(No Model.)

C. W. PINKNEY.

GAS ENGINE.

No. 504,614. Patented Sept. 5, 1893.

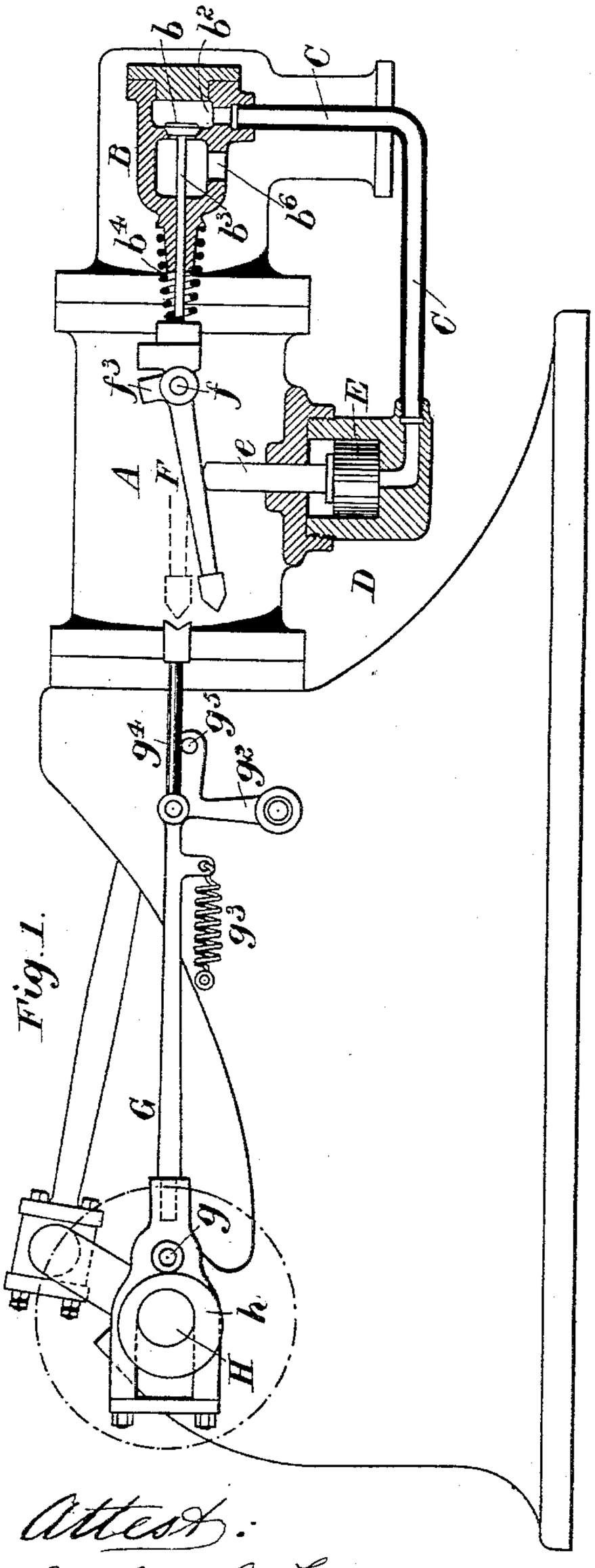

Fig. 1.

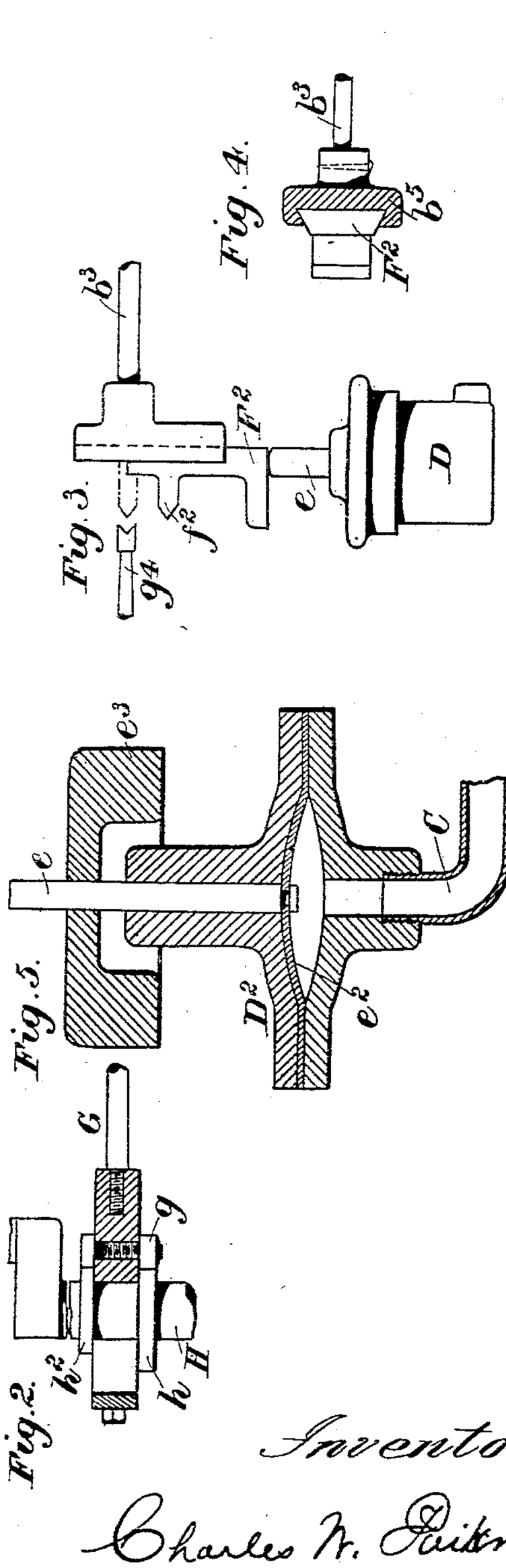

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

CHARLES WILLIAM PINKNEY, OF SMETHWICK, ASSIGNOR OF TWO-THIRDS TO GEORGE TANGYE AND GEORGE HANDEL HASWELL, OF BIRMINGHAM, ENGLAND.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 504,614, dated September 5, 1893.

Application filed February 13, 1893. Serial No. 462,189. (No model.)

To all whom it may concern:

Be it known that I, CHARLES WILLIAM PINKNEY, mechanical engineer, a subject of the Queen of Great Britain and Ireland, residing at 77 Raglan Road, Smethwick, in the county of Stafford, England, have invented certain Improvements in Gas-Engines, of which the following is a specification.

My invention relates to gas engines which work on what is known as the "Otto cycle," and the object of my invention is to simplify the engine by reducing the number of working parts, as I dispense with the ordinary gearing wheels, side shaft, brackets, valve levers, and the like, as hitherto used.

The present invention will be fully understood from the following description, reference being made to the accompanying drawings forming part of this specification, in which—

Figure 1 of the accompanying drawings is a horizontal section of so much of a gas engine as is necessary to explain the application of my invention thereto. Fig. 2 shows in plan a part of the crank shaft and of the attachment which operates the exhaust valve. Figs. 3, 4 and 5 show modifications of the device worked by the pressure of the charge and of the explosion as hereinafter described.

The engine herein shown and described operates on the four-stroke-cycle system, comprising (first) the charging stroke, (second) the compression stroke, which compresses the gases drawn in by the charging stroke (third) the working stroke caused by the explosion of the charge, and (fourth) the discharging stroke, for expelling the products of combustion. In the present invention the discharge valve remains closed during the charging, compression and working strokes, and is opened during the discharge stroke, the operating parts having been brought into position for operative connection during the compression stroke. At the end of the working stroke the parts drop by gravity into proper relative position for contact and the discharge valve is opened during the discharge stroke, as hereinafter more fully explained.

The exhaust valve box B into which the gases pass from the working cylinder A of the engine, before they pass through the exhaust valve b, to the outlet b^6, has a passage b^2 therefrom which leads, by the pipe C, into a cylinder, or vessel D, in which moves a piston E having attached to it a rod e, which, when the piston E is in its elevated position, brings a lever F, centered at f, on the end of the exhaust valve spindle b^3, into line with the rod G, having a jointed end portion or rod g^4 with a mouth shaped termination thrust rearward by the crank shaft. This is shown as being effected by a cam h on the crank shaft H acting on a roller g on the said rod G the crank shaft end of which is bifurcated as shown to embrace the shaft H between the cam h and collar h^2 which act as a support and guides therefor. The other end of the rod G is supported by a lever g^2 centered to the engine framing and having a pin g^5 for the rod g^4 to rest upon. g^3 is a spring which returns the rod G and its attachments after the cam h has acted upon it. When the engine is at work, as the piston in the main cylinder A makes its charging stroke the vacuum formed in the said main cylinder will, by the communication of the exhaust box B by the pipe C with the cylinder or vessel D draw the said piston E down or inward so that the lever F is not in line with the rods g^4. When the piston in the main cylinder returns and makes its compression stroke the pressure of the charge will cause the said piston E to rise or move outward so that the lever F will be finally brought into line with the rod g^4 as hereinafter explained and as indicated by the dotted lines the said lever F having a bearing piece f^3 to take the strain. As the piston (main-piston) advances during the compression stroke the pressure on the piston E increases, the action of the cam h at the same time advancing the rod G. As the lever F is not however raised to the line of extension g^4 until at or near the end of the compression stroke the extension g^4 misses the end of lever F, and rests on and is raised by the latter during its ascent. At the end of the compression stroke the explosion of the working charge of the cylinder A takes place the pressure still keeping the piston E in its last named position. When the crank of the engine has arrived at the posi-

tion at which the exhaust valve should be opened, that is to say, at the beginning of the discharging stroke, the extension g^4 having escaped the end of lever F and dropped by gravity into its normal position the rod G is by the cam h moved so that the mouth at the end of the rod g^4 meets and acts upon the end of the lever F which is now in its path as shown by the dotted lines and the exhaust valve b is opened until the main piston has reached the end of its exhausting stroke when the exhaust valve closes and is held tightly to its seat by its spring b^4. The piston in the main cylinder A now commences to make its charging stroke and a vacuum will again be formed in the said main cylinder and the piston E will take such a position that the lever F is out of line with the rod g^4 as shown in full lines and therefore although this portion of the revolution of the crank shaft corresponds with its position on the occurrence of the explosion the exhaust valve b will not be opened as the end of the rod g^4 will not abut against the lever F.

As before stated I do not limit myself to the precise details which I have illustrated as the attachment to the crank shaft and the attachment to the exhaust valve which is brought into line therewith may be arranged in any other convenient way. For example as shown in elevation and sectional plan respectively in Figs. 3 and 4 the lever F may be replaced by a piece F^2 sliding in guides b^5 in the end of the exhaust valve rod b^3 and acted upon by the rod e of the piston in the cylinder or vessel D to raise or lower the projection f^2 to bring it into line with the attachment g^4 to the crank shaft as indicated by the dotted lines in Fig. 3 it returning to its lower position by its own weight or under the action of a spring. Or I may use in place of the cylinder or vessel D a vessel D^2 as shown in Fig. 5 having in it a diaphragm e^2 to which the rod e is attached the said rod being weighted by the weight e^3 to return the rod and diaphragm to their lowered positions. Or I may use any other suitable device such as a Bourdon steam gage on the tube of which the pressure acts as the steam acts in a Bourdon gage.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a gas engine the combination with the exhaust-valve and its stem, of a vertically movable connecting bar at the end of the valve-stem, a cylinder and piston or equivalent device in communication with the explosion chamber for raising the connecting bar as the pressure in said chamber is increased, an oscillating rod driven from the crank-shaft of the machine, and a vertically movable extension at the end of the oscillating rod adapted to be elevated by the connecting rod during the compression stroke and returned to its operative position by gravity, substantially as described.

2. In a gas engine the combination with the exhaust-valve and its stem, of a pivoted connecting bar at the end of said valve stem, a cylinder and piston or equivalent device in communication with the explosion chamber for moving said bar, an oscillating rod driven from the main crank shaft, and a pivoted extension at the end of said oscillating rod, adapted to be brought into operative contact with the connecting bar for operating the exhaust valve, substantially as described.

3. In a gas engine the combination with the exhaust valve and its stem, of a connecting bar pivoted to the end of said valve-stem, a cylinder and piston or equivalent device communicating with the explosion chamber for elevating the connecting bar to its operative position, an oscillating rod driven from the main shaft of the machine, a swinging support for the outer end of said rod and a pivoted extension at said outer end normally supported in alignment for engagement with the connecting bar when the latter is elevated to its operative position, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

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