Oct. 25, 1960 C. LOWERY 2,957,491

COMBINED RESERVOIR AND CHEMICAL MIXER

Filed Dec. 10, 1956

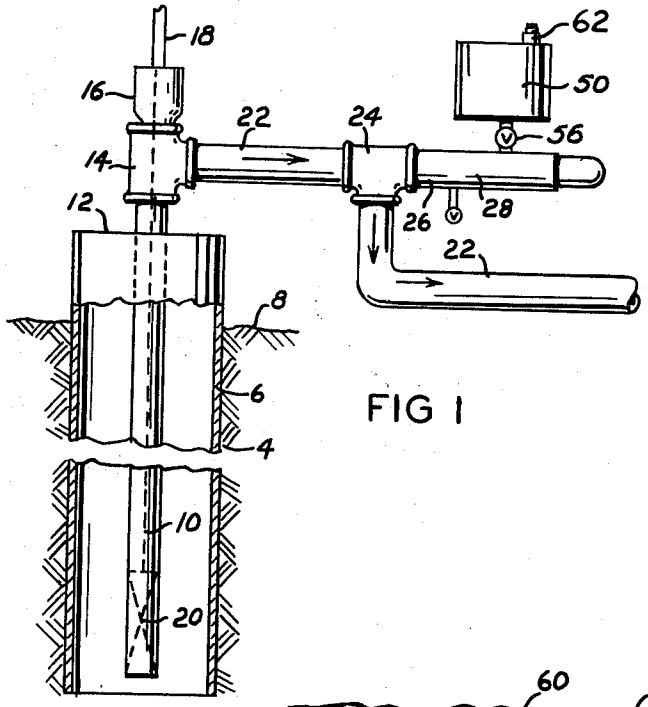


FIG 1

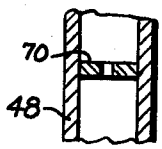


FIG 3

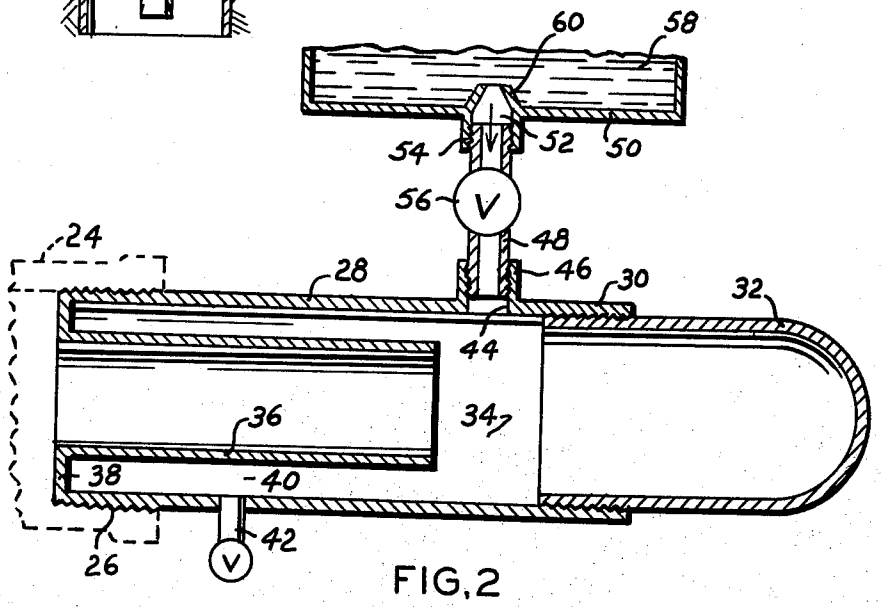


FIG. 2

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COMBINED RESERVOIR AND CHEMICAL MIXER

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4 Claims. (Cl. 137—206)

This invention relates to improvements in systems of producing oil wells, and more particularly, but not by way of limitation, to a system for minimizing the emulsion of oil and water in the fluids produced from an oil well.

As it is well known in the art, most oil wells produce a combination of oil, water and gas, with a large proportion of the oil and water being in the form of an emulsion. The water component of the well fluids is normally considered a useless product, and it is highly desirable to remove the water prior to storage and further processing of the oil. It is also well known in the art that the great majority of oil wells requiring an artificial lifting system are pumped by means of a reciprocating sucker rod type pump. This type of pumping mechanism tends to thoroughly mix the oil and water flowing into the well bore from the various producing strata, and inhances the emulsification of the oil and water.

In view of the above described problem, it is common practice to inject a suitable emulsion breaker into the well fluids in the vicinity of the well head to facilitate separation of the oil and water at a remotely located oil and water separating apparatus. At the present time the emulsion breaker is usually injected into the flow line by means of a small gear pump (or sometimes a reciprocating pump) actuated by the surface power unit which operates the well pump. The injection pump is usually positioned on the ground in front of the surface power unit and is operated by a rod or wire extending downwardly to the pump from the walking beam of the surface power unit. These injection pumps ordinarily have a limited reservoir for containing a supply of the emulsion breaker, and they frequently get out of order due to their constant operation and inherently delicate structure; thereby requiring frequent servicing and repair.

The present invention contemplates a novel system of producing oil wells wherein an emulsion breaker is periodically, or intermittently, injected into the well fluids adjacent the well without the use of an apparatus having moving parts. I contemplate connecting a surge chamber to the flow line leading from an oil well in such a manner that the well fluids surge into the chamber when the fluids are forced through the flow line, and the fluid in the surge chamber is discharged back into the flow line when the flow of fluid through the flow line decreases. The surging action of the well fluids in the flow line and the surge chamber is utilized to inject controlled quantities of emulsion breaker into the surge chamber. The injected emulsion breaker mixes with the well fluids and facilitates greater separation of the oil and water components of the well fluids.

An important object of this invention is to provide an economic system for injecting an emulsion breaker into fluids produced by an oil well.

Another object of this invention is to provide an intermittent injection of emulsion breaker into fluids produced by an oil well without the use of moving mechanical parts.

A further object of this invention is to provide an apparatus for injecting emulsion breaker into produced well fluids, which apparatus requires a minimum of attention by operating personnel.

A still further object of this invention is to facilitate the separation of the oil and water components of well fluids produced from oil wells.

Other objects and advantages of the invention will be evident from the following detailed description, when read in conjunction with the accompanying drawings, which illustrate my invention.

In the drawings:

Figure 1 is a schematic sectional view through an oil well illustrating the connection of my novel injection apparatus into the well installation.

Figure 2 is a vertical sectional view through the emulsion breaker injection apparatus.

Figure 3 is a sectional view through a modified portion of the injection apparatus.

Referring to the drawings in detail, and particularly Fig. 1, reference character 4 designates a well bore having the usual well casing 6 extending therethrough from above the surface 8 to the bottom of the well bore. A well tubing 10 is suspended in the casing 6 from the upper end 12 thereof by any suitable means (not shown) and extends into the lower portion of the well bore 4. For purposes of illustration, I have shown a T 14 secured to the upper end of the well tubing 10 above the upper end 12 of the casing 6. The upper end of the T 14 receives the usual stuffing box 16 surrounding the polished rod 18 of the surface power unit (not shown). The polished rod 18 has a series of sucker rods (not shown) secured in tandem relation to the lower end thereof and extending through the well tubing 10. A sucker rod pump, schematically shown at 20, is secured in the lower end of the well tubing 10 to receive and be actuated by the sucker rods extending downwardly through the tubing 10 from the polished rod 18.

The remaining outlet of the T 14 extends in a horizontal direction to receive one end of the flow line 22 which leads to a remotely located oil and water separator (not shown). A T connector 24 is interposed in a horizontally extending portion of the flow line 22, preferably adjacent the well 4. The T 24 is arranged in such a manner that the upstream portion of the flow line 22 is secured to one horizontally extending outlet of the T, and the adjacent, or downstream, portion of the flow line 22 connects to a lower outlet of the T 24. The remaining horizontally extending outlet of the T receives one end 26 of a tubular shaped housing 28.

Referring now to Fig. 2, it will be observed that the end 26 of the housing 28 is open and is externally threaded for connection with the respective outlet of the T 24. The opposite end 30 of the housing 28 is internally threaded to receive a bull plug 32, which bull plug closes off the end 30 of the housing. Thus, the housing 28 provides a surge chamber 34 to receive well fluids flowing through the flow line 22, as will be more fully hereinafter set forth. A tubular shaped baffle 36 is secured to the open end 26 of the housing 28 by means of a ring 38 and extends inwardly to approximately the center of the housing 28. The tubular baffle 36 is of a smaller diameter than the housing 28 to provide an anular shaped chamber 40 between the outer periphery

of the tube 36 and the inner periphery of the housing 28, for purposes which will be hereinafter set forth. A suitable valved drain connection 42 is secured to the lower portion of the housing 28 to drain the housing of its contents when desired.

An aperture or bore 44 is provided through the crown of the housing 28 between the adjacent ends of the tubular baffle 36 and bull plug 32. An internally threaded boss or coupling 46 extends upwardly from the housing 28 around the aperture 44. The boss 46 receives the lower end of a conduit 48 which depends from a reservoir 50. An aperture 52 is provided in the lower end of the reservoir 50, and a boss 54 extends downwardly from the bottom of the reservoir around the aperture 52 to threadedly receive the upper end of the conduit 48. If desired, the conduit 48 may serve as the sole support of the reservoir 50 on the housing 28. A valve 56, preferably of the needle valve type, is interposed in the conduit 48 to control the size of the passageway through the conduit 48, as will more fully hereinafter be set forth.

The reservoir 50 may be of any desired size and is utilized to contain a supply of emulsion breaker 58. The emulsion breaker 58 may be any of the commercially available types. A conical shaped baffle 60 is provided in the lower portion of the reservoir 50 in a position to surround the aperture 52 and prevent the entrance of sediment, such as dirt and the like, into the conduit 48 and the needle valve 56. Also, as shown in Fig. 1, a plugged inlet 62 is provided in the top of the reservoir 50. Thus, the reservoir 50 may be closed air-tight when the reservoir is partly filled with the emulsion breaker 58.

Operation

In the normal operation of the well installation, the polished rod 18 is reciprocated up and down by a surface power unit to operate the sucker rod pump 20 in the lower end of the well tubing 10. Well fluids, usually consisting of oil, water and gas, collect in the lower portion of the casing 6, are picked up by the pump 20 and forced upwardly through the well tubing 10 into and through the flow line 22. The sucker rod pump 20, being a reciprocating type pump, pumps the well fluids through the tubing 10 and the flow line 22 in an intermittent, surging fashion, whereby the pressure of the fluid is alterenately increased and decreased.

As the pressure of the well fluids is increased, a portion of the fluids are forced into the surge chamber 34 of the housing 28. And, when the pressure in the flow line 22 is decreased, the well fluids will flow out of the surge chamber 34 back into the flow line 22, since the air previously in the surge chamber 34 will then expand and expel the well fluids from the surge chamber. As previously noted, the well fluids will always contain a gaseous component, at least a portion of which is easily separated from the remainder of the well fluids. Thus, when well fluids are forced into the surge chamber 34, a portion of the gas will be separated and will tend to force its way upwardly through the conduit 48 and the needle valve 56 into the reservoir 50. Also, this gas joins with the air in the surge chamber 34 to facilitate a discharge of the well fluids back into the flow line when the pressure of the flow line is decreased.

Assuming that the needle valve 56 is partially opened, a portion of the gas in the surge chamber 34 (upon an increase in pressure in the flow line 22) will be forced through the conduit 48 and bubble up through the emulsion breaker 58 to provide a pressure on the top of the emulsion breaker. When the well fluids are next discharged from the surge chamber 34 and the pressure in the surge chamber is decreased, a portion of the emulsion breaker 58 will drain through the conduit 48 and the needle valve 56 into the surge chamber 34. When well fluids are again forced into the surge chamber, they will be mixed with the injected emulsion breaker and the emulsion breaker will remain with the well fluids when they are again discharged into the flow line.

It will be apparent that the degree of opening of the needle valve 56, in combination with the hydrostatic head of the emulsion breaker 58, will determine the amount of emulsion breaker injected into the surge chamber each time the pressure is decreased in the surge chamber. Thus, the amount of emulsion breaker injected into the flow line 22 may be easily controlled to provide the desired amount of emulsion breaker in the well fluids.

In addition to the direct injection of emulsion breaker into the well fluids, I provide the baffle 36 to facilitate the mixing of the emulsion breaker with the fluids and to retain a small portion of emulsion breaker in the surge chamber 34 in the event the reservoir 50 becomes depleted. As will be apparent, a portion of the well fluid entering the surge chamber 34 will be trapped in the annular space 40 below the bottom of the tubular baffle 36 and will not be permitted to flow back into the flow line 22. Each time the well fluids surge into the chamber 34, they will mix with the fluids trapped in the annular space 40 and pick up a portion of the emulsion breaker mixed with the trapped fluids. Thus, a small portion of emulsion breaker will be available and mixed with the well fluids for a substantial length of time after the reservoir 50 has been depleted. The reservoir 50 may be constructed any desired size, but in normal operation, the reservoir will sometimes be depleted through inattention of the personnel supervising operation of the well installation.

In lieu of the needle valve 56, I may use an orifice plate 70 as shown in Fig. 3. The plate 70 may be suitably secured in the conduit 48 to limit the flow of emulsion breaker 58 into the surge chamber 34. However, I prefer to use the needle valve 56, since greater adaptability may be had thereby.

From the foregoing it will be apparent that the present invention provides an economical system for the injection of emulsion breaker into fluids produced by an oil well. The necessary apparatus involves no moving parts which will be subject to wear during use. The minimum of attention is required for operation of the system, and the required emulsion breaker will be efficiently mixed with the well fluids.

Changes may be made in the combination and arrangement of parts or elements shown in the drawings and described in the specification without departing from the spirit and scope of the invention as set forth in the following claims.

I claim:

1. In a system of operating an oil well wherein the liquid and gaseous well fluids are discharged from the well in an intermittent, surging flow, the improvement which comprises: a flow line to receive the discharging well fluids, said flow line having a horizontally extending portion and a portion extending downward from one end of the horizontal portion, a housing connected to the flow line at the intersection of the horizontal and downwardly extending portions to form a surge chamber for the well fluids, an air tight container supported above said housing, a supply of emulsion breaker in the container only partly filling the container, a single conduit connecting the bottom of the container to an intermediate portion of the top of the housing, and a single restriction in said conduit providing continuous, but limited communication between said container and said housing to limit the flow of emulsion breaker into said surge chamber.

2. A system as defined in claim 1 characterized further in that said housing is tubular and is secured in a horizontal direction, said housing having a closed end and an open end, and a tubular baffle having a smaller diameter than said housing is secured around the open end of said housing in a direction to extend concentrically

into said housing and retain a portion of the well fluids in said housing upon a decrease of flow in the flow line.

3. A system as defined in claim 1 characterized further in that said restriction comprises a manually adjustable valve.

4. A system as defined in claim 1 characterized further in that said restriction comprises an orifice plate.

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