

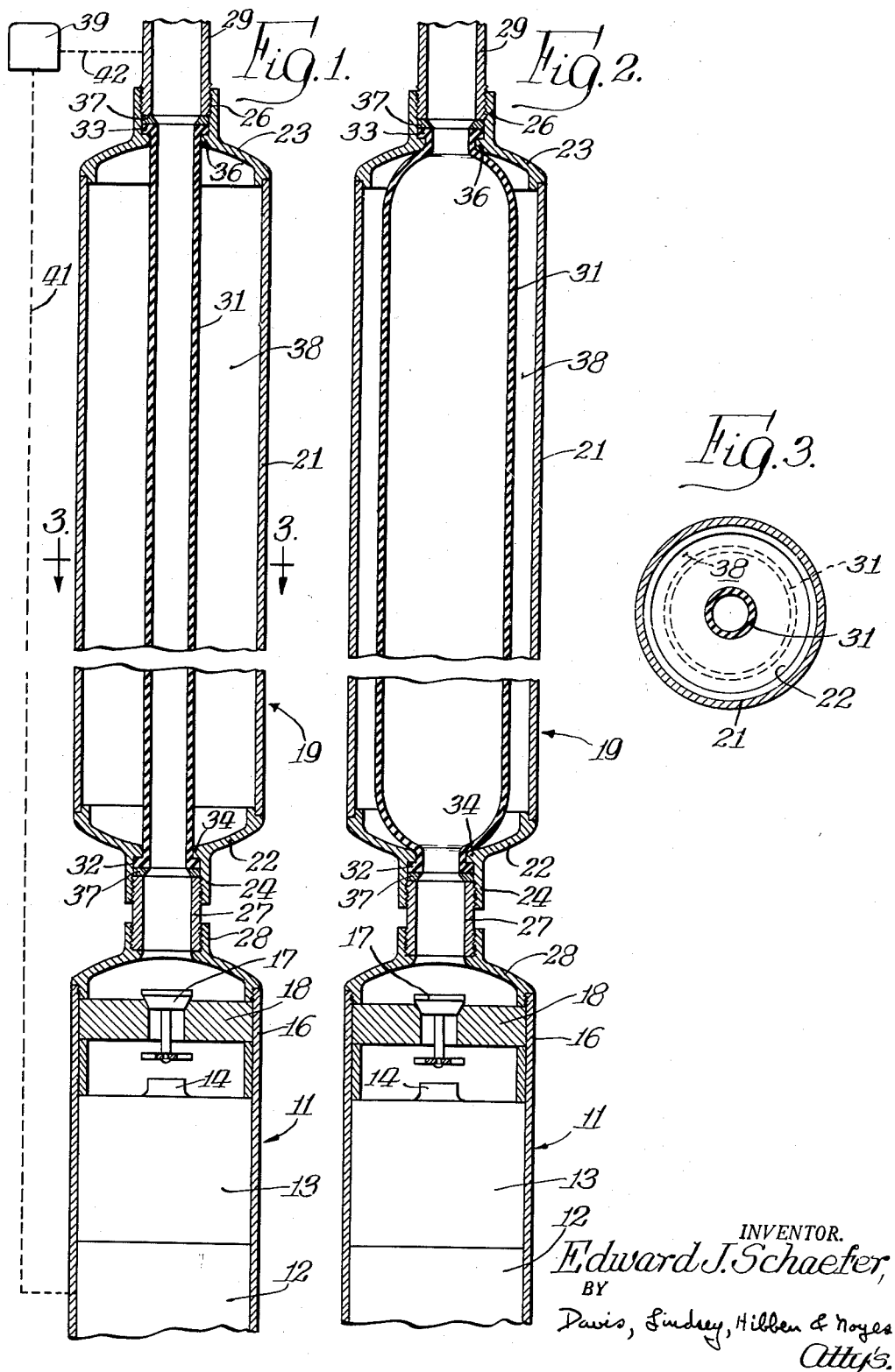
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SUBMERSIBLE WATER PUMPING SYSTEM

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SUBMERSIBLE WATER PUMPING SYSTEM

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This invention relates to improvements in water pumping systems and more particularly to a novel pressure storage means for such a system.

The usual home water system comprises a motor driven pump arranged to pump water from the well and discharge it into an air-containing pressure tank from which the water passes into the various service lines. The pump is automatically started and stopped by a control switch responsive to the pressure in the tank or the pump discharge so that a bulk supply of water under pressure is maintained at all times in the tank and is ready for instant use upon withdrawal through the service line.

Such systems have several well known drawbacks. In the first place, the initial supply of air in the pressure tank gradually becomes absorbed in the water so that the cushioning effect is lost and the system is said to become water-logged as reflected by erratic operation and frequent starting and stopping of the pump. Accordingly, air injection means must be provided for replenishing the air in the pressure tank as required. However, this arrangement is often unreliable and necessitates frequent maintenance and attention. Another objection to the conventional pressurized water system is that the relatively large volume of water retained in the pressure tank tends to become stale since the tank is rarely emptied. The fresh incoming water is mixed with the water in the tank so that the water passing to the service lines is never completely fresh water.

In addition to the foregoing problems, there has been an increasing demand for a simplified or so-called packaged unit which can be installed with a minimum of electrical and plumbing connections.

A primary object of my invention is to provide a novel simplified water system capable of being sold and installed as a packaged unit.

A further object of the invention is to provide a novel submersible water system in which the major components of the system are adapted to be located in the well below the ground level.

An additional object of the invention is to provide a novel packaged water system having a submersible unit adapted to be lowered into a well and prepared for operation merely by making electrical and outlet pipe connections from above ground.

Another object of the invention is to provide an improved water pumping system having novel pressure storage means for maintaining a supply of water under pressure.

Still another object of the invention is to provide a novel and improved water system which cannot become water logged, which does not require replacement of cushioning air, and which supplies substantially fresh water at all times.

Other objects and advantages of the invention will become evident from the subsequent detailed description taken in conjunction with the accompanying drawing, wherein:

Fig. 1 is a fragmentary longitudinal sectional view of

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a unit comprising one specific embodiment of the invention and having a motor driven pump and a pressure storage means;

Fig. 2 is a view similar to Fig. 1 but showing a different operating condition of the pressure storage means; and

Fig. 3 is a transverse sectional view as taken along the line 3—3 of Fig. 1.

Referring to the drawing, one specific embodiment of the invention which is shown merely by way of illustration comprises a motor driven pump unit indicated generally at 11 and having an electric motor section 12 and a pump section 13 with a discharge outlet 14. The motor and pump sections 12 and 13 are contained within an outer casing or housing 16 which renders the unit submersible. A check valve or foot valve 17 is mounted in a partition 18 in the upper end of the housing 16 for preventing loss of fluid head in the usual manner.

Immediately adjacent the upper or outlet end of the motor driven pump unit 11, I provide a pressure storage tank designated generally at 19, which constitutes the principal novel feature of my invention. The pressure storage tank 19 comprises an elongated tubular metal casing 21 having an apertured metal closure or head 22 at its lower end and a similar closure or head 23 at its upper end. The apertured head members 22 and 23 provide a fluid inlet and outlet, respectively, for the pressure tank and are formed with integral axially extending tubular stubs 24 and 26 which are internally threaded. The pressure tank 19 is connected in the water system by means of a threaded nipple 27 secured to the inlet stub 24 and also to a threaded outlet member 28 at the upper end of the motor-pump unit 11. The outlet stub 26 from the pressure storage tank 19 has a threaded connection with a discharge line 29, it being understood that the motor pump unit 11 and its interconnected pressure storage unit 19 will be disposed in the well with the discharge line 29 extending upwardly therefrom to the ground level for connection to various service lines.

Within the pressure tank 19 an elongated expandable tube 31 is disposed in axially extending relation with the outer concentric casing 21 spaced radially therefrom. The tube 31 may be made of any suitable water and air impervious material which is also flexible and elastic, e. g. natural or synthetic rubber or the like. The opposite ends of the tube 31 have annular flange portions, as at 32 and 33, which seat against complementary radial shoulder portions 34 and 36 surrounding the openings in the inlet and outlet members 22 and 23, respectively. For insuring an air and water tight hermetic seal between the expandable tube 31 and the outer rigid casing of the pressure tank 19, a sealing gasket 37 is placed against the outer axial end of each of the tube flanges 32 and 33 and a tight sealing connection is obtained by screwing the connecting nipple 27 and the discharge line 29 tightly into the threaded stubs 24 and 26 so as to clamp the flanged ends of the tube 31 against the shoulders 34 and 36.

From the foregoing description, it will be seen that the elastic and expandable tubular member 31 is disposed directly in the path of flow between the pump unit and the discharge line 29 for conveying pumped water there-through, and at the same time the tube 31 is in hermetically sealed relation with respect to the outwardly spaced rigid container 21—22—23. The annular space, designated at 38, between the tube 31 and the wall of the pressure tank 19 contains a fixed quantity of air, and therefore, functions as an air compression or cushioning chamber. In Fig. 1, the device is shown with the central expandable tube 31 in its normal unexpanded condition which might correspond to a situation where the pump is in operation and the service outlets are fully open so that there is insufficient back pressure to cause expansion of the

tube 31. However, in Fig. 2 the apparatus is shown with the central tube 31 in radially expanded condition as might be the case when the service outlets are fully closed and the pump has operated for a sufficient time to build up pressure within the pressure storage tank 19. As the outlet water pressure increases, the tube 31 expands radially and thereby compresses the fixed quantity of air contained in the annular chamber 38 whereby the water in the expanded tube is maintained under pressure.

A pressure control arrangement of the usual type will, of course, be provided for regulating the pressure in the storage capacity region within the expanded tube 31. Thus, in Fig. 1, I have shown in schematic fashion a control unit 39 which would ordinarily (but not necessarily) be located at the ground level and which has an electrical connection 41 with the motor section 12 and a fluid connection 42 with the discharge line 29. Obviously, the connection 42 which reflects the pressure in the system could also be made with the air cushion within the space 38. As is well known in this art, the controller 39 comprises a pressure responsive switch which can be set to start the motor pump unit when the pressure in the system falls below a predetermined level and which also functions to stop the pump when the pressure reaches a predetermined maximum. For example, a convenient adjustment of the control 39 for a home water system would be to have the pump start when the tank pressure drops to 20 pounds per square inch and to have the pump stop when the pressure rises to 40 pounds per square inch. Thus, the expansible tube 31 having the confined air cushioning means disposed therearound is interposed directly in the path of flow of the discharge water from the pump and functions to provide pressure storage capacity for the system in a unique and highly convenient manner.

As will be readily apparent, the foregoing arrangement has a number of advantages not heretofore conveniently available in water pumping systems of this general character. In the first place, the fixed quantity of cushioning air contained in the sealed space 38 is sealed off from the water in the system so that there is no possibility of the air being absorbed in the water and lost from the system. Thus, there are no difficulties with water-logged operation in my invention and it is not necessary to provide special air injection means for replenishing lost air. It will also be seen that because the pressure storage region is interposed directly in the path of flow between the pump and the discharge line there is a minimum opportunity for water to be retained in the pressure storage region and thereby become stale. On the contrary, with my invention the pressure storage tank will frequently be completely emptied during normal usage of the water system so that comparatively fresh water is usually available.

Another highly important advantage of the invention is the elimination of the separate pressure tank in its usual form as heretofore known. With the present invention, the pressure storage tank is integrally connected to

the pump so as to provide in effect a combined packaged unit which includes all of the essential components of the water system. Inasmuch as the arrangement herein described is a completely packaged system, the combined unit can be lowered into the well and put into operation in a very simple manner merely by making the necessary electrical and service line connections at the ground level. Thus, both the motor-pump unit and the pressure storage unit are integral parts of a completely submersible system.

Although the invention has been described above in connection with a particular specific embodiment thereof, it will be understood that various modifications and equivalent structures may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A submersible unitary water pumping and pressure storage apparatus adapted to be lowered into a well comprising elongated motor-pump means disposed at the lower end of the apparatus and having a water outlet at its upper end, and pressure storage means disposed above said motor-pump means at the upper end of the apparatus, said pressure storage means including an elongated rigid tubular casing connected at its lower end to said motor-pump means at said outlet, connector means providing a fluid flow connection at the upper end of said casing for connecting the same to a discharge line, an elongated resilient expansible tube disposed axially in said casing in annularly spaced relation therefrom, said tube being disposed in the path of flow from said outlet to said connector means for passage of pumped water therethrough, and means at the opposite ends of said tube providing a seal with said casing whereby to define an annular air compression chamber between the tube and said casing, the size of said pressure storage means being sufficient relative to the fluid capacity of the motor-pump means so that the internal volume of said expansible tube is adequate to provide a pressurized water storage chamber under the pressure of said expansible tube and the air in said compression chamber when the tube is expanded.

2. The structure of claim 1 further characterized in that said tubular casing is provided at its upper and lower ends with relatively restricted diameter tubular extensions, the extension at the lower end of the casing being connected to the outlet of said motor-pump means and constituting the sole support for said motor-pump means, the extension at the upper end of the casing comprising said connector means whereby the apparatus is adapted to be suspended solely from the discharge line, and said tube being disposed in fluid communication between said extensions for passage of water therethrough.

References Cited in the file of this patent

UNITED STATES PATENTS

17,726	Clark	July 7, 1857
1,579,891	Sandoz	Apr. 6, 1926
1,957,320	Coberly	May 1, 1934