No. 632,913. Patented Sept. 12, 1899.

F. BURGER.

GAS ENGINE.

(Application filed June 18, 1897.)

(No Model.) 3 Sheets—Sheet 1.

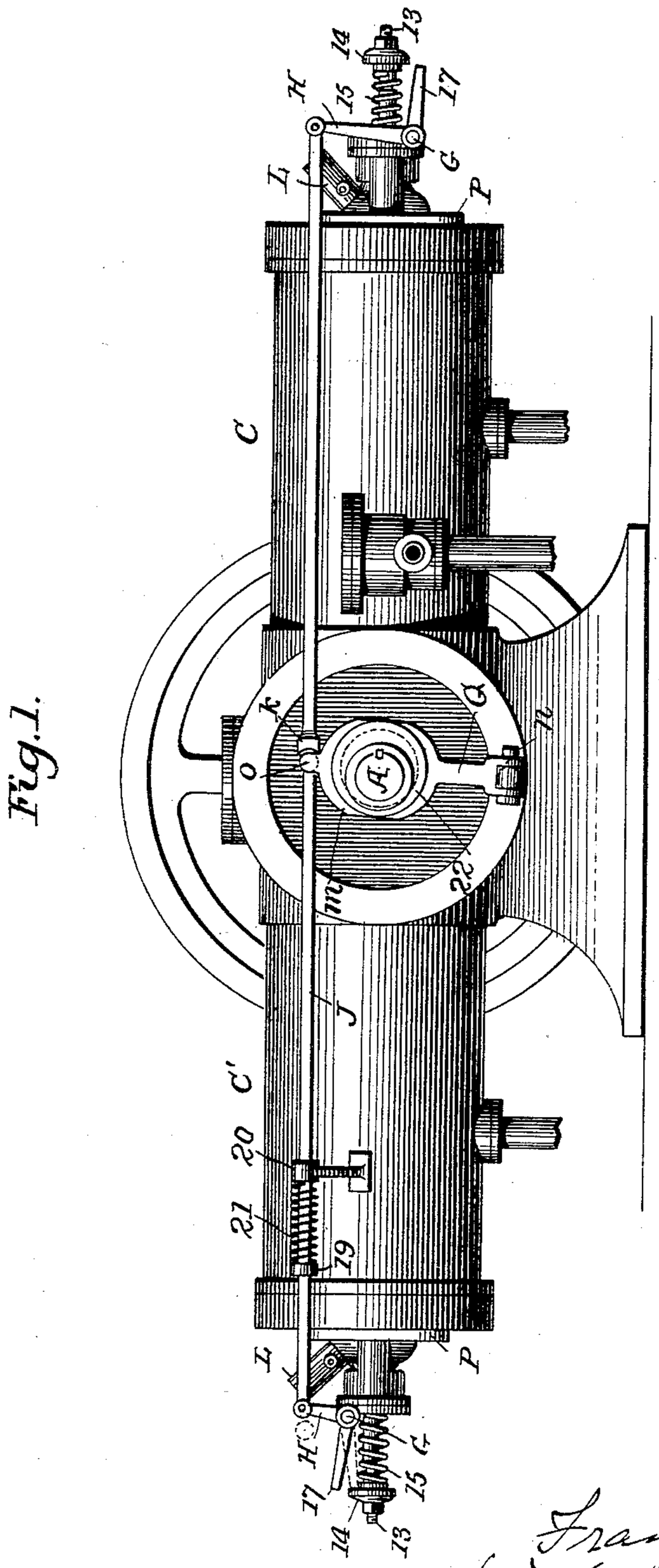


Fig. 1.

Witnesses
J. G. Hinkel
Fawcett Stevens

Inventor
Franz Burger
by Foster Freeman
Attorneys

No. 632,913. Patented Sept. 12, 1899.

F. BURGER.

GAS ENGINE.

(Application filed June 18, 1897.)

(No Model.) 3 Sheets—Sheet 2.

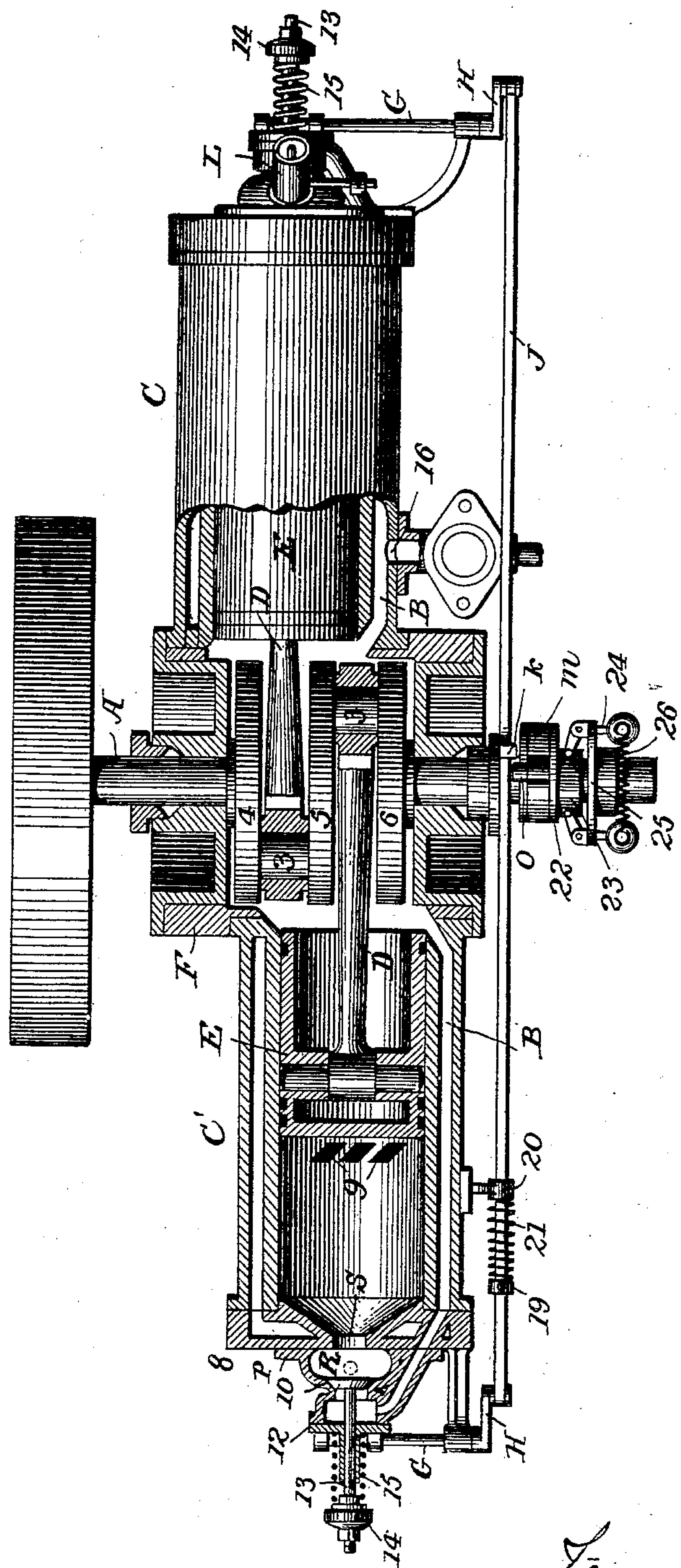


Fig. 2.

Witnesses
J. G. Hinkel
Francis D. Stevens

Inventor
Franz Burger
by Foster Freeman
Attorneys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 632,913.

Patented Sept. 12, 1899.

F. BURGER.

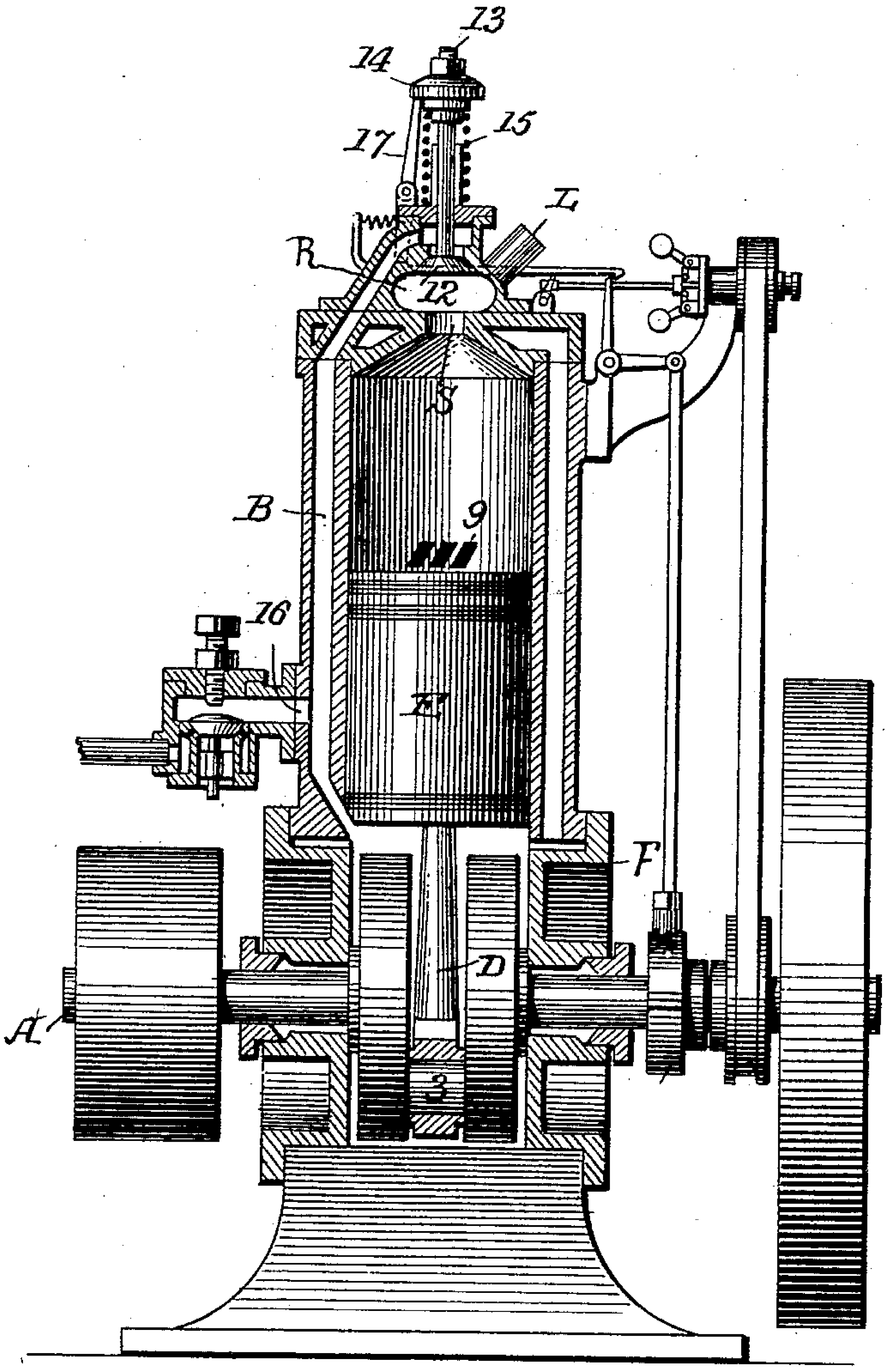
GAS ENGINE.

(Application filed June 18. 1897.)

(No Model.)

3 Sheets—Sheet 3.

Fig. 3.



Witnesses
J. G. Hinkel
[signature]

Inventor
Franz Burger
by Foster Freeman
Attorneys

UNITED STATES PATENT OFFICE.

FRANZ BURGER, OF FORT WAYNE, INDIANA, ASSIGNOR OF THREE-FOURTHS TO HENRY M. WILLIAMS, OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 632,913, dated September 12, 1899.

Application filed June 18, 1897. Serial No. 641,350. (No model.)

To all whom it may concern:

Be it known that I, FRANZ BURGER, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to that class of gas-engines in which the explosion of a charge is the means of propelling the piston and rotating the crank-shaft and in which the charge is under pressure while admitted to the cylinder; and my invention consists in an engine constructed so as to overcome the detrimental effects of sharp explosions, prevent premature ignition of the charges, and secure other advantages, as fully set forth hereinafter and as illustrated in the accompanying drawings, in which—

Figure 1 is a side view of a duplex gas-engine embodying my improvement, and Fig. 2 a longitudinal plan in part section. Fig. 3 shows such of my improvements as may be used in a single-cylinder engine.

A serious objection to gas-engines is the shock resulting from the explosion of the charge when the crank is on the dead-center. I have discovered that I can correct this by combining two engines connected to the crank-shaft on opposite sides of the latter and exploding both charges at the same time, so that the effect of one explosion neutralizes that of the other.

It is desirable, in order to save room and render the engine compact, to have the cylinders on the same horizontal plane with the shaft; but this cannot be done when it is necessary to have both pistons at the ends of their outstrokes at the same time and yet arrange the engines in line. I secure the desired result, however, by placing the two engines on the same plane at opposite sides of the shaft, but the engines connected with two diametrically-arranged crank-pins, so that the two engines are not directly in line with each other. Thus, as shown in Fig. 2, the crank-shaft A has two cranks 3 3, arranged between disks 4 5 6, as shown, the disks 4 6 are connected with different sections of the shaft. Each piston E is connected by a rod D with the opposite crank, so that the pistons alternately recede and approach each other simultaneously. The two sections of the crank-shaft pass through packing-boxes in the detachable heads of a casing F, which incloses the crank-disks 4 5 6 and which communicates with the inner end of each cylinder C C'. The outer end or head S of each cylinder has a somewhat contracted central port S, and about the center of the cylinder are the exhaust-ports 9, communicating with the exhaust-pipe and arranged to be closed and uncovered by the piston, as is common in some classes of gas-engines.

An objectionable feature incident to ordinary constructions of gas-engines is the tendency to premature ignition of the charge resulting from the introduction of the fresh charge into the cylinder, projecting the fresh charge centrally among the heated gases, some portions of which are either ignited or so hot as to ignite the new charge before the piston reaches the end of its back stroke. I have found that this result may be overcome by providing a comparatively restricted inlet-port S at the end of the cylinder and at the rear of the latter an explosion-chamber R, so that when the charge under pressure passes from the restricted inlet-port 10 into the explosion-chamber at a high rate of speed it will have an opportunity to expand and its speed will be reduced before it enters the cylinder. As a result it is not projected forward through the center of the hot gases prior to being exploded, but remains and fills the explosion-chamber, flowing out slowly until the piston reaches the end of its outstroke, when the charge is exploded in the explosion-chamber by means of the igniter L, of any suitable character, the said igniter communicating with the explosion-chamber, so that the flame will ignite the whole mass of the fresh charge in the explosion-chamber instantaneously. I have found that by this means I can secure a more rapid combustion, insure an ignition of every charge, and obtain more power from a weaker mixture than heretofore. While these results may be effected with different constructions, I prefer to form the explosion-chamber in a casing T, bolted to the head of the cylinder and provided with an inlet-port 10, to which is adapted a valve 12, having a

stem 13 extending through the end of the casing and carrying an adjustable collar 14, against which bears a spring 15. It will be understood that normally the valve will rise and permit the inflow of the new charge as the piston moves inward, that the charge is compressed in both cylinders as the pistons move outward, and the explosions take place in both cylinders when the pistons are at the limits of their outward strokes.

While the gaseous mixture may be mixed in and forced from any suitable chamber, I prefer to make use of the casing F as a mixing-chamber and compressing-chamber. The inlet-port 16 is supplied with the mixture of gas and air in any suitable manner, and when the two pistons move outward the mixture is drawn through said port into the casing F and into the inner ends of the cylinders. When the pistons next move inward toward each other, the gases are compressed, a check-valve in the inlet-casing *a* prevents any back-flow through said casing, and the compressed gas is forced through channels B B in the cylinders into the space at the rear of each valve 12.

Any suitable governing appliances may be employed to regulate the speed; but I prefer to lock each valve 12 to its seat, so as to prevent the introduction of any fresh charges as soon as the engine exceeds its normal speed. This I effect by means of a locking-arm 17 upon a rock-shaft G, turning in bearings upon the casing P, the arm 17 when in its horizontal position presenting its end in front of the sleeve 14 and holding the valve 12 to its seat. From each rock-shaft G extends an arm H, and these two arms are connected together by a connecting-rod J, and between a collar 19 on the said rod and a guide-bracket 20 intervenes a spring 21, which tends to throw the connecting-rod to the left and to bring each arm 17 into a position to lock the adjacent valve in place. I provide means, however, whereby the connecting-rod J is reciprocated at each rotation of the shaft A, so as to lift both arms away from the collars when the valves should open, and the governor throws such operating means out of action when the speed is excessive. Thus a lever Q is pivoted at its lower end *n*, so as to swing both laterally and outwardly, and has a yoke *m*, in which turns an eccentric 22 upon the shaft A, whereby the lever Q is reciprocated, and a pin *o* thereof is brought against a pin *k* of the connecting-rod J at each rotation of the shaft A, thereby lifting the arms 17, so as to leave the valves 12 free to move. The yoke *m* is provided with a hub 23, recessed to receive the inner ends of weighted crank-levers 24, pivoted to a cross-piece 25, carried by the shaft A, and connected by a connecting-spring 26. This construction constitutes a governor the weighted arms of which swing outward when the speed is excessive, drawing out the upper end of the lever Q and carrying the pin *o* away from the pin *k*, so that the arms 17 then remain in position to lock the valves 12 in place. While I have described this form of governor, any other suitable governing apparatus that will shift the positions of the locking-arms or locking devices may be employed.

In Fig. 3 I illustrate a single-cylinder engine, with the valve 12, chamber R outside the port S, and valve-operating appliances the same as in the double-cylinder engine. In this case also the crank turns in a casing F and there is a passage B, as before.

Without limiting myself to the precise construction and arrangement of parts shown, I claim—

1. The combination with the cylinder, piston and inlet-port of a gas-engine, of a valve adapted to the said port and having a stem provided with a collar, a locking-arm movable to and from position in front of said collar, means for shifting the position of the said arm at each revolution of the engine-shaft, and a governor and connections for throwing said shifting means out of action when the engine attains undue speed, substantially as set forth.

2. The combination of the two cylinders, valves, and locking-arms, a connecting-rod J connected with said locking-arms, a vibrating lever provided with a projection for contacting with a projection on the connecting-rod, and means for locking said lever on the rotation of the crank-shaft, and a governor for shifting the position of the said lever to throw the said projections in and out of contacting position, substantially as set forth.

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

FRANZ BURGER.

Witnesses:
GEO. D. CRANE,
F. E. ANDERSON.