No. 642,742.

Patented Feb. 6, 1900.

H. O. EVANS.

HYDROPNEUMATIC HOIST.

(Application filed Aug. 8, 1898.)

(No Model.)

2 Sheets—Sheet 1.

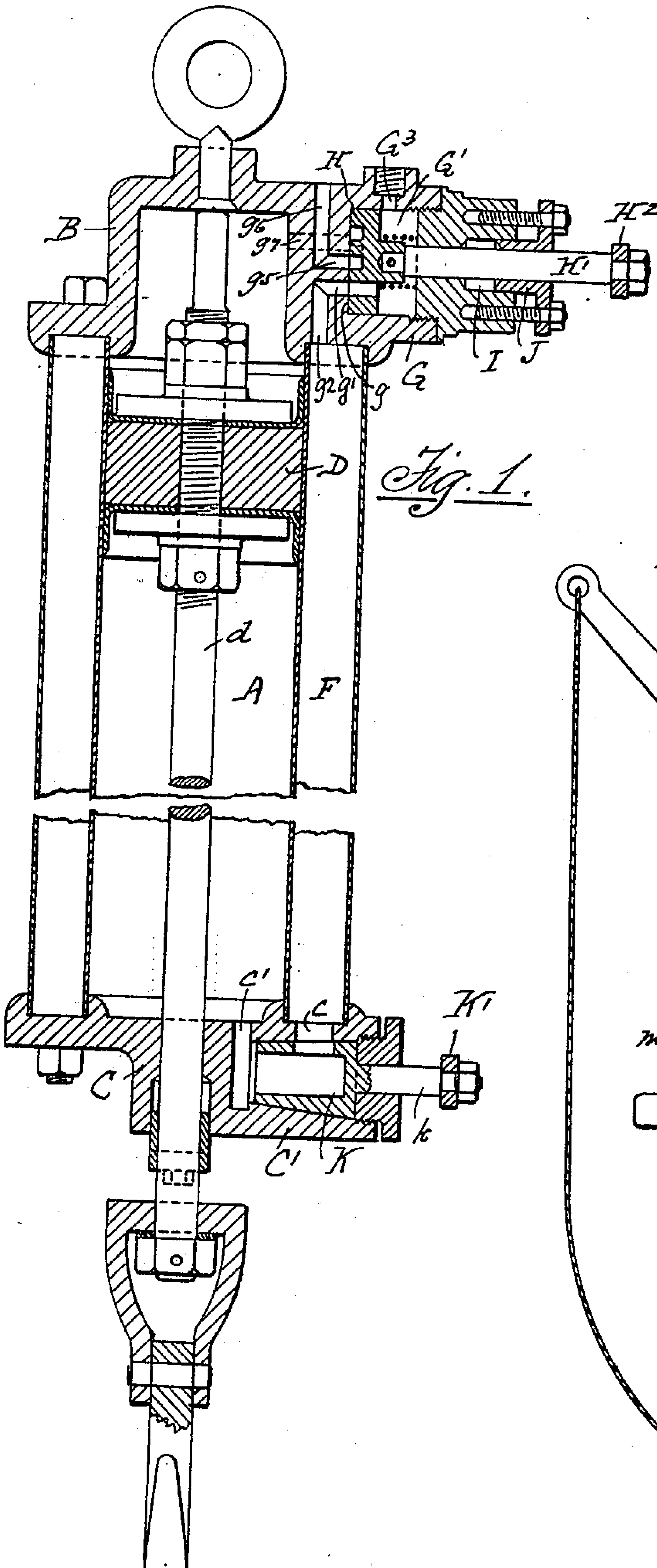

Fig. 1.

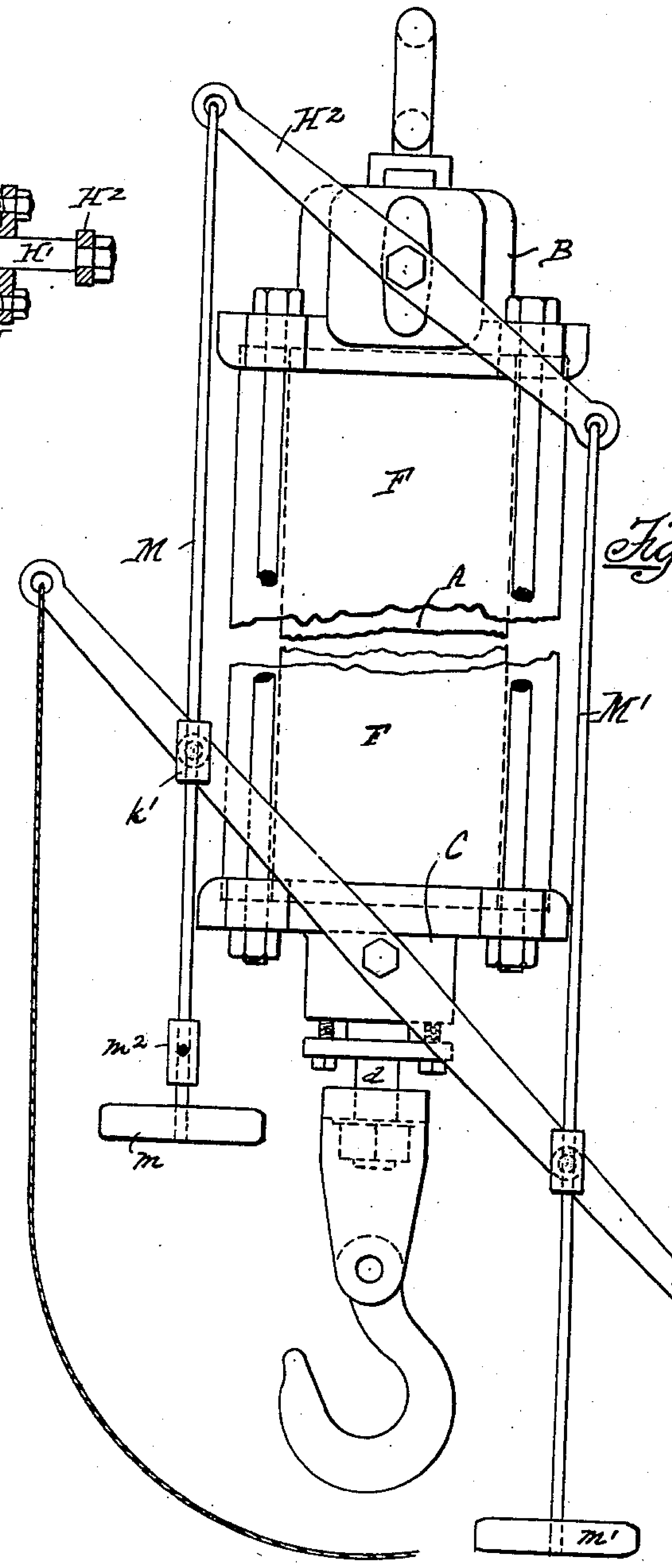

Fig. 2.

Witnesses.

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Fig. 3.

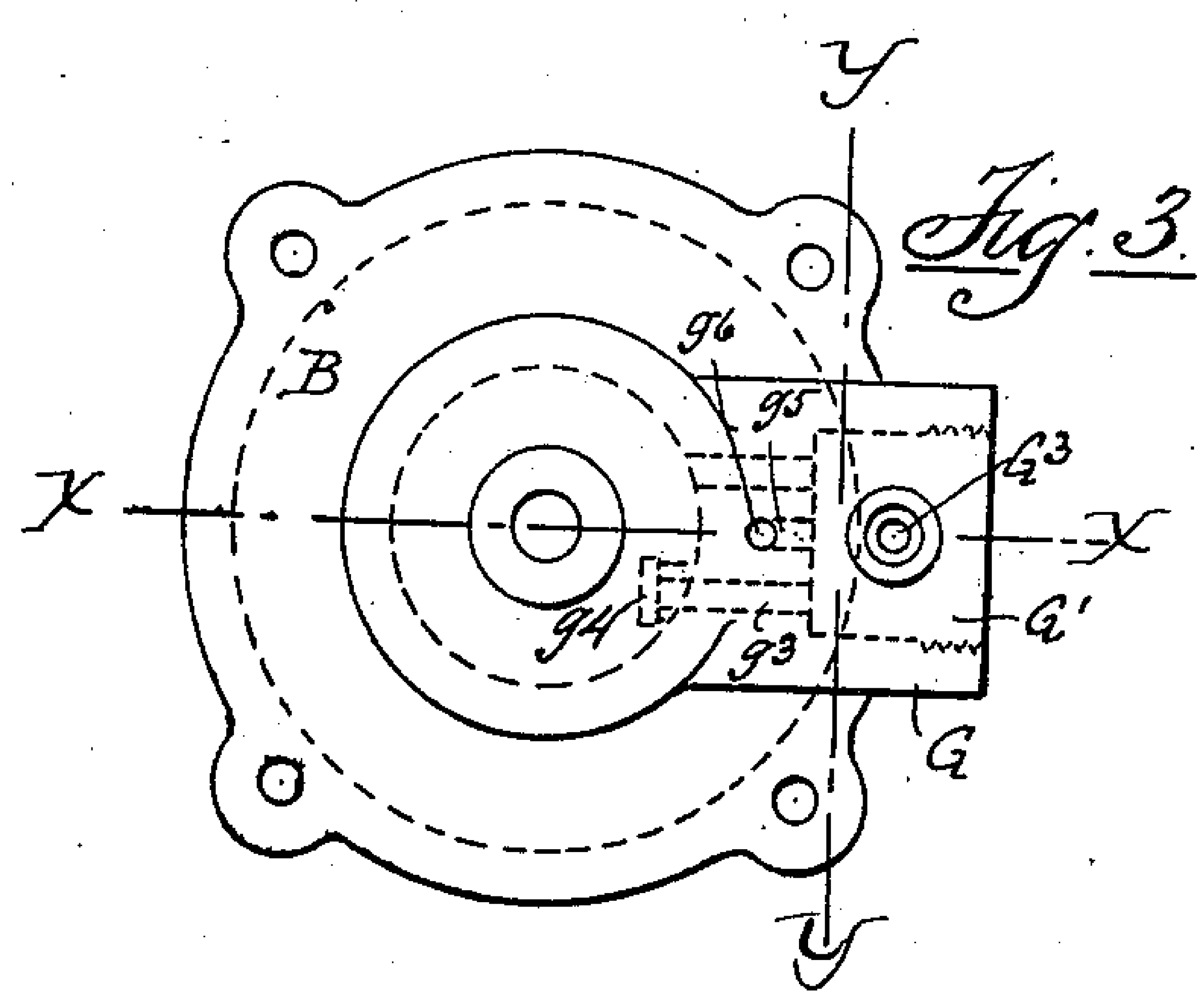


Fig. 4.

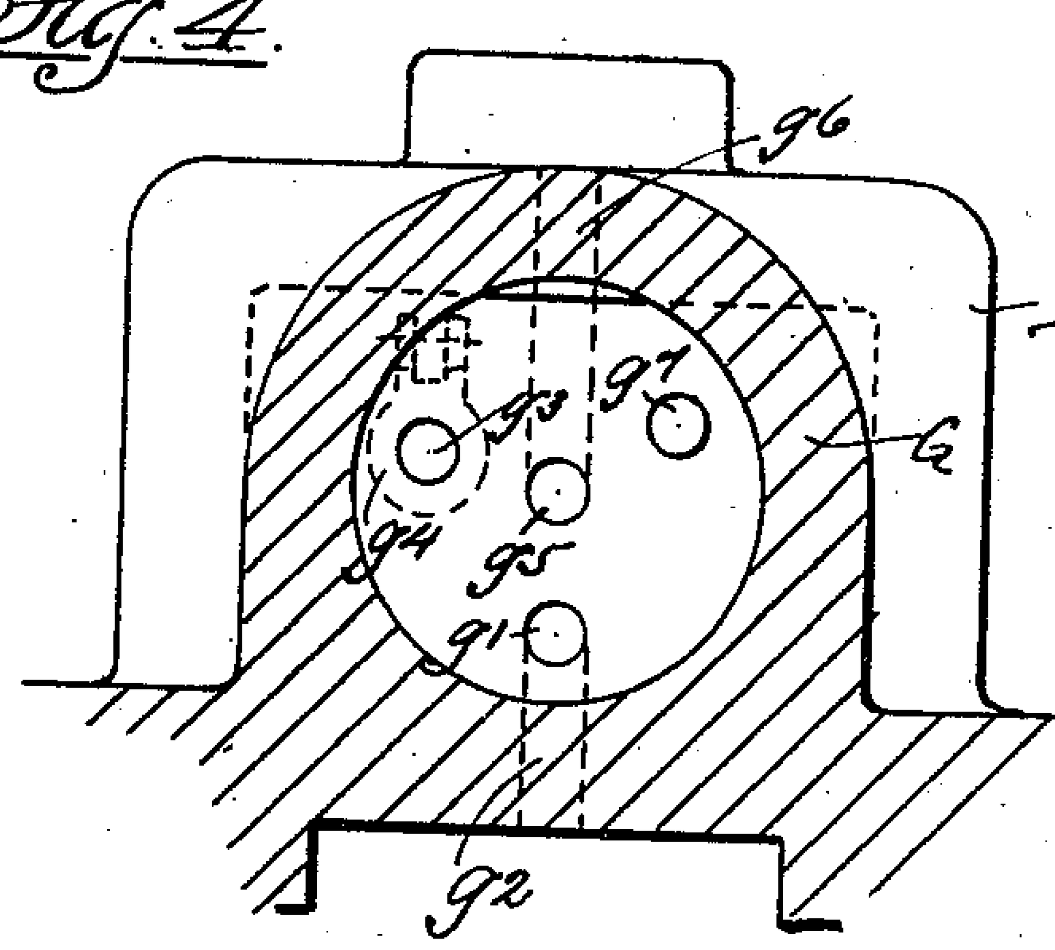


Fig. 5.

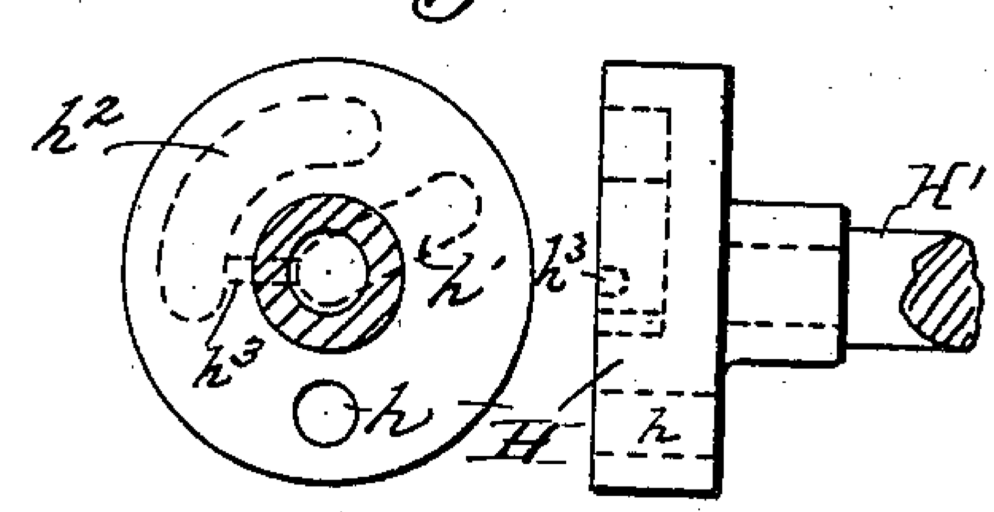
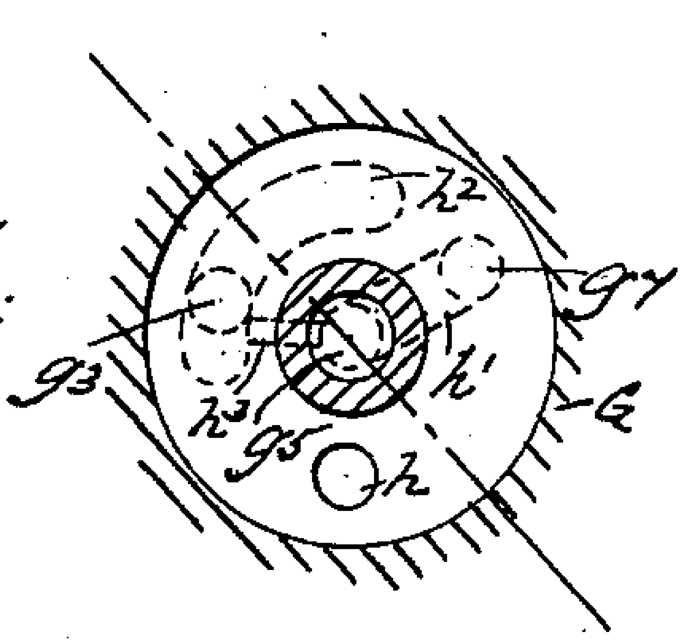


Fig. 6.



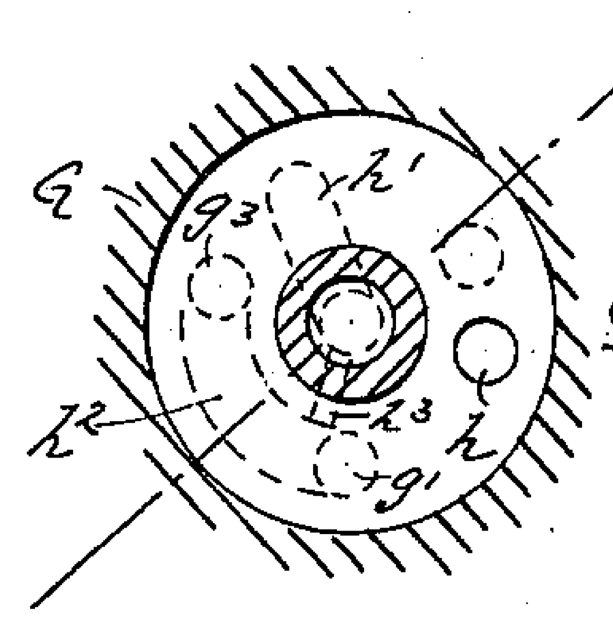


Fig. 7.

Witnesses.

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UNITED STATES PATENT OFFICE.

HENRY O. EVANS, OF POTTSTOWN, PENNSYLVANIA.

HYDROPNEUMATIC HOIST.

SPECIFICATION forming part of Letters Patent No. 642,742, dated February 6, 1900.

Application filed August 8, 1898. Serial No. 688,053. (No model.)

To all whom it may concern:

Be it known that I, HENRY O. EVANS, a citizen of the United States of America, and a resident of Pottstown, county of Montgomery, State of Pennsylvania, have invented certain new and useful Improvements in Hoists, of which the following is a specification.

My invention relates to that class of hoists in which an expansive fluid, such as compressed air, is employed; and my main object is to provide for a positive downward movement of the unloaded hoist by use of exhaust fluid and, in general, to facilitate and improve the operation and construction of the hoist. To this end I employ, in connection with the hoist cylinder and piston, a hydropneumatic reservoir having the liquid end thereof arranged in valve-controlled communication with one end of the hoist-cylinder and the compressed-fluid end of the reservoir provided with a valve arrangement adapted to regulate the inlet and outgo of the compressed fluid so as to positively control the upward or downward movement of the hoist.

The accompanying drawings illustrate a preferred construction embodying my invention, which is fully described in connection therewith.

Figure 1 is a sectional elevation on the line *x x* of Fig. 3. Fig. 2 is a full front elevation showing the valve-operating mechanism. Fig. 3 is a plan view of the top cylinder-head and air-valve casing. Fig. 4 is an enlarged sectional view on the line *y y* of Fig. 3, showing the valve-seat and ports. Fig. 5 shows the compressed-fluid valve separately in two views. Fig. 6 is a diagrammatic view showing the air-valve set to admit compressed air into the hydropneumatic reservoir, and Fig. 7 is a similar view showing the valve turned so as to throw said reservoir into communication with the upper end of the hoist-cylinder.

A represents the hoist-cylinder; B and C, the top and bottom cylinder-heads, respectively; D, the piston, and *d* the piston-rod, which passes through a stuffing-box in the cylinder-head C and carries a swiveled device for attaching the load.

F represents a separate chamber or reservoir, which, as shown, is of annular cross-section, inclosing the cylinder A. The lower end of this reservoir is adapted to be thrown into communication with the latter by means of a valve K, occupying a casing C′, which forms an extension of the cylinder-head C, ports *c* and *c′* from said casing into the reservoir and cylinder, respectively, being connected or disconnected by turning the valve, which is provided with a suitable lever K′, secured to its projecting stem *k*.

The upper end of the reservoir F is shown to be in variable communication with a compressed-air supply and also with the adjacent end of the hoist-cylinder by means of a specially-designed valve mechanism. The valve-casing G, forming an extension of the cylinder-head B, has a cylindrical valve-chamber G′ with inlet G^3 thereto for the compressed fluid. A disk valve H, fitted to this chamber, bears upon the circular seat *g* of the casing and is provided with a stem H′, which passes through a stuffing-box I and gland J and has an operating-lever H^2 secured to its projecting end.

The valve-seat *g* is provided with several ports, as follows: a central exhaust-port g^5 with right-angled extension g^6 to the atmosphere, an admission-port g' g^2 to the reservoir F, a check-controlled port g^3 into the hoist-cylinder, and an open port g^7 from the latter, which is thrown into or out of communication with the central exhaust-port g^5 g^6 by means of the rotating disk valve, the face of which is recessed to form a radial channel h', adapted to connect said ports g^5 and g^7 when set to register with both. Said valve is also provided with an admission-aperture *h*, adapted to register with the admission-port g' g^2 to the reservoir F, with a circular channel h^2, adapted to connect said reservoir F through said admission-ports with the check-controlled port g^3 to the cylinder, and with a contracted passage h^3 between the channels h' and h^2.

The air-valve H is operated by means of rods M M′, suspended from the opposite ends of the lever H^2 and provided with suitable handles, as *m m′*. These rods, as shown, pass through guides *k′*, pivoted to the lower valve-lever K′, and a suitably-located stop m^2 is provided to engage the lower lever when the rod M is moved downward to close the air-valve H, thereby operating simultaneously the liquid-valve K, as hereinafter described. The piston being in lowered position and the reservoir F nearly filled with oil or other liquid, the operation of raising the piston with the attached load consists in turning the air-valve H to the position indicated in Figs. 1 and 6, thus admitting the compressed air or other fluid to the reservoir F above the liquid contained therein and at the same time throwing the top of the cylinder A into communication with the atmosphere through the ports g^7, the valve-channel h', and exhaust-ports g^5 g^6, the liquid-valve K being then opened to a greater or less extent to regulate the speed of the lift. The upward movement of the load is thus effected positively and uniformly by the easily-controlled flow of incompressible liquid from the reservoir F into the cylinder A under pressure of the expansible fluid admitted through the valve H to the reservoir, said expansible fluid being at no time in direct contact with the movable piston. By this arrangement I avoid the liability of sudden acceleration of the movement of the latter due to possible changes in the load or in the actuating-pressure, the flow of the heavy liquid through the restricted valve-opening at c being subject to but slight variation under such differing conditions as compared with the flow of compressed fluid and the expansive action of the latter in no case affecting directly the movement of the piston, as is the case where it is admitted to the cylinder A, as is ordinarily done in this class of hoists. It also enables me to retain the load more satisfactorily than is practically possible where the compressed fluid is fed through the valve K, the heavy incompressible liquid being far more easy to control and far less liable to leakage than the compressed fluid, so that upon closing the valve K the load is positively held under all conditions. In order to use the compressed fluid economically, it is desirable to cut it off as soon as additional supply is unnecessary. This is effected by connecting the operating mechanism of the two valves H and K, so that they may be closed simultaneously, as described, while at the same time permitting independent operation.

In order to lower the load, the valve H may be turned by means of the lever H^2, thus throwing the valve-channel h^2 into communication with the port g^2 g' from the reservoir F, as well as the check-controlled port g^3, and closing the cylinder-exhaust port g^7, thereby permitting the air in said reservoir to flow into the top of the cylinder A through the check-valve g^4 until the pressures in the reservoir and cylinder are equalized, when the check-valve will automatically close. During this flow of compressed air from the reservoir to the cylinder it will be noticed (see Fig. 7) that the air is free to escape through the contracted passage-way h^3 of the valve to the central exhaust-port g^5 g^6; but owing to the relatively small size of this passage only a very limited amount of air will thus escape during the short time required to supply the cylinder A. This escape of air, however, continues after the check-valve g^4 is closed, thus constantly reducing the air-pressure in the reservoir below that in the cylinder and causing the expansive force of the air stored in the latter to positively but gradually depress the piston as far as desired, when the return of the valve H to intermediate position cuts off the escape of air from the reservoir and stops the movement. I am thus enabled to utilize the used air in the reservoir, which is ordinarily wasted, in positively lowering the unloaded piston instead of requiring the operator to pull it down, as is commonly necessary. If the check-controlled port g^3 be dispensed with, this advantageous use of the exhaust-air will be lost; but the operation will not otherwise be interfered with, and in any case new fluid may be used to effect this downward movement of the piston by merely turning the valve H a little farther than the position indicated in Fig. 7, so as to make the inlet-port h of the valve register with the port g^7 from the cylinder.

While the concentric arrangement of the reservoir F is decidedly advantageous, it is evident that this feature of the preferred construction shown, as well as other matters of detail, may be modified without departing from the spirit of my invention.

What I claim is—

1. The combination with the hoist cylinder and piston and with the hydropneumatic reservoir having valve-controlled liquid communication with one end of said cylinder, of a compressed-fluid-valve mechanism between the opposite ends of said cylinder and reservoir, said mechanism comprising a reservoir-supply port, two cylinder-ports one of which is provided with a check-valve, and an exhaust-port to the atmosphere, and a valve in said chamber arranged to control the flow of compressed liquid to and from said chamber through said ports, substantially as set forth.

2. In a hydropneumatic hoist the combination with the hoist-cylinder and communication-reservoir, of a compressed-fluid-valve mechanism comprising a valve-chamber provided with a reservoir-supply port, a check-controlled cylinder-port, and an exhaust-port to the atmosphere, and a valve for controlling said ports having a contracted exhaust-passage, as h^3, substantially as and for the purpose set forth.

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Witnesses:

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