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S. H., F. H. & W. G. HEGINBOTTOM.

# INTERNAL COMBUSTION ENGINE.

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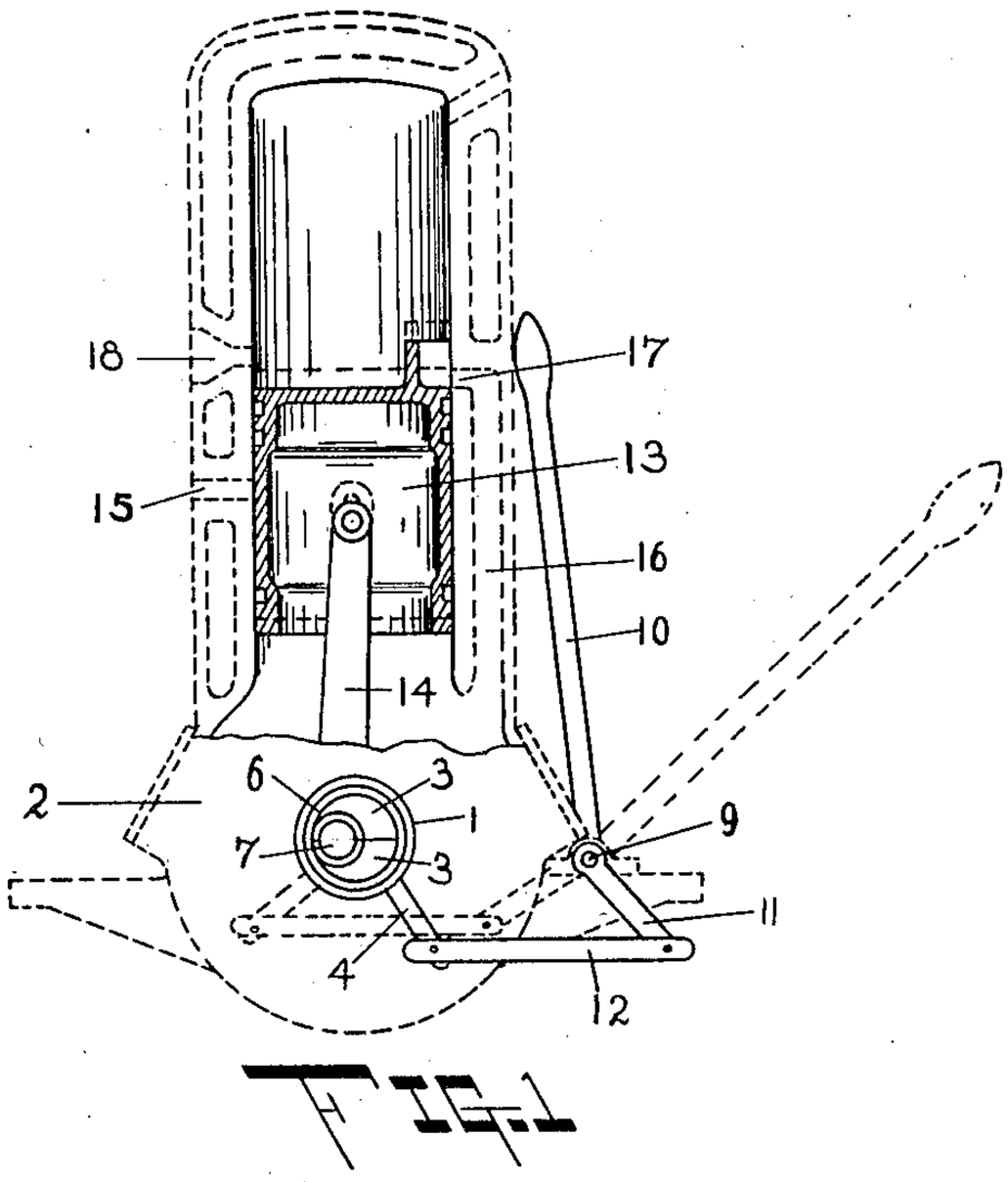


FIG. 1

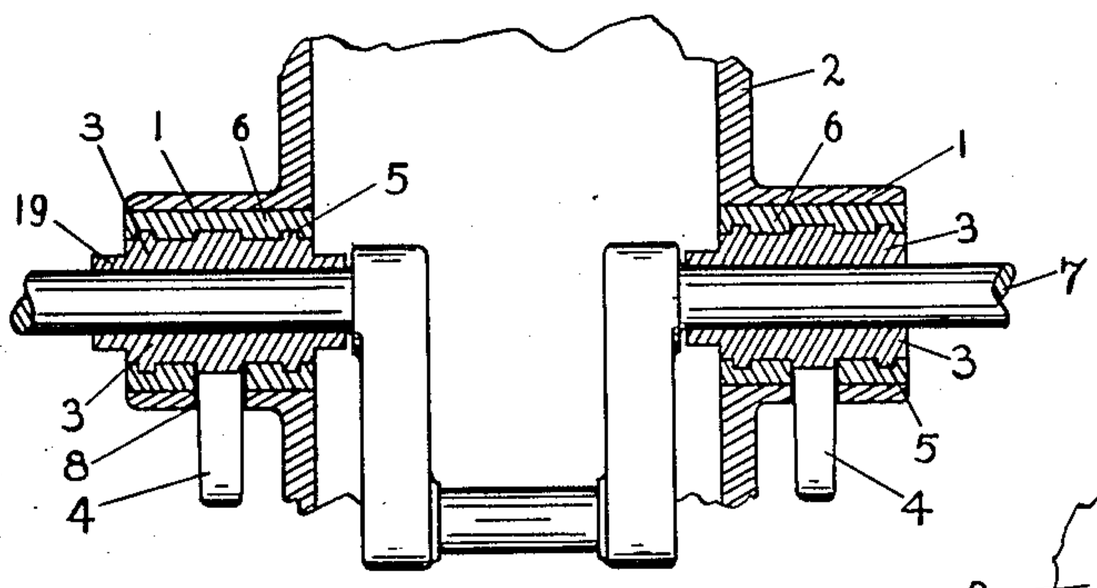


FIG. 2

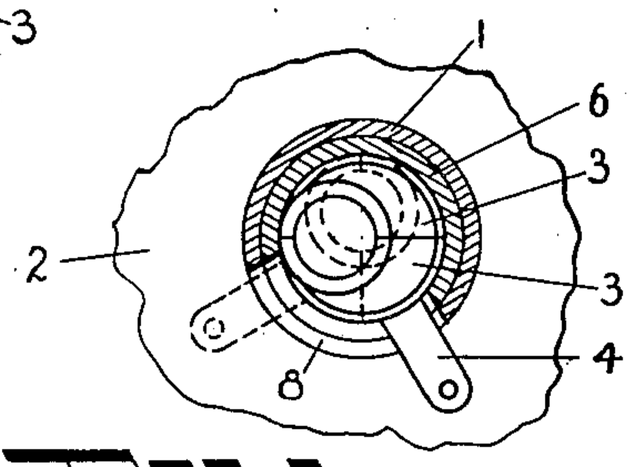


FIG. 3

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# UNITED STATES PATENT OFFICE.

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## INTERNAL-COMBUSTION ENGINE.

No. 887,633. Specification of Letters Patent. Patented May 12, 1908.

Application filed December 2, 1907. Serial No. 404,667.

*To all whom it may concern:*

Be it known that we, SAMUEL H. HEGINBOTTOM, FRANK H. HEGINBOTTOM, and WALTER G. HEGINBOTTOM, citizens of the United States, residing at Saginaw, in the county of Saginaw and State of Michigan, have invented certain new and useful Improvements in Internal-Combustion Engines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to internal combustion engines and more particularly to means for controlling the speed of such engines by regulating the amount of fuel admitted to the cylinder, one object attained being the absolute regulation of the speed of such engines without moving the carbureter or other valve controlling the supply of fuel to the engine, our invention being preferably applied to the closed crank base type of engine.

Hitherto it has been customary to check down the engine by shutting off the valve controlling the supply of fuel to the engine generally at the carbureter (in that class of engines using a hydrocarbon gas or vapor) by doing which a less amount of fuel is drawn into the crank base and expelled into the combustion chamber. Such action, however, results in backfiring in the closed crank base, because as the piston makes its inward stroke, it creates a vacuum within the crank base which is not replenished by any fresh incoming charge (the carbureter or other valve being checked down or even entirely closed) and hence when the small charge in the cylinder is exploded, and the piston driven outward on the power stroke, the exploded gases will be drawn down into the crank base and ignite the gas therein.

By means of our invention, backfiring is absolutely avoided and until the engine is completely stopped there may be a continuous feed of fuel from the source of supply to the crank base.

Hitherto it was impossible to run a two-cycle engine at anything approaching the low speed to which the four-cycle can be checked down to, but with our invention a two-cycle engine can be reduced to a hundred revolutions a minute or less without misfiring and the speed of revolution can be controlled and regulated with ease and despatch.

Our invention also attains other objects and consists of novel features and combinations, all of which will be more fully described hereinafter and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional view of a single cylinder engine equipped with one form of our invention; Fig. 2 is a detail cross sectional view of one means for adjusting the piston relative to the cylinder; and Fig. 3 is a detail end view of the eccentric split sleeves.

After considerable study and in view of the experience of others, it became plain to us that a perfect control of the speed of a two-cycle internal combustion engine could be obtained either by adjusting the engine cylinder relative to the piston and crank shaft or vice versa, by adjusting the crank shaft and piston relative to the cylinder to regulate the amount of fuel entering the cylinder. While it is possible to adjust the cylinder and its ports relative to the piston, it is less cumbersome to adjust the piston and crank shaft relative to the cylinder and is much more easily operated. In brief, then we have devised a means for adjusting the piston and crank shaft relative to the cylinder so as to cause the piston on its outward or power stroke to uncover the inlet port of the cylinder more or less completely to admit a greater or less amount of fuel to the combustion chamber and thus check or increase the speed of revolution of the crank shaft.

The adjustment of the piston may be accomplished in a variety of ways, such for instance, as by mounting the crank shaft in sliding boxes controlled in any suitable manner, but we prefer to use the following mechanism as being the easiest with which to attain the ends desired.

Mounted in the journals (1) projecting from the crank base (2) are a pair of eccentric split sleeves (3)(3) rotatable in the journals and provided with the peripheral ribs (5) (5) received in the usual Babbitt metal bearing (6), the ribs preventing endwise movement of the split sleeve bushing. The sleeves are each provided with corresponding half bearings for receiving the ends of the crank shaft (7), the crank shaft being sup-

ported eccentrically of the center of the crank base journals and adapted to be moved up and down in the arc of a circle relative to the center of the crank base journal. As one means for moving the crank in such arc we may employ the following mechanism. One of the split sleeves (3) is provided with an arm (4) projecting laterally through a slot (8) in the journal of the crank base. A rock-shaft (9) suitably journaled exteriorly, it may be, of the base is equipped with a controlling lever (10) and a crank (11), a link (12) connecting the crank (11) and arm (4), whereby to swing the latter through an arc limited by the length of the slot (8). Hence it will be seen that by swinging the lever (10) in one direction or the other, the crank shaft (7) is raised or lowered in the arc of a circle to raise or lower the piston (13) connected by a rod (14) to the shaft (7) in any convenient manner.

The engine is of the usual closed crank base type, a fuel supply (not shown) communicating with the crank base through a port (15), a passage (16) leading the charge from the crank base to the cylinder, such passage at its point of communication with the cylinder terminating in a port (17) controlled by the piston. On a plane above the inlet port (17) is the exhaust port (18) likewise covered and uncovered by the piston. When a charge is exploded in the cylinder the piston is at or near its inward limit of movement and covering or closing exhaust port (18) and inlet port (17) and uncovering fuel inlet port (15) as hereinafter set forth. The explosion drives the piston outward on its power stroke, the piston first covering the fuel inlet port (15) and then uncovering the exhaust port and the inlet port (17) in succession, the products of combustion and spent gases being permitted to escape from the cylinder in the usual manner before the new charge is admitted, such charge being forced into the passage (16) and out through port (17) by reason of the compression of the gas in the crank base caused by the outward movement of the piston. On its succeeding inward or suction stroke the piston first covers the inlet port (17) and then the exhaust port (18) finally uncovering the fuel inlet port (15) so that the vacuum created in the crank base by the instroke can be replenished by fuel gas drawn in through the port (15).

It is obvious that the engine operates in the usual manner and that when the piston is at the limit of its outstroke its upper end just uncovers the inlet port (17). Now, by adjusting the piston either in the manner heretofore set forth or in any other suitable manner, it can be so arranged that its upper edge will not quite clear the inlet port (17), thus limiting the amount of the fresh charge admitted to the cylinder and reducing the speed of the engine without manipulating the carbureter or other valve (not shown) controlling the fuel supply to port (15) and in fact, the piston may be so adjusted as not to uncover the inlet port (17) at all and thereby shut down the engine.

It is obvious that our invention can be applied to two, four, six, or any number of cylinder engines and that the piston can be adjusted while the engine is in operation.

Another feature is that in a two-cycle engine, making a large number of revolutions a minute, the time between the uncovering and covering of the inlet port (17) by the piston is the merest fraction of a second. Hence, in order to permit the entrance of a full charge to the cylinder it is customary to cause the piston to travel on its outstroke to a point somewhat below the inlet port. Now plainly, by raising the piston toward the inlet port by our adjusting means, even though the piston on its outward limit of movement does not overlap the port, the time during which the port remains open would be reduced so that a checking down of the engine would occur.

Our main invention is directed to the idea of so adjusting the piston and cylinder one relative to the other as to decrease or increase the speed of the engine by varying or controlling the amount of the charge entering through the inlet opening covered and uncovered by the piston.

It is evident that changes might be made in the form and arrangement of the several parts described and that other means than that specifically set forth herein might be used to accomplish the adjustment of the cylinder and piston.

Having thus fully disclosed our invention, what we claim as new is—

1. The combination with a cylinder having an inlet port and a piston adapted to open and close said port, of means for adjusting the cylinder and piston, one relative to the other to vary the amount of charge admitted to the cylinder through the inlet port.

2. An internal combustion engine comprising a cylinder having an inlet port, a piston adapted to cover and uncover the port, and means for adjusting the piston relative to the inlet port to vary the amount of charge admitted to the cylinder through the port.

3. An internal combustion engine comprising a cylinder having an inlet port, a piston in the cylinder adapted to close and open the port, a crank shaft, means connecting the piston and crank shaft, and means for adjusting the crank shaft and piston relative to the inlet port to vary the amount of charge admitted to the cylinder.

4. An internal combustion engine comprising a cylinder having an inlet port, a piston in the cylinder, adapted to control the port, a crank shaft, means connecting the piston

and crank shaft, rotatable members in which the crank shaft is eccentrically journaled, and means for rotating the members through the arc of a circle to vary the relation of the piston and inlet port.

5. An internal combustion engine comprising a cylinder having an inlet port, a piston in the cylinder adapted to control the port, a crank shaft, means connecting the piston and crank shaft, journals through which the crank shaft extends, rotatable members received in the journals, means for preventing endwise movement of the rotatable members, the crank shaft eccentrically journaled in the members, and means for rotating the members to vary the relation of the piston and inlet port.

6. An internal combustion engine comprising a cylinder having an inlet port, a piston in the cylinder adapted to control the port, a crank shaft, means connecting the piston and crank shaft, journals through which the crank shaft extends, rotatable members received in the journals, ribs on the rotatable members received in grooves in the journals for preventing endwise movement of the rotatable members, the crank shaft eccentrically journaled in the members, and means for rotating the members to vary the relation of the piston and inlet port.

7. An internal combustion engine comprising a cylinder having an inlet port, a piston in the cylinder, adapted to control the port, a crank shaft, means connecting the piston and crank shaft, split sleeves rotatably mounted in the engine, in which sleeves the crank shaft is eccentrically journaled, and means for rotating the split sleeves in the arc of a circle to vary the relation between the piston and the inlet port.

8. An internal combustion engine comprising a cylinder having an inlet port, a piston in the cylinder adapted to control the port, a crank shaft, means connecting the piston and crank shaft, rotatable sleeves in which the crank shaft is eccentrically journaled, arms projecting from the rotatable sleeves, and means for swinging the arms to rotate the sleeves and vary the relation between the piston and inlet port.

9. An internal combustion engine comprising a cylinder having an inlet port, a piston in the cylinder adapted to control the port, a crank shaft with which the piston is connected, journals on the engine, the journals being slotted, sleeves rotatably received in the journals, the crank shaft eccentrically mounted in the sleeves, arms projecting from the sleeves, through the slots, a rock-shaft, cranks on the shaft, a lever controlling the shaft, and links connecting the arms and cranks.

10. An internal combustion engine comprising a cylinder having an inlet port, a piston in the cylinder adapted to control the port, a crank shaft with which the piston is connected, journals on the engine, the journals being slotted, rotatable sleeves received in the journals, the crank shaft eccentrically mounted in the sleeves, arms projecting from the sleeves through the slots, and means for swinging the arms to vary the relation between the piston and inlet port.

11. An internal combustion engine comprising a cylinder having an inlet port, a piston controlling the port, and means for adjusting the piston and cylinder one relative to the other, to vary the speed of the engine.

12. A two-cycle engine comprising a cylinder having an inlet port therein, a piston adapted to cover and uncover the inlet port, a crank-shaft with which the piston is connected, rotatable bearings in which the shaft is eccentrically journaled, and means for rotating the bearings.

In testimony whereof, we affix our signatures in presence of two witnesses.

SAMUEL H. HEGINBOTTOM.
FRANK H. HEGINBOTTOM.
WALTER G. HEGINBOTTOM.

Witnesses:
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