Patented Nov. 28, 1950 2,531,829

UNITED STATES PATENT OFFICE

2,531,829

INHIBITION OF OIL WELL CORROSION

John L. Seymour, New Rochelle, N. Y.

No Drawing. Application January 31, 1948, Serial No. 5,685

13 Claims. (Cl. 252—8.5)

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This invention relates to the control of oil and gas well corrosion. Many oil wells are also gas wells. It is a frequent practice to recompress the well gas and force it down the casing. It has been discovered that the metallic parts of wells are subject to sporadic or continuous attacks which may destroy the well in a very short time, for instance, within three months. Consequently it has been assumed that pressure has been a material factor in the corrosion problem, but corrosion has also been observed in cases where excessive pressures are lacking and even in wells having no appreciable output of gas. It can be generally stated that while some types of corrosion have been catalogued or classified, the basic reasons for corrosion have not generally been understood. A good discussion of the problem is found in an article on "High Pressure Production Equipment Corrosion," by Thomas S. Bacon, of Dallas, Texas, which was presented at the spring meeting of the Southwest District of the American Petroleum Institute at Dallas, in 1944, and possibly published in certain newspapers at about that time. This case is a continuation in part of my application Serial No. 658,873, filed April 1, 1946 (now abandoned).

The destruction of a well results in great loss to the well owners and to the country. Even when wells can be salvaged by reborings, the cost is excessive and frequently prohibitive.

Attempts have been made to solve the problem by the use of special alloy steels and by putting various chemicals down the casing, but all proposals heretofore made have failed or have been accompanied by disadvantages about equal to those they were supposed to overcome.

It is an object of this invention to reduce the corrosion of gas well and oil well equipment, particularly that which is subjected to the action of natural or well gas under compression. The natural gas found in wells and pipelines and other oil and gas equipment include gases such as H_2S, CO_2, the volatile fractions from crude oil, and the combustible hydrocarbonaceous mixtures that are customarily called "natural gas" when a person is thinking in terms of industrial or home heat. The particular object of the invention is to reduce the corrosion of oil well and gas well equipment. The objects of the invention are accomplished, generally speaking, by treating the well continuously or occasionally with ethylene oxide.

Ethylene oxide is a gas and can be mingled with the gases returned to the well, when a return is employed. The frequency of use, and the

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concentration to be employed in use, will depend upon the rate of corrosion observed in a particular field or in a particular well and may vary from a minute decimal of 1% to 100%. Some fields show no corrosion. Others show corrosion of great rapidity which, although sporadic as to particular wells, is relatively uniform in its occurrence throughout the whole field. In wells or fields which show no evidence of corrosion, it is unnecessary to use ethylene oxide. When corrosion proceeds at a slow rate, it is possible to overcome it by occasional drenchings of low concentrations of ethylene oxide or by including in the returned gases a small percentage of ethylene oxide. The ethylene oxide can be added to the gases before the compressor, in the compressor, or after the compressor, although it is generally easier to add it before the compressor. This gives the ethylene oxide a chance to react with and neutralize corrosives before they have had an opportunity to attack the vital parts of the well. The concentration of ethylene oxide to be used should be regulated according to the problem which is to be solved, modified by the cost factor. In some cases where corrosion has already been observed, a very high concentration of ethylene oxide may be included, in the returning gas, even as high as 50 to 75%, or higher, until the well casing has been filled with the ethylene oxide mixture, whereupon the compressors may be turned off for a period of time to allow the ethylene oxide to react with and neutralize the corrosives that are attacking the apparatus parts. Thereafter, occasional drenchings with lesser percentages may be employed.

In a particular field operation the well treated had been drilled by cable tools and produced high gravity crude and a well gas analyzing 95–97% CO_2. The gas issued at a rate of 5 to 11 million cubic feet per day. About 4 to 6 barrels of water per day issued from the well. Caliper surveys indicated that the worst corrosion was occurring at about 2,000 feet of depth, although all parts of equipment subject to the oil corroded. Very high costs arose from the need to replace tubing, casing, lead lines, and plant equipment. The temperature varied from time to time from 120° F. above zero to 50° F. below zero in the one well, at times approaching the critical temperature and pressure for CO_2. To be useful the inhibitor had to be operative at these extreme conditions and to be miscible with the oil, well gas, and water, and to have negligible toxicity.

The ethylene oxide was blended with virgin stove oil and transported to the field in steel

drums, corrosion strips were placed in the well for two weeks and corrosion was measured. A lubricator, a steel container of 5 gallon capacity, was installed by connection to tubing and casing so that pressure admitted from the tube would displace the inhibitor into the casing. The test was run for 15 days and a varying quantity of inhibitor was added each day, ranging from .1 gallon to .4 gallon per day. Water analysis was run each day to discover the presence of ethylene oxide, but none was discharged, showing active use of all inhibitor.

At the end of the test the corrosion loss was determined by weighing the corrosion strips, and was compared with the corrosion loss as previously determined for the uninhibited well. Corrosion had been reduced by half, indicating 100% improvement.

It is to be understood that ethylene oxide can be replaced by compounds of similarly reactive chemical structure, examples of which are butylene oxide and propylene oxide. However, the use of such alkylene oxides is inferior from a cost standpoint, ethylene oxide being available in relatively large quantities and at relatively low prices and being satisfactory in its reactivity and stabilizing effects.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiment thereof except as defined in the appended claims.

What is claimed is:

1. The process of inhibiting the corrosion, by well fluids, of apparatus subject to the action of well gas under pressure that includes the step of injecting ethylene oxide into the well.

2. The process of inhibiting the corrosion, by well fluids, of apparatus subject to the action of well gas under pressure that includes the step of injecting butylene oxide into the well.

3. The process of inhibiting the corrosion, by well fluids, of apparatus subject to the action of well gas under pressure that includes the step of injecting propylene oxide into the well.

4. The process of inhibiting the corrosion of oil and gas well parts due to the corrosive character of fluids originating in the well, that comprises passing an alkylene oxide through the apparatus with the well fluids.

5. The process of inhibiting the corrosion of oil and gas well parts due to the corrosive character of fluids originating in the well, that comprises passing ethylene oxide through the apparatus with the well fluids.

6. The process of inhibiting the corrosion of oil and gas well parts due to the corrosive character of fluids originating in the well, that comprises passing butylene oxide through the apparatus with the well fluids.

7. The process of inhibiting the corrosion of oil and gas well parts due to the corrosive character of fluids originating in the well, that comprises passing propylene oxide through the apparatus with the well fluids.

8. The process of inhibiting the corrosion of oil and gas well apparatus by fluids originating in the well that includes the step of injecting an alkylene oxide into the well.

9. The process of inhibiting the corrosion of well apparatus subject to the corrosive action of hydrocarbonaceous well fluids under pressure that includes the step of injecting an alkylene oxide into the well.

10. The method of treating a hydrocarbon product in its natural state for the purpose of reducing its corrosive action on well tubing and associated apparatus which comprises injecting an alkylene oxide into the well containing the hydrocarbon product.

11. The method of preventing corrosion of metal parts in contact with oil well fluids that includes the step of mixing with said fluids a composition including, as its essential ingredient, an alkylene oxide.

12. The method of treating a hydrocarbon product in its natural state for the purpose of reducing its corrosive action on well tubing and associated apparatus which comprises injecting ethylene oxide into the well containing the hydrocarbon product.

13. The process of inhibiting the corrosion of oil well apparatus subject to the corrosive action of well fluids including natural gas under pressure that includes the step of injecting ethylene oxide into the well.

JOHN L. SEYMOUR.

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