July 28, 1925. 1,547,194

P. ARBON

SYSTEM FOR ELEVATING OIL

Filed Jan. 2, 1923 3 Sheets-Sheet 1

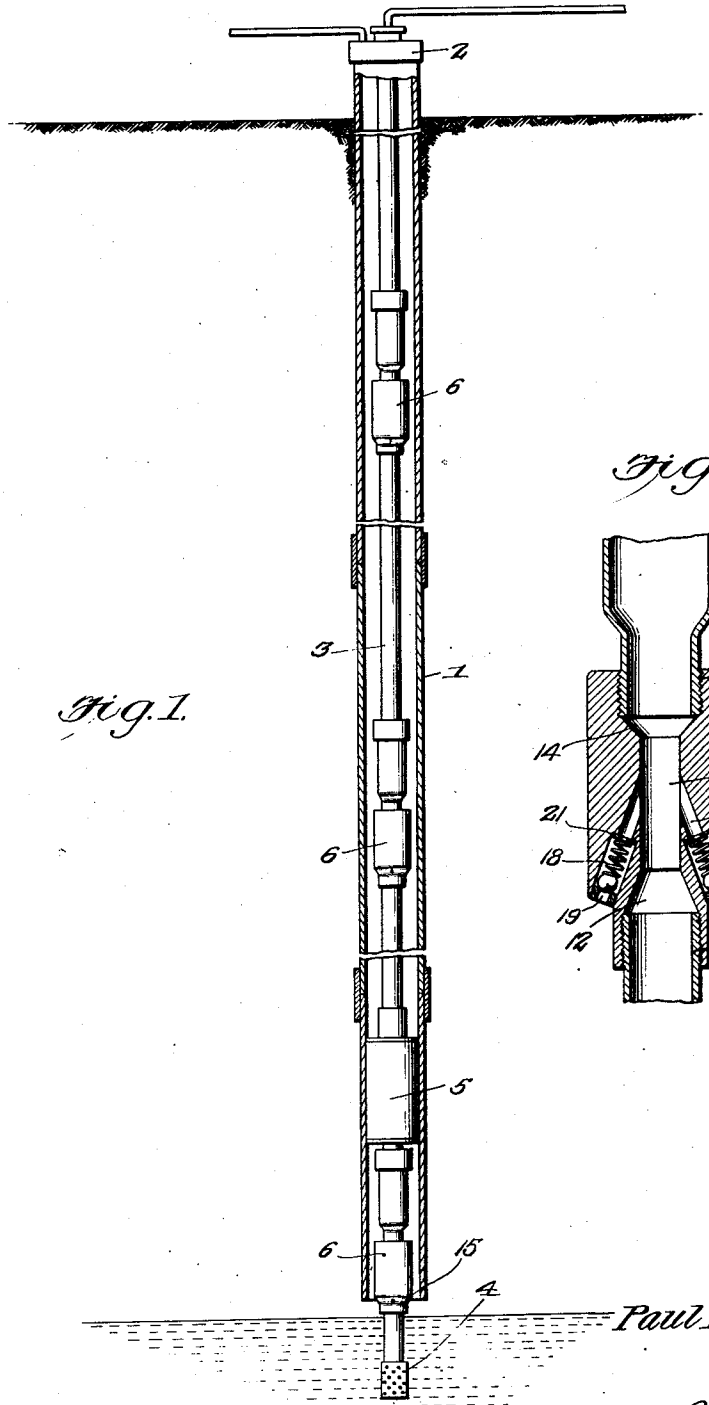


Fig. 1.

Fig. 4.

Inventor
Paul Arbon,

By Ralph D. Barnett
Attorney

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SYSTEM FOR ELEVATING OIL

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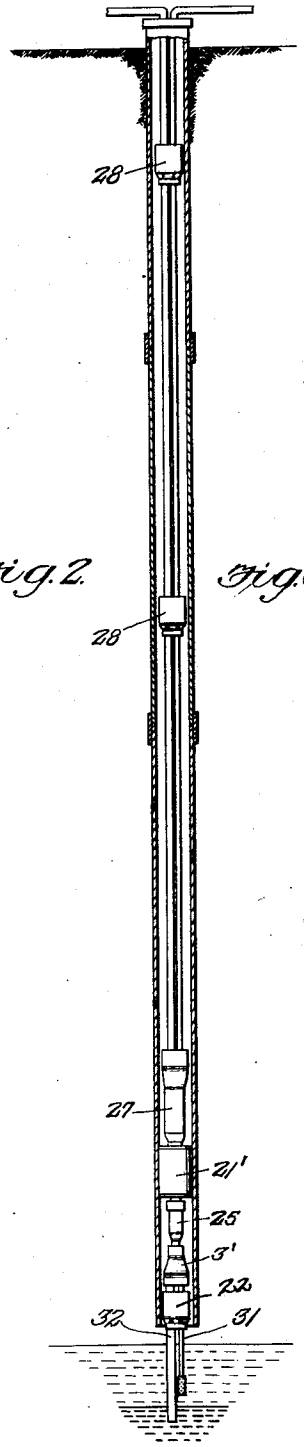


Fig. 2.

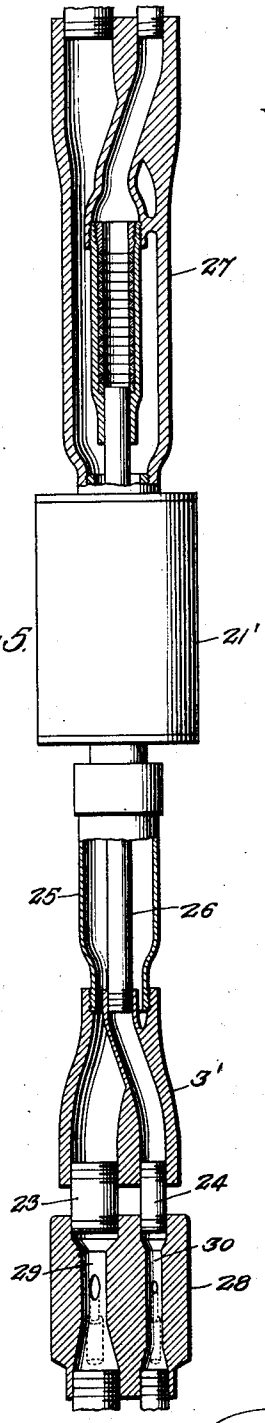


Fig. 5.

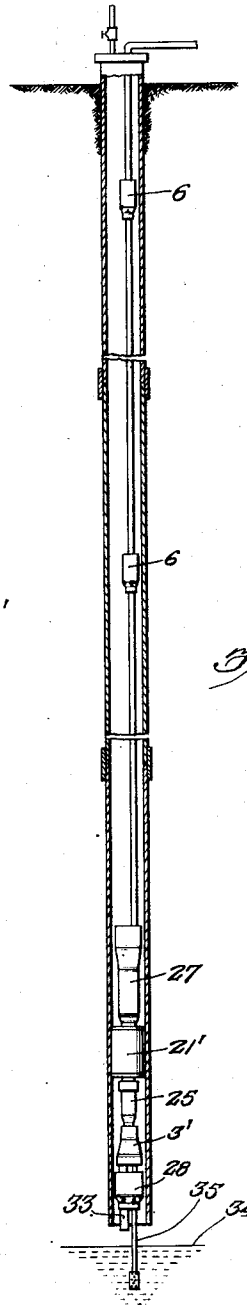


Fig. 3.

Inventor

Paul Arbon,

By Ralph D. Bassett

Attorney

July 28, 1925. 1,547,194

P. ARBON

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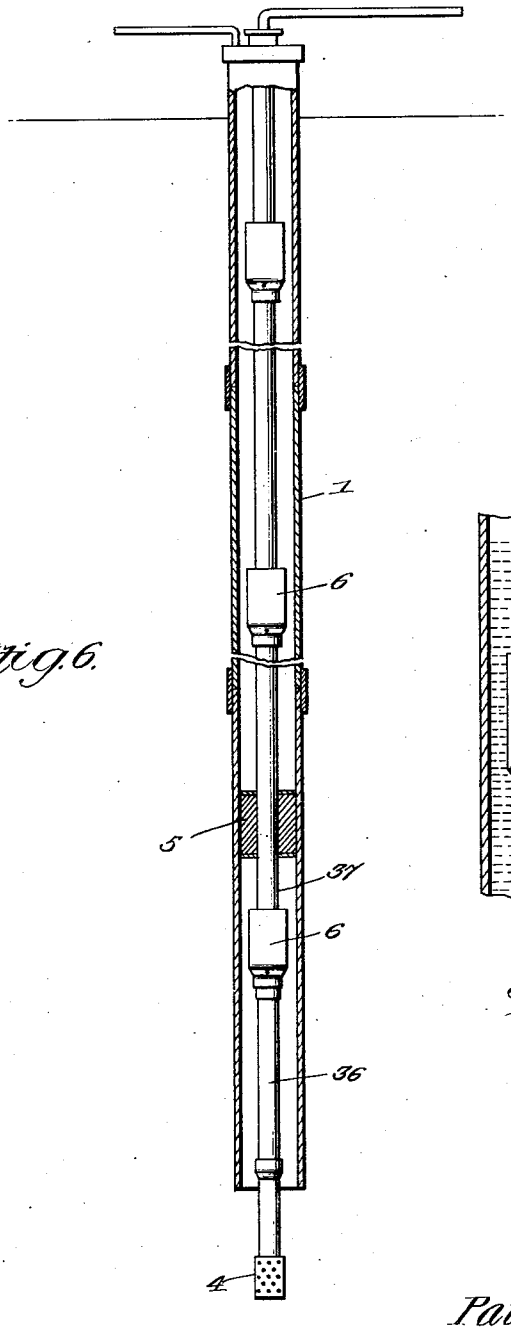


Fig. 6.

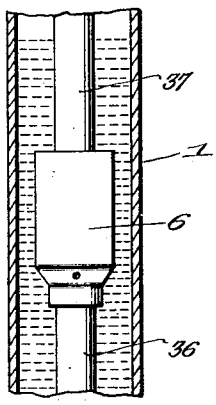


Fig. 7.

Inventor
Paul Arbon,

By Ralph D. Bassett
Attorney

Patented July 28, 1925. 1,547,194

UNITED STATES PATENT OFFICE.

PAUL ARBON, OF TULSA, OKLAHOMA.

SYSTEM FOR ELEVATING OIL.

Application filed January 2, 1923. Serial No. 610,265.

To all whom it may concern:

Be it known that I, PAUL ARBON, a subject of the King of Great Britain, residing at Tulsa, in the county of Tulsa and State of Oklahoma, have invented certain new and useful Improvements in Systems for Elevating Oil, of which the following is a specification.

The paramount object of this invention is to provide means for elevating oil from wells when possible without the use of pumps and necessary accessories which are not only expensive and subject to constant repair and attention, but do not remove a proper percentage of oil a well may be capable of producing under normal circumstances. In addition to pumping mechanism being unsatisfactory in normal wells, it is well known in the art that where a large amount of water is present and where the gas pressure in a well is abnormal difficulty is experienced. In the instance where water is found in considerable quantities an unusual loss is experienced through emulsification, i. e., the mixing of the oil and the water, the treatment of such emulsion being troublesome and expensive and having a great tendency to reduce productive value. In wells where the natural gas supply is abnormal the fluid is naturally forced back causing general disorder in both operation and production.

It has been found in the production of oil and is a recognized fact in the art, that wells in which the oil is forced out or elevated by natural gas produce not only for a longer period but also have a relatively larger production. Instances where oil is produced by this means are not common, there usually being either too little gas pressure or too great a gas pressure, and in either condition the oil is forced through the eduction tube in "heads" due to the necessary accumulation of gas. Where the gas pressure is low the time between the "heads" of oil is delayed to permit the accumulation of such gas as may be necessary to provide the pressure sufficient to elevate the oil and under this condition and also where the gas pressure is excessive the natural power supplied by such gas pressure is wasted by its escape with and subsequent to the discharge of the "heads" of oil.

The present invention not only contemplates the elimination of expensive and troublesome machinery but provides for the conservation and use of natural gas pressure to an extent heretofore impossible and in a manner which avoids the present disadvantages experienced where natural gas or artificial pressure is utilized to elevate oil. In other words by the present system the natural gas pressure is conserved and regulated and the oil is brought to the surface by means of this regulated pressure in a manner to obtain the very best production from a well.

Nor does the present invention conclude with the elevation of the oil and the conservation of the natural gas pressure, as the present method contemplates the use of artificial pressure where the natural gas pressure is insufficient. It is also intended and suitable and has proven of great valve in connection with wells in which pumps have been installed and in which the gas pressure is such as to force the oil above the working barrel as will more clearly hereinafter appear.

It is also within the scope of the present invention to provide means for the separation of casing head gas as it is obvious that where natural gas is used in the elevation of oil that a certain percentage of the lighter gases will saturate the natural gas. In fact in many instances the natural gas will be of value in this connection before its additional saturation through the elevation of the oil. The intention is, therefore, to provide when advisable a casing head outfit, so that the natural gas after its separation from the oil can be properly treated with heat under pressure in the presence of a suitable menstruum.

Should a well be making too much water means are provided whereby it will be possible to remove both the oil and the water, but separately, thereby preventing emulsification and saving the time and labor involved in separation to produce a commercial product. Where the natural gas pressure is in excess of that required in the proper production of oil under the present system, such excess will be permitted to escape to the upper part of the casing for the operation of the upper jets, as will more clearly appear. In the first case where there is an excess of water the gas pressure is caused to elevate both the water and the oil in independent eduction tubes.

More specificially the present invention

relates to the utilization of natural gas pressure through novel forms of jets, the first step in the system being the packing of the well between the casing and the eduction tube to permit the accumulation of the proper gas supply and consequent pressure. Another important step consists in the arrangement of jets, one jet, either of the single or double type as will more clearly appear, being located below the packer for the initial movement of the oil, and other jets, according to the nature of the well and condition of the earth strata, being arranged above the packer. The third feature, and perhaps the most important is the regulation of the valves controlling the jets, the regulation of such valves being dependent upon the pressure, depth of well and volume of oil.

Reference will be had to the accompanying drawings forming a part of this specification and wherein like numerals of reference designate corresponding parts throughout the several views, in which:—

Figure 1 shows a side elevation of a well the casing being in section.

Figures 2 and 3 are similar views showing modified forms of the present invention.

Figure 4 shows a vertical sectional view of a jet.

Figure 5 is a vertical sectional view of a multiple jet arrangement the connections with the packer and eduction tubes being shown.

Figure 6 is a similar view as Figures 1, 2 and 3 showing the invention utilized in connection with a pump, and

Figure 7 is a fragmentary section of Figure 6.

With reference now to Figure 1, a well is shown in condition for operation in the production of oil, and includes the conventional casing 1 formed in sections properly connected. The casing extends from the header 2, which closes the top of the well, to the approximate bottom of the well in the majority of instances, or as may be necessary due to the condition of the earth strata. Within the casing 1 the tubing 3 is arranged and through this tubing the oil is elevated. The tubing 3 includes the strainer 4 of conventional design, the packer 5 and the jets or ejectors 6.

The successful operation of this invention residing in the conservation and utilization of natural gas pressure particular attention is directed to the packer 5. This packer 5 is arranged near the lower joint of the casing or at such point along the casing as may be desired and as circumstances may demand and closes the passage between the casing and the eduction tube and retains the natural gas below and with the casing. The function of this packer will make it obvious to one skilled in the art, that the exact location of same will depend upon the nature of the well being equipped.

Below the packer and above the level of oil in the well the lower jet or ejector is arranged and above the packer are arranged a series of such ejectors or jets as may be necessary and proper for the elevation of the oil, the number of jets depending upon the depth of the well, the volume of oil and the gas pressure.

The construction of the ejector is clearly shown in Figure 4 and is described and claimed in detail in a co-pending application, Serial No. 610,264, filed Jan. 2, 1923. For the purpose of enabling a clear understanding of the function of the jet or ejector in this system attention is directed to the following description. The jet includes the body or casing 7 through which extends a longitudinal passage. The wall of the longitudinal passage is internally threaded as at 9 and 10 for the connection with adjacent tubing sections. The central portion 11 of the passage is restricted and is so formed by the walls converging inwardly gradually at 12 and 14. The lower portion of the casing is reduced and forms the inclined annular shoulder 15 shown more clearly in Figure 1 and through this shoulder there extends a plurality of converging passages which are substantially parallel to the lower converging wall 12. These passages each include the enlarged chamber 16 and the smaller jet passage 17 which connect the chamber with the interior of the casing. Within the enlarged portion of each of the passages is arranged a spring 18, one end of which seats the ball valve 19 against the adjustable seat 20 and the other end abuts against the washer plate 21. It will be obvious by reference to this construction that by turning the adjustable valve seats 20 which are threaded within the outer ends of the enlarged chambers that the tension of the springs may be readily regulated. The regulation of these springs, as previously stated, forms an important step in the successful application of this system in many instances. The washer plate by the removal of the valve seat and spring may be changed, and in this connection it will be seen that should it be desired to regulate the size of the passage and consequent volume of flow through the jets, a washer plate with a different size opening could be substituted.

Little need be said in connection with the operation of this single jet system in view of the foregoing, it being obvious that natural gas will accumulate below the packer and at a predetermined pressure, this having been accomplished through the adjustment of the spring tension, will force the valves from their seat in the jet casing and cause the elevation of oil in the tube. The jets arranged above the packer may be operated

either from a natural accumulation of gas or by means of artificial pressure introduced through the head. These jets are in number governed by the depth and nature of a well. The upper jet preferably is provided with smaller passages and the valves controlling the passages are under less spring pressure than those in the adjacent jet. This condition is true with each jet counting from the top as it will be obvious that the column of oil in the tube is reduced in height and volume above each jet and accordingly the amount of pressure necessary for elevation is in proportion.

Referring now to Figure 2 my invention is shown applied to a well where there is an excess of water and where it is desired and necessary to elevate both the oil and the water. As previously stated in this case the oil and water are both elevated separately and emulsification thus avoided. In wells of this character I have devised and utilized what I term a double jet and this apparatus consists of double piping and jet mechanism whereby the natural gas pressure utilized in the elevation also separates the oil and water. Before proceeding further with the operation of this feature of the present system attention is directed to the construction and arrangement of parts comprising my double jet, shown fully in Figure 5. In this figure the conventional packer is referred to by reference character 21′ and the double jet by reference 22. The connection between the packer and the double jet includes the double passage casting 3′, the intervening nipples 23 and 24 and the pipe sections 25 and 26. The object of this construction is to direct both the oil and the water through concentric pipes which extend through the packer from the parallel conduits or passages in the double jet, it being essential that the passages through the packer be arranged in concentric relation and the passages in the double jet be in parallel relation to permit the proper functioning of these elements. For connection the upper end of the packer with the duplicate tubing the multiple passage casting 27 is provided.

The double jet includes the casing 28 through which there extend the two passages 29 and 30, these passages being similar in construction as the passage in the single jet heretofore mentioned.

Referring again to Figure 2 it will be seen that by the use of the double jet and by connecting one of the passages in the double jet with suitable piping 31 and extending the latter into the oil and similarly connecting the other jet passage and extending this connection into the water (reference numeral 32), both the oil and water will be elevated independent of each other and by means of the accumulated gas pressure below the packer. In Figure 3 a similar arrangement is present in so far as the double jet and packer connections are concerned. In this arrangement, however, one of the pipes 33 extending below the jet is shortened and stops above the oil level 34 and the other jet connection 35 extends into the oil.

Attention is directed to the fact that in each arrangement illustrated a jet, either single or double, is located between the packer and the oil level.

With reference again to Figure 3, in which form the function is to provide for excess gas pressure it is necessary to arrange a safety valve on the casing cap to permit the escape of the excessive gas and the proper control of the gas within the casing.

Heretofore I mentioned the application of my idea to wells for use in conjunction with a pump. Necessarily, as pointed out, it is desirable to eliminate the pump and pumping mechanism where possible, however, instances exist where a pumping apparatus is installed and due to the condition of the gas pressure the oil is elevated between the casing and tubing above the pump inlet so that the action of the pump is without result. To provide for such a condition I have illustrated in Figures 6 and 7 an arrangement wherein an ejector 6 is located between the pump barrel 36 to which is connected the polished rod 38 and the upper adjacent section of tubing 37. The packer 5 is illustrated in full lines and its location is optional and governed by the well condition. With this arrangement the accumulated gas pressure will cause the oil to pass through the lower ejector and will result in a priming of the pump.

To a person skilled in the art it will be readily conceived how the various conditions which may and do exist in oil wells can be met by the proper application of the present invention and this specification and attached drawings illustrate the principle involved.

It will also be noticeable that in every instance the application to a well of this invention increases production and profit from every standpoint. This is particularly noticeable in instances where natural gas from an adjacent well is utilized to produce the required pressure in a well utilizing the present system, as such natural gas will accumulate the elements of casing head gas in large quantities by its association with the flowing oil and thus become a commercial product.

What I claim as new and useful and desire to secure by Letters Patent, is:—

1. A system for elevating oil consisting in packing a well between the eduction tube and casing to cause the accumulation of the gas, arranging valved ejectors in said tube above and below the packing, and regulating the valves to cause successive elevation of fluid in the tube.

2. A system for elevating oil from wells consisting in packing the well between the eduction tube and casing to cause the accumulation of the gas, arranging valved ejectors in said tube above and below the packing, permitting natural gas to act on an ejector below the packer for elevating the oil in the tube, also permitting gas to act upon the ejectors above the packing for raising oil in the tube, and regulating the valves in the ejectors to cause successive elevation of fluid in the tube.

3. A system for elevating oil consisting in packing a well between the casing and tubing to permit the accumulation of gas, providing a multiple conduit jet below the packer and jets above the packer, arranging separate pipe connection for the conduits of the multiple jet, and permitting the accumulated gas to escape through the jets to cause the separate elevation of two fluids.

4. A system for elevating oil and water from a well without emulsification consisting in packing said well between the casing and tubing, providing multiple conduit jets in said tubing and connecting the separate conduits with the oil and water, permitting the accumulation of natural gas below the packer, and permitting the escape of the natural gas through the jets into the oil and water in graduated quantities.

In testimony whereof I affix my signature.

PAUL ARBON.