No. 820,237. PATENTED MAY 8, 1906.

F. J. MOSER.

GAS WELL APPARATUS.

APPLICATION FILED APR. 8, 1905.

2 SHEETS—SHEET 1.

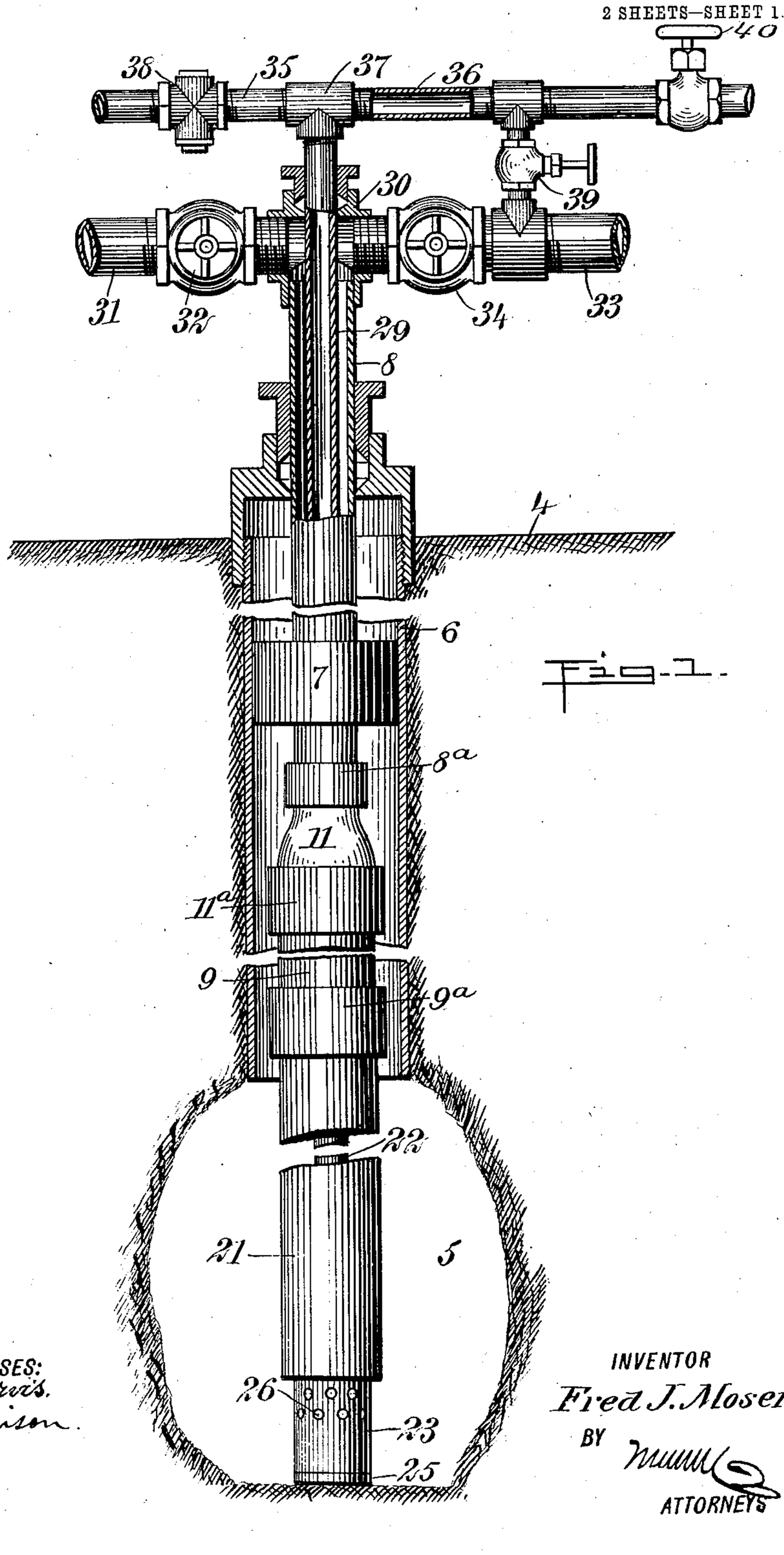

Fig. 1.

WITNESSES:
C. A. Jarvis.
W. Harrison.

INVENTOR
Fred J. Moser
BY
ATTORNEYS

No. 820,237. PATENTED MAY 8, 1906.

F. J. MOSER.

GAS WELL APPARATUS.

APPLICATION FILED APR. 8, 1905.

2 SHEETS—SHEET 2.

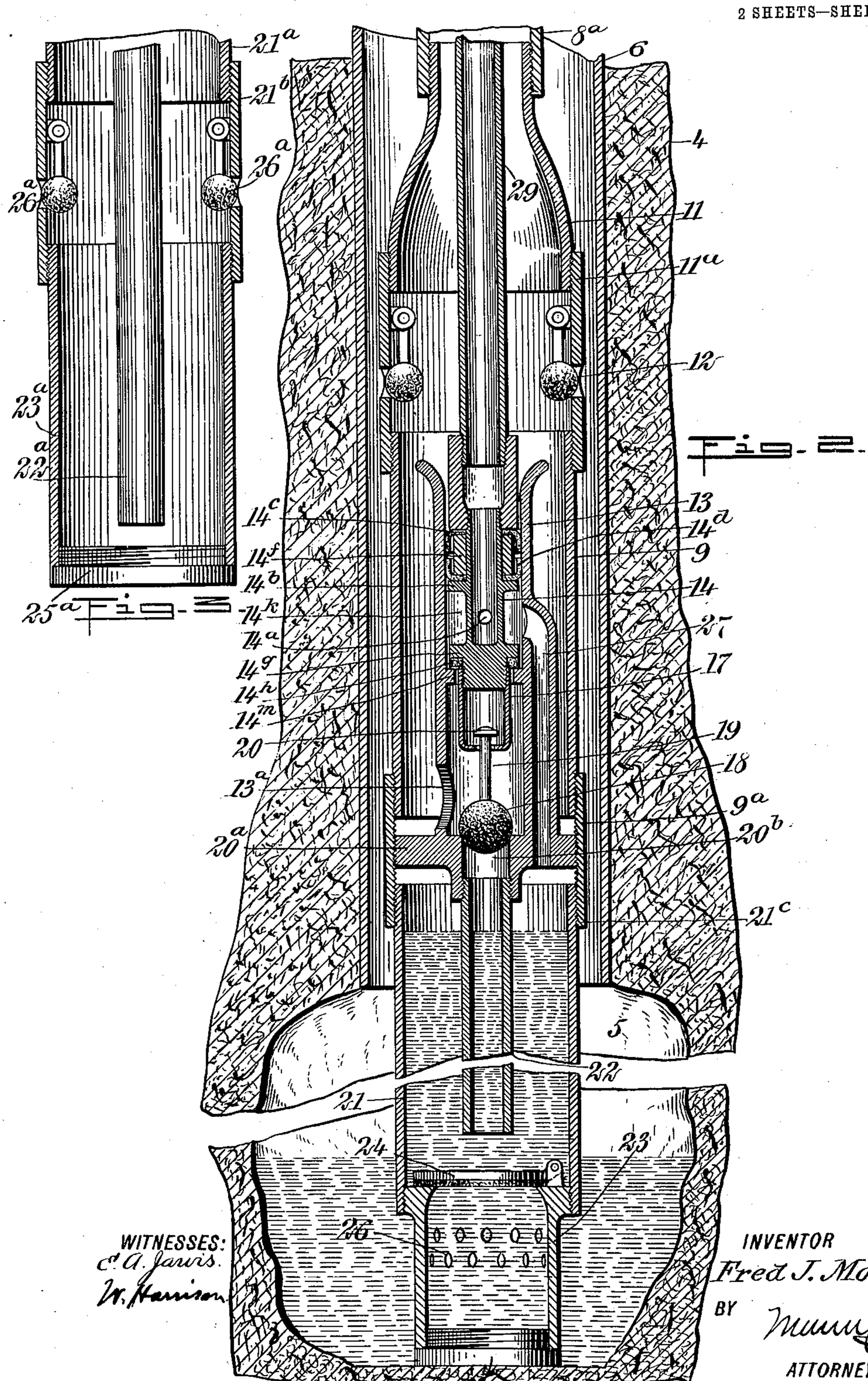

Fig. 2.

Fig. 3.

WITNESSES:
C. A. Jarvis.
W. Harrison.

INVENTOR
Fred J. Moser
BY
ATTORNEYS

UNITED STATES PATENT OFFICE.

FRED JOSEPH MOSER, OF KANE, PENNSYLVANIA.

GAS-WELL APPARATUS.

No. 820,237. Specification of Letters Patent. Patented May 8, 1906.

Application filed April 8, 1905. Serial No. 254,601.

To all whom it may concern:

Be it known that I, FRED JOSEPH MOSER, a citizen of the United States, and a resident of Kane, in the county of McKean and State of Pennsylvania, have invented a new and Improved Gas-Well Apparatus, of which the following is a full, clear, and exact description.

My invention relates to deep wells, more particularly used for supplying natural gas, my special object being to provide means for removing water from the bottom of the well.

My invention further relates to certain constructional details hereinafter described, whereby an efficient action of the mechanism of the well is brought about.

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 views.

Figure 1 is a vertical section through a well embodying my improvements, certain parts being in elevation and other parts broken away for the sake of clearness. Fig. 2 is an enlarged fragmentary section showing the water-barrel and its accompanying parts, and Fig. 3 is an enlarged view showing the bottom end of the water-barrel and also showing a mocification in the valve mechanism for admitting water to the water-barrel.

The ground is shown at 4, the shot-hole at 5, and the tubular casing in contact with the earth 4 is shown at 6, its outer boundary being coincident with the shot-hole. A packer of the usual construction appears at 7, a tubing at 8, and a coupling at 8^a. An upper cylinder is shown at 9 and is connected at its upper end by an annular coupling 11^a with a substantially frusto-conical head 11. The annular coupling 11^a is provided with inlet-valves 12, which should be of proper sensitiveness to be opened by the natural-gas pressure of the well. A sleeve 13, provided with a port 13^a, is mounted concentrically within the upper cylinder 9 and is rigid relatively thereto. A hollow core 14 is provided with passages 14^a and with an annular head 14^b. Encircling the core 14 are oppositely-disposed annular packings 14^c 14^d, preferably of leather. They are spaced apart and held in position by a ring 14^f. The lower end of the core 14 is provided with an annular bead 14^g, and engaging the under side of this annular bead is an annular packing 14^h, which rests upon an annular ledge 14^m. The annular beads 14^b 14^g are separated by an annular channel 14^k. From the core 14 depends a cage 17, which guides a ball-valve 18, having a stem 19 and a head 20. The annular beads 14^b 14^g are separated by an annular channel 14^k. Threaded centrally within the sleeve 9^a is a disk head 20^a, which is rigidly connected with the sleeve 13, so as to support the latter. The disk head 20^a is provided with a central passage 20^b. Registering with this passage and depending from the disk head 20^a into the lower cylinder 21 is a conductor-pipe 22. The disk head 20^a serves as a partition separating the upper cylinder 9 from the lower cylinder or water-barrel 21, thus separating the water-barrel proper from that portion of the mechanism normally filled with gas, while the valve 18 prevents the gas from entering the water-barrel from the upper end. The bottom end of the lower cylinder 21 is provided with a strainer 23, having perforations 26 and a closure-plug 25, which rests upon the earth, as indicated in Figs. 1 and 2. The upper end of the strainer 23 is provided with a valve 24 of any design adapted to open upwardly so as to admit water or other liquid, as will be understood from Fig. 2.

In the form shown in Fig. 3 the lower cylinder 21^a, containing a conductor-pipe 22^a, is connected with an annular sleeve 21^b, provided with inwardly-opening dependent valves 26^a, and to this annular member is rigidly connected a tube 23^a, constituting virtually a continuation of the lower cylinder 21^a and provided with a closure-plug 25^a. The action of the parts shown in Fig. 3 is analogous to that of the parts shown at the lower extremity of Fig. 2—that is to say, the liquid in entering the pipe 21^a merely opens the valves 26^a in much the same manner as, in passing through the perforations 26, it lifts the valve 24.

Connecting the sleeve 13 with the disk head 20^a is a tubular passage-way 27, which is comparatively small and is adapted to permit communication between the lower cylinder 21, designated as the "water-barrel," the annular passage 14^k, and the apertures 14^a. The water-barrel is of considerable depth, as indicated by the break shown in Fig. 2. The passages 14^a and 27 may be considered as virtual continuations of each other, as will be understood from Fig. 2. A supply-pipe 29 is used for forcing into the well at intervals a suitable quantity of an aeriform body, preferably compressed gas drawn from the well. If, however, for any reason it may be thought best to use compressed air, this can be done,

The upper end of the tubing 8 terminates in a T 30, and connected with this T is a water-discharge pipe 31 and a gas-discharge pipe 33, these pipes being controlled, respectively, by hand-valves 32 and 34. Somewhat similarly the upper end of the supply-pipe 29 terminates in a T 37, to which are connected comparatively small pipes 35 36, the former being provided with a valve 38 and being used as a blow-off pipe and the pipe 36 leading directly to a source for supplying the aeriform body. The pipe 36 is in connection with the pipe 33 by means of a hand-valve 39, provided for the purpose of economizing the gas, as explained below.

The operation of my device is as follows: At the outstart it will be understood that natural gas is a product of a porous rock, through which the gas forces itself toward any point from which pressure has been removed. It is customary, therefore, to "shoot" an oil-well. This has been done by lowering into the well to a point adjacent to the bottom an explosive substance and causing the same by its explosion to rend the gas-bearing rock, so as to form a cavity, (shown at 5 and designated as the "shot-hole."). By this means a considerable internal space is given to the well within the gas-bearing rock, so that the flow of the gas may reach its maximum. The gas-bearing rock or the rock above it, however, usually contains water, which percolates downward and gathers in the bottom of the well. The quantity of water within the well gets deeper and deeper, and the flow of gas into the well is thus obstructed to a considerable extent. In instances where the water becomes sufficiently deep and where the gas-pressure is sufficiently low the flow of gas into the well is completely stopped. Even if the gas-pressure be strong and the volume of water comparatively small the well labors under a considerable disadvantage unless the water can be readily removed. It is undesirable, however, for the operator to continually stop the normal working of the well in order to remove the water. By my present invention I seek to enable the operator to remove the water at intervals as often as desired without obstructing the flow of gas from the well or interfering in the slightest degree with the perfect working of the well or any part of the well. In fact, I seek to make the removal of water utterly independent of the normal action of the well for purposes of supplying gas. I seek, moreover, to take temporary care of such water as may drift into the well by storing it in a reservoir made for the purpose, so that its presence while in the well shall produce a minimum of hardship. The packer 7 prevents the rise of gas in the drill-hole of the well beyond that point and forces it into the tubing 8, past the inlet-valves 12, to be carried up to the surface of the earth. The gas being under pressure in the well, it presses down on the water in the shot-hole, forcing it up in the cylinder 21, and as the cylinders may be vented at the top of the well through the passages 27 14^k, tube 29, and valve 38 the distance the water will rise in the cylinder 21 higher than the level of the water in the shot-hole is equal to the pressure of the gas upon the water in the shot-hole, or, say, up to the dotted lines 21^c, Fig. 2. A considerable volume of water is thus virtually taken out of the shot-hole 5, or at least the level of the water within the shot-hole is considerably reduced, so that the porous rock is comparatively free to discharge its gas into the shot-hole. If now a compressed aeriform medium—such, for instance, as natural gas—be allowed to flow through the pipe 36 in the manner well known in this art, it passes downward through the supply-pipe 29 and passages 14^a and 27 into the upper end of the lower cylinder 21. It thereupon exerts pressure upon the upper surface of the water in the lower cylinder, (the upper level being represented by the dotted lines 21^c,) and thus forces the water up through the conductor-pipe 22, so as to lift the valve 18 and allow the water to pass out through the port 13^a, through the upper cylinder 9 and tubing 8, to the surface of the earth, where it is discharged through the pipe 31. For this purpose the valve 32 is opened and the valve 34 is closed. The pipe 33 leads to the usual devices used for conserving the flow of natural gas. The pipe 33 when the valve 34 is closed is filled with natural gas, which has a comparatively low pressure. If now after removing the water from the well, as above described, the valve 39 be opened by hand, the compressed aeriform body contained within the pipes 36 and 29 and the parts in communication with the same is released into the gas-discharge pipe 33 and conserved for future use. As this gas has while in the pipes a considerable pressure and as the pipes because of their great length have considerable capacity the saving in the gas thus effected, which would otherwise be wasted through the blow-off 38 to the atmosphere when venting the water-barrel, is considerable.

It will be noted that while any and all of the operations above described are employed the gas flowing into the shot-hole 5 is free to pass upward around the upper cylinder 9 and lower cylinder or water-barrel 21 and by its pressure opens the valves 12 inward. The gas then passes upward through the tubing 8 and out through the gas-discharge pipe 33, the valve 34 being opened and the valve 32 being closed. Of course during the moment while the water is being removed from the well the tubing 8 is filled with water; but this fact does not prevent the gas from accumulating within the drill-hole below the packer 7, so that its supply into the well is

uninterrupted, and the interruption with reference to the supply from the well to the pipe 33 lasts but a few minutes each time the water is removed. This object is effected mainly by the presence of the disk head 20[a]. Owing to the fact that this head allows the attainment of unequal pressures above and below it, the pressure of the aeriform body admitted through the supply-pipe 29 becomes entirely independent of the gas-pressure within the shot-hole 5 and as much of the drill-hole as is below the packer 7.

While I preferably use the packer 7, I do not limit myself to its employment, as some of the parts of my invention are independent of the work done by the packer.

Sometimes water accumulates in gas-wells to such a height that the gas becomes entirely "drowned out" and the tubing above the valve 12 becomes filled with water as high as the water stands in the well. This distance may be several hundred feet, and if the compressed medium were applied to raise the water it would not only have to raise the contents of the water-barrel, but in addition to it the volume of water standing in the tubing above the water-barrel. The pressure of this high column of water may exceed the pressure of the compressed medium normally employed, in which case the water could not be raised. This situation is provided for as follows:

The parts 14, 14[a], 14[b], 14[c], 14[d], 14[e], 14[f], 14[g], 14[h], 14[k], 17, 18, 19, and 20 as a whole are attached to the pipe 29 and may be raised therewith independent of all the other mechanism, so that when water accumulates, as above described, the pipe 29, together with the parts named, may be lifted up from its seat as far as desired. Then the compressed medium may be discharged directly into the water standing in the tubing above the water-barrel through the apertures 14[a], and thereby raise that portion of the water standing above the said apertures. This may be repeated as often as necessary, and when a sufficient quantity of water has been removed in this way the pipe 29 may be lowered to its original position and the water raised from the water-barrel.

When the compressed aeriform body has been applied, so as to raise the water in the water-barrel, as previously described, the liquid is lifted to the surface and ejected for the most part in the form of a solid column. The lower end of this column, however, is permeated to a greater or lesser extent by the aeriform body, which in expanding has a tendency to tear the lower end of the column and form a spray. This spray, being a mixture of gas and water, if allowed to pass out to the atmosphere wastes the gas, for the reason that if the removal of the liquid be complete the lower end of the column must allow a considerable quantity of gas to leave the tubing. To avoid this loss of gas, the valve 18 is mechanically closed as soon as the main body of liquid has been ejected and about the time the latter end of the discharge of liquid is turning into spray. This prevents the discharge of the spray at the surface and holds the gas that would otherwise be wasted in the spray within the tubing, and as the pressure of the gas within the tubing equalizes this portion of water representing the lower end of the column settles down on the partition 20[a] and accumulates in the tube immediately above this partition, after which the gas confined within the tubing may pass out into the gas-main by opening the valve 40.

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

1. The combination of a hollow member provided with a partition whereby it is divided into separate compartments, one being above the other, tubing connected with the upper of said compartments, means for admitting an aeriform body under pressure into the lower of said compartments, a valve mechanism for opening and closing the connection between said compartments, and means for admitting natural gas into the upper of said compartments.

2. In a device of the character described, the combination of an upper cylinder provided with inlet-valves adapted to open automatically, a lower cylinder provided with inlet-valve mechanism, also adapted to open automatically, a partition normally closing the connection between said upper cylinder and said lower cylinder, a valve coacting with said partition and adapted to control communication between said upper and lower cylinders, and tubing connected with said upper cylinder, for carrying to the surface of the earth quantities of gas and water.

3. In a device of the character described, the combination of a hollow member provided with a partition whereby it is separated into upper and lower compartments, pressure-controlled valves for admitting natural gas into the upper of said compartments, pressure-controlled valve mechanism for admitting a liquid into the lower of said compartments, a supply-pipe leading downward and provided with means for supplying an aeriform body under pressure into the lower of said compartments, valve mechanism for preventing retrogression of said liquid from the upper of said compartments to the lower compartment, and tubing connected with the upper of said compartments for discharging both said natural gas and said liquid.

4. In a device of the character described, the combination of an upper cylinder provided with pressure-controlled valves for admitting thereinto natural gas, a lower cylinder provided at a point adjacent to its bottom with inlet mechanism for permitting a

liquid to enter under pressure and for preventing the retrogression of said liquid, a partition disposed intermediate of said upper cylinder and said lower cylinder, a conductor-pipe mounted upon said partition and depending therefrom to a comparatively low point relatively to said lower cylinder, a valve for opening and closing said conductor-pipe, and tubing connected with said upper cylinder for the purpose of discharging said natural gas or said liquid therefrom.

5. In a device of the character described, the combination of an upper cylinder provided with a sleeve concentric therewith and also provided with a passage, inlet-valves connected with said upper cylinder for admitting thereinto a supply of natural gas under pressure, a supply-pipe provided at its lower end with a core for entering said sleeve and further provided with packings disposed upon opposite sides of said passage, said core being also provided with a second passage forming virtually, when said core is in position, a continuation of said passage within said cylinder, a lower cylinder connected with said upper cylinder and separated therefrom, valve mechanism for opening and closing communication between said upper cylinder and said lower cylinder, means for admitting a liquid into said lower cylinder and for preventing the retrogression of said liquid therefrom, and tubing connected with the upper end of said upper cylinder for the purpose of discharging said natural gas and said liquid from the same.

6. The combination of tubing, a packer for rendering the same gas-tight, an upper cylinder in communication with said tubing, inwardly-opening valves mounted upon said upper cylinder for the purpose of admitting natural gas into the same, a lower cylinder connected with said upper cylinder and separated therefrom by a partition, valve mechanism for admitting a liquid into the said lower cylinder, a valve mounted upon said partition and adapted to open upwardly, so as to permit the discharge of said liquid from said lower cylinder into said upper cylinder, said liquid being adapted, by its entrance into said upper cylinder, to close the valves thereof, and means, controllable at will, for supplying an aeriform body under pressure into said lower cylinder.

7. In a device of the character described, the combination of tubing, a packer for rendering the same gas-tight, a hollow member connected with said tubing and adapted to store a supply of a liquid, means for admitting said liquid into said member, and mechanism for relieving pressure upon said liquid within said member, so as to cause the same to rise to a considerable height within said hollow member.

8. In a device of the character described, the combination of a hollow member provided with an upper compartment and with a lower compartment, means for permitting natural gas to enter said upper compartment, tubing connected with said upper compartment and adapted to permit the flow of gas therefrom, means for forcing water into said lower compartment, valve mechanism for preventing retrogression of water into said lower compartment, and means for occasionally establishing communication between said lower compartment and said upper compartment for the purpose of removing said water from said lower compartment.

9. In a device of the character described, the combination of tubing, a packer encircling the same, mechanism having an upper compartment connected with the lower end of said tubing and provided with valves disposed above the upper level of the liquid in the well so as to admit natural gas into the upper portion of said mechanism, said mechanism being further provided with a lower compartment, means for admitting a liquid into the lower compartment, valve mechanism connecting said upper and lower compartments together so that said liquid may be ejected from said lower compartment through said upper compartment without retrogression, and means for applying an aeriform body to the liquid contained within said lower compartment.

10. The combination of a hollow member provided with two compartments, means for admitting a liquid from the well into one of said compartments and for preventing retrogression of said liquid therefrom, tubing connected with the other of said compartments, valve mechanism for allowing a portion of liquid to pass from the lower compartment to the upper compartment and for preventing retrogression of said portion of liquid thus elevated, means for applying an air-pressure to the liquid within said lower compartment so as to eject said liquid through the upper compartment, and means for normally admitting natural gas into said upper compartment and said tubing.

11. In a device of the character described, the combination of tubing, a packer for rendering the same tight so as to accumulate the pressure of natural gas into the well, a hollow member connected with said tubing for admitting thereinto a liquid pressed upon by natural gas, means for relieving pressure upon said liquid within said hollow member, valve mechanism for admitting said natural gas directly into said tubing, and mechanism controllable at will for raising said liquid from said hollow member to the surface of the earth.

12. In a device of the character described, the combination of tubing adapted to conduct a liquid to the surface of the earth, means for continuously admitting natural gas from the well directly into said tubing, a

supply-pipe mounted within said tubing and adapted to conduct an aeriform body into said well for the purpose of flowing the same, a gas-discharge pipe connected with said tubing for the purpose of saving any natural gas accumulating in the well, and means controllable at will for venting said supply-pipe into said gas-discharge pipe so as to save the gas contents of said supply-pipe.

13. The combination of a hollow member provided with a partition whereby it is divided into separate compartments one above the other, tubing connected with the upper of said compartments, means for continuously admitting natural gas into said tubing, valve mechanism for opening and closing communication between said compartments, a sleeve mounted within the upper compartment and in communication with the lower compartment, a hollow core mounted within said sleeve and provided with apertures, and a pipe connected with said hollow core for discharging an aeriform body thereinto.

14. The combination of a hollow member provided with a partition whereby it is divided into separate compartments one located above the other, tubing connected with the upper of said compartments, means for continuously admitting natural gas from the well into said tubing, a sleeve mounted within the upper compartment and in communication with the lower compartment, a hollow core mounted within said sleeve and provided with apertures, annular packings encircling said hollow core and engaging said sleeve so as to render said hollow core gas-tight relatively thereto, and means controllable from the surface of the earth for discharging an aeriform body into said hollow core.

15. The combination of a hollow member provided with a partition whereby it is divided into separate compartments one above the other, tubing connected with the upper of said compartments, means for automatically admitting natural gas from the well into said tubing, valve mechanism for opening and closing communication between said compartments, a sleeve mounted within the upper compartment and in communication with the lower compartment, a hollow core mounted within said sleeve and provided with apertures and with annular beads, annular packings encircling said core and engaging said annular beads, said packings also engaging said sleeve and forming an air-tight connection therewith, and means controllable at will from the surface of the earth for discharging an aeriform body into said hollow core.

16. The combination of a water-barrel having means for admitting water thereinto adjacent to its lower end, tubing communicating with said water-barrel and leading to the surface of the earth, a packer encircling said tubing, means for admitting the normal flow of gas from the well into said tubing at a point beneath said packer, a valve to prevent the said gas from passing downward into the water-barrel, means for venting said water-barrel at the surface of the earth so that the pressure of the natural gas within the well may form a column of water within the water-barrel, and means for applying an aeriform body under pressure to said water within said water-barrel for the purpose of raising said water to the surface of the earth.

17. A gas-well apparatus of the character described, comprising a system of piping disposed within the well, said piping being provided with inlet mechanism for admitting water at a point adjacent to the bottom of the well, and also provided with inlet mechanism for admitting gas at a level higher than the normal water-level of the well, a member disposed between said inlet for the water and said inlet for the gas, said member separating the interior of the piping into lower and upper compartments to enable the apparatus to convey the normal flow of gas to the surface of the earth under pressure through the upper compartment while relieving pressure from the lower compartment, thereby enabling a column of water to form therein and to stand higher than the normal water-level of the well, a packer for confining natural gas within the well, and means for applying a compressed medium to the water in said lower compartment.

18. In a device of the character described, the combination of tubing, a packer connected therewith for preventing the escape of the natural gas from the well, a hollow member provided with upper and lower compartments, said hollow member being connected with said tubing so that one of said compartments is always in communication therewith, valves for admitting natural gas into the compartment thus communicating with said tubing, said valves being adapted to prevent the escape of water passing upwardly therethrough, means for admitting a liquid into the other of said compartments, and mechanism for applying an air-pressure to said liquid thus admitted.

19. The combination of a water-barrel having means adjacent to its lower end for admitting water thereinto, a partition for preventing the ingress of gas into the water-barrel from the upper end thereof, means for venting said water-barrel at the surface of the earth to relieve it of internal pressure so that the pressure of the natural gas in the well may force water into said water-barrel to a level higher than that of the water in the well, tubing connected to the water-barrel for the purpose of conducting both the gas and the water to the surface of the earth, a packer for preventing the escape of said natural gas, valve mechanism for admitting said gas to said tubing, and means controllable at will

for admitting an aeriform medium under pressure from the surface of the earth to the water-barrel for the purpose of displacing the water in said water-barrel and forcing the same through said tubing to the surface of the earth.

20. The combination of a tube continuous from a point adjacent to the bottom of the well to the surface of the earth, means for admitting gas into said tube, means for admitting water into said tube, a partition within said tube disposed at a point between the inlet for the gas and the inlet for the water, said partition having a conductor-pipe attached thereto, a valve for preventing gas or water from passing downwardly from the tube above said partition, and means for applying an aeriform body to the water in the tube below said partition for the purpose of raising said water to the surface of the earth.

21. The combination of a tube continuous from a point adjacent to the bottom of the well to the surface of the earth, said tube having means for separating the interior into compartments, the upper of which normally conducts the gas from the well to the surface of the earth while that portion below the separation is used as a receptacle for water, means for admitting water from the well into said tube below said separation, means for admitting gas from the well into said tube above said separation, means for preventing gas or water from passing downward into the receptacle for the water from the upper separated interior, and means for applying an aeriform body to the water in the lower portion of the tube for the purpose of raising said water to the surface of the earth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRED JOSEPH MOSER.

Witnesses:
GEORGE P. SMITH,
EDWIN A. COLEMAN.