F. ROCHOW.

Hydraulic Engine.

No. 161,441. Patented March 30, 1875.

Fig: 1

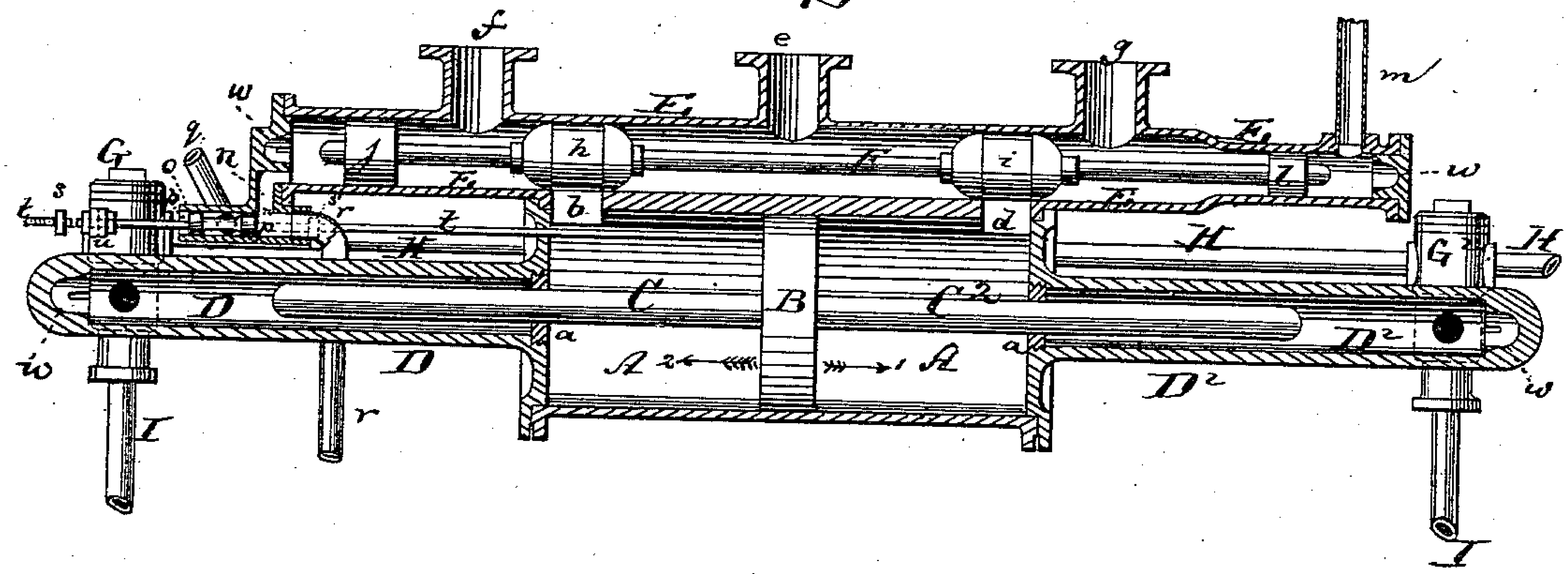


Fig: 2

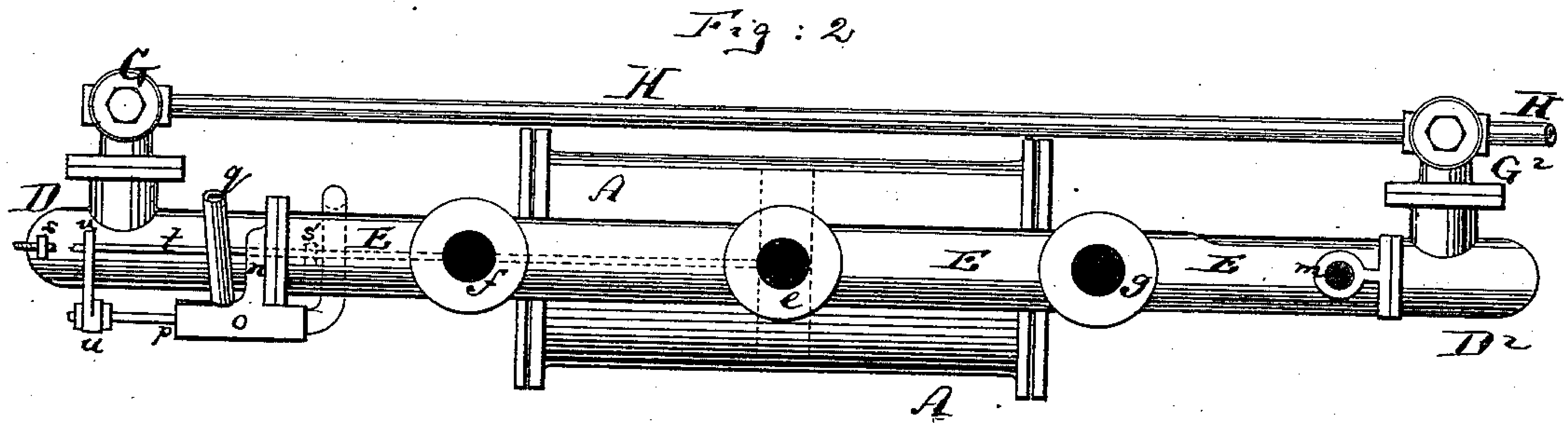


Fig: 3

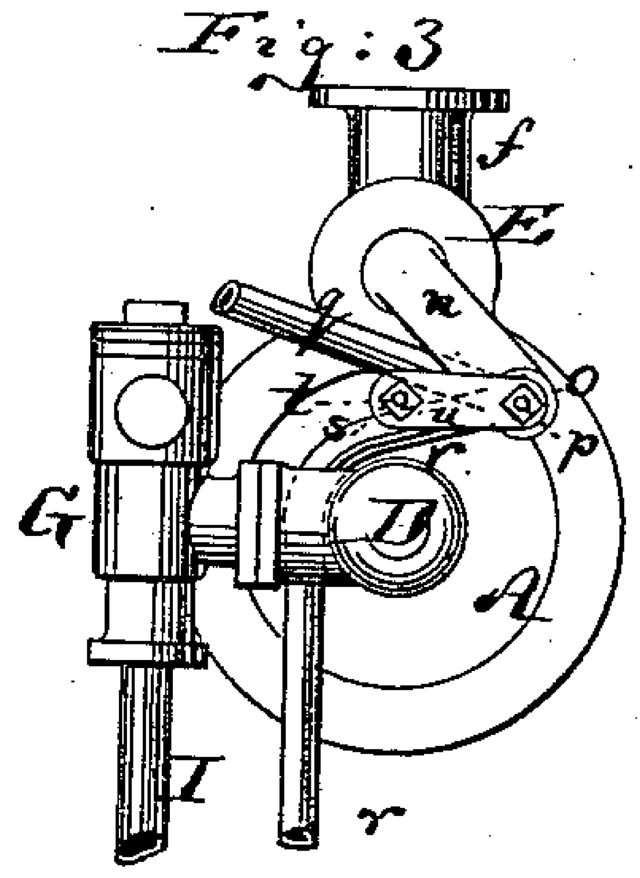


Fig: 4

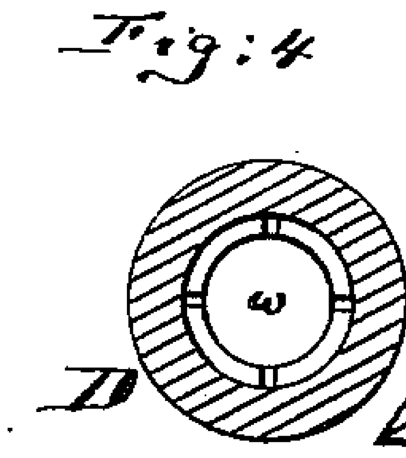
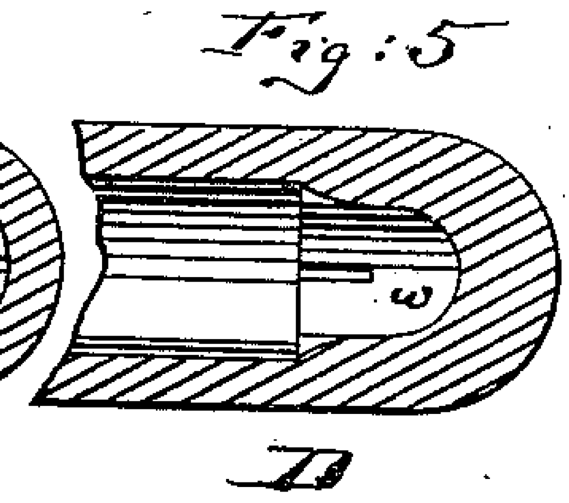


Fig: 5



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UNITED STATES PATENT OFFICE.

FERDINAND ROCHOW, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN HYDRAULIC ENGINES.

Specification forming part of Letters Patent No. 161,441, dated March 30, 1875; application filed January 28, 1875.

To all whom it may concern:

Be it known that I, FERDINAND ROCHOW, of Brooklyn, in the county of Kings and State of New York, have invented a new and Improved Hydraulic Engine, of which the following is a specification:

The object of this invention is to produce a reciprocating hydraulic engine, whose piston will, by direct connection with one or more pistons of smaller diameter, serve to create greater hydrostatic pressure than the pressure required to move the larger piston. In this way I will be enabled to force water or other liquid to a considerable height, by means of overflow—or other water having but small pressure—and to operate by the same small power hydraulic presses, hydraulic lifting apparatus, and other machinery requiring considerable pressure. I may also by my machine utilize the water-supply in cities for filling tanks that are located at a greater height than the source of supply.

The invention is intended to employ a different liquid for acting upon and operating the engine from the liquid which is compressed and forced by such hydraulic engine, which arrangement enables me to use oil or equivalent liquid in a continuous circuit for the engine to act upon, while overflow water can be used to set the engine in motion.

My invention consists principally in providing one or both heads of the main cylinder of the engine with projecting chambers of smaller diameter, and in providing one or both faces of the main piston with projecting plungers of a size to fit said chambers, so that the said plungers, moving in said chambers, will constitute pumps for forcing water with a degree of pressure greater than that required to move the large piston.

The invention also consists in details of construction and arrangement of parts, hereinafter more fully described.

In the accompanying drawing, Figure 1 represents a longitudinal vertical section of my improved hydraulic engine. Fig. 2 is a plan view of the same; Fig. 3, an end view of the same; Fig. 4, a detail cross-section through one of the pump-cylinders; and Fig. 5, a detail longitudinal section, through one end thereof, both Figs. 4 and 5 being shown on an enlarged scale.

Similar letters of reference indicate corresponding parts in all the figures.

A is the main cylinder of the hydraulic engine; B, its reciprocating piston. From the opposite faces of the piston project, parallel with its axis, two rods, C C^2, both of equal diameter, and each much smaller in diameter than the piston B.

D and D^2 are two cylindrical chambers, projecting, respectively, from the heads of the cylinder A, each of a diameter somewhat larger than that of a rod, C C^2, and both situated to receive the ends of said rods C C^2, respectively, as in Fig. 1. The length of each of the chambers D D^2 is such that they will allow the rods C C^2 to follow the full strokes of the piston B, and still always contain the ends of said rods. Suitable packing *a* is applied at the mouth of each chamber D D^2 around the rods C C^2 to prevent the liquid in the cylinder A from entering either of the said chambers, and vice versa.

The rods C C^2 constitute the plungers, and the chambers D D^2 the barrels of the pumps, which I wish to operate. The principle of my invention will be readily understood by an example, as follows:

Suppose the head of water acting on the piston B to exert a pressure of ten pounds on the square inch, and the piston B to have an area of one hundred square inches, the total pressure on the piston will then be one thousand pounds. Now, if the area of cross-section of each plunger C is only two square inches, the piston B would be enabled to create hydrostatic pressure to the amount of five hundred pounds per square inch by means of the plunger C, minus loss by friction. This increase of pressure on a smaller column of water than that required to operate the piston B is what I intend to obtain. It is obtained by each plunger C C^2, and I may have but one such plunger on one face of the piston, or one on each face, as shown, or more than one on one or both faces, and a corresponding arrangement of chambers D, &c., for the reception thereof.

For operating the piston B I have devised a valve mechanism, clearly illustrated in Fig.

1—that is to say: A cylindrical valve-chamber, E, connects, by two ports, *b* and *d*, with the respective ends of the cylinder A, is supplied with water through a middle pipe, *e*, and exhausts through pipes *f* and *g*. Within the chamber E is fitted a rod, F, parallel to the axis of the cylinder A, and carrying two valves, *h* and *i*, nearer the middle, and pistons *j* and *l* at the respective ends. Each valve *h* and *i* fits the chamber E like a piston, and the two said valves are as far apart from each other as the ports *b* and *d*. The piston *j* is as large in diameter as the valves *h* and *i*, but the piston *l* is smaller in diameter and is surrounded by a contracted end of the chamber E, as is clearly shown in Fig. 1. Through a small tube, *m*, a constant head of water is conducted into the contracted end of the chamber E and pressing against the outer face of the piston *l*. The opposite end of the chamber E connects, by a tube, *n*, with a small cylinder, *o*, within which moves a double-headed piston, *p*. A small water-supply pipe, *q*, having the same head as the pipe *m*, leads into the cylinder *o* and supplies the end of the chamber E, and presses against the larger piston *j* as long as the piston *p* does not interpose one of its heads, as it is shown to do in Fig. 1, between the pipe *q* and the tube *n*. In the latter position the tube *n* communicates with a small discharge-tube, *r*. The piston *p* is moved the short stroke required to connect *n* alternately with *q* and *r* by lugs *s s'* on a rod, *t*, that projects from the piston B, said lugs striking a crank, *u*, on the rod of the piston *p*. Now, if the piston B moves in the direction of the arrow 1, shown in Fig. 1, it will at the end of its stroke draw the lug *s* against the crank *u*, and move the piston *p* so as to establish connection between the pipe *q* and the tube *n*. The water will then press on the piston *j*, and, as the diameter of *j* is larger than that of the piston *l*, the pressure on *j* will prevail and push the rod F, with all its attachments, in the direction of the arrow 1. This will bring the valve *h* between the two ports *b* and *d* and between the port *b* and the supply-pipe *e*, whereas the valve *i* will be moved beyond the port *d*, establishing communication between the pipe *e* and the port *d* and closing the pipe *g*. The supply will then enter through *d* and move the piston B in the direction of the arrow 2, the exhaust escaping through the port *b* and thence through *f*. At the end of this stroke the lug *s'* will strike the crank *u* and move the piston *p* so as to close the pipe *q* and establish connection between *n* and *r*. The pressure on the smaller piston *l* will now prevail, there being none to counteract in the opposite direction, and thus the rod F, with all its appendages, will be moved in the direction of the arrow 2 until the valve *h* closes the discharge *f* and establishes communication from *e* to *b*, while the valve *i* will establish communication from *d* to *g*. The motion of the piston B is thus once more reversed and operation continued, as described.

It will be observed from the foregoing that I obtain the automatic adjustment of the valves *h i* by causing continuous pressure of water to bear on the smaller piston *l*, and alternate pressure on the larger piston *j*.

The chambers D D^2 communicate respectively with chambers G and G^2, each of which contains a suction-valve and a delivery-valve of usual style. A pipe, H, connects and joins the chambers G G^2, a discharge-pipe, H', extending to the machine or place destined to receive the water that is forced by the pressure-pumps C D and C^2 D^2. I I are suction-pipes.

In order to prevent the plungers C C^2, and also the rod F from coming to an abrupt termination of their motions, and creating shocks injurious to the machinery, the water which they meet at the ends of their strokes being nearly inelastic, I have applied a pocket, *w*, for the reception of every such rod—that is to say, the chambers D D^2 terminate in such pockets, and also the ends of the valve-chamber E. Every such pocket is just large enough in diameter to receive the end of its rod C, or C^2, or F, and has tapering notches cut into its sides, which notches are deepest at the mouth of each pocket, and become shallower the nearer they approach the closed end thereof, as is clearly shown in Fig. 5.

When the plunger C, for example, enters its pocket *w*, it will gradually, and in constantly-diminishing quantity, displace the water from within such pocket, the water escaping through the notches until the plunger closes the notches entirely. The water in the pocket will thus feebly resist the entry of the plunger into the pocket, and constitute, by virtue of its gradual and slow escape into the body of the chamber D, or D^2, or E, a cushion for gradually diminishing the speed of such plunger, and preventing injurious shocks.

It will be seen that my hydrostatic engine will be acted upon by one kind of liquid, and act upon another. I may force, for example, oil or other liquid, which greatly diminishes friction by the piston C, and draw such oil, after it has acted, back to the chamber G, creating a continuous conduit for the oil from the chamber G to the place where the force is to be applied and back to G, and losing nothing by evaporation, while I may use a suitable different fluid, such as overflow-water for, meanwhile, operating the engine.

I claim as my invention—

1. In combination, with the larger main cylinder A, piston B, and main valve-chamber E, the projecting smaller pressure-cylinder D, piston C, and valve-chamber G, the chamber E, having a valve for controlling the entry and discharge of the liquid which operates the piston B, and the chamber G having a separate suction and a delivery valve for the admission and discharge of the liquid which is acted upon by the piston C, substantially as described.

2. The valve-rod F, carrying the larger pis-

ton j at one end and the smaller piston l at the other end, to be affected automatically by continuous hydraulic pressure on the smaller piston, and alternate pressure on the larger piston, substantially as specified.

3. The reciprocating piston p, placed within the cylinder o, and combined with the supply-pipe q, tubes n and r, and chamber E, substantially as and for the purpose herein shown and described.

4. The pocket w, arranged at the end of a hydraulic chamber, for the reception of a plunger moving in said chamber, and provided with tapering notches, substantially as set forth.

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