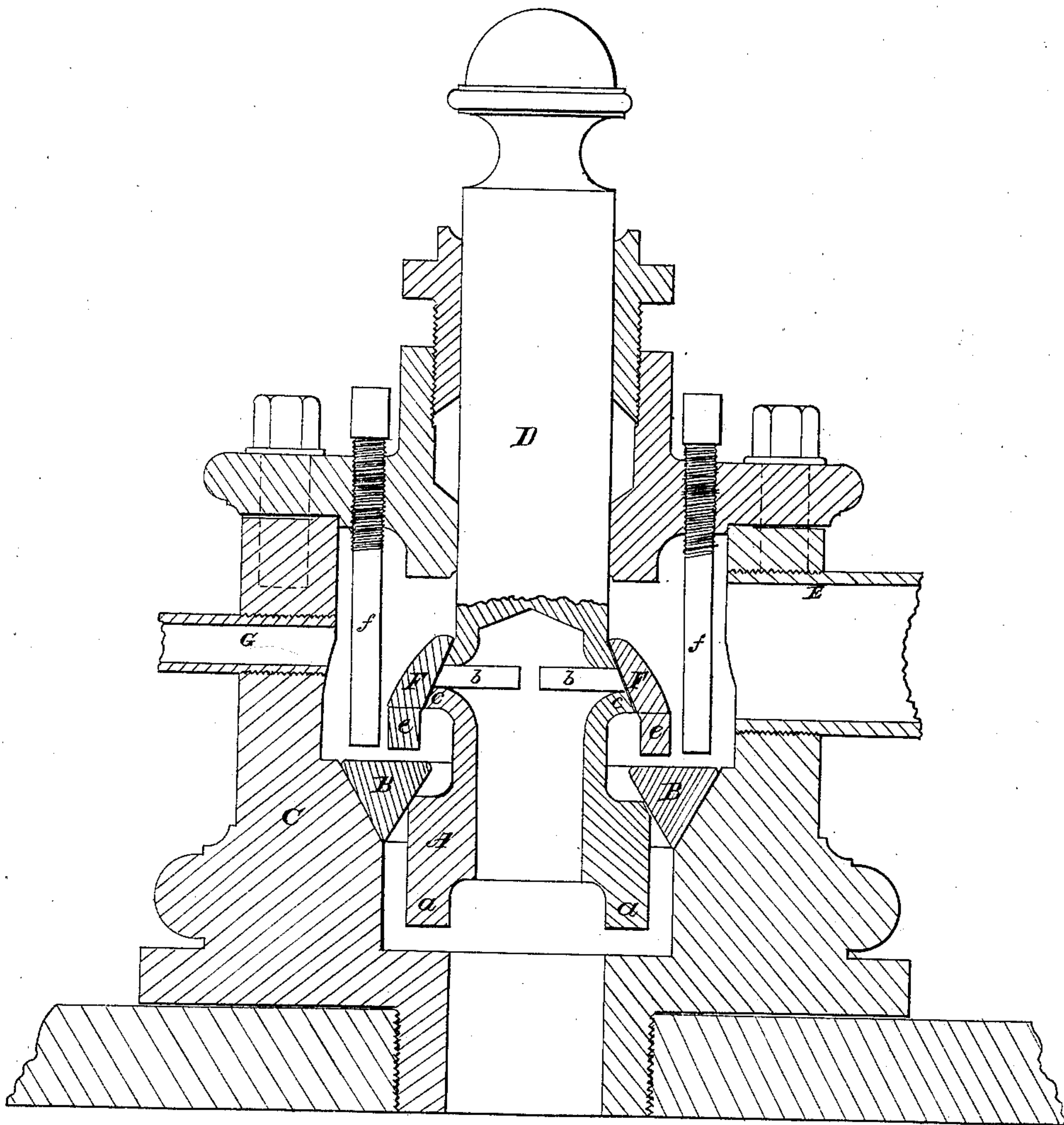


*A. Buchanan,*

*Steam Slide Valve.*

*N<sup>o</sup> 28,251.*

*Patented May 15, 1860.*



*Witnesses*

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# UNITED STATES PATENT OFFICE.

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## ARRANGEMENT FOR BALANCING SLIDE-VALVES OF STEAM-ENGINES.

Specification of Letters Patent No. 28,251, dated May 15, 1860.

*To all whom it may concern:*

Be it known that I, ANDREW BUCHANAN, of Jersey City, in the county of Hudson and State of New Jersey, have invented a new and Improved Device for Balancing Slide-Valves of Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, making a part of this specification, said drawing representing a vertical central section of my invention.

Similar letters of reference indicate corresponding parts.

The object of this invention is to regulate the pressure of the steam on the upper and on the under side of a slide valve according to the difference between that portion of the under surface of said slide valve which is exposed to the pressure of the steam and the entire upper surface of the valve, my device being more particularly applicable to that class of slide valves in which the steam from the boiler acts on the under side, thereby producing a tendency to lift up the valve and cause a leakage of the steam.

My invention consists in combining with a slide valve a common conical valve guided by a stem and inclosed in a steam tight chamber and otherwise arranged as will be hereinafter more fully explained, so that the area of the lowest and undiminished surface of said valve is in proportion to the upper surface of the same (the latter being diminished by the displacement of the stem to which it is attached) as the upper surface of the slide valve is to the channels and steam passages in the face of the slide valve and that by the natural tendency of said valve to follow the action of the steam on its lower and larger surface the pressure exerted by the steam on the two sides of the slide valve is equalized; and it consists also in arranging on the hollow stem of said cone valve a loose cap shutting down over suitable apertures for the purpose of facilitating the entrance of the steam; and it consists further in the combination with said cone valve of a movable seat together with said loose cap and with regulating pins in such a manner that in cutting off the steam from the under side of the slide valve that portion of the steam which remains in the steam chest above the slide valve is allowed to find its way back to the steam pipe.

To enable those skilled in the art to make

and use my invention I will proceed to describe its construction and operation with reference to the drawing.

A, is a valve which closes upward against a seat B, in the steam tight chamber C. The valve is attached to a stem D, which extends upward through a stuffing box on the top of the chamber to the open atmosphere. By having the stem attached to the upper surface of the valve a portion of that surface is occupied by the stem and when the valve is enveloped in steam, the area which its upper surface exposes to the action of the steam is smaller than the area which the lower surface of the valve exposes to the action of the steam, the difference being equal to the area of the cross section of the stem D. The under surface of the valve A, is furnished with projections or legs *a*, to prevent said surface coming down flat on the bottom of the chamber whereby nearly its whole surface is exposed to the action of the surrounding steam under all circumstances.

If new steam is admitted into the chamber C, the valve A, will begin to rise as soon as the pressure on the under side exceeds that point where the same as compared with the pressure of the supply steam is in an inverted ratio to the areas of the two surfaces and this proportion will never be disturbed as there is no chance for the steam to act on the upper end of the valve stem neither is it possible that the respective proportion of the two surfaces undergoing a spontaneous change.

The chamber C, is screwed in or otherwise attached to the top of the valve chest of a steam engine and the pipe E, which conducts the steam to the chamber C, connects with the steam pipe which serves to supply the valve chest. When the valve A, is closed as represented in the drawing the upper surface of the same is exposed to that pressure which exists in the steam pipe and which consequently acts on the under side of the slide valve and the lower surface of the valve A, is exposed to that pressure which exists in the upper portion of the steam chest and which consequently acts on the upper surface of the slide valve. The pressure therefore which acts on the under side of the valve A, and on the upper side of the slide valve and that one which acts on the upper side of the valve A, and on the under side of the slide valve are in an inverted ratio as the areas of the two surfaces of the



valve A, and if the area of that portion of the under surface of the slide valve which is exposed to the action of the steam viz. the superficial area of the channels and cavities on the under side of the slide valve and the superficial area of the upper surface of said slide valve are in direct ratio as the area of the upper and the lower surface of the valve A, the pressure on both sides of the slide valve will be perfectly balanced.

In order to adjust my device to a certain given slide valve, it is necessary to find out the area of the cavities and channels in the lower surface of the slide valve and also the area of the upper surface of the same slide valve and the areas of the two surfaces of my valve A, have now to be regulated in such a manner that the area of the upper surface of the valve is to the area of its under surface like the area of the under surface of the slide valve to the area of its upper surface. When thus adjusted the valve A, will close as soon as the pressures on the under and on the upper surfaces of the slide valve are in an inverted ratio to the areas on which they act and the slide valve will be perfectly balanced.

The stem of the valve A, is made hollow and apertures *b*, form a communication between this hollow portion of the stem and the upper part of the chamber C. The apertures *b*, are covered up by a cap F, which is placed loosely on the outside of a seat *c*, formed around the stem D. This cap is provided with legs or projections *e*, and when the valve is down, these legs by striking the upper surface of the seat B, raise the cap, thereby throwing open the apertures *b*. The object of this arrangement is to facilitate the entrance of steam to the upper part of the steam chest as it gives to the steam a chance to enter through the interior of the seat B, and through the apertures *b*.

Whenever steam is admitted to the under side of the slide valve before the same is kept down on its seat by a suitable pressure on its upper surface it is liable to fly up and disturb the correct operation of the engine. To counteract this tendency a pipe G, is provided which serves to admit steam from the boiler to the upper surface of the slide valve before the steam pipe is opened; when the engine is to be started this pipe is closed by a suitable stop cock. It must be remarked that the pipe G, communicates with the steam chest through the chamber C. When the engine is stopped, the steam inclosed in the upper part of the steam

chest has no chance to escape and if it should be left to condense in the steam chest, it would create a disturbance in the correct action of the engine. For this reason the seat B is placed loosely into the chamber C, being kept in its place as long as a pressure exists on its upper surface. But if the engine is stopped and when the steam in the upper part of the chamber C, and in the pipe E, and in the steam pipe condenses forming a partial vacuum, the action of the steam inclosed in the upper part of the steam chest, and acting on the under surface of the valve A, throws the seat B, up and the steam contained in the upper part of the steam chest has a chance to escape. As the seat B, is lifted up it strikes against the legs *e*, on the under side of the cap F, lifting the latter from its seat and affording an additional way of escape for the steam in the upper part of the steam chest through the apertures *b*, in the stem of the valve A. The amount of lift allowed to the seat B, is regulated by pins *f*, which screw into the cover of the chamber C.

The simplicity of this device and its correct action is unsurpassed and it is of particular advantage for locomotive engines, but it may be used with advantage in every case where the steam is admitted to the under side of the slide valve of a steam engine.

What I claim as new and desire to secure by Letters Patent is—

1. The combination with a slide valve to which the steam is admitted from the under side, of a valve A, arranged with a stem D, and inclosed in a steam tight chamber C, substantially as and for the purpose specified.

2. The arrangement of the cap F, with legs *e*, and fitting on a seat *c*, around the hollow stem D, in combination with the valve A, constructed and operating substantially as and for the purpose described.

3. The arrangement and combination of the valve A, movable seat B, cap F, and regulating pins *f*, constructed and operating substantially as and for the purpose set forth.

4. The arrangement of the pipe G communicating with the steam chest through the chamber C, substantially in the manner and for the purpose described.

ANDREW BUCHANAN.

Witnesses:

B. GIROUX,  
M. M. LIVINGSTON.