S. L. Wiegand,

Oscillating Steam Engine.

No. 45,199. Patented Nov. 22, 1864.

Fig. 1.

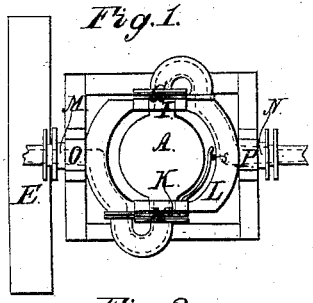


Fig. 7.

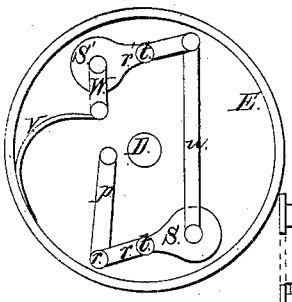


Fig. 4.

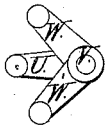


Fig. 8.

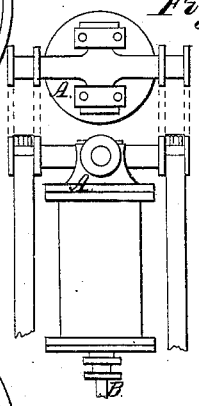


Fig. 2.

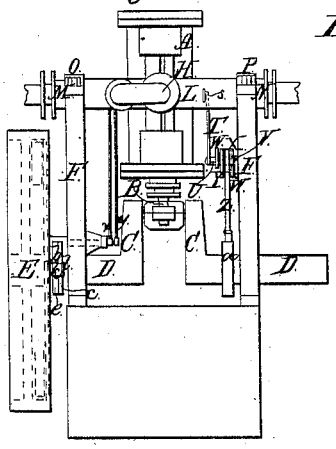


Fig. 3.

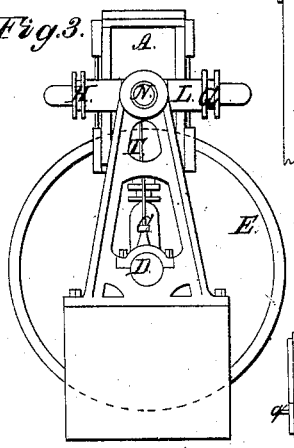


Fig. 5.

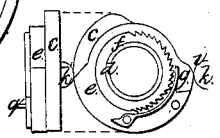


Fig. 9.

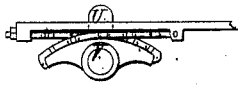


Fig. 10.

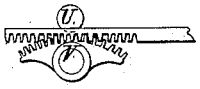


Fig. 6.

Fig. 6

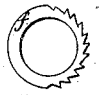


Fig. 6.

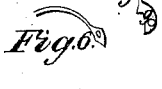
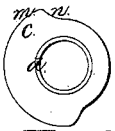


Fig. 6.



Witnesses.

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UNITED STATES PATENT OFFICE.

S. LLOYD WIEGAND, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. **45,199**, dated November 22, 1864; antedated November 9, 1864.

To all whom it may concern:

Be it known that I, S. LLOYD WIEGAND, of the city of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Steam and Pneumatic Engines; and I do hereby declare that the following is a full and exact description thereof, reference being had to the drawings annexed and making part of this specification, and to the letters of reference marked thereon.

The nature of my invention consists in suspending the cylinders of oscillating engines upon gimbal-rings, or their equivalents, so that a perfect parallelism of the axes of the cylinder-trunnions and the crank-shaft of the engine is not essential to the easy working of the engine. Another important advantage is realized in the suspending of the cylinder by a gimbal-ring—namely, that a space is permitted near the cylinder, at and near its axis of oscillation, for the attachment of rods to operate the valve-moving mechanism, so that the operation of the valves is not materially affected by the motion of the cylinder; and my invention also embraces some improved mechanism for operating the induction and exhaust valves of the engine, by means of which I economize power in the working of the valves and am enabled to employ a variable cut-off, controlled by the regulator or governor with less complex machinery than has heretofore been successfully employed.

Figure 1 represents a plan of the engine. Fig. 2 represents a front elevation of the engine. Fig. 3 represents a side elevation of the engine. Fig. 4 represents the rock-shaft of the exhaust-valve gear on an enlarged scale. Fig. 5 represents the cam of the steam-valve gear on an enlarged scale. Fig. 6 represents in detail the parts of the cam shown in Fig. 5. Fig. 7 represents the governor. Fig. 8 exhibits an oscillating cylinder suspended by a modification of this invention by a universal joint attached to the head.

The same letters of reference relate to the same parts in the several figures.

A is the cylinder of the engine, which may be of any of the known forms of construction, with sliding or partly rotative steam and exhaust valves.

B is the piston-rod. C is the crank. D is the shaft. E is the fly-wheel, and F is the frame of the engine.

G and H are the trunnions of the cylinder A, which, instead of resting upon bearings rigidly fixed to the frame of the engine, are supported in bearings I and K, formed by the ring L, which ring L is sustained by the trunnions M and N, resting in the bearings O and P in the frame F. It is obvious that a cylinder thus supported is free to vibrate in every direction, and as a consequence no straining of parts and undue friction will result when by wear or accident the shaft D ceases to be perfectly parallel with the axis of the trunnions M and N. The trunnions M, N, G, and H may be made tubular, and also the gimbal-ring L, so as to form channels or passages for the conducting of steam to and from the cylinder, as shown in sections by the dotted lines in Fig. 1. The exhaust-valves are worked by a lever, Q, whose fulcrum is upon the cylinder, and the center of the pin S, through which it receives motion, describes an arc passing through the axial line of the trunnions G and H. Motion is imparted to the lever Q by the link T, connecting it with the arm U of the rock-shaft V, which describes nearly or quite semicircular arcs. The effect of this motion of the rock-shaft V is to make the motion of the parts moved by the link T very rapid in the middle of the stroke and extremely slow as they approach the ends of the stroke, thus effecting a rapid and full opening of the exhaust-valves with but little motion when they are opened or when they are closed, and also a very rapid closing movement. There are two other arms, W and W′, to the rock-shaft V, through which it receives motion from the short links X and Y, which are of equal central lengths, and are attached by pins in the rod *z*, whose central distances from each other is equal to the central length of one of the short links X or Y. The rod *z* is operated by an eccentric or crank pin, *a′*, rotated by the main shaft of the engine, as shown in Fig. 2, or it may be moved by a cam on the shaft D, but I consider the crank or eccentric preferable.

The combined action of the eccentric *a*, rod *z*, links X and Y, and arms W and W′ is to impart, when the shaft D rotates, a vibratory motion to the rock-shaft V, which is very slow

as it approaches the extremes of its vibrations, but is rapidly accelerated near the middle of the vibration. This variable velocity of the rock-shaft V, combined with the effect of the semi-rotary motion of the arm U, moving the link T, which is connected either to a stem of the exhaust-valves or a lever operating the exhaust-valves, causes the motion of the exhaust-valves to be very slight when open and when closed, thus avoiding the friction when subjected to pressure, which is generally greatest during the travel of the piston, as is well understood by steam-engineers, and least at or near the commencement and termination of the strokes of the piston.

The rapid velocity of the valve affords a quick and free escape for the exhaust-steam from the cylinders without so great an enlargement of the exhaust-ports and valve or valves as would otherwise be requisite to accomplish the same end. The same motion of the rock-shaft V may be obtained by substituting for the arms W and W′ and links X and Y a sector and chains, as shown in Fig. 9, or a cogged segment and a rack, as shown in Fig. 10; but I prefer to use the links X and Y and the arms W and W′.

I am aware that a device has been made for causing the exhaust-valves of engines to have but little motion when closed and rapid movement when opening and closing by the use of a wrist-plate, with the studs so located that valves connected therewith have the most rapid movement when opening and closing; but this does not produce the slow motion or rest when the valves are opened which is attained by the use of the device I have hereinbefore described, and, as a consequence, both of the exhaust-valves cannot be operated from the same link and stud upon the wrist-plate, so that two valves having a larger extent of motion when opened are requisite on account of the velocity of the motion of them not being the same at the same time; but in my device one valve or two valves moved together can be used, because of the motion of the opened valve being the same as that of the closed valve, and for this reason a greater simplicity of parts in the valves is thus admissible without detriment to the working of the engine by resistance to the free escape of the steam, making a back pressure upon the piston.

The steam or induction valves are worked by the compound cam *b*, which consists of a cam, *c*, secured upon the shaft D, and which has a hub, *d*, upon which fits the cam *e*, so as to be susceptible of rotation. Against the cam *e* is placed a ratchet-wheel, *f*, fastened to the hub *d*, on which it is fitted. A pawl, *g*, is fixed on the side of the cam *e*, so as when the pawl *g* is engaged in the teeth of the ratchet *f* the cam *e* rotates with the cam *c* in whatever relative position it may be in to *c* at the time the pawl *g* engages in the ratchet *f*. The pawl *g* is of such a form that when disengaged from the ratchet *f* it projects beyond the cam *e* at the part marked *i*, in which position it is retained by the spring *h*, but when pressure is applied by the rollers *k* or *k′* on the levers *l* and *l′*, which operate the steam valves, the pawl *g* becomes engaged in the ratchet *f* with the effect hereinbefore stated.

The opening movement of the steam-valves takes place when the rollers *k* and *k′* descend from the more prominent part *m* of the cam *e* on the inclined part *n* to the smaller part, and remain open until the part *i* of the cam *e* moves the rollers to their former position, and thereby close the valves. It is obvious upon inspection that the duration of opening of the steam-valves is varied by the changes that are made in the relative position of the cam *e* to the cam *c*. The cam *c* is changed in position by the link *p*, attached to *c* by the pin *q*, and at the other extremity to the governor or regulator arm *r*. The governor consists of two weights or pendulums, *s* and *s′*, fastened upon the levers *r* and *r′*, which are hung upon the bearings *t* and *t′*, fixed diametrically opposite to each other at equal distances from the center of the shaft D upon the fly-wheel E; or they may be placed on a wheel made especially for them. The two pendulums *s* and *s′* are made independent of gravitation by being connected by the rod *u*, which is attached at one end to the pendulum *s* and at the other to the lever *r′* at the extremity opposite to that bearing *s′*. The pendulums thus balance each other, and they are forced in toward the center of the shaft by the spring *v*, connected to the pendulum *s′* by means of the link *w*.

The operation of this governor or regulator is as follows: When the fly-wheel E rotates, the pendulums *s* and *s′* describe larger circles in proportion as their velocity and consequent centrifugal force exceeds the elastic force of the spring *v* until an equilibrium is maintained between the centrifugal force of the pendulums and the elasticity of the spring *v*, and when the velocity of the wheel E diminishes the pendulums recede again toward the shaft by reason of the force of the spring V, the position of the pendulums and the levers *r* and *r′* which they are fastened upon is therefore determined by the velocity of rotation of the engine, and the cam *e* being connected by the link *q* to the lever *r*, the point of closing of the induction or steam valves is thus determined. The resistance of the induction-valves and their intermediate gear to receive motion from the cam *e* is prevented from reacting upon the governor by means of of the pawl *g* and ratchet *f* in the manner already explained. The same result might be attained by using a friction-clutch to hold the cam at intervals when it is closing the valve.

In all other respects than those in which I have already particularized, this steam-engine is like those in common use.

I am aware that engines have been made in which a cam or eccentric used for working the steam-valves has been varied and controlled in position by a centrifugal governor or regulator. This I therefore distinctly dis-

claim. I am also aware that a device has been made and patented for operating the valves of steam-engines by means of studs or pins upon a wrist-plate, which pins operate the valves, so that when open they have a large extent of motion and when shut have a small extent of motion in the valve at each end of the cylinder, being operated by a separate connecting-rod or link moved with a different velocity from the valve at the opposite end of the cylinder, as is set forth in the reissue patent of George H. Corliss, of May 13, 1851. This I distinctly disclaim; but in the mechanism which I have described and drawn I impart to both exhaust-valves one motion, and this motion is different from that produced by the device patented by said Corliss in this important particular—namely, that when opened at one and closed at the other end of the cylinder the exhaust valve or valves have little or no motion, and instead of rotating but nearly a quarter-circle my rock-shaft arm describes nearly semicircles, and the angular velocity of the said rock-arm is greatly augmented during the middle of its vibration by means of the peculiar arrangement of arms and links through which the said rock-shaft receives motion from the eccentric, and by reason of the great celerity of motion thus obtained and imparted to the valve when in mid travel I am enabled to use a form of exhaust-valve which during the instant of its greatest motion is open to both ends of the cylinder at once without experiencing any practical disadvantage in this adjustment of the valve; but

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

1. Closing the induction-valves by a positive movement of a cam, which, while it is adjusted and controlled in position by a centrifugal regulator, is locked or secured during the closing movement of the valve, so as to prevent the resistance of the valve-gearing from reacting upon the governor, substantially in the manner set forth and described.

2. Combining a centrifugal regulator whose plane of motion is coincident with or parallel to the plane of motion of the adjustable cam with the said cam used for operating the induction-valves, substantially in the manner set forth and described.

3. The arrangement of rock-shaft, in combination with the mechanism for imparting motion thereto, substantially as hereinbefore set forth and described, for operating the valves of steam or pneumatic engines.

4. Suspending the oscillating cylinder upon a universal joint, substantially as set forth and described.

5. Combining the centrifugal regulator with the fly-wheel in the manner set forth and described.

S. LLOYD WIEGAND.

Witnesses:
DENNIS MEAD,
JOHN WHITE.