(No Model.) 4 Sheets—Sheet 1.

J. W. SARGENT & R. H. RICE.

VALVE GEAR.

No. 526,267. Patented Sept. 18, 1894.

Fig. 1.

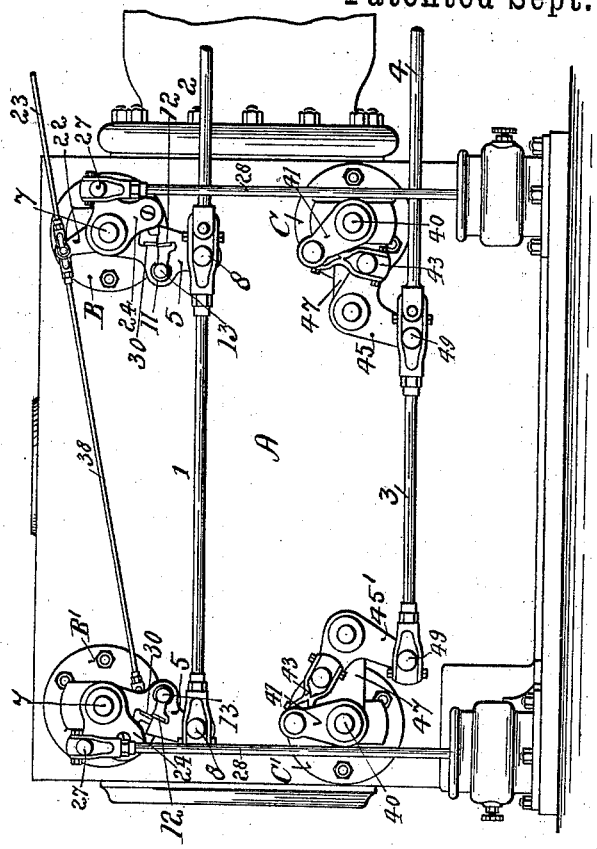
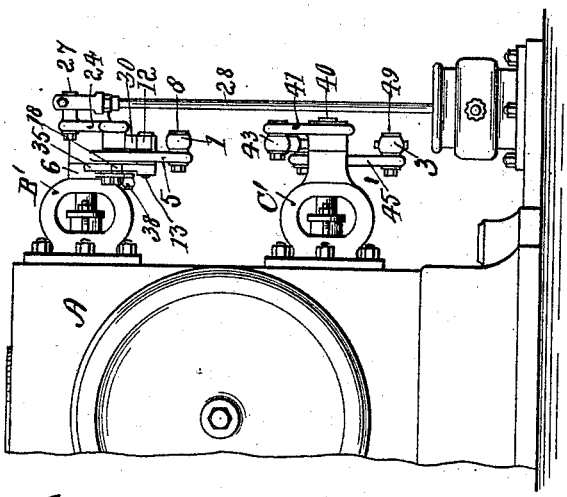


Fig. 2.



Witnesses.

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(No Model.) 4 Sheets—Sheet 2.

J. W. SARGENT & R. H. RICE.

VALVE GEAR.

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Fig. 3.

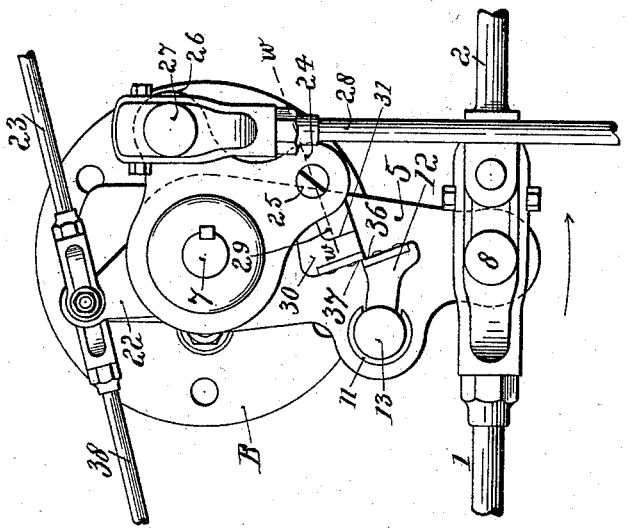
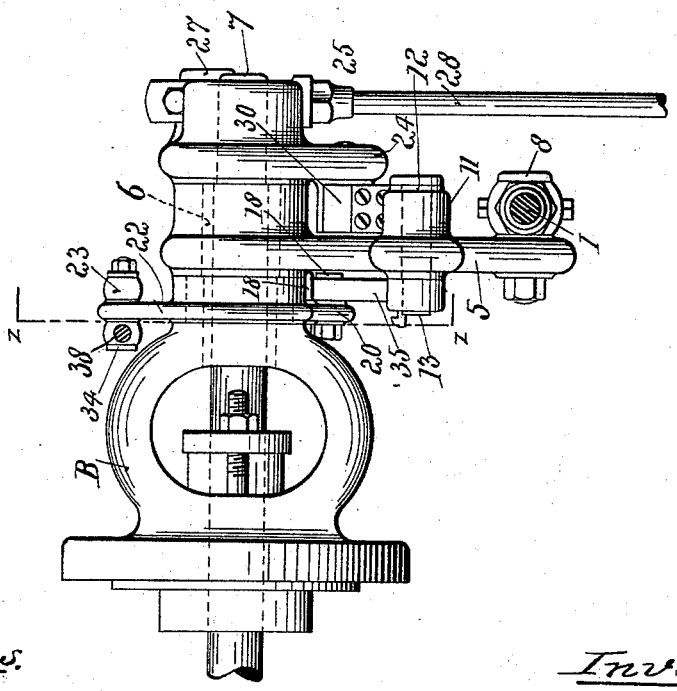


Fig. 4.



Witnesses.

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4 Sheets—Sheet 3.

J. W. SARGENT & R. H. RICE.

VALVE GEAR.

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Fig. 7.

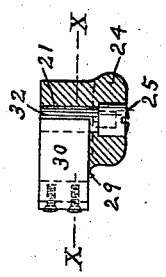


Fig. 8.

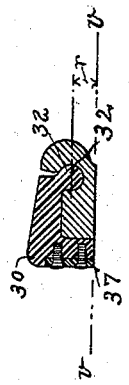


Fig. 6.

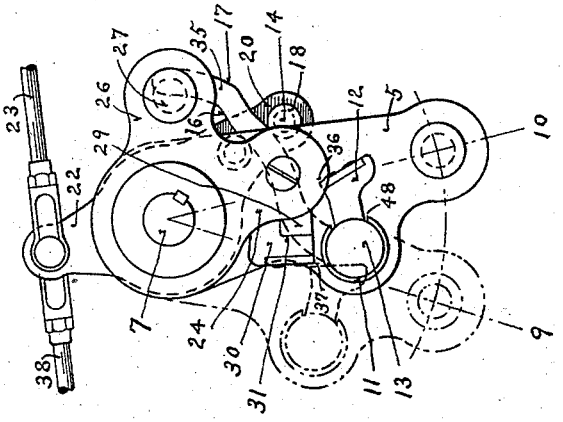
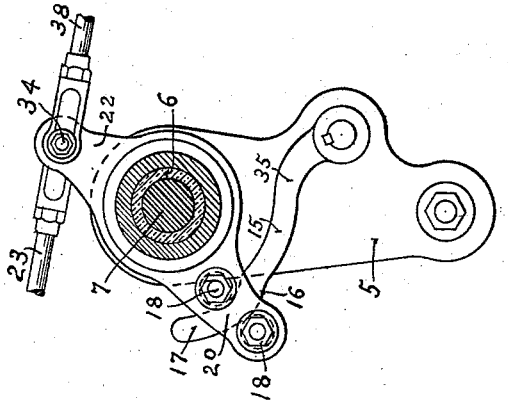


Fig. 5.



Witnesses.

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(No Model.) 4 Sheets—Sheet 4.

J. W. SARGENT & R. H. RICE.

VALVE GEAR.

No. 526,267. Patented Sept. 18, 1894.

Fig. 2.

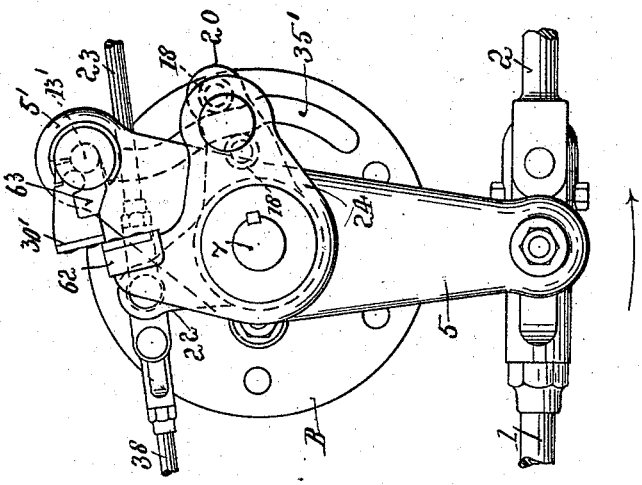
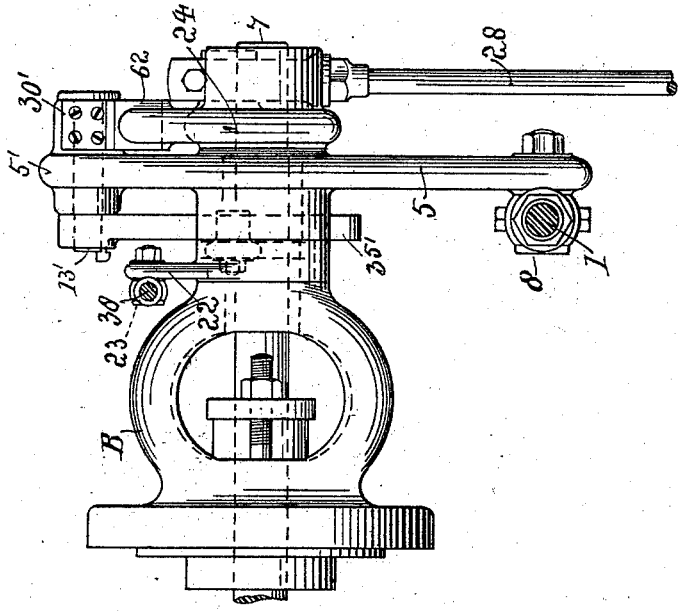


Fig. 10.



Witnesses.

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UNITED STATES PATENT OFFICE.

JOHN W. SARGENT AND RICHARD H. RICE, OF PROVIDENCE, RHODE ISLAND.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 526,267, dated September 18, 1894.

Application filed June 1, 1894. Serial No. 513,169. (No model.)

To all whom it may concern:

Be it known that we, JOHN W. SARGENT and RICHARD H. RICE, citizens of the United States, residing at Providence, in the State of Rhode Island, have invented a new and useful Improvement in Valve-Gear for Steam-Engines, of which the following is a specification.

Our invention relates to the valve gear and valves of automatic cut off engines, and it is especially adapted to the so called "Corliss" engine, or the rotary four valved type.

The object of our invention is to provide improved means for opening the steam valve with a locked engagement of the valve operating mechanism up to the point of cut off, which point is automatically controlled by the governor, to provide improved means for operating the exhaust valves by the wrist plate motion, whereby the strain on the exhaust bonnets is lessened, and the cost of construction cheapened.

In the accompanying drawings:—Figure 1, represents a side elevation of a steam engine cylinder provided with our improvement. Fig. 2, represents a partial end elevation of the same. Fig. 3, represents a detail front elevation of the cut-off valve gear showing the parts in their engaged position. Fig. 4, represents a detail side elevation of the same separate from the cylinder. Fig. 5, represents a section taken in the line z, z, of Fig. 4, showing the inner side of the rocker, the cam lever and the trip lever. Fig. 6, represents a detail front view as in Fig. 3, the rocker and driving toe being shown at their forward position, with the latch disengaged, and the valve closed the rearward position of the rocker and driving toe being shown by dotted lines. Fig. 7, represents a section taken in the line w, w, of Fig. 3, showing a top view of the latch. Fig. 8, represents a vertical section taken in the line x, x, of Fig. 7. Figs. 9 and 10, correspond with the views shown in Figs. 3 and 4, and show a modification.

In the drawings, Figs. 1 and 2, A is the cylinder of a "Corliss" engine; B and B′, the steam valve bonnets, and C and C′ the exhaust valve bonnets.

Heretofore it has been the custom to connect the four steam and exhaust valve rockers, to a wrist-plate carried on a separate stand at the side of the cylinder, the wrist-plate having a rocking motion imparted to it from an eccentric upon the main shaft. In our invention the two steam valve rockers suspended from the bonnets B, B′, are connected together at their lower ends by means of the link 1, and motion is imparted to the same by means of link 2, which is connected to an independent eccentric on the main shaft, the desired wrist-plate motion for each exhaust valve being obtained by attaching a bell-crank rocker lever 45 to each of the exhaust valve bonnets C, C′, preferably upon a projecting arm 47 which forms a part of the bonnet casting. As the valve gear for each end of the cylinder operates in the same manner, we will for illustration describe the valve gear for the front end of the cylinder, or the end toward the crank, in which the rocker 5 is journaled upon a fixed bushing 6, projecting from the bonnet B, which bushing surrounds and carries the valve stem 7, and a regular motion is imparted to the rocker by means of the link 2, which connects with pin 8 at the lower end of the rocker, and with the eccentric on the main shaft.

The rocker 5 is provided at about midway of its length with a bearing hub 11, for holding the driving toe 12, the said hub being cut away at 48, to provide for the forwardly projecting portion of the driving toe and allow the free vibration of the same upon its pivot or turning axis. A pivot spindle 13 forming part of the driving toe 12, has a free fit in the hub 11, and passes through to the rear, and to the rear end of the spindle 13 is keyed the cam lever 35, which is carried obliquely upward behind the rocker 5, and is a free fit between the two rollers 18, 18, which are held upon the pins 14 projecting in front of the trip lever 20, the said trip lever being pivoted upon the bonnet B concentrically with the valve stem, and provided with the upwardly extending arm 22, which is connected by means of the link 23 with the governor.

The valve lever 24, Figs. 3 and 4, is keyed to the valve stem 7, and has a branch arm 26 carrying the pin 27, from which connection is made to the dash pot by means of the link 28, for properly closing the valve.

The valve lever 24 projects downward at about an angle of forty-five degrees when in middle position, and carries from a lug 29 in the rear, a latch 30, which is engaged by the driving toe 12 of the rocker, to open the valve. Fig. 3 shows the parts engaged, and in the act of moving to the right, as shown by the arrow to open the valve. The normal position of the latch in relation to the lug 29 of the valve lever is shown in Figs. 3 and 6, and it is held in said position by its own weight, the front portion of the latch resting against the face 31 of the lug 29, and receiving the thrust of the toe 12 for opening the valve. The upper part of the latch extends backward over the lug, and is provided with a cylindrical turning point or pivot 32, whereby the latch may be raised, when the driving toe 12 passes under it on the return movement of the rocker 5. The bearing 21 for the latch 30, extends through the valve lever 24, and a cap-nut 25, is screwed upon the extension of the latch pivot, to prevent the lateral movement of the latch in its bearing.

In Fig. 8, the line *v*, *v*, indicates the direction of the pressure imparted to the latch from the toe 12 for opening the valve, and it is seen that the center of the pivot or turning point 32, is located at a considerable distance *r*, above the line of pressure, so that the latch will be prevented from rising while subjected to the action of the toe 12, the engaging corner 36 of which bears against the corner 37 of the latch, so that a very great amount of wear would be required to cause the latch to jump out of its engagement. This is an important feature of our invention as we are thus enabled to use a light gravity-latch, without the employment of springs, and at the same time the latch is automatically locked in position when at work. The cam lever 35, has a short incline 16, about midway of the length of the cam, thus dividing the length of the cam into two parts, 15 and 17, each of which is a segment of a circle, so arranged that its center will coincide with the center of the valve stem when the said segment is held between the rollers, so that in operation there will be no change in the relation of the cam lever and the attached driving toe 12 with the rocker 5, except when the incline 16 of the cam passes between the rollers 18. The segments 15 and 17, of the cam-lever 35, are made of equal radius, while their curves are struck from different centers, so that the said segments will be eccentric with each other, and when either segment is held between the rollers 18, 18, it will be concentric with the axis of the trip-lever, while the opposite segment will be eccentric thereto, which is a distinguishing feature of our invention.

In Fig. 5, the outer portion 17 of the cam is between the rollers, so that the cam lever and driving toe are in their highest positions, which is the position for engagement with the latch, the driving toe being thus connected by means of the cam lever with the trip lever 20, it is obvious that the driving toe has a resultant movement depending upon the motion of the rocker 5 and the varying location of the trip lever 20, which latter is under the control of the governor.

The movement imparted to the rocker by the eccentric, is represented by the space between the dotted lines 9 and 10 in Fig. 6, the position of the rocker and the driving toe at the commencement of the forward movement for opening the valve being shown by the dotted lines; and at this position of the rocker, the outer portion 17 of the cam lever will ordinarily be between the rolls 18, 18, with the toe 12 raised to its engaging position, the latch 30 having been dropped down in front of the toe, so that as the rocker advances, the corner 36 of the driving toe 12 will engage with the corner 37 of the latch, thus imparting an opening movement to the steam valve; and as the rocker 5 continues to advance, the incline 16 of the cam enters between the rollers, causing the driving toe 12 to be depressed sufficiently to effect the disengagement of the latch to close the valve. The toe 12 then continues its forward movement with the rocker, while the valve lever 24 being set free, is drawn back to the closed position of the valve, as shown in Fig. 6, by means of the dash-pot link 28, connected to the pin 27. On the return movement of the rocker 5, the incline 16 of the cam, returns between the rollers and raises the toe 12 for subsequent engagement with the latch, and as the toe 12 comes back to its first described position, the latch 30 is raised by contact with the upper surface of the toe 12, and then drops in front of the toe ready for re-engagement to open the valve as before. It is obvious that the angular position of the trip-lever 20, which is controlled by the governor, will regulate the amount of opening and time of closing of the valve, and the trip-lever may be depressed by the action of the governor so that only the inner portion 15 of the cam lever, will be held between the rollers, and the toe will not in this case engage with the latch; and on the other hand, the trip-lever may be raised by the action of the governor, so that the rollers will only engage with the outer portion 17 of the cam lever, and in this case the toe and latch will continue in engagement for the whole stroke, thus giving the latest possible cut-off of the steam: and between these extreme limits, the governor will control the cut off and supply of steam as required.

The governor link 23 is connected to the front side of the arm 22 of the trip-lever 20 located at the front end of the cylinder A, and a downwardly inclined link 38, extends from the pin 34 at the rear of the said trip-lever, to the rear of the trip-lever 20 at the opposite end of the cylinder, thus imparting the necessary reversal of motion to the two trip-levers.

The rollers 18, 18, are set out of line with the center of the valve stem 7, in order that

the cam lever 35 may be made of uniform width and fit the space between the rollers without backlash.

A modification of our invention is shown in Figs. 9 and 10, in which the rocker 5 is provided with the upwardly extending arm 5′, to which the cam lever 35′ is pivoted, and the pivoted latch 30′ is made to perform the function of the driving toe, the said latch being arranged to act upon a fixed portion 62 of the valve lever 24 above the valve stem 7, and being also actuated for engagement and disengagement by means of the cam lever 35′ which passes between the rollers 18, 18, as before described for the driving toe 12; and in this case the latch 30′ is pivoted to an arm 63 which is integral with the spindle 13′ to which the cam lever 35′ is attached, and the operation of this form of the device will be practically the same as that of the driving toe 12 and the latch 30 arranged below the valve stem 7, as before described.

We claim as our invention—

1. In an automatic cut-off engine, the combination with a rocker actuated by the eccentric, and a driving-toe jointed to the rocker and provided with a connected cam-lever having the circular segment portions, which are made of equal radius, eccentric with each other, and connected by an inclined cam portion, which joins the adjacent ends of the said segments, of the governor actuated trip-lever pivoted concentrically with the rocker, and provided with the rollers which embrace the opposite sides of the cam-lever and serve to actuate the connected cam-lever and driving-toe, substantially as described.

2. In an automatic cut-off engine, the combination with a rocker actuated by the eccentric, and the lever for actuating the valve, of the driving-toe controlled by the governor, and the latch having its pivot or turning axis out of the line of the driving pressure between the rocker and the valve lever, so that the latch will be automatically held in engagement by the direction of the thrust relatively to its pivot or turning point, substantially as described.

3. In an automatic cut-off engine, the combination with a rocker actuated by the eccentric, the lever for actuating the valve, and a latch jointed to the valve-lever and having its pivot or turning axis out of the line of driving pressure between the rocker and the valve lever, of a driving-toe controlled by the governor and adapted to impart an end thrust upon the latch, so that the latch will be automatically held in engagement, substantially as described.

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