United States Patent

Randles et al.

[15] **3,650,324**

[45] **Mar. 21, 1972**

[54] WELL PUMPING SYSTEM CONSTRUCTION

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[22] Filed: **Oct. 12, 1970**

[21] Appl. No.: **80,014**

[52] **U.S. Cl.**.....**166/68.5,** 166/101, 277/34.6, 417/36

[51] **Int. Cl.**.....**E21b 43/00,** F04b 49/08

[58] **Field of Search**.....417/38; 166/68.5, 101, 106; 277/34.6

[56] **References Cited**

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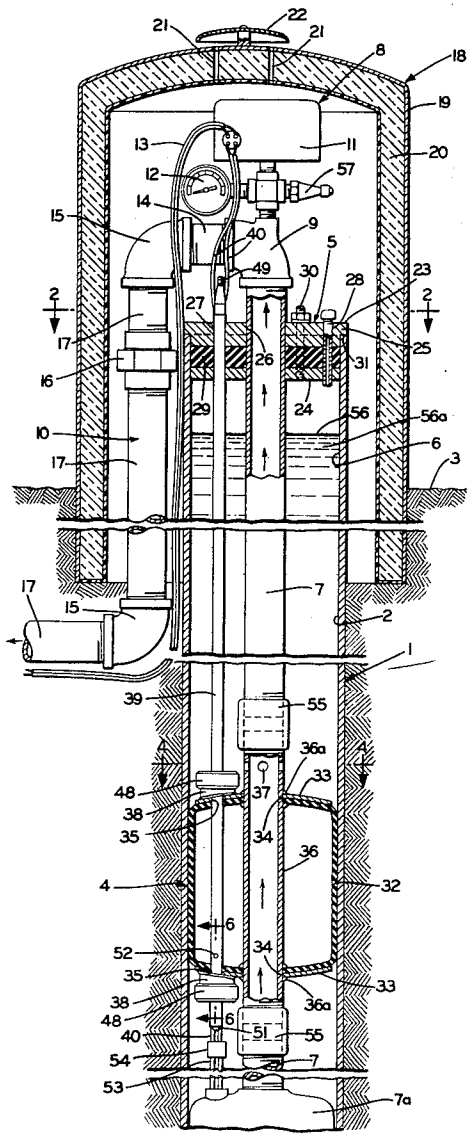
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Primary Examiner—Carlton R. Croyle
Assistant Examiner—Richard Sher
Attorney—Frease & Bishop

[57] **ABSTRACT**

A well pumping system construction having top and bottom seals spaced within a well casing or well shaft forming a combination water storage and air pressure tank chamber therein. A water delivery pipe communicates with and extends through the tank chamber and is connected at the lower end to a pump and is connected at the upper end to a water supply line above the well casing. Pump controls are located at top of the delivery pipe above the well casing and are enclosed by a protective housing. A conduit within the well casing provides the means for inflating the bottom seal, provides a well breather passage, and contains the electrical wires for the pump.

11 Claims, 17 Drawing Figures



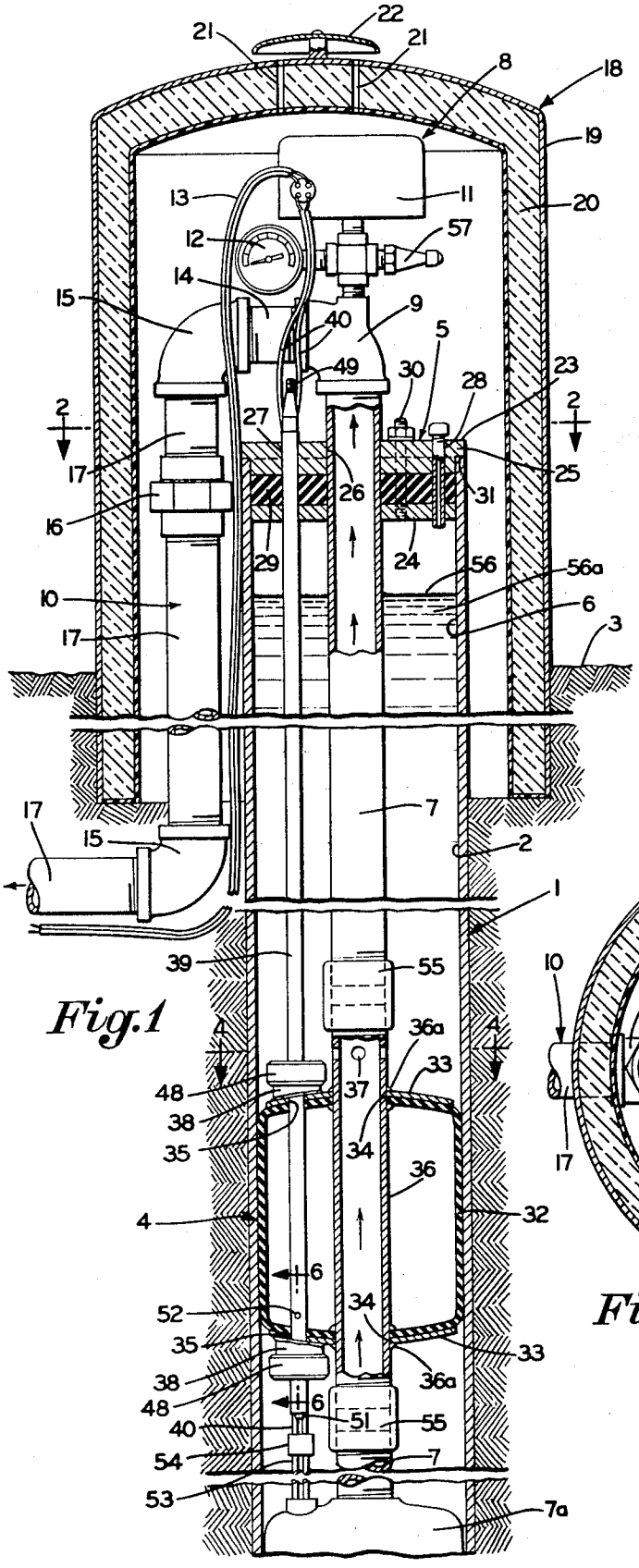


Fig. 1

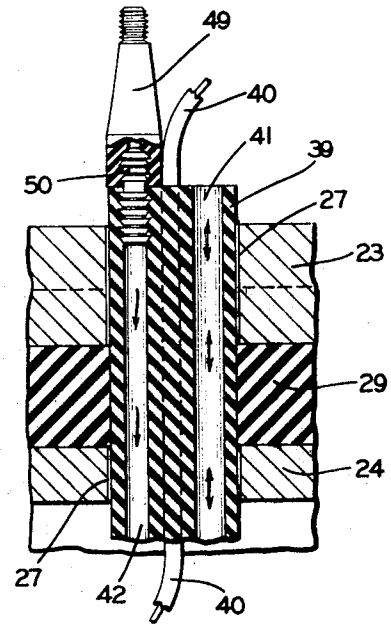


Fig. 3

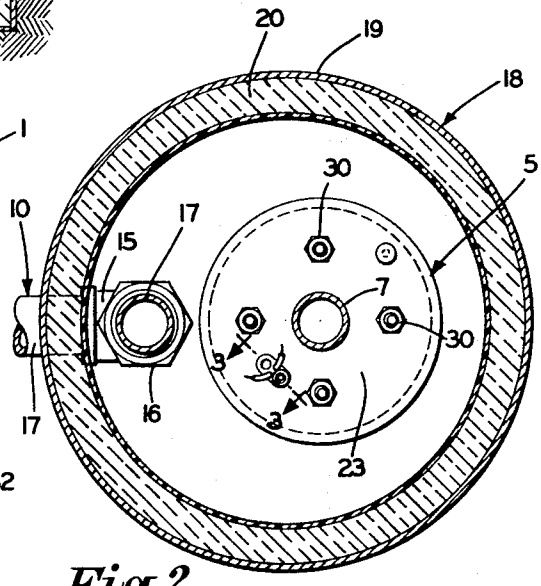


Fig. 2

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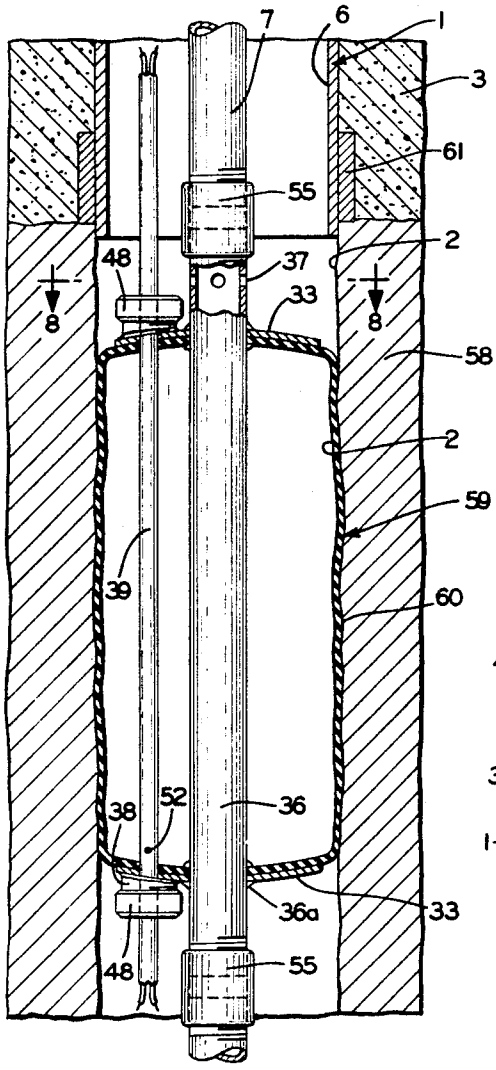


Fig. 7

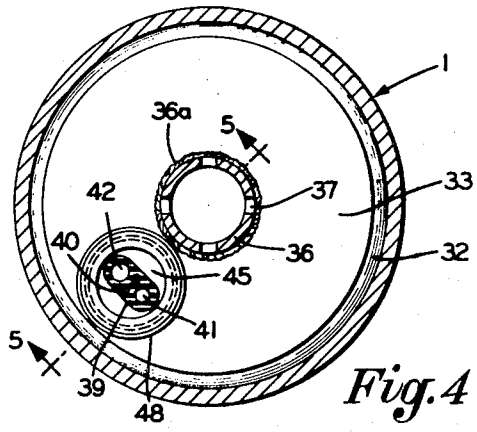


Fig. 4

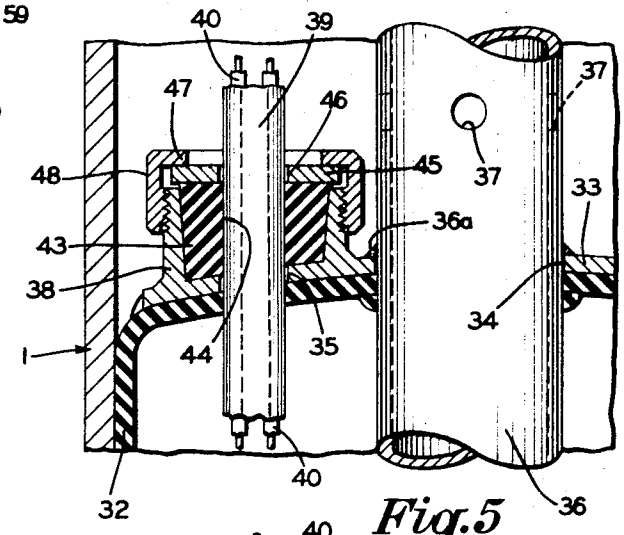


Fig. 5

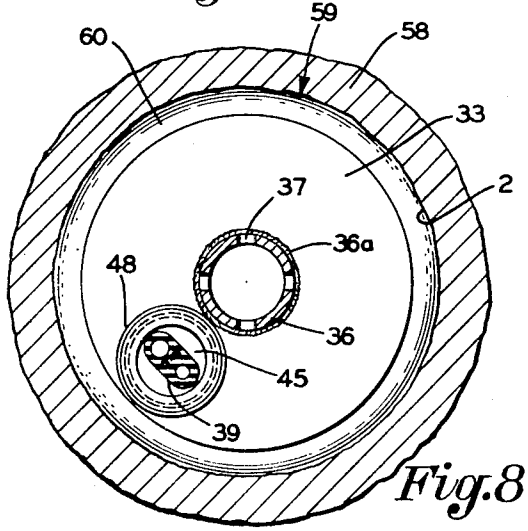


Fig. 8

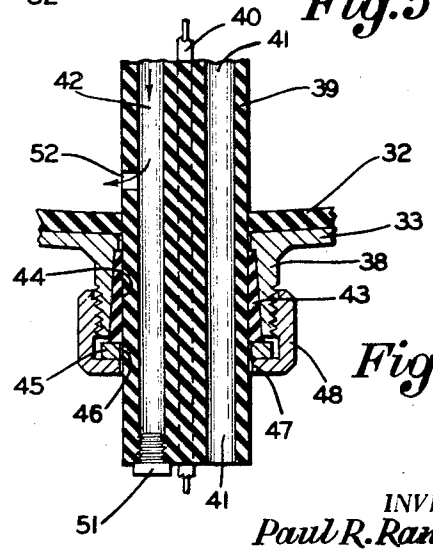


Fig. 6

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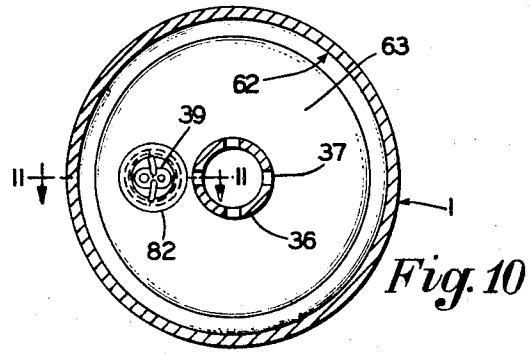


Fig. 10

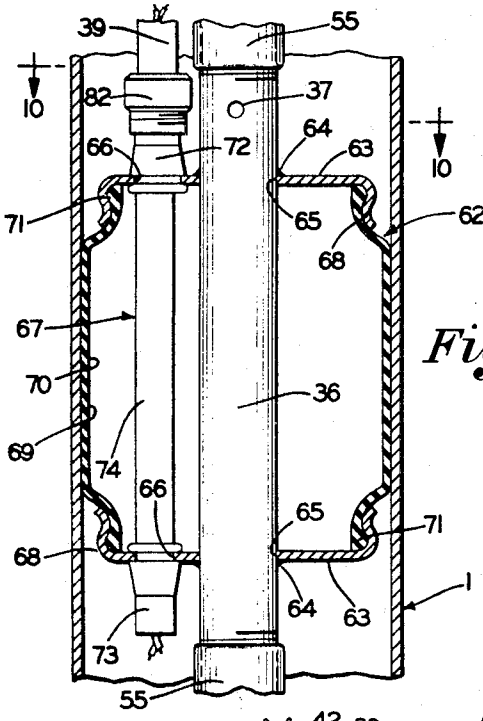


Fig. 9

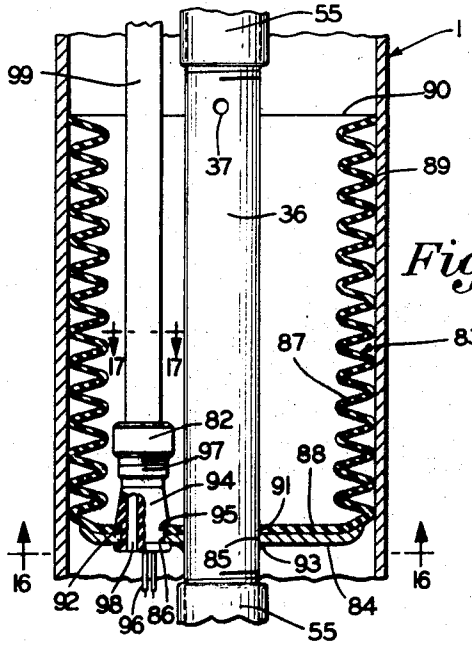


Fig. 15

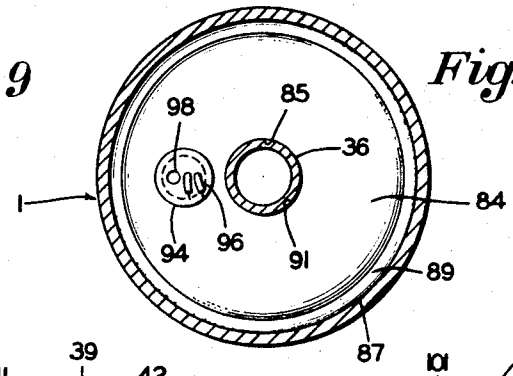


Fig. 16

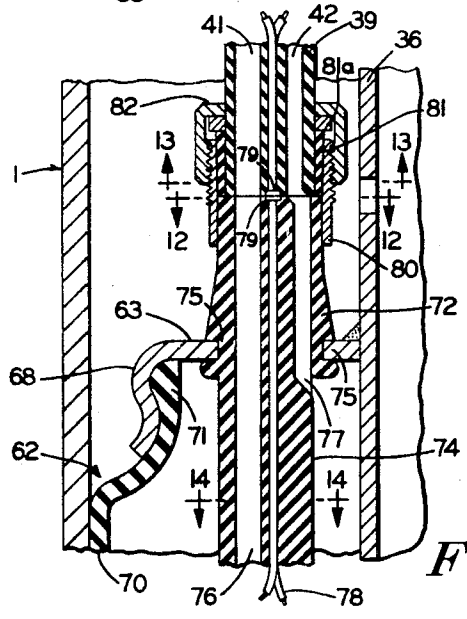


Fig. 11

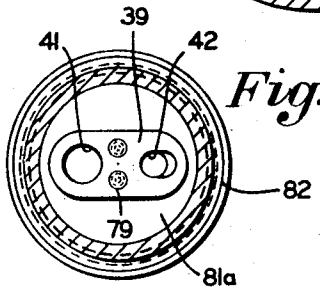


Fig. 13

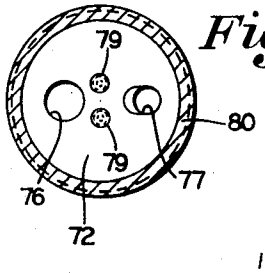


Fig. 12

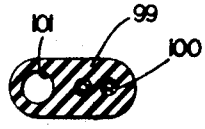


Fig. 17

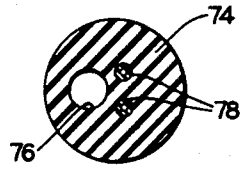


Fig. 14

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WELL PUMPING SYSTEM CONSTRUCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to water well pumping systems and more particularly to well system constructions in which a combination air pressure and water storage tank chamber is formed within the well casing or shaft. The tank chamber communicates with the related pump controls located on top of the well casing eliminating the need of a separate tank and controls at a distant location. The lower tank seal may be of various constructions for installation in the well casing or in the well shaft below the well casing in order to form a sufficiently large tank chamber.

2. Description of the Prior Art

Present deep water well systems used in many rural and suburban homes include a well casing which is inserted into a well shaft providing access to a water pool below. A delivery pipe extends throughout the well casing and well shaft having a submersible or jet pump attached at the lower end in the water pool. The delivery pipe is connected to a combination storage and pressure tank, generally located at a distant point, for maintaining the house water system pressure within a predetermined range and to eliminate repeated pump operations each time water is drawn out of the system. Such tanks are usually located in a basement, garage or pump room and have the associated pump control equipment located nearby.

This system has the disadvantage of the unsightly tank and control equipment in the basement or garage and the additional space required for their installation. A greater problem arises for mobile homes or homes built without a basement or garage in which to place such equipment. Such situations have resulted in the need to build a separate and expensive pump room to contain the tank and pump controls.

Known well constructions which attempt to eliminate these problems by incorporating the pressure and storage tank within or around the well casing have many disadvantages and have proved unsatisfactory. Some constructions provide a tank having a diameter larger than the well casing, placed in the ground and connected to the top of the well casing or surrounding the upper part of the well casing. These installations require large and deep excavations to contain the tank, since such tanks should be located beneath the frost line in cold climate areas to prevent freezing. Such tanks must be of a material capable to resist deterioration when buried in the ground and, therefore, are expensive. Likewise, the means used to connect the tank to the well casing and to the delivery pipe require special connections and discharge couplings which are expensive and difficult to install.

Well pumping constructions in which a tank is formed within the well casing, heretofore, have required special expensive discharge heads for exiting the delivery pipe from the well casing and tank chamber below the frost line. Also, known lower seals are difficult to install beyond a coupling joining two sections of casing without damaging the sealing ring. Thus, in most installations the lower seal must be located within the uppermost casing section thereby preventing a sufficiently large tank chamber from being formed to contain the needed amount of water and air to prevent numerous pump operations.

Likewise, elaborate float and valve means are needed in such belowground pressure and storage tanks to emit and eject water and air into the tank for proper pumping operations. Maintenance or replacement of these operating valves and floats is expensive due to their location within the tank chamber and well casing.

Occasionally in drilling a well shaft, rock will be encountered eliminating the need for installing a well casing through the rock area to the water pool. These situations prevent forming of a storage chamber within the well casing if a sufficient length of well casing is not installed prior to encountering the rock, since known chamber sealing means must be installed within a well casing.

These problems are solved and the difficulties encountered are eliminated by the well pumping system construction of the invention which permits a pressure and storage tank chamber to be formed and properly spaced in a well casing or well shaft with relatively simple sealing means, permitting an aboveground delivery pipe exit, and locating the pump controls at the well casing top exit.

SUMMARY OF THE INVENTION

Objectives of the invention include providing a well pumping system construction in which a pressure and storage tank chamber is formed within the well casing; providing a well system construction in which the tank chamber seals are of a simple construction, void of moving parts and in which the bottom seal is easily located at various depths in the well casing; providing a well system construction in which a delivery pipe exists aboveground eliminating expensive and difficult to install discharge heads; providing a well system construction in which the lower tank chamber seal can be located within the well shaft below the well casing; providing a well system construction in which the pump controls are located at the well casing exit above ground level without the danger of freezing; providing a well system construction eliminating the need for inducing and expelling air in and from the tank chamber during each pumping operation; and providing a well system construction which is simple in construction and installation, and which eliminates difficulties heretofore encountered, achieves the objectives indicated, and solves problems and satisfies needs existing in the art.

These objects and advantages are obtained by the well pumping system construction of the invention, the general nature of which may be stated as including a well shaft, a well casing extending from aboveground into the well shaft; bottom and top sealing means spaced within the well casing forming a tank chamber between the sealing means and the well casing; the bottom sealing means having an inflatable member expandable within the well casing; air-liquid separator means located within the tank chamber; a delivery pipe extending throughout the well shaft having openings formed therein, communicating with the tank chamber; pump means attached to a lower end of the delivery pipe; a supply pipe connected to the delivery pipe above the well casing; pump control means located above the well casing communicating with the pump means and the tank chamber; conduit means extending downward from a point above the well casing through the top and bottom sealing means; said conduit having electric wires contained within and formed with a breather passage and an inflate passage; said inflate passage communicates with the inflatable member in the bottom sealing means for inflating said member, said breather passage terminates in the casing below the bottom sealing means and said wires supply power to the pump means; and housing means placed over the pump controls and the aboveground well casing.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention - illustrative of the best mode in which applicants have contemplated applying the principles—is set forth in the following description and shown in the accompanying drawings, and is particularly and distinctly pointed out and set forth in the appended claims.

FIG. 1 is a fragmentary front elevational view, with parts in section showing the well casing pressure and storage tank construction;

FIG. 2 is a sectional view taken on line 2—2, FIG. 1;

FIG. 3 is a greatly enlarged fragmentary sectional view taken on line 3—3, FIG. 2;

FIG. 4 is an enlarged sectional view taken on line 4—4, FIG. 1;

FIG. 5 is an enlarged fragmentary sectional view taken on line 5—5, FIG. 4;

FIG. 6 is an enlarged fragmentary sectional view taken on line 6—6, FIG. 1;

FIG. 7 is a fragmentary sectional view, with parts broken away, of an alternate lower seal construction;

FIG. 8 is an enlarged sectional view taken on line 8—8, FIG. 7;

FIG. 9 is a fragmentary sectional view, with parts broken away, of another alternate lower seal construction;

FIG. 10 is a sectional view taken on line 10—10, FIG. 9;

FIG. 11 is an enlarged fragmentary sectional view taken on line 11—11, FIG. 10;

FIG. 12 is an enlarged sectional view taken on line 12—12, FIG. 11;

FIG. 13 is an enlarged sectional view taken on line 13—13, FIG. 11;

FIG. 14 is an enlarged sectional view taken on line 14—14, FIG. 11;

FIG. 15 is a fragmentary sectional view, with parts broken away, of a noninflatable alternate lower seal construction;

FIG. 16 is a sectional view taken on line 16—16, FIG. 15; and

FIG. 17 is an enlarged sectional view taken on line 17—17, FIG. 15.

Similar numerals refer to similar parts throughout the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The improved well pumping system construction (FIG. 1) includes a well casing 1 which extends into a well shaft 2 formed in the ground 3. A bottom seal 4 is located within casing 1 at a predetermined distance below a top seal 5 forming a tank chamber 6 between seals 4 and 5 and casing 1.

A delivery pipe 7 extends throughout casing 1 and shaft 2 to a water pool below, having a pump means 7*a* attached to the lower end of pipe 7 below the water level. The pump controls 8 are attached to an elbow 9 at the top end of pipe 7 at the junction with a supply line 10.

Pump controls 8 consist of a usual pressure switch 11, pressure gauge 12 and wires 13 which connect switch 11 to a source of electrical power. Supply line 10 connects delivery pipe 7 to the house or other location where the well water is to be pumped. Supply line 10 may consist of a sleeve 14, elbows 15, a coupling 16 and sections of pipe 17 which extend parallel to casing 1 into ground 3. Pipe 17 should extend a sufficient distance into ground 3 so as to be below the frost line before extending outward from casing 1.

A housing 18 which includes an outer shell 19 and an inner lining 20 of insulation, such as styrofoam, is placed over the exposed well system components to protect them from physical damage and from freezing in cold climates. The lower end of housing 18 preferably extends into ground 3 below the frost line. Air vents 21 are formed in the top of housing 18 and are covered by a baffle plate 22.

Top seal 5 is a usual packing type seal which includes upper and lower circular steel plates 23 and 24, respectively, which are slightly smaller than the inner diameter of casing 1. A flange 25 is formed on upper plate 23. A central opening 26, oblong opening 27 and a plug hole 28 are formed in each plate 23 and 24. A disc 29 of sponge or resilient material is located between plates 23 and 24 and is expanded outward against casing 1 providing an airtight seal when plates 23 and 24 are drawn toward each other by bolts 30. Likewise, flange 25 is seated tightly against the casing top edge 31 as bolts 30 are tightened.

Bottom seal 4 includes an inflatable bag 32 molded to and located between concave circular plates 33. Plates 33 are formed with central openings 34 and aligned offset openings 35. A short section of delivery pipe 36 extends through central openings 34 and bag 32, and is secured to plates 33 preferably by tack welds 36*a*. Pipe 36 has a plurality of openings 37 formed near the top end beyond top plate 33. A tubular boss 38 surrounds each opening 35 and extends outward from plate 33.

An oblong-shaped conduit 39 (FIG. 3), preferably molded of rubber and having electrical wires 40 embedded within, is formed with a breather passage 41 and an inflate passage 42 throughout its length. Conduit 39 is inserted through openings 27 in top seal plates 23 and 24 and secured therein by the expansion of disc 29. Conduit 39 extends through tank chamber 6 and through openings 35 in bottom seal plates 33, and terminates a short distance below bottom seal 4.

A rubber gasket 43 is located within each boss 38 and is formed with an opening 44 similar in shape and size to conduit 39 (FIGS. 5 and 6). A washer 45 having an opening 46 is forced against gasket 43 by the inturned edges 47 of nut 48. The force exerted by washer 45 expands gasket 43 within boss 38 forming an airtight seal for conduit 39.

A usual air valve stem 49 (FIG. 3) is connected to inflate passage 42 at the top of conduit 39 and may be secured therein by a coupling 50. A plug 51 is inserted into inflate passage 42 at the lower end of conduit 39 below bottom seal 4. An opening 52 is formed in conduit 39 prior to placing conduit 39 through seal 4 which opening is located within bag 32 and communicates with inflate passage 42 for inflating bag 32 (FIG. 6). The upper and lower ends of breather passage 41 are left open to provide an air passage between the atmosphere above ground 3 and the space below bottom seal 4 to prevent a vacuum from being formed above the water pool after repeated pumping operations. Likewise, breather passage 41 permits the air above the water pool, which is at a constant, moderate temperature, to be drawn into housing 18 which maintains the ambient air surrounding pump controls 8, tank chamber 6 and supply line 10 at a nearly uniform temperature. This prevents both freezing during the winter and overheating during the summer. Electrical wires 53 are connected with conduit wires 40 at 54, and extend downward to pump means 7*a*.

The assembly of the well pumping system construction is relatively simple requiring no special tools or equipment. The required distance between seals 4 and 5 needed for sufficient storage capacity is determined after drilling of well shaft 2 and insertion of well casing 1. Delivery pipe section 36 of bottom seal 4 is connected to delivery pipe 7 by sleeves 55 at a determined location, so that bottom seal 4 is at the proper distance below top seal 5 after pipe 7 is inserted into casing 1. Conduit 39 is inserted through and secured to bottom seal 4 and the wiring connection made at 54. Delivery pipe 7 is then lowered into casing 1 after attachment and connection of pump means 7*a*. Top seal 5 is then attached to casing 1 forming chamber 6 and securing pipe 7 and conduit 39 in their proper position. Bag 32 may then be inflated through inflate passage 42 by means of an air bottle, air compressor, or the like connected with valve stem 49 expanding bag 32 against casing 1 forming an air and watertight bottom seal.

Pump controls 8 are then installed and connected, and pump means 7*a* is operated, partially filling tank chamber 6 with water. A usual check valve (not shown) mounted in the pump means prevents return flow of the water from chamber 6 into the water pool. An oil base liquid, similar to mineral oil, normally used in aboveground well pressure and storage tanks is poured into chamber 6 through top seal hole 28 where it forms an air-liquid separator film 56 on top of the water 56*a*. A plug 28*a* may then be placed in hole 28 to seal chamber 6. A sufficient amount of compressed air is then introduced into chamber 6 through delivery pipe 7 and delivery pipe openings 37 by means of a second valve stem 57 connected to elbow 9, until the usual air and water ratio needed for efficient operation, as in an aboveground pressure-storage tank is obtained.

The pumping operation of the new well construction is similar to a usual aboveground pressure-storage tank system. Incoming water 56*a* which is forced upward by pumping means 7*a*, enters chamber 6 through openings 37 causing separator film 56 to rise in the chamber. The trapped air in the top of the chamber above film 56 is thus compressed causing the chamber pressure to increase. This pressure is transmitted through delivery pipe 7 to pressure switch 11 which is set to

deenergize the pumping means upon the pressure reaching a predetermined level. The chamber pressure decreases as water is withdrawn through delivery pipe **7** and supply line **10**. Switch **11** energizes the pump means when the chamber pressure drops to a predetermined minimum level refilling chamber **6** and thus repeating the above operation.

Well installations in which the lower end of shaft **2** is formed in sufficiently solid rock **58** eliminates the need of installing casing **1** completely throughout shaft **2**. Heretofore, in many such installations the forming of a sufficiently large tank chamber **6** has been prevented by this reduced casing length. The use of a slightly modified bottom seal **59** in shaft **2** at the location of rock **58** (FIGS. **7** and **8**) enables the correct size chamber **6** to be formed. Seal **59** is similar to seal **4** except a larger inflatable bag **60** is used between plates **33** to provide a greater sealing area against the uneven rock **58**. A usual collar sealing means **61** may be formed at the junction of casing **1** with rock **58**.

The diameter of uninflated bag **60** being smaller than the inner diameter of shaft **2** enables seal **59** to be easily located within shaft **2** without damaging bag **60** by movement against rock **58**. Bag **60** is inflated in a similar manner as bag **32**, after seal **59** is properly located within shaft **2**, and conforms to the uneven rock **58** providing an air and watertight bottom seal for chamber **6**.

An alternate inflatable bottom seal construction for mounting within well casing **1** is indicated at **62** (FIGS. **9** and **10**). Seal **62** includes spaced circular metal plates **63** secured to a short section of delivery pipe **36** as by tack welds **64**. Plates **63** are formed with central openings **65** through which pipe **36** extends, and is provided with aligned offset openings **66** through which a valve assembly **67** extends. The peripheries of plates **63** are formed with generally S-shaped flanges **68** which project toward the opposite plate **63**.

A replaceable tire-like boot **69**, formed preferably of neoprene rubber, has a flat center section **70** which terminates in inturned lips **71**. Boot **69** is easily compressed and snapped between plates **63** with lips **71** engaging plate flanges **68**.

Valve assembly **67** is preferably molded of rubber having an upper valve stem **72** and a lower valve stem **73** formed at its respective ends, with a short section of flexible conduit **74**, therebetween. Stems **72** and **73** are each formed with annular grooves **75** which engage plates **63** forming airtight seals at openings **66** when stems **72** and **73** are inserted through plates **63** (FIG. **11**).

A breather passage **76** is formed throughout valve assembly **67** with an inflate passage **77** being formed only in upper stem **72**. Conduit **74** may have a circular cross section as shown in FIG. **14** having electrical wires **78** molded within, and extending through lower stem **73** for connection with pumping means **7***a*. Wires **78** terminate in buttons **79** at the upper end of stem **72** for contacting similar buttons **79** attached to wires **40**. A threaded sleeve **80** is bonded to the upper end of stem **72**.

Installation of alternate seal **62** within well casing **1** is similar to the installation of seals **4** and **59** except for the connection of conduit **39** to seal **62**. A gasket **81** is inserted in stem sleeve **80** and the lower end of conduit **39** is telescoped through gasket **81** abutting the end of stem **72**. Breather passage **41**, inflate passage **42** and wires **40** of conduit **39** align with breather passage **76**, inflate passage **77** and wires **78** of stem **72**, respectively. A washer **81***a* and nut **82**, similar to washer **45** and nut **48**, secure conduit **39** within stem sleeve **80**.

An alternate, noninflatable lower seal construction for use in the new well pumping system construction is indicated at **83** and is shown in FIGS. **15** and **16**.

Seal **83** includes a circular plate **84** which is formed with a central opening **85** and an offset opening **86**. A flexible cylinder **87**, preferably formed of neoprene rubber or the like, is supported on plate **84**. Cylinder **87** includes a circular end wall **88** which abuts plate **84** and bellows-like side walls **89** which terminates in an open upper end **90**. End wall **88** is formed with a central opening **91** and an offset opening **92** which align with plate openings **85** and **86**, respectively.

A delivery pipe section **36** extends through central openings **85** and **91** for connection to delivery pipe **7** and is secured to plate **84** as by welds **93**. A valve stem **94** is inserted through and secured in offset openings **86** and **92** by means of annular groove **95** formed in stem **94**. Valve stem **94** is somewhat similar in construction to valve stem **72**, having wires **96** imbedded within, a threaded sleeve **97** secured to the stem top, and formed with a breather passage **98**.

A conduit **99** (FIG. **17**) preferably having an outer shape similar to conduit **39** has electric wires **100** imbedded within and is formed with a breather passage **101**. Conduit **99** is aligned and secured to valve stem **94** in a similar manner as valve **72** and conduit **39** described above, and extends through top seal **5** with wires **100** connected to pressure switch **11**.

Pipe **36** of seal **83** is connected to delivery pipe **7** by sleeves **55** prior to being lowered within well casing **1**. Side walls **89** are expanded lengthwise while being lowered within casing **1** by contact with casing **1**. After seal **83** is lowered to its proper depth, delivery pipe **7** is pulled upward a short distance, compressing side walls **89** and forming a tight seal against casing **1**. Water is pumped into chamber **6** through delivery pipe openings **37** filling cylinder **87** and expanding side walls **89** outward against casing **1** providing an even tighter seal with casing **1**.

A separator film **56** is formed in chamber **6** and compressed air is introducted to achieve the initial air to water ratio. Likewise, the pumping operation and the pump means control are the same as described above. However, no inflate valve stem **49** and inflate passage is required for alternate seal **83**.

Accordingly, the new well pumping system construction provides a means for forming an air pressure and water storage tank chamber within a well casing and well shaft; provides a construction having an aboveground delivery pipe exit and having the pump controls located near the well; provides a construction easy to install and maintain; and provides a construction which is effective, safe, inexpensive and efficient, which achieves all the enumerated objectives, provides for eliminating difficulties encountered with prior constructions, and solves problems and obtains new results in the art.

In the foregoing description, certain terms have been used for brevity, clearness, and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such terms are used for descriptive purposes and are intended to be broadly contrued.

Moreover, the description and illustration of the invention is by way of example, and the scope of the invention is not limited to the exact details shown or described.

Having now described the features, discoveries and principles of the invention, the manner in which the well pumping system construction is made and operates, the characteristics of the new construction, and the advantageous, new and useful results obtained, the new and useful structures, devices, elements, arrangements, parts, combinations, procedures, and methods are set forth in the appended claims.

We claim:

1. Well pumping system construction including a well shaft extending downwardly into the ground to a water pool below; a well casing extending from a point above the ground downwardly into said shaft; an inflatable bottom sealing means and a top sealing means spaced within said well casing, said sealing means forming an air and water chamber therebetween with said casing; a water delivery pipe extending from a point above the ground downwardly into the well shaft to said water pool; said delivery pipe being formed with openings, said openings communicating with said chamber; pump means communicating with said delivery pipe for pumping water from the water pool into the chamber; air-liquid separator means placed within said chamber; pump control means communicating with said pump means; a water supply pipe connected to said delivery pipe at a point aboveground; air breather means extending from below said bottom sealing

means to a point above said top sealing means; and means for inflating said bottom seal.

2. The construction defined in claim 1 in which the inflatable bottom sealing means includes a pair of spaced plates; in which each plate is formed with an opening, through which openings said delivery pipe extends; in which an inflatable member is located between said plates; and in which said inflating means communicates with said inflatable member.

3. The construction defined in claim 2 in which the inflatable means is bag-like and is bonded to said pair of spaced plates; in which a pair of oppositely located bosses extend outward from said plates; and in which said inflating means extends through said bosses and communicates with said inflatable means.

4. The construction defined in claim 2 in which the pair of spaced plates are each formed with central openings and opposite offset openings; in which said delivery pipe extends through said central openings and in which said inflating means extends through said offset openings; in which said plates have peripheral flanges extending inward toward each other; in which said inflatable means is a tire-like boot having a generally flat center portion when expended against said casing; and in which said center section terminates in inturned lips, said lips engaging said plate flanges.

5. The construction defined in claim 1 in which the inflating means is a molded flexible conduit formed with an inflate passage; in which an opening is provided in said conduit communicating with said inflate passage; and in which said opening communicates with the bottom sealing means.

6. The construction defined in claim 5 in which electric wires are embedded within said conduit; and in which said wires extend between and connect to said pump means and to said pump control means.

7. The construction defined in claim 5 in which said conduit means is formed with a breather passage; and in which said breather passage extends from below said bottom sealing means to a point above said top sealing means.

8. The construction defined in claim 1 in which a housing covers said well casing which extends aboveground; covers said pump control means; and covers said supply pipe.

9. Well pumping system construction including a well shaft extending downwardly into the ground to a water pool below; a well casing extending from a point above the ground downward into said shaft; a bottom sealing means and a top sealing means spaced within said well casing, said sealing means forming an air and water chamber therebetween with said casing; a water delivery pipe extending from a point above the ground downwardly into the well shaft to said water pool; said delivery pipe being formed with openings, said openings communicating with said chamber; pump means communicating with said delivery pipe for pumping water from the water pool to the chamber; air-liquid separator means placed within said chamber; pump control means communicating with said pump means; a water supply pipe connected to said delivery pipe at said terminal point aboveground; and air breather means extending from below said bottom sealing means to a point above said top sealing means.

10. The construction defined in claim 9 in which said bottom sealing means includes a plate, a flexible cylinder supported on said plate; in which said cylinder has an end wall abutting said plate, and bellows-like side walls forming an open upper end, in which said side walls contact said casing; in which a pair of openings are formed in said cylinder end wall; in which a pair of similar openings are formed in said plate, which plate openings align with said end wall openings; and in which the delivery pipe extends through one pair of aligned openings, and in which the air breather means and pump control means extend through the other pair of aligned openings.

11. Well pumping system construction including a well shaft extending downwardly into the ground to a water pool below; a well casing extending from a point above the ground downward in said shaft; a top sealing means disposed in said well casing and an inflatable bottom sealing means disposed in said well shaft spaced below said top sealing means, said sealing means forming an air and water chamber therebetween with said casing and shaft; a water delivery pipe extending from a point above the ground downwardly in the well shaft to said water pool; said delivery pipe being formed with openings, said openings communicating with said chamber; pump means communicating with said delivery pipe for pumping water from the water pool to the chamber; air-liquid separator means placed within said chamber; pump control means communicating with said pump means; a water supply pipe connected to said delivery pipe at said terminal point aboveground; and air breather means extending from below said bottom sealing means to a point above said top sealing means.

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