

## **Specification of Richard Leake and Joseph Beevers : preventing smoke in furnaces.**

### **Contributors**

Leake, Richard.  
Beevers, Joseph.

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183 Euston Road  
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A.D. 1868, 11th May. N<sup>o</sup> 1540.

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

OF

RICHARD LEAKE & JOSEPH BEEVERS.

PREVENTING SMOKE IN FURNACES.

LONDON

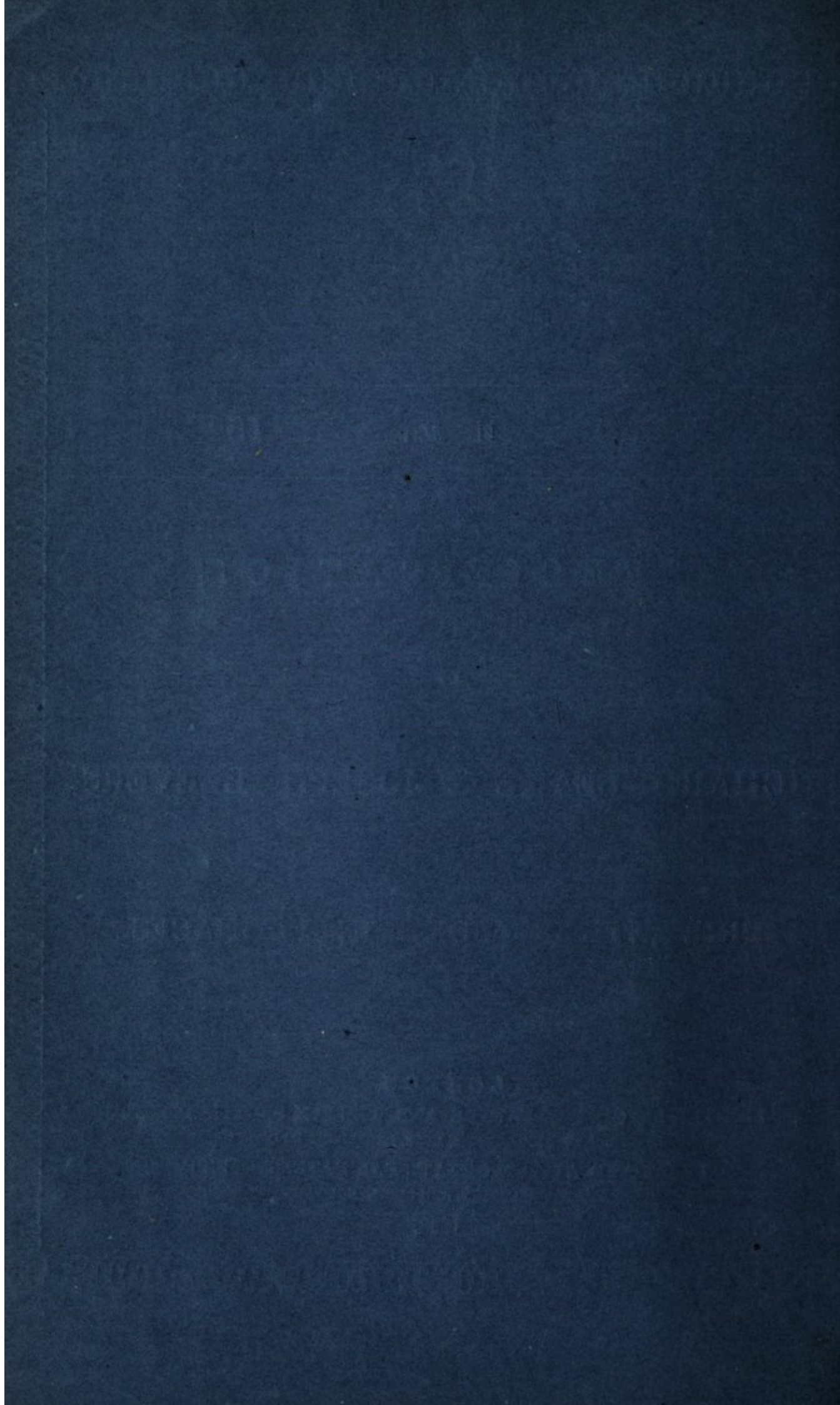
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1868.







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A.D. 1868, 11th *MAY*. N° 1540.

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**Preventing Smoke in Furnaces.**

**LETTERS PATENT** to Richard Leake and Joseph Beevers, both of Barnsley, in the County of York, for the Invention of "**IMPROVEMENTS IN APPARATUS FOR THE PREVENTION OF SMOKE IN STEAM BOILER AND OTHER FURNACES.**"

Sealed the 10th November 1868, and dated the 11th May 1868.

**PROVISIONAL SPECIFICATION** left by the said Richard Leake and Joseph Beevers at the Office of the Commissioners of Patents, with their Petition, on the 11th May 1868.

We, **RICHARD LEAKE** and **JOSEPH BEEVERS**, both of Barnsley, in the  
5 County of York, do hereby declare the nature of our said Invention for  
"**IMPROVEMENTS IN APPARATUS FOR THE PREVENTION OF SMOKE IN STEAM BOILER  
AND OTHER FURNACES,**" to be as follows:—

This Invention has for its object the prevention of smoke and the  
obtaining of more perfect combustion in steam boiler and other furnaces,  
10 and consists according to one mode of carrying out the Invention in the



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employment of a fire-door, perforated or otherwise, and hung upon centres at the top side so as to act as a flap and close by its own gravity. In this door there is attached a lever arm by depressing which the door will turn partly on its top centres or hinges inwards towards the furnace. This lever is connected to the lower end of a piston rod, the 5 piston of which works fluid-tight or nearly so in an inverted cylinder suspended on trunnions in brackets, attached either to the front of the boiler itself or to the edge of the setting. On the top of this cylinder there is fitted a receiver or receptacle for water or other liquid of any convenient form, such receiver communicating with the cylinder below 10 by a small perforation made in the bottom of the receiver or in the partition which separates the cylinder from the receiver. The water-way of this small perforation is capable of being regulated by a conical plug inserted therein passing down through the receiver and adjusted by a regulating nut or screw for the purpose herein-before explained. 15 In addition to this small perforation there is a larger aperture made in the bottom of the receiver, and to this opening there is fitted a spring valve opening downwards into the cylinder. Sufficient water or other liquid is poured into the receiver to fill the cylinder, and when the furnace door is opened for the purpose of stoking, the piston is simul- 20 taneously drawn down to the bottom of its cylinder, the liquid from the receiver or vessel above then entering by the valvular opening and filling that part of the cylinder which is above the piston. The furnace door by its own gravity now tends to descend or close, but it is controlled in its descent by the resistance of the liquid in the cylinder. As this 25 liquid is however caused by the upward movement of the piston to flow through the small adjustable perforation back into the receiver again, it follows that the door will slowly close, and that the time occupied in its closing may be varied to suit different kinds of fuel by increasing or diminishing the size of the perforation through which 30 the liquid is urged by the ascending piston. If desired, a ram or plunger may be substituted for the piston in the cylinder.

According to another modification the top vessel or liquid receiver above the cylinder may be dispensed with, the liquid being always contained within the cylinder itself either above or below the piston as 35 the case may be. The piston should either be fitted with a valve opening upwards or with a cup leather packing that will expand when



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the piston rises and contract when it is drawn down; the upper and lower ends of the cylinder should also be brought into communication either by a small perforation made in the piston itself, or otherwise arranged so as to control the flow or displacement of the liquid from  
5 one side of the piston to the other. On opening the furnace door, which is hung on top centres and connected by a lever with the piston rod as herein-before described, the piston is drawn down to the bottom of the cylinder, the fluid passing freely through the valve or past the sides of the cup leather packing, and as the door by its gravity tends  
10 to close, the liquid flows slowly through the small perforation or passage into the lower part of the cylinder again, the size of such thoroughfare regulating the duration of time of the closing of the furnace door.

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**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said Richard Leake and Joseph Beevers in the Great  
15 Seal Patent Office on the 10th November 1868.

**TO ALL TO WHOM THESE PRESENTS SHALL COME**, we, RICHARD LEAKE and JOSEPH BEEVERS, both of Barnsley, in the County of York, send greeting.

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her  
20 Letters Patent, bearing date the Eleventh day of May, in the year of our Lord One thousand eight hundred and sixty-eight, in the thirty-first year of Her reign, did, for Herself, Her heirs and successors, give and grant unto us, the said Richard Leake and Joseph Beevers, Her special licence that we, the said Richard Leake and Joseph  
25 Beevers, our executors, administrators, and assigns, or such others as we, the said Richard Leake and Joseph Beevers, our 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,  
30 within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "**IMPROVEMENTS IN APPARATUS FOR THE PREVENTION OF SMOKE IN STEAM BOILERS AND OTHER FURNACES,**" upon the condition (amongst others) that we, the said Richard Leake and Joseph Beevers, our executors or administrators, by an instrument in



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writing under our, or their, or one of their hands and seals, 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 5 Patent.

NOW KNOW YE, that we, the said Richard Leake and Joseph Beevers, 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:— 10

This Invention has for its object the prevention of smoke and the obtaining of more perfect combustion in steam boilers and other furnaces, and consists according to one mode of carrying out the Invention in the employment of a fire-door, perforated or otherwise, and hung upon centres at the top side so as to act as a flap and close by its own 15 gravity. In this door there is attached a lever arm by depressing which the door will turn partly on its top centres or hinges inwards towards the furnace, such lever being connected to the lower end of a piston rod, the piston of which works fluid-tight or nearly so in an inverted cylinder suspended on trunnions in brackets, attached either to the front of the 20 boiler itself or to the edge of the setting. This cylinder has fitted on its top a receiver or receptacle for water or other liquid of any convenient form, such receiver communicating with the cylinder below by a small perforation made in the bottom of the receiver or in the partition which separates the cylinder from the receiver. The waterway of this small 25 perforation is capable of being regulated by a conical plug inserted therein passing down through the receiver, and adjusted by a regulating nut or screw for the purpose herein-before explained. In addition to this small perforation there is a large aperture made in the bottom of the receiver, and to this opening there is fitted a (spring) valve opening 30 downwards into the cylinder. Sufficient water or other liquid should be poured into the receiver to fill the cylinder, and when the furnace door is opened for the purpose of stoking, the piston is simultaneously drawn down to the bottom of its cylinder, the liquid from the receiver or vessel above then entering by the valvular opening and filling that part of the 35 cylinder which is above the piston. The furnace door by its own gravity now tends to descend or close, but it is controlled in its descent by the



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resistance of the liquid in the cylinder. As this liquid is however caused by the upward movement of the piston to flow through the small adjustable perforation back into the receiver again, it follows that the door will slowly close, and that the time occupied in its closing may be varied  
5 to suit different kinds of fuel by increasing or decreasing the perforation through which the liquid is urged by the ascending piston. If desired, a ram or plunger may be substituted for the piston in the cylinder.

According to another modification the top vessel or liquid receiver above the cylinder may be dispensed with, the liquid being always  
10 contained within the cylinder itself either above or below the piston as the case may be. The piston should either be fitted with a valve opening upwards or with a cup leather packing that will expand when the piston rises and contract when it is drawn down. The upper and lower ends of the cylinder should also be brought into communication  
15 either by a small perforation made in the piston itself, or otherwise arranged so as to control the flow or displacement of the liquid from one side of piston to the other. On opening the furnace door, which is hung on top centres and connected by a lever with the piston rod as herein-before described, the piston is drawn down to the bottom of the cylinder, the  
20 fluid passing freely through the valve or past the sides of the cup leather packing, and as the door by its own gravity tends to close the liquid flows slowly through the small perforation or passage into the lower part of the cylinder again, the size of such thoroughfare regulating the duration of time of the closing of the furnace door.

## 25 DESCRIPTION OF THE DRAWINGS

accompanying these Presents, and of the manner in which the said Invention is to be performed or carried out in practice.

Fig. 1, section of our apparatus as applied to a boiler furnace; Fig. 2, front elevation of same; Fig. 3, plan; Figs. 4 and 5 show cheek plates and brackets or lugs for the door to work in; Fig. 6, view of door;  
30 Figs. 7, 8, and 9, diagrams showing modifications of the apparatus.

The chief feature of this Invention is the adoption of the perforated (or plain) door *a* at the mouth of the furnace working on pivots *b* opening inwards to the fire *c* and upwards to the boiler B. The pivots *b*  
35 are on the top edge of the door *a* and brackets *d* for the pivots of the door to work in (which are when applied to an old door frame screwed on



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to the same or cast on the door frame when it is a new one). These cheek plates extend into the furnace according to the inclination to be given to the door, the breadth of the dead plate being generally the guide. A lever *f* is attached to one end of the door for the purpose of opening and shutting the same; this lever *f* can be cranked either to the right 5 or left so as to be out of the way at the time of firing. Connected with the lever *f* of the door is a spring catch having notches in it to hold the door open or in any position between open and shut, according to the smoke-causing properties of the fuel used. A principal point in this Invention is that the angle at which the door is placed causes the 10 atmospheric air to impinge on the front of the fire in a long narrow film similar to the action of so many hydrogen blow pipes or smiths' bellows, which gives every particle of gas as it arises from the grate its due quantity of atmospheric air, thereby preventing smoke and the cooling down of the furnace at the time of firing or stirring the fire, 15 affording no back radiation to annoy the stoker as the front of the furnace remains quite cool. A self-actor may be used or not as may be desired, but when the self-actor is used only one notch in the spring catch is required to keep the door in position at the time of firing. 20

The construction of the self-actor is as follows:—First. Two cylinders *m* and *n*,  $2\frac{1}{2}$  or 3 inches in diameter each, are screwed together with a centre piece *g* between them to form trunnions *h*. For the cylinders to oscillate in there is a bracket *i* fixed to the end of the boiler or the top of the boiler case for the pivots of the centre piece of the two cylinders 25 forming the trunnions *h* to work in; this centre piece has two holes in it, a (spiral spring) valve *j* is fitted in one hole opening downwards into the bottom cylinder, a conical regulating plug *k* is fitted in the other; this plug *k* reaches through the lid of the top cylinder *m*, and is screwed with a lock nut *l* to hold it in position, the top cylinder *m* 30 being used simply as a receiver for the water or other fluid contained in the bottom cylinder *n*. The length of each cylinder should be from 18 to 20 inches, the bottom cylinder *n* being fitted with a piston *o*, piston rod *p*, and stuffing box *q*. The piston rod *p* is attached to the lever *f* of the door *a* with a slot hole and pin. The piston is of cast iron 35 turned to fit the cylinder, and has three small holes in it, with a leather or indian-rubber lid on the top, so that if any fluid passes by the side



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of the piston it can easily pass through the perforations of the piston when the lever of the door is pulled down for the purpose of opening the door *a*. A cup leather might be used instead of the perforations in the piston, and the self-actor may be constructed with one cylinder  
5 with pivots cast on it forming the trunnions, open at the bottom, with a bar for steadying the piston rod, and a lid on the top with a (spiral spring) valve in it opening downwards so as to admit air into the cylinder. Likewise a tap at the top of the cylinder to regulate the discharge of the air according to the time in which the door is required  
10 to fall or shut itself. When the stoker wishes to fire he weighs down the lever attached to the door, and then the piston *o* falls to the bottom of the cylinder *n*, and the fluid in the top cylinder or receiver *m* flows through the valve *j* in the centre piece into the bottom cylinder *n*, a catch being provided to hold the door open till he has done firing,  
15 when he knocks off the catch, and the door being heavier than the resistance of the fluid in the cylinder gradually closes itself, the time of closing being regulated by the conical plug *k* in the centre piece of the two cylinders, and if the air cylinder be used, then by the tap on the top of it. When the stoker wishes to stir the fire with the poker  
20 or scrag hook he raises the door *a* half open, and by the time he has done stirring, the door will nearly have closed itself. To use the door without the self-actor we use a spring catch with several notches in it, one to hold the door open and the other to hold the door at any angle between open and shut, according to the smoke-causing properties of  
25 the fuel. When the door is placed at the proper angle for preventing smoke the greatest heat is generated in the furnace, hence it is immaterial whether the door is closed entirely or not, as it is frequently one or two inches open, according to the state of the fire.

This Invention may be used in another form, that is, the mouth of  
30 the furnace may be constructed similar to a house oven without a door or back, and the shelf sliding in and out at the proper angle for preventing the smoke. The sliding shelf or door may be worked by a self-actor or by hand, as may be desired.

Having now particularly described the nature of this said Invention,  
35 and in what manner the same is to be performed, we hereby declare that we claim, the said Invention of improvements in furnaces and the doors thereof for the prevention of smoke in steam boilers and other



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furnaces, the nature and character whereof are set forth in the outset of this Specification by the words preceeding the words description of the Drawings.

In witness whereof, we, the said Richard Leake and Joseph Beevers, have hereunto set our hands and seals, this 5th day of November, 5 in the year of our Lord One thousand eight hundred and sixty-eight.

RICHARD LEAKE. (L.S.)

JOSEPH BEEVERS. (L.S.)

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LONDON:

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Printers to the Queen's most Excellent Majesty. 1868.



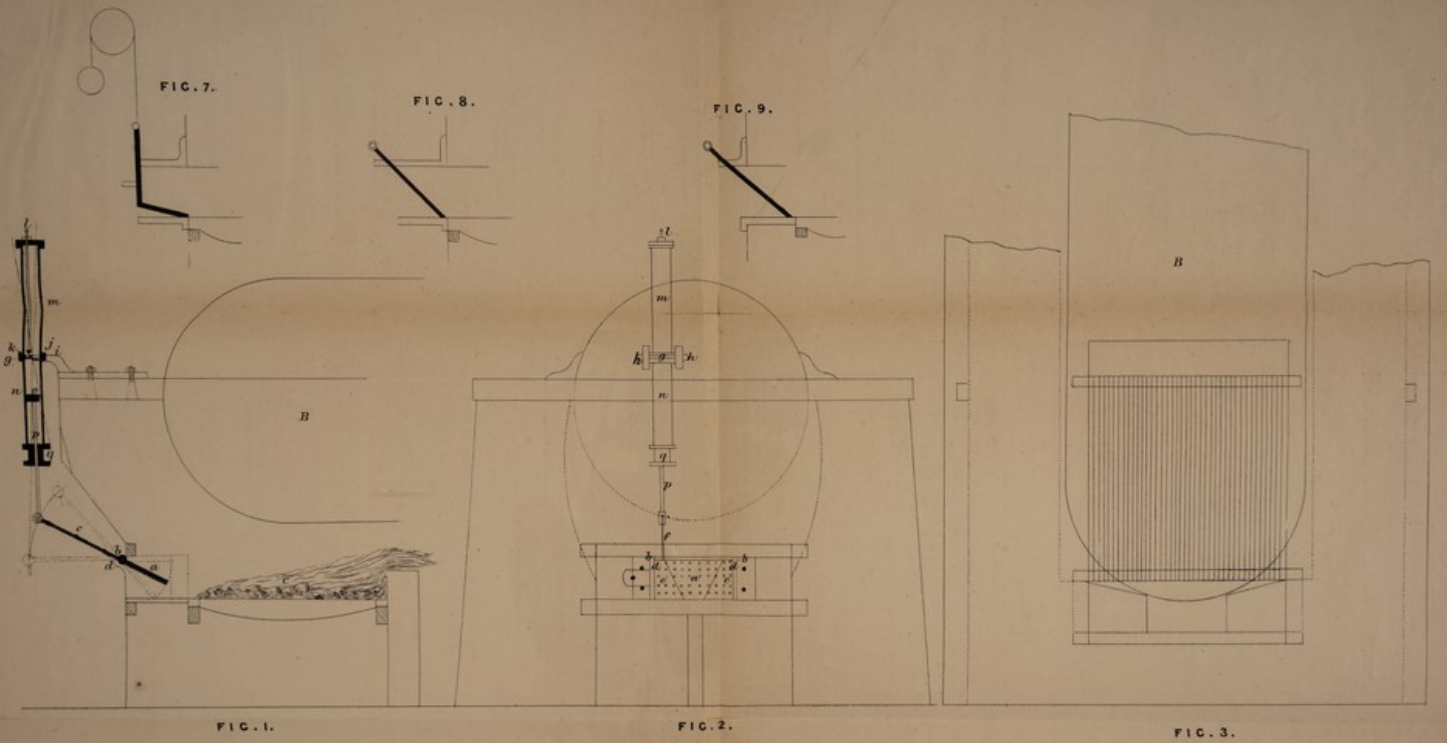


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

The filed drawing is not colored

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