April 21, 1942. F. A. CARPENTER 2,280,626

HIGH-LOW PRESSURE PUMPING SYSTEM

Filed Nov. 2, 1940

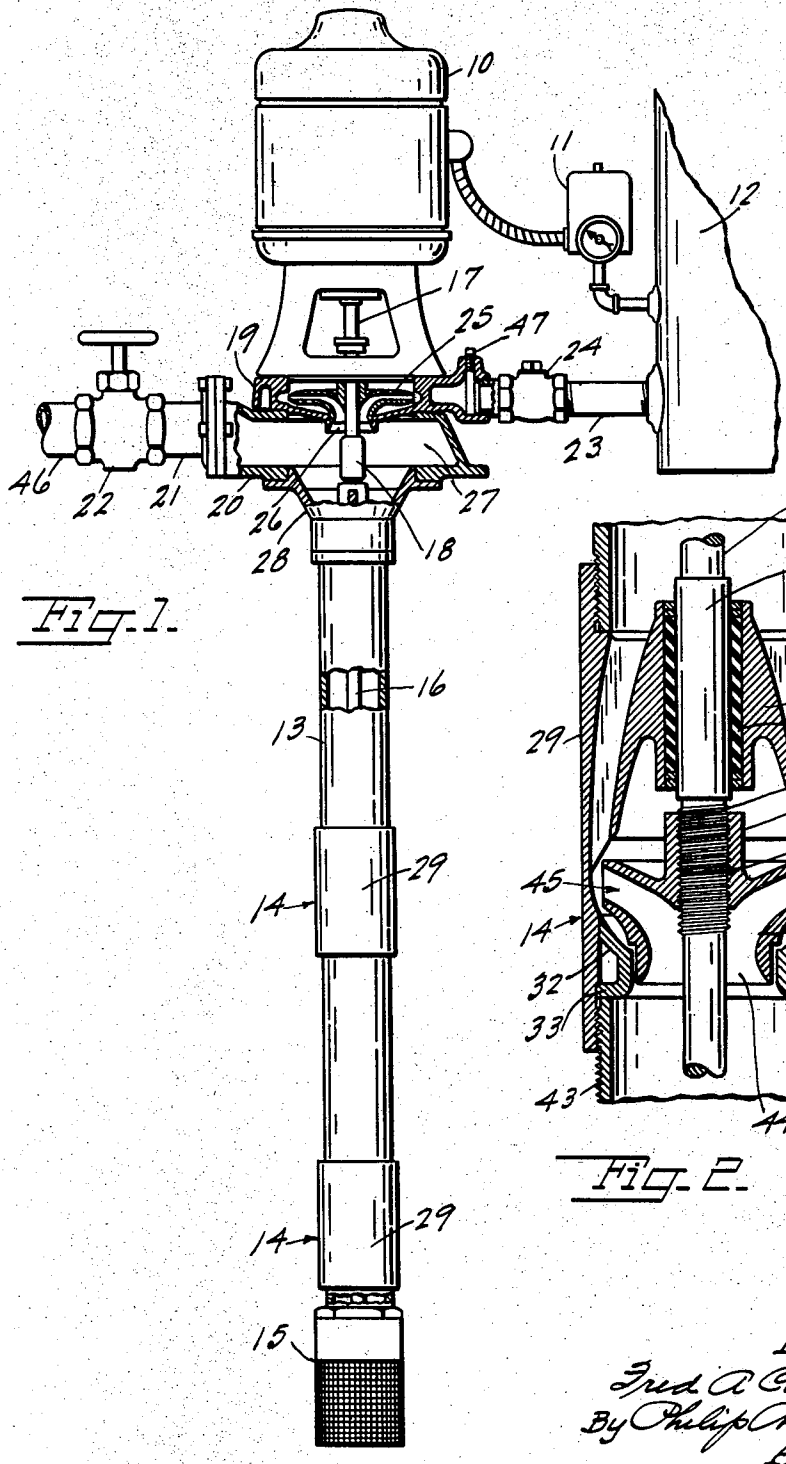


Fig. 1.

Fig. 2.

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Patented Apr. 21, 1942 2,280,626

UNITED STATES PATENT OFFICE

2,280,626

HIGH-LOW PRESSURE PUMPING SYSTEM

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Application November 2, 1940, Serial No. 364,003

7 Claims. (Cl. 103—10)

This invention, a high-low pressure pumping system, is designed to supply fluid under low pressure for irrigation and similar purposes and under high pressure for pressure water systems, sprinkling systems and the like, without the use of auxiliary equipment while being controlled for conversion to high or low pressure through the single operation of opening or closing a single valve.

Various types of high-low pressure systems have been advanced, but they invariably depend on a plurality of pumping units one for high pressure and the other for low, or upon the introduction of auxiliary apparatus for conversion from one pressure to the other.

This invention consists of a single pumping system which operates as a unit irrespective of whether the pumping is conducted at high or low pressure, and utilizes a valve on the low pressure side which when open delivers fluid at low pressure for irrigation and similar purposes, and when closed delivers the fluid at high pressure to a pressure tank or for direct use, as in a sprinkling system. The entire unit operates irrespective of the delivery pressure, and at the same speed.

The objects of the invention are as follows:

First, to provide a pumping system which can be converted at will to pump either at high or low pressure.

Second, to provide a pumping system which is convertible between two pressures merely by opening or closing a single valve.

Third, to provide a pumping system as outlined which can be converted from low pressure pumping to high pressure pumping through the sole operation of closing a valve in a low pressure discharge line, and from high to low pressure through the sole operation of opening said valve.

Fourth, to provide a special pump of the turbine type for lifting the fluid from the source and which pump is of unusually high efficiency for relay lifting of fluid.

In describing the invention reference will be made to the accompanying drawing, in which:

Figure 1 is a side elevation of the invention showing the high-low portion of the invention in section.

Fig. 2 is an enlarged sectional elevation through one of the relay pumping units.

The invention includes the customary prime mover such as the motor 10 which is shown as controlled by a pressure switch 11 which in turn is controlled by the pressure of the water in the tank 12, the pipe column 13, pumps 14, a strainer 15 in which the customary foot valve is located, and the pump or column shaft 16 which is coupled to the head shaft 17 by means of the coupling 18.

The motor 10 is mounted on the pump or booster case 19 which in turn is mounted on the prime mover base 20 and which is in direct communication with the discharge chamber 27 formed in said base. A low pressure discharge outlet 21 is in direct communication with the discharge chamber 27, and a valve 22 is installed in the low pressure discharge line 21 for manual control of the delivery pressure of the fluid pumped.

A high pressure discharge line 23 is in direct communication with the booster case 19 and delivers the fluid to the pressure tank 12 or to any other apparatus to which the high pressure fluid is to be delivered, such as to a sprinkling system or hydraulic apparatus, and a check valve 24 is installed in the high pressure line to hold the pressure.

Mounted in the booster case 19 is an impeller 25 which has its intake in direct communication with the discharge chamber 27 as indicated at 26, and the adjusting flange 28 provides a connection between the discharge chamber 27 and the column 13.

The pumps 14 are of the turbine type and are of a new type of construction and of unusually high efficiency, requiring a pump for each eight feet approximately of lift in comparison with the usual three foot spacing of the customary screw type. This pump consists of a sleeve 29 which coincidently functions as a coupling between the respective sections of the column 13, and the bowl for the pump, and is externally cylindrical in form and internally is provided with the shoulders 30 and 31 with the intervening portion between the shoulders formed to a slipstream shape which is continued at the lower end by the suction cover 32 which has a foot 33 formed at its lower end and which is clamped between the shoulder 31 and the top of the depending section of the column 13.

Formed integrally with the bowl 29 and located axially thereof is a combined bearing bracket and deflector 34 which is also of slipstream form and substantially conical and which is anchored to the bowl walls by the wings 35. A non-corrosive sleeve 36 is secured on the pump shaft 16 and this sleeve operates in a bearing 37 which is formed of suitable material, such as rubber or "Duprene" which is mounted in the bearing bracket 34.

Operating within the bowl is the combined shaft coupling and impeller which consists of a

hub 38 which forms a coupling for the two sections 39 and 40 of the pump shaft 16, and the impeller proper 41 the arms 42 of which are in communication with the depending section 43 of the column as indicated at 44 and have their passages inclined upwardly in the direction of lift of the fluid to minimize the reaction of the fluid on the walls of the bowl and change of direction and thereby increasing the efficiency.

The operation of the invention is as follows: For low pressure pumping, the valve 22 is fully opened and the motor 10 is set in operation. This motor drives the pump shaft 16, the impeller 25 and all of the impellers 45 throughout the height of the column. The impellers 45 lift the fluid to the discharge chamber 27 from which it escapes through the low pressure line 46 at a moderately low pressure. The impellers 45 suction the fluid through the intake 44 and discharge it against and upwardly along the slipstream walls of the pump bowl while the deflectors 34 cause a non-eddying flow into the upper section of the column, the flow being substantially in a direct line and free of violent changes in direction while acquiring all of the centrifugal force necessary for high volumetric efficiency.

The impeller 25 operates continuously during this pumping operation but practically idles in the water contained in the booster case, particularly if working against any appreciable resistance such as pressure in the tank 12. Any entrapped air can be released at will by removing the plug 47. During the low pressure pumping operation the impeller 25 absorbs a minimum of power.

When fluid under high pressure is desired it is merely necessary to close the valve 22. The fluid is then delivered to the intake 26 of the impeller 25 which delivers the fluid past the check valve 24 under high pressure to the terminal where it is to be used or stored, such as in the pressure tank 12. Thus the delivery of fluid is converted between high and low pressure delivery by the sole operation of opening or closing a single valve.

As is perfectly obvious, the impeller 25 could be installed in the discharge chamber 27 but this would entail a utilization of unnecessary power for low pressure pumping, while with the arrangement shown, the impeller 25 does practically no work when only low pressure is desired. Obviously both high and low pressure pumping can be carried out simultaneously to a modified degree by only partly closing the valve 22.

It will be understood that variations in construction and arrangement of parts, which variations are consistent with the appended claims, may be resorted to without detracting from the spirit or scope of the invention, or sacrificing any of the advantages thereof.

I claim:

1. A high-low pressure pumping system comprising a prime mover, a vertical pipe column for delivering water from a lower level, a shaft in said column and driven by said prime mover, and impellers mounted on said shaft within said column; a discharge chamber mounted at the top of said column and communicating directly therewith and having a low pressure discharge line and a low pressure valve for closing and opening said line at will; an impeller and a pumping chamber therefor mounted above and having its intake in communication with said discharge chamber and having a high pressure discharge, and means for operating said impeller; said impeller operating under minimum pressure and minimum fluid delivery conditions when said low pressure valve is open and delivering fluid at high pressure through said high pressure discharge when said low pressure valve is closed.

2. A high-low pressure pumping system comprising; a vertical pipe column for delivery of water from a lower level and a low-pressure pump located within and intermediate the height of said column; a low-pressure chamber having an outlet and located at the upper end of said column and a manually-operable valve adjustable to open and closed positions for said outlet for opening and closing said outlet at will; a high-pressure pump located above said chamber and having a high-pressure outlet and having its intake in communication with said chamber; a shaft for driving both of said pumps and a prime mover for driving said shaft; said high-pressure pump operating under minimum pressure and fluid delivery conditions when said valve is in open position and delivering fluid under high pressure when said valve is in closed position.

3. A high-low pressure pumping system comprising; a vertical pipe column and a shaft extending axially down into said column, and a prime mover for driving said shaft; impellers located throughout the height of said column in spaced relation and driven by said shaft for lifting water from a lower level to the top of said column; a low-pressure discharge chamber having a low-pressure outlet and a valve therefor and mounted at the upper end of said column for receiving water lifted by said impellers; a high-pressure pump case in communication with said discharge chamber and located thereabove and an impeller operating in said pump case and mounted on said shaft, and a high-pressure outlet for said pump case; said impeller operating under minimum pressure and minimum fluid delivery conditions in said pump case and in the water contained therein when said valve is open and delivering water from said discharge chamber under high pressure through said high-pressure discharge outlet when said valve is closed.

4. A high-low pressure pumping system comprising; a well-pump column; a low pressure discharge chamber mounted at the upper end of and in communication with said pump column, and a high pressure pump located above said chamber and having its intake in communication therewith; a discharge outlet for said high pressure pump, and a discharge outlet and a valve therefor for said chamber; a low pressure impeller in said pump column for lifting water to said low pressure chamber; and a prime mover mounted above said high pressure pump and having a shaft for simultaneously driving said pump and impeller.

5. A high-low pressure pumping system comprising; a prime mover for operating said system and having a base and a low pressure discharge chamber formed in said base, and a low pressure discharge outlet and a valve therefor for said chamber; a low pressure pump having its discharge in communication with said chamber; a high pressure pump mounted between said base and said prime mover and having its intake in communication with said chamber and having a high-pressure outlet; said low pressure pump delivering fluid at low pressure through said low pressure outlet, and said high pressure pump operating under substantially minimum pressure and fluid delivery conditions when said valve is open, and delivering fluid directly to said high

pressure pump for high pressure delivery of fluid through said high pressure outlet when said valve is closed.

6. A high-low pressure pumping system comprising; a prime mover having a base having a low pressure discharge chamber formed therein, and a low pressure discharge outlet and a valve therefor operable at will to open and closed positions for said chamber; a booster casing mounted between said prime mover and said base and having a high pressure discharge outlet; a high pressure impeller mounted in said casing and having its intake in communication with said chamber; a pump column depending from said base and having communication with said chamber; a shaft for said prime mover extending through said casing and said chamber and extending into said pump column and having said high pressure impeller mounted thereon; and vertically spaced low-pressure impellers mounted on said shaft within said column for delivering fluid to said chamber; said valve in its respective open and closed positions controlling delivery of fluid for low and high pressure delivery through the respective low and high pressure outlets.

7. A high-low pressure pumping system comprising; a vertical pipe column for delivering water from a lower level; a discharge chamber mounted at the top of said column, and a flow passage from the top of the column to the discharge chamber; a booster chamber mounted on top of said discharge chamber, and a flow passage from the discharge chamber to the booster chamber and a prime mover mounted on said booster chamber and having a shaft extending downwardly through said booster chamber, discharge chamber and axially down in said pipe column; spaced impellers mounted on said shaft within said pipe column and an impeller mounted on said shaft within said booster chamber; a low-pressure outlet for said discharge chamber and a low-pressure valve for opening and closing said outlet at will; and a high-pressure outlet for said booster chamber; said spaced impellers lifting water to said discharge chamber for low-pressure delivery through said low-pressure discharge outlet when said low-pressure valve is open, and lifting water to said booster chamber when said low-pressure valve is closed, the lifted water thereby being subjected to the action of said impeller to increase the pressure and being delivered through said high-pressure outlet.

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