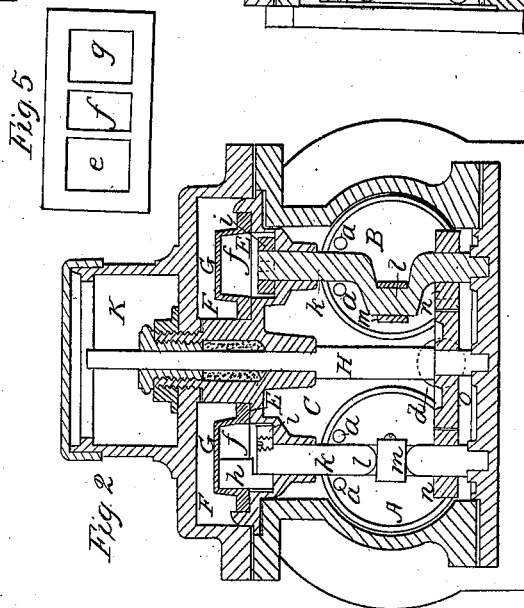
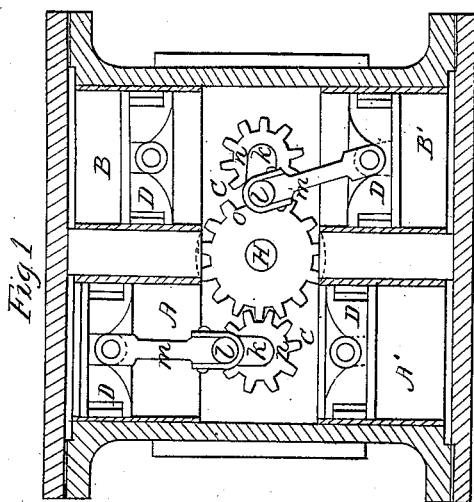
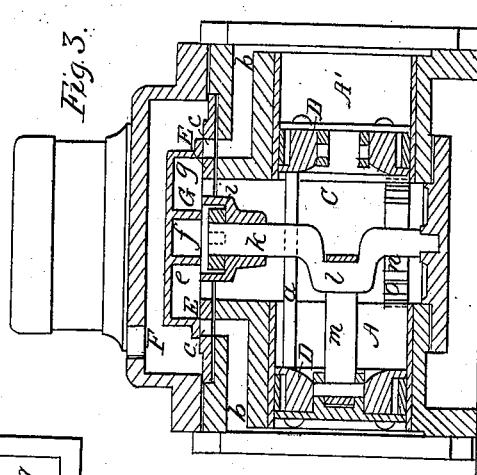
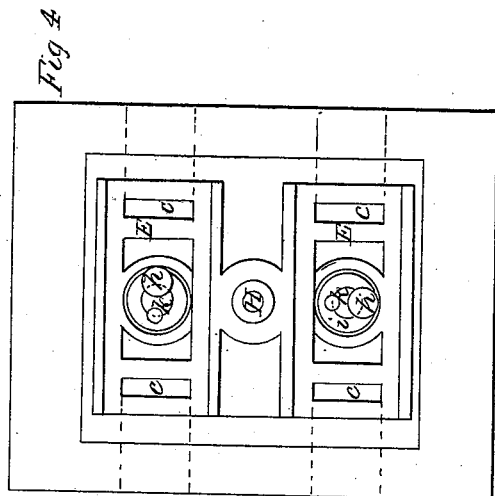


*J. S. Barden,*  
*Hydraulic Engine,*

*N<sup>o</sup> 50,651,*

*Patented Oct. 24, 1865.*



Witnesses:  
A. P. Hale Jr  
G. H. Whitham

Inventor:  
John S. Barden  
by his attorney  
R. W. Eady

# UNITED STATES PATENT OFFICE.

JOHN S. BARDEN, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO THE NEW ENGLAND BUTT COMPANY, OF SAME PLACE.

## IMPROVEMENT IN HYDRAULIC ENGINES AND METERS.

Specification forming part of Letters Patent No. 50,651, dated October 24, 1865.

*To all whom it may concern:*

Be it known that I, JOHN S. BARDEN, of the city and county of Providence, and State of Rhode Island, have invented an Improved Hydraulic Engine; and I do hereby declare the same to be fully described in the following specification and represented in the accompanying drawings, of which—

Figure 1 is a horizontal section, and Fig. 2 a longitudinal and vertical section. Fig. 3 is a vertical and transverse section taken through one pair of the cylinders and their two connected pistons. Fig. 4 is a horizontal section taken through the valve-seats.

This engine is designed to be either a measurer of the flowage of a liquid or a gas, or to be used as a mechanical motor to be operated by the agency of either steam, gas, or water. By applying to its main shaft a proper registering apparatus the engine may be used as a meter for determining the quantity of water which in any given time may flow through it under pressure. So, by properly combining with the main shaft any mechanism, the engine may be employed to impart motion to such mechanism.

In constructing this engine I make use of four cylinders, A A' B B', which are closed at their outer ends, and are arranged relatively to an eduction-chamber, C, in manner as shown in the drawings, such cylinders, at their inner ends, being made to open into such chamber. In each of the said cylinders there is a piston, D. The two pistons of each pair of cylinders, whose axes are in one straight line, are connected by two rods, *a a*, so that when one of such pistons is moved in its cylinder a corresponding movement of the other in its cylinder will take place. A port or passage, *b*, leads from the outer end of each cylinder to one of two valve-seats, E E, arranged on the bottom of a valve-chest, F. Between the two ports of each pair of cylinders there are two eduction-ports, *c c*, which lead through the valve-seat and open communication between the interior of the valve G thereof and the eduction-chamber C, through whose bottom there should be one or more holes of discharge. Furthermore, within the induction or valve chamber F there are two of the said valves

G G, which rest on the seats E E. An under-side view of one of the valves is exhibited in Fig. 5, wherein the said valve is shown as provided with three chambers, *e f g*, the middle one, *f*, of which is rectangular in shape, and is to receive one of two cranks or pins, *h h*, which project from two heads or rings, *i i*, that encompass and are fastened on two vertical shafts, *k k*, arranged within the eduction-chamber C. Each of the shafts *k k* has a bell-crank, *l*, from which one of two connecting-rods, *m m*, leads to and is jointed to one of the pistons of each pair of the connected pistons, the said cranks and connecting-rods being arranged as shown in Figs. 1, 2, and 3. Below its bell-crank and fixed on each of the shafts *k k* there is a pinion, *n*, which engages with a connection-gear, *o*, arranged between the two shafts and on the main shaft H, to which allusion has hereinbefore been made. While the two bell-cranks *l l* are arranged so as to stand at right angles to each other, and the two valve-operative cranks *h h* are also disposed at right angles to each other, each of the said bell-cranks is arranged at right angles relatively to the valve-crank of its shaft. These arrangements of the cranks cause each of the valves to be properly operated and each of the bell-cranks to be assisted over its dead-points by the other of the said bell-cranks.

Over the valve-chest there is a chamber or box, K, for containing a registering apparatus when applied to the main shaft, which extends into such chamber.

For operating the engine, water, steam, or a gas under pressure is to be introduced into the valve-chest by a pipe or conduit leading therein. By its action on each of the pistons each pair of them will be set in motion, the pairs being moved so as to produce by the machinery connecting them with the main shaft a continuous rotation of it. The water, while being discharged from each cylinder while the piston thereof is being moved toward the head of such cylinder, will be returned through the port leading from the cylinder, and will be driven into the eduction-chamber C, from which it will be discharged by the hole or holes *d*.

I claim as my invention—

The improved engine, substantially as described, the same consisting of the four cylinders A A' B B', the two pairs of connected pistons D D D D, and the eduction-chamber C, arranged as explained, in combination with the main shaft H, or its equivalent, the valve-chest E, valves G G, ports *b b b*, and mech-

anism to operate such valves by the pistons, substantially in manner as specified.

JOHN S. BARDEN.

Witnesses:

R. H. EDDY,  
F. P. HALE, Jr.