No. 667,331. Patented Feb. 5, 1901.

J. E. L. OGDEN.

PUMP ACTUATED BY STEAM OR OTHER FLUID PRESSURE.

(Application filed July 18, 1900.)

(No Model.) 5 Sheets—Sheet 1.

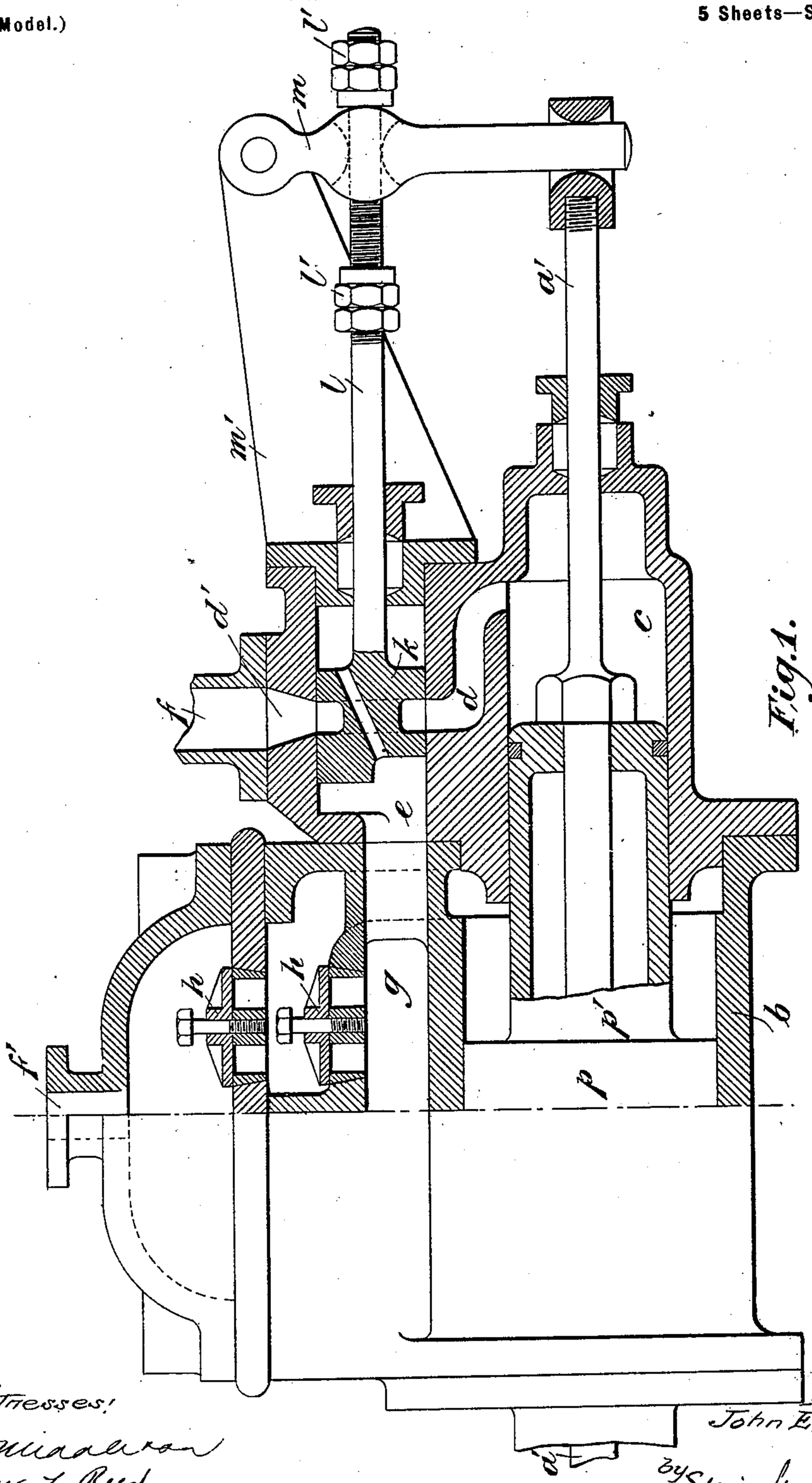

Fig. 1.

Witnesses:
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Edw. L. Reed

Inventor,
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(No Model.) 5 Sheets—Sheet 2.

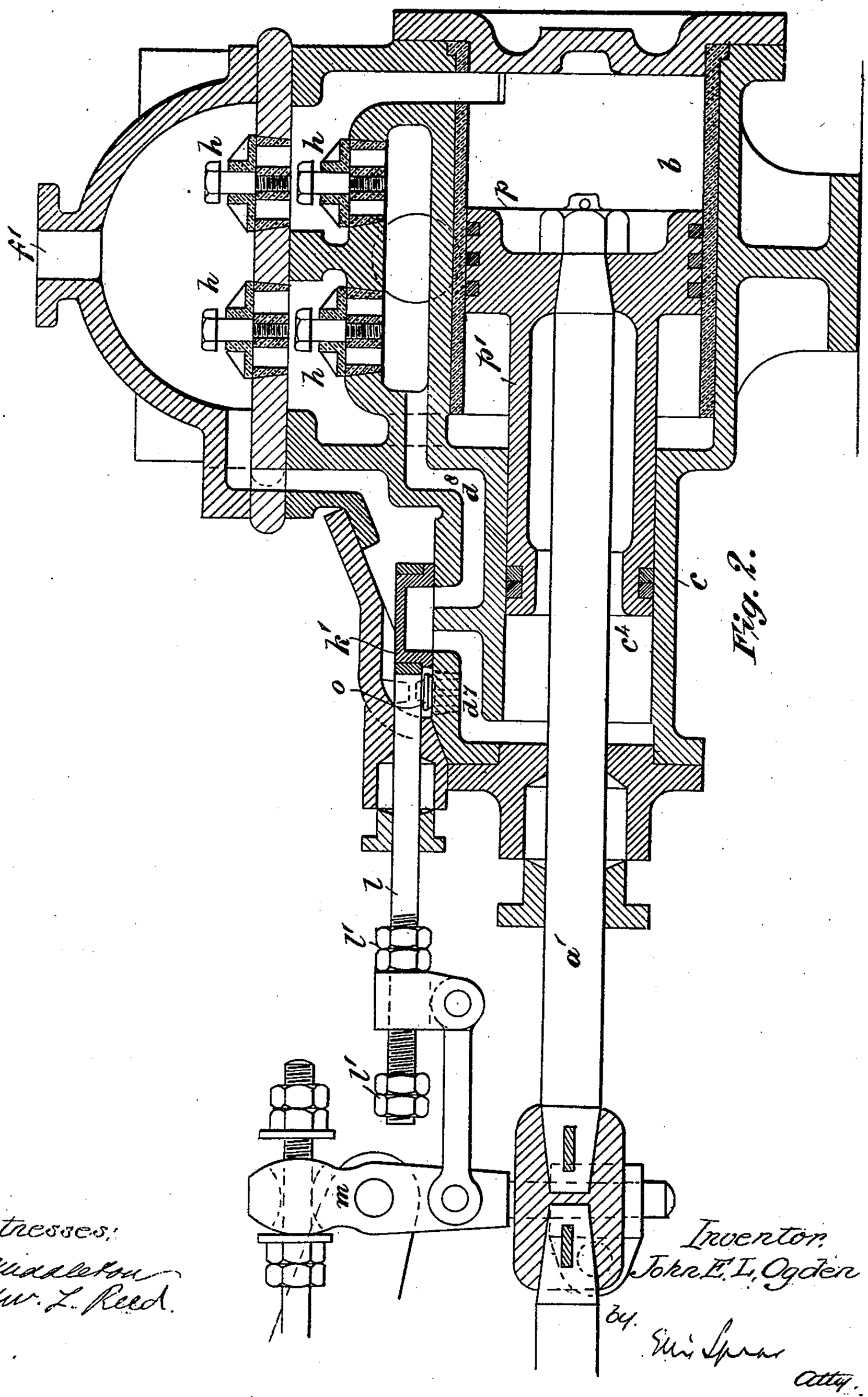

Fig. 2.

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(No Model.) 5 Sheets—Sheet 3.

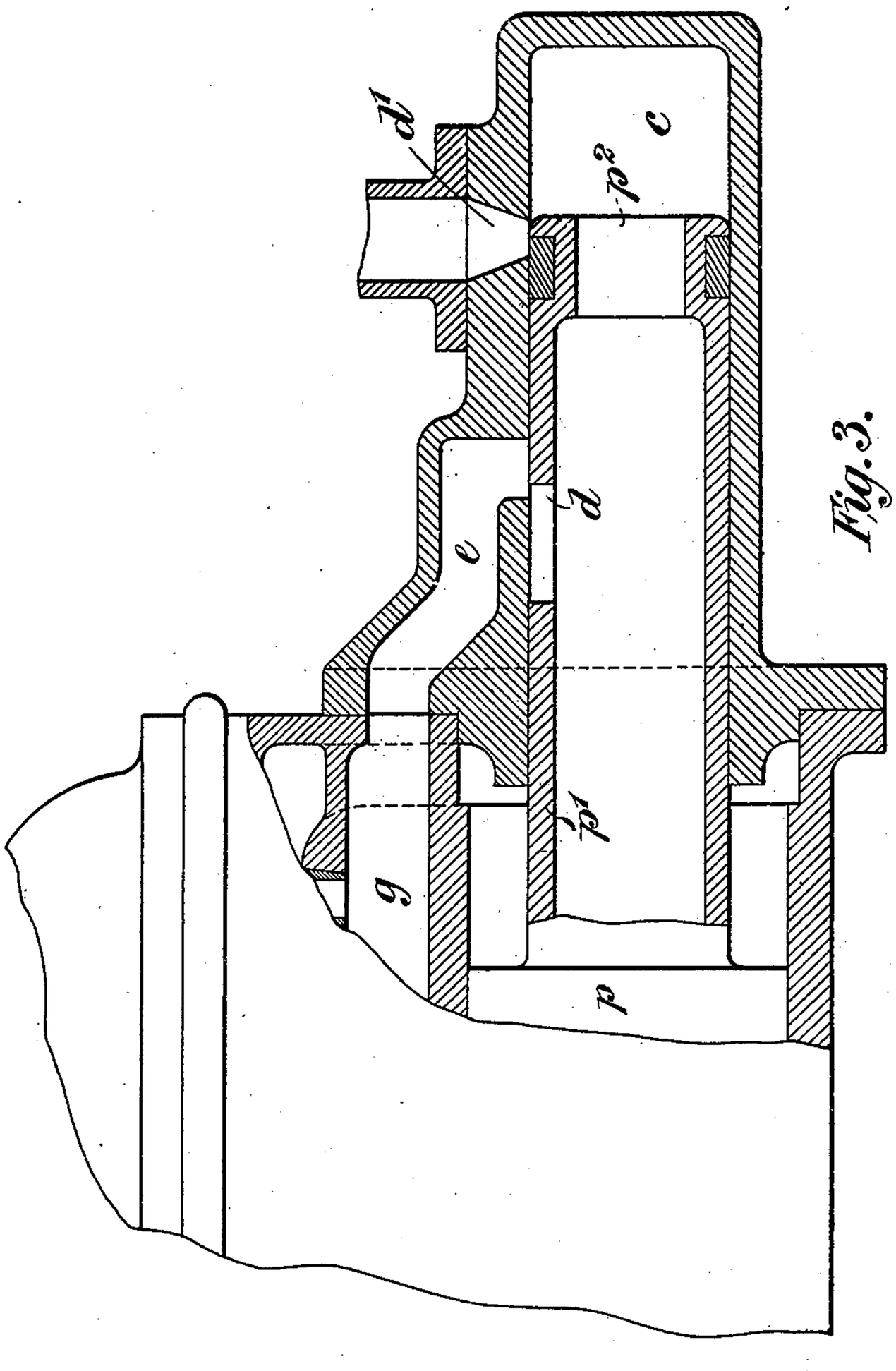

Fig. 3.

Witnesses:
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(No Model.) 5 Sheets—Sheet 4.

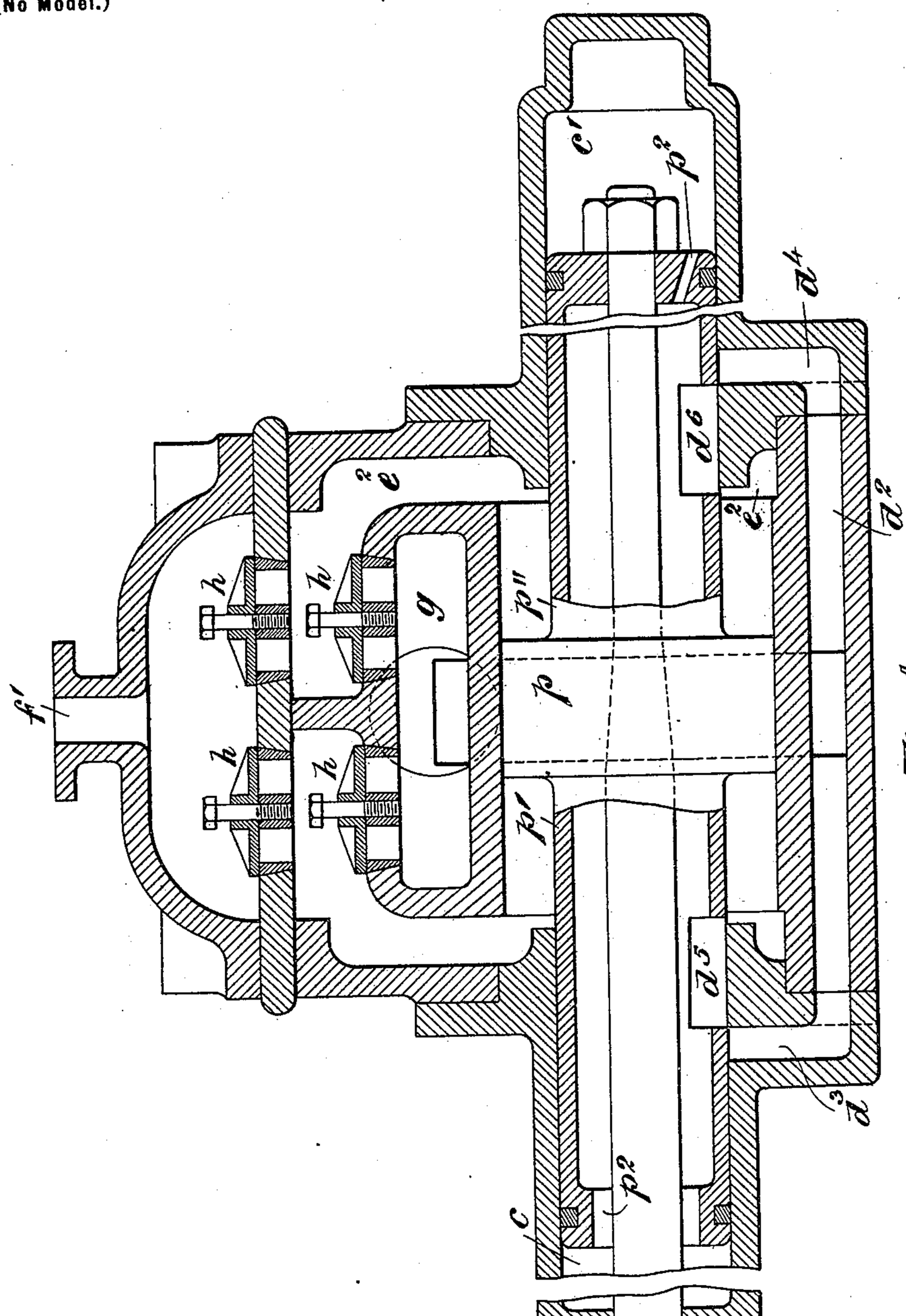

Fig. 4.

Witnesses:
J. Studdiford.
Edw. L. Reed.

Inventor:
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No. 667,331. Patented Feb. 5, 1901.

J. E. L. OGDEN.

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(Application filed July 18, 1900.)

(No Model.) 5 Sheets—Sheet 5.

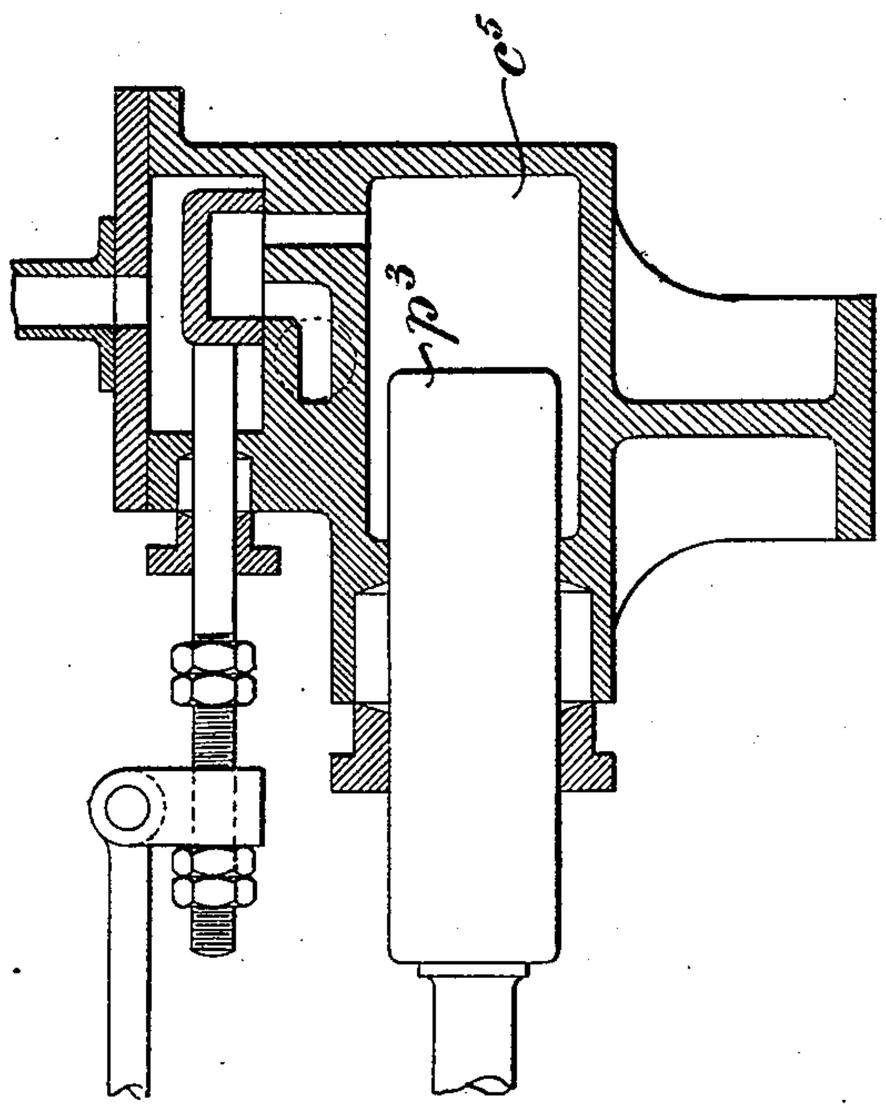

Fig. 5.

Witnesses:
Osmidallon.
Colin L. Reed.

Inventor.
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by
Wm Lyon
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UNITED STATES PATENT OFFICE.

JOHN EDWARD LEWIS OGDEN, OF LISCARD, ENGLAND.

PUMP ACTUATED BY STEAM OR OTHER FLUID PRESSURE.

SPECIFICATION forming part of Letters Patent No. 667,331, dated February 5, 1901.

Application filed July 18, 1900. Serial No. 24,080. (No model.)

To all whom it may concern:

Be it known that I, JOHN EDWARD LEWIS OGDEN, a subject of the Queen of Great Britain and Ireland, and a resident of 4 Marine Terrace, Liscard, in the county of Chester, England, have invented certain new and useful Improvements in Pumps Actuated by Steam or other Fluid Pressure, (for which I have made application for Letters Patent in Great Britain, No. 450, bearing date January 8, 1900,) of which the following is a specification.

This invention relates to improvements in connection with steam and the like pumping apparatus, the object being to provide a pump which can deliver fluid against a fixed head or pressure with a varying pressure of steam or other fluid in the actuating-cylinder, thus enabling the expansion of steam to be utilized in single-cylinder steam-pumps.

In steam-pumps as at present constructed various devices have been introduced for the purpose of enabling a compensating distribution of power upon the piston or pump-plunger at various predetermined positions of the stroke of the plunger. Fluid-pressure has also been employed to counteract and assist the motion of the pump-plungers at various portions of the travel; but such arrangements as have hitherto been employed for the counteracting or balancing and assisting the fluid-pressure acting upon the pump-plungers have been capable of application only by considerable alteration of the form of the pump parts and by costly assembling of the portions together.

My invention consists in constructing a pump in which the actuating-pressure upon the pump-plunger is balanced by the pressure of fluid within the pump at one period of the travel of such plunger and in which at another period of the travel the plunger is assisted by partially relieving the balancing-pressure and, further, in another portion of the travel the fluid-pressure is diverted, so as to augment the driving or forcing effort of the plunger, thus assisting the reduced pressure within the steam-cylinder. The periods and occasions of such variable efforts are modified and adjusted to suit the degree of expansion obtainable within the steam or motive-power cylinder.

In the accompanying sheets of explanatory drawings, Figure 1 is a sectional elevation of one type of my improved pump. Fig. 2 is a similar view of a modified form of such pump. Fig. 3 is a sectional elevation of a modified form of plunger and connection I sometimes employ. Fig. 4 is a sectional elevation of a pump having my improved extra chamber fitted at each end of the pump-barrel. Fig. 5 is a detail elevation of my improved auxiliary chamber for application to an ordinary plunger-pump.

In carrying my invention into effect in one convenient manner, as illustrated in Fig. 1, when constructing a steam-driven pump having the steam-valves controlled and actuated by any well-known arrangement of valve-gear I connect my pump-plunger *p* to the piston-rod of the steam-cylinder and arrange the pump-cylinder *b* in alinement with the said steam-cylinder. I provide at the back end of the pump-cylinder a separate or "extra" chamber *c*, in which a prolongation or extension *p'*, formed on the pump-plunger *p*, slides. This extra chamber is connected by a port or passage *d* with a valve-chest *e*, which is also provided with ports communicating, respectively, with the delivery-pipe *f* and suction-chamber *g* of the pump. The suction and delivery chambers of the pump are fitted with valves *h*, communicating with the main pump-cylinder in the usual manner.

The valve-chest *e*, above mentioned, is fitted with a double piston or other suitable valve *k*, adapted to control the passages between the delivery-pipe branch *f* and suction-chamber *g*, respectively, and the extra chamber *c*, fitted on the main cylinder. The motion of the valve *k* is controlled from the pump-plunger *a'*, so as to effect the required opening of these passages at proper intervals and in proper sequence. In order to obtain the desired motion of the valve *k*, the end of the valve rod or spindle *l* passes though a lever *m*, which is pivoted at one end upon a fixed bracket *m'* and loosely connected at its other end to a rod *a'*, attached to the pump-plunger extension. The valve-spindle *l* is screw-threaded for some distance from its end which passes through the lever *m*, and it is provided with two nuts *l'* or adjustable stops on either side of the lever. The valve is

moved each time the pivoted lever *m* comes in contact with these nuts, which can be adjusted to give the required cut-off and opening of the valve.

The operation of a water-pump constructed as hereinbefore described is as follows: Assuming, for example, that the pump-piston is at the outward end of its travel, with its plunger extension *p'* fully entered into the extra chamber *c* and the space in the pump-cylinder in front of the main plunger *p* filled with water, the piston-valve *k* is then in position cutting off the passage *d'* from the valve-chest to the delivery-pipe *f* and allowing free passage between the suction area *g* and the extra chamber *c* through *d*. Steam is admitted to the steam-cylinder, and the pump-plunger *p* is thereby moved in the inward direction, drawing water from the suction-chamber through *d* into the extra chamber *c* and into the annular space of the pump-cylinder behind the main plunger *p* and surrounding the plunger extension *p'*, water being simultaneously delivered from the space in front of the main plunger *p*. As the steam-piston approaches its point of cut-off the pivoted lever *m* upon the pump-chamber comes into contact with the inner stop or nut on the valve-rod *l* and moves the valve *k* into position, shutting off the passage *d* between the extra chamber *c* and the suction-chamber *g* of the pump and producing a slight opening of the passage *d'* between the extra chamber *c* and the delivery branch pipe *f*. Steam is then cut off, and the expansion takes place in the steam-cylinder, and as the motion of the plunger *p* continues under the reduced pressure of steam the pivoted lever *m* causes a gradually-increasing valve-opening of the passage between the delivery branch pipe *f* and the extra chamber *c*. High water-pressure thus passes into the extra chamber *c* from the main delivery-pipe and acts upon the plunger extension *p'*, thus assisting the expanding steam to complete the stroke of the pump. Upon the completion of the stroke the piston-valve *k* is in position, allowing full opening between the extra chamber *c* and the passage *d* from the valve-chest to the main delivery of the pump. Steam is then admitted to the steam-cylinder, and the pump commences its return or outward stroke. The pump draws water from the suction-chamber into the space in front of its main plunger *p*, and the back part of the plunger *p* and its extension *p'* deliver water through the main delivery-pipe *f'* and through the connection *d'* between the valve-chest *e* and the main delivery branch *f*, respectively. As the steam-piston approaches its point of cut-off the valve *k* on the extra chamber moves into position, shutting off the communication with the delivery-pipe branch *f* and opening communication between the extra chamber *c* and the suction-chamber *e* of the pump. Steam is then cut off, and expansion takes place under reduced counteracting pressure, the pressure upon the plunger extension being then relieved by the opening of communication between the suction-chamber *g* and the extra chamber *c*. As the expansion continues to the end of the stroke, the whole further delivery of water takes place from the annular space alone in the main cylinder surrounding the extension *p'* on the back of the plunger *p*. When the stroke is completed, the plunger *p* and valve *k* are in their initial position, and the cycle of operations above described is repeated.

In the arrangement of pump above described a very simple means of varying the cut-off and opening of the piston-valve *k* to suit the degree of expansion in the steam-cylinder is afforded by the adjustable nuts or stops *l'* upon the valve-rod.

Instead of employing a piston-valve for controlling the ports connected with my supplementary or extension chamber I sometimes arrange a valve with the ports and passages formed in connection with it, as illustrated in Fig. 2. Upon the pump-barrel I form an extension-chamber *c*, having ports or passages d^7 d^8, which are opened and closed by the valve *k'*, so as to place the area c^4 in communication with the suction or delivery chambers at determined positions of the stroke of the pump, the action of the valve *k'* and its function in relieving the pressure being similar to action of the pump hereinbefore described and as illustrated in Fig. 1.

I arrange a relief-valve *o* in connection with my supplementary delivery when providing for shock or variation of pressure such as may arise during the working conditions of the pump.

According to a modification of my invention, as illustrated in Fig. 3, I connect the water-plunger at one end to the piston-rod of the steam-cylinder and arrange the pump-cylinder in line with the steam-cylinder, as before; but I dispense with the separate valve-chest, piston-valve, and actuating-gear. I form a hollow extension *p'* upon the back end of the plunger *p*, which extension slides in a separate or extra chamber *c*, attached to the pump-cylinder, and is provided with a side port or aperture *d*. Ports or passages *e d'* are provided from the suction-chamber *g* and main delivery pipes, respectively, opening into the extra chamber *c*, as in the form of pump already described. The port *d*, formed in the side of the plunger extension *p'*, slides across these ports or passages. Apertures p^2 are also formed in the end of the pump plunger extension *p'* to admit of free passage of water through the extension. The plunger extension *p'* thus forms its own valve, and the action of this form of pump is similar to that of the form illustrated in Fig. 1 and already described.

According to a further modification of my invention I provide a pump-cylinder which is fitted with an extra chamber at each end, as illustrated in Fig. 4. The main trunk-plunger

p is provided on each side with a hollow prolongation or extension p' p'', fitting the corresponding extra chamber c, and the trunk-plunger p is connected to the piston-rod of the steam-engine, the pump-cylinder being arranged in alinement with the steam-cylinder. The suction-chamber g of the pump communicates with a channel d^2, which extends along the length of the pump-cylinder and which opens into the extra chambers c c' at each end of the cylinder. A side aperture or port d^5 d^6 is cut in each of the plunger extensions p' p'', and each aperture slides across the corresponding openings d^3 d^4 of the channel above mentioned. Openings p^2 are cut in the end of each plunger extension, so as to provide passages from the interior of each plunger extension into its corresponding extra chamber. The operation of this construction of pump is as follows: Assume the pump-plunger at the beginning of its stroke, with the extension p' on its inner end fully entered into its extra chamber c and with the outer extra chamber full of water. The side port d^5 on the inner hollow extension p' then presents a small amount of opening to the channel d^3 in communication with the suction-chamber, while the outer end d^4 of this channel is completely cut off, the side port d^6 on the outer extension then opening to the annular cylinder-space around the main trunk-plunger p''. Steam is admitted to the engine-cylinder and the plunger is moved outward, drawing water into the main cylinder p' and through the side port d^5 of the plunger extension into its extra chamber c, and the outer end of the chamber pump simultaneously delivers pressure-water. When the point of cut-off of steam is reached, the extension-port d^5 has passed the opening d^3 of the suction-channel, and the extension-port d^6 is then in communication with its suction-channel opening d^4. The pressure in front of the moving plunger is therefore partially relieved, and the steam expansion in the engine-cylinder can thus take place under the reduced counteracting pressure. Upon the completion of the outward stroke the port d^6 stops in a position uncovering a small part of the opening d^4 of the channel connecting with the suction-chamber. As the two ends of the pump-cylinder are symmetrical, the operation of the pump on the return stroke is exactly similar to its operation on the forward stroke. In this modification it will be observed that each back and forward stroke of the plunger is accomplished by partially relieving the counteracting pressure on the pump-plunger during both periods of steam expansion. In the two modifications above described in one of the steam expansion periods the motion of the plunger is assisted by augmenting the pressure on the pump-plunger.

When providing for the use of my invention in connection with ordinary plunger-pumps of a double-acting type, I arrange my extra chamber in one convenient form, as illustrated in Fig. 5, in which c^5 is an auxiliary compensating cylinder with a plunger extension p^3 for attachment to the pump-rod extension onto any side or other connecting or motion rod. When arranging the chamber c^5, however, with the pump-rod out of alinement with the cylinder, I find it desirable to employ one on each side to effect a balancing of the load and for efficiency of working.

It is obvious that instead of the arrangements of extra chamber or chambers above described an auxiliary cylinder or cylinders may be employed fitted with a plunger or plungers connected to the main pump-plunger, the cylinder or cylinders being suitably connected to the suction and delivery chambers in the main pump, and suitable valve-gear may be provided for actuating the valve controlling the suction and delivery connections, all without departing from the principles hereinbefore described.

I do not wish to limit myself to any particular valve means, and the port d of Fig. 3 may be regarded as such means when considered in conjunction with the parts of the cylinder-shell over which the port works.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a steam or like power pump, the combination of the pump-cylinder and piston, an auxiliary cylinder and a supplemental plunger therein connected with the main piston, and cut-off valves means moving with the piston and controlling the admission of the fluid to the supplemental plunger whereby the whole area of the main and supplemental piston is utilized for pumping in the first part of its stroke, a portion of such area only at another part of its stroke and whereby also the pump's power will be augmented at another part of its stroke by diverting the fluid-pressure to act on the supplemental plunger, substantially as described.

2. In combination in a steam or like power pump, the pump-cylinder, the piston or plunger therein, a supplemental cylinder having a piston or plunger therein, moving with the pump-plunger, said supplemental cylinder having communication with the suction and delivery mains and cut-off valves means for controlling such communications, substantially as described.

3. In a steam or like power pump, the pump cylinder and plunger, an auxiliary cylinder and plunger connected with the pump-plunger, said auxiliary cylinder having communication with the delivery and suction mains and an adjustable valve controlling said communications during the expansion periods of the motive-power fluid, substantially as described.

4. In a steam or other expansive motor-power pump, the combination of a pump chamber or barrel, with a supplementary or extra chamber formed or attached thereon,

having a passage or port which can be placed in communication with the suction-chamber alone at one period of the stroke and in communication with the delivery-chamber or delivery-main alone at another period of the stroke and valve means for controlling said communication substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

JOHN EDWARD LEWIS OGDEN.

Witnesses:
JOHN B. CLEMENTS,
HERBERT A. MARSHALL.