

United States Patent Office.

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POUGHKEEPSIE, NEW YORK.

Letters Patent No. 63,137, dated March 26, 1867.

IMPROVEMENT IN STEAM GENERATORS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that we, WILLIAM BUCHANAN, of the city and county of New York, in the State of New York, and J. M. TOUCEY, of Poughkeepsie, in the county of Dutchess, and State of New York, have invented certain new and useful Improvements in the Fire-Boxes of Locomotives; and we do hereby declare that the following is a full and exact description thereof.

We will first describe what we consider the best means of carrying out our invention, and will afterwards designate the points which we believe to be new. The accompanying drawings form a part of this specification.

Figure 1 is a front view partly in section of the fire-box of a locomotive constructed according to our invention; the section being on the line T T in fig. 2.

Figure 2 is a longitudinal section on the line S S in fig. 1.

Similar letters of reference indicate like parts in all figures.

A is the exterior shell of the locomotive boiler. B is the upper portion of the fire-box. C is the lower portion. B¹ and C¹ form respectively the upper and lower faces of the inclined partition which partially divides the interior of the fire-box, leaving a hole, D, through which the gaseous products of combustion may rise from the incandescent fuel on the grate, and after circulating in the upper portion of the fire-box, may be drawn through tubes and discharged up the stack. E E, etc., are small tubes tapped through the partition B¹ C¹. E' E' are stays also employed. The lower portion C, of the fire-box, is by preference made of copper. The upper portion, B, may be made of good iron. The lower portion, whether made of copper or iron, by reason of its being exposed to more intense heat, and more violent alternations of temperature than the upper portion, is soonest burned out or destroyed; and one object of our invention is to provide for the easy removing and replacing of the lower half, C, together with the lower half, C¹, of the inclined partition. The periphery of the hole D is formed by two broad flanges, b and c, which extend respectively from the upper and lower faces B¹ and C¹, in the manner indicated, and are joined by rivets, F. In order to remove the lower fire-box C with the attached parts C¹ and c, we cut off the rivets F, and remove the stays E E', and the stays G, which connect the lower portion, C, of the fire-box with the external shell A. The fastenings at the lower edge being also removed, the whole lower portion of the fire-box is lowered out of the boiler; and on applying the new one in the proper position, and inserting new fastenings at all the points referred to and properly caulking the seams if necessary, our locomotive is in good condition for use for a long period. There may be two holes D, instead of one, if preferred. H is a hollow ring, by preference of cast iron, made in two or more parts, properly secured together, and provided with nozzles, h, extending radially inward, as represented. H¹ H¹ are pipes, which lead the external atmosphere from the exterior of the boiler into the hollow interior of this ring H. I is a slide, fitted in ways, as represented, and adapted to close these passages for the admission of the air, either partially or entirely, when desired. The air admitted through these passages and through the nozzles h, mingles with the hot gases rushing upward through the opening D, and aid in completing the combustion of the smoke therein. M is an internal pipe made of strong gas pipe, or other suitable material, and capable of bearing the full pressure of the steam in the boiler, even when somewhat warped and damaged by occasional exposure to great heat. It is provided with nozzles, m, which lie within the nozzles h, and which are contracted at their mouths, leaving a narrow orifice through which the steam may issue in a very powerful jet. N is a pipe leading from the steam room of the boiler into the hollow ring M, and admitting the steam therein under the control of the cock n. Whenever this cock is opened, steam from the boiler fills the internal ring M, at nearly the full boiler pressure, and the live steam, in rushing from the nozzles m, draws inward great volumes of fresh air. This apparatus for admitting steam and air to mingle with the hot gases, may be employed with some advantage in many conditions of work; but one of its most important uses is to insure complete combustion of the smoke, when the locomotive is standing at the station. It has been found in the combustion of many fuels, that the gases are consumed very thoroughly when the locomotive is in full operation, moving a heavy train; but when the train is stopped, and the fire ceases to be urged by the strong artificial draught due to the action of the blast pipe, the combustion is sluggish; and the great volumes of carbonic oxide and of opaque matter emitted slowly from the stack greatly inconvenience the attendants, and even the passengers. We have tested our apparatus, and with success. On approaching the station, and shutting off the steam from the engines, the engineer opens the cock n, either partially or entirely, the slide I being supposed to be opened nearly all of the time to admit air into the ring H. The opening of the cock n allows the steam from the boiler to fill the internal pipe M, and to commence to blow through the nozzles m. The waste of steam is almost unappreciable, even if the cock n be wide open; but in most cases it is sufficient to open this cock to a small extent, and the air drawn in through the pipes H¹ H¹, and thrown into the fire through the nozzles h, mingles with the hot, combustible gases, and effects their complete combustion in the upper chamber, B, of the fire-box. The gases are turned out from the chimney in a condition

very nearly transparent, and the inconvenience is very greatly lessened. The placing of the hollow ring H and its contents above the inclined partition B¹ C¹, and so as to surround the hole D, as represented, protects the hollow ring from the intense radiant heat of the fire, and insures that the fresh air shall be thrown into the hot gases at such a point that they shall find sufficient heat to ignite them, with sufficient space above to allow time for the perfect combustion of the gases. The construction of our inclined partition allows a very active current of water, or water mingled with steam, to flow constantly from the lower edge to the higher. The water is drawn in freely from the water-leg on the front side of the lower portion of the fire-box, and becoming heated and partially changed into steam by the intense heat applied on the lower face C¹ of the inclined diaphragm, it divides and passes around the flanges b c, finding ample space each side, and between them if there are two, to rush actively upward and emerge at the upper edge, and rise in a strong current and discharge the steam into the steam space in the boiler. This action goes on uninterruptedly, and with great freedom. Where there are two or more of the holes D, it will of course be understood that there are a correspondingly increased number of the flanges b c, rivets F, and hollow rings H, and their connections. Our hollow rings H, and their connections provided with the strong steam jets issuing from the nozzles m, as described, form a very cheap and effective means of introducing fresh air under a considerable pressure in the upper part of the furnace. The effect is superior in several important respects to the introduction of air without pressure at this point, or to the introduction of air under pressure below the grate. Air, without pressure, will not enter in sufficient volumes to complete the combustion of the immense volumes of combustible gases and smoke. The air introduced by our means in the upper portion of the furnace enters with great force in sufficient volumes to complete the combustion, and by its forcible entering at these points does not in the least increase, but rather diminishes, the intensity of the upward draught through the incandescent fuel below. We propose to incline the nozzles m and h upward to a slight extent, as shall be found expedient, in order to induce the proper effect on the draught of the fire while the locomotive is standing still. If in any case it be found desirable to greatly retard the draught, we can incline one or more of the jets issuing from the nozzles m h slightly or directly downward. But we do not believe it necessary to incline them very greatly either upward or downward. We propose usually to project them inward with an upward inclination of about ten degrees, as represented. A¹ A² is an inclined joint in the shell directly opposite to the inclined partition B¹ C¹, and extending from the front to the back of the fire-box on each side of the boiler.

Some of the advantages due to certain features of our invention may be separately enumerated as follows:

1. By reason of the division of the fire-box B C into an upper and lower chamber, as represented, we are able to burn the gases with facility, to protect the metal of the upper portion from the violent heating and cooling to which the lower part is exposed, and to better allow of the additional features of our invention by which air is introduced at the right point; the apparatus therefore is protected, and the lower portion is renewed without disturbing the upper portion.
2. By reason of the fact that the flanges b c, and rivets F, are arranged as represented, relatively to the inclined partition B¹ C¹, and to the other parts, we are able to provide a strong and reliable connection of the parts and to allow a very easy separation when desired.
3. By reason of the fact that the hollow ring H, adapted to supply steam and air, as described, is arranged as represented relatively to the inclined partition B¹ C¹, and to the aperture D, therein, we are able to introduce the air under pressure in the upper part of the fire-box, and to graduate its influx at will by apertures well protected from the radiant heat of the fire, and to insure an efficiency in the introduction of the air and the mixing thereof with the flame at the proper period, which has not been heretofore attainable with equally simple apparatus.
4. By reason of the fact that the steam pipe M, with its nozzles m, is arranged as represented relatively to the air pipes H¹ H², and the steam pipe N, and to the nozzles h, we are able to protect the steam apparatus from destructive influences, and to preserve it in condition for supporting a powerful steam pressure even after it has been many times and for long periods in position with the steam shut off.
5. By reason of the fact that the slanting seam A¹ A², of the external fire-box, is arranged opposite to the inclined partition B¹ C¹, and has a corresponding inclination, we are able by cutting these lines of rivets, alone to disconnect the sheets, and to more conveniently remove and renew the lower portion of the outer fire-box as well as of the inner.

Having now fully described our invention, what we claim as new, and desire to secure by Letters Patent, is as follows:

1. We claim the divided fire-box B C, when constructed and arranged substantially as and for the purposes herein set forth.
2. We claim the arrangement of the fire-box, by which we are enabled to readily disconnect, remove, and replace the lower portion, as herein set forth and described.
3. We claim the hollow ring H, and its connections protected from the direct radiant heat of the fire, and adapted to throw fresh air and steam into the gases rising through the hole D, or its equivalent, substantially in the manner and for the purpose herein set forth.
4. We claim the steam blow pipe M, with its nozzles m, and connection N, arranged as represented relatively to the air pipe H, and nozzles h, substantially as and for the purpose herein specified.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

WM. BUCHANAN,
J. M. TOUCEY.

Witnesses:

W. C. DEY,
D. L. FREEBORN.