

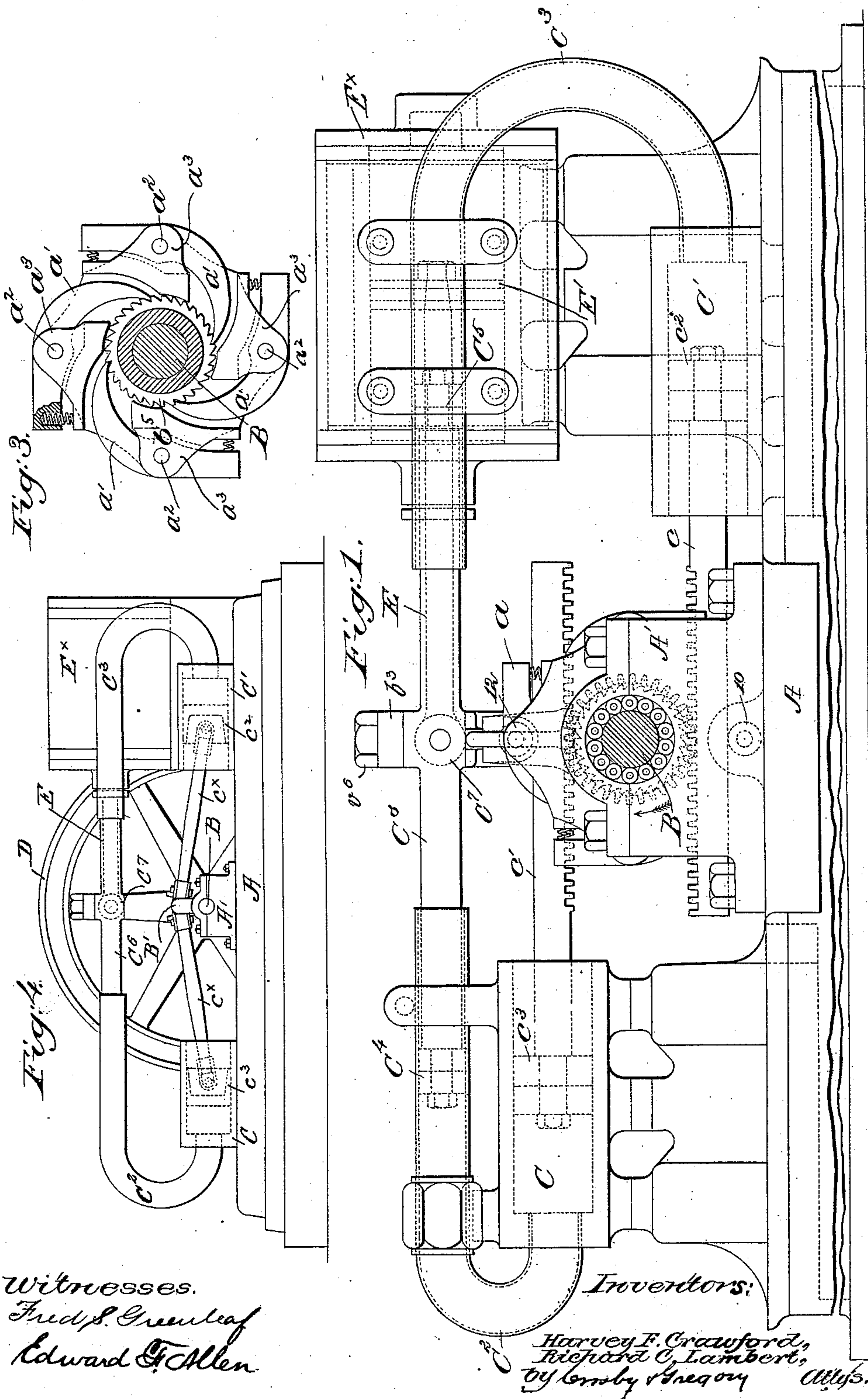
(No Model.)

2 Sheets—Sheet 1.

H. F. CRAWFORD & R. C. LAMBERT.  
HYDRAULIC ENGINE.

No. 472,942.

Patented Apr. 12, 1892.



Witnesses.

Fred S. Greenleaf  
Edward T. Allen

Inventors:

Harvey F. Crawford,  
Richard C. Lambert,  
by Lemby & Gregory Attys.

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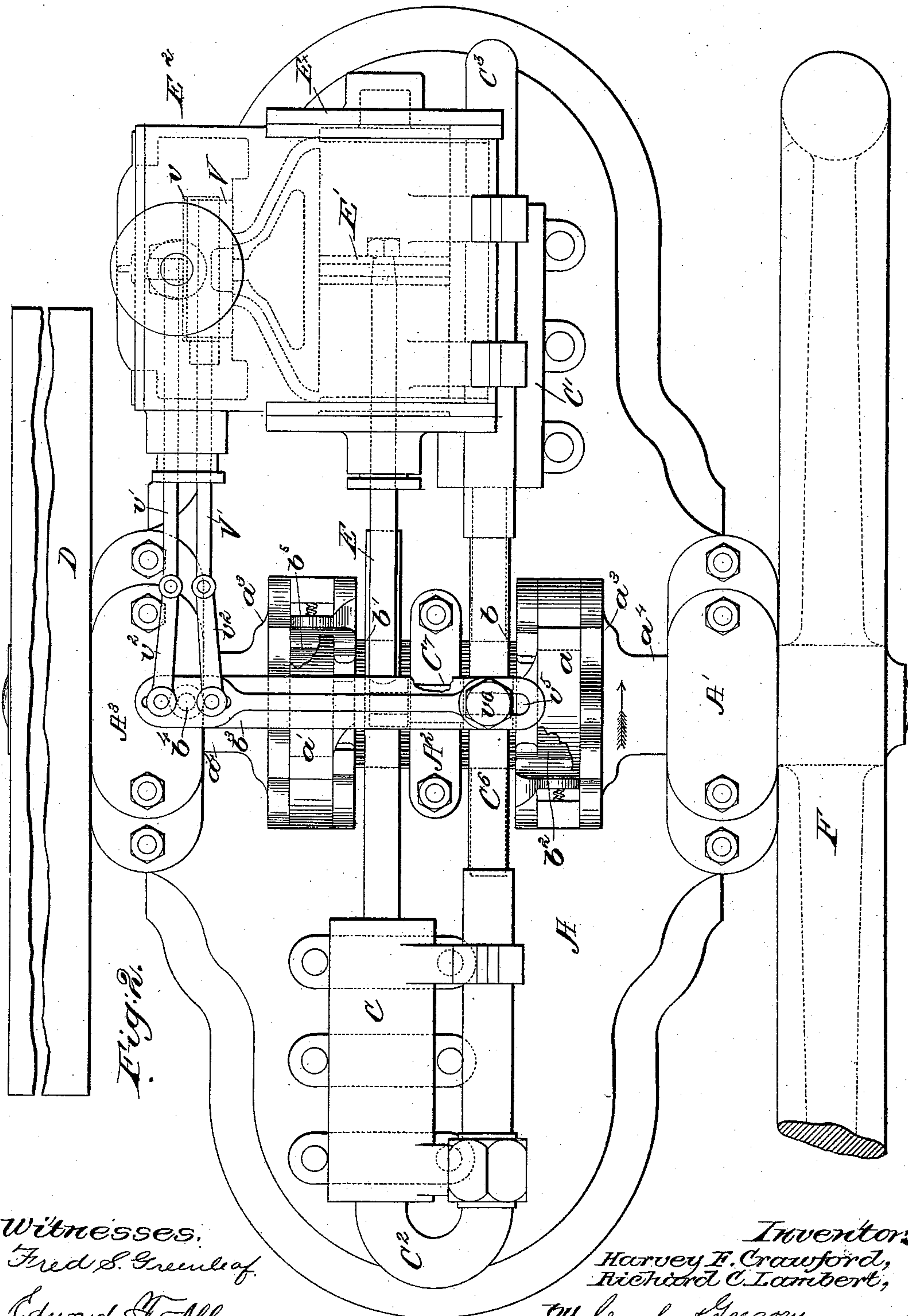
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# UNITED STATES PATENT OFFICE.

HARVEY F. CRAWFORD AND RICHARD C. LAMBERT, OF BROCKTON, MASSACHUSETTS; SAID LAMBERT ASSIGNOR OF ONE-THIRD OF HIS RIGHT TO SAID CRAWFORD.

## HYDRAULIC ENGINE.

SPECIFICATION forming part of Letters Patent No. 472,942, dated April 12, 1892.

Application filed February 13, 1891. Serial No. 381,300. (No model.)

*To all whom it may concern.*

Be it known that we, HARVEY F. CRAWFORD and RICHARD C. LAMBERT, of Brockton, county of Plymouth, State of Massachusetts, have invented an Improvement in Hydraulic Engines, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention has for its object to produce a novel hydraulic engine.

In our invention we employ a pair of hydraulic cylinders, each having its own piston, and connect such pistons with the shaft to be driven. Tubes containing a motor-fluid communicate with these cylinders, and these tubes contain plungers which have a common plunger-rod, and this plunger-rod is reciprocated by a steam-engine, so as to force the motor-fluid first into one cylinder and then into the other, in order to drive the pistons and so rotate the shaft, all as we will proceed now more particularly to set forth and finally claim.

Figure 1 represents in side elevation a hydraulic engine embodying this invention; Fig. 2, a top or plan view of the same, partially broken away; Fig. 3, a sectional detail showing the clutch mechanism to be described, and Fig. 4 a modification to be referred to.

Referring to the drawings, the bed A, of suitable shape and construction to sustain the various parts, supports at or near its middle the pillow-blocks A' A<sup>2</sup> A<sup>3</sup>, each containing a series of rolls which form bearings for the main crank or driving shaft B, having fast upon its opposite ends the fly-wheel F and driving-pulley D. (See Fig. 2.) Two toothed wheels b b' are loosely mounted upon the shaft B at opposite sides of the middle pillow-block A<sup>2</sup>, they having fast to or formed as a part of them the ratchet-toothed wheels b<sup>2</sup> b<sup>5</sup>, engaged by spring-controlled pawls a a', pivoted at a<sup>2</sup> in the heads a<sup>3</sup> of the hubs a<sup>4</sup>, fast on the shaft B. The toothed wheels b b' are engaged above and below, respectively, by the rack-teeth upon the inner sides of the piston-rods c c', fast to and moved by the pistons c<sup>2</sup> c<sup>3</sup> in the hydraulic cylinders C C', supported by the bed A. The bed A and pillow-

block A<sup>2</sup> are provided, respectively, with guide-rolls 10 12 (shown in dotted lines, Fig. 1) to keep the rack-teeth on the piston-rods c c' in engagement with their toothed wheels. The cylinders C C' are provided with chambers (represented as formed of tubes) C<sup>2</sup> C<sup>3</sup>, curved over to face each other, and the said tubes are fitted with plungers C<sup>4</sup> C<sup>5</sup>, arranged at the opposite ends of the plunger-rod C<sup>6</sup>, which rod at or near its middle is herein shown provided with a laterally-extended stud C<sup>7</sup>, (see Fig. 2,) to which is journaled the outer end of the piston-rod E, connected with and moved by the piston E' in the steam or power cylinder E<sup>x</sup>, supported in suitable manner by the bed A. The steam or power cylinder E<sup>x</sup>, as usual, is provided with a steam-chest E<sup>2</sup>, in which is placed a suitable valve or valves to control the admission of steam to the steam-cylinder E<sup>x</sup>, we having herein represented a main slide-valve V, (shown in dotted lines, Fig. 2,) upon the back of which slides the cut-off valve v, the said valves being actuated by valve-stems V' v', connected by links v<sup>2</sup> with the actuating-lever b<sup>3</sup> at opposite sides of its pivotal center b<sup>4</sup>, the said lever being pivoted or mounted on a boss raised upon the pillow-block A'. The actuating-lever b<sup>3</sup> has at its outer free end a slot v<sup>5</sup>, which receives a stud v<sup>6</sup> on the plunger-rod C<sup>6</sup>, movement of the plunger-rod communicating the proper movement to the valves V v through the lever b<sup>3</sup>. Any other desired mechanism may be employed to move the valve or valves, which may be of any desired form or kind other than the particular ones shown. Steam being admitted to the steam-chest E<sup>2</sup>, the piston E' in the steam-cylinder will be reciprocated, transmitting a corresponding reciprocating movement to the plunger-rod C<sup>6</sup> and plungers C<sup>4</sup> C<sup>5</sup>, which will force the water or other fluid contained in the chambers or pipes C<sup>2</sup> C<sup>3</sup> alternately into the cylinders C C' behind their pistons c<sup>2</sup> c<sup>3</sup>, causing the same to be reciprocated. When the pistons c<sup>2</sup> c<sup>3</sup> are reciprocated by movement of the plungers C<sup>4</sup> C<sup>5</sup>, the toothed wheels and their ratchet-wheels are given a rotary reciprocating motion by the rack-teeth on the piston-rods, the ratchet-wheels co-operating with



the pawls  $a a'$  to turn the shaft B in the direction indicated in Fig. 1. As the piston of the steam-cylinder acts on the small plungers  $C^4 C^5$ , which in turn force the fluid into the hydraulic cylinder behind the pistons therein, great power is obtained, which can be utilized to advantage in a variety of ways.

We do not limit this invention to the particular clutch mechanism shown, as any other suitable clutch mechanism may as well be employed, and even a crank may be substituted for the clutch mechanism, if desired, the pistons being connected to a crank  $B'$  on the shaft B by usual connecting-rods  $c^x c^x$ , as represented in Fig. 4.

If desired, two or more power-cylinders may be employed.

We claim—

1. A bed, the hydraulic cylinders C C', mounted thereon and having pistons, and the

shaft B, rotated thereby, combined with the pipes  $C^2 C^3$ , plungers  $C^4 C^5$ , plunger-rod  $C^6$ , the steam-cylinder  $E^x$ , and its piston to actuate said plunger-rod, substantially as described.

2. A bed, the hydraulic cylinders C C', mounted thereon and having pistons, and the shaft B, rotated thereby, combined with the pipes  $C^2 C^3$ , plungers  $C^4 C^5$ , plunger-rod  $C^6$ , the steam-cylinder  $E^x$ , its piston to actuate said plunger-rod, and the valve-actuating lever  $b^3$ , substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HARVEY F. CRAWFORD.  
RICHARD C. LAMBERT.

Witnesses:

BERNICE J. NOYES,  
EDWARD F. ALLEN.