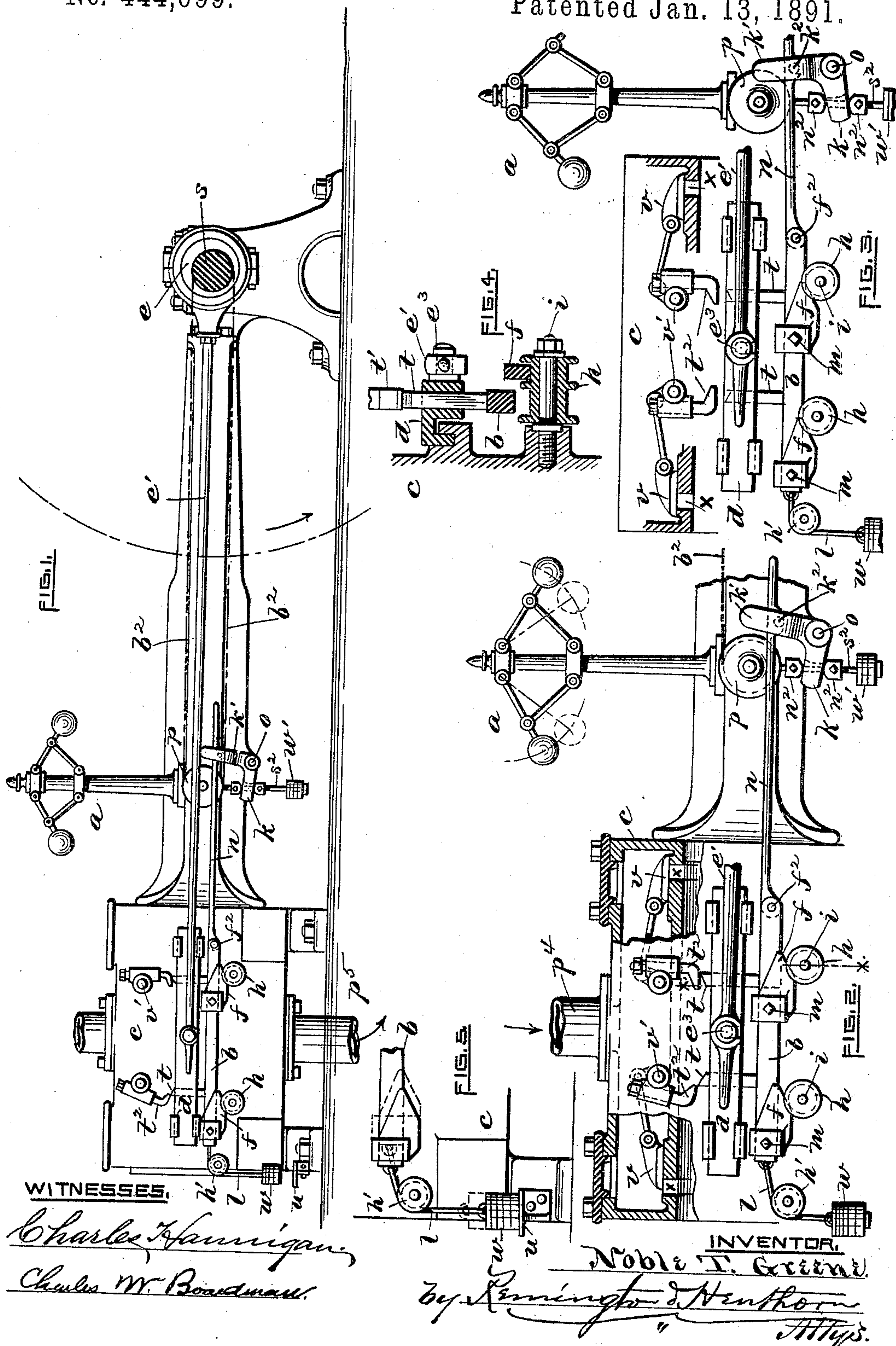


(No Model.)

N. T. GREENE.  
SAFETY VALVE GEAR FOR STEAM ENGINES.

No. 444,699.

Patented Jan. 13, 1891.





# UNITED STATES PATENT OFFICE.

NOBLE T. GREENE, OF PROVIDENCE, RHODE ISLAND.

## SAFETY VALVE-GEAR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 444,699, dated January 13, 1891.

Application filed October 17, 1890. Serial No. 368,458. (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 Safety 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.

My invention illustrated herewith is applicable to automatic cut-off steam-engines provided with detachable valve-gear having self-closing steam-valves. The device is, however, more particularly adapted to be employed in cut-off engines provided with governor-controlled vertically-moving tappets, examples of which have been patented to me by the following United States patents: No. 12,507, of March 13, 1855, No. 384,146, of September 4, 1888, and No. 425,219, April 8, 1890. The object I have in view is to render such engines safe from injury in case the governor-belt breaks, or, in other words, in the event of the sudden stoppage of the governor from any cause the device forming the subject of my present invention instantly comes into action, thereby automatically withdrawing the tappets from the toes of the steam-valve levers, the valves themselves at the same time closing the steam-ports communicating with the cylinder.

My invention consists, essentially, in the combination, with a mounted reciprocating tappet-carrying bar or slide and mounted toe-carrying valve-operating levers arranged to engage said tappets, of a mounted governor actuated and controlled gage-bar provided with means for changing the relation or position of the tappets to the toes of the said valve-levers, all as will be more fully hereinafter set forth and claimed.

In the accompanying sheet of drawings, Figure 1 is a side elevation of a steam-engine provided with my improvements, viewed from the back of the engine. Fig. 2 is an enlarged side elevation, in partial section, showing a

portion of the engine, the several parts being in a normal position, as in operation. Fig. 3 is also a side view, the relation of the parts corresponding to a depressed position of the governor-balls, as when the engine is not in operation. Fig. 4 is an enlarged transverse sectional view taken on line  $x-x$  of Fig. 2, and Fig. 5 is a partial side view showing a bracket or stop for limiting the endwise movement of the bar when disconnected from the governor.

The following is a more detailed description of the invention and the manner of its operation.

$a$ , referring to the drawings, indicates an engine fly-ball belt-driven governor of ordinary construction, the same having a central rod or shaft  $s^2$  arranged to move in a vertical direction in unison with the arc movement of the balls. (See dotted lines, Fig. 2.) The rod  $s^2$  is provided with counter-weights  $w'$  and a pair of collars  $n^2$ . The adjacent faces of the latter are well rounded and engage an arm  $k$  of a pivotally-mounted angle-lever. The other (and preferably longer) arm  $k'$  of the lever is bent or offset and provided with a pin  $k^2$ , to which is jointed a rod  $n$ , which in turn is jointed at  $f^2$  to the horizontally-mounted tappet-supporting or gage bar  $b$ . This bar is provided with two dogs  $f$ , adjustably secured thereto by set-screws  $m$ . The lower faces of the dogs are inclined or beveled and rest each upon a flanged wheel  $h$ , loosely mounted upon a stud or pin  $i$ . (See Figs. 2 and 4.) By this means it is obvious that any variation in the position of the governor-balls due to a change in load, &c., produces a corresponding change in the position of the rods  $s^2$ , and likewise an endwise movement of the bar  $b$ ; but as the latter is supported by the inclined surfaces of the dogs resting upon the wheels  $h$  it follows that the bar will also at the same time change its position in a vertical plane.

The drawings, Figs. 1 and 2, represent a steam-engine having a detachable valve-gear, substantially as set forth in the patents hereinbefore referred to. The valve stems or rods  $v'$  connect with and operate the steam-valves  $v$  to uncover the steam-ports  $x$ . To the rear end of the valve-rods are secured rocking le-



vers carrying toes  $t^2$ , the lower ends of which are beveled and adapted and arranged to engage the oppositely-inclined upper ends of the vertically-movable steel tappets  $t$ , mounted in  
 5 a sliding bar or carrier  $d$ , which reciprocates back and forth longitudinally of the cylinder  $c$  in suitable guides by means of the eccentric  $e$  and its rod  $e'$ , jointed to a pin  $e^3$ , secured to the bar. The tappets  $t$  extend through the  
 10 lower side of the sliding bar and rest upon the upper face of the supporting or gage bar  $b$ .  
 Now, from the foregoing description it is apparent that an engine having its governor  $a$  driven by a belt  $b^2$  will cause the rod  $s^2$  to  
 15 move vertically up or down in unison with any change in diameter of the circle plane described by the governor-balls, and as the angle-lever  $k$  is connected with and actuated by the said rod  $s^2$  such movement is trans-  
 20 ferred to the gage-bar through the medium of the connection  $n$ , jointed both to said bar and the other arm  $k'$  of the angle-lever. At the same time the sliding bar in reciprocating back and forth by the eccentric causes  
 25 the tappets to alternately engage the toes  $t^2$  of the rocking levers and uncover the steam-ports, thereby admitting live-steam into the cylinder and against the piston. The amount of steam-opening or point of cut-off is deter-  
 30 mined by the height of the tappets above the face of the sliding bar, an increased height causing them to engage the toes for a longer period, thereby producing a longer cut-off, the toes then moving through a greater arc be-  
 35 fore the tappets actually become disengaged therefrom. Upon such disengagement a weight or other device, as common, acts to instantly close the valve, the valve-levers re-  
 40 suming the normal position, substantially as indicated by Fig. 3. By this it will be seen that for a given cut-off the versed sine of the corresponding arc passed through by the valve-lever will be just equal to the portion of the tappet (measured vertically) in engagement with the  
 45 toe or lever, or, in other words, the tappet will be only in actual engagement with the toe, while the former is traveling horizontally a distance equal to the sine of the arc through which the lever moves. This arc is made au-  
 50 tomatically variable, in accordance with the load upon the engine, by means of the governor-actuated gage-bar  $b$ , which supports the tappets and determines their relative height above the sliding bar  $d$  by the inclined dogs  
 55  $f$ , secured to the gage-bar. These two dogs resting upon the loose wheels  $h$  also operate to maintain the bar  $b$  horizontally. As drawn, a flexible connection  $l$ , passing over a wheel  $h'$ , is secured to the rear end of the gage-bar,  
 60 the same having counter-weights  $w$  adapted to assist in carrying the bar endwise. If de-

sired, a stop  $u$ , Figs. 1 and 5, may be employed to check the downward movement of the weights. The free end of the connection  $n$  may be extended to form a handle by which  
 65 it can be readily unhooked from the pin  $k^2$  of the angle-lever, when desired. Now in case the governor-belt  $b^2$  breaks or the governor stops from any cause while the engine is running, then the weights  $w$ , &c., instantly act  
 70 to assist in forcing the gage-bar rearwardly to its limit, or substantially as indicated by Fig. 3, thereby at the same time lowering the bar onto the wheels  $h$ , the tappets simulta-  
 75 neously dropping in unison with the bar  $b$ , so that any further movement of the sliding bar  $d$ , although carrying the tappets past the now stationary valve-levers, will be inoperative.

I claim as my invention—

1. In an automatic cut-off steam-engine, 80 the combination of mounted steam-valve, operating rocking levers provided with toes, a reciprocating sliding bar, loosely-mounted tappets carried by the sliding bar and adapted to intermittently engage said toes, and a gov- 85 ernor actuated and controlled gage-bar having said tappets resting thereon provided with inclined bearing or supporting surfaces, whereby an endwise movement of the gage-bar imparts a vertical movement to the tappets, 90 substantially as hereinbefore set forth, and for the purpose specified.

2. The combination, in an automatic detach- able valve-gear having automatically-closing steam-valves, of a mounted and actuated slid- 95 ing bar carrying tappets arranged and adapted to engage the valve mechanism to uncover the steam-ports, and a governor-actuated horizontally-mounted gage-bar provided with inclined surfaces for controlling the vertical 100 movement of the tappets, substantially as hereinbefore set forth.

3. The combination, with a horizontally-mounted reciprocating sliding bar, tappets vertically mounted therein, and rocking valve- 105 levers provided with toes adapted to engage and be actuated by said tappets, of a horizontally-mounted counterweighted governor actuated and controlled gage-bar having said tappets resting thereon, dogs provided with 110 inclined faces adjustably secured to the gage-bar, and wheels supporting the gage-bar by the engagement of said inclined faces therewith, substantially as shown and hereinbefore described.

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

NOBLE T. GREENE.

Witnesses:

CHARLES HANNIGAN,  
 GEO. H. REMINGTON.