R. D. MILNE.

COMPENSATING CRANK.

No. 187,402. Patented Feb. 13, 1877.

Fig. 1

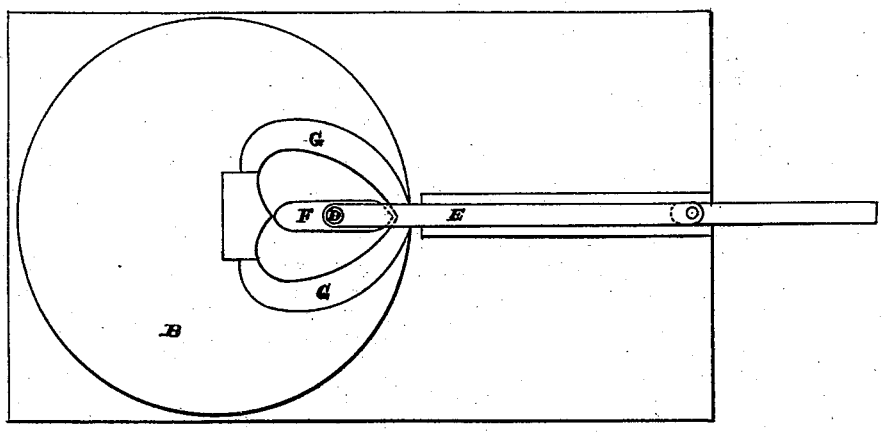


Fig. 2.

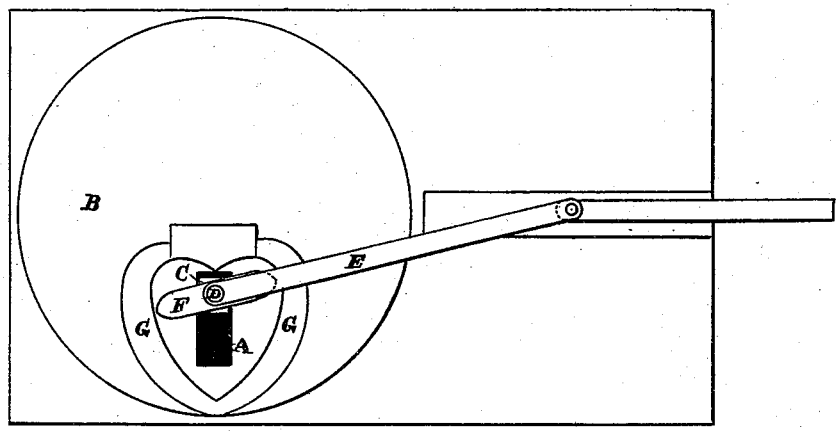
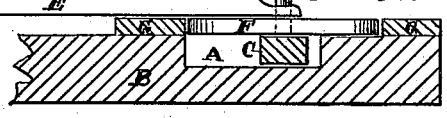


Fig. 3.



Witnesses

Geo. H. Strong.

Jno. L. Boone

Inventor

Robert Duncan Milne

by Dewey & Co.

Attys.

UNITED STATES PATENT OFFICE.

ROBERT D. MILNE, OF SANTA BARBARA, CALIFORNIA, ASSIGNOR OF PART OF HIS RIGHT TO EDWARD GRAHAM, W. W. HOLISTER, J. V. HART, H. S. GREELEY, W. S. CHAMBERLAIN, E. B. HALL, D. P. HATCH, J. B. REDFIELD, AND H. McLELLAN.

IMPROVEMENT IN COMPENSATING-CRANKS.

Specification forming part of Letters Patent No. **187,402**, dated February 13, 1877; application filed January 15, 1877.

To all whom it may concern:

Be it known that I, ROBERT DUNCAN MILNE, of Santa Barbara, county of Santa Barbara, and State of California, have invented a Compensating-Crank; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings.

The object of my invention is to provide a novel method for the conversion of reciprocating rectilinear motion into rotary motion by a mechanism by means of which the inequality of crank-power is equalized and balanced, in such a manner that the direct pressure of a piston or other motor is transferred to the crank with greater uniformity of action than in the case of an ordinary crank.

The mathematical principle of the invention consists in producing a series of changes in the line of direct propulsion as it affects the crank, so that the point of impact of force approaches or recedes from the center of the crank during its revolution, this point of impact being farthest from the center of the crank at the beginning and end of the stroke, and nearest at the middle of the stroke.

My invention is also designed to utilize the independent motion of the connecting-rod thus acquired by bringing it to bear upon the crank at such angular inclination as to be equivalent to direct propulsion in a line varying from the line of force inversely, as the angle which the connecting-rod makes with the crank varies from a right angle.

In the present case I have adopted one mechanical means for accomplishing the result, which will be more fully described in the accompanying drawings, in which—

Figure 1 is a side elevation, showing the crank at right angles. Fig. 2 is a view showing the crank just passing the center.

A slot, A, is cut in the body of the crank B, extending from its end to a point nearly equidistant from its end and center. Into this slot is fitted a square piece, C, called the compensator, so that it can slide from end to end of the slot. A pin, D, projects from the compensator, and forms and supplies the place of the crank-pin to which the connecting-rod E is attached, in the usual manner. Fixed to the end of the connecting-rod, and in line with it, and moving upon it, with the crank-pin, is an oblong piece, F, with curved ends running to a point, and of sufficient thickness to insure power and ease of motion, the length of which is equal to twice the distance the compensator moves in the slot. The piece F is called the regulator. Upon the body of the crank are fixed bearings G G, forming twin parabolic curves of the same thickness as the regulator, and running from a point in the center of the inner end of the slot to another point beyond and in line with the center of the outer end of the slot; these curves describing the figure which the regulator naturally makes upon the face of the crank while the compensator reciprocates once within the slot during a half revolution of the crank. The distance between these points is equal to the length of the piece called the regulator.

The operation of this combination of parts is as follows: The pressure of the connecting-rod E upon the crank-pin D at the beginning of the stroke causes the compensator C, of which the crank-pin forms a part, to move forward in the slot; this forward motion is, however, checked by the pressure of the regulator F, fixed to and moving in line with the connecting-rod upon the curved bearings G, which will only permit the regulator to move upon them at a certain angle; and until this angle is assumed by the connecting-rod, the compensator can slide no further. This condition causes the connecting-rod to expend its power upon the compensator only in proportion to the forward progress of the crank, and this action of the compensator and regulator decreases in proportion as the angle between the connecting-rod and the crank grows nearer a right angle, and ceases altogether toward the middle of the stroke, when the connecting-rod, acting direct upon the crank, and the compensator having moved to the inner end of the slot, there is no longer any necessity for their services. When the

middle of the stroke is past and the crank is moving toward the opposite center of its orbit, the angular inclination of the connecting-rod to the slot and the compensator is such that the compensator is again pushed toward the outer end of the slot. Meanwhile the regulator assumes the function of compensator, and the angle at which it presses on the curved bearings G is such as to be equivalent to direct propulsion in the direction in which the crank is moving, while the motion of the compensator forward in the slot permits this independent action of the regulator to take effect until the end of the stroke is reached. Thus the functions of the compensator and regulator are interchangeable, the former doing the work at the beginning, and the latter at the end of the stroke.

The novel points of my invention are the application of the mathematical principle defined above to the matter of crank motion, and also the mechanical means which I employ to accomplish that end, as described specificially above, separately and in combination.

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

1. The method of equalizing and balancing the varying pressure exerted by a piston or other motor upon a crank during its revolution, consisting in producing a series of changes in the line of direct propulsion by means of the compensator C, moving in the radial slot A, or equivalent device, so that the point of impact of force recedes from or approaches the center of the crank during its revolution, substantially as herein described.

2. The method for utilizing the independent motion of a connecting-rod between a crank and its reciprocating motor, consisting in bringing it to bear upon the crank at such an angular inclination as to be equivalent to direct propulsion in a line varying from the line of force inversely as the angle of the connecting-rod and crank varies from a right angle, by means of the curves G, acting upon the regulator F, or an equivalent device, substantially as herein described.

In witness whereof I have hereunto set my hand.

ROBERT DUNCAN MILNE.

Witnesses:
OLWYN T. STACY,
FRANK A. BROOKS.