E. W. PHILLIPS.

STEAM ENGINE.

APPLICATION FILED MAY 18, 1906.

1,036,701.

Patented Aug. 27, 1912.

5 SHEETS—SHEET 1.

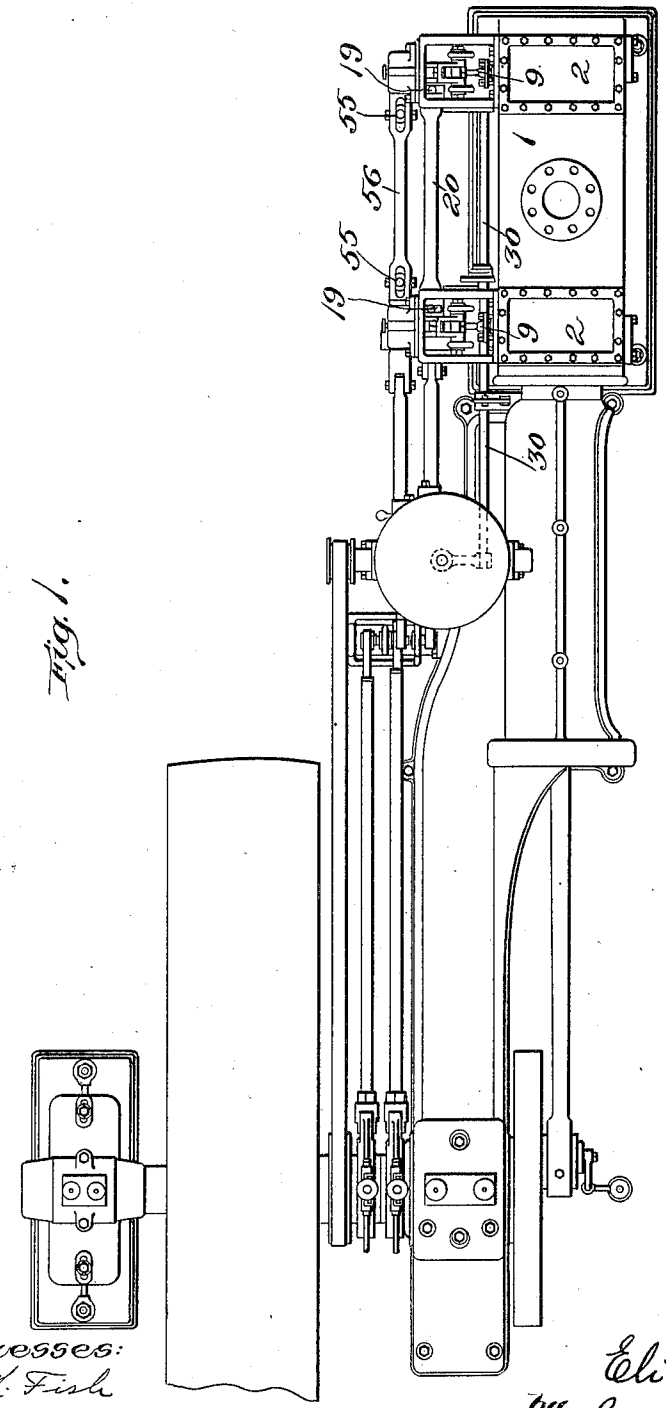

Fig. 1.

Witnesses:
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K. A. Dugan

Inventor:
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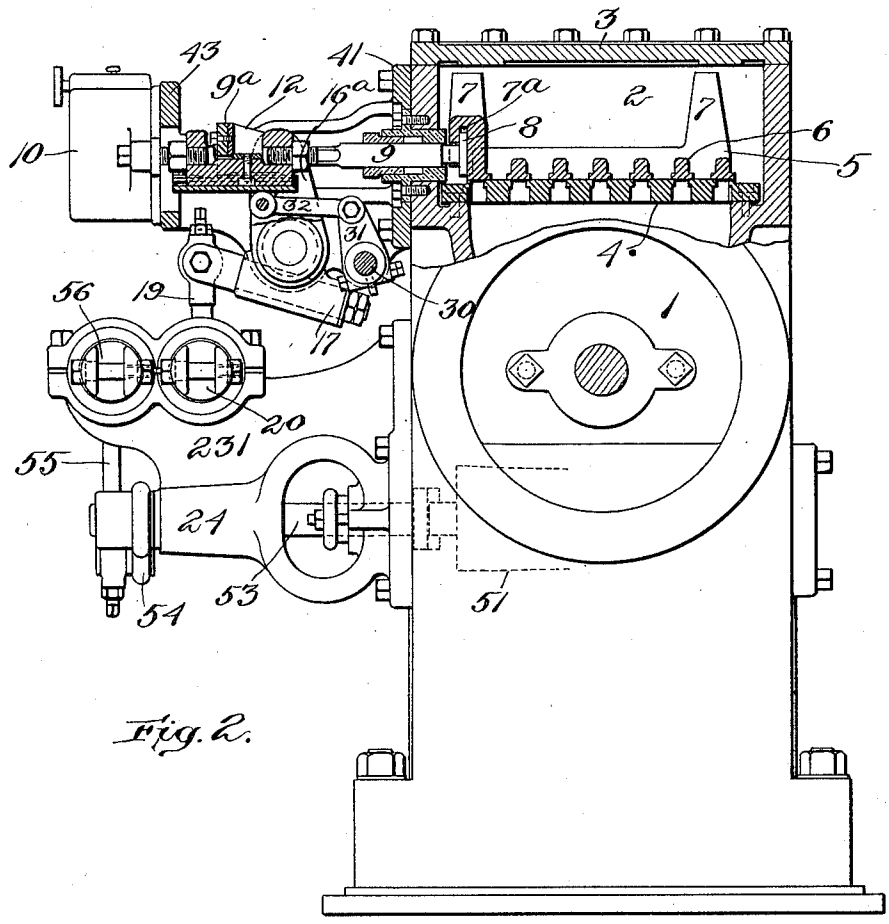

Fig. 2.

Witnesses:
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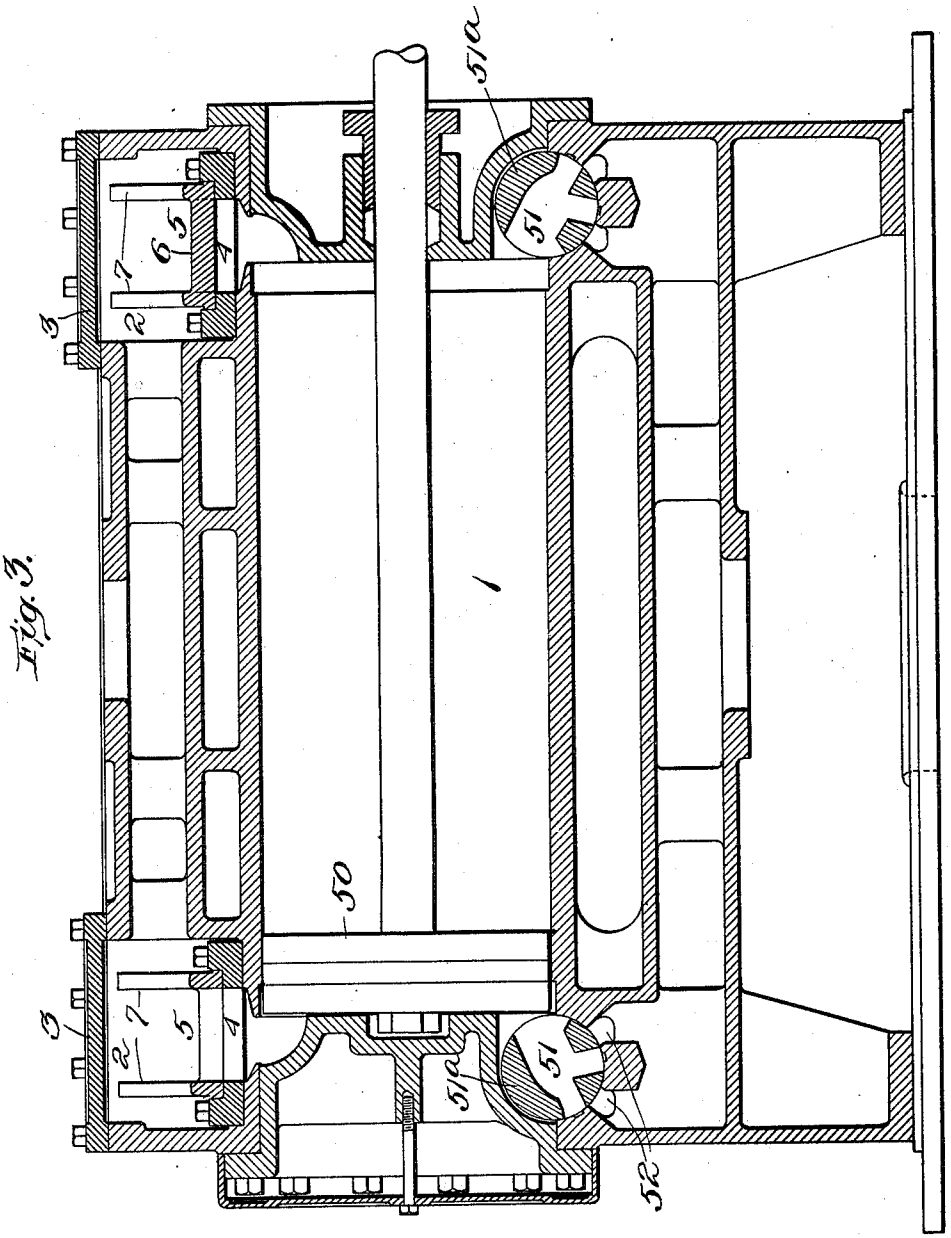

Fig. 3.

Witnesses:
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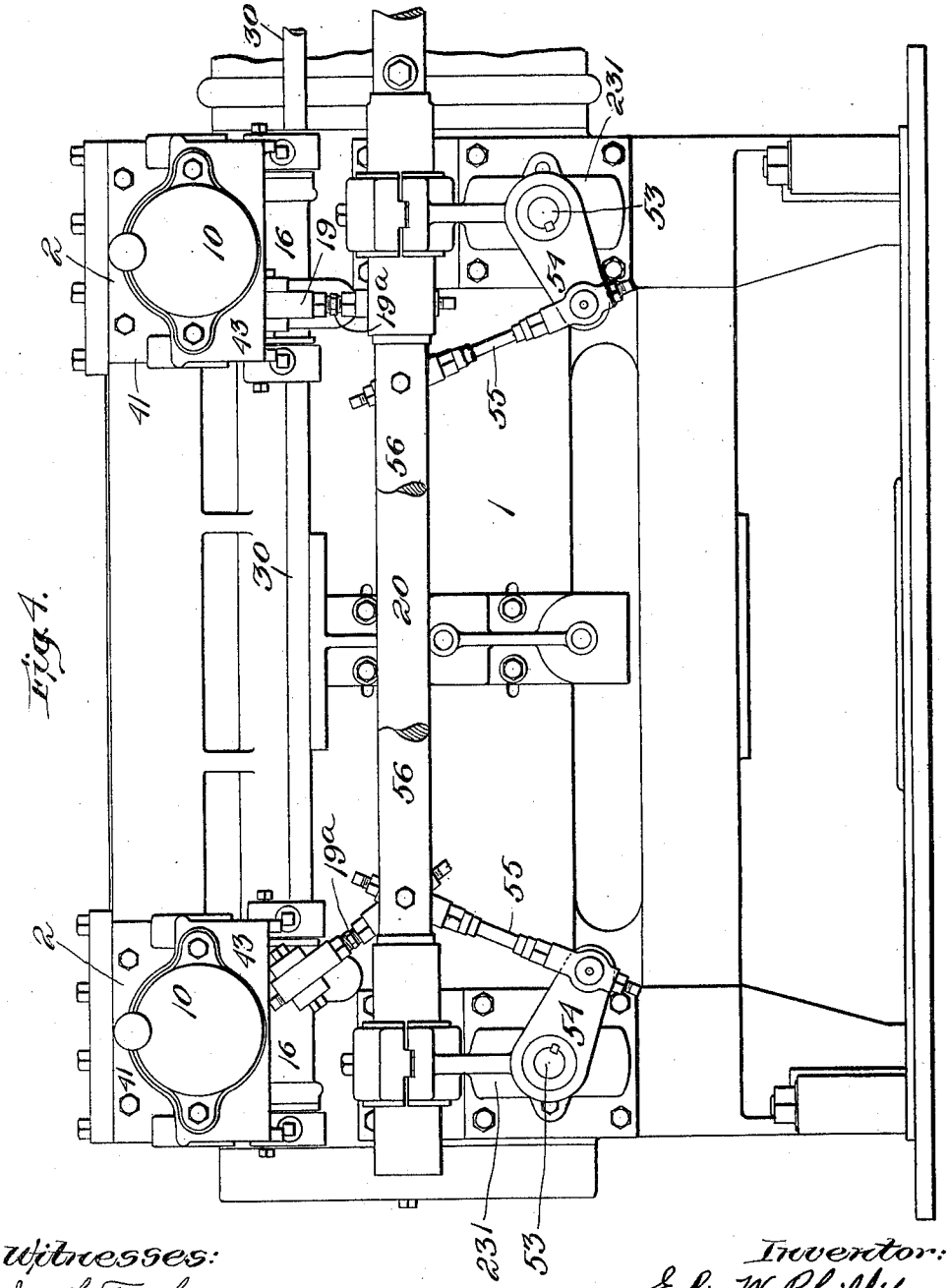

Fig. 4.

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APPLICATION FILED MAY 18, 1906.

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5 SHEETS—SHEET 5.

Fig. 6.

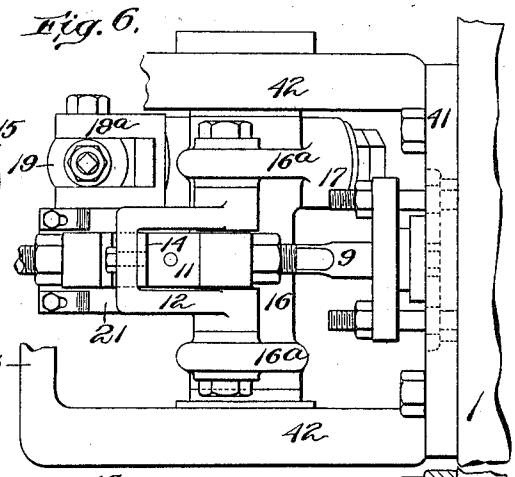


Fig. 8.

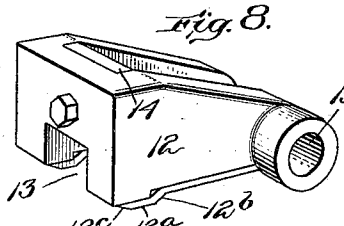
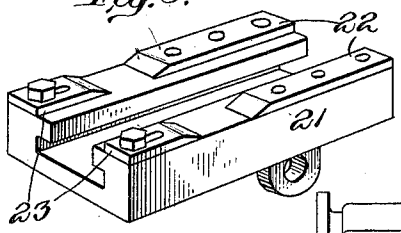


Fig. 9.



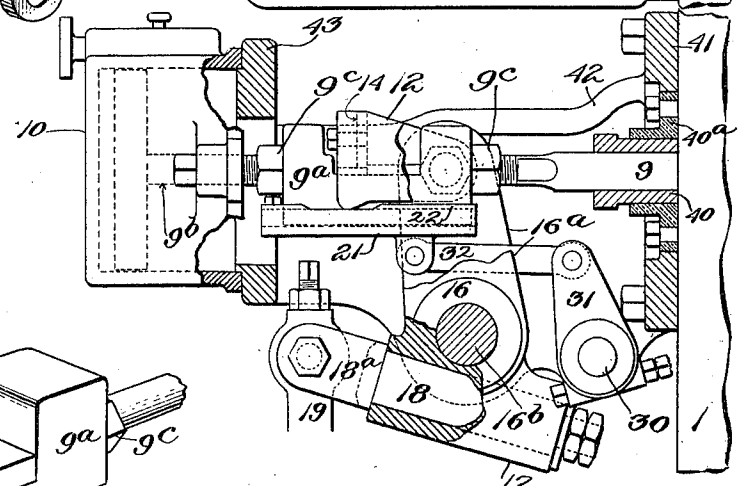
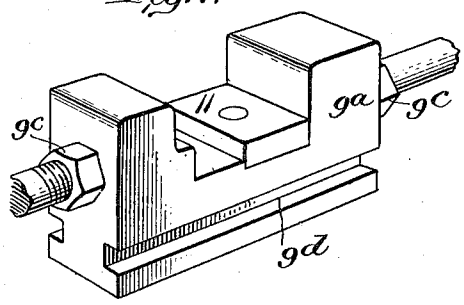


Fig. 5

Fig. 7.



Witnesses:
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F. A. Dugan

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UNITED STATES PATENT OFFICE.

ELI W. PHILLIPS, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO AMERICAN TOOL AND MACHINE COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

STEAM-ENGINE.

1,036,701. Specification of Letters Patent. Patented Aug. 27, 1912.

Application filed May 18, 1906. Serial No. 317,626.

To all whom it may concern:

Be it known that I, ELI W. PHILLIPS, citizen of the United States, and resident of Boston, county of Suffolk, Massachusetts, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification.

This invention relates to steam engines and the improvement herein disclosed relates more particularly to the valve and valve actuating mechanism of a steam engine of the reciprocating piston type.

Among other objects it is the purpose of these improvements to produce a simple and efficient construction and arrangement of parts whereby free and convenient access is given to various parts of the engine for the removal or replacement of parts or for their adjustment, and a further object is to improve and render more efficient the means for regulating and controlling the action of the cylinder valves.

In the accompanying drawings I have illustrated one of the forms of embodying my aforesaid improvements.

Figure 1 is a plan view of the engine in its entirety. Fig. 2 is an elevation partly in cross section through the steam chest showing the construction of the valve and the valve operating mechanism. Fig. 3 is a central longitudinal section through the cylinder and steam chest. Fig. 4 is a side elevation showing the position of the valve actuating mechanism according to the position of the piston shown in Fig. 3. Fig. 5 is a detail view in end elevation of the mechanism for actuating the inlet valve. Fig. 6 is a plan view thereof. Fig. 7 is a detail perspective of one of the valve stem members. Fig. 8 is a detail perspective of the hook latch by which movement is imparted to the valve stem. Fig. 9 is a detail view of the member for tripping the latch to cut off the steam.

In the practice of my invention the cylinder 1 may be of any approved construction and is provided at either end with superimposed steam chests 2 having removable lids or covers 3 for closing the open top. On the bottom of the steam chest is placed a slotted valve seat plate 4 which is detachably held in position by means of suitable fastening means such as screws. The valve 5 used is a slide valve, embracing a pair of ribs 6 separated by parallel slots, the ribs being of sufficient width to slightly overlap the slots formed in the valve seat 4. At its sides the valve is provided with upward extensions 7 which terminate slightly short of the bottom face of the lid or cover 3 so as to leave a slight clearance between these upward extensions 7 to allow the valve to lift slightly from its seat to permit the escape of any water or condensation that may have been tripped between the piston and the valve. The movement of the valve is transverse to the axis or length of the cylinder, the ports in the valve and valve seat being parallel to the axis of the cylinder. At the forward end the valve 7 is formed with an undercut notch or recess 7^a to engage the disk-like head 8 on the end of the valve stem 9. The object and advantage of this construction is that it permits the quick and easy removal of the valve and also of the valve seat without disturbing the adjustments of the valve stem or the valve actuating mechanism, since all that is required for this purpose is to remove the cover or lid 3, when the construction described permits the valve to be lifted bodily from its engagement with the headed valve stem. The valve seat may then be tipped up at the rear end and withdrawn from the steam chest after its fastening screws have been removed without necessitating any removal or disturbance of the valve stem. By the mechanism herein shown and described the unbalanced pressure of the steam in the steam chest on the valve stem will operate to hold the valve normally in the closed position.

I will now describe the mechanism by which the movements of the valve stem are accomplished. The valve stem is practically in three parts or members, the stem proper 9, a saddle-like member 9^a whose middle portion is formed with a recess adapted to receive a wear plate 11 detachably secured thereto to engage the hook latch hereinafter referred to. This intermediate or saddle-shaped member of the valve stem is adjustably attached to the outer threaded end of the valve stem 9, this adjustment being held against displacement by a jam nut 9^c. The other end of this valve stem member 9^a has a threaded engagement with the stem 9^b of the dash pot piston, a similar jam nut 9^c being employed to hold this connection against displacement or disturbance. Means for retracting the valve stem in order to open the

ports for the admission of steam in the steam chest consists of a hook latch 12 arranged to have engagement with the intermediate member 9^a of the valve stem, said hook latch being in the shape of a yoke having its transverse end recessed at 13, the width of said recess being equal to or slightly greater than the width of the member 9^a to permit the hook latch to fall into a position astride of the saddle member of the valve stem. The hook latch 12 is provided with a removable wear plate 14 on its inner face, said plate being arranged to drop into the space between the wear plate 11 and the outer shoulder of the saddle 9^a to form an operative engagement with the valve stem member. Both wear plates or face plates 11 and 14 are made exactly square and all edges are finished so that they may be set in different positions as each edge becomes worn or rounded in order to get the use of all eight edges of each plate. Obviously when the hook latch is in the position shown in Fig. 5 it has such engagement with the valve stem member 9^a that if it is retracted or drawn to the right, the valve stem must move in the same direction. To accomplish this movement I provide a pivoted lever 16 in the form of a yoke whose upwardly projecting arms 16^a are provided with journal bearings adapted to aline with the trunnions 15 of the hook latch with which it has pivotal connection by means of suitable pivot pins or journals. This lever 16 is hung on a suitable horizontal center 16^b and is provided with a depending bracket 17 bored out to receive a swivel pin 18 whose outer end is forked as shown at 18^a (Fig. 6), said fork receiving a toggle link 19 and being pivotally secured thereto by means of a pivot pin or bolt 19^a. The toggle link has pivoted connection with the reciprocating valve actuating rod 20 which is moved to and fro by the eccentric rod operated by an eccentric on the crank shaft in the usual manner. By reference to Figs. 4, 5 and 2 it will be seen that a movement of the slide rod 20 in one direction tends to move the toggle link 19 to a vertical position, thereby forcing upward the forked end of the swivel pin 18 which necessarily results in swinging the valve lever 16 toward the steam chest. This inward motion of the valve lever causes the valve stem and the valve to move inward owing to the engagement of the hook latch with the valve stem and thereby uncovers the steam inlet ports to admit steam to the cylinder.

The mechanism for automatically releasing the engagement between the valve lever and the valve stem also possesses some features of novelty. This mechanism comprises a sliding trip member 21 which is provided with a dovetail or undercut slot which engages parallel grooves 9^a formed on either side of the valve stem member 9^a so that the trip while suspended from the valve stem is free to move longitudinally thereof. The trip member is provided on either side with bevel plates or blocks 22 and is actuated or controlled from a rock shaft 30 which is actuated by the governor or regulator of the engine and which by means of the lever 31 adjustably secured to it and the link 32 has suitable connection with the sliding trip 21. The hook latch 12 which forms the engaging means between the valve actuating lever and the valve stem, is provided on its under face on either side with a plate 12^a having two oppositely bevel surfaces 12^b and 12^c. The lowermost portion of the plate or block 12^a rests normally upon the top face of the sliding trip 21. If, however, the sliding trip be moved outward relatively to the hook latch, the bevel block 22 will engage the bevel face 12^b on the bottom of the hook latch and will act to lift the hook latch sufficiently to disengage the wear plate 14 from the shoulder formed by the wear plate 11. When this upward disengaging movement of the hook latch is accomplished, the valve lever 16 is permitted to continue its inward movement, while the disengaged valve stem under the influence of the unbalanced pressure in the steam chest acts to force the valve back to the outward position where the inlet ports are covered or closed. The movement of the rock shaft by any suitable form of regulator or governor may be accomplished in any suitable or usual way and forms no part of this invention.

An emergency cut-off which acts in case the belt should run off the governor or if for any other reason the governor should fail to act is effected by providing the trip member 21 with additional adjustable trip blocks 23 having inclined faces for engaging the inclined faces 12^c under the hook latch. In case of such accident the trip member will be thrown to its extreme inward position, bringing the blocks 23 beneath the plate 12^a under the hook latch so that the hook latch will be instantly disengaged and cannot form any new engagement with the valve stem until the accident is remedied and the trip member moved back to its normal position.

It will be observed that the valve stem and valve actuating mechanism, including the dash pot 10, are all supported on a single bracket comprising a face plate 41 detachably secured to the side of the steam chest, the outwardly projecting arms 42 and the outer head 43. The absolute positioning of this face plate is insured by reason of the fact that the flange 40^a of the packing gland 40 is turned to fit the central bore formed in the face plate 41 so that the alinement and proper positioning of the valve actuating mechanism with reference to the valve stem is easily secured with

certainty. Moreover by releasing the screws which secure the gland and the face plate 41 to the steam chest, the entire valve actuating mechanism, including the valve stem, may be removed by uncoupling the joint between the toggle link 19 and the reciprocating rod 20. The toggle link 19 is made extensible or adjustable for length by means of a screw-threaded nut 19ª which is employed to connect the two parts or members of said link with each other.

One of the objects accomplished by the construction and arrangement of valve mechanism described is the relieving of the valve stem of all lateral pressure when acted upon by the trip or releasing mechanism. This object is accomplished in this case because the trip member is carried by the valve stem itself. Moreover, the upward thrust or pressure needed to release the hook latch is applied directly at the point or in the place where the hook latch has engagement with the valve stem. Thus a minimum of transverse pressure is employed in releasing the latch while securing an entire absence of any lateral thrust on the valve stem.

The outlet valves 51 are of the oscillating double-port type and their upper portions are filled up with metal as indicated at 51ª to reduce the clearance to a minimum. These valves are actuated by means of levers 54 secured to the valve stem 53, the levers themselves being connected with a slide rod 56 by means of the extensible or adjustable link 55. The slide rod is actuated from the crank shaft in any usual manner. It is to be observed that the bearings for the valve stem 53 and for the slide rods 20 and 56 are all formed in a single bracket 231, one end of which is formed into a face plate adapted to be bolted to the side of the cylinder, the web portion of the bracket being enlarged as shown at 24 to form a suitable bearing for the outlet valve stem 53. This construction and arrangement makes it possible to quickly and easily remove the outlet valves and actuating mechanism by simply disconnecting the links 19 and the valve rod and then removing the bolts which secure the brackets 231 to the cylinder. Moreover with the construction shown and described it is practically impossible to assemble the valve mechanism without getting it into exact and accurate position since the slide rods 20 and 56 serve to properly aline the brackets 231, while the glands 40 and the rock shaft 30 secure the absolutely accurate position of the brackets 41 which carry the inlet valve mechanism.

Without attempting to set forth the various modifications in form, construction and arrangement that may be made in the practice of my invention, what I claim is—

1. In a steam engine the combination of the slide valve and its projecting valve stem, a latch having intermittent engagement with said valve stem, means for imparting to said latch a uniform movement to move the valve stem, a trip provided with oppositely diposed portions for engaging and releasing the latch from the valve stem, and means for automatically shifting said trip in position to vary the cut-off through the action of one latch-engaging portion or to render the valve inoperative through the action of the other latch-engaging portion, substantially as described.

2. In a steam engine the combination of the slide valve and its projecting valve stem, an actuating lever for moving said valve, a latch forming intermittent engagement between said actuating lever and the valve stem, and a trip automatically adjustable longitudinally of the slide valve stem in either direction, arranged when in one position to keep the latch out of engagement with the valve stem and when in another position to release the latch from its engagement with the valve stem, and means for automatically controlling the position of said trip, substantially as described.

3. In a steam engine the combination of the slide valve for admitting steam to the cylinder, a valve stem, a valve stem lever, a latch carried thereby for intermittently engaging the valve stem, and a trip for disengaging the latch from the valve stem, said trip being supported by the valve stem and automatically adjustable thereon, substantially as described.

4. In a steam engine the combination of a slide valve and its valve stem, an actuating lever therefor, a latch carried by said lever and having intermittent engagement with said valve stem, means for adjusting the length of the valve stem, a trip for releasing the latch from its engagement with the valve stem, actuating means embracing an automatically operated rock shaft for shifting said trip to vary the cut-off, said trip-actuating means being also adjustable, substantially as described.

5. In a steam engine the combination of the slide valve provided with a projecting valve stem, an actuating lever, a pivoted latch carried by said lever to engage a portion of the valve stem, an automatically-operated trip device supported by the valve stem to slide in parallelism with the movement of the valve stem, said trip device being provided with two operative portions one for preventing the engagement of the latch with the valve stem and the other for releasing the latch from its engagement with the valve stem, substantially as described.

6. In a steam engine the combination of the slide valve, a projecting valve stem provided with an adjustable intermediate member formed with a recess intermediate of its

ends, an adjustable and detachable plate secured to the bottom of said recess to form a projecting shoulder, a U-shaped latch adapted to fall astride of said intermediate valve stem member in position to engage said shoulder, and means for moving said latch to actuate the valve stem, substantially as described.

7. In a steam engine the combination of a valve, a projecting valve stem provided with parallel ways or grooves, a latch for intermittently engaging said valve stem, means for actuating said latch to reciprocate the valve stem, a trip device arranged to slide in said ways and grooves and provided with means for throwing said latch out of engagement with the valve stem, substantially as described.

8. In a steam engine the combination of a slide valve, a projecting valve stem, an actuating lever having intermittent engagement with said valve stem, a reciprocating actuating rod, means for connecting said reciprocating rod with the actuating lever, said means comprising an extensible link having a connection with the actuating lever by means of two pivotal joints whose axes are angularly disposed to each other, substantially as described.

9. In a steam engine the combination of the slide valve, its valve stem, a latch for engaging said valve stem, means for actuating the latch to move the valve, a trip device supported by the valve stem by means of a sliding engagement, and automatically controlled means for varying the position of the trip device along the supporting valve stem in order to vary the cut-off, substantially as described.

10. In a steam engine the combination of the slide valve, a valve stem, a gravity operated latch for engaging said valve stem, means for actuating the latch to move the valve, a trip device having rectilinear movement parallel to the valve stem, and means for controlling said trip device to vary the cut-off, substantially as described.

In witness whereof, I have hereunto set my hand, this tenth day of May, 1906.

ELI W. PHILLIPS.

In the presence of—
GEO. N. GODDARD,
KATHARINE A. DUGAN.