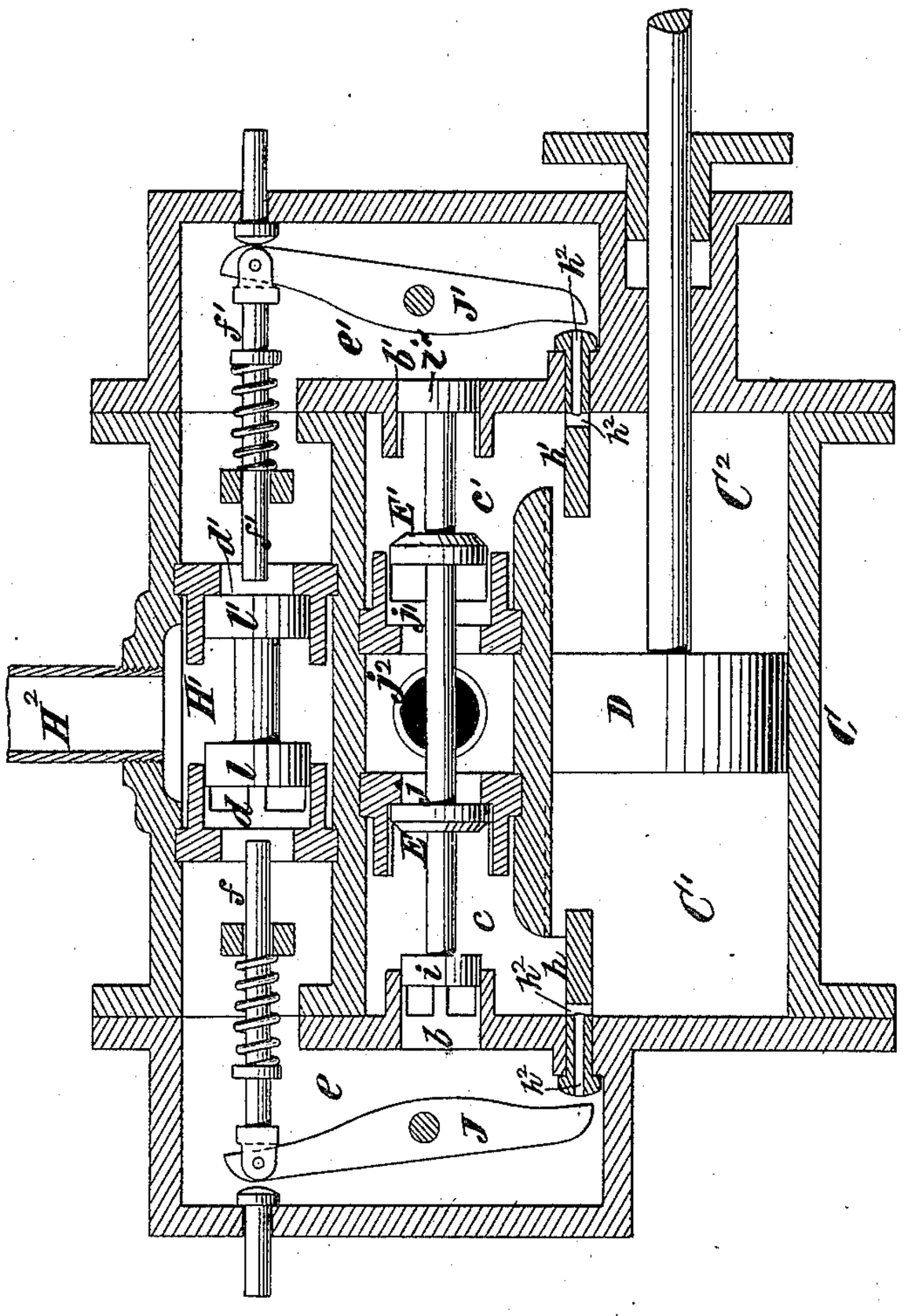
(No Model.)

C. W. COOPER.

VALVE MECHANISM FOR ENGINES.

No. 344,080. Patented June 22, 1886.



Witnesses:
Emil Horter.
Henry McBride

Inventor:
Chas. W. Cooper
by his atty
Brown & Hall

UNITED STATES PATENT OFFICE.

CHARLES W. COOPER, OF NEW YORK, N. Y.

VALVE MECHANISM FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 344,080, dated June 22, 1886.

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To all whom it may concern:

Be it known that I, CHARLES W. COOPER, of the city and county of New York, in the State of New York, have invented a new and useful Improvement in Valve Mechanism for Direct-Acting Engines, of which the following is a specification.

My invention is applicable to direct-acting engines, whether operated by steam, water, or other fluid, and whether employed for operating pumps or other machinery or for water-meters.

The invention relates to an improved valve mechanism comprising induction and eduction valves, and which serves to control the inlet of motive fluid to operate upon either side of the piston of a double-acting engine and the escape of motive fluid from either side of such piston, and it is perfectly obvious that in the combination to which my invention relates two single-acting cylinders and pistions would constitute the full equivalent of a single double-acting cylinder and piston.

My invention consists in a novel combination of parts, which includes the following elements:

First. An induction-chamber for the fluid operating the machine, which chamber contains valves that open outwardly relatively to the main cylinder, and which close alternately two openings leading to opposite ends of the cylinder, the valves being so connected that the closing of one insures the opening of the other, and the valves being arranged to open in a direction outward, or away from the main cylinder.

Second. Two eduction-valve chambers communicating with the main cylinder and containing valves that open inward relatively to the cylinder, and which are connected, so that the closing of one insures the opening of the other.

Third. Two intermediate passages, one leading from each opening of the induction-chamber to the eduction-valve chamber and the corresponding end of the main cylinder.

Fourth. Small pistons, which are connected with the eduction-valves, and which move in holes or small cylinders in the partitions between the intermediate passages and eduction-valve chambers. The eduction-valve chambers are practically extensions of the main-cylinder chambers. In some cases these valves may be immediately in those chambers.

Fifth. Connections through which the main piston, as it nears the end of its stroke, acts to start one of the induction-valves from its seat, whereupon the further opening movement of that valve and the closing movement of the other induction-valve is completed by the force of the current of motive fluid passing from the induction-chamber to one or other of the intermediate chambers or passages.

The accompanying drawing represents a longitudinal section of a double-acting engine embodying my invention.

C designates the main cylinder, within which is arranged a reciprocating piston, D, and the portions of the cylinder on opposite sides of the piston I have represented by the letters C′ C².

H² designates an induction-pipe, through whice steam, water, or other motive fluid under pressure enters the induction-chamber H′. From the induction-chamber H′ valve-openings *d d′* lead, respectively, to the chambers C′ C² at opposite sides of the main piston D.

In this example of the invention the course of motive fluid flowing from the valve-seat *d* or *d′* is first through an intermediate chamber or passage, *e* or *e′*, thence through a bore or small cylinder, *b* or *b′*, and through an eduction-chamber, *c* or *c′*, to the chamber C′ or C² at the corresponding end of the main cylinder C. In the eduction-chambers *c c′* are eduction-valves E E′, which are connected together, or which press upon each other, so that the closing of one produces the opening of the other. These valves E E′ close upon seats *j j′*, and control the exhaust of motive fluid from the eduction-chambers *c c′* to the exhaust opening or outlet *j²*.

The eduction-valves E E′ open in a direction toward or inward relatively to the chambers C′ C² at opposite ends of the main cylinder. Connected with the eduction-valves E E′ are small pistons *i i′*, which fit the bores or small cylinders *b b′*, and are capable of mov-

ing entirely out of these bores or cylinders, so as to afford communication at proper times between the intermediate passages, *e e'*, and the eduction-valve chambers *c c'*, and thence to the chambers C' C² at opposite ends of the main cylinder C.

Within the induction-chamber H' are arranged induction-valves *l l'*, which close, respectively, on the seats *d d'* and open in a direction away from the intermediate passages, *e e'*, and main cylinder C—that is to say, these valves, which are connected together so that the opening of one insures the closing of the other, have a movement in opening opposite to the direction in which the motive fluid flows through their respective valve-seats *d d'*. The two induction-valves may be made in one piece, or in separate pieces so connected that when one valve is closed the other is held open. The two eduction-valves E E' and their pistons *i i'* may be rigidly connected together, or they may be made in one piece, or may be composed of separate pieces arranged to press one upon another, so that they may move simultaneously in opening and closing. When the valve *l'* is closed upon its seat *d'*, the valve *l* is full open, so as to afford free passage for motive fluid from the induction-chamber H' through the intermediate passage, *e*, bore or small cylinder *b*, and eduction-passage *c* to the chamber C' at the left hand of the piston D. When the valve *l* is closed upon its seat, the motive fluid has free passage through the valve-seat *d'*, and through the corresponding parts, *e' b' c'*, to the chamber C² at the right-hand end of the main cylinder D. When the valve E is closed, the valve E' is held open and the piston *i* is moved out of its cylinder or bore *b*, so as to afford free passage for motive fluid from the chamber or passage *e* through the bore or small cylinder *b* and eduction-chamber *c*, and at the same time the small piston *i'* closes the bore or small cylinder *b'*.

J J' are rocker-arms, which are arranged in the intermediate chambers or passages, *e e'*, and upon which the main piston D acts as it nears the end of its movement through small plungers or tappets *h h'*. The movement of the rocker-arms J J' acts through tappets or push-rods *f f'* to start the valve *l* or *l'* from its seat *d* or *d'*. The small plungers *h h'* may be constructed with passages *h²* through them, as shown in the drawing, and when these plungers project fully into the cylinder C the passages *h²* through them are opened and afford communication between the intermediate passages, *e* or *e'*, and the cylinder C. When said plunger *h* or *h'* is driven by the piston into the intermediate passage, *e* or *e'*, the passage *h²* through it is closed.

The object now being to cause the piston D to move backward and forward for the purpose of transmitting motion to any machinery or to enable it to serve as a water-meter, the operation of the machine is as follows: Motive fluid under pressure is supposed to be entering through the pipe H² into the induction-chamber H', and in the position of parts shown this fluid is passing through the valve-seat *d*, the intermediate passage, *e*, piston-hole *b*, and eduction-valve chamber *c*, to the left-hand chamber, C', of the cylinder C, and is causing the piston D to move toward the right. At the same time the fluid is discharged or exhausted from the chamber C² at the right-hand side of the piston D, through the eduction-chamber *c'* and valve E' to the final exhaust *j²*. The piston D will continue to move toward the right until it strikes the tappet *h'*, and will then act through it and through the rocker-arm J' and tappet *f'* to press the valve *l'* from its seat *d'* toward the seat *d*, and will thereby partially close the valve *l* upon its seat *d*. The pressure meanwhile will continue upon the piston D, still causing it to move to the right; but when the valve *l* is moved near enough to the seat *d* the current of inflowing fluid from the pipe H² will complete the movement of the valves *l l'*, carrying them away from the tappet *f'* and closing the valve *l* upon the seat *d*. The tappet or plunger *h'* will meanwhile be pushed so far into the passage *e'* that communication will be closed between it and the cylinder C, and the fluid-pressure from the induction-chamber H' then being in the passage *e'* will act upon the piston *i'* and cause it to move toward the left and force the valve E' toward its seat *j'* and the valve E from its seat *j*. The discharging fluid will then complete the movement of the valve E' and close it upon its seat *j'*, and thus complete the opening of the valve E and the closing of the bore or small cylinder *b* by the piston *i*, and the piston *i'* will by this movement be forced entirely out of its cylinder *b'*, and will afford free communication through said bore or cylinder between the intermediate passage, *e'*, and the chamber C² at the right-hand side of the piston D. Communication for the inflowing motive fluid will therefore be established from the induction-chamber H', through the valve-seat *d'*, intermediate passage, *e'*, piston-bore or small cylinder *b'*, and eduction-valve chamber *c'* into the chamber C² at the right-hand side of the piston D, and the movement of the piston toward the left will thereupon take place and the reverse action to that just described will then ensue, the exhaust or discharge of the motive fluid from the left-hand side of the piston D being through the valve E.

What I claim as my invention, and desire to secure by Letters Patent, is—

The combination, with the main cylinder and piston of a double-acting engine, of an induction-chamber, intermediate chambers between the ends of the cylinder and the induction-chamber, and eduction-chambers communicating with the ends of the cylinder, induction-valves opening outward from the intermediate chambers, and connected together, so that the opening of one produces a closing movement of the other, eduction-valves open-

ing inward relatively to the eduction-chambers, and connected so that the closing of one insures the opening of the other, and pistons connected with the eduction-valves and working within bores or small cylinders in the partitions between the intermediate chambers and the eduction-chambers, and connections through which the main piston, as it nears the end of its stroke, acts to start one of the induction-valves from its seat, all organized for operation, substantially as herein described.

CHAS. W. COOPER.

Witnesses:
C. HALL,
FREDK. HAYNES.