No. 886,500. PATENTED MAY 5, 1908.

W. R. HARRIS.

EXPLOSIVE ENGINE.

APPLICATION FILED AUG. 31, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

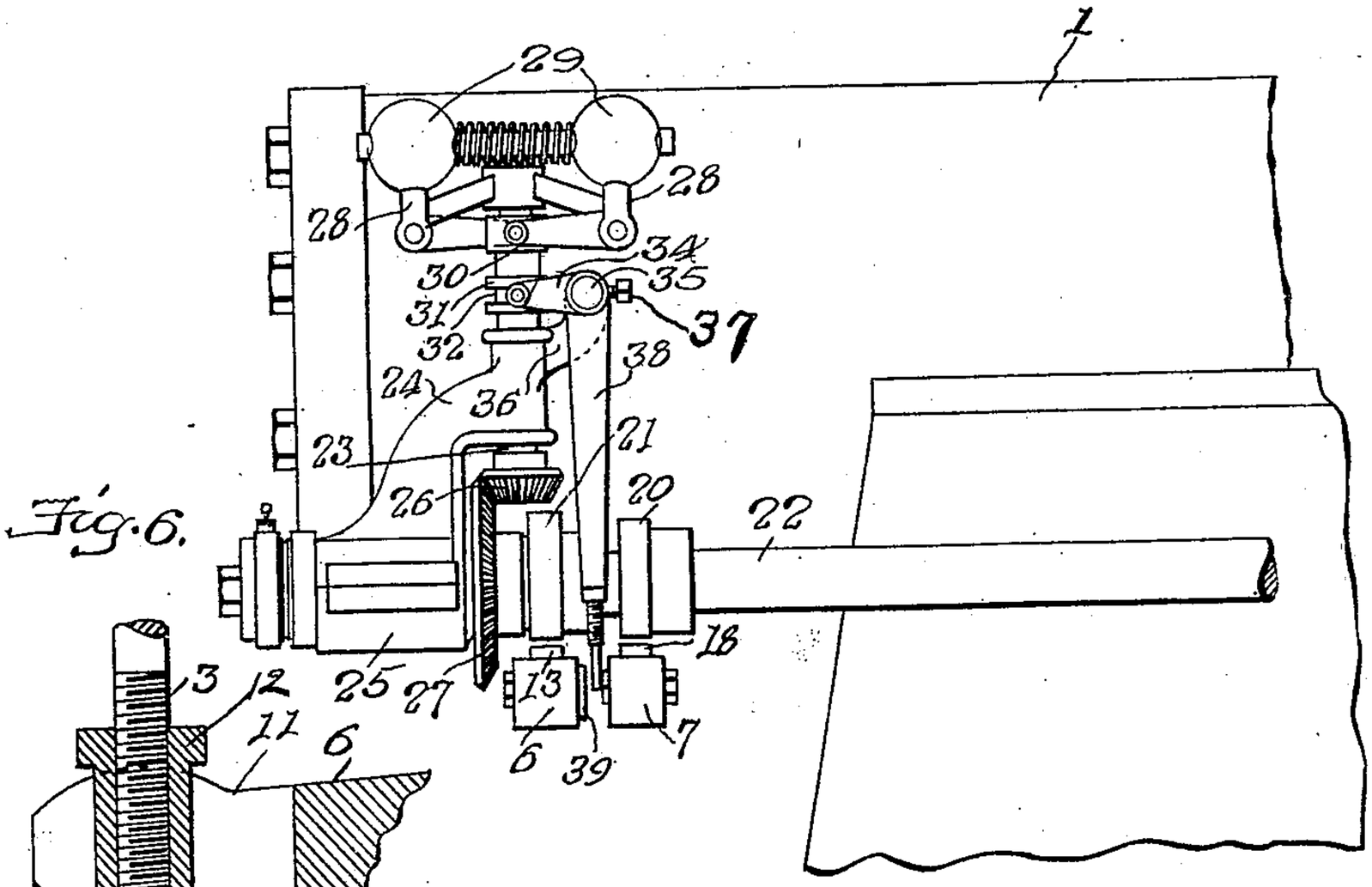

Fig. 6.

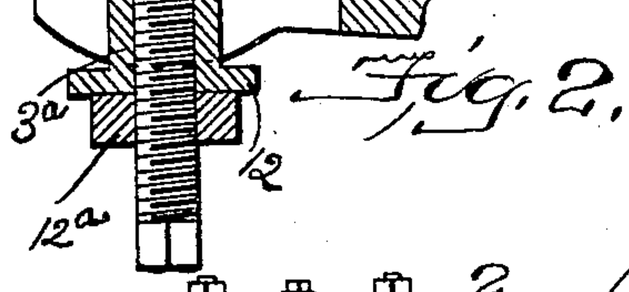

Fig. 2.

Witnesses

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2 SHEETS—SHEET 2.

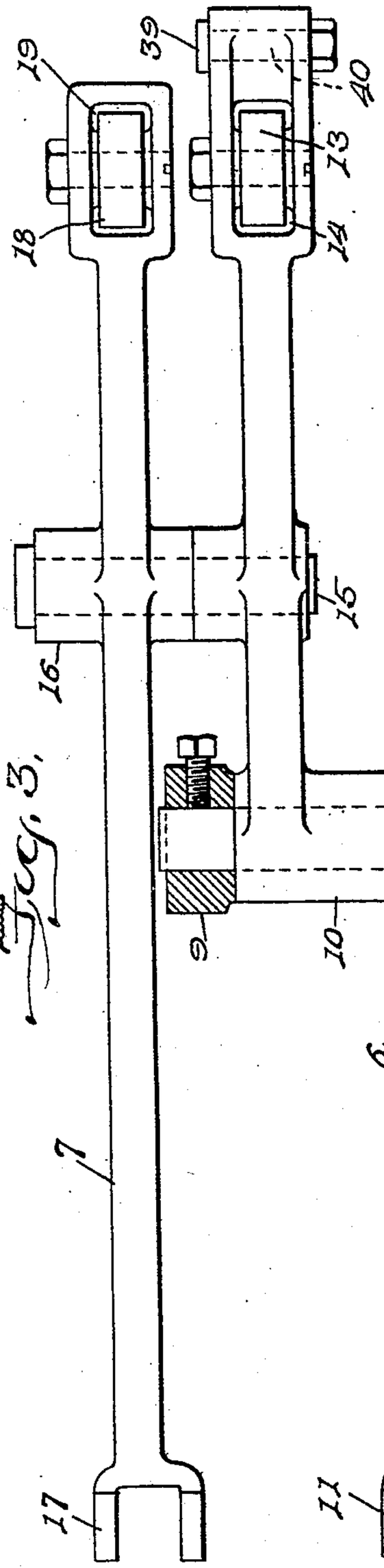

Fig. 3.

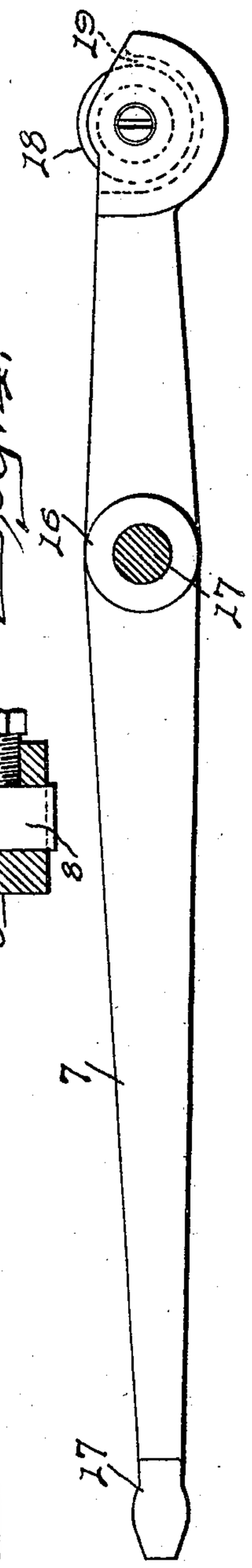

Fig. 4.

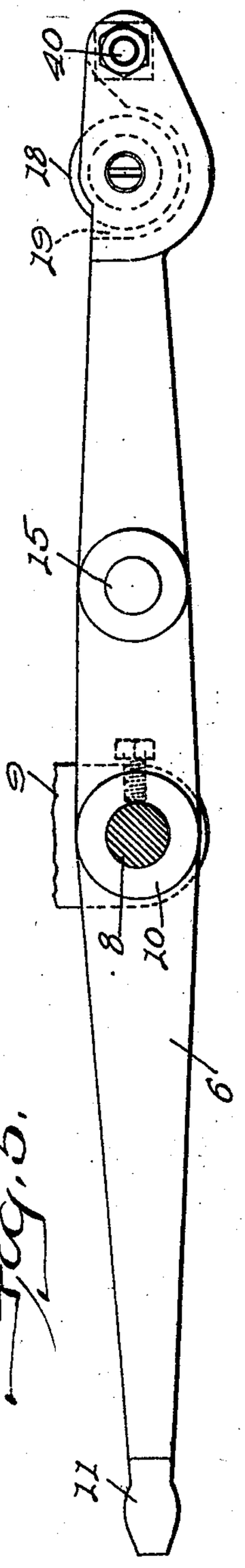

Fig. 5.

Witnesses

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UNITED STATES PATENT OFFICE.

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EXPLOSIVE-ENGINE.

No. 886,500. Specification of Letters Patent. Patented May 5, 1908.

Application filed August 31, 1907. Serial No. 390,854.

To all whom it may concern:

Be it known that I, WILLIAM R. HARRIS, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to explosive engines, and the object of the same is to provide an explosive engine with means for controlling the inlet and exhaust valves thereto, whereby the feeding of the fuel to the cylinder will be interrupted when the speed of the engine exceeds a certain predetermined limit and will be automatically started again when the speed of the engine falls below that limit.

With this object in view my invention consists in certain novel features of construction and in certain parts and combinations hereinafter to be described, and then more particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a portion of an explosive engine embodying my invention; Fig. 2 is an end elevation of the same; Fig. 3 is a top plan view of the valve-operating levers connected one to the other; Figs. 4 and 5 are detail views of the valve-operating levers, detached one from the other; and Fig. 6 is a sectional detail view showing the form of connection between the lever and valve stem.

In these drawings, I have illustrated the preferred form of my invention and have shown the same as applied to an engine of usual construction comprising a cylinder 1 and a chest 2 containing the inlet and exhaust valves, which valves are provided with valve stems 3 extending downwardly through the bottom of the chest 2 and provided with suitable springs for holding the valves normally in their closed position. Each spring is here shown as consisting of a spiral spring 4 coiled about the stem 3 and engaging the bottom of the chest 2 at its upper end and a suitable nut 5, mounted on the stem 3, at its lower end. The stem of the exhaust valve only is here shown, that of the inlet valve being located directly behind the stem of the exhaust valve and being identical therewith.

Suitable means are provided for positively operating the stems 3 of the inlet and exhaust valves for opening the same at the proper time to permit the feeding of the fuel to the engine and the exhausting of the burned charge therefrom. This operating means is preferably of such a construction that each valve may be operated independently of the other, but the operating means for the two valves are so connected that, when the exhaust valve is in its open position, the operating mechanism for the inlet valve will be held in an inoperative position with the valve closed. The operating mechanism which I prefer to employ consists of levers 6 and 7, pivotally supported by a fixed part of the engine and connected at one end to their respective valves and having their other ends extending to the opposite side of the cylinder or to some other suitable point where they are engaged by suitable actuating mechanism for rocking the same about their pivotal supports and operating said valves. In the construction which I prefer, the outer lever 6 actuates the exhaust valve and is supported upon a short shaft 8 mounted in apertured lugs 9 depending from the lower side of the cylinder 1, the lever 6 being provided with a suitable bearing aperture which is preferably elongated to form a bearing sleeve 10. The forward end of the lever 6 may be operatively connected with the valve stem 3 in any suitable manner, but I prefer the connection herein shown which consists in screw-threading the lower end of the valve stem 3 and mounting thereon a screw-threaded sleeve 3^a, having enlarged portions or collars 12 near its upper and lower ends, thus providing a reduced space between said collars adapted to receive the bifurcated forward end 11 of the lever 6, which is preferably rounded to permit of a limited pivotal movement relatively to said sleeve. One of the collars 12, preferably the upper one, has its edges flattened to form a wrench grasp, and the end of the valve stem 3 is provided with a suitable wrench grasp to enable the same to be rotated relatively to said sleeve. A suitable jam nut 12^a is mounted on the stem 3 beneath the sleeve 3^a to hold the same in its adjusted position. The opposite end of the lever 6 extends to the opposite side of the cylinder 1 and is there adapted to be engaged by suitable means for rocking the same about its pivotal center. This end of the lever is preferably provided with a suitable antifriction roller 13, journaled in a recess 14 formed near the end of

the lever. I prefer to construct this lever with an offset, as shown, which is provided by securing that end of the lever, which is connected to the valve stem, to the outer end of the bearing sleeve 10 and securing the opposite end of the lever to the inner end of the bearing sleeve, thus providing an elongated bearing for the lever, and, at the same time, locating a portion of the lever close to the inner end of the supporting shaft. The lever 7 is mounted upon the lever 6 in such a manner as to have a free pivotal movement independently of the movement of the lever 6, but in such a manner that, when the rear end of the lever 6 is depressed to hold the exhaust valve open, the rear end of the lever 7 and its pivotal support will both be depressed so as to hold the end of the lever out of engagement with its actuating mechanism and prevent the opening of the inlet valve. This support is preferably provided by mounting a stud shaft 15 on the lever 6 between the bearing sleeve 10 and the point where said lever is engaged by the actuating mechanism and in journaling the lever 7 on said stud shaft, this lever being provided preferably with an elongated hub or bearing sleeve 16 to afford the same ample bearing surface. This lever is also bifurcated at its forward end, as shown at 17, to engage the stem of the inlet valve, to which it is secured in the same manner as is the lever 6 to the stem of the exhaust valve, and is also provided at its rear end with an antifriction roller 18 mounted in a recess 19 formed near the rear end of the lever.

The means for actuating the levers 6 and 7 to rock the same about their pivotal supports and operate said valves may be of any suitable construction, but I prefer to employ suitable cams 20 and 21 which are mounted on a rotary part of the engine and are so adjusted as to engage the rear ends of the inlet and exhaust valve operating levers at the proper time to open the same. These cams are preferably mounted on a shaft 22, extending rearwardly along the cylinder and rotating from the main shaft of the engine by suitable mechanism. Suitable means are supplied, and adapted to be actuated by the governor, when the speed of the engine exceeds a certain predetermined limit, for locking the rear end of the exhaust valve operating lever in its lowermost position, with the exhaust valve open, and thus holding the inlet valve operating lever in an inoperative position with the inlet valve closed. In the construction here shown, the governor shaft 23 is mounted in a bracket 24, extending upwardly from the bearing 25 which supports the rear end of the shaft 22, and is provided with a bevel pinion 26 adapted to be engaged by a bevel gear 27 mounted on the shaft 22. The governor is of the usual type and consists of the usual arms 28 provided with weights 29 at one end and having their other ends connected to a collar 30 slidably mounted on the shaft 23 and held against rotation thereon so that, as the shaft 23 revolves, the balls 29 will be moved outwardly by centrifugal force and the collar 30 will move upwardly on the shaft 23. The collar 30 is connected to a second collar 31 having an annular groove 32 therein, which groove is adapted to receive a trunnion collar 33 carried by one arm 34 of a bell crank lever which is journaled on a suitable shaft 35, which is mounted on an arm 36 of the bracket 24 and is held therein by a set screw 37. The other and longer arm 38 of the bell crank lever extends downwardly such a distance that its lower end terminates in such a position that it may be moved into engagement with a part of the lever 6 when said lever is in its lowermost position. To this end, the extreme lower end of the arm 38 is provided with a straight flat surface and the rear end of the lever 6 is extended slightly beyond the point of engagement with the cam 21 and is provided with a suitable projection 39 adapted to engage the lower end of the arm 38. This projection preferably consists of the squared head of a bolt 40 which is passed through the extension on the rear end of the lever. Thus, when the speed of the engine rises, the governor will move the bell crank lever about its pivotal center and cause the lower end of the arm 38 to come into engagement with the side of the projection 39, and, when the cam 21 depresses the lever 6, the end of this arm will pass above said projection and prevent said lever rising under the influence of the spring 4 on the valve stem 3. The length of the arm 38 is preferably such that the lever 6 has a slight movement beneath the lower end thereof and is adapted to be engaged by the cam 21 and actuated through this limited space, thus moving the projection 39 out of engagement with the lower end of the arm 38 at each revolution of the cam 21 and thereby releasing the arm 38 and permitting the same to be moved out of the path of the arm 39 when the speed of the engine falls below said limit. When the lever 6 is located in this position, with the exhaust valve open, the rear end of the lever 7, together with its pivotal support, comprising the stud shaft 15 interposed between the bearing sleeve 10 and the point where the lever 6 is engaged by the cam 21, and engaging the bearing sleeve 16 on the lever 7, will be moved downwardly to such an extent that the rear end of said lever 7 will be moved out of the path of the cam 20 and said lever will be rendered inoperative and the spring on the stem of the inlet valve will hold the same in its closed position, thus permitting the piston to reciprocate within the cylinder 1 without drawing in a charge of fuel. Suitable means may also be provided for automatically cutting out the spark

in the cylinder, but as this forms no part of the present invention, it is not here shown.

The operation of the device will be obvious from the foregoing description, and it will be apparent that I have produced an explosive engine having a positively operated air and fuel valve and that I have provided means actuated by the governor for controlling the operation of said air and fuel valve, whereby the feed of the fuel to the explosive chamber of the engine may be controlled and the feed cut off and the exhaust valve opened when the speed of the engine exceeds a certain predetermined limit, and the feed of the fuel automatically restored when the speed falls below said limit.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

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

1. In a device of the character described, the combination, with the inlet and exhaust valves, of a lever pivotally supported from a fixed part of the engine and adapted to operate one of said valves, a second lever pivotally supported from the first-mentioned lever and adapted to operate the other valve, and independent means for actuating each of said levers.

2. In a device of the character described, the combination, with inlet and exhaust valves, of a lever pivotally supported from a fixed part of the engine and adapted to operate one of said valves, means for operating said lever, a second lever pivotally mounted on the first-mentioned lever at a point between its pivotal support and said actuating means and adapted to operate the other valve, and means for actuating the last-mentioned lever.

3. In a device of the character described, the combination, with the inlet and exhaust valves, of a lever having a bearing formed therein, a shaft carried by a fixed part of the engine and engaging said bearing, one end of said lever being adapted to operate one of said valves, means adapted to engage the opposite end of said lever to actuate the same, a second lever mounted on the first-mentioned lever and having its fulcrum interposed between said bearing and said actuating means, one end of said second lever being adapted to operate the other valve, and means adapted to engage the opposite end of said lever to actuate the same.

4. In an explosive engine, the combination, with a cylinder, inlet and exhaust valves therefor, stems for said valves, and a governor, of a lever pivotally supported from a fixed part of said engine and having one end adapted to engage the stem of said exhaust valve, means actuated by said engine for engaging the opposite end of said lever to move the same about its pivotal center, a second lever pivotally mounted on said first-mentioned lever at a point intermediate its pivotal support and said actuating means, said second lever having one end adapted to engage the stem of said inlet valve, and means actuated by said engine for engaging the opposite end of said second lever and moving the same about its pivotal support, and means controlled by said governor for locking said first-mentioned lever in such a position as to retain said exhaust valve in its open position.

5. In an explosive engine, the combination, with a cylinder, inlet and exhaust valves therefor, and stems for said valves, of a lever pivotally supported from a fixed part of said engine, a second lever pivotally supported from said first-mentioned lever, the forward ends of said levers being adapted to engage the stems of said exhaust and inlet valves, respectively, and to operate the same, cams rotatably mounted on said engine and adapted to engage the rear ends of said levers to move the same about their pivotal centers, a pivoted lever adapted to engage said first-mentioned lever to hold the rear end thereof in its lowermost position, and a governor adapted to operate said pivoted lever to move the same into and out of engagement with said first-mentioned lever.

6. In a device of the character described, the combination, with a valve, a valve stem having a screw-threaded portion between its ends, a wrench grasp at its lower end, and an actuating lever having a bifurcated end, of a screw-threaded sleeve mounted on said valve stem and having a reduced portion between its ends adapted to receive the bifurcated end of said lever, and means for holding said sleeve against rotation.

In testimony whereof, I affix my signature in presence of two witnesses.

WILLIAM R. HARRIS.

Witnesses:

EDWARD L. REED,

HARRIET L. HAMMAKER.