F. C. L. D'AIX.

INTERNAL COMBUSTION ENGINE.

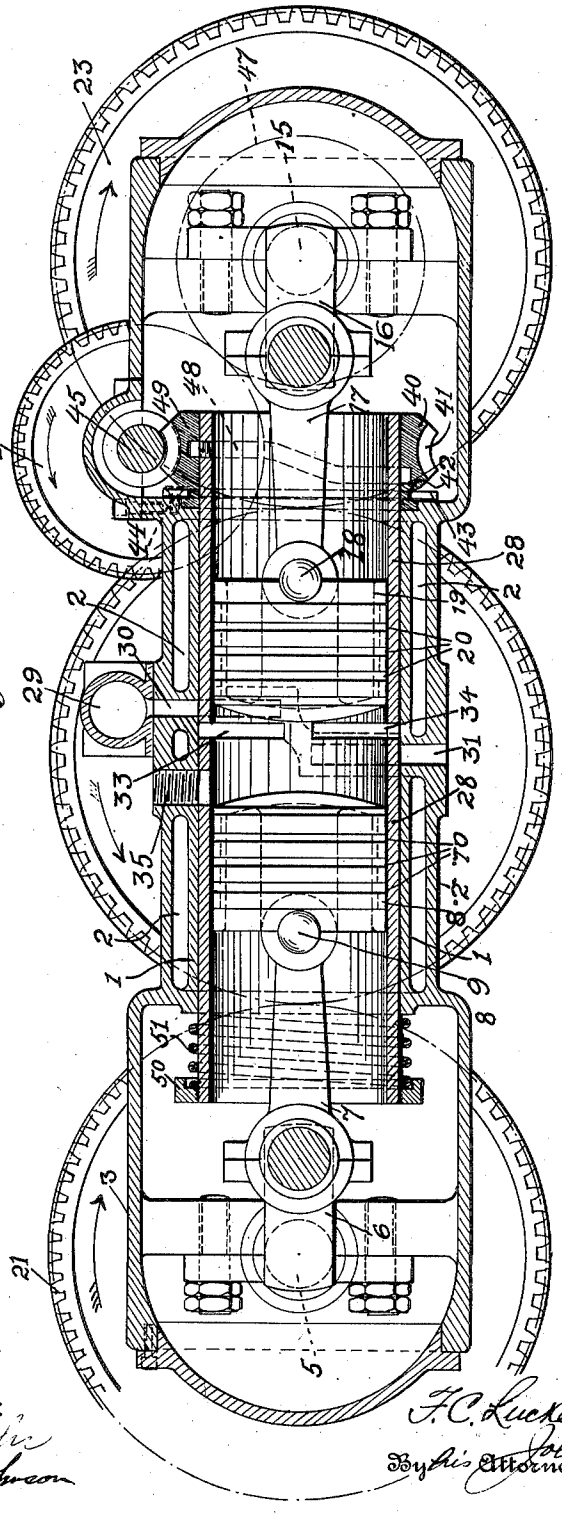
APPLICATION FILED OCT. 7, 1914.

1,308,400.

Patented July 1, 1919.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Louise Foltz

Alan M. Johnson

F. C. Lucke d'Aix Inventor

By his Attorney John R. Morgan

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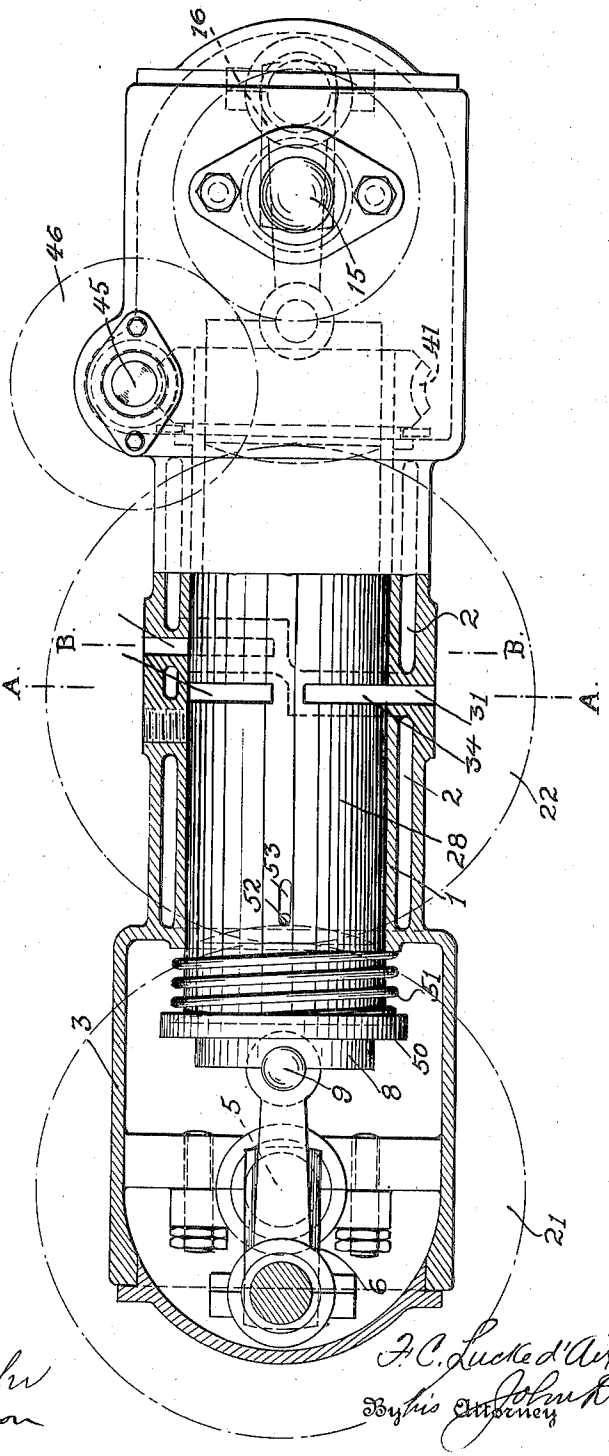
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3 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
Louisa Lahr
Alan M. Johnson

F. C. Lucke d'Aix Inventor
By his Attorney John D. Morgan

F. C. L. D'AIX.

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3 SHEETS—SHEET 3.

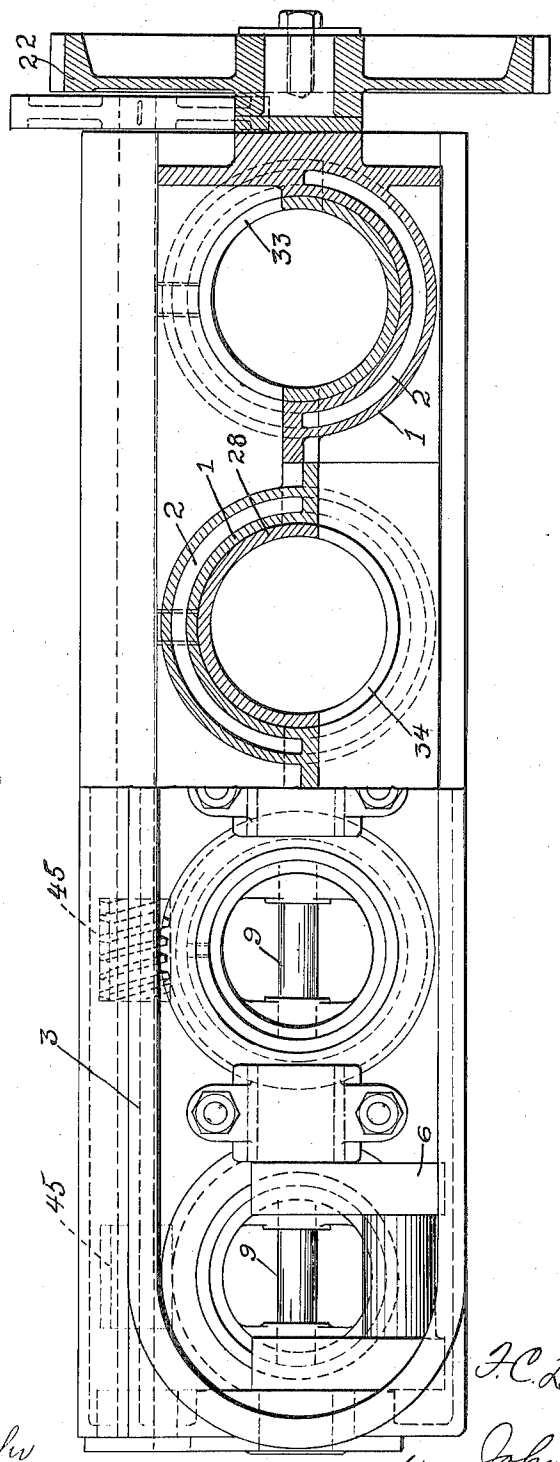


Fig. 3.

Witnesses:

Louis W. Zollw

Alan M. Johnson

F. C. Lucie d'Aix

Inventor

By his Attorney John D. Morgan

UNITED STATES PATENT OFFICE.

FRITZ C. L. D'AIX, OF BROOKLYN, NEW YORK.

INTERNAL-COMBUSTION ENGINE.

1,308,400. Specification of Letters Patent. Patented July 1, 1919.

Application filed October 7, 1914 Serial No. 865,443.

To all whom it may concern:

Be it known that I, FRITZ C. L. D'AIX, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

The invention relates to internal combustion engines, and in certain of its aspects more especially to four stroke cycle engines. Objects of the invention are to provide a novel engine wherein useless thrusts and vibrations are eliminated or neutralized, and useless and mischievous strains and stresses are avoided, thus preventing loss of efficiency and useless absorption of the power generated; to provide such an engine in which the reaction from the explosion of the charge is absorbed and transmitted to the engine shaft substantially in its entirety; to provide novel mechanisms having such characteristics and operating upon the four stroke cycle principle.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and forming a part hereof, illustrate one embodiment of the invention, and together with the description serve to illustrate the principles thereof.

Of the drawings:

Figure 1 is a central section through a cylinder and coöperating parts showing the pistons in position substantially at the end of the compression stroke and ready for the firing of the charge of compressed gas;

Fig. 2 shows a portion of the right hand end in elevation, showing the engine casing and shaft bearing, and in the central and left hand end showing the cylinder in section and the valve shell in elevation; and

Fig. 3 is an end elevation of the engine, the first cylinder from the left showing the engine shaft crank, the next cylinder showing the crank omitted, the third cylinder being in section on the line A—A of Fig. 2; and the last cylinder toward the right being in section on the line B—B of Fig. 2.

Referring to the accompanying drawings, illustrating by way of example one embodiment of the invention, a cylinder 1 is provided, preferably having a water jacket 2 for cooling. The cylinder 1 is open at both ends, said ends connecting respectively into casings 3 and 4. In the casing 3 is mounted an engine shaft 5, suitably journaled, and formed on said shaft 5 is a crank 6. Said crank 6 connects by a connecting rod 7 to a piston 8 by means of a wrist pin 9, said piston reciprocating in the cylinder 1. The piston 8 is provided with suitable piston rings 10.

In the casing 4 at the opposite end of the cylinder 1 is suitably journaled an engine shaft 15, having formed therein a crank 16. A connecting rod 17 connects from said crank 16 to a wrist pin 18 carried by a piston 19. Said piston 19 is reciprocably mounted in the cylinder 1. Piston 19 is provided with piston rings 20.

The shafts 5 and 15 are geared together so that the pistons 8 and 19 travel synchronously but in opposite directions in the cylinder 1. For this purpose said shafts 5 and 15 are geared together in a suitable manner. As embodied a gear 21 is fixed on shaft 5 to rotate therewith. Meshing with gear 21 is an intermediate gear 22 mounted on the engine frame. Meshing with gear 22 is a gear 23 fixed on shaft 15 to rotate therewith. Said gears are arranged to give equal revolutions of the shafts 5 and 15.

Suitable means are provided by the invention for causing the successive admission, compression, explosion and expulsion of the power producing gas. In the embodied form of such means, there is provided a valve shell 28 of cylindrical form and fitting as a lining within the cylinder 1, the pistons 8 and 19 working within the valve shell 28. Communicating with the cylinder 1 is a suitable gas intake conduit or manifold 29, which connects with a suitable carbureter or other power fluid supplying device. From the manifold 29 a port 30 communicates to the interior of the cylinder 1, said port 30 being preferably of arcuate form, and also preferably of somewhat less size than a semi-diameter on cylinder 1. A suitable exhaust port 31 is likewise provided in the cylinder 1, which is likewise preferably of arcuate form and of approximately semi-diametral size. The intake port 30 and the exhaust port 31 are located slightly out of alinement with each other in the cylinder 1 considered perpendicularly to the axis of the cylinder.

Means and movements are provided whereby the valve shell 28 controls the ad-

mission of fuel gas and the exhaust or expulsion of the burnt gases. As embodied, there is formed in said valve shell 28 an intake port or opening 33 of corresponding form to the intake port 30 of the cylinder. In the valve shell 28 there is also provided a port or opening 34 for the exhaustion of the spent gases, said port 34 being of corresponding form to the exhaust port 31 in the cylinder 1. The intake opening 33 and the exhaust opening 34 in the valve shell 28 are preferably diametrically opposite each other. In the embodied form the valve shell is movable longitudinally of the cylinder to open and close the ports, and the parts are preferably proportioned and arranged so that the valve shell 28 may be stopped at one position in its longitudinal travel with both its intake port 33 and its exhaust port 34 intermediate the intake port 30 and the exhaust port 31 of the cylinder, and with all the ports thus closed, (as shown in Fig. 1). Suitable ignition means are provided, and for this purpose an opening 35 is shown into which opening a spark plug may be screwed.

Means are provided by the invention for moving the valve shell to and fro longitudinally, and in the embodied form of such means there is loosely sleeved on the exterior of the valve shell 28 where it projects from the end of the cylinder (at the right hand in Fig. 1) a ring 40, which ring 40 has worm teeth 41 formed on the exterior thereof. Adjacent to said worm teeth 41 the ring 40 has formed therein a groove 42. Into the groove 42 projects a ring 43, which ring 43 is fastened to the end of the cylinder 1 by suitable means, such as lag screws 41. This holds the ring 40 in position at the end of the cylinder while leaving it free to rotate.

Meshing with the worm teeth 41 is a worm threaded shaft 45 suitably journaled in the machine frame and having fixed thereon to rotate therewith a gear wheel 46. Gear wheel 46 is suitably driven, as by a meshing gear 47 fixed on shaft 15. Formed on the interior face of the ring 40 is a cam groove 48, into which projects a pin fixed to the valve shell 28. At the opposite end of the cylinder 1 the valve shell 28 projects and screwed thereon is a collar 50, a coil spring 51 being in compression between said collar and the left hand end of cylinder 1 (referring to Fig. 1). Suitable means are provided for preventing rotational movement of the valve shell 28, and for this purpose there is shown a pin 52 fixed in the cylinder 1 and projecting into a longitudinally disposed slot 53 in the valve shell 28.

The foregoing description has been applied to but a single power unit, but it will be understood that a plurality of such power units may be connected to the same shafts in a well known manner, the cylinders being arranged to fire in any desired order, preferably on successive strokes, and being variously connected to the engine shaft in any desired angular relation. In Fig. 3 a unit of four cylinders connected to the engine shafts is shown.

The manner of operation of the herein described mechanism is substantially as follows:—

The engine may be assumed to be running, and about to start upon the gas intake stroke. The valve shell 28 will have been moved to the right from the position shown in Fig. 1 until the intake opening 33 in valve shell 28 is in registry with the intake port 30 of the cylinder. Both pistons, under the momentum of the engine, move away from each other and outwardly toward the respective ends of the cylinder 1, thus creating the suction for drawing in the charge of gas. By the time the pistons have reached the outward end of their travel, the worm ring 40 will have been turned sufficiently to shift the valve shell 28 toward the left of the position shown in Fig. 1, in which position the intake and exhaust ports are both closed. The pistons, on the next stroke, move backwardly in the cylinder 1 compressing the charge between them. The compressed charge of gas is than ignited and exploded to give the power impulse to the engine, a suitable timing device being employed to regulate the point of explosion in the usual manner. Under the impulse of the explosion, the pistons 8 and 19 are driven apart, and absorb practically the entire energy of the explosion. As the pistons approach the outward limit of their travel upon the explosion stroke, the valve shell 28 is again moved to the left from the position shown in Fig. 1 until the exhaust opening 34 in the valve shell registers with the exhaust port 31 in cylinder 21, as shown in Fig. 2. The pistons now move toward each other on the exhaust stroke and expel the burned gases from the cylinder. As the pistons approach the end of their travel on the exhaust stroke, the valve shell 28 is moved to the right in Fig. 1 until the intake opening 33 registers with intake port 30. This is effected as the pistons are traveling from each other in Fig. 1 and starting on the next suction stroke.

From all the foregoing it will be understood that an engine has been provided realizing the objects of invention and the advantages herein enumerated, together with other objects and advantages. It will also be understood that changes may be made from the mechanism shown and described, within the scope of the accompanying claim, without departing from the principles of the invention and without sacrificing its chief advantages.

I claim—

An internal combustion engine including

in combination a cylinder open at both ends, two shafts at opposite ends of said cylinder, two pistons in said cylinder, one piston connected to one of said shafts and the other piston connected to the other of said shafts, a longitudinally reciprocable cylindrical sleeve within said cylinder and about said pistons, said sleeve projecting from said cylinder at both ends, a spring acting on said sleeve at one end of the cylinder to impel it toward one end of its stroke, a cam ring mounted loosely on the opposite end of said sleeve and having an internal cam groove and an external driving gear, connections from the engine shaft for driving said gear, and a member on the sleeve working in the cam groove to reciprocate the sleeve.

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

FRITZ C. L. D'AIX.

Witnesses:
JOHN D. MORGAN,
LOUISA LOEHR.