J. B. CRAWLEY.
Steam-Engine.

No. 205,366. Patented June 25, 1878.

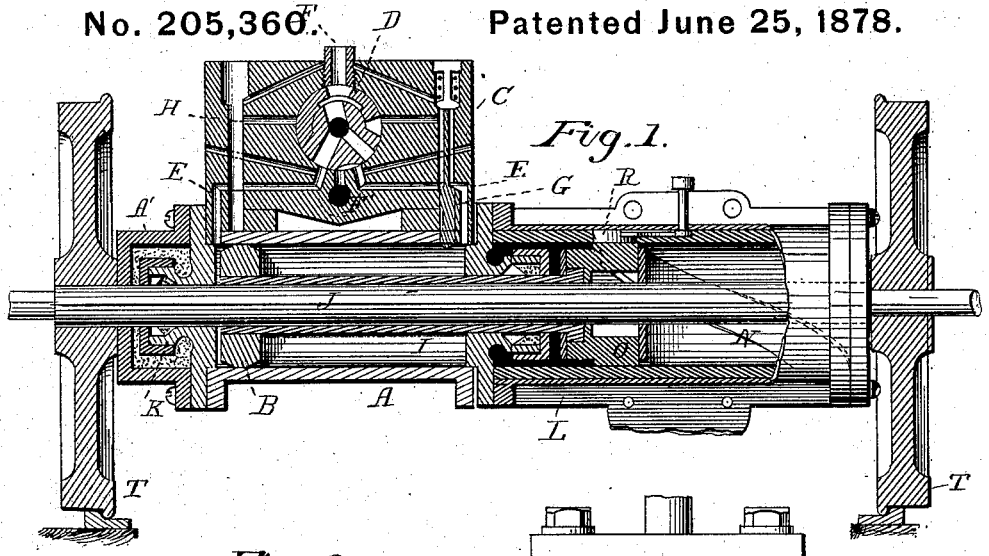


Fig. 1.

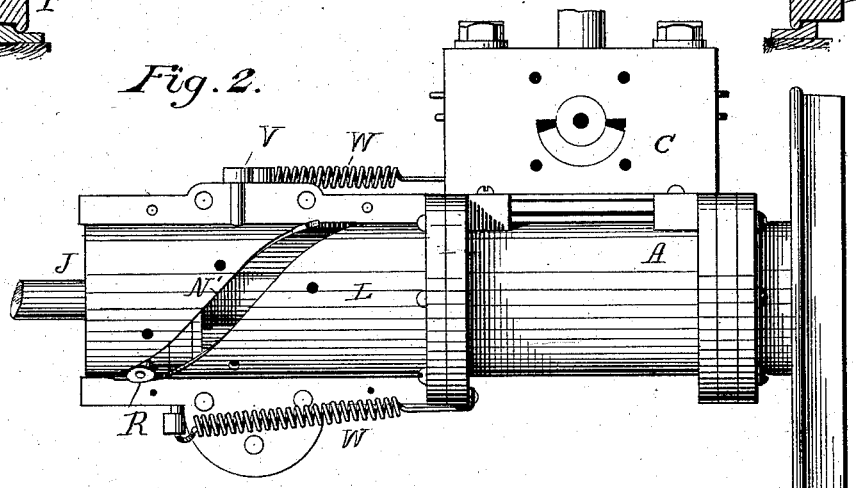


Fig. 2.

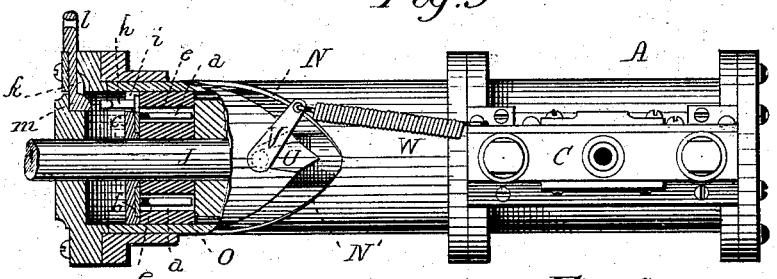


Fig. 3.

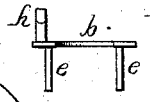


Fig. 5.

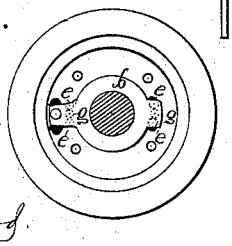


Fig. 4.

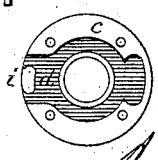


Fig. 6.

Witnesses:
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# UNITED STATES PATENT OFFICE.

JOHN B. CRAWLEY, OF BROOKLYN, NEW YORK.

## IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. **205,360**, dated June 25, 1878; application filed March 16, 1878.

*To all whom it may concern:*

Be it known that I, JOHN B. CRAWLEY, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification:

This invention relates to certain improvements in steam-engines, its object being to convert the reciprocating motion of an ordinary reciprocating steam-engine into a rotary motion without the employment of the ordinary crank and pitman, whereby the engine is rendered more compact and adapted to a variety of purposes for which the ordinary engine is inapplicable, owing to the amount of space required for its successful operation.

My invention consists in an ordinary steam-cylinder, constructed, as usual, with a valve-chest and suitable valves for admitting and exhausting the steam from each end, as usual. The piston-rod of said engine, however, is made hollow, and the shaft or journal to which a rotary motion is to be imparted extends through said piston and through a stuffing-box at the rear head of the cylinder.

The front end of the piston-rod extends into a supplementary cylinder, bolted to or forming part of the steam-cylinder, the shaft or journal extending entirely through the same, and to said front end of the hollow piston-rod is swiveled a rotating block, which is adapted to slide on a feather or in a groove on the shaft or journal. Said block is provided with friction-rollers, which are adapted to move in rifle-grooves formed on the inside of the supplementary cylinder, so constructed as to give a continuous rotary motion in the same direction as the piston-rod is reciprocated to said block, which carries the shaft or journal with it, thus imparting the proper rotary motion to the same.

In the drawings, Figure 1 represents a longitudinal section of my improved engine, which in the present instance is represented as applied to a railroad-car, although it is equally applicable to all other purposes for which a steam-engine may be required. Fig. 2 represents a bottom view, illustrating the outer portion of the supplementary cylinder broken away, so as to show one of the rifled spiral grooves; Fig. 3, a side elevation, representing the outer portion of the supplementary cylinder broken away, so as to show the reversely-set spiral grooves, and illustrating the sliding block and reversing mechanism in section; Fig. 4, a front view of the supplementary cylinder with its head removed, showing the front face of the block working therein; and Fig 5, detached views of portions of the reversing mechanism forming part of said block.

The letter A represents a steam-cylinder, of ordinary construction, and B its piston. C represents the valve-chest, provided in the present instance with an oscillating valve, D, which is operated to throw the ports E E leading to each end of the cylinder alternately into communication with the induction and eduction ports F F′ by means of the puppet-valves G, which are operated alternately by the piston B to admit steam to the passages H H leading to opposite sides of the valve.

The letter I represents the piston-rod, which is in the form of a hollow sleeve, through which passes the journal J, to which the rotary motion is to be imparted. Said journal passes also through a stuffing-box, K, on the rear end of the cylinder, and through a supplementary cylinder, L, hereinafter more fully described, and is journaled at each end in the journal-boxes of the car.

The cylinder L is secured to the front head of the cylinder A, or may be formed as an extension of said cylinder, and is provided on its outside with spiral rifle-grooves N N′, extending in opposite directions from end to end thereof.

The hollow piston-rod, at its extremity, has swiveled to it a block, O, which surrounds the shaft, and is provided with a groove sitting over a feather on the journal, or with a key sitting in a longitudinal groove in said journal, in such manner that while said block is free to move longitudinally on said journal it cannot move in a rotary direction without carrying the journal with it. Said block is provided with a projection or friction-roller, R, which is adapted to travel in the rifle-grooves N N′, taking the groove N on the forward movement of the piston and the groove N′ on the backward movement, which causes the said block to rotate in a continuous direction as the piston is reciprocated, giving a corre-

sponding rotary movement to the journal and to the car-wheels T T mounted thereon. In order to shift the friction-roller from one groove to the other at the end of each stroke to prevent it from returning in the same groove, cams U are provided, which are operated by levers V V on the outside of the cylinder, which are kept in position by springs W W, by means of which the cams may be thrown from one side to the other. Thus as the roller gets to the end of its rifled way and strikes this cam, it moves away and allows the roller to pass the spring, instantly drawing the cam back in its place, forming a surface on one side of the cam to guide the roller until it has passed.

The block is provided with two semicircular recesses, *a a*, and on the outer face of said block is secured a cam, *b*, by means of an annular plate, *c*, provided with a groove, *d*, to receive said cam *b*, and secured by bolts or screws to the face of the block. The rear face of said cam, at points opposite the recesses *a a*, is provided with pins *e e*, which project into said recesses, a loose friction-roller, *g*, being interposed in said recesses between each pair of pins *e e*.

The outer face of said cam is provided with a tappet, *h*, which projects through a slot, *i*, in the plate *c*, the forward end of said tappet being beveled on opposite sides to the extremity, forming a V-shaped point to said tappet, for the purpose hereinafter described.

In the head of the supplementary recess is formed a curved slot, *k*, across the center of which is arranged a slide, *l*, having a V-shaped projection, *m*, extending inwardly at its lower end. Said slide is under the control of the engineer and is employed for reversing the engine. Normally it is held in an elevated position, so that the projection *m* will not interfere with the tappet *h*, allowing the block and friction-roller to travel in a continuous rotary direction. Upon depressing said slide, however, the V-shaped projection *m* will fall in the way of the tappet *h* and hold the block from turning, so that the friction-roller will return in the same groove in which it took its forward movement, and thus reverse the engine. The cam and friction-rollers, having a slight movement in the circular recesses of the block, allow the tappet to oscillate slightly in order to properly clear the slot in the head of the supplementary cylinder. The rear end of the steam-cylinder is provided with a cap, A′, which covers the stuffing-box, and prevents the entrance of dust to the packing, and also forms a bearing against the wheel to keep the engine in place.

The operation of my invention will be readily understood in connection with the above description.

Upon admitting steam to the valve-chest the piston is put in motion, reciprocating the piston-rod back and forth upon the journal. The swiveled block secured to the end of the piston-rod travels back and forth with said rod, the friction-roller taking the proper rifled grooves at each stroke, which causes said block to rotate. As the said block travels on a feather on the journal said journal is rotated with it, making half a rotation on the forward stroke of the piston, and the other half-rotation on the backward stroke.

As thus constructed, a very compact engine is produced, which, on account of the little space it requires, is extremely applicable to propulsion of street-cars and other purposes where there is limited engine room.

What I claim, and desire to secure by Letters Patent, is—

1. A steam-engine having a hollow piston-rod, in combination with a driving-shaft extending through said piston-rod and the steam-cylinder, the piston-rod being provided with a swiveled block adapted to travel longitudinally on said driving-shaft and journal, said block being provided with lugs or projections adapted to travel in reversely-set spiral ways, whereby a rotary motion is imparted to the driving-shaft, substantially as set forth.

2. In combination with the steam-cylinder, its hollow piston-rod, and driving-shaft extending through the same, the swiveled block adapted to travel longitudinally on said shaft, and provided with lugs or friction-rollers, and the supplementary cylinder provided with reversely-set spiral grooves, in which said lugs or projections travel, substantially as set forth.

3. In combination with the rotating block, the cam mounted on a pin on the front face of the same, and the tappet connected with a lever under control of the driver, arranged to operate said cam on the rotating block for the purpose of throwing the projections or rollers into either grooves at will for the purpose of reversing the engine, substantially as set forth.

4. In combination with the rear head of the steam-cylinder, the cap secured to the same, whereby the access of dust to the packing is prevented and a bearing to support the engine is formed, substantially as set forth.

5. In combination with the piston-rod of the engine, the valve-chest, and oscillating valve, the poppet-valves, operated by the piston to admit steam alternately to each side of the valve for the purpose of shifting the same, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of the subscribing witnesses.

JOHN B. CRAWLEY.

Witnesses:
ROBERT PETERSON,
ALEX. CLUBB.