(No Model.)

2 Sheets—Sheet 1.

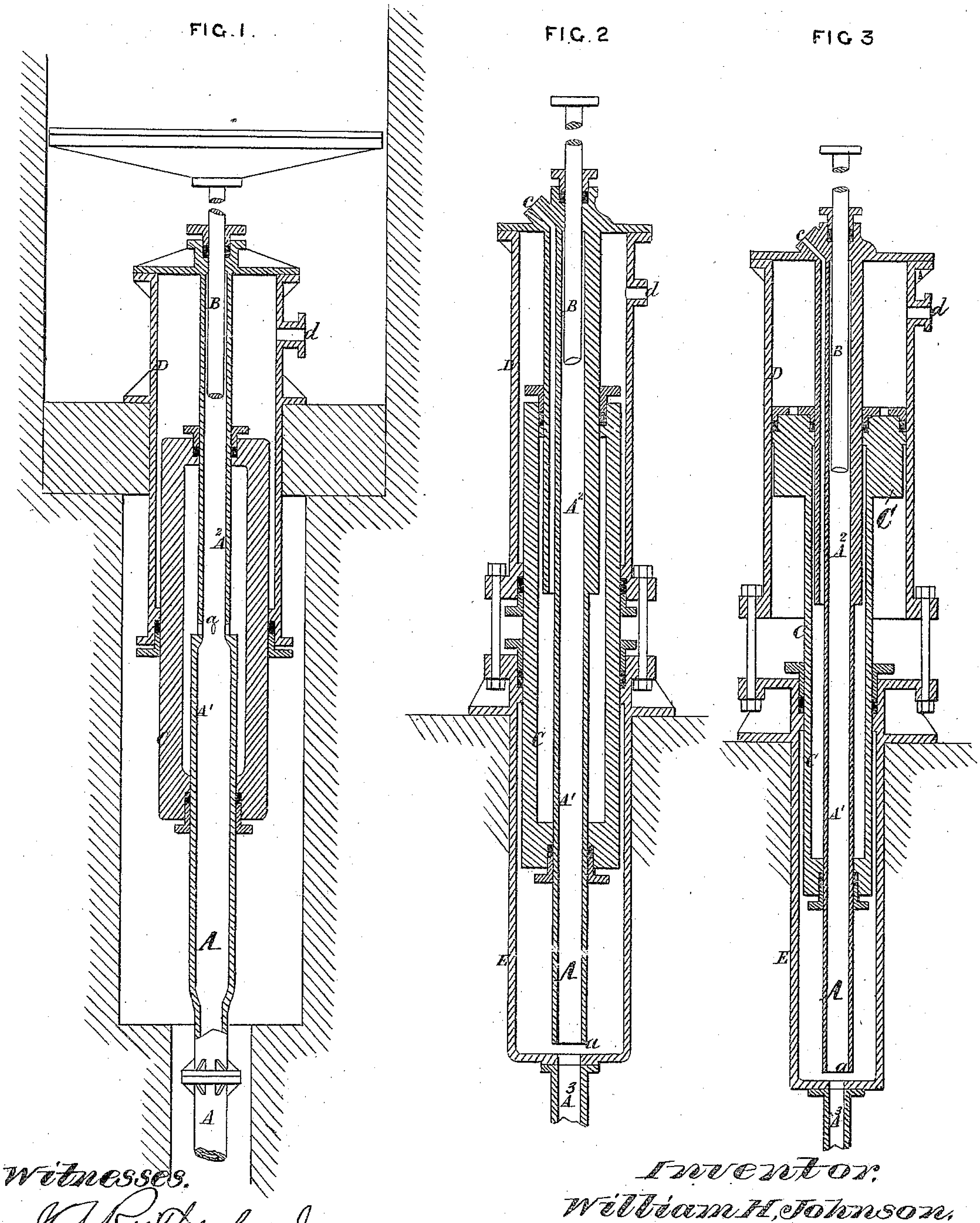
W. H. JOHNSON.

HYDRAULIC LIFT.

No. 311,327.

Patented Jan. 27, 1885.

FIG. 1. FIG. 2 FIG 3



Witnesses.
J. A. Rutherford
Robert Everett.

Inventor:
William H. Johnson.
By James L. Norris.
Atty.

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(No Model.)

2 Sheets—Sheet 2.

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FIG. 4.

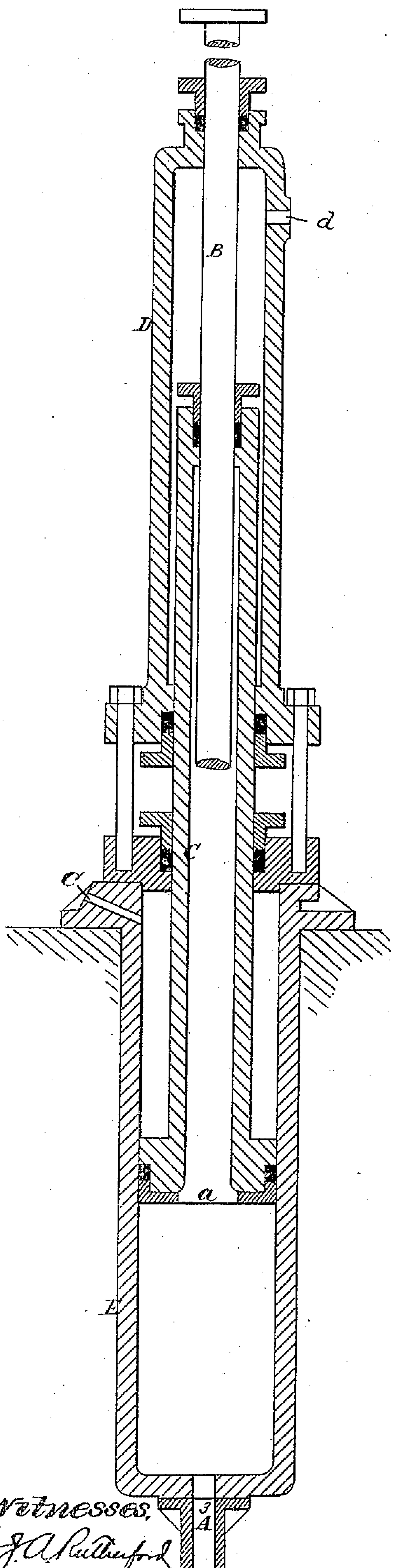


FIG. 5.

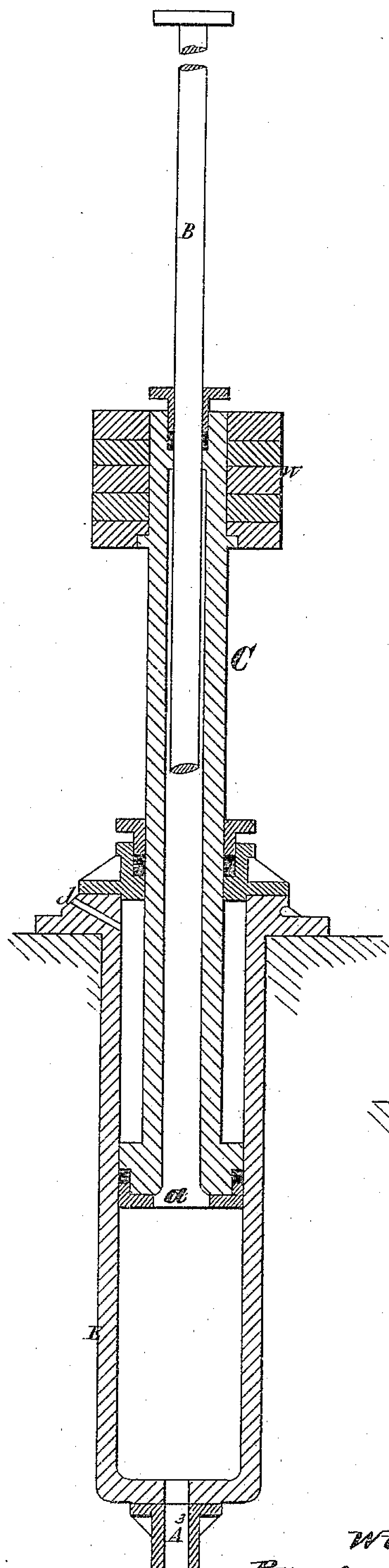
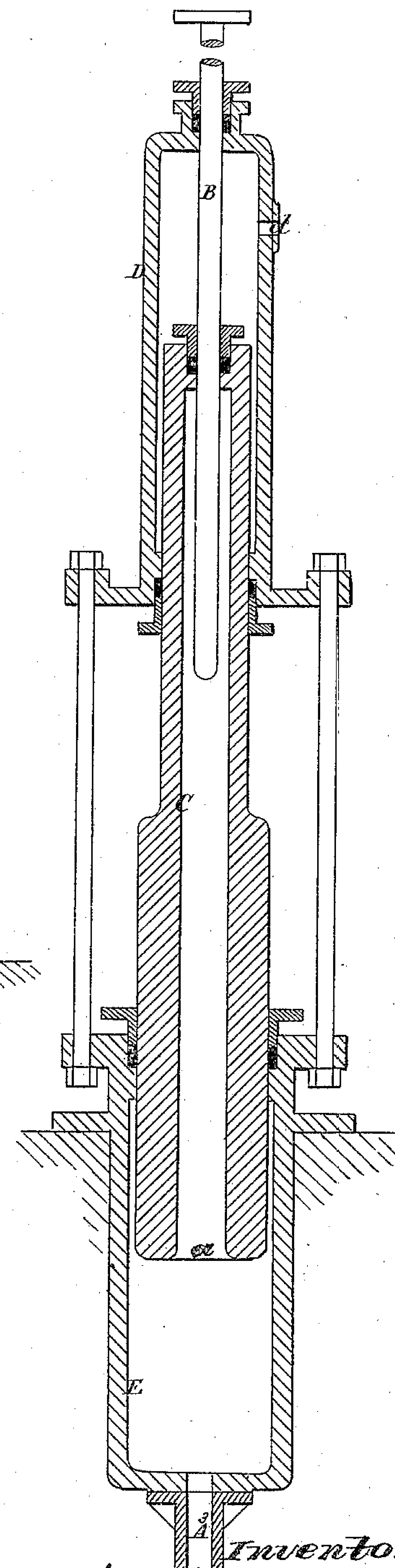


FIG. 6



Witnesses,
J. A. Rutherford
Robert Everett.

Inventor.
William H. Johnson,
By James L. Norris, Atty.

UNITED STATES PATENT OFFICE.

WILLIAM HUMBLE JOHNSON, OF WESTMINSTER, COUNTY OF MIDDLESEX, ASSIGNOR TO EDWARD BAYZAND ELLINGTON, OF CHESTER, ENGLAND.

HYDRAULIC LIFT.

SPECIFICATION forming part of Letters Patent No. 311,327, dated January 27, 1885.

Application filed November 24, 1883. (No model.) Patented in England March 13, 1883, No. 1,325.

To all whom it may concern:

Be it known that I, WILLIAM HUMBLE JOHNSON, a citizen of England, residing at Westminster, in the county of Middlesex, England, have invented an Improvement in Hydraulic Lifts, (for which I have obtained a patent in Great Britain, No. 1,325, bearing date March 13, 1883,) of which the following is a specification.

It has been proposed to employ hydraulic pressure instead of counter-weights for balancing so much as is necessary of the weight of the cages and plungers of hydraulic lifts, and this has been effected by arranging auxiliary cylinders to communicate with the lift-cylinders, and to have their pistons or plungers acted on by such pressures as are necessary to impart the required pressure to the contents of the lift-cylinders, and thereby to the plungers of the lifts. As the counter-balance requires in each case to be increased the more the lift-plunger protrudes from its cylinder, these auxiliary cylinders have been so arranged that the pressure-columns acting in them shall increase proportionally to the ascent of the lift-plungers and decrease proportionally to their descent, and thus the lift cages and plungers can be uniformly counterpoised at all parts of their stroke.

My invention relates to a construction and arrangement of such hydraulic counterpoising and compensating apparatus, whereby I am enabled to simplify their construction, to economize space for their accommodation, and to obtain facilities for erection and for repair when necessary. For this purpose I make the counterbalancing cylinders and plungers of the annular kind surrounding the lift-cylinder and its plunger, so that the whole apparatus is accommodated on one foundation within the space of the lift-shaft, and without requiring external pipe-connections.

The particular arrangements of the counterbalancing cylinders and plungers may be varied to suit various conditions. I will describe several arrangements as examples of the constructions which I adopt, referring to the accompanying drawings, in which Figures 1, 2, 3, 4, 5, and 6 are vertical sections, showing in each case part of the lift-cylinder A and plunger B with hydraulic balancing apparatus according to my invention.

Fig. 1 shows an arrangement that may be used when it is desired to intensify the service-pressure so as to have a greater pressure acting in the lift-cylinder. In this case part of the lift-cylinder A, which is closed at its lower end and extends down into a well, as is common with lifts of this character, at A' A^2 is made of differential area, and on it works an annular plunger, C, sufficiently heavy in itself, or loaded sufficiently to counterbalance the weight of the lift plunger and cage or any desired portion thereof. The differential space of the plunger C, when it is at the extreme of its upstroke, has capacity enough to contain all the liquid required to raise the lift-plunger B. Passages at *a* make communication between the lift-cylinder and the interior of the plunger C. A stationary cylinder, D, communicates at *d*, through a suitable valve-box, which may be of any of the ordinary and well-known forms, and therefore not shown, with the accumulator or supply-reservoir and with the discharge, as usual; and the plunger C works through packing at the bottom of D. On admitting the liquid under pressure to D, the plunger C is forced downward, and, owing to the difference of area of A' and A^2, liquid at increased pressure is forced through *a* from the interior of C into the lift-cylinder A, raising the plunger B and the cage. As by the descent of C the column of liquid pressing on it increases proportionally to the ascent of the plunger B, the variation of load due to the greater or less protrusion of B is compensated throughout the stroke. On opening *d* to the discharge, the weight of the cage and plunger B causes them to descend, forcing liquid through *a* into C and causing C to rise. In the arrangement shown in Fig. 2 the hollow plunger C works through packing not only in the cylinder D, but also in a lower cylinder, E, communicating at *a* with the lift-cylinder A, the lift-cylinder being divided at such point for that purpose, the lower section or portion of the lift-cylinder in such construction being indicated in Figs. 2 to 6 by the letter A^3. In this case the liquid of course passes into the cylinder E before entering the upper portion of the lift-cylinder. A passage, *c*, leading to the interior of C, will be in constant communication with the accumulator or pressure-reservoir, so that, in addition to the weight of C, this pressure acts as counter-balance, *d* being, as before, in communication with the supply and discharge valve box. Obviously the connections of *c* and *d* may be inverted, *d* being in constant communication with the accumulator, while *c* communicates with the valve-box.

In further explanation of the operation of the construction illustrated in Fig. 2, it may be added that, *c* being in constant communication with the pressure-reservoir, this pressure, acting within C on the difference of area between A^2 and A' and tending to force C down, forms practically an addition to the weight of C, operating as a counter-balance to the cage and plunger. Now, when pressure is admitted at *d*, this pressure adds still further to the downward force on C, making it descend. By the descent of C the water in E is forced through *a* into A, causing B to ascend. When the pressure is relieved by opening *d* to discharge, the weight of the cage and plunger sends back the water from A into E, causing C to rise, and the ascent of C causes the water within itself to flow back by *c* to the reservoir. By inverting the connections of *c* and *d*—that is, connecting *d* to the reservoir and *c* to the valve-box—the pressure in D acts on C outside of it, as a constant addition to its weight, and when C is opened to the reservoir there is the additional pressure brought to act inside C, so that the action is similar to that described. By a modification of this arrangement (shown in Fig. 3) a low-pressure supply, constantly communicating with D through *d* and acting on the enlarged piston-area of C, serves, in addition to the weight of C, for counter-balance, the working being effected by supply and discharge through *c*, the same as described for Fig. 2.

Fig. 4 shows another modification of the arrangement shown in Fig. 2, the parts in this case being so arranged that the plunger C works on the lift-plunger B, the only difference between the action of the parts shown in Figs. 2 and 4 being that in Fig. 2 the pressure admitted by *c* acts inside of C, whereas in Fig. 4 it acts on the annular piston area at the lower end of C. As in Fig. 2, so in Fig. 4, either *c* or *d* may constantly communicate with a pressure-reservoir, the other of them being connected to the valve-box. In the arrangement shown in Fig. 5 weights W, placed on C, serve for counter-balance, the working being effected through the passage *d*. By the arrangement shown in Fig. 6, C is made of sufficient weight or is loaded sufficiently for counter-balance, the working being effected by high-pressure liquid through *d*. The weight of C itself being sufficient for counter-balance, this weight produces within the cylinder E sufficient pressure to act on the area of B to overcome as much of the weight of the cage and plunger as may be necessary.

In Figs. 4, 5, and 6 the upper portion of the lift-cylinder is formed by the passage through the plunger or piston C, so that such part of the lift-cylinder and the plunger may be said to be in one piece. The operation of such parts, however, is the same in principle and so apparent to the skilled in the art that a detailed description of each would be a repetition, and therefore further description is not given.

Having thus described the nature of my invention and the best means I know of carrying it into practical operation, I would have it understood that I make no general claim to counterpoising the cages and plungers of hydraulic lifts by hydraulic pressure, nor to the application of the pressure in such a manner as to compensate for the greater or less protrusion of the lift-plungers; but

I claim in respect of hydraulic lifts to which such hydraulic counterpoising and compensating apparatus is applied—

1. The combination, with the central lift-cylinder and lift-plunger of a hydraulic lift, of a vertically-moving counterbalancing-plunger surrounding the lift-cylinder, and a cylinder surrounding said counterbalancing-plunger, substantially as described.

2. The combination, in a hydraulic lift, of the lift-cylinder and lift-plunger with the counterbalancing hollow plunger annularly surrounding the lift-cylinder and plunger and movable vertically thereon, and the cylinder for the counterbalancing-plunger also surrounding the lift cylinder and plunger, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 6th day of November, A. D. 1883.

WM. HUMBLE JOHNSON.

Witnesses:

OLIVER IMRAY,
JNO. P. M. MILLARD.