H. G. ASHTON & J. E. MAYNADIER.

Safety-valve.

No. 197,072. Patented Nov. 13, 1877.

Fig. 2.

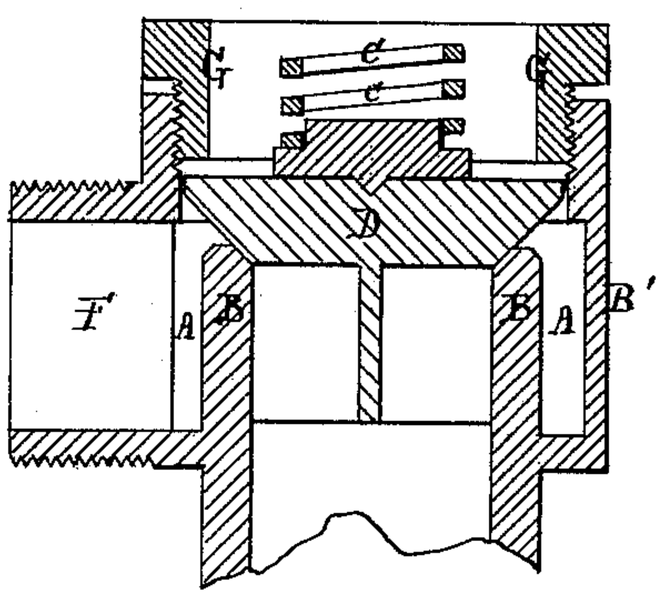



Fig. 3.

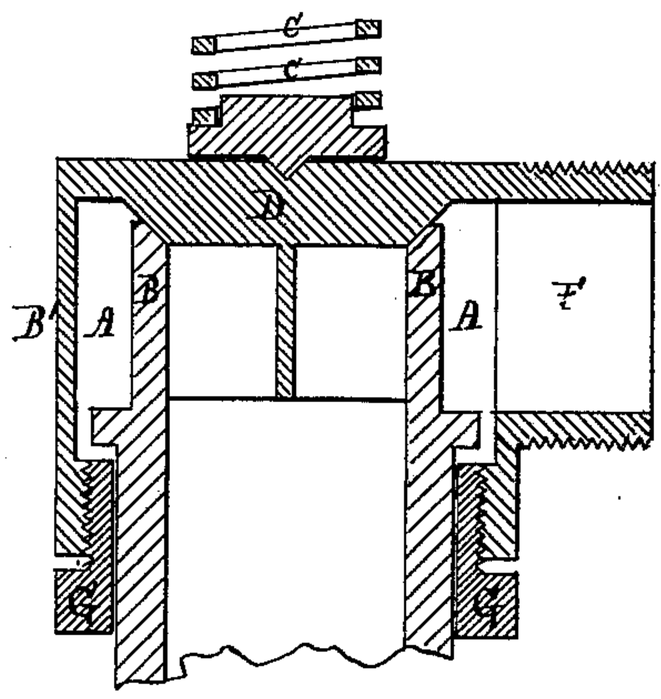
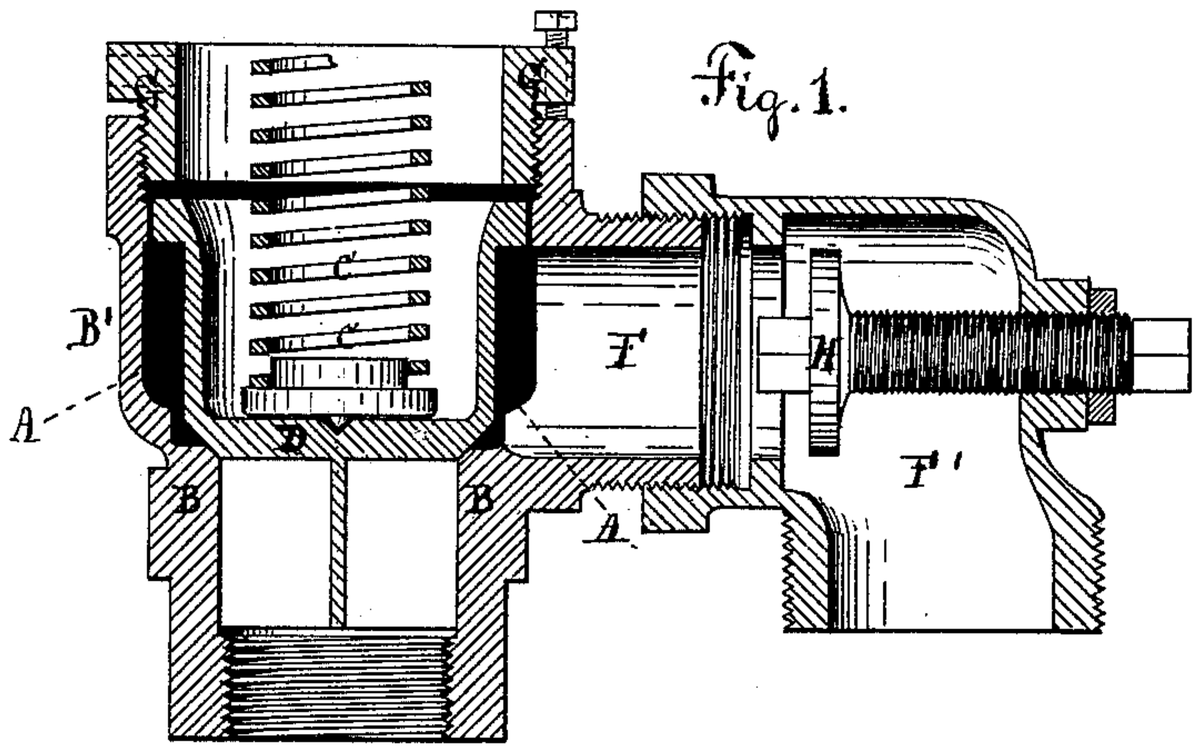



Fig. 1.

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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN SAFETY-VALVES.

Specification forming part of Letters Patent No. **197,072**, dated November 13, 1877; application filed June 24, 1876.

*To all whom it may concern:*

Be it known that we, HENRY G. ASHTON and JAMES E. MAYNADIER, both of Boston, in the county of Suffolk and State of Massachusetts, have invented a new Safety-Valve, of which the following is a description, in such full, clear, concise, and exact terms as to enable any person skilled in the art of making safety-valves to construct and use the same, reference being had to the accompanying drawing, making a part hereof.

Prior to our invention all safety-valves were so constructed that the waste-steam—that is, the steam which passed the ground joint of the valve, or a considerable portion of it—passed either directly or indirectly upward, and around the edge of the valve; and whenever this waste-steam was required to be carried to a given point away from the valve, a cover was required over the valve, into which the waste-steam passed, and from it by means of a pipe, which led from the cover to the point where the steam was to be discharged. In our invention the valve is open to the atmosphere on its outer surface, and the waste-steam does not ascend past the edges of the valve, but is discharged by means of a pipe which leads from a chamber of which the valve forms a part, as more fully described below; and this combination of the chamber of a safety-valve with a pipe for conducting the waste-steam to any desired point constitutes the main feature of our invention.

In the drawings, Figure 1 shows a safety-valve embodying our invention in the best form known to us, although we have constructed it in several other forms.

D is the valve proper, ground upon its seat in the usual way. B is the seat or bushing, which is secured to the boiler or other reservoir of power in the usual way; and C represents the spring or means of keeping the valve upon its seat until the pressure in the boiler exceeds the desired amount. In all these respects the valve does not differ from those in general use. Around the seat a chamber, A, is formed by the parts B of the casing forming the bottom of this chamber, the part B′ of the casing forming its sides, and the valve D completing this chamber, so that the steam which passes the seat of the valve enters this chamber, and cannot escape from it except by an outlet-pipe, F, which leads from the chamber A to any desired point.

In practice, this pipe F is supplied with a pipe, F′, which, together, make an outlet-pipe for carrying the waste-steam to the feed-water tank usually, so that the steam which escapes from the safety-valve is utilized in heating the feed-water. This chamber A, part of which is formed by the valve itself in combination with the pipe F F′, is the distinguishing characteristic of our new safety-valve.

The operation of our valve is as follows: When the pressure begins to exceed the amount at which the valve is set, the valve lifts slightly from its seat, and the steam escapes into the chamber A, creating a pressure in that chamber, which pressure is greater or less, according to the pressure of the steam in the boiler, the amount of rise of the valve, and the size of the outlet F. Thus, if the valve be raised, say, one one-hundred-and-twenty-eighth part of an inch from its seat, and the circumference of the valve at its seat be, say, six inches, the inlet-aperture through which the steam enters the chamber A will be nearly six one-hundred-and-twenty-eighth parts of a square inch, and the pressure of the steam in the chamber A will then depend upon the pressure of the steam in the boiler and the size of the outlet-aperture F, through which the steam escapes from the chamber A, as it is clear that steam of a given pressure entering a small chamber through a given aperture, and escaping from the same chamber by a given aperture, will produce a given pressure in the small chamber. This pressure in the chamber A is soon sufficient to lift the valve high enough to freely relieve any boiler, as the area of the valve which is exposed to pressure is greater when the valve is off its seat, and the chamber A is filled with steam under pressure, than when the valve is on its seat, and the steam thereby prevented from entering the chamber A.

It will now be obvious that the pressure in the chamber A can be made more or less with

a given pressure of steam in the boiler by making the outlet-pipe F smaller or larger, and consequently that the total pressure tending to raise the valve and keep it off its seat can be very accurately adjusted by changing the size of this outlet-pipe F relatively to the size of the inlet-aperture—that is, the aperture through which the steam escapes from the boiler and into the chamber A, the area of which aperture depends upon the size and rise of the valve.

With our safety-valve, when the outlet F is of the proper area relatively to the area of the inlet-aperture, the steam begins to "simmer"—that is, to escape very slightly—as soon as the pressure in the boiler reaches the point at which the valve is set; and a rise of a few ounces to the square inch above that pressure forces up the valve D high enough to cause the chamber A to be filled with steam under pressure, thereby bringing a greater pressure to bear, tending to lift the valve, and this greater pressure lifts the valve higher, and thus increases the area of the inlet-aperture, which increases the flow of steam into and the pressure in the chamber A, and consequently the valve "pops" or rises largely and suddenly very soon after the pressure passes the point at which the valve is set.

In practice, we regulate the rise of the valve by the cap G, which screws into the part B′ of the casing, this cap being set at the distance desired from the valve, so that the valve will abut against the cap when it has risen the desired distance. Of course, the greater the rise the more freely is the boiler relieved.

The valve has worked well with a rise of one-quarter of an inch, making the escape-aperture for the steam about one and a half square inch in area—much greater than in any other valve known to us, and much larger than is necessary for any locomotive-boiler. We commonly set the cap G so as to allow the valve to rise about one-tenth of an inch.

After the valve has popped, the escaping steam continues to pass through the chamber A until the pressure in the boiler reaches the point at which the valve was set; but as the pressure in the boiler diminishes, so does the pressure in the chamber A, and consequently the total pressure tending to hold the valve up is so much diminished that the spring C begins to force the valve toward its seat; but the least motion of the valve toward its seat diminishes the area of the inlet-aperture, through which the steam enters the chamber A, and consequently diminishes the pressure in the chamber A, so that the valve closes very rapidly after it once starts; and if the proportion between the area of the inlet and outlet apertures into and from the chamber A be correct, the valve will close when the pressure in the boiler is reduced a few ounces to the square inch below what it was when the valve opened.

In Fig. 1 of the drawings the valve D is shown as cup-shaped. This is for the purpose of enlarging the chamber A, and it is obvious that this is merely a matter of form, as illustrated in Figs. 2 and 3, the principle of our valve consisting in the use of a chamber, part of the wall of which is formed by the valve itself, and having an outlet-pipe leading from it to conduct the waste-steam either into the feed-water or to any other point desired.

The pipe F may be made of the proper area in the machine-shop when the valve is to be used for a given pressure of steam; but as this requires very nice workmanship to get the best effects, we, in practice, make this pipe F larger than can be required, and use an adjustable valve, H, by which the area of the pipe F can be not only accurately adjusted, but can be varied to suit different pressures of steam. This adjustable pipe F constitutes, in combination with our valve, an important feature of our invention.

When the valve D first leaves its seat, there will be, of course, a slight escape of steam between the valve and the walls, and this slight escape would continue were it not for the cap G, which, of course, stops it almost wholly; but the valve D should fit so nicely in the walls B′ of the casing as to make so slight a space between them that the amount of steam which escapes will be very slight; and we prefer to have a slight space, in order that the air may enter the chamber A after the valve D closes, and as the steam in the chamber A and in the pipe leading from it to the water in the feed-water condenses, in order to prevent the formation of a vacuum, which would cause the water from the tank to fill the chamber A, this being objectionable for some reasons.

Figs. 2 and 3 illustrate modifications in the form of our valve, and will be readily understood without further description.

We are aware of the patent to Naylor, No. 58,962, of 1866, reissued in 1869, No. 3,727, but disclaim the valve there shown, and all other valves in which any considerable part of the waste-steam escapes past the periphery of the valve.

What we claim as our invention is—

1. In combination with the seat B, casing B′, and outlet-pipe F F′, a safety-valve, D, fitted so closely as to prevent any considerable part of the waste-steam escaping past the periphery of the valve D, and to compel substantially the whole of the waste-steam to pass through the outlet-pipe F F′, and open to the atmospheric pressure on its outer surface, all as set forth.

2. In combination with a safety-valve, the seat B, casing B′, outlet-pipe F F′, and the adjusting-valve H, substantially as described.

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Witnesses:
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