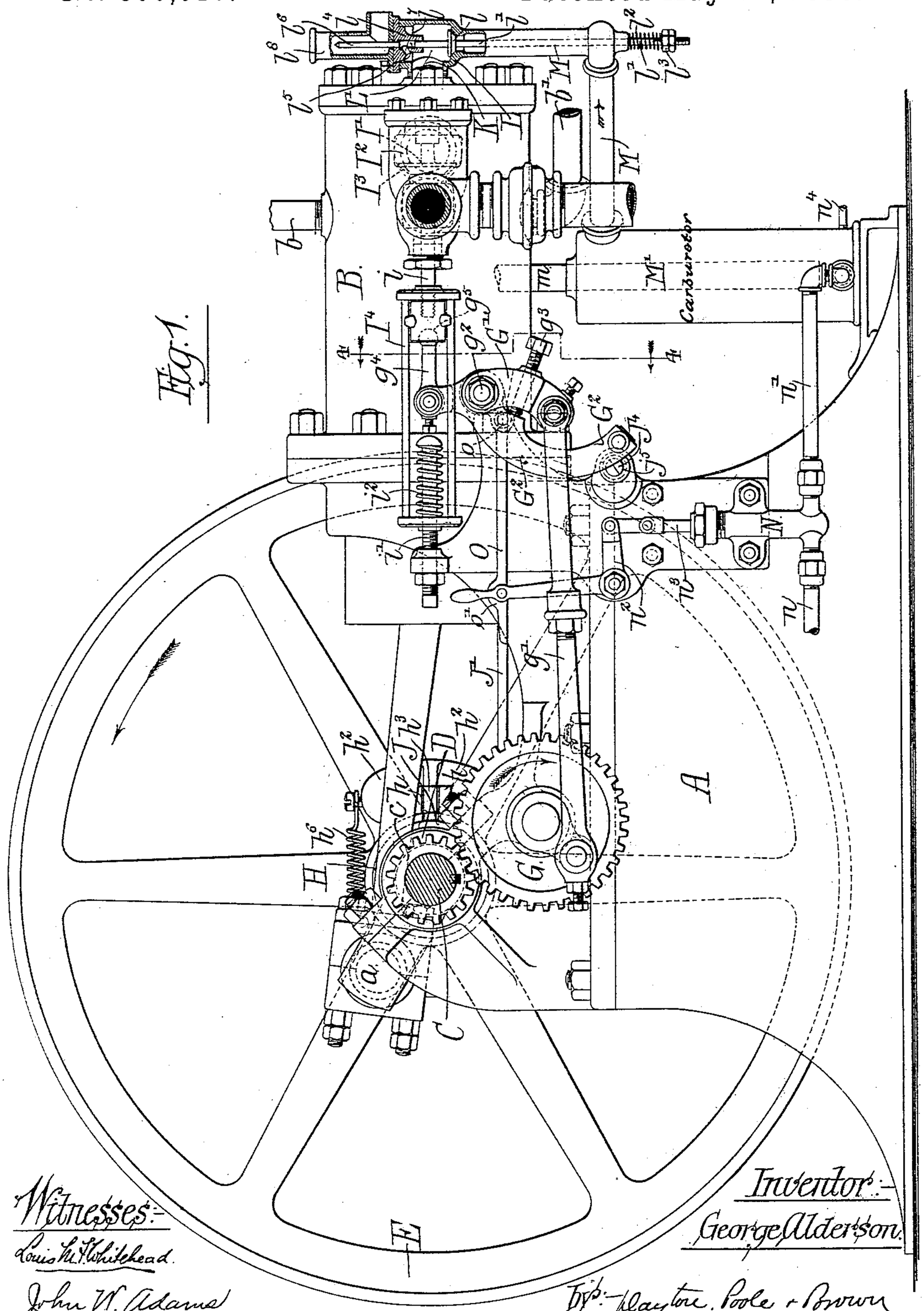
(No Model.) 3 Sheets—Sheet 1.

G. ALDERSON.

EXPLOSIVE ENGINES.

No. 560,016. Patented May 12, 1896.

Fig. 1.



Witnesses:-
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John W. Adams

Inventor:-
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Atty's:- Clayton. Poole & Brown
His Attorneys

(No Model.)

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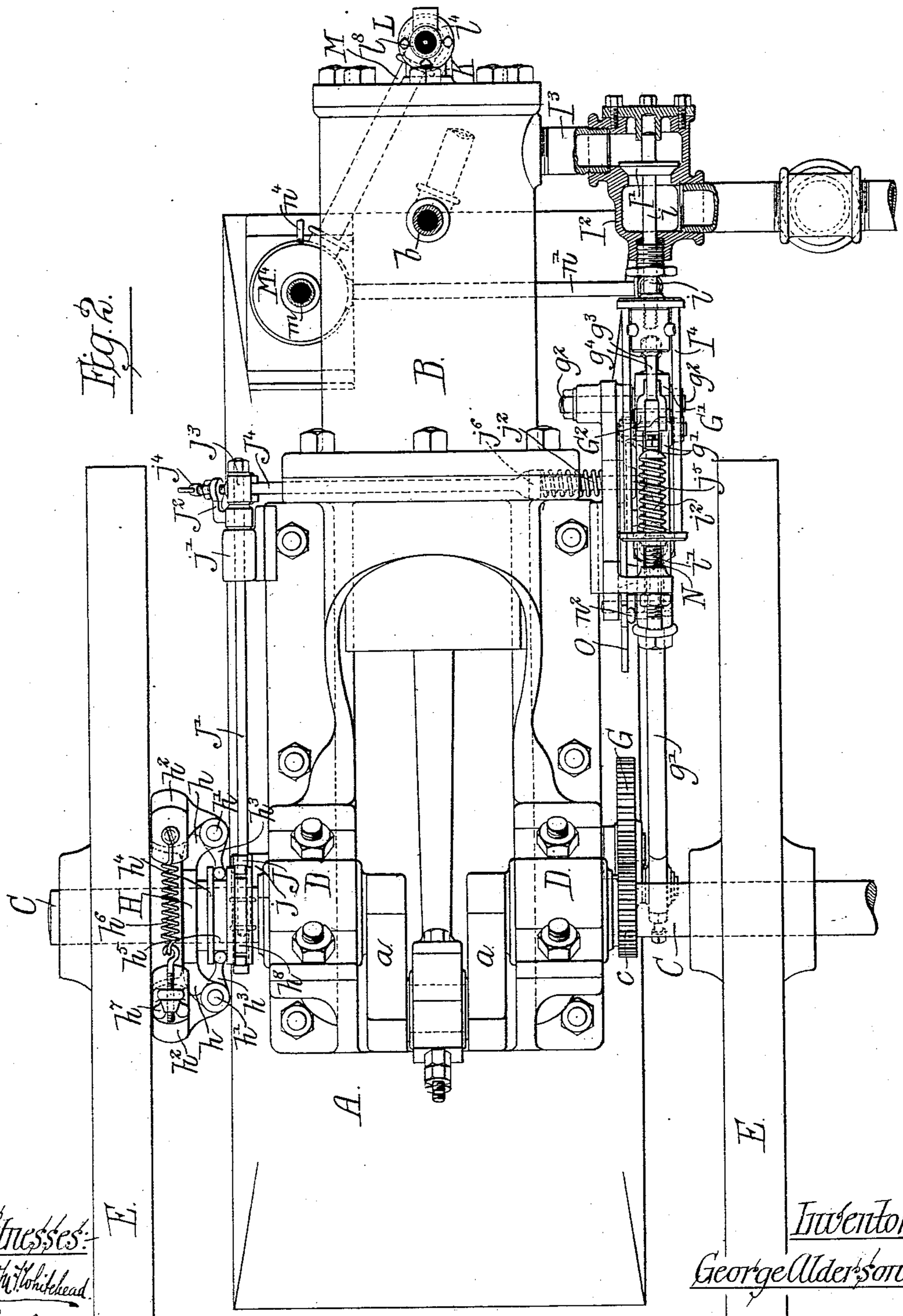
Fig. 2.



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(No Model.)

3 Sheets—Sheet 3.

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Fig. 4.

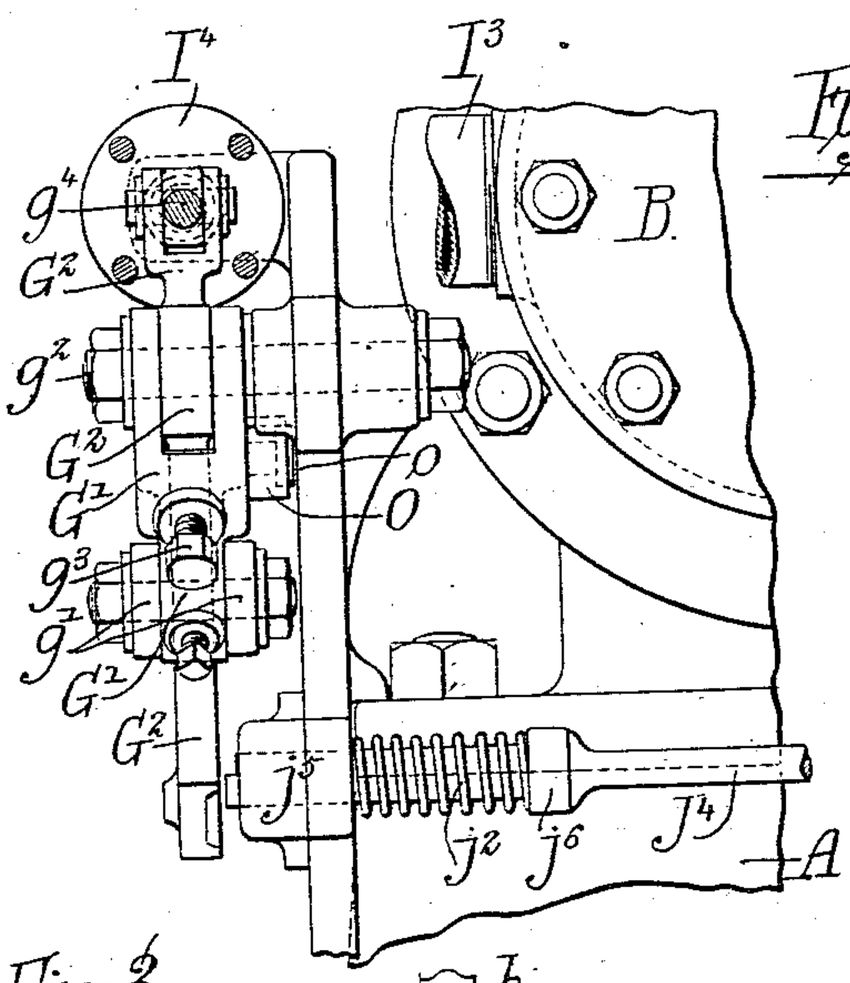
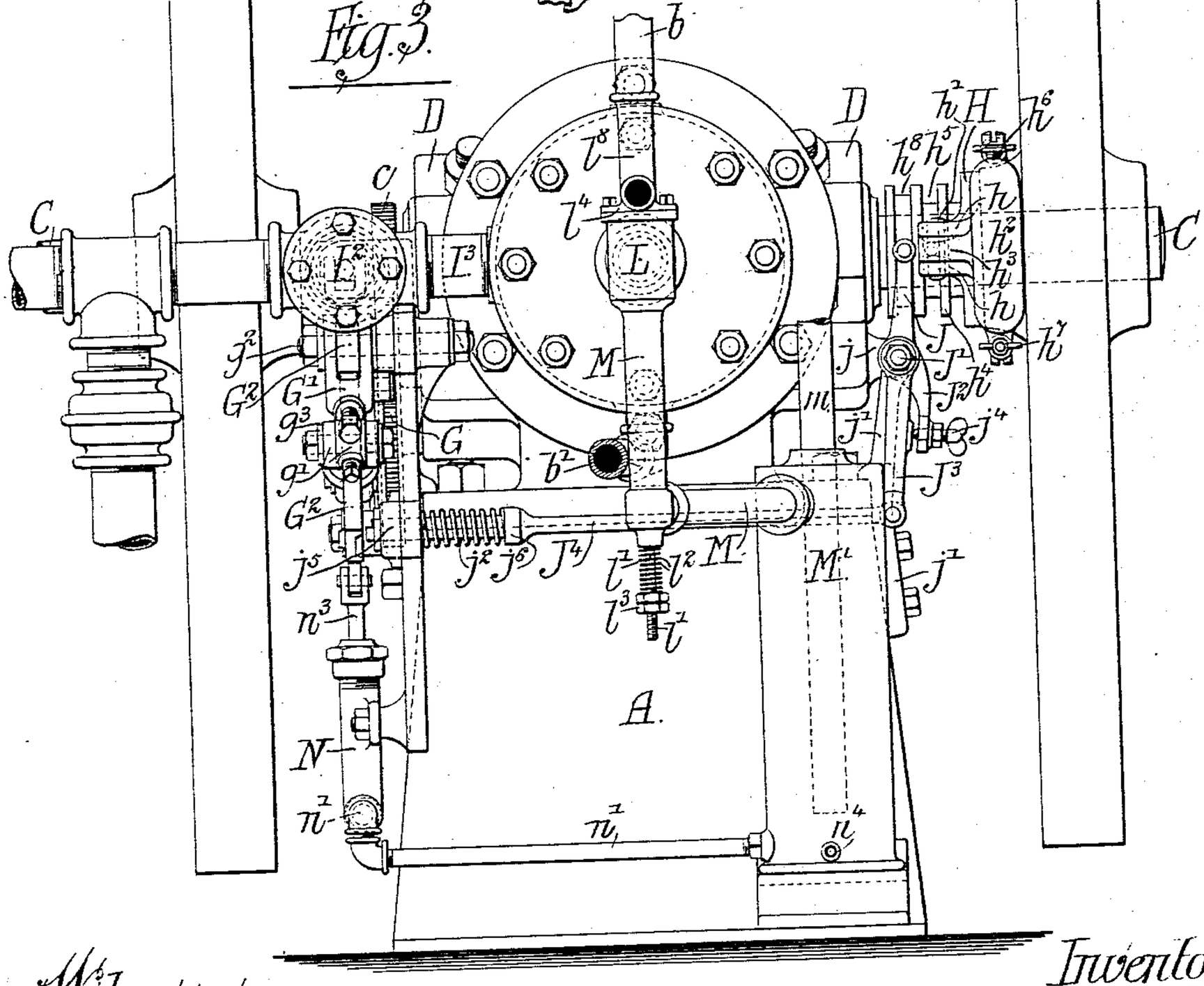


Fig. 3.



Witnesses:—

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Inventor:—

George Alderson.

By:—Dayton. Poole & Brown

His Attorneys.

UNITED STATES PATENT OFFICE.

GEORGE ALDERSON, OF LASALLE, ILLINOIS, ASSIGNOR TO CHARLES BRUNNER, OF PERU, INDIANA.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 560,016, dated May 12, 1896.

Application filed August 21, 1893. Serial No. 483,638. (No model.)

To all whom it may concern:

Be it known that I, GEORGE ALDERSON, of Lasalle, in the county of Lasalle and State of Illinois, have invented certain new and useful Improvements in Explosive-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to the general class of engines known as "gas-engines," and more particularly to engines having but a single cylinder which is alternately employed as a power-cylinder and as a compressor-cylinder, in which the charge of air and gas is compressed prior to the ignition of the same, the construction of the engine being such that upon the first instroke of the piston, after having been forced outward by the combustion of a charge, the exhaust-port will be opened and the devitalized gases expelled, and upon the next following revolution of the engine, which is accomplished by its own momentum, the exhaust-port will be held closed and a new charge of explosive mixture drawn into the cylinder by the outstroke and compressed by the instroke of the piston. The particular engine shown is designed to use gasolene or other volatile oil, being equipped with a carbureter for more rapidly and thoroughly vaporizing the oil; but it will be perfectly obvious that my invention may be readily adapted to use illuminating or other gas with satisfactory results.

The invention consists in the matters hereinafter explained, and more particularly pointed out in the appended claims, and will be readily understood by reference to the accompanying drawings, in which—

Figure 1 is a side elevation, with parts of the inlet-valve and ignition-chamber in section, of an engine embodying my invention. Fig. 2 is a plan view of the same. Fig. 3 is a rear or end elevation of the engine. Fig. 4 is an enlarged fragmentary view of parts shown in Fig. 3, showing details of the governing devices, taken on line 4 4 of Fig. 1, looking in direction of the arrows.

As shown in said drawings, A designates the bed or frame of the engine, B the cylinder, mounted horizontally on said bed, and C the main crank-shaft, which is mounted in bearings formed in pillow-blocks D and carries a balance-wheel E at each end thereof, the crank-arm *a* being in this instance formed in the central part of the crank-shaft. Said crank-shaft is provided on one end with a gear-pinion *c*, rigidly keyed thereon and adapted to intermesh with a gear-wheel G of twice the size of said pinion *c* and conveniently supported in bearings also formed in one of the pillow-blocks D.

The cylinder B is single-acting and is provided with a water-jacket outside of the cylinder proper, water being supplied to said jacket by a pipe *b* and after circulating about the cylinder allowed to escape through a second pipe *b'*. The exhaust-port is in this instance located in the side of the cylinder near its rear end, and is controlled by a valve I', arranged within a valve-casing I^2, connected with the port by a short section of pipe I^3. The valve I', which is of common construction, is arranged to reciprocate horizontally, its stem *i* being extended through the valve-casing toward the forward end of the cylinder and being screw-threaded for engagement with one end of a lantern I^4. This lantern I^4 is secured at its opposite end in axial alinement with the valve-stem *i* to a headed bolt or stud *i'*, passing loosely outward through the head of the lantern and through a bracket formed in the frame of the engine, in which bracket said bolt is adjustably held by means of check-nuts, as shown. Surrounding the bolt *i'* within the lantern is an expansion-spring i^2, which tends to hold the lantern and connected valve-stem in its most forward position, thereby closing the exhaust-valve I' against its seat.

Means for opening the valve I' at the proper time are provided as follows: Connected with a wrist-pin on the gear-wheel G by a connecting-rod *g'* is a curved lever or tappet G', said lever being loosely pivoted at its opposite end by a pivot-bolt g^2 to a bracket-support formed on the frame of the engine, and being provided with a set-screw g^3, passing through the central part of the lever and arranged to strike against a valve-actuating lever G^2, also piv-

oted at a point between its ends on the bolt g^2, as shown. Pivoted to the upper end of said lever G^2, which upper end extends within the central part of the lantern I^4, is a short connecting-rod g^4, having on its opposite end a spherical head arranged to fit within a socket or bearing g^5, secured to and within that end of the lantern I^4 nearest the valve I', thus forming a ball-and-socket joint. The lower end of the lever G^2 extends downwardly between the two arms of the connecting-rod g', which latter is of forked form in order to permit the levers G' and G^2 to be arranged opposite each other, and when the engine is running at normal speed vibrates freely back and forth.

Means for holding the exhaust-valve I' open at such times as the speed of the engine shall have reached a rate above that at which it has been set to run, and thus interrupt the recharging and ignition of the charge until it again resumes the desired speed, are provided as follows: At one end the crank-shaft C carries a centrifugal governor, said governor being constructed in the following manner: Keyed or otherwise secured on the shaft C by an aperture passing through its center is a concavo-convex plate II, having its concave side facing inwardly and being provided at each of two opposite points on its circumference with a pair of outwardly-projecting lugs h, these lugs being transversely pierced to receive pivot-pins $h' h'$, carrying the centrifugal weights $h^2 h^2$. These weights $h^2 h^2$ are conveniently made in the form of thick circular segments adapted to lie outside of or on the convex side of the plate H, and are each provided centrally with an inwardly-extending elbow-shaped pivot-arm h^3, pivoted at an angle between the pivot-lugs $h h$, the inner arm extending from the pivot-point toward the shaft C a sufficient distance to engage a groove h^5, formed in a sleeve h^4, carried by said shaft. The weights $h^2 h^2$ are of a length slightly greater than the diameter of the plate H and are connected together between their ends by tension-springs $h^6 h^6$, provided with thumb-screws $h^7 h^7$ for regulating their tension, as clearly shown in the drawings. The sliding sleeve h^4, controlled by the centrifugal governor-weights $h^2 h^2$, is provided with a second groove h^8, which is engaged at opposite sides by inwardly-turned ends of a yoke J, carried on the end of a longitudinally-extending rock-shaft J', which rock-shaft rests at this end in a bearing-bracket secured to the main frame of the engine beneath the crank-shaft C. The rock-shaft J' extends rearwardly to a point near the front end of the cylinder of the engine, at which point it passes through a second bearing j' and carries on its end two levers J^2 and J^3, of which one, J^2, is rigidly and the other, J^3, is loosely secured thereon. The lever J^3 extends downwardly and is pivotally connected at its lower end with a rod J^4, arranged transversely at the rear end of the engine-frame, while the lever J^2, which is the shorter one, extends downwardly and is offset or bent at its lower end, so as to bring its end in the same pivotal plane with the lever J^3, and is provided with a thumb-screw j^4, which passes through the lever and is arranged to strike against the lever J^3. The transversely-arranged rod J^4 is supported in bearings permitting a longitudinal movement thereof and carries at its end opposite that to which the lever J^3 is connected an expansion-spring j^2, arranged between the bearing j^5, through which the rod passes, and a collar j^6, formed on the rod J^4, thus acting to hold said rod retracted in a direction opposite that in which the action of the governor-weights (through the medium of the rod J' and lever J^3) would tend to force it. The rod J^4, at its end which extends through the bearing j^5, is provided with a square bearing-surface, which, when the rod is protruded through the bearing by the action of the governor, projects into the path of the lower end of the vibrating lever G^2 and will engage the end of said lever, which is also provided with a suitable engaging surface, when the latter is at or near the limit of its forward stroke, and thus hold the exhaust-valve open until the governor allows the rod to be again retracted out of the path of the vibrating lever.

The inlet or supply port K of the cylinder is located at the center of the rear end thereof, and is controlled by a valve l, vertically arranged within a valve-casing L, suitably connected with said port K, as clearly seen in Fig. 1. From the valve-casing L the inlet-pipe M leads downward a short distance and is then turned at a right angle and extended to the carbureter M'. The valve-stem l' of the valve l extends downwardly through the vertical pipe M and through the wall of the said pipe at the bend thereof, outside of which it is provided with an expansion-spring l^2 and regulating-nut l^3 for holding the valve l firmly against its seat. The valve-casing L is somewhat enlarged above the valve l and constitutes the ignition-chamber L' of the engine, the cap l^4, which forms the upper end of the chamber, being provided with a central aperture l^5 in axial alinement with the valve-stem l', into which the latter extends and is adapted to fit and slide, thereby forming a guide for said stem. An ignition-tube is shown as communicating at its lower end with the ignition-chamber through the aperture in the upper closing-cap thereof and through an obliquely-downward and laterally-extending aperture l^7, extending from the central aperture outward into the ignition-chamber. The upper end of the ignition-tube is shown as standing within a draft chimney or casing l^8, resting upon the upper end of the chamber L', said ignition-tube being closed at its upper end and, when in use, being kept at the required igniting temperature by a gas-jet or other suitable means. (Not herein shown.)

As a means of supplying oil to the carbureter M' an oil-pump N of common construc-

tion is shown as suitably secured to the bed of the engine at one side thereof, a pipe n communicating with any source of supply and supplying oil to the pump, while a pipe n' conveys the oil from the pump to the carbureter M', as shown. The carbureter is provided with an overflow-pipe n^4, leading from a point near the bottom thereof back to the source of supply, thus preventing the oil from rising above a predetermined point therein. The pump is operated by means of a bell-crank lever n^2, pivoted to a suitable support on the frame of the engine, the lower arm of said bell-crank lever being pivotally attached to the piston-rod n^3 of the pump, while the other vertical arm is engaged with a reciprocating connecting-rod O, having pivotal connection at one end with a pivot-lug o, formed on the inner or concave side of the curved lever G'. The connection between the vertical arm of the bell-crank lever n^2 and the connecting-rod O is in the form of a horizontally-projecting stud on the lever n', upon which a downwardly-opening hook o', formed in the connecting-rod O, is adapted to rest by gravity, this arrangement permitting the connecting-rod O to be lifted free from the lever n^2, when the latter may be operated by hand, the upper end of said lever n^2 being for this purpose formed in the shape of a handhold, as shown.

The carbureter M' is provided with an air-inlet pipe m, through which air is drawn into the carbureter by the exhaust action of the piston in the cylinder B, and in order to insure the admixture of air and vapor in proper proportions this pipe m is adapted to slide within its fitting, so that its inner end may be adjusted nearer to or farther away from the surface of the oil, as required.

The operation of the engine as thus constructed is as follows: Assuming the engine to be in the position shown in the drawings, in which the piston is shown as just beginning its instroke after having been forced out by an exploded charge of gas, and the exhaust-valve I' as just beginning to open, as the piston moves back the vitiated gases and products of combustion formed by the previously-exploded charge will be driven out through the exhaust-valve. As the piston reaches the end of its instroke the exhaust-valve will be closed, and upon the ensuing outstroke (which is accomplished by the momentum acquired by the explosion of the previous charge) the exhausting action of the piston causes the inlet-valve l to rise and fill the cylinder with vapor drawn from the carbureter. Upon the commencement of the return stroke of the piston the valve l closes, the charge of vapor in the cylinder is compressed by the instroke of the piston, the compressed charge then exploded by the ignition-tube, and the piston again forced out, when the parts of the engine will again be in the position illustrated and the cycle of operations repeated. It may be here stated that the time of explosion is controlled by regulating the heat of the ignition-tube and also by varying the proportions of air and gas in the charge admitted to the cylinder.

With the construction shown it is evident that the amount of gas or size of a charge drawn in by the piston may be regulated at pleasure, it being evident that by means of the set-screw g^3 in the lever G' the exhaust-valve I' may be held open during the entire instroke of the piston or during any less part of the stroke, thus regulating the charge that will be drawn in by the succeeding outstroke, it being plain that whatever portion of the vitiated gas is retained in the cylinder will prevent that much of the succeeding charge from entering.

The speed of the engine is regulated by means of the thumb-screw j^4, acting on the lever J^3, thus bringing more or less of the tension of the spring j^2 into opposition to the action of the governor-weights, which latter are also regulated by the tension of their connecting-springs. When thus regulated to run at a certain speed, should the engine for any reason exceed that speed the rod J^4 will be projected into the path of the vibrating lever G^2, which, engaging therewith, holds the exhaust-valve open, thus allowing free egress and ingress of air through that port and interrupting the charging action of the cylinder until the speed of the engine is properly reduced, whereupon the rod J^4 will be retracted by the expansion-spring j^2 and the engine will again resume its normal action, the slight lifting of the lever G^2 at each contact of the set-screw g^3 therewith insuring its prompt disengagement with the rod J^4 as soon as the governing devices permit the retraction of the rod.

I claim as my invention—

1. A gas-engine comprising a cylinder, an exhaust-valve a crank-shaft, and means for actuating the exhaust-valve embracing a vibrating lever having operative connection with said valve, an oscillating tappet, a pinion on the crank-shaft and a gear-wheel twice the size of the pinion, said tappet being driven through operative connections with the gear-wheel substantially as described.

2. A gas-engine comprising a cylinder, an exhaust-valve therefor, a crank-shaft and means for actuating the exhaust-valve embracing a vibrating lever having operative connection with the exhaust-valve, an oscillating tappet, a pinion on the crank-shaft, a gear-wheel twice the size of the pinion and a connecting-rod engaged with a crank-pin on the gear-wheel and with the said tappet, substantially as described.

3. A gas-engine comprising a cylinder, an exhaust-valve and means for actuating the exhaust-valve embracing a vibrating lever connected with the movable part of the valve and a vibrating tappet actuated from the crank-shaft of the engine and acting on said

lever, said tappet being provided with an adjustable contact-point, substantially as described.

4. A gas-engine comprising a cylinder, an exhaust-valve therefor, a crank-shaft, a vibratory lever having operative connection with the exhaust-valve an oscillating tappet for actuating said lever and a governing mechanism embracing a centrifugal governor which is driven by the crank-shaft, and a movable stop connected with and actuated by the governor and movable laterally into and out of the path of said vibratory lever, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

GEORGE ALDERSON.

Witnesses:
GEO. A. WILSON,
WM. S. MASON.

Correction in Letters Patent No. 560,016

It is hereby certified that the residence of the assignee in Letters Patent No. 560,016, granted May 12, 1896, upon the application of George Alderson, of Lasalle, Illinois, for an improvement in "Explosive-Engines," was erroneously written and printed "Peru, Indiana," whereas said residence should have been written and printed *Peru, Illinois;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 26th day of May, A. D. 1896.

[SEAL.]

JNO. M. REYNOLDS,
Assistant Secretary of the Interior.

Countersigned:

S. T. FISHER,
Acting Commissioner of Patents.