C. E. DURYEA.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED FEB. 23, 1912.

1,226,870. Patented May 22, 1917.

Fig. 1.

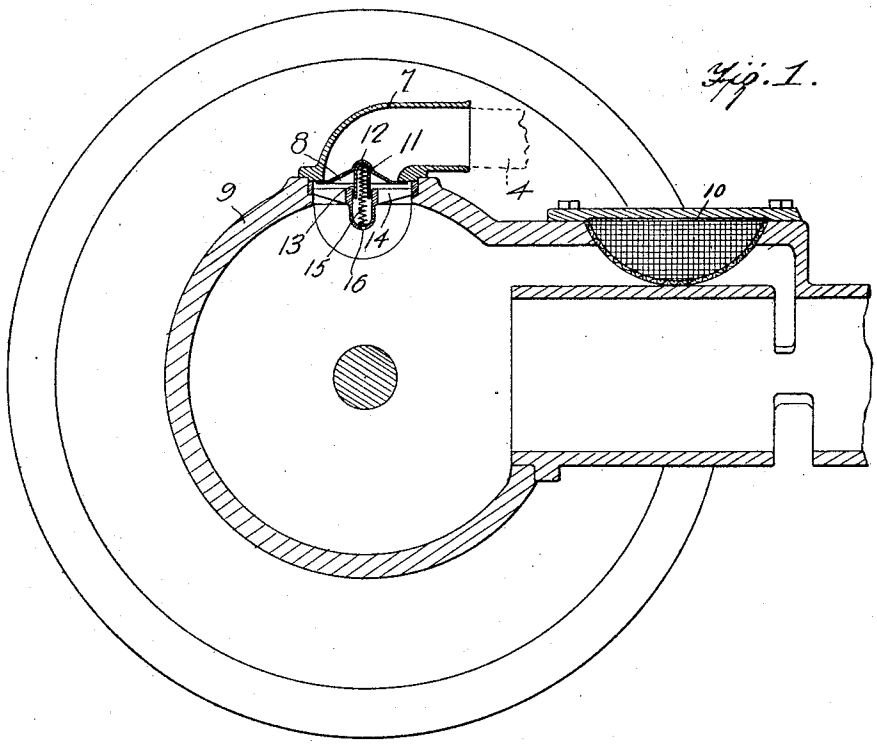


Fig. 2.

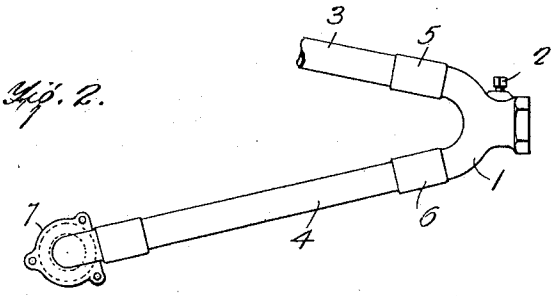
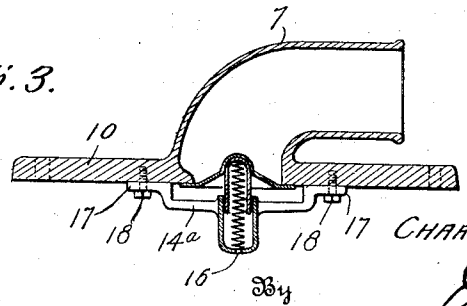


Fig. 3.



Witnesses

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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

1,226,870. Specification of Letters Patent. Patented May 22, 1917.

Original application filed April 28, 1910, Serial No. 558,235. Divided and this application filed February 23, 1912. Serial No. 679,375.

To all whom it may concern:

Be it known that I, CHARLES E. DURYEA, a citizen of the United States of America, and resident of Saginaw, in the county of Saginaw and State of Michigan, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to that class of engines of the internal combustion type, commonly called the "two cycle," wherein the piston uncovers an exhaust port near the end of the working stroke and wherein the next charge is, by the same movement of the piston, lightly compressed in the crank box, and by this compression is transferred to the cylinder ready for compression by the piston on its return stroke.

The present application is filed as a division of my application Serial No. 558,235, filed April 28, 1910, and it has for its objects among others the provision for the introduction of larger charges into the crank box, the introduction of these charges at high speeds and the equalizing of the quality of the charges.

I aim further at other and minor advantages and improvements in the details of construction whereby cheapness of manufacture is obtained, together with manifest improvements in results.

One efficient means for accomplishing these objects is shown in the accompanying drawings, but it is to be understood that the particular means herein illustrated can be varied materially without departing from the spirit of the invention or sacrificing any of its advantages, the form herein shown being given merely for the purpose of illustrating the manner in which my invention is preferably carried out.

The invention, in such form, is clearly illustrated in the accompanying drawings, which, with the numerals of reference marked thereon, form a part of this specification, and in which—

Figure 1 is a sectional elevation of the crank box of an engine with the inlet valve thereon, showing, also a portion of the cylinder and the transfer passage.

Fig. 2 is a plan of the inlet elbow which contains the inlet valve, showing also the manifold and the flexible pipe leading from the carbureter (not shown) to the crank inlet box.

Fig. 3 is an enlarged detail in section of the transfer passage cover with the inlet mounted thereon instead of on the crank box.

Like numerals of reference indicate like parts throughout the different views.

The explosive charge is presumably formed at the carbureter, but, as is well known, this is not a gaseous charge but is mostly sprayed liquid fuel which vaporizes more or less completely as it passes to the cylinders. Gravity, the shape of the passages, the throttle diaphragm and other causes, will affect this spray and often throw more of the liquid portions of it into one tube than into the other, so that one cylinder gets an overfat mixture while the other may get a mixture that is lean in quality. It is the main object of my invention to insure adjustments and equality of the mixture, and for this purpose I employ a manifold 1 having suitable means, as a set screw 2 for holding it where placed, 3 and 4 being pipes having flexible joints 5 and 6 at their points of connection with said manifold. These pipes are of some considerable length, say about two feet in a small engine, of three and three-quarter inch bore and stroke, which length in itself permits some time for vaporization, and being placed over the engine get some heat therefrom which assists vaporization.

The pipe 4 leads to the inlet elbow 7, and at the lower part of this elbow the inlet valve 8 is located, as seen clearly in Fig. 1. In this form the elbow is fastened to the crank box 9 in any suitable manner or to the transfer passage cover, or, as seen in Fig. 3, it may form an integral part of the transfer passage cover 10, the result being the same. This inlet valve is of specially light construction and of such shape that it offers more or less fully to the incoming charge an easy passage which permits the flow most fully. This valve is by preference pressed steel or similar metal of approximately conical shape with flanges or seating surface in a plane so that great accuracy of seating is not required. The conoid head of sheet metal is usually hardened after being shaped. This shape and the hardening both render it stiff and permit very thin sheet metal being used. It is placed with the cone toward the incoming charge so as to present lines of easy flow to such incoming charge, which placing adds several per

cent. to the amount that will enter at high speeds. This construction may be made much lighter than any forged or turned construction and its shape and the stiffening mentioned render it such that when once made perfectly true to the seating surface, it is likely to remain so. This valve is provided with a more or less hemispherical depression 11 at the center of its under side, which serves to receive the dome head 12 of the stem 13. This stem is not attached to the valve but simply bears against it and is preferably made hollow for lightness. The valve spider or guide 14 is axially bored to carry the valve stem, as seen in Fig. 1, while 15 is a spring received within such bore and within the hollow stem, as seen clearly in said Fig. 1. This disposition of the spring within the hollow stem permits of use of a greater length of spring and materially lengthens the life thereof. It will thus be seen that the valve, the stem and the spring may be made of the lightest possible construction and since the movement of the valve is limited by the spider, it is evident that the action and motion of the valve will be very easy and fast. The lightest possible vacuum in the crank box caused by the upward motion of the piston is not resisted by a heavy slow moving valve, but is readly yielded to and the new charge begins to enter. The shape of the passage permits its entrance with the least resistance. The length of pipe permits the inertia of the rapidly moving charge to continue longer than if a short pipe be used and thus to ram into the crank box a greater volume than can be introduced if the carbureter is placed closer. Furthermore, the valve being free to rock on the dome or hemispherical end of the stem, it is unlikely to be stuck to its seat as is the case with a valve which, because of having a stem rigid with the head, must lift all around at once. With such a valve, the liquid fuel or mixture of fuel and lubricating oil often sticks the seat surfaces together with such tenacity that much force is required to separate them. Where the valve can rock freely, as in the present instance, the seat loosens at one side and admits air so that it loosens all around quickly and easily. Having no stem, there is no tendency to vibrate and break the stem from the head, as in the more common constructions.

While the more common way is to drop the spider into a seat in the crank case and to hold the parts in place by the elbow and its screws, it is practicable to attach the spider to the inner face of the transfer passage cover plate 10, as shown in Fig. 3, and thus avoid one joint, and consequently, lessen the liability of leakage.

While the point of admission to the crank case may be varied as occasion may require, I have obtained most satisfactory results by placing the valve well toward the top so as to allow it to operate vertically, as shown in the present instance. Besides, this top placing permits the oil to drain away from it and not be likely to stick it to its seat, while the vertical action frees it from tendency to seat more on one side than on the other. The spider bore is provided with an opening 16, as seen clearly in Fig. 1, to allow of the escape of any oil or air that might tend to impede the free action of the valve stem.

It is, of course, to be understood that the pipe 3 seen in Fig. 2 leads to the other crank box or crank case.

Being light, the spring can be of slight tension and thus the valve will open under the slightest vacuum and the easy lifting allows the new charge to begin to enter the crank box earlier than if the valve stuck to its seat until late, or, being heavy, opened slowly. This construction favors large valve areas because the cost of construction, as well as the weight, is very little. Being large for a given size of motor, the valve need not lift high to get sufficient area of admission of the new charge, and it, therefore, will close quicker and retain in the crank box the full charge without allowing such an amount to escape as often happens. Being very light, it will practically close under the action of the first escaping gas and so in many instances the spring may be dispensed with. Such a valve closely approximates the theoretic requirements, and largely overcomes the defects, to overcome which, many designers use mechanical devices to open and close the valve.

In the form of construction shown in Fig. 3, the spider 14ª has the attaching lugs 17 adapted to receive screws or analogous means 18 for attaching the same to the under side of the cover 10.

The flexible joints 5 and 6 between the pipes 3 and 4 and the manifold 1 permit me to obtain the necessary adjustment to insure that all the engine cylinders may be fed alike. The differences may not be so objectionable in moderate speed engines but to secure high speed, it is essential that all cylinders behave alike so that the flame may be extinguished before the new charge enters, or otherwise back firing and a loss of speed and power will occur. By employing a set screw or analogous device, the manifold may be turned slightly one way or the other to allow gravity to carry more liquid fuel into one pipe and engine than into the other.

The plate 10 is used to hold down a removable screen in the transfer passage in such a manner that when the plate is removed the screen can be easily taken out for cleaning. I prefer to seat this screen in a

regular shaped cut easily produced by milling cutter or similar means so as to insure accurate fitting and no chance for fire to pass around the screen. To permit the freest flow of gases the screen should be quite coarse almost to the limit of ability to stop the fire. To insure certainty of action with this coarse screen, I shape it so the gases must pass through one end of it and then the other so as to get a double chance at stopping any flame without unduly stopping the flow of gases. When the inlet valve is mounted on the plate 10, as in Fig. 3, the inflow to the crank case cools the screen and cleans it and thus insures more certain action with a very coarse screen.

Other modifications in detail may be resorted to without departing from the spirit of the invention or sacrificing any of its advantages.

What is claimed as new is:—

1. In a high speed gas engine, a rockingly-mounted large, light sheet metal valve of approximately conoidal shape with its apex above its seat, said valve having its rocking support at the apex of the cone, said valve having flanges in a plane to insure accuracy of seating.

2. In a high speed gas engine, a rockingly-mounted large, light sheet metal valve of approximately conoidal shape with flanges in a plane to insure accuracy of seating, the conoid head being hardened with the apex of the cone above the valve seat, said valve having its rocking support at said apex.

3. In a gas engine, a rockingly-mounted large, light sheet metal valve having a conoid head with depression, said valve having the apex of the cone above the valve seat, and the rocking support of said valve being at said apex, a hollow stem separate from said valve and having an end conforming to and engaged in said depression, a guide for said stem, and a spring extending into said guide and stem.

4. In a gas engine, a rockingly-mounted large, light sheet metal valve having conoidal head and lateral flanges, a stem therefor supporting said valve and forming a rocking rest therefor, said valve having the apex of the cone above the valve seat, and the rocking support of said valve being at said apex, said stem being tubular and independent of the valve, a relatively fixed spider with tubular guide for said stem and within which it is received, and a spring in said stem and guide and bearing against the ends thereof.

5. In a gas engine, a rockingly-mounted large, light sheet metal valve having conoidal head and lateral flanges, a stem therefor supporting said valve and forming a rocking rest therefor, said valve having the apex of the cone above the valve seat, and the rocking support of said valve being at said apex, said stem being tubular and independent of the valve, a relatively fixed spider with tubular guide for said stem and within which it is received, and a spring in said stem and guide and bearing against the ends thereof, said spider bore having an axial vent to allow of the escape of oil and to insure free action of the valve stem.

6. In a gas engine, a spider with depending tubular guide, a large, light sheet metal valve with flanges and conoidal head, said valve having its apex above its seat, a tubular stem independent of the valve and having a conoidal end receiving the conoidal head of the valve and forming a rocking rest therefor at said apex, and a spring within said guide and stem, said valve being limited in its movement by said spider.

Signed by me at Saginaw, Mich., this 21st day of February, 1912.

CHARLES E. DURYEA.

Witnesses:
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."