

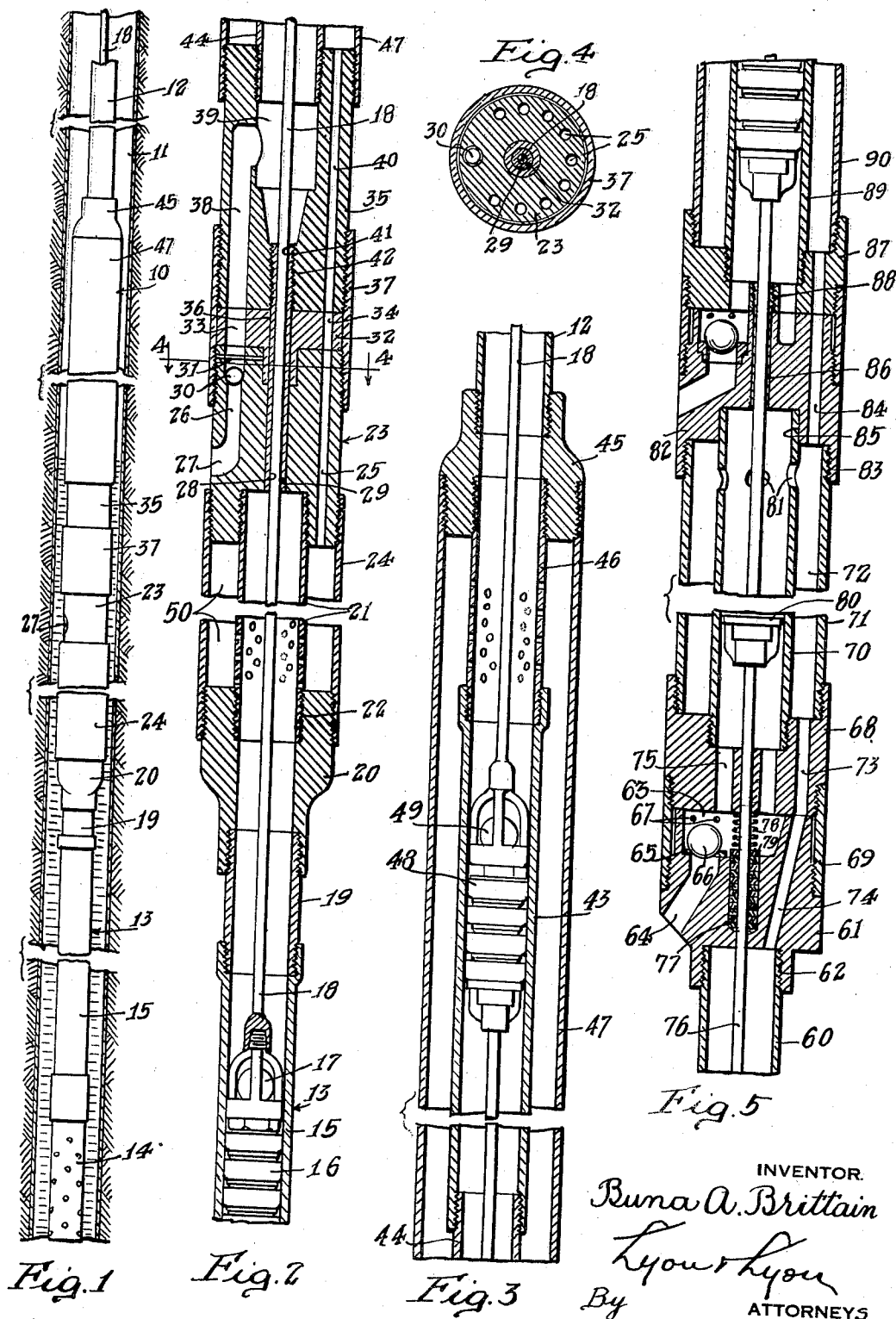
Dec. 31, 1940.

B. A. BRITTAIN

2,227,122

FLUID PUMP

Filed Jan. 24, 1938



INVENTOR.
Buna A. Brittain
By *Lyon & Lyon*
ATTORNEYS

UNITED STATES PATENT OFFICE

2,227,122

FLUID PUMP

Buna A. Brittain, Los Angeles, Calif.

Application January 24, 1938, Serial No. 136,651

15 Claims. (Cl. 103—184)

This invention relates to a fluid pump of the multi-cylinder type, especially applicable for oil well pumping.

It is one of the principal objects of this invention to arrange a multi-cylinder pump so that the suction or inlet passages for each cylinder will be of minimum length and of relatively large area, whereby a greater amount of fluid will enter the cylinders during each operating stroke, thereby greatly increasing the pumping capacity and efficiency of the pump. This feature is especially advantageous when applied to oil well pumps. Oil is a relatively heavy viscous fluid, and has entrained therewith considerable gas, and as a result, the oil cannot be sucked up a relatively long suction pipe of necessarily restricted area at a velocity sufficient to follow the movement of the pump plunger without causing the gas to separate therefrom, and partially if not totally filling the pump cylinder, resulting in little or no oil being pumped. This is especially true of the upper cylinder or cylinders, which, heretofore have had their suction pipes leading down to below the lowermost cylinder, and usually to the vicinity of the inlet port for that cylinder. When the inlets for the several cylinders all draw from the same locality, the pull on the oil at this point is unnecessarily great, thereby further tending to cause the gas to separate from the oil, and as a result, greatly adding to the tendency of the pump to become partially or totally gas-bound with the resultant loss of pumping efficiency.

A further object is to provide a simple and effective means for coupling the pumps together.

A further object is to provide the coupling means with an inlet or suction passage for communicating one of the connected pumps with the well bore, and for providing an inlet valve in said passage.

A further object is to provide a common discharge passage for the fluid pumped by each of said pumps, and for providing the coupling means with discharge ports for communicating the discharge passage at one end of the coupling with the corresponding passage located at the other end of the coupling.

Other objects and advantages of the invention will become apparent as the nature of the same is more fully understood from the following description and accompanying drawing, wherein is set forth what is now considered to be a preferred embodiment. It should be understood, however, that this particular embodiment of the invention is chosen principally for the purpose of exemplification, and that variations therefrom in details

of construction or arrangement of parts, may accordingly be effected and yet remain within the spirit and scope of the invention as the same is set forth in the appended claims.

In the drawing:

Figure 1 illustrates a side elevational view of the pump as it would appear when suspended in a well bore.

Figure 2 illustrates an enlarged sectional view extending from the upper end of the first pumping cylinder to and including a short portion of the lower end of the second pumping cylinder.

Figure 3 illustrates an enlarged sectional view of the upper end of the pump.

Figure 4 illustrates a sectional view taken substantially in the plane of line 4—4 of Figure 2.

Figure 5 illustrates an interrupted sectional view of a slightly modified form of pumping structure.

In Figure 1 the fluid pump 10 of this invention is shown suspended in an oil well 11 by means of oil delivery pipe or tubing 12.

The pump is suspended in the well bore in the usual manner, and therefore this detail has not been shown.

The pumping structure 10 includes a lower or first pump 13 of conventional design, and may include a perforated inlet pipe 14, a pump barrel 15 having the usual inlet valve, not shown, and a plunger 16. The plunger is of usual construction, including the usual form discharge valve 17, and is mounted upon the lower end of pump rod 18, which is reciprocated in the usual manner.

The pump barrel at its upper end is coupled to nipple 19 which, in turn, is coupled to the lower end of header 20, but if preferred, the pump barrel may be connected directly to the header. A perforated nipple 21 at one end is threaded into the header bore 22, and at its opposite end is threaded into the valve block 23. A discharge tube 24 is also threaded at its opposite ends to the header and block to form a discharge passage between the nipple and tube. The valve block is provided with a plurality of discharge ports 25 (Figs. 2 and 4), an inlet port 26 which communicates with the well bore as at 27, and a bore 28 for the pump rod bushing 29 through which the pump rod operates. The rod and bushing are closely fitted to form a fluid seal. However, any other appropriate sealing means may be provided for preventing the oil pumped by the first pump from leaking along the pump rod into the second pump. An inlet valve 30 is mounted in inlet port 26, and is prevented from lifting too far off its seat by pins 31, or other suitable means.

A spacer 32 having inlet passage 33 and discharge ports 34, is mounted between the inlet block and the pump head 35, and is provided with bore 36 for the pump rod bushing 29. The valve block 23 and head 35 clamp the spacer tightly between their opposed ends by means of threaded sleeve 37. It is important to maintain the ports and passages of these parts in alignment, and therefore, one of these parts is provided with a right-hand thread, and the other with a left-hand thread, and the sleeve is correspondingly threaded; and by this arrangement the valve block and head may be held against rotation while the sleeve is rotated until the spacer is tightly clamped between the block and head. The spacer may be held against rotation by locking it to the valve block by any form of appropriate dowel or key means, not shown.

The pump head 35 is provided with an inlet port 38, which communicates the inlet ports 33 and 26, of the spacer and block respectively, with the second pump cylinder bore 39, as may be clearly observed in Figure 2. The head is also provided with discharge passages 40, which communicate with the spacer and block passages 34 and 25, and with a pump rod bushing bore 41. As may be observed in Figure 2, the pump rod bushing at its upper end may be threaded into the head as at 42.

The second pump barrel 43 may be secured at its lower end directly to head 35, but I prefer to interpose between the head and barrel a short pipe section 44, Figures 2 and 3, while at its upper end the barrel is connected to the upper header 45 by the perforated pipe 46. A discharge tube 47 joins head 35 and the upper header 45 to form a discharge passage past the second pump. Pump plunger 48 is carried by the pump rod, and is of usual construction and is provided with a discharge valve 49. The upper header 45 is screw-threaded to the oil delivery pipe 12, and from this point on to the top of the well, the structure is of standard, well known construction.

In operation, a reciprocatory motion is given to the pump rod, thereby driving the two pump plungers 16 and 48 up and down in their respective barrels. On the up-stroke, oil will be drawn into the first pump barrel through the perforated inlet pipe 14 and its inlet valve, while at the same time oil will be drawn into the second pump barrel through inlet ports 26, 33 and 38, and during its flow lifts the inlet valve 30. As may be noted in Figure 1, the inlets 14 and 27 are spaced sufficiently apart to prevent an excessive pulling action from being exerted upon the fluid, and as a result, less gas will be drawn into the cylinders. It will be appreciated that if the two inlets were positioned at the same locality in the well bore as has been tried, that the suction in the locality of these inlets would be relatively high, and as the oil is relatively viscous and slow moving, the gas will be drawn out of the oil and into the cylinders, thereby reducing the amount of oil which will flow into the cylinders, and as a result, little or no oil will be pumped at normal pumping speed. This condition is particularly true of the upper pump, which must lift the oil a relatively great distance through a constricted inlet pipe due to lack of room. These faults and defects are entirely eliminated in the pump of this invention, wherein the inlet passage for each pump communicates with the well bore at a relatively great distance from each other; and of equal importance, both inlet ports are relatively short in

length and of relatively large area, whereby the pull on the oil is reduced to a minimum, and as a result, little or no gas is caused to be separated from the oil, so that the pump barrels will fill practically full of oil during the intake stroke, thus producing a high pumping efficiency. And further, due to my improved design, the pumps may be operated efficiently at a higher speed.

On the down-stroke, the inlet valve closes and the oil entrapped in the pump cylinders passes through the plungers, lifting the discharge valves 17 and 49. During the next up-stroke, the discharge valves close, and as the plungers rise the oil is forced upwardly. The oil discharged from the first pump flows through the holes provided in the perforated nipple 21 into the discharge space 50, formed between the nipple and discharge tube 24, and from the discharge space the oil flows through the passages 25, 34 and 40, provided through the coupling formed of block 23, spacer 32 and head 35. The oil passes from passages 40 into the discharge space 51 formed between the discharge tube 47 and the second pump, and from this space flows through the perforations in nipple 46 to join with the oil being discharged from the second pump, and is finally forced up through the oil delivery tubing 12 to the surface.

A pump of this type has been built, and has proven very efficient in operation.

In Figure 5 I have shown a slightly modified form of the invention as it may be applied to a pump structure having three or more pumping cylinders. It will be understood that the pump shown in Figures 1 to 4 may also be arranged to include any desired number of pumps.

In Figure 5 the first pumping barrel 60 is only partially shown, as it is of usual construction. The upper end of barrel 60 is fastened to valve block 61 as by threads 62. The valve block is provided with a valve pocket 63, which is communicated with the well bore by inlet port 64, and a valve seat 65 is mounted in the port at its juncture with said pocket. The valve ball 66 cooperates with seat 65, and pins 67 or other suitable means are provided for maintaining the valve in operative relation with its seat. The valve block is securely clamped to pump head 68, preferably by the same form of right and left-hand threads and sleeve member 69, as made use of in the first described form of my invention. By this arrangement the contacting faces of the blocks and head are brought into fluid-tight sealing relation. The second pump barrel 70 is fastened to the inner counterbored portion of the upper end of pump head 68, while the discharge tube 71 is also carried by the head so as to form an oil discharge passage 72 between the pump barrel and tube. Suitable discharge passages 73 and 74 are formed through the head and block respectively. The discharge passages 74 of the block are angularly inclined in order to communicate the bore of pump barrel 60 with passages 73, which passages in turn communicate with the oil discharge space or passage 72. The head is provided with one or more inlet ports 75 for communicating the valve pocket with the bore of the second pump barrel.

The pump rod 76 passes through the block and head, and in these members I have shown one form of packing means for sealing the pressure fluid discharging from the first pump, from leaking into the inlet side of the second pump. This packing means may include stuffing-box 77 filled with suitable packing material, which may be

yieldingly maintained compressed by spring 73 and gland 79. The spring may act between the head and gland, as shown.

It will be understood that the pump rod carries at its lower end a standard form of pump plunger for operating in the first pump barrel, and carries the pump plunger 83 of the type shown in Figure 3, for operation in the second barrel, and a similar type of plunger for each of the above barrels. The oil discharging from the second pump passes through suitable ports 81 located adjacent the upper end of the second pump barrel, into the discharge passage or space 72 to join with the oil delivered by the first pump. The valve block 82 is similar to valve block 81, but differs therefrom by providing a threaded bore 83 to receive the upper end of discharge tube 71, by providing vertical discharge passages 84, by providing a sliding fit in the counter-bore 85 for supporting the upper end of the second pump barrel, and by providing a pump rod bushing 86 for sealing the pump rod bore against leakage. The pump head 87 is like head 68 in all respects, with the exception of threading the pump rod bore 88 to receive the threaded end of the pump rod bushing 86.

The pump barrel for the third pump is shown at 89, and the discharge tube at 90. The oil discharged by the third pump passes through suitable ports into the discharge passage in the same manner as does the oil from the second pump. For each succeeding pump a coupling of the same type is provided to join the succeeding pumps, and the oil from each of these succeeding pumps will be delivered into the discharge passage until reaching the upper end of the final pump, which may be arranged like the upper end of the pump shown in Figure 3, wherein the oil from the discharge passage passes into the main oil delivery tube, which conducts the oil to the surface of the well.

Having fully described the invention, it is to be understood that it is not to be limited to the details herein set forth, but the invention is of the full scope of the appended claims.

I claim:

1. In a pump structure, an upper pump, an inlet head carried thereby and communicating said upper pump directly with the well bore, a lower pump, a discharge head carried thereby, said heads at their opposed ends being respectively threaded right and left hand, a correspondingly threaded sleeve for securely clamping said heads together without requiring rotation of one head relative to the other, an inlet for said lower pump, and a discharge passage communicating with said discharge head to conduct fluid discharged by said lower pump above said upper pump.

2. In a pump structure, an upper cylinder, an inlet head carried thereby, a lower cylinder, a discharge head carried thereby, a pump piston in each of said cylinders, said heads being threaded right and left hand respectively at their opposed ends, a correspondingly threaded sleeve for securely clamping said heads together, said heads having an inlet passage communicating the interior of the upper cylinder with the exterior of the structure, an inlet valve means mounted in said passage, an inlet for said lower cylinder, and discharge passages for said lower cylinder to conduct fluid discharged by said lower cylinder above said upper cylinder.

3. In a pump structure, an upper cylinder, an inlet head carried thereby, a lower cylinder, a dis-

charge head carried thereby, a pump piston in each of said cylinders, said heads being threaded right and left hand respectively at their opposed ends, a correspondingly threaded sleeve for securely clamping said heads together, said heads having an inlet passage communicating the interior of the upper cylinder with the exterior of the structure, an inlet valve means mounted in said passage, an inlet for said lower cylinder, a discharge pipe carried by said inlet head, and said heads having a discharge passage means communicating the interior of said lower cylinder with said discharge pipe, to conduct fluid discharged by said lower cylinder above said upper cylinder.

4. In a pump structure, an upper cylinder, an inlet head carried thereby, a lower cylinder, a discharge head carried thereby, said heads being threaded right and left hand respectively at their opposed ends, a correspondingly threaded sleeve for securely clamping said heads together, said heads having an inlet passage communicating the interior of the upper cylinder with the exterior of the structure, an inlet valve means mounted in said passage, an inlet for said lower cylinder, discharge means carried by the inlet head, said heads having a discharge passage means communicating the interior of said lower cylinder with said discharge means to conduct fluid discharged by said lower cylinder above said upper cylinder, a piston rod slidably mounted in said heads and extending through said cylinders, a piston mounted on said piston rod within each of said cylinders, and means carried by one or both of said heads for preventing fluid leakage along the piston rod from one of said cylinders to the other.

5. In an oil well pumping structure, a first plunger pump having an inlet passage communicating with the well bore, valve means mounted in said passage, operating means for said pump, a second plunger pump mounted above and in alignment with said first pump and operated by said operating means, coupling means for joining the two pumps, said coupling means including a sleeve, said sleeve being right-hand threaded at its upper end and left-hand threaded at its lower end, said first and second pumps being correspondingly threaded for engagement with the corresponding ends of said sleeve, said coupling means having an inlet port communicating the second pump directly with the well bore and discharge means for said first pump to conduct fluid discharged by said first pump above said second pump, and valve means for said port.

6. In an oil well pumping structure, a first plunger pump having an inlet passage communicating with the well bore, valve means mounted in said passage, operating means for said pump, a second plunger pump mounted above and in alignment with said first pump and operated by said operating means, a head mounted upon said first pump, an inlet port in said head communicating the second pump directly with the well bore, discharge means for said first pump to conduct the fluid discharged by said first pump above said second pump, valve means for said port, a threaded sleeve, the lower end of said threaded sleeve being left-hand threaded for engagement with a corresponding thread upon said head, and the upper end of said threaded sleeve being right-hand threaded for engagement with a corresponding thread upon said second pump.

7. In an oil well pumping structure, a first plunger pump having an inlet passage communicating with the well bore, valve means mounted

in said passage, operating means for said pump, a second plunger pump mounted above and in alignment with said first pump and operated by said operating means, a head mounted upon said first pump, an inlet port in said head communicating the second pump directly with the well bore, valve means for said port, discharge means for said first pump to conduct the fluid discharged by said first pump above said second pump, a threaded sleeve, the lower end of said threaded sleeve being left-hand threaded for engagement with a corresponding thread upon said head, the upper end of said threaded sleeve being right-hand threaded for engagement with a corresponding thread upon said second pump, and a spacer having an inlet for alignment with said inlet port and a discharge passage for alignment with said discharge means therein mounted upon said head within said sleeve.

8. In an oil well pumping structure, a first pump having an inlet passage communicating with the well bore, operating means for said pump, a second pump in alignment with said first pump and operated by said operating means, and means for joining the two pumps, said joining means having an inlet port communicating the second pump with the well bore at a point closely adjacent the lower end of said second pump, discharge means for said first pump to conduct fluid discharged by said first pump above said second pump, said joining means including a sleeve, said sleeve being right-hand threaded at its upper end and left-hand threaded at its lower end, said first and said second pumps being correspondingly threaded for engagement with the corresponding ends of said sleeve.

9. In an oil well pumping structure, a first plunger pump having an inlet passage communicating with the well bore, valve means mounted in said passage, operating means for said pump, a second plunger pump mounted above and in alignment with said first pump and operated by said operating means, a head mounted upon said first pump, an inlet port in said head communicating the second pump directly with the well bore at a point closely adjacent the lower end of said second pump, a discharge passage in said head for conveying oil pumped by said first pump past said second pump, valve means for said port, a threaded sleeve, the lower end of said threaded sleeve being left-hand threaded for engagement with a corresponding thread upon said head, and the upper end of said threaded sleeve being right-hand threaded for engagement with a corresponding thread upon said second pump.

10. In an oil well pumping structure, a first plunger pump having an inlet passage communicating with the well bore, valve means mounted in said passage, operating means for said pump, a second plunger pump mounted above and in alignment with said first pump and operated by said operating means, a head mounted upon said first pump, an inlet port in said head communicating the second pump directly with the well bore at a point closely adjacent the lower end of said second pump, discharge means for conveying fluid discharged by said first pump above said second pump, valve means for said port, a threaded sleeve, the lower end of said threaded sleeve being left-hand threaded for engagement with a corresponding thread upon said head, and the upper end of said threaded sleeve being right-hand threaded for engagement with a corresponding thread upon said second pump, and a

spacer mounted within said sleeve upon said head, said spacer having inlet and discharge passages therein adapted to align with corresponding passages in said head.

11. In an oil well pumping structure, a first plunger pump having an inlet passage communicating with the well bore, valve means mounted in said passage, operating means for said pump, a second plunger pump mounted above and in alignment with said first pump and operated by said operating means, a head mounted upon said first pump, an inlet port in said head communicating the second pump directly with the well bore, valve means for said port, a threaded sleeve, the lower end of said threaded sleeve being left-hand threaded for engagement with a corresponding thread upon said head and the upper end of said threaded sleeve being right-hand threaded for engagement with a corresponding thread upon said second pump, said head having other passages for conveying the oil pumped by the first of said pumps past the second of said pumps.

12. In an oil well pumping structure, a first plunger pump having an inlet passage communicating with the well bore, valve means mounted in said passage, operating means for said pump, a second plunger pump mounted above and in alignment with said first pump and operated by said operating means, a head mounted upon said first pump, an inlet port in said head communicating the second pump directly with the well bore, valve means for said port, a threaded sleeve, the lower end of said threaded sleeve being left-hand threaded for engagement with a corresponding thread upon said head, the upper end of said threaded sleeve being right-hand threaded for engagement with a corresponding thread upon said second pump, said head having other passages for conveying the oil pumped by the first of said pumps past the second of said pumps, and a spacer having an inlet and a discharge passage therein for alignment with the passages in said head, mounted within said sleeve upon said head to facilitate alignment of the respective passages.

13. In an oil well pumping structure, a first plunger pump having an inlet passage communicating with the well bore, valve means mounted in said passage, operating means for said pump, a second plunger pump mounted above and in alignment with said first pump and operated by said operating means, a head mounted upon said first pump, an inlet port in said head communicating the second pump directly with the well bore, valve means for said port, a threaded sleeve, the lower end of said threaded sleeve being left-hand threaded for engagement with a corresponding thread upon said head, the upper end of said threaded sleeve being right-hand threaded for engagement with a corresponding thread upon said second pump, said head having other passages for conveying the oil pumped by the first of said pumps past the second of said pumps, and a spacer mounted within said sleeve upon said head, said spacer having conveying passages to communicate with said inlet port and said other passages.

14. In an oil well pumping structure, a first pump having an inlet passage communicating with the well bore, operating means for said pump, a second pump arranged to be operated by said operating means, means for joining the two pumps and having an inlet port communicating the second pump with the well bore close-

ly adjacent the lower end of said second pump, said joining means having other passages for conveying the oil pumped by the first pump past the second pump, said joining means including a sleeve, said sleeve being right-hand threaded at its upper end and left-hand threaded at its lower end, said first and said second pumps being correspondingly threaded for engagement with the corresponding ends of said sleeve.

10 15. In an oil well pumping structure, a first pump having an inlet passage communicating with the well bore, operating means for said pump, a second pump arranged to be operated by said operating means, means for joining the

two pumps and having an inlet port communicating the second pump with the well bore closely adjacent the lower end of said second pump, said joining means having other passages for conveying the oil pumped by the first pump past the second pump, said joining means including a sleeve, said sleeve being right-hand threaded at its upper end and left-hand threaded at its lower end, said first and said second pumps being correspondingly threaded for engagement with the corresponding ends of said sleeve, and common means for conducting the oil discharged from the said pumps from the well.

BUNA A. BRITTAIN.