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W. RICHARDS.

DEVICE FOR RAISING LIQUIDS FROM WELLS.

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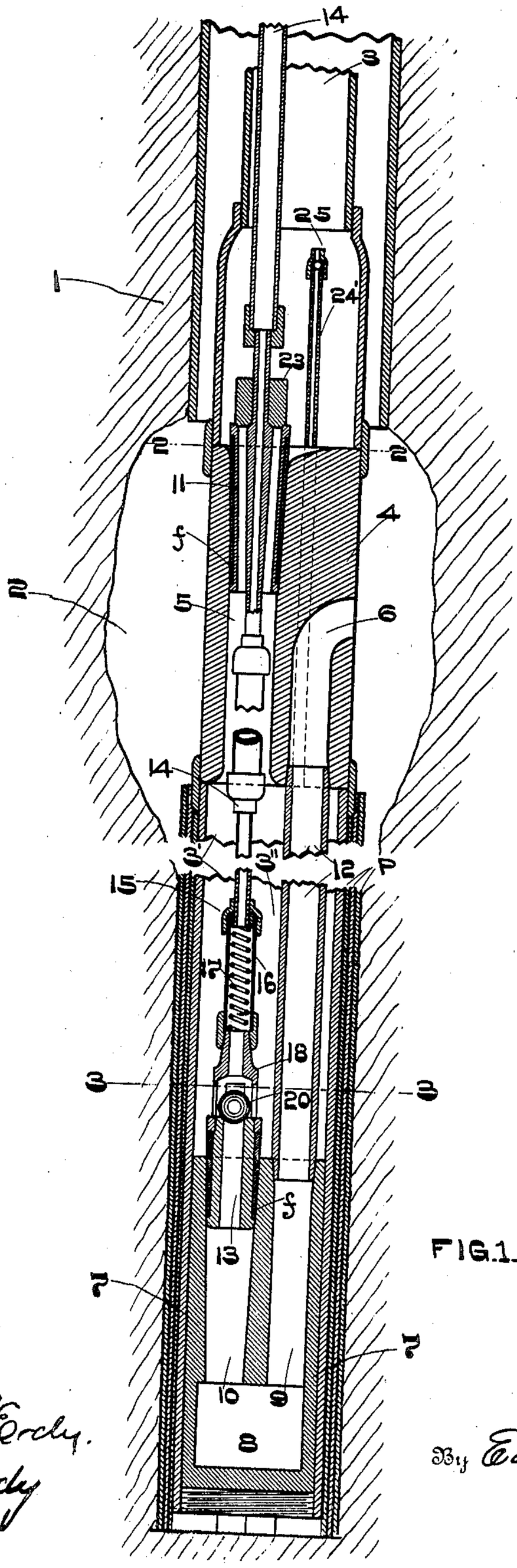

FIG. 1.

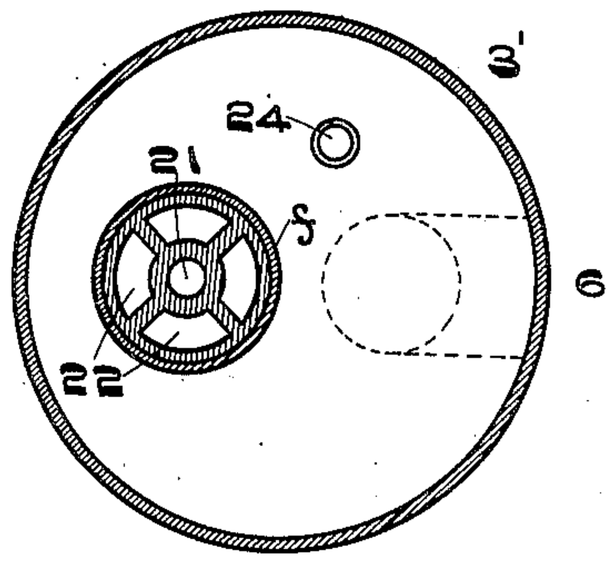

FIG. 2.

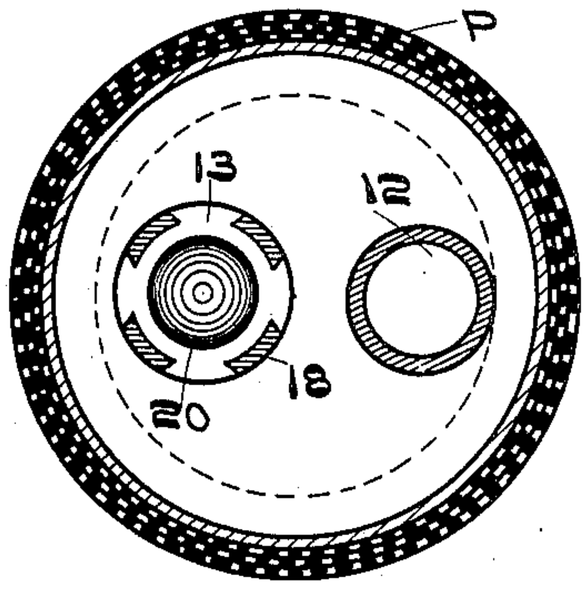

FIG. 3.

Witnesses
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UNITED STATES PATENT OFFICE.

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DEVICE FOR RAISING LIQUIDS FROM WELLS.

No. 813,322. Specification of Letters Patent. Patented Feb. 20, 1906.

Application filed February 3, 1904. Serial No. 191,841.

To all whom it may concern:

Be it known that I, WILLIAM RICHARDS, a citizen of the United States, residing at Mayburg, in the county of Forest and State of Pennsylvania, have invented certain new and useful Improvements in Devices for Raising Liquids from Wells, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improvements in devices for raising liquids, and especially oil, from wells by the use of compressed air and will be fully understood by a reference to the accompanying drawings, which form a part of this specification, and in which—

Figure 1 is a central vertical section of the lower portion of a well with my device in position therein, which is also shown in section. Fig. 2 is a transverse section of line 2 2 of Fig. 1. Fig. 3 is a transverse section of line 3 3 of Fig. 1.

The same reference characters indicate identical parts in the several views.

I am aware that certain devices are now and have for a number of years past been in use for raising liquids from wells by the use of compressed air, gas, and steam and that during later years these devices in various modified forms have been adapted to oil-wells; but so far as I am aware they are all more or less unsatisfactory and inefficient, even when new, and rapidly become more so in use by reason of not being properly constructed to exclude sand and particles of rock, which are always present in wells. Furthermore, certain types of these devices depend more or less upon placing the liquid in the well or "shot cavity" under pressure in order to force it into the reservoir where it is to be operated upon by the compressed air. This requirement is caused by one or both of two matters of defective construction in other devices of this class, and one of these defects is the matter of placing the reservoir directly in the shot-hole or on a level with the producing strata, by reason of which position the gravity of the liquid is given no opportunity to do its work. The other defect of construction is the failure to provide the reservoir with a proper vent for the escape of gas and air as the oil or other liquid flows into the same. The pressure thus required is injurious and detrimental to the producing capacity of the well in causing the production to be more or less intermittent and consequent damage to the walls of the producing strata in various ways which are readily apparent to any one acquainted with the art of oil production.

It is the object of my invention to overcome the objections stated above; and, whereas my device is so constructed that it is an impossibility for sand to enter the same or to settle about the same in such a manner as to cause it to become stuck in the well; further, inasmuch as the receiving-reservoir of my device is entirely below the oil-producing strata and its reservoir is provided with a vent of such construction, location, and capacity as to allow a ready escape for the gas and air therefrom and admits at all times of a free flow of oil or fluid thereinto by gravity alone, thus causing the well to be a constant and steady producer, and, furthermore, inasmuch as my device admits of the oil flowing freely at all times from the producing strata, and the wall thereof thus kept free from deposits of paraffin, therefore I claim to have overcome the objections above stated and to have attained various other advantages which will be hereinafter set forth. In all other devices of this class, so far as I am aware, the inlet-valves are so located that when they are closed for the expulsion of oil from the reservoir the oil must cease to drain from the producing stratum or shot-hole for the time being, and thus said drainage becomes interrupted to a certain degree, whereas in my device the inlet is so arranged that oil may continuously drain thereinto even when the inlet-valve is closed.

In the drawings, 1 represents the wall of the well, and 2 indicates the shot-hole, which is made in nearly all wells by means so well known to the art as to need no detailed description here. For the purpose of accommodating the receiving-reservoir of my device the drill-hole is continued below the shot-hole to a considerable distance, which may be more or less, as circumstances require, and determined principally by the production of the well.

My device is constructed as follows: As the tubing 3 nears the shot-hole 2 it is enlarged, and in said tubing, immediately within said shot-hole, is placed a bridge 4, which has a longitudinal hole 5 extending entirely through the same, and another longitudinal hole 6, which extends from the lower end of the bridge to about the middle thereof, where it opens laterally into the shot-hole. To the lower end of bridge 4 is attached the tubing 3′, the inte-

rior of which serves as a reservoir 3″ for the reception of oil or fluid, and in the lower part of tubing 3 is placed the return-chamber 7, a plan view of which is shown in Fig. 3. Said return-chamber is composed, preferably, of cast-iron, and in the bottom of same is a large chamber 8, and leading downwardly thereto are the ducts 9 10. The length of the tubing 3′ is preferably about forty feet and, as above stated, constitutes a receiving-reservoir for oil or other fluid. The upper portion of hole 5 in bridge 4 serves as a seat for valve 11, and the lateral opening 6 serves as an inlet for oil or other liquid from the shot-hole. A connecting-pipe 12 joins the inlet 6 with the duct 9 in the return-chamber, and into the upper end of duct 10 is seated the valve 13. Valves 11 and 13 are connected together by the air-pipe 14, and in order that irregularities in the distance between the respective seats of valves 11 and 13 may be accommodated by said pipe 14 a slip-joint 15 is placed in said pipe 14, which consists of a larger section of pipe 16, in which is inserted a spiral spring 17, which rests upon valve 13, and upon which spring rests in turn the lower end of pipe 14, which pipe 14 is preferably of such a length that when the spring 17 is normally extended the distance between the valves is considerably greater than the distance between their respective seats, so that when the valves are in position the spring 17 is considerably compressed, and hence it is assured that both valves 11 and 13 will be firmly seated. Pipe 14 is preferably enlarged throughout the greater part of its length in order to afford a freer passage for air or gas. Valve 13 is of the usual ball type, with an elongated taper seat to fit the duct 10 and having at the upper portion thereof a cage or crown 18, which contains the ball 20. Valve 11 is of peculiar construction and is shown in cross-section at Fig. 2. It has therein the central passage 21 for air or gas, (which is a continuation of pipe 14,) and around the same are the passages 22 for oil or other fluid. Operably seated upon said valve is the drop 23, which is free to play vertically. Extending through bridge 4 is a vent 24, and this is extended upward by the pipe 24′, which has at the upper extremity thereof a ball-valve 25, which allows air and gas to escape from the oil-reservoir in the pipe 3, thereby relieving all pressure and allowing a free inlet of the oil.

The operation of my device is substantially as follows: As oil or other fluid gathers in the shot-hole 2 and rises to the opening 6 it flows therein and downward through pipe 12 into the return-chamber 7 and up through the duct 8 and escapes through valve 13 into the chamber 3″ of pipe 3′, and this may continue until said chamber is filled, at which time air or gas under pressure is admitted through pipe 14 and the first office thereof is to force ball 20 of valve 13 firmly to its seat, and thus prevent the loss of the slightest quantity of oil or other fluid by regurgitation. The air or gas then escapes in the chamber 3″ and forces the oil or other fluid upward through valve 11, thence outward through the tubing 3 to the surface of the ground or to another reservoir above the bridge until enough oil has been accumulated to admit of being forced to the surface of the ground. The valve 25 is closed when the excessive pressure of air is admitted to expel the oil or other fluid from chamber 3″, but immediately resumes its normal position when the air or gas pressure is relieved. When the oil or other fluid is all expelled from the chamber 3″, the admission of air or gas through pipe 14 is stopped and oil or other fluid again flows into said chamber by gravity.

Be it understood that the valves 11 and 13 may be readily removed from the well by means of the pipe 14, to which they are attached, and that the peculiar construction, arrangement, and combination of said valves, and especially the provision of the slip-joint and spiral spring which insures the proper seating of said valves, are essential features of my invention.

It will be readily understood that the oil-inlet 6 being quite high up in the bridge no sand can enter the same; but all sand which finds its way to the shot-hole will settle to the bottom of same, and in order that such sand and sediment may not become firmly embedded about the pipe 3′ the same is wrapped with several layers of packing P, which may be any suitable material, but preferably corrugated paper, such as is extensively used for wrapping purposes. While this soon becomes a soft pulp under the action of the liquid in the well, it still effectively excludes the sand and sediment and permits the tubing to be easily withdrawn from the same, and any portion thereof which may remain in the well after the tubing is withdrawn can be easily cleaned out. The packing P above described is not intended to form a liquid-tight joint between the periphery of the casing and the wall of the well, and I do not here seek to claim a packing adapted to such purpose. My packing is for the purpose of preventing sand and sediment from settling about the reservoir in such manner as to cause it to become stuck to the well.

I am aware that certain Letters Patent of the United States, No. 715,141, dated December 2, 1902, and granted to one William Plotts, shows a process of shutting off water in drilled oil-wells, and which process consists in tamping sand or other suitable material between the outside of the casing and the wall of the well below a water-bearing stratum to prevent water from flowing downward past the same; but if such a method of packing were substituted for my packing P it would

cause the reservoir to become firmly stuck in the well, and this is precisely what my packing is adapted to prevent. Hence I specifically disclaim such packing or process as is shown in said Letters Patent to Plotts or any other "wall-packer," as the same is commonly understood and applied in the oil-producing industry, as any amount of liquid flowing downward about the reservoir is wholly immaterial. Hence the packing here shown is not a "wall-packer" in any sense which that word is employed in the art of oil production.

Valve 13 is of such diameter that it will readily pass through the hole 5 of the bridge 4, and thus when it becomes necessary to repair either or both of the valves 11 and 13 they may be readily drawn from the well by means of the air-pipe 14, to which they are attached.

The valves 11 and 13 have each a facing *f*, of comparatively yieldable metallic material, which readily accommodates itself to any irregularities in the seats therefor. The valves being thus wholly constructed of metal and without the use of leather, fabric, or rubber, they are able to withstand any degree of heat which is likely to be applied to them—as, for instance, where heated air is employed or where the well is flooded from above with hot oil for reasons well known to those skilled in the art of oil production.

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

1. In an improved device for raising liquids from wells, a reservoir located below the producing strata, a bridge located at the upper end of said reservoir, a valve located in said bridge, there being an air-passage and an oil-passage formed within the body of said valve.

2. In an improved device for raising liquids from wells, the combination of two valves connected together and adapted to seat one below the other, means in said connection adapted to automatically adjust said valves to irregularities of distance between their respective seats.

3. In an improved device for raising liquids from wells, the shot-hole in said well, in combination with a bridge located in said shot-hole, there being a fluid-inlet in said bridge, the reservoir attached to and extending below said bridge, the packing about said reservoir, substantially as and for the purpose specified.

4. In an improved device for raising liquids from wells, a bridge located in the shot-hole of the well, there being a valveless or non-closing fluid-inlet in said bridge, in combination with a fluid-receiving reservoir extending below said bridge, means of preventing the regurgitation of said fluid and means of forcing the fluid from said reservoir to the surface of the earth.

5. In an improved device for raising liquids from wells, a tubing located in the well, a bridge located in said tubing, a return-chamber located below said bridge and connected thereto by a reservoir, valve-seats in said bridge and said return-chamber, valves attached to an air-pipe and adapted to seat in said seats respectively, a slip-joint located in said pipe, adapted to secure the proper seating of said valves.

6. In an improved device for raising liquids from wells, tubing extending below the producing stratum, a bridge interposed in said tubing and located at the producing stratum, the tubing below said bridge being adapted as a receiving-reservoir, a fluid-inlet in said bridge, means of conducting the fluid entering by said inlet to said receiving-reservoir, means of preventing the regurgitation of said fluid, and means of forcing said fluid from the receiving-reservoir to the surface of the earth.

7. In an improved device for raising liquids from wells, a reservoir, a bridge located above said reservoir, a vent in said bridge adapted to the free escape of air and gas therefrom, a pipe secured in the bridge at said vent, and extending upward from said bridge, a valve attached to the upper end of said pipe, adapted to permit a normal flow of gas or air therefrom, and to be closed by an abnormal flow of gas or air, and to automatically open when said pressure or flow again becomes normal.

8. In an improved device for raising liquids from wells, a reservoir, a bridge located at the top of said reservoir, there being a longitudinal hole through said bridge and an oil-inlet in said bridge, communicating with the shot-hole, a return-chamber located at the bottom of said shot-hole and having an oil-duct therein adapted to admit oil to said reservoir, a valve seated in the duct of said return-chamber, a valve seated in the longitudinal hole of said bridge, a pipe communication between the oil-inlet in the bridge and in the return-chamber.

9. In an improved device for raising liquids from wells, tubing or pipe located in said well, a bridge in said tubing located in the shot-hole, a reservoir attached to said bridge and extending below the same, a return-chamber located in the bottom of said reservoir, means of admitting liquid to said reservoir by way of said bridge and return-chamber, an air-pipe located in said tubing, valves attached to said pipe and adapted to seat in said bridge and said return-chamber respectively, said valves being adapted to allow the liquid to pass upward therethrough and to prevent the return of same, means of admitting compressed air to said reservoir, and means of conducting oil to the surface of the ground, or to another storage-chamber above the bridge.

10. In an improved device for raising oil from wells, the combination of tubing ex-

tending from the surface down to the shot-hole or oil-producing stratum, a bridge affixed to said tubing and located in said shot-hole, there being a longitudinal hole extending through said bridge, and the upper end thereof adapted as a valve-seat, and a longitudinal hole extending from the lower end of said bridge partly through the same and having a lateral opening into the shot-hole, and adapted as an inlet for oil, tubing attached to the bottom of said bridge and extending downward therefrom below the oil-producing strata and adapted as a storage-reservoir, a return-chamber located at the bottom of said reservoir, means of conducting oil from the shot-hole into said chamber, means permitting said oil to pass into the storage-reservoir, an air-pipe extending from the surface of the ground down into the tubing, valves thereon adapted to seat in the bridge and in the return-chamber respectively and adapted to permit oil to pass upwardly through the same and to prevent the return thereof.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM RICHARDS.

Witnesses:
A. J. WALTER,
J. G. RICHARDS.