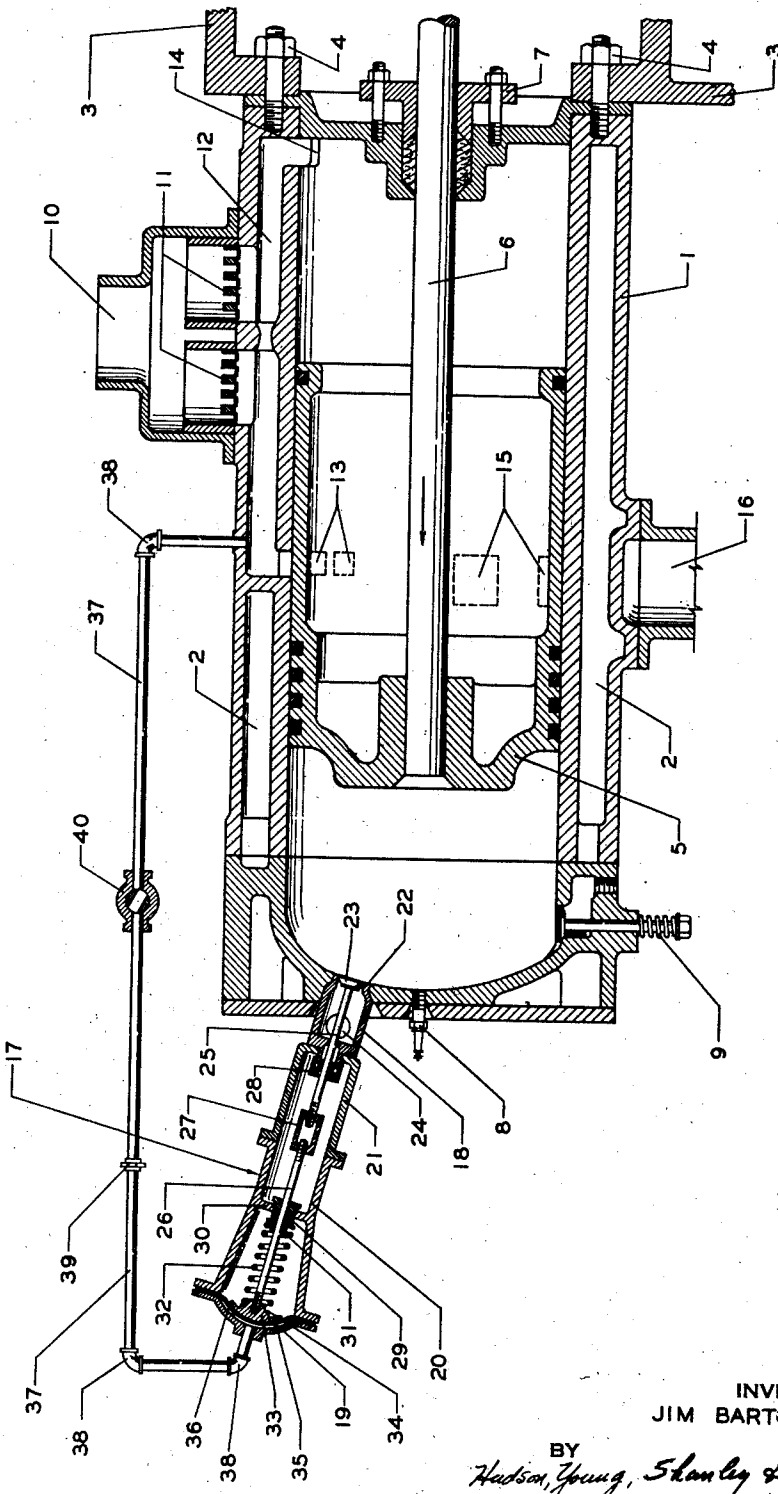
Nov. 10, 1942. J. BARTON 2,301,503

FUEL ADMISSION DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed April 24, 1939



INVENTOR
JIM BARTON

BY
Hudson, Young, Stanley & Yuiger
ATTORNEYS

Patented Nov. 10, 1942 2,301,503

UNITED STATES PATENT OFFICE

2,301,503

FUEL ADMISSION DEVICE FOR INTERNAL COMBUSTION ENGINES

Jim Barton, Pioneer, Tex., assignor to Phillips Petroleum Company, a corporation of Delaware

Application April 24, 1939, Serial No. 269,777

3 Claims. (Cl. 123—92)

This invention relates to internal combustion engines and in its more specific aspects to fluid fuel admission devices for internal combustion engines.

Heretofore, it has generally been the practice in the operation of two-cycle engines to introduce the fuel under pressure to the head end of the cylinder, during the compression stroke of the piston, by means of a fuel injector valve which includes a valve, a valve stem and a spring. The valve is opened through its cooperation with a rocker arm and a push rod or valve shaft, the latter being actuated by a geared connection at the crank end of the engine. After the fuel has been admitted to the cylinder, the above mentioned spring tends to close the valve. The "timing" (opening and closing) of the valve is controlled by a cam which operates one end of the rocker arm at predetermined intervals to open and close the valve.

The present invention contemplates the admission of fuel into the head end of an internal combusion engine cylinder by means of a device which consists of a valve, a stem and a spring all coacting with a flexible diaphragm. The valve is operated by the alternate pressure and vacuum created behind the piston during the expansion and compression strokes of the piston instead of by means of the complicated mechanism employed in the past. A small bore conduit places the main body of my device in communication with the back end of the cylinder, so that, as the piston moves forward on the compression stroke, a vacuum is created behind the piston. During the compression stroke, a spring closes the valve and cuts off the fuel supply. When the piston moves toward the back end of the cylinder on the expansion stroke of the piston, a pressure is produced in the conduit which actuates the diaphragm to open the valve and allows fuel to be injected into the cylinder. This device eliminates the former rocker arm, push rod and cam arrangement and effects a number of advantages which will be readily understood by those skilled in the art on a perusal of the detailed description hereinafter presented.

The primary object of this invention is to provide a fuel admission device which is adaptable to increase the power delivered by internal combustion engines.

Another object of my invention is to provide a fuel admission device which is operable in a positive and dependable manner on alternate pressures and vacua created behind the piston in internal combustion engines during expansion and compression strokes.

A further object of this invention is to provide an internal combustion engine fuel admission device which is simple in design, rugged in construction and inexpensive to manufacture. By virtue of the simplicity of my design and the relatively few parts which are subject to wear, the maintenance and replacement costs are reduced to a minimum.

A still further object of my invention is to provide a fuel admission device which is adapted to be readily substituted for other types of fuel admission means. This conversion may be quickly and inexpensively accomplished at the place of use, thereby avoiding costly delays which would result if the entire engine had to be returned to the factory or shipped to a shop which is especially equipped to carry out this work.

These as well as additional objects and advantages will be apparent by reference to the following specification and annexed drawing which is a longitudinal cross section view through the center of an internal combustion engine cylinder illustrating a preferred embodiment of my invention installed thereon.

Referring to the drawing, I have denoted therein an internal combustion engine cylinder 1, which is provided with the usual water-jacket 2 and is rigidly supported on an engine frame 3 by means of bolts 4. A piston 5 reciprocates within the cylinder and is connected to a piston rod 6 which passes through a packing gland 7 in the back end of the cylinder. A conventional spark plug 8 and air starting valve 9 are indicated at the head end of the cylinder. Air for normally operating the engine is introduced from the outside into an air inlet passageway 10, passes through air inlet valves 11 and chamber 12, and thence is admitted into the cylinder by way of inlet ports 13 and 14. The products of combustion are emitted from the cylinder by way of exhaust ports 15 and an exhaust outlet 16.

A housing, generally indicated by reference numeral 17, consists of a base member 18 constituting a fuel compartment, a top member 19, and two intermediate members 20 and 21, all assembled by any suitable means known in the art into a single compact unit. The portion of the housing above base member 18 may be properly termed a control compartment. The housing is securely mounted in the head end of the cylinder so that an opening 22, which serves as a seat for valve 23, is substantially flush with the inner surface of the cylinder. The base member is provided with a fuel inlet opening 24 for supplying fuel from a source not shown. Attached to valve 23 is an extensible stem which is composed of a pair of rods 25 and 26 and a connector 27 which is in threaded engagement with an end of each rod, as illustrated, in order to allow for ready adjustment of the length of valve stem to meet particular requirements. The lower portion of the valve stem, that is, rod 25, passes through a packing unit 28 which prevents fuel leakage into the upper regions of the housing. The upper

end of the valve stem, or rod 26, is slidably supported in a sleeve 29 which is threadedly mounted in a partition 30 in the housing. Concentric with rod 26 are a collar 31 and a compression spring 32. A bearing member 33, which is in threaded engagement with the upper extremity of rod 26, is provided with a shoulder 34 to receive and retain the compression spring in position. It will be observed that sleeve 29, collar 31, spring 32, and member 33 all coact with the valve stem to normally maintain valve 23 in closed position. The force exerted by the compression spring upon the valve stem may be readily varied by adjusting connector 27, sleeve 29, member 33, or any combination of these elements. In this manner I have provided a wide range of adjustability in the means for urging the valve into closed position. A convex surface or face 35 on member 33 bears against a flexible diaphragm 36 which is firmly held between top member 19 and intermediate member 20 of the housing assembly.

A suitable conduit arrangement establishes communication between the interior of the housing to the left of the diaphragm and chamber 12 in the engine cylinder. The conduit arrangement illustrated in the drawing consists of a series of tubing sections 37 which are joined into a continuous line of tubing by elbows 38, a coupling 39 and a pressure control valve 40.

For the purpose of outlining the mode of operation of my instant invention, it is first assumed that the piston 5 is moving in the direction indicated by the arrow on piston rod 6, that is, to the left or toward the head end of the cylinder. It will be noted that air ports 13 and exhaust ports 15 are all covered by the piston during this, the compression stroke of the piston. Starting valve 9 and fuel admission valve 23 are both closed, as indicated in the drawing; and the fuel and air mixture, which has been previously admitted to the cylinder, is compressed preparatory to firing. During this step in the operation, a partial vacuum is created back of the piston, extending from the back end of the cylinder, through air port 14, air chamber 12, the conduit arrangement, and lastly to the upper end of housing 17. The effect of this partial vacuum is to draw diaphragm 36 toward the housing top member 19 and permit compression spring 32 to urge valve 23 into completely closed position.

As the piston moves in the opposite direction during its expansion stroke, it will uncover exhaust ports 15 before air ports 13, allowing the products of combustion to exhaust by way of outlet 16. Air admitted through inlet 10 and valves 11 into chamber 12, is introduced to the head and back ends of the cylinder by ports 13 and 14, respectively. Continued travel of the piston in its expansion stroke compresses the air admitted into the back end of the cylinder and transmits this air under pressure through port 14, chamber 12, the conduit arrangement, and thence against the diaphragm in the housing. The diaphragm is forced against face 35 of member 33, actuating the valve stem in counteraction with the compression spring, thus opening valve 23 to admit fuel from fuel inlet 24 into the head end of the cylinder. When the piston has completed its expansion stroke and starts on its next compression stroke, the pressure exerted by the air on the diaphragm will be relieved; and, due to the action of compression spring 32, valve 23 will be returned to closed position.

It is merely a matter of mechanical skill to properly design and balance the diaphragm with relation to the spring means in order to provide a mechanism possessing the desired degree of sensitivity. Furthermore, by the use of control valve 40, the pressure effect of the air which is compressed in the back end of the engine cylinder may be regulated to increase or decrease the time period required to actuate the diaphragm and open the admission valve against the action of the compression spring. This valve is utilized both in starting and operating the engine under various load conditions.

From the foregoing it is believed that the construction, operation and advantages of my present invention will be readily comprehended by persons skilled in the art. It is to be clearly understood, however, that the form of my invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the size, shape, and arrangement of parts may be resorted to without departing from the spirit of my invention as defined by the appended claims.

I claim:

1. In apparatus for admitting fuel into an internal combustion engine having a cylinder and a piston arranged to reciprocate therein, the combination comprising a body member connected to the cylinder and including a control compartment and a fuel compartment, means for supplying fuel to the fuel compartment, a valve associated with the fuel compartment for controlling the flow of fuel into the cylinder, means for creating fluid pressure on each expansion stroke of the piston, and mechanical means in the control compartment responsive to the fluid pressure created on each expansion stroke of the piston, said last mentioned means including a diaphragm for positively actuating the valve to open the same and admit fuel into the cylinder.

2. In apparatus for admitting fuel into an internal combustion engine having a cylinder and a piston arranged to reciprocate therein, the combination comprising a body member connected to the cylinder and including a control compartment and a fuel compartment, means for supplying fuel to the fuel compartment, a valve associated with the fuel compartment for controlling the flow of fuel into the cylinder, means for normally maintaining said valve in closed position, means for creating fluid pressure on each expansion stroke of the piston, and mechanical means in the control compartment responsive to the fluid pressure created on each expansion stroke of the piston, said last mentioned means including a diaphragm for positively actuating the valve to open the same and admit fuel into the cylinder.

3. In a fluid operated fuel admission device for an internal combustion engine having a cylinder and a piston arranged to reciprocate therein, the combination comprising a body member adapted to be connected to the head end of the cylinder and including a fuel compartment and a control compartment, a fuel inlet and a fuel outlet for the fuel compartment, a valve associated with the fuel outlet for controlling the admission of fuel into the cylinder, means for normally maintaining the valve in closed position, and a diaphragm in the control compartment, said diaphragm being responsive to fluid pressure created on each stroke of the piston to open the valve and admit fuel into the cylinder.

JIM BARTON.