Specification of William Hargreaves, junior : furnaces and apparatus for consuming smoke, generating steam, &c.;

Contributors

Hargreaves, William.

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A.D. 1850 . . . . . N° 13,049.

SPECIFICATION

OF

WILLIAM HARGREAVES, JUNIOR.

FURNACES AND APPARATUS FOR CONSUMING SMOKE, GENERATING STEAM, &c.

LONDON:
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A.D. 1850 . . . . . N° 13,049.

Furnaces and Apparatus for Consuming Smoke, Generating Steam, &c.

HARGREAVES' SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, WILLIAM HARGREAVES, junior, of Bradford, in the County of York, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Royal Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Eighteenth day of April One thousand eight hundred and fifty, in the thirteenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said William Hargreaves, junior, my ex̃ors, adm̃iors, and assigns, Her especial license, sole privilege and authority, that I, the said William Hargreaves, junior, my ex̃ors, adm̃iors, and assigns, and such others as I, the said William Hargreaves, junior, my ex̃ors, adm̃iors, 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, within the Islands of Jersey, Guernsey, Alderney, Sark, and Man, and also within all Her said Majesty's Colonies and Plantations abroad, my Invention of "CERTAIN IMPROVEMENTS IN THE MEANS OF CONSUMING SMOKE, PARTS OF WHICH IMPROVEMENTS ARE ALSO APPLICABLE TO THE GENERATING OF STEAM;" in which said Letters Patent there is contained a proviso obliging me, the said William Hargreaves, junior, by an instrument in writing under my hand and seal, particularly to describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, and to cause the same to be enrolled in Her Majesty's High Court of Chancery within six calendar months next and immediately after the

date 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 William Hargreaves, junior, do hereby declare that the nature of my said Invention, and the manner in which the same is to be performed, are described and ascertained by the Drawing hereunto annexed, and forming part thereof, and the words and figures following, that is to say:—

The nature of this Invention, and the principle of construction which forms the basis thereof, consist in certain new mechanical combinations and arrangements of parts hereafter mentioned and described, constituting machinery or furnace apparatus whereby the means of consuming smoke or carbon and other impurities evolved in the combustion of coal or other fuel when used in boiler furnaces, or in any other description of furnace suitable for such apparatus, and thereby to increase the power of fuel, and thus economise heat and effect a saving in the consumption of coal, and consequently the cost attendant upon the working of steam machinery or other motive power; and further in this my said Invention, as described for the above two-fold purpose of consuming smoke and economising fuel, I also combine various mechanical arrangements of parts of the apparatus which are applicable to the purpose of generating steam, such parts not having been used or applied heretofore in the same manner in common furnaces or those wherein the consumption of smoke was a primary object.

In proceeding to describe my said Invention and apparatus, as drawn and set forth in the plan, elevation, section, and details hereunto attached and referred to throughout and in connection with this Specification, and for the clear understanding of the various parts thereof, I here set forth the following detailed references to the various mechanical parts of which the aforesaid machinery or furnace apparatus is composed, and which said detailed references and Drawings together are fully sufficient for the construction of my said Invention in all its parts and details for the purpose of obtaining the results in practice set forth in the title of this my said Invention, and as hereafter exemplified in the description contained in this Specification under the heads corresponding with the title, viz^{t}, consumption of smoke, and generation of steam, and economy of fuel. Here follow the references to the Drawings by letters marked thereon for the purpose herein-before explained.

Description of Drawings.

Figure 1 is a longitudinal sectional elevation of the furnace apparatus; Figure 2 is a horizontal or plan view of the same; and Figure 3 is a front

view of the door or hopper end of the furnace. A, A, the boiler; B, B, B, the main feed pipes; B*, B*, the escape pipe or eduction pipe; C, C, C, the hopper, and shows the hopper ends; D, D, D, pipes for generating steam, fed from the side pipes; E, E, E, branches from feed pipes to side pipes; F, F, F, side pipes, and feeding the pipes D, D; G, G, G, the fire bars moving horizontally; H, H, lever for moving the fire bars G towards the hopper C, and backwards; I, I, levers for supporting the ends of the bars G; K, K, a cross arm for connecting lever H with the principal lever L; L, L, the principal lever worked by a connecting rod and crank L*; M, the furnace door; N, brickwork for retaining the fuel till properly consumed; O, a doorway for getting out the ashes forced over the brickwork by the bars; P, a brick arch for the flame to pass over. *a*, *a*, pinions fast upon the shaft *i*, lifting the racks and door *b*; *b*, *b*, racks cast to the bottom door of the hopper; *c*, *c*, top door or plate bolted to the hopper ends; *d*, *d*, the feeder moved by the bars G; *e*, *e*, *e*, lugs cast upon the bars G for moving the feeder; *f*, *f*, a plate connecting the hopper ends; *g*, *g*, a dead plate bolted to the side pipes; *h*, a beam for connecting the side pipes; *i*, the pinion shaft; *j*, *j*, *j*, lugs cast upon the side pipes to bolt the beam *h* to; *k*, *k*, legs cast upon the side pipes for carrying the pedestals *l*; *l*, *l*, pedestals for levers; *m*, the ash-pit; *n*, a platform for the fireman; *o*, a shaft and chain to lift the furnace door.

Having by the above detailed table of references explained the several mechanical parts contained in the formation and construction of the machinery or apparatus composing this my said Invention, as generally applicable to steam boiler furnaces, it is proper to explain that this my said Invention can be adjusted in point of magnitude so as to meet various requirements, and any extent of power to be put in operation. And, moreover, I have adjusted the proportions, forms, substances, and principles for connecting the parts that will fully carry out my Invention with proper economy of cost, durability, and consistency of application, so that the Drawing and description as referenced will form a proportional scale or modulus for its universal construction. The materials of which I construct the various parts are in accordance with the general custom followed out in furnaces; wrought iron pipes I prefer for the pipes marked D, and for the service and feed pipes in connection. The remaining portions as described or inferred in the table of references to be of cast iron, or as usually made of wrought iron, are intended should be of the best iron or any other suitable metal commonly applied to such respective purposes.

I will now proceed to describe the application and principle of this my said Invention, as set forth in the title thereof; and, firstly,—

OF THE CONSUMPTION OF SMOKE.

For this purpose I construct the furnace, as shewn and described, with a hopper or feeder attached in front at C, in connection with the furnace door M, and for the purpose of rendering the process of feeding the furnace regularly and by a means commonly termed self-acting, but properly the result of certain mechanism for communicating such action.

To the pinion shaft *i* are attached the pinion wheels *a*, *a*, motion being communicated thereto by an eccentric crank attached to the elongated end indicated by the arrow in Figure 3; the racks and door *b* are thereby raised so as to admit of a certain quantity of fuel being forced or shaken out of the hopper C and deposited in front of the feeder *d* upon the dead plate *g*. This rotary motion is moderated by the length of the eccentric crank, and adjusted to the requirements of the furnace to be fed and power to be raised. The fuel thus deposited on the dead plate *g* is then forced forward on the bed of bars G by a similar rotary motion given to the bars G by the principal lever L, communicated to the lever H by the cranked eccentric L*, which said motion being communicated to the lugs *e*, *e*, cast upon the bars G, move forward the feeder *d* upon the dead plate *g*, and thus a continuous supply of fuel from the hopper is obtained. The process of feeding from the hopper by the mechanical apparatus herein described ends with the delivery on to the furnace bars G by the action of the feeder *d*, as described; the hopper is supplied with coal by the fireman continually as the consumption goes on. The shaft and chain O serve to raise the furnace door M worked by a cranked handle. The coal thus deposited on the furnace bars G and gradually entering into combustion, is, by the continual action of the feeder *d* and bars G, carried by degrees equally and evenly over the whole surface to the extreme end of the furnace, and finally driven over the brick banker or retaining wall at N into the ash-pit O, during which operation the smoke-consuming process is in full action, and is obtained and carried on in the following manner and by the following mechanical means and appliances. Referring to the plan, Figure 2, the whole surface of the furnace bars G is exhibited, forming the bed on which the coal enters into combustion, and on which the smoke-consuming process is carried on; the form of the said bars is also exhibited in section, Figure 3, and together exhibits the length and width of the interstices between them through which a portion of the ashes fall into the pit *m*; the bars also have solid ends or bearings working against each other, as shewn at *a**. The bed of bars thus described are supported in place, as shewn, by the levers H, K, I; the under side of the bars G are provided with ears *b**, which take the cross head of the

levers H, I, which work therein by the adjustment of said levers, as minutely shewn; in the table of references it is fully explained. The furnace bars G are moved in a horizontal direction by the levers H, I, K, L. The said levers H, I, K, L, obtain their motion directly from the principal lever L worked by a connecting rod and crank L*, as before described, and thereby gives the horizontal motion herein described to the furnace bars G; and by the revolution of the crank and lever aforesaid an oscillating motion is given to the whole bed of bars, regulated in its action by the stroke of the crank. The mechanical movement thus explained, combined with the minuteness of the interstices between the furnace bars, which keeps the coal longer in the furnace before it is sufficiently calcined to fall through into the ash-pit, and also the continual oscillating motion carried on by the entire bed of furnace bars, as explained, breaking up and grinding the fuel, is the means I pursue to accomplish the perfect combustion of the coal, smoke, carbon, and other gases evolved therefrom. It is by thus being retained in the furnace a longer period by my adjustment of bars with narrow interstices than in the common method, and the oscillating motion of the bars G constantly going on, which prevents the formation of clinker by vitrification, and also continually breaks up the coal, in the manner commonly understood by stoking, together with the sharp and rapid under current of air that drives through the narrow interstices, and by the regular and equalized quantity of coal that is spread at all times over the surface of the furnace, that I accomplish this said purpose of my Invention, namely the consumption of smoke, and the more perfect combustion of fuel obtained thereby. To give facility to the onward distribution of the fuel over the furnace bars, I fix the bed of bars G at an inclination or slope, as indicated by the red line x, x, in Figure 1, which adjustment greatly assists in practice the aforesaid purposes of this my said Invention. The slope of the brickwork N for retaining the fuel till properly consumed, and the height of the brick bridge P, which being carried up closely to the boiler, keeps back and prevents the flames passing out too quickly, is also a means in combination with the foregoing detailed process that I use, to accomplish more perfectly the consumption of smoke and combustion of fuel.

I now proceed to describe the second part of this my said Invention as herein specified, namely, the generating of steam by the application of a portion of the apparatus herein-before described, and forming part of the furnace, together with other apparatus in addition thereto for the purpose of raising or generating steam. The mechanical appliances which I adopt for this purpose are more especially the cranked pipes D, D, D, placed over the furnace bars, and are used in conjunction with and fed from the side pipes

F connected to the main feed pipes B, B, for the purpose of generating steam.

Referring again to the Drawing and table of references, the whole of my said Invention for the generating of steam as developed and contained therein are the following parts, namely, from the boiler A depends a supply of water by the main feed pipes B, B, which supply the side pipes F, which communicates with and feed the generating pipes D, D; E, E, E, are branches from feed pipes B, B, to side pipes F, F, which can also be fed at either end, causing a current of water to pass through them. The whole of the tubular mechanism and appliances herein referred to and set forth in this second part of my Invention by the Drawing, the references, and description herein contained, are the means I apply for the purpose of raising or generating steam as connected with this my said Invention, and in exemplification thereof, it is only requisite to point out the main features, namely, the generating pipes D being completely in connection with and immersed in the fuel when in combustion, such said pipes or tubular apparatus being fed from and connected with the main boiler A, will contain a certain number of cubic inches of water, which by this Invention are brought to boiling point long before any portion of water contained in the main boiler A, and by progressive ascension thereto, and a repeated replacement by less rarified fluid, to be also brought to boiling point, and in like manner ascending to the main boiler A, until the whole contents have passed through the furnace. Such circulation of the contents of the boiler through the burning fuel in manner set forth is a more speedy process for generating of steam than by the application of heat only to the under side of the boiler, or within the boiler, or as applied in the various ways and forms now practised, and upon which this my said Invention constitutes an improvement.

And connected with the first and second parts of this my said Invention, as herein-before described and set forth, and a consequent result therefrom, forms the third part of this Specification, that is to say, the economy of fuel arising from the full developement of the two first parts of this Invention, namely, for consuming of smoke and generating of steam by the process herein fully detailed, which first part or process by the peculiar construction and details of the furnace for consuming the smoke and calcining the fuel is in effect bringing into combustion an increased quantity of fuel over and above that obtained by other furnaces from a given weight of coal.

Having thus fully set forth and disclosed the whole of this my said Invention by means of the Drawing and Specification herein contained, and the manner in which I put in practice and construct the several parts

A.D. 1850. April 18. N° 13049.
HARGREAVES' Specification

1 SHEET

FIG. 1.

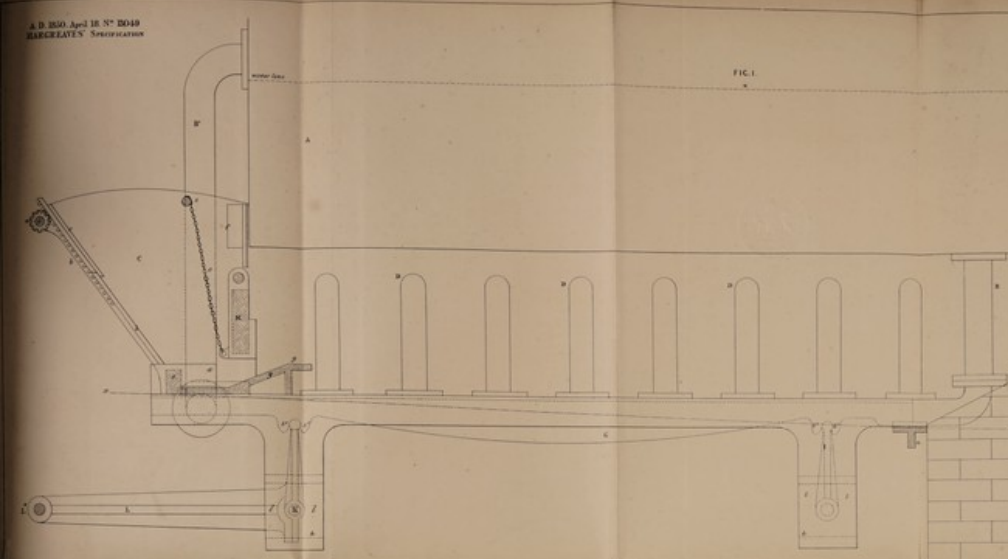


FIG. 2.

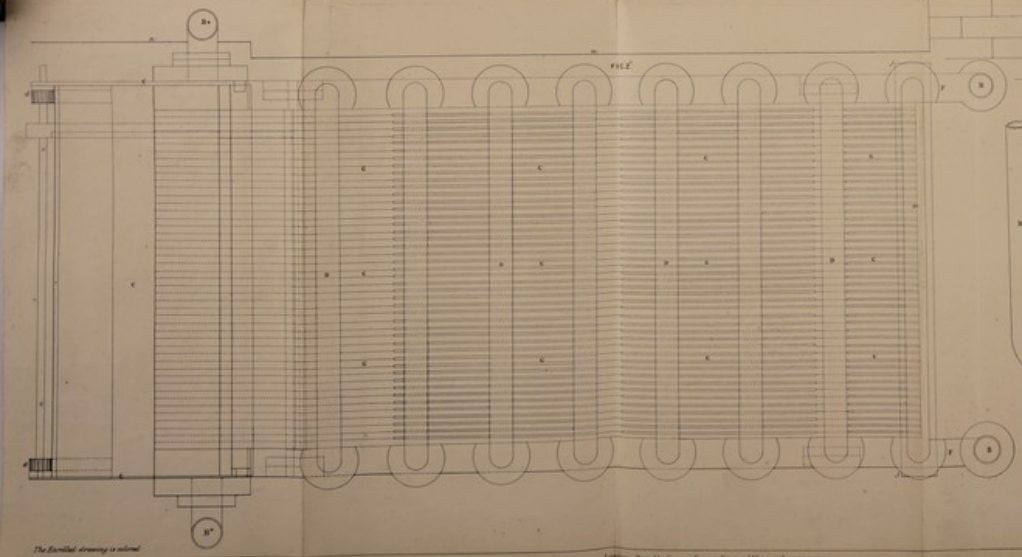
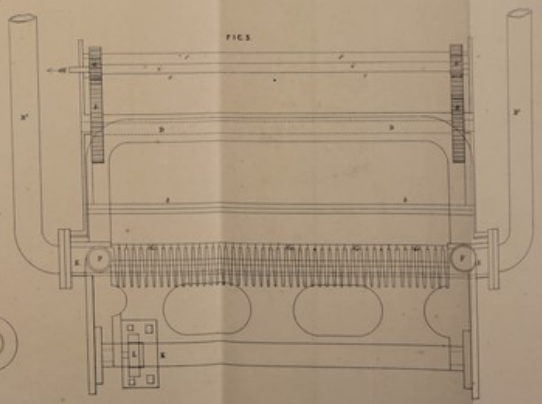


FIG. 3.



The Enrolled drawing is colored.

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Printers to the Queen's most Excellent Majesty. 1851.

thereof, and I have not, to the best of my knowledge and belief, withheld any part thereof, or of the manner in which I put the same in practice, and although I have been particular to shew and describe the various details of the forms, and construction as practised by me, yet I wish it to be distinctly understood that I do not confine myself to the various details herein mentioned, as the whole of the furnace bars may be made hollow instead of being made solid, and become part of the apparatus for generating of steam; and, if more convenient, the furnace bars can be made stationary, and the feeder *d* can be made to move by a crank or eccentric, or any other suitable motion, so as to give the desired result of feeding for consuming the smoke and saving the fuel; and I also wish it to be distinctly understood that I intend by the foregoing Specification and Drawing to set forth the principle only of this Invention, reserving to myself such immaterial variation of form and construction of the parts as practice may suggest, without departing from the principle of construction upon which this Invention is based, so long as the peculiar characters of either part of my Invention be retained; but what I claim is,—

First, I claim as my Invention the general arrangement, form, and construction of the furnace as relates to the smoke-consuming process, and the mechanical arrangement of feeding and distributing the coal evenly over the surface of the bars by the process fully described and set forth. Also the mechanical arrangement, as explained, to obtain the horizontal traverse of the furnace bars. Also the form of said bars, both to admit of said motion and their arrangement as to the interstices between them, and the inclination of the bed of bars G to a fall, as described. The whole of this said recited claim appertains to my Invention for consuming smoke.

Secondly, I claim as my Invention the form and construction of hollow tubes, as arranged in this my said Invention, for containing water for generating of steam, being the arrangement of tubes or pipes in the positions shewn over the furnace bars for generating of steam, and the feed pipes and side pipes in connection therewith; forming the whole arrangement as explained and set forth for generating steam. This said recited claim appertains solely to my Invention for generating of steam.

Thirdly, I claim as my Invention the economy in the consumption of fuel required for working steam boiler furnaces, as explained in the first part of my Invention, and resulting from the consumption of carbon, smoke, and all other gasses, combined with the economy in the consumption of fuel resulting from and explained in the second part of my Invention, obtained by the more speedily raising the water in the boiler to boiling heat, whereby steam

generated with a less quantity of coal than in the ordinary method, and as heretofore practised.

In witness whereof, I, the said William Hargreaves, have hereunto set my hand and seal, this Eighteenth day of October, in the year of our Lord One thousand eight hundred and fifty.

WILLIAM (L.S.) HARGREAVES.

AND BE IT REMEMBERED, that on the Eighteenth day of October, in the year of our Lord 1850, the aforesaid William Hargreaves 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.

Enrolled the Eighteenth day of October, in the year of our Lord One thousand eight hundred and fifty.

CROSBY.

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