

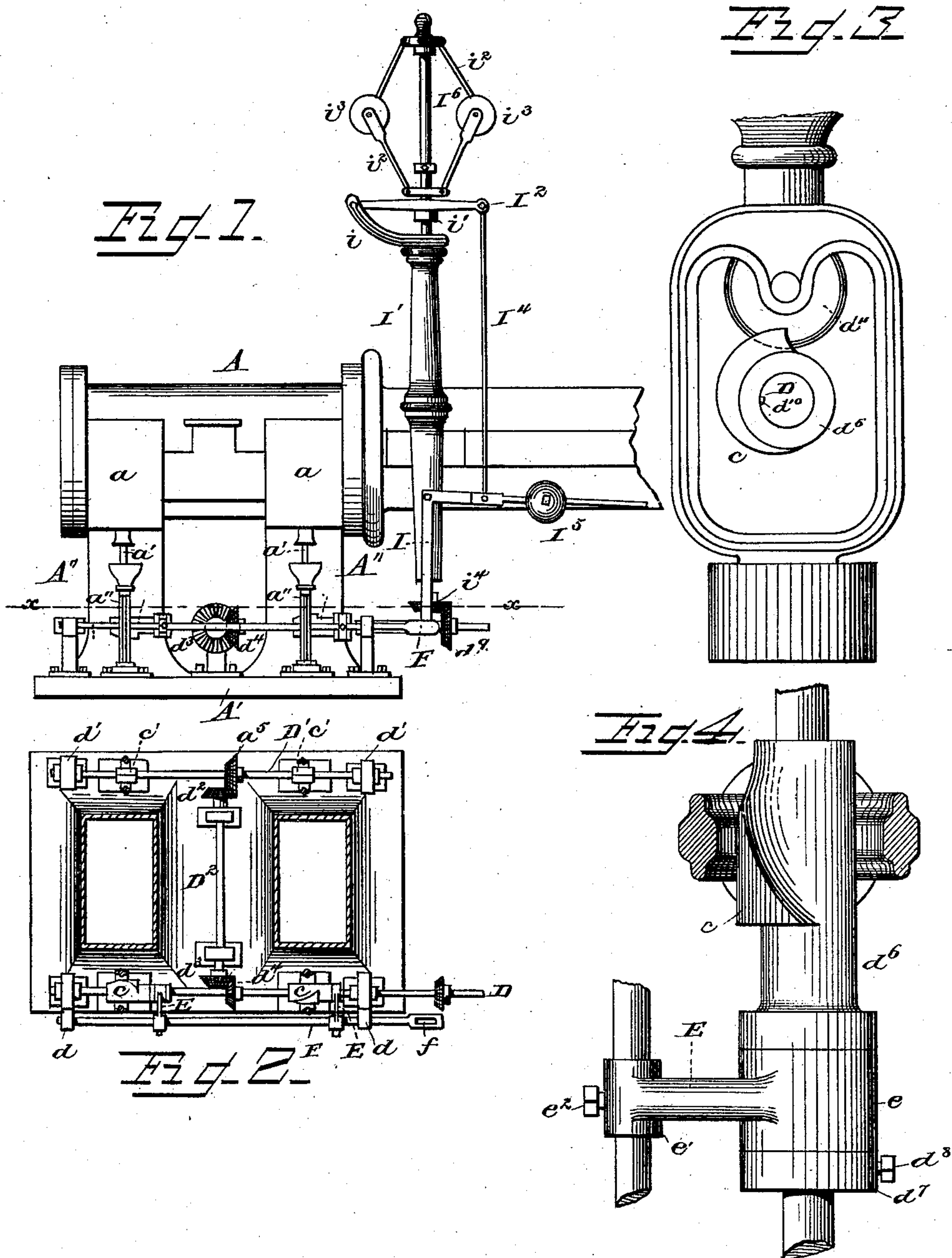
(No Model.)

O. F. HOWARD.

VALVE GEAR FOR STEAM ENGINES.

No. 297,997.

Patented May 6, 1884.



WITNESSES
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VALVE-GEAR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 297,997, dated May 6, 1884.

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To all whom it may concern:

Be it known that I, OLIVER F. HOWARD, a citizen of the United States, residing at Burlington, in the county of Des Moines and State of Iowa, have invented certain new and useful Improvements in Valve-Gear for Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to valve-gearing; and it consists in constructions and combinations hereinafter described.

In the accompanying drawings, which form a part of this specification, Figure 1 is a side elevation of the cylinder, gearing, and governor; Fig. 2, a horizontal section on line $x x$, Fig. 1; Fig. 3, a detail view, showing the roller in contact with the spiral cam; and Fig. 4, a detail showing the cam, sleeve, and arm for moving the sleeve in elevation and the arch in section.

Referring to the drawings by letters, the same letter indicating the like part in all of the figures—

A represents a cylinder supported from a base, A' , by standards $A'' A''$.

Upon each side of the cylinder are the valve-boxes a ; but as these parts may be of any ordinary construction, and do not constitute any part of my invention, further description of them is unnecessary. Extending from the interior of these valve-boxes are valve-rods a' , which pass through the top of a frame or arch, a'' , attached to the base in any suitable manner.

Pivoted to the lower end of all the valve-rods is a roller, a''' , (see Fig. 3,) which rests upon a cam, hereinafter described. These cams are four in number, and are designated by the letters $c c$ and $c' c'$, two on each side of the cylinder, and revolve with the shafts $D D'$, upon which they are placed. If desired, the cams $c' c'$ may be of spiral form; but for the purposes of my invention I propose to use any form of cam. The shaft D is journaled in suitable supports, d , fixed to a base, A' , and is connected at its inner end to a main shaft

by suitable gearing, (not shown,) which rotates it upon its axis. The shaft D' is journaled in similar supports, d' , attached at the opposite side of base A' to shaft D , and is connected to the latter by a shaft, D^2 , passing under the cylinder, and provided with miter-wheels d^2 and d^3 , which, respectively, gear with miter-wheels d^4 and d^5 on shafts $D D'$. The cams c' and c' are keyed to the shaft D' , so that the valves on the exhaust side of the cylinder will be moved a uniform distance with each revolution of the shaft. The cams c and c , however, are so arranged that the supply of steam to the induction-valves may be varied to meet the varying velocities of the rotating parts of the engine. This is accomplished by forming the spiral cams on a sleeve, d^6 , attached to the shaft D by a spline, d^{10} , which permits of a longitudinal motion on the shaft, but compels the sleeve to revolve with the latter.

The sleeve d^6 is provided with a shoulder, against which one end of a sleeve, e , upon arm E abuts. This sleeve e encircles the end of sleeve d^6 , opposite to that on which the cam c is formed, but does not revolve with it, and is held thereon by a collar, d^7 , having a set-screw, d^8 , which fixes the latter to sleeve d^6 .

The arm E is formed integral with the sleeve e , and is provided with a second sleeve, e' , which may be fixed at any desired point upon rod F by means of a set-screw, e^2 . This rod F is supported upon arms projecting from journals or supports d of shaft D , and is adapted to have a longitudinal motion to move the spiral cams $c c$ longitudinally upon shaft D , for the purpose of regulating the cut-off. This motion is imparted by means of a system of levers connected to the governor and said rod in the following or any suitable manner, as it is obvious that many changes could be made in the connecting-levers without departing from my invention. The inner end of rod F is provided with a slot, f , in which is loosely pivoted the lower end of bell-crank I . This crank is fulcrumed upon the spindle-casing I' , and is provided at its outer end with a counter-balance, I^5 . It is also connected to a bar-lever, I^2 , by a rod, I^4 , hinged at each end to the parts to which it is attached. The lever I^2 is fulcrumed upon an arm, i , and embraces the sleeve of and rests upon the slide i' , which is supported by

connecting-rods i^2 and moved by the rising and falling of the centrifugal balls i^3 when revolved by the governor-spindle I^6 . This spindle is provided at its lower end with a miter-wheel, i^4 , which gears with a miter-wheel, i^5 , on shaft D, which revolves the spindle at the same rate it is revolved. When the shaft D is revolved faster than desired, or exceeds the number of revolutions intended, the gravity of the centrifugal balls will be overcome, and they, by means of their connecting-rods, will lift slide i' , which in turn lifts the weight end of lever I^2 . This lever, by means of rod I^4 , lifts the weighted arm of crank-lever I, the pendent arm of which draws the rod F longitudinally upon its supports, and in such a manner and direction as to cause the arm E to draw the wide or base part of the spiral from contact with the roller a''' and present such a point of the former for contact with the latter as will cause sufficient steam to be cut off to compensate for the increased velocity of the power-shaft and bring it back to its normal motion. If the velocity of the shaft D should be less than desired, the slide i' will move downwardly on the spindle, and the counter-balance I^5 will operate the crank-lever I, which will move the rod and cams in such a manner as to force the wider portions of the spiral against the roller a''' and cause a greater inflow of steam to the cylinder.

It can readily be seen that after the cams c have been set to supply a certain amount of steam to the cylinder to produce a uniform velocity, the varying resistance of the engine will be imparted by the governor to the rod controlling the cut-off in such a manner that any increase or decrease in the speed will be compensated for by a decrease or increase of the surface of the spiral cam presented to the roller a''' on the valve-rod of the induction-valve, thus producing a cut-off that will be

sensitive to the slightest change in the velocity of the moving parts.

Having thus described my invention, I claim—

1. The combination of the induction-valves having their gearing on one side of the cylinder, the exhaust-valves having their gearing upon the opposite side of the cylinder, and a connecting-shaft passing under the cylinder for imparting motion from the induction to the exhaust-gearing.

2. The combination of the cylinder, induction-valves on one side of the cylinder, the exhaust-valves upon the opposite side of the cylinder, shafts for operating the valves, one below the induction and the other below the exhaust valves, and a shaft passing under the cylinder and connecting the valve-operating shafts, substantially as described.

3. The combination of the induction-valves on one side of the cylinder, the exhaust-valves on the opposite side of the cylinder, shafts D and D', respectively, beneath the induction and exhaust valves, and each having cams for operating said valves and a miter-wheel, and a shaft, D², having miter-wheels for connecting said shafts D and D', substantially as described.

4. The combination of the induction-valves having their gearing on one side of the cylinder, the exhaust-valves having their gearing upon the opposite side of the cylinder, a connecting-shaft passing under the cylinder for imparting motion from the induction to the exhaust gearing, and a rod, F, connected with the induction-gearing and the governor, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

OLIVER F. HOWARD.

Witnesses:

W. C. PERKINS,
H. W. SCHRAMM.