

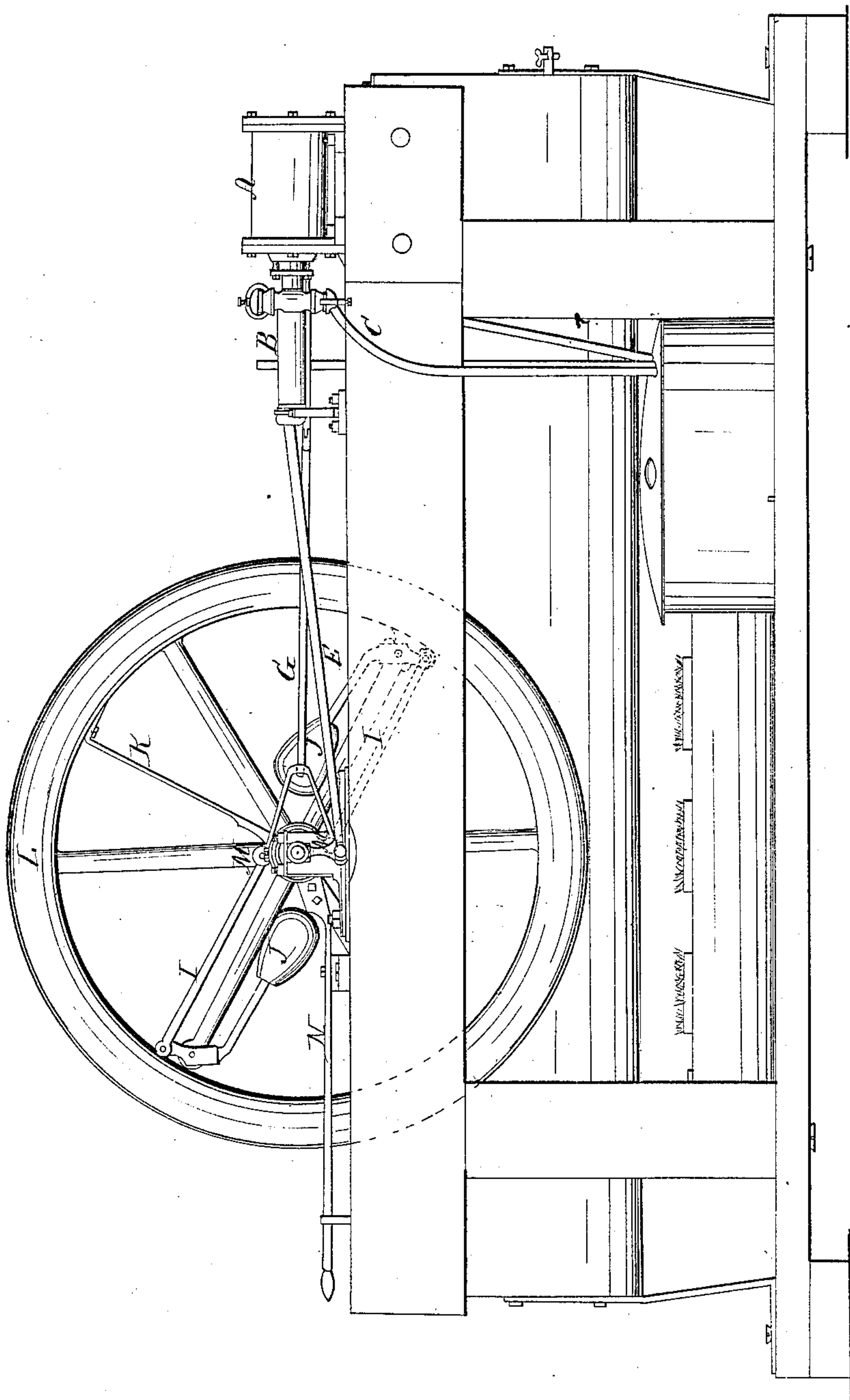
J. D. Custer, *2 Sheets-Sheet 1.*

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Governor.

N^o 1,179

Patented June 21, 1839.



J. D. Custer,

2 Sheets-Sheet 2.

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Fig. 4.

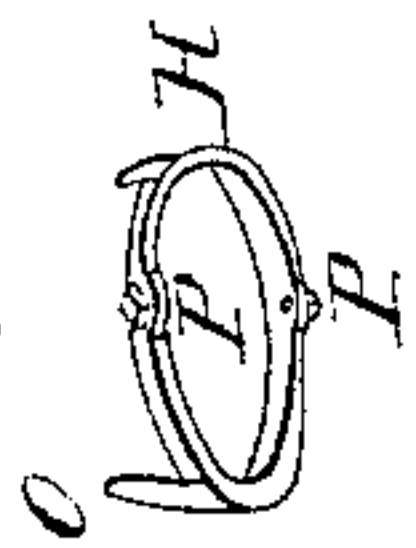


Fig. 6.

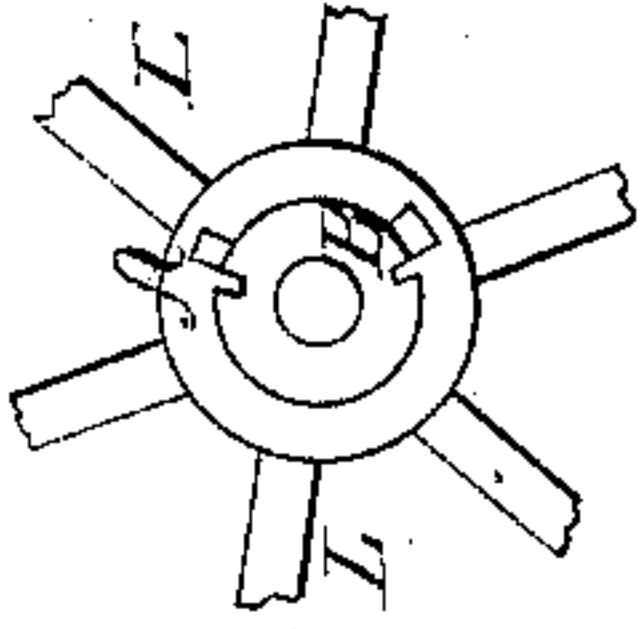


Fig. 5.



Fig. 3.

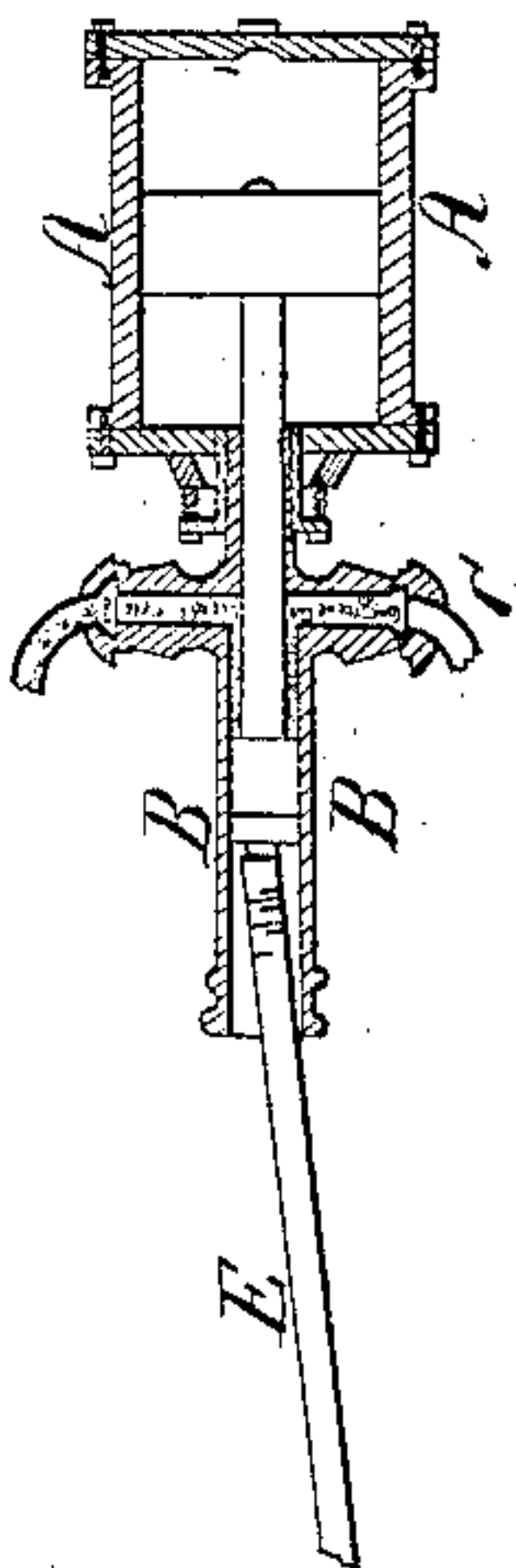
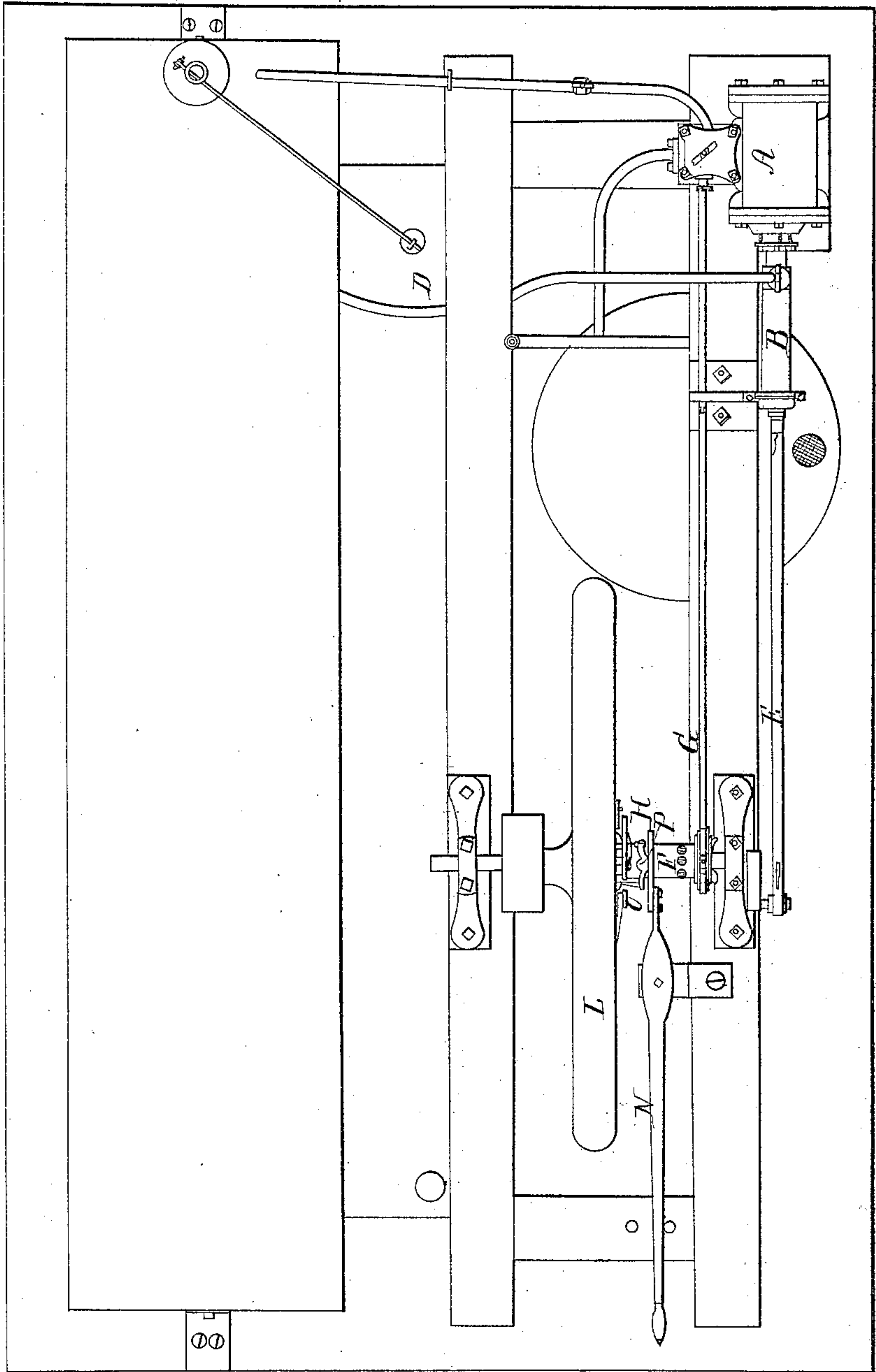


Fig. 2.



UNITED STATES PATENT OFFICE.

JACOB D. CUSTER, OF NORRISTOWN, PENNSYLVANIA.

MODE OF GOVERNING AND REVERSING STEAM-ENGINES, &c.

Specification of Letters Patent No. 1,179, dated June 21, 1839.

To all whom it may concern:

Be it known that I, JACOB D. CUSTER, of Norristown, in the county of Montgomery and State of Pennsylvania, have invented a
5 new and improved mode of governing steam-engines without diminishing the pressure of the steam and a new and improved mode of reversing the motion of steam-engines; and I do hereby declare
10 that the following is a full and exact description.

The nature of my invention, for governing steam engines, without diminishing the pressure of the steam, consists, in applying
15 balls, or weights, to the fly wheel, or to its appendages; so that they may move out from the shaft, when the motion of the wheel increases, and back again, when the motion of the wheel diminishes. I apply
20 a spring or springs, to the appendages of these balls, to assist the friction of the cylinder valves, to keep these balls from flying out too soon, and to force them back again, to the shaft of the fly wheel, when the motion of it diminishes. These governor balls,
25 I hitch to the arms, or brim of the fly wheel, by means of slides, or swinging levers. The balls, I fasten on the long ends of the swinging levers, and on the short ends of them, or near the pin on which they swing, I fasten rods, so as to form joints. These
30 rods, I call the governor connecting rods. And the other ends of these rods, I connect to pins which are on two stems of the tube of a shifting, eccentric, which open, and close the valves of the cylinder, or cylinders; so that when the balls move out from the shaft of the fly wheel, they operate on the shifting eccentric, by means of the governor
40 connecting rods, and move it forward, in relation to the dead points of the crank, and cut off the steam shorter, or nearer the dead points—that is, when the balls are in, it may be a threequarter stroke engine, and
45 when they are out, it may be a quarter stroke engine. Thus, while the cylinder valves are open, the steam will always strike the piston, with the same pressure, to the square inch, that it has in the boiler, which
50 is not the case in other governors, that govern by checking the progress of the steam, between the boiler, and the steam chest: for they diminish the pressure of the steam, so, that when it is up to one hundred pounds
55 to the square inch, in the boiler, it is worked

off in the steam chest and cylinder, at times, at, as low as five pounds to the square inch: which is a total loss of all the power of so much expansion.

The nature of my invention, for reversing
60 the steam engine, consists, in applying a spring latch H, to the tube F of the shifting eccentric, or eccentrics and a forward, and a backward motion notch, (shown at A, and B, in Figure 6,) to the axle, or shaft,
65 for the spring latch to fall into, and a banking pin (shown at A, and B, in Fig. 6) to the back part of each of these notches, to prevent them from passing the latch. This spring latch I make of sufficient
70 strength, to resist the friction of the cylinder valves, for there is nothing but this latch, to prevent this shifting eccentric, from standing still when the engine is in motion. And this spring latch H, top view Fig. 2,
75 must be made to raise out of the forward and backward motion notches, (shown in part at the bottom of the stem O, Fig. 2, and in whole at A, and B, in Fig. 6) but it must never be made to raise as high as to
80 permit the banking pins to pass under it, excepting for engines that require to be thrown out of gear. This spring latch is raised by a lever, with a ring to the short end of it, through which the tube of the
85 shifting eccentric, and axle passes, and when this latch is raised, by this lever, and ring, the latch and tube of the eccentric, the valve rod, and cylinder valves, stand still, while the wheels, and axle, make two thirds
90 of a revolution; [for the latch has two thirds of a revolution] to play in, between the two banking pins: and when the latch is in the forward motion notch, at the forward motion-banking pin, and the engine is moving
95 forward, the eccentrics, stand in such relation to the dead points of the crank, as to leave the steam enter the cylinders, after the cranks have passed the dead points, which drives the engine forward. Now the
100 lever is pressed, and the latch raised out of the forward motion notch, which is behind, and at the bottom, of the banking pin of the forward motion, and the latch, and all its appendages, stand still, until the wheels,
105 and axle make two thirds of a revolution, (or until the banking pin of the backward motion, comes around, behind the latch, and carries it along) which causes the eccentric, valve rod, and valves, to stand in such rela-
110

tion to the dead points of the cranks, as to leave the steam, enter the cylinder, at the end toward which, the piston is moving, and now the piston is checked, in its motion, and driven back,—before it passes the center, or middle, of the cylinder, and the motion of the wheels is changed.

To enable others skilled in the art, to make, and use my inventions, I will proceed to describe their construction, and operation.

The letter A, on the accompanying drawings, is the cylinder, with steam chest, slide valves, and pipes, as usual.

B, is the internal guide force pump. It, may be made on any of the known forms.

C, is the water pipe, leading from the water tank, to the lower part of the force pump.

D, is the water pipe, leading from the upper branch of the force pump, to the boiler. It is shown in the drawings, top view Fig. 2, No. 2.

E, is the connecting rod. It, may be made in this, or any of the known forms.

F, is the tube on which, the eccentric, or eccentrics, are fastened. It, is shown, in the drawings, top view, Fig. 2 No. 2. I slip this tube on the axle, or shaft of the driving wheels, and fasten the eccentrics, to it, permanently. For a stationary engine, I make two stems to this tube, (shown at M, M, Fig. 1,) opposite to each other. The top of the one, is shown, at M, in the drawings, (side view, Fig. 1, No. 1;) at the lower end of the connecting rod I. This rod, is connected, to this stem, by means of a pin, and key, and a corresponding rod I, (shown by dotted marks, Fig. 1, No. 1,) is hitched in the same manner to the other, opposite stem M, (shown by dotted marks, Fig. 1, No. 1,) of the tube F.

J, J, on the drawings, Fig. 1, No. 1, are the governor balls, or weights. I fasten them on the long ends of the swinging levers. These swinging levers, are, connected to two opposite arms, of the fly wheel, by means of pins and keys, so that the balls, may swing out, and in, between the arms of the fly wheel, as per draft. And to the short ends of these swinging levers, beyond the arms of the fly wheel to which they are connected, I hitch, the governor connecting rods I, I, by pins, and keys; so that when the motion of the fly wheel increases, and the centrifugal force of the governor balls, overcomes the friction of the cylinder valves, and the spring K, the said balls, will fly out from the shaft of the fly wheel, and move in the rods I, I, and as the one end of each of these rods, is connected to opposite or, corresponding stems, on the tube of the shifting eccentric,—they will move the tube F, and the eccentric, forward, in relation to the dead points of the crank, and cause the eccentric, the valve

rod G, (on the drawings side view, Fig. 1, No. 1,) and the cylinder valves, to stand in such relation to the dead points of the crank, as to cut off the steam shorter, or nearer the dead points of the crank, so that the engine will use off less steam and go slower. That is the valves, will not close, when the governor balls are in, until the piston is driven half way up the cylinder, but when the speed is great, and the balls are out the valves, will close, before the piston is driven one quarter up the cylinder. But while the valves are open, the steam will always strike the piston, with the same pressure to the square inch, that it has in the boiler.

K, in the accompanying drawings, is the governor spring. I fasten it to the brim of the fly wheel, by means of a pin, and a set screw, so as to set it for more, or, less speed. This spring may be fastened to any other suitable place on the wheel. It must be strong, so as to prevent the governor balls from flying out too soon, for they must be of sufficient weight, to prevent the friction of the cylinder valves, from vibrating them. When I make these governor balls light, I put a small, fly wheel to the tube F, on which the eccentric is fastened, to prevent the friction of the valves from vibrating them. This said fly wheel, is not shown in the model nor drawings.

The steam engines, the motion of which require to be reversed, I make without the governor balls, or rods; and apply the spring latch, H, to the tube F, (top view, Fig. 2 No. 2,) of the shifting eccentric, to keep it to its place, and to reverse the motion, by raising it out of its notches, by a lever, while the engine is in motion. This spring latch is shown at H, in top view, Fig. 2 No. 2, and in section No. 3, Fig. 4. In top view, Fig. 2, this spring latch is shown, in its raised position, with the ring of the reverse lever N, at H, pressing on it at one, side and the spring of the latch, pressing on it at the other side, also at H, and when the pressure of the lever N, is taken off, the spring at H, will press the long end, O, of this latch, into the notch at the bottom of it, opposite to H, at O. This notch, and its banking pin, and the other notch, and banking pin, are better shown in section, No. 3, Fig. 6. This spring latch, is connected to the tube of the shifting eccentric, by two screws, with square heads, (shown at P, P, Fig. 4, and at P, on the tube F, Fig. 2.) and a pin at the small end of each of them: one of them, is screwed, into the latch H, at each side, so that a pivot, extends into a pivot hole, at each side of the tube, and permits the latch to rise, and fall, so that when it is raised by the lever N, it will stop, with the shifting eccentric, valve rod, and valves; until the banking pin, and notch, of the other motion comes up to it, and carries it along. The friction of the

valves, will always cause the eccentrics to stand still, after the latch has been raised out of the forward motion notch, until the banking pin, of the other motion, comes up behind it, and carries it along, and it is the same, when the latch is raised out of the notch of the backward motion.

The banking pins, and notches, are shown in section No. 3, Fig. 6. This figure represents the shaft, or axle of the driving wheels. The square black mark, and notch, at A, in this figure is the banking pin and notch, of the forward motion, and the square black mark, and notch, at B, in this figure is the banking pin and notch, of the backward motion.

Section, Fig. 4, represents the latch H, and its spring, pressing on it at H. The stem, or pin on it, at the opposite side to H, at O, is the part of it, that catches in the notch at A, in Fig. 6, in forward motion, and in the notch at B, in this figure for backward motion. Now if this spring latch was unscrewed, and the short end of it, put where the long end of it now is, (as it is shown at H, in the drawings top view Fig. 2) so that the spring would press against the nipple, on the short end of it; and so that the long end, O, of it, would stand in the notch, at the bottom of the banking pin, of the forward motion, shown at A, in Fig. 6, then the steam would enter the cylinder, just after the cranks had passed the dead points, which would drive the engine forward. Now suppose the engine is going forward, the top of the wheel of the model, moving toward the cylinder, or the top of Fig. 6 moving to the right, and the long end of the latch H, in the notch, at the back part, and bottom of the banking pin of the forward motion, shown at A, in Fig. 6. Now the lever N, is pressed against the short end of the latch H, and the long end of it, is raised out of the forward motion notch (shown at A, in Fig. 6) and the latch H, the shifting eccentrics, the valve rods, and the cylinder valves, stand still, until the banking pin, of the backward motion, comes up behind the stem of the latch, and carries it along. Now the eccentrics, the valve rods, and valves, stand in such relation to the dead points of the cranks, as to have the steam enter the cylinders, at the end, toward which, the piston is moving, and now the motion of piston is checked, before it had passed the middle of the cylinder; the long end of the latch H, has fallen into the notch, at the bottom of the banking pin of the backward motion, shown at B, in Fig. 6, and the engine, is moving backward. Now to set it forward, I press the lever N, and raise the latch, out of the backward motion notch, at B, Fig. 6, and the latch, and its appendages, stand still, until the banking pin of the forward motion, comes to it, which puts on for-

ward steam, and the latch falls into the notch of the forward motion, and the engine moves forward.

If the lever N, is pressed, when the speed of the engine is great, the banking pin of the other motion will always come to the stem of the latch H, and carry it along, until the steam checks the speed, and changes the motion of the engine, so that it is only necessary for the latch to fall into the notch of the other motion, before it commences. It cannot fail to reverse, at any speed; for as soon as the banking pin, of the other motion, comes to the stem of the latch H, the steam, of the motion, that, that banking pin, and notch, is intended to give, is on, but when the momentum is great, it, is forced back, out of the cylinder, into the steam chest, and boiler, until the motion commences, which that banking pin, and notch is intended to give.

Section, Fig. 5, represents the lever N, by which the latch, H, is raised, out of the notches at the bottom of the banking pins, shown at A, and B, in Fig. 6. This lever N, I call the reverse lever. It has a ring, to the short end of it, through which, the axle, and tube, of the shifting eccentrics, pass. I, connect this lever to the frame, by a pin, or joint, so that the ring of it, may move out, and in on the tube of the shifting eccentrics, to raise the latch H. This latch, is now, unscrewed, on account of the governor, for the governor, and the reverse motion, cannot work together. To put the machine in order to reverse, the governor balls, and rods, must be taken off, and the latch H, unscrewed, and changed, so that the short end of it presses against the nipple, on the short end of the latch.

The same pressure of the lever N, will always reverse the motion the engine has, when it is pressed. The pressure of this lever, must always end, before the other motion commences, so that the stem of the latch, H, at O, may fall into the notch at the bottom of the banking pin of the other motion, before, it, commences.

I make four, six, or more holes in the tube F, to set a lever into, to reverse the engine, when it is standing still, and to work the valves by shifting the eccentrics around when the latch H, is raised by the lever N. These holes are shown, by three black marks, on the tube F, in top view, Fig. 2 No. 2. When it is necessary, for the engine to be thrown out of gear, I make the lever N, so that it will raise the latch H, so high, as to have the banking pins pass it, which throws the engine out of gear.

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

1. The attaching of the governor balls, in steam engines, to the fly wheel of the engine, and the connecting them to the eccentric in

the manner herein specified, by which means, the eccentric is made to move, backward, and forward, in relation to the dead points of the crank, and thus cut off the steam, 5 shorter, and longer.

2. I also claim the mode of reversing, the motion, of the steam engine, by means of a spring latch, attached to the tube of the shifting eccentric, in the manner specified, 10 which latch has a projecting pin upon it which falls into notches placed on the nave

of the wheel, and out of which notches, the latch is raised, by means of a lever, and ring, when the engine is in motion; all as herein described: using for these purposes 15 any material, and proportions which may answer best.

JACOB D. CUSTER.

Witnesses:

U. V. PENNYPACKER,
B. F. HANCOCK.