

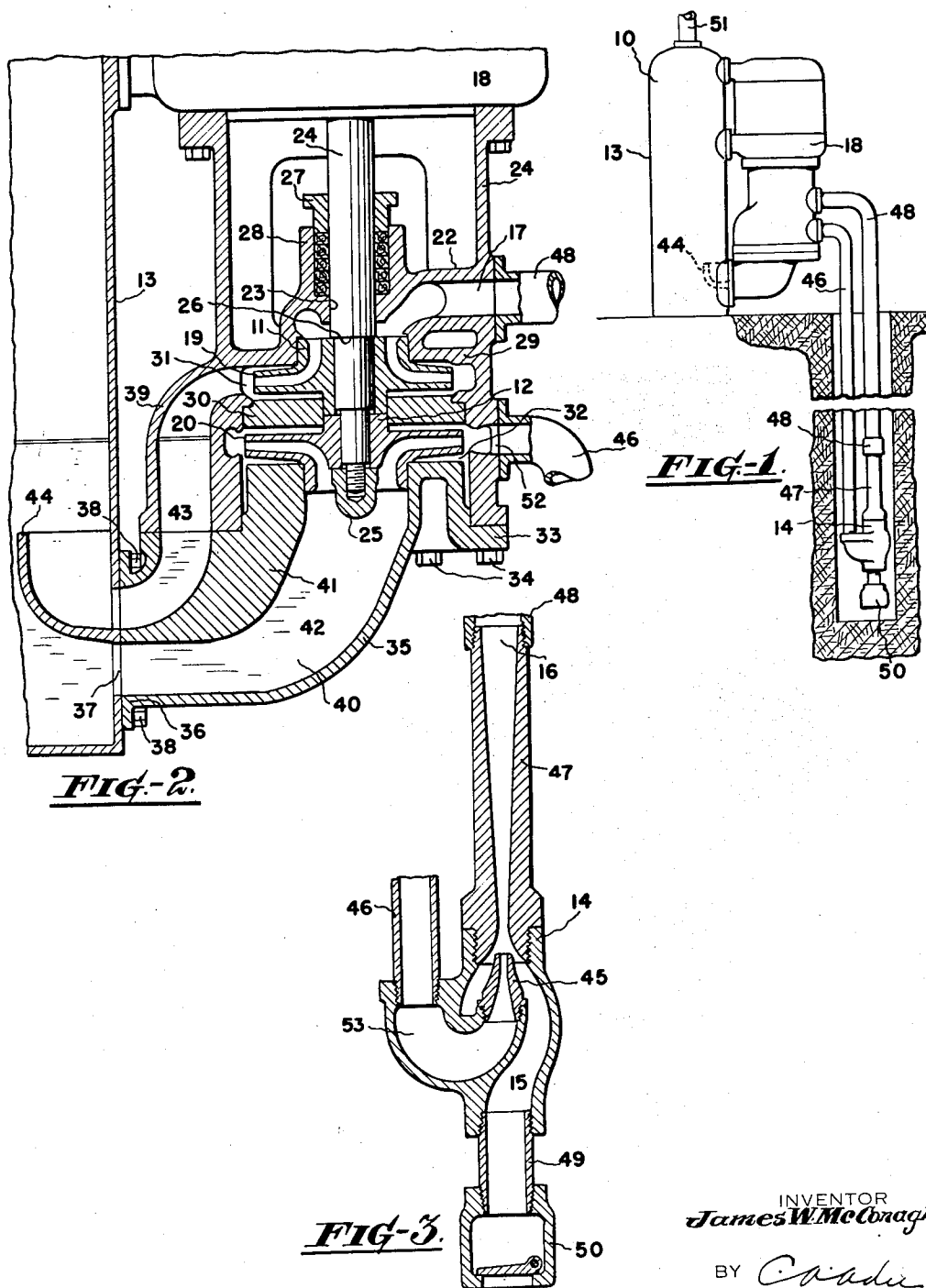
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PUMPING SYSTEM

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PUMPING SYSTEM

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1 Claim. (Cl. 103-5)

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This invention relates to pumping systems and, more particularly, to pumping systems adapted to be utilized where the source of the fluid being pumped is intermittent.

Heretofore, it has been impracticable to use centrifugal pumps under conditions where the flow of fluid being pumped may be interrupted in that such interruptions resulted in the loss of prime of the pump and, therefore, some form of positive displacement pump was generally used. However, due to several well known disadvantages of the positive displacement pump, as compared to the centrifugal pump, it is highly desirable to have a centrifugal pump which will operate efficiently under such conditions.

It is, accordingly, one object of this invention to construct a pumping system which utilizes centrifugal pumps and is capable of continuous and efficient operation under conditions where the source of the fluid being pumped is intermittent.

Another object of this invention is to provide a pumping system in which the danger of loss of prime of the pump is obviated regardless of the flow of the fluid to be evacuated.

A still further object of this invention is to construct a pumping system which is unusually compact and efficient.

Further objects of this invention will become obvious from the following specification and accompanying drawing in which,

Figure 1 is a vertical elevation of a pumping system constructed in accordance with the practice of the invention and adapted to evacuate fluid from a well.

Fig. 2 is a vertical elevation, partly in section, of a centrifugal unit adapted to a pressure tank, and

Fig. 3 is a vertical elevation, partly in section, of a jet pump utilized in cooperation with the centrifugal unit to evacuate fluid from a shaft or other source where the flow of fluid to be pumped may be intermittent.

Referring to the drawing, 10 designates a pumping system having a pair of coaxially mounted centrifugal pumps 11-12 connected in series i. e., the discharge of one pump being communicated with the inlet of the succeeding pump, through the pressure tank 13. In the present instance, the pump 11 discharges into the pressure tank 13 in which the fluid is deaerated and thence it flows into the intake of the second stage pump 12 in accordance with its demand. Fluid discharged from the pump 12 is conducted to and serves to motivate a jet pump 14 having its inlet 15 com-

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municated with the source of fluid to be evacuated and its outlet or discharge 16 connected to inlet 17 of the centrifugal pump 11.

With this arrangement, it is readily apparent that by maintaining a water level in the tank 13 sufficient to fill the pump 12, the pump 12 will at all times be self priming and, therefore, capable of continuous or intermittent operation, as desired; and, further, with this arrangement, the pump 12 will serve to supply fluid to the pump 11 for priming purposes irrespective of the flow of fluid to be evacuated by the jet pump 14. Thus, whenever the centrifugal unit is operating, the jet pump 14 will be supplied with motive fluid and the system, as a whole, will coact effectively to evacuate fluid from a source wherein the flow of fluid is intermittent—as for example, under conditions such as exist in mines wherein it is desired to evacuate water seepage from the mine. Under these circumstances, the centrifugal unit is located at a considerable distance below the surface of the earth depending, of course, on the pressure developed in the tank 14 by the centrifugal pump 11. The jet pump 14 is located at a point below the centrifugal unit at a low point in the mine where water seepage tends to collect. So positioned, the jet pump 14 serves to boost or pump such water seepage, mixed, of course, with the motive fluid, up to the centrifugal unit wherein fluid is removed from that portion of the system connecting the centrifugal pumps in series—namely, the pressure tank 13, according to the amount of fluid evacuated and passes it through a conduit 18, connected in the top of the pressure tank 13, to the surface for discharge from the system.

More specifically the pumping system comprises a pressure tank 13 on which is mounted a casing 18 for the motor (not shown) which rotates the impellers 19 and 20 horizontally mounted in the housing 21 depending from the lower end of the casing 18. The housing 21 is provided with an internal flange 22, having a central perforation 23, which encircles and provides a bearing surface for the motor driven shaft 24 extending into the housing 21. Relative rotation between the shaft 24 and the impellers 19 and 20, journaled on the lower end of the shaft, is prevented by means of a nut 25 threaded on the end of the shaft 24 and bearing against the lower end of the impeller 20 which, in turn, forces the impeller 19 into frictional engagement with a shoulder 26 on the shaft 24. Leakage of fluid along the shaft 24 into the upper portion of the housing 21 is prevented by a seal 27, of well known construction, mounted in

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a cup shaped extension or projection 28 on the upper surface of the flange 22.

The lower surface of the flange 22 cooperates with inwardly extending projection 29 on the housing 21 to define the inlet 17, and with a plate 30 mounted athwart the housing 21 between the impellers 19 and 20 to define the impeller chamber 31 for the pump 11. The chamber 32 for the impeller 12 is formed between the lower surface of the plate 30 and a cover 33 secured to the lower end of the housing 21 by a suitable means such as the bolts 34.

Depending from and integrally with the cover 33 is a tubular extension 35 having its lower or free end 36 encircling an opening 37 in the lower portion of the tank 13 and secured to the tank 13 by means of bolts 38. The extension 35 in cooperation with the shell 39 extending out from the housing 21 from a line adjacent the impeller 19, defines a channel 40 between the centrifugal unit and the pressure tank 13. In order to prevent turbulence in the fluid entering the pump 12, a partition 41 is provided within the channel 40 which separates the channel into an inlet passage 42 for the pump 12 and an outlet passage 43 for the pump 11; and to further minimize any turbulence in the inlet passage 42 and to permit air to escape from the fluid before entering the passage 42, the lower or free end 44 of the partition 41 extends into the tank 13 and is curved upwardly to direct the flow of fluid from the first stage impeller 19 away from the inlet 42, or that portion of the tank 13 from which the pump 12 drains fluid.

The jet pump 14 of the usual construction and comprising a nozzle 45 which is arranged to direct a high velocity jet of fluid, delivered thereto from the outlet 52 of the pump 12 through a conduit 46 threaded in the nozzle inlet passage 53, into a diffuser 47 which, in turn, is communicated with the inlet 17 of the pump 11 through a conduit 48. The fluid to be evacuated or pumped by the system is conducted to the jet pump 14 through a nipple 49 threaded at one end in the inlet 50 of the jet 14 and at the other end in a valve means, as shown, the foot valve 51, which is submerged in the fluid to be evacuated and serves to prevent fluid from draining from the conduits 46 and 48 when the pumping unit is not in operation.

In construction, the distance which the jet pump 14 is located below the pump 12 is determined, of course, by the design of the pump 12—that is, the jet pump 14 must, at all times, be able to force fluid through the conduit 48 to the pump 11. Assuming the water level in the pressure tank 13 is as shown in Figure 2 and that the foot valve 51 is submerged, upon starting the centrifugal unit the pump 12 will develop a predetermined pressure differential across the impeller and supply fluid for activating the jet 14 which, in turn, will pump fluid from the sump to prime the pump 11. The pump 11, in turn, will develop a predetermined pressure differential across the impeller 19 and thereby increase the pressure

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existing in the tank 13 which increases the pressure at the inlet of the pump 12. Thus, it may be seen, a regenerative cycle is obtained which will permit the discharge pressure of the pump 12 to increase, due to increasing inlet pressure, until a stable condition has been reached. The pressure within the tank 13 will be the discharge pressure of the pump 11 thereby making available a source of pressure for boosting or lifting the fluid to be evacuated to a point above the tank before being discharged from the system. When the supply of fluid to be evacuated is exhausted, the discharge pressure of the pump 11 will decrease due to the decrease in flow and the discharge pressure of the pump 12 will, accordingly, decrease and the flow of fluid throughout the system will be determined by the amount of fluid needed to operate the jet, or, in other words, the amount of fluid that passes through the nozzle 45.

It is now obvious from the previous discussion that the present invention provides an unusually simple and compact pumping system which accomplishes, among others, the object hereinbefore referred to.

While I have shown and described a specific form of my invention, it is to be understood that various changes and modifications may be made without departing from the spirit of the invention as set forth in the appended claim.

I claim:

A pumping system comprising a high pressure pump, a low pressure pump superposed on the high pressure pump, a jet pump located adjacent the source of liquid to be pumped, a conduit for conveying the discharge of the high pressure pump to the jet pump to form the jet, a conduit for conveying the discharge of the jet pump to the intake of the low pressure pump, a tank having an inlet opening and an outlet opening, said outlet opening adjacent to and below the inlet opening, a conduit to convey the discharge from the low pressure pump to the inlet opening of the tank, a conduit to convey liquid from the outlet opening of the tank to the intake of the high pressure pump, and means in the tank adjacent the inlet opening to deflect the discharge of the low pressure pump away from the outlet opening.

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