E. E. ARNOLD.

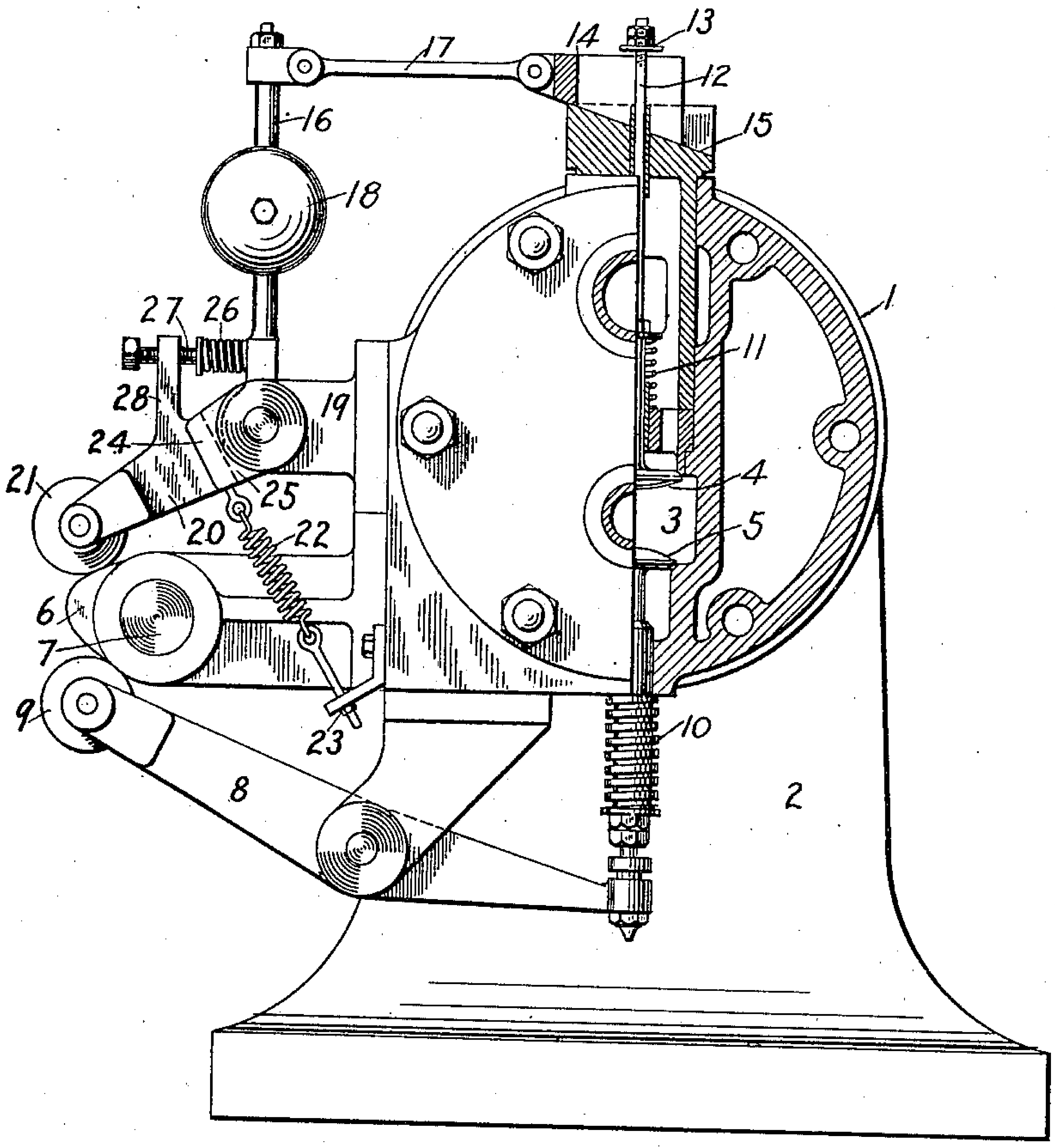
EXPLOSIVE ENGINE GOVERNOR.

APPLICATION FILED JAN. 20, 1904.

995,651. Patented June 20, 1911.

2 SHEETS—SHEET 1.

Fig. 1.



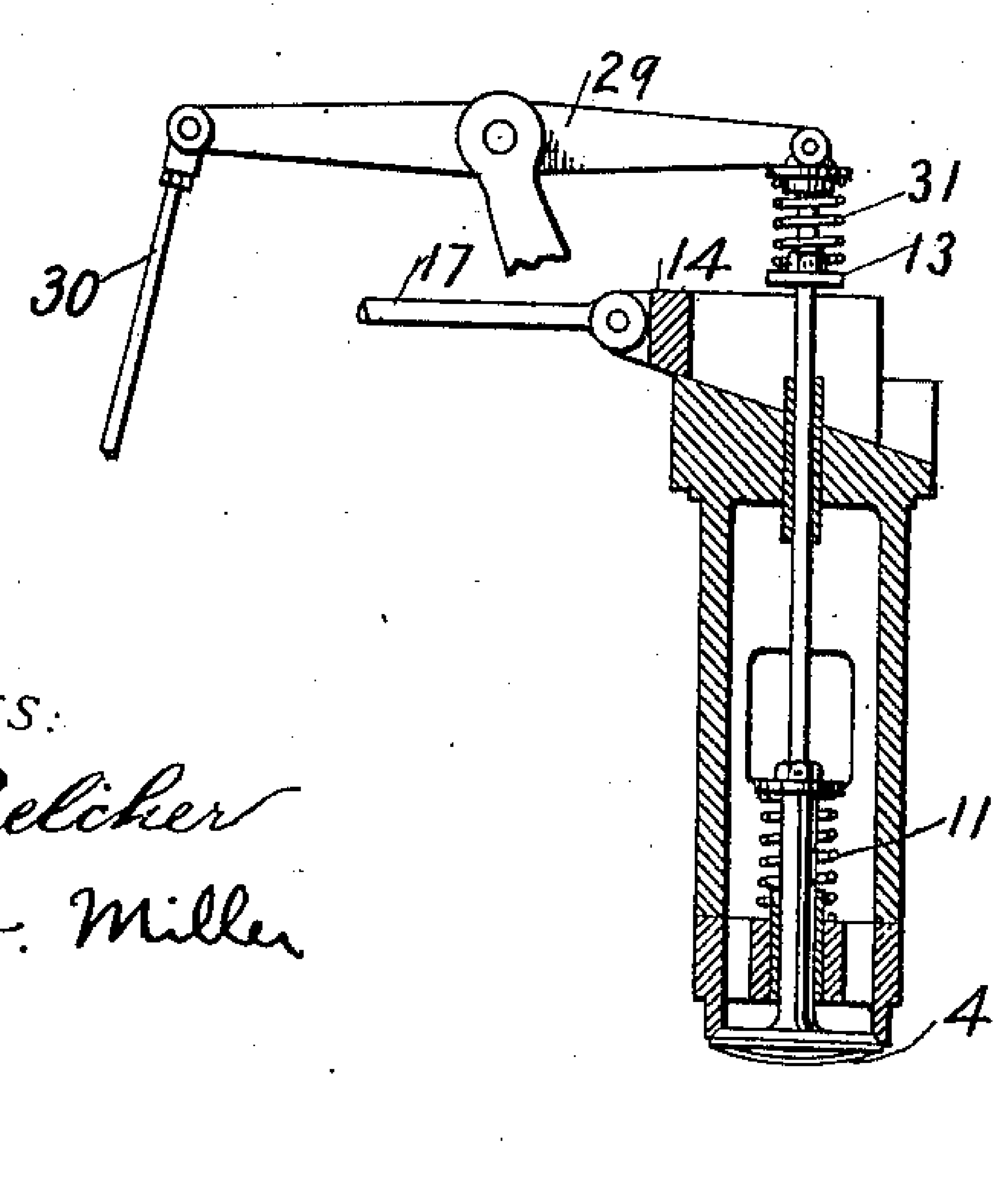


Fig. 2.

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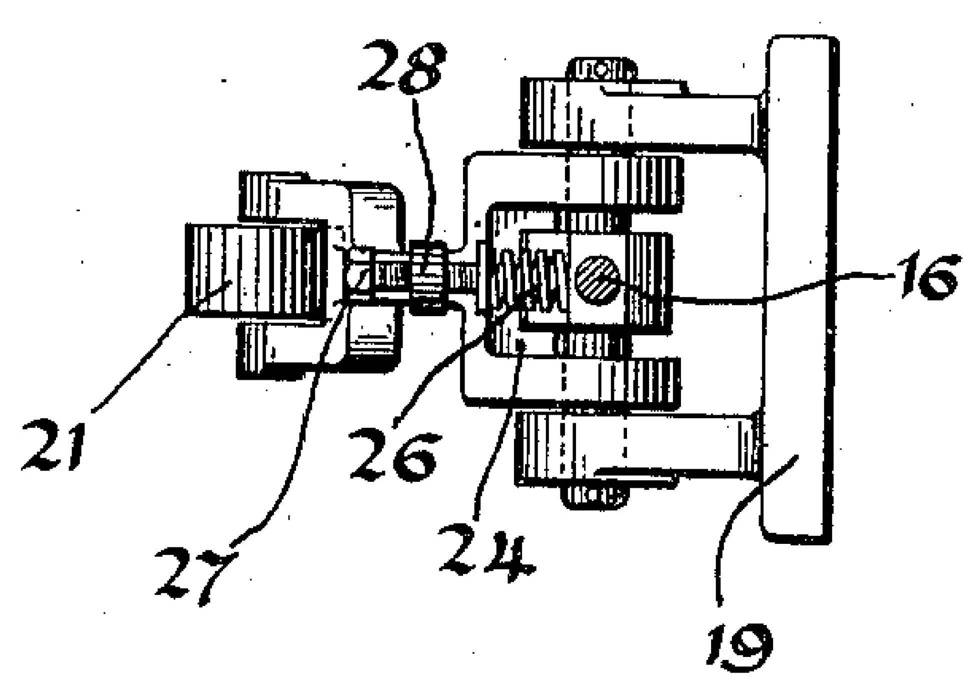

Fig. 3.

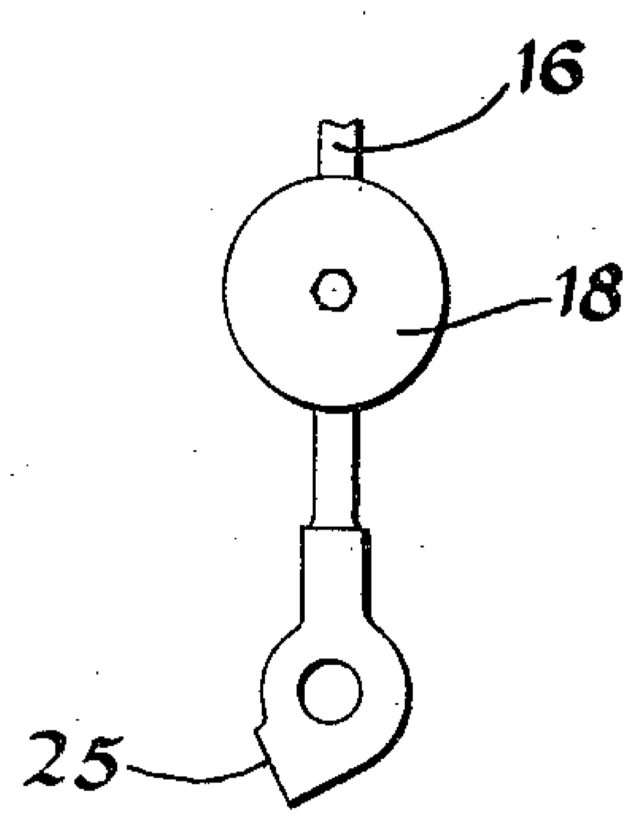

Fig. 4.

WITNESSES:
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UNITED STATES PATENT OFFICE.

EDWIN E. ARNOLD, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE COLONIAL TRUST COMPANY, TRUSTEE, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

EXPLOSIVE-ENGINE GOVERNOR.

995,651. Specification of Letters Patent. **Patented June 20, 1911.**

Application filed January 20, 1904. Serial No. 189,908.

To all whom it may concern:

Be it known that I, Edwin E. Arnold, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Explosive-Engine Governors, of which the following is a specification.

My invention relates to internal combustion engines, and particularly to automatic governing means therefor, and it has for its object to provide a governing means which shall automatically throttle the inlet of explosive mixture in accordance with the load on the engine and, consequently, properly regulate its speed.

In the accompanying drawing, Figure 1 is a view, partially in end elevation and partially in section, of an engine equipped with my improvements, and Fig. 2 is a sectional, detail view of a modification of one of the parts of the governing mechanism. Fig. 3 is a plan view illustrating a portion of the operating mechanism shown in Fig. 1. Fig. 4 is a side elevation of a detail of the apparatus.

My invention comprises a simple and effective means for performing all of the valve functions of an ordinary four-cycle explosive engine and at the same time governing the engine by throttling at the main inlet valve. This is effected by controlling the stroke of the inlet valve by means of an inertia governor, so that the quantity of explosive mixture admitted to the explosion chamber is automatically varied in proportion to the load on the engine. This combination enables me to omit entirely the special throttling valve which is usually employed with engines of this class.

Referring now specifically to the details of construction illustrated in the drawing, the cylinder 1 and frame 2 of the gas engine may be of usual or any desired construction, as may be also the combustion chamber 3, the inlet valve 4 and the exhaust valve 5, both of which open into the chamber 3. The exhaust valve 5 is operated from a cam 6 on a rotating shaft 7, which may be operated from the main shaft of the engine by means of any suitable gearing well known in the art, (not shown), a lever 8 being provided at one end with a roller 9 to be engaged by the cam 6 and being connected, at its other end, to the valve 5, the latter being seated by means of a coil-spring 10.

The devices thus far described are well known in the art and are here set forth merely for the purpose of making a full disclosure of the structure in connection with which my invention is used.

The inlet valve 4 is also normally held to its seat, by means of a coil-spring 11, and, as shown in Fig. 1, the valve is of the voluntary type; that is to say, it is opened at the desired intervals, when permitted by the mechanism to be hereinafter described, by the suction of the engine piston. The valve stem 12 is provided, at or near its upper end, with a stop-piece 13, beneath which is located a wedge 14, the inclined, under surface of which rests upon and is movable along an inclined surface 15, so that, as viewed in Fig. 1, if the wedge is moved to the right, its upper, horizontal surface will be depressed, and if moved to the left, the upper, horizontal surface will be raised.

The wedge 14 is connected to the upper end of an arm 16 by means of a link 17. The arm 16 is provided with a weight 18, at a suitable point intermediate its ends, and its lower end is pivoted to a suitable bracket 19 projecting from the engine frame. Pivoted concentrically with the lower end of the arm 16, is one end of a lever 20, the other end of which is provided with a roller 21 which rests upon the cam 6. The roller is held in engagement with the cam by means of a spring 22 the tension of which may be adjusted by means of a nut 23.

The lever 20 is provided with a face 24, against which normally rests a face 25 with which the lower end of the arm 16 is provided. The face 25 is normally held in engagement with the face 24 by a spring 26 one end of which rests against the arm 16 and the other end of which rests against the enlarged, inner end of a screw 27 that operates in a bracket 28 on the lever 20 in order to vary the pressure exerted by the spring.

During the operation of the engine under maximum load, the angle between the lever 20 and the arm 16, as shown in Fig. 1, will be maintained by the spring 26 and the opening movement of the valve 4 will therefore be uniform. During the downward movement of the lever 20 the face 24 thereon contacts with the face 25 of the inertia arm 16 and causes it to oscillate to the left. During the upward movement of the arm 20 the spring 26 absorbs the momentum of the inertia member due to the motion toward the left and starts it on the return oscillation. Thus the member is alternately moved in one direction by the unyielding contact of the faces 24 and 25, and in the opposite direction by the yielding contact of the spring 26. In case the load decreases, however, so that the cam 6 rotates at increased speed, the inertia of the arm 16, by reason of the weight 18, will be such that the spring 26 will be compressed and the angle between the arm 16 and the lever 20 will be decreased, in consequence of which the wedge 14 will be moved a less distance than before and the degree of opening movement of the valve 4 will be consequently decreased and the engine will be correspondingly slowed down.

As indicated in Fig. 2, the valve 4, instead of being opened by the suction of the engine piston, may be operated positively from the cam 6 by means of a lever 29 and a rod 30, the latter being connected, at its upper end, to the outer end of said lever and, at its lower end, to the lever 20, or the valve may be operated positively by any other suitable means. The inner end of lever 29 is connected to the stop-piece 13 by means of a spring 31, so that the adjustment of the wedge 14 will not interfere with the throw of the lever 29.

It is apparent that the position of the weight 18 may be varied, to suit the existing conditions, and rigidly locked or secured in place on the arm 16, since there is no relative motion between the arm and the weight during the operation of the engine; the radius of gyration of the inertia element remaining constant during the oscillations of the arm 16.

Variations in details of construction which do not materially change mode of operation or result are to be construed as within the scope of my invention.

I claim as my invention:

1. In a gas engine, an inlet valve having a limiting stop, a wedge to be engaged by said stop, a cam having a speed of rotation proportional to that of the engine, and connections between the cam and the wedge that embody an inertia element, the radius of gyration of which remains constant and which insures a decreased valve opening movement with a decrease of load.

2. In a gas engine, an inlet valve having a stem provided with a stop piece, a reciprocating wedge beneath said stop piece adapted to limit the motion of said valve, and means for reciprocating said wedge, which comprises an inertia member pivotally mounted on a stationary pin, a cam actuated lever pivotally mounted on said pin and held in definite relation to said inertia member by a stop lug and a spring.

3. In a gas engine, a reciprocating inlet valve, an inertia member pivotally mounted on a stationary pin, a cam actuated lever pivotally mounted on said pin and held in definite relation to said inertia member by a stop lug and a spring, and means, actuated by said inertia member, for limiting the amount of reciprocation of said valve in accordance with the speed of the engine.

4. In a gas engine, an inlet valve having a stem provided with a stop piece, a reciprocating wedge beneath said stop piece, an inertia member pivotally mounted on a stationary pin, a cam that rotates in accordance with the engine speed, and a lever, having a roller engagement with said cam, pivotally mounted on said stationary pin and held in definite relation to said inertia member by a stop piece and a spring, arranged to oscillate said member in one direction through said spring and in the other through said stop piece.

5. In a gas engine, the combination with an inlet valve and a device for varying its effective lift, of a cam that operates synchronously with the engine strokes, and connections between the cam and the varying device which embody a pivotally mounted inertia element, the radius of gyration of which remains constant, all operating to insure varying effective valve lift with variations in engine speed.

6. In a gas engine, in combination with its inlet valve, a rotary cam, an adjustable limiting device for the inlet valve, and connections between said device and the rotary cam embodying a pivotally mounted inertia element, the radius of gyration of which remains constant and the action of which serves to vary the effective lift of the inlet valve in accordance with the engine load.

7. In a gas engine, an inlet valve having a limiting stop, means for opening said valve at desired intervals, a movable wedge with which said stop is adapted to contact, a cam having a speed of rotation proportional to the engine speed, and connections between the cam and the wedge embodying a pivotally mounted inertia element, the radius of gyration of which remains constant and which limits the degree of valve opening in accordance with the load on the engine.

8. In a gas engine, an inlet valve, a member limiting the effective lift of said valve, a lever arm connected to rock synchronously with the engine strokes, a pivotally mounted inertia element, the radius of gyration of which remains constant, and a yielding con-

nection between said lever arm and said element whereby the position of said limiting member is controlled.

9. In a gas engine, an inlet valve, a sliding member limiting the effective lift thereof, a pivotally mounted inertia element, the radius of gyration of which remains constant, connected to move said sliding member, a shaft rotatable synchronously with the engine strokes, and agents between said shaft and said inertia element whereby at each revolution of said shaft said element is yieldingly oscillated.

10. In a gas engine, the combination with an inlet valve having a stem provided with a stop-piece, of a movable wedge beneath the stop-piece, a cam that is rotated proportionally to the engine speed, a lever having a roller that rests upon said cam, a weighted arm having one end pivotally mounted and normally held in definite angular relation thereto by a stop-piece and a compression spring, and a link connecting the free end of said arm to the wedge with which the valve stem stop-piece engages.

11. In a gas engine, the combination with an inlet valve having a stem provided with a stop-piece, of a movable wedge beneath said stop-piece, a cam that rotates in accordance with the engine speed, a lever having a roller in engagement with said cam, a substantially vertical weighted arm, the radius of gyration of which remains constant, having a spring-restrained pivotal connection with the lever, and a link connecting the free end of the arm with the wedge which is engaged by the valve stem stop-piece.

12. In a gas engine, the combination with an inlet valve having a limiting stop, of mechanism for opening said valve at desired intervals, a movable wedge in position to be engaged by said limiting stop when the valve is opened, a cam having a speed of rotation proportional to the engine speed, and connections between the cam and the wedge that embody a pivotally mounted inertia element, the radius of gyration of which remains constant, which limits the degree of valve opening movement in accordance with the load on the engine.

13. In a gas engine, the combination with an inlet valve having a limiting stop, of a laterally movable wedge in position to be engaged by said stop, adjusting mechanism for said wedge embodying a pivotally mounted inertia element, the radius of gyration of which remains constant, and actuating means, the movement of which is proportional to the speed of the engine.

14. In a gas engine, an inlet valve, a movable member limiting the effective lift thereof, a pivotally mounted inertia element, the radius of gyration of which remains constant, arranged to move said member, and means, comprising a spring which contacts with said inertia element, whereby said inertia element is yieldingly oscillated synchronously with the engine strokes.

15. In a gas engine, an inlet valve, a member limiting the effective lift of said valve, an oscillating lever arm rocked by a cam having a speed of rotation proportional to the engine speed, a pivotally mounted inertia element, the radius of gyration of which remains constant, and a yielding connection between said lever arm and said element whereby the position of said limiting member is controlled.

16. In a gas engine, an inlet valve, a sliding member limiting the effective lift thereof, a pivotally mounted inertia element, the radius of gyration of which remains constant, connected to move said sliding member, a shaft having a speed of rotation proportional to the number of engine strokes, and agents, comprising a spring which contacts with said inertia element, between said shaft and said element, whereby at each revolution of said shaft said element is yieldingly oscillated.

In testimony whereof, I have hereunto subscribed my name this 6th day of January, 1904.

EDWIN E. ARNOLD.

Witnesses:
WM. H. OTTERMAN,
BIRNEY HINES.