N. ARBEITEL.

GAS ENGINE.

APPLICATION FILED DEC. 10, 1919.

1,359,309. **Patented Nov. 16, 1920.**

2 SHEETS—SHEET 1.

Fig. 1.

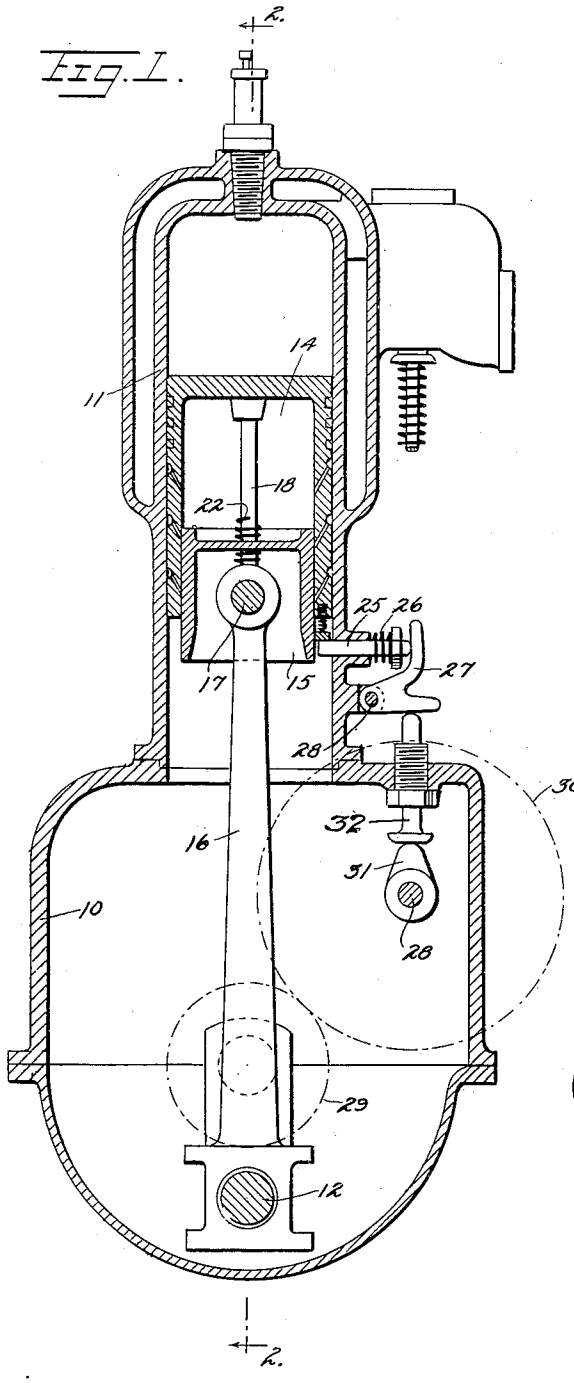
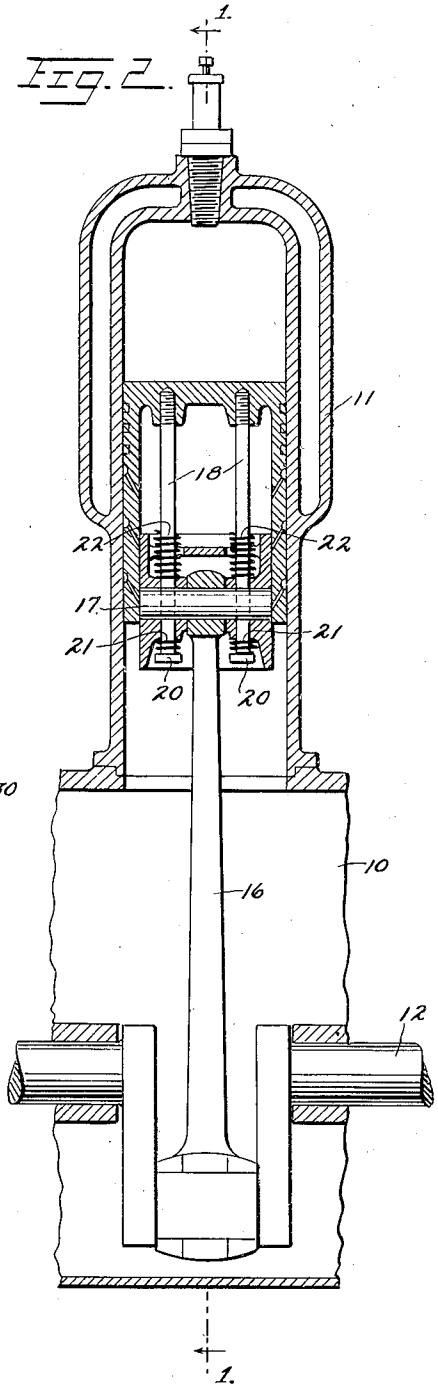


Fig. 2.



WITNESSES

H. T. Walker

J. C. Ledbetter

INVENTOR

NORBERT ARBEITEL

BY Munn & Co

ATTORNEYS

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2 SHEETS—SHEET 2.

Fig. 4.

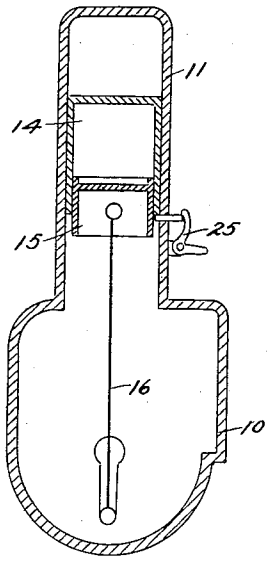


Fig. 3.

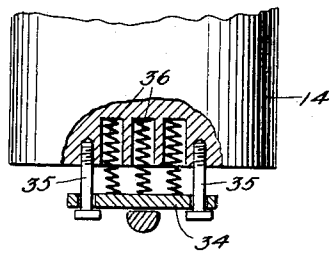


Fig. 5.

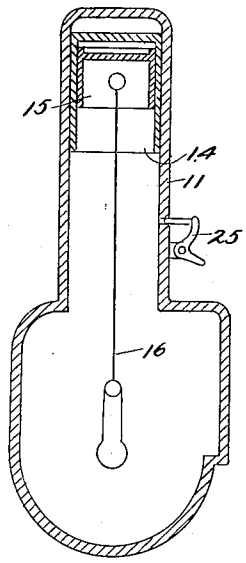


Fig. 6.

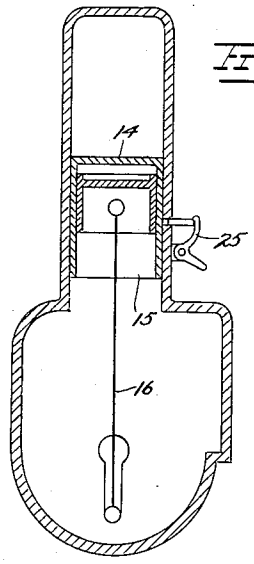
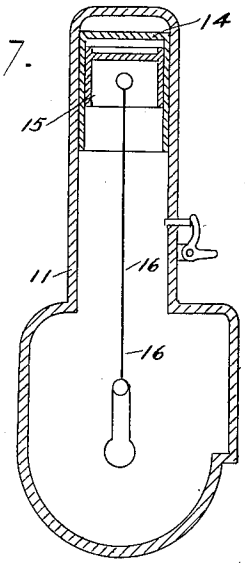


Fig. 7.



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J. C. Ledbetter

INVENTOR

NORBERT ARBEITEL

BY Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

NORBERT ARBEITEL, OF BRIDGEPORT, CONNECTICUT.

GAS-ENGINE.

1,359,309. Specification of Letters Patent. Patented Nov. 16, 1920.

Application filed December 10, 1919. Serial No. 343,825.

To all whom it may concern:

Be it known that I, NORBERT ARBEITEL, a citizen of the United States, and a resident of Bridgeport, in the county of Fairfield and State of Connecticut, have invented a new and Improved Gas-Engine, of which the following is a full, clear, and exact description.

This invention relates to engines and more particularly to internal-combustion motors.

The primary object of the invention is to produce an engine of the internal-combustion motor type having the advantage and facility of consuming a fractional part only of fuel for running the engine as compared to the amount of fuel employed for running engines of present-day design. More specifically, it is an object to produce a gas engine which draws into the explosion chamber about one-half of fuel for running the engine as compared to the amount of fuel consumed by the ordinary type of engine.

It is a purpose to produce an internal-combustion motor having means for limiting the intake charge of gas drawn into the compression and explosion chamber, but which does not limit the amount of piston travel and crank-shaft throw.

A feature of the invention relates to positively operated means for limiting the intake charge, and consequent consumption, of the fuel used to produce the power impulses incident to the operation of the engine.

It is a further purpose to produce an internal combustion motor highly adaptable for use in connection wth any form of service to which engines of this class are put; and to produce an engine comparatively simple in design and construction and unlikely to get out of order.

With the above principal objects and others in view the invention has relation to the simplified combination and arrangement of engine parts, one example of which is described in the following paper, portrayed in the accompanying drawings, and several modifications of which are presented in the appended claims.

Figure 1 illustrates a sectional view of the engine, together with positively-operated means for limiting the travel of the motor piston; while Fig. 2 illustrates a similar sectional view, but taken at a plane right angular to the Fig. 1.

The Fig. 3 illustrates parts of the positively-operated stop means for limiting the travel of the piston.

The remaining figures of the drawing are diagrammatical illustrations to show the position of parts at the end of each cycle of operation of the motor.

The Fig. 4 is a diagram showing the position of the motor parts at the end of the intake stroke, while Fig. 5 illustrates the position of parts at the end of the compression cycle. Fig. 6 illustrates the end of the explosion or expansion cycle of the engine, while Fig. 7 shows the position of parts at the end of the exhaust cycle.

An engine constructed in accordance with the plans and intent of this invention embodies an ordinary cylinder having a two-part piston with the usual form of connecting rod and crank shaft. The piston consists of telescoping parts with one part thereof limited in travel acting to conserve the fuel supply, while the other part is not limited in travel, thus undergoing an extended piston travel to deliver a relatively high power impulse to the crank shaft.

The engine has combined therewith mechanism coöperating with one of the parts of the piston to limit it in travel so as to insure a minimum influx of gas drawn into the engine during the intake cycle.

Presenting a more detailed description of my invention there is shown in the drawings an engine comprising a crank case 10 supporting an engine cylinder 11. The usual form of crank shaft 12 is journaled in the crank case, and other features of design are in accordance with the recognized engineering practice in building internal-combustion motors.

There is reciprocatively confined a two-part piston in the cylinder 11 for effecting the purposes of this invention as hereinbefore described. The piston consists of piston head 14 in which there is slidably confined a piston sleeve 15. The piston head acts to transmit the power impulse incident to the combustion and expansion of the fuel gases in the cylinder to the piston sleeve 15; and the piston sleeve 15 functions to transmit the power impulse to the crank shaft 12 through the connecting rod 16. The connecting rod 16 is pivotally joined with the piston sleeve 15 by employing a wrist pin 17.

The piston parts are slidably confined one on the other and perform in a guided rela-

tion. A number of guide rods 18 are anchored in the piston head and pass through guide holes formed through the piston sleeve 15 and through the wrist pin 17. The lower end of each guide rod is provided with a head 20 for confining a spring 21 on the guide rod between the head 20 and the piston sleeve 15. A spring 22 is likewise confined on each guide rod 18 between the piston head and the piston sleeve. It is seen how the piston sleeve may reciprocate within the piston head in a guided relation on the guide rods 18, and in this motion the springs 21 and 22 function to resiliently absorb any undue pounding or hammering action which might tend to occur between the piston parts 14 and 15. The guides 18 serve to prevent relative rotation between the two piston parts 14 and 15.

A stop mechanism is employed to limit the travel of the piston head 14 in the cylinder 11. This mechanism comprises a pin 25 confined in a guide formed in the cylinder wall. A spring 26 is confined on the pin between the cylinder and head on the pin to normally restrain the pin to outwardly-limit position in order that the inner end of the pin may be withdrawn from the line of piston travel within the cylinder. An actuator 27 is pivoted at 28 on the cylinder and lies in contact with the pin 25. A cam shaft 28 is driven through a two to one gear transmission comprising a gear 29 fixed to the drive shaft to drive the gear 30 fixed on the cam shaft. A cam 31 is carried on the cam shaft 28 and operates a lifter 32 confined in a guide in the crank case. The cam lifter and actuator mechanism is in many respects similar to the valve gear on an engine.

The operation of the cam gear is such that the pin 25 is intermittently driven in to act as a stop for limiting the travel of the piston 14, and in order to provide a resilient seat against which the piston is stopped there is employed a stop bar 34 which floats on guide pins 35 anchored in the lower rim of the piston head. A number of springs 36 are interposed between the piston head 14 and the stop bar 34. When the piston head 14 moves down against the stop pin 25 the springs 36 take up the shock incident to the movement of the piston against the pin, should there be any tendency of the piston to impinge the pin.

In the operation of this engine the flow of gas into the explosion chamber is induced in the usual way by the suction stroke or the intake stroke during the intake cycle of the engine. The piston head 14 is limited in movement to about one-half of the normal piston travel in the cylinder. The piston head 15 is permitted the normal piston travel through the length of the cylinder in order to execute the full crank throw of the engine. When the piston head 14 has traveled a portion of the distance downwardly to draw gas into the cylinder, there is created a partial vacuum in the explosion chamber, and this partial vacuum acts to retard the downward movement of the piston head 14, which causes said piston head to stop about midway of the cylinder. As the piston head 14 travels downward it gradually slows up and may, in fact, stop before impinging the pin 25. The pin 25, however, acts as a positive stop to limit the further travel of the piston. Since the piston head 14 has traveled only a part of the normal piston travel there is drawn into the cylinder only about one-half of the fuel otherwise consumed. In order that a maximum crank throw may be executed the piston sleeve 15 continues in its downward travel and slides along the guide rods 18 within the piston head 14. The engine has now completed its intake stroke and is in a position as shown in the Figs. 1 and 2 and in the diagram 4.

The crank shaft continues to turn and the engine enters upon its next cycle of operation, namely, the compression stroke, as shown in Fig. 5. When the piston parts have assumed that position shown in Fig. 5 the explosion occurs which drives the piston downwardly to deliver the power impulse and to undergo the expansion cycle, as shown in Fig. 6. In this position the stop pin 25 is withdrawn from the path of the piston travel to permit the piston head 16 to follow the piston sleeve 15 downwardly through the entire length of piston travel.

During the exhaust stroke of the motor the telescoping piston parts travel upwardly together, as shown in Fig. 7, to effect the explosion of the spent gases from the explosion chamber. At this cycle of operation the stop pin 25 again moves inwardly to intercept the downward travel of the pin upon the next stroke, where the next stroke is intended to be the intake cycle of the motor.

It is pointed out, therefore, that this engine operates in such a way that the intake stroke of the piston is limited in length of piston travel, while the crank shaft is permitted to undergo its usual radius of rotation. In this way the amount of gas drawn into the cylinder is limited, in that the volume of the explosion chamber is limited in capacity by the stoppage of the piston about one-half the way down the cylinder. During the other three cycles of operation there is no impairment in the piston travel of the piston head, for the piston head then undergoes its full length of travel, as shown in the diagrams 5, 6 and 7. It is only during the intake cycle of operation that the two-part piston comes into play and functions to limit the influx of gas to the engine. Expansion of the gas subsequent to combustion

thereof is not impaired, since the piston head 14 undergoes extended travel in the cylinder, as shown in Fig. 6; while the intake stroke of the piston is very short.

The engine is, therefore, economical in fuel consumption without in any way impairing the relatively large crank-shaft throw for developing the normal power output. In constructing engines in accordance with the plans of this invention it is possible to limit the fuel consumed to about one-half the capacity normally employed to run an engine of a given power.

It is pointed out that various modifications in design, structure and operation may be developed to effect the purposes of the two-part piston herein described. My invention is presented to cover variations in piston design built to limit the amount of fuel taken into the engine without decreasing the normal radius of the crank shaft.

Having thus described my invention, what I desire to secure by Letters Patent is:

1. An internal-combustion motor comprising, a cylinder, a crank case, a crank shaft, a piston head confined in the cylinder, a piston sleeve mounted to reciprocate in the piston head, a connecting rod joining one of the aforesaid piston parts to the crank shaft, and a stop mechanism carried by the cylinder and employed to limit the travel of the piston head in the cylinder.

2. An internal combustion engine, comprising a cylinder, a crank case, a crank shaft, a piston head slidable in the cylinder, a piston sleeve slidable in the piston head and secured thereto, and a pin in the cylinder positively limiting the downward movement of the piston head.

3. An internal combustion engine, comprising a cylinder, a crank case, a crank shaft, a piston head slidable in the cylinder, a piston sleeve slidable in the piston head and secured thereto, a pin in the cylinder actuated by a pivoted lever, in turn actuated by a lifting pin, and a cam shaft adapted to actuate the lifting pin.

4. An internal combustion engine, comprising a cylinder, a crank case, a crank shaft, a piston head slidable in the cylinder, a piston sleeve slidable in the piston head and secured thereto, and a pin secured in the cylinder normally out of the path of said piston head but adapted to be projected into the path of said piston head to limit the downward movement of the piston head.

5. An internal combustion engine, comprising a cylinder, a crank case, a crank shaft, a piston head slidable in the cylinder, a piston sleeve slidable in the piston head and secured thereto, a cam shaft geared to the drive shaft of the engine, and a pin secured in the cylinder and actuated by the cam shaft to positively limit the movement of the piston head in the cylinder.

6. An internal combustion engine, comprising a cylinder, a crank case, a crank shaft, a piston head slidable in the cylinder, a piston sleeve slidable in the piston head and secured thereto, a cam shaft geared to the drive shaft of the engine, a pin secured in the cylinder and actuated by the cam shaft to positively limit the movement of the piston head in the cylinder, and a cushioned bar on the piston head adapted to engage the pin.

NORBERT ARBEITEL.