(No Model.)

G. C. PHILLIPS.

GOVERNOR FOR PUMPING ENGINES.

No. 257,975. Patented May 16, 1882.

Fig. 1.

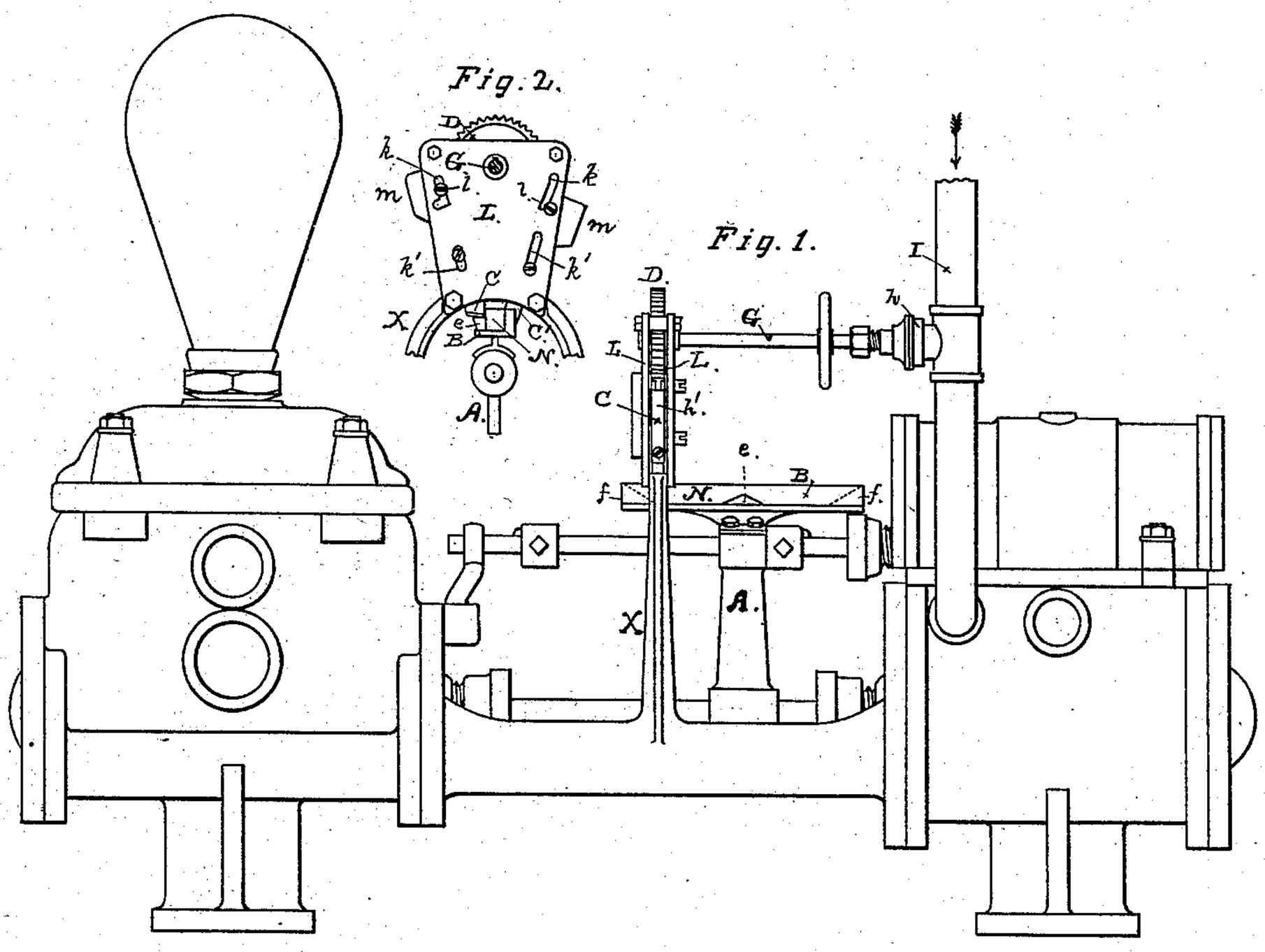


Fig. 2.

Fig. 3.

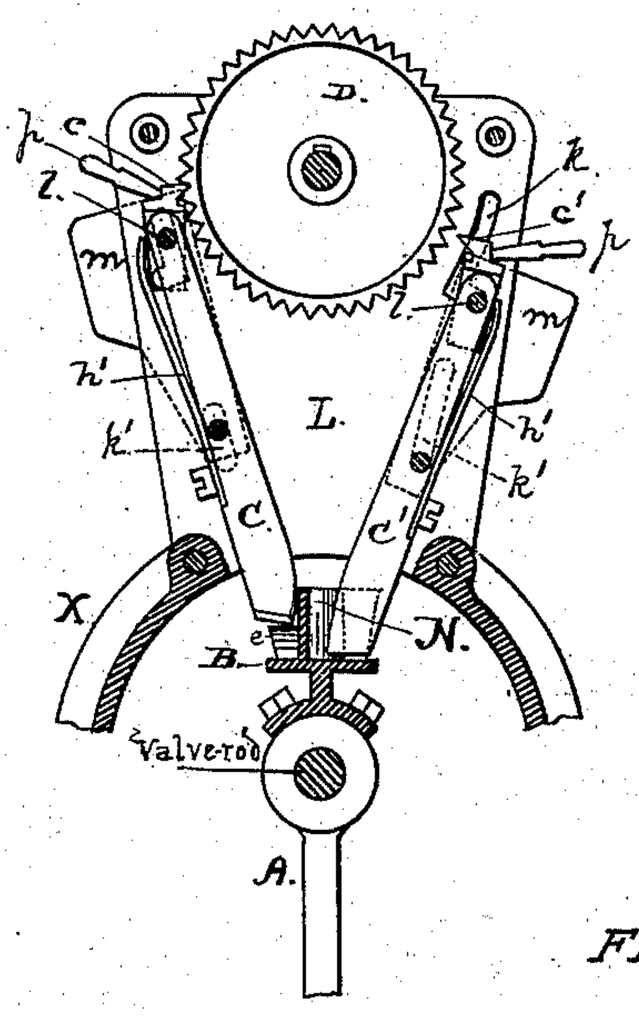


Fig. 4.

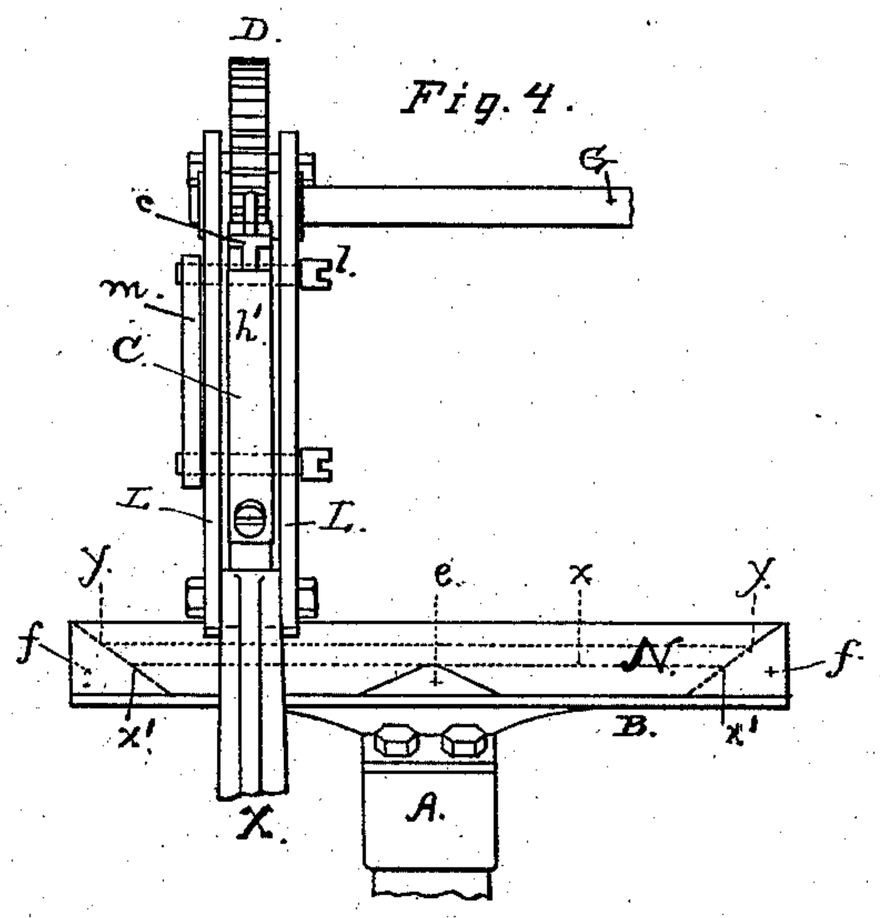
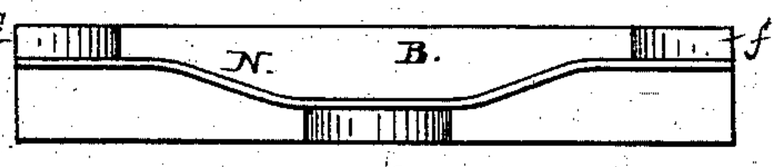


Fig. 5.



Witnesses:
Wm Voit
D. Dillecker

Inventor:
Geo. C. Phillips
By his Atty., Edwd. L. Osborn

UNITED STATES PATENT OFFICE.

GEORGE C. PHILLIPS, OF SILVER CITY, NEVADA.

GOVERNOR FOR PUMPING-ENGINES.

SPECIFICATION forming part of Letters Patent No. 257,975, dated May 16, 1882.

Application filed January 27, 1882. (No model.)

To all whom it may concern:

Be it known that I, GEORGE COWAN PHILLIPS, of Silver City, in the county of Lyon and State of Nevada, have invented a new and useful Improvement in Governors for Pumping-Engines; and I do hereby declare that the following is a full, clear, and exact description of my said invention, reference being had to the accompanying drawings.

My invention relates to a device for regulating the admission of steam to engines according to the length of strokes made by the piston, it being designed more particularly for application to direct-acting pumping-engines of the kind having no fly-wheel or gearing.

The object of the improvement, as will be more particularly set forth hereinafter, is to produce uniformity of stroke and regularity of motion in the engine by mechanical means controlled by and operated from the piston, so that the engine shall be self-regulating.

My improvement consists in operating a governor-valve, or a valve controlling the steam-supply, from the movements of the piston in such manner that any change in the length of the stroke shall affect the size of the steam-inlet and increase or diminish the supply of steam as often as the stroke falls short of or exceeds a given length, the same being produced in degree corresponding to the change in the stroke.

In the accompanying drawings, to which reference is made in the following description by figure and letter, Figure 1 is an elevation of an engine, showing a side view of my device. Fig. 2 is a back view of the device, showing the plate which furnishes guides for the pawl-levers. Fig. 3 is a front view of the device. Fig. 4 is a side view, showing the various strokes. Fig. 5 is a plan view of the tappet-plate.

A may represent a cross-head or any part fixed to or moved regularly by the piston of a direct-acting engine.

B is a bar or plate secured to this moving part, and adapted to have a reciprocating motion about equal in length to the stroke of the engine. This bar or plate is arranged to act upon two pawls, *c c'*, placed upon opposite sides of a ratchet-wheel, D, and engaging with the teeth in its rim to produce by their alternate movements a rotation of the wheel first in one direction, or forward, and then in the opposite direction, or backward, at each stroke of the piston, for which purpose the plate B is provided with fixed inclines *e f f* on its upper face in position to strike and act against the lower ends of pawl-carrying bars C C′ as the plate B is carried back and forth. These bars C C′ are held in guides, and are caused to drop back after such perpendicular movement of their own gravity. They carry the pawls *c c*, and by acting alternately they rotate the wheel D forward and backward as long as the pawls *c* are in position to engage with the ratchet-teeth of the wheel. To produce this alternate movement and action of the pawls *c c'*, the center tappet, *e*, or the one on the right-hand side of the bar, Fig. 2, is composed of a double incline placed in line with the lower end of the bar C, in position to strike and lift the bar as the plate B moves back and forth. It thus raises the pawl *c* and turns the wheel D once during each stroke of the piston. The other tappets, *f f*, are single inclines placed on the plate B in line with each other and in position to come in contact with and lift the bar C′ on the opposite side of the wheel. They are placed near the end of the plate B, so that one is carried under and caused to lift the bar C′ at the termination of each stroke. The distance between these inclines from the highest point of one to the highest point of the other in a straight line is made about equal to the greatest length of stroke that can be made by the piston, so that these tappets cannot pass beyond the ends of the bars C C′ in the longest movements of the plate B, but shall act to lift it as the piston approaches the termination of its stroke and allow it to drop and draw away the pawl *c'* as the piston returns or changes its direction of motion. The tappets *f f* and bar C′, as thus arranged and combined with the pawl *c'* at one side of the wheel D, give rotation in one direction, while the tappet *e*, its bar C, and the pawl *c* carried by it act against the opposite side of the wheel to move it in the contrary direction. This wheel D is connected with a throttle-valve, or a valve governing the admission of steam to the engine, in such manner that its rotation in one direction shall reduce the size of the steam-inlet and in the other direction

shall increase it, and thus, according to the direction of rotation of this wheel, the supply of steam shall be increased or diminished.

In the application of my improvement shown in Fig. 1 of the drawings the ratchet-wheel D is keyed to a shaft, G, which is in turn connected with the throttle-valve *h* in the steam-pipe I. By this construction the movement of the plate B in one direction will at some point in the length of its stroke turn the wheel D in one direction, or forward, and at some point at the termination of the stroke turn the wheel back again. Now, if these motions of the wheel are of equal length, it will be seen that the supply of steam will not be changed, for the size of the inlet at the throttle-valve will not be affected, and the quantity of steam supplied will be the same at each stroke; but by giving the wheel an increase of movement in one direction over its other movement the steam-inlet will be changed in size and the supply will be regulated accordingly. This result is effected by regulating the size and position of the inclines *e f f*, that work the pawls *c c'*, in such manner that as the length of stroke in the piston increases beyond a given point the backward rotation of the wheel D at each stroke shall exceed its forward rotation, and the valve will turn or close to reduce the steam-inlet; but as often as the piston fails to reach this length of stroke the operation of the wheel D will be reversed, and its forward movement will increase over its backward rotation. For this purpose the center incline, *e*, is made of a height to raise the bar C each time a distance or amount sufficient to engage the pawl *c* with the wheel D one tooth at a time, and at each perpendicular lift of the bar C to rotate the wheel D a given amount in a forward direction. This movement is regularly produced at each stroke of the piston, and it acts to increase the size of the steam-inlet a fixed amount at each rotation. The reverse of this is produced by the movement of the wheel D in a backward direction, and this is effected by the inclines *f f*, that at the end of each stroke act upon the bar C'. These are placed at such distance apart in the plate B and are of such length and degree of inclination that while the stroke of the piston remains of the normal or required length they shall pass beneath the end of the bar C at the end of each stroke a sufficient distance to move the wheel D around the distance or space of one tooth, or an amount equal to that produced by the opposite incline, *e*, and thus offset the action of that incline and keep the steam-supply uniform; but as the length of stroke in the piston increases, the additional movement of the plate B will carry the inclines *f f* at each stroke farther under the bar C', and thus give increased perpendicular movement to it and increase the rotary movement of the wheel D. At such time, therefore, the backward movement of the wheel at the end of the stroke will exceed its forward movement and the valve will act to decrease the steam-supply, and this will continue until the stroke is reduced by the diminution of the steam-pressure, and the length of stroke of the plate B no longer brings a higher portion of the incline *f* beneath and against the end of the bar C'. In like manner, when the stroke falls off, the inclines *f f* will not be carried far enough under the end of the bar C' to operate it, and the incline *e* will produce at each movement of the plate B a regular increase in the size of the steam-inlet, for at such time there will be a forward rotation only and no reverse movement of the wheel D, and the pressure will increase until the stroke becomes long enough to bring the inclines *f f* into action again beneath the bar C'. These tappets *f f*, by their length and degree of inclination, govern the amount of such perpendicular movement given to the bar C', and can be made to offset the reverse rotary movement of the wheel in greater or less proportion as the length of stroke changes. To illustrate this, the line *x*, Fig. 4, may represent the normal length of stroke, and the points *x' x'* may mark the part in the face of the incline where the end of the bar C' will strike at the end of each stroke. At such point the length of the incline will be sufficient to make the wheel turn backward a distance equal to the forward motion produced by the incline *e*. Now, if at any time the length of the stroke increases, as at *y y*, the inclines will be carried farther under the end of the bar, and the points *y y* will then act against the bar C' and give increased perpendicular movement, and of course increase the motion of the wheel in proportion. These inclines could be made movable and adjustable upon the reciprocating plate in order to allow the action of the bars C' to be increased or diminished in any given length of stroke; but in the construction here shown these inclines are fixed to the plate at the required distance apart for acting upon the bars C' in a fixed proportion as the length of stroke varies.

In the arrangement of the wheel D and its pawls it will be noticed that as the pawls act in opposite directions, each one must be thrown into and then out of action before the other one can act. For this purpose I fix the bars C C' in slotted bearings *k k'* between the face-plates L L. These slots *k* have an outwardly-inclined position to carry the upper end of the bars C away from the wheel as they drop down in the slots, and the upper ones of these bearing-slots are somewhat curved, and then enlarged at the bottom, to allow sufficient lateral movement of the bar at the top to bring the pawl out of contact with the ratchet-teeth when the bar drops down. To make this disengagement take place with certainty and without using springs, I employ the counter-weights *m m*, which increase the gravity at the upper end of the bars and cause them to drop outwardly as soon as the bolts or pins *l* reach the bottom of the slot *k'*. Before the perpendicular movement of the bar is to be

given the upper end is thrown forward against the wheel D, and the pin *l* is moved out of the recess in the bottom of the slots *k* by the action of the cam-plate N, which is secured on and carried by the plate B. This device is a curved plate or rod, N, fixed on the top of the reciprocating plate B, and having such curvature that it presses against and throws out the lower end of each bar a short time in advance of the action of the incline or tappet against the end of that bar, thus acting alternately as the plate reciprocates to throw first one pawl and afterward the other one into engagement with the toothed wheel. The pawls are hinged to the end of the carrying-bars C, and are held in working position by the springs *h'*, being thereby kept either from dropping away from or engaging too soon with the ratchet-teeth, as is shown in Figs. 3 and 4.

This device or instrument can be placed in fixed position upon some part of the cross-head guides where the reciprocating plate can be connected with the piston-rod; or an independent connection can be employed, and a separate rod moved from the piston can be arranged to drive the plate B, the object being to move the plate uniformly with the piston and with the same stroke. The pawls *c c* are provided with handles *p p*, so that they can be thrown out of action by hand.

In the application of my invention given in the drawings the governor is supported upon a yoke, X, immediately over the piston-rod and in position to be connected with the throttle-valve of the engine.

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

1. A governor for direct-acting engines, consisting of mechanism or a device having a step-by-step movement connected with the throttle-valve or governor-valve of the engine and operated by or from the movements of the piston by mechanism, substantially as described, for regulating the admission of steam to the engine according to the length of stroke, constructed and operating substantially as described.

2. A governor for direct-acting engines, consisting of the ratchet or tooth wheel D, adapted to be connected with a throttle or governor valve, and to produce by its rotation in one direction an increase of inlet area and in the opposite direction a decrease in the same, and means, substantially as described, connected with or operated by the reciprocations of the engine-piston, for producing alternate rotation back and forth of the said wheel and for changing the relative length or amount of the two movements of the wheel in degree corresponding to the variations in the length of stroke of the piston, substantially as described.

3. The combination, with a throttle or governor valve of an engine, of mechanism connected with and operated by or from the movements of the engine-piston to produce at some time in the stroke of the piston first an increase of the inlet-aperture and then a decrease of the said inlet through the valve, said mechanism, substantially as described, being adapted to increase the closing over the opening movement of the valve as the length of stroke of the engine increases or exceeds a given length, and to act oppositely upon the valve as the stroke falls behind such given length, substantially as described.

4. The combination, with the ratchet-wheel D, adapted to be connected with a governor or controlling valve, of the pawl-carrying bars C C′ and the tappet-plate B, with its inclines *e f f*, connected with or moved by the engine-piston, and having motion uniformly with such piston, substantially as described.

5. The combination, with the ratchet-wheel D, adapted to be connected with a governor or other controlling valve, of the pawl-carrying bars C C′, held in inclined slotted bearings *k*, the counter-weights at the upper ends, and the tappets or inclines *e f f* upon the plate B, which is connected with and to be driven by the engine-piston, substantially as described.

6. The combination, with the ratchet-wheel D, of the pawl-carrying bars C C′ and the reciprocating tappet-plate B, adapted to be connected with and having its motion produced uniformly by and with the engine-piston, as a means for producing rotation alternately in opposite directions of the ratchet-wheel from the stroke of the piston, substantially as described, for the purposes specified.

7. The plate B, having the tappets or inclines *e f f*, and adapted to be connected to or operated from the movements of the engine-piston to travel uniformly therewith, substantially as described.

8. The combination, with the pawl-carrying bars C C′, held in inclined slotted bearings, of the reciprocating plate B, having tappets or inclines *e f f*, and the cam plate or surface for producing from the reciprocations of the plate first a lateral movement of the upper end of the bar and then a perpendicular movement, substantially as herein described.

GEO. C. PHILLIPS. [L. S.]

Witnesses:
JOHN H. GRIER,
GEO. PHILLIPS, Jr.