restricted throat or orifice **28** is located within the connection **23** and disposed along the path of travel of water from the pump to the reservoir. Such nozzle is located in the inlet portion **24** and extends past the side openings **26** so that as water under pressure from the pump passes through the restricted throat **28**, the velocity of such water is accelerated and the pressure is reduced to create a negative pressure or suction within the side arms **26**.

A suction line **30** is connected at one end to one of the side arms **26** and at the opposite end is connected to a header **31**. A plurality of branch lines **32** may be connected to the header **31** and disposed at an angle thereto and each of such branch lines is connected to a series of well points **33** which extend downwardly into the earth to any desired depth up to approximately 30 feet. It is contemplated that the well points **33** would be connected directly to the header **31** when a single row of well points

is to be used. In order to control the suction applied to the header **31** the suction line **30** may have a cutoff valve **34** and a one-way check valve **35** to prevent backflow of water when the pump is not in operation and the cutoff valve **34** is open.

An auxiliary suction line **36** is connected to the other side arm **26** and is provided with a cutoff valve **37** and a check valve **38**. The auxiliary suction line **36** may be used for connection to additional well points or for miscellaneous suction service, such as for draining open ditches or the like. Either valve **34** or **37** may be cut off to apply all of the suction to the other side opening.

The system has been found to create sufficient suction to remove not only water, but also mud and small rocks and to discharge such material into the reservoir **17**. In order to prevent the heavier larger particles of material such as rocks from entering the pump and clogging the restricted throat **28**, the outlet line **19** is disposed at a higher elevation than the inlet line **18** and a screen **39** is disposed within the reservoir **17** below the outlet line and above the inlet line.

In the operation of the device a predetermined amount of water or other liquid **20** is placed within the reservoir **17** so that the water line **21** will be disposed above the inlet line **18** at all times. When the pump **15** is operated, such pump will draw liquid from the reservoir through the inlet line **18** and force such liquid under pressure through the outlet line **19** back into the reservoir through the nozzle **27**. The passage of the liquid through the restricted throat of the nozzle will create a high negative pressure or vacuum within the suction lines **30** and **36** to draw water upwardly through the well points **33** and discharge such water through the outlet line **19** into the reservoir. As additional water from the well points is discharged into the reservoir, the water line **21** will rise until it reaches the level of the discharge **22** at which time any additional liquid will be discharged from the reservoir. The reservoir will provide a constant pressure head for the pump so that water will be recirculated from the reservoir through the pump and back to the reservoir regardless of whether the well points have exhausted the liquid within the area or not. With the above system the pump can continue to operate after the initial water has been exhausted so that any seepage into the area of the well points will be removed as it enters the area of the well points and will not be permitted to accumulate.

With reference to FIGS. 4–7, a modified form of the invention is provided in which a container or reservoir **40** of upright, generally cylindrical configuration is mounted on the platform **10**. As illustrated in FIG. 5, the reservoir has a cylindrical side wall **41** with a top wall **42** fixed thereto in water-tight relation and a frusto-conical bottom wall **43** providing a sump at the lower extremity of the reservoir. Inlet and outlet lines or pipes **18** and **19**, respectively, provide communication between the pump **15** and the reservoir **40** so that fluid within the reservoir will pass through the inlet line into the pump and will be forced through the nozzle **27** and back into the reservoir under pressure from the discharge side of such pump. The discharge line **19** is adapted to discharge fluid into the reservoir generally tangentially thereof (FIG. 6) so that a swirling action will be provided within the reservoir. A discharge line **44** is connected to the reservoir **40** at a higher elevation than the outlet line **19**. The normal water level within the reservoir **40** when the pump is not in operation will be substantially level with or below the discharge line **44** and above the outlet line **19**.

A screen **45** such as a wire mesh or a perforated plate is fixed within the reservoir **40** between the inlet and outlet lines **18** and **19**, and such screen has openings of a size smaller than the restricted throat **28** of the nozzle **27** so that rocks or other debris which would not pass through the throat will be collected on the upper surface of the screen **45**. In order to remove such rocks periodically, the top wall **42** has an opening **46** normally covered by a manhole or cover plate **47** mounted on the top wall **42** by screws or other fasteners **48**. If desired a gasket **49** can be disposed between the cover plate **47** and the top wall **42** to preserve the air and water-tight integrity of the reservoir **40**.

Sand, gravel and other debris indicated at **50** which pass through the screen **45** will collect in the sump created by the bottom wall **43**. Periodically sand and other debris must be removed from the sump and in order to remove such materials a drain **53** is provided controlled by a manually operated valve **54**.

In some instances, particularly when most of the water and other liquid has been removed from the area of the well points, it is desirable to control the amount of suction applied to such well points to prevent the removing of large amounts of sand and mud which would be discharged into the reservoir **17** or **40**. In order to control the suction an orifice **55** is provided in the connection **23** in the area of the restricted throat of the nozzle **27**. An air line **56** is in communication with the orifice **55** and such air line has a valve **57** to control the amount of air passing through the line **56**. When water or other liquid under pressure is forced through the restricted throat **28** of the nozzle **27**, the pressure on such water will be reduced while the velocity will be increased in direct proportion to the reduction of pressure. The increase in velocity will create a suction in the lines **30** and **36** and additionally will draw air through the orifice **55** and entrain such air in the liquid being discharged through the outlet pipe **19** when the valve **57** is open. The greatest amount of suction applied to the well points **33** will be when the valve **57** is closed and no air is being entrained in the water; however, the suction can be controlled by opening the valve. The more the valve **57** is opened the more air will be introduced and the amount of suction on the well points will be reduced in direct proportion to the amount of air being introduced through the orifice **55**.

In the operation of this modification the pump **15** will remove liquid from the reservoir **40** through the inlet line **18** and will force such liquid under pressure through the restricted throat **28** of the nozzle **27** and then through the outlet line **19** and back into the reservoir. The passage of the liquid through the restricted throat will create a suction on the well points to draw water or other liquid through the same and discharge such water into the reservoir **40**. Since the outlet line **19** is connected to the reservoir substantially tangentially, a swirling motion will be induced in the liquid within the reservoir. The swirling of the liquid will create a vortex which will cause the liquid level to rise around the periphery of the reservoir and to lower in the central portion thereof. The raising of the water level around the periphery of the reservoir, as well as the introduction of additional liquid from the well points, will cause the water level to reach the discharge line **44** and force water under pressure through the discharge line. Air introduced through the orific **55** will be entrained within the water being discharged into the reservoir and such entrained air will reduce the weight of the water and thereby make such water easier to force through the discharge line **44**. The screen **45** will disrupt the circulation of water and cause any air bubbles to be collapsed to prevent the air from entering the pump. Sand, gravel and other debris which passes through the screen **45** will settle into the sump at the bottom of the reservoir where it can be removed periodically through the drain **53** by opening the valve **54**.

I claim:

1. A liquid removing device comprising a generally cylindrical reservoir adapted to contain a liquid, a pump located adjacent to said reservoir, inlet and outlet lines providing communication between said reservoir and the inlet and outlet portions of said pump to circulate liquid from said reservoir through said pump and back to said reservoir under pressure. a suction line connected at one

end to said output let line and the opposite end extending outwardly to a supply of liquid, a venturi nozzle having a restricted throat disposed within said outlet line and extending past said suction line connection in the direction of flow of the liquid so that liquid passing through said restricted throat will create a suction within said suction line to draw liquid from said supply of liquid and discharge the same into said reservoir, said outlet line located to discharge liquid into said reservoir and generally tangentially thereof, and a liquid discharge from said reservoir located generally tangentially thereof and disposed at an elevation higher than said outlet line, whereby liquid under pressure being introduced into said reservoir and generally tangentially thereof will create a swirling action therein.

2. The structure of claim 1 including an air line having an orifice in communication with said outlet line adjacent to said venturi nozzle, and means for regulating the amount of air introduced through said air line.

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DONLEY J. STOCKING, Primary Examiner

WARREN J. KRAUSS, Assistant Examiner

U.S. Cl. X.R.

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