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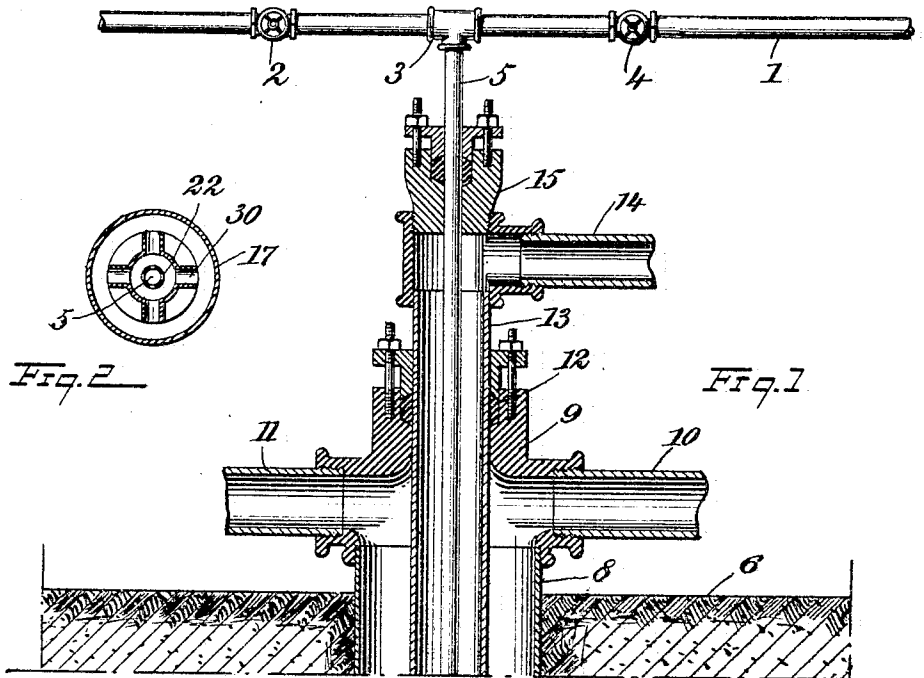
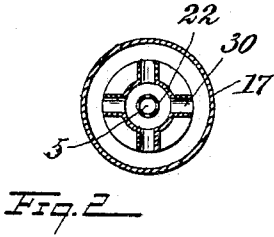
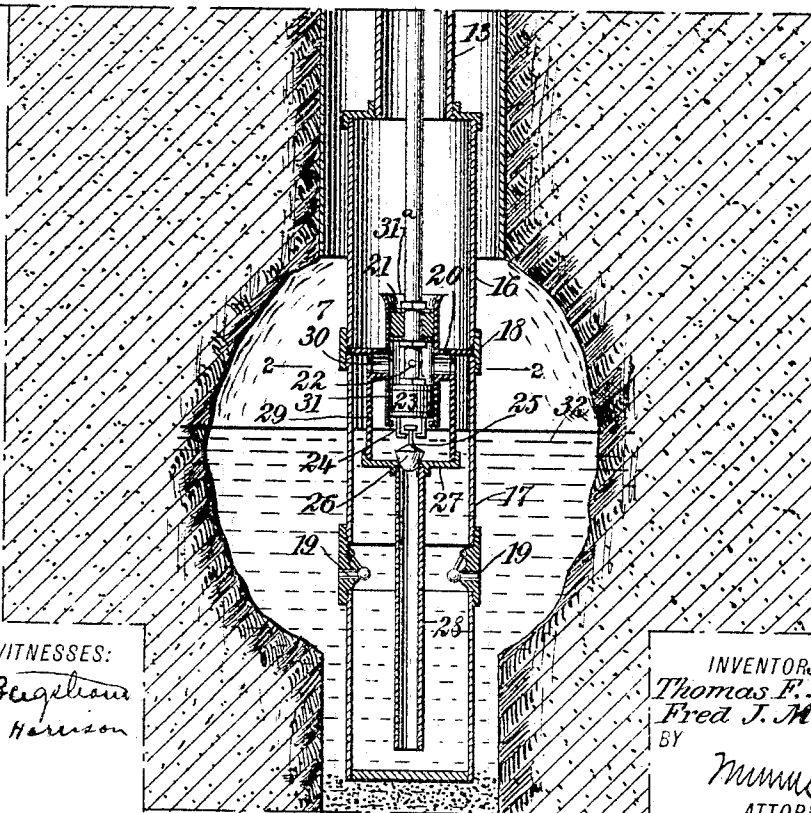
PATENTED FEB. 7, 1905.

T. F. MORAN & F. J. MOSER.

APPARATUS FOR RAISING LIQUIDS FROM DEEP DRILLED WELLS.

APPLICATION FILED DEC. 19, 1903.

2 SHEETS—SHEET 1.



WITNESSES:

John A. Beigelbauer
Wallon Harrison

INVENTORS
Thomas F. Moran
Fred J. Moser

BY

MUMFORD
ATTORNEYS

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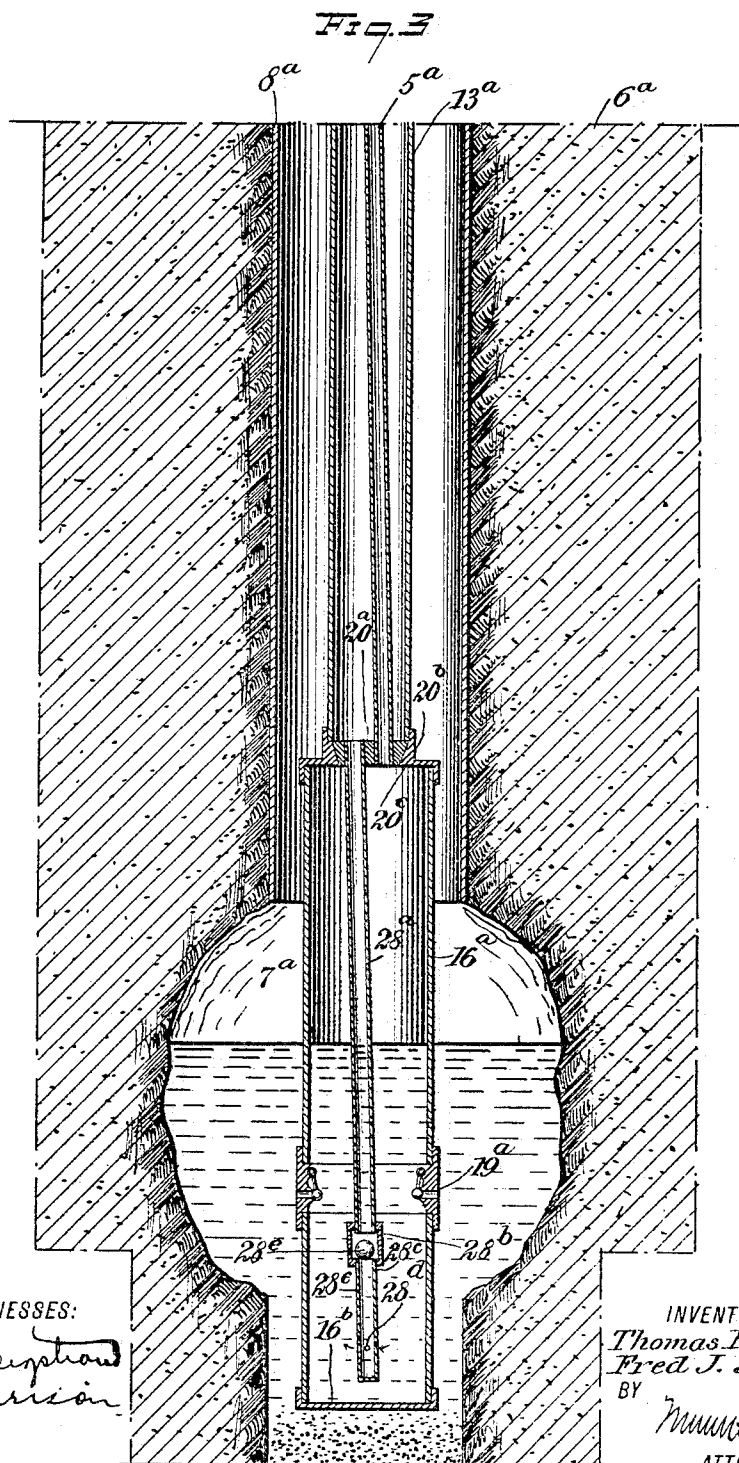
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WITNESSES:

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UNITED STATES PATENT OFFICE.

THOMAS FRANCIS MORAN, OF DE YOUNG, AND FRED JOSEPH MOSER, OF KANE, PENNSYLVANIA; SAID MORAN ASSIGNOR TO SAID MOSER.

APPARATUS FOR RAISING LIQUIDS FROM DEEP DRILLED WELLS.

SPECIFICATION forming part of Letters Patent No. 782,040, dated February 7, 1905.

Application filed December 19, 1903. Serial No. 185,825.

To all whom it may concern.

Be it known that we, THOMAS FRANCIS MORAN, a resident of De Young, in the county of Elk, and FRED JOSEPH MOSER, a resident of Kane, in the county of McKean, State of Pennsylvania, citizens of the United States, have invented a new and Improved Apparatus for Raising Liquids from Deep Drilled Wells, of which the following is a full, clear, and exact description.

Reference is made to our pending application, Serial No. 172,089, for a somewhat similar apparatus.

Our invention relates to lifting liquids from wells, and admits of general use, but is particularly adapted for service in deep drilled wells that have a small diameter and in which the liquid is comparatively shallow, frequently failing to afford the necessary submergence to seal the air without forming the liquid into a column of sufficient height above the level of the liquid in the well, so that it can be raised "plunger-like" from the well to the surface of the earth by the rapid and violent action of the air at high pressure.

Our lifting device is distinguished from hand-pumps or similar devices adapted to raise liquids from cisterns or comparatively shallow wells of a large diameter, such as will permit the installation of a large receptacle for the liquid at the bottom of the well of such proportions that the volume of liquid it contains may fill the discharge-tube to the surface of the earth and raise the liquid by the easy displacement by the air at low pressure, as shown, for instance, in patents to Wristen, No. 361,732, dated August 22, 1899; Sandbo, No. 647,202, dated April 10, 1900; Neff, No. 350,761, dated October 12, 1886, and in other patents.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 shows a vertical central section through our apparatus in use. Fig. 2 shows a horizontal section upon the line 2 2 in Fig. 1 looking toward the bottom of the figure,

and Fig. 3 is a vertical cross-section through another form of our device.

Referring to Figs. 1 and 2 of the drawings, the air-supply pipe is shown at 1 and is provided with hand-valves 2 4 and a T 3, from which depends the air-pipe 5. The ground is shown at 6, the shot-hole at 7, and the drill-hole casing at 8. A T 9 closes the upper end of the casing 8 and is provided with pipes 10 11 for utilizing the gas from the well, the stuffing-box 12 being for the purpose of preventing the escape of gas. The tubing is shown at 13 and passes through the stuffing-box 12, and the upper end of the tubing is provided with a stuffing-box 15 and with a fluid-discharge pipe 14. The casing 16 17 is made in two parts connected together by a coupling 18, the lower part 17 of the casing being provided with check-valves 19, opening inwardly, as shown, the casing being closed at its lower end. A partition 20 separates the two parts of the casing, so as to form upper and lower compartments. Mounted upon the air-pipe 5 are packings 21 23, spaced slightly apart, as shown. Intermediate of these packings is a series of holes or apertures 22, through which the air may make its escape from the air-pipe. Connected with the air-pipe 5 and projecting below the lower edge of the packing 23 are hooks 24, which loosely engage the head 25 of a movable valve 26, which is seated upon the head 27 of the casing 16. Depending from the head 27 is a conductor-pipe 28, which extends almost to the bottom of the casing, this conductor-pipe being disposed entirely within the lower compartment of the casing. A subcasing 29 is connected with the partition 20 and depends therefrom, as shown. This subcasing is provided with tubular apertures 30, disposed adjacent to the apertures 22 for permitting the escape of air. A tubular member 31 is provided at its upper end with a funnel-shaped portion 31^a and is rigidly connected with the partition 20. The air-pipe 5 may of course be removed by detaching the T 3 from the air-supply pipe 1 and raising the air-pipe directly upward. This with-

member 31 and also lifts the valve 26 by means of its head 25. This arrangement is very convenient for cleaning the valve in case it should become clogged or for purposes of repair.

Our invention is used as follows: The liquid 32 passes through the valves 19 into the lower portion 17 of the casing. The liquid within this part of the casing therefore assumes the same level as the general level of the liquid in the well. If now air-pressure be applied momentarily by closing the valve 2 and opening the valve 4, the air escapes through the apertures 22 and also through the apertures 30 into the lower portion 17 of the casing. The air-pressure within the lower portion of the casing forces the liquid up through the conductor-pipe 28 and through the subcasing 29 to the upper portion 16 of the casing. The valve 26 instantly drops into its seat after the liquid ceases to pass upward, and thereby prevents retrogression of the liquid. If there be a sufficient volume of liquid left in the well to reach above the level of the valves 19, the process just described may be repeated. Each time it is repeated a portion of the liquid is lifted from the lower portion 17 to the upper portion 16 of the casing and remains in the upper portion by virtue of the valve 26. Finally, when a sufficient volume of liquid has been accumulated in the upper portion 16 of the casing air-pressure is applied for a longer period, thus causing a free escape of air through the apertures 22 30 into the lower portion 17 of the casing, thereby causing the liquid in the upper portion 16 to rise to the surface of the earth. The last and most prolonged discharge of air practically expels the liquid within the lower portion 17 of the casing, together with that accumulated in the upper portion 16. Even if the liquid accumulated within the upper portion 16 of the casing, together with that in the lower portion 17 of the casing, aggregates a comparatively small quantity, air if applied for a sufficient length of time will raise the liquid to the surface if the liquid presents a sufficient volume to seal the tubing 13. In case a larger volume or a higher column of liquid has been built up in the upper compartment 16 then the air as normally applied can raise it to the surface of the earth. The air-pipe 5 can be raised bodily upward—say a foot or more—which withdraws the packings 21 and 23 from their seats and breaks the communication with the lower chamber or compartment 17. As the valve 26 for preventing retrogression of the elevated liquid is connected to the lower end of the air-pipe, it is thus raised from its seat and allows a portion of the liquid standing above the partition to recede to the lower chamber 17, thereby reducing the height of the column of liquid in the compartment 16. When the air-pipe is thus raised, the air may be discharged directly into the liquid

standing in the tubing above the partition through the small holes 22, which will raise a portion of the liquid standing above the point of air-discharge to the surface of the earth. The air-pipe 5 can then be relowered to seat, which again places the air in communication with the lower chamber 17.

In the form shown in Fig. 3, the ground is shown at 6^a, the shot-hole is shown at 7^a, the drill-hole casing at 8^a, the tubing at 13^a, the casing at 16^a, the air-pipe at 5^a, the valve admitting the liquid to the casing from the well at 19^a, and the closure-cap at 16^b. In this casing is a conical seat 20^b for the purpose of engaging the tapered packing 20^a, attached to the air-pipe 5^a, when the same is lowered to position, the seat and packing forming a partition 20^c, so that the casing 16^a takes the form of the lower chamber and the tubing 13^a becomes the upper chamber. The conductor-pipe is shown at 28^a, which is also lowered to position with the air-pipe and is provided, preferably near its lower end, with a ball-valve 28^c for the purpose of preventing retrogression of liquid through the same and also with an extension of the conductor-pipe 28^c below the valve 28^c, which may be open at the extreme lower end or provided with perforations 28^d for the liquid to enter the same. Where this form is employed, the lower end of the tubing 13^a is used for storing the small successive quantities of liquid as they are raised above the partition 20^c until a sufficient amount is accumulated therein to seal a discharge of air. The lower end of the air-pipe 5^a is connected with the partition in such a manner that air passes through the partition, so as to exert pressure upon the liquid within the casing 16^a. Air under pressure being admitted through the air-pipe 5^a passes beneath the partition and depresses the level of the liquid, which having no other outlet passes up through the conductor-pipe 28^a into the tubing 13^a, and egress is prevented by the valve 28^c in the conductor-pipe. When enough air is thus admitted through the air-pipe to lift a comparatively small quantity of liquid—to wit, the amount contained within the lower portion of the casing 16^a—it is at once raised to the tubing 13^a through the conductor-pipe 28^a, where it is allowed to remain, and another portion of liquid is raised in the same manner and merged with it. When, however, a sufficient quantity is accumulated within the lower end of the tubing 13^a, a comparatively long application of air is made through the pipe 5^a, the pressure continuing until substantially the entire contents of the casing 16^a, together with the liquid elevated to the tubing 13^a, is raised to the surface of the earth.

Our invention is particularly adapted for wells which have become almost exhausted and in which the liquid is so shallow as to become unusually difficult to raise to the surface by any other method of raising liquids with

compressed air, as the construction of the inlet mechanism 19 19^a and the extension of the casing 17 16^a below the same to the bottom of the well increases its efficiency over other devices for like purposes, using the ordinary lower valve for admitting the liquid, for the reason that gradual filling in of the shot-hole with sand and debris makes it necessary to place the inlet to all devices for admitting the liquid at a considerable distance above the bottom of the well, so that it will not at once become clogged with sand. The usual receptacles for devices of this character, to which the liquid is admitted from the well, have the valve mechanism disposed at the lower end of the same, as shown in the patents to Pease, No. 47,034, Waits, No. 371,006, and Moran, No. 721,594. To prevent their valve mechanisms from becoming clogged with the sand and debris that collects in the bottom of the well, the receptacle is either suspended off the bottom of the well or a short "anchor-pipe" is used below it to hold it up from the bottom. This anchor-pipe does not form a part of the receptacle for confining the liquid to be raised, and the distance that the receptacle is suspended off the bottom of the well is lost ground, as only the liquid standing above the valve in the receptacle is available to be raised by the air. In our device the inlet or valve mechanism 19 and 19^a is disposed about the same distance above the bottom of the well that the valve mechanisms in the patents cited are suspended or anchored, and the casing 16^a and 17 is continuous below the valve mechanism to the bottom of the well, thereby using the tube below the said valve mechanism as a part of the receptacle for confining the liquid to be raised. If the bottom of the well contains a quantity of soft sediment, this apparatus by reason of its closed lower end may be sunk through the sediment, so that it rests on the bottom of the well, while the inlet mechanism 19 being placed at some distance above the lower end and above the level of the sediment only the oil or other liquid to be raised is admitted to the casing 17, which fills it from its closed lower end up to or above the inlet, thereby forming the liquid into a column that extends down through the sediment to the bottom of the well. In case the bottom of the well was free of sediment when the apparatus was installed the disposition of the inlet mechanism at some distance above the closed lower end provides that the sand and debris that always drop in from the sides of the well may settle around the casing 17 as high as the inlet mechanism 19 without impairing the efficiency of the device, whereas a device of this character having its inlet at the lower end of the casing 17, as Pease, No. 47,034, would necessitate raising the device as the sediment accumulated in the bottom of the well, and thereby decrease the depth that the casing 17 would be submerged in the liquid to be raised, with a corresponding de-

crease in the amount of liquid that could be raised at one time. This construction allows the liquid to form into a continuous or unbroken column within the lower chamber, reaching from the bottom of the well upward indefinitely, thus increasing the available natural depth of liquid in the receptacle and correspondingly increasing the amount of liquid that can be lifted above the partition 20 and 20^c at each small discharge of air for the purpose of building up the necessary depth of liquid to seal the air so the liquid can be raised to the surface of the earth.

The inlet 19 19^a is a hollow member or long coupling having one or more openings through the side to admit the liquid to the casing from the well, and each opening is provided with a valve, preferably a hinged ball-valve, as shown, and being hollow the member 19 19^a provides ample space for the extension of the conductor-pipe 28 28^a through the same, making it possible to raise the liquid from nearly the extreme bottom of the well. The construction shown in Fig. 1 possesses another singular advantage. If there is at any time accumulated over the partition 20 a volume of liquid greater than can readily be handled, the air-pipe 5 may be raised a little distance—say about a foot—and by this movement the upper packing 21 is raised above the funnel-shaped member 31^a, so that air may be discharged from the apertures 22 directly into the upper compartment of the apparatus. The part of the liquid above the partition 20 may be removed by itself—that is, without encountering the additional load of the liquid within the lower compartment.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. In an apparatus of the character described, the combination of a casing provided with a partition separating the same into upper and lower compartments, a tubular member connected with said partition and provided with apertures disposed below the same, an air-pipe provided with packings engaging said tubular member and the apertures disposed intermediate of said packings, the apertures of said air-pipe being disposed adjacent to said apertures of the tubular member, a conductor-pipe in communication with said upper compartment and extending into said lower compartment to a point adjacent to the bottom thereof, and means for preventing retrogression of the liquid from said upper compartment to said lower compartment.

2. In an apparatus of the character described, the combination of a casing provided with a partition separating the same into upper and lower compartments, a tubular member connected with said partition and having a substantially funnel-shaped opening, said tubular member connecting with said upper and lower compartments, an air-pipe extend-

ing into said tubular member and provided with apertures disposed within the same, packings mounted upon said air-pipe and disposed respectively above and below said apertures, said apertures being in communication with said lower compartment, means for establishing communication between said upper and lower compartments, said means being provided with a valve-seat, and a valve fitting said seat and loosely connected with said air-pipe so as to be removable from its seat when said air-pipe is raised from the well.

3. In an apparatus of the character described, the combination of a casing provided with upper and lower compartments, separated by a partition, a subcasing disposed within said lower compartment, and connected with said partition, said subcasing being in communication with said upper compartment and being provided with a valve-seat, a valve loosely engaging said valve-seat, a conductor-pipe connected with said subcasing and depending therefrom to a point adjacent to the lower end of said lower compartment, a tubular member connected with said partition, and an air-pipe provided with mechanism for loosely engaging said valve for the purpose of raising the same at will from said seat.

4. In an apparatus of the character described, having a casing and a partition dividing the same into upper and lower portions, the combination of an air-pipe disposed within said upper portion and connected with said partition, said air-pipe extending to the surface of the earth, a subcasing disposed within said lower portion and adapted to conduct the liquid above said partition, a valve for admitting liquid from the well to said lower portion, a conductor-pipe connected with said subcasing, and a valve connected with said conductor-pipe for preventing retrogression of liquids therethrough when elevated above said valve.

5. In an apparatus of the character described, the combination of a casing provided with a partition, a hollow member connected with said partition, connections for applying air-pressure from said hollow member to the liquid to be raised for the purpose of elevating the same above said partition, an air-pipe provided with apertures for discharging air into said connections and with packings disposed respectively above and below said apertures, said packings normally engaging said hollow member but being free to move upwardly relatively thereto when lifted by movements of said air-pipe.

6. The combination of a casing, a partition dividing the same into upper and lower compartments, said lower compartment being adapted to serve as a receptacle for the liquid and said upper compartment being adapted to serve as a receptacle for the liquid and said upper compartment being adapted to hold the liquid when elevated higher than the level of the liquid in the well, said upper compartment

being open at the top for discharging the liquid, said partition being provided with means for permitting the passage of air and liquid through the same, means for admitting liquid to said lower compartment, mechanism for conducting said liquid from said lower compartment to said upper compartment, an air-pipe, and a valve for preventing retrogression of the liquid from the upper compartment to the lower compartment, said valve being connected to said air-pipe and removable therewith at will from said casing.

7. The combination of a vertically-disposed casing, the lower end of which forms a receptacle for a portion of the liquid, the upper end being connected with a conduit of reduced diameter to conduct the liquid to the surface of the earth, an air-pipe disposed within said conduit and said upper portion of said casing, a partition provided with passages therethrough for maintaining a portion of liquid at a higher level than the level of the liquid in the well, means for admitting liquid to the lower end of said casing, a conductor-pipe for conveying liquid from the lower end of said casing to a point thereof above said partition, an air-pipe, and a valve for preventing retrogression of the liquid through said partition, said valve together with said air-pipe being removable from said casing at will.

8. The combination of a casing, a partition connected therewith and provided with openings therethrough, said partition being further provided with a member having packing-seats, means for admitting a liquid into said casing at a point below said partition, a conductor-pipe disposed below said partition and within said casing to conduct the liquid from the bottom of said casing to a point above said partition, a valve to prevent retrogression of the liquid through said conductor-pipe, and an air-pipe provided with packings mounted upon its lower end, said packing being adapted to engage said packing-seats, said air-pipe being adapted, when said packings are seated, to discharge air below said partition, and when said air-pipe is lifted bodily from the seat for the purpose of breaking its communication with the lower portion of said casing to discharge the air into the liquid standing within apparatus above said partition, thereby elevating said liquid to the surface.

9. The combination of a casing, an air-pipe disposed partially within the same, a partition provided with passages therethrough and connected with said casing, said air-pipe being provided at its lower end with means for packing the same relatively to said partition so as to discharge air below said partition, and a valve to prevent retrogression of liquid through said partition, said valve and said means for packing being removable from said casing along with said air-pipe at will.

10. In a device of the character described, the combination of a casing, a partition dis-

posed therein and provided with passages, an air-pipe communicating with said partition and extending to the surface of the earth, and a valve for preventing retrogression of the liquid through said partition, said valve, together with said air-pipe, being removable at will from said casing.

11. In a device of the character described, the combination of a casing, an air-pipe extending thereinto, a partition connected with said air-pipe and provided with passages, and a valve for preventing retrogression through said partition of liquid elevated above the level of the liquid in the well, said valve being connected with said air-pipe and removable therewith from said casing at will by raising said air-pipe to the surface of the earth.

12. In a device of the character described, the combination of an air-pipe provided with means for packing the lower end thereof, a casing encircling a part of said air-pipe, a partition mounted within said casing and provided with passages therethrough, and a valve for preventing retrogression through said partition of liquid elevated above the level of the liquid in the well, said valve being removable from said casing at will by raising said air-pipe to the surface of the earth.

13. In a device of the character described, the combination of an air-pipe, a casing encircling the same, a partition disposed within said casing for the purpose of dividing the same into upper and lower compartments, and a valve for preventing the retrogression of liquid from the upper compartment to the lower compartment, said valve being connected with said air-pipe and removable at will from said casing by raising said air-pipe to the surface of the earth.

14. The combination of a casing provided with means for admitting liquid to the same and with a partition for dividing the same into upper and lower compartments, said partition being provided with passages therethrough and being disposed above the point at which the liquid is admitted to said casing, a conductor-pipe, and an air-pipe, said air-pipe normally communicating with said partition and being loosely connected thereto so that when seated the air will discharge beneath said partition to raise the liquid from the lower compartment, and when said air-pipe is raised from its seat, the air will discharge into the portion of liquid within the upper compartment, thus elevating the said portion of liquid to the surface.

15. The combination of a casing forming a receptacle, valve mechanism for admitting liquid to said casing and disposed at a point above its lower end, said valve mechanism being of a construction permitting the lower end of said casing therebelow to hold a portion of the column of liquid, tubing connected with said casing and leading to the surface of the

earth, a partition disposed at a point adjacent to the top of said casing and provided with means for permitting the passage of air and liquid therethrough, a conductor-pipe disposed below said partition, an air-pipe loosely connected with said partition so that when said air-pipe is seated the air may discharge beneath the partition to raise the liquid within said casing, and when said air-pipe is raised from its seat, the air may discharge into the liquid standing within the tubing above said partition and thereby raise a portion of liquid standing thereover, and a valve loosely connected with said air-pipe for preventing the retrogression of a liquid standing over said partition, said valve being movable at will by raising the air-pipe to the surface of the earth.

16. The combination of a casing, a partition mounted therein having means for permitting the passage of air and liquid therethrough, mechanism for admitting liquid to said casing at a point below said partition, an air-pipe extending into said casing and loosely engaging said partition, a member for conducting the liquid from a point adjacent to the lower end of said casing to a point above said partition, the liquid being conducted to the surface of the earth from the partition through a tube distinct from said tube conducting it to the partition, a valve to prevent retrogression of the liquid through said partition, said valve and said air-pipe being removable from said casing at will, and a tubular member connected with said casing for conducting the liquid to the surface of the earth.

17. The combination of a casing provided with a partition, said partition having means for permitting the passage of air and liquid through the same, valve mechanism for admitting liquid to said casing at a point intermediate of said partition and the lower end of said casing, said valve mechanism being so constructed that the liquid within said casing below said partition forms a continuous unbroken column from a point adjacent to the lower end of said casing to a point above said valve mechanism, a tube for conducting the liquid from a point below said valve mechanism to said partition, a separate tubular member connected with said casing for conveying the liquid to the surface of the earth, and a valve for preventing retrogression of liquid through said partition, said valve and said air-pipe being removable from said casing at will.

18. The combination of a casing, a partition disposed within the same, an air-pipe disposed partially within said casing and loosely engaging said partition, and a valve for preventing retrogression of liquid through said partition, said air-pipe and said valve being removable at will from said casing while said casing is installed in the well.

19. The combination of a casing provided with a partition for forming a portion of said casing disposed below said partition into a

chamber to confine the liquid to be raised, said partition being provided with means for permitting the passage of air and liquid through the same, and further provided with
 5 mechanism for engaging a packing, an air-pipe disposed within said casing above said partition and provided with packing adjacent to its lower end so that when said packing engages said mechanism connected with said
 10 partition the air will be conducted below said partition, and when said air-pipe is raised bodily upward so as to disengage said packing the air will discharge into the liquid standing within the tubing above said partition, a
 15 conductor-pipe, and a valve for preventing retrogression of liquid through said partition.

20. The combination of a casing provided with a partition for forming that portion of said casing disposed below said partition into
 20 a chamber to confine the liquid to be raised, said partition being provided with means for permitting the passage of air and liquid through the same, and further provided with
 25 means for engaging an air-pipe, said air-pipe being disposed partially within said casing and above said partition for conducting the air below said partition when said air-pipe engages said partition and when said air-pipe is
 30 raised bodily upward so that it is disengaged from said partition the air will discharge into the liquid above the partition, means for admitting liquid to said casing, a conductor-pipe, and a valve for preventing retrogression of liquid through said conductor-pipe,
 35 said valve and said air-pipe being removable independently of said casing.

21. The combination of a casing having its lower end closed, a partition mounted within said casing, means for admitting liquid to said
 40 casing between said partition and said lower end so that a continuous column of liquid may extend from said lower end to said partition unbroken by said means for admitting said liquid, said partition being provided with
 45 means for permitting the passage of air and liquid through the same, and also with means for engaging an air-pipe, an air-pipe disposed within the apparatus above said partition, a conductor-pipe for conveying liquid from a
 50 point below the admission-point up to said partition, and a valve for preventing retro-

gression of liquid through said conductor-pipe, said valve and said air-pipe being removable at will from said apparatus while installed in the well.

22. The combination of a casing having a closed lower end, means for admitting liquid to said casing above said closed lower end, a member provided with passages acting as a partition between a definite portion of the ap-
 60 paratus used as a receptacle for the liquid and another portion used to convey the liquid to the surface of the earth, a conductor-pipe to convey the liquid to the partition, a tube separate and distinct from the conductor-pipe
 65 to convey the liquid to the surface of the earth, an air-pipe, and a valve for preventing retrogression of liquid through said conductor-pipe, said valve and said air-pipe being removable from said apparatus together
 70 at will.

23. The combination of a casing having a closed lower end, means for admitting liquid to said casing above said closed lower end, a member provided with passages acting as a
 75 partition between a certain portion of the apparatus used as a receptacle for the liquid and another portion used in conveying the liquid to the surface of the earth, a conductor-pipe to convey the liquid to the partition, a valve
 80 to prevent retrogression of the liquid through the conductor-pipe, a tube to convey the liquid to the surface of the earth separate and distinct from said conductor-pipe, and an air-pipe disposed within the tube conveying the
 85 liquid to the surface of the earth, said air-pipe being provided with means for engaging said partition, said air-pipe also being removable from said tube encircling it at will while said tube is installed in the well.
 90

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

THOMAS FRANCIS MORAN.
 FRED JOSEPH MOSER.

Witnesses to the signature of Thomas F. Moran:

H. G. STEVENS,
 J. T. WATSON.

Witnesses to the signature of Fred J. Moser:
 GEO. P. SMITH,
 D. E. LANPHEAR.