

## **Specification of John Hawkins and Charles Hawkins : furnaces, &c.;**

### **Contributors**

Hawkins, John.  
Hawkins, Charles

### **Publication/Creation**

London : Great Seal Patent Office, 1860 (London : George E. Eyre and William Spottiswoode)

### **Persistent URL**

<https://wellcomecollection.org/works/hz863jje>

### **License and attribution**

This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
<https://wellcomecollection.org>



A.D. 1859, 6th DECEMBER. N° 2748.

SPECIFICATION

OF

JOHN HAWKINS AND CHARLES HAWKINS.

FURNACES, &c.

LONDON:

PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,

PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY:

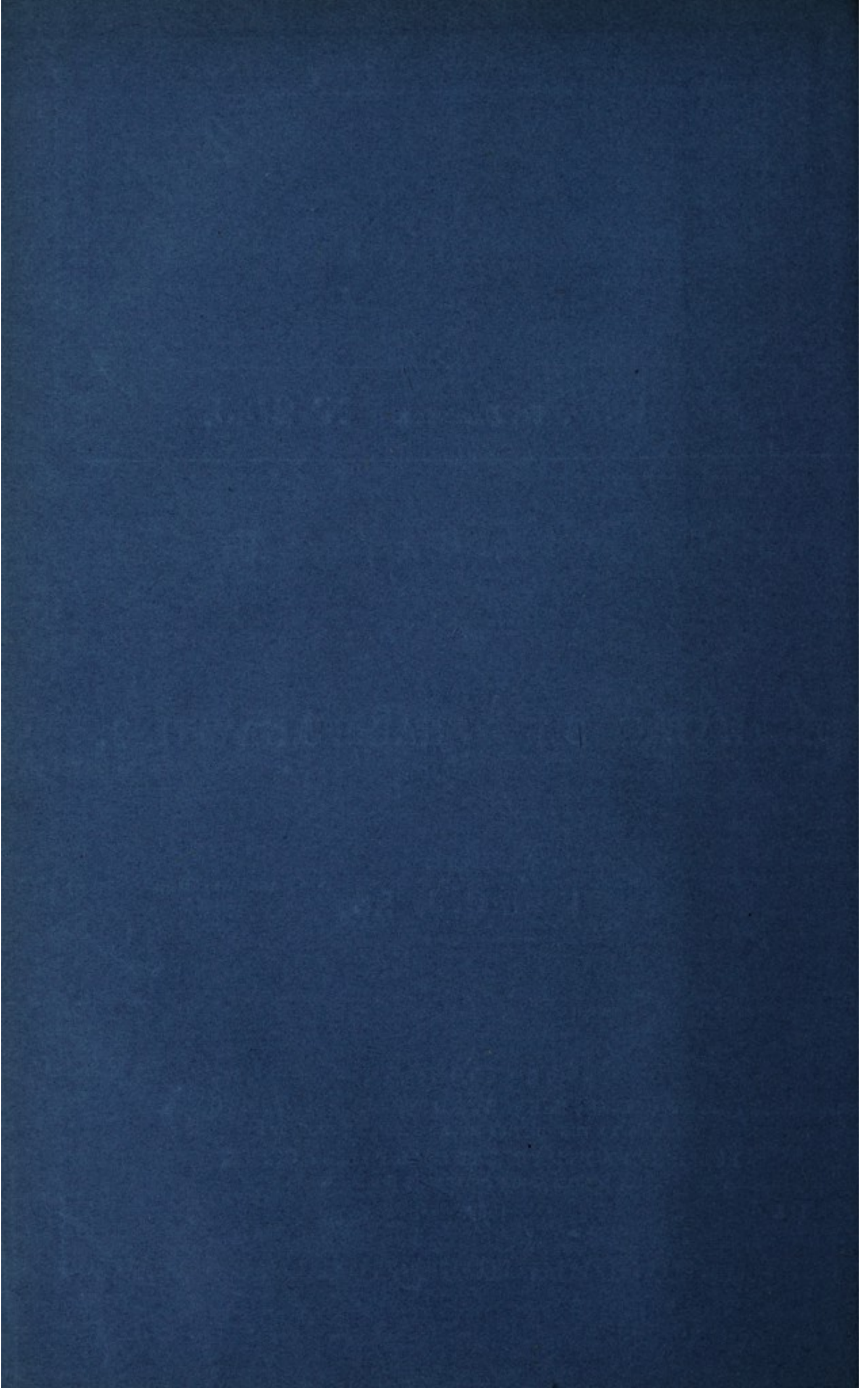
PUBLISHED AT THE GREAT SEAL PATENT OFFICE,

25, SOUTHAMPTON BUILDINGS, HOLBORN.

Price 11d.

1860.









---

A.D. 1859, 5th DECEMBER. N° 2748.

---

**Furnaces, &c.**

---

**LETTERS PATENT** to John Hawkins, of Lisle Street, London, in the County of Middlesex, and of Walsall, in the County of Stafford, Bit, Spur, and Stirrup Manufacturer, and Charles Hawkins, of Walsall aforesaid, Manager of the Works of the said John Hawkins, for the Invention of "**CERTAIN IMPROVEMENTS IN THE CONSTRUCTION OF FURNACES FOR CONSUMING SMOKE, APPLICABLE TO STATIONARY AND MARINE BOILERS AND OTHER CLOSED FIRE-PLACES.**"

Sealed the 1st June 1860, and dated the 5th December 1859.

---

**PROVISIONAL SPECIFICATION** left by the said John Hawkins and Charles Hawkins at the Office of the Commissioners of Patents, with their Petition, on the 5th December 1859.

We, JOHN HAWKINS, of Lisle Street, London, in the County of Middlesex,  
5 and of Walsall, in the County of Stafford, Bit, Spur, and Stirrup Manufacturer, and CHARLES HAWKINS, of Walsall aforesaid, Manager of the Works of the said John Hawkins, do hereby declare the nature of our said Invention for "**CERTAIN IMPROVEMENTS IN THE CONSTRUCTION OF FURNACES FOR CONSUMING SMOKE, APPLICABLE TO STATIONARY AND MARINE BOILERS AND OTHER CLOSED FIRE-**  
10 **PLACES,**" to be as follows (that is to say):—

Our Invention consists in the introduction of additional means for supplying furnace bridges with hot air; and, secondly, in so constructing the bridges that they may be eleoaced or depressed as required, and the manner in which we



*J. & C. Hawkins' Improvements in the Construction of Furnaces, &c.*

purpose carrying our Invention into effect is by constructing air-ways on one or both sides of our furnace fire, preferring to use iron pipes for the purpose, and connecting them with pipes that pass from side to side and again returned to pass along to the bridge; thus the air is made to enter at the side and to cross and re-cross as desired through the fire in the air-way tube, and from thence to the bridge to escape through holes at the top in such a highly rarefied condition that it will ignite and consume the smoke as it passes over it. And by allowing the air-way tube or tubes to come up underneath the bridge, we are enabled to elevate or depress the bridge as desired according to the condition of the fire, which, when first lit from the air-way tubes being cold we are not able to obtain a current of hot air; but to prevent the smoke from the fresh coals escaping over the bridge or bridges as desired, we apply a gas pipe within the bridge in connection with jets that come through on the top, and by connecting this pipe with a supply pipe and a stop cock we are enabled to obtain the same effect from lighting the gas on the bridge for consuming the smoke as we should obtain from generating hot air. This arrangement may be applied to the furnaces of stationary or marine engines or other fire-places, subject to the generation of undue quantities of smoke.

**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said John Hawkins and Charles Hawkins in the Great Seal Patent Office on the 5th June 1860.

**TO ALL TO WHOM THESE PRESENTS SHALL COME**, we, JOHN HAWKINS, of Lisle Street, London, in the County of Middlesex, and of Walsall, in the County of Stafford, Bit, Spur, and Stirrup Manufacturer, and CHARLES HAWKINS, of Walsall aforesaid, Manager of the Works of the said John Hawkins, send greeting.

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fifth day of December, in the year of our Lord One thousand eight hundred and fifty-nine, in the twenty-third year of Her reign, did, for Herself, Her heirs and successors, give and grant unto us, the said John Hawkins and Charles Hawkins, Her special license that we, the said John Hawkins and Charles Hawkins, our executors, administrators, and assigns or such others as we, the said John Hawkins and Charles Hawkins, our executors, administrators, or assigns, should at any time agree with, and no others, from time to time and at all times thereafter, during the term therein expressed, should and lawfully might make, use, exercise, and vend, within



*J. & C. Hawkins' Improvements in the Construction of Furnaces, &c.*

the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "CERTAIN IMPROVEMENTS IN THE CONSTRUCTION OF FURNACES FOR CONSUMING SMOKE, APPLICABLE TO STATIONARY AND MARINE BOILERS AND OTHER CLOSED FIRE-PLACES," upon the condition (amongst others) 5 that we, the said John Hawkins and Charles Hawkins, by an instrument in writing under our hand and seal, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters 10 Patent.

NOW KNOW YE, that we, the said John Hawkins and Charles Hawkins, do hereby declare the nature of our said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, that is to say:—

15 In giving effect to our Invention for the more thorough combustion of the gases arising from the various furnaces and other close fires now so generally required in the manufacturing districts, which as a natural consequence are generally thickly populated, makes it imperative for the sake of health that the smoke arising from such furnaces or fire-places should be thoroughly and 20 completely consumed. And while we do not purpose to effect this by any new agency, nevertheless, our arrangements will be found novel and efficient and applicable to the consuming the smoke from some description of closed fires that hitherto have been entirely neglected, to the detriment and injury of the neighbourhood in which they exist.

25 And in carrying out our Invention we are not confined to shape or position of the fire-place or furnace to which we apply our new arrangement for the consuming or combustion of smoke, as our improvements are as applicable to the furnaces of marine as to stationary engines or other furnaces, as will be seen from the description of the Drawings hereunto annexed, which we will 30 now proceed to describe.

Fig. 1 represents a front longitudinal section of the brickwork or setting and furnace for a common or ordinary stationary boiler. A, A, is the side flue for passing around the boiler in the ordinary way; B, B, represents the furnace or fire-bars, which may be of the ordinary or common kind, or be 35 made and fixed on the more modern principle of alternately vibrating or moving if preferred; C is the dead plate, and D, D, brickwork, terminating the fire hole, and supporting the fire bars, the top row of which, at the inner ends of the fire-bars, should be composed of fire-clay, as well as the face bricks E, E, forming the side of the furnace; F, F, G, G, and H, H, are



*J. & C. Hawkins' Improvements in the Construction of Furnaces, &c.*

cast-iron pipes or air-ways, built up in the brickwork, and which air-ways continues (as here shown by the dotted line), and descends so as to form a connection with the flue I, formed in the brickwork D, and which flue is covered with a strong metal plate, having three vertical tubes applied to it, a centre one here shown in section marked J, and the one behind it marked K; 5 these tubes ascend into a hollow bridge, also shown in section marked L, L, the top of which is curved down so as to preserve as near as possible a uniform distance between the bottom of the boiler and top of the bridge, the crown of which is perforated with holes for the air to escape, hereafter to be referred to. This bridge works in side plates marked M, M, built in the brickwork 10 with projecting flanges, so as to form a channel or groove for the bridge to work up and down in, as it forms an important feature of our Invention, that the bridge should be raised and lowered as desired; and in this case we purpose doing it by attaching a rod or a chain at each end, and carried up, to be counterpoised by levers and weights on the outside. At the back of the 15 moveable bridge L we form a bridge of brickwork in order that no air shall escape behind, but what goes into the fire for supporting combustion. *a, a,* is a stuffing box for holding fire-clay or any other suitable composition, and which stuffing box is formed on the bottom of the moveable bridge for surrounding the vertical tube J, so as to prevent an undue escape of air at that 20 part, and for the same object a stuffing box must be fitted to each vertical tube.

Fig. 2 represents as much of the ground plan section of Figure One necessary for our description, as taken through the dotted lines *b, b,* representing seven fire-bars in position, supported in the front by the dead plate C, 25 and terminating at the back with the fire bricks D. The side air-way tube H, H, shows its position protected by the fire-clay bricks E, and in this view it is seen that the air-way at the back of the tube H descends and crosses transversely under the plate N, and which plate is secured and made air-tight by the brickwork D, D, and D, D, partly resting on it. To the plate N two 30 of the vertical air tubes are shown attached or secured by flanges at the bottom, marked as at Figure One, J and K, the moveable bridge being omitted in this Figure to avoid confusion.

Fig. 3 is a front irregular section of Figure One, as taken through the vertical dotted lines *c, c,* and *d, d,* representing the air-ways F, G, and H on the left 35 hand side with six of the fire-bars in section, marked B, B, and on the right hand side a section exhibits the descending air-way from H to I, I, below the plate N, to which, as before stated, the vertical air-way tubes are fastened. The front of the moveable bridge L, L, is represented broken for the purpose



*J. & C. Hawkins' Improvements in the Construction of Furnaces, &c.*

of showing the position of the vertical tubes within, marked J and K, the one to the left being shown in dotted lines; the shape of the top of the bridge is also defined in this Figure, following the curve as near as convenient of the circumference of the boiler O. P, P, are circular-ended levers, working on  
5 supports or fulcrums at Q, and over the curved ends of these levers chains work, the lower ends of which are carried down and attached on each side to the moveable bridge L, against the weight of which the balls R, R, act as a counterpoise, the sliding in or out of which to or from the fulcrums will cause the bridge to descend or rise as desired.

10 And having pointed out the various details, we will now describe the active effect of our improvements. The cold air entering the air-ways on each side, as at F, Figure One, passes along and returns through G, and again descends and enters the air-way H, and by taking this tortuous course, encased as it were in red-hot bricks, it becomes highly rarefied, fit to descend to the  
15 transverse air-way I, to ascend through the vertical tubes into the bridge, which derives great heat from its position, so that the air is again further heated before it escapes through the holes on the top of the bridge, which, from its high state of rarefaction, is capable of igniting the gaseous smoke that is emitted from the coals or fuel as soon as it is carried back to the  
20 bridge, and this igniting or burning the smoke close under the boiler affords to the generating of steam the utmost limit of heat the fuel or coal used are capable of giving out.

In practice it is found that the greatest quantity of smoke is generated on the occasion of supplying fresh fuel, which arises from the want of a sufficient  
25 quantity or intermingling of rarefied atmospheric air. And we purpose applying sliding doors over the air-ways F in front, which doors may be opened when fresh coals are applied, and closed as soon as the lower fire shall begin to burn freely through the fresh coals; but in order to ensure due attention to this requirement, we purpose applying a self-acting arrangement,  
30 whereby the air-ways shall be opened by the act of opening the furnace door, and although the furnace door shall be immediately closed after supplying the coal, the covers or dampers for the air-ways shall only progressively close, occupying a sufficient amount of time in the closing as shall afford the due proportion of atmospheric air to consume the excess of gas thrown off in the  
35 shape of smoke at each firing, and which self-acting apparatus shall be capable of being timed and regulated as desired. This may be effected in many ways, as, for instance, a lever fastened to the hinge side of the furnace door, projecting down so as to work in underneath the door plate; and to the end of this lever a chain may be attached in any suitable way, working under



*J. & C. Hawkins' Improvements in the Construction of Furnaces, &c.*

and over pullies, and the other end of the chain may be attached to a weighted piston working in a cylinder full of water, and which piston may also be attached or connected in any suitable way with the dampers of the air-ways, so that the effect of opening the furnace door will also elevate the piston and the dampers, and after firing, the furnace door may be closed, allowing the piston to descend in the cylinder at its leisure, or according to the size of the escape hole for the water to rise from below the piston to allow it to descend, as well also as the weight of the piston, the air-ways gradually closing as the piston descends. And as our object in all cases is to provide means whereby the air necessary for the consuming of smoke in furnaces shall be heated in a much higher degree than has hitherto been done by the means provided, we wish to add, that should the air not be found sufficiently heated, either from the extent of the furnace or other causes, we purpose that the air shall be again brought forward before it retires to the back air-way, or that it shall be made to cross from air-way to air-way immediately under the boiler, in pipes or tubes placed at suitable distances apart, or such cross air-ways may be placed at the back of the bridge. And the bridge in some instances we purpose coating in front and top with fire-clay, not only for the purpose of protecting the iron, but for generating and holding the heat, this may be effectually done by fastening or forming lugs or pins on the front or part of the bridge desired to be so protected.

Fig. 4 represents a sectional plan also of a common stationary engine furnace, drawn for the purpose of showing that we are not compelled to supply and heat the air in the way exhibited and described in the former Figures, nor to the manner of elevating and depressing the bridge. In this case we supply air through tubes or air-ways placed on each side underneath the fire-bars, three of which are represented broken off, for the purpose of showing the ingress air-way marked T; the top of the bridge S is represented as broken away, for the purpose of showing its interior. The air from the tube T passes through the bridge at A<sup>1</sup> to the air-way B<sup>1</sup>, from whence it passes through the tube Y and Z to X, and from thence to the interior of the bridge to escape through the perforations at the top, while the air on the other side in like manner crosses the flue through the tubes V and W to the air-way C<sup>1</sup>, C<sup>1</sup>, to enter the bridge in the direction of the arrows, as before described. Fig. 5 represents a longitudinal section taken through the dotted lines *f, f*, of Figure Four, showing the bridge in section, as also the cross tubes V, W, and Y, Z, which are curved upward for the purpose of bringing them in immediate contact with the flame of the burning smoke or ignited gas, which tends greatly to increase, the heat of the air passing through them, the rarified con-



---

*J. & C. Hawkins' Improvements in the Construction of Furnaces, &c.*

---

dition of which ignites the smoke or gas on its passing over the bridge. And the manner we purpose elevating and depressing the bridge is by means of the rack and pinion working on the axes *e*, which may be carried through the side brickwork and back bridge, to be actuated by any suitable contrivance or  
5 handle for raising, lowering, or retaining the bridge in the position desired. And in connection with this Figure we have represented the applicability of our improved arrangements to the consuming and thereby utilising the gas or smoke generated in the making of coke, a process extensively carried on in some districts, which, from the quantity of gaseous smoke and sulphur pro-  
10 duced and thrown off (in the process), renders the air in the immediate neighbourhood pernicious, even to the extent that vegetation is destroyed by it, and the atmosphere rendered murky and unhealthy. And we effect this as exhibited at Fig. 7. *D*<sup>1</sup>, *D*<sup>1</sup>, represents in section part of a heap of coal, which is piled up in the common or ordinary way around a short stack of  
15 open brickwork, marked *E*<sup>1</sup>, and covered over on the outside with a crust or covering of small waste or fine particles of coal, which always accumulates at collieries or places where large quantities of coal are got or used.

The heap of coal when put together is lit at the top close to the stack, and requires according to the bulk three or four days, more or less, to burn  
20 through, and when fire is seen around the outer lower edge, it indicates that the whole batch or heap has been converted, during the progress of which gaseous and sulphurous smoke is continually vomiting out of the centre of the stack. In some instances to get rid of this nuisance, the workman in attendance will apply a light to the smoke and burn it, but in a general way it is  
25 allowed to escape and mingle with the atmosphere as long as the coke heaps are on fire, and which coke heaps are generally made and burnt in close proximity to each other. And the application of our improvements to these description of close fires consist in fitting a cover to the top of the stack marked *F*<sup>1</sup>, and applying a large tube concentrically at the bottom of the  
30 stack as at *G*<sup>1</sup>, and such like tubes we purpose connecting or applying to (say) four stacks, and concentrating them to a main tube as at *H*, from which the tube *I*<sup>1</sup>, *I*<sup>1</sup>, is connected; and *J*<sup>1</sup> is a mouth-piece of the same area as *I*<sup>1</sup>, but of the sectional form, exhibited at Fig. 6; nevertheless, it is not essential that it should be of this shape, but we prefer it for the purpose of building up in  
35 the brickwork, and that the broad way of its mouth should cross the furnace, as shown by the dotted lines at *g*, *g*, Figure Four. *K*<sup>1</sup>, *K*<sup>1</sup>, is a steam way or pipe under the regulation of the stop cock *L*<sup>1</sup>, which pipe passes underneath the coal heap to delivery pipes as at *M*<sup>1</sup>, preferring to have four such pipes for each heap of coal, or more or less as may be desired, distributed or placed at



---

*J. & C. Hawkins' Improvements in the Construction of Furnaces, &c.*

---

equal distances around the centre or stack E<sup>1</sup>. These delivery pipes we cover over with a hollow perforated fire-clay brick, as here shown in section marked N<sup>1</sup>. With this general arrangement we will, for example, suppose that the furnace O<sup>1</sup>, O<sup>1</sup>, is in full fire, the smoke flying off in the direction of the arrows from the top of the coal, and that the air is entering the airways, and escaping 5 from the crown of the bridge, there igniting the smoke into a flame, which is drawn back under and over the air-way tubes and along under the boiler by the natural draft of the stack or chimney; and supposing the coal heap or heaps are also on fire the same draught or suction from the engine stack or chimney, and the cover F<sup>1</sup> drawn back for the admission of air, the gaseous 10 smoke instead of escaping here will be drawn from the burning coals through the stack E<sup>1</sup> down into tube G<sup>1</sup> and I<sup>1</sup>, I<sup>1</sup>, to the mouth J<sup>1</sup>, and along underneath the boiler, as indicated by the arrows; and should this gaseous smoke not be ignited while passing over the furnace fire, it will be ignited in passing over the bridge, thus adding a great auxiliary to the generating of steam as it 15 streams back in a powerful flame underneath and around the boiler flue, thereby saving an important item in the amount of coal otherwise required, independent of rendering the operation of converting coal into coke as unobjectionable as the carrying on of any other branch of manufacture. And we will further suppose that the heap is now thoroughly burnt, and that it is 20 desirable to cool it and shift it as quick as possible. To do this we prefer closing the cover F<sup>1</sup>, and opening the steam way L<sup>1</sup>, thereby admitting steam from the four jets before referred to, in and through the very heart or body of the yet burning mass, which not only stays its further burning, but drives out the injurious sulphureous gas that may remain in it, which commingling with 25 the steam and air is sucked or drawn along through the pipes to the fire as before described to be consumed, or this process may be reversed, namely, by closing a valve in the tube G<sup>1</sup>, and drawing back or removing the cover F<sup>1</sup>, and in a very little time the admission of steam will cool down the cokes so that it may be removed and a fresh batch or heap piled up, and the operation 30 repeated, thus insuring the great advantage of economy and expedition; and as the connection in the tube G<sup>1</sup> may be cut off by the closing the valve before named, the removal of the burnt cokes, and the piling or making up of a fresh heap, do not interfere with the burning or converting process going on in the other heaps that may be connected with the tube I<sup>1</sup>, I<sup>1</sup>. We have not 35 thought it necessary to further illustrate our Invention, as the details herein shown have only to be slightly varied to make it applicable to the furnaces of Cornish boilers, as well as to the furnaces of marine engines or other close fire-places, subject to the generation of large or objectionable quantities of



---

*J. & C. Hawkins' Improvements in the Construction of Furnaces, &c.*

---

smoke. In the case of Cornish boilers, various mechanical arrangements may be used or applied for the elevating and lowering of the bridge, such as a rack and pinion actuated from the front, or a compound lever may be beneficially used for this purpose; or the bridge may be elevated by two vertical  
5 screws properly geared and set in motion from the front, and in each instance the air may be admitted and superheated, either in the way herein-before described and exhibited in Figure One or as at Figure Five.

In our Provisional Specification we have described as a part of our Invention the introduction of a gas pipe with jets properly placed, to be brought into use  
10 at the time of first lighting the furnaces of stationary engines, but in practice we have found that the advantage gained by this is not of sufficient importance to introduce or claim in this our Complete Specification.

And although we have only described and exhibited one moveable bridge, nevertheless we do not purpose limiting ourselves to the use of one only, as in  
15 some instances two or more may be beneficially used.

In witness whereof, we the said John Hawkins and Charles Hawkins, have hereunto set our hands and seals, this Second day of June, in the year of our Lord One thousand eight hundred and sixty.

JOHN HAWKINS. (L.S.)

20

CHARLES HAWKINS. (L.S.)

Witness,

ISAAC B. SAVAGE,

Clerk to James S. Cockings,

Patent Agent, Birmingham.

---

LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,  
Printers to the Queen's most Excellent Majesty. 1860.



J. & C. Hawkin's Invention in the Construction of Locomotives

In the case of certain engines, various mechanical arrangements may be used or applied for the elevating and lowering of the bridge, such as a rack and pinion actuated from the foot, or a compound lever may be advantageously used for the purpose; or the bridge may be elevated by two vertical screws, properly geared and fast in motion from the front, and in each instance the air may be admitted and exhausted either in the way herein before described and exhibited in Figure One or as at Figure Five.

In our Provisional Specification we have described as a part of our invention the introduction of a gas pipe with jets properly placed, to be brought into use at the time of first lighting the furnace of stationary engines, but in practice we have found that the advantage gained by this is not of sufficient importance to introduce or claim in this our Complete Specification.

And although we have only described and exhibited one movable bridge nevertheless we do not purpose limiting ourselves to the use of one only, as in some instances two or more may be beneficially used.

In witness whereof we the said John Hawkins and Charles Hawkins have hereunto set our hands and seals this second day of June, in the year of our Lord One thousand eight hundred and sixty.

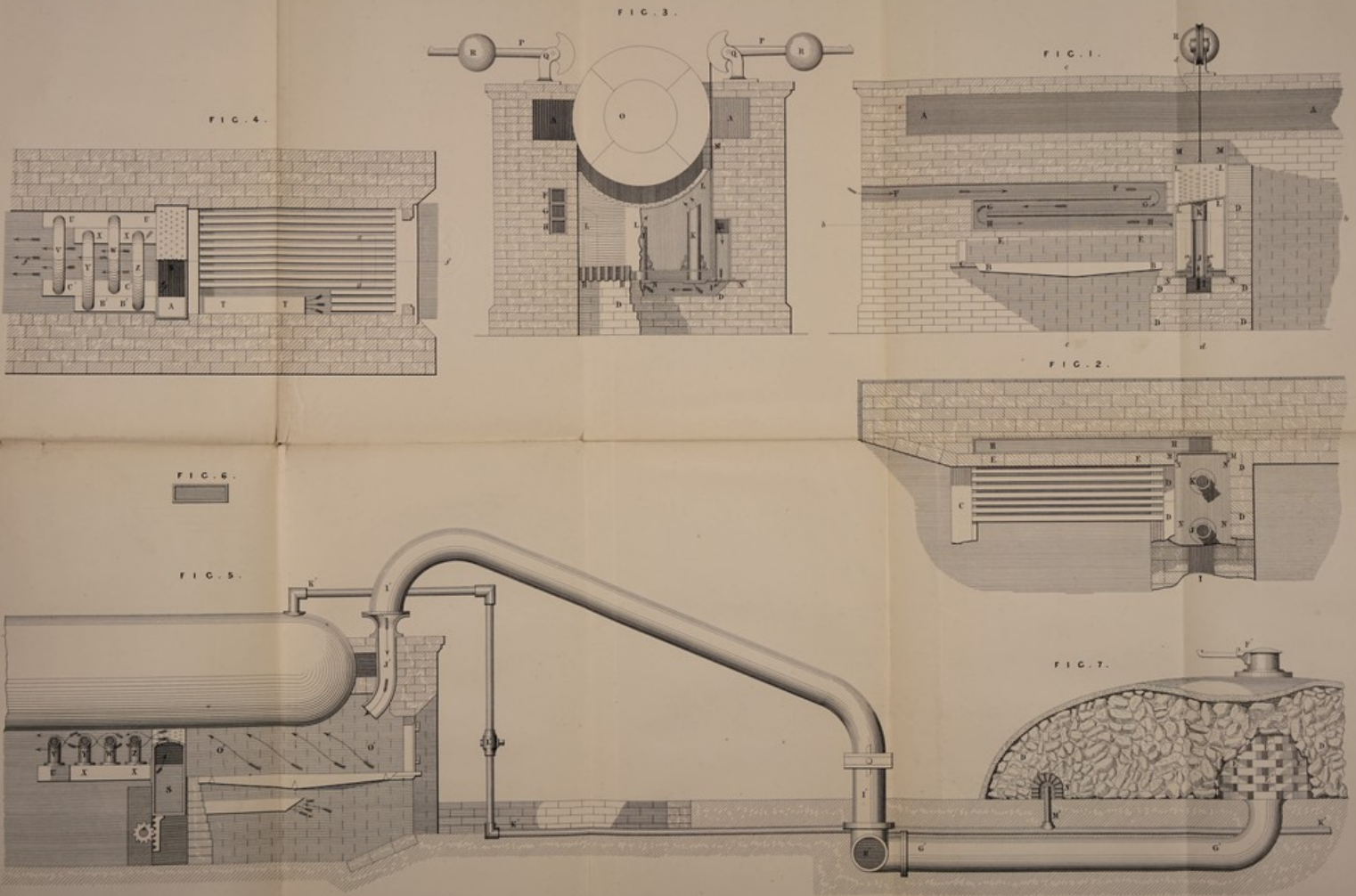
JOHN HAWKINS. (s.)  
CHARLES HAWKINS. (s.)

Witness  
IRAN R. STARR,  
Clerk to James S. Cocking,  
Patent Agent, Birmingham.

LONDON:

Printed by GEORGE TAYLOR and WILLIAM BROTHWOOD,  
Printers to the Queen's most Excellent Majesty. 1850.





The filed drawing is not colored.

LONDON: PATENT LAWYERS, LAWSON, EMMETT, AND HUTTON, 11, ABchurch Lane, Strand, W.C.

Drawn in Stone by Miller & Sons.



