

(No Model.)

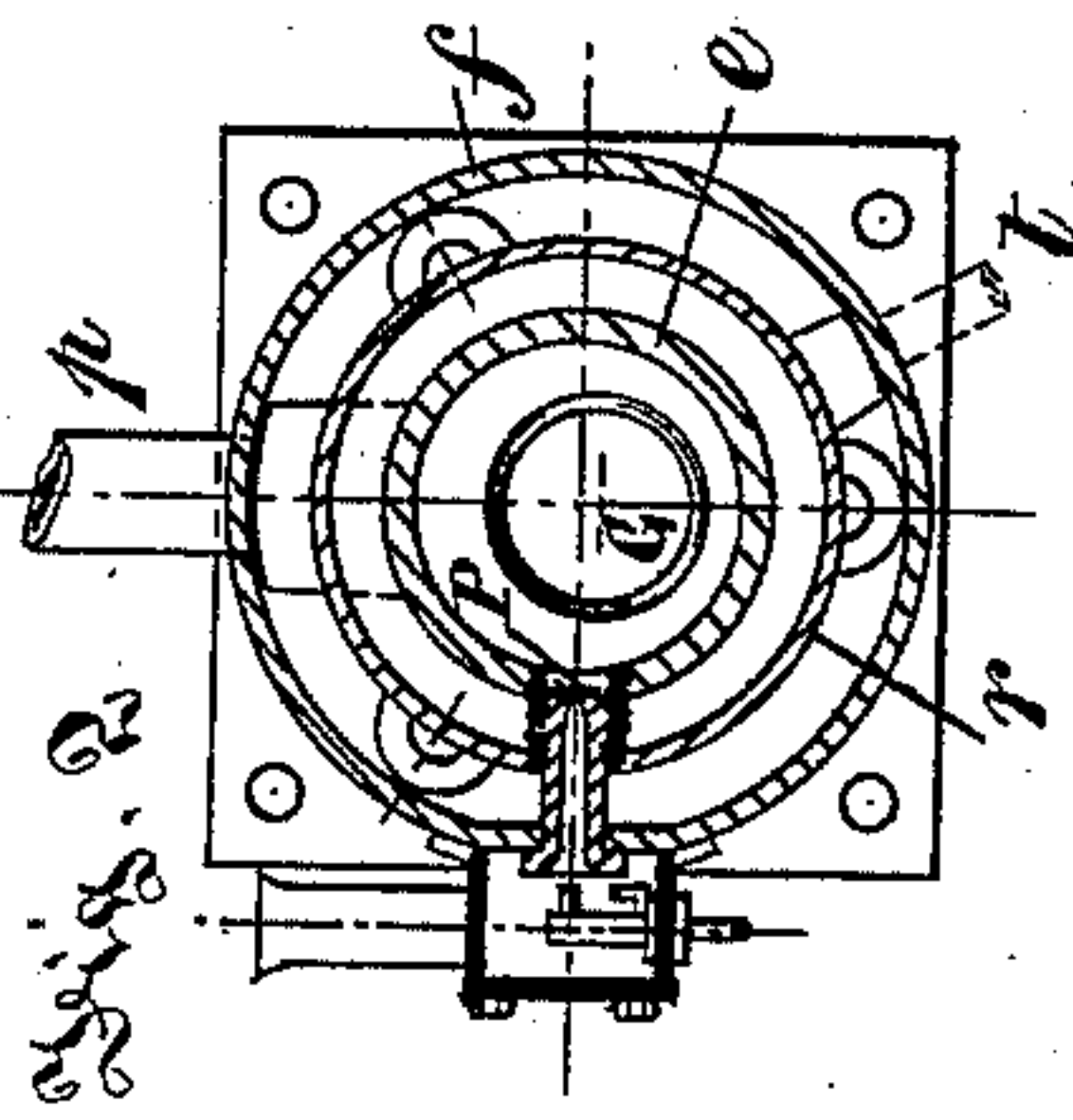
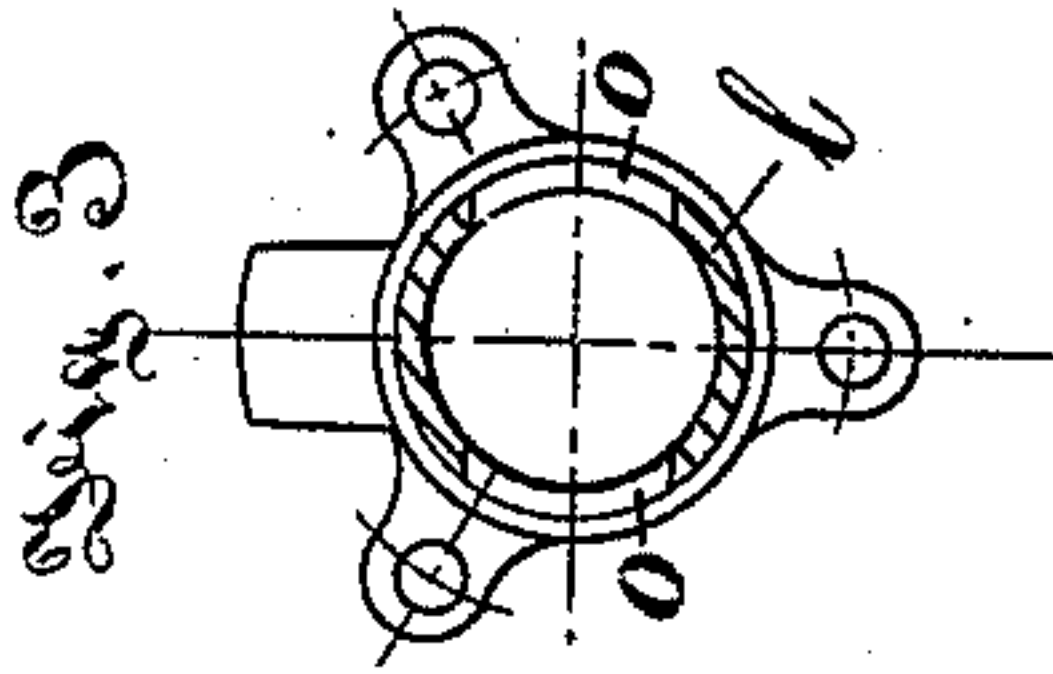
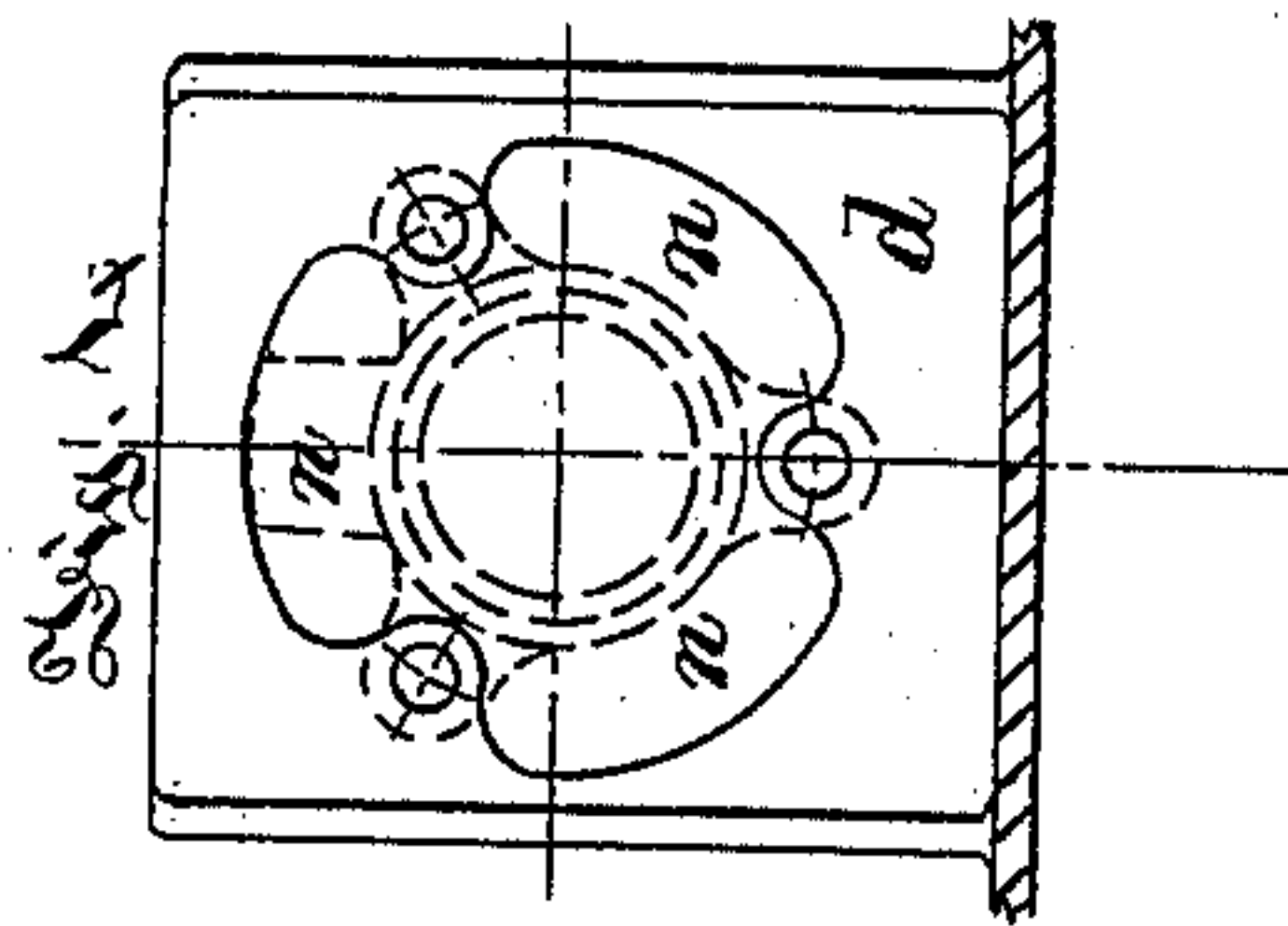
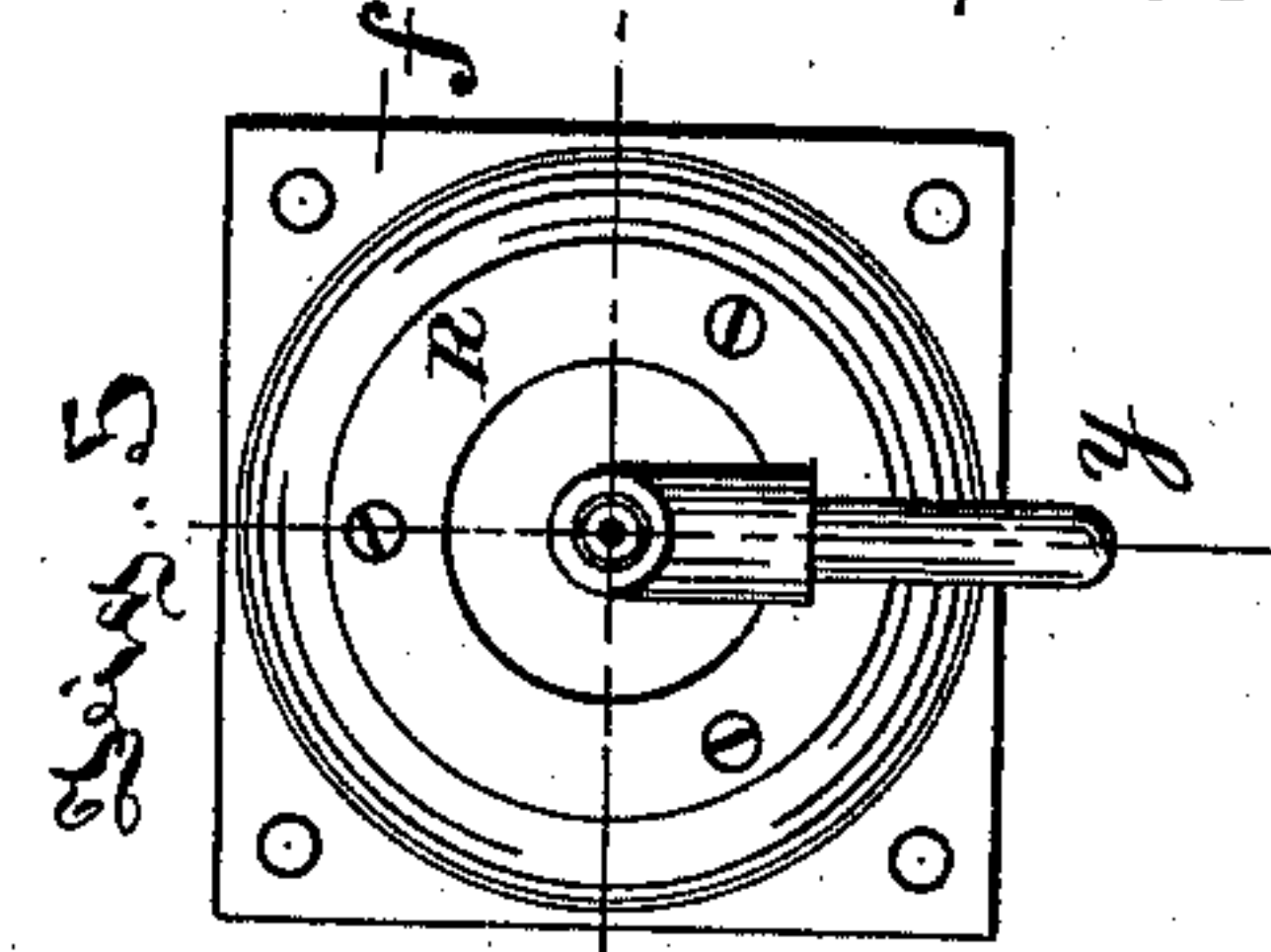
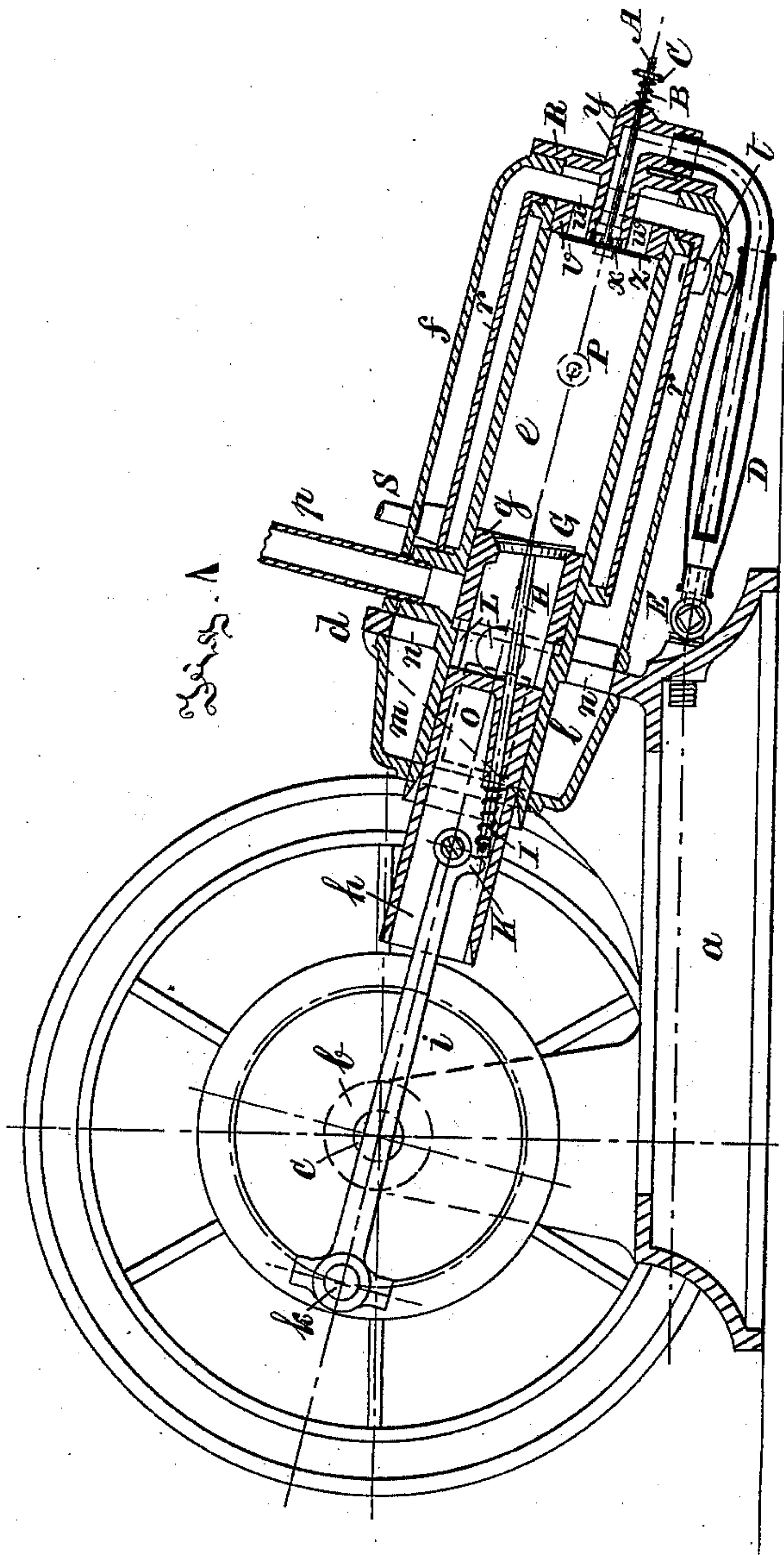
2 Sheets—Sheet 1.

E. EDWARDS.

GAS ENGINE.

No. 300,453.

Patented June 17, 1884.



Witnesses:
Chas. R. Abell
M. Chaffee

Inventor:
Edmund Edwards.
By John H. Halsted & Son
his Atty.

(No Model.)

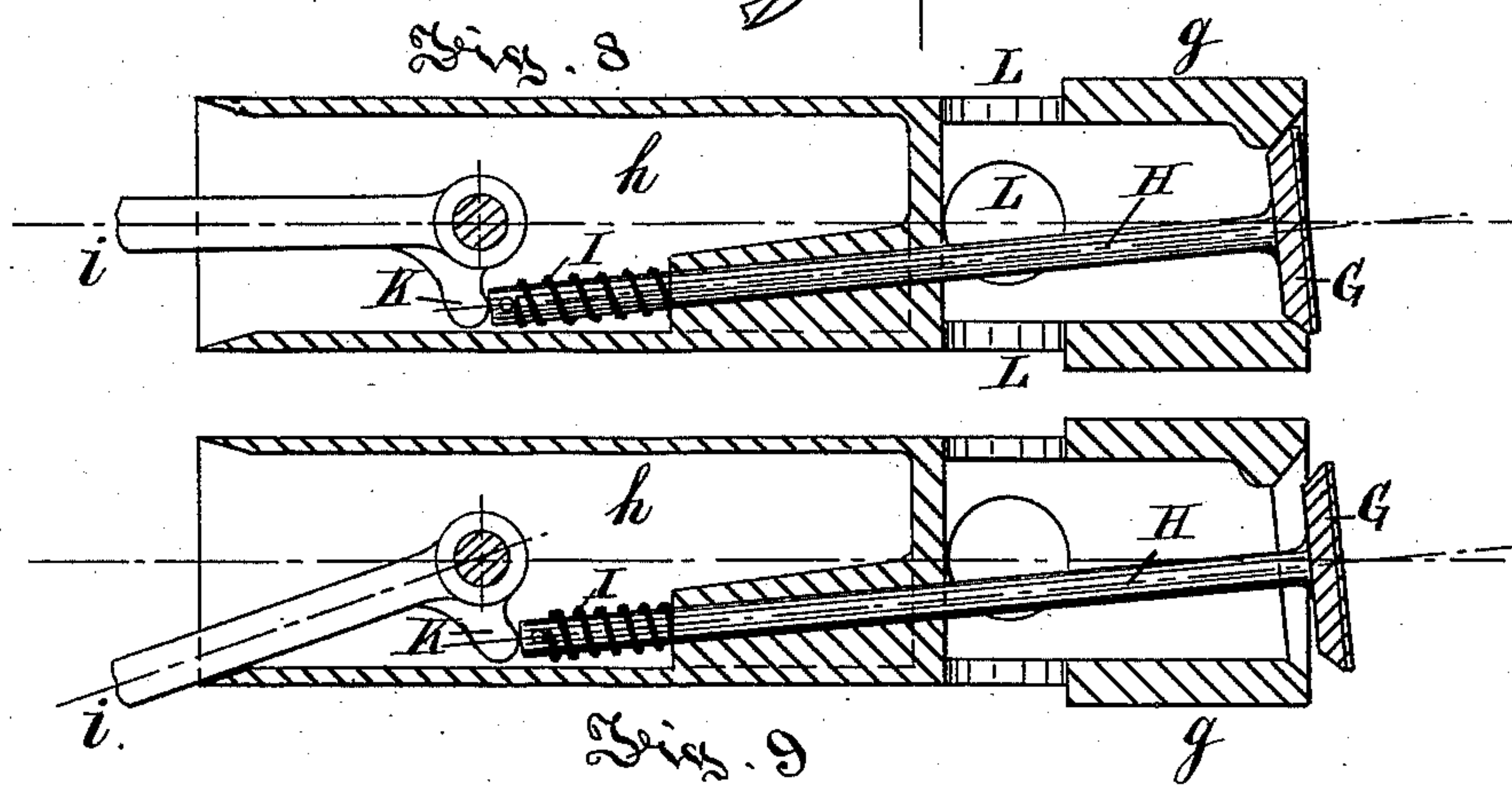
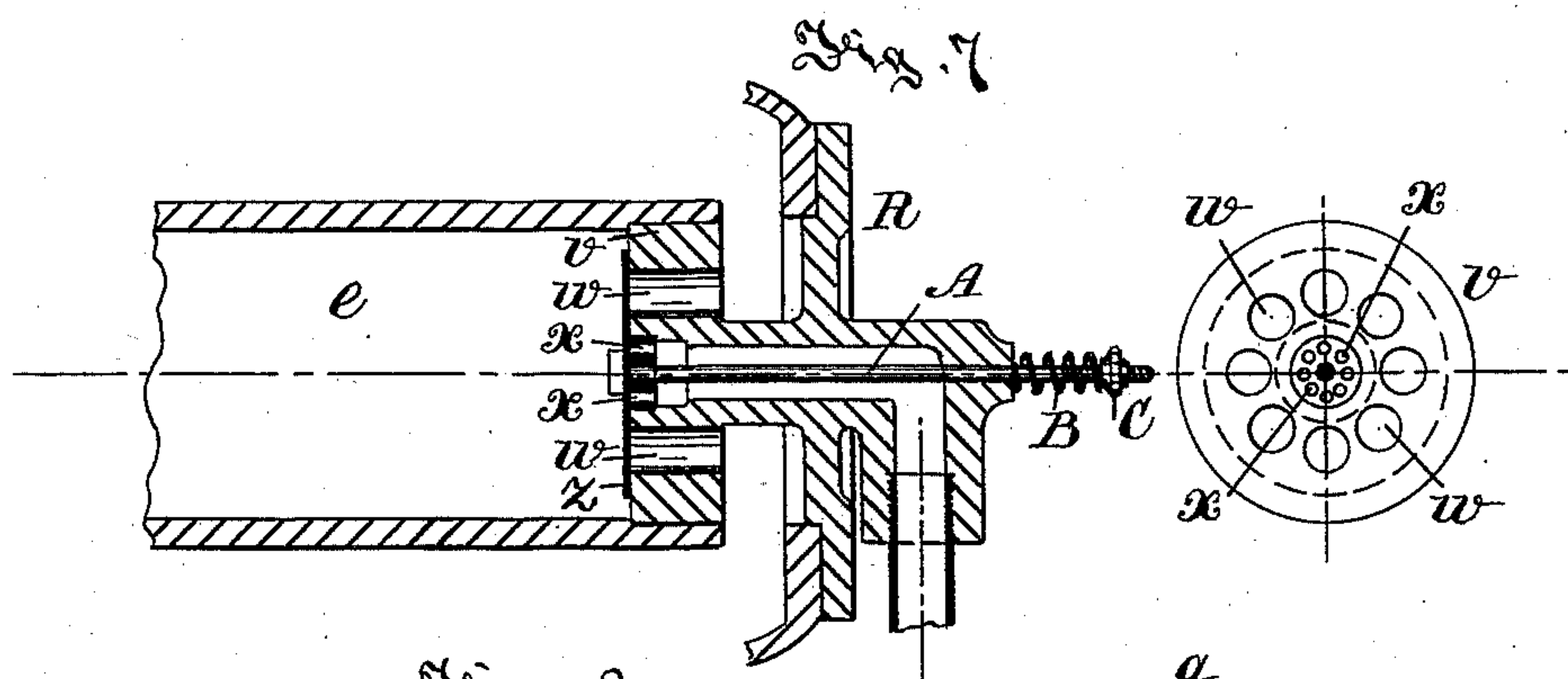
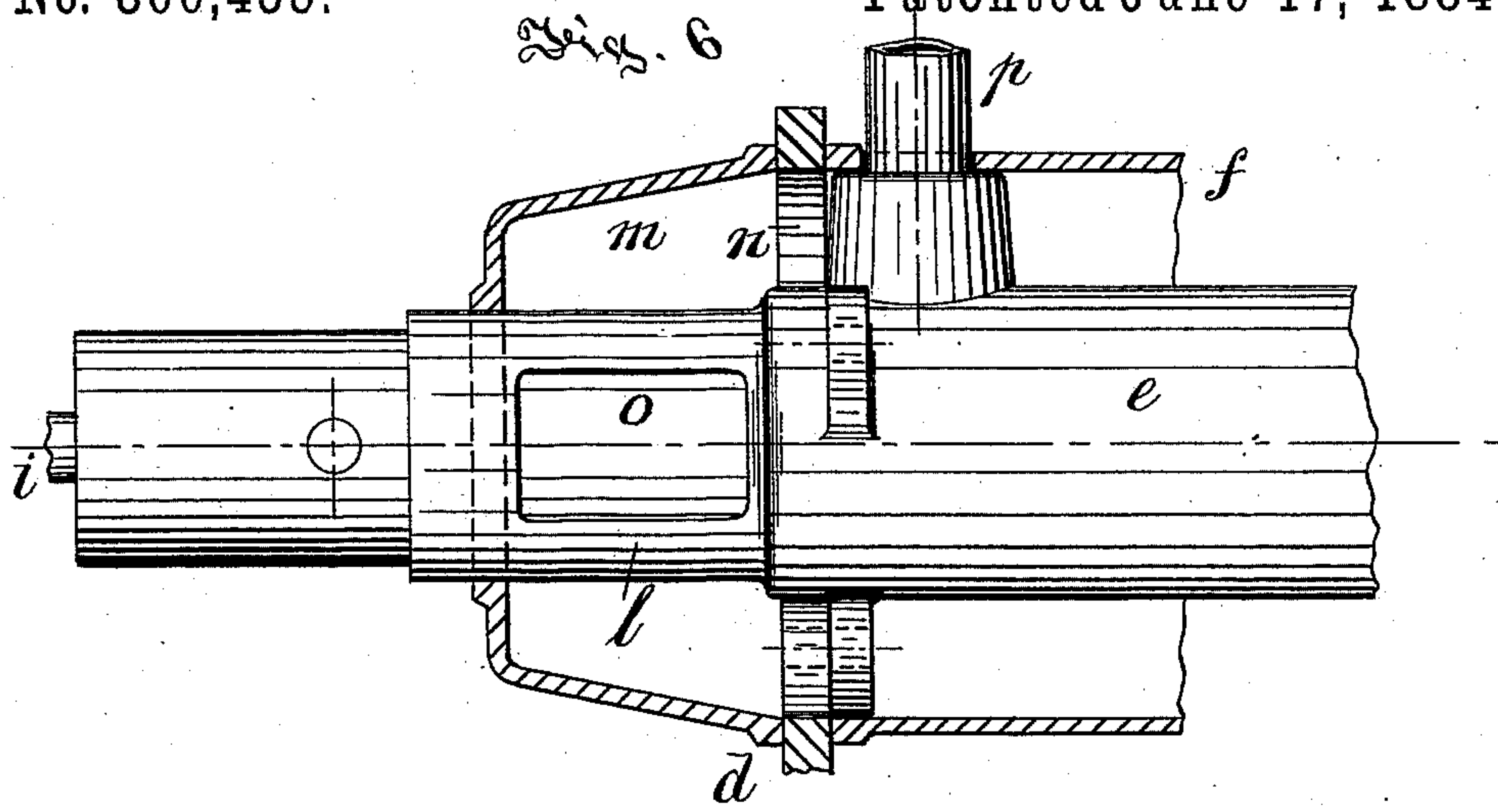
2 Sheets—Sheet 2.

E. EDWARDS.

GAS ENGINE.

No. 300,453.

Patented June 17, 1884.



Witnesses:
Chas. R. Abell
W. B. Chaffee

Inventor:
Edmund Edwards.
By
John J. Halsted & Son
his attys

UNITED STATES PATENT OFFICE.

EDMUND EDWARDS, OF 40 SOUTHAMPTON BUILDINGS, COUNTY OF MIDDLESEX, ENGLAND.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 300,453, dated June 17, 1884.

Application filed October 11, 1883. (No model.) Patented in England February 20, 1880, No. 760, and April 23, 1881, No. 1,765; in France August 19, 1880, No. 133,326; in Belgium August 20, 1880, No. 52,371, and in Germany August 25, 1880, No. 14,262.

To all whom it may concern:

Be it known that I, EDMUND EDWARDS, a subject of the Queen of Great Britain, residing at 40 Southampton Buildings, in the county of Middlesex, 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in gas-engines, in which a mixture of air and inflammable gas or vapor is drawn into a cylinder during the first part of the stroke of a piston therein, the mixture being then exploded, and the piston being forced forward during the remainder of its stroke by the expansion of the air and gas, the return-stroke of the piston and the expulsion of the remaining air and gas being effected by the momentum of a fly-wheel.

The objects of my improvements are, first, to provide a self-acting valve through which the air and gas are admitted in regulated quantities during the first part of the out-stroke of the piston; second, to provide and operate an exhaust-valve for the discharge of the hot air and gas during the return-stroke of the piston; third, to keep the cylinder cool; and, fourth, to prevent or lessen the noise of the explosions. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of the entire engine. Fig. 2 is a transverse section through the cylinder and casings. Fig. 3 is a transverse section through the piston-rod guide. Fig. 4 is a front view of the plate to which the cylinder is attached. Fig. 5 is a view from behind of the cylinder, air-casing, and gas-admission pipe. Fig. 6 is a longitudinal section, on a larger scale, of the air-casing, showing the cylinder and the openings through which air is admitted and cut off. Fig. 7 is a longitudinal section and front view of the admission-valve for air and gas, and Figs. 8 and

9 are longitudinal sections of the pistons and exhaust-valve, showing the connecting-rod and valve in different positions.

Similar letters of reference refer to similar parts throughout the several figures.

a is the foundation-plate of the engine, having the bearing *b*, in which the crank-shaft *c* revolves.

d is an inclined plate upon the foundation *a*, to which the cylinder *e* and casing *f* are bolted.

g is a piston working in the cylinder *e*, and having a hollow rod or trunk, *h*, to which is jointed the connecting-rod *i*, which drives the crank-pin *k*. The guide *l* fits upon the hollow trunk *h*, and is itself surrounded by the air-casing *m*, which communicates with the casing *f* through openings *n n* in the inclined plate *d*. The guide *l* has openings *o o*, through which air enters the casing *m* when the hollow trunk *h* is at the inner end of its stroke.

p is the exhaust-pipe, and *r* is a casing round the cylinder *e*, through which water may be made to circulate by pipes at *s t*. The valve-seat *v* fits into the cylinder *e*, and has holes *w* for the admission of air, and *x* for the admission of gas through the central pipe, *y*.

The valve *z* consists of a disk of metal covering these holes and guided by a spindle, *A*, the outer end of which is fitted with a metal or india-rubber spring at *B* and a regulating-nut, *C*. The gas-pipe *y* is shown supplied from a flexible bag, *D*, the supply to which from any convenient source is regulated by a cock or valve at *E*.

The piston *g* contains a disk exhaust-valve, *G*, the spindle *H* of which is fitted with a closing-spring, *I*, and the end of the spindle is pressed down during the inner stroke of the piston by a tail-piece, *K*, on the inner end of the connecting-rod *i*. Holes *L* open from the hollow piston above the exhaust-valve *G* into the cylinder, round the hollow trunk *h*, and thence to the exhaust-pipe *p*. At or near one-third of the stroke of the piston a firing-valve, *P*, is arranged, having an inlet hanging valve of the usual kind, through which a flame burning outside (preferably in a "Bunsen" burner) is drawn when the valve is uncovered by the piston *g*. The outer end of the casing *f* is closed by a cover, *R*, to which the

valve-seat *v* and gas-inlet pipe *y* are connected.

The operation of the engine is as follows: The piston *g* being at the inner end of its stroke, the crank is turned round in the direction of the arrow, and the piston draws air in through the holes *w* and gas through the holes *x*, the two mixing as they pass under the inlet-valve *z*. When the piston has advanced far enough to uncover the firing-valve *P*, Figs. 1 and 2, the flame is drawn in and the inflammable mixture exploded, the expansion of the air and gas closing the inlet-valve *z*, and carrying the piston to the end of its stroke. The momentum of the fly-wheel then carries the piston back through its return-stroke, during which the tail-piece *K* presses the spindle *H* and opens the exhaust-valve *G*, through which the expanded air and gas escape to the exhaust-pipe *p*. When the piston arrives at the inner end of its stroke, the exhaust-valve *G* is closed by the spring *I*, and a fresh supply of air and gas is drawn in through the inlet-valve seat *v* as the piston again commences its outer stroke. In order to keep the cylinder *e* sufficiently cool, whether the water-casing at *r* be used or not, the whole supply of air is drawn from the front end of the cylinder through the openings *n n*, and thence between the cylinder *e* and the casing *f*, and round the end of the latter to the inlet-valve *v*; and in order to prevent or lessen the noise of the explosions I make the hollow trunk *h* of such length that its front edge closes the openings in the guide *l*, through which air is drawn into the air-casing *m*, and through the openings *n n*, just before the explosion takes place, the noise of which, therefore, cannot escape. For the same purpose fibrous or porous material—such as mineral or slag wool—may be placed loosely in the space between the cylinder *e* and the casing *f*. A disk of asbestos may be placed between the valve *z* and the seat *v*.

The engine may be made to revolve in the opposite direction to the arrow by turning the piston and connecting-rod round so that the tail-piece upon the latter is above instead of below, and instead of the water-casing *r* radial ribs may be formed upon the cylinder *e*, from which the air passing between them inside the casing *f* absorbs the heat.

I prefer to arrange the cylinder in the inclined position shown in Fig. 1; but it may be fixed in any other convenient position.

A governor of any ordinary kind may be used to regulate the supply of gas to the flexible bag *D*, which I prefer to arrange, as shown in Fig. 1, outside a pipe, *S*, closed at its end, but having holes on its upper side, which are closed by the flexible bag when the desired quantity of gas has been withdrawn.

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

1. In a gas-engine, the combination, with the piston *g*, of the exhaust-valve *G*, tail-piece *K* on the connecting-rod *i*, and the hollow trunk *h*, having holes *L*, substantially as set forth and shown.

2. In a gas-engine, the combination, with the engine-cylinder, of the outer casing, *f*, its cover *R*, air-casing *m*, and the plate *d*, having openings *n n*, substantially as set forth and shown.

3. In a gas-engine, the combination of the engine-cylinder, the outer casing, *f*, the cover *R*, and the openings *n n*, with the openings *o o* in the guide *l*, and the air-casing *m*, substantially as set forth and shown.

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

EDMUND EDWARDS.

Witnesses:

ARTHUR E. EDWARDS,
W. R. EDWARDS.