Jan. 18, 1955 E. M. STEVENS 2,699,729

DEEP WELL PUMP

Filed Nov. 14, 1950 3 Sheets-Sheet 1

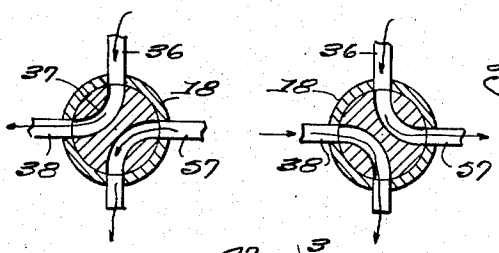


Fig. 5.

Fig. 1.

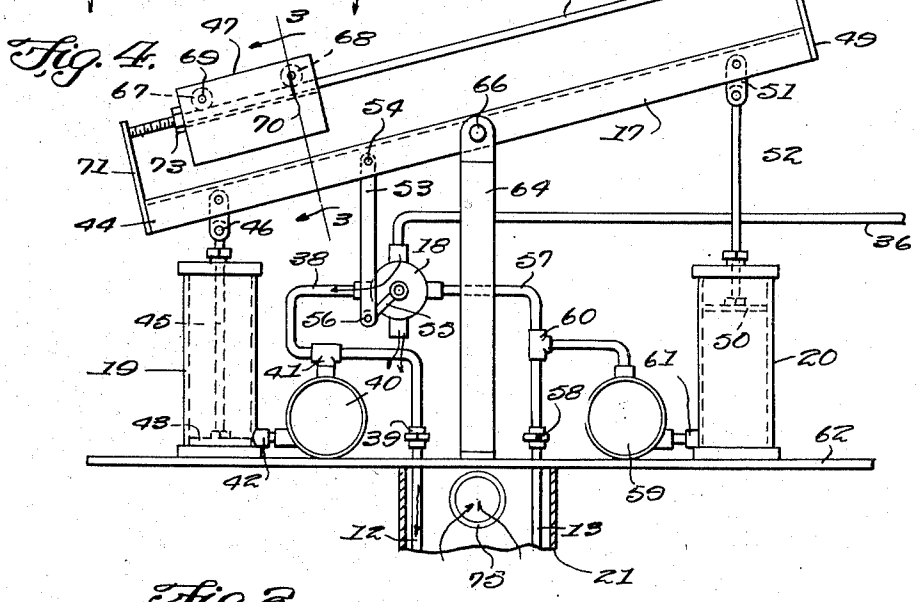
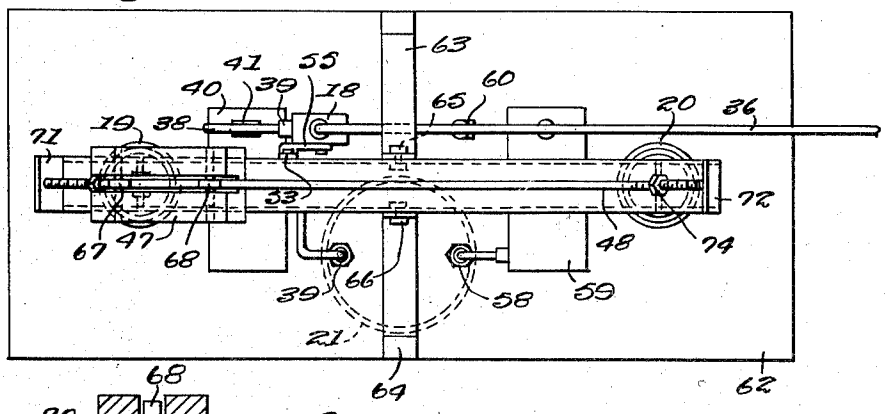


Fig. 4.

Fig. 2.



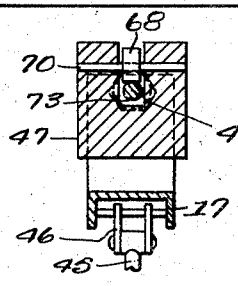


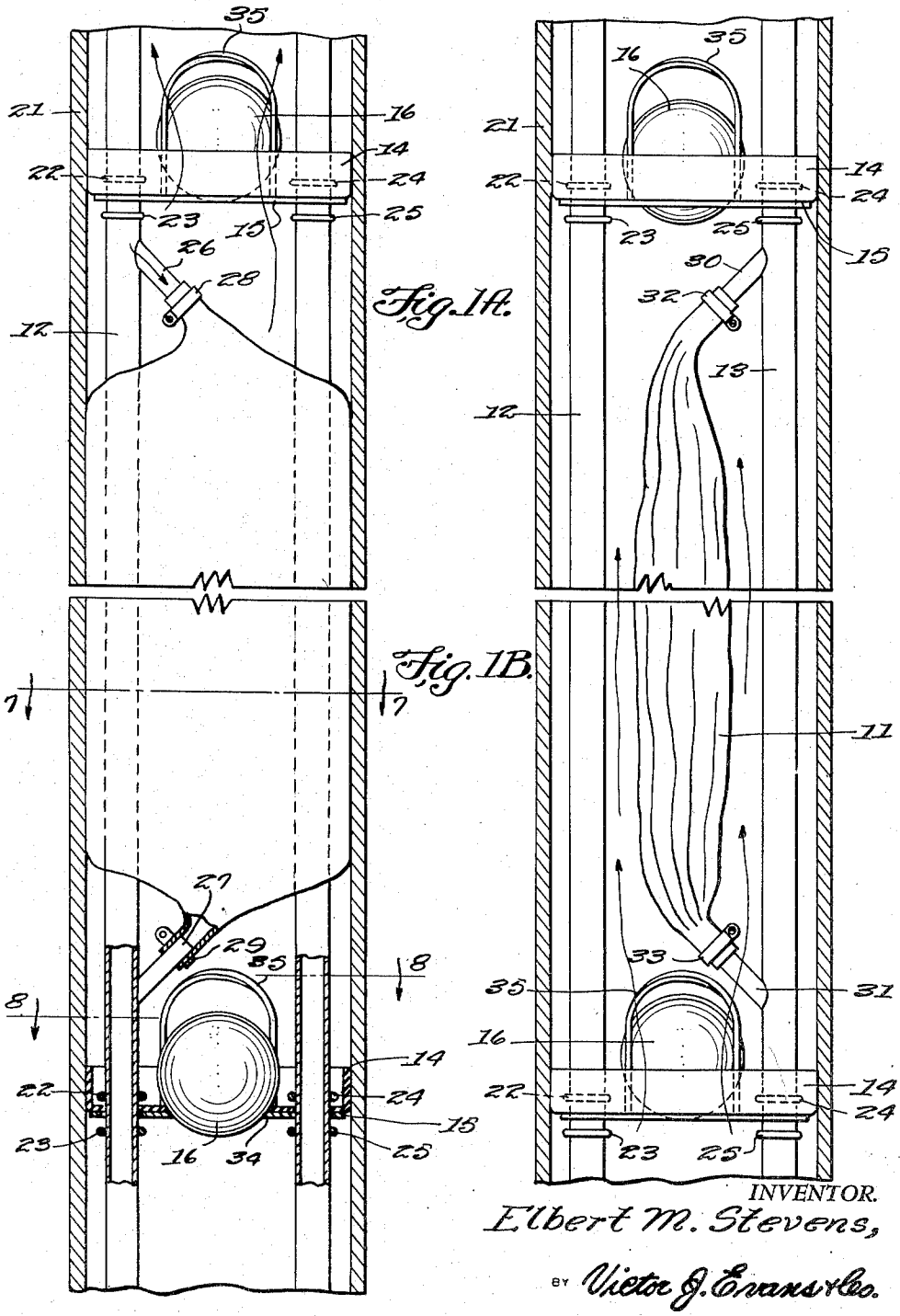
Fig. 3.

INVENTOR.
Elbert M. Stevens,
BY Victor J. Evans & Co.
ATTORNEYS

Jan. 18, 1955 E. M. STEVENS 2,699,729

DEEP WELL PUMP

Filed Nov. 14, 1950 3 Sheets-Sheet 2



INVENTOR.
Elbert M. Stevens,
BY Victor J. Evans & Co.
ATTORNEYS

Jan. 18, 1955 E. M. STEVENS 2,699,729

DEEP WELL PUMP

Filed Nov. 14, 1950 3 Sheets-Sheet 3

Fig. 6.

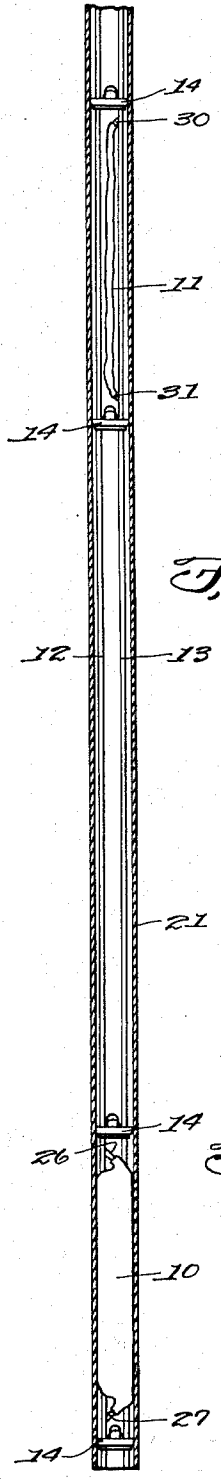


Fig. 7.

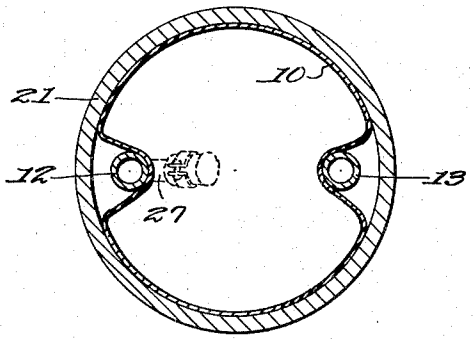


Fig. 8.

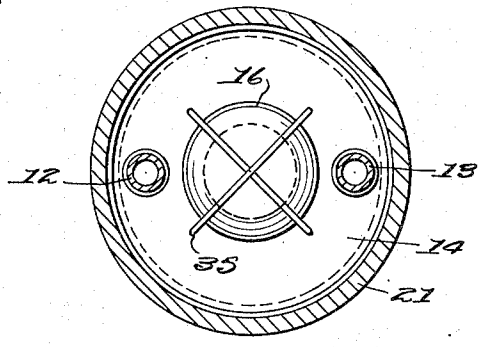
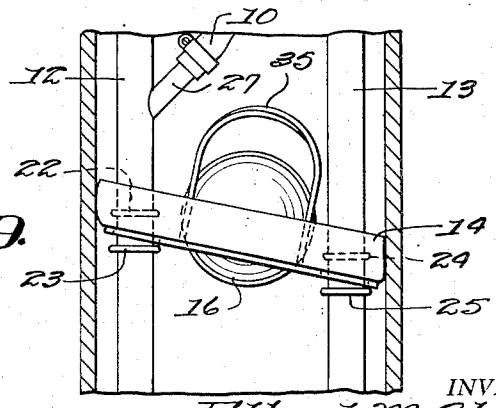


Fig. 9.



INVENTOR.
Elbert M. Stevens,
BY Victor J. Evans & Co.
ATTORNEYS

United States Patent Office 2,699,729 Patented Jan. 18, 1955

2,699,729

DEEP WELL PUMP

Elbert M. Stevens, San Antonio, Tex.

Application November 14, 1950, Serial No. 195,621

3 Claims. (Cl. 103—46)

This invention relates to deep well pumps of the type used for elevating fluid where the head is too great for conventional pumping operations, and in particular an air pressure actuated pumping device where flexible pressure bags are inflated in valved sections of well casings for forcing fluid in the sections upwardly into superimposed sections.

The purpose of this invention is to provide means for pumping water and other fluid from well casings and the like without the use of extended and bulky piston rods and other mechanically actuating instrumentalities.

The purpose of this invention is to provide means for utilizing the pressure of the gas from a gas well, or from the gas accompanying oil in the well, to pump oil merely by application of its pressure head without requiring a compressor.

The purpose is also to provide a pumping system which it is practical to lower into existing standard casings and to remove therefrom for any very rarely required repair.

In the conventional pumping unit the distance from the pump to the water or fluid level is limited as the head breaks the seal and the pump ceases to operate. Also well casings vary from plumb line vertical with sections at some times extending horizontally at points far underground. With this thought in mind this invention contemplates means for forcing fluid upwardly through pipes or well casings by compressed fluid with the fluid pumped or injected into the well casing and exhausted therefrom by comparatively small pipes and with the fluid elevated intermittently from one section of the casing to another, so that it flows from the upper end of the casing in an intermittent or interrupted stream.

The object of this invention is, therefore, to provide means for efficiently pumping water from well casings by compressed air wherein the air is controlled to elevate the fluid from one section of the casing to another.

Another object of the invention is to provide a deep well pumping system for pumping liquid by means of pressurized air or other gas alternately by one system of chambers and then by the other, and wherein several units or a single unit may be used independently in a shallow well.

A further object of the invention is to provide an improved deep well pumping system for pumping water and other fluids from well casings and the like which is comparatively simple and inexpensive.

With these and other objects and advantages in view the invention embodies a pair of air pipes having spaced transversely disposed seals with valves therein carried by the pipes and rubber composition or plastic bags connected to the pipes and positioned between the seals.

Other features and advantages of the invention will appear from the following description taken in connection with the drawings wherein:

Figure 1 is an elevational view illustrating the pressure control mechanism showing the apparatus positioned toward the upper end of a well casing with the end of the casing shown in section.

Figure 2 is a plan view of the apparatus illustrated in Figure 1.

Figure 3 is a cross section taken on line 3—3 of Figure 1 showing the mounting of a balancing weight on the rod of the rocking cradle.

Figure 4 is a cross section through a control valve showing the valve in the position of applying pressure to the air supply pipe in the left hand side of the casing with the pipe in the right hand side opened to the exhaust.

Figure 5 is a similar view showing the position of the valve reversed.

Figure 6 is a vertical section through a well casing showing the deep well pump incorporated therein with a bag in one section of the casing inflated and with a bag in a section above deflated.

Figure 7 is a cross section on an enlarged scale taken on line 7—7 of Figure 1*a* showing the pressure bag inflated.

Figure 8 is a similar detail taken on line 8—8 of Figure 1*a* showing a plan view of one of the valve seals in the casing.

Figure 9 is a vertical section through a portion of the well casing showing the seals and air pipes while in process of being lowered and set in the casing, or while being raised out of the casing.

Figure 1*a* is a vertical section through a portion of the well casing, also on an enlarged scale showing the pressure bag in the section inflated and showing a seal at the lower end of the bag in section.

Figure 1*b* is a similar view showing the bag deflated and illustrating the position of the valves with fluid passing upwardly into the section and with the seal shown in elevation.

Referring now to the drawings wherein like reference characters denote corresponding parts the improved deep well pump of this invention includes a plurality of flexible pressure bags **10** and **11**, an air pressure tube **12** to which the bags **10** are connected, a similar tube **13** through which the bags **11** are connected, cup shaped washers **14**, of flexible material, forming seals, discs **15** upon which the seals are positioned, units **16** which, in combination with the discs, provide valves, a rocking cradle **17**, a control valve **18** and pressure cylinders **19** and **20**.

In the design shown the air pressure tubes and bags are incorporated in a well casing **21** with the seals positioned by collars **22** and **23** on the tube **12** and **24** and **25** on the tube **13**.

With the parts arranged in this manner the pressure tubes are lowered into the well casing with the seals retained in spaced relation by the collars on the tubes, particularly as shown in Figure 9, and with the bags **10** secured to the ends of nipples **26** and **27** extended from the tube **12** by clamps **28** and **29**, respectively, and also with the bags **11** secured to similar nipples **30** and **31** of the tube **13** by clamps **32** and **33**, respectively.

With the pressure bags alternated whereby every other bag is connected to the tube **12** and the intermediate bags to the tube **13** the bags on one side are expanded to force the fluid upwardly through the valves in the seals above with the valves in the seals below the bag preventing the fluid passing downwardly. As the bags of the tube **12** are inflated or expanded the bags **11** of the tube **13** are deflated providing sufficient area for the fluid and after this step is completed the bags **11** are expanded and the bags **10** deflated whereby the fluid is forced upwardly to the next stages or sections.

The parts **10** and **11** are illustrated as connected to the air pressure tubes with diagonally positioned or sloping nipples and in the design illustrated in Figure 1*a* the lower nipple is closed with the tube **12** so that the nipple **27** merely forms a support for the lower end of the bags. It will be understood that both of the nipples may be opened so that air may be supplied to and removed from both ends of the bags, or only one nipple may be opened to the pressure tube with the other providing a support, or the bags may be provided with single connections, only at either the upper or lower ends with the opposite ends closed.

It will be also understood that expansible units or elements of any suitable type or design may be used and these elements which may be of any suitable size or shape may be connected to the supply tubes or pipes at any suitable point or points.

It will be noted that as the bag **11** shown in Figure 1*b* is inflated water pressure of the section above the seal **14** at the lower end of the bag moves the ball **16** at the lower end on the seat whereas the ball in the opposite or upper end is elevated above the seat by the flow of water passing upwardly through the upper seal.

The discs **15** are provided with centrally disposed

openings **34** which provide seats for the units **16** forming valves and the discs are also provided with cages **35** that retain the units in position in relation to the valve seats and at the same time permit freedom of movement thereof. Although the valve units are illustrated as being formed with balls, valves of other types or designs may be used.

It will be understood that air may be supplied to the pressure tubes **12** and **13** by any suitable means and that in Figures 1 to 5 a typical control mechanism is provided wherein air pressure supplied by any suitable means is provided through a pipe **36** to the valve **18** and with the valve positioned as shown in Figure 4 the air pressure is supplied through the port **37** to a connection **38** which is connected to the upper end of the tube **12** by a union **39**.

The connection **38** is connected to an auxiliary tank **40** by a connection **41** and the tank **40** is connected to the lower end of the cylinder **19** through a connection **42**.

The air pressure is supplied to the bag **10** and when the bags are fully expanded the pressure builds up in the tank **40** and forces a piston **43** in the lower end of the cylinder **19** upwardly whereby the rocking cradle **17** is actuated until the end **44** which is connected to the connecting rod **45** of the piston **43** by a clevis **46** is elevated above the center and to such a position that a weight **47** carried by a rod **48** passes down the rod and forces the opposite end **49** downwardly with a piston **50** in the cylinder **20**, which is connected to the cradle **17** by a clevis **51** through the upper end of the connecting rod **52** moving downward. In this movement a link **53** pivotally connected to the cradle **17** by a pin **54** at one end and to an arm **55** extended from the valve **18** by a pin **56** at the other, reverses the position of the valve whereby pressure from the pipe **36** is applied to the tube **13** through a connection **57**. The connection **57** is attached to the upper end of the tube **13** by a union **58** and to the cylinder **20** through an auxiliary tank **59** to which it is connected by a connection **60**, the tank being connected to the cylinder **20** by a connection **61**.

The rocking cradle **17** with the cylinders **19** and **20** are mounted upon a base **62** and the base may be positioned over the upper end of the well casing **21**. The rocking cradle **17** is pivotally mounted on the base by brackets **63** and **64** with pins **65** and **66**.

The weight **47** is provided with rollers **67** and **68** which are rotatably mounted on pins **69** and **70** and the rod **48** upon which the weight is mounted is supported by end plates **71** and **72** from the ends of the rocking cradle. The rod **48** is provided with threaded ends and adjusting nuts **73** and **74** are adjustably mounted on the rod, providing means for adjusting the travel of the weight **47** whereby the pressure to the bags **10** and **11** may be cut off as desired.

The upper end of the well casing **21** is provided with discharge openings **75** and these openings may be positioned at any suitable point or points.

With the deep well pump of this type parts may be assembled above a well casing and lowered into the casing

by the tubes **12** and **13** and, as illustrated in Figure 6 expansion of a bag **10**, with the valve in the seal below the bag closed, forces fluid upwardly through the casing and at the completion of this step, expansion of the bag **11** in the section above with the valve in the seal below the bag closed, forces the fluid further upward.

The bag **10** and sealing washers **14** may be formed of rubber or any suitable material and the parts may be connected by any suitable means.

It will be understood that other modifications may be made in the design and arrangement of the parts without departing from the spirit of the invention.

What is claimed is:

1. In a deep well pump, the combination which comprises a vertically disposed well casing, fluid pressure means including a pair of tubes positioned in the casing, spaced expansible bags positioned in the casing, means connecting alternate ones of the said expansible bags to one of the said tubes, means connecting the remainder of the said bags to the other of the said tubes, so that said bags are alternately connected to said tubes at both ends thereof, seals extended across the casing between the bags, and check valves in the said seals.

2. In a deep well pump, the combination which comprises a vertically disposed well casing, a pair of tubes positioned in the casing, spaced expansible bags positioned in the casing, means connecting alternate ones of the said expansible bags to one of the said tubes, means connecting the remainder of the said bags to the other of the said tubes, so that said bags are alternately connected to said tubes at both ends thereof, seals extended across the casing between the bags, check valves in the said seals, means supplying air under pressure through the tubes to the said bags alternately.

3. In a deep well pump, the combination which comprises a vertically disposed well casing, a pair of tubes positioned in the casing, spaced expansible bags positioned in the casing, means connecting alternate ones of the said expansible bags to one of the said tubes, means connecting the remainder of the said bags to the other of the said tubes, so that said bags are alternately connected to said tubes at both ends thereof, seals extended across the casing between the bags, check valves in the said seals, means whereby air under pressure is supplied to a lower one of said tubes, and control means whereby upon reaching a predetermined pressure the supply of air under pressure is applied above said first tube with the pressure in the first tube relieved.

References Cited in the file of this patent

UNITED STATES PATENTS

1,851,666	Evans	Mar. 29, 1932
2,162,748	Richards et al.	June 20, 1939
2,196,993	Kidder	Apr. 16, 1940
2,404,524	Norton	July 23, 1946
2,435,179	McGovney	Jan. 27, 1948
2,606,500	Schmidt	Aug. 12, 1952