Sept. 2, 1969 T. W. CHILDERS ET AL 3,464,495

WASHING A WELL

Filed Sept. 11, 1967

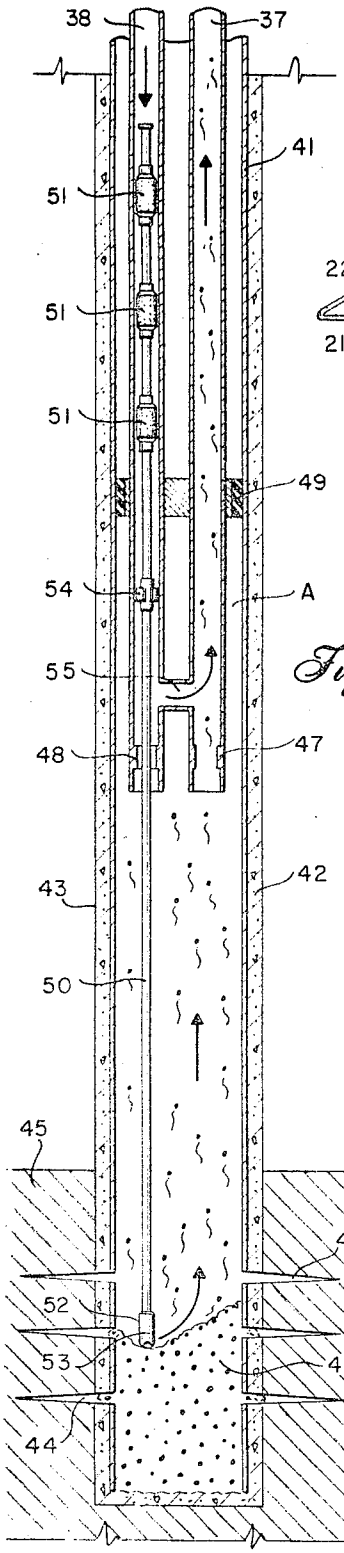


Fig. 3.

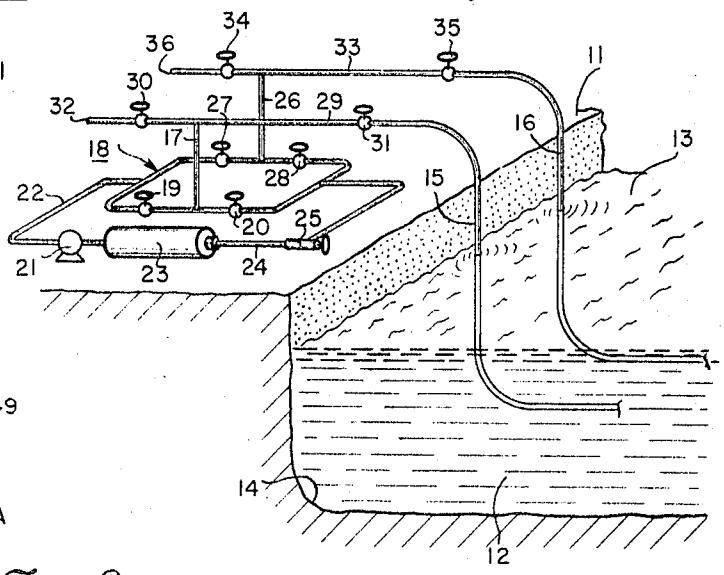


Fig. 1.

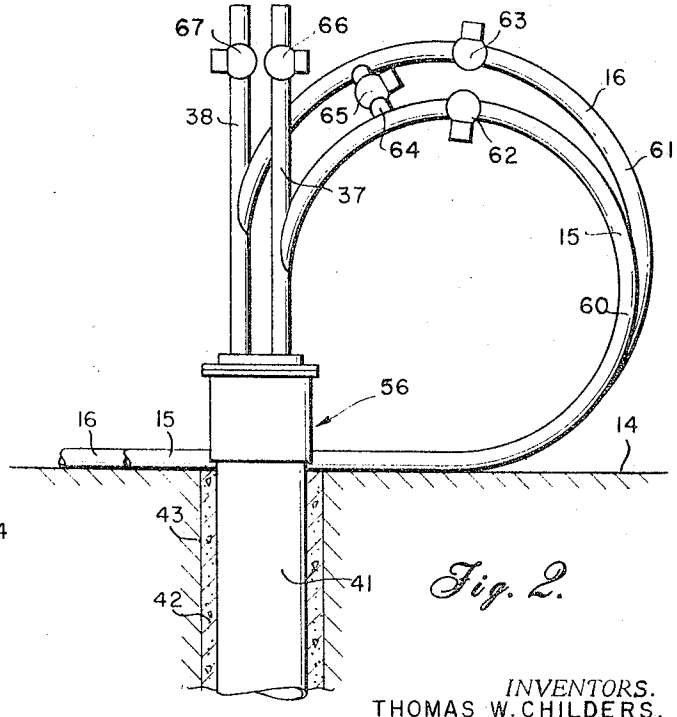


Fig. 2.

INVENTORS.
THOMAS W. CHILDERS,
EDMOND R. GENOIS,
BY CHARLES A. BRASIER,

ATTORNEY

United States Patent Office 3,464,495 Patented Sept. 2, 1969

3,464,495

WASHING A WELL

Thomas W. Childers, Metairie, Edmond R. Genois, New Orleans, and Charles A. Brasier, Metairie, La., assignors to Esso Production Research Company

Filed Sept. 11, 1967, Ser. No. 666,623
Int. Cl. E21b 21/00, 33/12
U.S. Cl. 166—312 9 Claims

ABSTRACT OF THE DISCLOSURE

Sand is washed from a well provided with interconnected tubing strings arranged with their lower ends above perforations in a well casing covered by the sand by propelling a tubular member equipped with loose-fitting pistons by fluid pressure through one of the tubing strings to extend to the sand; the tubular member follows the diminishing level of sand as the sand is washed up the other string by fluid circulation part of which bypasses around the loose-fitting piston thus providing additional fluid for washing the sand up the other string.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention is directed to method and apparatus for washing debris from a well. More particularly, the invention is concerned with washing sand and the like from a well. In its more specific aspects, the invention is concerned with washing sand from a well wherein a tubular member is propelled into the well and retrieved from the well by fluid pressure, the tubular member following the diminishing level of sand as the sand is removed and allowing fluid to by-pass around it.

Description of the prior art

It is known to wash material from a well with a tubular member which seats in and sealed with the lower end of the tubing. Such equipment, however, is adaptable to be lowered into and retrieved from substantially vertical wells by wire lines. It is also known to pump well tools into a well having a wellhead on water bottom by fluid circulation. However, the prior art has always provided for the well tools to be sealed in the lower end of the tubing strings and thus the only fluid available to remove sand and the like is that pumped down through the sealed tool which may be inadequate because of the decrease in velocity by virtue of the large diameter casing. Also, a telescopic member has been required with the apparatus to permit the tubular member to follow the sand. The telescopic member would have a limited stroke which would possibly require several "trips" to complete the washing. This invention overcomes the limited travel problem and permits the sand to be washed with one trip in well.

SUMMARY

The present invention may be summarized and described as a method of washing sand and the like from a well casing having at least first and second pipe strings providing a circulation path for fluid extending into a casing to a point above a body of sand and the like covering perforations in the casing. The fluid circulation path may involve a single pipe string and the annular space between it and the casing. There is introduced into the first pipe string an elongated tubular member of sufficient length to extend from the lower end of the first pipe string at least to the body of sand, the tubular member being provided with means on its trailing free

end for restricting flow of liquids. Liquid under sufficient pressure is introduced against the tubular member to cause the tubular member to travel through the first pipe string until the leading free end of the tubular member rests on the body of sand and its trailing free end and restricting means remain in the pipe string above the interconnection between the two pipe strings. Liquid is continued to be introduced under pressure to wash the sand from the body with the sand flowing up the second pipe string intermingled with liquid flowed down the pipe string and tubular member, the tubular member moving downwardly by pressure of liquid introduced into the first pipe string as sand is washed up the second pipe string until the perforations are uncovered.

The present invention also involves apparatus for use in well casing which involves first and second pipe strings fluidly interconnected adjacent their lower ends; stop means are arranged adjacent the lower end below the fluid connection. A free elongated tubular member of selected length is arranged in the first of the pipe strings for movement through the tubular member and is provided with restriction means for exertion of fluid pressure against the restriction means and permitting passage of fluid through the pipe string, the tubular member moving through the pipe string to extend therefrom a selected distance; engaging means on the tubular member spaced longitudinally ahead of the restriction means is provided for engaging with the stop means in the lower end of the pipe string below the fluid passage means, such that when the engaging means and stop means engage, the restriction means remains above the fluid passage. This allows retrieval of the tubular member by fluid pressure exerted against the restriction means.

BRIEF DESCRIPTION OF THE DRAWING

The present invention will be further described by reference to the drawing in which:

FIG. 1 illustrates a shore installation terminus of the present invention; and

FIG. 2 is a partial sectional view of the well and wellhead; and

FIG. 3 is a sectonal view of the lower portion of a well illustrating the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT AND BEST MODES RELATIVE TO THE DRAWING

Referring now to the drawing, and particularly to FIG. 1, numeral **11** designates the shore or a platform adjacent or in a body of water **12** having a water surface **13** and a shelving bottom **14** leading out to deep water. A first conduit or line **15** extends from the shore or a platform **11** to a well and wellhead which will be described further and a second line **16** likewise extends to the well and wellhead which will be discussed further. Line **15** is provided with an interconnecting line **17** which connects to a manifold **18** with valves **19** and **20** to connect line **17** with either the pump **21** which discharges through line **22** or with liquid source tank **23** through line **24**. An adjustable choke **25** is provided to regulate back pressure on return fluids. Line **16** is connected to the manifold **18** by line **26** and valves **27** and **28** control direction of flow from line **16**. Line **15** is provided with a lubricator section **29** and with valves **30** and **31** for insertion of well tools such as tubular members and the like through opening **32**. Line **16** is likewise provided with a lubricator section **33** and with valves **34** and **35** for insertion of well tools as may be desired through opening **36**. Line **15** connects into a wellhead, generally indicated by the numeral **56**, and line **16** likewise connects to the wellhead **56**. Lines **15** and **16** are interconnected adjacent the wellhead

through interconnection means 64 controlled by valve 65. It is to be noted that lines 15 and 16, respectively, are provided with radius bends 60 and 61 provided with valves 62 and 63. The wellhead 56 has vertical line 37 to which line 15 connects by way of bend 60 and vertical line 38 to which line 16 connects by way of bend 61. Both lines 37 and 38 are provided with valves 66 and 67 for control thereof as desired. Lines 37 and 38 extend as tubing strings into the well casing 41 which is cemented in well bore 43 by cement sheath 42 filing the space between the casing 41 and well bore 43. The vertical pipes 37 and 38 extend into the casing 41 to a selected distance above perforations 44 in the hydrocarbon productive horizon or stratum 45 and hydrocarbons such as oil and/or gas may be produced from stratum 45. This is a sand producing stratum and sand has been produced and accumulated in the casing 41 to form a body of sand 46 covering the perforations 44 and preventing production of desirable hydrocarbons.

In order to remove the sand, it is desirable to wash the sand from the casing and up one pipe string 37 or 38. In this situation, it is desirable to equip the pipe strings 37 and 38 when they are run in and set with a stop means such as landing nipples 47 and 48 which are arranged respectively in the lower ends of pipe strings 37 and 38. This stop means may be other stop means but a suitable J-nipple is described in the Composite Catalog of Oil Field Equipment and Service, 1966–67, page 3817. With the equipment of both pipe strings 37 and 38 with stop means, it is possible to use either one of the pipe strings 37 or 38 in the present invention. The annular space A between strings 37 and 38 and the casing 41 is closed by a suitable packing means 49. Such packing means are well known in the art.

To remove the sand body 46 in accordance with the present invention, a tubular member 50 provided with a plurality of piston members 51 is inserted in the pipe string 16 at the shore 11 and pumped through the pipe string 16 into the pipe string 38 around the radius bend 61. The pistons 51 are loose-fitting pistons which allow some fluid to pass around the pistons. The pistons may also be designed to allow fluid to flow through a pressure differential valve arrangement positioned between the piston wall and the pipe 50. By providing a restriction means, a pressure differential allows the tubular member 50 to be pumped into the pipe string 38 from the shore 11 by means of pump 21 supplied with liquid by conduit 24 and tank 23. The tubular member flows through the connection pipe 16, radius bend 34 and down into the pipe string 38 until its lower free end 52 provided with a ported nose guide 53 rests on and is slightly buried in the sand body 46.

The tubular member 50 is also provided with a shoulder or no-go ring 54 which is spaced from the lower piston 51 a sufficient distance such that the shoulder 54 engages the landing nipple or stop means 48. The lower piston 51 is above the interconnection or passage means 55 connecting the pipe string 37 with the pipe string 38 adjacent their lower ends.

It is important that the spacing between the shoulder 54 and lower piston 51 be selected such that the lower piston 51 is always above the interconnection 55; thus the distance between shoulder 54 and piston 51 is the distance required to maintain the piston above interconnection 55. This distance may be from about 1 to 10; feet; usually about 1 to 5 feet will be sufficient.

Likewise, the tubular member 50 should extend from the lower end of pipe strings 37 and 38 a distance sufficient to allow removal of sand body 46. With the level of perforations 44 known, the tubular member may be of selected length to reach the sand body 46 by extension from the lower end of pipe strings 37 and 38. This tubular member is of sufficient rigidity to support its own weight but has sufficient flexibility to travel through the various pipe strings connected to the well. This pipe may have a diameter of about ¾" tubing which will satisfactorily perform as indicated.

With the tubular member 50 in the position as shown in FIG. 3, fluid pressure is continued down the pipe 16, the radius bend 61 and pipe 38 passing through the tubular member 50 and around the pistons 51. The portion passing around piston 51 flows through interconnection 55 and thence up the string 57 to pipe 15 and to storage at shore 11 for further use and separation of sand therefrom. A portion of the fluid passes down through the tubular member out of the ported nose guide 53 and washes the sand up the casing 41 into the pipe 37. The fluids entering interconnection 55 increases the flow up the pipe string 38. As the level 56 of sand body 46 decreases by removal of sand, the tubular member by its own weight and force of fluid follows the level of sand down until the shoulder 54 engages the stop means 48 which signifies that the lowest perforation 44 has been uncovered and sand has been removed sufficient to allow production of hydrocarbons. When this occurs, circulation down pipe string 38 is terminated and circulation down the pipe string 37 is begun which allows fluid pressure to be imposed on piston 51 and allows the tubular member 50 to be retrieved from the pipe string to the shore 11.

In accordance with the present invention, a tubular member 50 having a length of 30 feet extending from pipe 38 may suitably require about three pistons 51. However, any number of pistons may be used depending on the length of the tubular member 50. Longer tubular members 50 may require more pistons.

Thus, in accordance with the present invention, a method and apparatus have been provided for washing sand and other particulate materials which are removable by washing with fluids, such as: fluid cement, debris, and the like, from a well.

The advantages of this invention are (1) the additional fluid which bypasses the leaky packers increases the flow up the second string, thereby insuring that the sand or debris is flushed from the tubing string; (2) the need for a telescopic member in the tubular member is eliminated as the tube can follow the top of the sand as it is lowered; and (3) sand washing can be accomplished with one trip in the hole. Thus, a jetting action is provided to remove sand, debris, fluid cement and the like. When the ported nose guide, such as 53, hits the sand body, such as 46, it may bury itself several inches in the sand. A piston, such as 51, acting as loose packers, provides a pressure differential across each piston. The total pressure differential is approximately equal to the pressure differential between the top of tubular member 50 and the top of the sand body 46 and allows flow through the tubular member 50, and sand and other debris may be washed out until the shoulder 54 stops in the restriction or stop means 48.

The nature and objects of the present invention having been completely described and illustrated and the best mode and embodiment contemplated set forth, what we wish to claim as new and useful and secure by Letters Patent is:

1. A method of washing a well having at least two pipe strings arranged therein which comprises:

introducing into one of said pipe strings an open-ended tubular member having at least one annular piston adapted to permit fluid to flow past said piston through the annulus between the outer surface of said tubular member and the inner wall of said one pipe string when fluid is introduced into said one pipe string to create a pressure differential across said tubular mmeber which causes said tubular member to move through said one pipe string; and

introducing fluid into said one pipe during under sufficient pressure to move said tubular member through said one pipe string until one end of said

tubular member extends from the lower end of said one pipe string, the fluid circulation path being down said one pipe string and up said other pipe string.

2. A method in accordance with claim 1 including continuing the introduction of fluid into said one pipe string and up said other pipe string, while maintaining at least one annular piston in said one pipe string, said fluid when flowing through said one pipe string flowing through said open-ended tubular member and also through the annulus between the outer surface of said tubular member and the inner wall of said one pipe string past said piston.

3. A method in accordance with claim 2 in which said two pipe strings are in side-by-side relationship.

4. A method in accordance with claim 3 in which said tubular member is retrieved up said one pipe string by introducing fluid under sufficient pressure into said other pipe string and flowing said fluid down said other pipe string and up said one pipe string.

5. A method of washing a well having at least two pipe strings arranged therein and a body of material to be washed from said well which comprises:

introducing into one of said pipe strings an open-ended tubular member of selected length and having at least one annular piston adapted to permit flow of fluid past said piston through the annulus between the outer surface of said tubular member and the inner wall of said one pipe string when fluid is introduced into said one pipe string to create a pressure differential across said tubular member which causes said tubular member to move through said one pipe string;

introducing fluid under sufficient pressure into said one pipe string to move said tubular member through said one pipe string until one end of said tubular member rests on said body of material, the other end of said tubular member being positioned within said one pipe string;

continuing introduction of fluid into said one pipe string under sufficient pressure to wash said body of material from said well up said other pipe string while maintaining at least one annulus piston in said one pipe string, said circulation flow path for said fluid being down said one pipe string through said open-ended tubular member and also through the annulus between the outer surface of said tubular member and the inner wall of said one pipe string past said piston and then up said other pipe string;

said material flowing up said other pipe string as it is washed from said well.

6. A method in accordance with claim 5 in which said two pipe strings are in side-by-side relationship.

7. A method in accordance with claim 6 in which said tubular member is moved downwardly by said fluid introduced into said one pipe string to follow the level of said material as said material is washed from said well until engaging means on said tubular member engages stop means on said one pipe string.

8. A method in accordance with claim 7 in which said tubular member is retrieved up said one pipe string by introducing fluid into said other pipe string, said circulation flow path being down said other pipe string and up said one pipe string.

9. A method in accordance with claim 8 in which said material washed from said well is sand.

References Cited

UNITED STATES PATENTS

2,782,860	2/1957	Tausch et al.	166—44
2,810,442	10/1957	Tausch	166—156
3,020,955	2/1962	Tausch	166—44
3,163,226	12/1964	Lagucki	166—156
3,263,753	8/1966	Corley	166—189

JAMES A. LEPPINK, Primary Examiner

U.S. Cl. X.R.

166—155