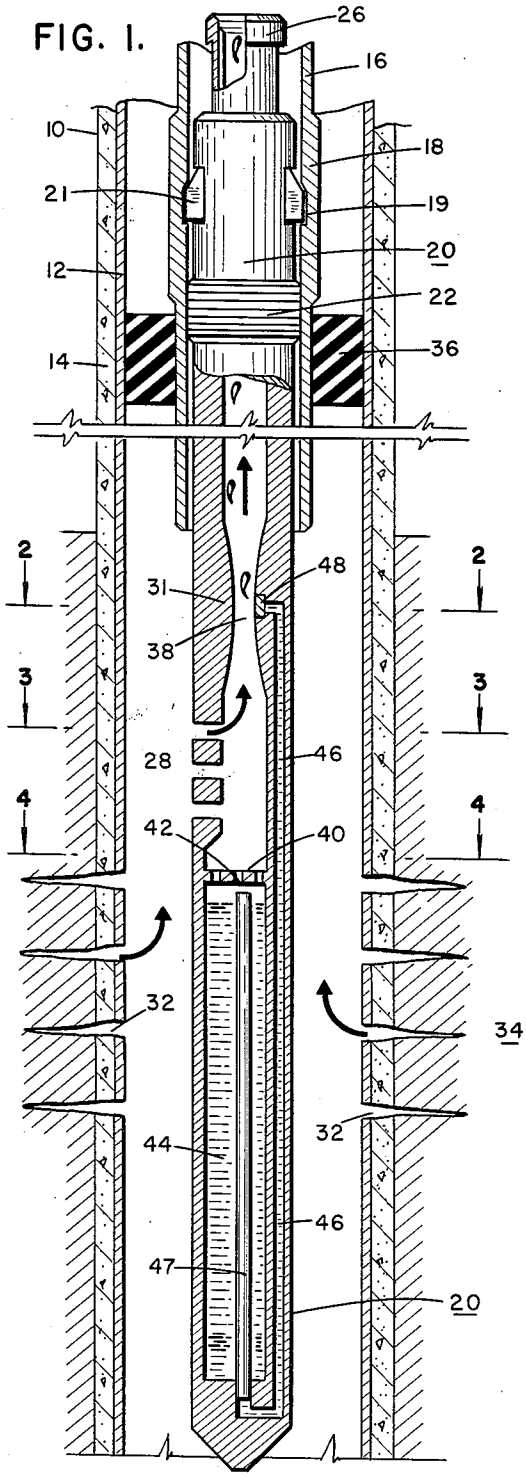
Sept. 24, 1963 L. H. ROBINSON, JR., ETAL 3,104,715

TREATING LIQUID DEVICE FOR GAS WELL

Filed Aug. 10, 1960

FIG. 1.



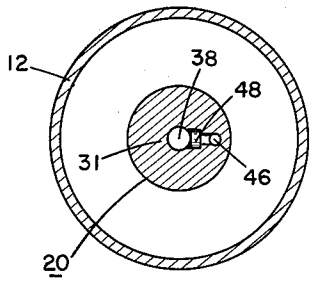


FIG. 2.

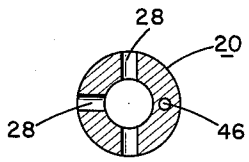


FIG. 3.

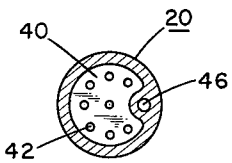


FIG. 4.

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TREATING LIQUID DEVICE FOR GAS WELLS

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6 Claims. (Cl. 166—162)

This invention relates to gas producing wells. More particularly, this invention is an improved device for ejecting treating liquids, such as a corrosion inhibitor, at a point in the gas producing well to protect the subsurface equipment.

For various reasons, it is often necessary to inject a treating liquid into a subsurface well. For example, the tubing and casing in a subsurface well are subject to corrosion. Therefore, it is desirable to protect the tubing and casing from the effects of corrosion by lining the tubing and casing with corrosion inhibitor. This invention is a device for ejecting treating liquids for treating subsurface borehole equipment in a gas producing well. The rate of injection of the treating liquid is controlled to provide continuous treatment for a long period of time.

The invention as well as its many advantages will be further understood by reference to the following detailed description and drawing in which:

FIG. 1 is a sectional elevational view showing the device used with permanent well type completion subsurface equipment;

FIG. 2 is a view taken along lines 2—2 of FIG. 1; and

FIG. 3 is a cross-sectional view taken along lines 3—3 of FIG. 1.

FIG. 4 is a cross-sectional view taken along the lines 4—4 of FIG. 1.

Referring particularly to FIG. 1, a borehole **10** is shown. The usual casing **12** is cemented to the sides of the borehole **10** by the usual cement **14**.

A production tubing **16** extends from the earth's surface and terminates at a point above the bottom of the borehole **10**.

A landing nipple **18** having recesses **19** is provided adjacent the lower end of the production tubing **16**. The recesses **19** are adapted to receive locking dogs **21** on extension tubing **20**. A packer **22** is mounted about the extension tubing **20** below locking dogs **21**. The extension tubing **20** may be lowered into position from the earth's surface by means of a wire-line tool (not shown) which would be connected to the fishing neck **26**.

The tubing extension **20** is provided with a plurality of gas inlet ports **28**. Perforations **32** have been made to extend through the casing **12** and cement **14** and into the gas producing formation **34**. A large packer **36** is mounted on the production tubing **16** and in the annulus between the production tubing **16** and the casing **12**. Packer **36** isolates the pressure from the formation **34**. Thus, gas produced from formation **34** will flow through perforations **32**, into gas inlet ports **28**, up through and out the upper end of tubing extension **20**, and up the production tubing **16** to the earth's surface.

The portion of the tubing extension **20** located above the ports **28** is provided with an annular protrusion **31** to provide a constriction **38** in the flow path of the gas. A transverse member **40** having holes **42** formed therein is provided across the tubing extension **20** and below the gas inlet ports **28**. Thus, a container or reservoir **44** is provided in the lower part of the tubing extension **20**. The treating liquid, such as corrosion inhibitor, is located in the reservoir **44**.

A passage **46** extends from the bottom of the reservoir **44** upwardly past the transverse member **40** and into the protrusion **31**. The extreme bottom of the passage **46** is

J-shaped. A continuation of passage **46** is formed by tube **47**. Tube **47** may extend upward through the reservoir **44** and is made of an oil-wet, liquid permeable member. This prevents the entrance of any produced water into the tube **47**.

A liquid permeable member **48** is positioned at the outlet of the passage **46**. The liquid permeable member **48** may be made of various types of liquid permeable material, such as sintered metals (e.g., stainless steel, copper, brass, aluminum, etc.), sintered ceramics, or sintered plastics. Preferably, the liquid permeable member **48** is made oil-wet. The oil-wet characteristic of the member **48** will prevent gas from flowing into the liquid permeable member **48**. The entrance of gas into liquid permeable member **48** would increase the resistance to the flow of the corrosion inhibitor into the tubing **20**. The member **48** may be made oil-wet by materials such as surface active agents, e.g., high molecular weight quaternary ammonium salts, fatty acid derivatives, or crude oils.

In operation, the tubing extension **20** is lowered into the borehole **10** and seated in the landing nipple **18** of production tubing **16**. The gas from gas producing formation **34** will flow through inlets **28** and through the constriction **38** and out the upper end of extension **20** up to the earth's surface. The constriction **38** causes the gas to increase in velocity as it flows through the constriction. This causes a lower pressure at the constriction when compared to the pressure on each side of the constriction. Thus, the pressure present in the reservoir **44** is greater than the pressure at the constriction **38**. Corrosion inhibitor will therefore flow out of the reservoir **44**, upwardly in the passage **46**, through the liquid permeable member **48**, and into the tubing extension **20** and production tubing **16** to protect the tubing **16** from corrosion.

The reservoir **44** may be made up of a plurality of tubular members connected together. This will provide a corrosion inhibitor reservoir of high capacity. Also, the rate of flow of corrosion inhibitor through liquid permeable member **48** is very small. Thus, because of the large capacity of reservoir **44** and the low rate of flow of liquid through permeable member **48**, the corrosion inhibitor is continuously applied for a long period of time to treat the subsurface equipment.

We claim:

1. A subsurface device for ejecting treating liquids for treating subsurface borehole equipment in a gas producing well comprising: a tubular member having at least one formation gas inlet port formed therein and a portion thereof shaped to provide a constriction in the flow path of the gas to thereby cause a lower pressure in the flow path of the gas at said constriction than the higher pressure elsewhere in the flow path of the gas; a packer mounted on the tubular member above the gas inlet port; a treating liquid reservoir; at least one passageway directly exposing the treating liquid reservoir to the pressure of the gas flowing through the gas inlet port; and a treating liquid conduit leading from the reservoir to the constriction and having an outlet into the flow path of the gas.

2. A subsurface device in accordance with claim 1 wherein a liquid permeable member is positioned in the outlet of the treating liquid conduit.

3. A subsurface device in accordance with claim 2 wherein the liquid permeable member is oil-wet.

4. A subsurface device for ejecting treating liquids for treating subsurface borehole equipment in a gas producing well comprising: a tubular member having at least one formation gas inlet port formed therein and a portion thereof shaped to provide a constriction in the flow path of the gas to thereby cause a lower pressure in the flow path of the gas at said constriction than the higher pressure elsewhere in the flow path of the gas; a packer

mounted on the tubular member above the gas inlet port; a treating liquid reservoir in the tubular member and below the formation gas inlet port; at least one passageway directly exposing the treating liquid reservoir to the pressure of the gas flowing through the gas inlet port; and a treating liquid conduit leading from the reservoir to the constriction and having an outlet into the flow path of the gas.

5. A subsurface device in accordance with claim 4 wherein a liquid permeable member is positioned in the outlet of the treating liquid conduit.

6. A subsurface device in accordance with claim 5 wherein the liquid permeable member is oil-wet.

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