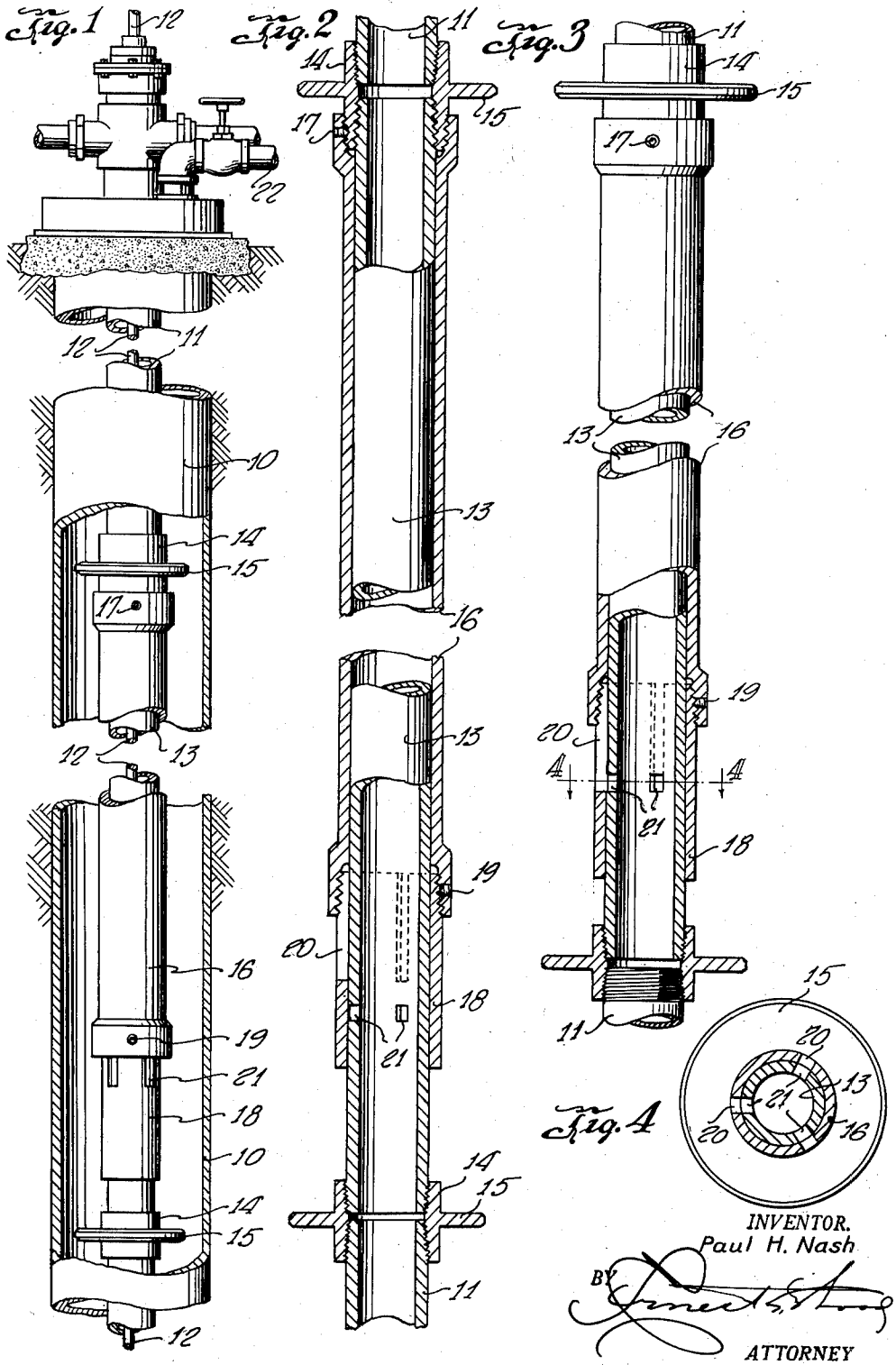
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APPARATUS FOR LIQUEFYING PARAFFIN IN WELLS

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APPARATUS FOR LIQUEFYING PARAFFIN IN WELLS

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3 Claims. (Cl. 166—17)

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This invention relates to paraffin extractors for oil wells and more particularly to apparatus for removing paraffin deposits from the walls of tubing without interrupting pumping operations.

The principal object of the invention is to provide a device adapted to be incorporated in the string of tubing in a well above the traveling valve therein and which is itself equipped with a novel form of heat sensitive valve by which steam introduced into the casing surrounding the tubing is caused to enter the latter and thus liquefy the paraffin coating the walls of the tubing, permitting the liquid paraffin to be elevated and discharged from the well by the pump, along with the oil. In this manner, paraffin deposits are carried out of the tubing without suspending the operation of the pump and are not permitted to precipitate in the tubing below the pump to again congeal and reduce the yield of the well.

Another object of the invention is to provide a paraffin extractor for wells in which the valve for opening the tubing to ingress of steam consists of a tubular element surrounding the tubular body of the device and which is composed of a metal having a higher coefficient of expansion than the tubular body and when heated by steam entering the space between the casing and tubing, will elongate sufficiently to bring into register a group of ports in a sleeve carried by the lower end of the element, with a like number of ports in the tubular body of the device which is incorporated in the tubing string in a well. When introduction of steam is suspended, the tubular element will resume its normal length, thereby closing the ports in the tubing.

With the foregoing objects in view, the invention has further reference to certain features of accomplishment which will become apparent as the description proceeds, taken in connection with the accompanying drawings wherein:

Figure 1 is an elevational view of the invention shown incorporated in the tubing of a well.

Figure 2 is an elevational view of the invention, per se, partly in section and on a slightly larger scale.

Figure 3 is a view similar to Figure 2 but showing the tubular element of the valve elongated, and

Figure 4 is a transverse sectional view taken on line 4—4 of Figure 3.

Continuing with a more detailed description of the drawing, reference numeral 10 denotes the casing of a well into which is suspended the string of tubing 11. The sucker rod string is indicated by reference numeral 12 in Figure 1 and operates to actuate the conventional pump (not shown) in the tubing 11.

Many and varied devices and methods have been used with indifferent success to minimize paraffin trouble in wells. Mechanical means

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employed for the purpose include scrapers and the like while temporary relief has been attained by various forms of heaters. Some methods employ steam for liquefying the paraffin but in all of these, pumping must be suspended and in cases where ball check valves are employed, the valves are frequently fouled by congealing paraffin and it therefore becomes necessary to pull the valve for cleaning, which results in further pumping losses. This is true also where the tubing is required to be pulled to remove from its walls the coating of paraffin which has reduced the yield of the well. These methods and devices offer but temporary relief and require expensive shutdowns.

The invention seeks to provide a medium by which the congealed paraffin may be periodically removed from the tubing before its presence therein becomes a serious impediment to normal pumping operations and to accomplish this while pumping is proceeded with.

With the foregoing in view the invention consists of a tubular body 13 whose inner diameter is the same as that of the tubing 11. This member is exteriorly threaded at each end to be received by the threaded ends of couplings 14, each of which latter is provided with an annular flange 15, slightly less in diameter than the inside diameter of the casing 10. Into the opposite end of each coupling 14 is threaded an end of a section of tubing 11. Thus, the tubular body 13 is incorporated in the length of the tubing string and disposed at a level in the well at which paraffin is most likely to congeal. In any case, the pump operates in the tubing at a point below the tubular body 13 to insure a condition which will become evident presently.

Surrounding the tubular body 13 in close slidable engagement is an elongated tubular element 16. This element 16 is formed from a metal having a higher coefficient of expansion than that of the tubular body and has on its upper end threads numbering preferably four to the inch to engage corresponding threads on the lower end of the uppermost coupling 14. The large threads compensate for diameter changes in the element 16 but to insure against separation of the element from the coupling 14, when expanded a set screw 17 is inserted in aligned apertures in the end of element 16 and the coupling.

To the lower end of the tubular expansion element 16 is attached a sleeve 18 of hardened steel which snugly embraces the tubular body 13. Number four threads are also provided for securing the tubular expansion element and sleeve 18 together for the same reason as explained above and a set screw 19 prevents separation of these parts during expanded periods of the element 16.

While the nature of the metal composing the expansion element 16 and the length of the latter determines its degree of expansion under predetermined temperatures, it is considered under test that approximately five-sixteenths of an inch in linear expansion is sufficient to bring into register a group of circumferential ports 20 in the sleeve 18 with a like number of similarly arranged ports 21 in the tubular body 13 and thus to provide opening of sufficient area to admit steam into the tubing in adequate volume to reduce to liquid the paraffin solids coating the walls interiorly of the tubing 11.

It will be observed in Figure 1 that the flanges 15 of couplings 14 are smaller in diameter than the casing 10 yet will protect the expansion element 16 against damage and yet will not interfere with downward passage of steam introduced into the casing through pipe 22 at the surface. As the expansion element 16 becomes heated in the presence of the steam it elongates and moves the sleeve 18 downwardly where the ports 20 thereof will eventually come into register with ports 21 of the tubular body 13. When this occurs it is evident that steam exteriorly of the tubing will enter the latter through the ports 20 and 21 to heat the paraffin deposits within the tubing, causing the same to return to liquid form. It is also apparent that operation of the pump within the tubing 11 need not be suspended during injection of steam since the ingress of steam at the ports 20—21 will prevent escape of oil therethrough, although this would be negligible. As a matter of fact continuous operation of the pump is preferred since the paraffin in liquid form is easily pumped out of the well into the flow tank with the oil.

Manifestly, the construction as shown and described is capable of some modification and such modification as may be construed to fall within the scope and meaning of the appended claims is also considered to be within the spirit and intent of the invention.

What is claimed is:

1. In a paraffin extractor for cased wells, an elongated tubular body incorporated in the length of the tubing string in a well and composed of a material having a low coefficient of expansion, said body having circumferentially spaced ports therein adjacent its lower end, a tubular expansion element surrounding said body and composed of a metal having a high coefficient of expansion, said tubular expansion element being in fixed relationship with said tubular body at its upper end, a sleeve attached to the lower end of said tubular expansion element, slidable on said tubular body and having ports alignable with those of said tubular body and means for introducing steam into the casing of said well, the difference in coefficient of expansion between said tubular expansion element and said body being sufficient under the temperature of said steam to cause said expansion element to expand and to bring into register the ports of said sleeve and body for the admission of steam into said body and tubing string.

2. In a paraffin extractor for a cased oil well, a tubular body of low coefficient of expansion incorporated in the length of tubing string in said well and having ports therein adjacent its lower end, a tubular element of relatively high coefficient of expansion embracing said tubular body, means securing said tubular element at its upper end in fixed relation to said body, a sleeve affixed to the lower end of said tubular element and slidably embracing said body, said sleeve having ports alignable with those of said tubular body, the coefficient of expansion of said tubular body being sufficiently different from that of said tubular element to effect a differential degree of expansion of said body and said element in the presence of heat to cause alignment of said alignable ports and means for introducing steam into the casing of said well to expand said tubular element and effect alignment of said ports to admit steam into said tubular body and tubing string through said aligned ports.

3. In an apparatus for liquefying congealed paraffin in the tubing string of a cased oil well during pumping thereof, an elongated tubular body of low coefficient of expansion incorporated in the length of said tubing string and having ports therein, a tubular element of a material having relatively high coefficient of expansion surrounding said body and in fixed relation therewith at its upper end, a sleeve connected to said tubular element and having ports adapted to register with those of said body when said tubular body and said tubular element are exposed to high temperatures to expand said tubular element on said body and means for introducing steam into the casing of said well to expand said tubular element to effect registration of said ports and admit steam interiorly of said body and tubing string.

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