W. B. WIGLE.

HEATING APPARATUS FOR OIL WELLS.

APPLICATION FILED JAN. 31, 1911.

1,012,777. Patented Dec. 26, 1911.

Fig. 1.

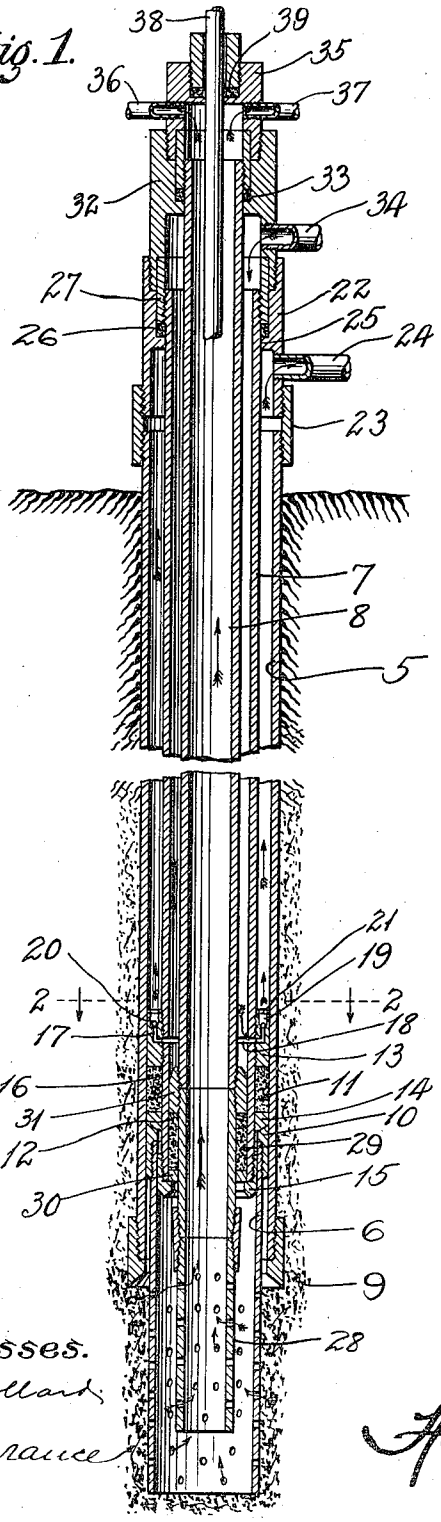


Fig. 3.

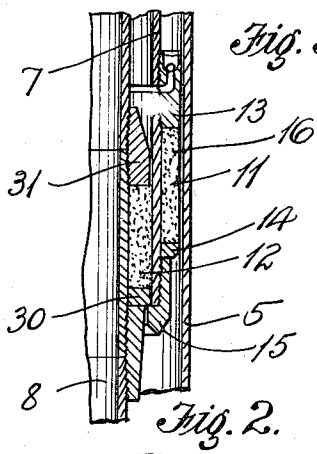


Fig. 2.

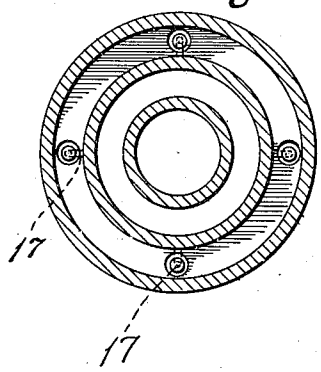
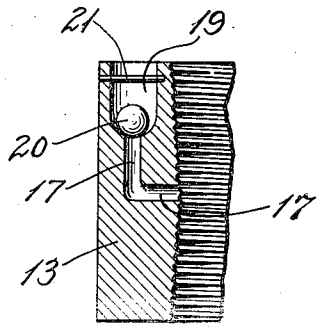


Fig. 4.



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UNITED STATES PATENT OFFICE.

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HEATING APPARATUS FOR OIL-WELLS.

1,012,777. Specification of Letters Patent. Patented Dec. 26, 1911.

Application filed January 31, 1911. Serial No. 605,745.

To all whom it may concern:

Be it known that I, WILSON B. WIGLE, a citizen of the United States, residing at Santa Maria, in the county of Santa Barbara and State of California, have invented new and useful Improvements in Heating Apparatus for Oil-Wells, of which the following is a specification.

This invention relates to improvements in means for heating oil as it flows from wells and it is particularly adapted for the warming and increasing the fluidity of heavy oils in pumping and extracting the same from wells, by means of a warming agent which is forced into the casing of the well adjacent to the pumping tubes.

It is an object of the invention to place suitable casings in a well and around the pumping tube and provide the same with packing means and inlet and outlet piping by means of which heated water may be caused to circulate around the pumping tube of an oil well and within the outer casing thereof.

In the accompanying drawing forming a part of this specification, Figure 1 is a vertical central longitudinal section through the casing and tubing of an oil well showing the present invention applied thereto. Fig. 2 is a transverse horizontal sectional view taken upon the line 2—2 of Fig. 1. Fig. 3 is a detail sectional view showing the members of the packing device before they are inserted in the well. Fig. 4 is an enlarged detail sectional view of a portion of one of the packer rings showing one of the ball valves mounted therein.

The features of the present invention will now be more particularly described reference being had to the parts shown in the accompanying drawing in which—

5 indicates an outer casing, 6 a liner, 7 a packer carrying casing and 8 an inner tubing through which the oil is to be pumped. In equipping the well with the mechanism forming the subject matter of this invention, the casing 5 is driven into the ground until it reaches the oil bearing sand, say at about 9 indicated upon Fig. 1 of the drawing, the lower end of the said casing being permitted to rest upon said sand. An inner perforated liner or tube 6 is then inserted through the casing and driven below the same into the oil bearing sand as clearly shown in Fig. 1. The upper end of this liner is usually provided with a collar 10, which is screwed upon the upper edge of said liner and is adapted at its upper thickened edge to support and limit the downward movement of the outer member of the tube packer. The tube packer is preferably made up of an outer member 11 and an inner member 12 which are arranged partially opposite each other so as to telescope somewhat with respect to each other.

The outer packer member 11 is inserted in the well by being secured to the outer surface of the tubing 7, the said tubing forming an inner casing. This casing may be made up of any necessary number of end to end casing sections, for reaching to the depth at which the packer is to be placed, and the said casing also extends upwardly usually above the outer casing 5 at the top of the well. The said outer packer member 11 comprises a collar 13 which is provided with screw threads upon its inner surface and is screwed upon adjacent sections of the casing 7. The said packer also comprises a loose ring 14 slipped upon the lower section of the casing 7 and held in place by a collar 15 screwed upon the lower end of said section.

Packing or yielding material 16, such as rubber, hemp, canvas or the like may be mounted between the collar 13 and ring 14. When the casing 7 is lowered into the well the ring 14 will rest upon the collar 10 of the liner 6 and be limited in its downward movement thereby. The weight of the casing 7 will then rest upon the packing 16 and will tend to compress the same and cause it to bulge outwardly against the inner surface of the casing 5. The bulging of the said packing under the weight of the casing 7 will make a water tight joint between the outer casing 5 and the inner casing 7 at this point. The collar 13 is provided with a series of passages 17 adapted to communicate with the space left between the adjacent sections of the casing 7, which are connected by the collar 13 whereby communication is established between the spaces within the inner casing 7, and the space between the same and the outer casing 5. The passages 17 are angular in shape and open through the upper edge of the collar 13, the said upper ends being enlarged as at 19 to receive ball-check valves 20. The said balls normally tend to fall over the narrow por-

tion of the passages 17 and thus check any back flow of liquid through the same. The balls are prevented from being thrown out of their sockets by means of pins 21 as clearly shown in Fig. 4 of the drawing. As shown in Fig. 2 a plurality of such passages and ball valves are employed, four of them being generally found sufficient, and in order to hold the upper end of the inner casing 7 in position at the top, the lower section 22 is put in position being adapted to just fit upon the outer surface of the casing 7 while its lower end is of larger diameter and is connected by means of a suitable coupling or collar 23, with the upper end of the outer casing 5. Above the collar 23 the said cap section 22 is provided with an outlet pipe 24, extending to any suitable point and through which the hot water or other heating liquid finds an exit from the casing. The central portion of the said cap section 22 engages the inner casing at 25 and above this point a packing as 26 is inserted which is adapted to be held in place by a collar 27 which is screwed upon the upper end of the inner casing 7. By securing the collar 27 down snugly against the packing 26, a water-tight joint is formed between the cap section 22 and the said inner casing 7. Within the casing 7 is an oil pumping tube 8 which is made of any desired number of sections and carries at its lower end a section 28, which is generally perforated as shown for admitting the oil to the interior of the tubing as well as through the end of the tube.

The inner packer 12 is carried by one of the lower sections of the tubing 8 and comprises yielding packing material as rubber, fiber, canvas or the like, indicated at 29 which is limited at the bottom by the ring 30 and at the top by a collar 31. The parts 30 and 31 with the packing 29 between them are placed upon the tubing 8 before it is lowered into the well and it is then lowered in the well until the ring 30, engages the inwardly projecting annular flange formed by the thickened lower edge of the ring 15 secured to the inner casing 7. This ring 15 limits the descent of the ring 30 and the weight of the tubing 8 rests upon the packing material 29, through the agency of the collar 31 and thereby compresses and bulges the same so as to make it fill tightly the space between the tubing 8 and the casing 7, thus forming a water tight joint at the lower end of the said casing 7.

By the use of the sections of the packer as 11 and 12 described, the casing about the tubing 8 contains two concentric, cylindrical passages through which the heated water may be circulated for warming up and tending to liquefy the heavy oils drawn from the well. The upper end of the inner casing 7 for the purpose of this circulation is closed by means of a second cap section 32 which screws into the upper end of the lower cap section 22. This cap section 32 fits quite closely upon the tubing 8 and is provided with a packing gland at 33 for forming a tight joint between the tubing and said section. The said section 32 is also provided with an inlet at 34, suitable piping being secured in an aperture in said cap at this point as clearly shown in Fig. 1 of the drawing. The upper end of the tubing 8 is closed by a top cap section 35, which is provided with one or more outlet pipes 36 and 37 for the exit of the oil which is being pumped. The usual pump rod 38 is adapted to move up and down through the said top cap 35 and is provided with a packing gland at 39 for preventing the escape of oil about the said rod 38. The top cap pieces 35 are screwed into the upper end of this section 32 so that when it is removed the full diameter of the tubing 8 is opened for the withdrawing or insertion of tools or implements used in connection with the well.

In pumping oil of certain characteristics from wells particularly where the oils are heavy and sluggish in movement the movement of the said oil is greatly facilitated by increasing its temperature and thus increasing its fluidity.

The piping for accomplishing the circulation of the heating medium is connected with any suitable heating and pumping means, as for instance an ordinary hot water or steam boiler and an ordinary pump. The liquid in its hot condition is pumped through the piping 34 into the space between the inner casing 7 and the tubing 8. It thence passes downwardly and through the apertures in the lower end of said casing 7, and the passageways 17 past the valves 20 and into the outer casing 5. The heating medium will then pass upwardly and find an exit through the pipe 24. In actual use water is found to be the preferred means for heating the oil and may be used over and over again, since it does not lose all of its heat in this way and does not require a great deal of additional heating to maintain it in the proper temperature when it is to be returned to the well again.

In the event of the necessity for removing the inner tubing 8, the pumping operation is stopped and the water in the outer casing 5 is prevented from returning or running into the well by means of the valves 20. The water in the inner casing is forced outwardly in drawing the tubing 8 with its packer section 12 out of the wall. The formation of the cap sections is such, that they each receive an equal amount of the heat units as the water enters the casing and will expand or contract evenly so as not to loosen their joints.

Since the rubber or other material in the

packer sections is compressed and bulged by means of the weight of the super-imposed piping and casing, the said packer sections can be easily withdrawn if necessary by the lifting of said sections or pipes, which permit the packing material to spread out to its normal shape. The packer sections are preferably located at a considerable distance below the working head at the top of the well.

The packer sections are usually arranged just above the oil sand and thus oil comes in contact with the heating apparatus as soon as it leaves the sand, making it possible for the heat to reach and affect the oil before it reaches the working barrel on the tubing 8. The said working barrel is usually put several hundred feet above the sand in deep wells. In this way the oil has ample opportunity to become quite warm before it reaches the pumping apparatus.

What I claim is:

1. A well warming mechanism comprising outer and inner casings, extended over the pumping tubing of a well apparatus, and packing means interposed between the tubing and the inner casing and between the lower ends of the two casings, passages being provided in the inner casing for establishing communication between the spaces within the casings, and permitting of the forcing a heating medium into one casing and then through the other for heating the tubing within the casing.

2. A mechanism for heating oils in extracting heavy oils from the earth comprising an outer casing, an oil extracting tube extending into the same, and an intermediate casing arranged between the outer casing and the tube, and packing means between its lower end and the said tube and casing, the structure being such as to permit the driving of a heat medium through the compartments, formed between the said tube and outer casing.

3. A heating mechanism for facilitating the extraction of heavy oils in wells, comprising concentric casings arranged outside an oil extracting tubing, packer heads interposed between said concentric casings and between the inner casing, and the oil extracting tubing, the said packer heads being adapted to be compressed by the weight of the inner casing and the extracting tubing for making tight joints between the parts, and means for delivering hot water between the oil tubing and the inner casing, and an outlet for the water between the concentric casings, the wall of the inner concentric casing being provided with a passageway for the water from the inner casing to the outer casing.

4. A mechanism for heating heavy oils to facilitate their extraction from wells, comprising in combination with the oil extracting tube of the well, concentric tubing arranged about the same having spacing means between them and between the inner concentric tube and the oil extraction tube for forming concentric cylindrical passages, the said passages being closed at the bottom and extending approximately the full depth of the well, an inlet pipe for directing a heating agent into the inner concentric passage, and an outlet pipe for providing for the discharge from the outer concentric passage.

5. An oil well heating mechanism comprising an outer casing set in the earth and extending to the oil bearing sand, an inner casing of less diameter set therein, and having an opening in its walls for the passage of heating fluids, a packer interposed between the lower ends of said casings comprising packing retaining rings and elastic packing mounted between them capable of expansion by the weight of the inner casing, the upper ring of said packing means being provided with passages communicating with the said opening in the walls of the inner casing for establishing communication between the inner and outer casings, valves controlling said passageways, an oil extracting tube mounted within the inner casing, a packer interposed between the lower end of said inner casing, and said tube, means for closing the upper ends of said casings, the said casings being provided with hot water inlet pipes and hot water discharge pipes, the opening in the walls of the inner casing affording a passageway for the water from one casing to the other.

6. A heating means for oil wells, comprising concentric casings of different diameters arranged outside the oil pipe of a well, annular connecting heads for closing the upper ends of said casings, packer sections capable of being lowered into the well between the concentric casings and upon the oil tube, each of said packers comprising rings, one of which is movable, and packing material interposed between them whereby the packing material will be caused to bulge and seal the space between the parts, the parts being arranged for directing a driven heating agent between the oil tube and the inner casing and thence between the inner and outer casings.

7. A heating mechanism for oil wells comprising concentric spaced tubular casings, one of which is provided with an opening in its walls, and a central oil extracting tube, packing rings mounted between the lower ends of the concentric casings, and about the oil extracting tube, one of said rings having passages formed therein coöperating with the opening in said casing for establishing communication between the casings, ball valves mounted over the outlets of said passages for preventing a back flow there-

through, pins for preventing the balls from being forced out of position, and means directing hot water into the concentric casing and from the same again in maintaining the oil tube at a suitable temperature to facilitate the flow of oil therein.

In witness that I claim the foregoing I have hereunto subscribed my name this 26th day of January, 1911.

WILSON B. WIGLE.

Witnesses:
HENRY C. BAGE,
DEANE LAUGHLIN.