F. N. LIVINGSTON.

CRANK MOVEMENT.

APPLICATION FILED OCT. 7, 1908.

1,128,885. Patented Feb. 16, 1915.

Fig. 1.

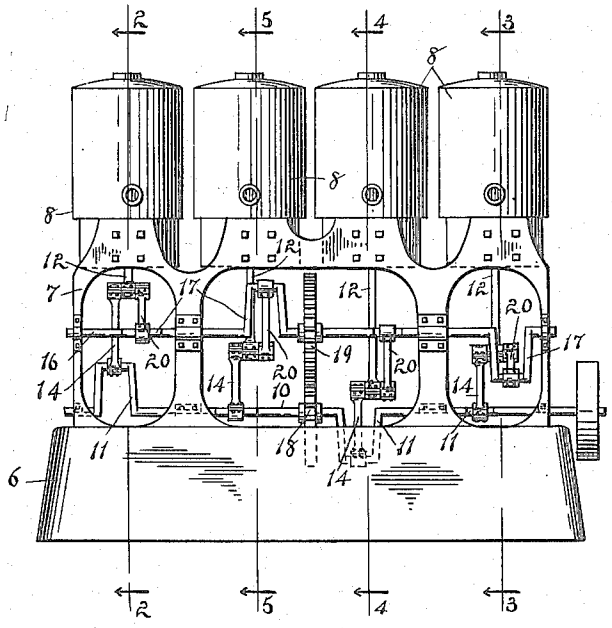


Fig. 2.

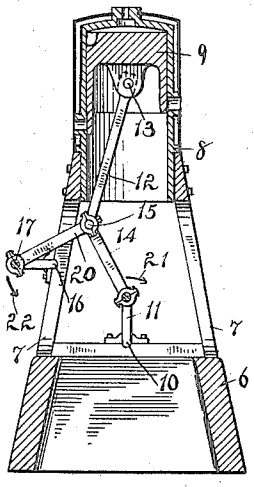


Fig. 5.

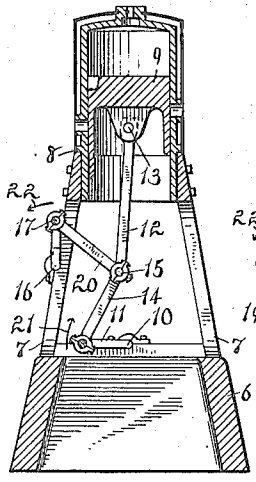


Fig. 4.

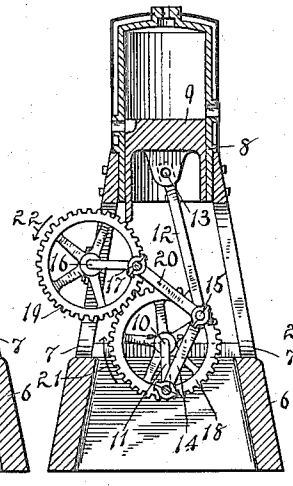
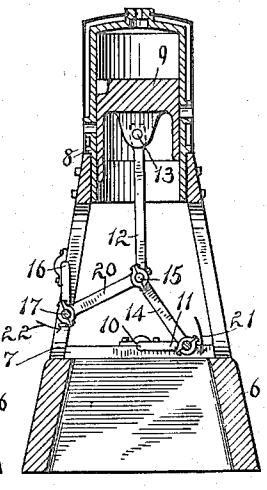


Fig. 3.



WITNESSES:

Matthew J. Marty

C. F. Bassett

INVENTOR

Fred N. Livingston

BY Frederick Benjamin

ATTY.

UNITED STATES PATENT OFFICE.

FRED N. LIVINGSTON, OF SEATTLE, WASHINGTON.

CRANK-MOVEMENT.

1,128,885. Specification of Letters Patent. Patented Feb. 16, 1915.

Application filed October 7, 1908. Serial No. 456,552.

To all whom it may concern:

Be it known that I, FRED N. LIVINGSTON, citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Crank-Movements, of which the following is a specification.

My invention relates to crank movements and is especially applicable to reciprocating engines of the four cylinder type.

The chief objects of the improvements which form the subject matter of this application are:—to provide a mechanical movement for transmitting the reciprocating motion of the pistons to the engine shaft in such a manner as to largely increase the efficiency of the engine to which it is applied; to furnish a device for the purpose stated that will be simple in construction and positive in its action and to produce a mechanism that will eliminate the defects of the ordinary connection between the pistons and shaft giving a practically uniform action upon the engine shaft, whatever the relative positions of the cranks.

I accomplish the desired results by means of the mechanism illustrated in the accompanying drawing, which forms a part of this application and in which the details of construction are set forth in the following views:—

Figure 1 is a side elevation of a four cylinder engine of the explosive type equipped with my improved crank movement; Figs. 2, 3, 4 and 5, are sectional views taken on the lines 2—2, 3—3, 4—4, and 5—5, respectively, of Fig. 1.

Referring to the details of the drawing, the numeral 6 indicates a base, and 7 the frame of an ordinary engine, upon which are mounted four cylinders 8. Each cylinder is furnished with the usual piston 9, and has suitable inlet and outlet ports which are not specifically described since the cylinder construction forms no part of this invention. The usual engine shaft 10, provided with cranks 11, is journaled upon the frame in the ordinary manner. Each piston it attached to its corresponding crank by means of a piston rod 12, pivoted to the piston at 13, and having a connecting rod 14 interposed between its end and said crank, thus forming a joint at 15. Arranged parallel with the engine shaft is a second or countershaft 16 also provided with cranks 17 each corresponding with one of the cranks 11. The said shafts 10 and 16 are connected by means of spur gears 18, 19, so that any impulse given to either shaft will be uniformly transmitted to the coöperating shaft. Each crank 17 is connected with the joint 15 of its corresponding piston rod by a link 20. It will be seen that this arrangement may be readily applied to all varieties of engines, giving a movement that is positive, the action of all the pistons being equalized so that the slight inequalities incident to this class of movement will be mutually balanced as will be more particularly set forth hereinafter.

The operation of the mechanism thus described is as follows:—Fig. 2 represents the position of the crank and connecting rods at the beginning of the power stroke, Fig. 3, shows the piston in its position when the stroke is half completed, and in Fig. 4 the piston is shown in its lowest position or at the completion of the downward stroke, the crank shaft 16 having completed half a revolution. Fig. 5 shows the position of the piston and attachments when the upward stroke is half completed, the crank 17 being within a quarter turn of the initial position shown in Fig. 2. The arrows 21, 22, indicate the movements of the crank arms, 11 and 17 respectively. Referring to Fig. 2, the crank 11 is in a vertical position above the engine shaft 10, the crank 17 extending horizontally on the side opposite to the position of the piston rod. As the said crank 17 moves in the direction of the arrow 22, the link 20 will carry the piston rod 12 to a vertical position, the connecting rod 14 retaining its relative angle with the piston rod as the crank 11 revolves in the direction of the arrow 21, until the shafts have made a quarter turn, reaching the position seen in Fig. 3. As the parts move onward the action of the link 20 will be to throw the center 15 toward the line connecting the crank 11 with the center 13, thus bringing the piston rod and connecting rod into a right line at a point half way between the positions shown in Figs. 3 and 4, and when the cranks have reached the position seen in Fig. 4, the joint 15 has carried the rods 12 and 14 beyond said right line as shown. As the shafts continue to revolve the cranks 11 and 17 remain at practically the same distance apart during the next quarter turn the force of the upward movement of the rod 12 through the link 20 acting upon the crank 17 at an ad-

vantageous angle and as the movement is positively transmitted through the gears 18, 19, the effect will be practically the same as if the force were applied directly to the engine shaft.

In Fig. 5 it will be seen that the connecting rod 14 and link 20 are in such a relation to their centers that the power will be advantageously applied thereto, carrying the parts to their initial position shown in Fig. 2. It will thus always be possible for the piston to exert leverage on the main shaft. By inspection of Fig. 4 it will be seen that the connecting rod 14 and piston rod 12 exert a pull upon the link 20 as the piston nears the end of its downward movement, turning the crank 17 in the direction of the arrow, while the same rods 12 and 14 in the position assumed in Fig. 3 are retarding the crank 17 but these two forces balance so that there is no appreciable effect upon the crank 11. The same balance is maintained between the actions developed in Figs. 2 and 3, and likewise in the relative positions illustrated in Figs. 4 and 5. As a result of this arrangement an approximately full crank-length leverage will be maintained during the entire stroke of the piston, experiments which I have made showing a large percentage of gain in power.

Having thus described my invention what I claim as new is:—

1. In a crank movement, a plurality of shafts, meshing gears on the shafts, a crank for each shaft, a pitman, a link pivoted directly to each crank and to the end of the pitman, one of the links being approximately perpendicular with reference to the other link during the complete rotation of the shafts.

2. In a crank movement, a plurality of shafts, meshing gear wheels on the shafts, a crank for each shaft, a pitman, a link pivoted directly to each crank and to the end of the pitman, one of the links being approximately perpendicular with reference to the other link during the complete rotation of the shafts, the cranks being at an angle with each other.

3. In a device of the class described, a plurality of shafts, meshing gear wheels on the shafts, a crank for each shaft, a pitman, a link pivoted directly to each crank and to the end of the pitman, one of the links being approximately perpendicular with reference to the other link during the complete rotation of the shafts, the cranks being at an angle with each other, a moving element pivoted to the end of the pitman, one of the shafts being substantially in a line with the path of said element and the other being remote from said path, the distance between the shafts and pivotal connection last mentioned being unequal.

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

FRED N. LIVINGSTON.

Witnesses:
ANNA M. LIVINGSTON,
LUCY LIVINGSTON.