No. 823,105. PATENTED JUNE 12, 1906.

W. H. COLLIER.

PRESSURE ACTUATED VALVE GEAR.

APPLICATION FILED MAR. 31, 1904.

3 SHEETS—SHEET 1.

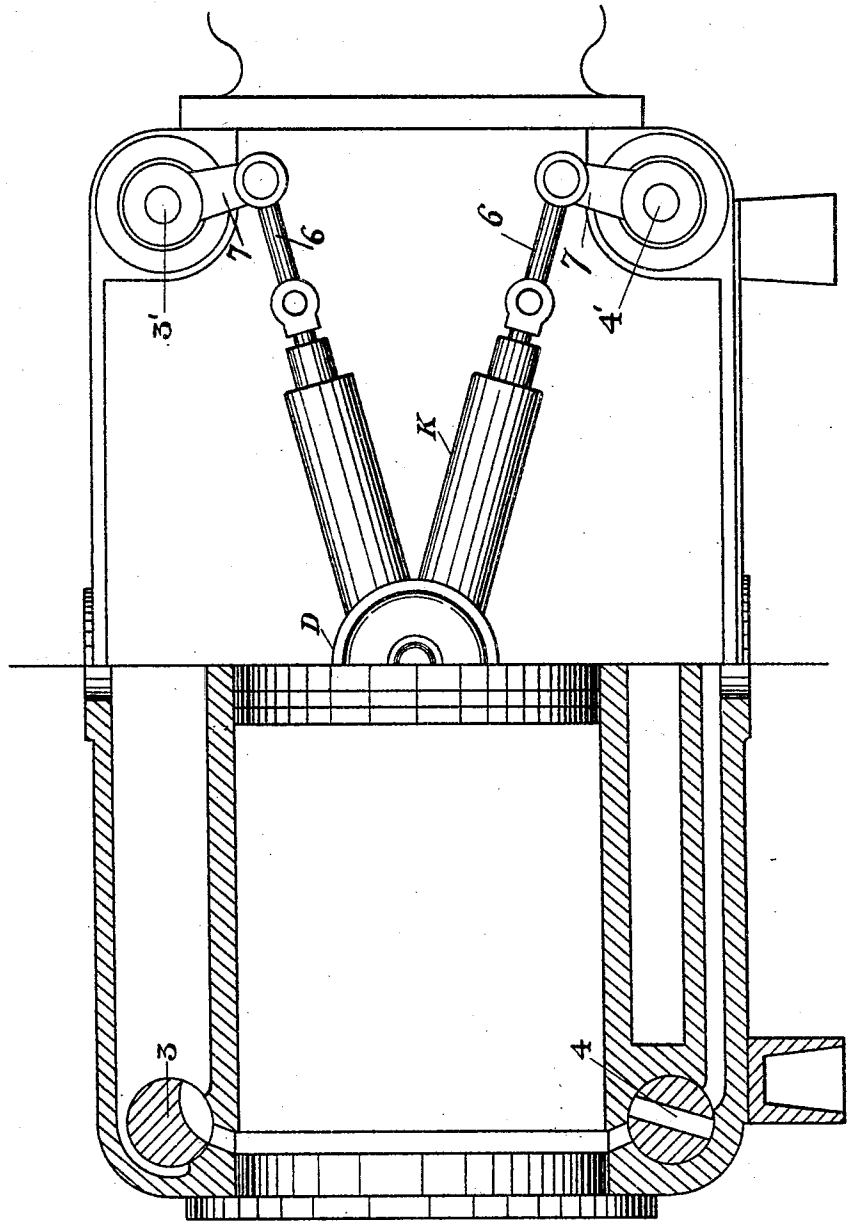

Fig. 1

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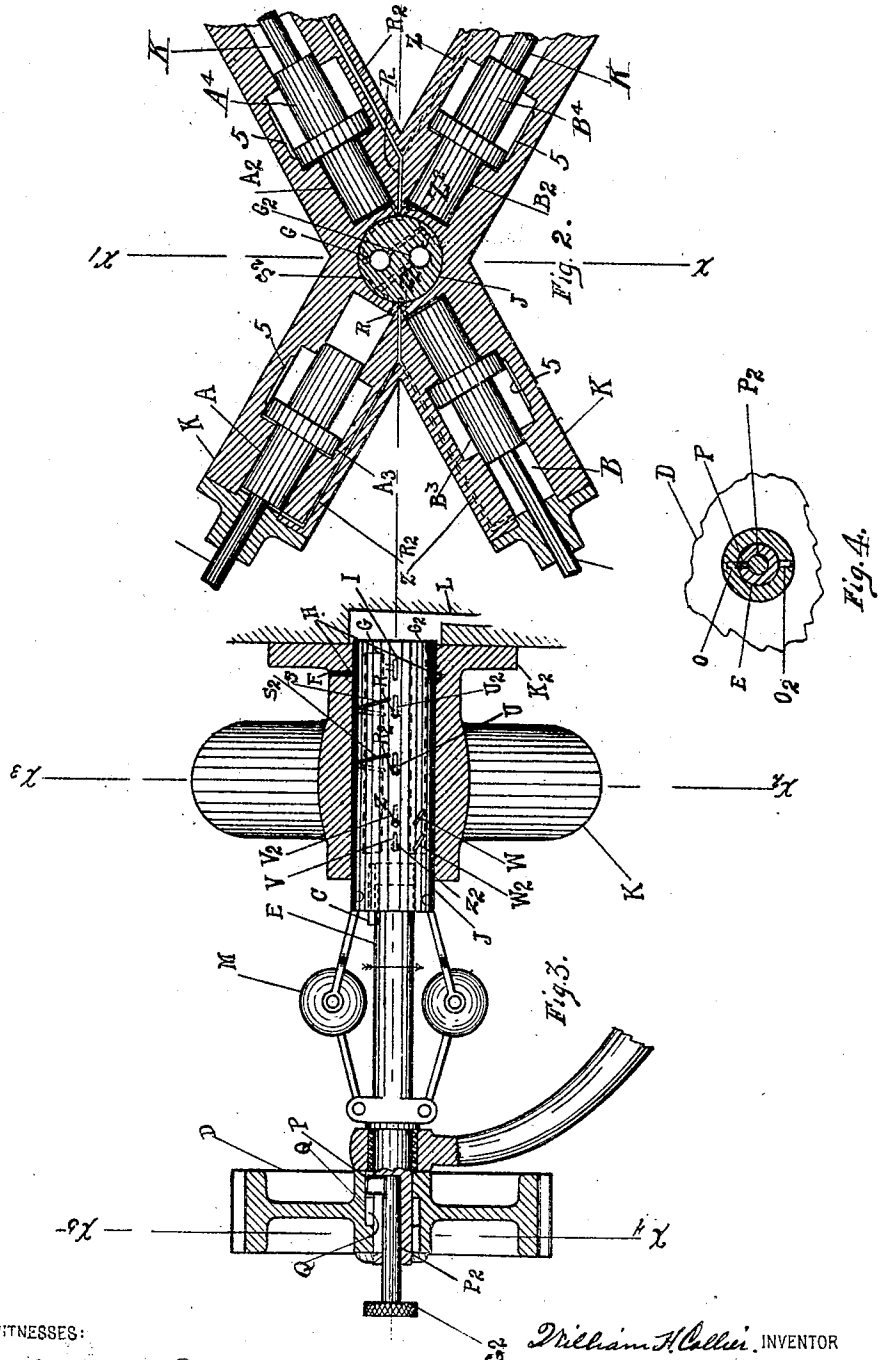

Fig. 2.

Fig. 4.

Fig. 3.

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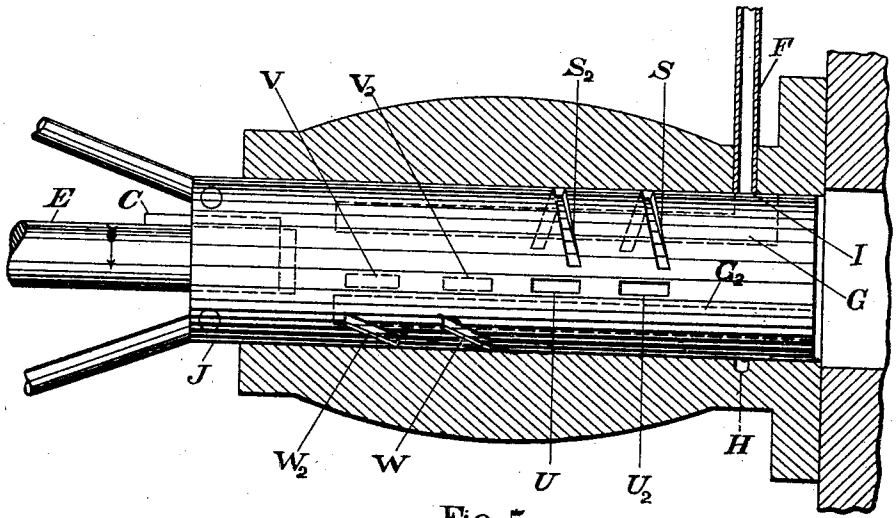

Fig 5

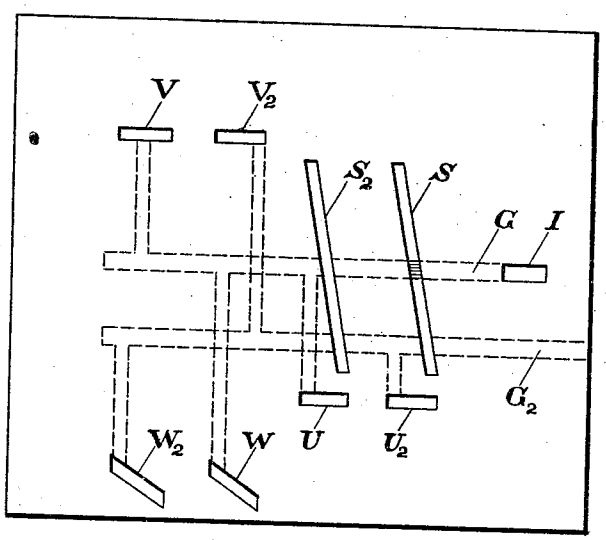

Fig 6

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WILLIAM H. COLLIER, OF JACKSON, TENNESSEE.

PRESSURE-ACTUATED VALVE-GEAR.

No. 823,105. Specification of Letters Patent. Patented June 12, 1906.

Application filed March 31, 1904. Serial No. 201,023.

To all whom it may concern:

Be it known that I, WILLIAM H. COLLIER, a citizen of the United States, residing at Jackson, in the county of Madison, State of Tennessee, have invented a Pressure-Actuated Valve-Gear, of which the following is a specification.

My invention relates to valve-gear for fluid-pressure engines, such as steam and compressed-air engines, air-compressors, and other machines operated by or operating upon fluid under pressure.

The objects of my invention are to obtain good distribution of the working fluid; to obtain wide and rapid port opening and rapid port closing; to improve and simplify the valve-gear of such engines; to improve and simplify the governing devices of such engines; to avoid the use of eccentrics and similar devices; to prevent running away of the engine without the use of safety-stops and the like; to render it impossible to get the valves of the engine out of adjustment, and generally to produce a valve-gear which is simple, efficient, durable, and relatively inexpensive.

I will now proceed to describe my invention with reference to the accompanying drawings, illustrating one embodiment thereof, and will then point out the novel features in claims.

In the said drawings, Figure 1 shows a partial side view and partial central vertical section of an engine-cylinder provided with my improved valve-gear. Fig. 2 shows a central vertical section on a plane parallel to the axis of the engine-cylinder through the center of the valve-actuating cylinders and the controlling-valve on the line X^2 X^3 of Fig. 3. Fig. 3 shows a vertical section through the axis of the controlling-valve, the plane of section being at right angles to that of Fig. 2 on the line X X′ of Fig. 2. Fig. 4 shows a detail transverse section taken on the line X^4 X^5 of Fig. 3. Fig. 5 shows a detail view, on a larger scale than the preceding views, of the controlling-valve, the view being a section through the center of the chamber of said controlling-valve on a plane parallel to the axis of the valve. Fig. 6 shows a development of said controlling-valve.

In this valve-gear the admission and exhaust valves are operated by fluid-pressure-actuated means, usually cylinders and pistons, the action of which is controlled by a controlling-valve driven by a moving portion of the engine and itself controlled in its operation by a centrifugal governor. I preferably employ separate admission and exhaust valves for both ends of the engine-cylinder, and for operating these valves employ a separate cylinder and piston for each valve, the said cylinders being grouped about a common controlling-valve of the rotary type, which valve and its inclosing casing have suitable ports and passages by means of which fluid under pressure is admitted to and permitted to exhaust from said actuating-cylinders at suitable times. This valve is driven from some suitable moving part of the engine, such as the crank-shaft, and I have found that by properly proportioning the size of the ports a maximum speed may be fixed beyond which the engine will not run, even though the load be thrown off and the governor thrown out of action, thus doing away with safety stops and the like. Such maximum speed will customarily be somewhat above the speed at which the engine is intended to run, and the design of the ports to fix such a maximum speed does not prevent or interfere with rapid and efficient operation of the engine at what is intended to be the normal speed.

I arrange the controlling-valve so that it is capable of being moved axially in and out under the control of a suitable governor, such as a centrifugal speed-governor, and provide the valve with spiral ports controlling the points of closure of the admission-valves, which ports will cause the point of cut-off to vary as the valve is moved in and out.

Referring now to the said drawings, reference character 1 designates the engine-cylinder; 2, the piston thereof; 3 and 3′, admission-valves thereof, and 4 and 4′ exhaust-valves thereof. The valve-actuating cylinders and the casing of the controlling-valve are secured to the side of this cylinder 1. Reference characters K designate the bodies of these cylinders.

Of the actuating-cylinders A and A^2 are for actuating admission-valves 3 and 3′, respectively, and B and B^2 are for actuating exhaust-valves 4 and 4′, respectively. Each of these cylinders has an enlarged portion near its center forming a second or cushioning cylinder, and the corresponding pistons A^3, A^4, B^3, and B^4 have corresponding enlargements working as pistons in these cushioning-cylinders. Each such cushioning-cylinder has a groove 5 in its central portion serv-

ing as a by-pass passage, so that the pistons will be cushioned only when they near the ends of their strokes. The said pistons are connected to the corresponding valves by links 6, connected to valve-arms 7, as shown. Pistons A^3 and A^4 are arranged to open their corresponding admission-valves 3 and 3′ during their outward movement and to close said valves during their inward movement. Pistons B^3 and B^4 are arranged to open their corresponding exhaust-valves 4 and 4′ during their inward strokes and to close said valves during their outer strokes.

The valve-actuating cylinders are grouped about a central valve-chamber containing a rotary controlling-valve J. Said valve J contains two longitudinal passages G and G^2, of which the first is a supply-passage, being in registry with the annular groove H in the valve-chamber, to which groove the supply-pipe F is connected. Passage G^2 is an exhaust-passage communicating with a chamber at the inner end of the valve communicating with an exhaust-passage L in the engine-cylinder.

The actuating-cylinders A and A^2 of the admission-valves have each ports R and R^2, connecting the two ends of each such cylinder with the chamber of controlling-valve J, and the actuating-cylinders B and B^2 of the exhaust-valves have similar ports Z and Z^2. Ports U, S, W, and V are connected to the supply-passage G, as indicated in Fig. 6, and are arranged to register during the rotation of the valve with ports R, R^2, Z, and Z^2, respectively. Ports U^2, S^2, W^2, and V^2 are connected to the exhaust-passage G^2, as indicated in Fig. 6, and are arranged to register during the rotation of the valve with ports R^2, R, Z^2, and Z, respectively. Assuming valve J to be driven by suitable means, (as it will be shown to be hereinafter,) the operation of the valve-gear is as follows: Beginning first with valve 3 in the rotation of the controlling-valve J, ports U and U^2 will register simultaneously with ports R and R^2 of cylinder A for an instant during such rotation, causing the piston of cylinder A to move outward, opening valve 3. The said ports remain in registry for an instant only; but when they are no longer in registry the piston of cylinder A will still continue at the outer end of its cylinder and the valve 3 will remain open until said piston is caused to move in by the admission of fluid under pressure in front of said piston. Fluid under pressure is so admitted in front of the piston of cylinder A, and cut-off, therefore, occurs when port S registers with port R^2. Port S^2 simultaneously registers with port R, permitting escape of the fluid in rear of the piston while said piston moves in to close valve 3. Near the end of the stroke of the main engine-piston 2 ports V and V^2 come simultaneously into registry with ports Z and Z^2 of actuating-cylinder B, thereby causing the piston of such cylinder to move inward, and thereby open valve 4, causing exhaust to begin. At or about the beginning of the opposite stroke of engine-piston 2 ports U and U^2 come into registry with ports R and R^2 of actuating-cylinder A^2, causing valve 3′ to open, and when ports S and S^2 come into registry with said ports R and R^2 of cylinder A^2 valve 3′ is closed and cut-off begins. At a suitable time in the period of exhaust through valve 4 ports W and W^2 register momentarily with ports Z^2 and Z of cylinder B, causing valve 4 to close and compression to begin, and at a suitable time ports V and V^2 register with ports Z and Z^2 of cylinder B^2, causing valve 4′ to open. Ports S and S^2 are oblique or spiral ports, and obviously by moving valve J in or out the time of cut-off may be varied. Ports W and W^2 are likewise oblique or spiral ports, so that adjustment of valve J to vary the point of cut-off varies the degree of compression to correspond. Ports U, U^2, V, V^2, and I (the latter being the external orifice of supply-passage G) are elongated lengthwise of the valve, so that movement of the valve in or out does not vary or interfere with the action of said ports. Valve J is driven by a shaft E and a sprocket-wheel D, the latter being driven by a sprocket-chain from any suitable portion of the engine, such as the crank-shaft. A centrifugal governor M on shaft E moves valve J in and out to govern the speed of the engine by variation of cut-off. Sprocket-wheel D is connected to shaft E through a sliding key P, which may engage either slot O or slot O^2 of the gear D or may be entirely disengaged from the gear, lying within a certain circular recess Q of the gear, which permits shaft E and key P to revolve without revolving gear D. Said key may be moved in or out by the stem P^2, having on it the knurled knob Q^2, by which said stem and the shaft E and valve J may be turned when the key is within the recess Q out of engagement with gear D. In starting the engine, pin P^2 is withdrawn until key P is out of engagement with the gear D, and the valve J is then turned by means of the knob Q^2 until the engine starts, whereupon the key is moved into engagement with the gear D. It is obvious that this same valve-gear is applicable to compressors, and such use I regard as being within my invention, and I intend the term "fluid-pressure engine" as herein used to include air-compressors.

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

1. In an engine, the combination with an engine-cylinder, and separate valves for the two ends thereof, of separate fluid-pressure-actuated valve-operating means for each of said valves, and a common rotary controlling-valve for said fluid-pressure-actuated valve-operating means, controlling the operation

thereof, and automatic means for rotating the same.

2. In an engine, the combination with an engine-cylinder, and separate valves for the two ends thereof, of a common rotary controlling-valve, separate fluid-pressure-actuated valve-operating means for said cylinder-valves, arranged about said controlling-valve and controlled thereby, and automatic means for rotating said controlling-valve.

3. In a fluid-pressure-actuated valve-gear, the combination with fluid-pressure-actuated valve-operating means, of a rotary controlling-valve controlling the action of said valve-operating means and movable axially for governing, and an automatic governor connected to said valve and arranged to move the same axially.

4. In a fluid-pressure-actuated valve-gear, the combination with fluid-pressure-actuated valve-operating means, of a rotary controlling-valve controlling the action of said valve-operating means, and movable axially for governing, and having ports coacting with corresponding ports of said valve-actuating means, said ports comprising oblique cut-off ports whereby axial motion of the valve varies the point of cut-off, and an automatic governor connected to said valve and arranged to move same axially.

5. In a pressure-actuated valve-gear, a controlling-valve having spiral cut-off and oblong admission-openings, a governor attached to said valve and actuating cylinders and pistons controlled by said valve, said pistons being connected to and operating engine-valves.

6. In a pressure-actuated valve-gear the combination of a controlling-valve, a governor attached thereto, said valve being arranged to be connected to and to rotate with shaft of engine, and actuating cylinders and pistons, the latter connected to main valves of engine and operated by said controlling-valve.

7. In a pressure-actuated valve-gear, the combination of a valve-shaft, a gear connected thereto, a governor on said shaft, a rotary controlling-valve driven by said governor, and fluid-pressure-actuated valve-operating means controlled by said controlling-valve and connected to main valve means of the engine.

8. In an engine, the combination with an engine-cylinder and valves therefor, of valve-gear therefor comprising a cylinder-casing having in it a chamber for a rotary controlling-valve and cylinders for valve-actuating pistons arranged about said chamber and connected thereto by suitable ports, pistons in said cylinders connected to said valves, a rotatably and longitudinally movable controlling-valve in said chamber having ports coacting with the ports of said chamber, means for rotating said valve automatically, and means for shifting said controlling-valve longitudinally.

9. In an engine, the combination with an engine-cylinder, and valves therefor, of valve-gear therefor comprising a cylinder-casing having within it a chamber for a rotary controlling-valve and cylinders for valve-actuating pistons arranged about said chamber and approximately radially with respect thereto and connected thereto by suitable ports, pistons in said cylinders connected to said valves, a controlling-valve rotatably mounted in said chamber, and having ports coacting with the ports of said chamber, and automatic means for rotating said controlling-valve.

10. In an engine, the combination with an engine-cylinder, and valves therefor, of valve-gear therefor comprising a controlling-valve chamber, fluid-pressure-actuated valve-operating means connected to said engine-valves and having ports communicating with said valve-chamber, a controlling-valve rotatably mounted in said chamber and consisting of a round plug having supply and exhaust passages extending longitudinally therethrough, one of said passages communicating with supply and the other with exhaust, and automatic means for rotating said controlling-valve.

WILLIAM H. COLLIER.

Witnesses:
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