(No Model.)

J. FRAZIER.

VALVE GEAR FOR STEAM ENGINES.

No. 271,577. Patented Jan. 30, 1883.

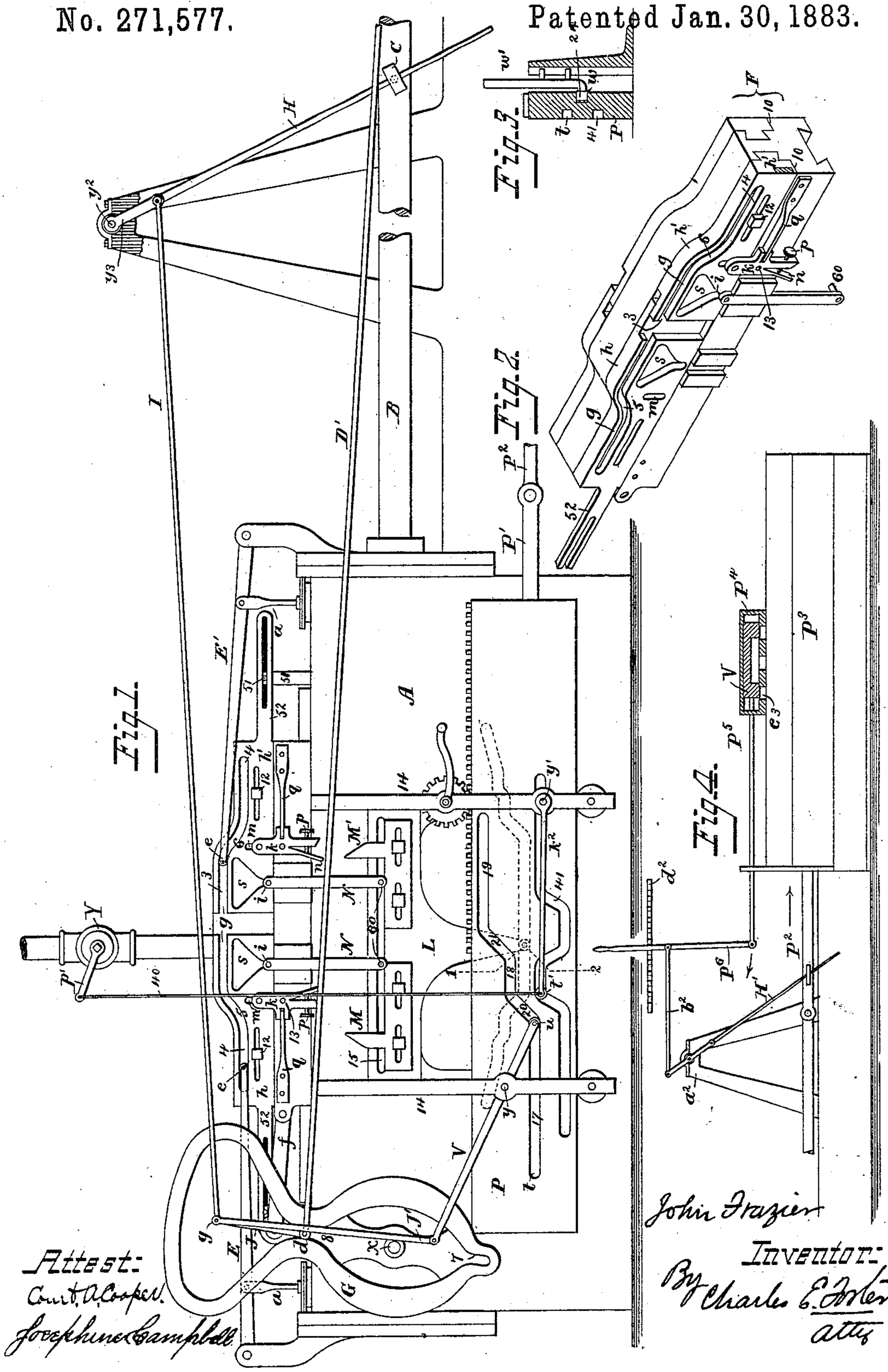

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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VALVE-GEAR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 271,577, dated January 30, 1883.

Application filed December 29, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN FRAZIER, of Searcy, White county, Arkansas, have invented certain Improvements in Valve-Gear for Steam-Engines, of which the following is a specification.

My invention is an engine constructed, as fully described hereinafter, so as to facilitate cutting off the steam, the reversing of the motion, and the manipulation of the various parts.

In the drawings, Figure 1 is a side elevation of sufficient of a reciprocating engine to illustrate my improvements. Fig. 2 is a perspective view of the valve-operating slide. Fig. 3 is a transverse section on the line 1 2, Fig. 1; and Fig. 4 is a side view, in part section, of the engine used for operating part of the main engine.

The cylinder A of the engine is provided with the usual piston, to which is connected the piston-rod B, the connecting-rod being generally attached to the crank of a shaft carrying the usual eccentric operating the eccentric-rod D′, from which the puppet-valves are moved. The stems *a a′* of the inlet-valves extend upward, and are connected to levers E E′, as shown. As each lever is raised the valve is lifted, and steam is admitted to that end of the cylinder. The levers are lifted alternately by means of a slide, F, moving in suitable guides upon the top of the valve-chest or cylinder, and reciprocated by the oscillation of a reversing-link, G, in the shape of a figure **8**, pivoted at *x*, connected by a rod, *f*, to a slide, F, said link receiving the pin *d* on the end of the eccentric-rod D′.

In the face of the slide F is a groove, *g*, the horizontal central portion, 3, being higher than the end portions, 4, and inclines 5 6, connecting the two portions; and pins *e*, carrying anti-friction rollers, extend from the levers E E′ into the groove. When the slide moves to the right the incline 6, immediately after the piston completes its stroke, lifts the end of the lever E′ and admits steam to the port at the right of the cylinder. The reverse takes place when the slide moves to the left.

The arrangement of levers and slot above described is duplicated on the opposite side, Fig. 2, to lift and lower exhaust-valves which are arranged at the other side of the cylinder in a manner too well known to need illustration, each exhaust-valve being opened immediately after the adjacent inlet-valve is closed. The valves are thus moved positively and held in place until it is time to again move them. The engine is stopped by bringing the pin *d* into the wider portion of the link G, and the direction of the motion is determined by bringing the pin *d* either into the notch 7 at the bottom of the link G or into the narrow channel 8 at the center.

To render it impossible to arrest the engine with its crank upon the dead-center, I combine with the same means whereby, when the pin *d* is at about the point *x*, a valve is opened to admit steam to one or other end of the cylinder whenever the piston is beyond the center of its stroke in either direction, but which closes said valve automatically when the piston is brought to a central position. Different devices may be used for this; as shown a pendulum-bar, H, vibrating with a shaft, y^2, and which extends through an eye, *c*, on the piston-rod; the shaft carries an arm, y^3, which is connected by a rod, I, to an arm, J, pivoted to the pin *d* and carrying a pin, *g*. When the pin *d* is brought opposite the center *x* to stop the engine the bar H, if the piston is beyond the center of its stroke, will be swung to such an extent that the pin *g* can only enter the channel 8 by tilting the link G, the effect of which is to move the slide F and open one of the valves, when the steam will enter the cylinder and move the piston. Then as the piston moves toward the center of the cylinder the link G carries back the slide F and closes the valve when the piston occupies a central position. To cut off at the required point of the stroke, it is necessary to make the inclines 5 6 adjustable on the slide F. This I do by forming the slide in sections, two sections or plates, *h h′*, resting on a rib or shoulder, 10, of the body of the slide on each side, and held in place on the latter so as to be longitudinally adjustable by bolts 12. By bringing these plates together the valves are closed sooner than results when said plates are separated. Into a vertical slot, *m*, in each plate *h h′* enters a pin on a lever, K, pivoted at 13 to the side of the slide F, and split at the lower end to form a spring or flexible tongue, *n*, which may be set to and from the end of the lever by a screw, *p*. A spring, *q*, tends to keep each lever in a ver-

tical position. In place of or in addition to this spring *q*, a pin, 51, on a standard, 50, opposite each end of the slide F, may enter a slot in an arm, 52, projecting from the plate of the slide, so that as the slide reaches the end of its movement in either direction the pin 51, striking the end of the slot, will stop the movement of the plate and bring it positively to place, thus avoiding dependence on the uncertain action of springs.

A vertically-adjustable plate, L, sliding between guides 14, carries two adjustable tappets, M M′, so arranged that after the plate is raised the movement of the slide F will bring the lower ends of the levers K against the tappets, so that said levers will be oscillated, sliding the plates *h h′* alternately and cutting off the steam sooner than would otherwise be the case. This results as the slide moves from either end toward the center of the cylinder, bringing the tongue *n* against the tappet M or M′, and by adjusting the tongue by the screw the exact moment of moving the valve may be determined. As the slide moves back the contact of the end of the lever K with the tappet sets the plate *h* or *h′* to its first position.

To lock the plates in place when the slide L is down and the cut-off not working, I use two bolts, N N, each sliding in guides on the slide F, and having lips 60 at the lower end entering a longitudinal groove, 15, in the plate L, so that the slide F and bolts can move horizontally without affecting said plate L. A pin, I, at the upper end of each bolt enters a notch in the adjacent plate *h* or *h′*, which notch extends toward the top to form a triangular recess, *s*, so that as the bolts are carried down the pins *i*, by contact with the sides of the recesses, will slide the plates *h h′* to their proper places, and by entering the notches at the ends of the recesses will lock the plates in place. When the bolts are lifted the plates can slide longitudinally without contact with the pins.

To raise and lower the end of the eccentric-rod, there is a longitudinally-sliding plate, P, moving in guides on the frame above, below, or alongside of the cylinder, and with a groove, *t*, having three horizontal parts, 17 18 19, and two inclines, 20 21. This groove receives an anti-friction roller, *u*, upon a lever, V, having its fulcrum *y*, and connected to a rod, J′, attached to the pin *g*. By moving the plate P to the right the roller *u* is carried into the groove 17, the eccentric-rod is raised, and the engine moves in one direction. By moving the plate to bring the roller *u* into the groove 18 the rod D′ and pin *d* are lowered and the engine stopped, and by moving the plate farther to the left the roller *u* is brought into the groove 19 and the engine started in a reverse direction. The adjustment of the cut-off devices is effected in like manner by prolonging the movement of the plate P in either direction when the engine is started. A groove, *w*, on the rear face of the plate P, Fig. 3, receives a pin, 24, on an arm, *w′*, attached to the plate L. The ends of the groove *w* are inclined, so as to raise the plate L whenever the plate P is moved after the engine is started, the degree of incline being increased toward the ends, so that the higher the plate L is raised the quicker will be the cut-off.

To turn on or cut off the steam, according to the position of the other parts, I connect the handle or arm *y′* of the steam-cock Y by a rod, 40, to a lever, K^2, pivoted at *y′*, and carrying an anti-friction roller, *t′*, that enters a groove, 41, in the plate P. Such groove is formed, as shown, so as to move the lever K^2 and cut off the steam when the engine is to be reversed and to turn on the steam at other times.

By forming the grooves *t w* 41 with longitudinal portions, as described, the levers are held in position after adjustment, and displacement from the jarring of the vessel is prevented.

To facilitate the setting of the plate P in any desired position, I combine therewith an operating-engine. (Shown in Fig. 4.) This consists of a cylinder, P^3, having the usual inlet and exhaust ports, a valve-chest, P^4, and slide-valve V, the stem P^5 of which is connected to the lower end of a loose hand-lever, P^6. The piston-rod rocks a bar, H′, as in the engine Fig. 1, and an arm, a^2, on this bar is connected by a rod, b^2, to the lever P^6, at one side of which is a stationary rack-bar, d^2. If the lever P^6 is set in the position shown by the dotted line, the valve V will be moved to the right and uncover the port e^3, and the piston will move in the direction of the arrow, carrying the plate P with it. As the piston moves, the lower end of the lever P^6 (bearing on one of the teeth of the rack as a fulcrum) will be drawn in the direction of its arrow until the port e^2 is closed, and as the lever takes the position shown in full lines and the engine ceases its movement. Thus by setting the lever P^6 the valve may be shifted so as to set the engine in motion, and the engine arrests itself after moving to any desired extent. The piston-rod P^2 may be connected to a rod, P′, of the plate P.

Without limiting myself to the precise construction of parts shown, I claim—

1. The combination, in a steam-engine, of the cylinder, puppet-valves, and reciprocating slide F, having a groove, *g*, with inclines 5 6, and levers E E′, connected to the valve-stems, and having lugs extending into said groove, substantiatially as set forth.

2. The slide F, composed of sections, the outer sections being grooved and adjustable longitudinally, as specified.

3. The combination of the slide, its adjustable grooved sections, levers K, carried by the slide, and tappets M M′, substantially as set forth.

4. The levers *k*, combined with the slide and tappets, and provided with spring-tongues and set-screws *p*, as specified.

5. The combination, with the slide and levers, of tappets M M′, secured to a vertically-adjustable plate, L, having a slot, 15, and carrying bolts N N, substantially as specified.

6. The standards 50 and pins 51, combined with the slide F and slotted arms 52, as specified.

7. The combination, with the cylinder, its slide F, and valves operated thereby, of the 8-shaped reversing-link G, and eccentric-rod D′, carrying a pin, *d*, and being adjustable, as set forth.

8. The combination, with the cylinder, slide, reversing-link, eccentric-rod, and pin *d*, of the arm H, vibrated by the piston-rod, rod I, pin *g*, and rod J, substantially as specified.

9. The combination, with the engine and appurtenances described, of the plate B, having slots *t w*, and lever J′, connected to the pin *g*, substantially as set forth.

10. The plate P, having a groove, 41, in combination with the cock Y, lever K^2, and rod 40, as described.

11. The combination, with the cylinder of the auxiliary engine, of the valve V, rock-arms H′ a^2, lever P^6, rack-bar d^2, and rods b^2 P^5, substantially as set forth.

12. The combination, with a steam-engine and with its valves and valve-operating appliances, of connecting devices, substantially as described, between said valves and an operating part of the engine, whereby said valves are maintained open except when the piston reaches about a central position, and are then automatically closed, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN FRAZIER.

Witnesses:

CHARLES E. FOSTER,

A. E. T. HANSMANN.