(No Model.) 2 Sheets—Sheet 1.

N. T. GREENE.

LIBERATING VALVE GEAR FOR ENGINES.

No. 422,769. Patented Mar. 4, 1890.

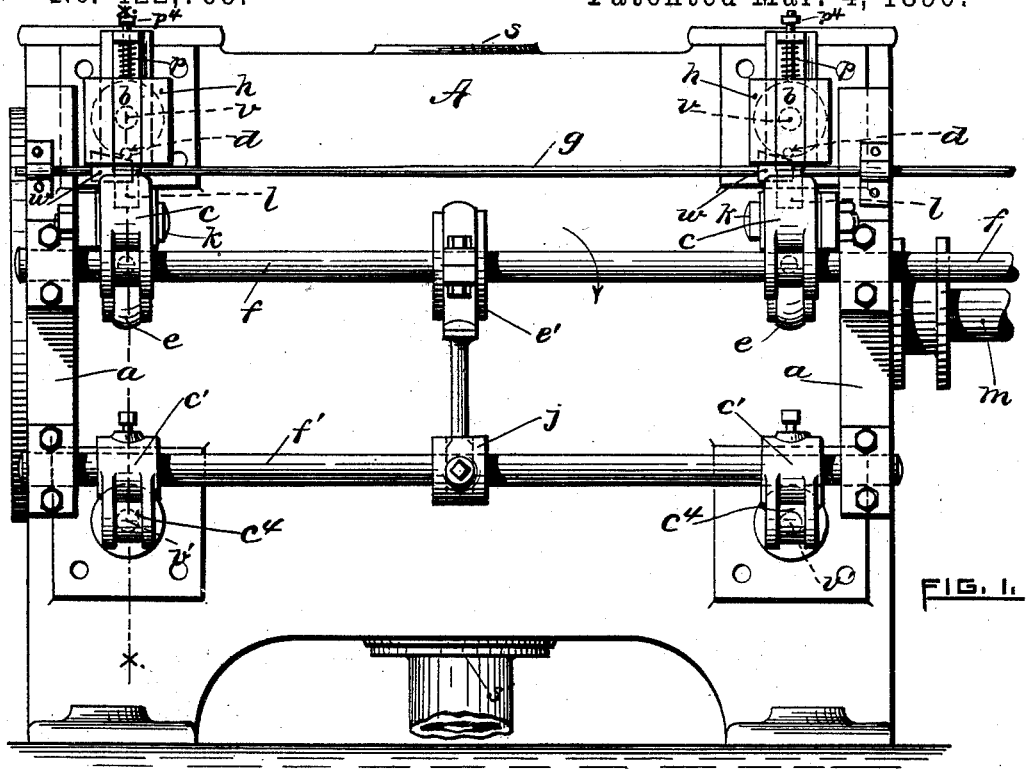

FIG. 1.

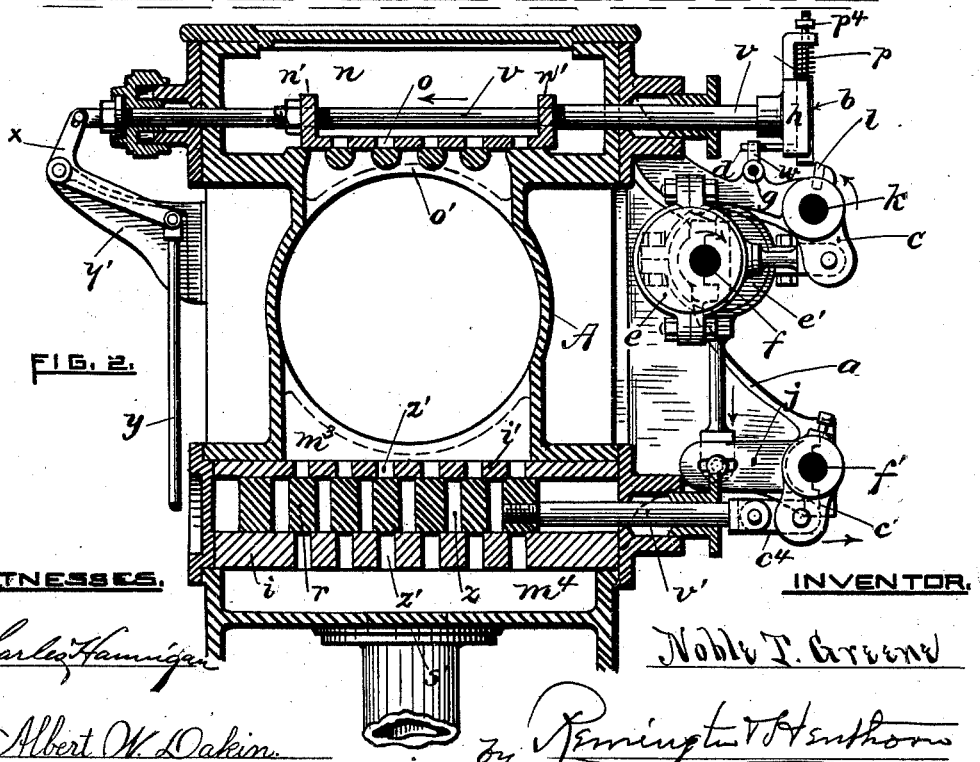

FIG. 2.

WITNESSES.

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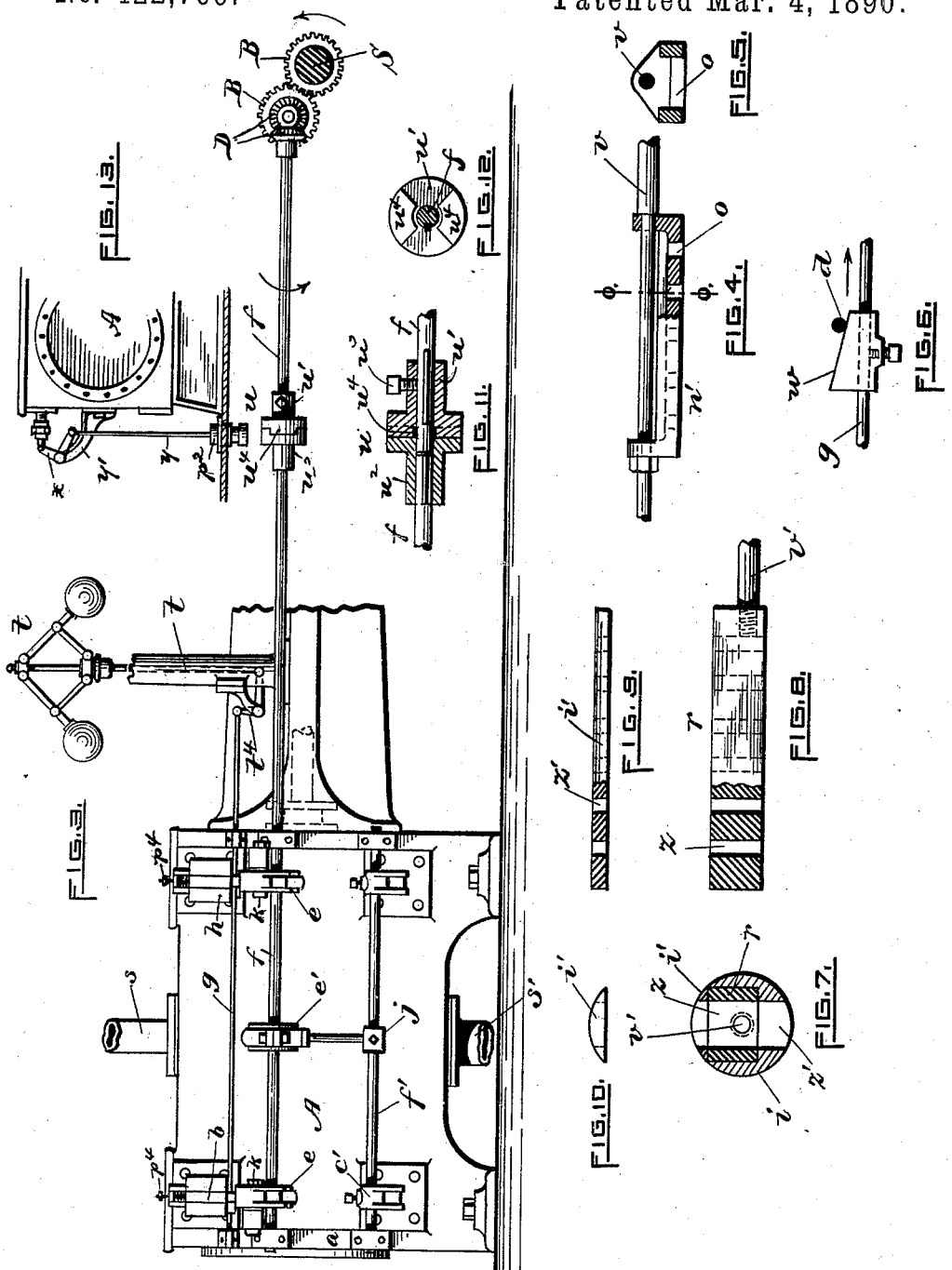

FIG. 13.

FIG. 12.

FIG. 11.

FIG. 5.

FIG. 4.

FIG. 6.

FIG. 3.

FIG. 9.

FIG. 8.

FIG. 10.

FIG. 7.

WITNESSES.

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UNITED STATES PATENT OFFICE.

NOBLE T. GREENE, OF PROVIDENCE, RHODE ISLAND.

LIBERATING VALVE-GEAR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 422,769, dated March 4 1890.

Application filed October 21, 1889. Serial No. 327,692. (No model.)

To all whom it may concern:

Be it known that I, NOBLE T. GREENE, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Liberating Valve-Gear for Steam-Engines; and I do hereby 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 letters of reference marked thereon, which form a part of this specification.

The improvements forming the subject of my present application relate to liberating valve-gear for steam-engines; and it consists, essentially, of a transversely-arranged self-closing slide-valve, a valve-rod carrying a governor-controlled latch, and a tappet operating crosswise of the cylinder, all as will be fully hereinafter set forth and claimed.

The object I have in view is to provide automatic cut-off engines with an improved liberating valve-gear arranged to operate the steam-valves crosswise of the cylinder.

By means of my improvements the several adjustments of the valve-gear may be readily effected.

In the accompanying two sheets of drawings, Figure 1, Sheet 1, is a side elevation of a steam-engine cylinder provided with my improvements viewed from the back side, the cylinder having crosswise-working slide-valves. Fig. 2 is a transverse sectional view taken on line $x\ x$ of Fig. 1. Fig. 3, Sheet 2, is a side elevation viewed from the rear side thereof, showing in reduced scale the cylinder, valve-gear, and governing and driving mechanism therefor. Fig. 4 is a side view, in partial section, of an ordinary gridiron or register slide-valve—that is, a valve having multiple ports. Fig. 5 is a transverse sectional view taken on line $o\ o$ of Fig. 4. Fig. 6 is a side view of the wedge or lifter-block directly actuated by the governor. Fig. 7 is a cross-sectional view of the exhaust-valve and its seat. Fig. 8 is a side view, in partial section, of the exhaust-valve. Fig. 9 is a similar view of the ported covering-plate for the valve. Fig. 10 is an end view of the plate. Fig. 11 is a longitudinal sectional view of a clutch adapted to reverse the engine's movement. Fig. 12 is an end view, and Fig. 13 is a partial end view, of the cylinder, in reduced scale, showing a weight or dash-pot of usual construction for closing the steam-valve.

The general construction and arrangement of the cylinder, frame, pillow-blocks, main shaft, and other parts of the engine, excepting the liberating valve-gear and the manner of operating the same, are substantially the same as common to engines of this class or type. Therefore I deem it unnecessary to more specifically describe such common parts in detail.

The following description refers more particularly to my present invention.

A, referring again to the drawings, designates a steam-engine cylinder as a whole provided with register-valves and seats.

n is the steam-chest, and m^4 the exhaust-chest, the former having the series of port-openings o', the latter having the large port m^3. As drawn, the exhaust-chest is bored out to receive the seat i, provided with ports z', the seat itself being planed out to receive the valve r, which in turn has a series of openings or ports z, which coincide with those of the seat. To the top of the valve is fitted a stationary covering-plate i', having openings z', all as clearly shown in Figs. 2 and 7 to 10.

The exhaust-valves are actuated by an eccentric e', secured to a mounted shaft f, revolving in unison with the main shaft of the engine. The eccentric is jointed to an arm or lever j, secured to the rocker-shaft f', mounted in bearings at the ends of the cylinder. Near each end of the rocker-shaft is secured a short lever c', which, through the medium of a link c^4 and valve-stem v', secured to the valve, reciprocates the corresponding exhaust-valve crosswise of the cylinder, as in opening and closing, the exhaust-steam passing into the chest m^4 and thence to the exhaust-pipe s', as common.

Each of the steam-chests n is fitted to receive a gridiron-valve n', secured to a valve-stem v, passing transversely through each end of the chest, the ports or openings o coinciding with those o' of the seat. To the front

end of the valve-stem is jointed a pivoted lever x, which in turn is jointed to a drop-rod y, attached to a weight or piston p^2, fitted as common to a dash-pot. (See Fig. 13.) By this means it is evident that the weight or vacuum formed beneath the piston p^2 acts to close the steam-valve upon being released by the valve-gear about to be described. Obviously the valve-stem is prevented from turning on its axis by being rigidly secured to the valve n', or by other suitable means. The valve-stem thus travels to and fro across the cylinder through the stuffing-boxes without turning, similar to a piston-rod. At the rear end of the stem is secured a head h, which is planed out to receive a steel sliding piece or latch b, adapted to slide up and down therein and resisted at the top by the pressure of a guided small spring p. To the latch is secured a pin d, which extends rearwardly therefrom and rests upon the cam or wedge-shaped block w, adjustably secured to a guided rod g, controlled and actuated by the governor t, all as clearly shown. The distance between the adjacent faces of the head h and cam w exceeds somewhat the extreme movement of the valve.

The eccentric-carrying shaft f and the rocker-shaft f' are mounted in bearings formed in brackets or extensions a, projecting from the rear side of the cylinder. The shaft f is driven through the medium of the main shaft S, toothed wheels B B, and the miter-gears D. (See Fig. 3.) At or near the ends of the cylinder and contiguous to the latches b are mounted stationary studs k, each carrying a lever c, provided at its upper side with a steel tappet l, the face of which engages the lower portion of the latch b. A vibratory movement is imparted to the tappet-lever c by means of an eccentric e, secured to the shaft f, the eccentric-strap being jointed to the lever, all as clearly represented in Fig. 2. I would state that I prefer to so arrange the latch and stud k with relation to each other that the working-face of the former stands directly in line with the axis of the latter when the steam-ports are closed, the face of the tappet l at the same time just engaging its latch, while the corresponding eccentric e is on its "dead-center."

The regulation of an engine provided with my improved valve-gear is effected substantially as common—that is to say, the vertical movement of a fly-ball governor t, Fig. 3, is imparted to a lever t^4, which in turn imparts to the horizontal governor-rod g a simultaneous movement to and fro parallel with the cylinder. To the governor-rod g is adjustably secured a wedge or tripping block w, (see Fig. 6, &c.,) having its upper face beveled in the direction of its length. From this it will be apparent that the point of cut-off is determined or controlled by the position of the wedge and the latch resting thereon through the medium of the pin d in conjunction with the curvilinear movement of the tappet l. Obviously now as the speed of the engine increases the governor-balls in their revolutions depress the lever t^4, thus carrying the rod g ahead or in the arrow direction, Fig. 6, and consequently lifting the latches b against the resistance of the springs p and resulting in a shorter cut-off, an extreme of speed lifting the latches to such an extent as to allow the tappets to vibrate clear of them, thus preventing the parts from "hooking on."

In Figs. 11 and 12 I have represented an arrangement for reversing the engine or changing the direction of rotation. This is effected by withdrawing the loose half u' of the clutch u from its fellow u^2, mounted upon a shaft f, consisting of two pieces, and then turning the crank-shaft around the desired distance, or that portion of the shaft f having the several eccentrics secured thereon may be correspondingly revolved, after which the said parts u' u^2 are reclutched. If necessary, the eccentrics may be loosened and reset in addition. As this manner of reversing an engine will form the subject of a subsequent application for United States Letters Patent to be filed by me, I do not deem a fuller description thereof necessary to the present specification.

Assuming now that a cut-off engine having slide-valves working crosswise of the cylinder be provided with my improvement, the operation is substantially as follows: Motion is given to the valve-gear shaft f by means of suitable gearing, &c., worked directly from the main shaft. Each steam-valve is operated by an independent short-stroke eccentric e, adjustably secured to the shaft f, thereby vibrating the tappet l a uniform distance at each revolution of the engine. An advantage derived from such construction is that the steam-valves may be kept open during the full length of the stroke of the piston, as well as permitting of the shortest cut-off. By means also of the individual eccentrics it is evident that the steam-valves may be so set as to correct any peculiarities in the cylinder, such as compression, lead, &c. The face of the tappet l engages the outer face of the sliding latch b at its lower end, (see Fig. 2,) the latter being so adjusted that the degree of contact will be sufficient to completely open the steam-valve before "unhooking." Immediately upon thus releasing the valve the latch will be forced rearwardly past and over the tappet by means of the weight p^2, thereby quickly shutting off the steam from the cylinder, the valve now being in its normal or stationary position. The continued movement of the eccentric e carries the tappet back to its normal position, as in Fig. 2, the tappet in its rearward movement passing under and lifting the latch, which instantly drops to its limit by the action of the spring p. The maximum downward movement of the latch may be regulated by an adjusting-nut p^4 at the upper end of the latch's stem. Obviously the rela-

tive vertical position of the tappet to the latch is mainly controlled by the governor through the medium of the tripping-block *w* and the pin *d*, secured to the latch, a long cut-off maintaining the latch and tappet in contact through a much greater arc than a short cut-off, the former position corresponding, say, to Fig. 6, whereas for the latter the block *w* would be advanced in the arrow direction, thereby preventing the pin *d*—*i. e.*, the latch—from falling so far. The pin, as before stated, slides back and forth transversely of and resting upon the block in unison with the valve's movement, the relative position of the block being automatically changed by the governor, as common, according to the load imposed upon the engine.

The exhaust-valves are operated by a single eccentric *e'*, adjustably secured to the rocker-shaft *f'*.

It is no doubt generally understood that in engines of this class or type the several valves and connections are so arranged that both steam or both exhaust valves are not open at the same time. The regulation may be effected by a fly-ball governor, as common, a weight or dash-pot being employed to cut off the steam by the closing of the steam-valve upon the release of the latch by the oscillating tappet.

It occasionally happens in operating automatic cut-off engines that it may be desirable, owing to a temporary derangement of the valve-gear, to run the engine by a fixed or positive cut-off. I am enabled by means of my improvements to readily accomplish this result through the medium of the adjusting nut or nuts p^4, or other equivalent means attached to the upper end of the latch *b*, thereby limiting the elevation or movement of the latch, the blocks *w* in such case being removed. When thus arranged, the tappet acts to open the valve and the weight p^2 to close it. Unscrewing the nut increases the vertical movement of the latch and produces a longer cut-off, screwing down the nut obviously shortening the point of cut-off.

What I claim is—

1. The combination, in a cut-off steam-engine provided with exhaust-valves working crosswise of the cylinder, of self-closing steam-valves, also adapted to work transversely of the cylinder, self-dropping latches mounted in heads secured to the steam-valve rods or stems and moving in unison therewith, governor-controlled tripping-blocks engaging said latches and determining the amount of their vertical movement, and eccentric-driven pivoted tappets vibrating transversely of the cylinder engaging the lower end of said latches to open the steam-valves.

2. The automatic detachable valve-gear for steam-engines, substantially as hereinbefore described, the same consisting of two self-closing steam-valves working transversely of the cylinder, valve-rods having said valves secured thereon, a head secured to each rod, a self-dropping or spring latch mounted to travel vertically in each head and at the same time traveling to and fro in unison with the steam-valve's movement, tappets mounted to vibrate on stationary pins, continuously-revolving eccentrics vibrating said tappets to uncover the steam-ports, and governor-controlled tripping-blocks or cams directly engaging the latches, for the purpose specified.

3. In an automatic steam-engine having steam and exhaust valves adapted to work transversely of the steam-cylinder, the combination of a mounted eccentric-carrying or valve-gear shaft parallel with the axis of the engine and revolving in unison with the crank-shaft, two steam-eccentrics adjustably secured to the valve-gear shaft adjacent to the steam-valves, pivoted tappets transversely vibrating by means of said eccentrics, governor-controlled self-dropping latches mounted in heads secured to the steam-valve stems and engaging the tappets, an exhaust-eccentric adjustably secured to the valve-gear shaft, a rocker-shaft actuated by means of the exhaust-eccentric, and levers secured to the rocker-shaft and jointed to the exhaust-valve stems, substantially as shown and hereinbefore described.

4. The combination, in a cut-off steam-engine, of governor-controlled tripping-blocks or cams, adjustable self-dropping latches engaging the tripping-blocks, pivoted tappets engaging the latches and actuated by continuously-revolving independent adjustable eccentrics, self-closing gridiron steam-valves arranged to travel crosswise of the cylinder, and valve-rods carrying said valves and latches, all combined and operating substantially as hereinbefore described.

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

NOBLE T. GREENE.

Witnesses:
CHARLES HANNIGAN,
ALBERT W. DAKIN.