No. 666,368. Patented Jan. 22, 1901.

H. F. WALLMANN.

INTERNAL COMBUSTION ENGINE.

(Application filed Oct. 5, 1897.)

(No Model.)

FIG. 2.

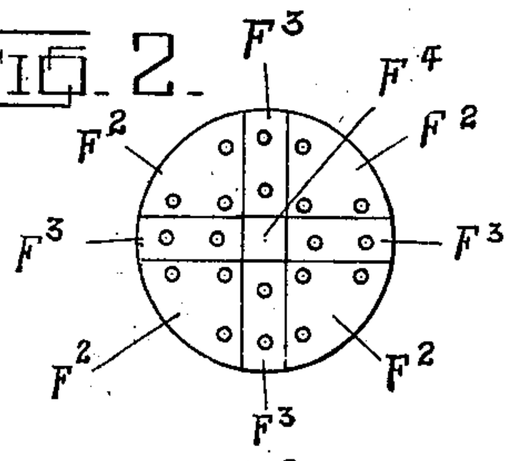
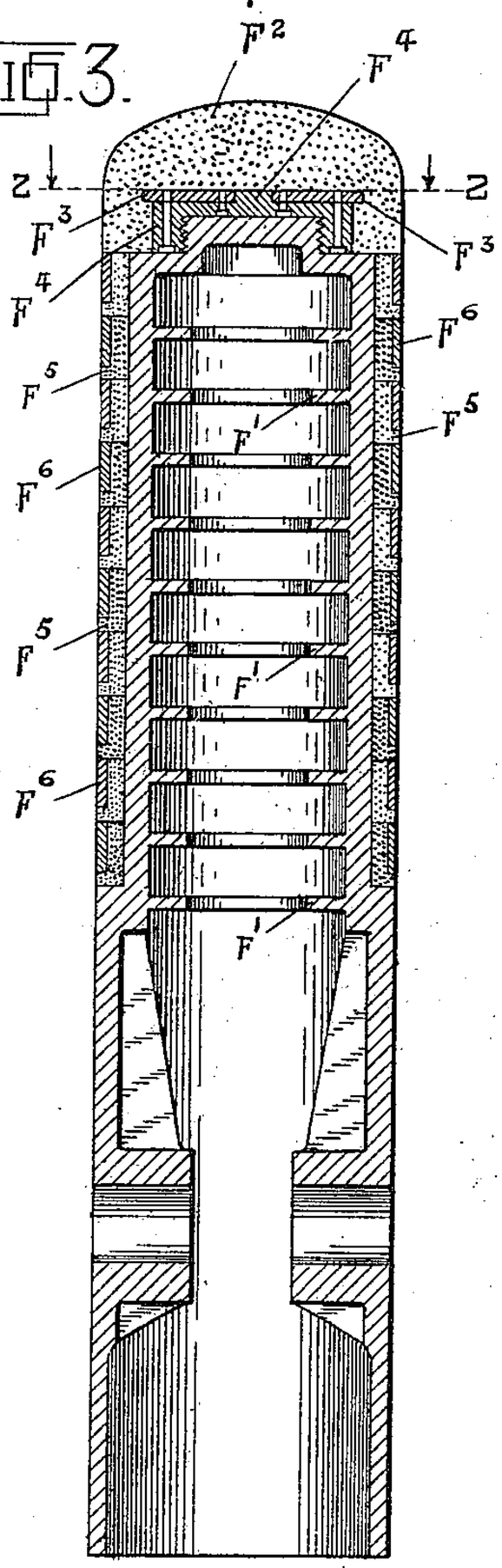


FIG. 3.



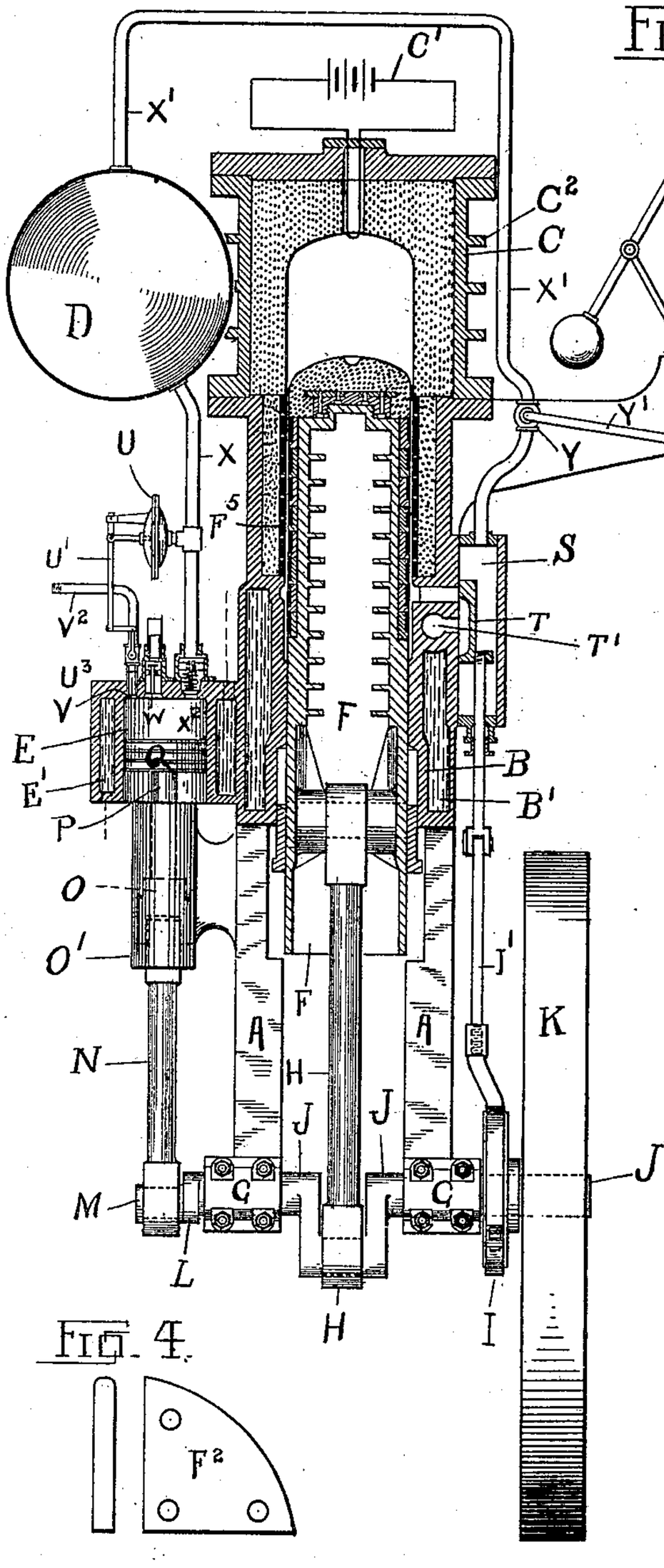


FIG. 1.

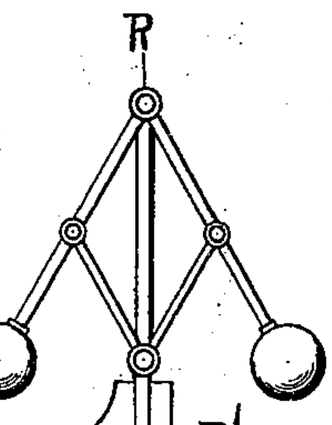
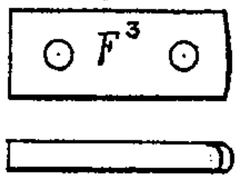


FIG. 4.

FIG. 5.



Witnesses
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HENNING F. WALLMANN, OF CHICAGO, ILLINOIS.

INTERNAL-COMBUSTION ENGINE.

SPECIFICATION forming part of Letters Patent No. 666,368, dated January 22, 1901.

Application filed October 5, 1897. Serial No. 654,122. (No model.)

To all whom it may concern:

Be it known that I, HENNING FRIEDRICH WALLMANN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to heat-motors in which air, and particularly compressed air, is heated and expanded by the internal combustion of gas, petroleum, coal-dust, or any other suitable fuel. A motor of the class referred to and of my invention is set forth in Letters Patent of the United States No. 548,824, dated October 29, 1895.

My present invention is in the nature of improvements upon the construction of the motor presented in my aforesaid patent; and the objects of my improvements are, first, to preparatorily heat the fuel and the air, or a mixture of both, in a regenerator within the combustion-cylinder before they enter the combustion-chamber thereof, the regenerator preferably consisting of the inclosures of an interposed annular space between the elongated cylinder and its piston; second, to improve the controlling speed and pressure regulating devices, and, third, to improve some detail constructions, especially the construction of the regenerator and of the combustion-cylinder and its piston.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of the engine, part of which is shown in central vertical section; Fig. 2, an end view of retaining-plates for the fireproof cap of the piston as they would appear from line 2 2 of Fig. 3; Fig. 3, a detailed view of the piston shown in central vertical section; Fig. 4, a face and an edge view of the corner-piece for the retainer, and Fig. 5 a face and an edge view of the center pieces for the retainer.

Similar letters refer to similar parts throughout the several views.

The frame A, the combustion-cylinder B, with its extension C, the reservoir D, and the compression or pump cylinder E constitute the main stationary parts of the engine. The piston F imparts motion to the crank-shaft J by means of the connecting-rod H. Shaft J is supported in bearings G at the base of the frame A and carries the fly-wheel K, the eccentric I, and the crank L.

The eccentric I actuates the slide-valve T by means of the eccentric-rod I′, the valve T controlling the inlet of the air and fuel into the combustion-cylinder and also the exhaust of the products of combustion therefrom. Crank L imparts motion to the piston Q in the compressing or pump cylinder E by means of the connecting-rod N, cross-head O, and piston-rod P, the cross-head O sliding in guides O′.

A governor R is placed close to the valve-chest S and receives motion by any suitable or desired connection from the crank-shaft J and is connected to a throttle-valve Y on the pipe X′, which carries air or air and fuel to the valve-chest S.

The reservoir D is placed somewhere along the pipe X X′ and receives the compressed air or air and fuel, which is forced out from the cylinder E by the upward motion of the piston Q. A pipe X carries the air or the air and fuel from the compressor E to the reservoir D, and the pipe X′ conducts the same further on to the valve-chest S. The compressor E is provided with a water-jacket or other suitable means for artificially cooling the air or the air and fuel during the compression thereof in order to decrease the amount of power required of the engine to compress the same, and the compressor carries on its top an inlet W and a discharge-valve X^2. In case the compressor is employed for compressing air and fuel it may besides be provided with a fuel-inlet V. A diaphragm U, connected to the discharge-pipe X, operates, by means of lever U′, link U^2, and lever U^3, a throttle-valve V′, placed in the fuel-supply pipe V^2.

The combustion-cylinder and that part of its piston remaining during its operation always within the combustion-cylinder are lined with fireproof material and provided with metal rings F^6, constituting a two-part regenerator. These metal rings F^6 are separated by means of non-conductors of heat, preferably porcelain rings F^5, from the inside

iron body of the piston F and by similar porcelain rings or a porcelain shell from the outside iron body or shell of the cylinder C.

The piston F is at its inner end protected by a fireproof cap, held in position by four retaining-plates F^3 and four retaining-plates F^2, which eight retaining-plates constitute a retainer bolted to a metal cap F^4. This cap is rigidly fastened to the inside iron body of the piston F, which may be provided with internal cooling-ribs F'. The combustion-cylinder C is provided with an igniter, preferably an electric igniter C', and its packing and the packing of its piston may be protected from the heat by means of water circulating within a water-jacket B'. The upper part of the combustion-cylinder C may be provided with external cooling-ribs C^2.

The engine operates as follows: The exhaust-port T' just having opened and the piston F just starting its inward stroke, the gases exhaust from the combustion-cylinder through the regenerator, imparting their heat to the latter, until the inward stroke of the piston F is nearly completed. Then the slide-valve T closes the exhaust and by uncovering the cylinder-port admits compressed air or a mixture of compressed air and fuel into the cylinder. The fuel may, if preferred, be injected into the upper end of the cylinder above the regenerator through a separate port, the air alone passing through the regenerator. After the air or mixture of air and fuel has been preparatorily heated within the regenerator the charge is ignited and heated by combustion within the combustion-chamber between the closed end of the cylinder and the inner end of its piston and expands during the outstroke of the piston. In the meantime the compressor E has supplied a charge of compressed air or compressed air and fuel to the reservoir D. If the engine runs beyond its normal speed, the governor R throttles the supply of compressed air or of compressed air and fuel to the valve-chest S, and if in consequence the pressure rises above its normal height within the reservoir D the diaphragm U throttles the supply of fuel, thereby lowering the temperature of combustion, increasing the amount of compressed air consumed by the engine, and thus lowering the pressure within the reservoir.

In case the compressor is employed for the compression of air only it is necessary to provide the engine with a separate fuel-pump.

I wish to claim—

1. In an internal-combustion engine, the combination with a combustion-cylinder and its piston having a two-part regenerator, one part being located in the inner walls of the cylinder and the other on the outer surface of the piston, of means for supplying a combustible charge to the cylinder, the compressed air for said charge being introduced to the combustion-chamber through said regenerator, in which it is preparatorily heated, and the products of combustion being exhausted through said regenerator and imparting their heat thereto, substantially as described.

2. In an internal-combustion engine, the combination with a combustion-cylinder and its piston having a two-part regenerator, one part being located in the inner walls of the cylinder and the other on the outer surface of the piston, of a compressor for supplying air or air and fuel under pressure for the combustible charges, a slide-valve located on the side of the cylinder immediately below the lower end of the regenerator, and serving to admit compressed air or air and fuel to the combustion-chamber through said regenerator and to exhaust the products of combustion therefrom, and a governor-controlled connection between the compressor and the said slide-valve, substantially as described.

3. In an internal-combustion engine, the combination with a combustion-cylinder and its piston having a two-part regenerator, one part being located in the inner walls of the cylinder and the other on the outer surface of the piston, of a compressor for supplying air or air and fuel under pressure for the combustible charges, a slide-valve located on the side of the cylinder immediately below the lower end of the regenerator, and serving to admit compressed air or air and fuel to the combustion-chamber through said regenerator and to exhaust the products of combustion therefrom, a reservoir interposed between said compressor and said slide-valve, and a governor-controlled connection between the reservoir and the said slide-valve, substantially as described.

4. In an internal-combustion engine, a combustion-cylinder interiorly lined with some suitable heat-resisting substance and having a water-jacket surrounding its lower portion and a series of heat-retaining metal rings lining a part of its upper portion, in combination with an elongated piston, the upper portion of which is surrounded by a series of heat-retaining metal rings forming with the metal rings in the cylinder-walls a regenerator, and the lower portion of which reciprocates in contact with the water-jacketed portion of the cylinder, all substantially as set forth.

5. In an internal-combustion engine, a combustion-cylinder interiorly lined with some suitable heat-resisting substance and having a water-jacket surrounding its lower portion and a series of heat-retaining metal rings lining a part of its upper portion, in combination with an elongated piston, the upper portion of which is surrounded by a series of heat-retaining metal rings forming with the metal rings in the cylinder-walls a regenerator, and is further provided with a fireproof cap protecting its upper end, and

the lower portion of which reciprocates in contact with the water-jacketed portion of the cylinder, all substantially as set forth.

6. In an internal-combustion engine, the combustion-cylinder and its piston provided with metal rings set in the opposing inner and outer surfaces thereof respectively and forming a regenerator, and being separated by means of non-conductors of heat from the inner metal body of the piston and the outside metal shell of the cylinder.

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Witnesses:
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