G. RIETTI.

COMBUSTION ENGINE.

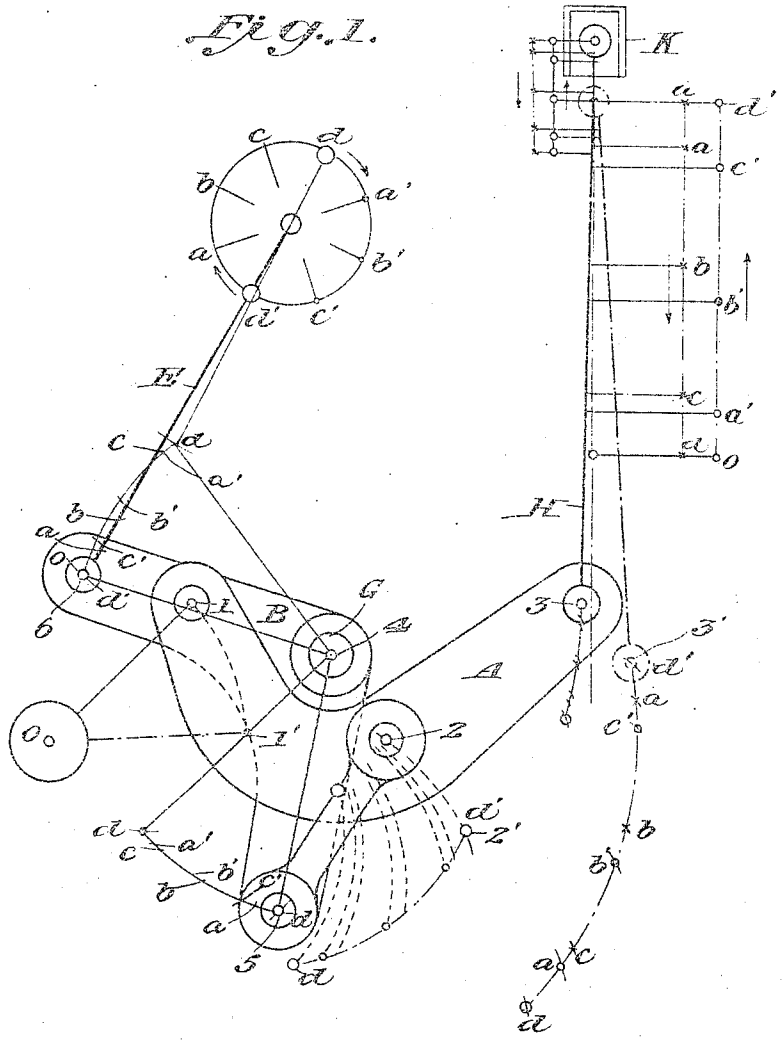
APPLICATION FILED JUNE 1, 1911.

1,095,675.

Patented May 5, 1914.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Eugene Wming
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Inventor:
Giacomo Rietti
by
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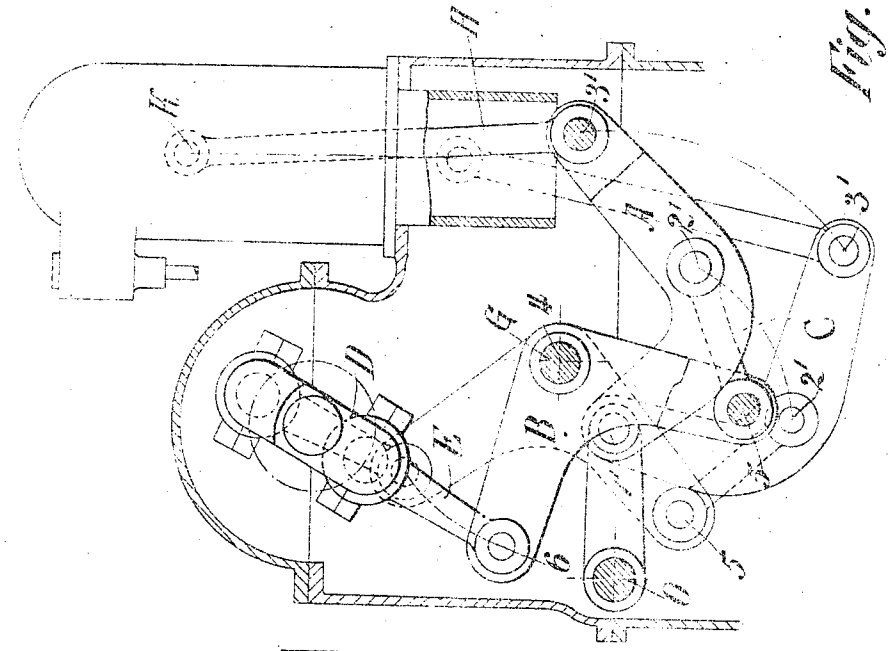


Fig. 3.

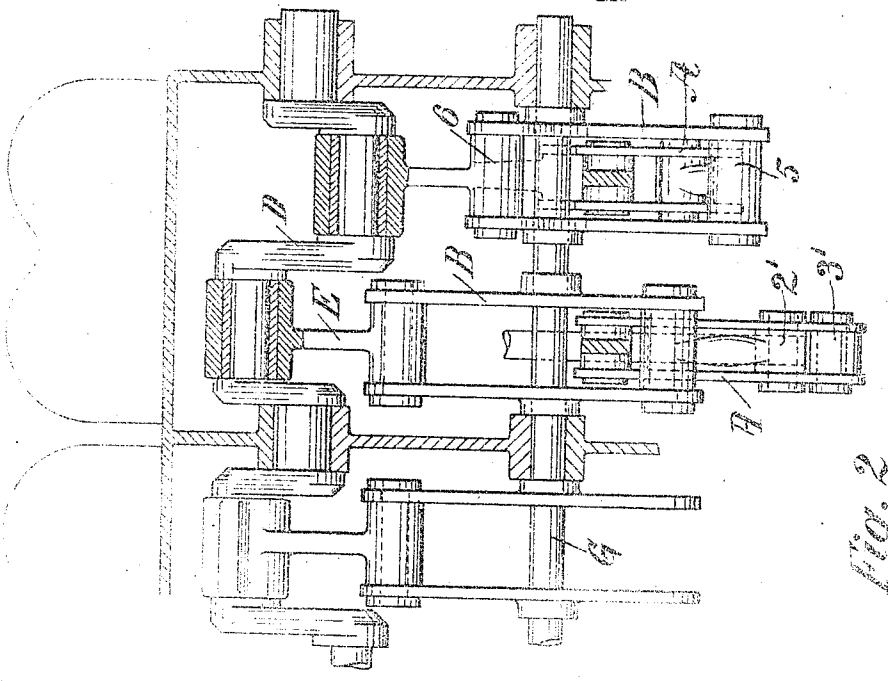


Fig. 2.

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UNITED STATES PATENT OFFICE.

GIACOMO RIETTI, OF ZURICH, SWITZERLAND.

COMBUSTION-ENGINE.

1,095,675. Specification of Letters Patent. Patented May 5, 1914.

Application filed June 1, 1911. Serial No. 630,623.

To all whom it may concern:

Be it known that I, GIACOMO RIETTI, citizen of Bologna, Italy, residing at Zurich, Switzerland, have invented certain new and useful Improvements in Combustion-Engines, of which the following is a specification.

My invention relates to combustion motors or engines having at least two parallel cylinders, wherein the stroke and the compression space are varied simultaneously, so that the degree of compression is uniform for all lengths of stroke. The cranks for two adjacent pistons are arranged at an angle of 180° to each other, and in four-cylinder engines the usual arrangement is to have the two outer and the two inner cranks projected in the same direction.

In the ordinary type of engine, the piston does not travel with a simple harmonic motion, but during the first half of its downward stroke, it travels with a faster than simple harmonic motion, so that when the crank has turned a quarter revolution, the piston will have moved more than half way down, and during the next quarter turn of the crank, the piston will move with a slower than simple harmonic motion, so that it moves less than half a stroke. The other piston 180° in advance on the crank shaft will be moving faster than with simple harmonic motion at the time the first piston is moving slower, and vice versa, so that at any time the speeds of the respective pistons will not be the same.

I have found that the irregularity above referred to in the respective piston speeds is augmented by the devices ordinarily interposed between piston and connecting rod for varying the clearance, and the primary object of my invention is designed to correct this defect.

By means of my invention the speed of one of the oppositely moving pair of pistons is substantially the same at all times as that of the other piston, whereby I am enabled to accomplish the object aimed at.

The invention is illustratively exemplified in the accompanying drawing, wherein—

Figure 1 diagrammatically represents the application of the invention; Fig. 2 is a side elevational view of a motor, the motor casing being shown in section, having my invention applied thereto; and Fig. 3 is a view taken at right angles to Fig. 2.

In the drawing, D is the crank; E the crank-connecting-rod; K the piston and H the piston rod.

The mechanism for one piston only is shown in one of its extreme positions, and the mechanism for the other piston is assumed to be in the other extreme position indicated by dotted lines, the cranks being assumed to be at an angle of 180° to each other.

Two bell-crank levers A and B are connected together by means of a short arm C. The fulcrum 4 of the lever B is fixed on the shaft G passing through all the cylinders. The fulcrum 1 of the lever A is relatively fixed. The fulcrum 1 is movable in a predetermined arc from 1 to 1′ to vary the piston stroke and the compression space. When the piston strokes are equal the position of the fulcrum 1 of the lever A is fixed. At 3 the lever A carries the piston rod H having the piston K, and the pin 2 is connected to the pin 5 of the lever B by means of the arm C. The distance of the points 2 and 3 from the fulcrum 1 of the lever A may be determined by calculation or experiment.

The point 6 of the lever B describes an arc, having the radius 4—6, about the center 4. The speed of this point is dependent upon that of the crank D. Point 5 also describes an arc, having the radius 4—5, about the center 4. For equal radii 4—5 the point 5 moves at the same speed as point 6. The irregularities resulting from the limited length of the connecting rod and acting on the movements of the points 6 and 5 are compensated for or equalized by the lever A. The point 2 of the lever A connected by the arm C with the point 5 describes an arc, having the radius 1—2, about the center 1. The point 3 connected with the piston rod describes an arc, having the radius 1—3, about the center 1. The direction of the arc of the point 2 as compared to that of the arc of the point 5 is so chosen that the distances traversed by two oppositely moving bodies are more nearly in accord than are those of the points 5 and 6, or differently expressed, the paths traversed simultaneously by the two oppositely moving points 2 and 3 (and the piston connected to the latter) are substantially equal. By adjusting the point 1 to 1′ for a greater piston stroke, the point 2 passes to 2′ and 3 to 3′ and the arcs of these points are described

about 1′ as a center. The movements of these points 2′ and 3′ are in the same relation as about fulcrum 1, this being true of all intermediate positions (that is for all lengths of piston stroke) between 1 and 1′.

The relation of the paths traversed by the pistons moving simultaneously is substantially of the value 1.

In the drawing

$$\frac{o—a}{o'—a'}=1;\ \frac{a—b}{a'—b'}=1.05;\ \frac{b—c}{b'—c'}=\frac{1}{1.05};\ \frac{c—d}{c'—d'}=1$$

As the manner of adjusting the point 1 to vary the stroke and compression space forms no part of the present invention I have not shown means therefor on the accompanying drawing. The form of the levers may also be varied. It is only essential that the relative position of the interconnected levers is such that the irregularities resulting from the limited length of the crank-connecting-rod are transmitted to the piston in a greatly reduced degree.

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

1. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, and means interposed between said piston rods and said connecting rods whereby the relative speeds at which said piston rods move in directions opposite to each other are rendered uniform.

2. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, and levers interposed between said piston rods and said connecting rods whereby the relative speeds at which said piston rods move in directions opposite to each other are rendered uniform.

3. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, and a pair of interconnected levers interposed between said piston rods and said connecting rods whereby the relative speeds at which said piston rods move in directions opposite to each other are rendered uniform.

4. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, and a pair of interconnected bell-crank levers interposed between said piston rods and said connecting rods whereby the relative speeds at which said piston rods move in directions opposite to each other are rendered uniform.

5. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, levers interposed between said piston rods and said connecting rods whereby the relative speeds at which said piston rods move in directions opposite to each other are rendered uniform, and an arm for movably connecting said levers together.

6. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, a lever connected to each connecting rod and movable about a fixed point, and a lever connected to each piston rod, said last named levers being connected to said first named levers and being adjustable relatively thereto.

7. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, a lever for each connecting rod, said levers being movable about fixed points and each thereof having an arm connected to one of the connecting rods, and a lever for each piston rod, said last named levers being movable about adjustable fulcrums and each thereof having an arm connected to one of the piston rods.

8. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, a bell-crank lever for each connecting rod, said levers being movable about fixed points and each thereof having an arm connected to one of the connecting rods, and a bell-crank lever for each piston rod, said last named levers being movable about adjustable fulcrums and being connected to said first named levers and to said piston rods.

9. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, a bell-crank lever for each connecting rod, said levers being each movable about a fixed fulcrum and having one arm connected to one of the connecting rods, a bell-crank lever for each piston rod, each of said second named levers having one arm adjustable in

the arc of a circle in an arm of one of the first named levers, and another arm connected to one of the piston rods, and means for connecting said first named levers and said second named levers together.

10. An internal combustion engine, embodying therein a plurality of cylinders, a piston operable in each cylinder, piston rods connected to said pistons, cranks set 180° apart, connecting rods for said cranks, a bell-crank lever for each connecting rod, said levers being each movable about a fixed fulcrum and having one arm connected to one of the connecting rods, a bell-crank lever for each piston rod, each of said second named levers having one arm adjustable in the arc of a circle in an arm of one of the first named levers, and another arm connected to one of the piston rods, and an arm connecting said first and second named levers in pairs, said arm having one end bearing in one arm of one of the first named levers and its other end being adjustable and serving as a fulcrum for one of the second named levers.

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

GIACOMO RIETTI.

JOHANNES AUMUND,
AUGUST RUEGG.