

UNITED STATES PATENT OFFICE.

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EXPLOSIVE-ENGINE.

997,138.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, THOMAS W. KEEN, of Swissvale, Allegheny county, Pennsylvania, have invented a new and useful Improvement in Explosive-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical cross-section of a horizontal double-acting gas engine embodying my invention; and Fig. 2 is a detail view showing one preferred form of the slot or traveling fulcrum for the valve-actuating lever.

My invention relates to the class of explosive engines, and is designed to prevent accidental abnormal opening of the inlet valve without the use of the heavy springs which have heretofore been employed for such purpose. The invention is also designed to give a positive movement to the inlet valve, by which the valve is locked and positively held at every point in its movement. My invention also is designed to carry out the same system upon the exhaust valve, and at the same time provide proper timing of the valves.

By the use of the invention the actuating mechanism is greatly simplified; the use of heavy springs is avoided, and the engine and operating parts may be generally made lighter, owing to doing away with the necessity for opposing the action of heavy springs.

In the drawings, 2 represents a gas engine cylinder, having an inlet port 3, and exhaust port 4, these being controlled respectively by inlet valve 5 and exhaust valve 6. The cylinder may be provided with the usual holes 7 and 8 for ignition plugs; 9 for indicator plug, and 10 for air starting valve plug. The inlet valve 5 seats against the removable seat 11, having spider arms 12 leading to guide 13 for the valve stem 14. These parts are located within an air and gas chamber 15, which is open to the air, and to which gas is admitted from the upper gas chamber 16 through puppet valve 17, secured to an intermediate part of stem 14, and seating upwardly against a hole in the partition 18. The stem 14 extends on beyond the valve 17 and up through guide 19 in the top of the gas chamber, and its projecting end is pivoted to an intermediate point in a lever 20. The lever 20 is actu-

ated by an eccentric rod 21, pivoted to its upper end and extending to an eccentric 22 on a two-to-one shaft extending lengthwise of the cylinder in the form shown. The lower end of the lever 20 is not fulcrumed at a fixed point, but is forked and provided with a connecting bush or roller covered pin 23 extending through a slot in a bracket 24, secured to the gas chamber in this form. A portion of this slot is preferably formed on a radius struck from the axis of the pivotal connection with the valve stem, while the remaining portion is at an angle thereto. During the movement of the valve fulcrum through this arc-shaped portion with such radius, the movement is idle and the valve is not actuated. When, however, the fulcrum pin passes the corner portion 25, as shown in Fig. 2, and enters the portion 26 of the slot, the valve will be positively moved toward or away from its seat.

The operating arrangement for the valve stem of the exhaust valve is similar to that above described, similar parts being designated by similar numerals, with the letter "a" applied. In this case also the eccentric rod 21^a, leading to eccentric 22^a, is, of course, set at a suitable angle nearly opposite to that of the eccentric 22. The eccentrics are so set and the insulated fulcrums are so arranged that the proper timing is given to the valves, they being actuated through the proper periods in the cycle of the engine.

It will be noted that each valve is of the puppet type, and has a positive movement in closing as well as opening; and is not opened against the pressure of any spring. It will also be noted that the movement of each valve is positive, and is locked at every point in the stroke, while at the same time the proper stroke is given for the desired functions.

The advantages of my invention will be obvious to those skilled in the art, since the heavy and cumbersome inlet valve springs are done away with and consequently less power is required to operate such valves, and the operating parts may be made lighter and less strong. The advantages of positive valve actuation are provided, and there is no possibility of accidental or abnormal opening of the inlet valve such as some times occurs, especially when the engine is running light and developing a considerable vacuum in the cylinder. The movement of the valve is positively held at every point

in its stroke, so that there is no danger of abnormal movement at any period or stage.

The invention may be applied to any or all puppet valves of an explosive engine within the scope of my invention; the actuating gear for the valve may be widely varied as well as the type of gas engine; and other changes may be made without departing from my invention, since I consider myself the first to positively open and close the puppet inlet valve of a gas engine.

I claim:—

1. In an explosive engine, an inlet valve arranged to seat for closing, and a lever pivoted to said valve between its ends arranged to positively move said valve throughout its opening and closing movements; substantially as described.

2. A gas engine having a puppet inlet valve, and an eccentric having actuating connections arranged to positively move said valve during both opening and closing movements, said connections being adapted to hold said valve at any point in its stroke; substantially as described.

3. In a gas engine, a puppet inlet valve, and an eccentric for positively moving the same through both opening and closing movements, said mechanism moving idly through a part of its stroke; substantially as described.

4. A gas engine having a puppet inlet valve and an exhaust valve, and eccentrics having actuating connections for positively

opening and closing both of said valves; substantially as described.

5. In an explosive engine, a reciprocating puppet inlet valve having a stem, a lever having a shiftable fulcrum pivoted to the valve stem, and connections for positively actuating the lever and the valve stem in both directions; substantially as described.

6. In an explosive engine, a reciprocating puppet inlet valve, a lever arranged to actuate the valve in both directions, connections for actuating the lever, and a shifting fulcrum for said lever, said fulcrum being arranged to allow idle movement of the actuating lever through a part of its stroke; substantially as described.

7. A puppet inlet valve having a gas valve attached to its stem, and actuating connections arranged to positively move said valves through their opening and closing movements; substantially as described.

8. A gas engine having a two-to-one shaft, a puppet inlet valve, and eccentric connections leading from the two-to-one shaft to said inlet valve and arranged to move the same positively throughout its opening and closing stroke; substantially as described.

In testimony whereof, I have hereunto set my hand.

THOMAS W. KEEN.

Witnesses:

J. A. HAMILTON,
W. H. CORBETT.