(No Model.)

3 Sheets—Sheet 1.

P. L. HIDER.

EXPLOSIVE ENGINE.

No. 599,235. Patented Feb. 15, 1898.

Fig. 1.

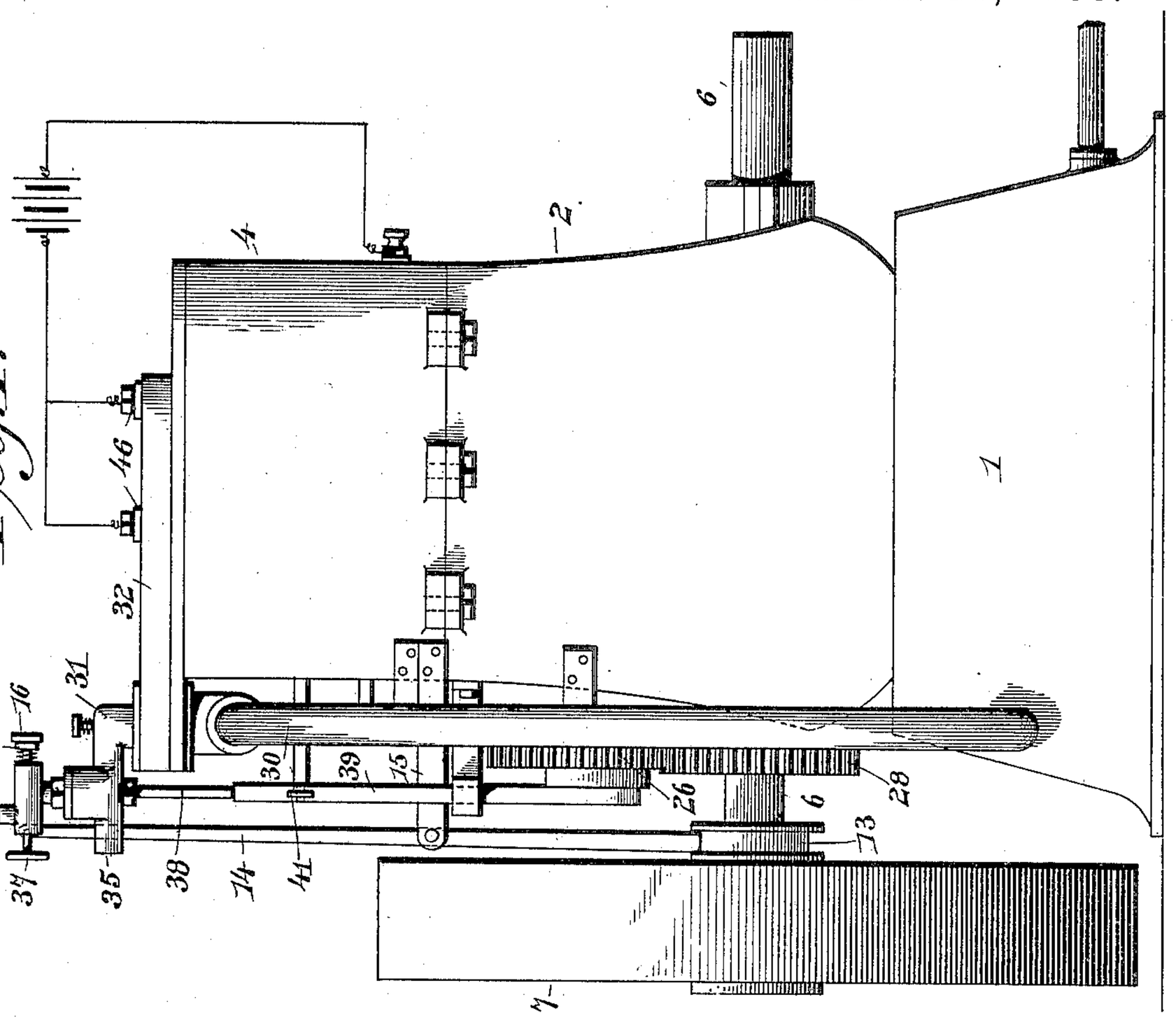


Fig. 6.

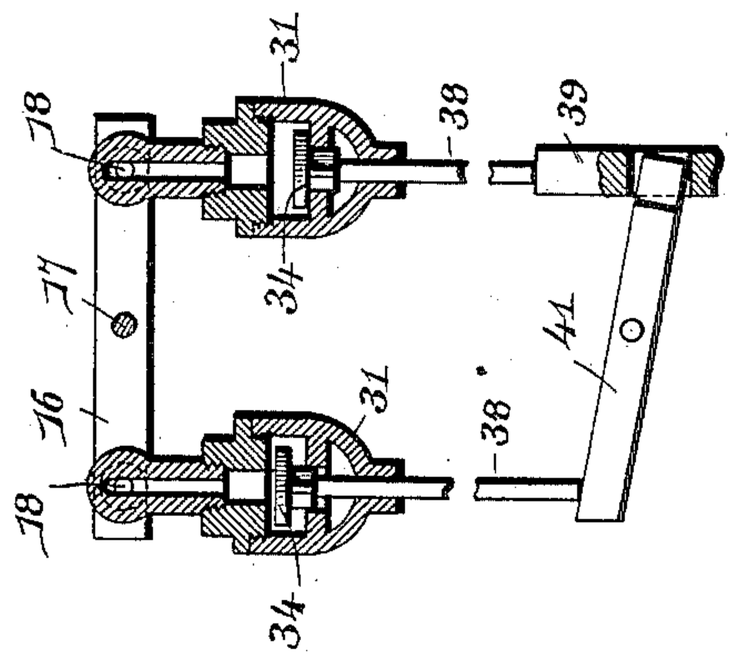
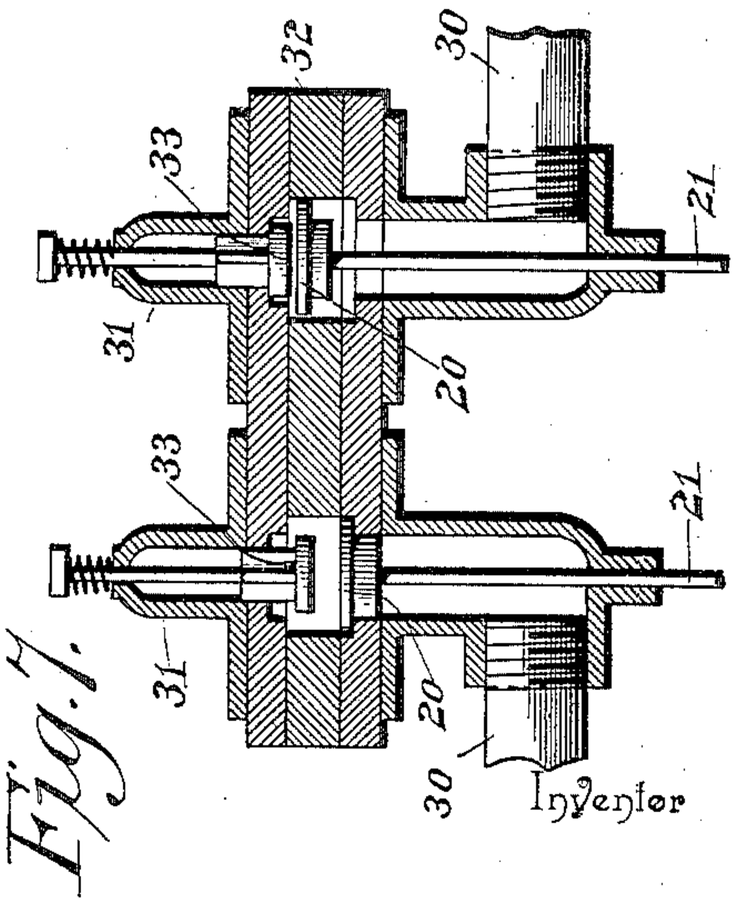


Fig. 7.



Witnesses
Jas. K. McCathran
C. B. Hillyard.

Inventor
By his Attorneys,
Peter L. Hider
C. A. Snow & Co.

(No Model.) 3 Sheets—Sheet 2.

P. L. HIDER.

EXPLOSIVE ENGINE.

No. 599,235. Patented Feb. 15, 1898.

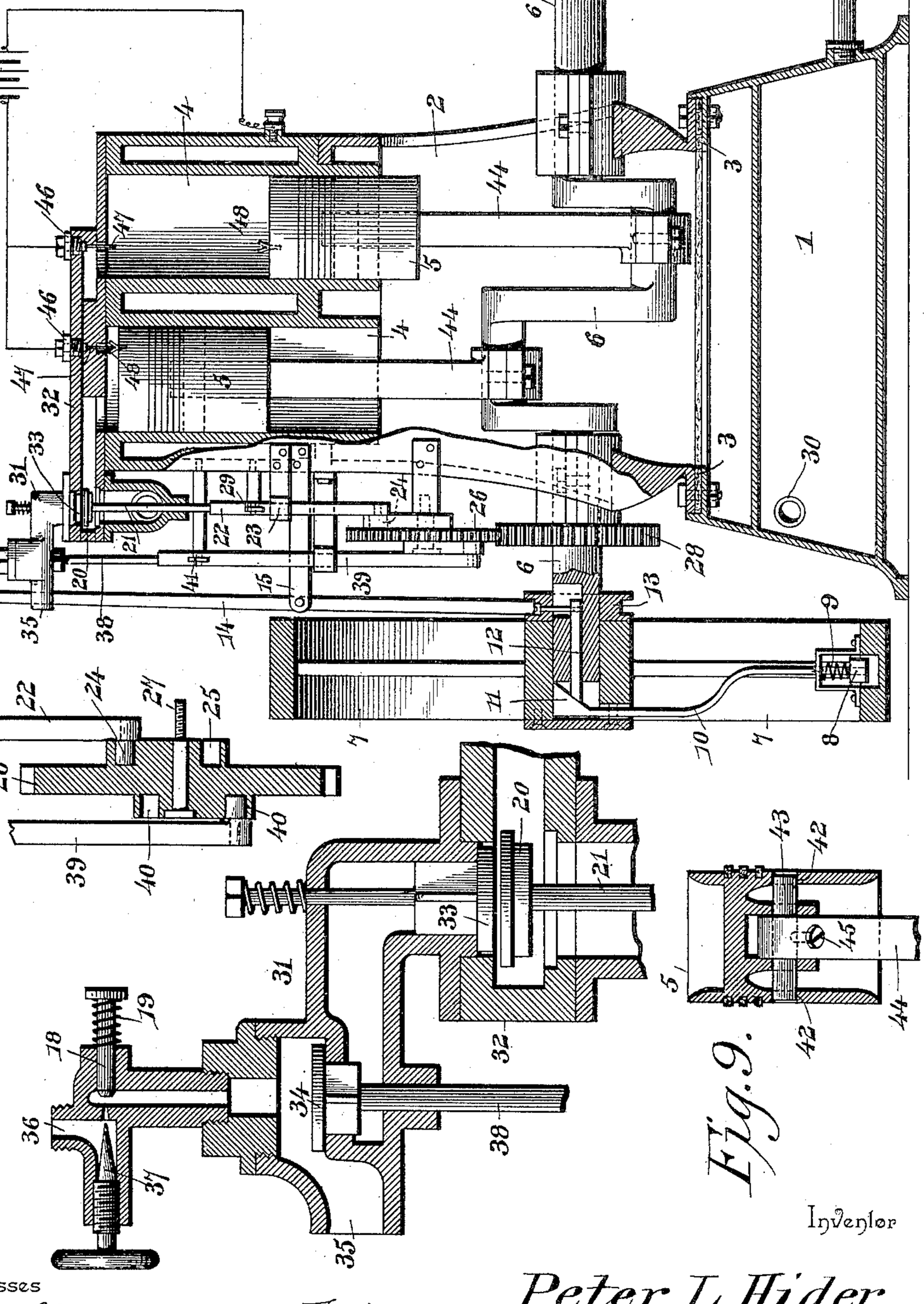


Fig. 2.

Fig. 8.

Fig. 5.

Fig. 9.

Witnesses
Jas. K. McCathran
V. B. Hillyard.

Inventor
Peter L. Hider
By his Attorneys,
C. A. Snow & Co.

(No Model.) 3 Sheets—Sheet 3.

P. L. HIDER.

EXPLOSIVE ENGINE.

No. 599,235. Patented Feb. 15, 1898.

Fig. 3.

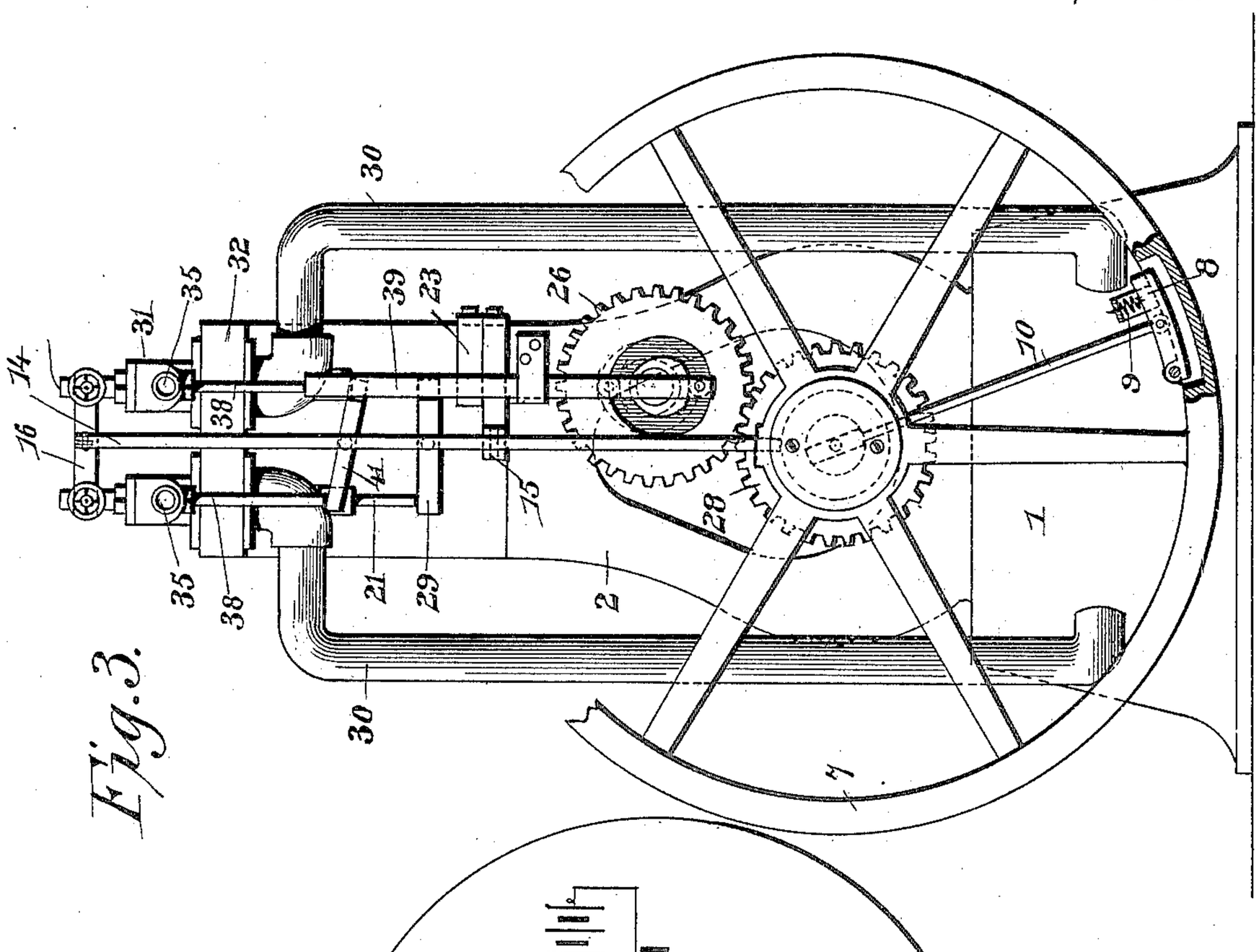
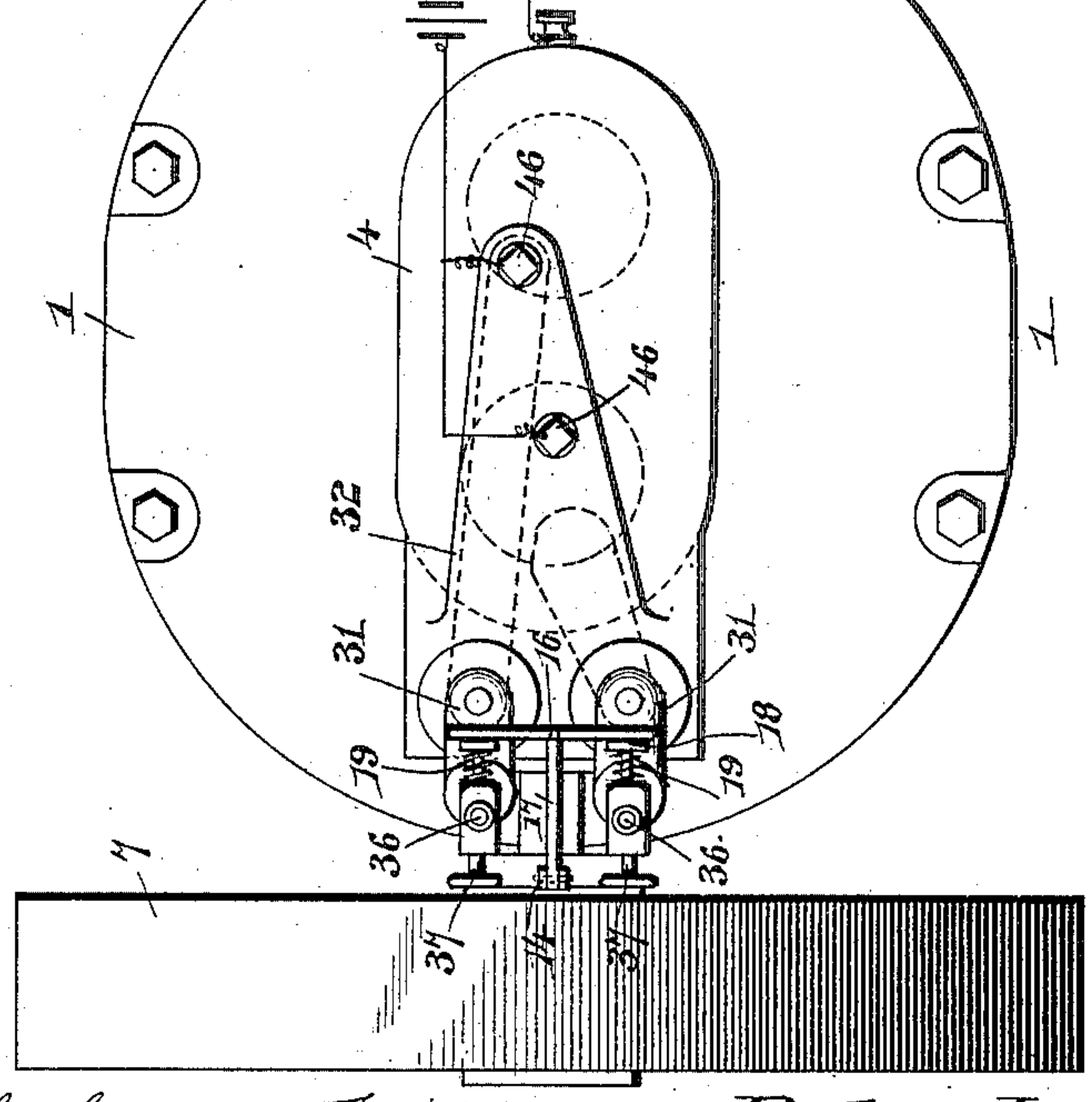


Fig. 4.



Witnesses
Jas. K. McCathran
V. B. Hillyard.

Inventor
By his Attorneys, Peter L. Hider
C. A. Snow & Co.

UNITED STATES PATENT OFFICE.

PETER L. HIDER, OF OTTAWA, KANSAS.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 599,235, dated February 15, 1898.

Application filed December 21, 1896. Serial No. 616,487. (No model.)

To all whom it may concern:

Be it known that I, PETER L. HIDER, a citizen of the United States, residing at Ottawa, in the county of Franklin and State of Kansas, have invented a new and useful Explosive-Engine, of which the following is a specification.

This invention relates to engines in which a piston is reciprocated within a cylinder by the explosion of a gaseous mixture consisting of a combination of air, compressed air, or air under pressure and gas or its equivalent in proper proportions, and has for its object to produce an engine of this type which will convert a maximum amount of the explosive force into available energy for use in the industrial arts and which will be practically noiseless when in operation and less subject to vibration, thereby obviating a serious objection urged against the use of explosive-engines. The engine may be single or double, according to the power required and nature of the work to be performed. If double, the pistons will be arranged to operate alternately, so as to secure a practically steady and uniform motion and obviating in a great measure the vibrations incident to single engines, wherein the crank-shaft is driven positively through a half-revolution only, the momentum of the fly-wheel being such as to sustain the load and turn the crank-shaft the remaining half of its revolution.

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 rear view of an engine especially designed for attaining the ends of this invention. Fig. 2 is a view similar to Fig. 1, partly in section and having portions broken away. Fig. 3 is a side elevation, parts of the fly-wheel being broken away. Fig. 4 is a top plan view. Fig. 5 is a sectional detail showing the relative disposition of the coöperating valves. Fig. 6 is a detail view of the supply-valves, showing one open and the other closed. Fig. 7 is a detail view of the exhaust-controlling valves and the check-valves coöperating therewith, the one being open and the other closed. Fig. 8 is a detail view in section of the gear-wheel having the cams on its opposite faces for controlling the supply and exhaust valves. Fig. 9 is a sectional detail of a piston, showing the connection between it and the pitman.

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 is of the upright type and is mounted upon a base 1, which is hollow and forms a muffler, the exhaust discharging into the space thereof and cooling prior to being discharged into the open air, thereby obviating the noise so common in this class of engines resulting from the rapid discharge of the spent gases into the open air through a small orifice. The frame 2 of the engine is mounted upon the base 1 and is bolted or otherwise secured thereto, a layer of asbestos 3 or other non-heat-conducting material being interposed between the frame and base to prevent the transmission of heat between these parts. The engine proper is located at the upper end of the frame and consists of one or more cylinders 4, a piston 5 for each cylinder, and valves and valve-controlling mechanism for the proper admission and exhausting of the motive medium. When the engine is single, a single set of valves will be provided; but when it is double, as shown in the drawings, the valves are duplicated, the valve-actuating mechanism being substantially the same in each instance. The crank-shaft 6 is mounted in bearings provided on the frame, and its crank portions are disposed in diametrically opposite relation, whereby the pistons are caused to operate alternately and travel in opposite directions. The fly-wheel 7 is secured to an end of the crank-shaft and is provided with the governor mechanism, the latter consisting of a counterbalanced weight 8, pivoted at one end to the inner side of the fly-wheel rim and located in a recess formed therein, a spring 9 serving to hold the free end of the weight away from the rim, whereby the governor is nor-

mally held out of action. A rod 10 is pivotally connected at its outer end with the weight 8, and its inner end operates in a channel formed in the end of the crank-shaft 6 and has a cam or inclined portion 11 to effect a longitudinal movement of a rod 12, slidably mounted within a longitudinal opening formed in the end portion of the crank-shaft 6 and engaging with a grooved collar or sleeve 13, so as to move the latter on the crank-shaft to regulate the supply of gas or its equivalent to the engine. A lever 14 is fulcrumed about midway of its ends to an arm 15, projecting from the frame 2, and its lower end engages with the grooved collar or sleeve 13, and its upper end has a rod or bar 16 connected therewith by means of a stem 17, the end portions of the rod or bar 16 being disposed so as to engage with the stems of valves 18, whereby the gas, hydrocarbon, or their equivalent is regulated in its supply to the engine. The stems of the valves 18 are moved outward by springs 19, and one of these springs is stronger than the other, so as to offer a greater resistance to the action of the governor when the latter is brought into action by reason of the engine acquiring an abnormal speed, thereby rendering it possible for one engine or cylinder to be completely cut off from a supply of gas without shutting off the supply to the other. When the engine exceeds a given speed, the weight 8 will move outward at its free end and cause the rod 10 to correspondingly move outward, thereby bringing the cam or wedge 11 into forcible contact with the rod 12 and moving the latter and the collar or sleeve 13 inward, carrying with it the lower end of the lever 14 and causing the upper end of the said lever to move outward, whereby the rod or bar 16 is drawn against the stems of the valves 18, with the result and for the purpose herein described. The bar 16 has pivotal or loose connection with the stem 17 to admit of its turning when moved forward by the lever 14, whereby provision is had for the differential movement of its opposite ends.

A valve 20 is provided for each exhaust-port and opens upward, and its stem 21 projects below the valve-casing to be positively actuated at the proper time to uncover the exhaust-port for the escape of the spent gases. A reciprocating bar 22 is slidably mounted in a bracket 23, projecting from the frame 2, and is adapted to engage with the stem 21 of an exhaust-valve 20, and has a roller or lateral extension 24 at its lower end to enter a cam-groove 25, formed in a side of a gear-wheel 26, which is mounted upon a pin or stud shaft 27, secured to the frame 2, and which is driven by means of an intermeshing gear-wheel 28, mounted upon the crank-shaft 6, so as to revolve therewith. A rocker-bar 29 has connection at one end with the reciprocating bar 22, and its opposite end is adapted to engage with the stem of the other exhaust-valve 20. Thus it will be seen that as the bar 22 ascends and engages with the stem of an exhaust-valve the free end of the rocker-bar 29 lowers, thereby permitting the other exhaust-valve to become seated, and as the reciprocating bar 22 descends the exhaust-valve previously opened will close, and the free end of the rocker-bar 29, engaging with the stem of the exhaust-valve previously closed, will unseat it. Hence the construction of the exhaust-valve-actuating mechanism is such as to alternately open the exhaust-valves, thereby permitting one engine to exhaust while the other engine is operating under the explosive action of the gaseous mixture. The exhaust is conveyed to the muffler or hollow base 1 by means of pipes 30.

A valve-casing 31 is bolted or otherwise secured to the head or cap 32 of the engine and communicates with the passage formed therein leading to the cylinder. A downwardly-opening check-valve 33 prevents the escape of the gaseous mixture when exploded and opens to permit the supply of the said mixture to the engine at the proper time. A supply-valve 34 controls the admission of the air or gaseous mixture into the space formed between the valves 33 and 34, and the valve 33 opens automatically to permit the charging of the engine, and the valve 34 is opened positively by mechanism substantially the same as that resorted to for actuating the exhaust-valves. The air under pressure is supplied to the valve-casing at 35 and the gas or hydrocarbon is supplied at the point 36, both the air and gas being conveyed to the respective points 35 and 36 in any convenient and well-known manner. A needle-valve 37 controls the supply of gas or hydrocarbon to the valve-casing, and the air and gas or hydrocarbon are mixed in the valve-casing prior to their entrance into the cylinder. The stems 38 of the supply-valves 34 project below their respective valve-casings for a short distance, for a purpose presently to be explained.

A slide-bar 39 is adapted to engage with a stem 38, and its lower end has a lateral extension, which enters a cam-groove 40, formed in the opposite side of the gear-wheel 26 to that bearing the cam-groove 25, the cam-grooves 25 and 40 being so disposed that the exhaust and supply valves will be alternately actuated and both prevented from being open at the same time. A rocker-bar 41 engages at one end with the slide-bar 39, and its opposite end is adapted to engage with the stem of the other supply-valve, whereby the supply-valves are alternately actuated in precisely the same manner as the exhaust-valves.

Each piston 5 has a transverse opening 42 for the passage of a pin 43, by means of which connection is had of the pitman 44 therewith, the said pin 43 being secured rigidly in an opening in the end of the pitman by means of a binding-screw 45. The pin 43 oscillates with the pitman 44 in the opening 42 and is lubricated from the cylinder by reason of the lubricant passing into the end of

the opening 42, thereby preventing the pin from running dry and prolonging the life of the connection between the pitman and piston because of the self-lubrication and the extended bearing-surface.

Plugs 46 are let into the head or cap of the engine and are electrically insulated therefrom and support one terminal 47 of a battery or electric generator, and the corresponding terminal 48 is attached to the piston and is of V form, so as to receive the terminal 47 between its members and thereby insure the formation of a spark, so as to explode the gaseous mixture at the proper time. One pole of the electric generator is connected with the terminal 47 and the other pole with a convenient portion of the engine, the latter forming a conductor to convey the current to the terminal 48.

In order the attain the best results, the air is supplied to the engine under pressure and the parts are disposed so that the gaseous mixture is exploded at each complete stroke of the piston, thereby materially increasing the efficiency of the engine over such as draw in a supply of air and explode the gaseous mixture at each alternate stroke of the piston. The air and gas may be supplied separately or may be mixed in proper proportions prior to their entrance into the cylinder; but it is of the utmost importance that the same be supplied under pressure, for the purposes set forth.

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

1. In an explosive-engine, the combination of a valve for controlling the supply of gas to the engine, a weight having pivotal connection at one end with the fly-wheel, a spring for holding the weight in a normal position, a rod having connection with the aforesaid weight and moved thereby, and provided at its inner end with a cam or inclined portion, a collar or sleeve slidably mounted upon the crank-shaft and moved thereon by the cam portion of the aforesaid rod, and a lever between the collar and valve for varying the position of the said valve to control the admission of gas to the engine, substantially as set forth.

2. In an explosive-engine, the combination of a valve for controlling the supply of gas thereto, a counterbalanced weight applied to the rim of the fly-wheel, a rod having connection at its outer end with the weight and provided at its inner end with a cam portion operating in a channel formed in the crank-shaft, a rod slidably mounted within a longitudinal opening in the crank-shaft and moved in one direction by the cam portion of the aforesaid rod, a collar mounted upon the crank-shaft and having connection with the slidable rod so as to move therewith, and a lever connecting the collar with the aforesaid valve for controlling its position to regulate the supply of gas to the engine, substantially in the manner set forth.

3. In an explosive-engine, the combination of two valves for controlling the supply of gas or hydrocarbon to the engine, springs of different strength for holding the said valves open, and a governor mechanism for exerting an equal pressure against the valves for closing them, the parts being so disposed that the valve having the weaker spring will close prior to the valve having the stronger spring and offering greater resistance, substantially as and for the purpose set forth.

4. In an explosive-engine, the combination of independent engines, a pair of controlling-valves therefor, a bar mounted to make direct connection with one of the valves for unseating it, means for reciprocating the said bar, and a rocker-bar having direct connection at one end with the reciprocating bar and adapted to alternately engage at its opposite end with the other valve, whereby the said valves and engines are alternately actuated, substantially as set forth.

5. In an explosive-engine, the combination of a pair of exhaust-valves and a pair of supply-valves, reciprocating bars adapted to engage with one of the valves, rocker-bars adapted to engage with the other of the said valves and operated from the reciprocating bars, and a rotatable wheel having cam portions to alternately actuate the reciprocating bars in reverse directions, whereby the exhaust and supply valves are alternately opened and closed, substantially as and for the purpose set forth.

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

PETER L. HIDER.

Witnesses:
FRED. HESS,
EVA WEBB.