

## **Specification of Charles Stevens : smoke-consuming furnaces.**

### **Contributors**

Stevens, Charles.

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A.D. 1860, 30th NOVEMBER. N° 2942.

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SPECIFICATION

OF

CHARLES STEVENS.

—  
SMOKE-CONSUMING FURNACES.  
—

LONDON:

PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,  
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY:

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Price 10d.

1861.









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A.D. 1860, 30th *NOVEMBER*. N° 2942.

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**Smoke-consuming Furnaces.**

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**LETTERS PATENT** to Charles Stevens, Manager of the British & Foreign Office for Patents, 1<sup>B</sup>, Welbeck Street, Cavendish Square, in the County of Middlesex, for the Invention of "**IMPROVEMENTS IN SMOKE-CONSUMING FURNACES.**"— A communication from abroad by Toni Fontenay, of Grenoble, in the Empire of France.

Sealed the 22nd May 1861, and dated the 30th November 1860.

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**COMPLETE SPECIFICATION** filed by the said Charles Stevens at the Office of the Commissioners of Patents, with his Petition and Declaration, on the 30th November 1860, pursuant to the 9th Section of the Patent Law Amendment Act 1852.

**5 TO ALL TO WHOM THESE PRESENTS SHALL COME, I, CHARLES STEVENS,** Manager of the British & Foreign Office for Patents, 1<sup>B</sup>, Welbeck Street, Cavendish Square, in the County of Middlesex, send greeting.

**WHEREAS** I am in possession of an Invention for "**IMPROVEMENTS IN SMOKE-CONSUMING FURNACES,**" and have petitioned Her Majesty to grant unto me, my  
**10** executors, administrators, and assigns, Her Royal Letters Patent for the same, and have made solemn declaration that it has been communicated to me from abroad by Toni Fontenay, of Grenoble, in the Empire of France.

**NOW KNOW YE,** that I, the said Charles Stevens, do hereby declare the following Complete Specification under my hand and seal fully describes and



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ascertains the nature of the said Invention, and the manner in which the same is to be performed (reference being had to the accompanying Drawings), that is to say:—

The present Invention consists of improvements which may be applied to furnaces of all descriptions. 5

A, B, C, D, Fig. 1, represents the section of a furnace; E, F, is the grate on which the fuel H rests, the latter being introduced as required by means of a door G, situated at the side, but which may also be placed above, between the points A, D. The chimney or flue F, K, L, begins immediately beneath the grate, so as to facilitate the draught as much as possible. The air required for 10 the combustion enters at the door G above mentioned, passes through the fuel and grate, and after thus serving in the combustion escapes with the gases by the chimney. The space E, B, C, K, which receives the ashes, is furnished with a door at B or any other point, by means of which the fire is stoked and the ashes removed. Care must be taken that this door shuts sufficiently close 15 to prevent the draught from being affected during the combustion, although in some cases (as when the layer of fuel is very thick) it may be best to allow a small quantity of air to enter by it. Bellows may also be adapted to facilitate the draught, the tube being placed near the door G, in which case the doors G, B, must be well closed during the working of the bellows. 20

A, B, C, D, Fig. 2, represents the section of the fire box of a locomotive. This fire box, instead of being open at the bottom, is closed from B to C by a double partition, the interior of which is in communication with the boiler, and serves as heating surface, and receives the ashes at the same time. The ashes are removed and the fire stoked by means of a door B, closing tightly, but 25 which may, if necessary, be left a little way open, so as to allow the air to penetrate, and thus render the combustion of the gases more complete. The grate is placed at E, F, extending the whole width of the fire box, and to prevent its being too rapidly consumed, is composed of hollow bars communicating with the boiler by their extremities, and filled with water. The bars thus 30 serve as heating surface. In order to facilitate the circulation of the water, it is advisable to bring the injection pipes of the feed pumps of the boiler into the vicinity of the lower extremities of the bars, which should be capable of being easily dismantled for cleaning when required. Above the grate is a double partition G, K, F, the interior of which is filled with water, and com- 35 municates with the boiler and the bars of the grate, and consequently serves as heating surface. This double partition may be crossed at its lower part, from L to F, by tubes, serving as tie pieces and heating surface, and in which the flame passes. It occupies the whole width of the fire box, and forms, with the



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grate and the sides of the fire box, a receptacle E, F, K, G, in which the fuel H is introduced by the door I. The air required in the combustion enters at the same door and passes through the fuel and the grate E, F, then through the tubes F, L, and after serving in the combustion ascends with the gases  
5 towards the tubes T of the machine, and passing through them escapes by the chimney. At the point M a door is placed, by means of which the tubes T are cleaned and stopped. To facilitate the draught, air may also be introduced by means of bellows near the door I. The doors I, B, and M, should then be well closed during the working of the bellows, which are put in motion by  
10 means of gear work communicating with one of the axles of the tender. In order that the bellows should work both when the engine is advancing and when it is going backward, the pipe A, B, Fig. 3, communicating with the furnace, is connected to the bellows E, C, D, by means of two pipes B, C, and B, D, which are opened or closed according to the direction in which the  
15 engine moves by a balance valve B working spontaneously from the different degrees of pressure in the two pipes. The adoption of these bellows would give the advantage of allowing the water of the tender to be utilised by heating it, the escaping steam serving in the draught, and would also lessen the counter pressure in the slide valves and cylinders, and so increase the useful  
20 effect of the machine.

Fig. 4 is the same as Fig. 2, but shows, in addition, the form which might be given to the furnace in case the fire box of the locomotive to which the furnace is to be applied should be two small. Instead of hollow bars containing water and communicating with the boiler, others may be employed, in  
25 which is made to pass the whole or part of the current of cold air serving in the draught. This arrangement is represented, Fig. 5, as adapted to a locomotive. The bars extend from E to F, and are independent of each other, and may be removed as easily as ordinary bars. Openings placed at the point E in the fire box allow of the introduction of cold air, which passes  
30 through the whole length of the bars, then into a partition extending from F to G, and escapes by the openings at the point G, to serve afterwards in the combustion. This arrangement may be advantageously employed in fixed machines where there is a strong draught, and especially suited to fixed machines not worked by steam, and in which there is no boiler filled with  
35 water, which can be placed in communication with the hollow bars of the furnace.

Fig. 6 shows the same arrangement as Fig. 4, except that the hollow bars of the grate only extend from the point F to E, the space between E and E<sup>1</sup>



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being furnished with ordinary bars, which allow the fire to be removed. A double partition, containing water, communicating with the boiler and the hollow bars, is placed between E and B, dividing the ash box into two parts, and having a door which allows the fire between the hollow bars to be stoked. The part of the ash-box situated beneath the ordinary grate is closed by ordinary 5 partitions E<sup>1</sup>, B<sup>1</sup>, and B<sup>1</sup>, B, and has a sliding door at the point E<sup>1</sup>, B<sup>1</sup>, which may be opened or shut at will during the movement of the machine, according to the requirements of the combustion.

Fig. 7 shows the same arrangement as in the Figure last described, with the exception that the hollow bars F, E, are replaced by a double partition com- 10 municating with the boiler and tie-pieced with tubes, through which pass the flames, and serving as heating surface.

Fig. 8 represents an arrangement, one of the advantages of which is, that it may be applied with great facility to all kinds of existing locomotives.

A, B, C, D, is the longitudinal section of the fire box of an ordinary loco- 15 motive. This fire box is entirely closed from B to C by an ordinary bottom piece. A door is placed between the points E, C, for cleansing the space E, C, D, G. The partition G, F, E, is double and contains water communicating with that in the boiler. At the upper part, from G to F, this partition is held together by ordinary tie pieces, and in the lower part, from F to E, 20 tubes in which the flames pass, and which serve, as well as the two faces of the double partition as heating surface; these tubes are 200 or more in number in an ordinary locomotive. The partition is furnished at the point H with a door, which is kept shut during the working of the machine, and serves, when it is desired, to examine or repair the tubes T. As this door may be 25 momentarily exposed to the fire on both sides, it is advisable, if practicable, to avoid this inconvenience by placing it on the side of the fire box at the point H<sup>1</sup>, for instance, I, J, K, L, is an ordinary grate formed of bars twisted into the shape of the letter S, and having laterally, from J to K, fastenings which keep the bars at proper distances. The fuel P is introduced as required by the 30 door I, M, through which also passes the air necessary for the combustion. The latter then traverses the upper part only of the fuel, and the lower part of the grate I, J, K, L, then the fuel then passes with the gases into the tubes situated in the lower part of the partition G, E, reaches the tubes T of the machine, and escapes by the chimney. A door is placed at the point N, by 35 means of which the ashes are removed, the fire stoked, &c., and which, in case of need, may allow of the introduction of a small quantity of air to direct the fire properly during the movement.



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The whole of the arrangements above described may be applied to fixed machines. Thus the arrangement indicated, Fig. 8 is represented Fig. 9 as applied to a fixed steam engine.

A, B, and C, D, are the boiler tubes of the machine; E, F, the double  
5 partition already described, connected at its upper part by ordinary tie pieces, and at the lower part by tubes, in which the flames pass; this double partition, which contains water communicating with that in the boiler tubes, serves as heating surface; G, H, F, is the grate on which the fuel is placed, the latter being introduced together with the air serving in the combustion by the  
10 door K. The door L, which is kept shut, is used when the ash box is to be emptied, or the fire stoked. Another door, not indicated in the Figure, is placed in the stonework of the side, for the purpose of cleansing the space E, F, M, N.

A, B, C, D, Fig. 10, shows the longitudinal section of the fire box of an  
15 ordinary locomotive. This fire box is entirely closed from B to C by an ordinary bottom piece, which may also be doubled and held together between the points B, E, and will then contain water communicating with that in the boiler, and serve as heating surface. G, F, is a second partition, also double, and containing water in communication with that in the boiler, and is held  
20 together by ordinary tie pieces, its two faces serving as heating surface. This partition has at the point H a door, which is kept shut during the movement of the machine, and serves, when it is desired, to examine or stop the tubes T, and as this door is at any moment liable to become exposed to the fire on both sides, it should be placed at the side of the fire box  
25 as at the point H. At the point F on the side of the fire box a suitable opening is arranged for cleansing the interior of the partition G, F, from incrustations; this opening may be closed by means of a screw plug; I, J, K, L, is an ordinary grate formed of S-shaped bars, having laterally, from L to K, fastenings for maintaining the bars at proper distances; P is the fuel, which  
30 is introduced as required by the door I, M. The air necessary for the combustion enters at the same door, crosses the upper part only of the fuel, and the lower part of the grate I, J, K, L, passes through the fuel, reaches with the gases the tubes T of the machine, and escapes by the chimney. A door is placed at the point N, by means of which the ashes are removed and the fire  
35 stoked, and which, if required, allows the entrance of a little air to direct the fire properly during the movement.

All the above arrangements are applicable to fixed machines. In those which are not worked by steam, and in which there is no boiler filled with water, which may be placed in communication with the interior of the partition



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G, F, the latter should communicate with the open air to prevent the surface from being too quickly destroyed. The partition may, however, be an ordinary one, and constructed of either metal or brick, or the upper part may be of brick and the lower part of metal. The latter arrangement may be applied in machines of every form. The metallic part may then be hollow and contain 5 water communicating with that in the boiler, and thus serve as heating surface.

In the arrangement represented Fig. 10, some difficulty is experienced in examining the tubes T during the progress of the locomotive. This may be remedied by adopting the arrangement shown Fig. 11, which consists princi- 10 pally in retaining the door M for examining the tubes, and in placing one or two doors at the point N, by means of which the fuel is introduced, together with the air (or part of the air) required in the combustion. As in the preceding Figures, the door of the ash box may also serve for the introduction of a certain quantity of air to direct the fire during the working. The partition 15 A, B, C, is hollow, and contains water communicating with the boiler. One or more openings are placed in the side of the fire box to allow of the interior of the partition being cleansed.

Having thus described my Invention, what I claim and desire to secure by Letters Patent is, the various arrangements above-described and represented 20 in the accompanying Drawings, which may be adapted to furnaces of all descriptions, whether for locomotives, fixed machines, or otherwise.

In witness whereof, I, the said Charles Stevens, have hereunto set my hand and seal, this Thirtieth day of November, in the year of our Lord One thousand eight hundred and sixty.

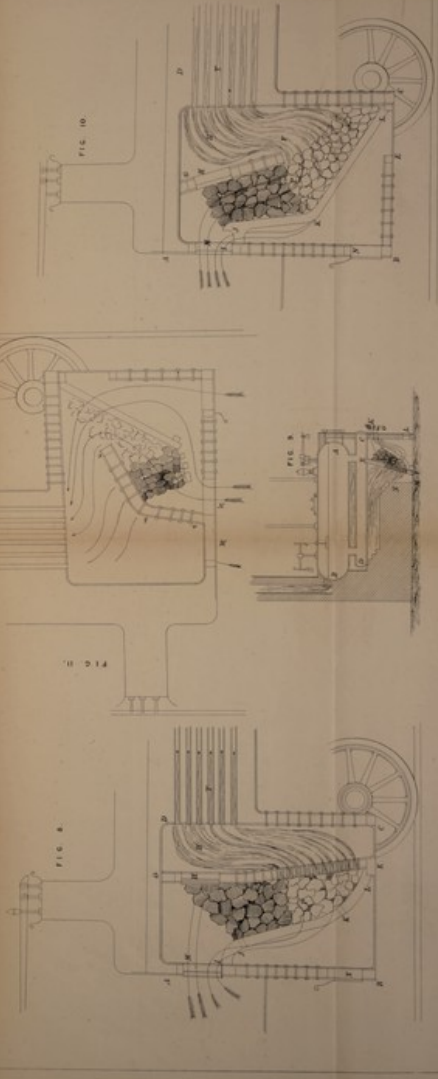
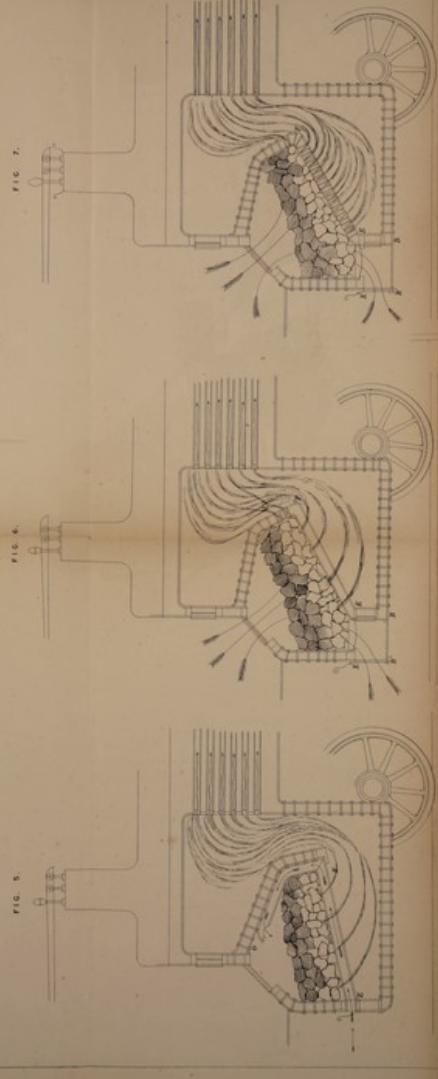
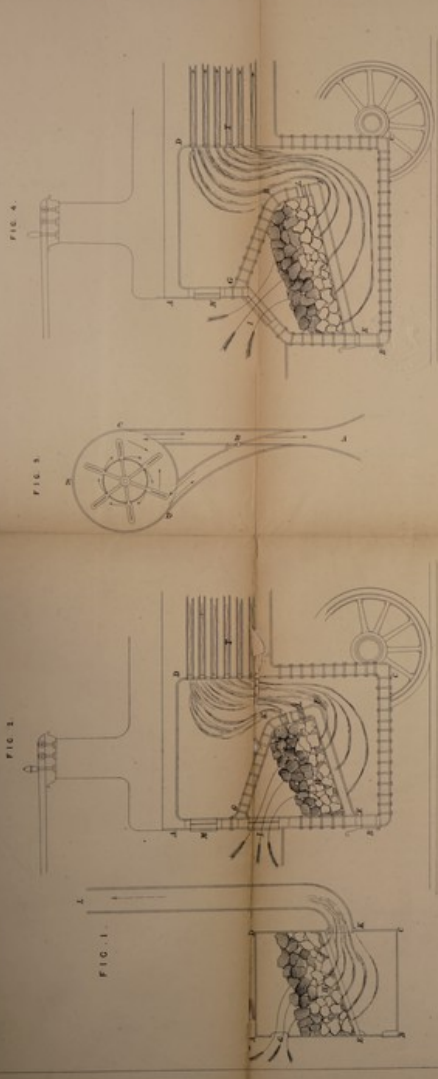
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CHARLES STEVENS. (L.S.)

LONDON :

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,  
Printers to the Queen's most Excellent Majesty. 1861.





The filed drawings is not reduced

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Drawn by John E. Cox



