Specification of William Grindley Craig : furnaces.

A.D. 1854 . . . . . N° 2280.

SPECIFICATION

OF

WILLIAM GRINDLEY CRAIG.

FURNACES.

LONDON:
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1855.

A.D. 1854 . . . . . N° 2280.

Furnaces.

LETTERS PATENT to William Grindley Craig, of Gorton, near Manchester, in the County of Lancaster, Engineer, for the Invention of "IMPROVEMENTS IN THE MODE OR METHOD OF CONSUMING SMOKE, AND IN THE MACHINERY OR APPARATUS EMPLOYED THEREIN."

Sealed the 20th April 1855, and dated the 26th October 1854.

PROVISIONAL SPECIFICATION left by the said William Grindley Craig at the Office of the Commissioners of Patents, with his Petition, on the 26th October 1854.

I, WILLIAM GRINDLEY CRAIG, of Gorton, near Manchester, in the County of Lancaster, Engineer, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN THE MODE OR METHOD OF CONSUMING SMOKE, AND IN THE MACHINERY OR APPARATUS EMPLOYED THEREIN," to be as follows:—

I propose to arrange the fire-places of furnaces and boilers, whether for locomotive or stationary purposes, in such a manner that the smoke shall always pass over or through a part of the fire, which is very hot, which I can accomplish by either making two fire-places, so connected, that whilst one is in a green or smoky state, the other will be red hot, over or through which the smoke will pass, and be thus consumed; or if I have only one fire-place I arrange tubes or flues in it, so as to cause a separation, and convey the smoke over a red part of the fire.

Craig's Improvements in the Mode of Consuming Smoke, &c.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said William Grindley Craig in the Great Seal Patent Office on the 25th April 1855.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, WILLIAM GRINDLEY CRAIG, of Gorton, near Manchester, in the County of Lancaster, Engineer, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Royal Letters Patent, bearing date the Twenty-sixth day of October, in the year of our Lord One thousand eight hundred and fifty-four, in the eighteenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said William Grindley Craig, Her special licence that I, the said William Grindley Craig, my executors, administrators, and assigns, or such others as I, the said William Grindley Craig, my executors, administrators, and 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 the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN THE MODE OR METHOD OF CONSUMING SMOKE, AND IN THE MACHINERY OR APPARATUS EMPLOYED THEREIN," upon the condition (amongst others) that I, the said William Grindley Craig, by an instrument in writing under my 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 Royal Letters Patent.

NOW KNOW YE, that I, the said William Grindley Craig, do hereby declare the nature of the 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):—

My Invention consists of a peculiar arrangement of the furnaces or fire-places of locomotive, marine, or stationary steam boilers, vats, dye pans, distilling apparatus, or any furnaces where coal or other combustible materials are used, by which the smoke first produced in the front part of the coal fire always passes over, under, or through a portion of the advanced red-hot or carbonised fire; and with a limited amount of oxygen or atmospheric air being admitted to the mouth of the furnace at the time of charging the coal, a complete combustion of the gases and smoke is obtained, which I accomplish by making two fire-places, so connected, that whilst one of them is in a green

or smoky state, the other will be red hot, over, under, or through which the smoke will pass and be consumed; or if I use only one fire-place or furnace I adopt certain obstructions in the form of tubes, water spaces, arches of fire-bricks or Welsh lump, and bars, by which the smoke produced in the front part of the coal fire is caused to pass over, under, or through the advanced red-hot or carbonised fire; and in conjunction with a limited amount of oxygen or atmospheric air admitted at the mouth of the furnace, a complete combustion of the gases and smoke is effected at the time of charging the coal. I further submit any part of the smoke which may have escaped being consumed to the action of water, by means of a jet, shower, or dash from a rose, sieve, or wheel; I also apply when necessary a series of return tubes, as a further means of consuming the smoke; or one or more water spaces, hanging from the top of the fire box, or other convenient position. These my said improvements will be clearly understood by reference to the accompanying three Sheets of Drawings, in which the letters of reference refer to each Figure separately.

In Sheet 1, Fig. 1 is a cross section, and Fig. 2 a longitudinal section, of an ordinary stationary boiler with the application of my improvements. *a* represents a tube, water space, or obstruction, which causes the smoke from the coal fire *b* to descend upon the red-hot or carbonised fire *c*, and by the admission of air through the aperture in the furnace door *d*, the smoke is consumed. Fig. 3 is a longitudinal section of a tubular boiler, in which *a* represents another form of my improved obstructions or water spaces, causing the smoke from the coal fire *b* to descend upon the red-hot or carbonised fire *c*, and air is admitted through an aperture in the furnace door *d*, as before described; *f* is a bridge to contract the draught.

Fig. 1, Sheet 2, is a longitudinal section of a locomotive, marine, or other tubular boiler with my improvements, as described in Fig. 3, Sheet 1; and also shewing the application of return tubes, in which *g* represents the ordinary tubes of the boiler; *h*, the smoke box; *i*, the return tubes; and *k*, the take-up, or chimney. Fig. 3, Sheet 2, is a section of a locomotive fire box; in which *a* represents another application of the water spaces or obstructions; *b*, the position of the coal fire; *c*, the red or carbonised fire; *d* and d^1, the fire doors. The tube *a* causes the smoke to descend from the position *b* to *c*, and air is admitted as before. *f* represents an improved revolving grate bar, made to revolve by means of the ratchet wheel f^1 in the ordinary manner. Fig. 4, Sheet 2, is a section of part of a locomotive boiler, shewing the fire box, in which the water space or obstruction *a* is suspended from the roof of the fire box; *b* shews the position

of the fresh fire; *c*, the red-hot or carbonised fire; *d*, the outer fire door; d^1, an inner door in the water space; and d^2, a passage from the same. Fig. 5, Sheet 2, is a section of part of a locomotive boiler, shewing the fire box; and Fig. 6, a cross section of the same, in which *a*, *a*, shews two transverse water spaces or obstructions. The coal is introduced through the side door *d* into the middle space *b*, and the smoke branches to the two outer positions *c*, *c*, which represent the red or carbonised fire, where the smoke is consumed. Fig. 7, Sheet 2, shews my improvements applied to kilns, bakeries, and similar purposes: in which *a* represents the obstruction, made of brickwork; *b*, the coal fire; *c*, the red or carbonised fire; and *d*, the furnace door. Fig. 8, Sheet 2, is a section of part of a locomotive boiler, shewing the fire box, in which the obstruction or water space *a* is placed in an angular position, and attached to the front part of the fire box; *b* represents the green coal fire; *c*, the red-hot or carbonised fire, over, under, or through which the smoke passes and is consumed on the admission of air through an aperture in the fire door *d*.

Figs. 1, 2, 3, 4, 5, 6, 7, and 8, Sheet 3, are sections of fire boxes of locomotive boilers, shewing various modifications of my improved arrangements of water spaces or obstructions, placed so as to direct the smoke and gases issuing from the green or coal fire through, under, or over the red-hot or carbonised fire, and air admitted as before. In Fig. 1, Sheet 3, *a* and *b* represent the water spaces or obstructions, causing the smoke from the green or coal fire *e* to pass through the passage or chamber *f* under the red-hot or carbonised fire *i* when air is admitted as before. In Fig. 2, Sheet 3, the water spaces or obstructions, are shewn at *a*, *b*, and *c*. In this plan there are two separate fires, forming distinctly a separate coal and red-hot fire, represented by the letters *e*, *e*, i^1, and i^1. The coal is alternately thrown on the furnaces at *e* and *e*, becoming red hot at i^1 and i^1. *f* is a passage or chamber from which smoke may escape from the upper fire to be consumed by the lower; the air to assist the combustion is admitted alternately through apertures in the furnace doors *k*, *k*. In Fig. 3, Sheet 3, the water spaces or obstructions are shewn at *a* and *b*, the green or coal fire at *e*, and the red-hot or carbonised fire at *i* and i^1; the coal is placed upon the fire at *e*, becoming red hot at i^1. The smoke escaping from this upper furnace passes through the chamber or passage *f*, and is consumed in the red-hot fire *i*, assisted by the admission of air through an aperture in the door *k*; k^1, in all the Figures, is a door by which coke can be thrown in to feed the red-hot fire, when required. Figs. 4 and 5, Sheet 3, are longitudinal and cross sections of a locomotive fire box, in which the water spaces or obstructions are shewn at *a* and *b*; the

FIG. 1.

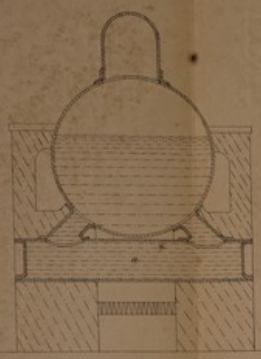

FIG. 2.

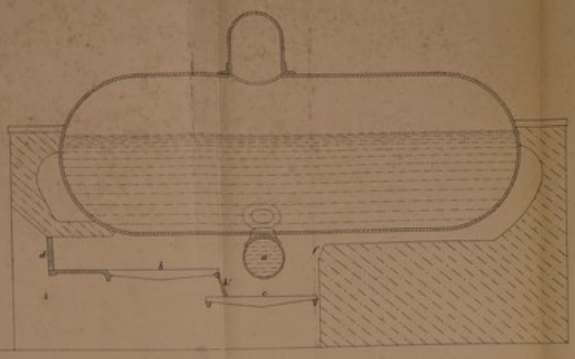

FIG. 3.

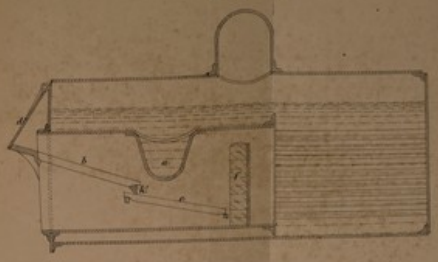

FIG. 4.

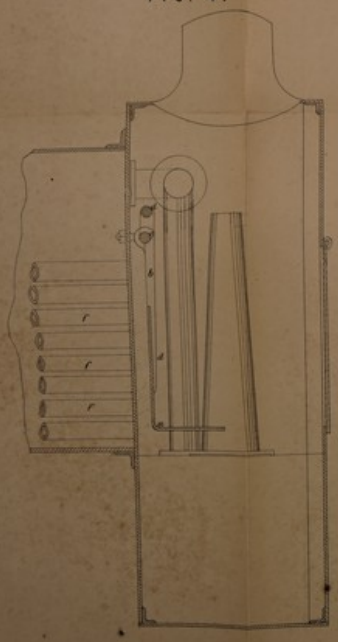

FIG. 5.

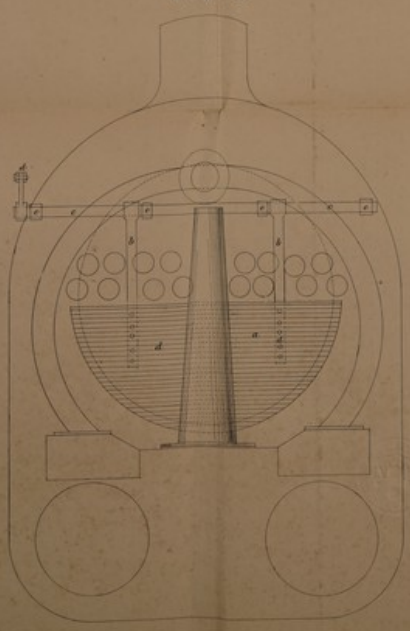

FIG. 6.

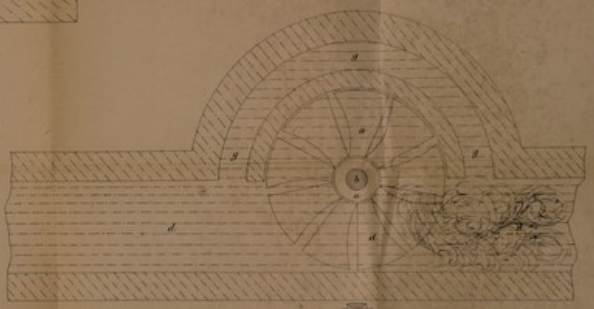

FIG. 7.

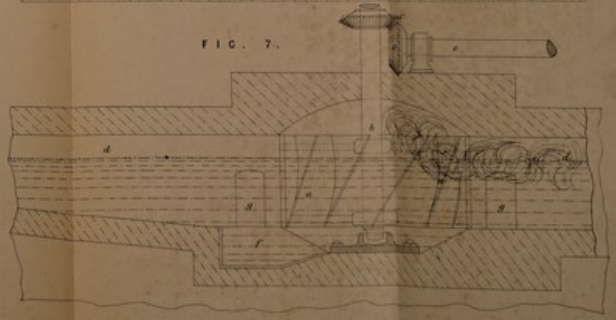

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FIG. 1.

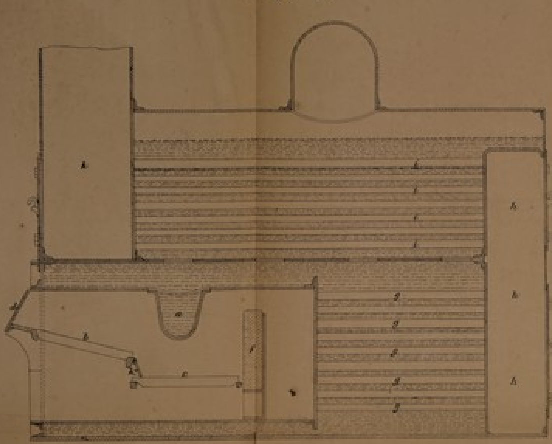


FIG. 2.

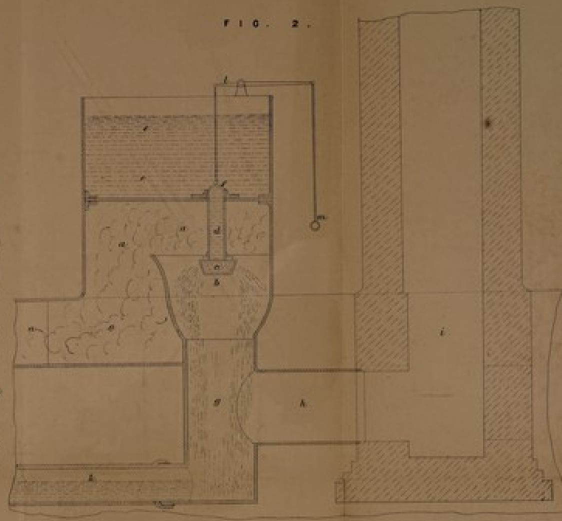


FIG. 3.

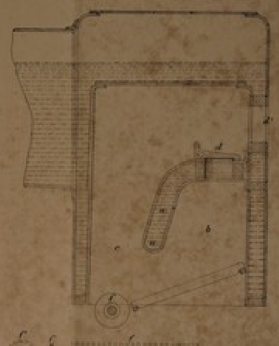


FIG. 4.

FIG. 5.

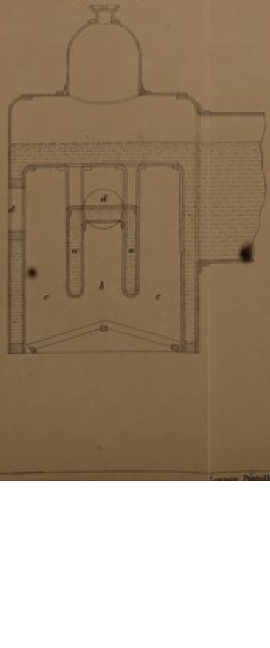


FIG. 6.

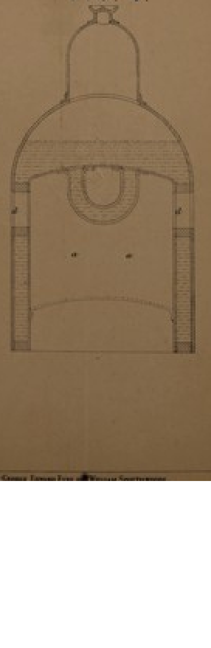


FIG. 7.

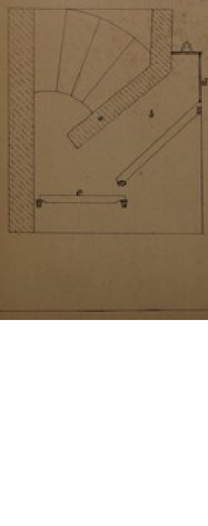
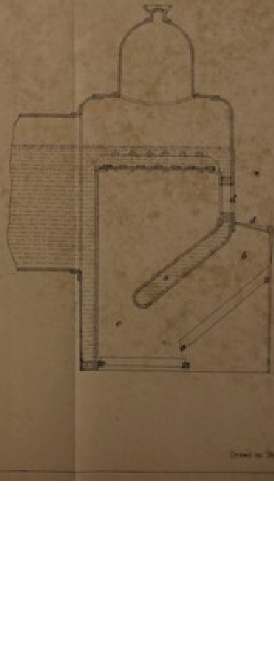


FIG. 8.



The filed drawing is partly colored.

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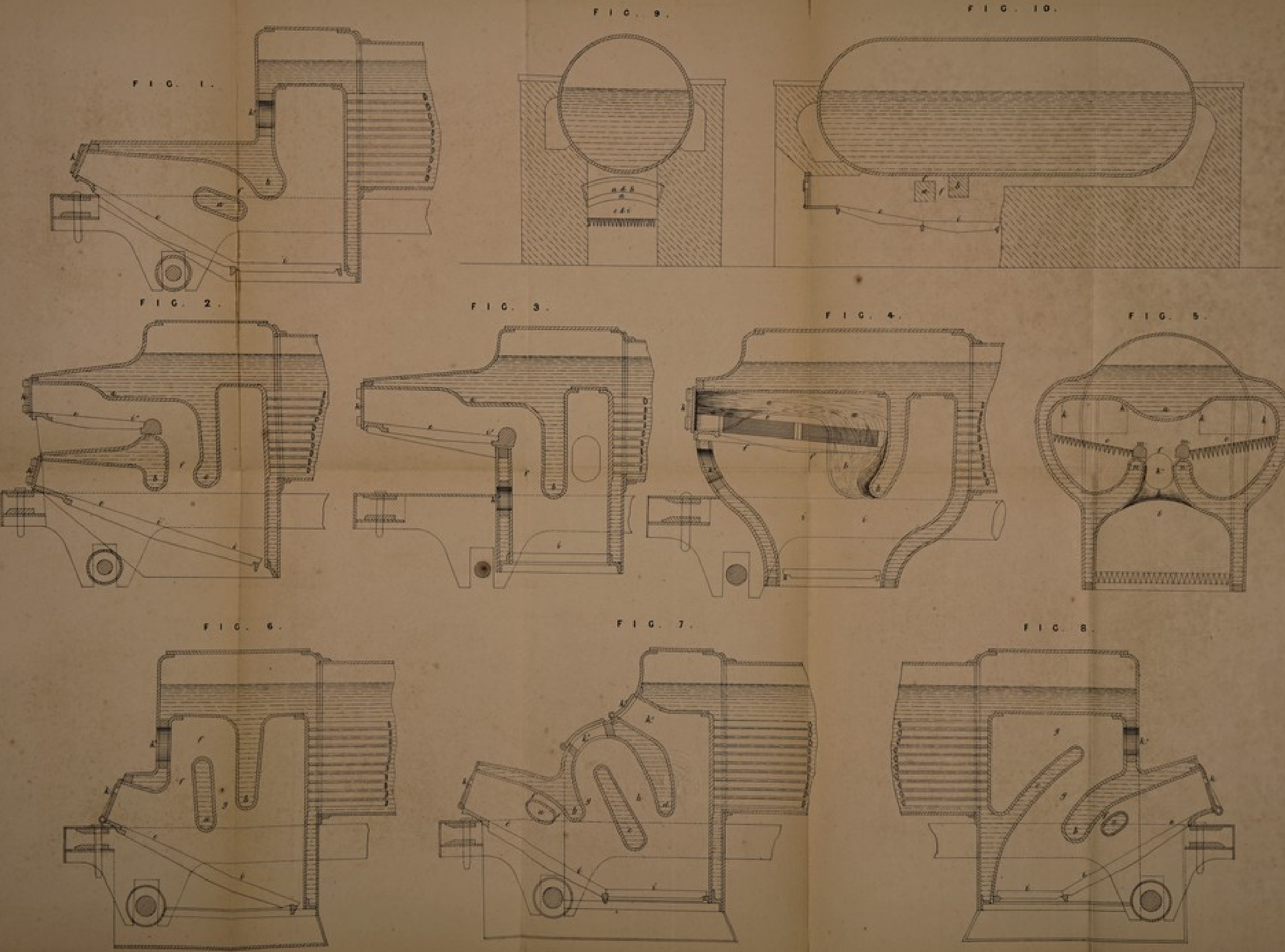

The filed drawing is partly colored.

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Drawn on Stone by Malby & Sons.

green or coal fires are placed on inclined fire bars at *e*, *e*, and afterwards fall upon the red-hot or carbonised fire *i*. The smoke from the upper fires *e*, *e*, passes through the chambers or passages *f*, and is consumed by the red-hot fire *i*, air being admitted as before. *m*, *m*, represent two cast-iron bridges, to protect the parts *n*, *n*, from the action of the flame. In Fig. 6, Sheet 3, the water spaces or obstructions are shewn at *a* and *b*, green coal is placed on the fire bars at *e*; the passages or air chambers through which the smoke passes are shewn at *f* and *g*, which smoke is consumed by the red-hot fire at *i*, assisted by the admission of air as before. In Fig. 7, Sheet 3, *a*, *b*, *c*, and *d* are the water spaces or obstructions, which cause the smoke from the green or coal fire *e* to pass through the passages or air chambers *f*, *g*, and *h* to the red-hot or carbonised fire *i*, and air is admitted through an aperture in the furnace door *k*; k^1 is another furnace door, through which small quantities of coke can be put on to feed the red-hot or carbonised fire *i*, as may be required. In Fig. 8, Sheet 3, the water spaces or obstructions are shewn at *a*, *b*, and *c*, the green or coal fire at *e*, the passages or air chambers at *f*, *g*, and g^1, through which the smoke passes to the red-hot or carbonised fire at *i*, *i*, and is consumed, as already described. Figs. 9 and 10, Sheet 3, are longitudinal and cross sections of an ordinary boiler to which my improvements are attached; in which *a* and *b* are obstructions, made of fire-brick, tubes, bars, or other suitable material, by which the smoke is prevented having a direct passage, and caused to descend upon the red-hot fire *i*; the green or coal fire is shewn at *e*, and air is admitted as before.

In Figs. 4 and 5, Sheet 1, are shewn a section and end view of the smoke box of a locomotive boiler; in which *a*, *a*, represent the covering or baffle plates, connected to the arms *b*, which vibrate or swing upon the shaft or centre *c*, supported on the bearing *e*; *d* is a lever, for regulating the distance of the covering or baffle plates *a*, *a*, from the ends of the tubes *f*, by which means the draught can be encreased to certain portions of the tubes and decreased in others, as may be found desirable. In Sheet 1, Fig. 6 is a plan, and Fig. 7 a longitudinal section, of one of my improved arrangements for washing the smoke which comes from the furnace, passing through the passage *d*, and is met by a dash of water from the wheel *a* on the shaft *b*. The wheel *a* is furnished with oblique vanes or paddles, partially immersed in water, and revolves with a considerable velocity through the medium of the wheels *c* and cross shaft *e*. The eddy of the water is aided by the concentric flue *g*, thus causing the rapid motion of a large quantity of water with a small amount of power, by which means a continual shower or dash of water is obtained, the draught of the furnace accelerated, and the smoke con-

densed. *f* is a well or receptacle for any deposit from the smoke. Fig. 2, Sheet 2, shews another modification of my plan for washing the smoke, in which *a*, *a*, represents the passage of the smoke from the furnace by the bell-mouth of the pipe *g*, through which the smoke has to pass. The smoke at *b* is met by a jet of water from the rose *c*, and in its descent with the shower of water down the pipe *g*, which should be made as long as convenient, by which means the smoke is condensed. *e* represents a cistern for the supply of water; *f*, a valve, which is opened by the lever *l* and handle *m*, to cause the jet to work when required; *d*, the pipe leading to the rose *e*; *h*, the flue or continuation of the pipe *g*, leading to the chimney *i*; and *k* is the drain to carry off the waste water and deposit.

Having thus fully described the nature and particulars of my said Invention, and the manner of carrying the same into practical effect, I desire it to be distinctly understood that I do not confine myself to the exact details herein described, as such may be varied or modified without departing from the principle thereof; but I claim as my Invention, and which, to the best of my knowledge and belief, has not been hitherto used within this realm, the arrangement of one or more furnaces or fire-places projecting from or formed in upper or lower shelves, or in one continuous line within the fire box, in conjunction with a series of water spaces, blocks, or bridges, forming obstructions and chambers or passages for smoke and flame, causing them to pass through, under, or over the coked or carbonised fire in advance of or below the coal or green fire or fires, with a revolving bar or grate, and a door or doors to the water spaces, by which, with the admission of oxygen or atmospheric air at the time the fire or furnace is fed with fresh fuel, the smoke is consumed; as all such improvements are herein described, and illustrated in the accompanying three Sheets of Drawings.

In witness whereof, I, the said William Grindley Craig, have hereunto set my hand and seal, this Twenty-fourth day of April, One thousand eight hundred and fifty-five.

WILLIAM GRINDLEY CRAIG. (L.S.)

Signed, sealed, and delivered by the within-named
William Grindley Craig, in the presence of
E. J. HUGHES,
Patent Agent, Manchester.

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