W. A. PITT.

RECIPROCATING ENGINE.

APPLICATION FILED APR. 8, 1910.

1,107,837.

Patented Aug. 18, 1914.

2 SHEETS—SHEET 1.

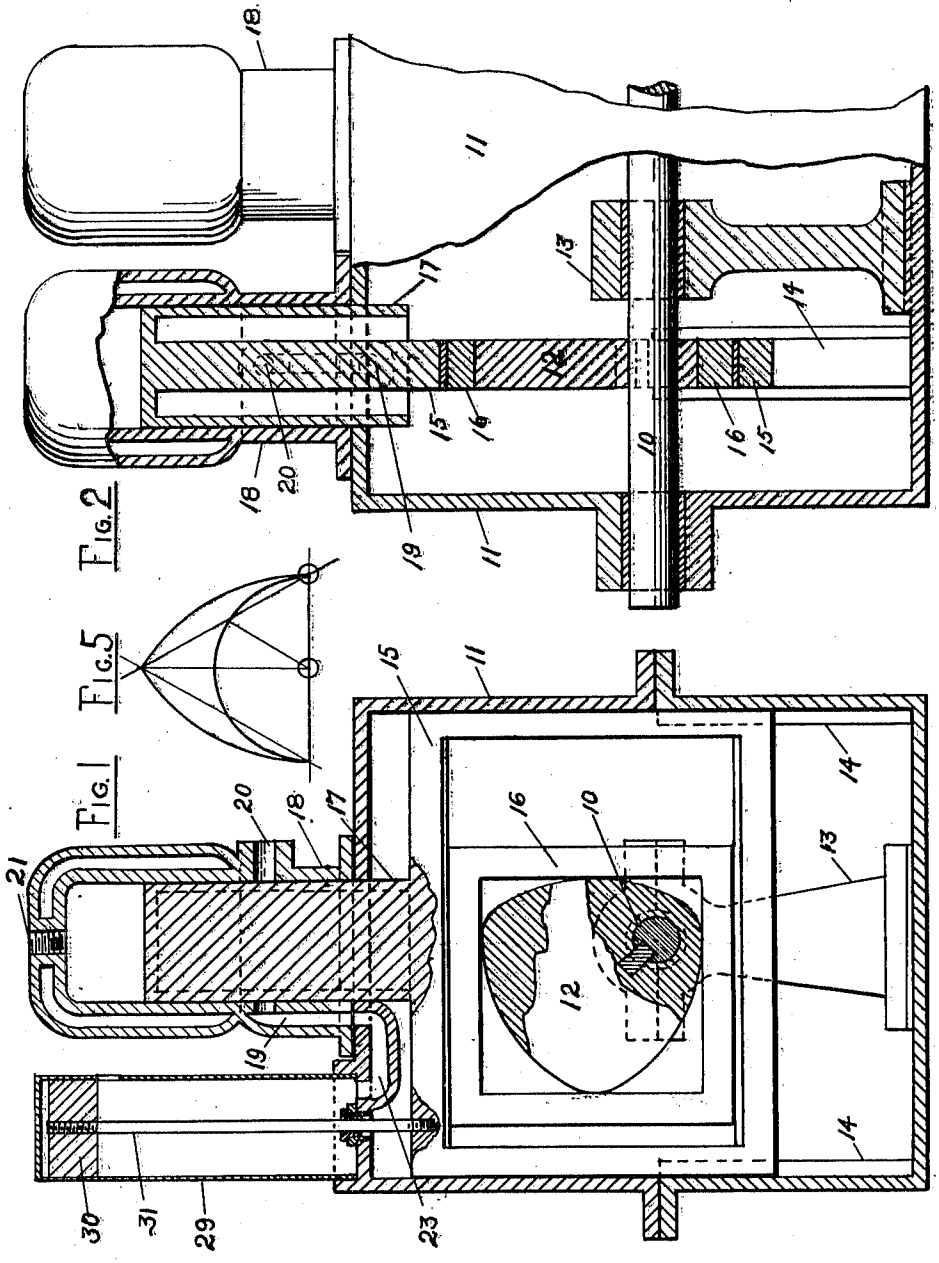


FIG. 2

FIG. 5

FIG. 1

WITNESSES:

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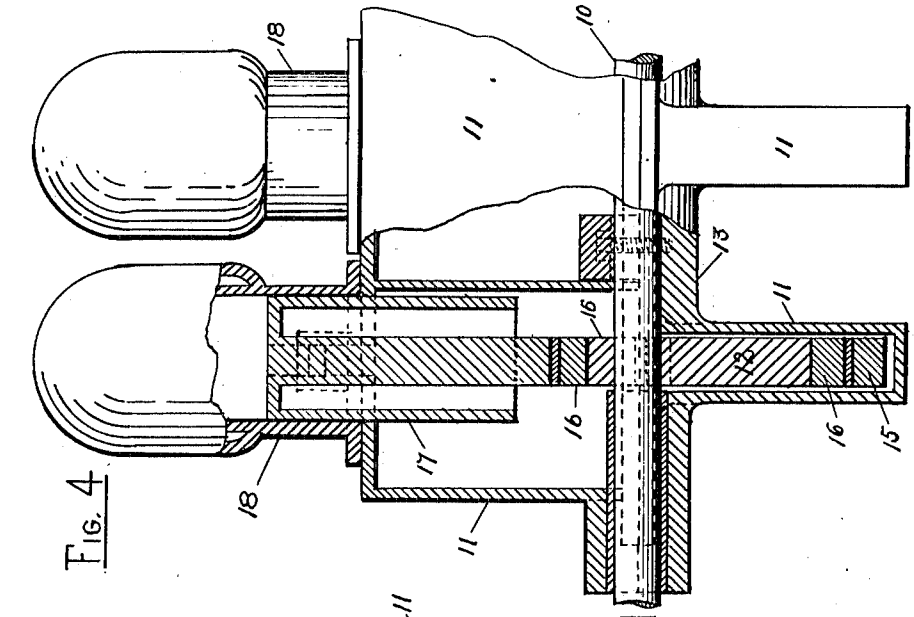


FIG. 4

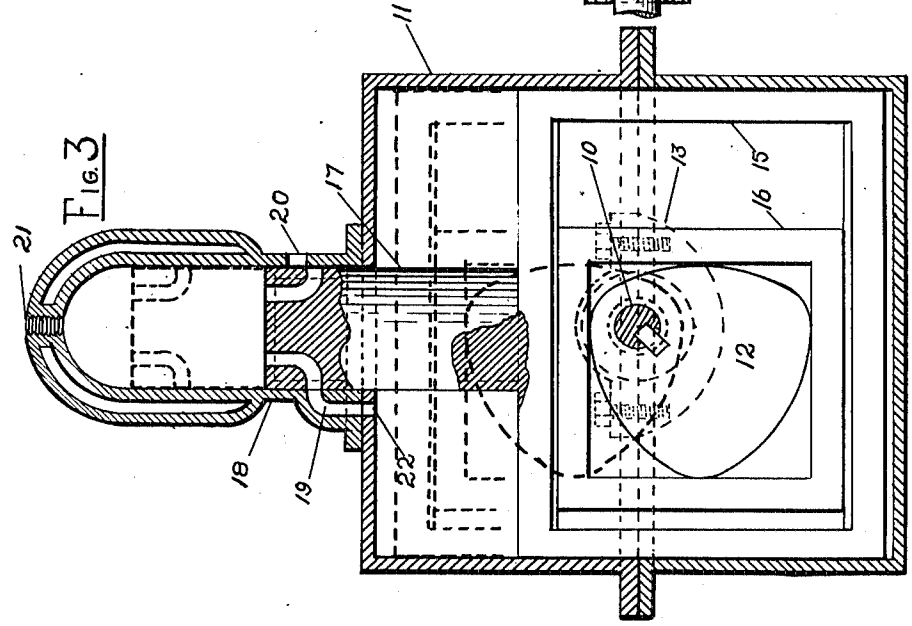


FIG. 3

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UNITED STATES PATENT OFFICE.

WILLIAM A. PITT, OF NEW YORK, N. Y.

RECIPROCATING ENGINE.

1,107,837. Specification of Letters Patent. Patented Aug. 18, 1914.

Application filed April 8, 1910. Serial No. 554,238.

To all whom it may concern:

Be it known that I, WILLIAM A. PITT, a citizen of the United States, and a resident of the city and State of New York, have invented certain new and useful Improvements in Reciprocating Engines, of which the following is a specification.

My invention relates to that class of engines in which the reciprocating motion of one or more pistons together with their connections is converted into rotary motion by the operation of a yoke which is attached to the piston and which engages with and upon an equilateral triangular cam, rigidly attached to the rotatable shaft. One form of such an engine, employing such a cam, is shown and described in Letters Patent No. 546,055, granted to me September 10, 1895, the cam being there shown in combination with four cylinders and pistons adapted to be operated by steam. The result of the application to such an engine of the herein described embodiment of the present invention is to increase the efficiency of an engine of this triangular-cam type, by eliminating a large part of the friction thereof, and in other ways. For instance, it is obvious that in the embodiment of my invention shown in the accompanying drawings the outer yoke serves to guide the piston so that the same is always in line with the cylinder axis, and no connecting rod is necessary. Furthermore, this invention causes a dwell in the reciprocating movement of the piston at the upper and lower ends of its stroke which is of great benefit in reciprocating engines both of the internal combustion and non-combustion fluid operated types.

I have shown the invention in connection with a two-cycle internal combustion engine provided with one cylinder only in order to disclose and explain the great advantage of such an engine when operating a shaft by means of an equilateral triangular cam; but I do not limit myself to engines of the internal combustion type, nor to an engine having one or any particular number of cylinders.

The invention consists of the novel construction, arrangement and combination of the various devices and parts hereinafter described and shown in the accompanying drawings.

In the said drawings, Figure 1 is a vertical section, in the direction transverse to the shaft, of a two-cycle internal combustion engine, showing the position of the operating parts at the beginning of a stroke; Fig. 2 is a vertical section of the same taken parallel to the shaft; Fig. 3 is a vertical section of a modified form of the invention; Fig. 4 is a view similar to Fig. 2 but showing all the moving parts at the end of the stroke as in Fig. 3; and Fig. 5 is merely a diagram showing an equilateral triangle which is the basis of the cam construction.

In carrying my invention into effect I provide a shaft 10, suitably journaled in the cam and yoke case or body of the engine, 11, or if desired, in ordinary standard bearings as 13. I key or otherwise rigidly secure to this shaft an equilateral triangular cam, 12. The three sides of the cam are curved as shown in Figs. 1 and 3, the curves being arcs of circles of which the two sets of radii employed are at equal distance from the points of intersection of the sides of the basic-equilateral triangle as shown in Fig. 5. On the inner walls of the body 11 of the engine guideways 14, may be provided in which freely slides a cam yoke 15, with power direction, and in this cam yoke freely slides a similar or secondary cam-yoke 16. The larger yoke 15 is in the shape of a parallelogram, while the smaller interior yoke 16 is square, the interior individual side measurement being equal to the greatest distance measured by a line intersecting any one of the angles across the cam 12, all of which will be clearly seen by reference to Figs. 1 and 3.

Rigidly attached to the larger cam-yoke 15, or, if desired, made integral therewith, is the piston 17. This slides in the usual manner in a cylinder 18, secured to the body of the engine. The cylinder is provided with the usual inlet port 19, for the intake of the explosive charge of air and hydrocarbon, either in a mixed state or delivered separately to the cylinder through such inlet 19. The cylinder is also provided with an outlet port 20, for the escape of the spent gases, and a spark plug socket 21. In the form of the invention shown in Fig. 3, the inlet port 19 connects by a passage 22 with the cam and yoke case, in which the air is compressed to a lesser or greater degree before being delivered into the cylinder as shown, but in the form shown in Fig. 1 the inlet port 19 connects by a passage 23 with an air compressor or cylinder 29 exterior to the cam and yoke case but located thereon. In

the said compression tube 29 is a piston 30, provided with a piston rod 31, the lower end of which is secured to the larger cam-yoke 15. In the top of the compression tube and just beneath the piston when it stands at its highest position is an inlet for the intake of free air or a mixture of free air and hydrocarbon. This air compressed either in the cam and yoke case or in the tube 29, in its free state or mingled with the vapor of any hydrocarbon, is injected into the cylinder through the intake opening or passage 19, and is there compressed ready for ignition and explosion at the proper time. Ordinarily the free air and the vapor of the hydrocarbon are delivered separately and allowed to combine as they enter the engine cylinder through the passage-way 19, the velocity of the air in its passage drawing in its supply of the vapor of the hydrocarbon from any regulated source of supply, such as is known as a carbureter (not shown in the drawings.)

The operation of the herein described embodiment of my invention is as follows: When the parts are in the position shown in Figs. 1 and 2, that is to say, at the beginning of a stroke, the compressed charge in the upper part of the cylinder is ignited, and the explosion forces the piston 17 downward. This motion is communicated to the cam-yokes 15 and 16 and thence to the cam 12, which is thereby caused to rotate, in a counter-clockwise direction. As the piston 17 descends, by reason of the explosion, or by operation by hand or otherwise, to secure the first charge to start the engine, thereby forcing the yokes 15 and 16 to the limit of their downward travel, the rod 31 and the piston 30 which are attached to the yoke 15 are drawn down and compress the contents of the cylinder 29. After the downward stroke has been completed, and the parts have reached the position shown in Figs. 3 and 4 the piston and the yoke integral with it comes to a state of rest while the cam and the shaft continue to rotate for 60° of the full rotative movement carrying at the same time the smaller yoke 16, to the inner opposite side of the larger yoke 15 from which point or location the upward movement of the yokes and the piston immediately commence. Just before however the piston has reached the end and while it is completing the balance of its full downward stroke, the intake opening and the exhaust opening 20 in the cylinder are uncovered by the piston and thereafter remain full open while the piston comes to a state of rest during 60° rotation of the cam, thereby giving ample time for a complete exhaust of the spent gases from the cylinder and for the delivery and full intake of the new charge of the explosive mixture. As soon after the piston 18 has been at rest for the 60° rotation of the cam and shaft, it begins to ascend on its return stroke through the continued rotation of the cam and shaft, being impelled thereto by their own momentum and that of a fly-wheel affixed rigidly to the shaft (not shown). This fly-wheel may be located within the case if desired so that the ends of the shaft may protrude through the ends of the cam and yoke case 11, for direct connections without the intervention of such fly-wheel being between such connections and the case; preferably, it will be located exterior to the cam case.

During the ascending and return movement of the piston 17 it closes the intake opening 19 in the cylinder as also the exhaust opening 20 in the cylinder at its start and then with its further movement compresses the charge of the explosive mixture during such time as it takes to complete its upward or return stroke. As soon as the piston 17 has reached the limit of its upward stroke, the explosive mixture in the meantime having been compressed, it comes to a state of rest as it did at the end of its downward stroke for and during 60° rotation of the cam and shaft and while the small yoke is being carried to the opposite inner side of the larger yoke from where it was carried during the 60° of piston rest at the end of its downward stroke. After such 60° of piston rest at the upper end of the cylinder, the cam (analogously crank) is on the upper dead center of the engine; after being removed a little therefrom with scarcely any perceptible downward movement of the piston 17, the piston is in a position to receive the force and impact of the explosion of the compressed explosive charge when the latter is then and there ignited and caused to explode. While the piston 17 is at rest for the 60° rotation of the cam and shaft at the end of its upward movement the charge already compressed in the head of the cylinder has time to absorb more or less heat from the walls and heads of the cylinder and piston that increases its pressure and compression thereby rendering it in a state to secure a higher power efficiency by its explosion.

By the introduction of the smaller square yoke 16, the cam 12 during its rotation causes the small yoke to horizontally traverse the larger yoke from side to side, thereby causing a rolling motion of the cam 17 against the yoke 16, so that such pressure applied to the cam is robbed of nearly all its attendant friction that would otherwise take place if the cam was operated upon by the upper inside of the larger yoke 15 directly and without the intervention of the smaller yoke 16, where a rolling action is now performed in lieu of an entire sliding and slipping at the central part on the under side of

the upper part of the yoke. This same condition takes place when the piston is at the bottom of its stroke. When the piston is in motion in either or both of its strokes, the rolling action takes place alternately on the vertical inner sides of the small yoke and the cam. After the cam (analogously crank) has passed the upper and lower dead center positions, the rolling motion is transferred to the sides including the angle of the cam where the shaft is located, and the upper and lower insides of the small yoke. The greatest amount of friction that takes place during the engine operation is between the top and bottom outsides of the small yoke 16 and the top and bottom inner sides of the large yoke 15 in the traversing of the small yoke from one side to the other of the large yoke. Such friction however would be mostly negligible, because proper lubrication which will be afforded, will be no greater than that between a cross-head and its sliding ways in an ordinary built steam engine properly lubricated.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is as follows:

1. The combination with an engine having a reciprocating piston therein, of a rotatable shaft and means connecting the piston and the shaft for causing the reciprocation of the former to rotate the latter, said means comprising an equilateral triangular cam secured against rotation on said shaft, a yoke exterior to said cam, a second yoke exterior to said first-mentioned yoke, and means connecting said second yoke with said piston, whereby the reciprocation of the piston will continuously rotate the shaft while the piston will dwell in its reciprocating movement near the end of both its inward and outward strokes.

2. The combination with an engine having a reciprocating piston therein, of a rotatable shaft and means connecting the piston and the shaft for causing the reciprocation of the former to rotate the latter, said means comprising an equilateral triangular cam secured against rotation on said shaft, a yoke exterior to said cam, a second yoke exterior to said first-mentioned yoke, the said first-mentioned yoke being adapted to reciprocate transversely in the said second yoke, and means connecting said second yoke with said piston, whereby the reciprocation of the piston will continuously rotate the shaft while the piston will dwell in its reciprocating movement near the end of its inward stroke.

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Witnesses:
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