June 25, 1940. R. A. WILSON 2,205,739

GAS RELEASE VALVE FOR WELLS

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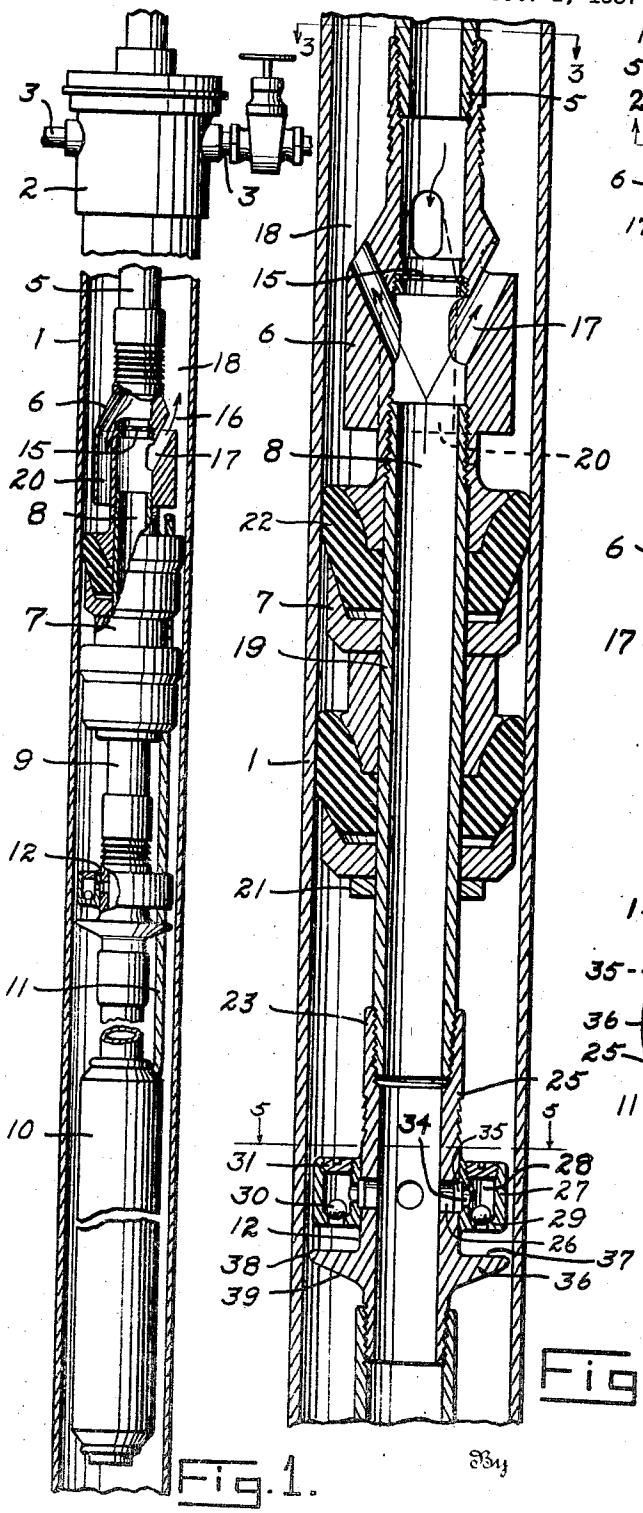


Fig. 1.

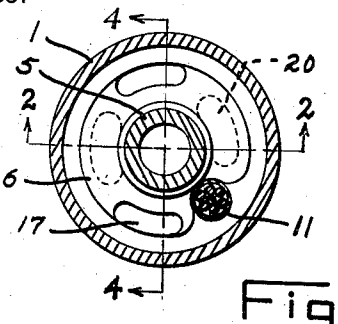


Fig. 3.

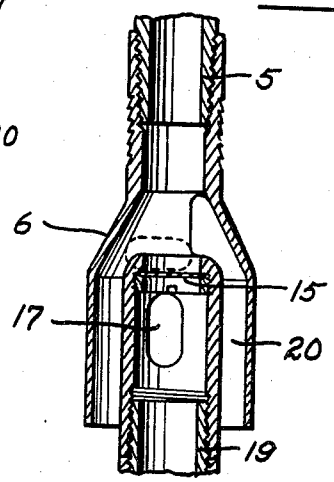


Fig. 4.

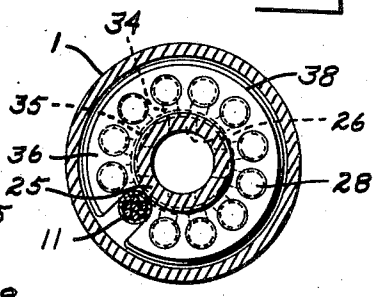


Fig. 5.

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GAS RELEASE VALVE FOR WELLS

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Application October 1, 1937, Serial No. 166,839

4 Claims. (Cl. 166—2)

The invention relates to well producing equipment and comprises a continuation-in-part of my copending application, Serial No. 112,444, filed November 24, 1936, for Gas flow packer.

In certain oil producing areas formation pressures are insufficient to effect natural flowing of wells and the height through which the oil must be lifted is too great for practical and efficient production by air lift or mechanical pumping. To remove oil from wells in such areas a cheaper and more efficient system, as hereinafter disclosed, has been devised, such system including a stage lift comprising the combination of a submerged centrifugal pump and a gas lift, the latter being effective above a packer in the well at such a level that the pump and air lift will operate at maximum efficiency.

With the removal of large quantities of oil where this system of production is used, gas is released below a packer and builds up a pressure on the producing formation which retards flow from the formation and which will eventually lower the fluid level until gas lock of the pump mechanism occurs. When this condition occurs it is necessary to remove the unit from the well unless provision is made to relieve the gas pressure below the packer. When the unit is removed for this purpose, or for the purpose of making any repair thereto, the pressure below the packer is not released until the instant the packer is withdrawn from the bore hole. At such time material amounts of oil are sprayed for a considerable distance from the well, thus creating a fire hazard, as well as other obvious disadvantages.

It is the primary object of the invention to provide a construction which eliminates vapor or gas lock in a pumping system of the class described.

An important object is to provide a construction which obviates the spraying of oil as above described when removing the pumping unit from the well.

Another object is to provide a pumping system of the class described in which a gas release valve releases into the flow line any gas pressure which has built up below the packer within the well.

Still another object is to provide a release valve assembly that will not become clogged from paraffin or other obstructing material which has accumulated in the well bore.

With the foregoing objects as primary objects the invention has particular reference to mechanism which will be manifest from the following description taken in connection with the drawing disclosing a preferred embodiment and in which:

Fig. 1 is a vertical elevation showing the device of the present invention in a well, certain parts being shown in section.

Fig. 2 is a detail sectional view taken on the line 2—2 of Fig. 3 and showing the construction of the packer and gas release valve of the invention and their relative positions within a well.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a sectional plan view taken on the line 5—5 of Fig. 2.

Referring particularly to Fig. 1, a well casing 1 is shown as provided with a casing head 2 having outlets 3 for conducting the flow of liquid from the well. Within the casing 1 is a tubing string 5 connected to a stage connector 6 which has been described and claimed in the above mentioned copending application. A packer assembly 7 is connected to the stage connector 6 and has a central bore 8 which is continuous through a flow line 9, which extends downwardly from the packer 7 to a submergible pump unit generally designated as 10 and which is preferably electrically driven by energy delivered thereto through an electric cable 11 which passes downwardly within the casing 1. As gas may be released within the casing 1 below the packer 7 whereby a pressure is built up against the producing formation and forcing the liquid level downwardly about the pump 10 to thereby cause a gas lock, a gas release valve generally designated as 12 is provided in the flow line 9 below the packer 7.

In the device thus generally described the submergible pump unit 10 forces the submerging liquid upwardly within the flow line 9 to the stage connector 6 in which a barrier 15 is placed in the central bore 8 of the flow line. The pumped fluid is hence forced outwardly as shown by the arrow 16 through passages 17 in the stage connector and into the annular space 18 within the casing 1 and above the packer 7. The stage connector 6 is also provided with downwardly extending passages 20 from above the barrier 15 and an aerating fluid is forced downwardly through the tubing 5 and through these passages whereby it is exhausted into the annular space 18 at a point below that at which the pump fluid is exhausted into this annular space. This feature is most clearly shown and is believed apparent by reference to Figs. 2 to 4.

The packer 7 comprises a mandrel 19 which is attached to the lower end of the stage connector 6 and has an outwardly extending shoulder 21 which is suitably affixed thereto or may be made integral with the mandrel 20 whereby the packing cups 22 and their associated spacing or retaining elements are supported in desired relative position. The lower end of the mandrel 20 is provided with threads 23 for engagement with complementary threads on the gas release valve 12 which will now be described.

The gas release valve assembly 12 comprises the body 25 which is threaded at both ends for connection in the flow line 9 to provide a continuous passage through the flow line. Intermediate its ends the body 25 is provided with radial openings 26 and surrounding the body in the plane of these openings is an annular ring 27, which is secured to the body 25 as by welding. Alternatively, it is obvious that the ring 27 may be made integral with the body 25.

The ring 27 is provided with a plurality of longitudinal counter-bored openings 28. The lower ends of these openings are beveled at 29 to serve as a seat for a ball valve member 30 placed therein prior to closure of the counterbores, as by threaded caps 31. The inner cylindrical surface of the ring 27 has an annular groove 35 and radial passages 34 leading from this groove to the respective counter-bored openings 28. From this construction it is apparent that the respective valves open inwardly to permit the passage of fluid into the central passage or bore 8 of the body 25 whenever the external pressure exceeds the internal pressure.

Below the ring 27 the body 25 is provided with an annular radial skirt 36 which has a radially extending upper face 37, a rounded peripheral edge 38 and a tapered lower face 39. Paraffin accumulates on the walls of the wells and when the unit above described is lowered into the well this paraffin balls up ahead of the packer and may also be scraped from the walls of the well by the radial ring portion 27 of the gas release valve 12 when the unit is lowered to its operating position. The skirt 36 serves as a radial protector flange to prevent paraffin from entering the valve openings in the release valve 12 and hence prevents the clogging of the release valve as the unit is lowered into the well.

As previously explained, fluid submerging the pump unit 10 in a well is pumped upwardly by means of the pump and is exhausted through passages 17 of the stage connector 6 into the casing 1 above the packer 7. The column of fluid is then aerated by means of a gaseous fluid forced downwardly through a tubing string 5 and in this manner a large volume of fluid is easily lifted to the surface and discharged through the flow line 3. If, however, a gas pressure builds up below the packer 7 such pressure forces the fluid level downwardly and gas locking of the pump 10 results. When this condition exists the unit may be shut down and when the pressure in the flow line becomes less than the pressure in the annular space below the packer 7, the release valve 12 permits relase of the pressure below the packer until the internal and external pressures are equalized and in this manner the principal object of the invention is attained.

On the other hand, a unit of the class described may be provided with means for shutting down the unit at predetermined intervals whereby the undesirable gas pressure will be released automatically and gas lock of the pump unit will at all times be avoided.

It is to be understood that the invention is not limited to the specific construction and use above described but comprehends other embodiments and uses which will readily occur to persons skilled in the art. The invention is therefore limited only as indicated by the scope of the appended claims as viewed in the light of the foregoing disclosure and the prior art.

What is claimed as new is:

1. In a flow line provided with a surrounding packer, gas release means below the packer, said means comprising a plurality of valves opening inwardly to the interior of the flow line, and an outwardly extending skirt below said valves to deflect clogging material from the valves.

2. A gas release valve comprising a body threaded at its ends for connection in a tubing string, valve means on said body for admitting fluid to the interior of said body, and an annular skirt extending outwardly from the body adjacent said valve means to deflect clogging material from the valves.

3. A gas release assembly comprising a tubular body portion having an outwardly extending skirt thereon, openings in said body above the skirt, a hollow annular flange about the body in the plane of said openings, there being passages from the interior of said flange to said openings, and valved openings in the flange adjacent said skirt.

4. In a flow line provided with a surrounding packer, a gas release valve comprising a body connected in the flow line below the packer, said body having an axial bore continuous with the bore of the flow line, passages from the exterior to the interior of said body, valve means operable to open the passages inwardly when pressure on the exterior of the body exceeds that on the interior, and an annular outwardly extending skirt about the body and adjacent said valve means to deflect clogging material from said means.

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