J. W. SMITH.

EXPLOSIVE ENGINE.

APPLICATION FILED JAN. 6, 1908.

920,405.

Patented May 4, 1909

2 SHEETS—SHEET 1.

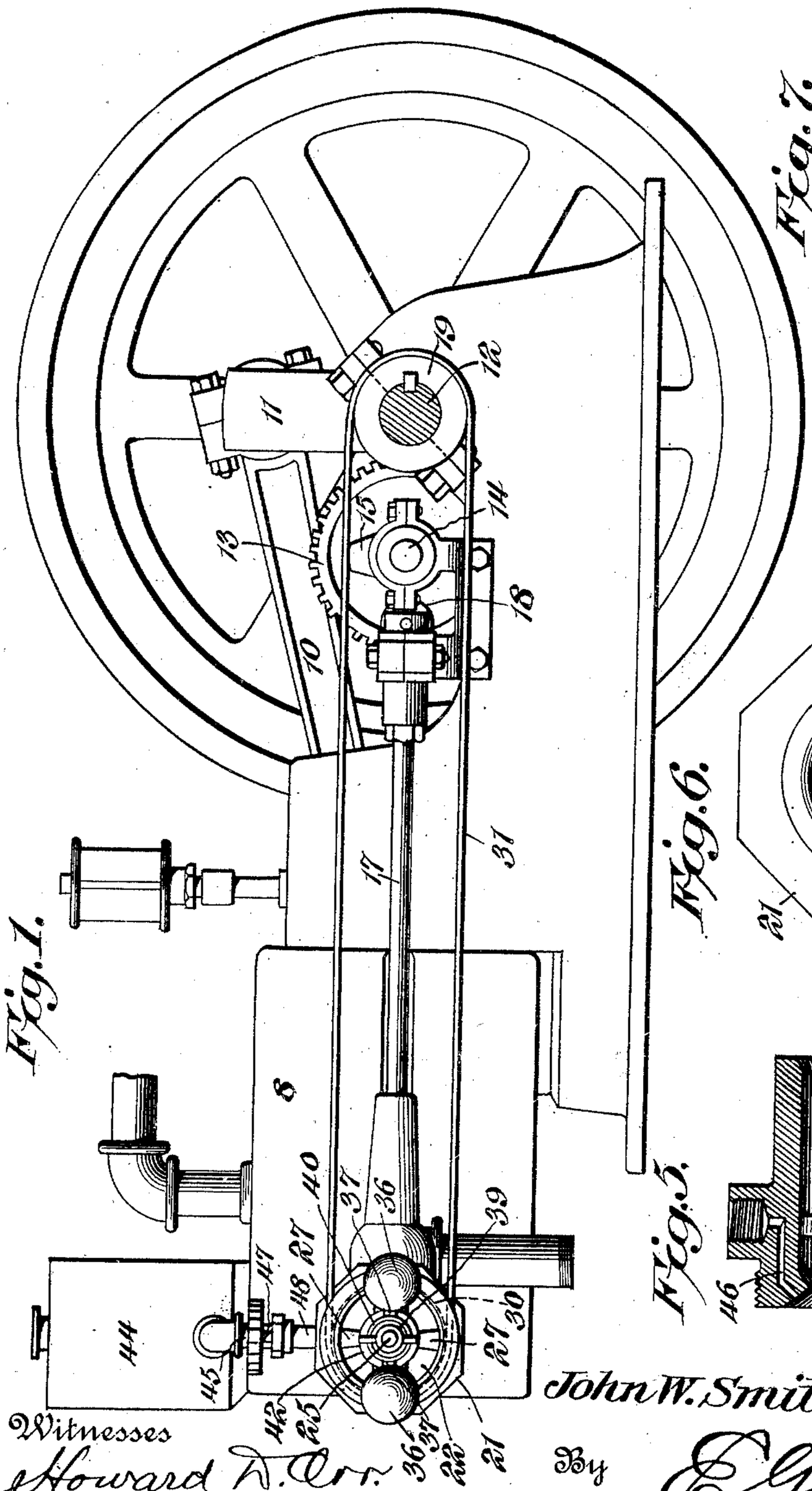

Fig. 1.

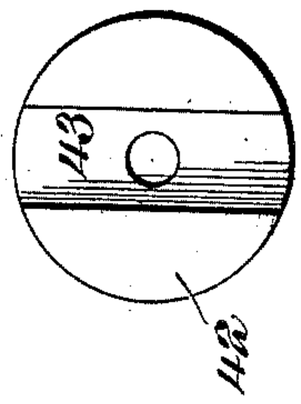

Fig. 7.

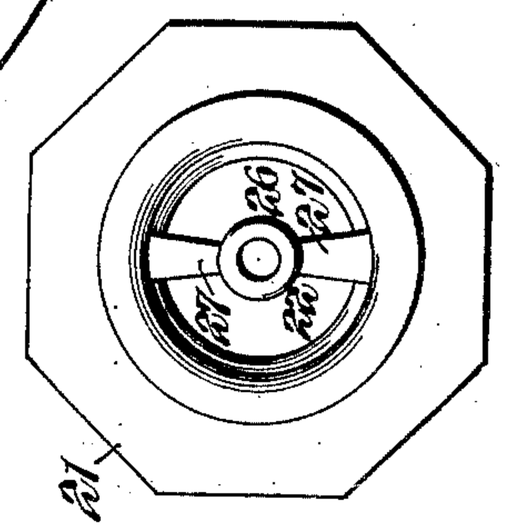

Fig. 6.

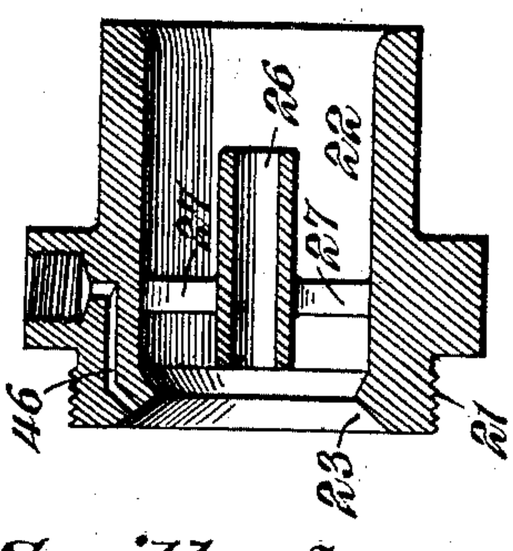

Fig. 5.

Witnesses

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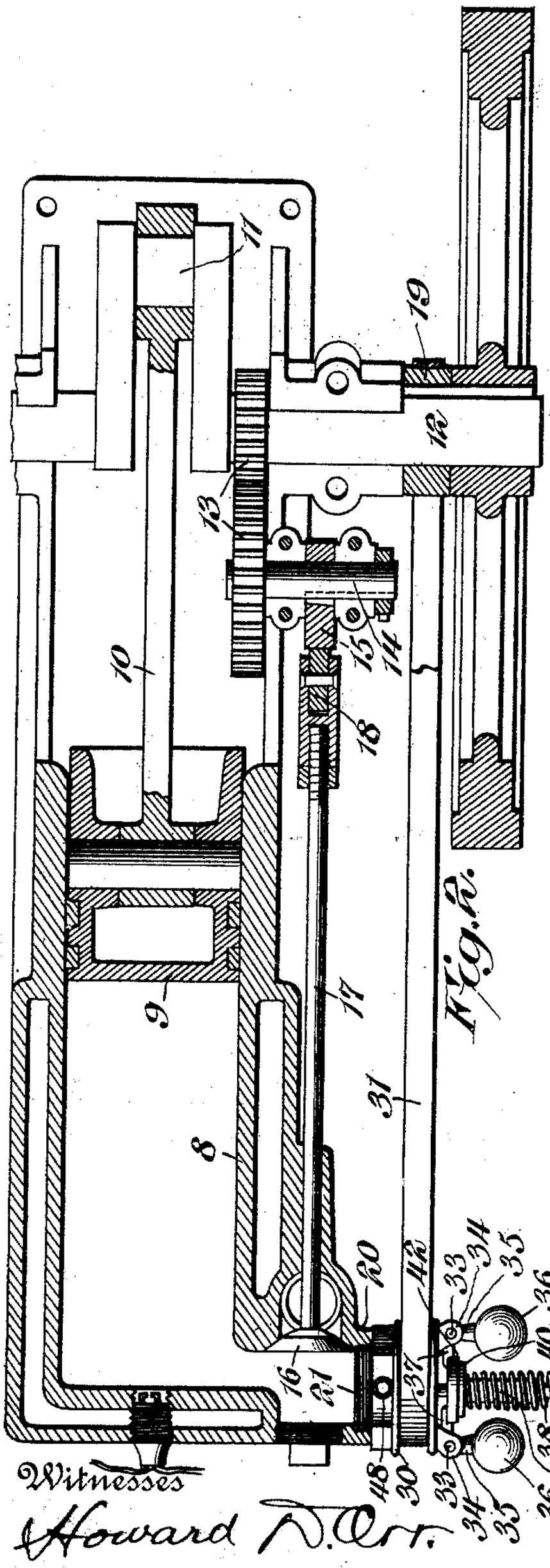

Fig. 2.

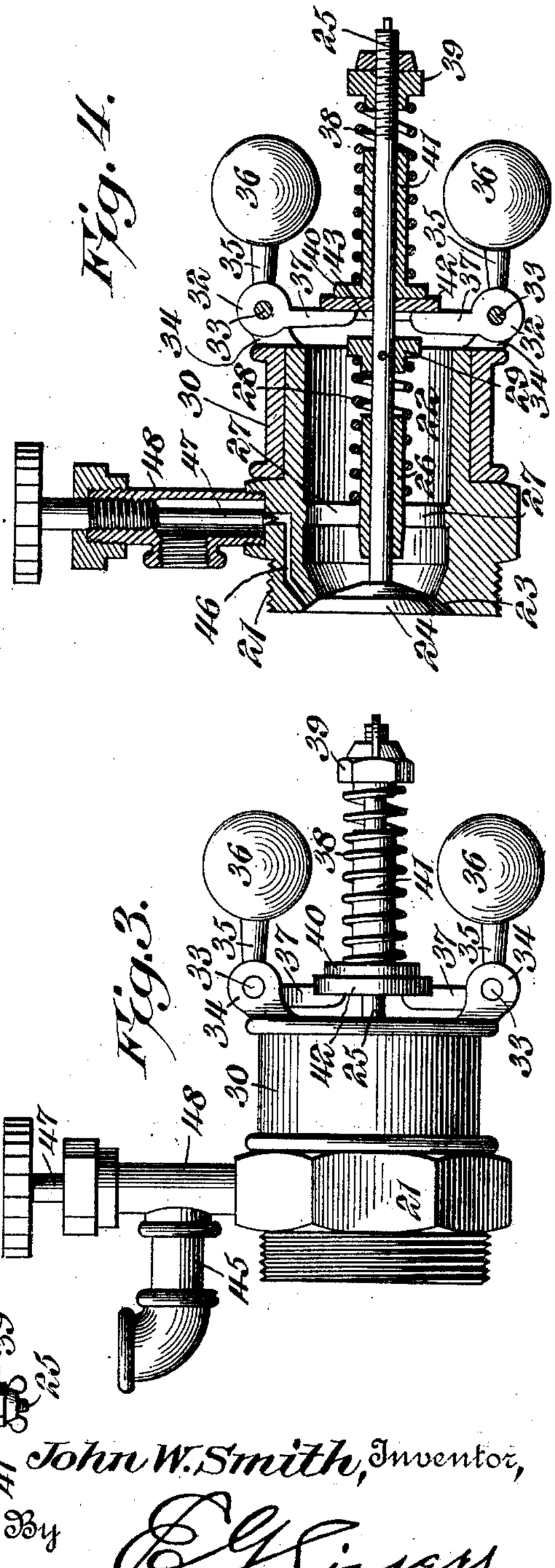

Fig. 4.

Fig. 3.

Witnesses

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UNITED STATES PATENT OFFICE.

JOHN WILLIAM SMITH, OF AURORA, IOWA.

EXPLOSIVE-ENGINE.

No. 920,405. Specification of Letters Patent. Patented May 4, 1909.

Application filed January 6, 1908. Serial No. 409,568.

To all whom it may concern:

Be it known that I, JOHN WILLIAM SMITH, a citizen of the United States, residing at Aurora, in the county of Buchanan and State of Iowa, have invented a new and useful Explosive-Engine, of which the following is a specification.

The present invention relates more particularly to means for controlling the supply of charges to the cylinder of an explosive engine and the principal object is to provide a novel, an exceedingly simple, and thoroughly practicable apparatus, which can be readily applied to practically any type of explosive engine, by means of which the charges delivered to the engine will be automatically varied according to the speed of such engine.

The preferred embodiment of the invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a side elevation of an engine, showing the improvements applied thereto. Fig. 2 is a horizontal sectional view therethrough. Fig. 3 is a side elevation on an enlarged scale of the controlling means. Fig. 4 is a vertical longitudinal sectional view therethrough. Fig. 5 is a longitudinal sectional view through the casing. Fig. 6 is an end elevation of said casing. Fig. 7 is a side elevation of the abutment washer.

Similar reference numerals designate corresponding parts in all the figures of the drawings.

The engine, which may be of any suitable type, in the present embodiment, comprises a cylinder 8 in which operates a reciprocatory piston 9, said piston being connected by a pitman 10 to the crank 11 of the engine shaft 12. This shaft is geared as shown at 13 to a stub shaft 14, on which is mounted a cam 15 for operating the exhaust valve 16. The said exhaust valve is provided with a stem 17 having a roller bearing 18 against the cam. On the engine shaft 12 is also mounted a pulley 19 by means of which the charge supply governing mechanism is operated, as hereinafter described.

Located at the rear end portion of the cylinder member and at one side is a boss 20, into which is threaded the inner end of a valve casing 21, said valve casing being tubular in form and having an air supply passageway 22 extending longitudinally therethrough. This passageway has an outer open end, and its inner end is surrounded by a valve seat 23. An inwardly opening valve 24 coöperates with the valve seat 23, and has a valve stem 25 that extends longitudinally through the air passageway 22 and projects from the outer end thereof. The said stem has a slidable bearing in a guide sleeve 26 located centrally in the air passageway, and held in position by spider arms 27. A spring 28 bearing against the spider arms and against a collar 29 fixed to the stem, normally maintains the valve 24 in closed condition.

The outer end portion of the valve casing 21 is circular in cross section and constitutes a bearing or support for a rotatable driving gear member, in the form of a pulley 30 connected to the pulley 19 of the engine shaft by a belt 31. This pulley also constitutes a support for a centrifugal governor, the governor comprising bell cranks 32 pivotally connected as shown at 33 to ears 34, projecting from the outer side of said pulley. The outstanding arms 35 of the bell cranks have weights 36, and the inwardly extending angularly disposed arms 37 are located on opposite sides of the stem 25. A coiled spring 38 bears at its outer end against an adjusting nut 39 threaded upon the outer end of the valve stem 25, and its inner end bears against the flange 40 of a sleeve 41 slidably mounted on the valve stem. This sleeve in turn is engaged with an abutment washer 42 having a transverse groove 43 in its inner side, said groove receiving the inner ends of the arm 37.

Hydrocarbon or other motive fluid, derived from any suitable source of supply, as for instance, a reservoir 44 mounted on the engine or cylinder and having a pipe 45 that is connected to the top of the casing 21, communicates with a supply channel 46 that opens through the valve seat 23. The valve 24 consequently controls not only the air passageway 22 but the channel 46. The supply of motive fluid is controlled by a suitable needle valve 47 that closes the outer end of the channel 46 and is threaded into a suitable casing portion 48.

The operation of the structure, it is thought will be readily understood by those skilled in the art. Upon the intake stroke of the piston, the valve 24 will be opened, due to the greater pressure of the air on the outer side of the same. Upon the opening movement of the valve, hydrocarbon or

other suitable motive fluid will be drawn in through the channel 46, and mixing with the inrushing air that passes the bore 22 of the casing will be vaporized, as it is carried into the engine cylinder. During the explosion or working stroke and the exhaust, the valve 24 will remain closed. As the engine shaft 12 rotates, the pulley 30 will be rotated, because of the belt connection with the pulley 19, and as the speed of the engine increases, the arms 35 under the action of the centrifugal weights 36 will swing outwardly. The result is that the abutment disk 42 will be moved outwardly toward the nut 39, thus compressing the spring 38 and producing greater resistance to the opening movement of the valve.

The peculiar advantage resulting from the use of the two springs, 28, 38, is that the spring 38 is normally not under tension, while the spring 28 is under tension at all times. Thus the spring 28 acts as the usual valve spring and operates under normal conditions or when the engine is starting, while the spring 38 is brought into action only after the speed of the engine has reached such a point that the governor is actuated. The governor then puts the spring 38 under tension by compressing it between the disk 42 and the nut 39. The tension of this spring 38 therefore acts to additionally hold the valve to its seat against the opening movement and to limit to this extent the opening movement of the valve, thus decreasing the amount of the charge which will enter the cylinder.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. In governing mechanism for explosive engines, the combination with a casing, of a controlling valve in the casing, a valve stem projecting out of the casing, a rotatable element concentric to the stem but independent thereof, a spring surrounding the stem and holding the valve closed, a disk sliding on the stem and bearing against the spring, and bell crank levers pivoted to the rotatable member, one arm of each bell crank extending inward against the disk, the other arm of the bell crank being provided with a weight.

2. In governing mechanism for explosive engines, the combination with a casing, of a controlling valve in the casing having a stem extending through and projecting from the casing, a spring contained within the casing coiled about the stem, a spring exterior to the casing and coiled about the stem, both springs having bearings at their outer ends against the stem, an adjustable bearing for the inner end of one of the springs, and a centrifugal governor for adjusting said bearing.

3. In governing mechanism for explosive engines, the combination with a casing, of a valve operating therein and having a stem projecting out therefrom, a spring contained within the casing and acting against the valve to hold it closed, a spring surrounding that portion of the stem which is exterior to the casing and acting against the valve, a rotatable element mounted upon the casing, a disk surrounding the valve stem and bearing against the inner end of said last-named spring, and a series of bell cranks mounted upon the rotatable element having inwardly projecting arms engaging with the disk, and arms projecting parallel with the stem having governor balls thereon.

4. A governing mechanism for explosive engines, the combination with a casing, of a valve operating therein and having a stem, a spring coiled about the stem and having a bearing against the same, a sleeve slidably mounted on the stem and interposed between the same and the spring, said sleeve having an outstanding flange, a disk rotatably and slidably mounted upon the stem and bearing against the flange, said disk having a groove, and a centrifugal governor rotatably mounted on the casing and including weighted arms that engage in the groove.

5. In governing mechanism for explosive engines, the combination with a casing having an air passageway therethrough provided with an outer open inlet end, of an inwardly opening valve controlling the passageway and having a stem projecting from the outer inlet end and of less cross sectional area than the same, and a centrifugal governor rotatably mounted on the casing and rotatable about the stem as an axis, said governor cooperating with the stem for controlling the movement of the valve.

6. In governing mechanism for explosive engines, the combination with a tubular valve casing having an air passageway therethrough, of a valve seat located at the inner end of the passageway, said passageway opening through the outer end of the casing, an inwardly opening valve coöperating with the valve seat and having a stem extending longitudinally through the passageway and projecting beyond and of less cross sectional area than the outer end of the casing, a driving gear member rotatably mounted on the tubular casing, centrifugal arms pivoted on the member, and connections between the arms and the stem.

7. In a governing mechanism for explosive

engines, the combination with a valve casing having a passageway therethrough, of an inwardly-opening valve controlling said passageway and having a stem projecting from the casing, a spring surrounding the stem and located in the interior of the casing for holding the valve closed, a spring surrounding that portion of the stem which projects from the casing, an abutment mounted upon the end of the stem against which said last named spring bears, a disk surrounding the stem and bearing against the other end of the spring, a pulley journaled on the casing and having ears, and a series of bell cranks mounted in the ears having inwardly-projecting arms engaging with the disk, and arms projecting parallel to the stem having governor balls.

8. In governing mechanism for explosive engines, the combination with a tubular casing having a valve seat at its inner end and open at its outer end, of an inwardly opening valve coöperating with the seat and having a stem extending through and projecting beyond the casing, said stem being of less diameter than the opening in the outer end of the casing, an adjustable bearing mounted on the stem, a spring engaged with the bearing and surrounding the stem, an abutment member slidably mounted on the stem and bearing against the spring, a pulley journaled on the casing, and crank arms pivoted between their ends on the pulley, said arms having their outer ends weighted and their inner ends bearing against the abutment.

9. In governing mechanism for explosive engines the combination with a valve casing, of a charge supply valve in the casing, a spring acting against the opening of the valve and normally under tension, a spring normally not under tension but which when under tension additionally acts against the opening of the valve, and a centrifugal governor operating to place the second-named spring under tension upon an increase of speed in the engine.

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

JOHN WILLIAM SMITH.

Witnesses:

GEO. RICHARDS,

F. D. JENNEY.