

Specification of Samuel Hall : apparatus for supplying air to furnaces.

Contributors

Hall, Samuel.

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A.D. 1842 N° 9345.

S P E C I F I C A T I O N

OF

SAMUEL HALL.

APPARATUS FOR SUPPLYING AIR TO
FURNACES.

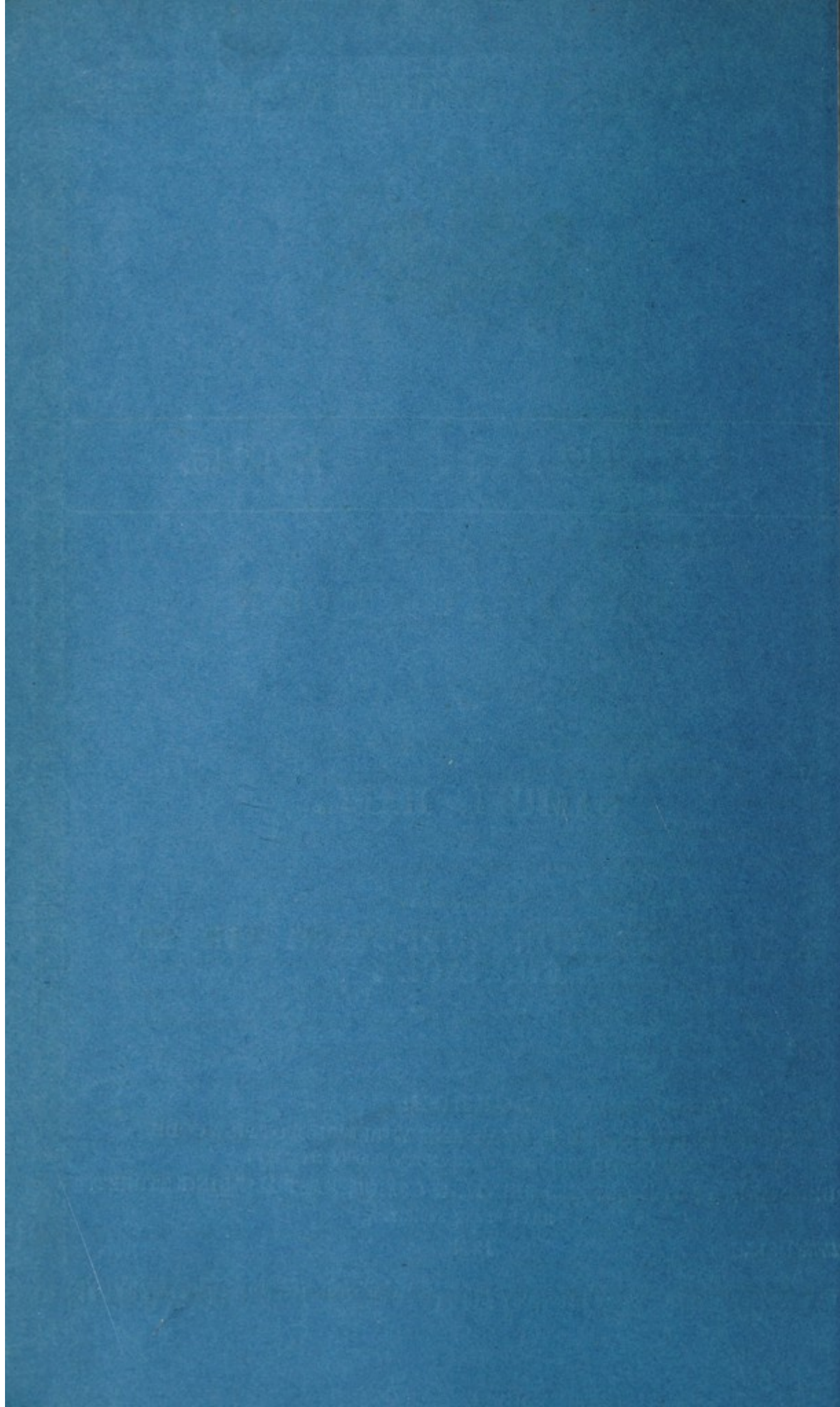
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A.D. 1842 N° 9345.

Apparatus for Supplying Air to Furnaces.

HALL'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, SAMUEL HALL, of Basford, in the County of Nottingham, Civil Engineer, send greeting.

WHEREAS Her present most Excellent Majesty Queen Victoria, by Her
5 Letters Patent, under the Great Seal of Great Britain, bearing date at Westminster, the Ninth day of May, in the fifth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Samuel Hall, Her especial licence, full power, sole privilege and authority, that I, the said Samuel Hall, my exors, adñors, and assigns, or such others
10 as I, the said Samuel Hall, my exors, adñors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick upon Tweed, and within the Colonies and Plantations abroad, my Invention of "IMPROVEMENTS
15 IN THE COMBUSTION OF FUEL AND SMOKE;" in which said Letters Patent is contained a proviso that I, the said Samuel Hall, shall cause a particular description of the nature of my said Invention, and in what manner the same is to be performed, to be inrolled in Her said Majesty's High Court of Chancery within six calendar months next and immediately after the date

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of the said in part recited Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Samuel Hall, do hereby declare that the nature of my said Inventions and the manner in which the same are to be performed, are fully described and 5 ascertained in and by the following description thereof, reference being had to the Drawings hereunto annexed, and to the figures and letters marked thereon, the same letters denoting the same parts in all the Figures, (that is to say) :—

The objects of my Inventions are improvements upon and additions to my 10 methods and apparatus for more perfectly effecting the combustion of fuel and smoke, as described in the Specifications of my Patents of Twenty-fourth June One thousand eight hundred and thirty-six, Thirtieth July One thousand eight hundred and thirty-eight, and Fourteenth January One thousand eight 15 hundred and forty-one.

Figures 1 and 2 represent my Invention as applied to the furnace of an ordinary waggon-shaped boiler for a stationary engine. Figure 1 being a vertical and longitudinal section taken through the middle, and Figure 2 a horizontal section taken through the flame or smoke flues. *a* is the fire-place; *b*, the bridge; *c*, the smoke flue, through which the smoke and heated 20 gases pass to the chimney *d* in the course shown by the arrows; *e, e*, are two metallic plates, inserted at the top and bottom of the passage where the smoke flue leads from the boiler into the chimney. In these two plates the ends of a number of pipes *f, f*, are fixed, the upper ends of which are open to the atmosphere and the lower ends to the hot air flue *g*, which passes under 25 the boiler and under the main branch of the flame or smoke flue, as shewn in Figure 1, until it arrives at the bridge *b*, where it branches off right and left, so as to form two small flues *h, h*, one on each side of the fire-place, and beneath a portion of the smoke flue, as shown by dotted lines in the horizontal section, Figure 2. From the flues *h, h*, as well as from the lining of the door, 30 small apertures *i, i*, open into the fire-place. The draught of the chimney produces a descending current of air through the pipes *f, f*, and along the air flues *g* and *h*, and through the openings *i, i*, into the fire-place, as shown by arrows; the temperature of this air is greatly raised in its passage through the pipes *f, f*, and flues *g* and *h*, and then mingles with the smoke and 35 inflammable gases as they are liberated from the burning fuel and effectually consumes them.

Figures 3 and 4 represent my Invention as applied to a bleacher's pan,

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dye's pan, brewing copper, or other similar vessel. Figure 3 is a vertical section, and Figure 4 a horizontal section taken through the flame or smoke flue. *a* is the fire-place; *b*, the flue, through which the flame or heated gasses pass (as shown by the arrows) to the chimney *c*; *d, d*, are a series of pipes or passages through the brickwork into the fire-place and below the flame or smoke flue, for the purpose of distributing a supply of air in jets or streams among the smoke or inflammable gases to effect their combustion. Air may be taken immediately from the atmosphere or it may be heated by a system of pipes placed in the flue leading from the pan or copper to the chimney, bringing it in at the sides of the flue by a method similar to that herein described, as applied to the waggon-shaped boiler.

Figure 5 represents my Invention as applied to the furnace of a baker's oven, or to any other description of furnace. *a* represents the fire-place; *b*, the ash-pit; *c, c*, the air passages, running parallel with the fire-place; and *d, d*, the apertures, which may be of any proper shape, and of which there may be any suitable number, for introducing jets or streams of air, either from the atmosphere or previously heated, into the furnace; *e* is the opening at the end of the furnace to convey the flame from it to the bakers' or any other description of oven.

In the Specification of my before-mentioned Patent of One thousand eight hundred and thirty-eight, I described a plan for supplying air to the furnaces of marine steam engine boilers and other boilers of a similar construction, by inserting within the water spaces bent pipes to convey jets of air from the ash-pit to the fire-place above the fuel; the upper ends of these pipes open into the fire-place and the lower ends into the ash-pit. The pipes are therein shown as secured in their places, so as to make a water and steam joint with the metal of the boiler, by means of double nuts. One of the improvements relating to such apparatus in this my present Patent, consists in an improved mode of securing such pipes. In lieu of the double nuts above mentioned, I employ conical ferrules driven tightly into the open ends of the tubes, in the same way as is done in securing the fire tubes of locomotive boilers. This improvement is shown in Figure 6, wherein *a* represents the fire-place; *b*, the ash-pit; *c, c*, the air tubes, placed in the water spaces, with their upper ends opening into the fire-place and their lower ends into the ash-pit; and *d, d*, are the ferrules driven into the ends to press them into close contact with the boiler plate to make secure joints.

Figures 7, 8, 9, and 10, represent the apparatus which comprises my improvements, as applied to a tubular boiler of a locomotive steam engine.

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Figure 7 is a longitudinal section of the engine, taken through the centre. Figure 8 is a transverse section, taken as shown by dotted lines from *u* to *u* in Figure 7, looking towards the safety valve. Figure 9 is another transverse section, taken from *v* to *v* in Figure 7 through the smoke box, and looking towards the fire-place; and Figure 10 is a horizontal section of the furnace and 5 of the apparatus within it, taken as shown by dotted lines from *v*¹ to *v*¹ in Figure 7. These four Figures contain some of the improvements set forth in the Specifications of my Patents of One thousand eight hundred and thirty-six and One thousand eight hundred and forty-one, combined with my present improvements, the description of which is necessary the more clearly to 10 explain my present improvements. *a* and *a*¹ are the usual pipes or tubes; *a*¹ being such of them as are converted into air-inlet tubes, which may be more or less numerous and differently interspersed among the others as experience may show to be the most efficacious. The pipes *a*¹ have other pipes *a*¹¹ inserted into one end of them to convey atmospheric air through the smoke or 15 exhausting box A (by which it is partially heated) to such pipes *a*¹ on its way to the fire. *a*¹¹¹, *a*¹¹¹, *a*¹¹¹, are small tubes around the fire to convey atmospheric air, as above mentioned, above the fuel, to combine with or consume the smoke and inflammable gases generated from the fuel. Beside the air pipes described in the Specifications of my said Patents, there is also one or more tiers of similar 20 tubes or apertures *a*¹¹¹¹, *a*¹¹¹¹, to answer the same purpose as fire-bars, videlicet, for the admission of air into the lower part of the furnace and among the fuel, to effect the combustion of the carbonaceous parts of it. The other part of my apparatus before mentioned for effecting the above purposes, and which may be applied or not at pleasure, consists of a metallic apparatus E, Figures 7, 8, 25 and 10. The spaces *c*, *c*, *c*, are connected with the boiler, and are full of water; a number of oval or oblong tubes *d*, *d*, are to answer the same purpose as the tubes or apertures *a*¹¹¹¹, *a*¹¹¹¹, and are to give an additional quantity of air among the fuel, which air is brought to them through the passage *e*, the same being open at the bottom to the atmosphere. As the draught of the 30 atmospheric air through the fire-bars, as well as through the air tubes *a*¹¹, *a*¹¹¹, and *a*¹¹¹¹, is very slight when the engines are stopped, and no steam passes from them up the chimney, I apply a pipe *w* and a valve *x* to the boiler, to pass a portion of steam, while the engines are at rest, up the chimney, for the purpose of producing a draught of air, in the same way as is effected by 35 the steam which escapes through the exhausting pipe or pipes of the engines when they are in activity. To the pipe *w* I apply a cock *w*¹, to receive a quantity of steam from any other boiler or vessel, and pass it through the

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pipe *w* into the chimney, for the purpose of creating a current of air through the fire when it is first lighted, in order to get the steam up in the boiler more expeditiously than is done in the usual way. In some cases, instead of introducing a quantity of steam into the chimney for the above purpose by cock *w*¹ and pipe *w*, I convey it from such other boiler or vessel, and introduce it by a separate pipe *w*¹¹, which can be let down into the chimney and withdrawn at pleasure.

As that part of my improvements which causes a current of air to pass through the fires of locomotive engines when they are at rest would cause a waste of fuel if the steam then generated were allowed to escape into the atmosphere, I make another addition to the apparatus to render the steam so generated available. This consists of a pipe *x*¹, applied also to the boiler, to pass the steam generated by such fuel (which would otherwise be wasted, as above stated) into a system of pipes placed within the water in the tender, thereby heating it previously to its entering into the boiler, and thus forming a component part of my apparatus. I place another valve *y*, Figure 7, to the boiler, with a lever *z* attached to it, which is properly weighted, so as to allow the waste steam to pass through the pipe *x*¹ into the tender, instead of escaping into the atmosphere through the safety valve, and at the same time to prevent the pressure of the steam in the boiler from being too much lowered. The steam may, however, if required, be passed with much greater velocity through the pipe *x* into the tender, by reducing the weight on the valve *y*, or by any other suitable means. B, B, Figures 7 and 9, is a bent metallic plate, which leaves a space C, C, C, between it and the sides and top of the smoke box A; this plate is perforated with a great number of small holes, their aggregate area being equal at least to the area of the chimney, but I prefer them to be equal to double its area or even more, so as to give a free passage of the gaseous matters through them into the space C, C, C, on their way from the box A to the chimney, and at the same time to prevent the passage from the former to the latter of any large pieces of fuel. D is a pipe, perforated with small holes, and communicating with the force pump by a pipe supplied with a stop-cock; the use of this pipe and cock is to throw a jet of water into the smoke box at pleasure. F, F, is a steam-tight casing around the chimney, through which a portion of the water may be passed on its way from the tender to the boiler for the purpose of being partially heated; this casing may be connected or not with the casing around the smoke box, as described in the Specification of my Patent of the Fourteenth of January One thousand eight hundred and forty-one, and comprised in the eighth claim made therein. G is a pipe to convey

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the water from the water pumps to the casing; and H another pipe to convey the water from the casing to the boiler. I is a casing, applied to the doors of the smoke box, to be filled with water to keep them cool, and may be connected or not with the casings around the chimney or smoke box, or both.

Having described the various apparatus which comprise the subjects of this Patent, I now proceed to explain the extent of my claims.

As regards stationary and marine engines and furnaces, I claim:—

First, the particular mode, as herein described, of taking air for effecting the combustion of smoke from the atmosphere, and passing it underneath the main flame flues or passages from the fire-places which pass under the bottoms of steam engine or other long boilers, in combination with the introduction of such atmospheric air at the bridge of the fire-place.

Second, the above particular mode of taking atmospheric air, under the above mentioned main flues of boilers, in combination with its introduction either in the front or sides of the fire-place, or both, or all around it.

Third, the combination of the mode of taking atmospheric air to furnaces, as described in the above first and second claims, in combination with the previous heating of the air by the means described and claimed in this Patent and my aforesaid Patents of One thousand eight hundred and thirty-six and One thousand eight hundred and forty-one.

Fourth, the introduction of air of atmospheric temperature by any other means than the above described, at the two sides of the above description of furnaces, with or without admitting any at the front or back thereof.

Fifth, the introduction of heated air to furnaces in the manners described in the last or fourth claim.

Sixth, the introduction of air of atmospheric temperature all around the flues of bleachers, dyers, brewers, and other similar pans or boilers, or as nearly all around them as may be required, or as is convenient and efficient.

Seventh, the introduction of heated air, as described in the last or sixth claim.

Eighth, the combination of the feeders for supplying fires with fuel, known by the name of Stanley's feeders, with each of the methods of supplying air to furnaces, described in this Specification and those of the Patents of One thousand eight hundred and thirty-six, One thousand eight hundred and thirty-eight, and One thousand eight hundred and forty-one respectively, to which furnaces such feeders are applicable.

Ninth, the introduction of jets or streams of air of atmospheric temperature to the furnaces of bakers or other ovens; also to roasting, smelting, calcining,

FIG. 1.

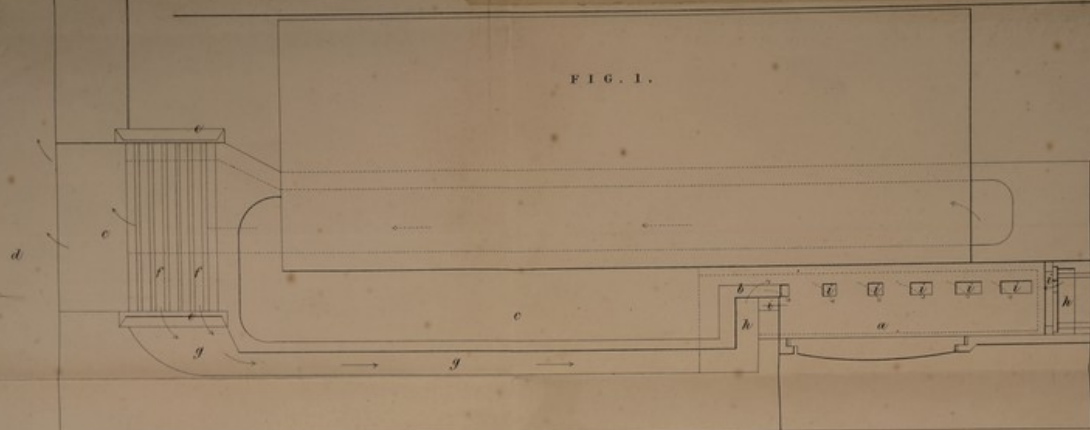
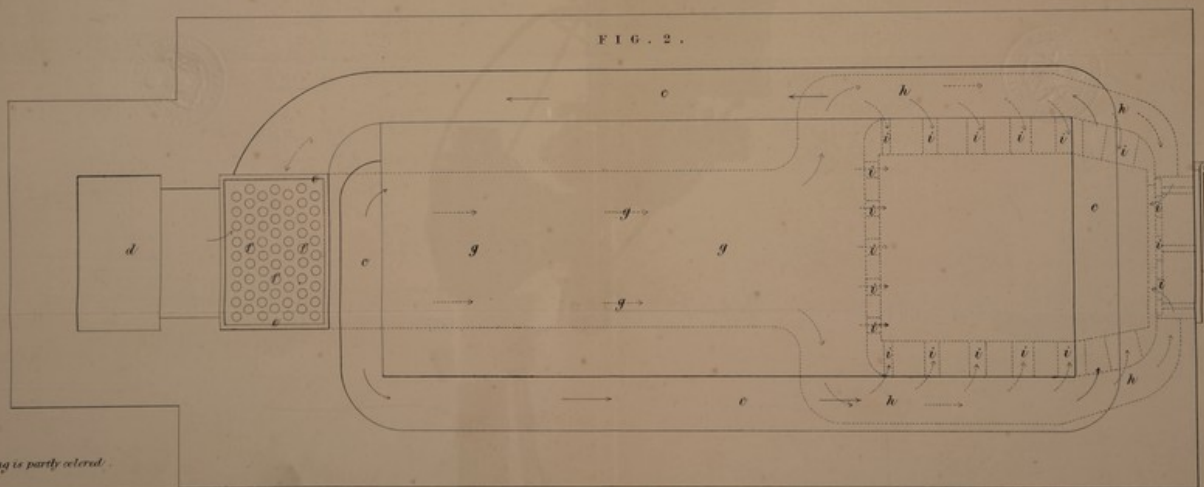


FIG. 2.



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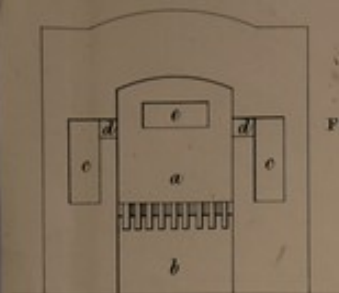


FIG. 5.

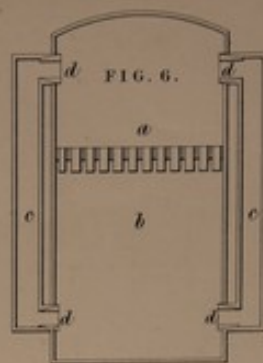


FIG. 6.

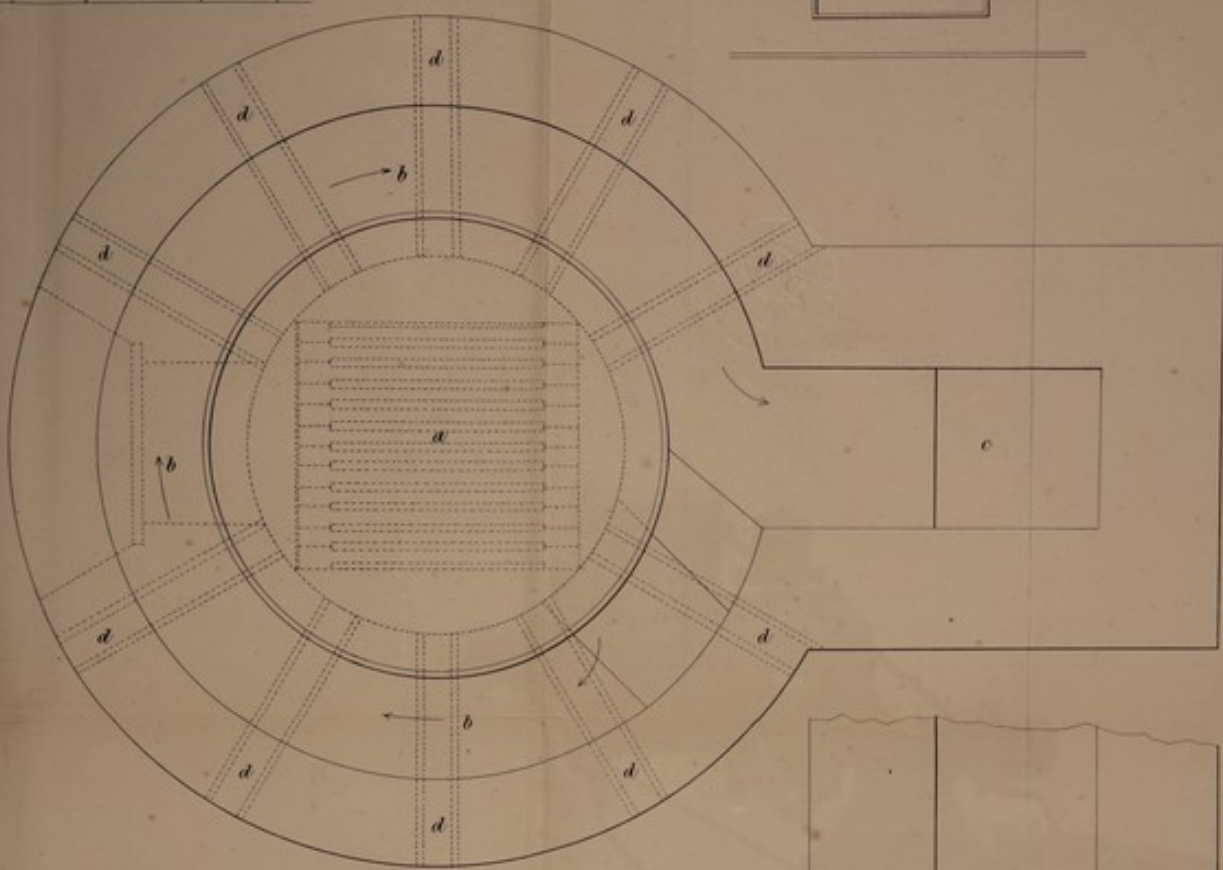


FIG. 4.

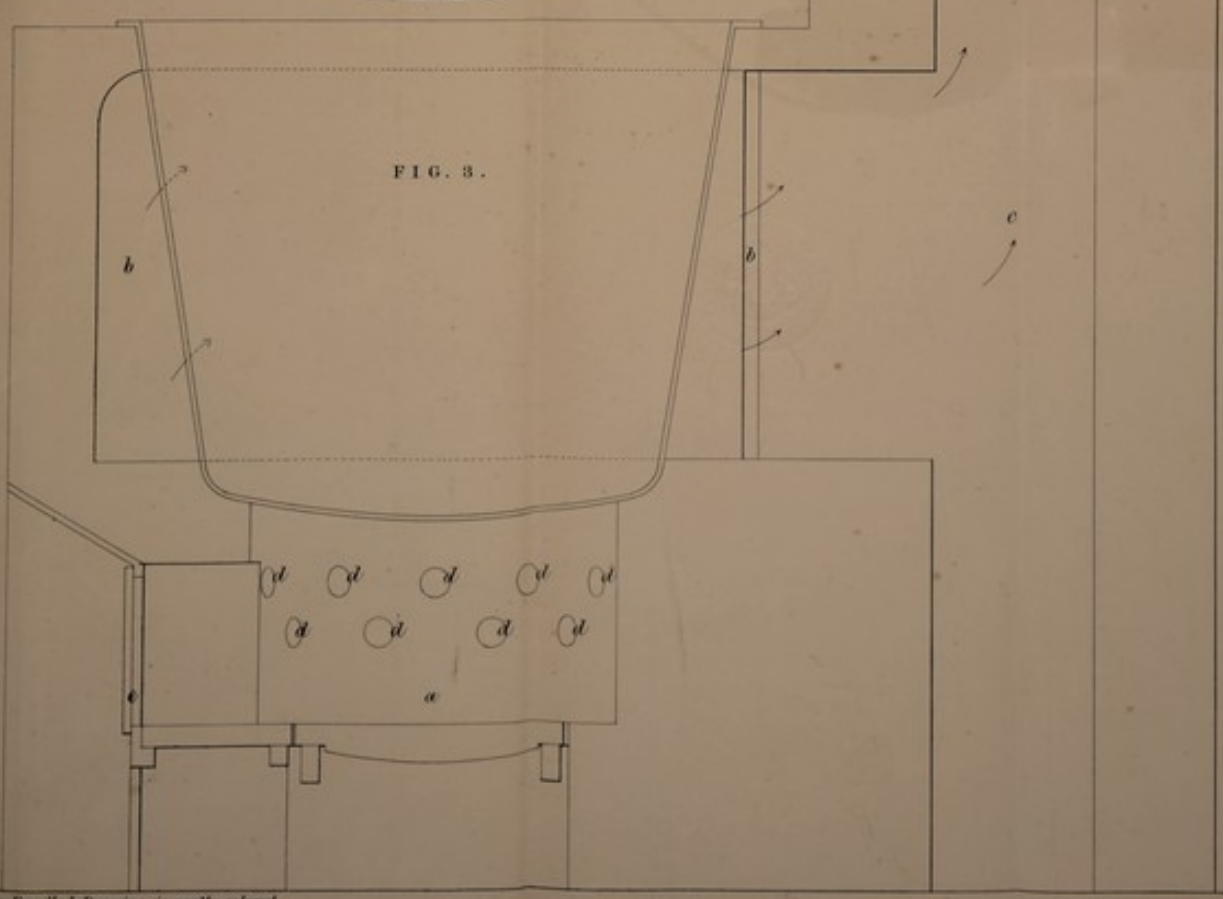


FIG. 3.



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FIG. 8.

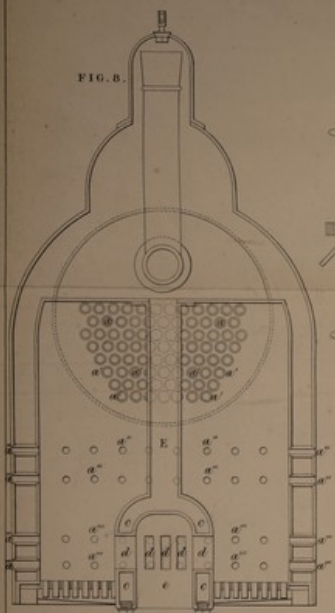


FIG. 10.

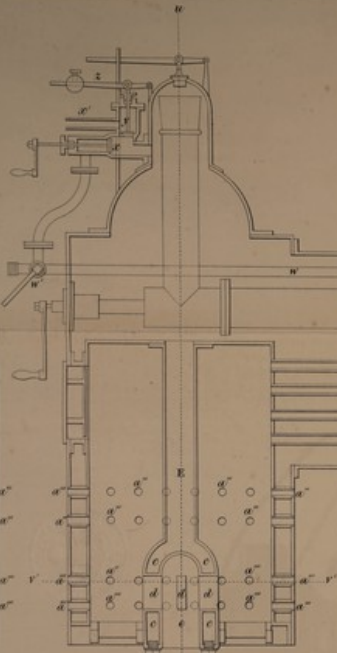
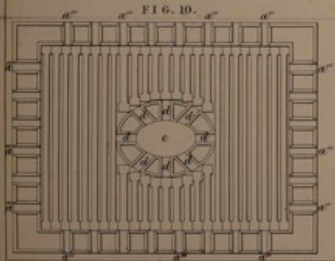


FIG. 7.

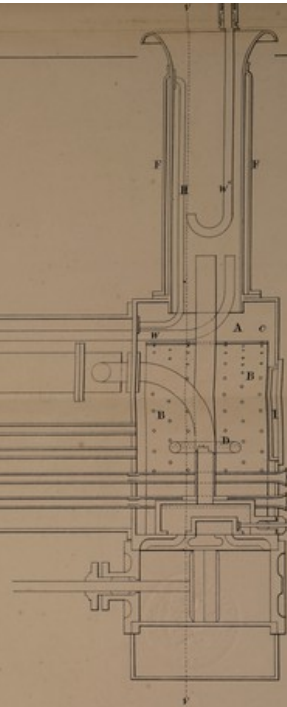
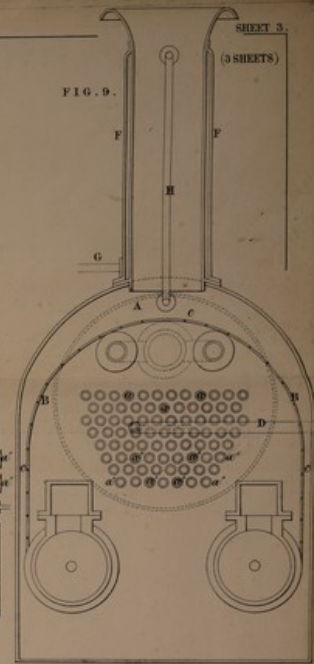


FIG. 9.



SHEET 3.
(3 SHEETS)

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and all other furnaces, whether taken into such furnaces by the means shewn by Figure 5 or Figure 6, or in any other way.

Tenth, the introduction of heated air in the manner and to the furnaces described in my last or ninth claim.

5 Eleventh, the improved method, herein described, of fixing the pipes for supplying air to the furnaces of marine or other similar boilers.

As regards locomotive engines, locomotive boilers, and other similar boilers, I claim :—

First, the use of one or more series of tubes, as shewn by a^{1111} , Figures 0 7, 8, and 10, placed around and near the bottom of the fire, to effect the combustion of the carbonaceous parts of the fuel in the same way as tubes a^{111} effect the combustion of the volatile inflammable parts of such fuel.

Second, the employment of the apparatus placed within the furnace, as shewn herein, to give a still further supply of air to the furnace through 5 the apertures d, d, d , to the central part of the furnace, whether such apertures open into the carbonaceous or into the volatile parts of the fuel, or into both.

Third, the means of causing a draft of air through the fire when the engines are stopped, in combination with the supply of a sufficient quantity of air to 20 the furnaces, whether inclusive or exclusive of that sent through the tubes (shown herein by $a^{11} a^{11}$) placed in the smoke box.

Fourth, the use of a jet of water within the smoke box at pleasure, for the purpose of keeping it cool, and quenching any sparks or fire that may enter or take place therein.

25 Fifth, the means herein described of creating a draft through the fire by introducing a jet of steam into the chimney from any other boiler, for the purpose of accelerating the getting up of the fire, and of course of the steam in the first instance.

Sixth, the means herein described of supplying a portion of water to the 30 boilers of locomotive engines, by passing it through a casing around the chimney, whether such casing be connected or not with the casing of the smoke box or smoke box doors, or both of them.

In witness whereof, I, the said Samuel Hall, have hereunto set my hand and seal, this Eighth day of November, One thousand eight hundred 35 and forty-two.

SAMUEL (L.S.) HALL.

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SENIOR.

AND BE IT REMEMBERED, that on the Eighth day of November, in the year of our Lord 1842, the aforesaid Samuel Hall came before our said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose. 5

Enrolled the Ninth day of November, in the year of our Lord One thousand eight hundred and forty-two.

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