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Peevey

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[54] **PERFORATIONS WASHING TOOL**

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[51] **Int. Cl.** **E21b 23/00,** E21b 37/00

[58] **Field of Search** 166/311, 185, 191, 166/202, 186

[56] **References Cited**

UNITED STATES PATENTS

2,918,973	12/1959	Ozinga	166/202
2,802,535	8/1957	Taylor	166/191
2,897,897	8/1959	Breukelman	166/202
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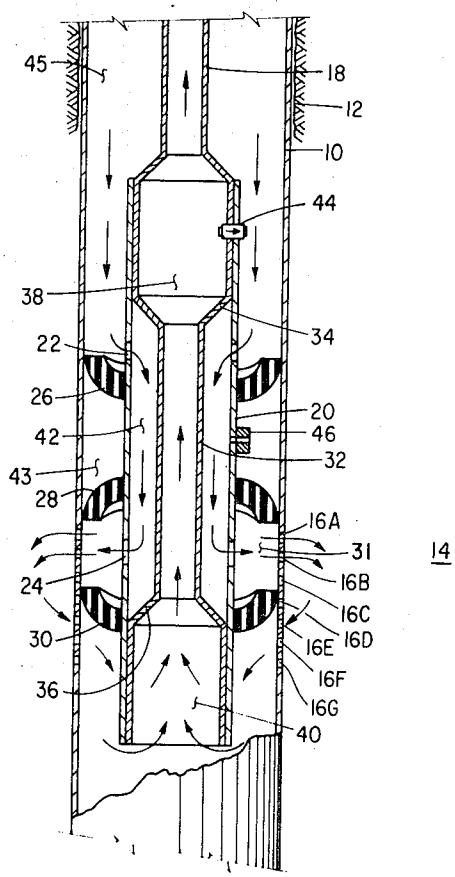
Primary Examiner—James A. Leppink

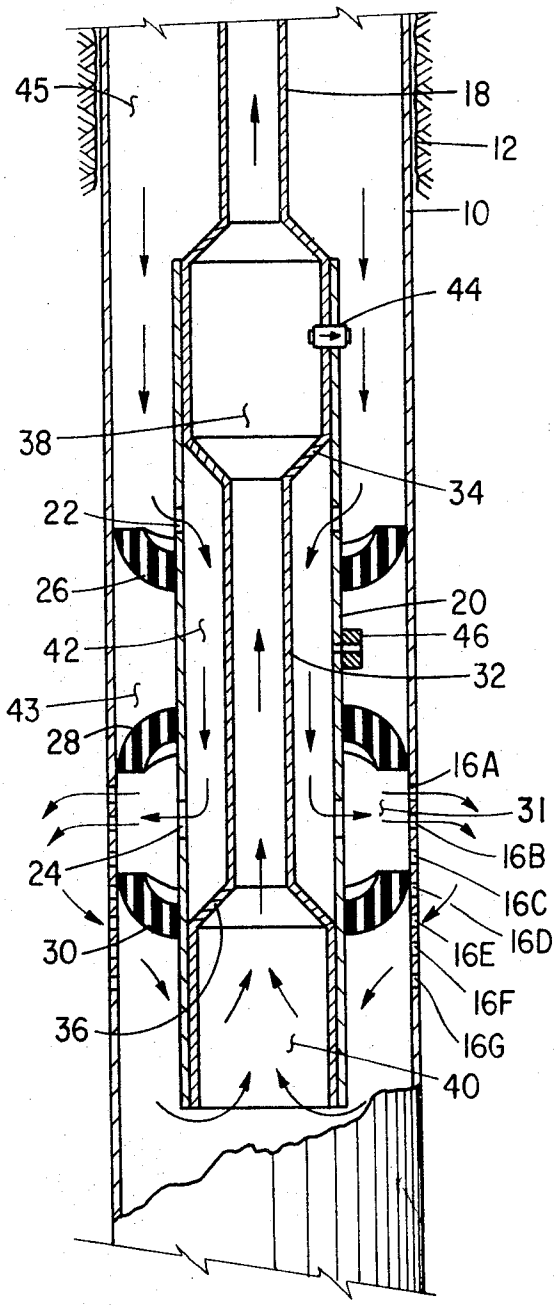
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[57] **ABSTRACT**

This invention concerns a tool for washing perforations in a casing set in a well bore. It includes a cylindrical housing having an upper port, and a lower port. The housing is connected to the lower end of a string of tubing hung from the well bore. The housing has various packers and passages so that cleaning fluid circulated down the annulus between the tubing string and casing flows in through the first port and out the second port through perforations at the same level as the second port. The cleaning fluid returns through lower perforations in the casing carrying sand or other plugging material with it and is returned up the tubing string.

7 Claims, 1 Drawing Figure




45
18
12
10
44
38
34
22
26
20
46
42
32
43
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16A
31
16B
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16C
16D
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16E
16F
36
16G
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14

PERFORATIONS WASHING TOOL

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a tool for washing perforations in a casing run in a well bore. It particularly relates to a tool whereby cleaning liquid is circulated down the annulus, forced into perforations at selected levels, and flows back into the well bore through lower perforations and upwardly through the tubing.

Setting of the Invention

Ordinarily when wells are drilled in the earth for the purpose of obtaining liquids such as oil or gas, a string of steel casing is set in the well bore. The casing is perforated at the level or interval at which it is desired to produce fluid from the surrounding formation. Frequently, it is desired to clean these perforations. A most common method is the washing technique whereby cleaning fluid is forced through the perforations. One common method of this is to use a Yowell tool manufactured by the Halliburton Company. This tool is attached to the lower end of a string of tubing and is provided with an upper packer and a lower packer which are used to isolate the perforations into which it is desired to inject cleaning fluid. In this system fluid is circulated down the tubing, through perforations isolated between the packer, back in through other perforations and up the annulus between the tubing and the casing. The biggest disadvantage of this method is that the fluid must be circulated at a very high rate to carry sand up the annular space because the area of the annulus is much larger than the area of the tubing. I have invented a perforations washing tool which is quite simple and permits the cleaning fluid to be circulated down the annulus through the perforations and back up the smaller tubing.

The Yowell tool and method of operating it is the most common way of cleaning perforations and is probably the most pertinent prior art system. However, there are many of the systems which have been suggested for cleaning perforations. One such tool is shown in U.S. Pat. No. 2,918,973. As can be seen, the cleanout tool of that patent is much more complicated than mine. Further, I provide pressure equalizing means or other valve means which are not shown in that patent.

BRIEF SUMMARY OF THE INVENTION

This is a tool for washing perforations in a casing set in a well bore and is connected to the lower end of a string of tubing suspended in the well bore. The tool has three cup type packers. There are two vertically spaced perforations in the housing of the tool. The upper perforation is above the upper packer and the lower flow port is between the two lower packers. A smaller tubular member extends from below the lower ports to above the upper port. The upper and lower ends of this tubular member are flared to form a seal with the internal wall of the housing. The lower end of the housing is open to the annulus immediately below the lower packer. In operation, the tool is set so that the perforations to be washed are between the lower two packers. Cleaning fluid is circulated down the annulus through the upper port of the housing and out its lower port between the lower packer and through the perforations in the casing. The fluid returns through the lower perforations below the lower packer and up the tubular member within the interior of the tool and is returned to the surface through the string of tubing.

BRIEF DESCRIPTION OF THE DRAWING

A better understanding of the invention, its objectives and operations, can be made with the following description taken in conjunction with the Drawing which is a cross sectional view of the perforations washing tool of this invention shown positioned in a well bore.

DETAILED DESCRIPTION OF THE INVENTION

Attention is directed to the drawing which shows a casing **10** set in borehold **12** which extends through producing formation **14.** The casing has perforations **16A** through **16G** which are at the same level as formation **14.**

A string of tubing **18** is suspended in the casing **10.** Both the tubing **18** and casing **10** extend to the surface where suitable wellhead equipment (not shown) is provided. The perforations washing tool is connected to the lower end of tubing **18.** This tool includes cylindrical housing **20** which has upper fluid port means **22** and lower fluid port means **24.** Three cup-like packers surround housing **20.** This includes an upper upwardly facing packer **26** which is positioned just below upper port means **22** and a pair of cup packers which face each other which are downwardly facing packer **28** and upwardly facing packer **30** which are above and below, respectively, lower port **24.**

Concentrically mounted within housing **20** is an inner tubular member **32** which extends from above port means **22** to below port means **24.** The upper end of tubular member **32** is flared with a flare section **34** which seals with the inner wall of housing **20.** The lower end of tubular member **32** is likewise flared with a flare section **36** which is sealed with the inner wall of housing **20.** Thus, there is formed an upper chamber **38** and a lower chamber **40** within housing **20** which are in fluid communication only through passage or tubular member **32.** The annular space **42** between passage **32** and housing **20** is thus sealed from chambers **38** and **40.**

Valve **44** is provided in the wall of chamber **38.** This can be either a check valve which permits flow only from chamber **38** to the exterior thereof or it can be any valve means that can be opened or enclosed from the surface. The function of this valve will be explained later.

Means are provided to permit controlled flow between annular space **42** and chamber **43** which is that space between packers **26** and **28** exterior of housing **20.** This can be a flow restriction device such as orifice **46** or it can be a valve which can be opened and closed from the surface. The desirability of having pressure equalization means in the wall of housing **20** between packers **26** and **28** will become apparant in the later description of the operation.

I shall now briefly describe the operations of the tool shown in the drawing. I suspend the tool shown in the drawing at the lower end of the tubing string **18.** I then start lowering the device. I tried one device without pressure euqalizing means **46.** Frequently, low pressure fluid was caught in the annular space **43** between packers **26** and **28.** As the tool was lowered through the fluid-filled borehole the hydrostatic pressure increased. This hydrostatic pressure was greater than the pressure in chamber **43** and forced upper packer **26** down and

lower packer 28 upwardly. The greater the differential pressure across each of these packers, the greater the force pushing the packer into an engagement with the casing. If this force becomes sufficiently high, it becomes impossible to lower the device through the well bore. In other words, it becomes stuck. I now avoid this difficulty by providing a pressure equalizer means 46 in the wall of housing 20 so that the pressure in chamber 43 will, under any static conditions, approach the pressure in the annulus above and below packers 26 and 28. Orifice 46 is sufficiently small so that when I pump cleaning fluid down annulus 45 between tubing 18 and casing 10 packers 26 and 28 will nevertheless set.

When I lower my tool through the fluid in the well bore, the fluid is being displaced by such movement. I therefore provide convenient means for the fluid to flow from below the tool to above the tool. Thus, I provide valve 44. Fluid can then flow from below the device up through center passageway 32 and out check valve 44.

I continue to lower the perforation washing tool until perforation 16A is between packers 28 and 30. At this time I start pumping cleaning fluid down annulus 45. This strikes the upper face of cup packer 26, setting it. The cleaning fluid flows through upper port 22 of the tool downwardly through annular space 42 and out port 24 where it is directed through upper perforations 16A, 16B and 16C. I can set packers 28 and 30 sufficiently close so that only one perforation is between them. The flow of fluid through annular space 31 between packers 28 and 30 tends to set those packers. The fluid returns through lower peforations 16E, 16F and/or 16G to the interior of the casing to below lower packer 30. This fluid then flows upwardly through chamber 40, longitudinal passage 32, chamber 38 to tubing string 18 where it is returned to the surface. After I have washed the perforations between packers 28 and 30 I shut off my cleaning fluid, let the packers 26, 28 and 30 relax, then I lower the tool to clean the next lower set of perforations.

While the above invention has been described with considerable detail, it is possible to make many modifications thereof without departing from the spirit or the scope of the invention.

I claim:

1. An apparatus for washing perforations in a casing set in a well bore and for connecting to the lower end of a tubular member suspended in the casing which comprises:
- a cylindrical housing having an upper port and a lower port in the walls thereof,
- a first packer surrounding said housing and placed below said upper port,
- a second packer surrounding said housing and positioned below said first packer and above said lower port,
- a third packer surrounding said housing and positioned below said lower port,
- a first chamber at the upper end of said housing and containing means connectable into said tubular member,
- a second chamber at the lower end of said housing and open at its lower end to the interior of the casing immediately below said third packer,
- a passage means extending between said first and second chamber.

2. An apparatus as defined in claim 1 in which said first packer is a cup type packer facing up, said second packer is a cup type packer facing down and said third packer is a cup type packer facing up.

3. An apparatus as defined in claim 1 including an orifice in the wall of said housing between said first and said second packers.

4. An apparatus as defined in claim 1 including a valve means between the first chamber and the exterior of said housing.

5. An apparatus as defined in claim 2 and including a flow restriction means in the wall of said housing between said first packer and said second packer.

6. An apparatus as defined in claim 5 in which said flow restriction means is an orifice.

7. An apparatus as defined in claim 4 in which said valve means permits only unidirectional flow from within said first chamber to the exterior thereof.

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