

2 Sheets—Sheet 1.

No. 515,695.

Patented Feb. 27, 1894.



Reverence.
 Fred. W. Baker.

INVENTOR

Louis C. Royer
by G. B. Brock atty

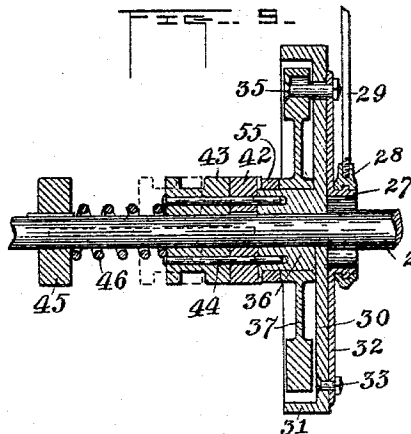
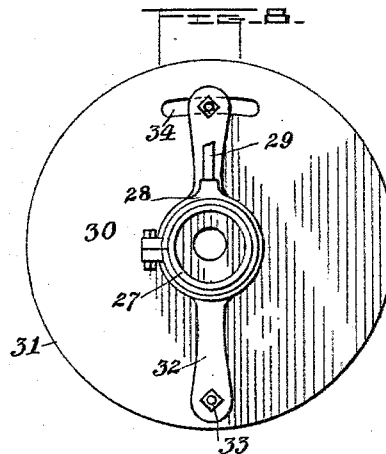
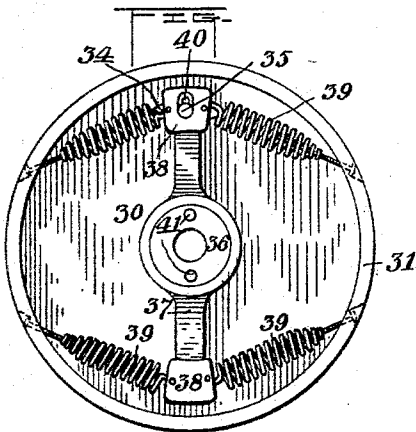
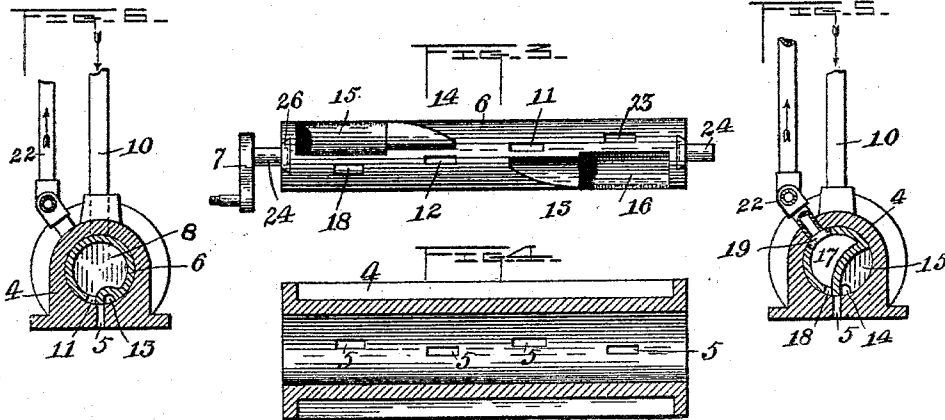
(No Model.)

2 Sheets—Sheet 2.

L. C. ROYER.
STEAM ENGINE.

No. 515,695.

Patented Feb. 27, 1894.



WITNESSES

G. J. C. Royer,
Chas. J. C. Royer.

INVENTOR

Louis C. Royer
by C. D. Brock, atty

UNITED STATES PATENT OFFICE.

LOUIS C. ROYER, OF DAYTON, OHIO, ASSIGNOR TO FENELON B. BROCK,
OF WASHINGTON, DISTRICT OF COLUMBIA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 515,695, dated February 27, 1894.

Application filed May 20, 1891. Serial No. 393,420. (No model.)

To all whom it may concern:

Be it known that I, LOUIS C. ROYER, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Steam-Engines; and I do 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 the figures of reference marked thereon, which form a part of this specification.

My improved engine is of the single-acting compound type, steam being used first in the two smaller cylinders and then exhausted over upon the pistons of the two larger cylinders.

Figure 1 is a perspective view of a multi-cylinder steam engine to which I have applied my improvements. Fig. 2 represents a central vertical sectional view of the same. Fig. 3 is a bottom plan view of the engine valve. Fig. 4 represents a top horizontal section of the valve chamber or steam chest. Fig. 5 is a transverse section of the valve and valve chamber, through one of the outer ports of the valve and seat. Fig. 6 is a similar transverse section through one of the inner ports of the valve and seat. Fig. 7 is a front elevation of the engine governor. Fig. 8 represents a reverse view thereof. Fig. 9 is a sectional vertical view of the engine governor and its connections, with the engine shaft in elevation.

My invention relates to engines.

The objects of my improvements are to construct a steam engine in such manner that in its valve action it will use the steam effectively and with the highest efficiency; and that, in the government of the valve, it will be under perfect and automatic control when the engine is running forward or backward, and in reversing either motion.

To effect these objects my invention consists in the following construction and combination of parts which will first be fully described, and the features of novelty then pointed out in the claims.

In the drawings—in the present instance

I have shown my improvements applied to a single-acting quadruple cylinder engine, but it is obvious that I may apply them to double-acting, compound, single or multi-cylinder engines, by suitable modifications.

1 is the engine bed.

2 is the crank-shaft and 2' the inclosing casing and bearings.

3 are four single acting cylinders arranged side by side, but I may use a less number when desired.

4 represents the valve chamber.

5 are the steam ports in said chamber communicating with the steam cylinders.

6 represents the valve which is of the hollow cylindrical type having an oscillating motion.

7 is the operating valve crank.

8 is the live steam chamber of the valve.

9 is the inlet orifice of chamber 8.

10 is the live steam pipe from the boiler which always registers with the inlet orifice 9 throughout the motion of the valve.

11 is the live steam inlet port for cylinder 3'.

12 is the steam inlet port for cylinder 3².

13 is the exhaust channel for cylinder 3' communicating with said cylinder in the oscillation of the valve, and 14 is a similar exhaust channel adapted to register with cylinder 3².

15 is the exhaust chamber communicating at all times with channel 14, and adapted to register with cylinder 3³ whereby the exhaust from cylinder 3² operates the piston in cylinder 3³, and 16 is a similar exhaust chamber upon the opposite side of the valve communicating with exhaust channel 13, and with the cylinder 3⁴ for charging the latter with the exhaust from cylinder 3'.

17 is one of the outer re-exhaust chambers in the valve 6 having a port 18 adapted to register with cylinder 3³ and an exhaust orifice 19 in communication at all times, with the exhaust pipe.

20 is the other outer opposite re-exhaust chamber in the valve communicating by a port 23 with the cylinder 3⁴, and by the exhaust orifice 21 with the exhaust pipe.

22 is the exhaust pipe having branches con-

necting the valve chamber 4 with the exhaust orifices 19 and 21.

24 are the trunnions or journals of the valve 6, having suitable bearings in the valve chamber heads 25.

26 are dovetail slides on either end of the valve working diametrically to the trunnions, and to which the former are rigidly attached. This construction compensates for the wear of the valve and valve seat, the valve in its oscillation being free to gravitate toward the valve seat upon the slides 26. The inner edges of all four ports 5 in the valve seat are upon the same line, and each alternate port is coincident in its position in the valve chamber.

27 is the eccentric on the shaft 2 for controlling the motion of the valve 6. 28 is the eccentric strap thereon, and 29 the pitman rod connecting strap 28 with the valve crank 7.

The governor device consists of disk 30 having a flanged rim 31, and connections.

32 is a lever pivoted on the back of disk or wheel 30 by a bolt 33. The eccentric 27 is formed on or carried by this lever, and encircles the engine shaft.

34 is a slot formed in the wheel 30 opposite the pivot bolt 33.

35 is a bolt rigidly secured to lever 32, and projects through said slot where it and the lever have a limited vibratory play carrying the eccentric and its strap with it to one side or the other of the shaft 2.

36 is the hub of wheel 30 upon which is mounted the weighted spring balanced counterpoise lever 37.

38 are the weighted ends, and 39 the four springs secured to the opposite sides and ends of the lever 37 and to the periphery of the governor wheel.

40 is a slot in lever 37 at right angles to the slot 34 in wheel 30 within both of which slots the bolt 35 on the lever 32 plays.

41 are pin holes in the hub 36, to receive a clutch mechanism.

42 is a collar keyed to the engine shaft 2, and having pin holes to receive the clutch pins.

43 is the clutch proper keyed on the shaft to prevent rotation but having a free sliding movement thereon.

44 are the pins secured to the clutch and moving therewith.

45 is another collar rigidly secured to the shaft 2, and 46 is a coiled spring resting between the clutch 43 and the collar 45 and tending to throw the clutch toward the governor wheel.

47 is a bracket projecting from the engine, upon which is secured a segmental notched bar 48.

49 is the clutch operating lever pivoted at 50 and having a bifurcated end 51 which rests in the annular groove 52 in the clutch 43.

53 is the usual locking toggle for the lever 49.

54 is a lever the inner end of which is provided with an annular rim 55 mounted loosely

upon the hub 36 of wheel 30 so as to swing thereon as a center.

56 is a brake shoe or clutch pivotally mounted upon the lever 54, and connected with the toggle lever 57. The inner outer edge of the flange or rim 31 of wheel 30 is serrated or roughened, preferably, so that, by operating toggle lever 57, the brake clutch 56 is brought firmly against said rim for the purpose of rotating the wheel and the eccentric carried thereby, by hand.

In describing the operation of my invention, we will assume that the engine is in a state of rest, and that the valve is set for running the engine in one direction—say forward—and it is desired to reverse the engine and valve. To accomplish this the toggle lever 53 is unlocked, and the clutch lever 49 is moved inwardly throwing the clutch 43 out of engagement with the governor and its connecting eccentric 27, due to the withdrawal of the pins 44 from the pin holes 41 in the hub 36 of governor wheel 30 against the pressure of spring 46. With the other hand the lever 54 and the toggle lever 57 are grasped bringing the brake shoe 56 to bear firmly against the inner side of the flange or rim 31 of wheel 30. The lever 54 is then swung upwardly carrying the wheel 30 and its attached eccentric 27 with it, the wheel 30 being rotated sufficiently far so that the eccentric 27 is carried a half revolution or opposite its former position, in relation to the engine shaft, or, in other words, until the withdrawn pins of the clutch, bearing against the hub 36 register with the diametrically opposite pin-holes 41, and snap back therein by the pressure of the spring 46. This movement of the eccentric 27 has carried the strap 28 with it and moved the pitman 29, crank 7 and valve 6, to cause a reversal of the ports of the valve. Just previous to this reversal the engine is shown with the engine cylinders 3' and 3³ just completing their piston stroke. The live steam entering through pipe 10 into chamber 8 passes through port 11 into cylinder 3', while at the same moment, the channel 14 is brought in line with cylinder 3³ so that the exhaust from said cylinder will enter the chamber 15 and pass into cylinder 3³ for the purpose of operating that cylinder piston. At the same time the exhaust port 23 of re-exhaust chamber 20 has been brought in line with cylinder 3⁴, and the re-exhaust from that cylinder passes out through exhaust pipe 22. Then the motion of the eccentric causes the valve 6 to rock closing port 11 and bringing channel 13 in line with cylinder 3', and the exhaust passes into chamber 16 to actuate the cylinder piston 3⁴; and, at the same time, the port 12 registers with piston 3² which receives the live steam direct from chamber 8 of the valve, while the port 18 is brought opposite cylinder piston 3³ which exhausts into re-exhaust chamber 17, and out through pipe 22. The counterpoise lever 37

is affected by the speed of the engine shaft and the wheel 30. The speed of governor wheel 30, whether running forward or backward, tends to exceed the speed of the lever, as it is loosely mounted on the wheel hub 36, and yieldingly connected with the wheel by the springs 39. This movement causes the lever 36 to be deflected to one side which deflection is constantly counteracted by the tendency of the springs to bring the lever back to its intermediate normal position which it assumes when the engine is at rest. This deflection according to the speed and direction of motion acts upon the bolt 35 attached to lever 32, and moving in slots 34 and 40, carrying said bolt and lever with it to one side or the other upon the pivot 33. The vibratory motion of lever 32 carries the eccentric 27 and strap 28 with it thereby decreasing the vertical movement of the pitman 29, and, through its connection with the valve, decreasing its movement also, the effect of which is to gradually cut off the steam to the engine as the speed increases and to supply more steam as the speed decreases, whether the engine is running forward or backward.

The most important object in view in constructing a valve device for this type of engine, and, in fact, for all others, is to make provision for a minimum travel or movement of the steam in the valve before and after the steam is admitted to the cylinder pistons. Where steam has to move any considerable distance through the valve it is liable to become condensed in a more or less degree; which objection is further followed by a tendency to create a vacuum in the valve creating back pressure.

My improved reverse action eccentric and its connections, may, by suitable modifications, be used in connection with other reverse automatic governors than the one here shown.

Provision will be made in the construction of my engine for reducing the tendency to

form a vacuum to the lowest practical minimum.

I claim—

1. The combination of a cylinder, a valve, a crank shaft, a governor wheel upon the shaft, a balanced weighted arm upon one side of the governor wheel mounted centrally upon the wheel hub, a second arm on the opposite side of said wheel pivoted at one end, and, at the other, connected to the weighted arm by a pin connection passing through the wheel, an eccentric formed upon the central portion of said second lever arm, and connections between said eccentric and said valve.

2. The combination of four cylinders having ports, and a valve communicating with the cylinders having a live steam chamber communicating alternately with two of said cylinders, two exhaust chambers communicating alternately with two cylinders, two channels in the valve leading alternately from two of the cylinders to said exhaust chambers, and two re-exhaust chambers communicating alternately with two of the cylinders.

3. The combination of four cylinders, ports therefor, and a valve having a central interior live steam chamber, interior reexhaust chambers upon each side of the live steam chamber, exterior exhaust chambers opposite the reexhaust chambers, and exterior exhaust channels leading from points opposite the live steam chamber to the exterior exhaust chambers.

4. The combination of a cylinder, a valve device, a governor, connections between the governor and the valve, a drive shaft, a clutch for engaging the governor with the shaft, and a shifting device for moving the governor and reversing the valve through said governor and valve connections.

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

LOUIS C. ROYER.

Witnesses:

GEO. L. CLARK,
F. B. BROCK.