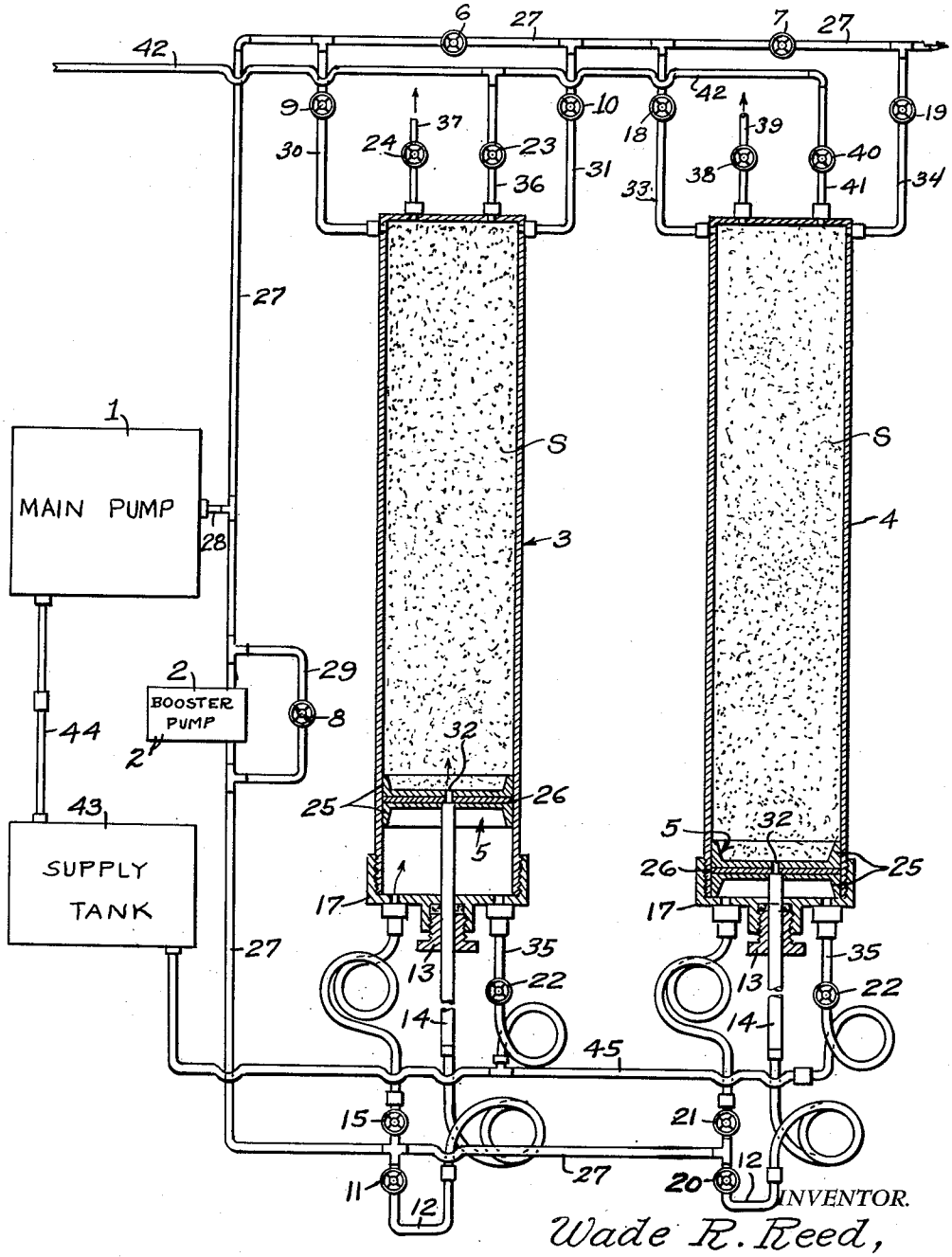
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SAND AND GRAVEL INJECTOR FOR OIL WELL SERVICING

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SAND AND GRAVEL INJECTOR FOR OIL WELL SERVICING

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1 Claim. (Cl. 302—14)

This invention relates to oil well servicing equipment, and more particularly to an assembly for injecting sand and gravel into oil wells.

The object of the invention is to provide an assembly for use in injecting sand and gravel into oil wells in order to increase the productive capacity of the wells.

Heretofore in oil well operations, methods known as hyda-fracking and strata-fracking have been used. Thus, according to these methods crude oil or gasoline jell is pumped into the well tubing or casing under high pressure in the neighborhood of 2000 to 3000 pounds per square inch, and this crude oil or gasoline jell has mixed therewith a hard sand which includes grains of about .025 inch in diameter. In actual practice a mixture of about one pound of sand to a gallon of fluid is used and this high pressure cracks up the oil formation whereby the sand lodges in the crevices to prevent the crevices from coming back together after the pressure is released. Thus, there is formed a multitude of leaks in the oil formation to thereby create a marked increase in the production of the well. However, one difficulty with this process is that the sand mixture passes through the high pressure pump to cause a great amount of damage to the pump and also, another disadvantage is that the size of the grains of sand is limited and if sand or gravel having a larger diameter is used the crevices could be held further apart after releasing the pressure.

It is, accordingly, another object of the invention to produce an assembly which will eliminate the foregoing disadvantages.

A further object of the invention is to provide a sand and gravel injector for oil wells which is extremely simple and inexpensive to manufacture.

Other objects and advantages will be apparent during the course of the following description.

In the accompanying drawings, forming a part of this application, and in which like numerals are used to designate like parts throughout the same the single view is a view, with parts broken away and in section showing the present invention.

Referring in detail to the drawing, the numeral 1 designates a high pressure hydraulic pump which can be of conventional construction providing it will produce pressures up to several thousand pounds per square inch. The assembly further includes a small capacity booster pump 2, and the numerals 3 and 4 designate cylinders of heavy construction which will withstand the required high pressures. Each of the cylinders 3 and 4 are adapted to hold a quantity of sand and gravel for a purpose to be later described, and this sand and gravel is indicated by the letter S. Reciprocably or slidably arranged in each of the cylinders 3 and 4 is a piston 5, and each of the pistons 5 includes a pair of rubber cups 25 which have a plate 26 therebetween. A conduit 28 leads from the main pump 1 to a conduit 27, and one end of the conduit 27 is adapted to lead to the oil well casing. A bypass or branch conduit 29 is connected to the conduit 27, and a valve 8 is interposed in the bypass 29.

A pair of valves 6 and 7 are interposed in the conduit 27 for a purpose to be later described. A pair of conduits or pipes 30 and 31 lead from the conduit 27 to one end of the cylinder 3, while a similar pair of conduits 33 and 34 lead from the conduit 27 to the other cylinder 4. A valve 9 is arranged in the conduit 30, a valve 10 is arranged in the conduit 31, and valves 18 and 19 are arranged in the conduits 33 and 34, respectively.

A high pressure tube or conduit 12 has one end connected to a detachable or removable head 17 which is mounted on the other end of each of the cylinders 3 and 4. One end of the tube 12 communicates with a tube 14 which is adapted to convey a certain amount of hydraulic fluid or oil into the interior of the cylinders so that the sand and gravel will have a sufficient quantity of oil intermixed therewith to prevent the sand and gravel from solidifying. The tube 14 may be slidably mounted in a packing or stuffing box 13 which is arranged on an end of each of the heads 17. A pair of valves 11 and 15 are interposed in the high pressure hose or conduit 12. For the purposes of clarity, the valves in the hose 12 for the cylinder 3 are indicated by the numerals 11 and 15, while the valves in the hose 12 for the other cylinder 4 are indicated by the numerals 20 and 21.

There is further provided a conduit 35 which extends from each of the heads 17, and the conduit 35 is connected to a hose or conduit 45 which leads to a supply tank 43. A valve 22 is interposed in each of the conduits 35.

The numeral 42 designates an air line or conduit which is adapted to convey air under pressure from a suitable source of supply. A conduit 36 leads from the air line 42 to one end of the cylinder 3, and a similar conduit 41 connects the cylinder 4 to the air line 42. A valve 23 is interposed in the conduit 36, and a value 40 is interposed in the conduit 41. A bleeder line 37 having a valve 24 therein leads from the cylinder 3, and a similar bleeder line 39 having a valve 38 therein leads from the other cylinder 4.

The conduits 36 and 41 leading from the air line 42 are adapted to supply compressed air to the cylinders 3 and 4 when the pistons 5 are to be forced back to their original positions.

The conduits 35 having the valves 22 therein communicate with the supply tank 43 through the conduit 45 so that the hydraulic fluid or oil can be returned to the supply tank 43. A conduit 44 interconnects the supply tank 43 and the main pump 1. Each of the pistons 5 is provided with a central opening 32 whereby fluid passing from the tubing 14 can pass through the cylinder 4 and intermix with the sand or gravel S.

From the foregoing, it is apparent that a sand and gravel injecting mechanism for oil well servicing has been provided. In use, crude oil or gasoline jell under high pressure is pumped into the well tubing or casing and a mixture of hard sand is pumped in with the oil or jell. This high pressure cracks up the oil formation and the sand lodges in the crevices to prevent the crevices from coming back together after the pressure is released to thereby form a multitude of leaks in the oil formation so that a marked increase in the well's production is accomplished. By means of the present invention the sand mixture will not go through the high pressure pump 1 so that there will be no damage to the pump during the operation. Also, the sand and gravel can be of larger diameter grains than is ordinarily used.

The operation of the assembly is as follows: the cylinders 3 and 4 are first loaded with the desired quantity of sand or gravel S and this sand or gravel may be initally saturated with the fluid to be pumped. The pump 1 may be driven by means of a power take-off on a truck

and pressure is built up to the bottom of the well. At this time the valves **6** and **7** are open. Assuming that the cylinder **3** on the left is to be emptied first, the stops or valves **9** and **10** are opened and the valve **6** is closed to thereby cause the discharge stream to pass through the end of the cylinder **3** through the conduit **31**, then through the conduit **27** in the direction of the arrows. Next, the valve **11** is opened and the bypass valve **8** is closed slightly. This causes the fluid to flow through the hydraulic hose **12** and through the tubing **14** and into the cylinder **3** behind the sand and gravel. The tubing **14** passes through the stuffing box **13** and is connected to the discharge line of the booster pump **2** by means of a suitable fitting. The valve **15** is also interposed in the line **12** and the line **12** leads to the cylinder head **17**.

The fluid passing through the tubing **14** enters the cylinder **3** through the opening **32** and this fluid keeps the sand and gravel loosened up in the cylinder to thereby prevent the sand and gravel from becoming locked or solidified. When the valve **15** is opened, the piston **5** moves forwardly in the cylinder **3** and since the discharge from the pump **1** is passing through the end of the cylinder, the sand and gravel S will be moved forwardly and will be carried through the outlet **31**, to the conduit **27** and into the well. The amount of pressure and quantity of fluid required to keep the sand loosened up and the forward travel of the piston **5** is controlled by the bypass valve **8** and the valves **11** and **15**. Suitable graduations or markings can be arranged on the tubing **14** so that an indication will be given as to the required amount of gravel per gallon of fluid being used.

After the piston **5** in the cylinder **3** has reached the extreme forward travel in its cylinder, the valve **6** is opened and the valves **9** and **10** are closed. Then, the bypass valve **8** is opened and the valves **11** and **15** are closed and this completely cuts off the cylinder **3**. Next, the valves **18** and **19** for the cylinder **4** are opened and the valve **7** is closed to thereby cause the fluid to pass through the end of the cylinder, this cylinder having been previously loaded for operation. Next, the valve **20** is opened, the valve **8** is closed slightly and the valve **21** is opened slightly. This process is repeated for the cylinder **4** in the same manner as the previously described cylinder **3**.

When the cylinder **3** is to be reloaded, the valve **22** is opened to permit fluid behind the piston **5** to drain back to the supply tank **43**. The valve **23** is then opened and air pressure from the hose **42** is injected into the forward end of the cylinder **3** to force the piston **5** back to the opposite end of the cylinder and force the remaining

fluid out through the conduit **35**, then into the conduit **45** and back to the supply tank **43**. The air is shut off and the pressure released through the bleeder line **37**. The cylinder heads **17** can be removed and also the piston **5** can be removed. Thus, the cylinder head can be removed when the cylinder is to be reloaded with sand and gravel. After the cylinder is refilled with the desired quantity of sand and gravel, the piston and head are replaced and the cylinders are ready for operation. Although the apparatus has been shown to include two cylinders, it is to be understood that more than two cylinders can be used and the parts can be adjusted and controlled so that there is a minimum amount of delay between discharge of the cylinders so that the cycle is continuous. The connections to the removable heads on the cylinders are high pressure conduits or hoses so that there will be no danger in using such parts.

I claim:

In a sand and gravel injector for oil well servicing equipment, a main pump, a booster pump, a pair of cylinders adapted to hold a quantity of sand and gravel, a piston reciprocably arranged in each of said cylinders and each of said pistons being provided with a central opening therein, a first conduit leading from said main pump, a second conduit connected to said first conduit, said second conduit adapted to lead to an oil well casing, a bypass line connected to said second conduit and having a valve therein, a pair of valves interposed in said second conduit, a first pair of pipes leading from said second conduit to one end of one of said cylinders, a second pair of pipes leading from said second conduit to an end of said other cylinder, valves arranged in each of said pipes, a head mounted on the other end of each of said cylinders, a third and fourth conduit connected to said second conduit and having one end connected to said heads and their other ends communicating with the openings in said pistons, valves in said third and fourth conduits, fifth conduits connecting said heads to said supply tank, a sixth conduit adapted to be connected to a source of air under pressure and communicating with said cylinders, bleeder lines connected to said cylinders, and a seventh conduit connecting said supply tank to said main pump.

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