

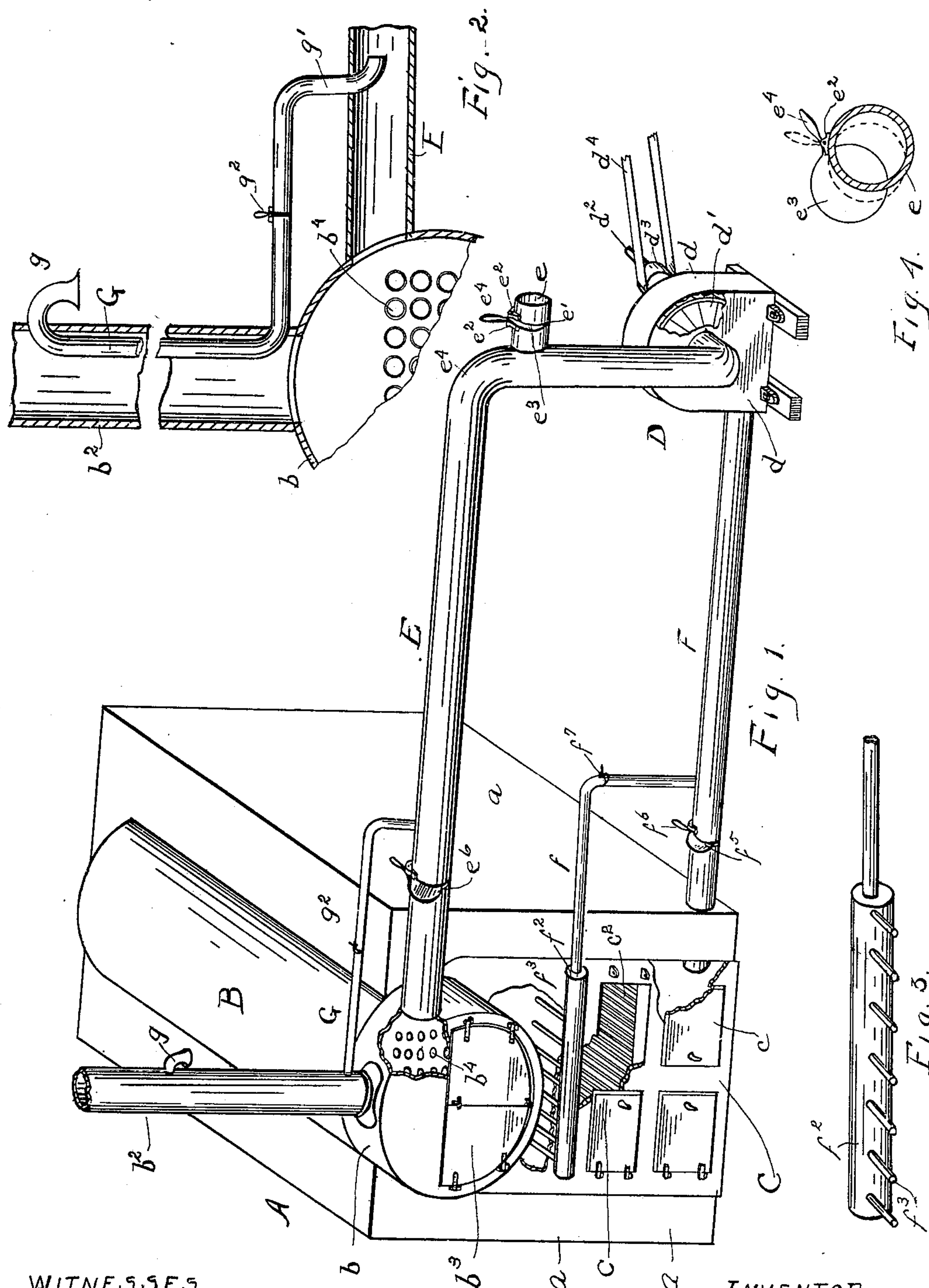
No. 672,077.

Patented Apr. 16, 1901.

W. J. FOSTER.  
STEAM BOILER FURNACE.

(Application filed July 23, 1900.)

(No Model.)



WITNESSES.

Leroy L. Perme.  
Annie L. Greer.

INVENTOR.

Walter J. Foster.  
per Richard H. Manning Atty



# UNITED STATES PATENT OFFICE.

WALTER J. FOSTER, OF KANSAS CITY, MISSOURI.

## STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 672,077, dated April 16, 1901.

Application filed July 23, 1900. Serial No. 24,545. (No model.)

*To all whom it may concern:*

Be it known that I, WALTER J. FOSTER, a citizen of the United States of America, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Steam-Boiler Furnaces; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

My invention has for its objects, first, to create an artificial draft of air within the smoke-jacket of a steam-boiler furnace and draw the smoke and gases from the jacket and force the same within the furnace beneath the furnace-grate and at the same time feed the elements of combustion above the grate with the lighter gases separated from the smoke and heavier gases introduced beneath the grate, and, second, to control the admixture of the mixed air and gases forced within the furnace above and below the grate with the products of combustion in the proper proportions within the smoke-conducting flue, so as to economize in the consumption of the fuel and produce a highly-inflammable gas.

The invention consists in the novel construction and combination of parts, such as will be first fully described, and specifically pointed out in the claims.

In the drawings, Figure 1 is a view in perspective of a steam-boiler furnace, showing the suction and force apparatus and the conductors for the mixed air and gases and the feeding-pipe for the gases in the smoke-flue connected with the conductor of the mixed smoke and gases, a portion of the furnace-front and the smoke box or jacket upon the boiler being broken away to show the tubes extending through the furnace-front and the tubes in the boiler. Fig. 2 is a detail sectional view of a portion of the smoke-box and smoke-stack and a portion of the conductor of the mixed smoke and gases and also the feeding-pipe connected therewith and with the smoke-stack. Fig. 3 is a detail view of the case or receiver on the outside of the furnace-front. Fig. 4 is a detail view of one of the valves.

Similar letters of reference indicate corresponding parts in all the figures.

Referring to the drawings, A represents a steam-boiler furnace, and *a a* are the side walls to said furnace.

B is the steam-boiler, and *b* the smoke-receiving drum or box on the forward end of the boiler.

*b*<sup>2</sup> is the smoke stack or pipe extending upwardly from the smoke-box.

*b*<sup>3</sup> represents the doors to the smoke-box.

*b*<sup>4</sup> represents the smoke-flues in the boiler B.

C represents the furnace-front, and *c c* the doors to said furnace-front.

*c*<sup>2</sup> is the furnace-grate.

D represents a suction and force blast fan-case arranged in position a suitable distance from the furnace-wall A, having sides *d d*, and in which case is a blast-fan *d'*, which is mounted upon the shaft *d*<sup>2</sup>.

With the outer side of the smoke box or jacket *b* is connected one end of a smoke and gas conducting pipe E, of considerable size, which extends horizontally from the box or jacket *b* to a position above the suction and force apparatus D, thence bent at right angles, as at *e*<sup>x</sup>, and extended downwardly to a position opposite the axial line of the fan-shaft *d*<sup>2</sup>, and thence bent at right angles and connected with the induction-opening in the side *d* of said fan-case D.

With the induction or blast opening in the fan-case D is connected one end of a smoke and gas returning pipe F, which is smaller in circumference than the pipe E, the other end of which pipe is extended through the furnace-wall *a* to a position beneath the furnace-grate *c*<sup>2</sup> and near the lower doors *c* in the furnace-front C. With the pipe F, a short distance from the outside of the furnace-wall, is connected one end of a branch gas-conducting pipe *f*, the other end of which pipe is extended a short distance in an upward direction, thence outside the furnace-wall to a position near the furnace-front a short distance above the furnace-doors, and with said pipe is connected a cylindrical gas-mixing chamber or case *f*<sup>2</sup>. In the side of the case *f*<sup>2</sup> are the nipples *f*<sup>3</sup>, which extend in series horizontally through the furnace-front plate C above the furnace-grate *c*<sup>2</sup>.

With the pipe E, a short distance above the



fan-case D, is connected a short length of pipe  $e$ , within which the air is admitted to pipe E for admixture with the smoke and furnace-gases. In the pipe-joint  $e$  is a transverse slot  $e'$ , extending about half-way through the side of said joint. Upon the outer upper side of said pipe-joint, upon both sides of the slot  $e'$ , are lugs  $e^2$   $e^2$ . Within the slot  $e'$  is a circular valve-plate  $e^3$ , pivotally connected with the lugs  $e^2$   $e^2$ . With the valve-plate  $e^3$ , near its pivotal point of connection with pipe-joint  $e$ , is connected a handle  $e^4$ .

In the pipe F, between the point of connection of pipe  $f$  with the said pipe F and the furnace-wall  $a$ , is an equalizing-valve  $f^5$ , which is similar to the valve  $e^3$  in the joint  $e$  and is pivotally connected with the pipe F, so as to be operated by a handle  $f^6$  in the same manner as the handle  $e^4$  in the valve  $e^2$ . In the pipe  $f$  is a valve  $f^7$ , which is similar to the valve  $e^3$ .

Within the smoke-stack  $b^2$ , close in position to the inner side of said stack, is an air-feeding pipe G. The upper end of the pipe G is bent at right angles and extends through the side of the smoke-stack and beyond the outer side of said stack is bent at right angles and in a downward direction and is bell-shaped, as at  $g$ , so as to prevent the entry of water. The lower end of the pipe G extends downwardly within the smoke-stack nearly to the smoke-jacket  $b$  and is bent at right angles and extended through said stack in a plane parallel with the pipe E, thence bent downwardly and extended through the side of said pipe, and thence bent at right angles within said pipe and extended a short distance in the direction of the end of the said pipe having the valve  $e$ . In said pipe G is a valve  $g^2$ , which is similar to the valve  $e^3$ . In the conducting-pipe F, between the furnace-wall and the lower end of pipe G, is a valve  $e^6$ , which is similar to valve  $e^3$ . On the shaft  $d^2$  in the fan-case D is a pulley  $d^3$ , over which extends one end of a belt  $d^4$ , the other end of which belt extends over a suitable band-pulley upon a driving-shaft of an engine. (Not shown.)

In operation power is communicated to the suction and blast fan  $d'$  through the belt  $d^4$  and pulley  $d^3$  from the source of power, and an artificial draft of more or less power is communicated to the smoke and gases within the smoke-box jacket  $b$ , which enter said smoke-box from the smoke-flue  $b^4$  in the boiler B. The unconsumed smoke and gases under the suction of the fan pass through the pipe E into the fan-case D and are forced out of the case, after the treatment hereinafter described, through the pipe F, beneath the furnace-grate  $c^2$ , the lighter gases, with the air, being forced through the pipe  $f$  into the chamber of the furnace above the furnace-grate.

In starting the fire in the furnace when the fuel in the grate  $c^2$  is giving off a large per cent. of smoke the valve  $f^5$  is nearly closed and the valves  $f^6$  in pipe  $f$  and the valve  $g^2$  in pipe G opened. The smoke and gases

which are drawn through pipe E being subjected to the mixture with air within the said tube, which is drawn through the air-feeding pipe G into the pipe E, the total amount of smoke and gases drawn within the fan-case is therefore charged with an amount of oxygen sufficient to cause its rapid entrance within the furnace through the pipe  $f$  above the furnace-grate, effecting a rapid combustion, and as the products of combustion become less charged with carbon the valve  $f^5$  is opened to a larger extent, admitting the mixed gases and air both above and below the grate.

In order to control the amount and also the rapid passage of the heated air through the pipe G and its admixture with the heated furnace-gases drawn from the furnace by the suction and blast fan, the valve  $e^3$  is opened sufficiently to admit the cold air supplying, consequently, more oxygen, and the admixture of the heated air and gases is controlled in quantity, and the draft of the heated air and gases is controlled in quantity, and the draft of the heated air through the pipe E is regulated in degree.

In my invention the gases are returned repeatedly to the furnace until by the complete utilization of the mixed air and gases the combustion of the fuel upon the furnace-grate is made nearly perfect. The valve  $e^6$  may be closed in pipe E and the heated air fed direct to the furnace.

Having fully described my invention, what I now claim as new, and desire to secure by Letters Patent, is—

1. The combination with a steam-boiler furnace, and with the smoke-stack of a suction and blast apparatus, separate smoke and gas conducting pipes connected at their outer ends with the respective induction and education openings in the said suction and blast apparatus, and their inner ends extending into the smoke-box of said steam-boiler and through the furnace-wall beneath the furnace-grate respectively, an air-feeding pipe within said smoke-stack, having its upper end extending through said stack and its lower end extending through said stack and also within the conductor for the mixed smoke and gases leading to the induction-opening in the suction and blast apparatus, a branch pipe connected with the smoke and gas returning conductor and extending within the furnace above the furnace-grate and within the heating agent, and a valve in the conductor leading to the smoke-box from the induction-opening in the suction and blast apparatus located between the smoke-box and the exit-opening of the air-feeding pipe.

2. The combination with a steam-boiler furnace and with the smoke-stack of the steam-boiler, a suction and blast fan-case and fan, a conductor for the mixed smoke and gases connected with the smoke-jacket of said steam-boiler and also with the induction-opening to the fan-case and a smoke and gas returning conductor connected with the education



tion-opening to the fan-case at one end, and  
having the other end extending through the  
furnace-wall beneath the furnace-grate, an  
air-feeding pipe within the smoke-stack hav-  
5 ing its upper end extending through the said  
stack and its lower end extending through  
said stack and within the conductor for the  
mixed smoke and gases leading from the  
smoke-jacket to the induction-opening to the  
10 fan-case and a pipe-joint connected with the  
said conductor at a point between the exit-  
opening of the air-feeding pipe and the in-  
duction-opening to the fan-case, a case or re-  
ceiver for the mixed gases near the furnace-

front plate, having jet - tubes extending 15  
through said plate, a branch tube connected  
at one end with said case or receiver, and  
with the conductor leading from the induction-  
opening of the fan-case at the other end, and  
a valve located in the pipe-joint controlling 20  
the entrance of the cold air between the lower  
end of the air-feeding pipe and the induction-  
opening to the fan-case.

WALTER J. FOSTER.

Witnesses:

JAMES M. KENT,  
JOHN T. MARSHALL.