(No Model.)

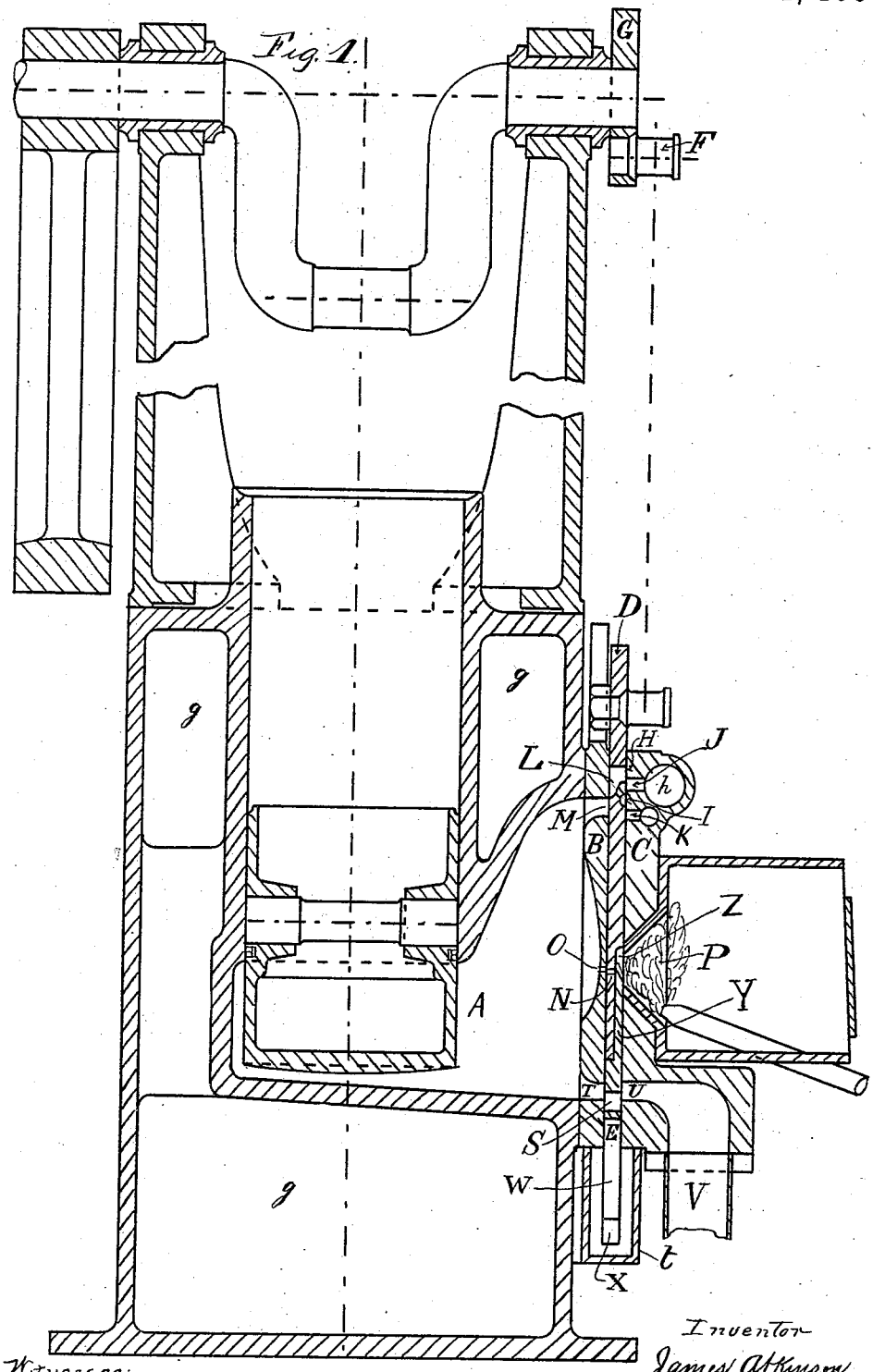
2 Sheets—Sheet 1.

J. ATKINSON.

GAS ENGINE.

No. 306,712. Patented Oct. 21, 1884.

Fig. 1.



Witnesses:
Chas S. Kalb
Tom R. Stuart

Inventor
James Atkinson
By his Attorney
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(No Model.)

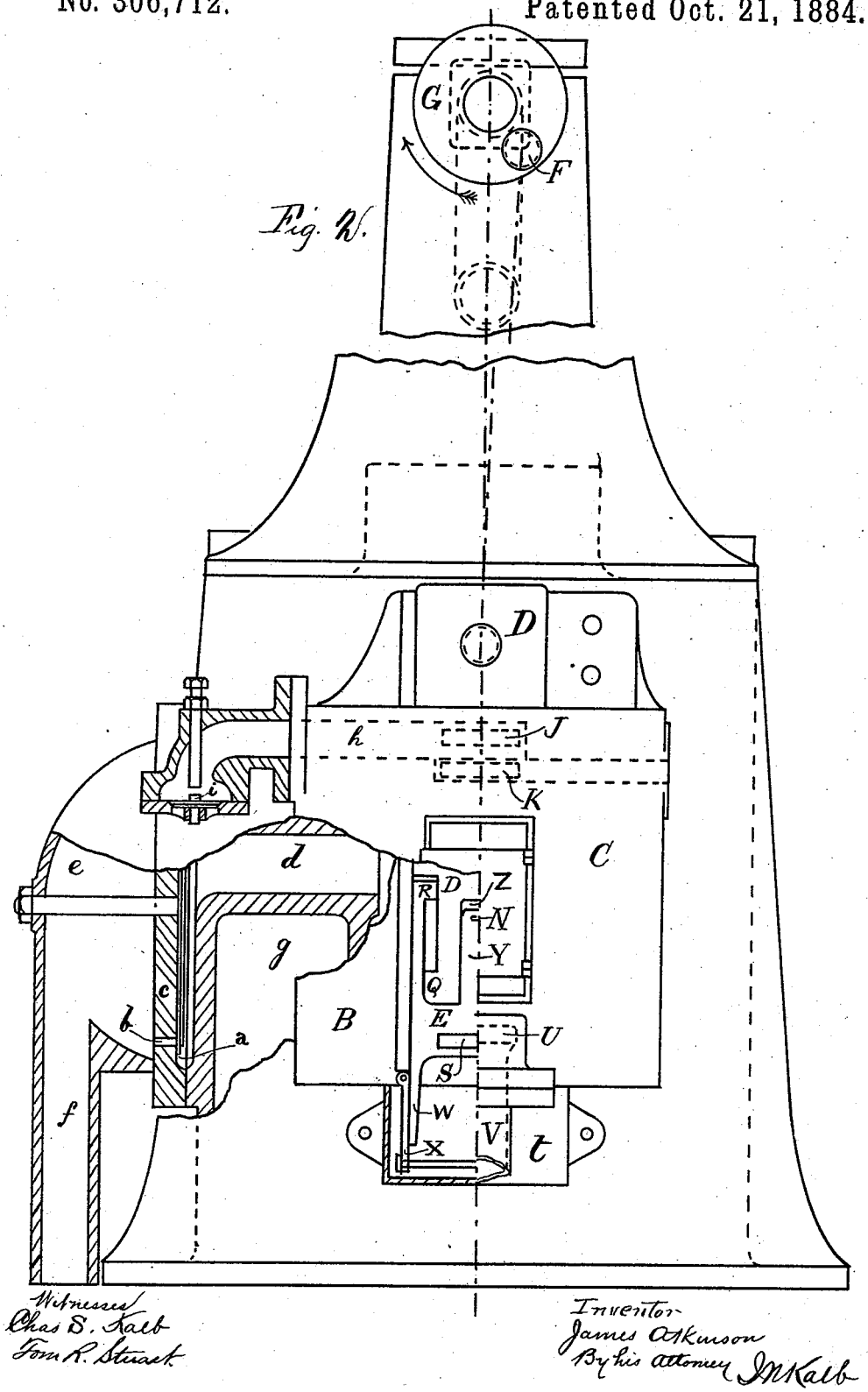
2 Sheets—Sheet 2.

J. ATKINSON.

GAS ENGINE.

No. 306,712. Patented Oct. 21, 1884.

Fig. 2.



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Inventor:
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UNITED STATES PATENT OFFICE.

JAMES ATKINSON, LONDON, COUNTY OF MIDDLESEX, ENGLAND.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 306,712, dated October 21, 1884.

Application filed November 22, 1883. (No model.) Patented in England September 22, 1881, No. 4,086, and September 14, 1882, No. 4,378.

To all whom it may concern:

Be it known that I, JAMES ATKINSON, a subject of the Queen of Great Britain, residing at London, in the county of Middlesex and Kingdom of England, have invented certain new and useful Improvements in Gas-Engines, (for which I have obtained Letters Patent in Great Britain No. 4,086, bearing date September 22, 1881, and No. 4,378, bearing date September 14, 1882,) of which the following is a specification.

My invention relates to improvements in gas-engines in which the power is obtained by the ignition and subsequent expansion of a combustive mixture of gas and air, such gas and air being exploded or ignited at atmospheric pressure; and the objects of my improvements are, first, to provide a main slide admitting gas and air and igniting the same, combined with a supplementary slide to regulate the exhaust; second, to provide a separate self-acting air-inlet, in combination with a slide valve or valves for admitting gas and air, for the purpose of obtaining full atmospheric pressure in the cylinder at the time of ignition; third, to cover the ignition-port excepting at the right time for ignition. I attain these objects by the mechanism illustrated on the accompanying sheets of drawings, in which—

Figure 1 is a vertical section through a gas-engine embodying my improvements, and Fig. 2 is a vertical elevation, partly in section, of the same engine.

Similar letters of reference indicate similar parts in each of the figures, respectively.

I employ a vertical single-acting open-top cylinder having a piston or plunger working in it, and by means of a connecting-rod driving an overhead-crank in an ordinary manner. A small passage, A, from the under side, of the plunger communicates with the various ports in the inside cover, B. Between this inside cover, B, and the outside cover, C, the main slide D and the separate exhaust-slide E work almost without friction. The covers B and C are fixed definitely a certain distance apart, and there are no springs on the outside cover, C. In these engines the slides are made very thin, being from one-fourth to one-half an inch in thickness in the various sizes; consequently they do not expand to any material extent with the heat. Though made to move perfectly easy between the two covers B and C, they are practically kept tight by means of a film of oil, thus working satisfactorily without any material wear or friction, and as the outside cover, C, is screwed dead against strips on the inside cover, B, an unmechanical attendant cannot grip the slides D and E so as to cause them to cut. The main slide D is driven through a connecting-rod by a small crank-pin, F, fixed in a disk, G, attached to one end of the crank-shaft. The engines are reversible by shifting this disk G round in relation to the main crank, the slide crank-pin F being adjusted so as to be a little behind the main crank in whichever direction it is going.

The working of the engine is as follows: When the piston is at the bottom of its stroke, as shown in Fig. 1, Sheet 1, two ports, H and I, in the outer face of the main slide D are just commencing to open into two corresponding ports, J and K, in the face of the outer cover, C. The rising plunger draws in air through these higher ports, H and J, and gas through these lower ones, I and K. These two ports H and I in the outer face of slide D run into one port, L, on the inner face of the slide D, thus thoroughly intermingling the entering gas and air which form an explosive mixture, which passes through the highest port, M, in the inside cover, B, filling the passage A to the under side of the piston and the cylinder itself, until the piston has made from about one-third to about one-half of its stroke, (the smaller proportion for larger engines and the larger proportion for smaller engines,) during which time the admission-ports H, I, J, and K have opened and closed again. As soon as the admission-ports H I J K are cut off a small ignition port or passage, N, in the slide D is opened to a similar port or passage, O, in the inside cover, B, the slight amount of suction in the cylinder sucks in a portion of the external igniting-flame P, thus igniting the contents of the cylinder, which expands and causes a working-pressure to the end of the stroke. The ignition-ports N and O are narrow, and as the slide D is traveling comparatively rapidly the ports N and O pass each other and are closed by the time the contents

of the cylinder are ignited. When the piston arrives at about the top of its stroke, the main slide D is approaching the top of its stroke. At the lower end of the main slide D there are projections Q, which engage similar projections, R, on the exhaust-slide E, which draws up this exhaust-slide E, and a passage, S, in the exhaust-slide E opens corresponding passages, T and V, in the inside and outside covers, B and C, allowing the exhaust to pass from the cylinder into the exhaust-pipe V during the whole descent of the piston. When the piston arrives at the bottom, the slide D also is approaching the bottom end of its travel, and pushes down the exhaust-slide E, thus closing the exhaust-ports T and U. Fingers W on the sides of the exhaust-slides E extend below it. These are gripped by clips X, which are adjusted so as to cause sufficient resistance to hold the exhaust-slide E in the position given it by the main slide D. A finger, Y, is attached to the exhaust-slide E, working in a groove, Z, recessed out of the main slide D, and is of such a length that it just covers the ignition-port N in the main slide D while the main slide D is descending at the time the ignition-ports N and O pass each other; but, being left behind with the exhaust-slide E when the main slide D is rising, it leaves the ignition-port N uncovered at the proper time for igniting, thus effectually preventing ignition excepting at the proper time. As there is a slight interval between the time the admission-ports H, I, J, and K are cutting off and the ignition actually taking place, and also as the area through these ports H, I, J, and K is being contracted during the time they are cutting off, there would be a considerable decrease of pressure in the cylinder before ignition, which would act very prejudicially as regards the economical and satisfactory working of the engine. I therefore provide a separate self-acting valve, *a*, (see Fig. 2, Sheet 2,) opening inward. This valve *a* may be of thin sheet india-rubber, copper, or similar material, opening and closing small holes *b* or grooves in the cover *c*. The passage *d* from this valve *a* is covered by the plunger until the time when the admission-ports H and I in the slide D are closing, and is fully open when the ignition takes place. As the passages *b* through the cover *c* are made of ample area, and the valve *a* is very tight, the pressure inside the cylinder before ignition is practically atmospheric pressure. The ignition itself closes the valve *a*. To modify and reduce the concussion of air due to this valve *a* closing, I inclose it by means of a dome-cover, *e*, having a small passage, *f*, from it, which may be turned in any direction in a vertical plane. The passage *f* may terminate in a suitable quietening-box or be passed through the floor or led outside. The cylinder is cast in one with a substantial base, forming a water-jacket, *g*, the weight of the base and the contained water giving stability to the engine. The air-passage *h* in the outer cover, C, terminates in a self-acting valve, *i*, which prevents gas escaping if the engine should be left standing with the gas on in such a position that the ports I and K are open.

Having fully described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. A main slide-valve working between two surfaces and controlling the admission of gas and air and flame for ignition, in combination with an exhaust-valve driven by the slide-valve by tapping it backward and forward between the same faces or surfaces, substantially as and for the purpose set forth.

2. The combination, in a gas-engine, of the main slide D and supplementary slide E with the air-valve *a*, substantially as described.

3. In a gas-engine, the combination of a slide-valve admitting gas and air, with a self-acting valve admitting air during the same stroke, as set forth.

4. The finger Y, attached to the exhaust-slide E, and operating the opening and closing of the ignition-port by the movements of the main slide D, substantially as described.

JAMES ATKINSON.

Witnesses:
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