P. G. TACCHI.

INTERNAL COMBUSTION ENGINE.

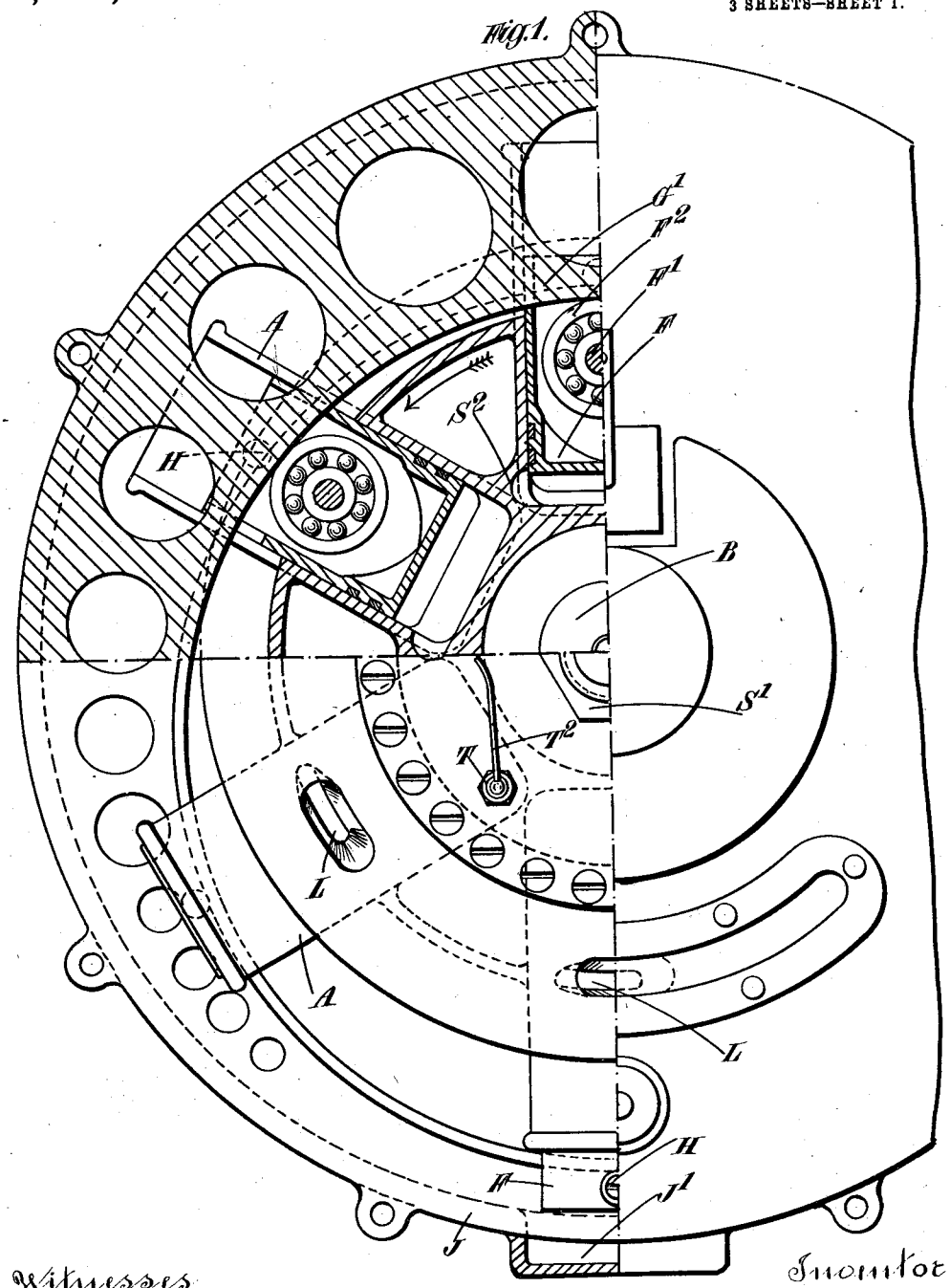
APPLICATION FILED JULY 15, 1912.

1,086,953.

Patented Feb. 10, 1914.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

Oliver W. Holmes.

Inventor

Percy George Tacchi

by Wilkinson, Wilkinson & Mackay

his Attorneys

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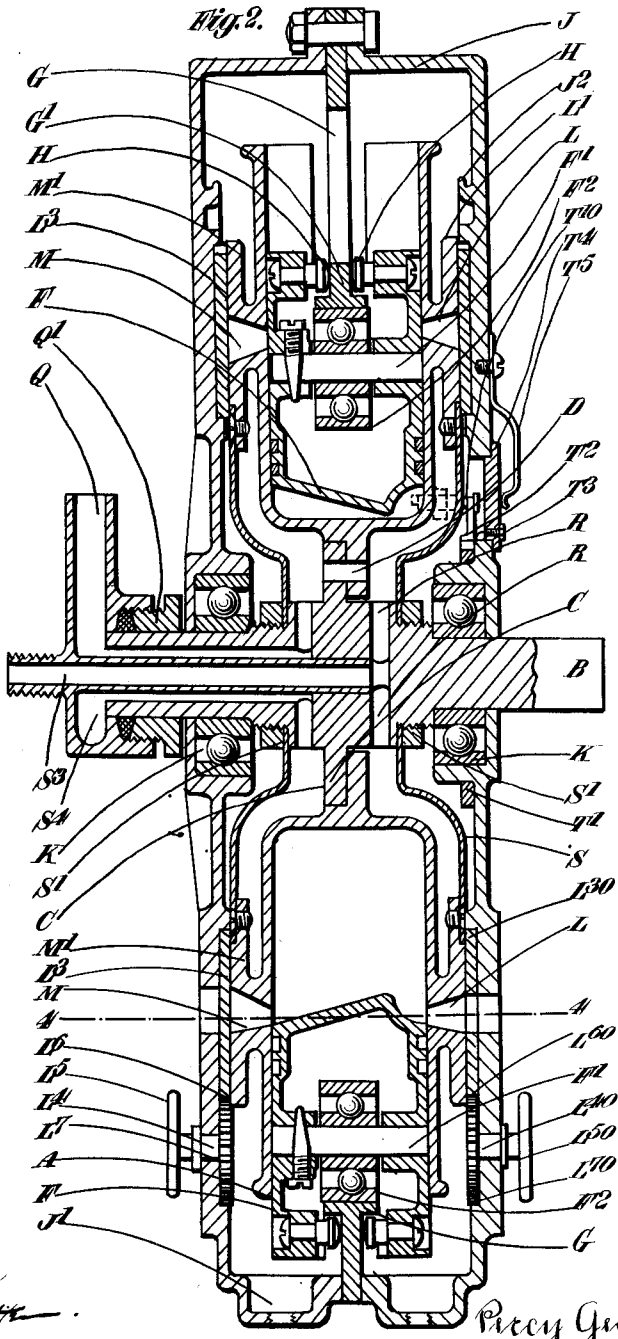
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3 SHEETS—SHEET 2.

Fig. 2.



Witnesses

Oliver W. Holmes.

Inventor

Percy George Tacchi.

by Dickinson, Wilkinson & Holcombe

his Attorneys

P. G. TACCHI.

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3 SHEETS—SHEET 3.

FIG. 3.

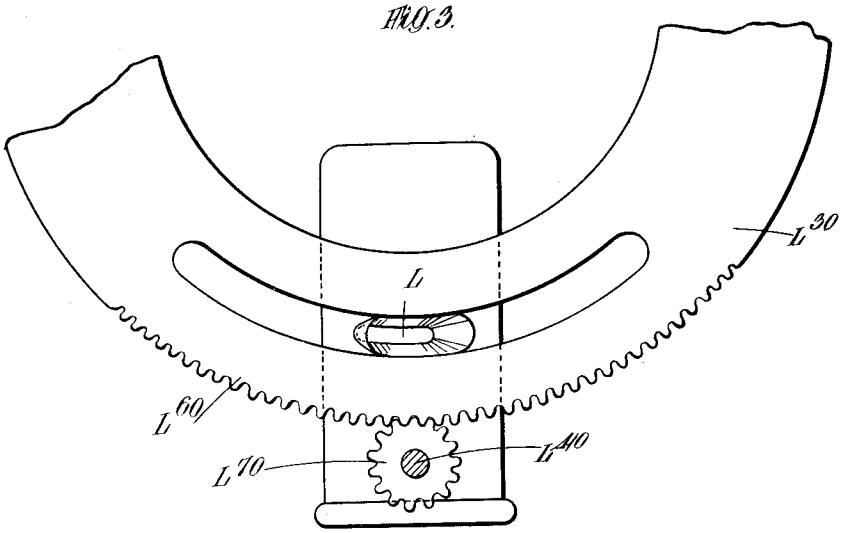
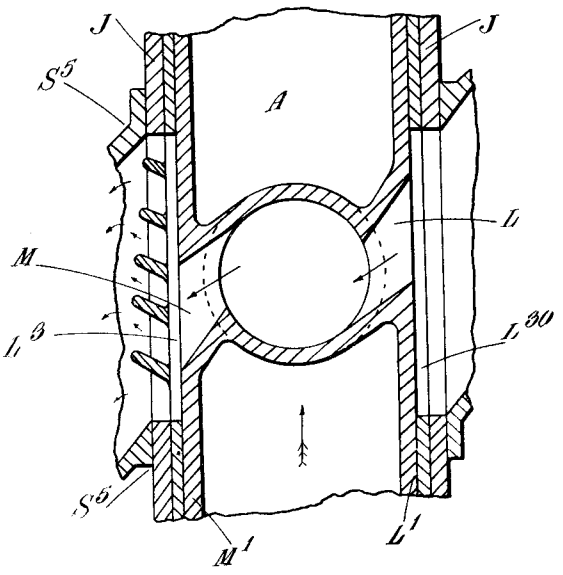


FIG. 4.



Witnesses

Oliver W. Holmes

Inventor

Percy George Tacchi

by Cushman, Watson & Morsey

his Attorneys

UNITED STATES PATENT OFFICE.

PERCY GEORGE TACCHI, OF ACTON, LONDON, ENGLAND.

INTERNAL-COMBUSTION ENGINE.

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Application filed July 15, 1912. Serial No. 709,525.

To all whom it may concern:

Be it known that I, PERCY GEORGE TACCHI, a subject of the King of Great Britain, residing at 29 Nemoure road, Acton, London, in the county of Middlesex, England, engineer, have invented a new and useful Improvement in or Relating to Internal-Combustion Engines, of which the following is a specification.

This invention relates to two-stroke internal combustion engines with revolving cylinders arranged either radially or tangentially, and integral with a central shaft or axle and having their heads toward the center; the piston in each cylinder attached to or carrying rollers which engage or travel on outside stationary eccentric rings in the plane of the cylinders and has for its object the simplification of the mechanism and the increase of the efficiency of the engine. Hitherto in these engines the combustible charge has been supplied to the cylinders through the central shaft and each piston has either been provided with two rollers situated one at each end of a gudgeon and bearing upon tracks at each side of the ring or connected to a movable ring by means of rods. According to my invention I supply and exhaust the combustible charges through movable ports on rings arranged in the stationary casing, over which ports in the sides of the cylinders travel and I provide each piston with one central roller which engages a ring in the same plane as the axes of the cylinders.

The invention consists essentially in an improved internal combustion engine of the above type in which the cylinders have their heads toward the center and secured to the shaft or axle, the piston of each cylinder engages preferably both internally and externally with a ring or track arranged in the central plane of the cylinders, the track enveloping or intersecting the outer ends of the cylinders and pistons and having an internal periphery eccentric to and at right angles to the axle or shaft. Each cylinder has inlet and exhaust ports over which the piston travels in the known manner but there are provided also for rendernig the opening and closing of the ports independent of the travel of the piston, adjustable floating rings with ports corresponding to the ports in the cylinder and in the stationary outer case. These rings are carried in guides in the outer case and are situated between the outer case and rings or flanges cast with or attached to the cylinders. The floating rings are capable of a partial rotary movement under control, the adjustment of the floating rings serving to determine the duration of the opening of the ports, independently of the travel of the piston.

The accompanying drawings represent an engine constructed in accordance with the present invention.

Figure 1 is an end elevation in part section with a portion of the cover plate removed. Fig. 2 is a section through the plane of the shaft. Fig. 3 is a detail of one of the circular valve plates showing a port. Fig. 4 is a plan of a cylinder in section on the line 4—4 of Fig. 2 and shows the inlet and exhaust ports in the cylinder in alinement with the corresponding ports in the ring and casing.

In the example illustrated the engine has six cylinders A arranged radially about the axle or shaft B, the latter being hollow and having a flange C to which the cylinders A are secured by bolts D. In each cylinder there reciprocates a piston F provided with a gudgeon pin F^1 upon which is mounted a roller F^2, which may be journaled on ball or roller bearings. The roller F^2 bears against the inner periphery of a stationary ring G, the inner periphery G^1 being eccentric to the axle or shaft B about which the cylinders A rotate. On the outer end of each piston A is mounted a pair of safety rollers or stops H which normally do not touch the ring G but come into action should there be a tendency on the part of the piston to resist outward movement in the cylinder as for example at starting.

The ring G is secured preferably between the joining flanges of a stationary casing J, which supports two ball bearings K, one on each side, upon which the cylinders A revolve. The outer ends of the cylinders A and the pistons F are slotted to clear the ring G and to prevent the pistons from twisting axially within the cylinders.

Projections or other suitable devices may be employed to prevent the pistons twisting or turning on their axes within the cylinder instead of or in addition to the envelopment of the ring G before described.

Each cylinder is provided with an obliquely directed inlet port L, and an obliquely directed outlet port M, to facilitate

the entry and obtain the reactionary effect of the gases respectively, extending through the cylinder walls and through the continuous flanges or rings L′ M′ which may be formed in or attached to the cylinder unit. The case J is also provided with inlet and outlet ports, the latter having inclined vanes, which at certain positions of the cylinders register with the ports L, M, also inclined for similar purposes respectively.

Between the rings L′ and M′ and the case J are floating rings L^{3}, L^{30}, having ports to correspond with those in the case J and cylinders A and forming the valve plates. These plates are adjustable by means of the racks L^{6} and L^{60} meshing with pinions L^{7} and L^{70} on the spindles L^{4} and L^{40} of the handwheels L^{5} L^{50}. These devices provide variable openings for the inlet and exhaust ports. Suitable guides may be provided for guiding the valve plates or rings within the case J and for rendering them gas tight. The rings L^{3} and L^{30} are preferably kept in contact with the rings M′ and L′ by suitable springs to prevent leakage of gas. The inlet valve ring need not necessarily be made adjustable. By means of this adjustable valve plate the timing of the inlet and exhaust openings can be varied, so as to obtain economical running and increased efficiency. The port L in the case J receives the mixture of air and fuel from a suitable pump or blower driven by the shaft B with conduits suitably connected to the case J.

The engine may be air cooled in the known manner but is preferably cooled by water supplied through the hollow axle shaft B and thence through passages R to spaces inclosed between the walls of the cylinders A and disks S secured to the rings M′ and L′ and the axle or shaft by the nuts S′. Water enters through the stationary lead S^{3} to the space surrounding the cylinders and passes around the connecting webs S^{2} and out at S^{4}. The conduit Q for the cooling water connects with the hollow shaft B by means of a stuffing box Q′. Alternatively, the water may be made to enter the axle or shaft B at one end and leave at the other.

The sparking plugs T project into the cylinders preferably on the side of the inlet ports, being screwed into bosses cast upon the cylinders; the plugs collect the current at the desired moment as they revolve from a fiber ring T′ mounted in the outer case J and having an insulated contact-segment T^{10} by means of the spring wiper T^{2} which receives electric energy through the terminal T^{3} in the insulating cover T^{4}, which is detachably secured by a spring arm T^{5}.

The action is as follows:—As the engine revolves the pistons follow a path eccentric to the shaft determined by the ring G and the rollers H and F^{2}. By this device the pistons receive both the reciprocatory and the translatory or rotatory motion required in engines of this type. When the piston is at the outer end of its working stroke it is out beyond the inlet port L and the exhaust port M, at the same time the cylinder ports are opposite the ports in the case J. The port L is connected preferably with a blower which forces the charge from the carbureter into the cylinders, and the port is directed obliquely to the cylinder in the direction of rotation so as to afford easy entry for the charge and in the same way the exhaust port is directed obliquely to utilize the discharge of the exhaust gases and provide a turbine or reaction effect. The direction and action of the ports may be seen in Fig. 4. The opening or closing of each port is independent of the position of the piston and is effected preferably by the valve plate or ring, since the valve plates or rings for the inlet and exhaust ports are independent of one another, the duration of the exhaust in relation to that of the supply can be determined at will. When the piston moves past the point corresponding to the end of its outward stroke, it begins to be forced inward in the cylinder by the pressure of the eccentric ring G against the roller F^{2}, it then travels over the ports of which however the exhaust may be already closed by the valve plate or ring. As the motion continues, the piston is driven farther inward compressing the charge until the fixed limit of the compression stroke is reached at about which time ignition occurs. The explosion taking place, the piston is driven outward causing the cylinder to continue revolving about the axis of the shaft B. This cycle of operations takes place in each cylinder, there is a continuous rotary motion of the whole cylinder unit. The continual pressure of compression or expansion together with the centrifugal force keeps the piston against the inner periphery of the ring G while the engine is working.

In order to provide for the lubrication of the engine, there may be provided in the stationary casing a supply of oil into which the pistons dip as they pass this point, it will be noted that the pistons are then at the outer end of their stroke.

A sump J′ is arranged at the bottom of the casing to serve for the removal and replenishment of the oil by pump or otherwise. Oil may also be delivered under pressure to or on to the working parts and bearings. Around the upper part of the casing, there may be formed a gutter J^{2} to prevent excess of oil running down upon the port faces and rings; these parts are lubricated by means of special grooves cut in their faces for this purpose in the known manner.

The engine will continue to revolve in whichever direction it is started. It will be noted that the moving parts are subject to non-reversing (though varying) pressures, and travel in circular paths, and that since the turning effort is applied farther from the center than would be the case were a crank used to produce an equivalent movement of the piston within the cylinder, the strains and pressures upon the working parts are proportionately reduced. The delivery of the charge by means of a pump or blower causes a slight initial compression which is subjected to the final mechanical compression by the working piston.

I do not confine myself strictly to the above description and construction but hold myself at liberty to make any such modifications of my invention as fall fairly within the scope thereof. For example, instead of the cylinders being set at radii, they may be arranged tangentially to a circle of any diameter, or the internal periphery of the ring G may be an ellipse or other figure instead of a true circle.

What I claim as my invention and desire to secure by Letters Patent is:—

1. An internal combustion engine embracing a main shaft, cylinders projecting from and rotatable with said shaft, pistons in said cylinders, a casing having on opposite sides elongated inlet and outlet openings respectively for the fuel and exhaust, each produced in the arc of a circle struck from the axis of said main shaft, said cylinders passing successively between said openings to receive fuel and to discharge the waste gases, a cam-shaped track mounted in said casing and embracing the outer ends of said cylinders, and means connecting said pistons to said track which serves first to force the pistons inwardly to compress the charge and then to permit the outward stroke of the pistons after explosion has taken place in each cylinder.

2. An internal combustion engine comprising a main shaft, cylinders projecting from and rotatable with said shaft, pistons in said cylinders, a track embracing the outer ends of said cylinders and forming a cam-shaped path means connecting said pistons with said track, an annular casing inclosing said cylinders and track and having on opposite sides inlet and outlet openings respectively with which the inlet and eduction parts of said cylinders successively register, and means controlling either of the openings in said casing.

3. An internal combustion engine comprising a main shaft cylinders projecting from and rotatable with said shaft, pistons in said cylinders, a track embracing the outer ends of said cylinders and forming a cam-shaped path, means connecting said pistons with said track, an annular casing inclosing said cylinders and track and having on opposite sides inlet and outlet openings respectively with which the inlet and eduction ports of said cylinders successively register, ported valve plates for controlling the passage of the fuel and the gases through the openings in said casing, and means for adjusting said valve plates.

4. An internal combustion engine comprising a main shaft, a plurality of cylinders rotatable with said shaft and having inlet and outlet ports, working pistons in said cylinders which open and close the ports in the latter, a track embracing the outer end of said cylinders and forming a path which is eccentric to said shaft, means connecting said pistons to said track, an annular casing inclosing said track and cylinders and having oppositely disposed inlet and outlet openings located opposite the space between the main shaft and said track where the latter is at its greatest distance from said shaft, the openings in said case being, moreover, opposite the path of the ports in said cylinders, a ported valve for controlling the admission and discharge through the openings in said case, and means for adjusting said ported valves.

5. An internal combustion engine comprising a main shaft, a plurality of cylinders rotatable with said shaft and having inlet and outlet ports, working pistons in said cylinders which open and close the ports in the latter, a track embracing the outer end of said cylinders and forming a path which is eccentric to said shaft, means connecting said pistons to said track, an annular casing inclosing said cylinders and track and having an inlet and an outlet opening on opposite sides thereof with which the ports in said cylinders successively register, stationary annular plates mounted in said casing and covering the ports in said cylinders, said plates being formed with ports with which the ports in said cylinders register, and means for adjusting said anular plates.

6. An internal combustion engine comprising a main shaft, a plurality of cylinders rotatable with said shaft and having obliquely directed inlet and outlet ports, working pistons in said cylinders, a track embracing the outer ends of said cylinders and forming a path which is eccentric to said shaft, means connecting said pistons to said track, a casing inclosing said track and cylinders and having obliquely directed inlet and outlet passages respectively on opposite sides thereof with which the ports in said cylinders successively register, stationary annular plates mounted in said casing and covering the ports in said cylinders but each having a port opposite the open-

ings in said casing, inclined vanes provided in the outlet opening in said casing, and means for adjusting said annular plates.

7. An internal combustion engine comprising a casing having inlet and exhaust ports therein, means for controlling the area of said ports, a shaft mounted in said casing having separate series of radial passages and having a hollow journal in communication with one series of said passages, a hollow casting loosely mounted over the end of said hollow journal, a pipe extending from said casting centrally through said hollow journal and having its outer end in communication with the other series of said passages, cylinders projecting from and rotatable with said shaft having ports therein adapted to register with the ports in said casing, jackets for said cylinders adapted to be supplied with a cooling medium through one series of the passages in said shaft and circulated through the other series of passages, pistons in said cylinders, a cam track carried by said casing and embracing said cylinders, and means connecting said pistons with said cam track.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

PERCY GEORGE TACCHI.

Witnesses:

E. L. H. ELLIOTT,

C. J. ASHDOWN.