C. HARTSON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JAN. 12, 1917.

1,282,824.

Patented Oct. 29, 1918.

3 SHEETS—SHEET 1.

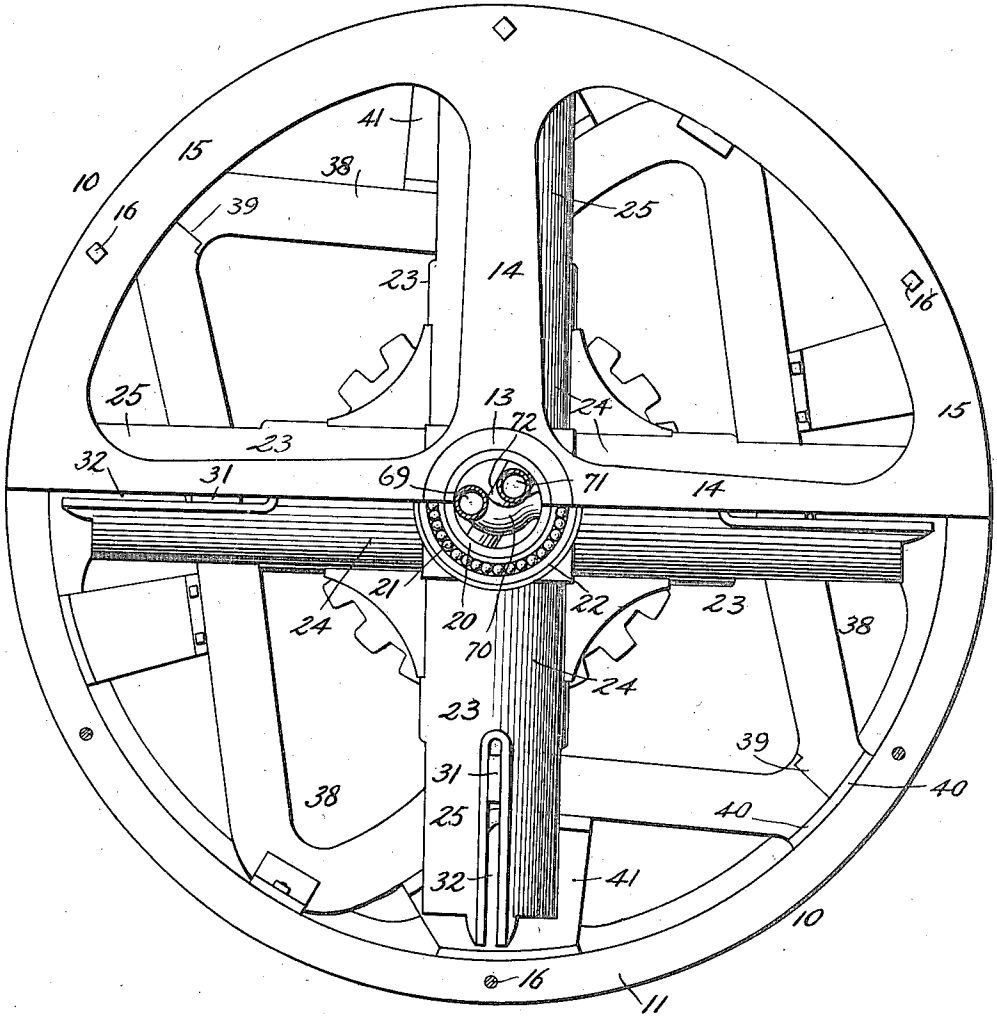


Fig. 1.

WITNESSES

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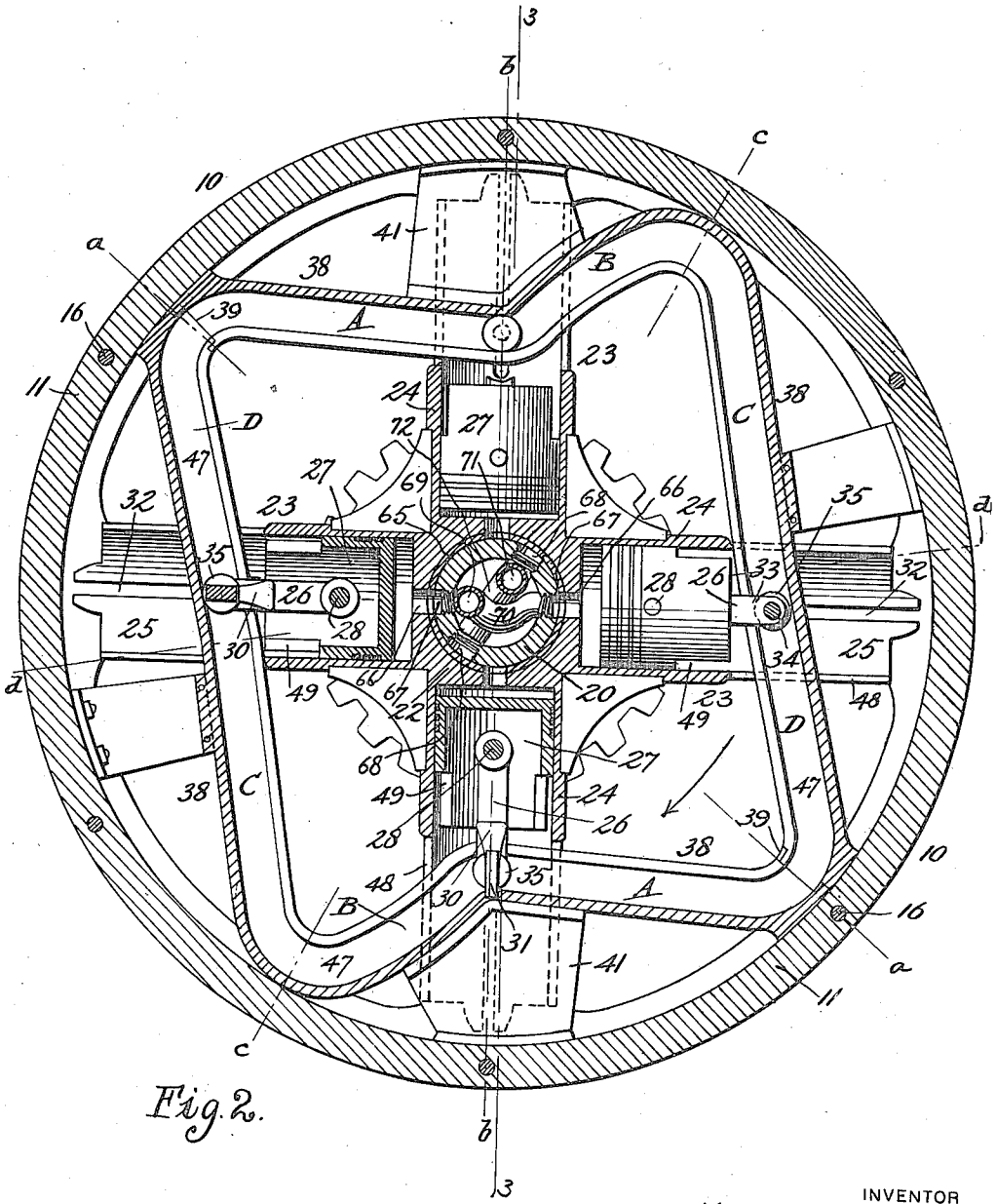


Fig. 2.

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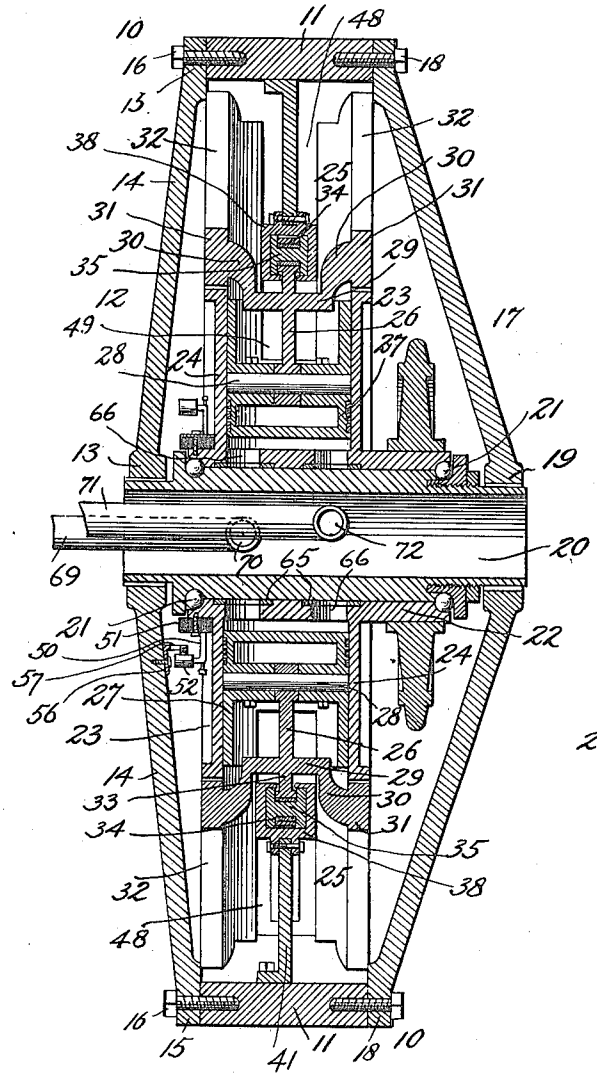


Fig. 3.

Fig. 4.

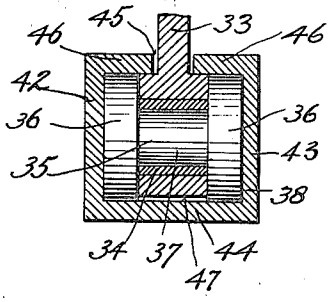
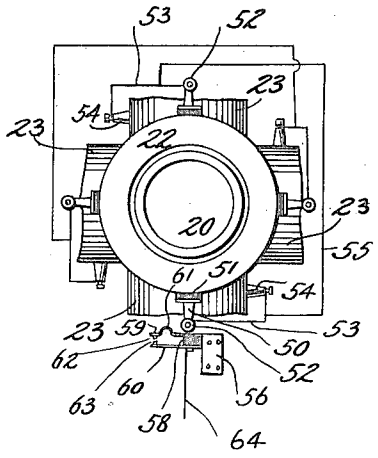


Fig. 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

CLIFFORD HARTSON, OF EL CENTRO, CALIFORNIA.

INTERNAL-COMBUSTION ENGINE.

1,282,824. Specification of Letters Patent. Patented Oct. 29, 1918.

Application filed January 12, 1917. Serial No. 142,027.

To all whom it may concern:

Be it known that I, CLIFFORD HARTSON, a citizen of the United States, residing at El Centro, in the county of Imperial and State of California, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines of the rotary type and has for its principal object the production of an engine of this class which shall be of simple construction, strong and light, and one that will run without vibration; and to obtain this object, the cylinders of the engine of which there are four or more arranged in opposite pairs and having reciprocating pistons, rotate about a central bearing and by their rotation serve as a balance wheel for the engine and thereby eliminate the weight of the wheel, and through their contact with the air as they rotate the cylinders are cooled.

Another object of the invention is to provide a rotary internal combustion engine with a plurality of cylinders each containing a reciprocating piston, said cylinders functioning as a four cycle engine twice in each complete revolution, the explosions occurring simultaneously in each pair of oppositely arranged cylinders as they successively reach certain points in each half revolution.

Yet another object of the invention is to provide a rotary internal combustion engine that operates without movable valves, cam shafts, or gearing, gas being introduced through fixed ports in the center of rotation which ports in turn deliver into the rotating ports traveling with the cylinders, and the arrangement of parts for transferring the explosive mixture from the fixed to the movable members is such as to prevent the leakage of gas, and the necessity of providing expensive packing devices that are difficult to install and produce more or less friction, is eliminated.

A further object of the invention is to provide in connection with a rotary internal combustion engine having rotating cylinders and reciprocating pistons therein, a cam track with which said pistons are connected and by which the pistons are controlled in their reciprocations. The cam track furthermore is so formed that at the moment of explosion in each cylinder the force of the explosion will be expended against the cam track where the latter is inclined at an angle of 45° with the line of movement of the piston, and thus develops the greatest power of the engine throughout the full stroke of the piston to cause the cylinder to rotate. The connection of the pistons with the cam track is of such a nature as to eliminate the jumping of said connections from one high point of the track to another in the event that the engine misses fire, and thus a smooth and easy movement is provided.

With the above as the principal objects in view the invention consists in the novel construction, combination and arrangement of parts hereinafter described, pointed out in the appended claims and illustrated in the accompanying drawings in which:—

Figure 1 is a side elevation of an internal combustion engine of the rotary type showing the application of the present invention thereto, the lower portion of the framework on one side being removed,

Fig. 2 is a vertical central sectional view of the improved engine in a plane perpendicular to the axis of the engine,

Fig. 3 is a vertical cross sectional view through the center of the engine on the line 3—3 of Fig. 2,

Fig. 4 is an enlarged detail sectional view through the outer end of the piston rod and the rollers thereon in engagement with the cam track,

Fig. 5 is a side view of the shaft and the revolving pistons illustrating the electrical connections for igniting the gases within the cylinders.

In the drawings, 10 indicates the stationary frame of the engine comprising an exterior ring 11 of circular shape and here shown as being of a width substantially equal to the diameter of the cylinders, and of a thickness sufficient to resist all strains and shocks to which the engine may be subjected. Bolted to the edge of the ring 11 at one side thereof is a spider-frame 12 comprising a central hub 13, a plurality of radial arms 14 extending from said hub, and a circular connecting ring 15 joining the outer ends of the arms 14, through which ring 15 the fastening bolts 16 pass to connect the spider-frame 12 to the ring 11. On the opposite side of the ring 11 is a somewhat similar spider-frame 17 connected by bolts 18 to the ring 11 and having a central hub 19.

Keyed in the hubs 13 and 19 are the ends of a hollow fixed shaft 20, near each end of which within the aforesaid hubs are anti-friction bearings 21 for a rotatable hub 22. In the present instance the hub 22 for a portion of its length between the ends is made square exteriorly and from each of said square sides there projects an engine cylinder 23 preferably cast integrally with the hub as shown in Fig. 2. The cylinders extend outwardly in radial lines nearly to the inner face of the ring 11, only the inner portion 24 of each cylinder serving as an explosion cylinder, the exterior half 25 of the cylinder acting as a guide for the pitman 26 and for the rotating movement of the cylinders.

Within the explosion end 24 of each cylinder 23 is a reciprocating piston 27 having suitable packing as shown and preferably made hollow with an open outer end, from which hollow portion there projects a pitman 26 pivoted to the piston by a through pin 28. The outer end of each pitman 26 is provided with a T shaped head 29 from each end of which there extends a curved arm 30 directed toward opposite sides of the cylinder 23 and terminating at their ends in guide plates 31 fitted to move in straight longitudinal slots 32 on the front and rear sides of the guiding end 25 of the cylinder 23. As thus constructed the pitmen 26 are maintained at all times whatever the position of the pistons in the axial line of the cylinders.

Each pitman 26 has a short stem 33 projecting from its outer end beyond the T head 29, said stem terminating in a bearing 34 within which is journaled a guide roller 35 here shown as formed of two disk-like members 36 spaced apart and connected by a short shaft 37 that turns in the bearing 34.

Within the frame ring 11 is a fixed cam track 38 that at certain points contacts with the inner surface of said ring and is secured thereto. The cam track 38 is preferably made in two pieces for convenience of installation, these pieces or parts having their ends flanged as at 39 to form an interlocking connection. These ends are also provided with lateral flanges 40 by means of which the track 38 is bolted to the frame ring 11. At other points brackets 41 are bolted to the cam track and also to the ring 11. In cross section the cam track 28 has a trough-like shape, it having two parallel sides 42 and 43 connected by an outer or bottom side 44 the side opposite the bottom 44 being open at the center as at 45, a flange 46 projecting inwardly from the sides 42 and 43 partly bridging the space 45. Within the cam track 38 and adapted to travel in the way 47 defined by the sides 42, 43 and 44 and the flange 46 are the guide rollers 35 carried by the ends of the pitman 26. The guide rollers 35 fit snugly in the way 47, the diameter of the disks 36 of said rollers being the same as the distance from the inner face of the side 44 and the lug 46, and the length of the guide rollers from outside to outside of said disks is the same as the distance between the inner faces of the sides 42 and 43. From this it will be apparent that as the guide rollers travel around in the cam track 38 these rollers are prevented by the flanges 46 of the cam track from leaving said track or jumping from point to point therein, and while these rollers fit snugly within the cam track, this fit is not so close as to cause undue friction between the parts. In order that the cylinders 23 may revolve freely without interference from the cam track 38, and to enable the pitmen to act in a direct line with the cam track, the outer or guide ends 25 of said cylinders are slotted as at 48 to permit the cylinders to straddle the cam track and rotate freely without engagement therewith. The pistons 27 are each similarly soltted at their outer ends as at 49 to prevent their interference with the cam track at the outer end of the stroke.

Each section of the cam track 38 includes four oppositely but non-symmetrically inclined portions, said portions being joined by easy curves so as to form on the whole a continuous sinuous track. The portion A extending from dotted line *a* Fig. 2 to dotted line *b* is, for convenience, called the compression incline, the portion B extending from dotted line *b* to dotted line *c* is called the power decline, the part C extending from dotted line *c* to dotted line *d* is the exhaust incline while the portion D extending between dotted lines *d* and *a* is called the intake decline. The special use of these several inclined portions will be described later.

It is to be noted that the several portions A, B, C and D of each half of the cam track which control a complete cycle of each cylinder are of different angular lengths, that is to say, their lengths in the plane of rotation of the engine between the angular lines *a*—*b*, *b*—*c*, etc. It will also be understood that the outer ends of the sections are equally distant from the axis of the engine shaft. The inner ends of said sections are also equally distant from said axis, the radial distance between the outer and inner ends being equal to the length of the piston stroke. It follows therefore, that with the inner and outer ends of the sections equally spaced apart radially and the sections themselves having different angular lengths, these several sections, will, necessarily, be differently inclined, the shorter sections having a steeper inclination with respect to the line of piston stroke than the longer sections. This has been found to be desirable, and in fact necessary, to properly function the engine, so that it will work with the greatest smoothness and freedom, and develop the

maximum amount of power with the least frictional and other resistance.

Simultaneous ignition of the charges in diametrically opposite cylinders is caused by the electrical circuit breaking mechanism illustrated particularly in Fig. 5. As shown at 50 there are a plurality of radially projecting arms equal in number to the number of cylinders and each mounted on a block 51 of insulating material secured to the hub 22 from which the pistons 23 radiate. These arms are equally disposed around the hub 22 and mounted on their outer ends which are turned to lie parallel to the axis of rotation of the engine are rollers 52. From each arm 50 there extends a wire 53 to the spark plug 54 of the adjacent cylinder 23. This spark plug is of any approved type and therefore requires no special description. The wires 53 of diametrically opposite cylinders are electrically connected by a branch wire 55 so that if an electrical circuit be sent through either of the wires 53, both spark plugs will be operated.

Bolted to one of the arms 14 of the spider frame is a bracket 56 from which an arm 57 projects inwardly and is secured to a block of insulating material 58 that lies substantially in horizontal position, and has secured thereto on the upper and lower sides spring fingers 59 and 60 that project in parallel relation in the plane of rotation of the rollers 52, the spring finger 59 having an upwardly projecting extension or lug 61 in position to be engaged by each roller 52 as the engine rotates and depressed in order to bring into contact points 62 and 63 on the respective fingers 59 and 60 and thereby close the circuits from a spark coil or magneto generator, not shown, through a wire 64.

As thus described the ignition occurs whenever a roller 52 strikes the projection 61 of the switch fingers 59 and 60. The circuit from the generator will then pass between the fingers and to the roller 52, thence to the wire 53 where it divides and a portion passes to the nearest spark plug 54 and through the branch wire 55 to the plug 54 of the diametrically opposite cylinder, thus causing simultaneous ignition in these two cylinders. As soon as the roller 52 passes from the projection 61 the circuit is broken to be again closed when the next two cylinders are in position, the roller 52 of one of which cylinders closing the circuit ignites the charge of two cylinders.

The inner or bearing surface of the engine hub 22 is provided with two thin bearing rings 65 seated in shallow grooves in the hub. These rings bear against the outer surface of the shaft 20 and prevent leakage of gas passing into the cylinders and of the exhaust leading therefrom. In the bottom of each cylinder 23 is one or more ports 66 that extend through the hub 22 and through the packing rings 65 and register in certain positions of the cylinders as they rotate with inlet and outlet ports 67 and 68 formed through the walls of the hollow shaft 20. Both ports in the hollow shaft and the rotating hub are without valves and depend upon their position as the cylinders rotate to take in the gas and discharge the products of combustion. An inlet pipe 69 passes into the hollow shaft 20 from one side and branches as at 70 to connect with the two inlet ports 67 in the hub 20. An exhaust pipe 71 passes in a similar manner into the hollow shaft 20 and branches at 72 to connect with the exhaust ports 68.

In the operation of this engine it is to be understood that it is without valves, cam shafts or gearing and that each cylinder functions as a four-cycle engine twice in each revolution, diametrically opposite cylinders operating simultaneously to impart rotary motion to the engine when they reach certain points in their cycle of movement. When the rotating cylinders 23 arrive in the position indicated in the drawings, all the pistons 27 will be at the inner limit of their strokes, the vertical cylinders ready for ignition of the gas therein under pressure while the horizontal cylinders are each about to draw in a charge of gas. In the position shown ignition in the vertical cylinders is caused by bringing the fingers 59 and 60 of the single circuit closing switch into contact by means of one of the rollers 52 striking the enlargement 61 on the finger 59. The current then passes from the generator of any approved type through lead wire 64, switch fingers 59 and 60, roller 52 in contact therewith, and by wire 53 from the post 50 and by the branch wire 55 to the spark plugs 54 of opposite cylinders 23. Explosion immediately takes place in these two cylinders, the pistons of which are forced outwardly and the rollers 35 on the ends of the pitman caused to travel along the portion B of the cam track 38. This movement of the piston by means of the angular disposition of the portion B called the power decline carries the cylinder through an arc extending from the point *b* to the point *c*. Here the ports 66 of the cylinders coincide with the exhaust ports 68 of the shaft 20 and the products of combustion are forced outwardly from the cylinder as the latter moves through the arc *c* to *d*, the piston being moved inwardly to effect the exhaust by the roller 35 passing along the portion C of the cam track and called the exhaust incline. From the angular position *d* the roller 35 travels the portion D of the cam track called the intake decline and the piston 27 is drawn outwardly filling the cylinder with gas through the ports 66 and 68 from the inlet pipe 69, the cylinder moving through the arc between the dotted lines *d* and *a*. Further movement of

the cylinder will cause an inward movement of the piston to compress the charge by reason of the travel of the roller 35 in the portion A of the cam track called the compression incline, the cylinder moving during this portion in the arc extending from *a* to *b* and at the completion of this movement the cylinder which was at th top of the engine will now be at the bottom, while the cylinder heretofore at the bottom will be at the top and ignition will be caused in these two cylinders by the roller 52 now at the bottom acting on the switch and closing the circuit from the generator to the spark plugs of the upper and lower cylinders. It is to be understood that when the cylinders have made a quarter revolution after explosion, those cylinders which previously were in a horizontal position have arrived at the vertical position and the gas therein will be ignited in turn so that an impulse of revolution will be given at each quarter revolution of the engine and each cylinder will be caused to function at every half revolution.

While I have shown and described what I consider to be the best form of the invention, it is to be understood that various changes in the construction and arrangement of parts may be made without departing from the spirit of the invention and remaining within the terms of the appended claims.

What I claim is:

1. In an internal combustion engine of the four-cycle type, the combination with a fixed shaft, a hub rotatable on said shaft and having a plurality of explosion cylinders projecting radially therefrom, said cylinders being arranged in diametrically opposite pairs, a piston longitudinally movable in each of said cylinders, a pitman pivoted to each piston continuous, a cam track extending around the outer ends of said cylinders having two opposite sections in its length of relatively short angular extent and steep inclination and three other sections therebetween on each side of greater angular length and less inclination, said sections of the track being adapted to control the movement of the pistons and also to transmit explosive force within the cylinder into a rotary motion, said short sections of steep inclination acting on the pistons during the working stroke thereof to impart rotatable motion to the cylinders to the best advantage, an inlet pipe within said hollow shaft connected to oppositely disposed inlet ports in the hub leading to the cylinders, and an exhaust pipe similarly connected to exhaust ports also leading from the cylinders.

2. A cam track for a rotary internal combustion engine comprising a continuous track to encircle the cylinders in a plane perpendicular to the axis of rotation, said track consisting of two equal parts formed with differentially inclined sections and of different angular lengths for controlling the several functions of the piston during a semi-revolution whereby said pistons are caused to make a complete series of movements during the semi-rotation of the engine.

3. In combination with a rotary internal combustion engine having radial cylinders and radially movable pistons, of a cam track for controlling the movement of said pistons encircling the cylinders in a plane perpendicular to the axis of rotation of the engine, said cam track being of tubular formation in cross section having a continuous slot on its inner side, the track being formed of two equal diametrically divided parts disengageably connected together, each part comprising four differently inclined sections having different angular lengths to control the several functions of the piston during a semi-revolution of the engine whereby said pistons are caused to make a complete cycle of movement, a piston rod connected to each piston, and rollers on the outer ends of said rods adapted to travel within and be controlled by said tubular cam track.

In testimony whereof I affix my signature in presence of two witnesses.

CLIFFORD HARTSON.

Witnesses:
A. GILLETTE,
EDNA A. STRANG.