(No Model.)

A. S. HODGES.

STEAM ENGINE.

No. 413,231. Patented Oct. 22, 1889.

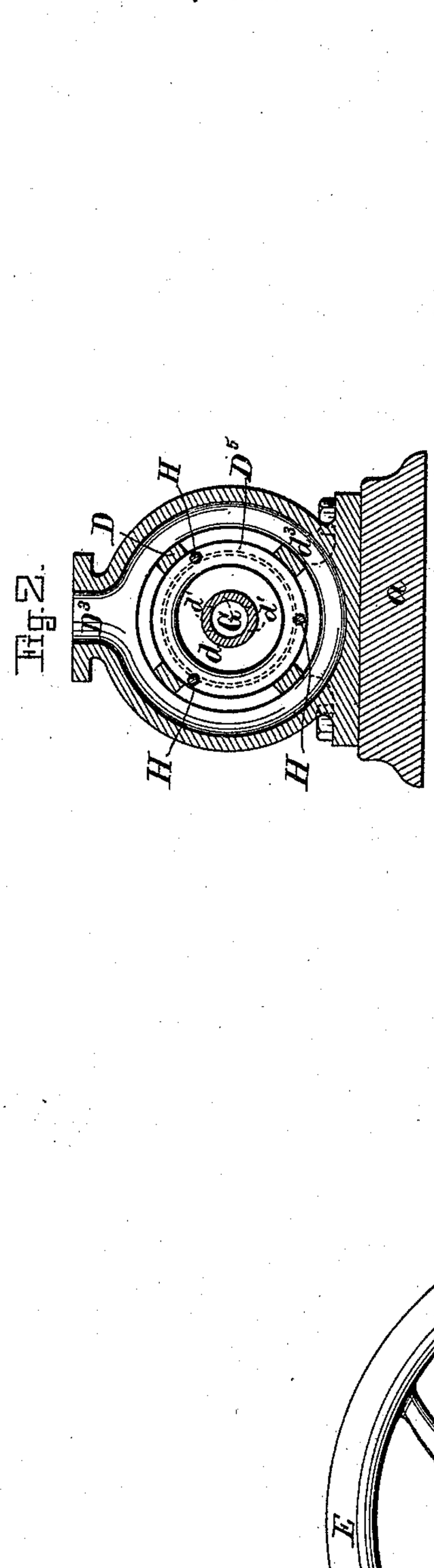

Fig. 2.

Fig. 1.

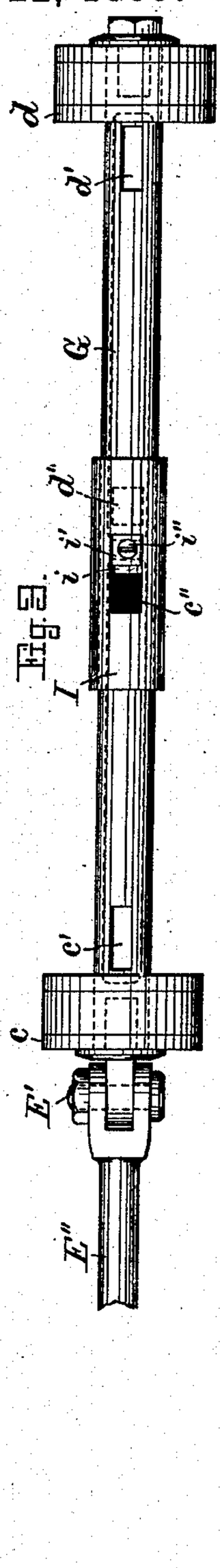

Fig. 3.

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UNITED STATES PATENT OFFICE.

ADDISON S. HODGES, OF CHELSEA, MASSACHUSETTS.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 413,231, dated October 22, 1889.

Application filed February 4, 1889. Serial No. 298,654. (No model.)

To all whom it may concern:

Be it known that I, ADDISON S. HODGES, a citizen of the United States, and a resident of Chelsea, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Steam-Engines, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention relates to improvements in steam-engines, water-motors, or liquid-meters, and it is carried out as follows, reference being had to the accompanying drawings, wherein—

Figure 1 represents a central longitudinal section of the improved engine. Fig. 2 represents a cross-section on the line A B, shown in Fig. 1; and Fig. 3 represents a detail plan view of the reciprocating pistons and their ported connecting-pipe.

Similar letters refer to similar parts wherever they occur on the different parts of the drawings.

a represents the frame or base-plate, to which are secured in a suitable manner the cylinders C and D and the pillow-block *b*, as shown in Fig. 1. In the pillow-block or bearing *b* is journaled the driving-shaft *e*, having secured to it the balance-wheel E and crank *e'*, as is usual in steam or other engines.

e'' is the crank-pin on the crank *e'* in the ordinary manner.

The cylinders C and D are arranged centrally in a line with each other at a proper distance apart and are open in their outer ends, as shown in Fig. 1. To the inner ends of said cylinders are secured, respectively, the annular flanges C' and D', that are connected to or cast in one piece with the pipe F, as shown in Fig. 1, said pipe being provided with a supply branch F', that is to be suitably connected to the steam or other pressure supply in any well-known manner.

Within the cylinders C and D are located the respective pistons *c d*, provided with peripheral packing-rings, as usual, so that said pistons may fit steam-tight in the said respective cylinders C and D. The pistons *c* and *d* are rigidly connected together by means of the central longitudinal pipe G, which pipe is closed midway between its ends by means of the division-wall or diaphragm G', as shown in Fig. 1. Said pipe has at or near the junction with the piston C one or more ports or perforations *c' c'*, and likewise at or near the junction with the piston D one or more perforations or ports *d' d'*, as shown in Figs. 1 and 2. In addition to said ports the pipe G has on opposite sides of the central division-wall or diaphragm G' the respective ports or perforations *c''* and *d''*, as shown in said Figs. 1 and 3.

The cylinder C has at or near its inner end an exhaust branch C^3, that communicates with the circumferential exhaust-groove c^3 on the interior of the cylinder C, as shown in Fig. 1. D^3 is a corresponding exhaust branch on the cylinder D, communicating with the circumferential exhaust-groove d^3 on the interior of said cylinder D, as shown in said Fig. 1. To the outer end of the piston *c* is pivoted in a suitable manner at E' the connecting-rod E'', the opposite end of which is connected to the crank-pin *e''*, as shown in Fig. 1.

Within the connecting-pipe F, at or near the junction with the flange C', is arranged the packing-ring c^4, packing c^5, and adjustable screw-threaded gland c^6, for the purpose of effecting a steam-tight connection between the interior of the pipe F and exterior of the connecting-pipe G, as shown in Fig. 1. d^4, d^5, and d^6 are corresponding parts at or near the junction of the pipe F and flange D', as shown in Fig. 1.

Within the cylinder C, between its piston *c* and annular flange C', is located the annular valve-ring C^4, having annular packing-ring C^5, for effecting a steam-tight connection between it and the interior of the cylinder C, as shown in Fig. 1. D^4 and D^5 are corresponding valve and packing-ring arranged within the cylinder D, as shown in said Fig. 1.

Between the annular valves C^4 and D^4 are located the rods H H H, the ends of which lie in contact with the interior faces of the respective annular valves C^4 D^4, as shown in Fig. 1, by which arrangement the movement of one of said valve-rings will cause a corresponding movement of the other during the operation of my improved engine. The rods H H H are made to pass through stuffing-boxes c^7 and d^7 in the respective flanges C' and D', as shown in Fig. 1.

Midway upon the pipe G is located the sleeve I, having a port or perforation *i*, adapted

to be brought in communication with one or the other of the central ports c'' d'' on the sleeve G, as shown in Figs. 1 and 3, which sleeve I is guided forward and back on the sleeve G by means of the plate or washer i', fitting within the perforation or port i and secured to the pipe G by means of the screw i'' or equivalent device, as shown in Figs. 1 and 3.

C^6 and D^6 are oil-cups attached to the respective cylinders C and D at or near their outer ends, as shown in Fig. 1, for the purpose of lubricating the interior portions of said cylinders and their respective pistons during the reciprocating motions of the latter without any back-pressure of the live steam or other motive power usually encountered in engines or motors.

The operation of my improved engine or motor is as follows: We will suppose that the parts are in their respective positions, as shown in Fig. 1. The steam or other pressure from the branch F′ enters the port i' in the pipe I and passes through the port c'' into the pipe G and out through the ports c' c' into the cylinder C, between its head or flange C′ and the piston c, causing the latter to move in the direction of the arrow shown in Fig. 1, and thus to impart a partial rotary motion of the crank e' and its shaft e, while at the same time the steam in the cylinder D is permitted to pass out through the annular valve D^4, passage d^3, and exhaust branch D^3, as shown in Fig. 1. During this movement of the pistons c d the exhaust passage leading to the exhaust C^3 is closed by the annular valve C^4, as shown in Fig. 1. As the pistons c and d reach the end of their stroke in this direction, the piston d comes in contact with the annular valve D^4, causing it to move forward sufficiently to close the annular port d^3, leading to the exhaust D^3, and, as the valve D^4 actuates the valve C^4 by the agency of the rods H H H, the said valve C^4 is moved in the direction of the arrow shown in Fig. 1 sufficiently to connect the interior rear portion of the cylinder C with the exhaust branch C^3 at or about the same time as the end of the sleeve I is brought in contact with the stuffing-ring c^4, causing the port i on said sleeve I to be brought in communication with the port d'' on the sleeve G, and thus a reversal of the movements of the respective parts takes place, and so on.

What I wish to secure by Letters Patent, and claim, is—

The cylinders C D, open in their outer ends, and having the pressure-supply pipe F secured to and connecting their inner ends, and having the respective circumferential exhausts c^3 d^3, combined with the pistons c d, connected together by means of the ported pipe G, having partition G′, supply-ports c'' d'' on opposite sides of said partition, the ported valve-sleeve I, surrounding the pipe G, as described, ports c' d' at or near the respective pistons c d, and the annular valves C^4 D^4, connected together for operation, as herein set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 10th day of January, A. D. 1888.

ADDISON S. HODGES.

Witnesses:

ALBAN ANDRÉN,

HENRY CHADBOURN.