

(No Model.)

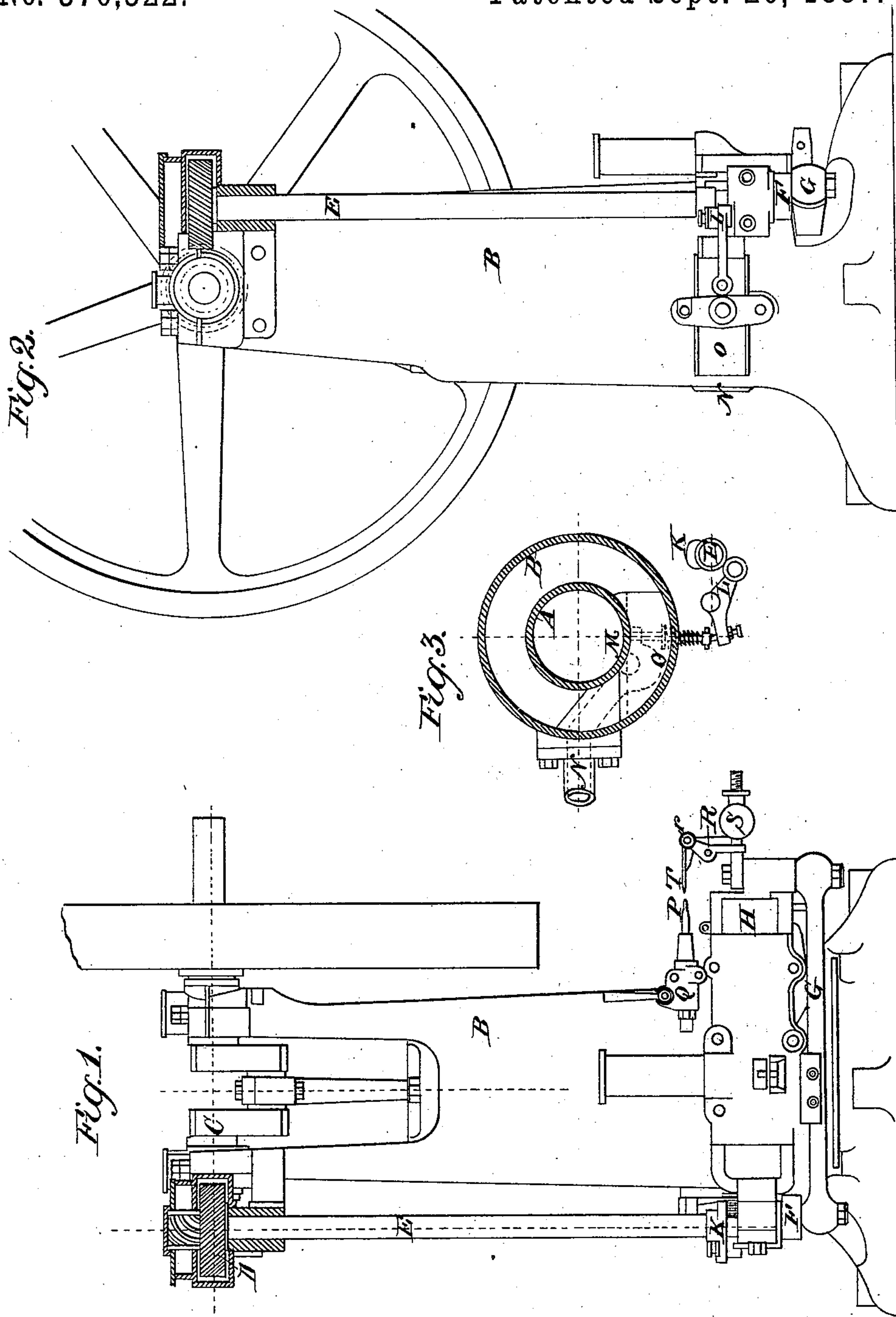
2 Sheets—Sheet 1.

F. W. CROSSLEY.

GAS ENGINE.

No. 370,322.

Patented Sept. 20, 1887.



Witnesses
D. Fred. Stollard
Vernon M. Dorsey.

Inventor
Francis William Crossley.
By his Attorney
C. S. Whitman

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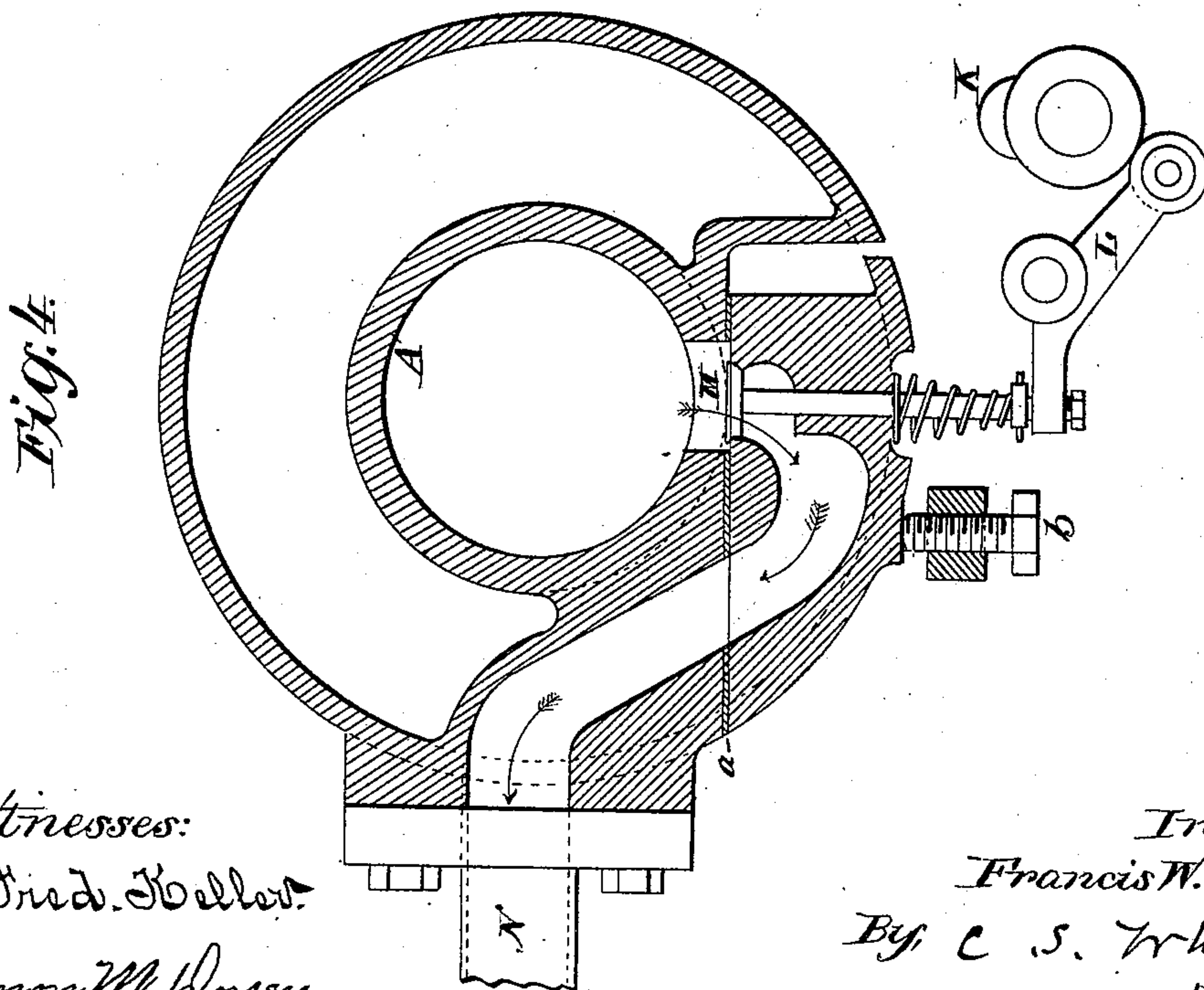
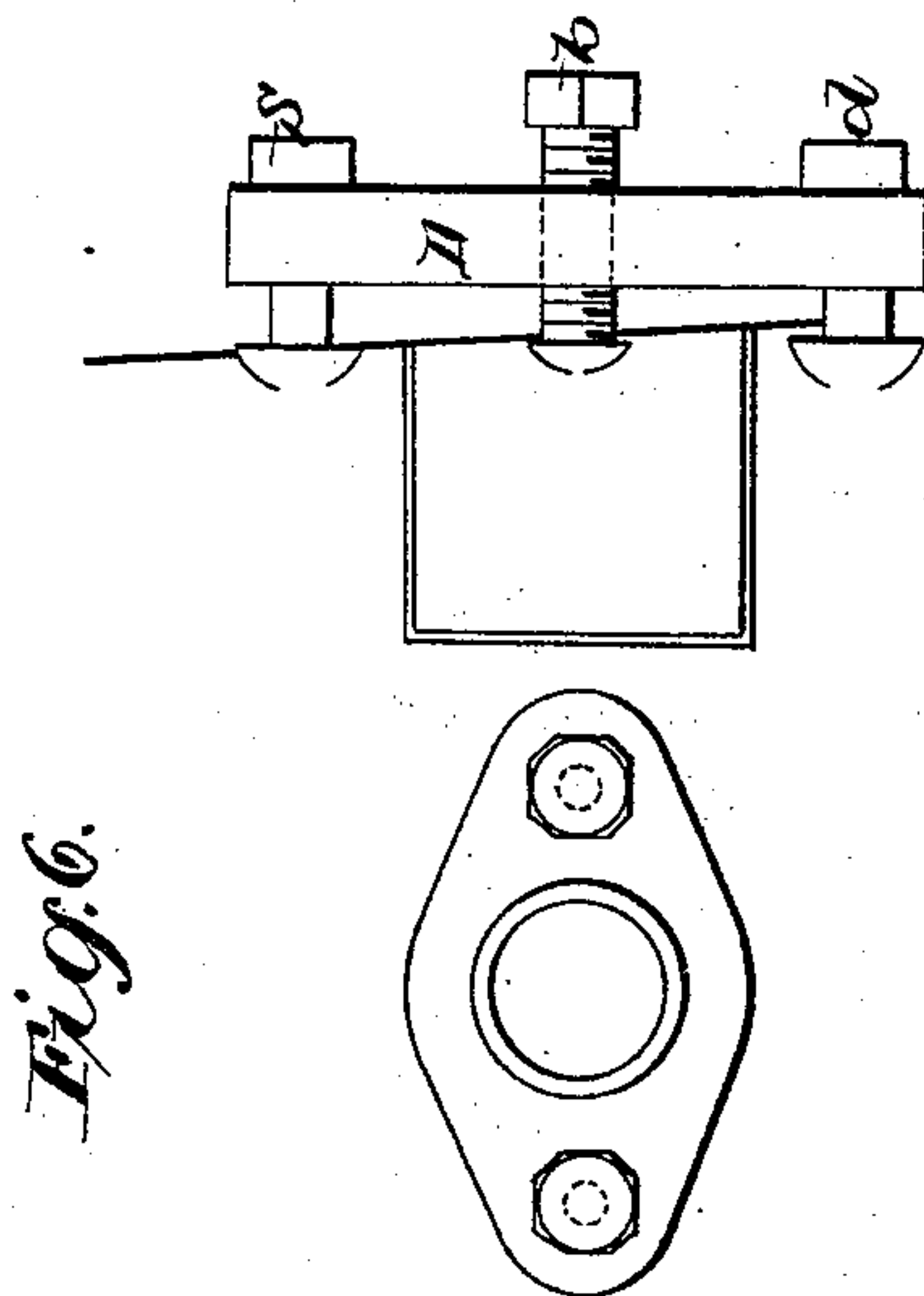
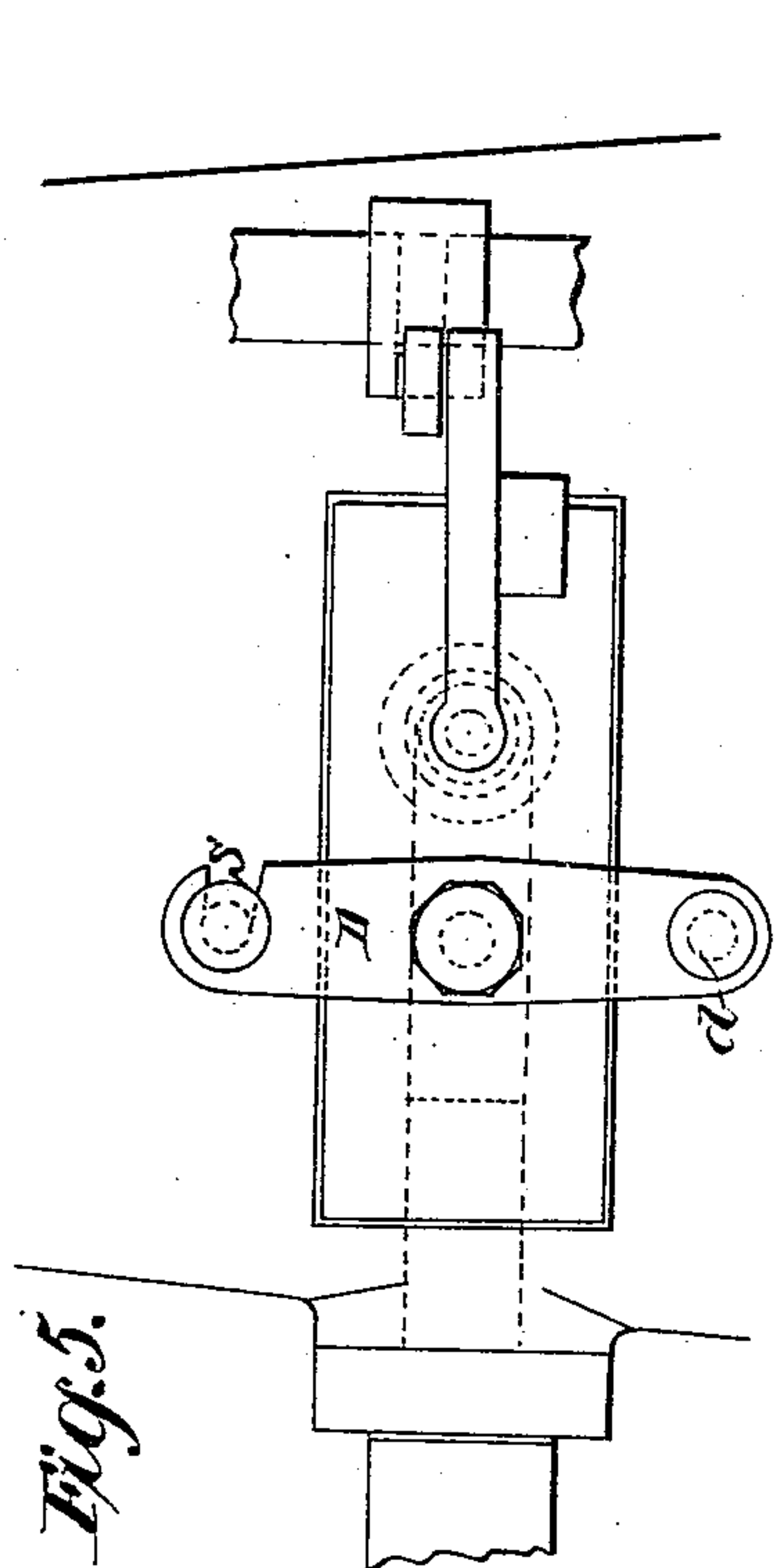
2 Sheets—Sheet 2.

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No. 370,322.

Patented Sept. 20, 1887.



Witnesses:
O. F. H. Keller.
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Inventor:
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UNITED STATES PATENT OFFICE.

FRANCIS WILLIAM CROSSLEY, OF OPENSHAW, MANCHESTER, COUNTY OF LANCASTER, ENGLAND.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 370,322, dated September 20, 1887.

Application filed December 2, 1886. Serial No. 220,468. (No model.) Patented in England July 4, 1885, No. 8,134.

To all whom it may concern:

Be it known that I, FRANCIS WILLIAM CROSSLEY, a subject of the Queen of Great Britain, residing at Openshaw, Manchester, in the county of Lancaster, England, have invented certain new and useful Improvements in Gas-Engines; 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 appertains to make and use the same.

My invention relates to a compact construction of gas-motor engines, operating in the manner of what is known as the "Otto" engine, but with its cylinder arranged vertically and with an overhead crank-shaft. The shaft, by bevel or helical gear, drives a vertical spindle at half the speed of the shaft. On the lower end of this spindle is a cam, which works the exhaust-valve, and a crank which works the slide. The exhaust-valve is held by a spring in a seating formed in a small recess at the side of the cylinder, near its bottom, this recess being only large enough to hold the valve and give passage around it, so that there is no waste space or needless cooling-surface, such as occurs when the valve is in a passage of some length leading from the cylinder. This valve and seating can be removed with the greatest facility and without uncoupling the exhaust-pipe. The cam on the vertical spindle unseats the valve during the period of exhaust. The slide governs ports formed at the side of the cylinder, close to its bottom, these ports being arranged for admission of air and gas and for ignition of the charge in the manner usually adopted in gas-engines of the Otto kind. For the purpose of governing the engine, I mount on the slide a pendulous lever carrying a weight that can be adjusted nearer to or farther from the vertical line of suspension. This lever has an arm which, when the weight remains in a certain position in each instroke of the slide, meets the stem of the gas-supply valve and opens it, allowing gas to enter the cylinder; but when the engine moves faster than the rate to which the weight is adjusted, the inertia of the weight causes it to shift its position, and the lever-arm in that case misses the stem of the gas-

valve, which is held closed by the spring. Then, when the speed of the engine exceeds that to which the weight is adjusted, the supply of gas is cut off until the engine becomes retarded.

Figures 1 and 2 of the accompanying drawings are front and side views of a gas-motor engine according to my invention. Fig. 3 is a sectional plan. Fig. 4 is an enlarged sectional plan illustrating the exhaust-valve. Fig. 5 is an enlarged front view of the removable segment-block, and Fig. 6 is an end view of the same.

The single-acting cylinder A is situated within a hollow column, B, which forms a water-casing, and is fitted with a piston connected to a crank of an overhead fly-wheel shaft, C, which revolves in bearings at the top of the column B. By helical gear D the crank-shaft C drives at half its speed a vertical spindle, E, at the lower end of which is a crank, F, that, by means of a connecting-link, G, works the slide H for admission and ignition of the cylinder charge.

On the shaft E is a cam, K, which, acting on a roller on a lever, L, opens, in opposition to a spring, the exhaust-valve M. This valve and its seating, and a bent passage from it to the exhaust-pipe N, are accommodated in a segmental block, O, which can be readily removed for giving access without disturbing the joint of the pipe N.

A suitable packing, a, is placed between the plane surface of the column B, and the plane surface of the segmental block, which is held in position by the screw b passing through the cross-piece D. The said cross-piece is arranged to swing upon the pivot-pin d and to catch upon the pin S. Should it be necessary to inspect the valve M or its seats, the screw b is loosened and the cross-piece which carries it is swung around the pivot-pin d out of the way. The segment-block may then be removed with facility and the valve M examined without disconnecting the exhaust-pipe N. The direction of the exhaust gases when traveling through the opened valve is indicated by the arrows.

The gas-supply valve in the valve-box Q has a projecting stem terminating in a knife-

edge, P. On the slide H is mounted a lever, R, carrying a weight, S, which, by means of a screw-nut, can be adjusted nearer to or farther from the vertical line drawn by the fulcrum 5 of the lever R. The horizontal arm of the lever is a knife-edge spring-blade, T, directly facing the valve-stem P. So long as the slide H reciprocates at such a rate that the weight S reciprocating with it remains relatively 10 stationary, the edge of T meets the edge of P, and the valve-stem is pressed inward in opposition to an internal spring opening the gas-valve and allowing gas to pass to the slide-port; but when the slide H reciprocates so 15 fast that the inertia of the weight S causes it to hang a little behind, the edge of T, being thus depressed, fails to meet the edge of P, and consequently the gas-valve is not opened. This may occur during several successive 20 strokes, the engine receiving no supply of gas until its speed becomes so far reduced that the inertia of S no longer operates to move T out of its horizontal position. By adjusting S nearer to or farther from the vertical line from 25 the normal speed of the engine may be regulated, the speed being greater the farther S is from the vertical line of suspension.

It is to be understood that the cylinder and piston, the slide and its facings and ports, the 30 arrangements for ignition, the gas-valve in Q, and generally those parts of the engine which are not shown in details on the drawings are similar in construction to the corresponding parts as they are commonly used in Otto gas- 35 motor engines.

The application filed by H. P. Holt and myself November 6, 1886, No. 218,199, describes a governor which is not worked by rotary motion, but is attached to a reciprocating part of

the engine, and has one weight only, which 40 acts when the speed is exceeded, and by gravity alone. This governor has proved a practicable and highly valuable device in gas-engines, but improvements were made upon it 45 in order to have it act not only under excessive speed, but also when the speed drops below a certain point. These improvements, which act as a safeguard for cutting off gas when the engine stops accidentally, are described in the application of H. P. Holt, F. 50 H. Anderson, and myself, No. 195,933, filed March 20, 1886.

I do not wish to be understood as claiming in the present application anything which is 55 claimed in the said applications Nos. 218,199 and 195,933.

I claim, and desire to secure by Letters Patent—

1. A vertical gas-motor engine having its cylinder within the lower part of a column 60 which, at its top, has bearings for the crank-shaft, this shaft working by helical gear at half its speed a vertical spindle, which, by a crank, gives reciprocating movement to the admission and ignition slide, and by a cam 65 opens the exhaust-valve, substantially as described, and illustrated by the drawings.

2. In a gas-engine, the exhaust-valve M, and its seating and passage in a removable 70 segment-block, O, as herein described.

In testimony whereof I affix my signature in presence of two witnesses.

FRANCIS WILLIAM CROSSLEY.

Witnesses:

EDWD. WYTHWAY,
Solicitor, Manchester.
ROBT. TOMLINSON,
His Clerk.