No. 612,047. Patented Oct. 11, 1898.

L. H. MILLEN.

GAS ENGINE.

(Application filed May 26, 1897.)

(No Model.) 2 Sheets—Sheet 1.

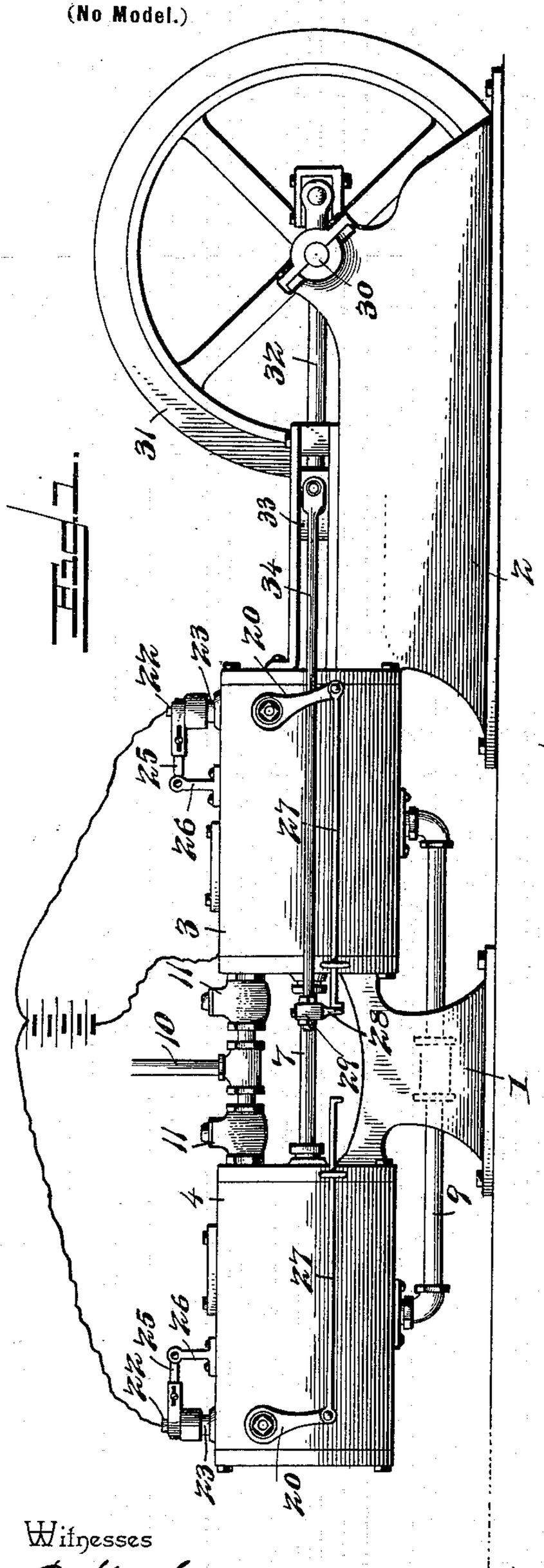

FIG. 1.

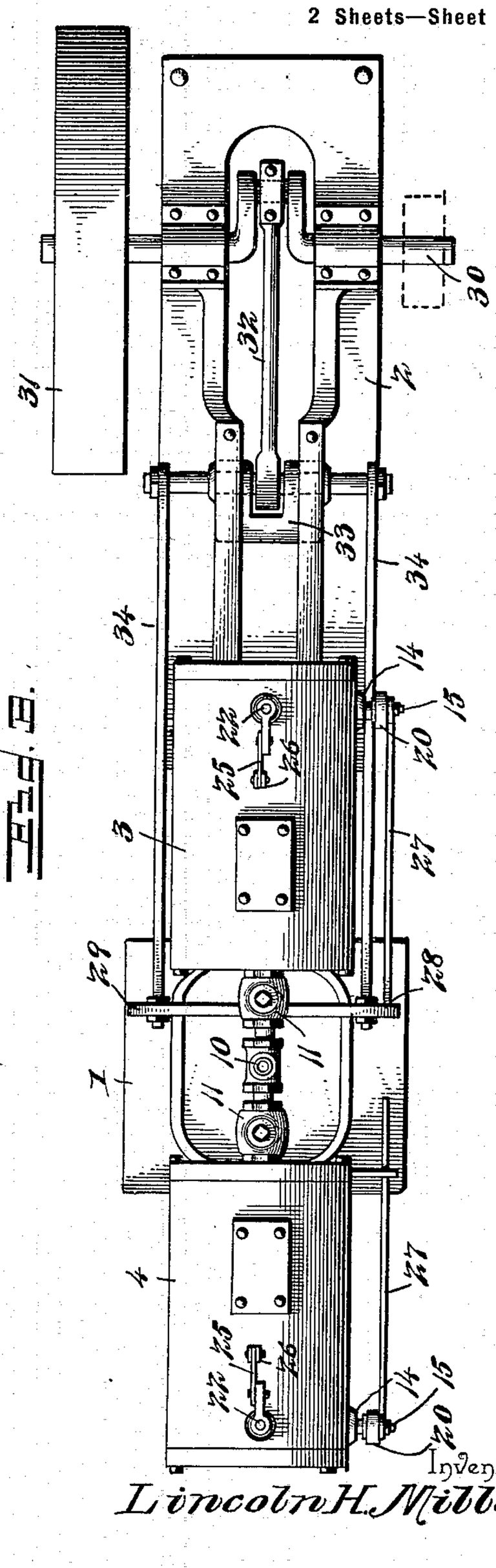

FIG. 2.

Witnesses
E. H. Stuart
V. B. Hillyard.

Inventor
Lincoln H. Millen
By his Attorneys,
C. A. Snow & Co.

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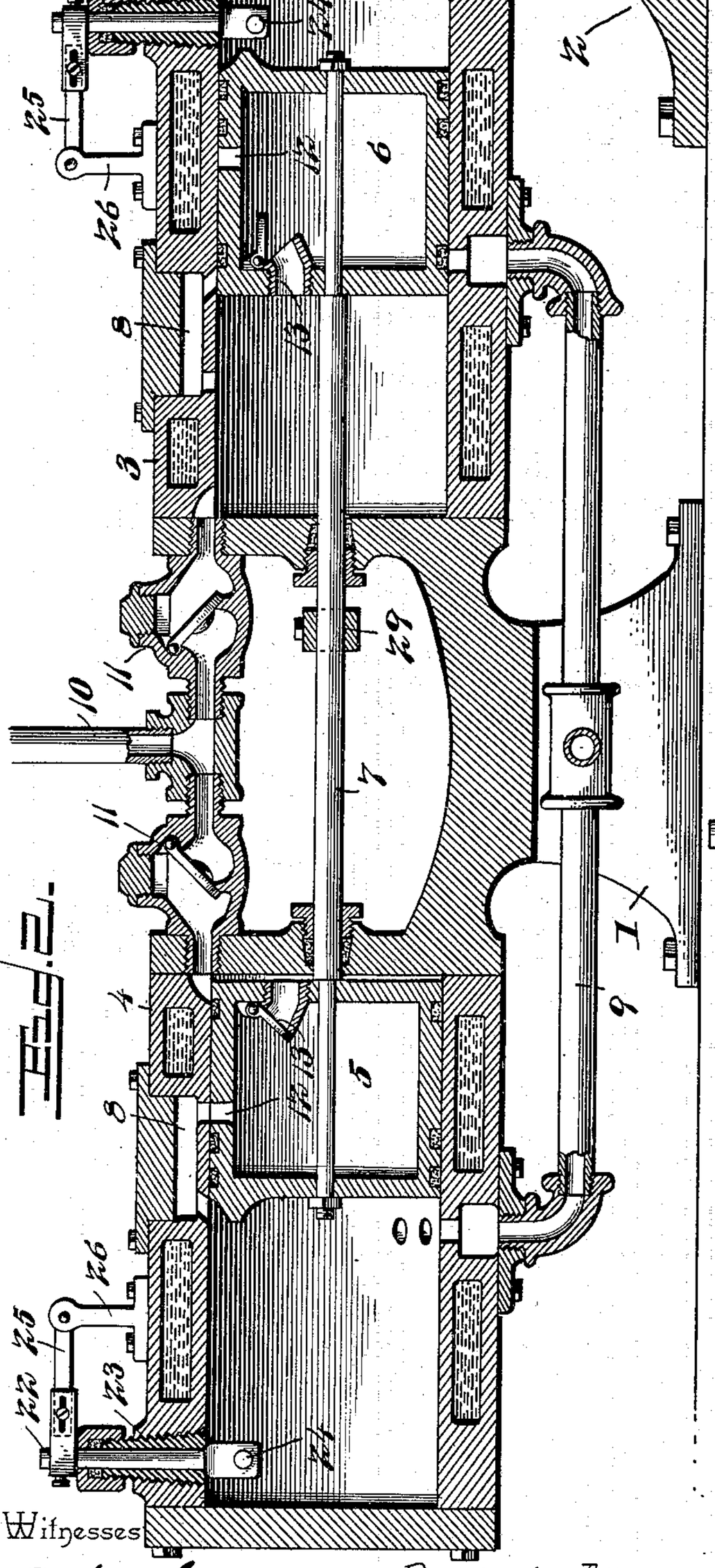

FIG. 2.

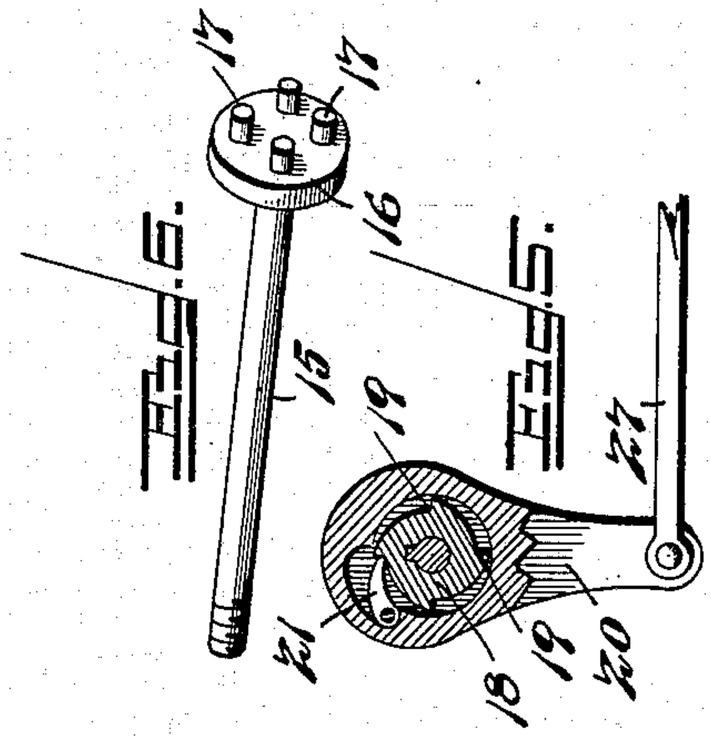

FIG. 5.

FIG. 6.

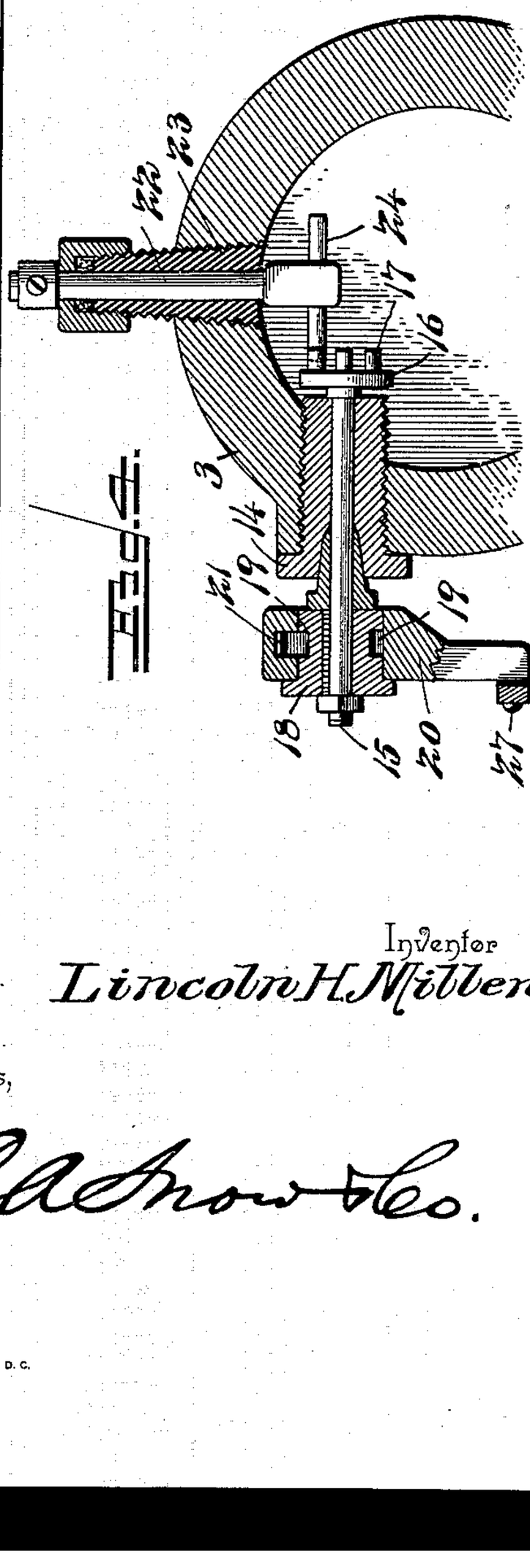

FIG. 4.

Witnesses
E. K. Stewart.
C. B. Hillyard.

Inventor
Lincoln H. Millen
By Wes Attorneys,
C. A. Snow & Co.

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

UNITED STATES PATENT OFFICE.

LINCOLN H. MILLEN, OF BEATRICE, NEBRASKA, ASSIGNOR OF ONE-HALF TO S. S. SIMS, OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 612,047, dated October 11, 1898.

Application filed May 26, 1897. Serial No. 638,300. (No model.)

To all whom it may concern:

Be it known that I, LINCOLN H. MILLEN, a citizen of the United States, residing at Beatrice, in the county of Gage and State of Nebraska, have invented a new and useful Gas-Engine, of which the following is a specification.

This invention relates to engines or motors which utilize gas, gasolene, naphtha, or other hydrocarbon as the primary motive medium, said gas or gaseous vapor being combined with air in proper proportions to produce an explosive mixture which is caused to combine by suitable igniting devices, whereby the piston is given an initial impetus for driving the machine or part connected with the engine to be operated.

The invention deals more particularly with that class of engines or motors which combine two cylinders placed tandem and having their pistons connected so as to operate in unison and governed by means of a balance-wheel, whereby the engine is caused to run steady and uniform, according to the load imposed thereon.

One of the principal objects of the invention is the construction of an engine of the type specified which will admit of a fly-wheel of comparatively small size and light weight being advantageously and successfully employed; also, to obviate the use of cams and trips for actuating the valves controlling the admission of the explosive mixture to the engine and the exhausting of the spent gases after combustion, thereby reducing the friction and the number of working parts, so that the major part of the energy generated by the explosion may be converted into effective work.

A further purpose of the improvement is to obviate the necessity of providing intermediate storage-chambers for receiving the charge which is subsequently exploded for driving the piston, and to utilize the piston for this purpose, said piston being made hollow and of an interior capacity approximating the size of the chamber formed at the receiving end of the cylinder, so as to contain and receive the explosive mixture upon the forward stroke of the piston, said charge being compressed slightly, due to the slight variation of space between the interior of the piston and the end chamber of the cylinder.

For a full understanding of the merits and advantages of the invention, reference is to be had to the accompanying drawings and the following description.

The improvement is susceptible of various changes in the form, proportion, and the minor details of construction without departing from the principle or sacrificing any of the advantages thereof, and to a full disclosure of the invention an adaptation thereof is shown in the accompanying drawings, in which—

Figure 1 is a side elevation of an engine or motor of especial design embodying the vital features of this invention. Fig. 2 is a longitudinal section thereof on a larger scale, an end portion being broken away. Fig. 3 is a plan view. Fig. 4 is a detail view, in transverse section, showing the disposition of the parts comprising the igniter. Fig. 5 is a detail view of the means for operating the igniter. Fig. 6 is a detail view of the shaft having the disk bearing a series of electric terminals.

Corresponding and like parts are referred to in the following description and indicated in the several views of the accompanying drawings by the same reference characters.

The engine or motor when in service or in position for effective work will be bolted or otherwise secured to a base, foundation, or support and comprises a bed which, as shown, is composed of two parts 1 and 2, which are bolted to an intermediate cylinder 3. A companion cylinder 4 is secured in any substantial manner to the outer end of the part 1 and is in line with the cylinder 3, the pistons 5 and 6 being connected together by a rod 7, operating through stuffing-boxes in the opposing or contiguous ends of the tandem cylinders. The cylinders and pistons are similarly constructed, and a detailed description of one set will be sufficient for a clear understanding of both, like parts being designated by the same characters. Each cylinder has one or more annular spaces in its walls for the circulation of air, water, or other medium, whereby the cylinder is kept cool when the engine is in operation. At an intermediate point a passage 8 is formed in a side of the cylinder,

the ends of the passage being deflected and communicating with the interior of the cylinder at points spaced a proper distance apart, so as to provide for the exhausting of the charge from the piston into the cylinder prior to compressing and exploding the same. The exhaust-pipe 9 communicates with the cylinder at an intermediate point, the outlet being a series of openings, whereby the portion intermediate of the openings forms a support for the packing-rings surrounding the piston and by means of which a tight joint is secured between the piston and cylinder. The supply-pipe 10 has branches which communicate with the inner or opposing ends of the cylinders, each branch having a check-valve 11, which is adapted to open toward the respective and contiguous cylinders, so as to admit of the explosive mixture passing from the supply-pipe into the cylinders, and which close automatically to prevent the escape of the charge upon the return stroke of the piston.

The pistons are hollow and are of a size so that their interior capacity approximates the space or chamber at the receiving end of a cylinder, whereby upon the forward stroke of the piston the confined mixture will pass from the receiving end of the cylinder into the piston and be stored therein until the piston reaches a proper position in its forward stroke, when the confined charge will escape from the piston through the passage 8 into the end of the cylinder containing the igniter and in which the gas is compressed and exploded for generating power which is expended for driving the machine or part to be operated in the usual way.

A port 12 is provided in a side of each piston at a point to register with the end of the passage 8 remote from the igniter or explosion chamber, whereby the charge confined in the piston may pass therefrom around the piston into the explosion-chamber through the said passage 8, as clearly indicated to the left in Fig. 2. A valve 13 controls an inlet at the end of the piston facing the receiving end of the cylinder, and this valve opens inwardly with respect to the piston, so as to admit of the gaseous mixture passing readily therein when the piston is driven forward under the influence of the expanding gases due to explosion and combustion, thereby charging the piston with a proper quantity of explosive mixture to be subsequently utilized for generating power.

At the outer ends of the cylinders is placed an igniter, the same consisting of a sleeve 14 fitted into an opening in the side of the cylinder and receiving a shaft 15, which is journaled therein, said shaft being provided at its inner end with a disk 16, bearing a series of blocks or projections 17, which constitute a set of electric terminals. A collar 18 is secured to the outer end of the shaft 15 and is formed with a series of teeth 19 corresponding in number with the electric terminals 17, and upon this collar 18 is mounted an oscillating arm 20, having a pawl 21 to engage with the teeth 19, whereby the shaft 15 is turned a distance to bring an electric terminal into proper position for producing the spark at the proper time to effect a combining of the combustible mixture confined within the explosion-chamber of the cylinder in condition for action. A pin or shaft 22 is journaled in a sleeve 23 electrically insulated from the cylinder and mounted in an opening therein, and this pin 22 is provided at its inner end with a cross-bar 24, forming the other electric terminal and which is adjusted so that one end will make electrical connection with the terminals 17, thereby completing the circuit and producing the spark. A spring 25, secured at one end to a bracket 26, provided on each cylinder, has its opposite end slidingly connected with the pin or shaft 22, so as to hold the latter in proper position and yet admit of its turning slightly to permit the electric terminals 17 and 24 to come into contact to complete the circuit and separate to break the said circuit and produce the spark. The electrodes will be connected in any suitable manner with a battery or other device for generating an electric current, whereby the ignition of the combustible energizing fluid or motive medium is effected. A rod 27 extends from each arm 20 and is adapted to be engaged by a tappet 28, projecting from the cross-head 29, applied to the piston-rod 7 at a point intermediate of the cylinders, so as to rock the arms 20 upon the collars 18 and turn the shaft 15 to successively bring the electric terminals 17 into engagement with the electrode 24, whereby the circuit is completed and interrupted.

The crank-shaft 30 is provided with a balance-wheel 31 and has its crank connected by a pitman 32 with the cross-head 33, to which the cross-head 29 is connected by means of rods 34, exterior to and upon opposite sides of the cylinder 3, thereby distributing the strain equally upon opposite sides of the cylinders and causing the parts to wear equally and the engine to run steady. When one piston, as 6, is moving toward the explosion end of its cylinder, the opposite or receiving end of the cylinder is receiving a charge from the supply-pipe 10 through its valve-controlled branch, and when the piston 6 has reached a proper position at its return stroke the igniter is actuated and the spark passes and combines the gases confined in the explosion end of the cylinder, thereby driving the piston 6 forward or toward the receiving end of its cylinder. During the forward stroke of the piston 6 its valve 13 opens and the gaseous mixture received in the end of the cylinder opposite the explosion-chamber passes into the piston and is compressed by reason of the variation in capacity between the space within the piston and the chamber formed at the receiving end of the cylinder when the piston

is at the limit of its stroke just prior to the explosion. When the piston 6 is driven forward by the force of the explosion, the piston 5, connected therewith, is advanced toward the explosion end of its cylinder and compresses the gas received therein from the piston 5, as it must be remembered that when the piston 5 is at the limit of its stroke toward the receiving end of the cylinder its port 12 registers with the passage 8, thereby providing for the escape of the charge confined in the piston 5 into the explosion end of the cylinder containing the said piston 5. When the said piston 5 advances toward the explosion end of its cylinder, the exhaust-port or series of openings comprising the same is closed and the port 12 and passage 8 are brought out of register, and as the piston advances the explosive mixture is compressed until when the piston is at or near the end of its stroke the spark passes and the explosion takes place, thereby driving the piston 5 in the opposite direction, when the operation just described is repeated.

Having thus described the invention, what is claimed as new is—

1. In a gas or hydrocarbon engine, the combination of a cylinder having a passage communicating interiorly therewith at different points in its length, and a hollow piston having a valve-controlled inlet for the admission of the gaseous mixture, which is compressed within the piston during its forward stroke, and having a port to register with one end of the aforesaid passage when the piston reaches the limit of its forward stroke and just prior to moving back, whereby the compressed gaseous mixture passes from the piston into the front end of the cylinder and is further compressed by the return stroke of the said piston, substantially as set forth.

2. In a gas or hydrocarbon engine, the combination of a cylinder having a passage communicating interiorly therewith at different points in its length, a hollow piston having packing-rings at or near its ends and a port between the packing-rings to register with one end of the aforesaid passage when the piston is at the limit of its forward stroke, and a valve-controlled inlet at the rear end of the piston opening automatically for the admission of the gaseous mixture into the piston during its forward stroke and closing when the port of the piston registers with the aforedescribed passage, thereby admitting of the compressed mixture passing from the piston to the front end of the cylinder, substantially as set forth.

3. A gas or hydrocarbon engine comprising companion cylinders, each having a passage communicating interiorly therewith at different points in its length, and having an exhaust intermediate of its ends, hollow pistons connected to operate simultaneously and in opposite directions with respect to their cylinders, each having a port in its side to register with an end of the passage of its cylinder and provided with a valve-controlled inlet for the admission of the gaseous mixture into the piston and its simultaneous compression during the forward stroke of the piston, said mixture passing into the front end of the cylinder when the piston is at the limit of its forward stroke, and a supply-pipe having valve-controlled branches in communication with the inner or rear ends of the cylinders, substantially as set forth.

4. The herein-described gas or hydrocarbon engine, comprising cylinders having a tandem arrangement, and each having a passage communicating interiorly therewith at its ends and at different points in its length, an exhaust-pipe communicating with the cylinders at an intermediate point, hollow pistons connected to operate simultaneously and in opposite directions, each having a port to register with an end of the aforesaid passage of its cylinder, and having a valve-controlled inlet at its rear end, a cross-head mounted upon the bed of the engine and having connection with the crank-shaft, a second cross-head connected to the piston-rod intermediate of the cylinders, side rods connecting the cross-heads, igniters in the outer ends of the cylinders, rods having connection with the igniters and adapted to be alternately engaged by the cross-head secured to the piston-rod, and a supply-pipe having valve-controlled branches in communication with the inner ends of the cylinders, substantially as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

LINCOLN H. MILLEN.

Witnesses:

A. ALLEE,

S. S. SIMS.