Nov. 3, 1925. 1,559,694

W. HARPER, JR

INTERNAL COMBUSTION ENGINE VALVE

Original Filed May 12, 1919

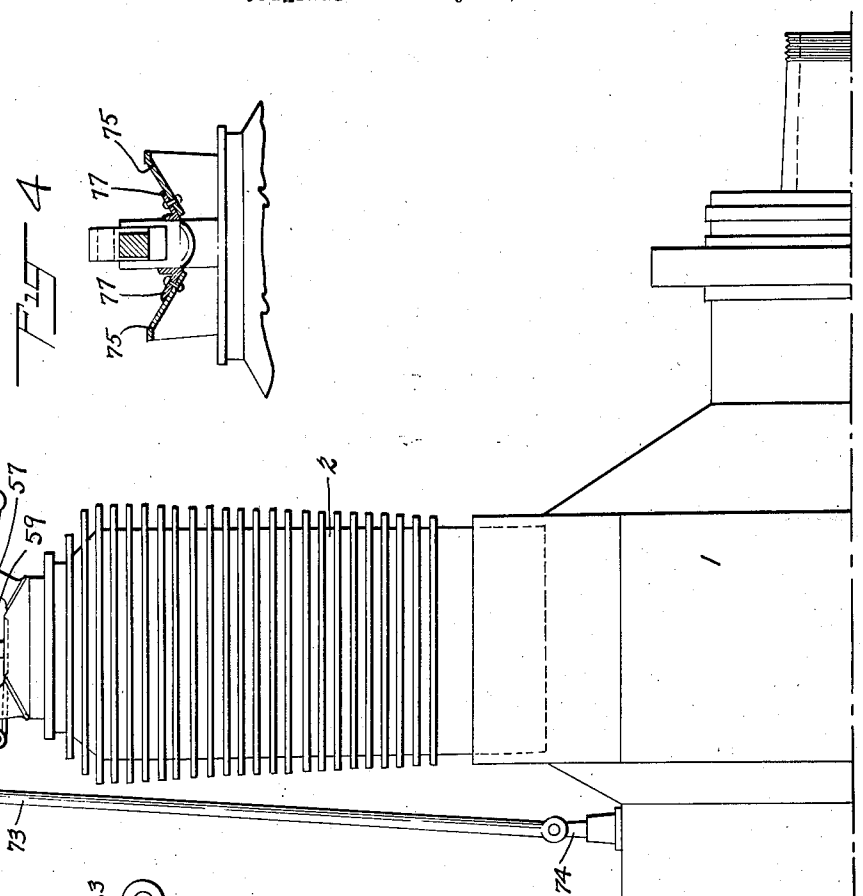

Fig. 1

Fig. 4

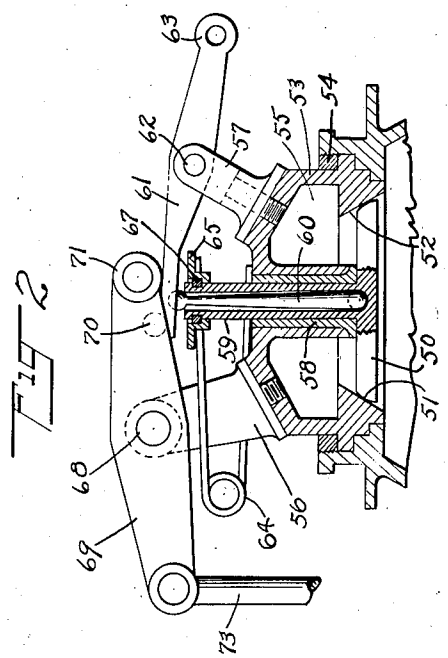

Fig. 2

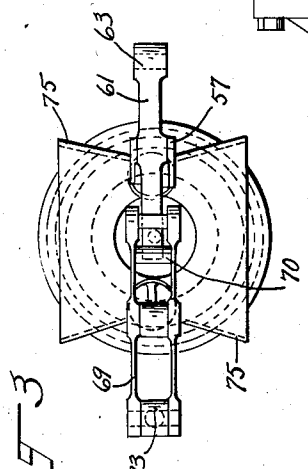

Fig. 3

INVENTOR
William Harper, Jr.
BY J. Wooster
ATTORNEY

Patented Nov. 3, 1925. 1,559,694

UNITED STATES PATENT OFFICE.

WILLIAM HARPER, JR., OF NEW BLOOMFIELD, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GAS TURBINE CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

INTERNAL-COMBUSTION-ENGINE VALVE.

Original application filed May 12, 1919, Serial No. 296,358. Divided and this application filed December 8, 1921. Serial No. 520,911.

To all whom it may concern:

Be it known that I, WILLIAM HARPER, Jr., citizen of the United States, and resident of New Bloomfield, in the county of Perry and State of Pennsylvania, have invented certain new and useful Improvements in Internal-Combustion-Engine Valves, of which the following is a specification.

This invention relates to internal combustion engine valves, and more particularly to exhaust valves of the usual poppet type. Such valves must be opened by a positively actuated means against a pressure considerably in excess of atmospheric.

I have devised an exhaust valve and actuating means therefor, whereby the initial movement of the valve against the pressure within the cylinder is relatively slow, but as soon as the valve is lifted from its seat, the movement becomes more rapid. The valve itself is so formed, in conjunction with the valve seat, as to produce an ejector-like action, thus facilitating escape of the exhaust gas. A guide is provided to insure proper seating of the valve, and special means are employed to prevent the transmission into the valve of side thrust from the actuating means. The invention herein set forth is applicable to engines of the rotating cylinder type as well as to engines having stationary cylinders.

With these and other objects in view, I have devised the apparatus described in the following specification and illustrated in the accompanying drawing, of which

Figure 1 is a side elevation of an engine cylinder, showing the valve actuating means,

Figure 2 is a detailed sectional elevation through the valve and valve seat,

Figure 3 is a plan view of the cylinder head and valve actuating mechanism, and

Figure 4 is a sectional elevation of the exhaust hood.

Referring to the drawing, 1 represents the crank case of an internal combustion engine, and 2 the cylinder of said engine. Cylinder 2 may be provided with the usual carbureter inlet pipe and inlet valve (not shown), or if a rotating cylinder, fuel may be supplied from the crank case 1 through a valve in the piston (not shown). In either case the exhaust valve and associated features will be the same.

The exhaust valve 50 is provided with a curved periphery 51, instead of the usual conical periphery, seating on the conical valve seat 52 provided on the ring 53 for creating an ejector action in the initial exhaust. The ring 53 seats on top of the cylinder head and is held by clamping ring 54. The ring 53 is provided with gas ports 55 and lugs 56, 57, and a valve stem bushing retainer or guideway 58. 59 is the valve stem, which is made hollow to receive a ball-end tapered valve actuating rod 60, which is engaged by the end of a lever 61 pivoted at 62 in lug 57, 63 being a counterweight. The ball-ended actuating rod is pivotally connected to the valve at a point near the valve head, thereby insuring that there will be no appreciable side thrust on the valve. The valve 50 is kept seated by a double coil spring 64, having one end straddling the lug 56 and the other end engaging a shouldered ring 65 mounted on valve stem bushing 58. The ring 65 is held on the valve stem bushing by a split ring 67, resting in the groove in the upper end of bushing 58 and held there by the ring 65 under the tension of spring 64. Mounted in the lug 56 at 68 is an actuating rocker 69 carrying an actuating pin 70 and actuating end 71, operating in succession on lever 61. The pin 70 first engages the lever 61, and hence causes the exhaust valve to be opened at an increased leverage but lower speed, as compared with the engagement of end 71 with lever 61. The purpose of this is to provide an exhaust valve opened at a varying leverage and rate, being initially opened at the time of maximum pressure against a short leverage, and the leverage increasing as soon as the initial pressure has partially exhausted. Further movement of lever 69 on lever 61 through the roller 71 thus imparts a wider opening to the exhaust valve, so that there is not only provided an exhaust valve which is opened with maximum leverage against maximum pressure, but also one

which is given an increased opening owing to the variable leverage. The lever 69 is connected by link 73 with a push rod 74, which is operated by a fixed cam in the usual manner.

In engines of the rotating cylinder type, a hood 75 is provided to aid in the exhaust of the gases, this hood opening on one side in the direction in which the cylinder is rotating so as to take in air and cause it to blow across the exhaust valve and then out at the rear side of the hood, thus not only cooling the exhaust valve but aiding in the exhaust of the gases by eduction. Hood 75 has flaring open ends, and constitutes, in effect, a Venturi nozzle. The rounded valve edge 51, in cooperation with the conical valve seat 52, or the reverse, tends to produce an ejector-like action at the initial opening of the valve, since the exhaust gases under high pressure rush through the conical opening formed by the rounded valve edge and the valve seat and then expand on the other side, similar to an ejector. The resistance of the escaping gases is very much diminished, and the pressure building up on the outside of the valve head helps to balance the same. The hood 75 can be mounted in any desired manner, but as herein shown is mounted on lugs 77 carried by the valve seat 53, these lugs being cut or otherwise formed thereon and then bent up so as to receive the hood end. As will be seen, the entire exhaust valve mechanism is readily removable.

This case is a division of my co-pending application Serial No. 296,358, for method and apparatus for treating engine fuel, filed May 12, 1919.

What I claim is:

1. In an internal combustion engine, a spring closed exhaust valve provided with a hollow stem, an actuating rod in the stem, a lever engaging said actuating rod, and a rocker engaging said lever at spaced points so as to suddenly vary the leverage during opening of the valve.

2. The combination with a valve stem, of a co-operating lever for moving the stem, said lever being fulcrumed at one side and projecting over said stem, means for actuating said lever at one point for moving the valve stem at a slow speed and at another point for moving the valve stem more rapidly, said stem being located intermediate said points of lever actuation.

3. A device for actuating internal combustion engine exhaust valves of the poppet type, comprising a pivoted lever adapted to engage the valve, a second pivoted lever having a plurality of spaced bearing means adapted successively to engage said first mentioned lever, the points of contact of said respective bearing means being of spaced points located at successively increasing distance from the pivot of said second lever and of successively decreasing distance from the pivot of first said lever, one of said bearing means comprising a roller, and means for rocking second said lever about its pivot.

Signed at New Bloomfield in the county of Perry and State of Pennsylvania.

WILLIAM HARPER, JR.