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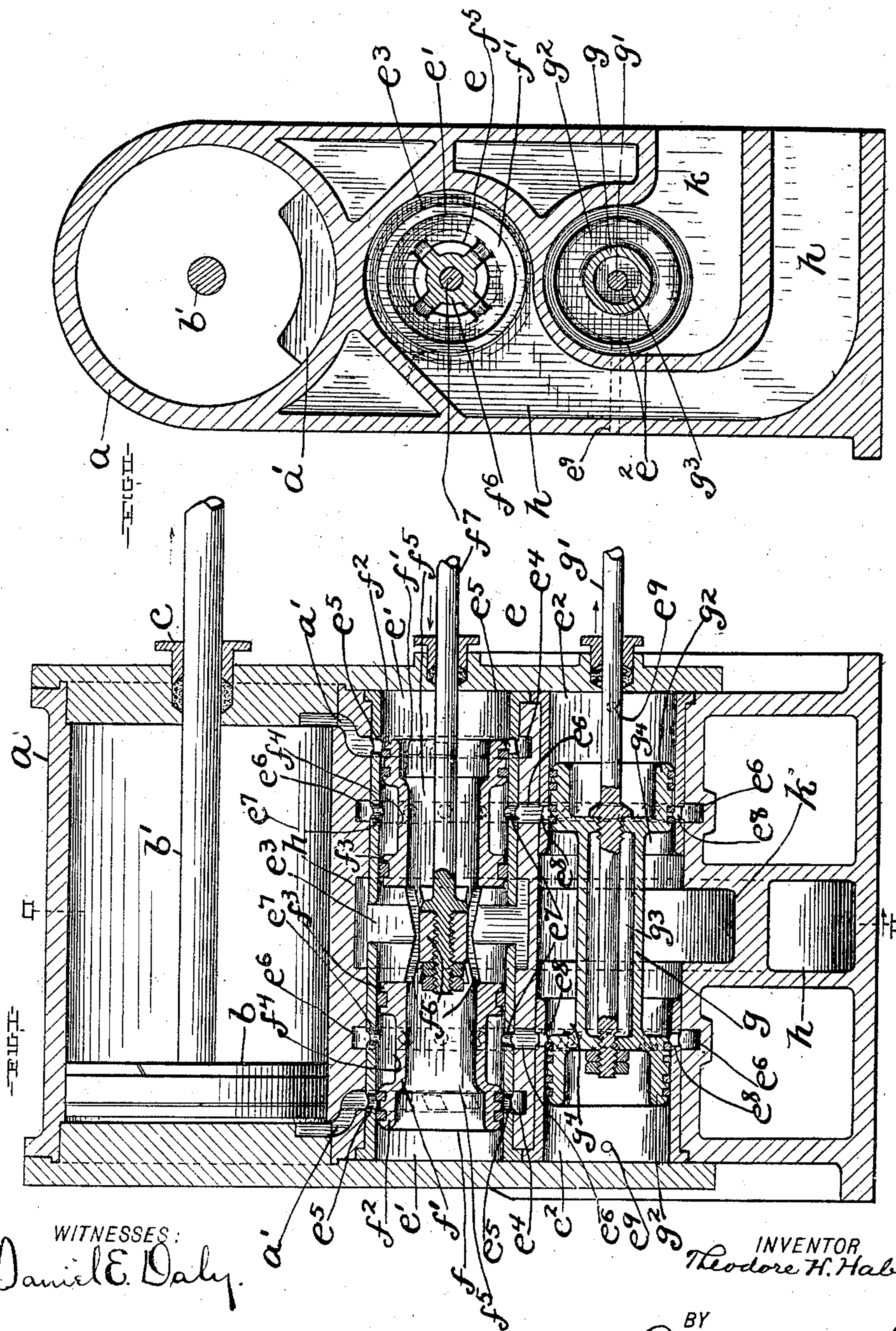
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VALVE MECHANISM FOR ENGINES.

(Application filed June 12, 1901.)

(No Model.)

2 Sheets—Sheet 1.



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UNITED STATES PATENT OFFICE.

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VALVE MECHANISM FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 702,423, dated June 17, 1902.

Application filed June 12, 1901. Serial No. 64,312. (No model.)

To all whom it may concern:

Be it known that I, THEODORE H. HABERKORN, a resident of Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Valve Mechanism for Engines Operated by Fluid under Pressure; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

This invention relates to improvements in valve mechanism for engines operated by steam or other fluid under pressure.

The primary object of this invention is to provide a construction of valve mechanism which will operate with great facility and effect greater economy in the use of the fluid under pressure required to operate the engine comprising the said valve mechanism.

With this object in view and to the end of realizing other advantages hereinafter appearing the invention consists in certain features of construction and combination of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure I is a side elevation, mostly in central section, illustrating the valve mechanism embodying the invention which constitutes the subject-matter of this application. Fig. II is a left-hand side elevation relative to Fig. I in section on line II II, Fig. I. Fig. III is a side elevation, in central section, of the engine-cylinder and connected valve-casing, but the heads of the cylinder and valve-casings are omitted in this figure. Fig. IV is a vertical section on either one of lines IV IV, Fig. III, looking in the direction indicated by the arrow. Fig. V is a vertical section on either one of lines V V, Fig. III, looking in the direction indicated by the arrow. Fig. VI is a vertical section on either one of lines VI VI, Fig. III, looking in the direction indicated by the arrow.

Referring to the drawings, *a* designates the cylinder of a steam-engine or any other engine designed to be operated by fluid under pressure, *b* the piston contained and arranged to operate within the cylinder, and *b'* the piston-rod, which extends through a stuffing-box *c* with which the rear head of the cylinder is provided in the usual manner.

The casing *e* of the valve mechanism is rigid with the engine-cylinder and has a chamber *e'* formed therein next alongside and externally of the cylinder, and the main valve *f* of the valve mechanism is contained and arranged to operate within the said chamber. The chamber *e'* is arranged longitudinally of the cylinder, between the cylinder and another chamber, *e''*, with which the valve-casing is provided. The chamber *e''* is arranged parallel with the chamber *e'*, and the cut-off valve *g* is contained and arranged to operate within the chamber *e''*. The chamber *e'* is connected centrally between its ends, as at *e'''*, with the exhaust-port *h*, which is formed in the valve-casing at one side and externally of the chambers *e'* and *e''* of the said casing and centrally between the ends of the said chambers. The chamber *e'* is preferably cylindrical, and the valve-casing near each end of the said chamber is provided with an annular port *e⁴*, which extends around the respective end of the chamber. Each port *e⁴* is connected with the chamber *e'* by an annular series of apertures *e⁵*, which are formed in the surrounding wall of the said chamber a short distance apart around the said chamber.

The cylinder *a* is provided with two ports *a'* and *a''*, formed in opposite ends, respectively, of the cylinder and communicating with the different annular ports *e⁴* and *e⁴*, respectively, of the valve-casing. It will be observed, therefore, that each port *e⁴* and the connected port *a'* and apertures *e⁵* constitute a passage-way between the chamber *e'* and the chamber of the cylinder *a*, and consequently opposite ends of the chamber *e'* are connected with opposite ends, respectively, of the said cylinder-chamber.

Two ports *e⁶* and *e⁶* are formed in the valve-casing and surround both chambers *e'* and *e''* of the said casing, between the exhaust-port *h* and the different cylinder-ports *a'* and *a''*, respectively. Each port *e⁶* is connected with the chamber *e'* by an annular series of apertures *e⁷*, formed in the surrounding wall of the said chamber and arranged at short intervals around the said chamber. Each series of apertures *e⁷* is of course arranged between the exhaust-port *h* and the adjacent series of apertures *e⁵*.

Each port *e⁶* is connected with the chamber *e''* of the valve-casing by an annular series

of apertures e^8 , formed in the surrounding wall of the said chamber at short intervals around the chamber, and the two series of apertures e^8 are arranged between the fluid-pressure-supply port k , which is formed in the valve-casing and connected with the chamber e^2 centrally between the ends of the said chamber, and opposite ends, respectively, of the said chamber e^2 . Each port e^6 and the connected apertures e^7 and e^8 constitute a continuous passage-way between the chambers e' and e^2 of the valve-casing.

The surrounding wall of the chamber e^2 is provided near each end with a lateral vent orifice or perforation e^9 , which leads from the said chamber to the external atmosphere.

The cut-off valve g is adapted to reciprocate or slide within and endwise of the chamber e^2 in a plane parallel with the plane in which the main valve f operates, and g' represents the stem of the cut-off valve, which stem extends outside of the valve-casing in the usual manner. The chamber e^2 is cylindrical, and the cut-off valve g has two correspondingly cylindrical piston-heads g^2 and g^2 arranged at opposite ends, respectively, of the valve. Each head g^2 nicely fits the surrounding wall of the chamber e^2 to prevent leakage between the opposing surfaces of the said head and wall. The central portion of the cut-off valve g , which is smaller transversely than but connects together the two piston-heads g^2 and g^2 of the said valve, is chambered or hollow, as at g^3 , and the stem g' of the valve extends centrally and longitudinally through the chamber g^3 and through the end walls of the said chamber g^3 and is attached to the said central portion of the valve in any approved manner.

The live steam or fluid under pressure which is to be supplied to the engine-cylinder enters the chamber e^2 at the junction of the fluid-pressure-supply port k and the said chamber and fills the annular chamber g^4 , formed centrally of the cut-off valve, between the two piston-heads g^2 and g^2 of the said valve, and the said piston-heads have such length and arrangement relative to the two passage-ways formed between and connecting the chambers e^2 and e' of the valve-casing that the cut-off valve controls the passage of fluid under pressure to the said passage-ways, and the arrangement of parts is such that the fluid under pressure received within the valve-chamber g^4 , centrally between the two heads g^2 and g^2 of the cut-off valve, is supplied to the one or the other of the said passage-ways, according as the cut-off valve is slid or actuated in the one direction or the other. It will be observed, therefore, that the cut-off valve controls the supply of fluid under pressure to the main-valve-containing chamber e' .

The vent ports or perforations e^9 and e^9 , which are formed, as already indicated, in the surrounding wall of the chamber e^2 at opposite ends, respectively, of the travel of the

cut-off valve, are for the purpose of enabling the said valve to work freely and not be impeded by the compression of air or fluid within the ends of the said chamber during the reciprocation of the cut-off valve.

The main valve f comprises two cylindrical portions f' and f' , arranged in line endwise and a suitable distance apart, and each member f' is provided with two cylindrical piston-heads f^2 and f^3 , formed upon the outer end and inner end, respectively, of the said member f' , and each of the said piston-heads f^2 and f^3 nicely fits the surrounding wall of the chamber e' and prevents leakage between the opposing surfaces of the respective piston-head and the said wall. By the construction hereinbefore described it will be observed that each section or member f' of the main valve has an annular chamber f^4 formed externally of the said valve between the piston-heads f^2 and f^3 of the said valve section or member f' . Each valve-section f' has an internal passage-way f^5 extending longitudinally therethrough, which passage-way communicates at the outer end of the said valve-section with the chamber e' and is in open relation at its inner end with the exhaust-port h . The main valve f has its two sections or end portions f' and f' connected together by a bridge or web f^6 , which is constructed in any approved manner to avoid materially obstructing communication between the exhaust-port h and the passage-ways f^5 of the valve. The stem f^7 of the main valve is suitably attached to the bridge or web f^6 and extends outside of the valve-casing in the usual manner.

The arrangement of the parts is such that the live steam or fluid under pressure admitted to the passage-ways (apertures e^8 , ports e^6 , and apertures e^7) between the chambers e' and e^2 passes into the chambers f^4 of the main valve, and consequently surrounds the main valve between the inner and outer piston-heads of the said valve, that the outer piston-heads f^2 and f^3 control the admission of the said fluid under pressure to the cylinder, that one of the chambers f^4 of the main valve shall be placed in open relation with the cylinder-port at one end of the cylinder or the other chamber f^4 of the said valve shall be brought into open relation with the cylinder-port at the other end of the cylinder, according as the main valve is actuated in the one direction or the other, that when one of the cylinder-ports has about commenced to receive fluid under pressure from the main valve the other cylinder-port shall have commenced to exhaust into the chamber e' and the exhaust steam or fluid from the exhausting-cylinder port shall pass through the adjacent passage-way f^5 of the main valve to the exhaust-port h , that the chambers f^4 of the main valve are always in open relation with the passage-ways formed between the chambers e' and e^2 of the valve-casing, and that the cut-off valve shall

perform its function of cutting off the admission of fluid under pressure to the main valve at the desired point of stroke of the piston *b*.

The construction hereinbefore described avoids disturbance with the valve mechanism by the exhausting steam or fluid, because the exhausting fluid is permitted to pass through the main valve, and hence does not act upon the valve. The arrangement of the main fluid-pressure-supply port *k* and the exhaust-port *h* centrally between the ends of the valve-casing and connected cylinder also simplifies the construction of the cylinder-casting. It will be observed also that the wall between the valve-containing chambers *e'* and *e''* is rigid and acts as a valve-seat for both valves. It will of course be understood that the main valve and the cut-off valve are actuated simultaneously, but in opposite directions, respectively, and any suitable mechanism for operating the said valves and attached to the stems of the valves may be provided. The valve mechanism herein disclosed is especially well adapted for locomotive-cylinders, and the mechanism for operating the valves is preferably the same as that disclosed in United States Letters Patent No. 555,858, granted to J. A. Haley and myself March 3, 1896.

What I claim is—

1. The combination, with an engine-cylinder, and the piston within the said cylinder, of valve mechanism comprising the following: a valve-casing arranged externally and longitudinally of the chamber of the cylinder; two chambers *e'* and *e''* formed in the valve-casing and arranged longitudinally of the cylinder, with the chamber *e'* between the chamber *e''* and the cylinder; means for exhausting the cylinder; a fluid-pressure-supply port *k* connected with the chamber *e''* centrally between the ends of the said chamber; two passage-ways connecting opposite ends of the chamber *e'* with opposite ends, respectively, of the chamber of the cylinder; two passage-ways connecting together the chambers *e'* and *e''* between the fluid-pressure-supply port and the different aforesaid cylinder-connecting passage-ways, respectively; a cut-off valve *g* contained within and movable endwise of the chamber *e''* and having two piston-heads *g''* and *g'''* at opposite ends, respectively, and a fluid-pressure-receiving chamber *g''* formed between the said heads, and a main valve *f* contained within and movable endwise of the chamber *e'* and having two external fluid-pressure-receiving chambers *f''* and *f'''* arranged a suitable distance apart longitudinally of the valve, all relatively arranged and operating substantially as shown, for the purpose specified.

2. The combination, with an engine-cylinder, and the piston within the said cylinder, of valve mechanism comprising the following: a valve-casing arranged externally and longitudinally of the chamber of the cylinder; two parallel cylindrical chambers *e'* and

e'' formed in the valve-casing and arranged longitudinally of and parallel with the cylinder, with the chamber *e'* between the chamber *e''* and the cylinder; means for exhausting the cylinder; the fluid-pressure-supply port *k* connected with the chamber *e''* centrally between the ends of the said chamber; two passage-ways connecting opposite ends of the chamber *e'* with opposite ends, respectively, of the chamber of the cylinder; two passage-ways connecting together the chambers *e'* and *e''* between the fluid-pressure-supply port and the different aforesaid cylinder-connecting passage-ways, respectively; a cut-off valve *g* contained within and movable endwise of the chamber *e''* and having two cylindrical piston-heads *g''* and *g'''* fitting the surrounding wall of the said chamber *e''* and arranged a suitable distance apart longitudinally of the valve so as to form a fluid-pressure-receiving chamber *g''* between the said heads, and a main valve *f* contained within and movable endwise of the chamber *e'* and having two external annular chambers *f''* and *f'''* arranged a suitable distance apart longitudinally of the valve, with the end walls of the said chambers formed by cylindrical piston-heads fitting the surrounding wall of the said chamber *e'*, all relatively arranged and operating substantially as shown, for the purpose specified.

3. The combination, with an engine-cylinder and the piston within the said cylinder, which cylinder has two ports *a'* and *a''* connecting with opposite ends, respectively, of the cylinder, of valve mechanism comprising the following: a valve-casing arranged externally and longitudinally of the chamber of the cylinder; two chambers *e'* and *e''* formed in the valve-casing and arranged longitudinally of the cylinder, with the chamber *e'* between the chamber *e''* and the cylinder; the fluid-pressure-supply port *k* connected with the chamber *e''* centrally between the ends of the said chamber; two ports *e''* and *e'''* surrounding the chamber *e'* near opposite ends, respectively, of the said chamber and communicating with the different cylinder-ports, respectively; an annular series of apertures formed in the surrounding wall of the chamber *e'* and connecting one of the ports *e''* with the said chamber; another annular series of apertures formed in the said wall and connecting the other port *e''* with the said chamber *e'*; two passage-ways connecting together the chambers *e'* and *e''* between the fluid-pressure-supply port and the different aforesaid cylinder-connecting passage-ways; a cut-off valve contained within and movable endwise of the chamber *e''* and having two piston-heads *g''* and *g'''* arranged a suitable distance apart longitudinally of the valve so as to form the fluid-pressure-receiving chamber *g''* between them, and a main valve contained within and movable endwise of the chamber *e'* and comprising two external chambers *f''* and *f'''* arranged a suitable distance apart lon-

gitudinally of the valve, all relatively arranged and operating substantially as shown, for the purpose specified.

4. The combination, with an engine-cylinder, and the piston within the said cylinder, of valve mechanism comprising the following: a valve-casing arranged externally and longitudinally of the chamber of the cylinder; two chambers e' and e^2 formed in the valve-casing and arranged longitudinally of the cylinder, with the chamber e' between the chamber e^2 and the cylinder; the fluid-pressure-supply port k connected with the chamber e^2 centrally between the ends of the said chamber; two passage-ways extending from opposite end portions, respectively, of the chamber e' to and connected with opposite ends, respectively, of the chamber of the cylinder; two ports e^6 and e^6 surrounding both chambers e' and e^2 between the exhaust-port and the different aforesaid cylinder-chamber-connecting passage-ways, respectively; an annular series of apertures formed in the surrounding wall of the chamber e' and connecting one of the said ports e^6 with the said chamber e' ; another annular series of apertures formed in the said wall and connecting the other port e^6 with the said chamber; an annular series of apertures formed in the surrounding wall of the chamber e^2 and connecting the said chamber with one of the aforesaid ports e^6 , and another annular series of apertures formed in the said wall and connecting the other port e^6 with the said chamber e^2 ; a cut-off valve contained within and movable endwise of the chamber e^2 and having two piston-heads g^2 and g^2 separated longitudinally of the valve to form the chamber g^4 between them; and a main valve contained within and movable endwise of the chamber e' and having two external chambers f^4 and f^4 arranged a suitable distance apart longitudinally of the valve and piston-heads forming the end walls of the said chambers f^4 and f^4 , all relatively arranged and operating substantially as shown, for the purpose specified.

5. The combination, with an engine-cylinder, and the piston within the said cylinder, of valve mechanism comprising the following: a valve-casing arranged externally and longitudinally of the chamber of the cylinder; two chambers e' and e^2 formed in the valve-casing and arranged longitudinally of the cylinder, with the chamber e' between the chamber e^2 and the cylinder; an exhaust-port h connected with the chamber e' centrally between the ends of the said chamber; the fluid-pressure-supply port k connected with the chamber e^2 centrally between the ends of the said chamber; two passage-ways connecting opposite end portions, respectively, of the chamber e' with opposite ends, respectively, of the chamber of the cylinder; two passage-ways connecting together the chambers e' and e^2 between the fluid-pressure-supply port and the different aforesaid cylinder-connecting passage-ways, respectively;

tively; a cut-off valve contained within and movable endwise of the chamber e^2 and having two piston-heads g^2 and g^2 arranged a suitable distance apart longitudinally of the valve to form an annular fluid-pressure-receiving chamber g^4 between the said heads, which valve has a stem g' extending through and attached to the central portion of the valve, and a main valve contained within and movable endwise of the chamber e' and comprising two end portions or sections f' and f' arranged in line and a suitable distance apart endwise with each of the said sections f' provided with two piston-heads f^2 and f^3 separated to form a chamber f^4 between them, which main valve is provided, also, with the following: a bridge or web f connecting the two sections f' and f' together, passage-ways extending through the said sections f' from the outer ends of the said sections to the exhaust-port, and a stem f^7 attached to the said web or bridge, all relatively arranged and operating substantially as shown, for the purpose specified.

6. The combination, with an engine-cylinder and the piston within the said cylinder, of valve mechanism comprising the following: a valve-casing arranged externally and longitudinally of the chamber of the cylinder; two parallel chambers e' and e^2 formed in the valve-casing and arranged longitudinally of the cylinder, with the chamber e' between the chamber e^2 and the cylinder; means for exhausting the cylinder; the fluid-pressure-supply port k connected with the chamber e^2 between the ends of the said chamber; two passage-ways connecting opposite end portions of the chamber e' with opposite ends, respectively, of the chamber of the cylinder; two passage-ways connecting together the chambers e' and e^2 between the fluid-pressure-supply port and the different aforesaid cylinder-connecting passage-ways, respectively; a cut-off valve contained within and movable endwise of the chamber e^2 and having two piston-heads g^2 and g^2 arranged a suitable distance apart longitudinally of the valve to form a fluid-pressure-receiving chamber g^4 between them; two vent ports or orifices e^9 and e^9 formed in the surrounding wall of the chamber e^2 at opposite ends, respectively, of the travel of the cut-off valve, and a main valve contained within and movable endwise of the chamber e' , having two external chambers f^4 and f^4 arranged a suitable distance apart longitudinally of the valve and piston-heads forming the end walls of the said chambers f^4 , all relatively arranged and operating substantially as shown, for the purpose specified.

Signed by me at Fort Wayne, Indiana, this 4th day of June, 1901.

THEODORE H. HABERKORN.

Witnesses:

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