No. 795,466. PATENTED JULY 25, 1905.

W. N. WEINMAN & C. L. MAHNICKE.

STEAM VALVE MECHANISM FOR DEEP WELL PUMPS.

APPLICATION FILED SEPT. 19, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

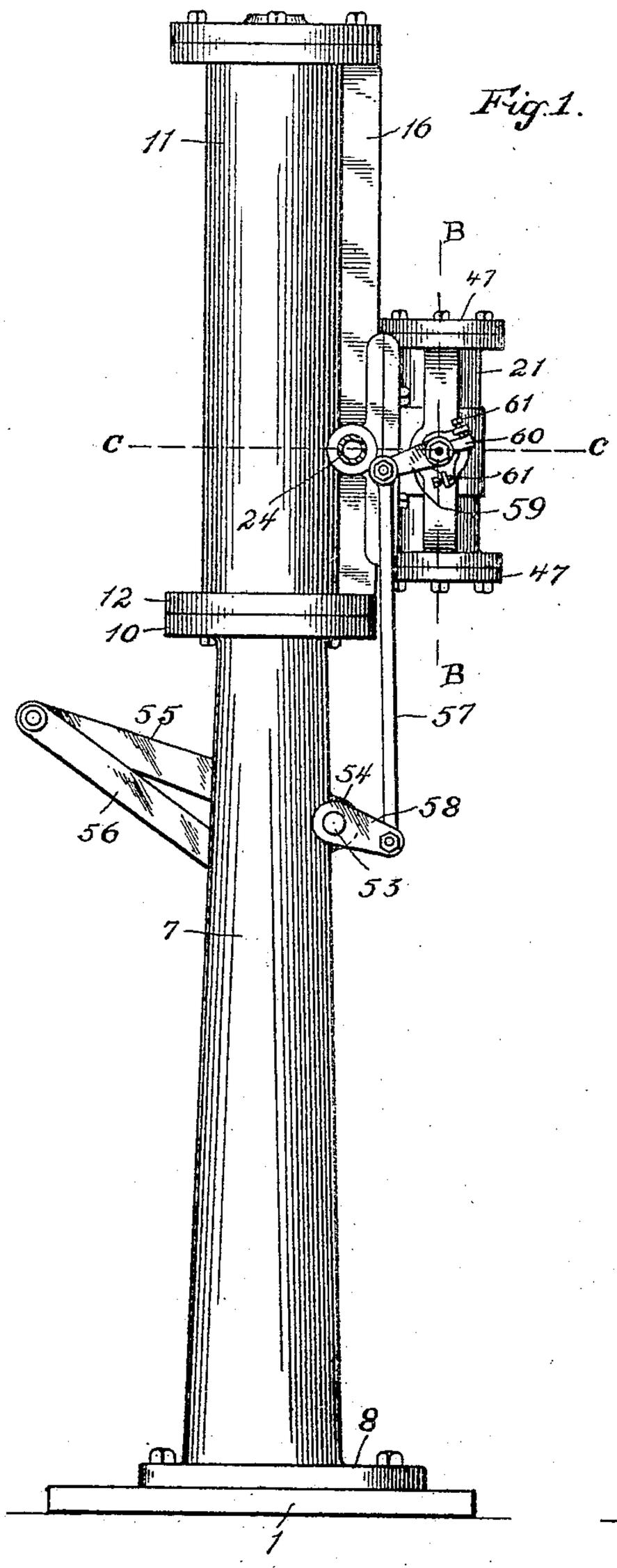

Fig. 2

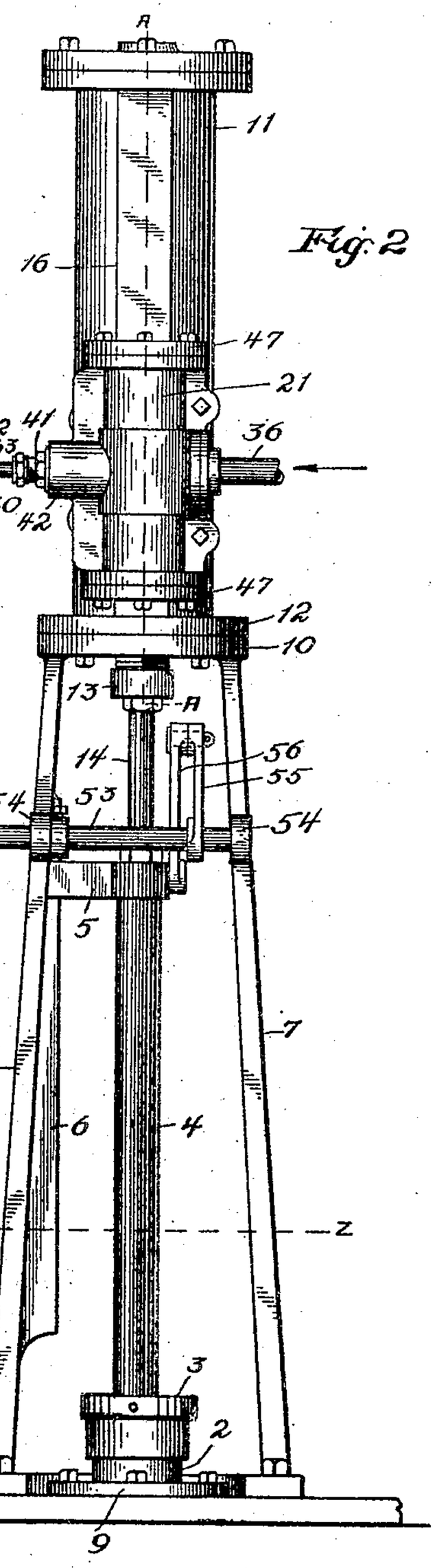

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Fig. 3.

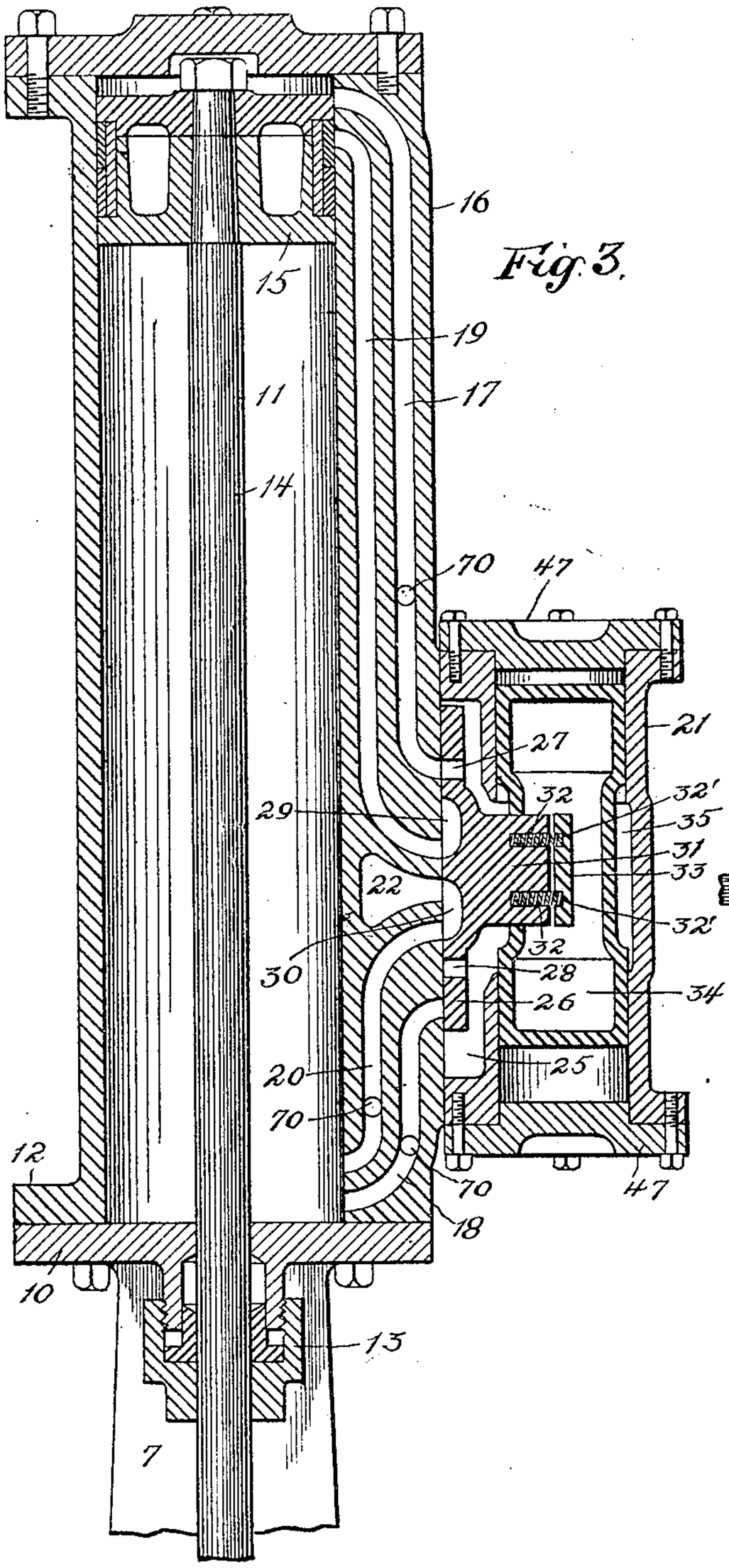
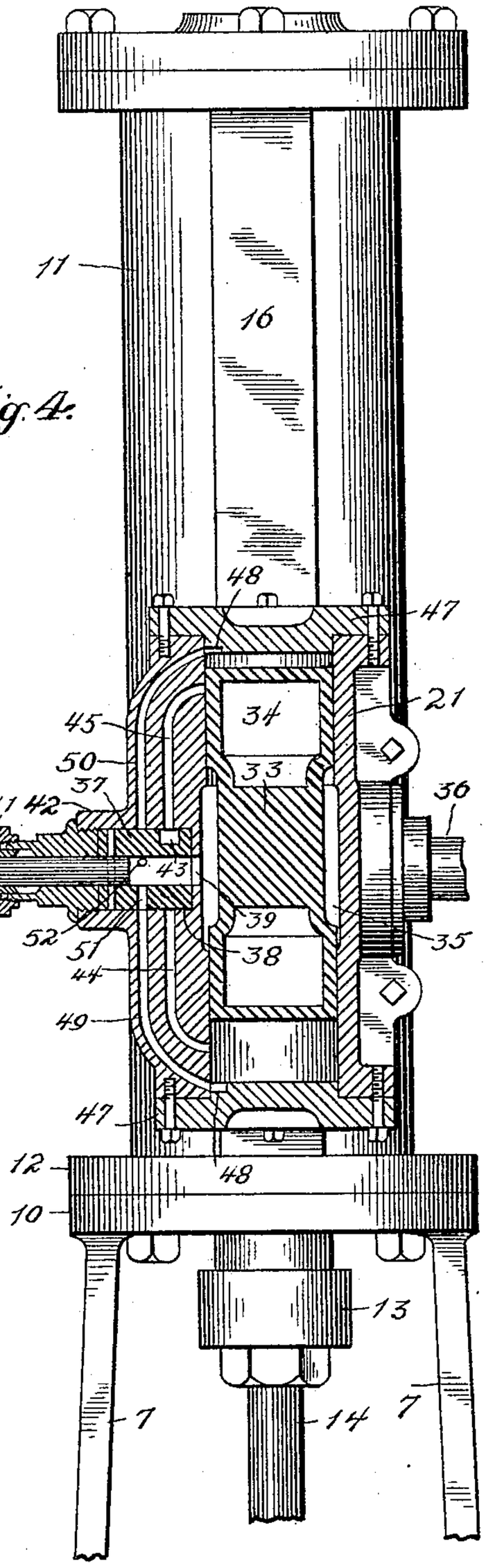


Fig. 4.



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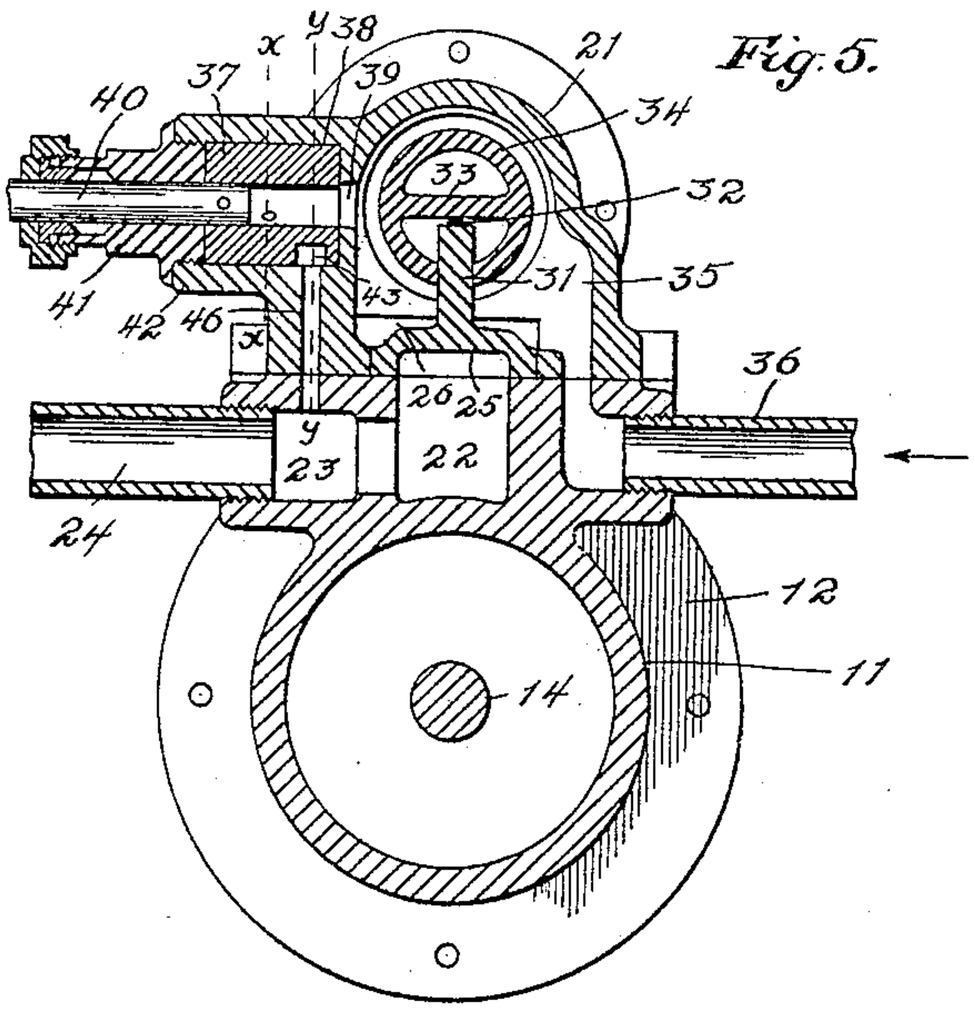
3 SHEETS—SHEET 3.

Fig. 5.



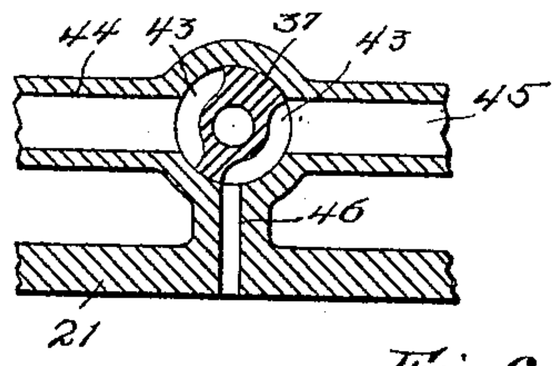


Fig. 6.

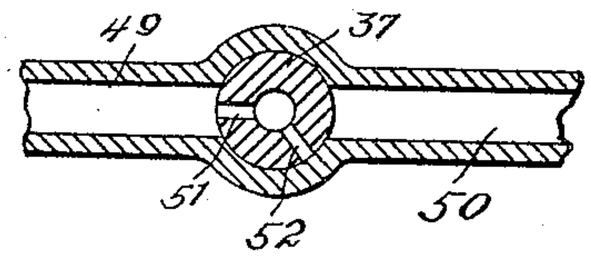
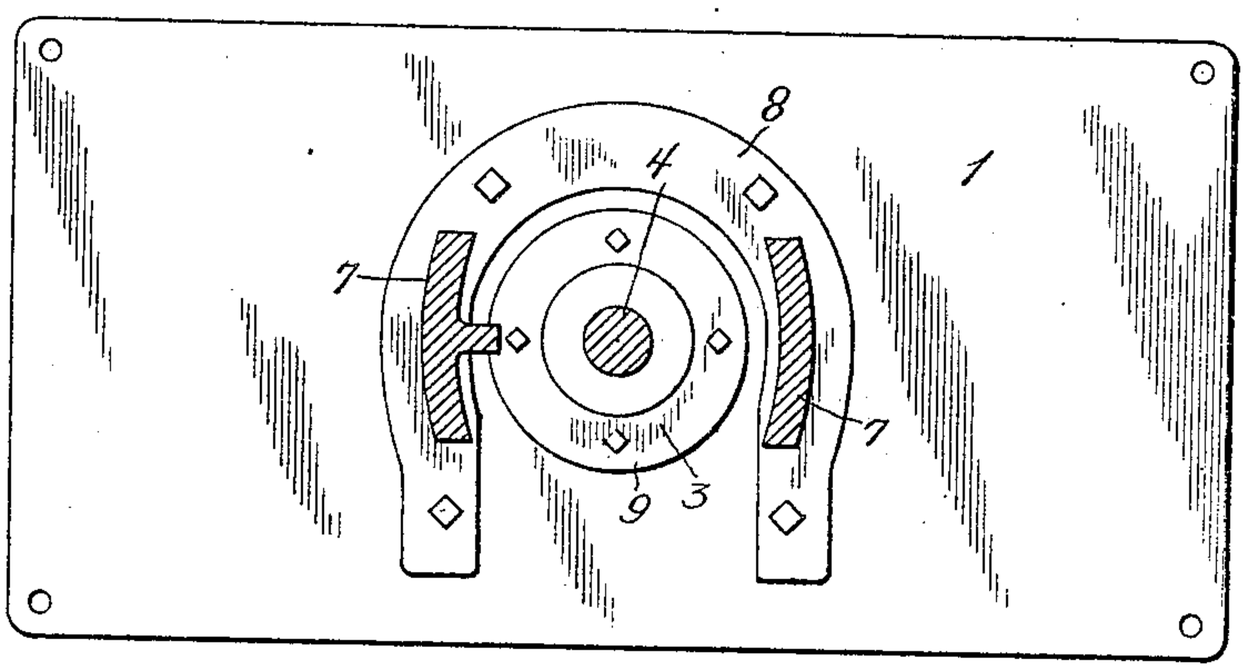


Fig. 7.

Fig. 8.



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WILLIAM NELSON WEINMAN AND CHARLES LUDWIG MAHNICKE, OF COLUMBUS, OHIO.

STEAM-VALVE MECHANISM FOR DEEP-WELL PUMPS.

No. 795,466. Specification of Letters Patent. Patented July 25, 1905.

Application filed September 19, 1904. Serial No. 225,000.

To all whom it may concern:

Be it known that we, WILLIAM NELSON WEINMAN and CHARLES LUDWIG MAHNICKE, citizens of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented a certain new and useful Improvement in Steam-Valve Mechanism for Deep-Well Pumps, of which the following is a specification.

This invention relates to a new and useful improvement in steam-valve mechanism for deep-well pumps.

The object of the invention is to provide a pump of superior construction in which the simplicity of the structure is the essential feature.

Another object resides in the auxiliary valve which controls the slide-valve and which may be regulated to vary the speed at which the pump is operated.

Finally, the object of the invention is to provide a device of the character set forth that will be strong, durable, and efficient and simple of construction and one in which the several parts will not be liable to get out of working order.

With the above and other objects in view the invention consists of the novel details of construction and operation, a preferable embodiment of which is described in the specification and illustrated in the drawings, wherein—

Figure 1 is a side elevation of the pump. Fig. 2 is a front elevation. Fig. 3 is a vertical sectional view on the line A A of Fig. 2. Fig. 4 is a partial front elevation of the pump, showing the valve-casing in vertical section on line B B of Fig. 1. Fig. 5 is a cross-sectional view taken on line C C of Fig. 1. Fig. 6 is a detailed vertical sectional view on line Y Y of Fig. 5. Fig. 7 is a similar view taken on line X X of Fig. 5, and Fig. 8 is a longitudinal sectional view taken on line Z Z of Fig. 2.

In the drawings the numeral 1 designates the base-plate, which is suitably supported over the well and through which the upper end of the casing 2 protrudes. A stuffing-box 3 is secured on the end of the casing 2 to form a tight joint about the rod 4. The well-rod 4 carries a cross-head 5, which engages the web 6, projecting inwardly from one of the standards 7, and thus it is prevented from twisting as it is reciprocated. The standards extend upwardly from a yoke-shaped bed-plate 8, which is securely bolted to the base-plate 1, while the casing 2 is held against displacement by the ring 9, also bolted to the base-plate. The standards 7 taper upwardly and are connected at their upper ends by a circular plate 10, which constitutes the lower head of the cylinder 11 and which is secured to the cylinder by bolts which pass through the flange 12. A packing-gland 13 projects downwardly from the plate 10, through which the piston-rod 14 passes. The cylinder 11 is cast with a vertically-extending enlargement 16, having inlet-passages 17 and 18 and exhaust-passages 19 and 20 extending between the opposite ends of the cylinder and a valve-casing 21, which is securely fastened upon the cylinder nearer the lower end thereof. Disposed between the outlet ends of the exhaust-passages 19 and 20 is an exhaust-opening 22, communicating with an exhaust-chamber 23, from which extends the exhaust-pipe 24. The valve-casing 21 is formed with a longitudinal recess 25, in which is disposed a slide-valve 26, formed with inlet-ports 27 and 28 and exhaust-ducts 29 and 30, the inlet-ports 27 and 28 being arranged so as to register with the passages 17 and 18 alternately, while the ducts 29 and 30 alternately connect the exhaust-passages 19 and 20 with the exhaust-opening 22. The valve 26 is formed with an outwardly-extending tongue 31 and is held to its seat by a pair of coiled springs 32, bearing in seats 32′, formed in the bridge-piece 33 of the piston 34, which is hollow and through one wall of which the tongue 31 projects. It will therefore be seen that when the piston 34 is moved the slide-valve 26 is likewise moved. The valve-casing 21 is formed with a live-steam space 35, into which the steam is supplied by the pipe 36. Thus when the valve 26 is in the position indicated in Figs. 3 and 4 steam entering the space 35 passes into the recess 25, through the port 27 into the passage 17, and out of the same into the cylinder 11 back of the piston-head 15, thus driving the same downward, while the exhaust-steam in front of the piston passes out through the passage-way 20 and is conveyed, by means of the duct 30, into the exhaust-opening 22, from which it passes to the chamber 23 and pipe 24. Upon moving the piston 34 downward the slide-valve is also carried downward and the port 28 thereof caused to register with the steam-passage 18, while the exhaust-duct 29 establishes communication between the ex-

haust-passage 19 and the exhaust-opening 22, the steam-passage 17 and exhaust-passage 20 being closed. The piston-head now being at the bottom of the cylinder 11, steam passing from the recess 25 through the port 28 and into the cylinder by way of the passage 18 below the piston-head drives the same upward, causing the steam in front of the piston-head to be driven out through the passage 19 and by way of the duct 29 into the exhaust-opening 22. As a means for operating the piston an auxiliary valve 37 is employed. The valve 37 is made in the form of a sleeve and is oscillatingly mounted in an annular seat 38, which communicates with the steam-space 35 by means of an aperture 39. The valve is provided with a stem 40, which passes through the cap 41, which is screwed into the extension 42 of the valve-casing. The auxiliary valve 37 is cut away on opposite sides near its inner end to form exhaust-ducts 43, which are adapted to establish communication between exhaust-passages 44 and 45 and an exhaust-passage 46, which latter terminates in the exhaust-chamber 23. The exhaust-passages 44 and 45 extend through the wall of the valve-casing, entering the bore thereof a short distance from the casing-heads 47. The casing-heads 47 are formed with offsets 48, which communicate with the steam-passages 49 and 50, which latter extend to the seat of the auxiliary valve 37, which is provided with ports 51 and 52, disposed so as to alternately register with the steam-passages 49 and 50. The steam from the space 35 passes through the opening 39 into the auxiliary valve 37, and when the same occupies the position shown in Figs. 4 and 5 the port 51 is in register with the passage 49, through which the steam is conducted into the casing behind the piston 34, thus driving the same upward, the steam-passage 50 and exhaust-passage 44 being closed, as indicated in Fig. 4. As the piston 34 passes upward the steam above the same passes out through the exhaust-passage 45 and into the passage 46 by way of one of the exhaust-ducts 43. As the piston continues upward, having passed over the opening of the passage 45, and the passage 50 being closed, a steam-cushion is formed, which eases the movement of the piston. As a means for rocking the auxiliary valve a rock-shaft 53 is mounted in ears 54, projecting from the standards 7. A lever 55, keyed upon the shaft, is pivotally connected to a link 56, which is pivoted to the cross-head 5. Thus as the rod 4, which is connected to the piston-rod 14, is reciprocated the shaft 53 is rocked. The rocking movement of the shaft is imparted to a rod 57 by means of a crank 58, carried on the outer end of the rock-shaft. The rod 57 is pivotally connected to a lever 59, loosely mounted on the valve-stem 40. The lever 59 is formed with a tripping-lug 60, in the path of which are arranged set-screws 61, adjustable in lips 62, extending laterally from the flanged collar 63, which is keyed upon the stem 40 of the auxiliary valve. Thus it will be seen that as the lever 59 is swung by the rod 57 the valve-stem and the auxiliary valve will only be moved when the trip-lug 60 is in contact with the screws 61 and that while the lug is traveling between the screws the valve is given a period of rest. When the auxiliary valve is in the position shown in Fig. 4, the operating means just described occupies the position shown in Figs. 1 and 2, the piston being at the limit of its upward stroke. The steam entering back of the piston by way of the passage 17, as before described, forces the same downward, thus moving the rod 4 also downward. During this downward movement the shaft 53 is rocked and the rod 57 and the lever 59 are carried upward, causing the tripping-lug 60 to swing downward. The auxiliary valve is at rest during the greater portion of the swing of the tripping-lug 60; but as the piston nears the end of its downward stroke the lug 60 contacts with the lower screw 61 and rocks the auxiliary valve, so as to aline the port 52 with the steam-passage 50 and the exhaust-duct 43 with the exhaust-passage 44, closing the steam-passage 49 and the exhaust-passage 45, thus causing the steam to pass through the passage 50 into the offset 48 and drive the piston 34 downward, part of the steam in front thereof exhausting through the passage 44 and the remaining steam cushioning the piston 34 after it passes the opening of the passage 44. As the piston 34 moves downward it slides the valve 26 so as to cause the port 28 to register with the steam-passage 18 and the duct 29 with the exhaust-passage 19 and exhaust-opening 22, cutting off the steam from the passage 17 and closing the exhaust-opening 20, thus completing the stroke of the piston. Steam entering behind the piston-head 15 and piston 34 carries the same upward, as hereinbefore described, during which upward stroke the shaft 53 is rocked, moving the rod 57 downward, the tripping-lug contacting with the upper screw 61, moving the auxiliary valve to the position shown in Figs. 4 and 5. It is to be understood that by adjusting the screws 61 the stroke of the piston-head 15 may be varied and the speed at which the pump is operated may be controlled. Owing to the fact that the load is much heavier on the upward stroke of the piston 15, due to the weight of the well-rod, it is necessary to provide some means for controlling the downward stroke to prevent the pump from "pounding." To accomplish this, any suitable form of choke-valve 70 is arranged in each of the passages 17, 18, and 20. By adjusting these choke-valves the amount of steam delivered to and exhausted from the cylinder may be

regulated. Should the pump be stopped while the piston is on its upward stroke, the weight of the well-rod would very likely cause the same to be gradually drawn down, which, if the piston-valve 34 remained in the position shown in Fig. 3, would prevent the starting of the pump when steam was again admitted to the steam-space 35. However, the slide-valve 26 and piston 34 are of such specific gravity that they will gradually work downward when the pump is stopped, and thus when steam is again admitted to the space 35 the parts will be in operative relation.

Having now fully described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In a deep-well pump, the combination with a vertical cylinder having a downwardly-projecting piston-rod, a valve-casing having a valve therein arranged on the cylinder and in communication therewith, and a slide-valve for controlling the movement of the piston, of an auxiliary valve mounted in the casing, a stem projecting from the auxiliary valve, a device having lips and rigidly secured upon the stem, stops arranged on the lips so as to be independently adjustable, a tripping-lever adapted to alternately engage with the stops, and mechanism connected to the tripping-lever and operated by the piston-rod for rocking the said lever.

2. In a deep-well pump, the combination with the cylinder and the valve-casing, of a vertically-arranged piston-valve in the casing having a bridge-piece, a slide-valve connected to the piston-valve, springs interposed between the slide-valve and the bridge-piece of the piston-valve for holding said slide-valve on its seat, a hollow auxiliary valve having live-steam openings and peripheral exhaust-ducts adapted to control the operation of the piston and means for intermittently operating the auxiliary valve.

3. In a deep-well pump, the combination with a pair of standards, of a vertical cylinder having a downwardly-projecting piston-rod supported on top of the standards and an enlargement formed longitudinally of the cylinder and provided with inlet-passages and outlet-passages extending therethrough and communicating with the cylinder, a valve-casing mounted on the enlargement, a slide-valve working in the casing and having inlet-ports and exhaust-ducts disposed to alternately register with the passages of the enlargement, a piston positively connected to the valve and arranged in the bore of the casing, an auxiliary valve mounted in the casing at substantially right angles to the piston and the slide-valve, a stem projecting from the auxiliary valve through the casing, said casing having passages extending from the opposite end of its bore to the auxiliary valve, a rock-shaft mounted on the standards below their upper ends, an arm having one end pivotally connected to the main piston-rod, a second arm fixed on the rock-shaft and pivotally engaging the free end of the first arm, a crank-arm fixed upon the outer end of the rock-shaft, a rocking device secured on the end of the valve-stem, a lever having a projection adapted to intermittently engage with the said rocking device and loosely mounted on the said stem, and a rod connecting the lever and the crank-arm.

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In presence of—
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M. B. SCHLEY.