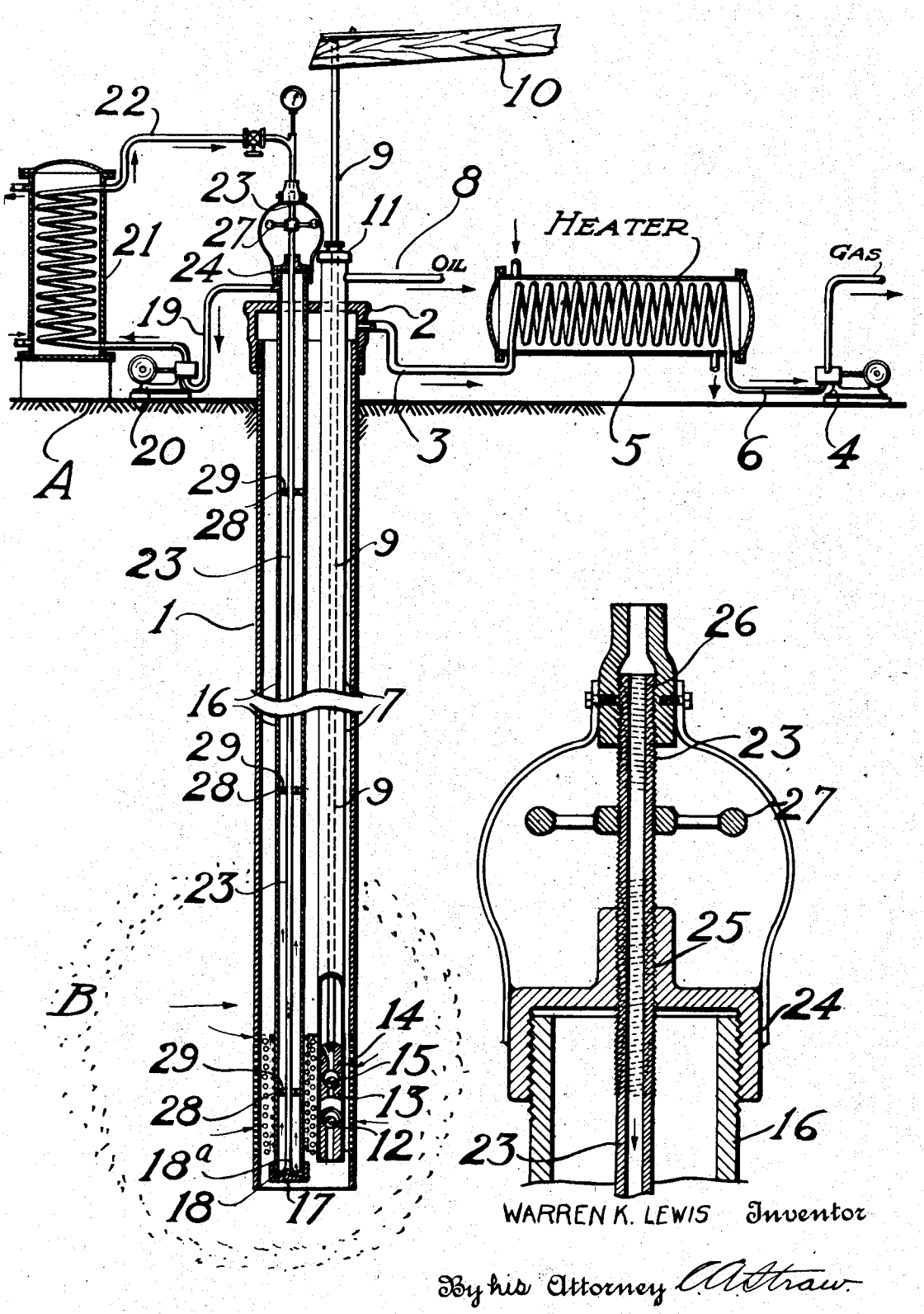
June 30, 1931. W. K. LEWIS 1,812,267

PROCESS FOR OPERATING OIL AND GAS WELLS UNDER REDUCED PRESSURE

Filed July 28, 1928



WARREN K. LEWIS Inventor

By his Attorney Attraw

Patented June 30, 1931 1,812,267

UNITED STATES PATENT OFFICE

WARREN K. LEWIS, OF NEWTON, MASSACHUSETTS, ASSIGNOR TO STANDARD OIL DEVELOPMENT COMPANY, A CORPORATION OF DELAWARE

PROCESS FOR OPERATING OIL AND GAS WELLS UNDER REDUCED PRESSURE

Application filed July 28, 1928. Serial No. 296,008.

The present invention relates to a method for obtaining petroleum products from the earth and more specifically comprises an improved process for obtaining natural gas and natural gas gasoline. My invention, which may be considered as an improvement over the process disclosed in my copending applications, Serial Nos. 296,006 and 296,007, filed July 28, 1928, will be fully understood from the following description and the drawings which illustrate the operation of my process.

In the drawings, Fig. 1 is a semi-diagrammatic view in section showing a gas well, a casing, and the related apparatus both below and above ground by which my process is operated.

Fig. 2 is an enlargement of the means for adjusting the expansion nozzle.

It is well known that gas and oil will decline in production as time goes on and it is necessary to apply vacuum to the casinghead to remove the gas, which is compressed to atmospheric pressure or higher for extraction of casinghead gasoline. Heretofore, it has been impractical to obtain a vacuum of more than about 28 inches of mercury on the casinghead which corresponds to approximately two inches of mercury, absolute pressure. It will be readily understood that the pressure on the gas or oil sands is considerably higher than that at the casinghead due to the frictional losses in flowing up the casing.

It is customary to abandon gas wells after the vacuum at the casinghead has reached about 27 inches of mercury, due to the decline in the quantity of gas and gasoline although the gasoline content of the gas may have increased measurably. In my present invention, I have succeeded in greatly reducing the absolute pressure on the producing sands and thereby greatly increasing the production of gas and gas condensate.

Referring to the drawings, Fig. 1, the ground level is indicated at A and a gas well is shown in a semi-diagrammatic section broken so as to show both the upper and lower ends. The lower end of the casing penetrates the gas or oil sand which is indicated by B. Reference character 1 designates the well casing which may be similar to those in general use but care should be taken to make the joints tight and it is advantageous to use as large a size as is available to reduce frictional losses.

The upper end of the casing is closed by casinghead 2 which is fitted with an exit duct 3, which may be directly connected with a vacuum pump 4 but which preferably leads to a heating chamber 5 and thence by line 6 communicates with the vacuum pump. Chamber 5 may be heated in any satisfactory manner as by a steam jacket and the vacuum pump 4 discharges into a gasoline recovering system (not shown) of any satisfactory type.

A pipe 7 comprises a working barrel for a pump for removing liquid from the well. The upper end of pipe 7 extends through the casinghead 2 down to the bottom of the casing.

A branch pipe 8 is provided to carry off the liquid pumped up, as will be described, and conducts the liquid to storage (not shown). Sucker rod 9 is located within pipe 7 and extending out at the top is fastened to an arm 10 of a walking beam which is not completely shown. It will be understood that power for pumping is transmitted to the walking beam and thence to the sucker rod which is packed at 11.

In the lower end of pipe 7, a foot valve 12 is placed and may be of any preferred type, such as a ball valve which is shown. A plunger or piston 13 fastened to the sucker rod is packed at 14 in the ordinary manner and is fitted with an exit valve 15 which may be a ball valve similar to 12. It will be understood that alternate up and down strokes of the sucker rod and piston effect a pumping of liquid from the well to the ground surface.

A second pipe 16 is placed within the casing 1 and extends preferably to the bottom where it is closed off by a plug 17 which is fitted with a conical projection 18, Pipe 16 extends through the casinghead 2 and is provided with a branch pipe 19 which communicates with a compressor 20, cooler 21 and

by pipe 22 with a line 23. Line 23 is placed within pipe 16 and extends to the bottom where it is flared out at 18*a* to fit over projection 18, forming with the projection an annular nozzle. Pipe 23 passes through a plug 24 which closes the upper end of pipe 16, and the outside of pipe 23 is formed with right hand threads corresponding to similar right hand threads on the plug 24 at 25, best shown in Figure 2. Connection of pipes 22 and 23 is preferably made by providing the outside of pipe 23 with left hand threads and the inner surface of a portion of pipe 22 with corresponding threads at 26. Hand wheel 27 is fastened rigidly to pipe 23 so that by rotating the wheel the opening of the nozzle 18*a* may be suitably regulated. Spacers 28 may be placed in pipe 16 to guide the pipe 23 and to keep it properly centered. The spacers are pierced with holes 29 to provide passage of gas through tube 16.

In the operation of my process, positive chilling of the gases in the well is effected by a readily liquefiable gas such as propane which is circulated through the system, comprising tubes 23 and 16, line 19, compressor 20 and cooler 21. While I prefer the use of propane or ethane, other common gases used for refrigeration such as CO_2, SO_2 and ammonia may be used. The annular nozzle formed by pipe 23 and projection 18 is readily adjustable and allows the expansion of highly compressed liquefied gas from 23 into the outer pipe 16. The cooling effect due to the expansion chills the gas in the casing 1 and produces a condensate which may be pumped from the well by the plunger or deep well pump, as is the practice with pumping oil wells. In this manner a relatively large quantity of condensate may be formed and only the residual gas need be passed up the casing. In consequence, the frictional drop in pressure will be greatly reduced and a much lower pressure can be maintained on the sands.

It will be readily noted that when vacuum on the sand is above say 26 inches, an increase of vacuum of one inch or half an inch or even less is large in comparison with the absolute pressure and that within this range, a change of an inch is equivalent in its effect to a much greater pressure change at higher absolute pressures.

By the use of my process, I have been able to produce vacuum on the sands of gas and oil wells which have never before been attained and production may be considerably increased. I contemplate the use of vaccua at the base of wells in excess of 28″ of mercury and as high as 29 or 29.5″. The use of my process is not limited to high vaccua but it finds particular application in operation under high vaccua, as has been described.

The cooling medium is preferably admitted to pipe 23 under pressure of 100–500 pounds per square inch and temperature in the well may be reduced by 50 to 100° F. or more. It will be understood that the greatest possible quantity of cooling medium is recirculated commensurate with cost.

If desired a refrigeration chamber and a drum for the removal of condensate may be placed in line 3 before the heater 5 or in fact any suitable means may be used for increasing the difference between the temperature of the gas mixture and that at which incipient condensation takes place as disclosed in my co-pending application Serial No. 296,007 above mentioned.

My process is applicable to use with oil wells or gas wells and is particularly advantageous for wells in which the pressure is low.

My invention is not to be limited by any theory of the mechanism of the process nor by any example given merely by way of illustration. My invention is to be limited only by the following claims in which I wish to claim all novelty inherent in the process.

I claim:

1. The method of obtaining natural gas from a well, which comprises introducing a refrigerating agent into a well to cool the gases in the lower portion of the well to condense the vapors therein, and withdrawing the residual gases by suction.

2. An improved process for obtaining natural gas and oil from wells under reduced pressure, comprising chilling the gas in the lower portion of the well by expansion of a highly compressed fluid out of contact with the contents of the well, collecting condensate formed thereby and pumping it from the well, and withdrawing residual gas from the well and compressing it to atmospheric pressure.

WARREN K. LEWIS.