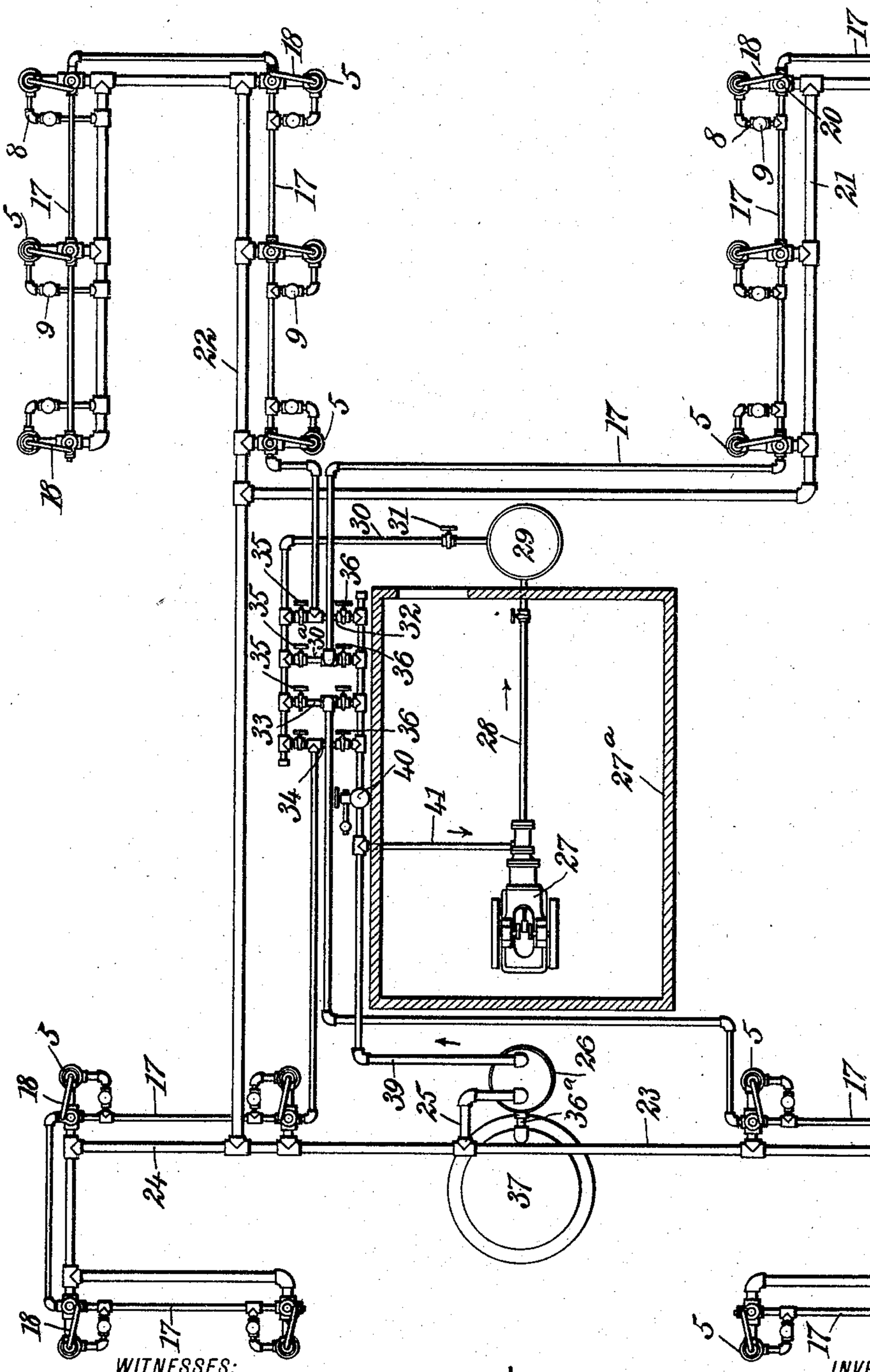
No. 782,681. PATENTED FEB. 14, 1905.

F. J. MOSER.

OIL WELL SYSTEM.

APPLICATION FILED JULY 16, 1904.

3 SHEETS—SHEET 1.



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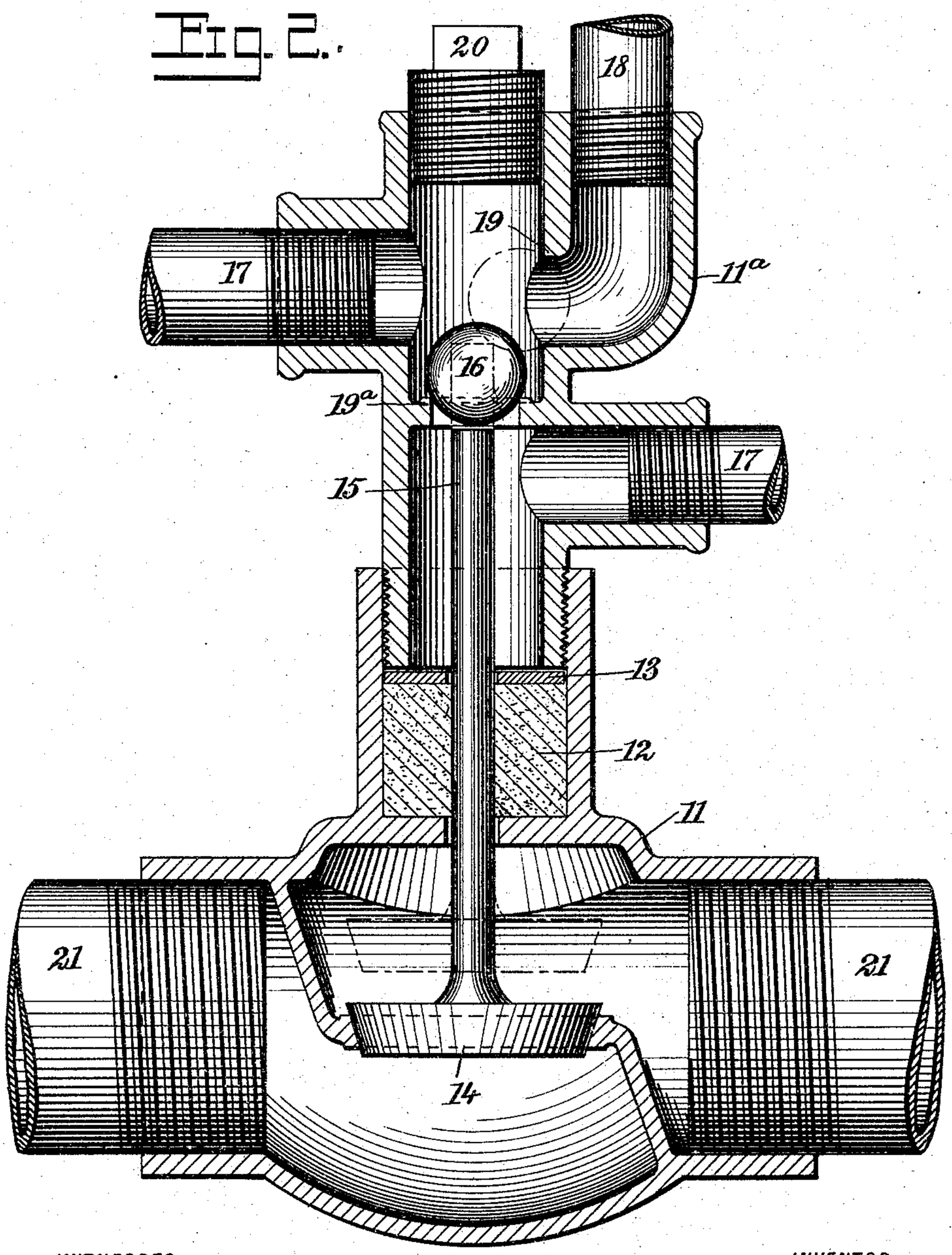
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 4.

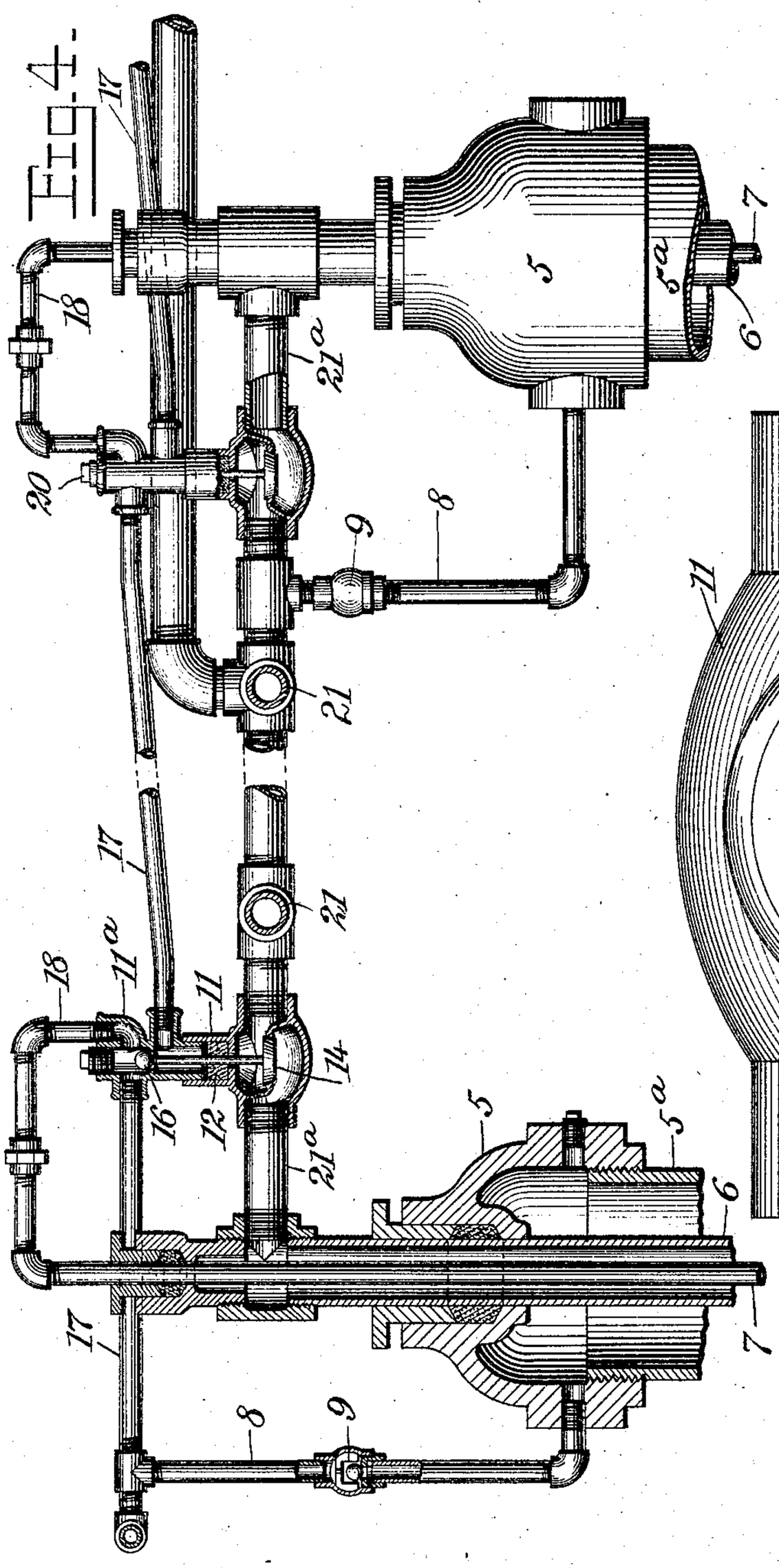
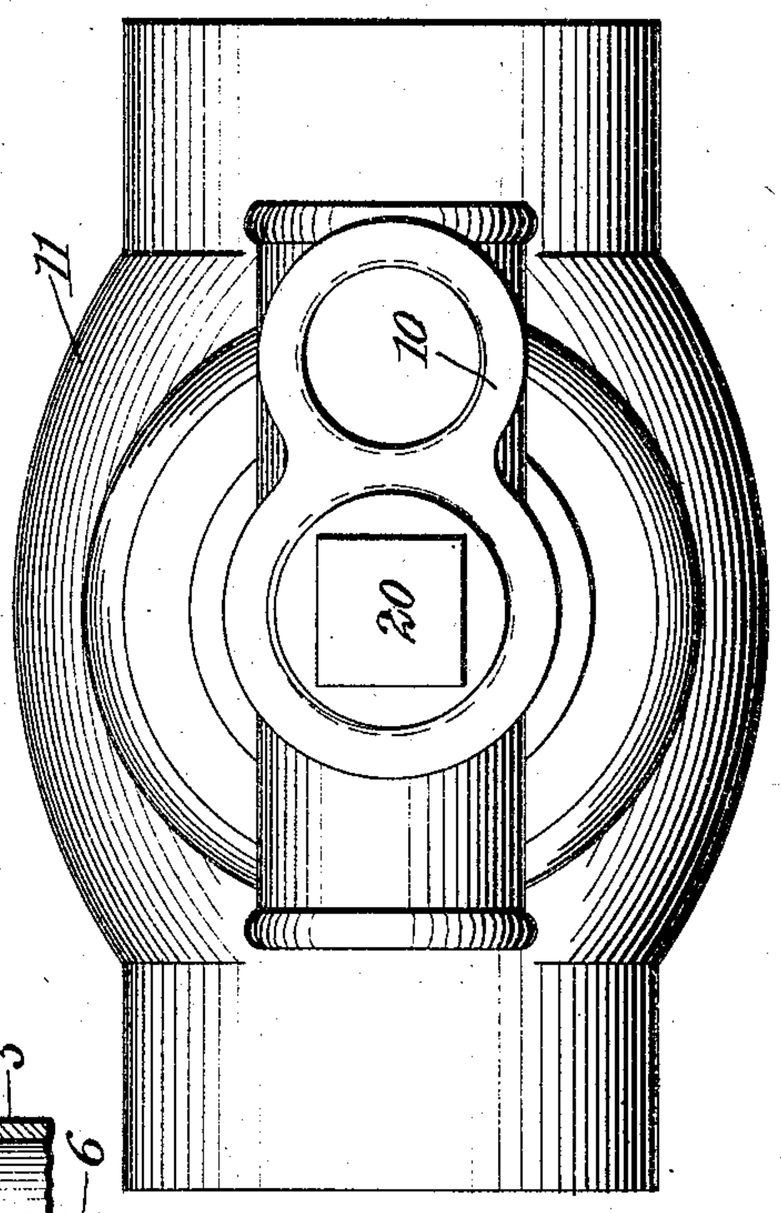


Fig. 5.



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No. 782,681. Patented February 14, 1905.

UNITED STATES PATENT OFFICE.

FRED JOSEPH MOSER, OF KANE, PENNSYLVANIA.

OIL-WELL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 782,681, dated February 14, 1905.

Application filed July 16, 1904. Serial No. 216,835.

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 Oil-Well System, of which the following is a full, clear, and exact description.

My invention relates to oil-well systems, my more particular object being to connect a number of wells together in the form of a system for the purpose of attaining certain desirable objects accomplished by means of mechanism hereinafter described, and pointed out in the accompanying claims.

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 is a diagrammatic representation of my system complete. Fig. 2 is a vertical section through one of the controller-valves 11, comprising a part of the system. Fig. 3 is a plan view of one of the controller-valves 11; and Fig. 4 is an elevation, partly broken away and showing the manner in which the different wells are connected together and yet operated separately.

A casing-head 5 is mounted gas-tight upon the upper end of a casing 5^a, and within this casing 5^a is a tube 6 and an air-pipe 7, these parts being preferably of the construction shown in the Patent No. 746,980, dated December 15, 1903, to Moran and Moser, and the mechanisms at the several wells are substantially duplicates of each other. A pipe 8 is connected to each casing-head 5 and is provided with a check-valve 9, as shown at the left of Fig. 4. A controller-valve 11 is provided with a threaded portion 11^a, forming a pipe connection, and is also provided with a self-closing packing 12, having a washer or gasket 13, as will be understood from Fig. 2. A movable valve member 14 is mounted within the controller-valve 11 and is provided with an upwardly-projecting stem 15, which is free to engage a movable ball or valve member 16. This ball normally occupies the position indicated by full lines in Fig. 2 or may be moved upward so as to occupy the position indicated by dotted lines in said figure. A number of sinuous pipes 17 are provided for the purpose of supplying gas to "flow" the wells and of recovering a portion of the same therefrom. Connected with the threaded portion 11^a of each controller-valve 11 is a pipe 18, which forms a virtual continuation of the air-pipe 7, usually denominated the "air-pipe" of the well. It should be understood, however, that compressed air may be used; but this system is preferably used in connection with gas-pressure rather than with air-pressure. The ball 16 is provided with two seats 19 19^a and may be moved from its seat 19^a by an upward movement of the valve-stem 15. The upper end of the controller-valve 11 is closed by a plug 20, which is removable for the purpose of inspecting, cleaning, or repairing the mechanism inclosed. The oil-pipes are shown at 21, 22, 23, 24, and 25. The distribution of these pipes is such that they connect the wells serially together, though as an independent feature they may be branched to any desired extent. The oil-pipes 25, into which the other oil-pipes discharge their contents, are connected with a gas-tank 26, which is of the usual construction for separating gas from oil. This tank being old in the art, I do not deem it necessary to describe it in detail.

It will be noted that the valve shown in Fig. 2 comprises an air-chamber and a fluid-chamber separated by a packing.

A compressor is shown at 27 in a power-house 27^a. From the compressor a pipe 28 leads to a receiving-tank 29, adapted to hold gas under pressure. From the receiving-tank 29 leads a pipe 30, provided with a hand-valve 31 and which is connected with the respective pipes 32, 30^a, 33, and 34, as shown in Fig. 1. These pipes are provided with distributing-valves 35 and with receiving-valves 36, the purpose of which is hereinafter explained. A general oil-tank is shown at 37 and is connected by a pipe 36^a with the gas-tank 26. From this tank a gas-pipe 39 is connected with the suction side of the compressor. An automatic regulating-valve 40 of the usual construction is connected with the pipes 32, 30^a, 33, and 34 to reduce the high pressure of the gas drawn back from them after flowing before feeding it into the compressor to avoid overloading.

Fig. 4, while showing the general method of connecting the wells together, also shows two ways of caring for the gas, taking the same from the casing-head in both ways as it is produced, which is usually at a very low pressure in oil-wells.

The well at the left, Fig. 4, shows the pipe 8 connected to the casing-head and to the high-pressure pipe 17 for the purpose of feeding the gas into the pipe 17 at certain periods, as hereinafter explained. When the wells on any particular branch are being "flowed," the high pressure in the pipe 17 used to flow them with causes the check-valve 9 to close, thereby preventing the escape of the high-pressure gas into the casing of the well. When the flowing is completed and the compressed gas is withdrawn from the pipe 17, the gas in the well is free to leave the casing-head through the pipe 8, check-valve 9, and through the pipe 17 to the power-house. The well at the right shows the pipe 8 connected to the oil-pipe 21, and the path of the gas from the well is through the pipe 8, check-valve 9, oil-pipe 21, to the gas-tank 26, from which it is drawn through the pipe 39 to the power-house. The check-valve 9 in this instance prevents the oil in the pipe 21 from passing into the casing of the well through the pipe 8. In either way the flow of gas from the well is only arrested during the operation of flowing the wells on that series.

The method of operating my invention is as follows: The compressor 27 being in action, the valves 36 (in case the gas is drawn from the well through the pipe 17, as above described) are opened and the gas is forced under pressure into the receiving-tank 29. In case the gas-pipe 8 is connected to the oil-pipe 21, as above described, the gas follows that course to the gas-tank 26 and is conducted to the compressor through the pipe 39 and forced into the tank 29 under pressure. When a sufficient pressure is accumulated in the tank 29, the compressed gas is then admitted into any of the distributing-pipes 17. For this purpose either the main valve 31 or any one of the separate valves 35 may be employed. The gas therefore passes out through one of the distributing-pipes 17 and acts successively upon the several wells constituting the series, beginning with the one nearest the power-house. The gas passes into the controller-valve 11, (see Fig. 4,) and as the ball 16 is resting upon its lower seat 19^a the gas passes upward through the pipe 18 and downward through the pipe 7, so as to discharge the oil contents of the well, the oil passing upward through the tube 6, as explained in the patent above mentioned. The oil next passes through the pipe 21^a and the lower portion of the controller-valve 11, thereby raising the valve member 14 and lifting the ball 16 slightly, so that the latter engages its upper seat 19. I have found from experience that when the air-pressure in the pipe 7 is so applied as to lift the oil through the tube 6 the air or gas pressure may be abruptly cut off when the liquid reaches the surface, and the well will continue to flow. The reason is found in the fact that as the oil is elevated through the tube 6 by pressure from below the column of oil gradually becomes shorter and lighter, so that as the aeriform body gradually expands and has less power the load to be lifted becomes correspondingly lighter and the initial compressed energy is sufficient to finish the "flowing" of the well. When, therefore, the valve member 14 is lifted so as to raise the ball 16, the latter immediately adheres to its seat 19, being held against the same by the inequality of the pressure in the pipes 17 and 18. The oil contents of the well having been discharged, the valve member 14 drops back to its normal position and acts as a check-valve against oil in the pipe 21, backing into the well; but the ball 16 is still held against its upper seat 19, completely closing the pipe 18 and preventing the further entrance of gas into the well. The gas therefore passes freely through the seat 19^a, out through the right-hand outlet and travels through the next successive portion of the pipe 17 to the next well, where it performs an office similar to that just described. The wells are thus severally caused to flow in a predetermined order, and as they are arranged serially it follows that each well when its work of flowing is finished is thrown out of action. It also follows that no well on the line can be skipped and that no two wells can act at the same time. After the last well of a pipe-line has been flowed the pressure of the pipe 17 of that line is as great as it was at the beginning of the operation, for the reason that the pipes are closed and have no relief except by moving the oil contents of the different wells. Of course the oil thus discharged into the several oil-pipes 21 to 25 contains more or less of the gas used in flowing the wells and perhaps some traces of the natural gas absorbed, which admixes with the oils in the wells and finds its way with the oil into the gas-tank 26.

The gas-tank 26 causes a separation of the gas and the oil, so that the gas may be used over and over again. This gas-tank may of course be dispensed with in cases where the gas is so abundant that there is no need of economizing the same. Suppose now that all of the wells upon one of the pipe-lines—say the pipe 22—have been relieved of their oil-contents and it is desired to empty the wells upon another line. The valve 35 of the pipe 32 is now closed, and the valve 36 of this pipe is opened. The valve 35 of one of the other pipes—say 30^a—is also opened, the valve 36 of this pipe of course remaining closed. The gas from the receiving-tank 29 now passes through the pipe 30, the valve 35 of the pipe 30^a, and thence along the pipe-line to the several wells

located thereupon and shown in the lower right-hand corner of Fig. 1. These wells are all emptied serially in the manner above described, the oil reaching the common reservoir 37. As the valve 36 of the pipe 32 is open, however, the gas in the pipe 17 (shown in the upper right-hand corner of Fig. 2) being under pressure, as above stated, passes through the valve 36 of the pipe 32 and thence through the pipe 41 to the compressor 27, whence it is forced out through the pipe 28 to the receiving-tank 29, thus mingling with the gas already in that tank. The same gas is therefore used over and over. It may happen that the other two pipes 17 also contain gas under pressure. If desired, they may be caused to discharge their gas through the pipe 41 to the compressor. Indeed, I prefer to force the gas out upon one of the lines while receiving it from the entire number of other lines which may be employed, there being three such other lines in the particular system shown.

In regions where oil-wells accumulate comparatively small quantities of gas and where it is desirable to use this gas to the best advantage the natural gas is caused to accumulate within the casings 5^a of the several wells in the manner described in the several patents heretofore patented by Moran and Moser, including the patent above mentioned. The natural gas thus accumulated can pass upward through the pipes 8 and the valve 9 into the common gas-pipes 17. The natural gas from the several casings 5^a can never enter the pipes 17 except when the gas-pressure is greater within the casing 5^a than within the pipe 17. This occurs when the pipes 17 are under a minimum of pressure—as, for instance, after the wells have been flowed and the compressed gas within them has been removed.

The general arrangement of the oil-pipes 21 to 25, inclusive, is largely a matter of expediency, and I recommend that the oil-pipes be laid in such manner as to save the greatest amount of material. Of course if from the accumulation of the gas in the wells there be a surplus of the gas in the system of pipes, so that the gas-pressure within the several pipes gradually increases beyond the requirements, the excess gas can be utilized for any desired purpose or thrown away, as desired.

While many of the features above described may be utilized in connection with systems employing air instead of gas, there are manifest advantages in using gas rather than air. In the first place the pipes are easily corroded or pitted by the use of air, especially in the wells containing any salt water, as is sometimes the case. The contact of air upon metal which has been wet with salt water is such as to quickly render the pipes unsafe and even to destroy them. I have found that gas may be used in contact with iron or with practically any other metal without deleterious effects upon the metal even when the latter is admixed with large quantities of salt water. By the system above described the air is permanently excluded from the interior of the pipe, and all corrosion because of the contact of the air with the internal surfaces of the pipes is prevented.

It will be noted that the system above described comprises a minimum of piping. It virtually consists of an oil-pipe and a gas-pipe, together with the necessary connections, and the gas-pipe is used for conducting the gas in two opposite directions.

A valuable adjunct of my system is the controller-valve. (Shown in Fig. 2 and above described.) The air-pressure within the air-chamber by compressing the packing 12 renders the valve-stem 15 gas-tight.

The parts are designed and proportioned to obtain the desired results by the natural action of the oil and gas—as, for instance, the area of the member 14 being several times larger than the member 16 a comparatively small pressure of the liquid against the member 14 is required to shift the member 16 against the high pressure of gas within the air-chamber, and the flow of oil from the well is but slightly retarded in the operation. Then as the packing has a certain gripping effect upon the stem 15, which would prevent it from dropping to its seat by its own weight, the area of the stem within the air-chamber is sufficiently large to be driven down by the compressed gas after the fluid ceases to hold up the members 14 15 by passing through the fluid-chamber. Thus the lift and the drop of the members 14 15 is a positive automatic action, as is also the shift of the member 16 from the outlet 17 to the outlet 18 when the pressure is no longer needed within the pipe 18 to flow that well, as the shift can only take place when the well flows, thereby making the flow positive and necessary before the compression can be switched onto the next well. As one well after another has been flowed and the outlets 18 successively closed in each controller to the end of the pipe-line 17 the compressed gas is free to travel to the last well on the series as long as the pressure remains in the pipe, where it may, if desirable, be used for any other purpose—such as, for instance, to blow a whistle to indicate that all the wells have been flowed or any other purpose. As soon, however, as the compression is shut off at the power-house and the pressure is exhausted in the pipe-line 17 all the members 16 in a series drop to the seat 19^a, their original position. If the character of the wells require that they be flowed several times in succession, the compression may be turned on in the pipe 17 again as soon as the pipe has been exhausted after the first flow and the members 16 dropped to their seats 19^a, and the operation of flowing one well at a time will be repeated to the end of the series. The member 16 rests lightly on the seat 19^a, and when the pipe contains no

compression the gas from the well is free to pass through the pipes 8 and 17, lifting the member 16 off the seat 19ª and passing through the entire length of the pipe-line 17 to the power-house, so that the gas from all the wells in a series may be feeding the compressor at one time. The member 14 in the fluid-chamber also acts as a check-valve against fluid in the oil-pipe 21 running back in the well—as, for instance, if well No. 1 of a series contained no check-valve the flow of oil from well No. 2 and succeeding wells might partially escape into it instead of all going to the tank.

It will be understood, of course, that where a number of wells are linked up, as above described, so as to form a series or group, the last well of the series may or may not be provided with a controller, for the reason that the air goes no farther and the only purpose of the controller would be to enable the system to be extended at some future time. If, however, the well at the end of the line is equipped with a controller, the opening to the next well should be plugged so that as soon as the last well flows the line remains full of compressed air.

I do not limit myself to the exact mechanical details herein shown and described, as various changes may be made therein without departing from the spirit of my invention. Neither do I limit myself to the particular use for which the apparatus is best adapted.

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

1. A controller-valve, comprising an air-chamber, a valve member mounted therein and provided with two seats, each of which closes an air-exit, and means controllable by movements of a fluid for shifting said valve member from one of its seats to the other.

2. A controller-valve, comprising a fluid-chamber provided with a valve member for opening and closing the same, said valve member being provided with a stem, an air-chamber encircling a portion of said stem and provided with a plurality of valve-seats, a second valve member mounted within said air-chamber and movable relatively to both of said seats, and a pipe connected with said air-chamber and adapted to be obstructed when said last-mentioned valve member engages one of said seats.

3. An oil-well system, comprising a series of wells each provided with mechanism for removing oil therefrom by pressure of an aeriform body, means for supplying said pressure to said mechanism, and a series of controller-valves located at the several wells for shifting the pressure of said aeriform body from one well to another in succession so as to empty said wells in a predetermined definite order.

4. In an oil-well system, the combination of a compressor, a receiving-tank connected therewith for storing an aeriform body under pressure, piping extending from said receiving-tank to a plurality of wells, mechanism in each well for lifting a fluid therefrom, said mechanism being actuated by pressure of said aeriform body, and a plurality of controller-valves disposed at the several wells and connected with said mechanism thereof for the purpose of automatically shifting said pressure of said aeriform body from one of said wells to another in succession.

5. In an oil-well system, the combination of a plurality of mechanisms disposed in the several wells for lifting the fluid contents thereof, and adapted to be operated by pressure of an aeriform body, a single pipe-line connecting all of said mechanisms together in series, and means for automatically shifting the pressure of said pipe-line from one to the other of said mechanisms, thereby causing the same to operate upon said wells one at a time and in a predetermined order.

6. In an oil-well system, the combination of a plurality of mechanisms located in different wells for raising liquids therefrom, an oil-pipe connected with said mechanisms for permitting said liquid to flow therefrom in one direction, and a plurality of separate valve members mounted within said oil-pipe, said valve members being adapted to close to prevent the liquid from one of said wells from retrogressing and thus entering another of said wells.

7. In an oil-well system, the combination of a plurality of mechanisms mounted in different wells for raising liquids therefrom, an oil-pipe connected with said mechanisms for permitting said liquids to flow therefrom in one direction, a plurality of separate valve members mounted within said oil-pipe, said valve members being adapted to close to prevent the liquid from one of said wells from retrogressing and thus entering another of said wells, and a separate air-valve disposed adjacent to each of said first-mentioned valve members for controlling the position thereof.

8. A controller-valve comprising an air-chamber provided with a plurality of valve-seats, a valve member disposed within said air-chamber and movable so as to engage either of said seats, and a fluid-chamber having a valve member mounted therein, said valve member being provided with a portion for displacing said first-mentioned valve member from one of its seats.

9. A controller-valve comprising an air-chamber, a pipe connected therewith for supplying an aeriform body under pressure thereto, a second pipe connected with said air-chamber for causing said aeriform body to lift the fluid from a well, and a valve member mounted within said air-chamber and adapted to close communication between said last-mentioned pipes and said air-chamber.

10. A controller-valve comprising a fluid-chamber and an air-chamber, a valve member

mounted within said fluid-chamber and extending into said air-chamber, a self-closing packing encircling said stem for the purpose of rendering the same gas-tight, and a valve member mounted within said air-chamber and provided with two seats, one of which it occupies normally, said last-mentioned seat being disposed in a predetermined relation to said stem.

11. An oil-well system, comprising a plurality of wells provided with mechanism whereby they may be flowed by pressure of an aeriform body, a continuous pipe connected with the several mechanisms for supplying an aeriform body under pressure thereto, and separate valve mechanisms located at the several wells for automatically shifting the pressure of said aeriform body from one of said wells to the other for the purpose of operating upon said wells in a predetermined successive order.

12. The combination of a number of wells each provided with mechanism for raising the fluid contents thereof, said mechanisms being actuated by pressure of an aeriform body, a pipe-line connected with all of said mechanisms for supplying an aeriform body under pressure thereto, an oil-pipe connected with all of said mechanisms for receiving the oil thus raised from said wells, a gas-tank for separating said oil from any gas with which it may be admixed, a compressor connected with said gas-tank and with said pipe-line for the purpose of utilizing said gas continuously, and separate controller mechanisms located respectively at the several wells for shifting the pressure of said pipe-line from one to the other of said wells in succession.

13. The combination of a plurality of oil-wells each provided with mechanism for raising the fluid contents thereof, a pipe-line connected with all of said mechanisms for supplying an aeriform body under pressure thereto, mechanism for distributing the pressure of said aeriform body relatively to the several wells so as to flow the same in a predetermined successive order, an oil-pipe connected with said mechanisms for conducting to a central point the fluid contents thus raised, a receiving-tank connected with said oil-pipe, a compressor connected with said receiving-tank, and mechanism connected with said compressor for withdrawing an aeriform body from other pipe-lines so as to use the same continuously.

14. An oil-well system, comprising a fluid-chamber and an air-chamber, piping connected with said air-chamber for supplying an aeriform body to a well for the purpose of raising a liquid therein, a valvular member mounted within said air-chamber for allowing gas from the well to pass into said piping so as to be recovered for subsequent use, and a valvular member movably mounted within said fluid-chamber and provided with a stem for moving said valvular member mounted within said air-chamber.

15. An oil-well system, comprising controllers provided with valve members each adapted to occupy two positions, one for allowing an aeriform body to pass into a well and the other for allowing the escape of gas from said well, and means actuated by pressure of a liquid for dislodging said valve members from said first-mentioned position.

16. The combination of a plurality of wells arranged in groups, pipe-lines extending to said groups for the purpose of supplying an aeriform body thereto, controller-valves located at the several wells for controlling the distribution of pressure of said aeriform body thereto, and mechanism located at a central point for reversing the direction of flow of said aeriform body relatively to one of said groups for the purpose of conserving said aeriform body.

17. The combination of a pipe-line, a plurality of wells disposed along the same, a central station provided with mechanism for forcing an aeriform body to said pipe-line, controllers located at the respective wells and actuated by said aeriform body so as to shift the pressure from one of said wells to the other in a predetermined order, and means located at the central station for reversing the general direction of travel of said aeriform body for the purpose of allowing the same to retrograde to said central station for future use.

18. The combination of a pipe-line, a plurality of wells disposed at intervals along the same, an air-chamber disposed adjacent to one of said wells, an inlet-pipe connected with said air-chamber for admitting an aeriform body into the same, means for forcing said aeriform body through said inlet-pipe, an outlet-pipe leading from said air-chamber into said last-mentioned well for the purpose of raising a liquid therefrom, another outlet-pipe leading from said air-chamber to the inlet-pipe of another air-chamber located at another well, a movable member connected with said air-chamber for controlling the flow of said aeriform body through said outlets, and mechanism connected with said air-chamber and actuated by the flow of liquid from the well immediately adjacent thereto for shifting said movable member and thereby changing the course of said aeriform body from one of said outlets to the other.

19. In an oil-well system, the combination of a plurality of wells, a liquid-discharge pipe common to all of said wells, a separate controller at each of said wells, a pipe-line common to all of said wells, means for forcing an aeriform body through said pipe-line, internal pipes leading from said pipe-line to the respective wells for flowing the same, and a

separate controller located at each well and connected with said pipe-line, said controller being provided with mechanism for automatically shutting off the pressure of said aeriform body from one to another of said internal pipes of said separate wells so as to flow said wells in a predetermined successive order.

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

FRED JOSEPH MOSER.

Witnesses:

E. C. ANDERSEN,

C. E. ROBINSON.