No. 799,577. PATENTED SEPT. 12, 1905.

F. SAGE.

FLUID PRESSURE PUMP MOTOR.

APPLICATION FILED OCT. 29, 1904.

2 SHEETS—SHEET 1.

FIG. 1

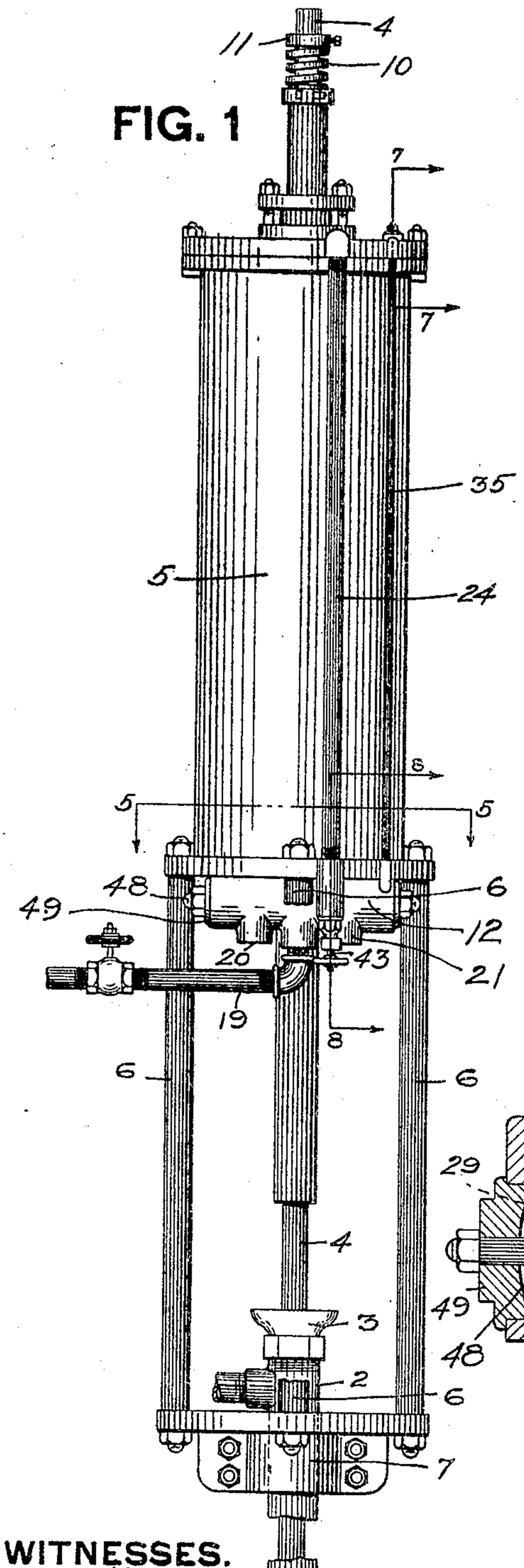


FIG. 2

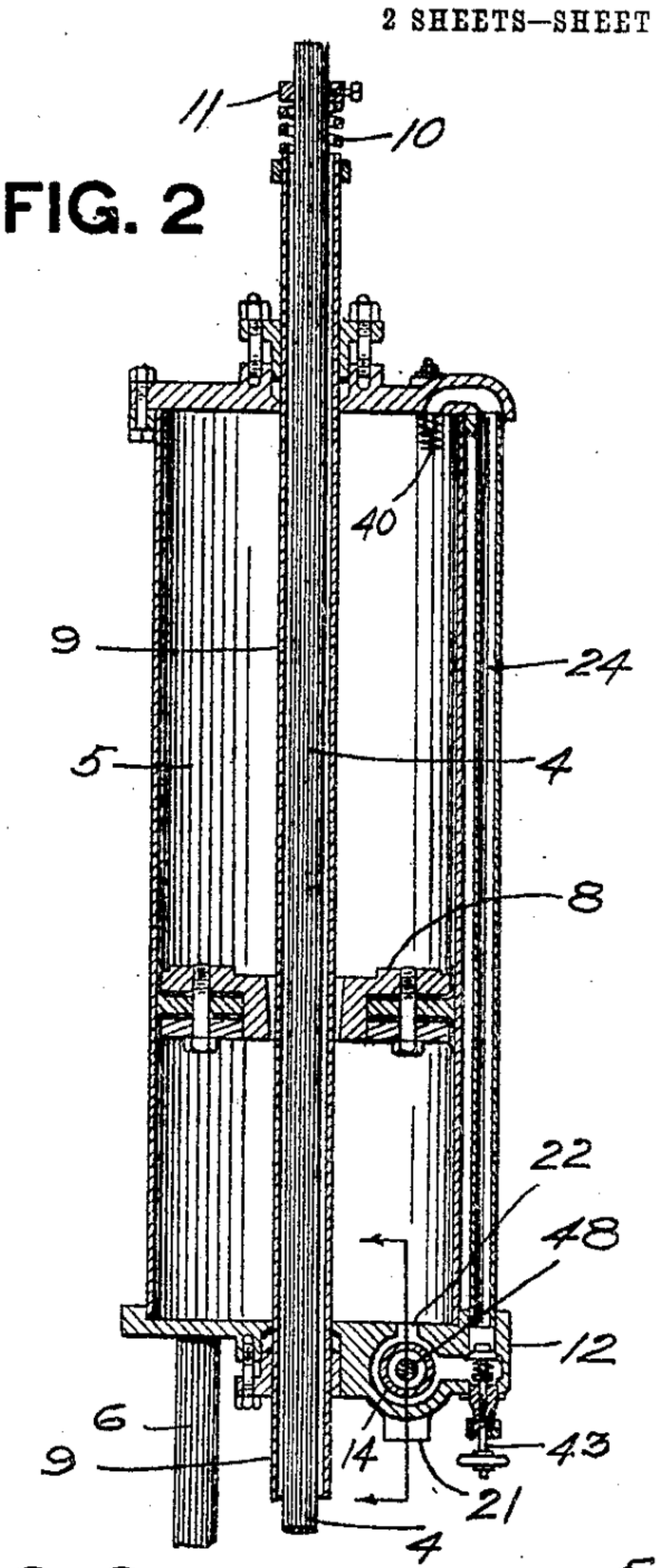
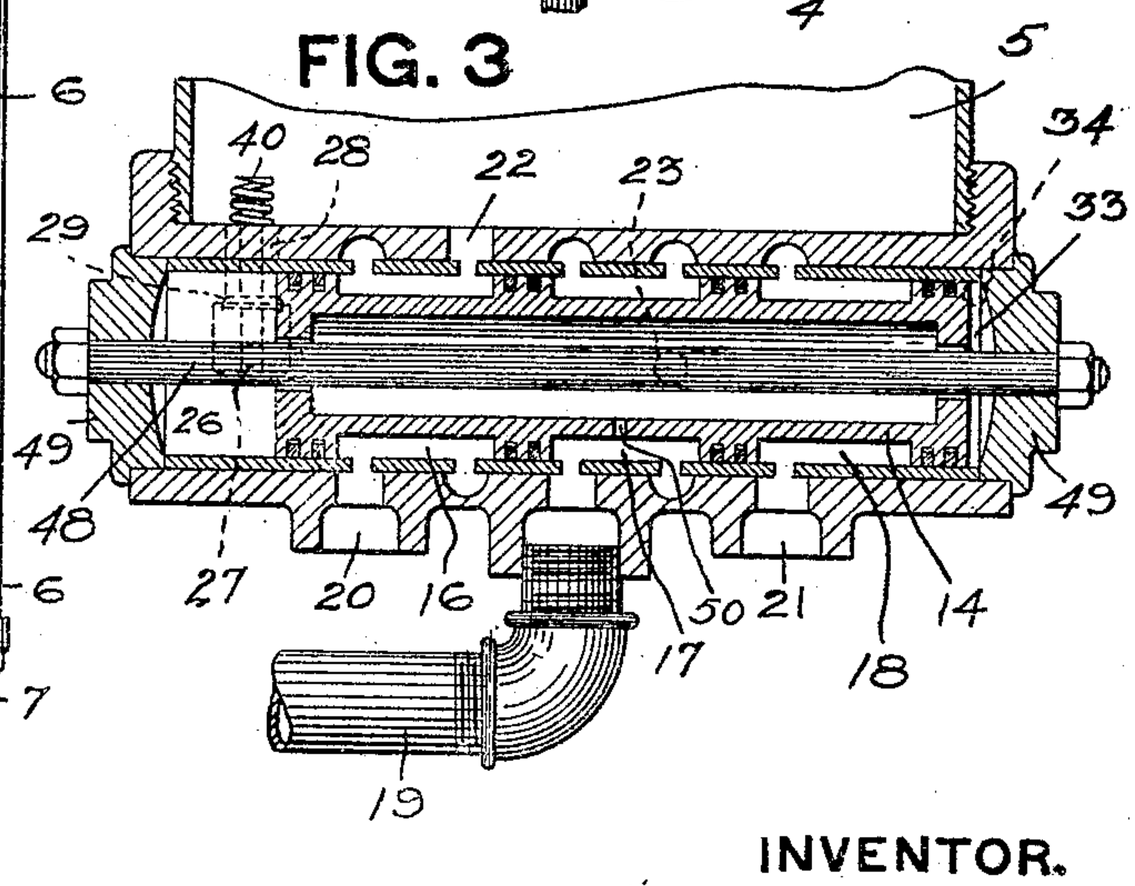


FIG. 3



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2 SHEETS—SHEET 2.

FIG. 4

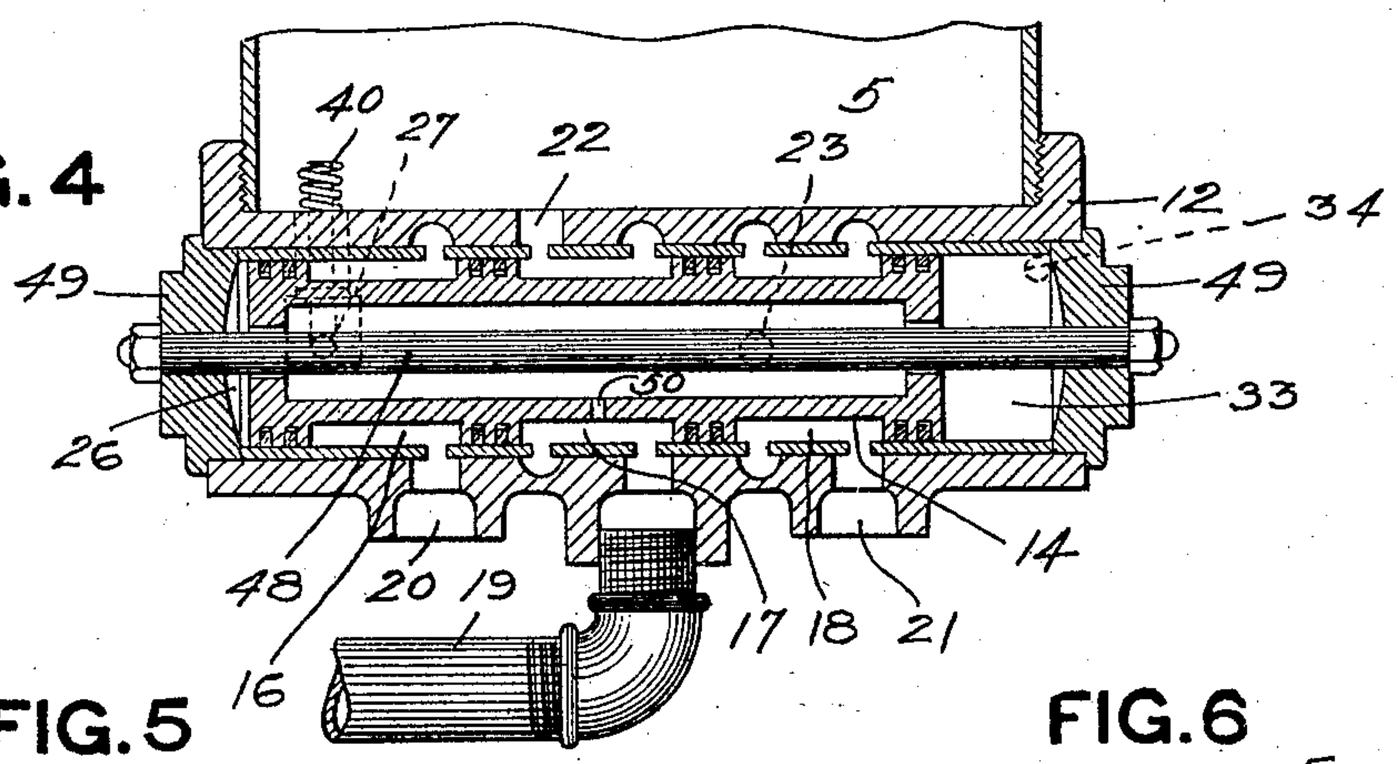


FIG. 5

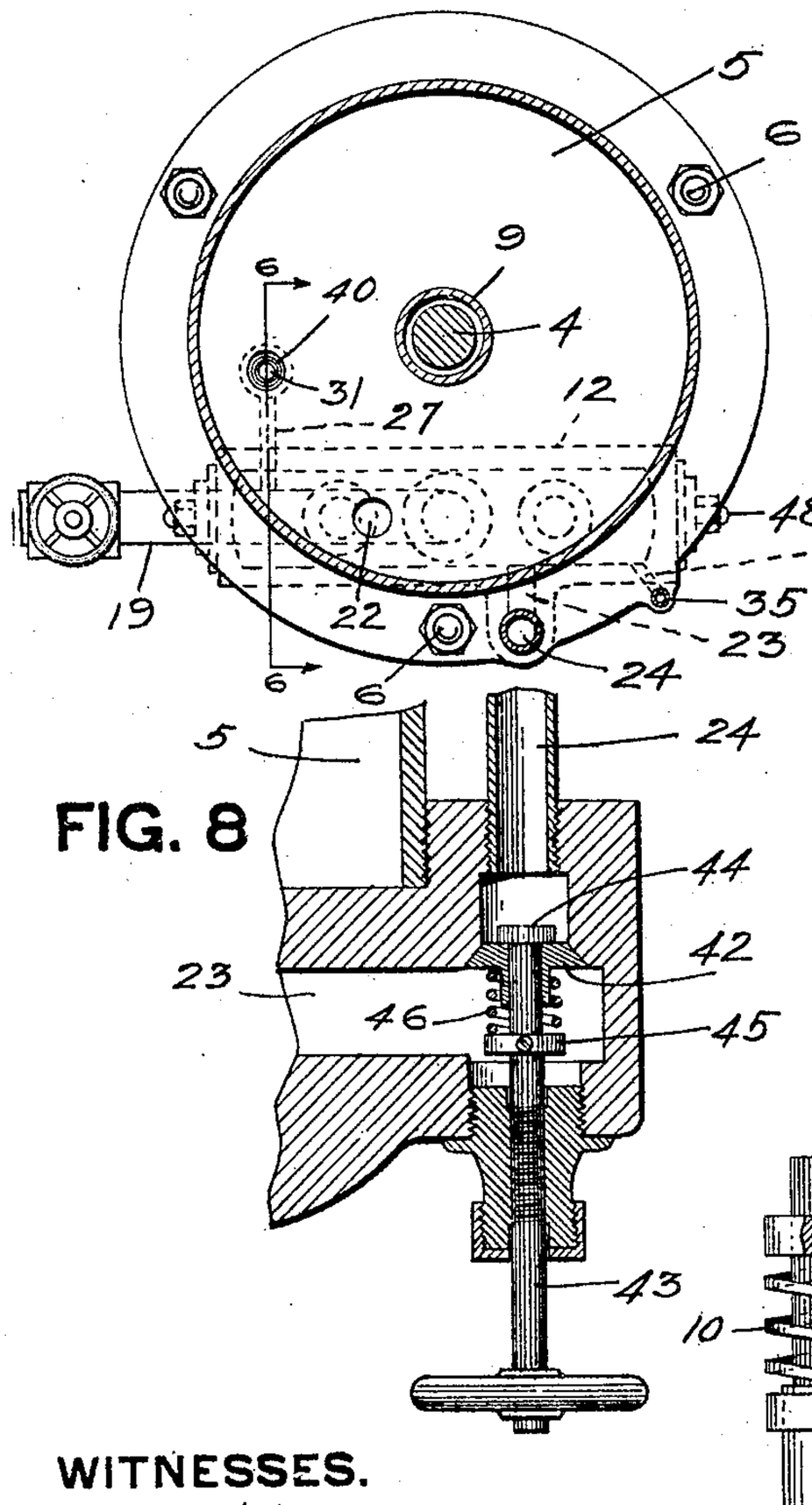


FIG. 6

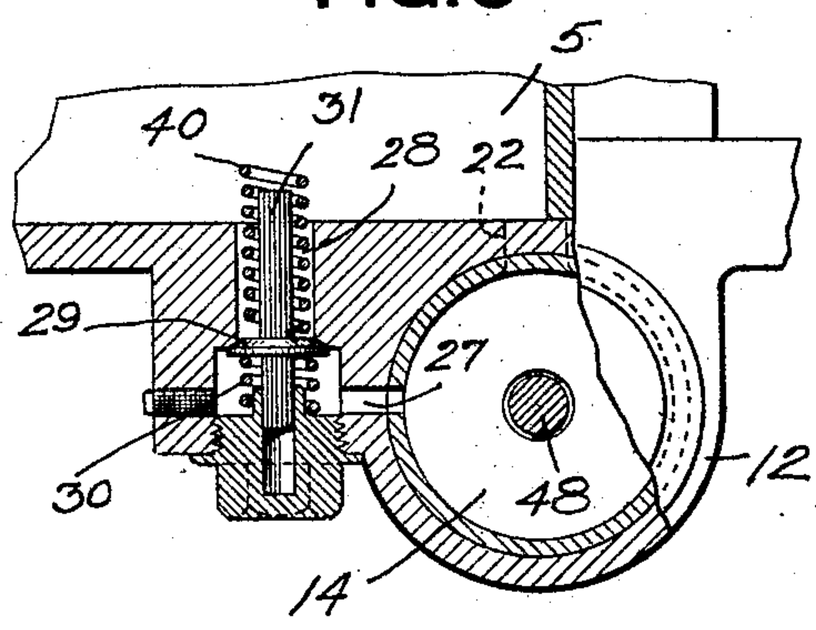


FIG. 7

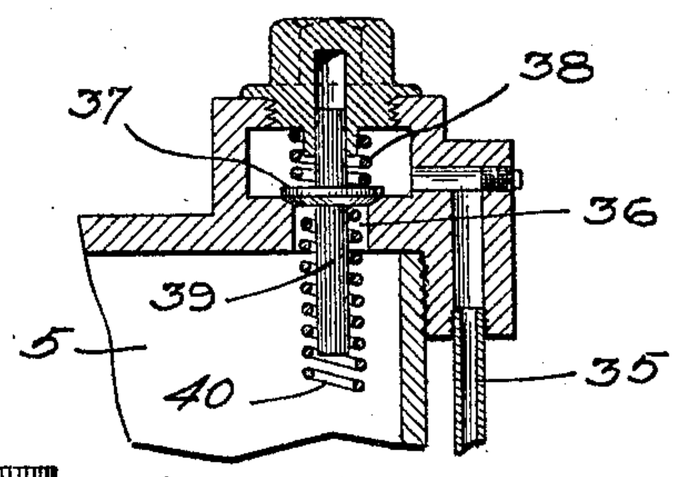
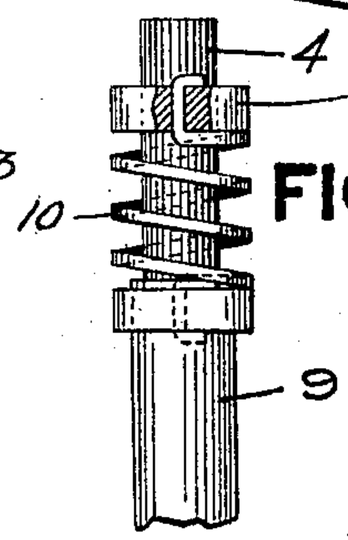


FIG. 8

FIG. 9



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UNITED STATES PATENT OFFICE.

FREDERICK SAGE, OF JOHNSONBURG, PENNSYLVANIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF FORTY-FIVE PER CENT. TO HIMSELF, THIRTY PER CENT. TO ENOS B. SAGE, OF RED ROCK, PENNSYLVANIA, AND TWENTY-FIVE PER CENT. TO CYRUS B. SAGE, OF JOHNSONBURG, PENNSYLVANIA.

FLUID-PRESSURE PUMP-MOTOR.

No. 799,577. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed October 29, 1904. Serial No. 230,595.

To all whom it may concern:

Be it known that I, FREDERICK SAGE, a resident of Johnsonburg, in the county of Elk and State of Pennsylvania, have invented a new and useful Improvement in Fluid-Pressure Pump-Motors; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to motors or engines for pumps; and the object is to provide a motor or pump-head which is self-contained, which dispenses with the usual walking-beams, rig-timbers, derricks, and engines of existing pumping outfits and which is so constructed that it can be applied to all existing pumping outfits without modification.

A further object of the invention is to provide a pumping-engine which does away or reduces to a minimum the clearance, so as to prevent the wastage of live motive fluid, which will automatically throttle the inlet to the upper end of the cylinder and automatically open a free exhaust therefrom, which is so constructed as to take up the shocks and strains placed on the pump-rod in its upward movements, and in general to modify and render more efficient pumping-motors.

In deep-well pumping, such as oil-wells and the like, the present practice is to connect the pump-rod, sucker-rod, or polish-rod, as the case may be, to a walking-beam mounted or trunnioned in suitable rig-timbers or derricks and operate said oscillating beam by means of an ordinary engine. There are many objections to this old form of pumping-rig.

My invention has for its object to dispense entirely with such rig and to mount the motor or cylinder directly on the pump-tubing and connect the piston of the cylinder directly to the polish-rod, sucker-rod, or pump-rod, as the case may be.

With this end in view the invention consists in the arrangement hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a side elevation of my pumping head or engine. Fig. 2 is a vertical section through the cylinder, taken transversely of the main valve. Fig. 3 is a vertical section taken longitudinally of the main valve. Fig. 4 is a similar view showing the valve in its opposite position. Fig. 5 is a horizontal section taken on the line 5 5, Fig. 1. Fig. 6 is a vertical section taken on the line 6 6, Fig. 5. Fig. 7 is a vertical section taken on the line 7 7, Fig. 1. Fig. 8 is a vertical section on the line 8 8, Fig. 1; and Fig. 9 is a detail view showing the manner of connecting the polish-rod to the piston-rod.

In the drawings the well-casing is shown at 1 and the pump-tubing at 2. The latter at its upper end is provided with an outlet and with the usual stuffing box or gland 3. Passed through the latter is the rod 4, which is the pump-rod and may be either a sucker-rod or a polish-rod as is now used in deep-well pumping.

My improved pumping-head comprises a fluid-pressure cylinder 5, arranged vertically and directly above the pump-tubing, being supported in any suitable way, the drawings showing it supported directly from the tubing by means of vertical rods 6 and a split clamp-collar 7, which is fastened around the pump-tubing. In this manner the cylinder 5 is supported above and in axial line with the pump-tubing. The cylinder 5 is provided with a piston 8, secured to a hollow piston-rod 9, which projects through both heads of the cylinder. The pump or polish rod 4 passes up through this hollow piston-rod and is secured to the upper end thereof by means of the coil-spring 10, which is fastened to both the upper end of the hollow piston-rod 9 and to a collar 11 on the pump-rod 5, so that said spring will act both as a tension and compression spring. The object of this spring is to lessen the shock and jar which occurs when the pump-rod begins to lift and the weight of the fluid comes onto the same. The object of making the piston-rod 9 hollow is to adapt the motor-head to existing oil-well rigs. It is now the custom to connect the pump or polish rod 4 to one end of a walking-beam, and consequently said rods project a considerable distance above the ground. In order to locate the cylinder 5 as low as possible and still not necessitate a cutting off of the rod 4 or the replacement thereof by a shorter rod, I make the piston-rod hollow, so that the full length of present pump or polish rods can be

retained and passed up through the hollow piston and secured to the upper end thereof. The main valve of the cylinder is located in a suitable casing 12, formed on or secured to the lower head of the cylinder. This main valve preferably will be automatically moved by the fluid-pressure itself. It is shown as a cylindrical piston-valve 14, slidably mounted in the casing 12 and provided with four pistons, so as to provide the connecting passages or spaces 16, 17, and 18, respectively. The fluid-pressure inlet is through the pipe 19, substantially midway of the length of the valve-casing. The exhaust-ports are shown at 20 and 21. The walls of the valve-casing are cored out, so as to provide passages for the fluid-pressure, one of which passages communicates, through the port 22, with the lower end of the cylinder 5 and another port 23 of which communicates, through the pipe 24, with the upper end of the cylinder, 5. The end 26 of the valve-chamber communicates, through a port 27, with another port 28, leading to the lower end of the cylinder. The port 28 is controlled by a check or puppet valve 29, which normally is held closed by means of a spring 30, but is provided with a stem 31, projecting up into the cylinder, so that when the main piston 8 reaches the limit of its downward stroke it will contact with this stem and open the puppet-valve 29. In a similar manner the end 33 of the valve-casing communicates, through a port 34 and pipe 35, with a port 36, which opens into the upper end of the cylinder 5. This port 36 likewise is controlled by a puppet or check valve 37, which is kept normally seated by a spring 38 and has a stem 39 projecting down into the cylinder in position to have the main piston 8 contact therewith at the limit of its upward movement to open the puppet-valve. Both the puppet-valves 29 and 37 have spiral springs 40 surrounding their stems and projecting slightly beyond their ends, these springs serving as cushions to lessen the shock when the main piston 8 strikes the stems of said valves and also to hold the valves 29 and 37 open for a longer period of time than would otherwise be the case in order to give a more positive movement to the main valve 14.

The arrangement of the main valve 14 and puppet-valves 29 and 37 is not claimed in this application, but is claimed in a division hereof filed December 5, 1904, Serial No. 235,551.

In the port 23, communicating with the pipe 24, leading to the upper end of the cylinder, I place an automatically-operating throttle and check valve, this comprising an ordinary disk valve 42, which seats toward the upper end of the cylinder and which is carried by a manually-adjustable threaded stem 43. The valve 42, however, is not rigidly connected to the stem, but is slidable thereon between the collars 44 and 45 on said stem. A coiled spring 46 holds the valve normally against the collar or head 44. By turning the stem 43 the valve 42 can be drawn away from its seat the required distance to admit the necessary quantity of motive fluid to the upper end of the cylinder. When the exhaust occurs, this valve will slide freely down the stem against the tension of the spring 46, thus opening a free passage to the exhaust and permitting the exhaust from the upper end of the cylinder without resistance. As soon, however, as the fluid-pressure comes in the opposite direction, the disk valve 42 will at once slide up against the head 44, and thus throttle the passage to the upper end of the cylinder and not admit any more fluid thereto than is determined by the position of the adjustable stem 43.

The main valve 14 is made hollow and is perforated from end to end. Through this projects a bolt 48, which serves not only to secure in place the ends or heads 49 of the valve-casing, but also as a guide for the main valve. This through-bolt does not completly fill the openings in the ends of the main valve, so that fluid-pressure can leak through to both ends of the valve-casing. The interior of this main valve is constantly open to the inlet 19 through a port 50 in the valve-shell.

My pumping-engine will operate with either steam, compressed air, gas, hydraulic pressure, or the like, but preferably steam or compressed air will be used. Its operation will be as follows: When the main valve is in the position shown in Fig. 3, the fluid-pressure entering at the pipe 19 will pass, by means of the passage 17 in the valve and corresponding cored-out passage in the casing, to the port 23, and thence, when the throttle-valve 42 is open, by means of the pipe 24, to the upper end of the cylinder. This will force the main piston downwardly, and at the limit of its downward movement said piston will contact with the stem 31 of the puppet-valve 29, thus opening the end 26 of the valve-chamber to the lower end of the cylinder 5. The lower end of this cylinder is already opened through the port 22 and passage 16 in the main valve to the exhaust-port 20. As a consequence when the puppet-valve 29 is opened the pressure in the end 26 of the valve-chamber will be exhausted, so that the fluid-pressure in the opposite end 33 of the valve-chamber will force the main valve over to the position shown in Fig. 4. In this position the passage 17 of the main valve will connect the inlet-pipe 19 with the port 22, leading to the lower end of the cylinder, thus forcing the main piston upwardly. At the same time the passage 18 of the main valve will connect the port 23 with the exhaust-port 21, thus connecting the upper end of the cylinder with the atmosphere, so that the fluid-pressure will escape down through the pipe 24, past the throttle-valve 42, to the port 23, and thence to the atmosphere. This escaping fluid-pressure will force the throttle-valve 42 downwardly

against the tension of the spring 46, thus giving a very large opening for the exhaust and preventing the retention of any resisting fluid-pressure against the free upward movement of the main piston. The upward movement of the main piston will continue until it strikes the stem of the puppet-valve 37. This will open the valve and put the upper end of the cylinder in communication with the pipe 35, which is connected to the port 34, leading to the end 33 of the valve-chamber. As the upper end of the cylinder is in free communication with the atmosphere, it follows that as soon as the puppet-valve 37 is opened the pressure in the end 33 of the valve-chamber is reduced, thus permitting the pressure in the opposite end 26 of the valve-chamber to force the main valve back to the position shown in Fig. 3, when the first-mentioned operation will be repeated.

It will be observed that all of the inlets into the valve-chamber and into the cylinder are from below, so that the parts can be easily drained of condensation and the freezing of the valve prevented. Furthermore, the main valve is located on the lower head of the cylinder, and consequently there is only a slight amount of clearance at the port 22. Also the throttle and check valve 42 is located in proximity to the main valve. By this arrangement the wastage of motive fluid at a high pressure is reduced to a minimum.

The automatically-acting throttle and check valve 42 is of importance, as thereby I can accurately regulate the downward thrust of the piston-rod. It will be obvious that greater power is required to raise the pump-rods than to depress the same, and as a consequence less fluid-pressure need be admitted to the upper end of the cylinder than to the lower end; also, that on the upstroke of the main piston all pressure above the same should be relieved, so as to offer no resistance to the upward travel of the piston. The automatically-acting throttle and check valve described secures these desirable results. By properly adjusting the stem 43 I can regulate the opening, and consequently the amount of fluid-pressure passing to the upper end of the cylinder. As soon as the exhaust occurs this valve will slide downwardly upon its stem, thus making the opening very large and preventing the retention of any pressure in the upper end of the cylinder. As soon, however, as the fluid-pressure is again admitted to the upper end of the cylinder the valve 42 will automatically move upwardly against the head 44 of its stem, and thus throttle the passage to the upper end of the cylinder and regulate the amount of fluid-pressure passing thereto.

The pumping-head described is entirely automatic and self-contained, is very simple of arrangement, cannot easily get out of order, can be attached directly to the pump-tubing, and by reason of this hollow piston-rod is adapted to be applied to existing pumping-rigs without necessitating any alteration in the rods now in use. All of the rig-timbers, walking-beam, derrick, and usual engine are dispensed with.

What I claim is—

1. In a pumping-engine, the combination of a power-cylinder adapted to be supported in a vertical position, a controlling-valve for admitting motive fluid alternately to and exhausting it from the opposite ends of said cylinder, and an automatically-operating throttling and check valve in the passage to the upper end of said cylinder.

2. In a pumping-engine, the combination of a power-cylinder adapted to be supported in a vertical position, a piston in said cylinder, a hollow piston-rod connected to said piston and extending through both heads of the cylinder, a controlling-valve for admitting motive fluid alternately to and exhausting it from the opposite ends of said cylinder, and an automatically-operating throttling and check valve in the passage to the upper end of said cylinder.

3. In a pumping-engine, the combination of a power-cylinder adapted to be supported in a vertical position, passages or ports leading to opposite ends of said cylinder, a controlling-valve for said passages arranged to admit motive fluid alternately to and exhaust it from the opposite ends of said cylinder, said valve being located at the lower end of the cylinder, and a throttling-valve at the same end of the cylinder and located in the passage leading to the upper end of the cylinder.

4. In a pumping-engine, the combination of a power-cylinder adapted to be supported in a vertical position, passages or ports leading to the opposite ends of said cylinder, a controlling-valve for said passages arranged to admit motive fluid alternately to and exhaust it from the opposite ends of said cylinder, said valve being located at the lower end of the cylinder, a throttling-valve at the lower end of the cylinder and located in the passage leading to the upper end of the cylinder, a piston in said cylinder, and a hollow piston-rod connected to said piston and extending through both heads of the cylinder.

5. In a pumping-engine, the combination of a power-cylinder adapted to be supported in a vertical position, a piston in said cylinder, a hollow piston-rod connected to said piston and extending through both heads of the cylinder, a coiled spring connected to the upper end of said hollow piston-rod and adapted to be connected to the pump-rod, a controlling-valve for admitting motive fluid alternately to and exhausting it from the opposite ends of said cylinder, and an automatically-operating throttling-valve in the passage to the upper end of said cylinder.

6. In a pumping-engine, the combination of a power-cylinder, a controlling-valve for admitting and exhausting motive fluid alternately to and from the opposite ends of said cylinder, and a valve located in the passage leading to the end of the cylinder which gives the downstroke to the pump-rods, said valve being arranged to automatically open on the exhaust and to automatically close on the admission against an adjustable stop.

7. In a pumping-engine, the combination of a power-cylinder, a controlling-valve for admitting and exhausting motive fluid alternately to and from the opposite ends thereof, and a valve in the passage leading to the end of the cylinder which gives the downstroke to the pump-rods, said valve being slidably mounted on an adjustable stem having a stop to limit the closing movement of said valve.

8. In a pumping-engine, the combination of a power-cylinder, a main valve for admitting and exhausting motive fluid alternately to and from the opposite ends of said cylinder, a valve in the passage leading to the end of the cylinder which gives the downstroke to the pump-rods, an adjustable stem on which said valve is slidably mounted, said stem being provided with a stop to limit the closing movement of the valve, and a spring for normally holding said valve against said stop.

9. An automatically-acting throttle and check valve for engines comprising a valve, a normally stationary stem on which said valve is slidably mounted, and a stop on said stem for limiting the closing movement of said valve.

10. An automatically-acting throttle and check valve comprising a valve, an adjustable stem on which said valve is slidably mounted, a stop on said stem for limiting the closing movement of said valve, and a spring connected to said stem independently of its adjusting means and arranged to hold the valve normally against said stop.

11. An automatically-acting throttle and check valve comprising a valve-seat, a freely-slidable valve coöperating with said seat on the exhaust side thereof, a spring for pressing said valve toward said seat, a stop for limiting the closing movement of said valve, and means for adjusting said stop without affecting the tension of said spring.

12. In a pumping-engine, the combination of a cylinder, a controlling-valve for admitting and exhausting motive fluid alternately to and from the opposite ends of said cylinder, a valve in the passage leading to an end of the cylinder, said valve being arranged to automatically open on the exhaust and to automatically close partially on the admission.

13. In a pumping-engine, the combination of a cylinder, a controlling-valve for admitting and exhausting motive fluid alternately to and from the opposite ends of said cylinder, and a valve in the passage leading to an end of the cylinder, said valve being arranged to automatically open on the exhaust and to automatically close against a stop on the admission.

In testimony whereof I, the said FREDERICK SAGE, have hereunto set my hand.

FREDERICK SAGE.

Witnesses:
F. S. O'DONNEL,
H. L. BAYLESS.