(No Model.)

2 Sheets—Sheet 1.

E. FOX.

FURNACE DOOR.

No. 286,692. Patented Oct. 16, 1883.

Fig. 1.

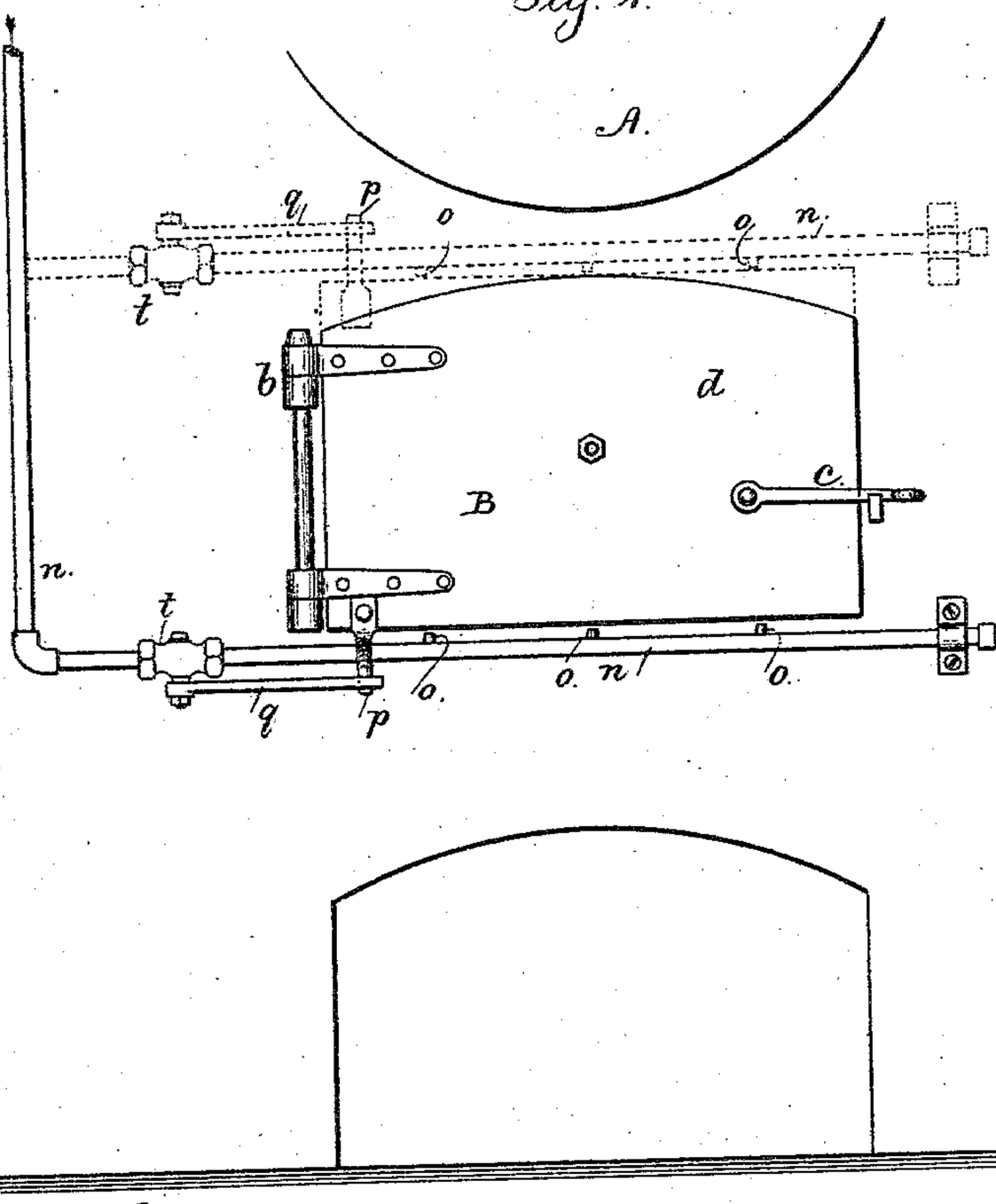


Fig. 2.

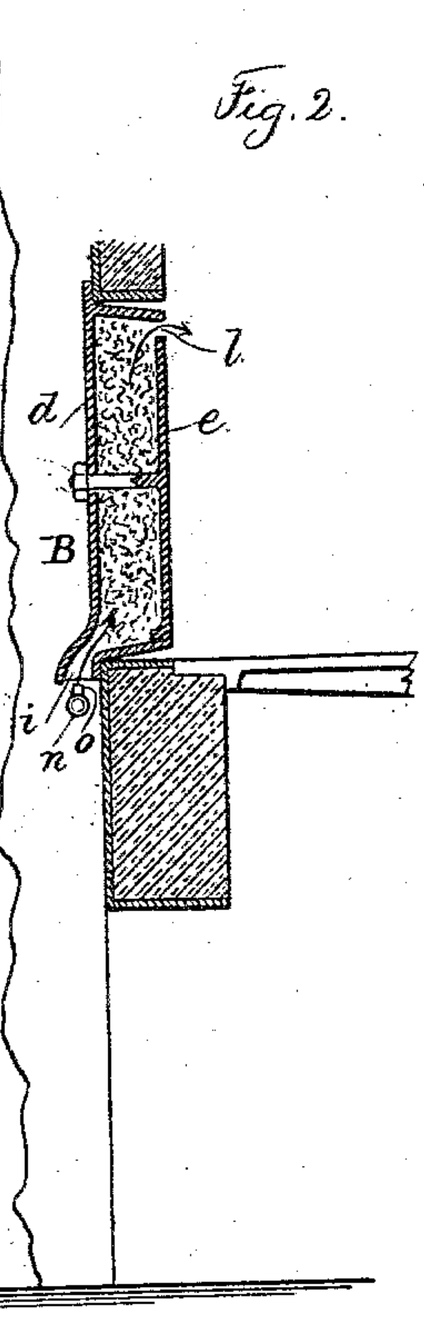


Fig. 4.

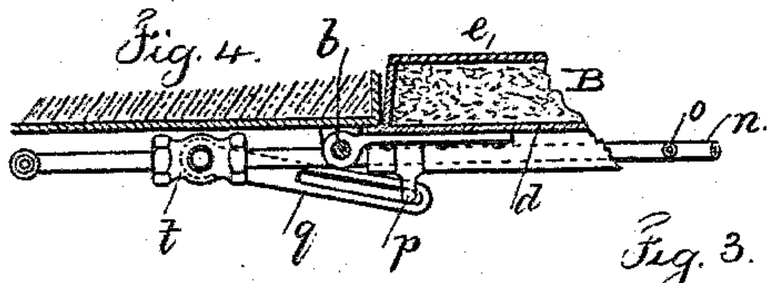
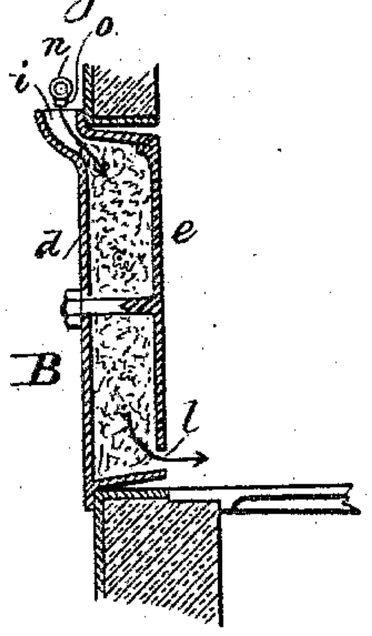


Fig. 3.



Witnesses

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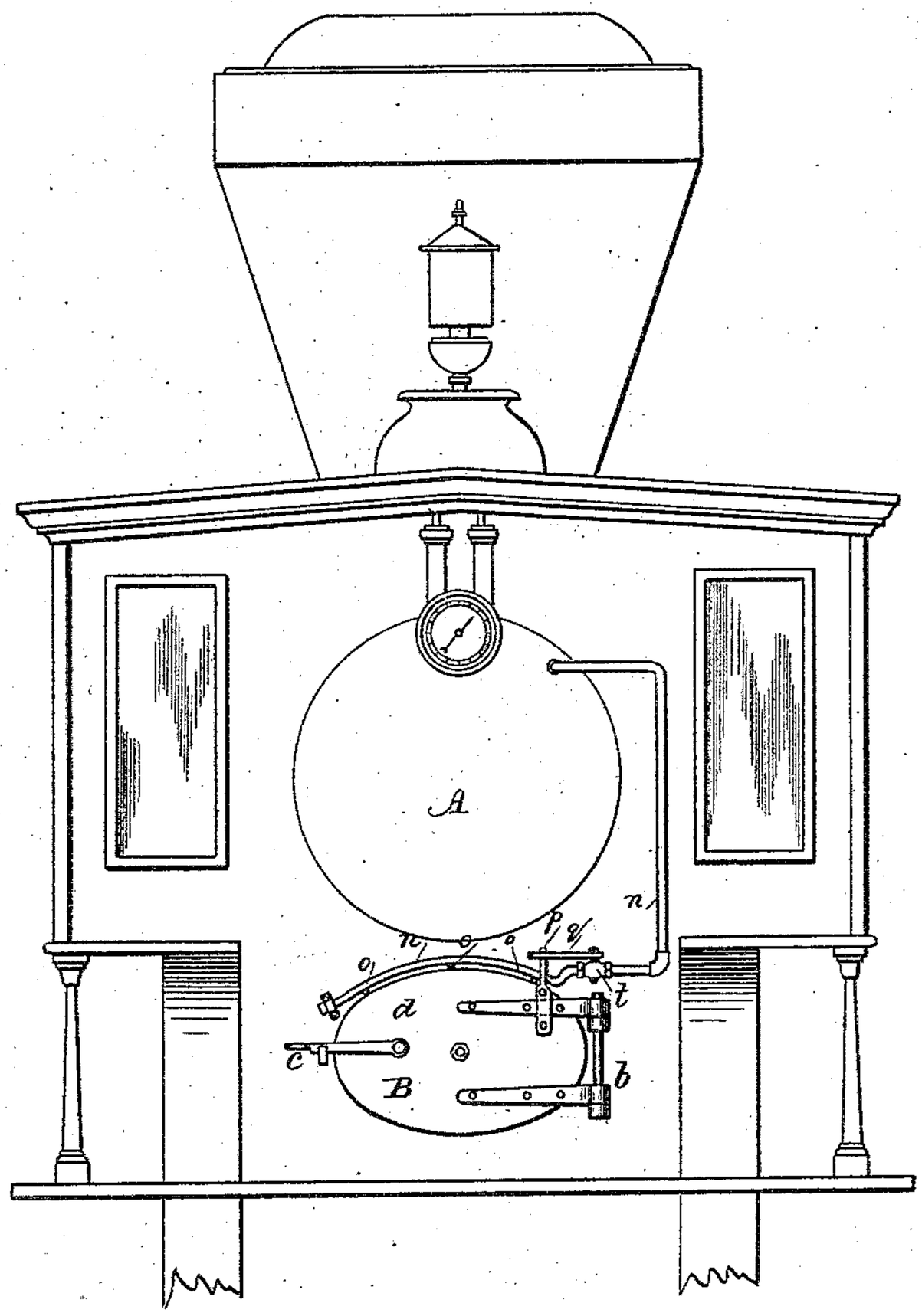
(No Model.) 2 Sheets—Sheet 2.

E. FOX.

FURNACE DOOR.

No. 286,692. Patented Oct. 16, 1883.

Fig. 5.



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UNITED STATES PATENT OFFICE.

EDWARD FOX, OF BROOKLYN, NEW YORK, ASSIGNOR TO PATRICK REILLY, OF SAME PLACE.

FURNACE-DOOR.

SPECIFICATION forming part of Letters Patent No. 286,692, dated October 16, 1883.

Application filed February 19, 1883. (No model.)

To all whom it may concern:

Be it known that I, EDWARD FOX, of Brooklyn, in the county of Kings and State of New York, have invented an Improvement in Furnace-Doors, of which the following is a specification.

The object of my present invention is to prevent smoke, economize fuel, and at the same time preserve a high degree of heat in the furnaces of steam-boilers. I accomplish these results with the proper quantity of air mixed with steam, which is caused to enter the furnace through its hollow door, and while passing through said door I cause the air and steam to be thoroughly commingled and heated.

I am aware that attempts have been made to consume smoke in furnaces by allowing a large quantity of atmospheric air to the fire through openings and passage-ways into the furnaces. This method, while partially remedying one evil by preventing smoke, creates another and greater one—namely, that it reduces the temperature of the furnace and causes the consumption of more fuel, for reasons that I will now set forth. With perforated furnace-doors admitting only atmospheric air into the furnaces, four-fifths of the air admitted into the furnaces is composed of nitrogen, which is not only useless in combustion, but retards it by absorbing a large portion of the heat of the fire and escaping with it up the chimney. Owing to this large proportion of useless nitrogen double the quantity of air is usually fed to the fire in order to obtain enough oxygen to produce perfect combustion. If the quantity of air is reduced, there will not be enough oxygen to develop carbonic acid, but only enough to form carbonic oxide, and the unconsumed carbon will settle on the tubes, flues, and top of the boiler, causing a great waste of heat and fuel by preventing the heat being conducted to and through the flues, tubes, &c., to the water in the boiler. The temperature of the furnace is also much lower than if the combustion had been perfect, resulting in the formation of carbonic oxide. In all other furnace-doors intended for consuming smoke heat is wasted by the admission of too much air into the furnace, and only a portion of the smoke is consumed, and then only at the expense of cooling down the tubes, flues, &c., which have been heated by the consumption of coal in the fire. If too small a quantity of air is used, only a partial conversion of the particles of carbon ensues, and a large portion of the most valuable combustible gases pass out of the furnace unconsumed. To avoid these two great difficulties is the aim of my present invention, which is an economical application to steam-generating furnaces of well-known chemical reactions produced by the introduction of highly heated steam with atmospheric air.

I will now describe my improvement and the devices I employ for overcoming the difficulties of producing a perfect combustion of fuel.

I furnish the necessary quantity of oxygen to combine with the carbon of the coal to form carbonic acid by a mixture of steam and air combined in proper proportions. I cause the air and steam to pass through a chamber within the furnace-door, and which I call a "commingling-chamber," and which is filled with scraps or bundles of metallic wires, plates, or other heat-conducting substances. By this means the air and steam become highly heated and thoroughly commingled before entering the furnace, and a high temperature in the furnace is maintained with a minimum quantity of air, and the heat generated by the combustion is not carried off by the excessive quantity of nitrogen usually introduced into the fire when atmospheric air alone is employed. My method prevents smoke and the formation of carbonic oxide, and keeps the tubes, flues, &c., clear, which adds greatly to the steam-generating capacity of boilers, and also saves a large amount of fuel.

In the drawings, Figure 1 represents part of the front of a stationary boiler. Fig. 2 is a vertical section through the furnace-door with the steam-supply below the door. Fig. 3 is a similar view with the steam-supply above the door. Fig. 4 is a partial sectional plan of the door, and Fig. 5 represents a locomotive-boiler front with the improvement applied thereto.

The boiler A or steam-generator is to be of any desired character, and the furnace-door B is to be of a shape to fit the opening. It is provided with hinges *b* and latch *c*, as usual. This furnace-door is usually composed of an outer

plate, *d*, and an inner plate, *e*, and in many instances these are perforated for the passage of air.

In my improvement I make use of an opening at *i*, through the outer plate, *d*, and an opening at *l*, through the inner plate, *e*, and fill in the space within the door by loose clippings of sheet-iron, wire, or other metal that will not obstruct the passage of air and steam, but which will serve as conductors for conveying the heat from the inner plate, *e*, and radiating the same, so that the air and steam as it passes through the commingling-chamber formed of the hollow door will receive sufficient heat to lessen the chilling influence of the same within the fire-chamber, as aforesaid. When the inlet-opening *i* is at the top of the outer plate, *d*, as in Fig. 3, the opening *l* will be near the lower edge of the inner plate, *e*, and the reverse, as seen in Fig. 2.

Across the front of the boiler or the front plate of the furnace there is a steam-pipe, *n*, with jet-nipples *o*, that point into the openings *i* in the outer plate of the door; but these nipples are sufficiently distant from the door to allow the same to be opened or closed, and in this pipe *n* there is a cock or valve, *t*, by means of which the supply of steam may be regulated, and an arm, *p*, upon the furnace-door enters a slot in the lever-handle *q* of the cock, so that as the door is opened the supply of steam will be shut off, and the reverse. The steam-jets carry with them into the commingling-chamber within the furnace-door a certain amount of atmospheric air, and such steam and air are thoroughly commingled and pass into the furnace in a heated condition, and there is a decomposition of the steam, the oxygen thereof combining with the carbon in the presence of the intense heat, the hydrogen also being consumed, and, in consequence of the presence of sufficient oxygen from the steam and atmosphere, the products of combustion are principally carbonic acid, which, with the nitrogen of the atmosphere, escape by the flue or chimney.

I remark that in places where a damper-regulator is used connection can be made to a stop-valve on the jet-pipe, so that the regulator operates to close the damper, and also to close the stop-valve, supplying steam to the jet-pipe.

By using a regulator to open and close a valve on the steam-jet pipe the draft can be regulated and the steam in the boiler maintained at a steady pressure.

The door can be adapted to any furnace and will not take up any more space than the common door. The space which I use as a commingling-chamber to heat and mix the air and steam is usually unemployed. It is the space between the inner and outer door, and sets in from the front of the furnace. In this otherwise waste space I place numerous scraps of wire, sheet-iron, or their equivalents, to absorb heat and prevent it from being radiated through the front of the door, and to present a large heating-surface to act on the steam and air in its passage through the door into the furnace. A small amount only of steam is required to operate the jet, and I prefer to have the jet-orifices similar to the burners used in burning gas.

No alteration of the furnace is required for my improvement, and no cutting of holes or disfiguring the boiler-front is needed in attaching the same to any style of boiler-furnace using any sort of fuel.

If I require to attach the door to any old or odd-shaped furnace-front, a frame for the door may be provided, the same being bolted to the boiler or furnace front, and upon this the door is hinged, so that a regular style of door may be used.

The stop-valve and lever can be dispensed with, if desired, by providing a swinging ground bracket-joint on the steam-jet pipe in line with the hinges of the door. This bracket will act as a hinge and cock, so that as the door opens the supply of steam is shut off. The jet-pipe in this instance opens with the door, and is attached to the same, instead of being upon the boiler or furnace front.

I do not claim a hollow furnace-door, nor strips of metal or netting within the same, nor a flexible pipe for the steam. Neither do I claim a perforated steam-pipe with a cock that is opened as the furnace-door is opened. This is the reverse of my improvement, as it turns on the steam when the furnace-door is opened, instead of the same being done while the furnace-door is shut.

I claim as my invention—

The hollow furnace-door forming a commingling-chamber and having openings through the outer and inner plates of the door, in combination with a steam-pipe and openings from which jets of steam pass into the furnace-door and draw in with them the atmosphere to be commingled with the steam and heated previously to passing into the fire, metallic scraps or pieces within the hollow furnace-door, and a steam-supply cock, and connection to the furnace-door for closing the cock automatically as the door is opened, substantially as specified.

Signed by me this 15th day of February, A. D. 1883.

EDWARD FOX.

Witnesses:
GEO. T. PINCKNEY,
WILLIAM G. MOTT.