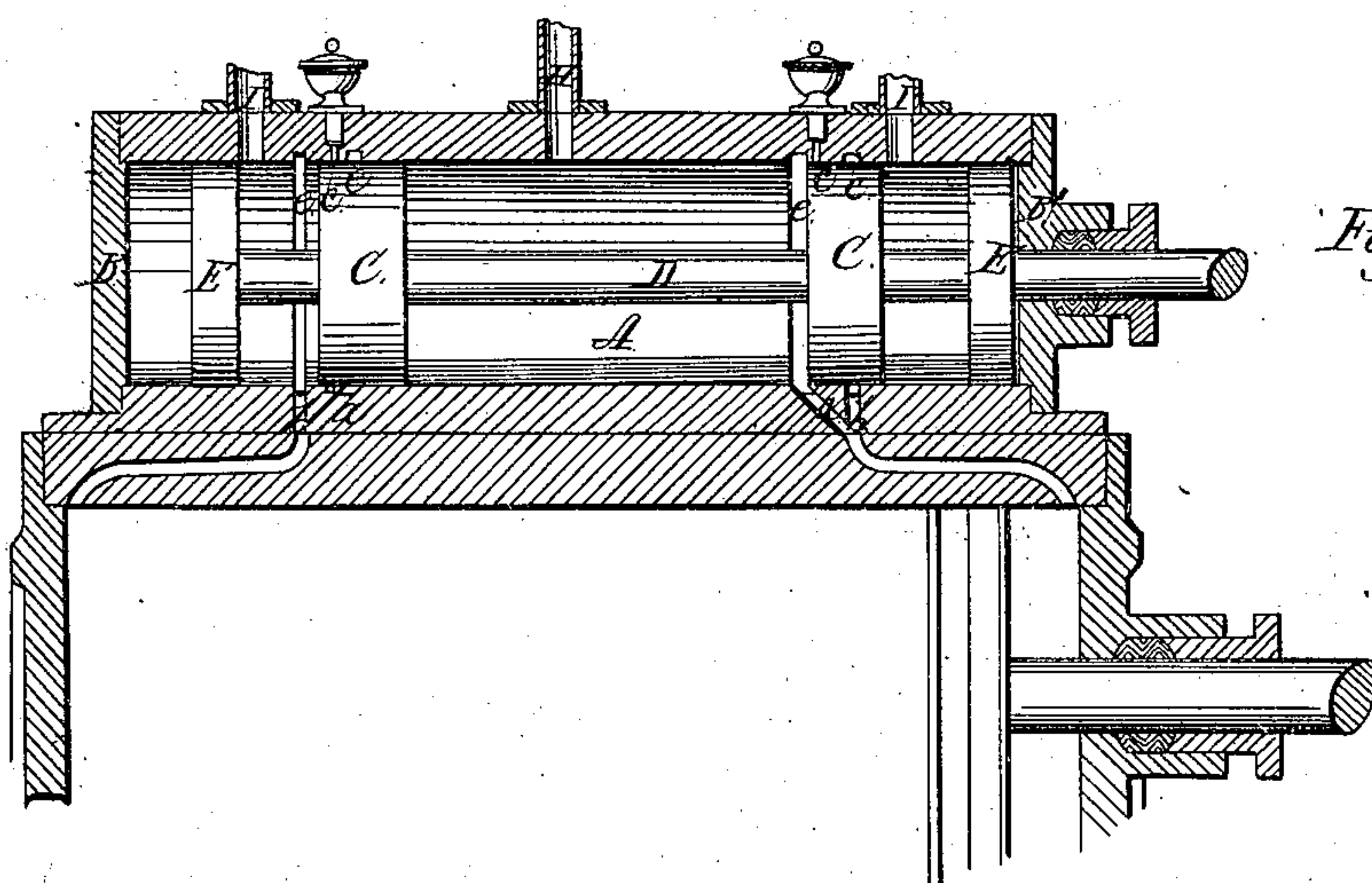


*T. C. Ball,*  
*Steam Balanced Valve.*

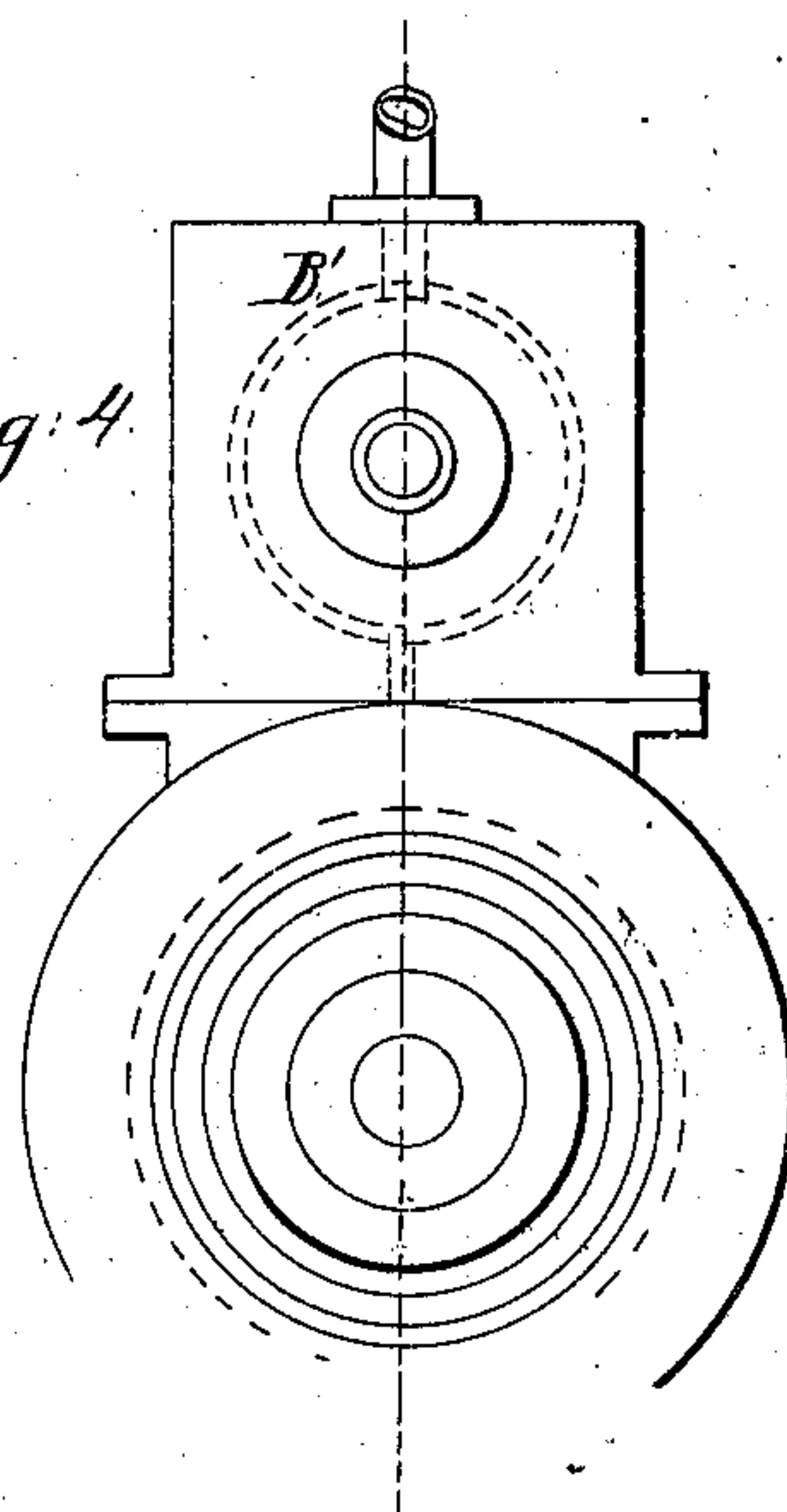
*N<sup>o</sup> 41,035.*

*Patented Dec. 22, 1863.*

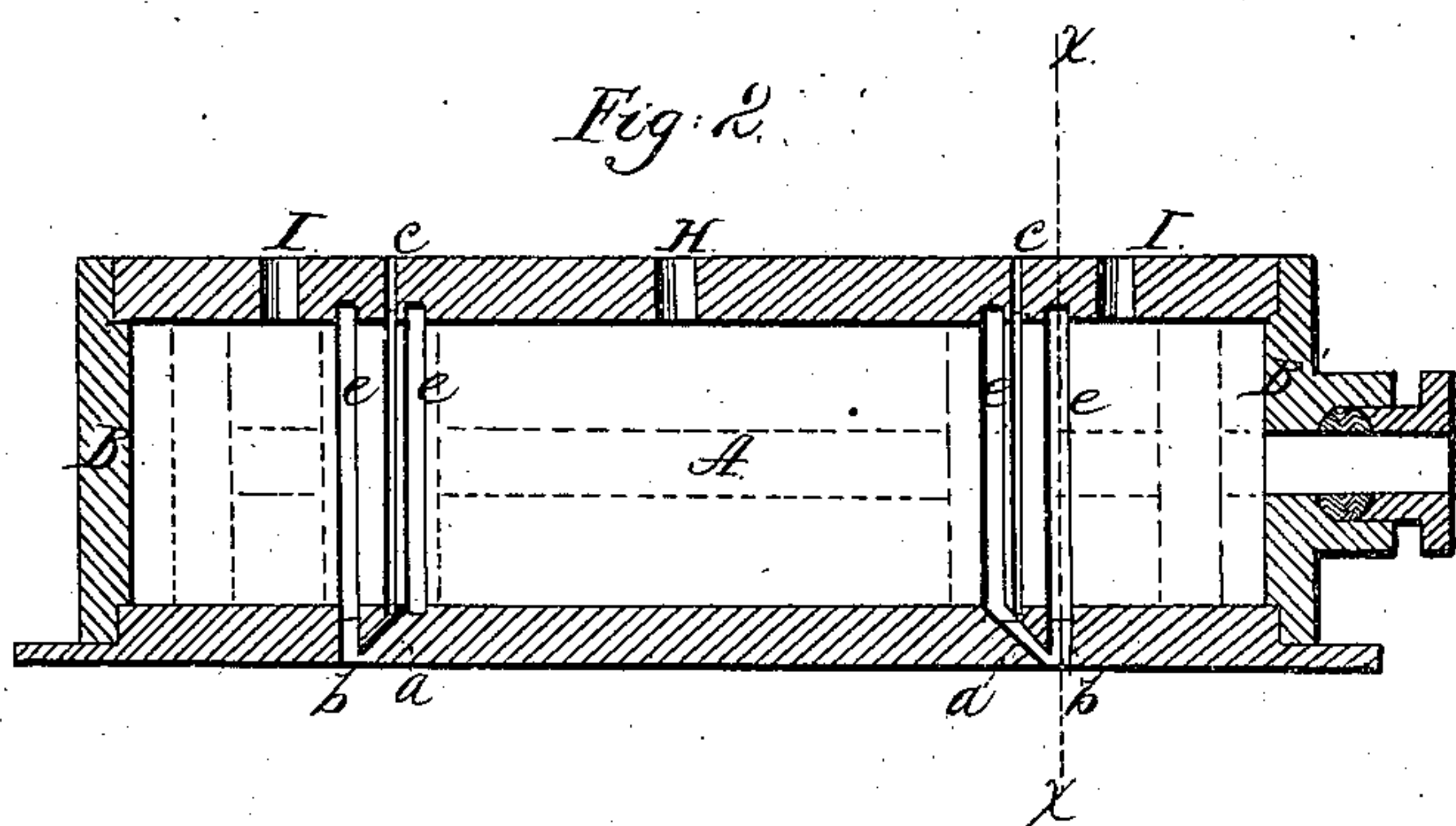
*Fig. 1.*



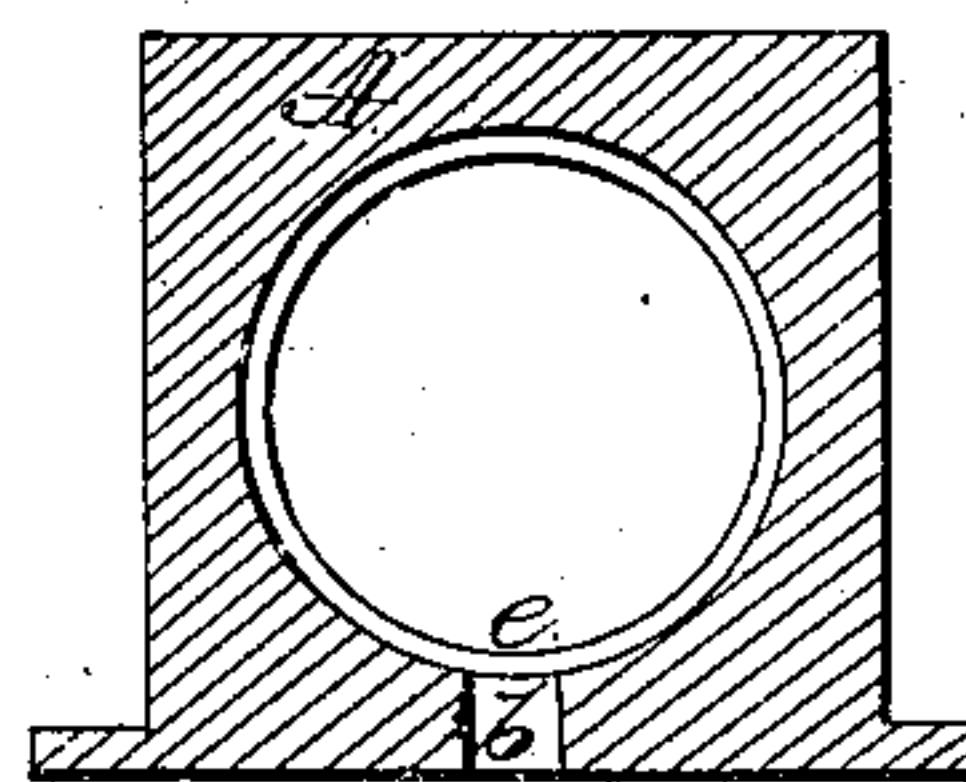
*Fig. 4.*



*Fig. 2.*



*Fig. 3.*



*Witnesses:*  
*James E. Bradley*  
*Charles D. Smith*

*Inventor:*  
*T. C. Ball*



# UNITED STATES PATENT OFFICE.

THOMAS C. BALL, OF BELLOWS FALLS, VERMONT, ASSIGNOR TO HIMSELF  
AND M. L. BAXTER.

## IMPROVEMENT IN PISTON-VALVES FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. 41,035, dated December 22, 1863.

*To all whom it may concern:*

Be it known that I, THOMAS C. BALL, of Bellows Falls, in the county of Windham and State of Vermont, have invented certain new and useful Improvements in Balanced Slide-Valves for 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 drawings, making a part of this specification, in which—

Figure 1 represents a longitudinal vertical section of a valve-chest and elevation of a valve constructed according to my invention. Fig. 2 is a similar view of a valve chest, showing the valves by dotted lines in the position they occupy in relation to the ports when steam is cut off at less than a full stroke of the piston. Fig. 3 is a transverse section of the steam-chest in the line *x x* of Fig. 2. Fig. 4 is a front end view of the steam-chest.

Similar letters of reference indicate corresponding parts in the several views.

The object of this invention is to obtain in a balanced piston valve or valves a cut-off, and also a means of lubricating the valves; and to this end the invention consists in having formed in the steam-chest, near each end thereof, separate induction and eduction steam-ports, which open into one another at the junction of the steam-chest with the steam-cylinder, in combination with piston-valves, which are balanced by the pressure of a surrounding body of steam contained in grooves of corresponding width with the induction and eduction ports.

The invention also consists in providing the valve-rod with two extra pistons or heads, whereby the effect of the exhaust upon the piston-valves is counteracted.

The invention further consists in certain means provided for lubricating the valves, all as will be hereinafter fully explained.

To enable others skilled in the art to which my invention appertains to understand the same, I will proceed to describe it.

In the accompanying drawings, A represents a steam-chest, which is bored cylindrically through from end to end and fitted up with heads B B' in the usual manner. C C are two cylindrical or piston valves, adapted to work in the steam-chest, and secured to the rod D, which works through a stuffing-box in

the head B'. The valves may be packed on their peripheries so as to work steam-tight in the chest A by metallic split rings in the usual manner; or they may be packed in any other suitable manner. Attached to the rod D, outside of the piston-valves C C, are two other pistons or heads, E E, which are of considerable less width and of slightly less diameter than the valves C C, so that they work freely in the steam-chest.

In one side of the steam-chest, near each end, are two oblong ports, *a b*, the former being the induction port or the opening through which steam passes into the cylinder, and the latter the eduction port or the opening through which the steam after use escapes from the cylinder into the steam-chest, whence it is conducted off into a condenser or into the open air, as may be desired.

The ports *b* at each end of the steam-chest pass directly through the same at right-angles with the bore thereof, and the ports *a* pass obliquely through and form a junction with the port *b* near the outer surface of the steam-chest, or where it unites with the steam-cylinder, making there one common port of equal length and of little less width than the two ports, *a* and *b*, combined. Opposite the induction and eduction ports *a* and *b*, at each end of the steam-chest, there are formed around the interior grooves *e*, which correspond in width with the ports *a* and *b*, and which are filled with steam from the ports, so that the piston-valves are balanced on all sides in passing the ports. Between the grooves *e*, above mentioned, at each end of the steam-chest, is formed a slight annular cavity, *c*, through which the lubricating material or compound contained in the cups *d* passes to lubricate the piston-valves C C. At no time in the working of the valves are the annular cavities *c* uncovered; consequently the oil has a free and uninterrupted flow, and is not interfered with by the steam contained in the steam-chest.

The steam from the boiler enters the chest A between the valves C C through a central opening, H, whence one of the diagonal ports, *a*, being uncovered, it passes into the steam-cylinder at one end, and after moving the piston (represented by red lines in Fig. 1) to the opposite end of the cylinder it escapes through the straight or eduction port *b* into the space



between the piston-valve C and head E in the steam-chest, at the same end at which it previously passed into the steam-cylinder, and thence passes out of the steam-chest through an opening, I, into a suitable condenser, or into the open air, as may be desired.

When the engine is taking steam at either end of the cylinder, a portion of the steam fills the grooves in the steam-chest and forms a nearly perfect balance of the valve. The same effect is also produced in a less degree by the exhaust-steam.

The pistons or heads E E are only designed to counteract the effects which the exhaust-steam would otherwise have upon the valves, and they are fitted loosely in the steam-chest, so as not to create a vacuum behind them in moving away from the ends of the steam-chest.

The valves may be worked by any suitable valve-gear, and they are so arranged in connection with the induction and eduction ports that they may be made to cut off steam at any desired point in the stroke of the steam-piston and leave the exhaust open at the opposite end of the cylinder until nearly the whole stroke is made or until the steam-piston has traveled the entire length of the cylinder.

The steam and exhaust or induction and educ-

tion ports in both ends of the steam-chest are never closed at the same time.

If both ports at one end of the steam-chest are closed, the exhaust at the other end is open.

The invention is so clearly shown in the drawings as to render further description unnecessary.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The induction and eduction ports *a b*, formed in the steam chest, near each end thereof, in combination with the balanced piston-valves C C, when arranged to operate in the manner described.

2. In combination with the balanced piston-valves C C and steam chest A, closed at its ends, the pistons or heads E E, arranged to operate in the manner and for the purpose specified.

3. In combination with the balanced piston-valves C C, the annular cavities *c*, formed around the interior of the steam-chest, in the manner and for the purpose specified.

THOS. C. BALL.

Witnesses:

M. L. BAXTER,  
F. W. KELLY.