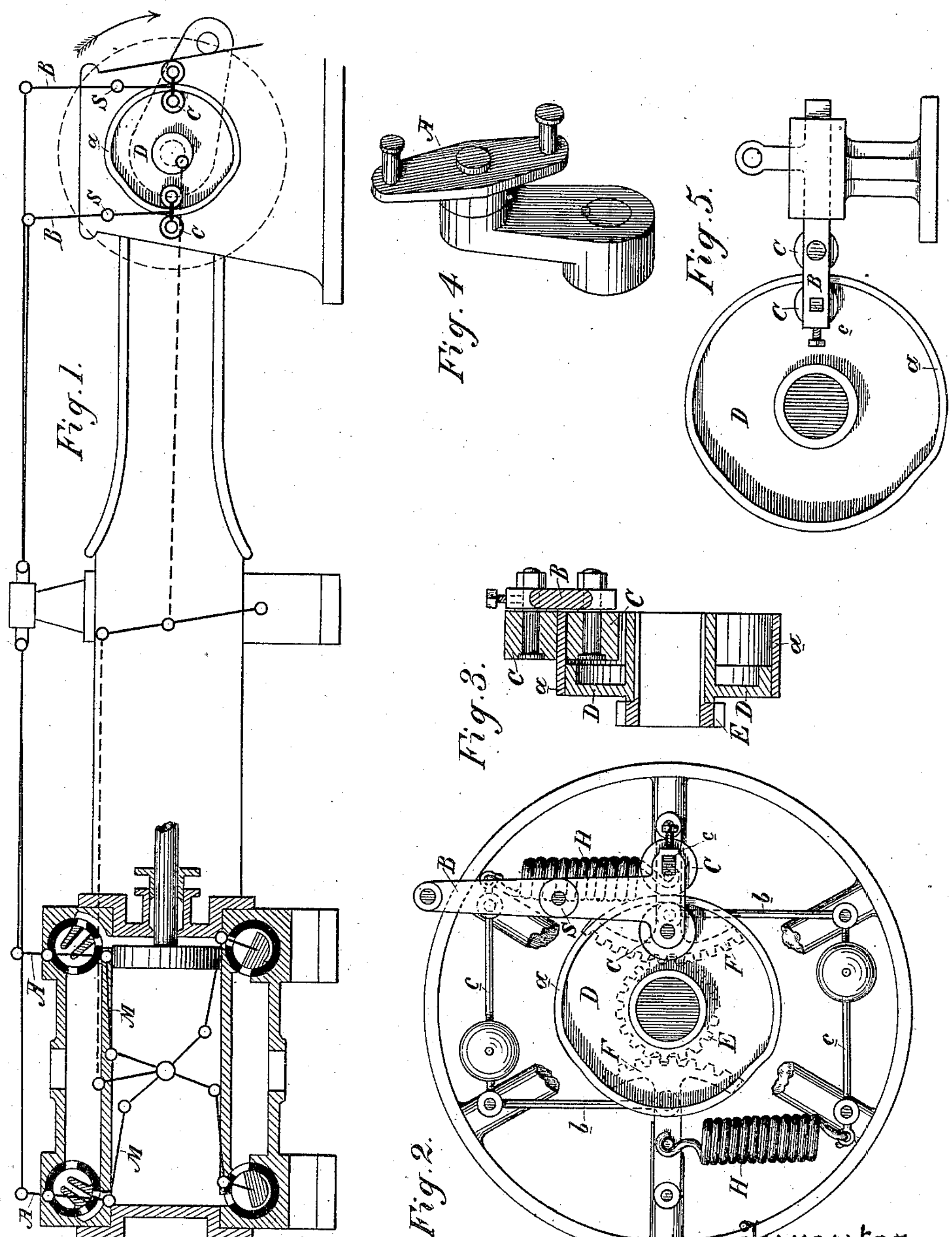
(No Model.)

J. B. PITCHFORD.

VALVE GEAR.

No. 342,035. Patented May 18, 1886.



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JOHN B. PITCHFORD, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-HALF TO WILLIAM T. GARRATT, OF SAME PLACE.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 342,035, dated May 18, 1886.

Application filed August 13, 1885. Serial No. 174,370. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. PITCHFORD, of the city and county of San Francisco, State of California, have invented an Improvement in Engine-Valve Gear; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to certain improvements in the means for actuating the valve-gear of engines. It consists in a novel manner of constructing cams, and in their application for the working of the valves of steam-engines, so as to cut off the steam either at a fixed point in the stroke or at one which is automatically variable.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a longitudinal elevation with a part section of a Corliss engine, showing the application of my device. Fig. 2 shows the annular cam and the means for controlling it by a centrifugal governor. Fig. 3 is a section of the cam and rollers. Fig. 4 is a perspective view of the equalizing-levers and arm of the steam-valve stem. Fig. 5 shows the annular cam imparting movement to a sliding bar.

A A are the equalizing-levers attached to the arms on the stems of the steam-valves. One end of each lever is connected by a rod, M, to the rock-plate—such as is used in most of the Corliss engines—and the other ends of the levers A are connected to the levers B B. These levers B are fulcrumed on pins S, which are secured to the pillow-block or other fixed portion of the frame. The lower ends of the levers B are connected with a cam, by which they are caused to oscillate about their fulcrums, thus operating the levers A, so as to actuate the valves to cut off the steam at the proper time after it has been admitted by the action of the rock-plate upon the valves and that of the regular eccentric by which the rock-plate is moved.

In my invention I have shown an improved method of forming the cam. It consists of the solid portion D, which has its periphery turned or otherwise formed in the desired shape, after which a wrought-iron or steel band, *a*, is shrunk upon it, being fitted to its curvature, and having one edge projecting beyond the face of the part D so as to form a flange.

Upon the lower ends of the levers B are journaled the rollers C C, so that one roller runs upon one side and the other upon the opposite side of the flange or ring *a*. The irregular form of the cam acts upon these rollers and the lower end of the lever, so as to cause the latter to vibrate. One of the rollers has its pin fitted into a slotted hole in the supporting-arm, so that it may be adjusted to take up any wear from time to time, as shown at *c*, Fig. 2. By this construction, with the rollers running upon opposite sides of the cam-flange, instead of a single roller running in a grooved cam, I obtain the following advantage: When a single roller runs in a grooved cam it sometimes turns in one direction and sometimes in the opposite direction, its rotation being reversed a number of times in each revolution, depending upon the form of the cam and the number of times that it changes the side of the groove upon which it travels. This soon wears the single roller flat and impairs its efficiency; but in my device the rollers always run in the same direction, and consequently wear but very little.

The cam is fitted loosely upon the engine-shaft, and has a pinion, E, connected with it. I prefer to bore the cam out, so as to receive a bronze or other suitable bushing, which is fitted tightly into it, and which turns upon the shaft.

F is a quadrant having its periphery toothed, and having a single arm extending to the center, from which the curve is struck. This arm is pivoted to the disk or wheel, which is secured to the shaft upon the side of the cam, and it is connected by a link, *b*, with a weighted lever-arm, *c*, which has one end pivoted to another portion of the disk.

The centrifugal action causes the weight to be thrown outward more or less, and it thus acts through the link upon the quadrant F, which in turn acts upon the pinion E, and thus turns the cam, so as to cause it to act through the rollers C upon the levers B and the valve-gear. When the speed decreases, the weighted lever-arm is drawn back again by the spring H, which is also connected at one end with the lever *c* and at the other with the arm of the toothed quadrant F. The link which connects the weight with the quadrant is con-

nected with the quadrant at a point between its periphery and its fulcrum, the spring being connected with the quadrant-arm nearer to the fulcrum than to the weight. By this arrangement the action of the governor is exceedingly sensitive, as the weight moves but a short distance to cause the quadrant to act upon the pinion and cam sufficiently to regulate the engine.

The operation of the cam is as follows: While any portion of the curve which is concentric with the center is in contact with the rollers the levers B will remain stationary; but when the cam is revolved so as to bring its irregular portion between the rollers it will impart a motion to the levers B equal to the difference in its outline, and this motion is in turn communicated to the valves of the engine by any suitable connection or mechanism.

It will be manifest that the rollers C may be either applied at the end of the lever or levers B, as shown in Fig. 1, or they may be attached to the sliding bars, which move in suitable guides, as shown in Fig. 5, which may be connected with the parts to be moved, the action being essentially the same.

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

1. A cam fitted to an engine-shaft so as to be rotated backward and forward around the shaft, said cam having a flange or rim projecting at right angles from one edge, in combination with a lever or sliding block having plain-faced rollers pivoted thereto, so as to roll in contact with the opposite sides of the flange, and an equalizing-lever having its central portion swinging upon a pin on the rocker-arm or valve-stem, by which the valve is moved, a rod connecting the upper end of said equalizing-lever with the first-named lever or the sliding block, while the lower end of the equalizing-lever is connected with the fixed eccentric on the engine-shaft by which it is moved, substantially as herein described.

2. In an engine, a lever having its central portion suspended and swinging on a pin that is connected with the stem of a steam-valve, one end of said lever receiving motion from an eccentric or rock-plate, and the other end from one end of a second lever having its central portion swinging upon a fixed fulcrum, in combination with an adjustable cam upon the engine-shaft, through which the opposite end of the second lever is reciprocated intermittently, substantially as herein described.

3. In an engine, a rotary valve and equalizing arm or lever, having its central portion swinging upon a pin on the rocker-arm, by which the valve is moved, a fixed eccentric imparting motion to one end of the equalizing-lever through suitable connections, in combination with an irregular cam adjustable upon the engine-shaft and a lever-arm turning upon the fulcrum-pin in its central portion and having one end connected with the cam, so as to receive an intermittent motion from it, while the other end is connected with the end of the equalizing-lever opposite to the one actuated by the fixed eccentric, substantially as herein described.

In witness whereof I have hereunto set my hand.

JOHN B. PITCHFORD.

Witnesses:
S. H. NOURSE,
H. C. LEE.