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(54) APPARATUS AND METHOD FOR CLEANING WELLS AND PIPELINES

(57) A steam producing apparatus (13) is used for forcibly moving contaminants build up on the wall of the well (11) and to open up the fractures to allow the flow of oil into the well. Steam is generated in a structure that is lowered into the well and to apply pressurize steam

onto the well wall and against the fractured areas to release oil and to allow oil to flow more freely, thereby producing more oil. The pressure of the produced steam can be regulated within the structure lowered into the well. It can also be monitored from the surface.

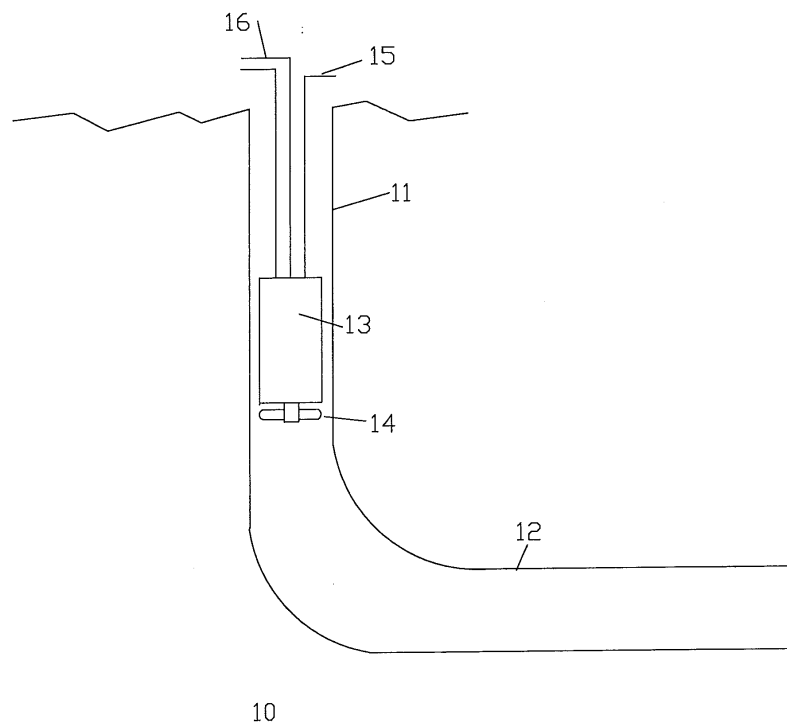


FIGURE 1

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Description

FIELD OF THE INVENTION

[0001] The Invention relates to oil/gas wells, sewer lines, infrastructures lines, water lines, pipe lines and oil transmission lines, and to an apparatus and method of cleaning and removing oil, tar, paraffin's, contaminants and biologicals from them.

BACKGROUND OF THE INVENTION

[0002] Oil Wells, after a period of production, will have deposits on the walls of solid oil/tar build-up on the wall of the well bore, and in the fractures from which the oil is extracted from the sub-surface. There can also be a build-up of biologicals formed in the well. This build-up of oils decreases the flow of oil and thereby reducing the production of oil from the well.

[0003] Similarly, in oil transmissions lines there will be a build-up of oil/tar on the walls, reducing the flow of oil through the pipe line.

[0004] Sewer lines, after a prior of time will have a layer of sludge or decay of the infrastructures on the walls, which can slow the flow of fluids through the sewer line, and can also produce odors in the line.

[0005] U.S. Patent 5, 506, 391 describes (For Figure 3) a system in which a heating device is lowered into an oil well and produces heat by generating steam to warm the surrounding oil, allowing it to flow more easily. There is no mention that it will also remove the oil/tar build-up within the well. The steam is controlled from the surface, and the steam is retained in the well by a seal.

[0006] U. S. Patent 8, 950, 496 describes a system where shock waves are generated to remove deposits from the casing. It appears from the patent and illustration that the cleaning is above the oil level as it states that the area being cleaned has primarily water.

SUMMARY OF THE INVENTION

[0007] The present invention is to an apparatus for forcibly moving contaminant build up on the wall of the well and to open up the fractures to allow the flow of oil into the well. Steam is generated in a structure that is lowered into the well and to apply pressurize steam onto the well wall and against the fractured areas to release oil and to allow oil to flow more freely, thereby producing more oil. The pressure of the produced steam can be regulated within the structure lowered into the well. It can also be monitored from the surface. The pressure is regulated to prevent undo high pressure from causing damage within the well. The pressure can be changed to allow a lower pressure to clean the well wall, and a higher pressure can be used to clean and open the fractures in the well allowing a greater flow of oil.

[0008] A similar apparatus can be used in oil/gas wells, sewer lines, infrastructures lines, water lines, pipe lines

and oil transmission lines. These type lines may run vertically, but generally run horizontally and not as deep as oil wells, so they can be cleaned more easily, but with the same type systems.

[0009] The technical advance represented by the invention as well as the objects thereof will become apparent from the following description of a preferred embodiment of the invention when considered in conjunction with the accompanying drawings, and the novel features set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIGURE 1 shows the basic system in an oil well; FIGURE 2 shows in more detail the heat generating/cleaning apparatus; FIGURE 3 is an end view of the apparatus of FIGURE 2; FIGURE 2a shows one of the spring loaded wheels or ball bearings (know as rollers) that can used with the cleaning apparatus; FIGURE 4 shows an apparatus that can be used in the vertical and horizontal oil/gas wells, sewer lines, infrastructures lines, water lines, pipe lines and oil transmission lines; FIGURE 5 is an end view of the apparatus of FIGURE 4; FIGURE 6 illustrates controls that can be used with the cleaning apparatus; FIGURE 7 shows a steam unit in the horizontal portion of the well; FIGURE 8 illustrates a spring loaded pressure nozzle; and FIGURE 9 shows recycling water for use.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0011] FIGURE 1 shows a simple layout of one feature of the present invention. Well 10 has a vertical part 11 and a horizontal part 12. A steam generating apparatus 13 is lowered into well 10. Steam generated in steam generating apparatus 13 has a steam nozzle 14 which sprays pressurized steam against the wall/bore of the well to remove the oil/tar and other material that accumulates on the wall of the bore of the well. Water is supplied to steam apparatus 13 through pipe 16 and power, for example a high alternating current voltage is supplied to steam apparatus by power line 15. Steam is generated in a steam apparatus 13 that is lowered into the well and to apply pressurized steam onto the well wall and against the fractured areas, particularly in the horizontal portion 12 of the well, to release oil and to allow oil to flow more freely, thereby producing more oil. The pressure of the produced steam can be regulated within the steam apparatus lowered into the well.

[0012] FIGURE 2 illustrates additional features of the

steam generating apparatus 13. Apparatus 13 has roller/spacers to help center steam apparatus in the well bore 11. These rollers position the steam apparatus in the center of the well bore 11 and help to move it up and down. The rollers are rollers 21-26 and 29 as shown Figure 3.

[0013] Also shown is the rotating steam nozzle 14 which projects steam against the well bore wall to remove oil/tar build up from the wall 11. Rotating nozzle 14 has two steam outlets 20 and 21 (as shown in FIGURE 3). Steam from outlets 20 and 21 rotates nozzle 14 while projecting pressurized steam 27 and 28 against bore wall 11. Also shown is water inlet 16 and power line 15.

[0014] FIGURE 2a is the same Figure as FIGURE 2 with the exception that it is illustrated that the rollers are used to help center steam apparatus in well bore 11 and are spring loaded. As illustrated, roller 24 on mount 31 is held in an outward position by spring 32. The spring is mounted in housing 30. If the well bore 11 were to narrow, well 24 would be pushed inward to housing 30 compressing spring 32. If the well bore would widen then spring 32 would push roller 24 outward against well bore 11. This same structure exists with all of the rollers.

[0015] FIGURES 4 and 5 illustrate an example of a steam generating and cleaning system 40 that can be used in horizontal and vertical oil/gas wells, sewer lines, infrastructures lines, water lines, pipe lines and oil transmission lines. The steam generating system 42 moves along pipe line 41 of rollers 44, 45, 51, and one roller not illustrated. Pressurized steam can be applied to the wall of pipe line 41 by a rotating steam nozzle as illustrated in FIGURES 2 and 3, or a circular nozzle 43 with a plurality of openings 48 around the peripheral of nozzle 43. Water input line 46 and power line 47 are shown.

[0016] FIGURE 6 shows an example of a steam apparatus for use in a well, particularly the horizontal portion of a well. The steam pressure needs to be regulated depending on the portion of the well it is in. The vertical portion of the well typically has concrete walls to seal it from the surrounding area. Excessive pressure can cause damage to the concrete wall. Therefore the steam pressure would need to be lower in the vertical portion than, for example, in horizontal portion of the well where the fracturing is done to release oil (or gas) from the surrounding area. In view of the need for different steam pressures, a steam pressure gauge 55 can be mounted just before the steam nozzle 14. The steam pressure information is then sent back to a valve 56 by line 57. If the steam pressure exceeds a predetermined amount, the water valve 56 is partially closed to reduce the amount of water inflow to the steam unit, therefore reducing the amount of steam produced and the steam pressure. The steam pressure can also be monitored at the surface of the well by line 58 which provides steam pressure information at the surface of the well. The amount of water flow can also be regulated at the surface of the well to control steam pressure. Water valve 56 can also be a one way valve to prevent steam pressure from causing

a back flow up water line 16.

[0017] In a cleaning process, the steam can be kept at a lower pressure as it is lowered down the well to clean the well, and then the pressure can be increased as the steam unit enters the horizontal portion of the well not only cleaning the horizontal portion, but also removing oil/tar from the horizontal portion and cleaning out the fractures, and providing additional fracturing as needed.

[0018] Figure 7 shows the steam unit in the horizontal portion of the well, which is below the fluid level 70 of the well. As the steam unit 13 is lowered into the well, it first is above the fluid level and there is no interference with the steam as it cleans the well wall. As the steam unit 13 enters the area of the well where there is fluid, the pressure may be needed to be increased to go through the fluid to clean the wall.

[0019] FIGURE 8 illustrates a steam nozzle that may be extended to place the nozzle closer to the wall so there is less fluid to be penetrated before the steam hits the wall. The nozzle has a movable portion 60 which encloses a spring 61 and exit opening 63 for the steam. As steam enters the nozzle 64, it enters line 67 which directs the steam into the chamber 65 which encloses spring 61. Steam entering chamber 65 will press against wall 66 moving the nozzle outward toward the well wall stretching spring 61. When the steam pressure is reduced, spring 61 will pull the nozzle back away from the well wall. Seal 62 prevents steam from escaping while steam line 67 moves back and forth. Moveable portion 60 of the nozzle is stopped when seal 62 comes into contact with the end 72 of nozzle 64.

[0020] FIGURE 9 illustrates the recycling of water condensed from the steam that is injected into the well. A water supply tank 80 is provided on the surface. Water is then directed through pipe 81 and provided for the steam unit 13 shown in FIGURE 1. The steam in the well condenses into water. It is then pumped up pipe 82 back into the water tank 80. By recycling the water used to produce steam, the amount of water on site of the well is minimized and the water is not wasted.

Claims

1. A method of cleaning a well to remove built-up oil residue and other contaminants, comprising the steps of generating pressurized steam within a unit lowered into the well, directing the pressurized steam against the well wall to dissolve and remove oil/tar build up on the well and other contaminants, and regulating the pressure of the steam applied against the well wall depending upon the area of the well to be cleaned.
2. The method according to claim 1, wherein the pressurized steam is applied to the well wall by rotating nozzles directed against the well wall.

3. The method according to Claim 2, wherein the nozzles are rotated by the steam leaving the nozzles.
4. The method according to Claim 1, wherein the steam is generated by providing a flow of water into the steam unit and applying a high voltage alternating current to the water. 5
5. The method according to Claim 1 wherein when the pressurized steam unit is lowered into the well, the steam unit is centered by a plurality of rollers on the steam unit. 10
6. The method according to Claim 5 where in the rollers are spring mounted to compensate for variations in the well diameter. 15
7. The method according to Claim 3, wherein the nozzles are extended by steam pressure to move the nozzles closer to the well wall. 20
8. The method according to Claim 4 wherein the flow of water into the steam unit is controlled by a one way valve to prevent pressure back flow into the water source. 25
9. The method according to Claim 1, including a surface monitoring system to regulate the pressure of the steam. 30
10. A method of cleaning a well to remove built-up oil residue and other contaminants, comprising the steps of generating pressurized steam within a unit lowered into the well, directing the pressurized steam against the well wall with rotating nozzles to dissolve and remove oil/tar build up on the well and other contaminants, and regulating the pressure of the steam applied against the well wall depending upon the area of the well to be cleaned. 35
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11. A method of cleaning a well according to Claim 1, wherein water produced by condensed steam in the well is recycled into a storage tank on the surface and is reused to produced steam. 45
12. A steam generating unit for applying high pressure steam to at least one of oil/gas wells, sewer lines, infrastructures lines, water lines, pipe lines and oil transmission lines, comprising; a housing into which water and an alternating current voltage is applied to generate steam; at least one steam nozzle for projecting the produced high pressure onto the wall of the well, pipeline and sewer line to remove build-up of materials and contaminants that restrict the flow of fluids, and a pressure sensor to regulate the pressure applied. 50
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13. The steam unit according to Claim 12 in which the steam nozzle is a rotating nozzle.
14. The steam unit according to Claim 12 including a one way valve to introduce water into the steam unit.
15. The steam unit according to Claim 12, including rollers for positioning the steam unit in the center of oil/gas wells, sewer lines, infrastructures lines, water lines, pipelines and oil transmission lines,

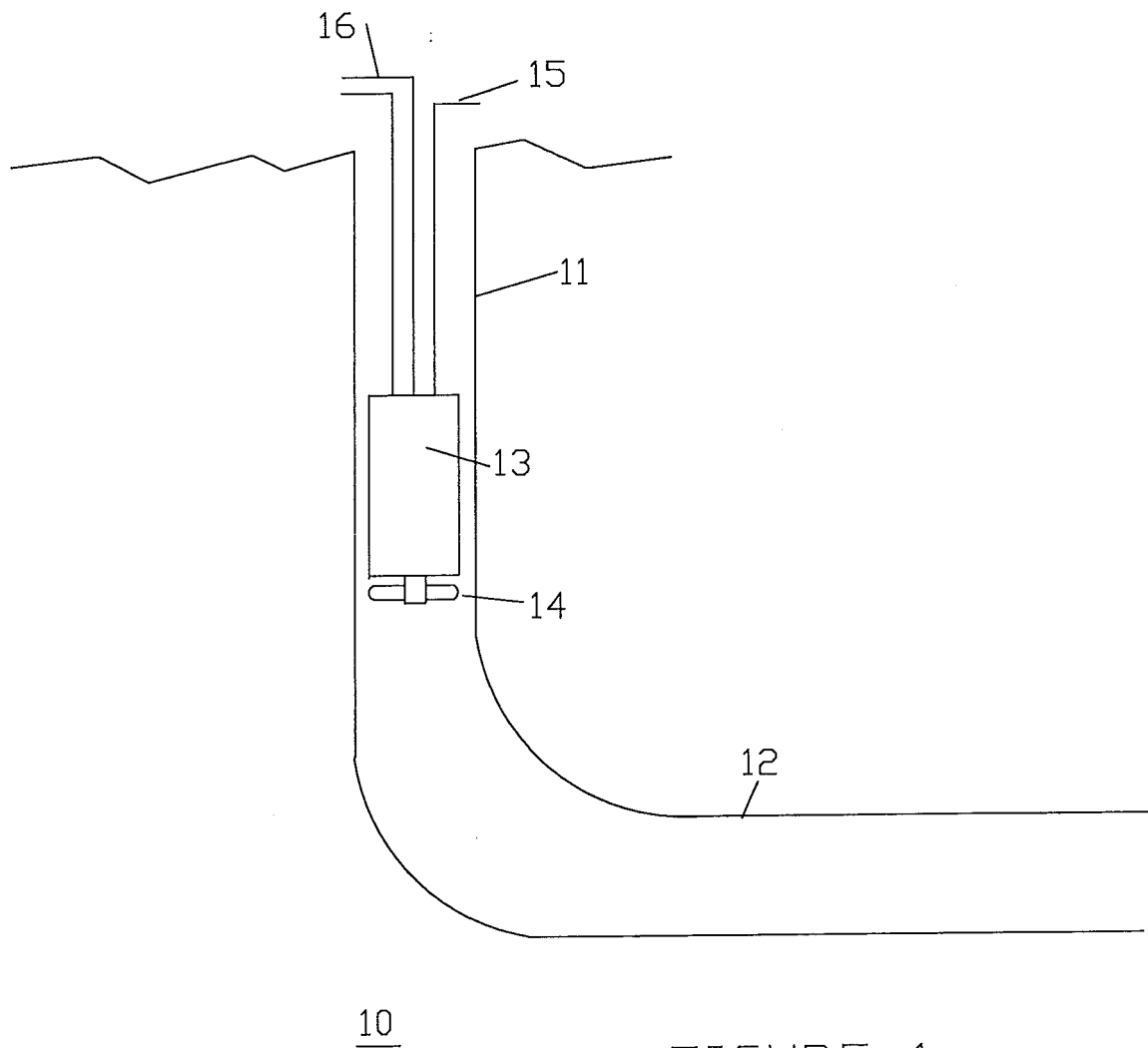


FIGURE 1

FIGURE 2

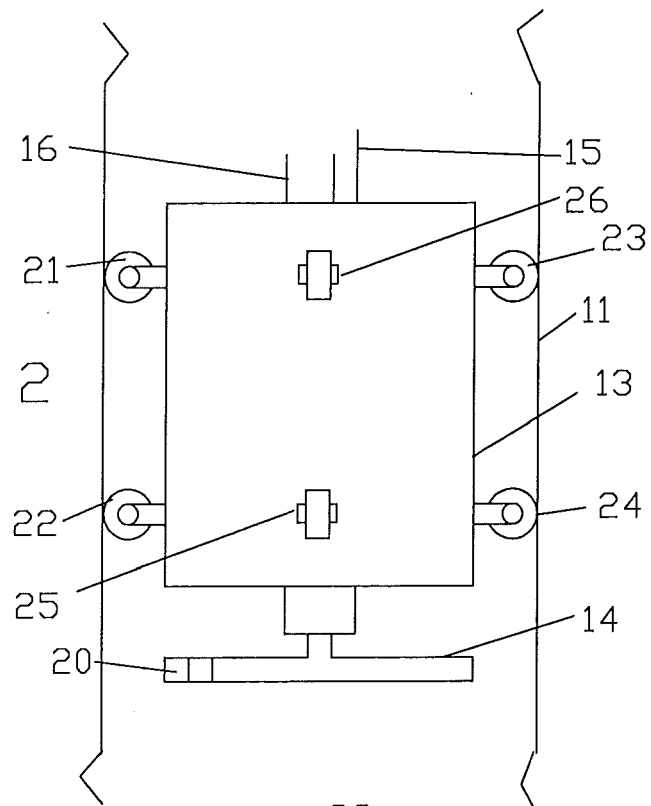
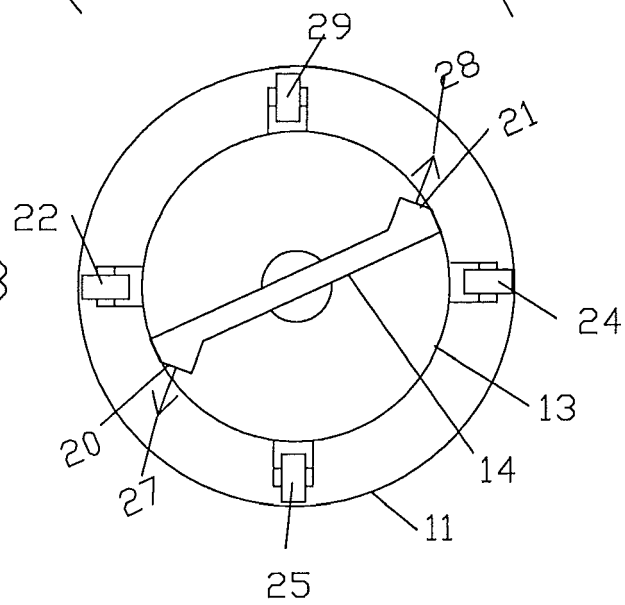


FIGURE 3



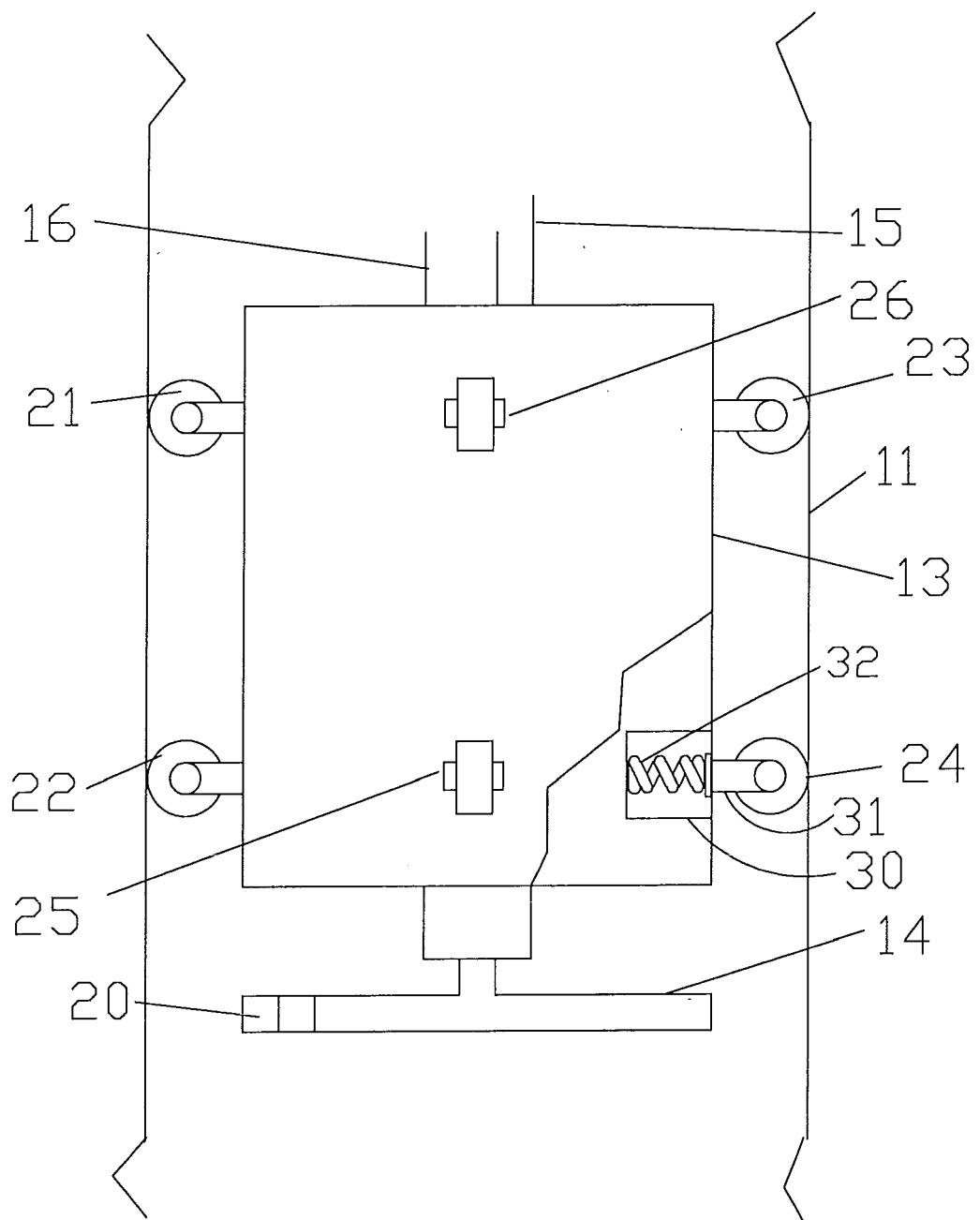


FIGURE 2a

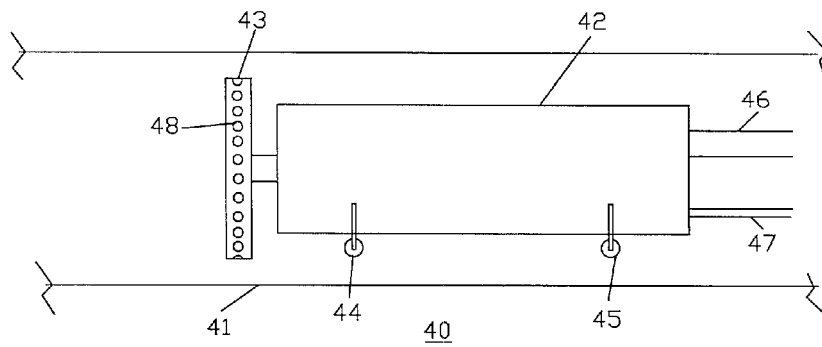


FIGURE 4

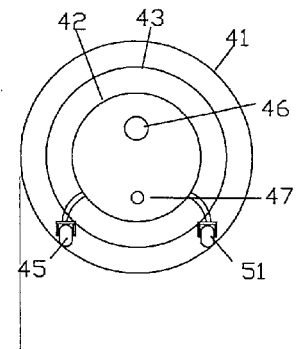


FIGURE 5

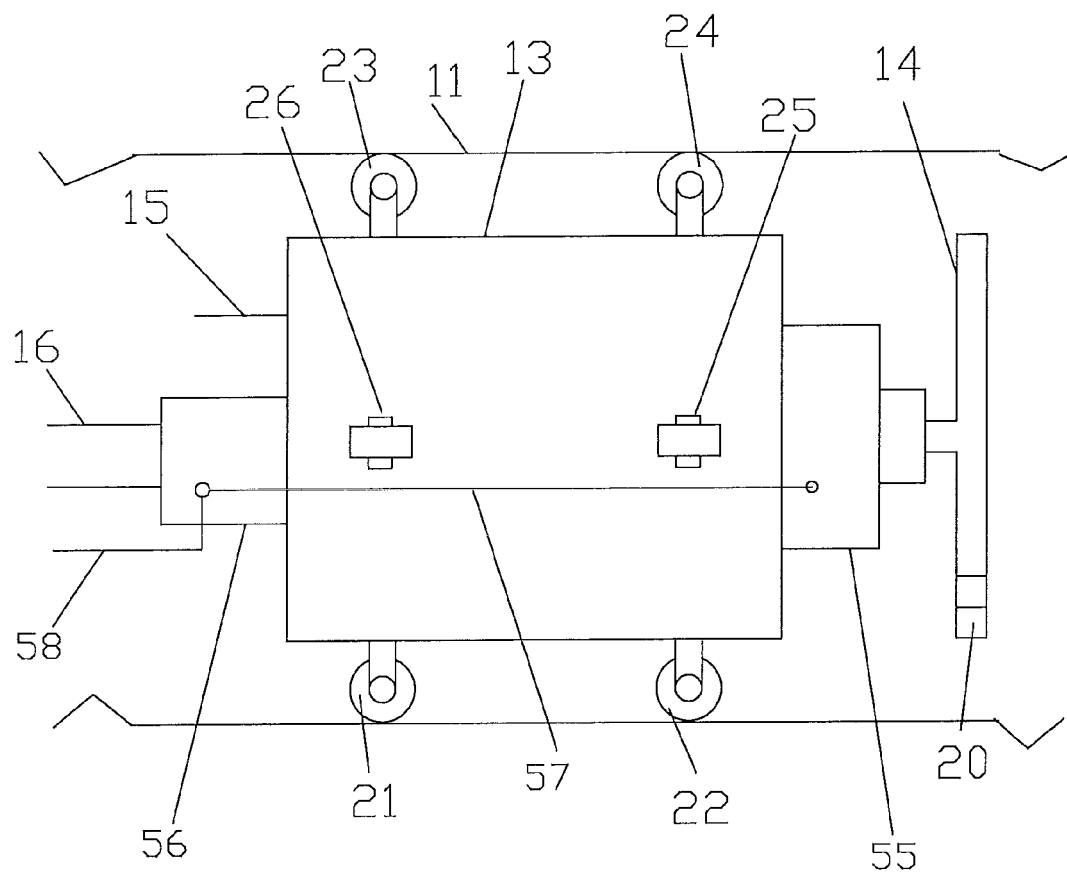


FIGURE 6

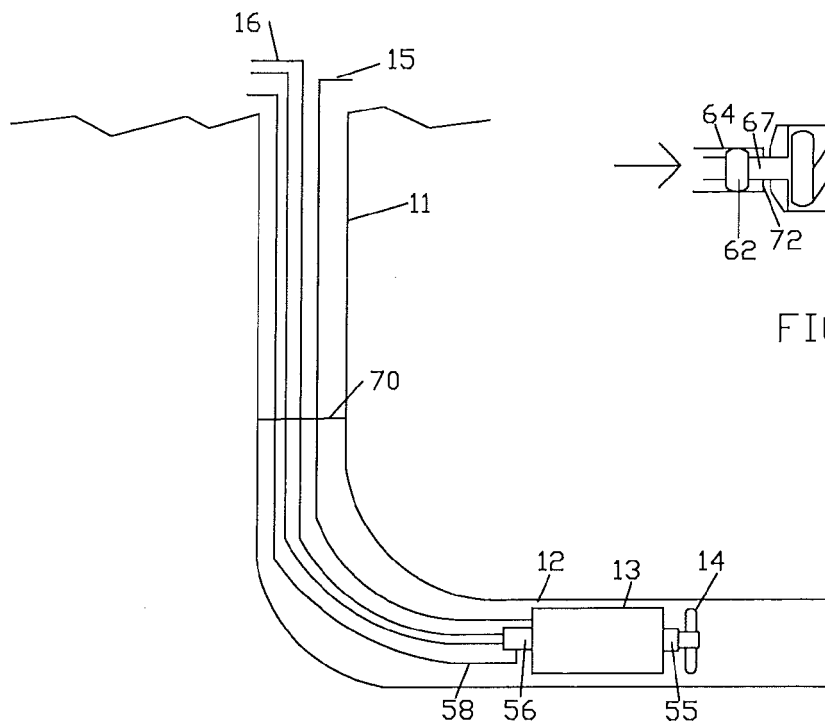


FIGURE 7

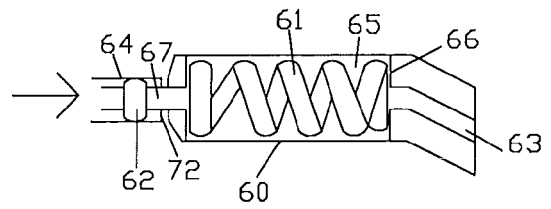
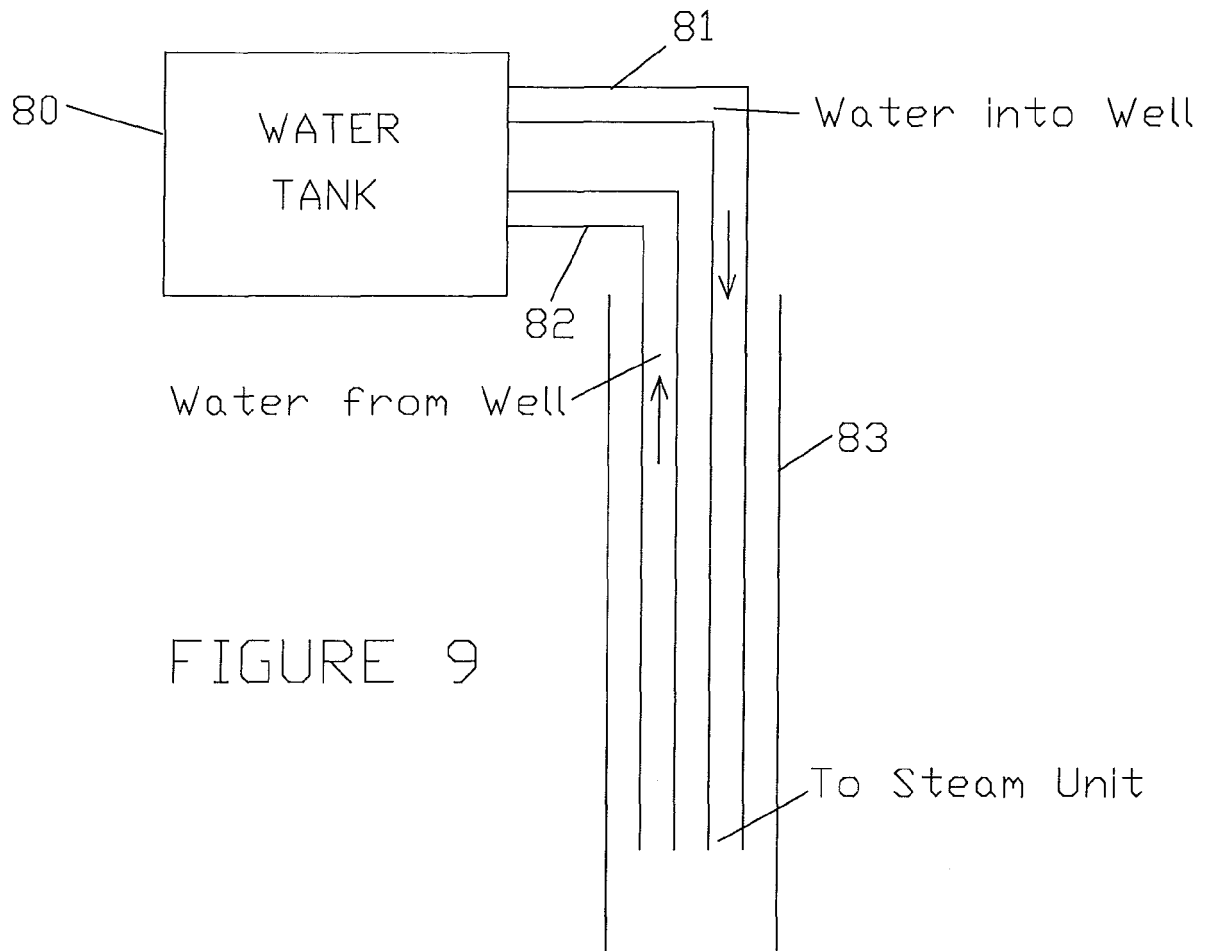


FIGURE 8





EUROPEAN SEARCH REPORT

Application Number
EP 16 18 1050

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2006/185622 A1 (SNYDER BRUCE C [US]) 24 August 2006 (2006-08-24)	12	INV. E21B37/10 E21B37/00
Y	* paragraphs [0009], [0017], [0018], [0021], [0023] - paragraph [0024]; claims 1, 4; figures 1, 2 *	13,15	
Y	----- US 2012/018163 A1 (NELSON DAN [US] ET AL) 26 January 2012 (2012-01-26) * paragraph [0013]; figure 1 *	13,15	

			TECHNICAL FIELDS SEARCHED (IPC)
			E21B E03B E03F B08B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 October 2016	Examiner Patrascu, Bogdan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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28-10-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006185622 A1	24-08-2006	NONE	
US 2012018163 A1	26-01-2012	NONE	

REFERENCES CITED IN THE DESCRIPTION

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