

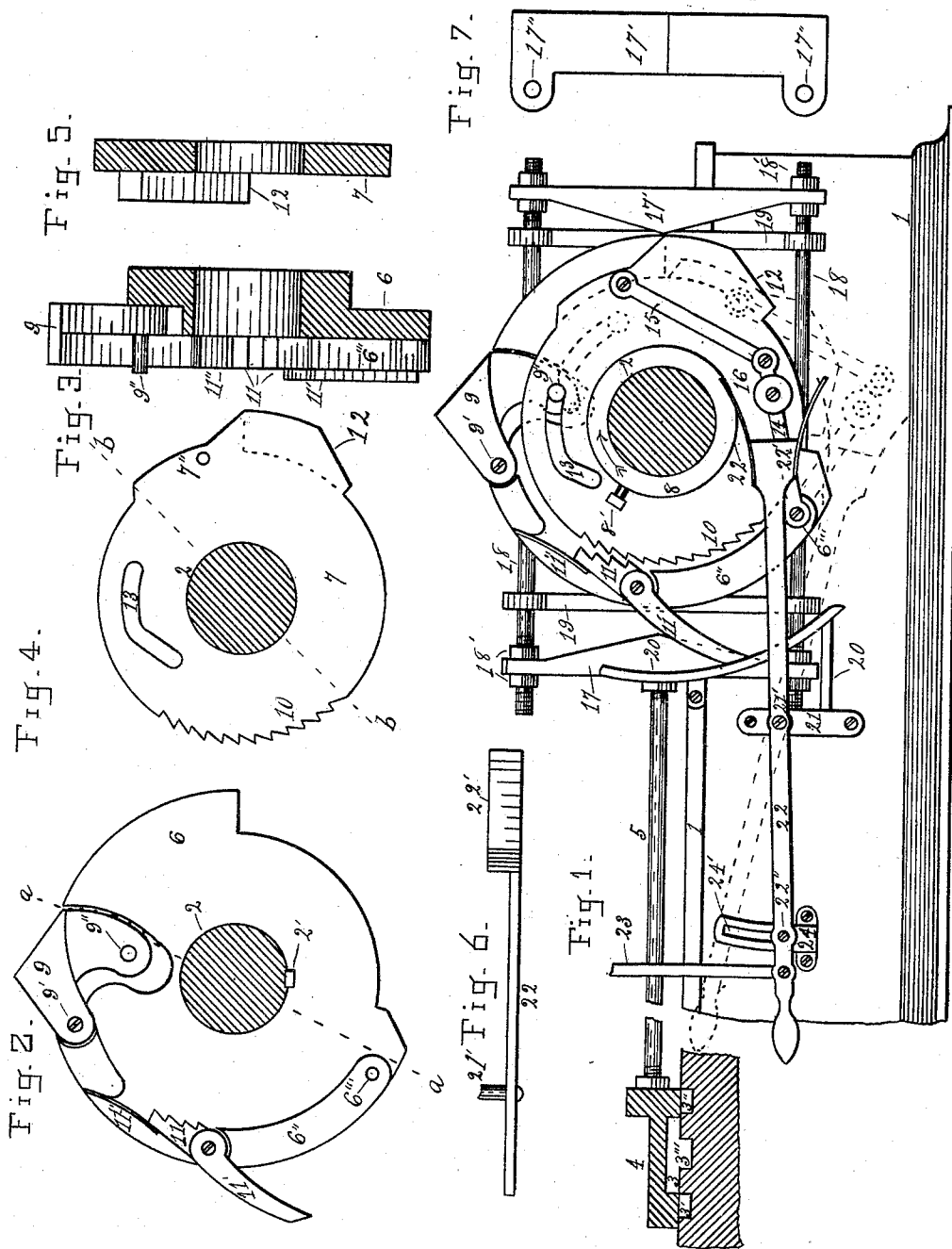
(No Model.)

2 Sheets—Sheet 1.

P. JENNINGS.
VALVE GEAR.

No. 474,452.

Patented May 10, 1892.



Witnesses.
Carl Koch
Carl Koch Jr.

Inventor.
Peter Jennings.
By *G. H. Albee.*
his Atty.

(No Model.)

2 Sheets—Sheet 2.

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Fig. 8.

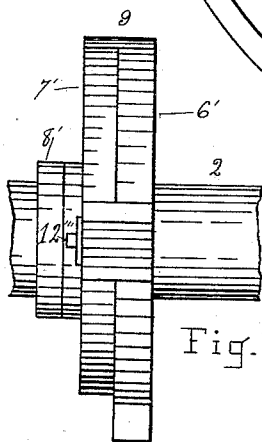
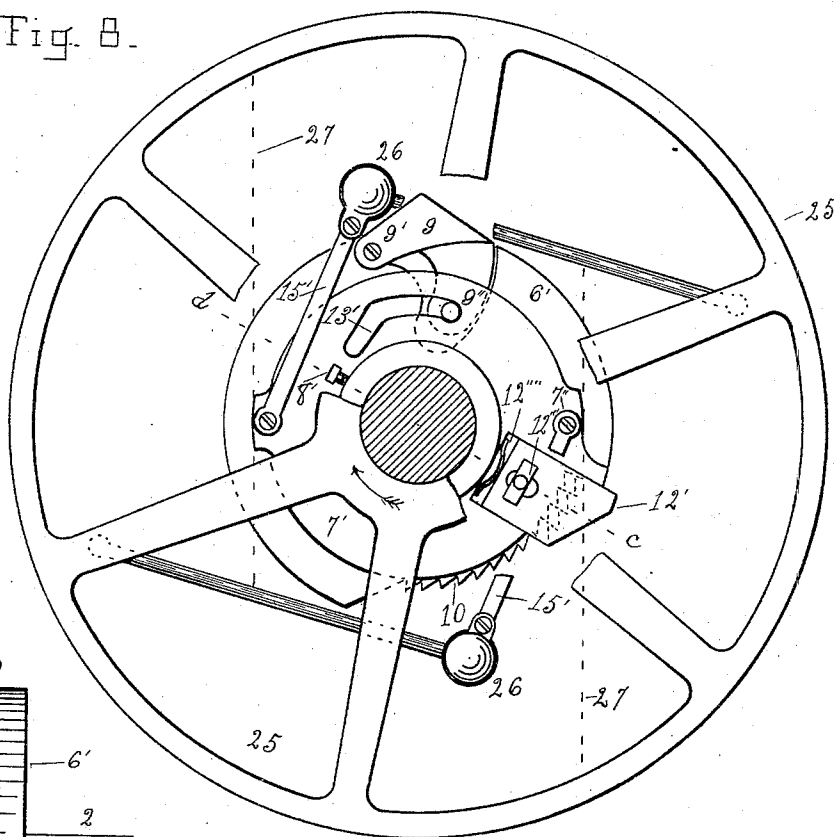


Fig. 9.



Fig. 10.

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UNITED STATES PATENT OFFICE.

PETER JENNINGS, OF MENASHA, WISCONSIN.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 474,452, dated May 10, 1892.

Application filed August 24, 1891. Serial No. 403,560. (No model.)

To all whom it may concern:

Be it known that I, PETER JENNINGS, a citizen of the United States, residing at Menasha, in the county of Winnebago and State of Wisconsin, have invented a new and useful Improvement in Valve-Gears, of which the following is a specification.

My invention relates to an improved device for operating the valves of engines, and is designed, primarily, for steam-engines, and to which the following description of this specification applies, but may also be used for operating the valves of engines which are driven by another force than steam; and the object of the invention is to provide a simple device for the movement of the valves, one in which the amount of steam admitted to the cylinder at each opening of said valve can be varied to accord with the labor imposed, the length of time it is allowed to enter before cutting off its admission be varied, and also the time relative to the stroke of the piston at which the exhaust-port is opened for its escape, (the motion of the valve-rod being intermittent,) and producing thereby a variable cut-off. I attain said objects by the device illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a portion of the crank end of an engine-bed, showing the crank-shaft in section, the cams composing the device upon it, the stops upon which the cams operate, the supports upon which said stops are reciprocated, the valve-rod, and at its left a portion of a valve-seat of a steam-chest and a valve thereon. The remaining figures are details, Fig. 2 being a plan of a fixed cam-wheel; Fig. 3, a section thereof upon the line *a a* of Fig. 2 as seen in looking toward the left; Fig. 4, a plan of an adjustable disk; Fig. 5, a section of the same upon the line *b b* of Fig. 4 as seen in looking toward the right; Fig. 6, an edge view of a lever used in applying the action of the engineer or of an engine-governor to the aforesaid movable disk; Fig. 7, a plan of the working face of a stop against which the cams impinge in their revolution and which are arranged to slide parallel and in unison with the engine-valves; Fig. 8, a plan showing a modification of the cam-wheel and adjustable disk arranged for the application to the crank-shaft

of a governor for the automatic operation of said cam-wheel and disk; Fig. 9, an edge view of said cam-wheel and disk as they appear upon the shaft in looking in the direction of the line *c* to *d*, and Fig. 10 a rear view of the cam of the disk as modified in Figs. 8 and 9.

Similar figures of reference indicate like parts in the several views.

The figure 1 indicates the engine-bed; 2, the crank-shaft; 3, a valve-seat; 3' 3'', induction-ports; 3''', a port leading to an exhaust-pipe; 4, a valve; 5, a valve-rod; 6 6', cam-wheels secured to the shaft by a key 2', (shown in Fig. 2); 6'', a raised portion or rim on part of the circumference of the disk 6, and 6''' a hole in said rim; 7 and 7', disks loosely mounted upon the shaft; 7'', a hole in the disk 7; 8, a collar secured upon the shaft by a set-screw 8', between which and the cam-wheel the disks are permitted a partial revolution upon the shaft; 9, a cam hinged to the cam-wheel by a pin 9', and 9'' a bolt or pin in the disengaged end of said cam, adapted to engage a slot in the disk and to throw the hinged cam outward or inward during a part of each revolution of the shaft.

10 are teeth upon the disk 7; 10', teeth upon the cam-wheel 6; 11, a pawl pivoted to the outer edge of the cam-wheel; 11', an extension of said pawl by which it is thrown out of engagement with the teeth of the disk; 11'', a spring arranged to bear upon said pawl and engage it with the aforesaid teeth; 12, a cam upon the disk, that part of it the form of which is indicated by dotted lines in Fig. 4 extending outward from its rear side and being adapted to be received within the cut-away portion of the circumference of the cam-wheel.

13 is a slot formed through the disk and in which the pin 9'' of the hinged cam is adapted to move freely; 14, an arm connected to the cam-wheel at the point 6''' at one end and carrying near the other a roller 16, said end being connected by the link 15 to the disk at the point 7'', and 17 17' stops of corresponding form arranged for the action thereon of the cams of the cam-wheel and disk, and also arranged for longitudinal movement in a direction transversely of the crank-shaft.

18 are rods entering the holes 17'' and connecting said stops to each other; 18', nuts

upon the rods for adjusting the distance between the stops and also the position of the stops with relation to the cams; 19, brackets extending outward from the engine-bed and supporting the rods 18 and stops 17 and 17'; and 20 a tripping-bar located in the path of the end 11' of the pawl for the purpose of disengaging the pawl and the teeth upon the disk during a portion of each revolution of the shaft, said bar being upon brackets extending out from the engine-bed and being bolted to it, the bracket 21 having also a bolt 21', upon which is fulcrumed the lever 22, said lever having two wings 22', between which the roller 16 passes during each revolution of the shaft, the other end of the lever being provided, as desired, either with means for its connection in a fixed position, as by a bolt through it and the slot 24' of the bracket 24, or means for its connection with a governor, as by the rod 23.

25 represents a shaft-governor having balls 26 hinged to it by rods connecting them with arms of the governor-wheel, the dotted lines 27 representing coiled springs for counteracting the tendency of the balls to fly outward as the speed of the engine increases. Said governor is, however, no part of my invention, it being introduced here only for the purpose of showing how one may be applied for controlling the volume of steam admitted to the cylinder, any other shaft-governor being as well adapted for the purpose. Parts of its hub and arms are broken away for the purpose of showing more plainly the valve-gearing.

Two cams are shown in this invention. The cam 9 opens the valve for admitting steam, and the cam of the disk closes it, the time from the opening to the closing being governed by the position of the last-named cam relative to the other. The cams act upon the sliding stops 17 17', which are connected with the valve-rod 5. The form of the face of the stops may be angular or circular at the point of contact of the cams and adapted to receive the action of cams which revolve to the right or left. The swinging cam is capable of adjustment at various distances from the center of the shaft. It being at its greatest distance the induction-port will be opened to its greatest extent, and at a less distance a diminished opening is made, whereby the quantity of steam admitted may be governed, as demanded.

It being desired to use the steam with economy, the disk having the cam is applied and used in connection with the cam upon the cam-wheel. The disk being adjustable in a circumferential direction upon the shaft relative to the cam-wheel, the opening and closing cams can be placed at points farther from or nearer to each other, as may be desired, thereby making the time of contact of the opening-cam with one stop to that of the closing-cam with the other one long or short. These several parts being properly adjusted and the shaft revolved in the direction of the arrow, the

cam 9 will strike the stop 17' and open one of the induction-ports, when the cam of the disk next reaching the stop 17 will close said port, shutting off the admission of steam and allowing its expansion until the valve is opened for its escape. In the position the cams are in as they are represented by heavy lines, Fig. 1, the cam 9 will open the induction-ports to their full extent and the cam 12 will delay their closing to the latest moment for which the device is adapted, while in the position indicated by dotted lines the cam 9 moves the stops a less distance than before, and consequently admits less steam. The cam 12 reaches the opposite stop sooner after action upon one by the cam 9 closing the induction-port earlier in the stroke and obtaining the benefit of steam-expansion, as before described. The disk is retained in position relative to the cam-wheel during a portion of each revolution of the shaft by means of its connection with the pawl 11, said pawl being released from said connection by a trip-bar 20 during a part of said revolution, the extension 11' coming in contact with said bar, and during which time the wings 22' are arranged to receive the action of the roller 16 and to make such change in the position of the two cams as the action of the governor requires. It will be evident that if no governor is used the lever 22 is capable of adjustment by the operator and of being secured in any desired position upon the bracket 24 by means of a bolt through the lever and through the slot 24' of the bracket, changes in its position being made as often as the labor imposed upon the engine requires.

The adjustment of the cams with reference to each other by means of a governor may be made in various ways, according to the construction of the governor and the place of its location. If it be an ordinary ball-governor and stationary, it may be connected to the lever 22 by means of the rod 23, so that the rise and fall of the governor-balls will cause a corresponding movement to the lever, while the wings 22', being acted upon by the roller 16, will, through the medium of the arm 14 and link 15, move the disk and change the position of its cam relative to the cam 9.

A method of controlling the position of the cams by means of a governor applied to the shaft is shown in the modification Fig. 8, the cam-wheel and disk having the means for their engagement and disengagement arranged in a different manner for the purpose of adapting the device to fast-speed engines. In this modification the teeth 10 upon the disk 7 are transferred to the cam-wheel, the pawl 11, its extension 11', the spring 11'', arm 14, roller 16, and lever 22 are dispensed with, and the cam 12 of the disk 7 (designated as 12' and 7', respectively, in Figs. 8, 9, and 10) is made to slide toward and from the center of the disk. It has teeth 12'', which engage with teeth 10' upon the cam-wheel for holding the disk in position relative to the

cam-wheel, has a bolt and keeper 12''' for holding the sliding cam to its seat in the disk, and a spring 12''', which latter normally holds the teeth of the cam disengaged from the teeth of the cam-wheel and allows the disk to revolve independently of the cam-wheel any distance within the limits of the slot 13'. The cam 12', striking one of the stops, is pushed inward, the teeth of cam and cam-wheel engaged, and thereby connecting the cam-wheel and disk.

A governor 25 is secured upon the shaft 2 and has its governor-balls connected by links 15' to the disk, the action of said balls as the speed of the governor changes turning the disk and moving the cam 12' farther from or nearer to the cam 9, and thereby making the time between the opening of the induction-ports and their closing longer or shorter. It will be observed that the form of the slot 13 is such that as the cam of the disk is moved away from the cam 9 said cam is drawn inward, whereby less steam will be admitted as the stops are moved a shorter distance than when the cam is thrown outward to its greatest limit.

I do not confine my invention to the particular manner here shown for engaging and disengaging the disk and cam-wheel, as other simple devices may effect it; neither do I confine it to the manner shown for conveying the action of the cams upon the stops to the engine-valves, as it may be direct or indirect, according to the position of said stops relative to the valves; nor do I consider it essential that the cam 9 be hinged to the cam-wheel, as it may be made adjustable otherwise than by its being made to swing. It may be arranged in the cam-wheel so as to slide in and out and said movement produced by means of the curved slot and pin, as it is now done.

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

1. The combination of a valve, its rod, two stops connected therewith, a revoluble shaft having a cam-wheel secured thereon, said wheel having a cam, a pawl, and a swinging arm having a roller thereon, a disk mounted loosely on said shaft and being provided with a cam, a portion of the circumference of said disk having teeth adapted to be engaged by said pawl, a stationary trip for their disengagement during a portion of each revolution

of said shaft, a link connecting said disk and the arm aforesaid, and a lever having a stationary fulcrum and being provided at one end with guiding-wings, between which the aforesaid roller is arranged to pass at each revolution of said disk, all arranged and operating substantially as described.

2. The combination of a valve, a rod, two stops connected therewith, a revoluble shaft having a cam-wheel secured thereon, said wheel having an adjustable cam, a pawl, and a swinging arm, the latter having a roller thereon, a disk provided with a cam mounted loosely on said shaft, a curved slot in said disk adapted to engage the adjustable cam aforesaid, teeth upon a portion of the circumference of said disk adapted to be engaged by said pawl, a stationary trip for their disengagement during a portion of each revolution of said shaft, a link connecting said disk and the arm aforesaid, and a lever having a stationary fulcrum and being provided at one end with guiding-wings, between which the aforesaid roller is arranged to pass at each revolution of said disk, its opposite end being adapted for connection to a governor for its movement thereby, substantially as set forth.

3. The combination of a valve, its rod, two stops connected therewith, a revoluble shaft, a cam-wheel having an adjustable cam secured upon said shaft, a disk provided with a cam mounted loosely on the shaft, said cam-wheel and disk being provided with devices for connecting one to the other and for their disconnection during each revolution of said shaft, and a governor arranged for moving the cam of said cam-wheel outward and inward from the shaft during a portion of said revolutions and for controlling the position of the cam of the disk relative to the cam of said wheel, substantially as described.

4. The combination of a revoluble shaft, two cams thereon, and a governor, one of said cams being provided with connections for its connection with and adjustment by said governor and being connected with and adapted by its movement for adjusting the other of said cams, substantially as described.

PETER JENNINGS.

Witnesses:

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