No. 646,322 Patented Mar. 27, 1900.

C. SINTZ.

EXPLOSIVE ENGINE.

(Application filed May 4, 1897.)

(No Model.) 3 Sheets—Sheet 1.

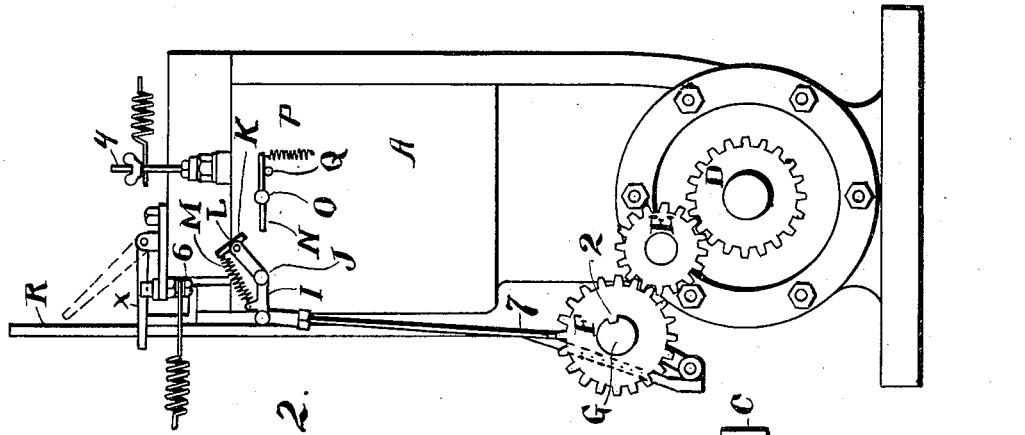

Fig. 2.

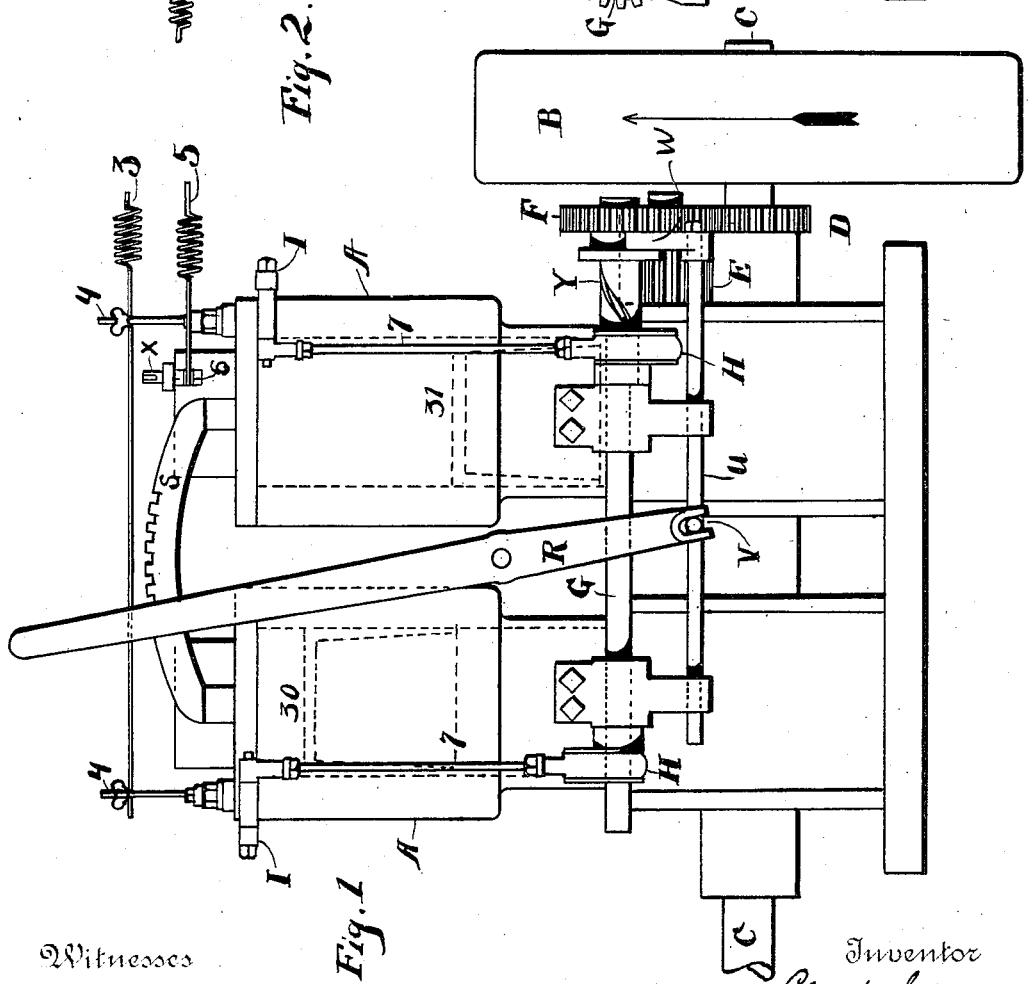

Fig. 1.

Witnesses

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Fig. 5.

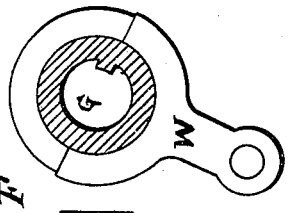


Fig. 6.

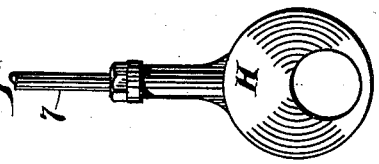
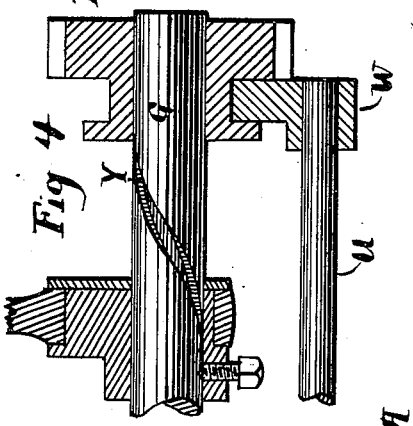


Fig. 4



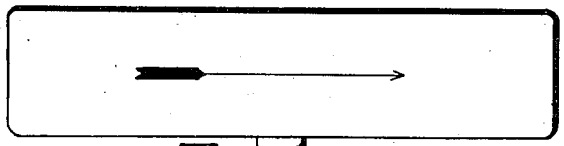


Fig. 3.

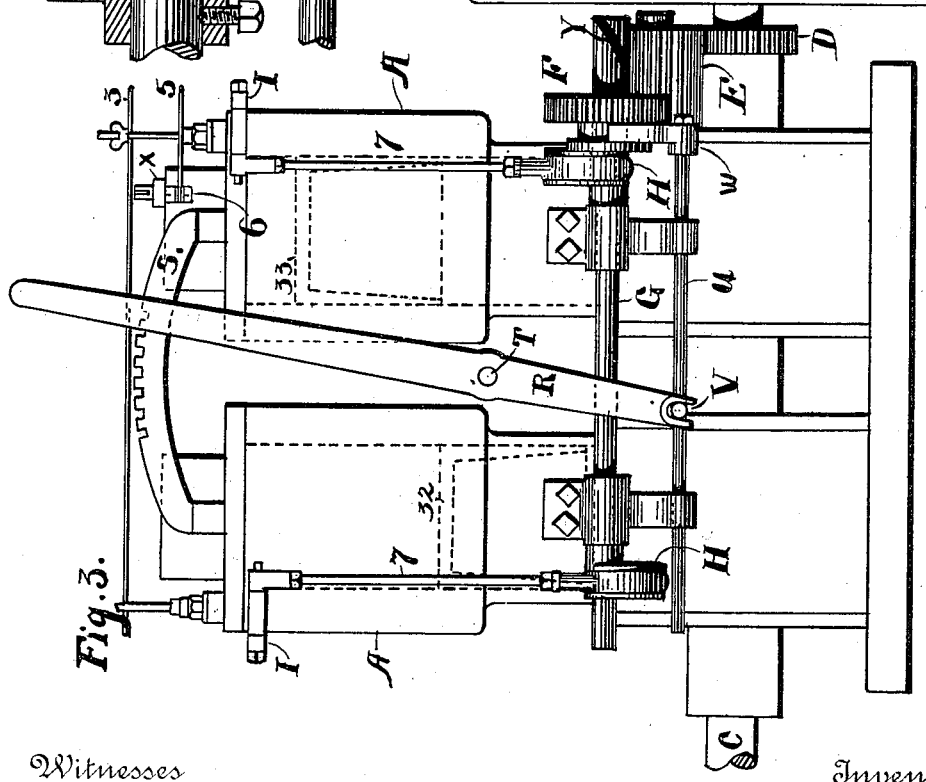


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Fig. 10.

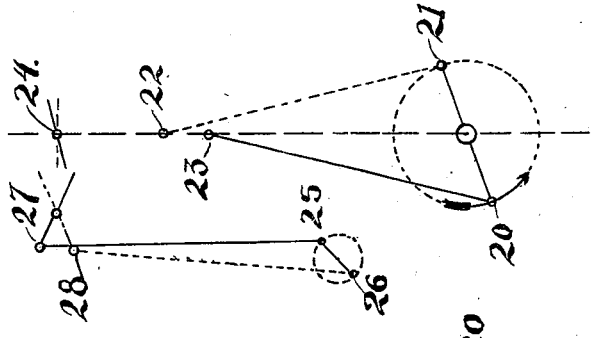


Fig. 9.

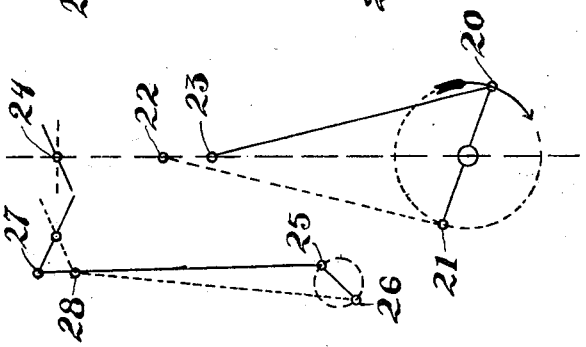


Fig. 8.

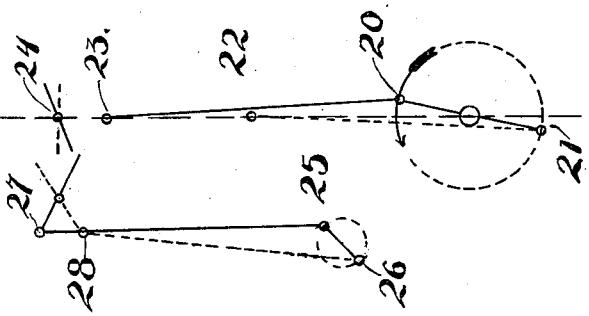
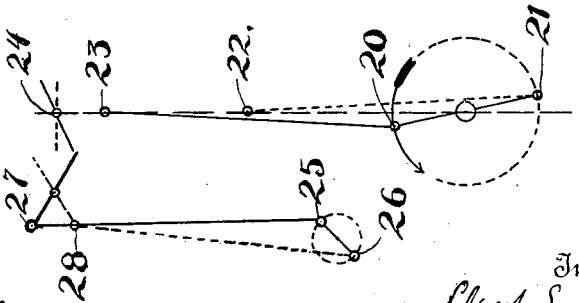


Fig. 7.



Witnesses
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Christopher Vondelinck

Inventor
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By his Attorneys
Edward Taggart

UNITED STATES PATENT OFFICE.

CLARK SINTZ, OF GRAND RAPIDS, MICHIGAN, ASSIGNOR TO THE WOLVERINE MOTOR WORKS, OF SAME PLACE.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 646,322, dated March 27, 1900.

Application filed May 4, 1897. Serial No. 635,022. (No model.)

To all whom it may concern:

Be it known that I, CLARK SINTZ, a citizen of the United States, residing at the city of Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification.

This invention relates to certain new and useful improvements in explosive-engines; and the invention consists in the construction of an explosive-engine wherein the charge may be exploded in any cylinder at any required position of the piston within the cylinder, also in the arrangement and combination of parts which enables the operator to shift the parts operating the exploding device so as to explode the gas or other explosive in the cylinder whenever the piston is in any required position within the cylinder, also in the arrangement and combination of parts which enables the operator to shift the exploding mechanism so as to start the engine by simply operating the exploder, and also in other novel features particularly described and pointed out in the specification and claims.

The objects of my invention are, first, to furnish an explosive-engine which can be started by merely operating the exploder; second, to provide means whereby the engine can be reversed by changing the time of explosions without stopping the same, and, third, to enable the operator to set the mechanism which operates the exploder so as to operate the exploder or exploders within the cylinders at any required point of the movement or position of the pistons within the cylinders. These objects I accomplish by means of the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of an explosive-engine containing two cylinders, showing the reversing-lever when set in position for running in the direction indicated by the arrow on the fly-wheel, the dotted lines showing the position of the pistons within the cylinders. Fig. 2 shows an end elevation of an explosive-engine constructed in accordance with my invention, the fly-wheel being removed for the purpose of showing my preferred form of gearing for operating the eccentric and exploders. Fig. 3 shows a side elevation with the reversing-lever in position to run the engine in a direction opposite from the direction illustrated in Fig. 1 and in the direction indicated by the arrow on the drive-wheel. The dotted lines in this figure show the position of the pistons within the cylinders. Fig. 4 shows a sectional view of the eccentric-driving gear, operated by a shifting-fork, with shaft and rod. Fig. 5 is an end view of the shifting-fork and a sectional view of the eccentric. Fig. 6 is an end view of an eccentric detached from the shaft. Figs. 7, 8, 9, and 10 are diagrams showing the various positions of the cranks at different points of the explosions.

Similar letters and figures refer to similar parts throughout the several views.

A A represent the cylinders, constructed in any suitable manner.

B represents the fly-wheel.

C represents the crank-shaft, operated by a pitman connected to the pistons in the ordinary manner.

D is a gear-wheel on the crank-shaft C, which gear-wheel engages with the intermediate gear-wheel E, the gear-wheel E engaging with a cog-wheel or gear-wheel F, which cog-wheel F drives the eccentric-shaft G, the eccentric-shaft G operating the eccentrics H H in the ordinary manner. Each eccentric is provided with an eccentric-rod 7, which eccentric-rods are adapted to operate the exploder.

In Fig. 2 the exploding device is more fully illustrated, I showing a rock-lever turning or rocking on the pivot J, carrying on its outer end a pawl K, which pawl K swings on the pivot L. M is a spring adapted to return the pawl to its normal position when moved out of place in passing the lever N, the lever N being the exploder-lever. O is the stem of the exploder lever N and turns with it. P is a spring adapted to return the lever N to normal position, or until the same reaches the stop Q.

I have described above the form of exploder adapted for use in connection with my invention; but any other suitable form of exploder may be used, as in this application I make no claim whatever to the peculiar form of the exploder.

R is a reversing and starting lever turning upon a fulcrum attached to the shell or framework of the engine and provided with forks adapted to engage with the stud V on the rod U, said rod U being the shifting-rod, which moves the shifting-fork W, and thereby the gear-wheel F on the eccentric-shaft G, said gear-wheel F being provided with a tongue which engages with the cam or curved groove Y, and as the gear-wheel F is moved the eccentric-shaft G is turned, thereby shifting the position of the eccentrics with reference to the time or point of explosions. The gear-wheel E having considerable length allows for the movement of the gear-wheel F upon the eccentric-shaft without disconnecting gear-wheel F from the gear-wheel E.

S is a quadrant provided with teeth or notches with which the lever R engages and is retained when set in any required position. Any form of device for retaining the lever R may be used. T is the fulcrum on which the lever R turns.

X is an electric switch, constructed in any ordinary manner.

2 is the pin or tongue, adapted to move in the groove Y of the eccentric-shaft G for the purpose of changing the position of the eccentric with reference to the crank-shaft, so as to cause the explosions to be made at different points of the stroke of the piston.

3 is one of the wire connections to an electric battery with the insulated exploder-screw 4. 4 is an exploder-screw. 5 is also a battery wire connected to the switch X by the insulated screw 6.

7 is the eccentric-rod, connecting the eccentric H with the lever 1.

The batteries and wires whereby the explosion is caused are of any ordinary construction.

In diagram Fig. 7 is shown the position of the crank, pistons, eccentrics, and connections at the time of the explosions. 20 shows the position of the crank when the piston is up, at which time the explosion will give a very slow motion. 21 shows the position of the lower crank when the piston is down. 22 shows the position of the piston connected with the lower crank when the piston is down. 23 shows the position of the piston when the piston is up connected to crank 20 when the crank is up. 24 and 27 show the positions of the igniter in position when it has just exploded the charge. 25 shows the position of the eccentric at its point of stroke when the charge is exploded. 26 shows the position of the eccentric near its lower stroke. 28 (dotted lines) shows the position of the exploder near the lower stroke of the eccentric. 27, above referred to, shows in full lines the position of the exploder near the upper stroke. Each of the diagrams is intended to illustrate a double-cylinder engine with two pistons, two eccentrics, and two cranks.

Referring now to diagram Fig. 8, 20 shows the position of the crank when the explosion takes place before the crank passes the center line of its upward stroke. The other numerals in both Figs. 7 and 8 show the corresponding positions of the other parts named above. If the explosion, as shown in Fig. 8, is just before the crank passes the center of its upward stroke, the fly-wheel will carry it beyond its center, and the explosion will merely continue the motion in the same direction. The object of exploding before the center is reached is to get the full force of the explosive when the crank is on the center, and this is best accomplished by exploding before the crank has reached its center.

Referring now to diagram Fig. 9, 20 shows the position when the explosion is intended to reverse the engine. This position is at some distance before the crank reaches the upward stroke, the other numerals showing the position of the several parts when the explosion takes place at the point 20 of Fig. 9 for the purpose of reversing the engine. The arrow in Fig. 9 shows the direction of the engine after it has been reversed by the explosion at point 20.

Referring now to diagram Fig. 10, 20 shows the position of the crank when the explosion takes place to again reverse the engine, so as to turn in direction to that shown in Figs. 7 and 8. This explosion takes place when the crank has passed some distance beyond its lower stroke.

I have given only the relative positions, which may be changed more or less in reversing the engine or in starting the engine. The diagrams are made to illustrate the operation of a two-cylinder engine. It will be readily understood, however, by those familiar with the operation of gas or explosive engines that the same principle can be applied to any explosive-engine having a plurality of cylinders and a plurality of pistons.

The operation of starting the engine is as follows: If the lever R is placed in a perpendicular position, the wires being connected to operate the exploder and all parts being in position, the cranks of the engine standing off the center, the lever is moved to the right, as shown in Fig. 3. This will move the shifting-rod U, shifting-fork W, and with it the gear F, to the left, revolving the eccentric-shaft and the eccentrics in position to operate the exploder, thereby starting the engine in motion and driving the same in the direction shown by the arrow on the fly-wheel B. When the crank has made a half-revolution, the charge is exploded in the other cylinder and the engine is fully under way.

In order to reverse the engine, all that is necessary to do is for the operator to shift the lever R, moving the shifting-rod U, shifting-fork W, and gear F, thereby turning the eccentric-shaft G and the eccentrics, and thereby shifting the relative position of the eccentric connecting-rods with relation to the positions of the pistons within the cylinders, so as to cause the explosion to take place at any

required position of either piston in either of the cylinders, the explosion taking place at the points above described in reference to diagrams Figs. 9 and 10.

Having thus described my invention, what I claim to have invented, and desire to secure by Letters Patent, is—

1. In an explosive-engine, the combination with a cylinder, a piston moving therein, and an exploder, of an eccentric-shaft having a cam-groove therein and carrying an eccentric having connection with the exploder, a driven gear movable longitudinally on said eccentric-shaft and in engagement with the cam-groove therein, and lever mechanism to move said gear and thereby rock or shift the eccentric-shaft to control the operation of the exploder at any required position of the piston, substantially as described.

2. In combination with a piston, a pitman driven thereby, a pitman-crank and a shaft rotated by said crank, a gear-wheel upon said shaft, an eccentric-shaft provided with a movable gear, an intermediate gear between the gear on the driving-shaft and the gear on the eccentric-shaft, a cam-groove in the eccentric-shaft, means for shifting the gear on the eccentric-shaft for the purpose of setting the eccentric-shaft in any required position for the purpose of changing the relative times of explosions, substantially as described.

3. In combination with a piston, a pitman, a pitman-crank, a shaft revolved by the said crank, an eccentric-shaft provided with a groove therein, a gear provided with a tongue moving in the said groove, an eccentric-rod, an exploding device operated by said eccentric-rod, and means for shifting the eccentric-shaft and thereby changing the time of explosion with reference to the movement of the piston, substantially as described.

4. In an explosive-engine, the combination with a cylinder, a piston moving therein, and an exploder, of an eccentric-shaft carrying an eccentric having connection with the exploder, a gear longitudinally movable on said shaft and driven by the engine, and means actuated by said gear when the latter is moved longitudinally on said shaft for shifting the eccentric-shaft to control the operation of the exploder at any required position of the exploder, substantially as described.

5. In an explosive-engine, the combination with a cylinder, a piston moving therein, and an exploder, of an eccentric-shaft carrying an eccentric having connection with the exploder, a gear longitudinally movable on said shaft and driven by the engine, means actuated by said gear when the latter is moved longitudinally on said shaft for shifting the eccentric-shaft to control the operation of the exploder at any required position of the latter, and means for shifting the said gear longitudinally on the shaft independently of its rotary movement communicated by the engine, substantially as described.

In witness whereof I have hereunto set my hand and seal in the presence of two witnesses.

CLARK SINTZ. [L. S.]

Witnesses:
EDWARD TAGGART,
CHRISTOPHER HONDELINK.