No. 694,735. Patented Mar. 4, 1902.

S. A. FREEMAN & C. E. THROOP.

GAS ENGINE.

(Application filed Oct. 20, 1900.)

(No Model.) 2 Sheets—Sheet 1.

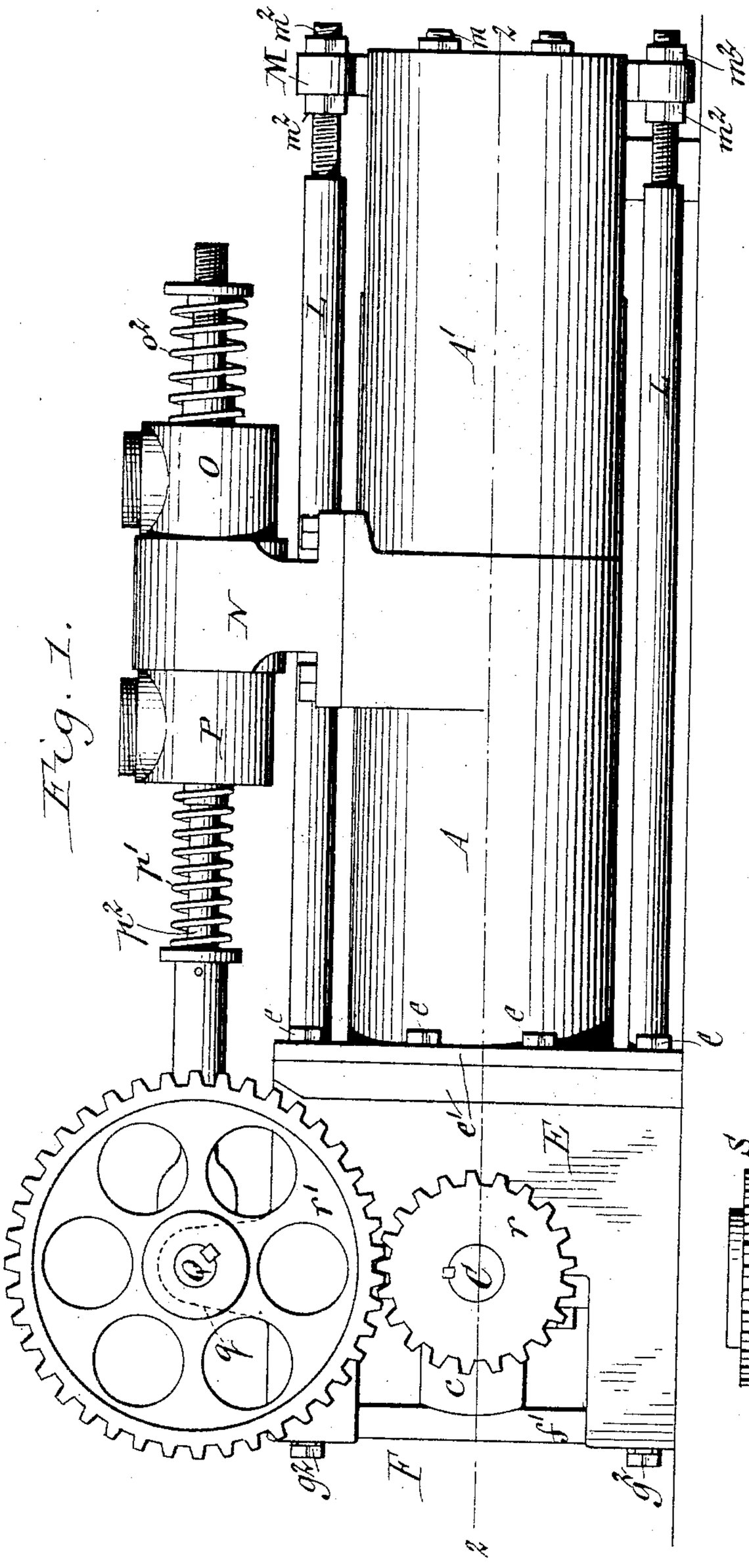

Fig. 1.

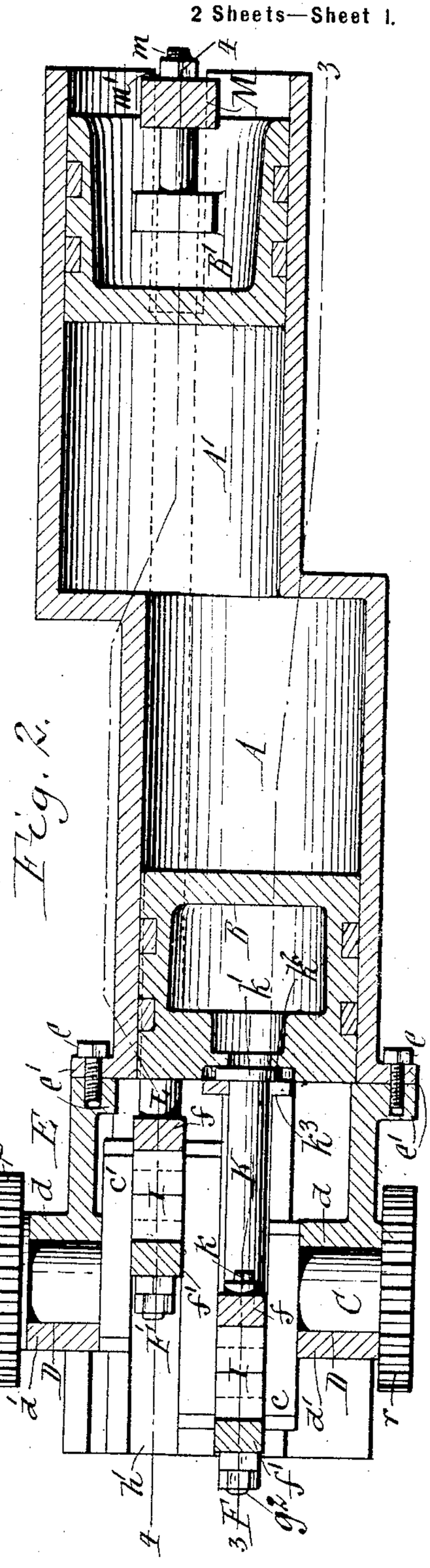

Fig. 2.

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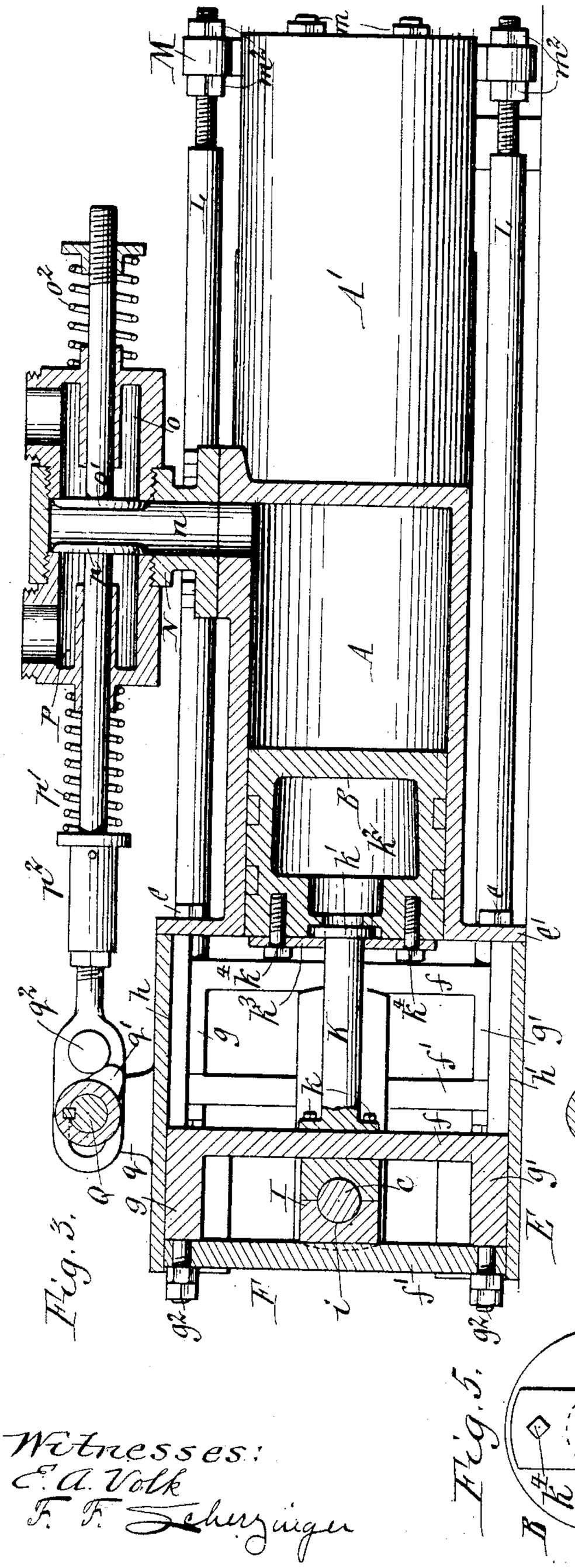

Fig. 3.

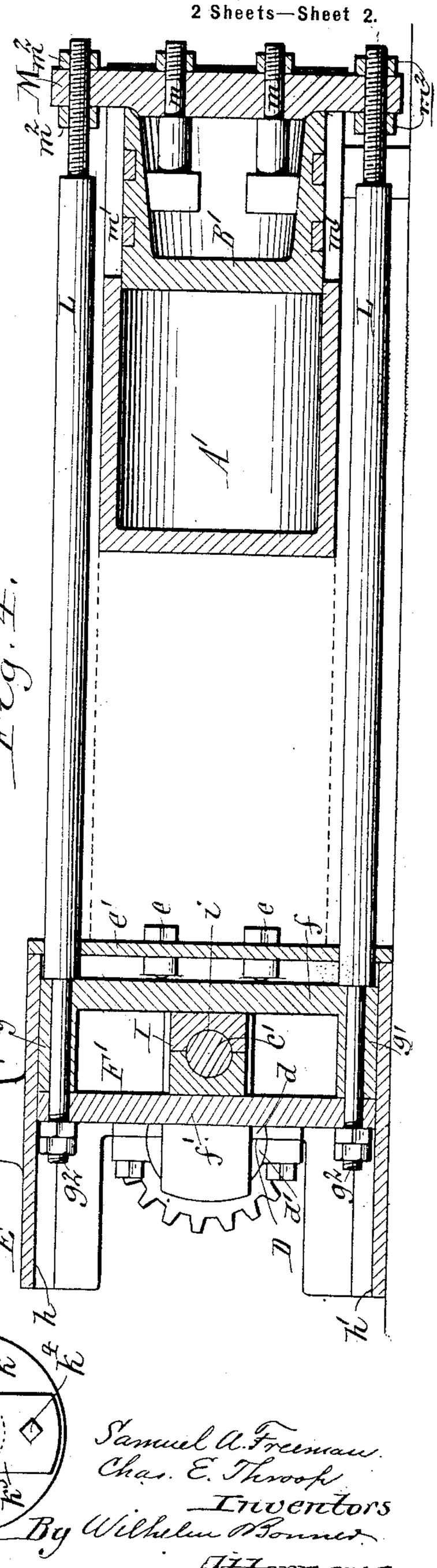

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

SAMUEL ARTHUR FREEMAN AND CHARLES EDMUND THROOP, OF BUFFALO, NEW YORK.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 694,735, dated March 4, 1902.

Application filed October 20, 1900. Serial No. 33,666. (No model.)

To all whom it may concern:

Be it known that we, SAMUEL ARTHUR FREEMAN and CHARLES EDMUND THROOP, citizens of the United States, and residents of Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to a gas-engine in which the firing ends of two cylinders are connected so that the two pistons in the cylinders are actuated by the explosion of one charge of fuel.

The object of our invention is the production of a gas-engine of this character which is comparatively simple and compact in construction and which is not liable to get out of order.

To that end our invention consists principally in arranging a crank-shaft adjacent to the outer end of one of the cylinders and connecting the pistons directly with sliding yokes mounted on the cranks of the shaft.

Our invention consists, further, in several details of construction.

In the accompanying drawings, consisting of two sheets, Figure 1 is a side elevation of a gas-engine embodying our improvements. Fig. 2 is a horizontal section thereof in line 2 2, Fig. 1. Figs. 3 and 4 are vertical longitudinal sections in lines 3 3 and 4 4, Fig. 2. Fig. 5 is a front view of one of the pistons with its rod in section.

Like letters of reference refer to like parts in the several figures.

A A′ represent two cylinders which are arranged end to end and have their inner firing or explosion ends communicating with each other. These cylinders are preferably arranged out of line or offset slightly, but are parallel, as shown in Fig. 2.

B B′ represent the pistons which are arranged in the cylinders and which may be of any suitable construction.

C represents a transverse crank-shaft arranged adjacent to the outer end of the cylinder A and provided with two diametrically opposite cranks *c c′*, which are arranged in line with the pistons B B′, respectively. This shaft is journaled in bearings D D, which are arranged on a frame E, secured to the outer end of the cylinder A by bolts *e e*, passing through lugs or flanges *e′* on the cylinder and frame.

Each of the bearings D is preferably divided and consists of a stationary inner section *d*, which is formed on the frame E, and a detachable outer section *d′*, which is secured to the inner section by bolts or otherwise, thereby permitting the shaft to be conveniently inserted or removed from the frame.

F F′ represent two sliding yokes which are reciprocated by the pistons and which are connected with the cranks, so as to impart a rotary movement to the shaft. Each of these yokes consists of inner and outer upright bars *f f′*, which are separated, and horizontal upper and lower cross-bars *g g′*, which are preferably formed integrally with the inner vertical bar and connected by bolts g^2 with the outer vertical bar. The upper and lower cross-bars of each yoke are guided in ways *h h′*, arranged on the upper and lower sides of the frame E parallel with the line of movement of the pistons. Each of the cranks passes through one of the yokes and is slidably connected therewith by a box or slide I, which slides up and down between the inner and outer bars *f f′* of the yoke and is provided with a bearing *i*, in which the wrist of the crank turns. The slide is divided into two sections for convenience in assembling the parts, and these sections are confined within the yoke by the arms of the crank on opposite sides of the yoke.

The movement of the piston B is transmitted to the crank-shaft by a longitudinal connecting-rod K. This rod is secured to the inner or rear bar of the yoke F by bolts *k*, passing through ears on the connecting-rod. The rear end of the latter is connected with the piston B by a collar *k′*, arranged on its rear end and bearing against a seat k^2 on the outer side of the piston, and a notched plate k^3, secured to the piston by screws k^4 and bearing against the outer side of said collar, as shown in Figs. 3 and 5.

L L represent two connecting-rods, whereby the rear piston B′ is connected with the yoke F′. These rods are arranged lengthwise above and below the cylinders and are connected at their front ends with the yoke F′, preferably

by forming them in one piece with the bolts g^2, which connect the front and rear bars thereof, as shown in Fig. 4.

M represents a cross-bar, whereby the rear ends of the connecting-rods L L are connected with the rear piston. This cross-bar is secured vertically to the outer end of the rear piston by bolts m and projects with its upper and lower ends through slots m', formed lengthwise in the upper and lower parts of the rear cylinder, at the outer end thereof. Each of the connecting-rods L is provided with an externally-screw-threaded rear end, which passes through an opening in the adjacent end of the cross-bar M and is secured thereto by screw-nuts m^2, applied to the threaded part of the connecting-rod on opposite sides of the cross-bar.

During the operation of the engine the pistons reciprocate toward and from each other in their respective cylinders and impart a rotary movement to the shaft by means of the rods and yokes which connect the pistons with the cranks of the shaft. This means of connecting the pistons with the crank-shaft is very compact and simple in construction and renders the engine especially desirable for motor-cycles or for other purposes where economy in space and weight are important factors.

The pistons of both cylinders are driven forward with a working stroke by the explosion of one charge of fuel, and the products of combustion in both cylinders are carried off through the same exhaust by connecting the fuel-supply and exhaust with the space between the inner ends of both cylinders. The means for controlling the fuel-supply and the exhaust of the engine may be of any suitable construction, that shown in the drawings, Figs. 1 and 3, being constructed as follows:

N represents a valve-chest arranged above the cylinders and provided with a valve-chamber n, which opens into the space at the inner or firing ends of the cylinders. O is a fuel-chamber connected with a gas and air supply and opening into the rear side of the valve-chamber. The fuel-supply chamber is normally closed by an inwardly-opening fuel-valve o', which is held against a seat at the outlet of the fuel-chamber by a spring o^2, bearing against the stem of the valve.

P represents an exhaust-chamber connected with an exhaust-pipe and opening into the front side of the valve-chamber. The exhaust-chamber is normally closed by an exhaust-valve p, which is held against a seat at the inlet of the exhaust-chamber by a spring p', bearing against the forwardly-projecting exhaust-valve stem p^2.

Q represents a cam-shaft which is journaled transversely in bearings q on the upper side of the supporting-frame. This shaft is provided with a cam q', which engages with a pin or roller q^2 on the exhaust-valve rod and which shifts the latter for opening the exhaust-valve once during every rotation of the cam-shaft. The cam-shaft is rotated once during every two rotations of the crank-shaft by a gear-pinion r, secured to one end of the crank-shaft and meshing with a gear-wheel r' on the cam-shaft.

During each cycle of operations the pistons during their outward or forward movement draw a charge of fuel into the inner ends of the cylinders and compress the same during the subsequent inward or backward stroke. At the end of this inward or backward stroke the compressed charge of fuel is ignited by an igniter of any suitable construction, whereby the charge of fuel is exploded and both pistons are driven forwardly with a working stroke. During the next-following backward stroke the exhaust is opened and the spent gases are expelled from the cylinders.

For the purpose of permitting the amount of compression of the fuel to be regulated the stroke of one or both pistons may be adjusted so as to vary the distance which the pistons approach each other at the end of their inward or compression stroke. The preferred means for accomplishing this adjustment consists in loosening the screw-nuts m^2 on the rods L on one side of the cross-bar M and tightening the screw-nuts m^2 on the other side thereof, whereby the rear piston B′ is shifted relatively to its cylinder and to the front piston B and the amount of compression is varied.

The crank-shaft is provided with a gear-wheel S or other means for transmitting the power of the engine to the parts to be driven.

We claim as our invention—

1. In a gas-engine, the combination with two opposing cylinders arranged end to end and having their adjacent firing ends connected and the pistons arranged in the cylinders, of a crank-shaft at the outer end of one cylinder provided with two diametrically opposite cranks, two reciprocating yokes which are arranged side by side and receive said cranks, a connecting-rod entering one of the cylinders and connecting the outer end of the piston therein with one of said yokes, and two connecting-rods arranged lengthwise on opposite sides of the other cylinder and connecting the piston therein with the other yoke, substantially as set forth.

2. In a gas-engine, the combination with two opposing cylinders arranged end to end and having their adjacent firing ends connected and the pistons arranged in the cylinders, of a crank-shaft at the outer end of one cylinder provided with two diametrically opposite cranks, two reciprocating yokes which are arranged side by side and receive said cranks, a connecting-rod entering one of said cylinders and connecting the piston therein with one of said yokes, a cross-bar projecting through longitudinal slots in the other cylinder and connected with the piston therein, and connecting-rods connecting the outer ends of the cross-bar with the other yoke, substantially as set forth.

3. In a gas-engine, the combination with two opposing cylinders arranged end to end and having their adjacent firing ends connected, and the pistons arranged in the cylinders, of a crank-shaft at the outer end of one cylinder provided with two diametrically opposite cranks, two reciprocating yokes which are arranged side by side and receive said cranks, a rod connecting one of said pistons with one of said yokes, a cross-bar connected with the other piston, connecting-rods secured to the other yoke and having threaded portions which are arranged in openings in said cross-bar, and screw-nuts arranged on the threaded portions of said last-mentioned rods on opposite sides of said cross-bar, substantially as set forth.

4. In a gas-engine, the combination with two opposing cylinders arranged end to end, one cylinder being offset laterally with respect to the other, and pistons in said cylinders, of a crank-shaft arranged at the outer end of one cylinder and provided with two cranks, and rods connecting one crank with one piston and the other crank with the other piston, whereby the cranks and connecting-rods work in parallel planes close together, substantially as set forth.

Witness our hands this 6th day of September, 1900.

SAMUEL ARTHUR FREEMAN.
CHARLES EDMUND THROOP.

Witnesses:
THEO. L. POPP,
HENRY L. DECK.