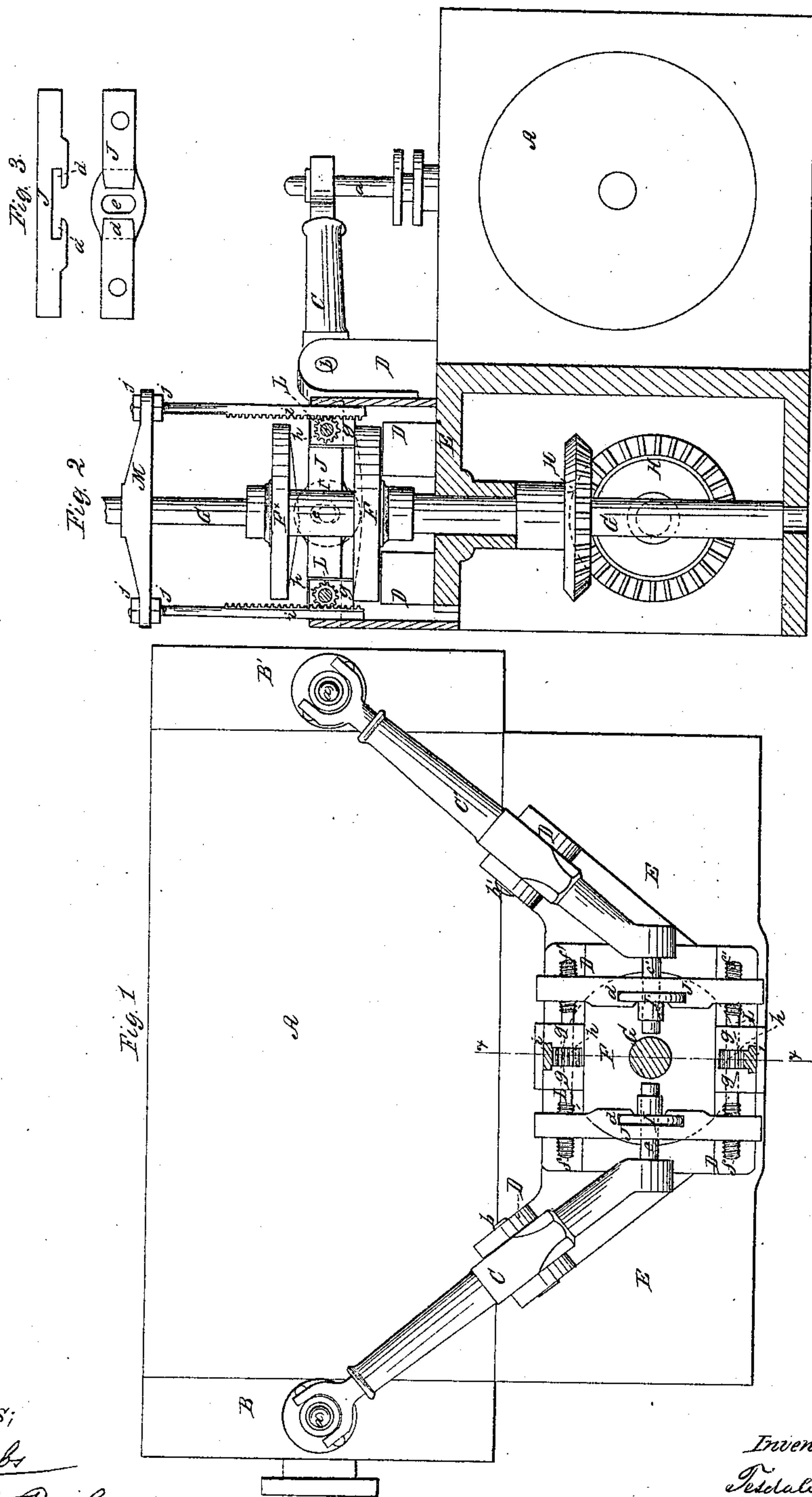


*T. Carpenter,*  
*Steam-Engine Valve-Gear.*  
*No 40,905.      Patented Dec. 15, 1863.*



*Witnesses;*  
*J. W. Coombs*  
*Thos. H. Douglas*

*Inventor;*  
*T. Carpenter*  
*per Wm. H. Allen.*



# UNITED STATES PATENT OFFICE.

TISDALE CARPENTER, OF PROVIDENCE, RHODE ISLAND.

## IMPROVEMENT IN VALVE-GEAR FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. 40,505, dated December 15, 1863.

*To all whom it may concern:*

Be it known that I, TISDALE CARPENTER, of the city of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in the Valve Gear of Steam or other Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan of the cylinder and valve-gear of an engine, showing the valve-gear partly in section. Fig. 2 is a transverse vertical section of the same in the line *x x* of Fig. 1. Fig. 3 is a top view of a portion of the valve-gear. Fig. 4 is a side view of the same.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates more especially to valve-gear which is permanently and positively connected both with the induction or cut-off valves of the engine and with a regulator, but which is yet variable under the control of the regulator to regulate the velocity of the engine by means of those valves.

The principal object of the invention is so to connect the regulator with the valve-gear that a slight force only need be exerted by the regulator to materially alter the admission of steam to the cylinder, and by that means make the cut-off sensitive to slight variations in speed; and to this end it consists in a novel system of right and left hand screws, racks, and pinions, combined with the regulator and with the levers or their equivalents, with which the valves are connected, whereby friction-rollers or other devices attached to the said levers are shifted upon the varying face, or between the varying faces, of a cam, by which the operation of the valve is produced, and thereby obtain the necessary variations in the operation of the valves to regulate the velocity of the engine.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A is the cylinder of the engine, having the induction-valves fitted to its heads B B'.

*a a'* are the valve-stems, connected each with one end of one of two rocking levers, C C', which work on fixed fulcra *b b'*, secured in a frame, D, which is erected upon the bed-plate

E, which supports the whole of the valve-gear. These levers C C' are arranged at such an angle to each other that antifriction rollers I I', attached to the other ends of the levers, may both work in contact with the same cam, F F\*, and that the two valves may be worked by one cam. The said cam is carried by an upright shaft, G, which at the same time constitutes the spindle of the regulator, and which is driven at the same speed as the crank-shaft of the engine by suitable gearing, H H. The cam F F\* is substantially like that described in the specification of my Letters Patent of January 29, 1861, and of my Reissued Letters Patent of September 1, 1863—that is to say, it is composed of two disks, F and F\*, the opposite faces of which are of such varying form as to give the required motion to the valve by their action upon anti-friction rollers attached to the levers with which the valves are connected, and that such motion may be varied to keep the valves open for a longer or shorter time by moving the said rollers nearer to or farther from its center; but to adapt the cam to this improvement its face is modified so that a shorter traverse of the rollers toward and from the center of the cam will produce the necessary amount of variation in the opening and closing of the valves.

The rollers I I', which work between the two disks F F\* of the cam, are fitted to move longitudinally upon two pins, *c c'*, secured rigidly in the levers C C', and also turn freely upon the said pins, and they are arranged in line with each other, radial and perpendicular to the axis of the shaft G, one being on one side and the other on the opposite side of the said shaft. Each of the said rollers is received in a vertical longitudinal slot, *d*, provided in one of two parallel horizontal bars, J J', arranged at right angles to the pins *c c'*, and the pins *c c'* pass through transverse slots *e e* in the said bars, the latter slots being long enough vertically to permit the rocking motion of the levers C C'. The bars J J' are drilled and tapped or fitted with nuts near each end for the reception of right and left hand screw-threads *f f'* on two small horizontal shafts, L L, which are arranged parallel with the pins *c c'* in fixed bearings *g g* on the frame D. These shafts are furnished with pinions *h h*, gearing with two upright toothed racks, *i i*, which are fitted to slide up and down in



guides in the frame D, and which are both connected with a cross-head, M, which is fitted to slide up and down on the shaft G, and this cross-head is suspended from or connected with the slide of the regulator. Each of the shafts L L has the right-hand screw-thread on one end and the left-hand screw-thread on the other end, and each of the bars J J' receives the right-hand thread of one shaft L and the left-hand thread of the other, the arrangement of the right and left hand threads on the two shafts being reversed.

The operation is as follows: The upward and downward movement of the cross-head with any variation in the height of the regulator-slide causes the racks *i i* to turn the pinions *h h* and shafts L L in opposite directions, and the screw-threads on the latter shafts cause the two bars J J' to approach or recede from the shaft G, and move the rollers I I' upon the pins *c c'* toward or from the center of the cam, according as the regulator-slide has ascended or descended, and in this way the necessary variation in the action of the valves and in the amount of steam admitted to the engine is produced. To adjust the valve-gear to make the engine run at different speeds, it is only necessary to raise or lower the toothed racks relatively to the yoke by means of the screw-threads on the stems of the racks *i i* and nuts *j j*, fitted to the said threads above and below the yoke.

The particular advantage of this mode of varying the positions of the rollers relatively to the center of the cam over that described

in my Letters Patent hereinbefore mentioned is that any tendency toward an outward thrust by the action of the cams upon the rollers is checked by the right and left hand screw-threads. Consequently the rise or inclinations on the face of the cam may be made much steeper, and the traverse of the rollers toward and from the center of the cam is made much less, and consequently the burden upon the regulator is much reduced, and the regulator allowed to rotate smoothly and without vibration.

One of the screw-shafts L, pinions *h*, and racks *i* can be dispensed with, and a single shaft, pinion, and rack be made to effect the same result. The bars J J' in such case, being only required to embrace the anti-friction rollers on one side of their pins *c c'*, are made short and fitted to slide along a suitable guide, which both supports them and directs their motion.

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

The employment, in a steam or other engine, of one or more right and left hand screws, *f f'*, pinions *h h*, and racks *i i*, combined with each other, with the regulator, and with the induction-valve-operating mechanism, and co-operating substantially as described to produce the necessary variations in the operation of the valves for the regulation of the engine.

TISDALE CARPENTER.

Witnesses:

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