E. A. HORNBOSTEL.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED OCT. 16, 1911.

1,043,769.

Patented Nov. 5, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

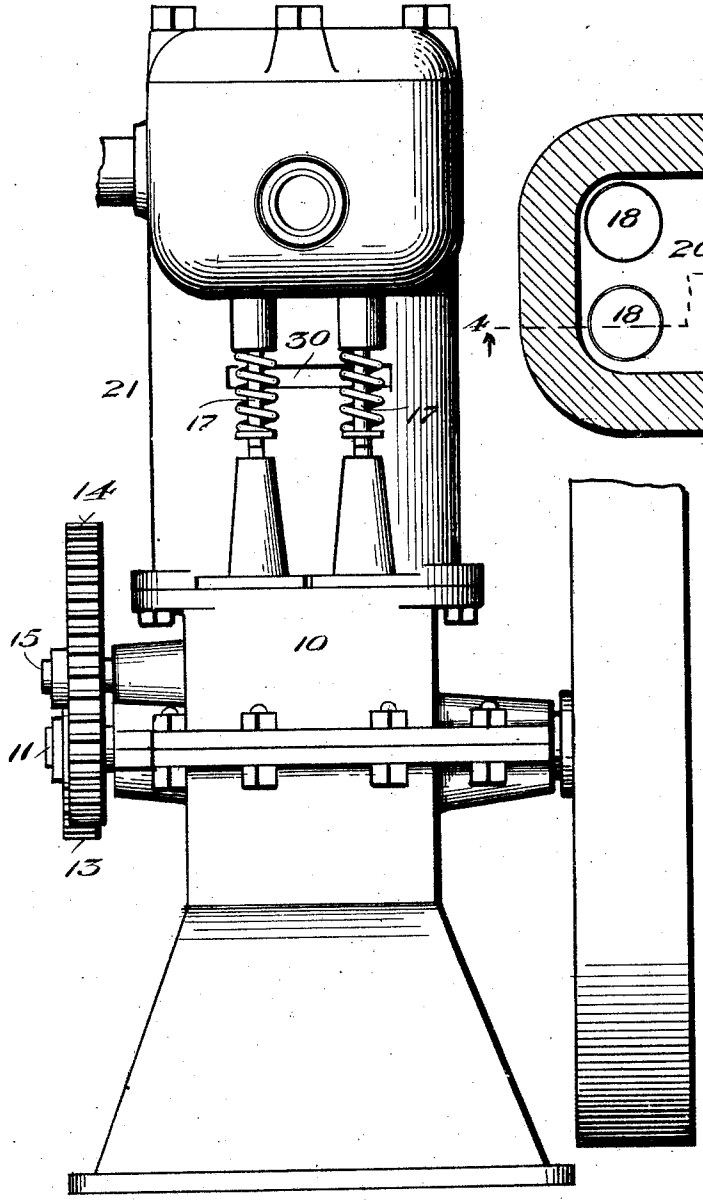


Fig. 2.

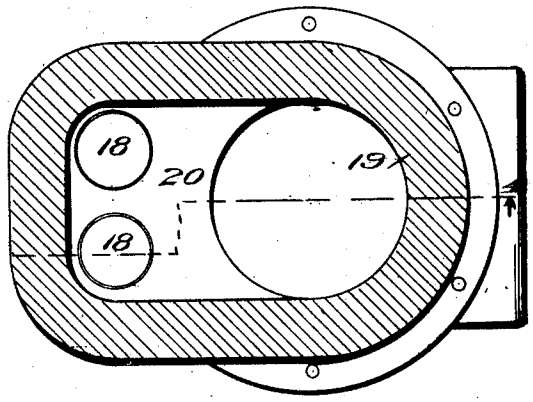
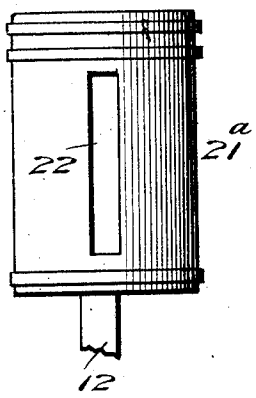


Fig. 3.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 4.

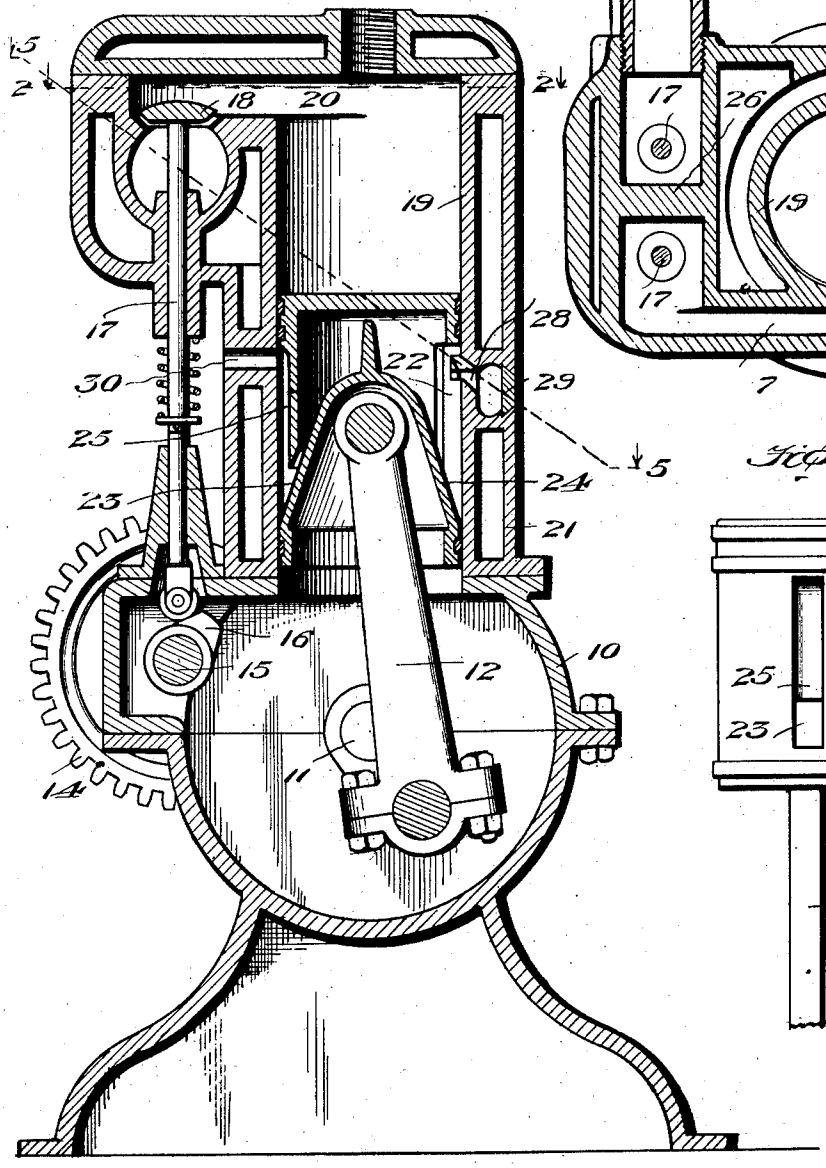
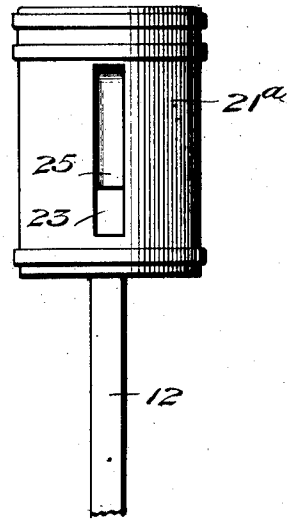


Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE.

EDWARD A. HORNBOSTEL, OF DES MOINES, IOWA, ASSIGNOR TO S. P. C. GAS ENGINE COMPANY, OF DES MOINES, IOWA, A PARTNERSHIP.

INTERNAL-COMBUSTION ENGINE.

1,043,769. Specification of Letters Patent. Patented Nov. 5, 1912.

Application filed October 16, 1911. Serial No. 654,822.

To all whom it may concern:

Be it known that I, EDWARD A. HORNBOSTEL, a citizen of the United States, residing at Des Moines, Polk county, Iowa, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

The object of my invention is to provide an internal combustion engine of simple, durable and inexpensive construction in which the sound of the exhausting gases resulting from the explosions is muffled, and in which the efficiency of the engine and muffler is materially increased as compared with the ordinary engines and mufflers now in use.

A further object is to provide an engine and muffler of this character in which the water jacket surrounding the cylinder is made to serve as part of the muffler in addition to its ordinary function.

A further object is to provide a hollow piston for an engine of this class and also to so construct the engine that the piston and the surrounding water jacket jointly form a muffler of great efficiency and of very simple and inexpensive construction. More specifically in this connection it is my object to provide a muffler which will aid in the efficiency and operation of the engine by cooling and condensing the exploded gases to thereby minimize their tendency to create a back pressure upon the piston as they are being forced from the cylinder.

A further object is to provide an engine of this class in which the gases discharged from the cylinder are directed to impact upon the side of the piston opposite from the side within the cylinder so that such impact will tend to give an upward thrust to the piston and thus increase the general efficiency of the engine.

My invention consists in the construction, arrangement and combination of the various parts of the engine whereby the objects contemplated are obtained as hereinafter more fully set forth, pointed out in the claims and illustrated in the accompanying drawings, in which:

Figure 1 shows a side elevation of a complete engine embodying my invention; Fig. 2 shows a horizontal sectional view on the line 2—2 of Fig. 4; Fig. 3 shows a side elevation of the piston, illustrating the side thereof through which the gases enter; Fig. 4 shows a vertical central sectional view through the complete engine embodying my invention, on the line 4—4 of Fig. 2; Fig. 5 shows a sectional view on the line 5—5 of Fig. 4; and Fig. 6 shows a side elevation of the piston illustrating the exhaust opening.

Corresponding and like parts are referred to in the following description and indicated in all the views of the accompanying drawings by the same reference characters.

Referring to the accompanying drawings, I have used the reference numeral 10 to indicate the engine crank case, having therein an engine shaft 11 provided with a pitman 12. On the engine shaft is a gear wheel 13 in mesh with a gear wheel 14 on the cam shaft 15. The cam shaft is provided with cams 16 of the ordinary construction one of which is illustrated in Fig. 4 and they are arranged to operate the valve stems 17 having the valves 18 thereon one of which is illustrated in Fig. 4. Above the crank case is the engine cylinder 19 having a valve chamber 20 at its upper end. Said cylinder is provided with a water jacket 21.

All of the parts just described are of the ordinary construction and operate in the ordinary manner.

In order to increase the efficiency of the engine and its economy of fuel consumption, I have provided a piston comprising a hollow body portion 21^a. This piston is provided on one side with a vertical slot 22 and on the opposite side with a second vertical slot 23. Within the interior of the piston is a partition 24 tapered upwardly from both sides to a point near the top of the piston, said parts being so arranged that when the exploded gases are forced into the piston through the inlet opening 22 they will be deflected upwardly by said partition and strike forcibly upon the top of the piston and will then pass over the partition and be discharged outwardly through the slot or discharge opening at the opposite side of the piston. This slot 23 in the discharge side of the piston extends only a short distance upwardly from the lower end of the piston and above the slot is a passageway 25 for discharged gases. Hence all of the discharged gases must pass downwardly over the partition 24 before they can escape through the slot 23 and the passageway 25.

Referring to Fig. 5 of the drawings, it will be noted that in the valve chamber 20 is

the partition 26 separating the inlet chamber from the exhaust chamber.

In order to conduct the exploded gases into the piston with the least possible amount of friction I have provided an inlet passageway 27 which extends downwardly and around the cylinder, through the water jacket to a point near the bottom of the cylinder on the side opposite from the exhaust port. At the end of the passageway 27 is an inlet port 28 in the wall of the engine cylinder. This port is, as will be seen in Fig. 4, inclined upwardly so that the gases are discharged in an upward direction. In order that the muffler may when desired, be cut cut, I have provided a slide plate 29 at the end of the passageway 27, which, when opened, will uncover a discharge port in the side of the passageway 27. To provide for the discharge of the exploded gases from the interior of the piston I have provided a discharge opening 30 in the side of the cylinder opposite from the inlet opening 28. This discharge opening 30 is so arranged with reference to the passageway 25 that the gases may be discharged through the said passageway and opening during any position of the piston stroke.

In practical operation and assuming that an explosion has just taken place and the cylinder is filled with the exploded gases, then as the piston starts upwardly or when the exhaust valve is opened by the cam, said exploded gases will then escape through the passageway 27 and the opening 28 into the interior of the piston. These gases will be deflected by the partition 24 and also by the upwardly inclined opening 28 so that they will forcibly strike upon the under surface of the piston during its upward movement and whatever force there is to the impact of said gases will be expended in creating an upward pressure upon the piston during its up stroke. The exploded gases will then move through the piston to the other side of the partition and may freely pass out through the passageway 25 and the opening 30.

One of the advantageous features of my invention is that the water jacket will tend to keep the walls of the muffler relatively cool and the heated exploded gases will be rapidly cooled during their passageway through the muffler so that they will quickly condense, so that before being discharged through the opening 30 they will have materially decreased in volume and they will also have lost considerable of their velocity. Another advantageous feature is that the walls of the muffler being surrounded by a water jacket will provide a very efficient barrier to the sound waves and hence the noise of the explosion will be greatly decreased.

I am well aware that the passing of the exploded gases through the piston tends to heat the piston and the water jacket and that it is objectionable to heat the piston and water jacket beyond a certain degree. I have, however, demonstrated by actual experiment with an engine made in the manner shown in the drawings that the amount of heat imparted to the piston and water jacket in an engine of this type is not objectionable and that it does not heat the piston and cylinder to such an extent as to interfere with the proper lubrication. I have further demonstrated by experiment that the amount of heat applied to the piston and cylinder in an engine of the kind shown in the drawings is advantageous rather than otherwise and results in an economy of fuel. It is well known that when the gases are introduced in cold condition into a comparatively cool cylinder the mixture of air and gas is not as perfect as when the gas is discharged into a heated cylinder. This is well understood by those skilled in the art and is demonstrated by the fact that an engine of this type runs better and more efficiently after the cylinder has been heated which occurs in the ordinary type of engine after a considerable period of use. With my improvement the passing of the heated exploded gases through the piston and the lower part of the cylinder quickly warms the piston and the cylinder to the desired degree without injuriously overheating them, and hence the cold gases introduced in the cylinder are rapidly and quickly heated and are thoroughly commingled before they are exploded, and I have demonstrated that when the gases are discharged directly to the outside atmosphere by opening the slide 29 the fuel consumption of the engine is increased as compared with the operation of the engine when the gases are passing through the piston and the lower end of the cylinder.

Assuming that a muffler is a necessary adjunct to an engine, my improvement results in the production of an engine and muffler having an increased efficiency as far as power is concerned over an engine and muffler of the ordinary type, and my improvement further results in an increased efficiency of fuel consumption. As far as the muffler feature itself is concerned, I have provided a muffler of great efficiency in that sound waves are almost wholly absorbed within the piston and the water jacket.

Having thus described the invention, what is claimed as new is:

1. In an engine of the class described, the combination of a cylinder having an exhaust port, a hollow piston, said piston being provided with an inlet opening and with an outlet opening, means for conducting the exploded gases from the exhaust port to the interior of the piston, and means for per-

mitting the escape of the exploded gases from the piston.

2. In an engine of the class described, the combination of a cylinder having an exhaust port, a hollow piston, said piston being provided with an inlet opening and with an outlet opening, means for conducting the exploded gases from the exhaust port to the interior of the piston, and means for permitting the escape of the exploded gases from the piston, said means being so arranged as to permit the discharge of said gases from the piston during all positions of the piston movement.

3. In an engine of the class described, the combination of a cylinder having an exhaust port, a hollow piston having an inlet opening on one side and a discharge opening on the other, said engine cylinder being provided with an opening extended upwardly to direct exploded gases to strike against the side of the piston head opposite from the side within the cylinder, means for conducting the exploded gases into said opening, the said cylinder being also provided with an opening on its opposite side through which the exploded gases may escape from the piston.

4. In an engine of the class described, the combination of a cylinder having an exhaust port, a hollow piston having an inlet opening on one side and a discharge opening on the other, said engine cylinder being provided with an opening extended upwardly to direct exploded gases to enter the piston and to strike against the side of the piston head opposite from the side within the cylinder, means for conducting the exploded gases into said opening, the said cylinder being also provided with an opening on its opposite side through which the exploded gases may escape from the piston, and a partition within the hollow piston arranged to direct the exploded gases toward the side of the piston opposite from the side within the cylinder.

5. In an engine of the class described, the combination of an engine cylinder having an exhaust port at one side, said cylinder being formed with a passageway leading from said exhaust port around the cylinder and toward the end of the cylinder opposite from the exhaust port, said cylinder being provided with an opening at the end of said passageway, a hollow piston having an inlet opening at one side in communication with the said opening in the side of the cylinder and also having an exhaust opening on the other side, said cylinder being also formed with an opening for discharged gases communicating with the latter opening in the piston.

6. An engine of the class described comprising a cylinder having an exhaust port, a water jacket surrounding the cylinder, a hollow piston having openings in opposite sides thereof, means for conducting exploded gases into the piston at one side, and said cylinder and water jacket being provided with an exhaust opening on the other side in communication with the hollow piston.

Des Moines, Iowa, October 12, 1911.

EDWARD A. HORNBOSTEL.

Witnesses:

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W. P. BAIR.

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