F. W. WILLEY & W. GALLETLY.

TWO-CYCLE ENGINE.

APPLICATION FILED MAY 25, 1912.

1,138,919. Patented May 11, 1915.

Fig. 1.

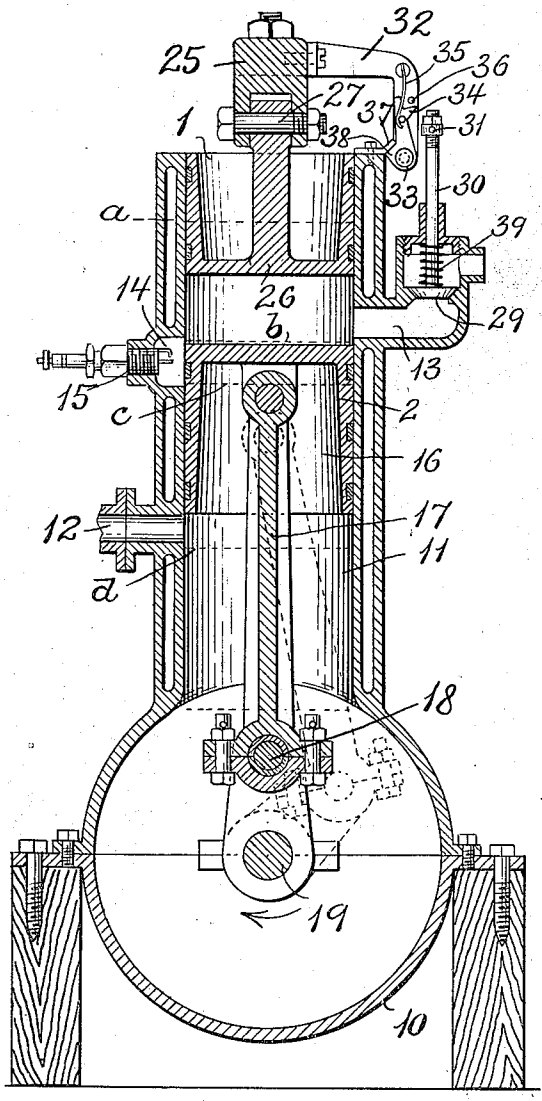


Fig. 2.

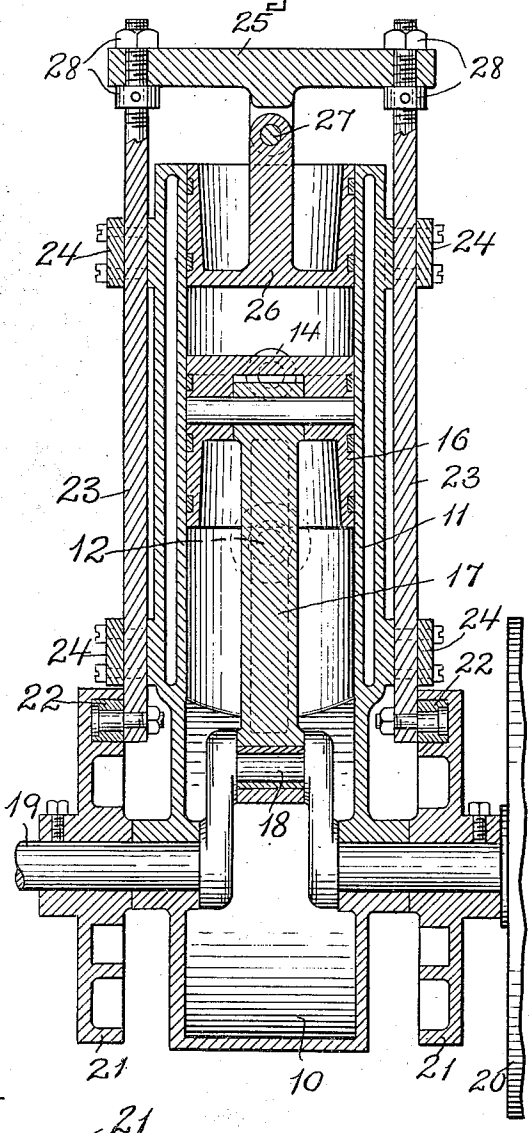
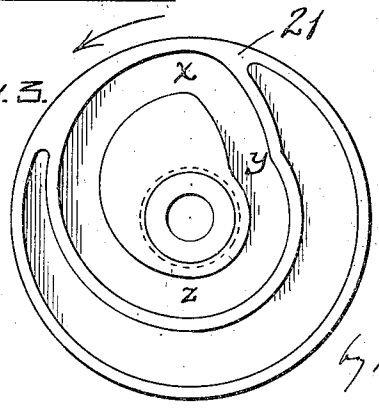


Fig. 3.



WITNESSES.

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UNITED STATES PATENT OFFICE.

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TWO-CYCLE ENGINE.

1,138,919. Specification of Letters Patent. Patented May 11, 1915.

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To all whom it may concern:

Be it known that we, FRANK W. WILLEY and WILLIAM GALLETLY, citizens of the United States, and residents of Boston, in the county of Suffolk, and of Melrose, in the county of Middlesex, State of Massachusetts, have invented certain new and useful Improvements in Two-Cycle Engines, of which the following is a specification.

This invention relates to internal combustion engines and especially to such engines of the two-cycye type although it is to be understood that I do not limit myself to such specific type of engine.

The principal object of the invention is to provide an engine so constructed as to obtain the maximum compression of the charge ready for ignition when the piston-driven crank has passed dead center and through substantially 45° of its rotation past dead center.

Further objects are to provide improvements which will be explained hereinafter.

The invention consists chiefly in combining with the cylinder of an internal combustion engine, and with the piston thereof, a movable charge-compressing head similar to a piston, which head is movable in the same direction as the piston during the first portion of the stroke of the latter beyond dead center, and at a greater speed than that of said piston, thereby obtaining the maximum compression of the charge when the crank is at a point to receive the highest effect of the impulse of explosion.

The invention further consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings:—Figure 1 represents a vertical section, transverse of the driven shaft, illustrating the invention as embodied in a two-cycle engine. Fig. 2 represents a vertical section of the same at a right angle to the view in Fig. 1. Fig. 3 is an inner face view of the cam disk shown at the left in Fig. 2.

The same reference characters indicate the same parts in all the figures.

The body of the engine comprises a suitable crank case 10 and cylinder 11, the latter having an exhaust 12 and an inlet 13 for the charge of explosive mixture. In one side of the cylinder a recess 14 is provided for the inner end of a suitable ignition plug 15.

The piston 16 is connected by a piston rod 17 with a crank 18 of the driven shaft 19, the latter having, as usual, a suitable fly or momentum wheel 20.

Firmly secured on the shaft 19 are two disks 21, each having on its inner face a cam groove. The two disks 21 are formed with similar cam grooves which receive antifrictional rolls 22 carried by the lower ends of two rods 23 mounted in suitable guides 24 on the outer side of the cylinder. The upper ends of the two rods 23 are connected by a cross head 25, said cross head carrying a movable cylinder head 26 having a piston-like formation. While said movable head might be integral with the cross head 25 it is illustrated as connected to said cross head by a pin connection 27. In order that the movable head 26 may be adjusted to vary the size of the space between its inner face and the face of the piston 16, suitable means for such adjustment may be provided such as nuts 28 upon threaded portions of the rods 23 which threaded portions pass through apertures in the cross head 25.

The valve 29 for controlling the admission of the charge has its stem 30 provided with an adjustable collar 31. An arm or bracket 32 extending outwardly from the cross head 25 carries at its outer and lower end a pawl pivoted at 33 to said arm or bracket 32 and having its upper end provided with a tooth or dog 34. A spring 35 connected to bracket 32 and bearing against a pin carried by the pawl or dog acts normally to press said dog outwardly or toward the valve stem. A stop pin 36 limits the movement of said pawl or dog. A trip lug 37 projecting outwardly from the end of the cylinder is in the path of a cam projection 38 of the pawl or dog so that when the cross head is just approaching its extreme upward or outward position, the cam 38 engages the trip lug 37 so as to insure the movement of said pawl or dog to the position shown in Fig. 1. When the cross head descends as hereinafter described, the dog 34 is immediately thrown outward by its spring 35 but will ride freely downwardly past the collar 31. On the upward

movement, however, the said dog will engage the under side of the collar 31 and lift the valve. The dog will be caused to release said valve, however, by the engagement of its cam 38 with the stop lug 37, the spring 39 of the valve then returning the valve to its seat.

The operation of compression is as follows: In Fig. 3 there are three portions of the cam groove indicated at x, y and z. The two cam disks rotate in the direction of the arrow in Fig. 3. It is to be understood that the cam disk shown in Fig. 3 is supposed to be the one removed from the front when looking at the engine according to the illustration in Fig. 1. The rotation of the shaft 19 is, of course, in the direction of the arrow in Fig. 1. When the parts are in the position shown in Fig. 1, the rolls 22 of the rods 23 occupy the portions of the cam groove shown at x in Fig. 3, the piston and crank and movable head 26 all being then in the positions shown by full lines in Figs. 1 and 2. As the shaft and disks rotate in the direction indicated by the arrow in Figs. 1 and 3, the cam grooves act through the rolls 22, rods 23 and cross head 25 to bring the movable head 26 down to the position indicated by the dotted lines a and b in Fig. 1, the dotted line a representing the position of the upper edge of the movable head and the dotted line b indicating the position of the face of the movable head. As will be seen in Fig. 3, the shape of the cam grooves of the two disks will cause the movable head 26 to move rapidly, it being understood that the portions of the cam grooves from x to y are those portions which impart, to the head 26, the stroke from the full line position of Fig. 1 to the dotted line position a, b, as described. During this movement of the head 26, the crank moves from the full line position of Fig. 1 to the dotted line position of that figure which is substantially a movement of 45° of its rotation past dead center. The dotted line c in Fig. 1 indicates the position of the face of the piston 16 when the crank is so moved 45°. It will now be understood that during the time that the head 26 moves from its full line position to the dotted line position of Fig. 1, the piston 16 moves from its full line position only to the dotted line position c, this movement of the piston 16 being very considerably less than the movement of the head 26. The members 16 and 26 are both moving in the same direction at this time which is during the first portion of the stroke of the piston after passing dead center, and the head 26 is traveling much faster than the piston 16 and therefore the maximum compression of the charge is reached when the crank is in the dotted line position of Fig. 1. During further rotation of the shaft, and while the rolls 22 are engaged by the portions of the cam grooves from y to z, the head 26 remains practically stationary, or dwells, while the continued movement of the crank to its lowest position, or 180° from the full line position of Fig. 1 occurs while the piston 16 moves to carry its face from the dotted line position c down to the dotted line position d in Fig. 1.

The timing of the ignition is such that the explosion occurs when the crank is at about the dotted line position of Fig. 1 which, as stated, is when the charge is under maximum compression. The effect of the explosion therefore is felt by the piston while it moves from said dotted line position c to the dotted line position d, during the latter portion of which movement the piston passes the exhaust 12 to permit the products of combustion to escape. The ignition, of course, occurs at the moment when the space between the opposing faces of the piston and head are at the minimum, and also at the moment when the piston rod 17 is swung well away from dead center and the crank 18 is at such angle that the highest effect of the impulse of explosion is obtained at the moment when the crank is past dead center and in the most effective position to receive and transmit the force of the explosion.

As has been stated, the shape of the two cams is such that the movement of the head 26 in its charge-compressing direction is very rapid. It then dwells, and its return motion is slow, being effected by the cam portions from z to x. On the other hand, the motion of the piston 16 is the same as in an ordinary engine, being the same in both directions. The motion of the head 26 being differential, as described, results in a quick compression of the charge, a dwell of the head during the movement of the piston under the impulse of the ignited charge so that none of the effect of the explosion is lost by retreat of the head, and then a slow return motion of the head during the drawing in of a fresh charge. This action is such as to result in a saving of gasolene, due to the compression of the charge being effected by the rapid advance of the head 26 toward the piston during the time that the latter is moving from its "dead center" position to the position which is most effective for commencing the power stroke, as hereinbefore described.

We claim:—

1. An internal combustion engine comprising a cylinder, a piston, a movable charge-compressing head within the cylinder, an inlet for the charge having a controlling valve and means connected with said movable head for opening the charge-admitting valve.

2. An internal combustion engine comprising a cylinder, a piston, a movable charge-compressing head within the cylin-

der, an inlet for the charge having a controlling valve and means connected with said movable head for opening the charge-admitting valve, said means comprising a yielding dog movable with said head, and a valve stem having a collar adapted to be engaged by said dog.

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

FRANK W. WILLEY.
WILLIAM GALLETLY.

Witnesses:
C. F. BROWN,
P. W. PEZZETTI.