No. 719,855. PATENTED FEB. 3, 1903.

A. F. PARKS.

STROKE VARYING MECHANISM FOR EXPLOSIVE ENGINES.

APPLICATION FILED JAN. 23, 1902.

NO MODEL.

Fig. 1.

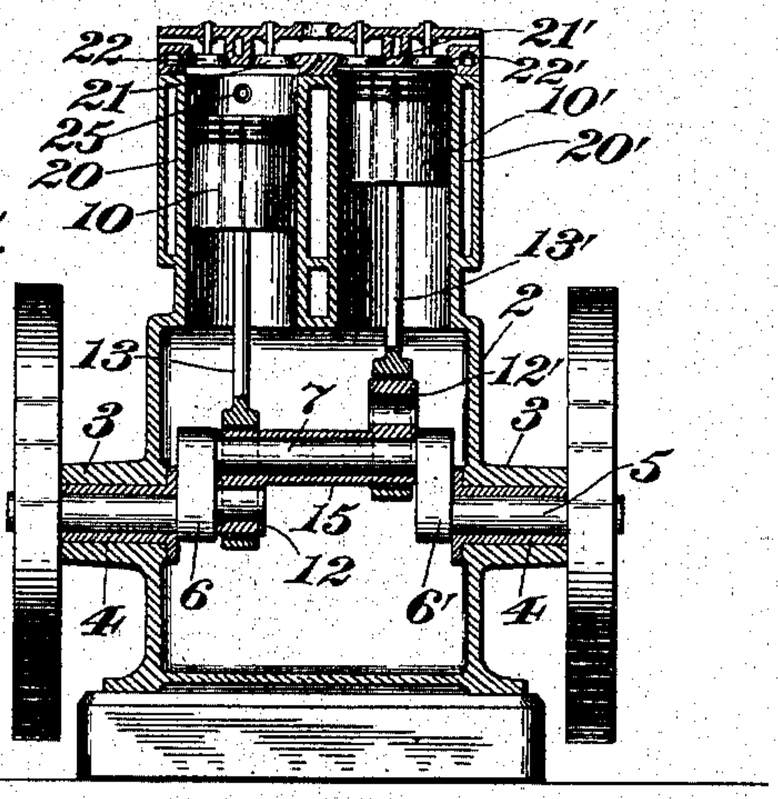


Fig. 2.

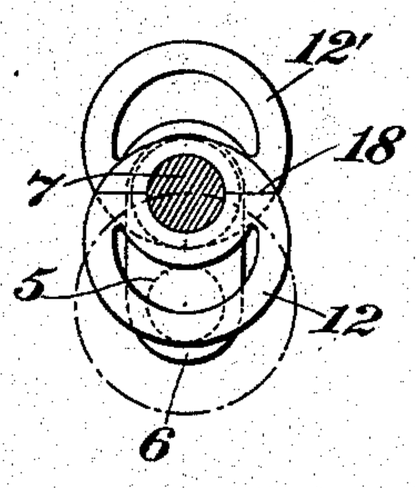


Fig. 3.

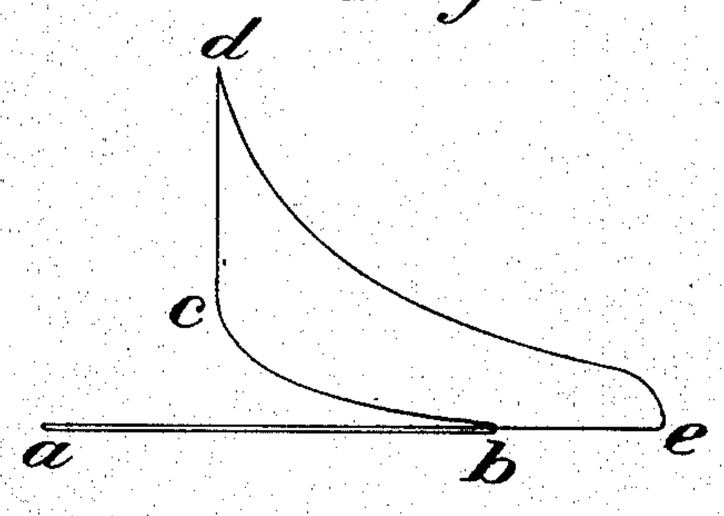
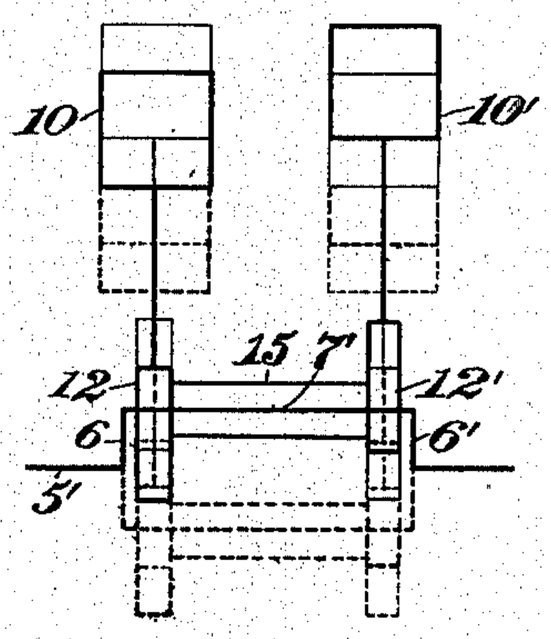


Fig. 4.



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STROKE-VARYING MECHANISM FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 719,855, dated February 3, 1903.

Application filed January 23, 1902. Serial No. 90,913. (No model.)

To all whom it may concern:

Be it known that I, ALBERT F. PARKS, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Stroke-Varying Mechanism for Explosive-Engines, of which the following is a specification.

In the drawings accompanying this specification and forming part of this application, Figure 1 is a central vertical section of a duplex explosive-engine of the vertical type embodying my present invention. Fig. 2 is an enlarged detail illustrating the mode of mounting the eccentrics on the crank-shaft. Fig. 3 is an ideal indicator-diagram, illustrating the cycle of such explosive-engine. Fig. 4 is a diagrammatic view showing the four principal positions of the pistons and the mechanism controlling the movements thereof.

Similar characters designate like parts in all the figures of the drawings.

My invention is illustrated in the drawings as embodied in a duplex explosive-engine of the vertical type, the main casting of which is designated by 2 and has the usual bearings 3, suitably bushed, as shown at 4, for the reception of an engine-shaft or crank-shaft 5, which in this case has a double crank, somewhat wide and made up in the usual way of a pair of crank-arms 6 and 6′, connected by a long crank-pin 7. This crank-pin constitutes an orbitally-movable carrier, the orbital axis of which is shown in Fig. 4 by the line 5′, and the center of connection of the same with the cranks 6 and 6′ is designated by the line 7′. For the purpose of regulating the movements of the piston or other member I make use of a member having a working surface surrounding and disposed at different distances from such center of connection 7′ and shift the position of said working surface relatively to the orbital axis, a suitable element coacting with this working surface being interposed between the same and such piston. This member will usually be so mounted as to turn about a rotary axis (indicated here by the line 7′) and in this case has a circular working surface eccentric to such rotary axis. It will be evident, therefore, that this member or eccentric will be orbitally movable with the crank-pin and will also be capable of turning about the axis of such crank-pin for the purpose of varying the position of the periphery of the eccentric relative to its axis of rotation, and thus lengthening or shortening the stroke of the piston or other member governed by it. When a piston, such as 10, is mechanically connected with such an eccentric, as 12, in the ordinary manner—that is, by means of a strap-rod 13—it will be evident that the connections to the piston from the crank-shaft will cause the piston to travel in a manner determined solely by the movements of the mechanically-connected parts and that the piston will have a positive cycle of mechanical movements invariable by any forces other than those due to the movements of elements coacting in a purely mechanical manner.

The devices just described are sufficient for the purpose of varying the stroke of a single piston of an explosive-engine, but for the purpose of operating pistons of a duplex engine differentially; but in similar cycles provision must be made for balancing the movements of the pistons and also for effecting the shifting of the working surface of each orbitally-movable controller or eccentric in a simple and effective manner and so that the parts will coöperate to form an easy-running engine. In order to enable the pistons or other members to operate differentially, so that, for instance, one will have its compression-stroke while the other is expelling burned gases or so that one will have its induction-stroke while the other is expanding a charge, a pair of orbitally-movable members or eccentrics having differential working surfaces each surrounding and disposed at different distances from a center of connection or rotary axis located at one side of the orbital axis should be employed, and in this construction the differential working surfaces have a fixed relation to each other, two eccentrics being shown in the drawings located in different angular positions and so connected as to move in unison. These two eccentrics are designated herein by 12 and 12′, respectively, and are either fixed on or formed integral with a sleeve 15, which may be of sufficient length to fill the space between the crank-arms 6 and 6′, this sleeve being properly journaled on the crank-pin. In this case said eccentrics are disposed

oppositely with respect to the axis of the crank-pin—that is to say, they are one hundred and eighty degrees apart—and hence the movements in the cycle of one piston will have a lead of one hundred and eighty degrees over the corresponding movements in the cycle of the other piston. The sleeve and the eccentrics thereon may be formed in two main parts, as indicated in Fig. 2, they being divided in this case in a plane intersecting the axis of the crank-pin and perpendicular to the line of throw of the crank, as shown at 18. One of the elements or strap-rods connecting an eccentric with a piston has been hereinbefore referred to. The other is similar thereto and connects the eccentric 12′ with the piston 10′ and is designated by 13′.

All of the parts hereinbefore described may be embodied in an explosive-engine of any suitable type, that shown herein being of the duplex type, having at the upper end thereof parallel twin cylinders 20 and 20′, preferably of the same size and located in like positions. Fuel charges may be supplied to the compression-spaces behind the pistons in these cylinders in any suitable manner—as, for example, through inlet-ports controlled by admission-valves 21 and 21′—and the burned products of combustion may be swept out through exhaust-openings controlled by exhaust-valves, such as 22 and 22′. These valves may be operated by means of any well-known valve-gear, (not shown,) it being apparent that each exhaust-valve may remain open until the piston corresponding thereto is almost in contact with the face of such valve. Igniting devices, such as 25, of any suitable construction may be employed, and these may be operated in any well-known manner to ignite and explode each charge.

In Fig. 4 I have illustrated diagrammatically the positions which the various operating parts assume at four principal points in a complete cycle of operations, the heavy lines indicating the positions of the parts when the piston 10 has reached the end of its compression-stroke and the piston 10′ the end of its expulsion-stroke. The light full lines indicate the corresponding positions when the piston 10′ reaches the end of its compression-stroke and the piston 10 the end of its expulsion-stroke, the difference in the lengths of the compression and expulsion strokes being clearly indicated by the positions of these parts. The heavy dotted lines indicate the positions of the parts at the end of the instroke corresponding to the heavy lines in this view, while the light dotted lines show the positions at the end of the instroke which correspond to the positions shown by light full lines. From this view it will be apparent that each piston in turn accomplishes a cycle of operations consisting of four strokes of unequal lengths, two of these strokes being of the same length, but occupying different portions of the cycle, while the other two are respectively shorter and longer than said first two movements. The two strokes of substantially equal lengths are the induction and expansion strokes, while the compression-stroke is somewhat shorter and the expulsion-stroke considerably longer than either the induction or the compression stroke.

The cycle of the engine is shown graphically in Fig. 3, from which diagram it will be seen that the piston draws in its charge at or slightly below atmospheric pressure and on the outstroke moves in compressing the charge to a point considerably in the rear of the extreme limit of its outstroke, whereupon the charge is ignited and exploded, and during the returning instroke the gases are expanded substantially in the usual manner, except that the extreme limit of the expansion-stroke is considerably beyond the corresponding point of the induction-stroke. After expansion is complete the burned products of combustion are expelled substantially at atmospheric pressure by a piston-stroke $e\ a$ equal to either the induction-stroke $a\ b$ or the expansion-stroke $d\ e$ plus the distance $b\ e$, which represents the amount of displacement of the extreme points of the expansion-stroke as compared with those of the induction-stroke.

What I claim is—

1. The combination with a pair of connected cranks, of a pair of connected differential eccentrics loosely mounted on said cranks, and a pair of elements coacting respectively with said eccentrics and controlled thereby.

2. The combination with a pair of connected cranks, of a pair of connected eccentrics loosely mounted on said cranks in different angular positions, and a pair of elements coacting respectively with said eccentrics and controlled thereby.

3. The combination with a crank-shaft having a double crank, of a sleeve mounted to turn on said crank and having a pair of eccentrics fixed thereto in different angular positions, and a pair of elements coacting respectively with said eccentrics and controlled thereby.

4. In an explosive-engine, the combination with a pair of cylinders, and with a pair of variable-stroke pistons movable therein, of a pair of connected cranks, a pair of differential connected eccentrics shiftable on said cranks, and connections between said eccentrics and said pistons.

5. In an explosive-engine, the combination with a pair of cylinders, and with a pair of variable-stroke pistons movable therein, of a crank-shaft having a double crank, a pair of connected differential eccentrics shiftable on said crank, and a pair of strap-rods connecting said respective eccentrics with said pistons.

6. In an explosive-engine, the combination with a pair of cylinders, and with a pair of variable-stroke pistons movable therein, of a crank-shaft having a double crank, a sleeve mounted to turn on said crank and having a

pair of eccentrics fixed thereto in different angular positions, and a pair of strap-rods connecting said respective eccentrics with said pistons.

7. In an explosive-engine, the combination with a pair of cylinders, and with a pair of variable-stroke pistons movable therein, of an orbitally-movable shaft, and a pair of connected differential crank-motions located at different points in the length of said shaft and connected thereto and also connected with said pistons.

Signed at New York, in the county of New York and State of New York, this 22d day of January, A. D. 1902.

ALBERT F. PARKS.

Witnesses:
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