(No Model.)

A. J. CLIFF.

SMOKE PREVENTING ATTACHMENT FOR FURNACES.

No. 438,839. Patented Oct. 21, 1890.

Fig. 1.

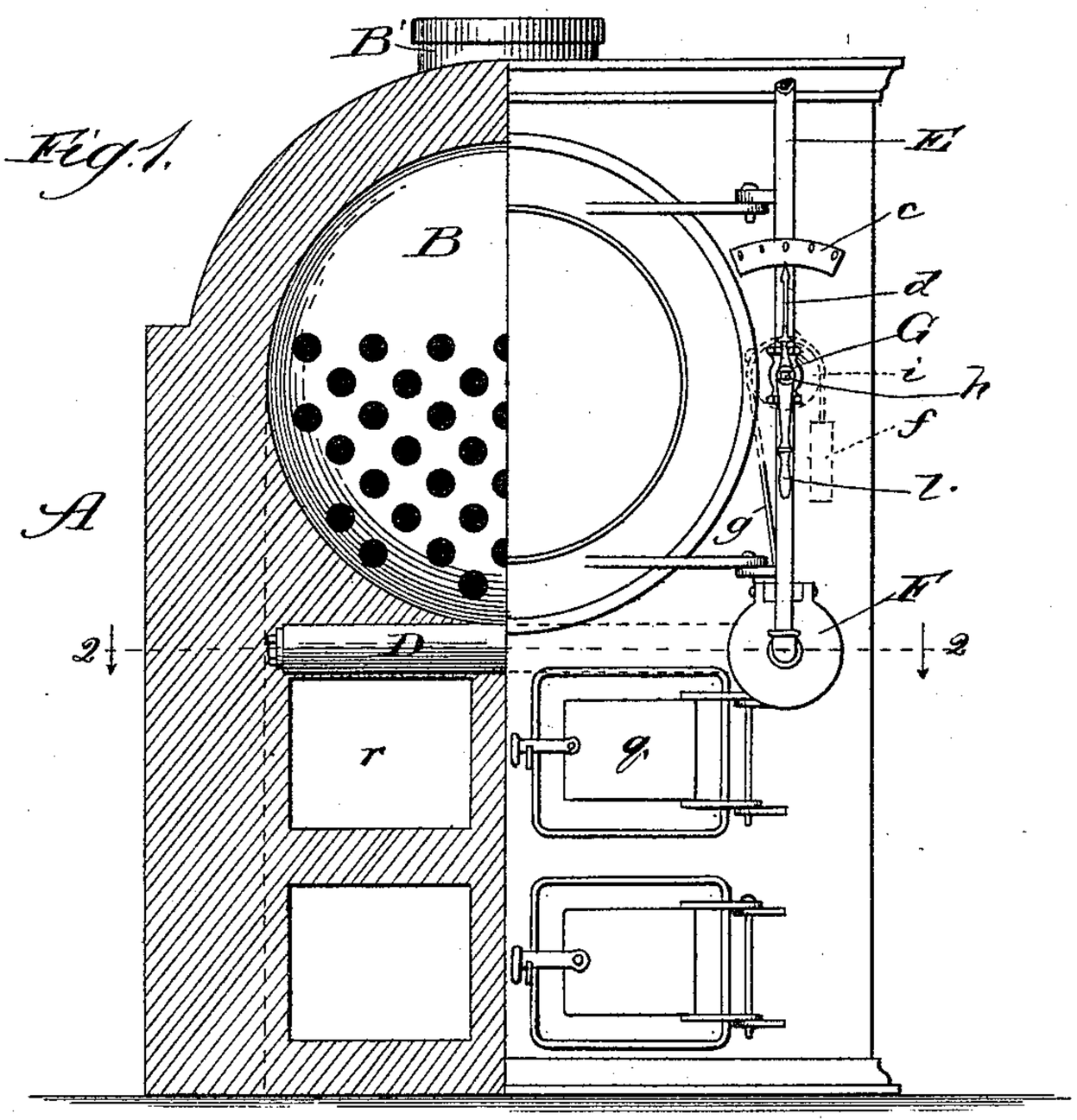


Fig. 3.

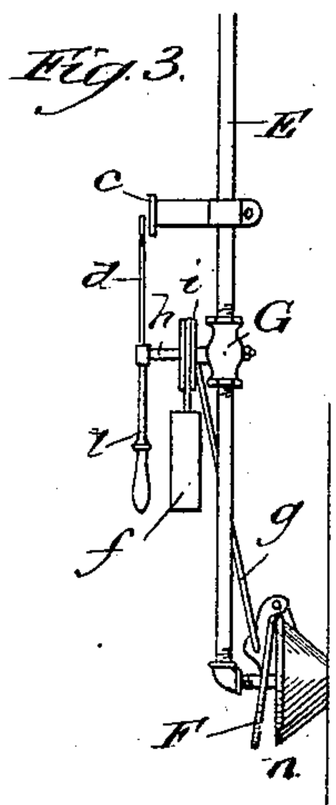
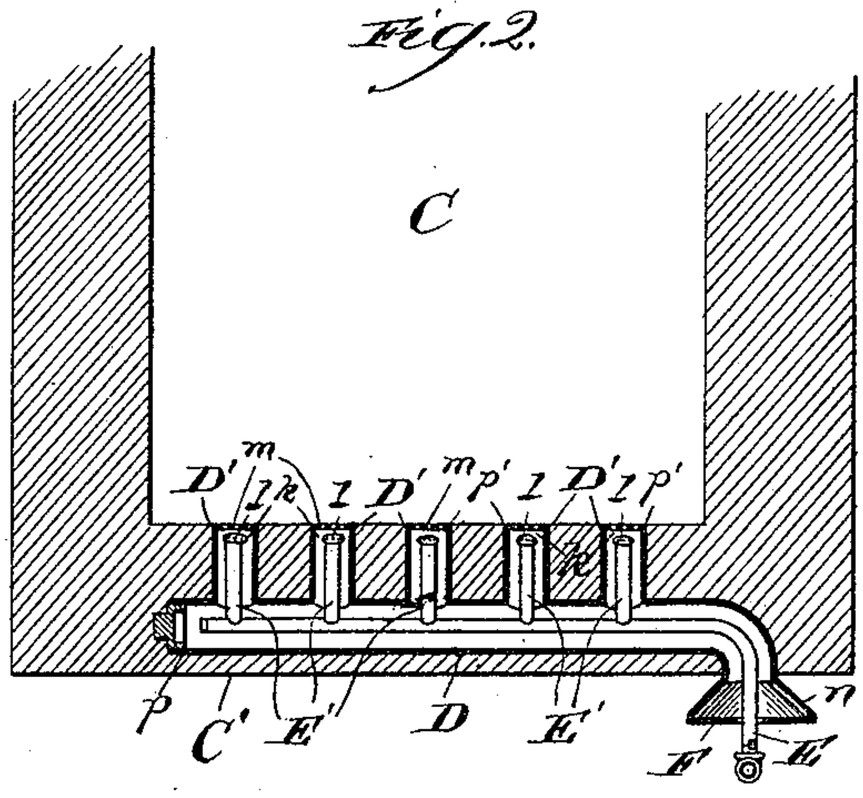


Fig. 2.



Witnesses:
Chas. E. Gaylord.
Clifford O. White.

Inventor:
Arthur J. Cliff.
By Dyrenforth & Dyrenforth,
Attys.

UNITED STATES PATENT OFFICE.

ARTHUR J. CLIFF, OF CHICAGO, ILLINOIS.

SMOKE-PREVENTING ATTACHMENT FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 438,839, dated October 21, 1890.

Application filed June 11, 1890. Serial No. 355,070. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR J. CLIFF, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Smoke-Preventing Attachments for Furnaces, of which the following is a specification.

My invention relates to an improvement in the class of apparatus for injecting air and steam upon the fuel in the fire-chamber of a furnace to prevent, or at least materially reduce, the generation of smoke by inducing more thorough combustion of the fuel.

The objects of my improvement are to provide a generally-improved construction of apparatus of the class referred to, to so apply it to or combine it with a furnace as to render it practically as durable as the furnace itself by maintaining it out of contact with the flame, and thus protecting it against burning out, and, furthermore, to provide means for permitting ready regulation of the proper proportion of steam and air to be admitted to the combustion-chamber for a given quantity of the fuel (coal) supplied thereto.

My invention consists in the general construction of my improved apparatus, and it also consists in details of construction and combinations of parts, all as hereinafter more fully set forth.

In the accompanying drawings, Figure 1 is a view in broken end elevation of a furnace surmounted by a steam-boiler and provided with my improved apparatus, shown in part by dotted lines; Fig. 2, a section taken at the line 2 2 of Fig. 1 and viewed in the direction of the arrows; and Fig. 3, a view in elevation, regarded from the right-hand side of Fig. 1, of my improved means for regulating the supply of air and steam.

A denotes a furnace-wall of any desired or usual construction, and B is a steam-boiler surmounting it. In the front wall C′ of the fire or combustion chamber C, directly above the feed-passages *r*, provided with doors *q*, I provide a channel *p*, of about the length of the width of the fire-chamber and extending parallel with the front side thereof, and from the channel *p* extend at intervals and at right angles to the channel branch channels *p′*.

D is a pipe for air, fitting inside the channel *p* and extending through a wall, (preferably the front wall, as shown,) where it should flare into the funnel shape illustrated at *n*. Branches D′ extend at intervals from the pipe D through the respective branch channels *p′*, reaching to the inner surface of the front wall C′ of the fire-chamber, where they are provided with perforated ends *m*.

E is a steam-pipe, which leads from the dome B′ of the boiler B, and which enters the air-pipe D through its funnel-shaped outer end *n*, and extends lengthwise through it, being provided at intervals corresponding with those at which the branches D′ of the pipe D are provided with branches E′, extending into the branches D′, but short of the inner extremities of the latter, whereby between the end of each branch D′ and its contained branch E′, which is provided with a finely-perforated bulb or head *l*, a mixing-chamber *k* for the air and steam before they enter the fire-chamber C is provided.

On the flaring outer end of the air-pipe D, I provide a hinged lid or valve F, and in the steam-pipe E, above such flaring end, is a valve G for controlling the flow of steam, and provided with a pulley *i* on its stem *h*. A rope, chain, or the like *g* is secured at one end to the hinged lid F, passes thence over the pulley *i*, and has secured to its opposite end a weight *f* to counterbalance the lid. A handle *e* is secured to the outer end of the stem *h*, and is extended into an index-finger *d*, pointing to a gage *c*, on which is marked a scale in, say, hundred pounds.

The arrangement of the scale, hinged lid, and valves F and G is such that when the two said valves are closed the index-finger points to zero, and that when it points to any desired number on the scale indicating the number of pounds of fuel fed at any one time to the fire, the turning of the finger to such indication, by manipulating the handle *e*, will open the valves G and F accordingly—that is, to permit the admission of the proportionate quantities of steam and air for the amount of coal so fed to produce complete combustion of the latter, and thus prevent the generation of smoke.

From the foregoing description the operation of my improved apparatus will have been understood to be produced by opening the

air and steam valves. This admits steam under pressure into the pipe E inside the air-pipe D, whence it is diffused through the branches E′, emerging from the perforated bulbs *l* thereon into the mixing-chambers *k*, into which it draws air through the pipe D and its branches D′, mixing with and heating the air and forcing the mixture in diffused currents upon the burning fuel in the fire-chamber.

The generation of smoke by the burning fuel in the fire-chamber is very profuse before my improved apparatus is operated; but the effect on opening the air and steam valves, and which effect is instantaneous, is to induce such complete combustion of the fuel as to prevent the generation of any smoke, or at least of any visible smoke, in the fire-chamber, and obviously, also, produce material saving in fuel.

The embedding of the apparatus in the front wall of the furnace so effectually shields it from access of the flame of the burning fuel that no such injury ensues to the apparatus as by burning out, the heat which comes into contact with it being prevented from working any injury by the resisting cooling effect on the parts of the cool air introduced through the pipe D and its branches. Furthermore, the apparatus exerts no injurious effect on the boiler or boiler-setting, since sufficient cold air is mixed with the steam to temper the latter and modify its heat before it is introduced.

What I claim as new, and desire to secure by Letters Patent, is—

1. In combination, a furnace A, having a channel *p* formed in the front wall C′ of its fire-chamber C and provided at intervals with branches *p′*, leading into the fire-chamber, an air-pipe D in the channel *p*, and having branches D′ extending into the branches *p′* and provided at its outer end with an adjustable cover F, a steam-pipe E, extending lengthwise inside the air-pipe and having branches E′ leading into the branches D′, but shorter than the latter, and thereby forming mixing-chambers *k* between the extremities of the respective branches, a valve G in the steam-pipe, and a handle *l*, for turning the said valve, substantially as and for the purpose set forth.

2. In combination, a furnace A, having a channel *p* formed in the front wall C′ of its fire-chamber C and provided at intervals with branches *p′*, leading into the fire-chamber, an air-pipe D in the channel *p*, and having branches D′ extending into the branches *p′* and provided at its outer end with an adjustable cover F, a steam-pipe E, extending lengthwise inside the air-pipe and having branches E′ leading into the branches D′, but shorter than the latter, and thereby forming mixing-chambers *k* between the extremities of the respective branches, a valve G in the steam-pipe, having a pulley *i* on its stem, connected with the cover F by a weighted rope *g* or the like, a handle *l* on the said valve-stem, provided with an index-finger *d*, and a scale *c*, supported adjacent to the said index-finger, the whole being constructed and arranged to operate substantially as described.

ARTHUR J. CLIFF.

In presence of—
DOUGLAS DYRENFORTH,
M. J. FROST.