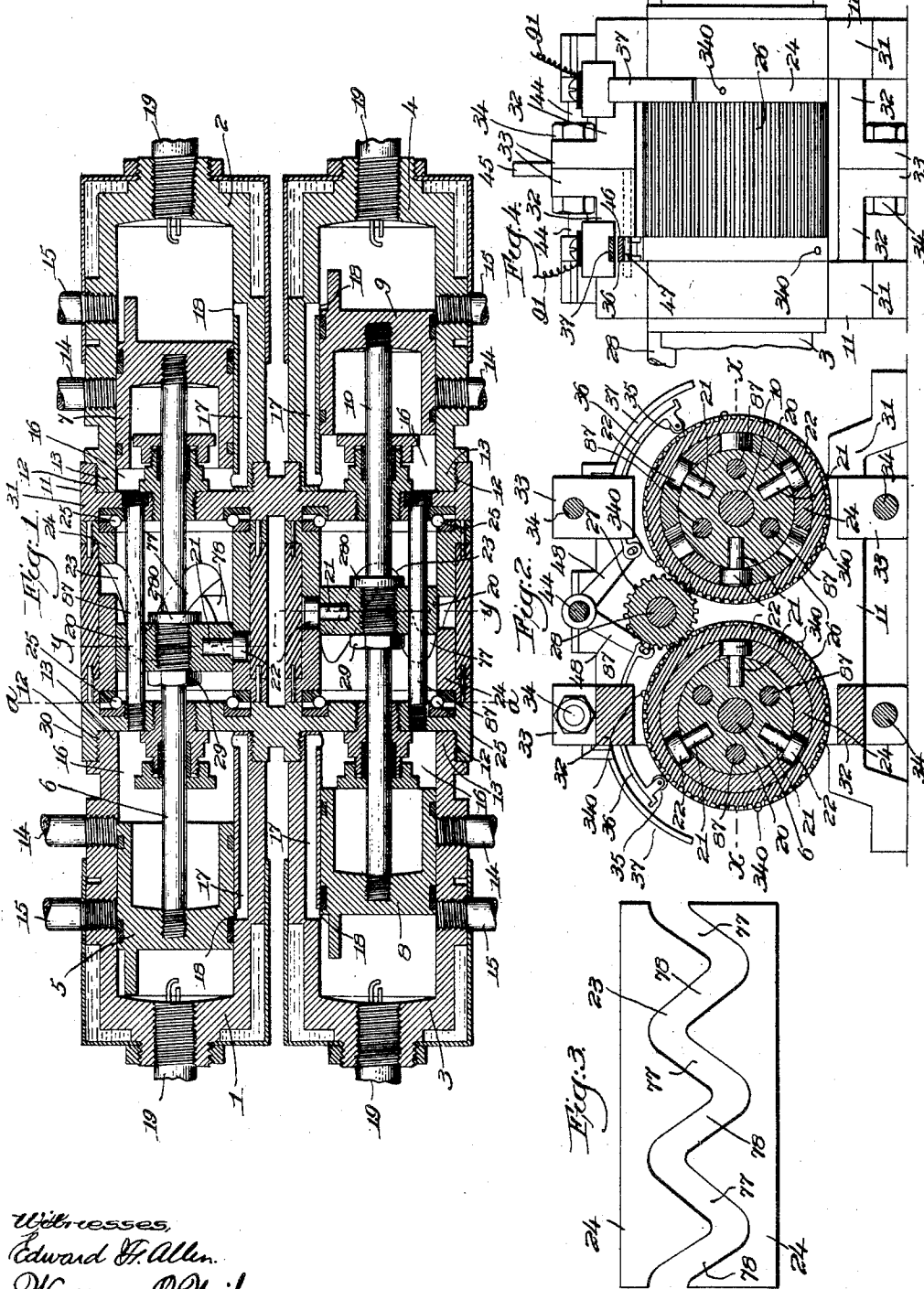


O. A. ANDERSON.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED JULY 17, 1911.

1,076,807.

Patented Oct. 28, 1913.

2 SHEETS—SHEET 1.



Witnesses,
Edward F. Allen.
Nanon O'Neil.

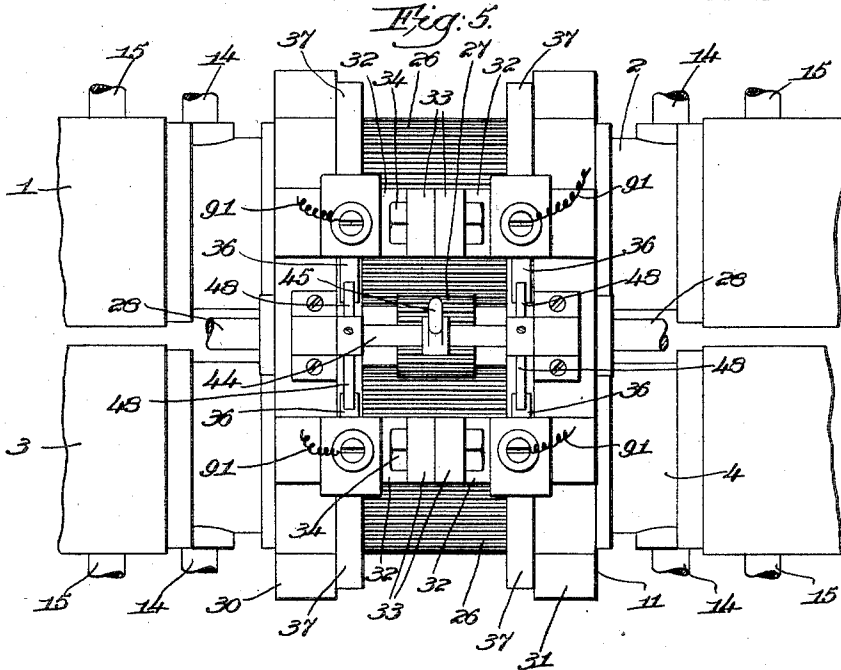
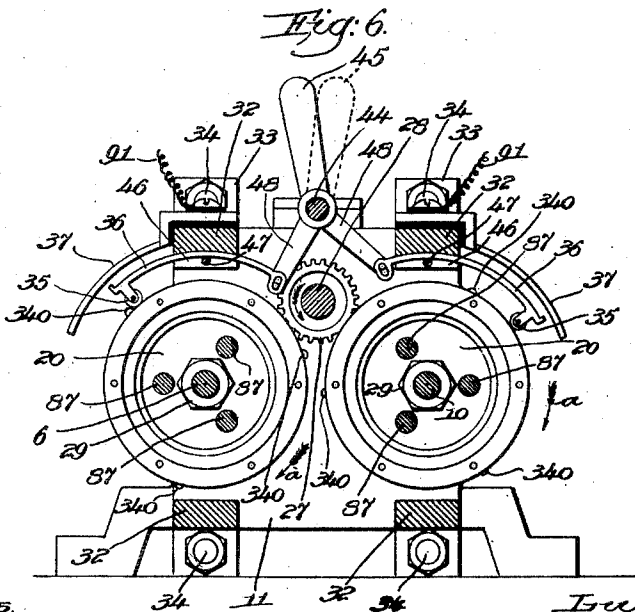
Inventor,
Olof A. Anderson,
by Edwards Hand & Smith

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UNITED STATES PATENT OFFICE.

OLOF A. ANDERSON, OF BOSTON, MASSACHUSETTS.

INTERNAL-COMBUSTION ENGINE.

1,076,807.

Specification of Letters Patent.

Patented Oct. 28, 1913.

Application filed July 17, 1911. Serial No. 638,816.

To all whom it may concern:

Be it known that I, OLOF A. ANDERSON, a citizen of the United States, residing at Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Internal-Combustion Engines, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to internal combustion engines and has for its object to provide a novel engine in which the power is transmitted from the piston to the driving shaft by means of cams instead of by means of the crank shaft as is usually done in engines, and for another object to simplify and cheapen the cost of manufacture of engines of this type; and for still another object to provide a simple and efficient arrangement for advancing the spark.

I will first describe one embodiment of my invention and then point out the novel features thereof in the appended claims.

Referring to the drawings, Figure 1 is a central sectional view of an engine embodying my invention, said section being taken on substantially the line $x-x$, Fig. 2; Fig. 2 is a vertical sectional view taken on substantially the line $y-y$, Fig. 1; Fig. 3 shows the cam groove of the cam member developed; Fig. 4 is a side view of a portion of the engine; Fig. 5 is a top plan view of the engine with the exception of the cylinders; Fig. 6 is a section on the line $a-a$, Fig. 1.

In my improved engine the piston rod is provided with a pin or roll which operates in a cam groove in a rotary part, said groove being so arranged that reciprocating motion of the piston rod will give rotary motion to the rotating part. I prefer to arrange my cylinders in pairs with the cylinders of each pair oppositely disposed, and to provide each piston rod with a piston at each end thereof. I have herein shown two such pairs of cylinders and the cylinders are designated 1, 2, 3 and 4, respectively, the cylinders 1 and 2 constituting one pair and the cylinders 3 and 4 constituting another pair. The cylinder 1 has a piston 5 therein connected to one end of a piston rod 6, and the other end of said piston rod has a piston 7 thereon operating in the cylinder 2. Similarly the cylinders

3 and 4 have pistons 8 and 9 therein, both of which are connected to a piston rod 10. Each pair of pistons, therefore, move in unison.

The cylinders may be supported in any suitable way. As herein shown they are sustained by a main frame 11 which is adapted to be bolted to the floor or secured to any suitable support. This frame has at each end interiorly-screw-threaded sockets 12 into which the ends of the cylinders are screwed, said cylinders being provided with the exteriorly screw-threaded ends 13 for this purpose. Each cylinder is provided with the usual inlet port to which is connected an inlet or supply pipe 14, and also with an exhaust port to which is connected an exhaust pipe 15, the inlet port leading to the inner end 16 of the cylinder. This chamber 16 is connected with the working end of the cylinder by a by-pass or transfer passage 17 which opens into the working end of the cylinder at 18. The inlet and outlet ports are so disposed that when the piston is at the beginning of its power stroke the inlet port is uncovered thereby to admit an explosive charge to the chamber 16, and when the piston is at the end of its power stroke the exhaust port is opened and the port 18 is also opened, thus permitting the explosive charge which has been compressed in the chamber 16 by the power stroke to be delivered to the working end of the cylinder where it is exploded by any suitable sparking plug 19 in a manner well known to those skilled in the art.

Each piston rod has fast thereon a collar 20 carrying a plurality of radially-extending pins 21 each preferably provided at its end with a roll 22. In the illustrated embodiment of my invention there are three such pins and rolls carried by each collar 20. The rolls 22 play in a cam groove 23 formed on the interior of a rotatable power-transmitting member 24, there being one such power-transmitting member for each pair of pistons. These power-transmitting members are in the form of cylinders which are concentric with the piston rods and are rotatably mounted in the frame 11, said power-transmitting members preferably being sustained by suitable roller bearings 25. Each power-transmitting member is provided on its exterior with gear teeth 26 and the gear teeth of the two members mesh

with a pinion 27 mounted on a driven shaft 28 from which power may be taken from the engine.

The cam grooves 23 have a zig-zag shape, as shown in Figs. 1 and 3, that is, each cam groove is provided with a series of oppositely-inclined portions 77 and 78. When either piston rod moves to the right, Fig. 1, the rolls 22 operate on the inclined portion 77 of the groove, thus rotating the power-transmitting member, and when the piston reaches the end of its stroke and begins its reverse movement to the left the rolls work in the inclined portions 78 of the groove and thus continue the rotary movement of the power-transmitting member. Where two pairs of pistons are used I propose to so position the pairs of pistons relative to each other that when one pair of pistons have reached the end of their stroke and are reversing the other pair of pistons are at approximately half stroke so that the latter pistons will furnish the power to keep the parts rotating while the first pair of pistons are reversing their movement. In the arrangement shown in Fig. 1 I propose to provide for causing an explosion first in the cylinder 1 thereby to drive said piston 5 to the right Fig. 1, and when said piston is approximately at half stroke and the piston 8 has completed its stroke to the right to cause an explosion in the cylinder 4, thus to start the piston 8 to the left, and then when the piston 5 has completed its stroke to cause an explosion in the cylinder 2, and when the piston 7 has reached its half stroke to cause an explosion in the cylinder 3. Each of the cylinders operates on the two-cycle principle and with this arrangement four explosions will be produced at each complete reciprocation of each piston rod.

The collars 20 must be held from rotation in order to give rotation to the power-transmitting member, and this may be accomplished in a variety of ways without departing from my invention. As herein shown I employ guide rods 87 which extend from one end of the frame 11 to the other and pass through said collars, said guide rods holding the collars from turning and guiding them in their reciprocating movement. These collars may be secured to the piston rods 4 in any suitable way. I have shown each collar as screw-threaded to the piston rod and as confined between a flange 280 thereon and a nut 29 which is screw-threaded thereto.

The frame 11 is preferably made in two sections that are secured together, said sections being designated 30 and 31, respectively, and each section constituting an end of the frame into which the cylinders are screwed. These sections may be connected in any suitable way and as herein shown each is provided at its top and bottom with

inwardly-projecting fingers 32 having up-right flanges 33 at the end thereof, said flanges abutting each other and being secured together by bolts 34. This construction makes a rigid frame for the rotating parts and also facilitates assembling the parts or dismantling the engine for repairs.

In operating the spark plugs I propose to use means associated with the power-transmitting members, such means operating to close the circuit through the spark plugs at appropriate times. As herein shown each power-transmitting member has at each end thereof a plurality of pins or cam projections 340 which are adapted to engage a roll 35 carried by a movable contact member 36 so that as the power-transmitting member rotates the contact member 36 is given a movement by each pin 340. There are four such movable contacts 36, one at each end of each of the power-transmitting members. Associated with each movable contact is a fixed contact 37 secured to but insulated from the frame 11, each contact 37 being connected by a wire 91 to the insulated core of a spark plug 19. The pins 340 are so arranged that as the power-transmitting members rotate each pair of contacts 36, 37 will be closed together at the proper time to operate the spark plug connected therewith and the pins in the various power-transmitting members are so disposed that the explosions in the cylinders will be timed properly relative to each other.

I have provided for reversing the direction of rotation by shifting the position of the sparking device. As herein shown the movable contacts 36 are all connected to a rock-shaft 44 sustained by the frame and which is provided with a suitable handle 45 by which it may be turned, the turning of said rock-shaft shifting the position of the movable contacts relative to the fixed contacts. As herein shown each movable contact is slidably mounted in the arm 32, said contact occupying a notch or groove 46 in said arm and resting on a pin 47 extending across the notch. The inner end of each movable contact is pivoted to an arm 48 rigid with the rock shaft 44 so that movement of the rock shaft will move the contacts 36 in the direction of their length. When the contacts are in the position shown in Fig. 6 the power-transmitting members will be rotated in the direction of the arrows *a*. To reverse the engines it is simply necessary to swing the handle 45 into the dotted line position Fig. 6 thereby carrying the contacts 36 into the dotted line position and giving them a new position relative to the projections 340. With the parts in the new position the explosions are so timed as to reverse the direction of the engine, as will be obvious.

Having fully described my invention, I

what I claim as new and desire to secure by Letters Patent is:—

1. In an engine, the combination with a pair of oppositely-disposed cylinders separate and independent from each other, of pistons in the cylinders, a piston rod connecting said pistons, a rotary cylindrical power-transmitting member surrounding the piston rod and situated between the cylinders, said member having an interior cam groove, a collar secured to the piston rod and fitting within said cylindrical member, and a projection on the collar operating in said groove.

2. In an engine, the combination with a pair of oppositely-disposed cylinders separate and independent from each other, of pistons within the cylinders, a piston rod connecting said pistons, a rotary cylindrical power-transmitting member surrounding the piston rod and situated between the cylinders, said member having an interior cam groove, a collar secured to the piston rod and situated within said cylindrical member, a projection on the collar operating in said groove, and means situated within said cylindrical member to prevent the collar from turning.

3. In an engine, the combination with a pair of oppositely-disposed cylinders separate and independent from each other, of pistons within the cylinders, a piston rod connecting said pistons, a rotary cylindrical power-transmitting member surrounding the piston rod and situated between the cylinders, said member having an interior groove, a collar secured to the piston rod and situated within said cylindrical member, a projection on the collar operating in said groove, and stationary guide rods situated within the cylindrical member and extending through the collar and on which the latter slides.

4. In an engine, the combination with a frame, of a cylinder at each end thereof, pistons in the cylinders, a piston rod connecting said pistons, a cylindrical power-transmitting member rotatively mounted on the frame and situated between the cylinders and through which the piston rod extends, said member having an interior cam groove, a collar mounted on the piston rod and provided with a projection operating in said groove.

5. In an engine, the combination with a frame, of a cylinder at each end thereof, pistons in the cylinders, a piston rod con-

necting said pistons, a cylindrical power-transmitting member rotatively mounted on the frame and situated between the cylinders and through which the piston rod extends, said member having an interior cam groove, a collar mounted on the piston rod and provided with a projection operating in said groove, and stationary guide rods carried by the frame and extending through the collar and on which the latter slides.

6. In an internal combustion engine, the combination with a cylinder, of a piston therein, a piston rod, a rotary cylindrical power-transmitting member encircling the piston rod and rotated by the reciprocating movement of said rod, a spark plug, an insulated fixed contact electrically connected thereto, a movable contact and situated exterior to said power-transmitting member, and cam projections on the exterior of the rotary power-transmitting member for closing the movable contact against the fixed contact.

7. In an internal combustion engine, the combination with a cylinder, of a piston therein, a piston rod, a rotary cylindrical power-transmitting member encircling the piston rod, means for rotating said member by the reciprocations of the piston rod, a spark plug, an insulated fixed contact electrically connected thereto, a movable contact, cam projections on the power-transmitting member for closing the movable contact against the fixed contact, and means to shift the movable contact relative to the fixed contact circumferentially of the power-transmitting member thereby to reverse the direction of the engine.

8. In an internal combustion engine, the combination with a cylinder, of a piston therein, a piston rod, a rotary cylindrical power-transmitting member encircling the piston rod, means for rotating said member by the reciprocations of the piston rod, a spark plug, a circuit therefor including a pair of contacts situated exterior to the power-transmitting member, and means to close said contacts by the rotative movement of the power-transmitting member.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

O. A. ANDERSON.

Witnesses:

LOUIS C. SMITH,
THOMAS J. DRUMMOND.