(No Model.) 2 Sheets—Sheet 1.

M. J. LYNN.

AUTOMATIC SMOKE CONSUMING FURNACE.

No. 475,876. Patented May 31, 1892.

Fig. 1.

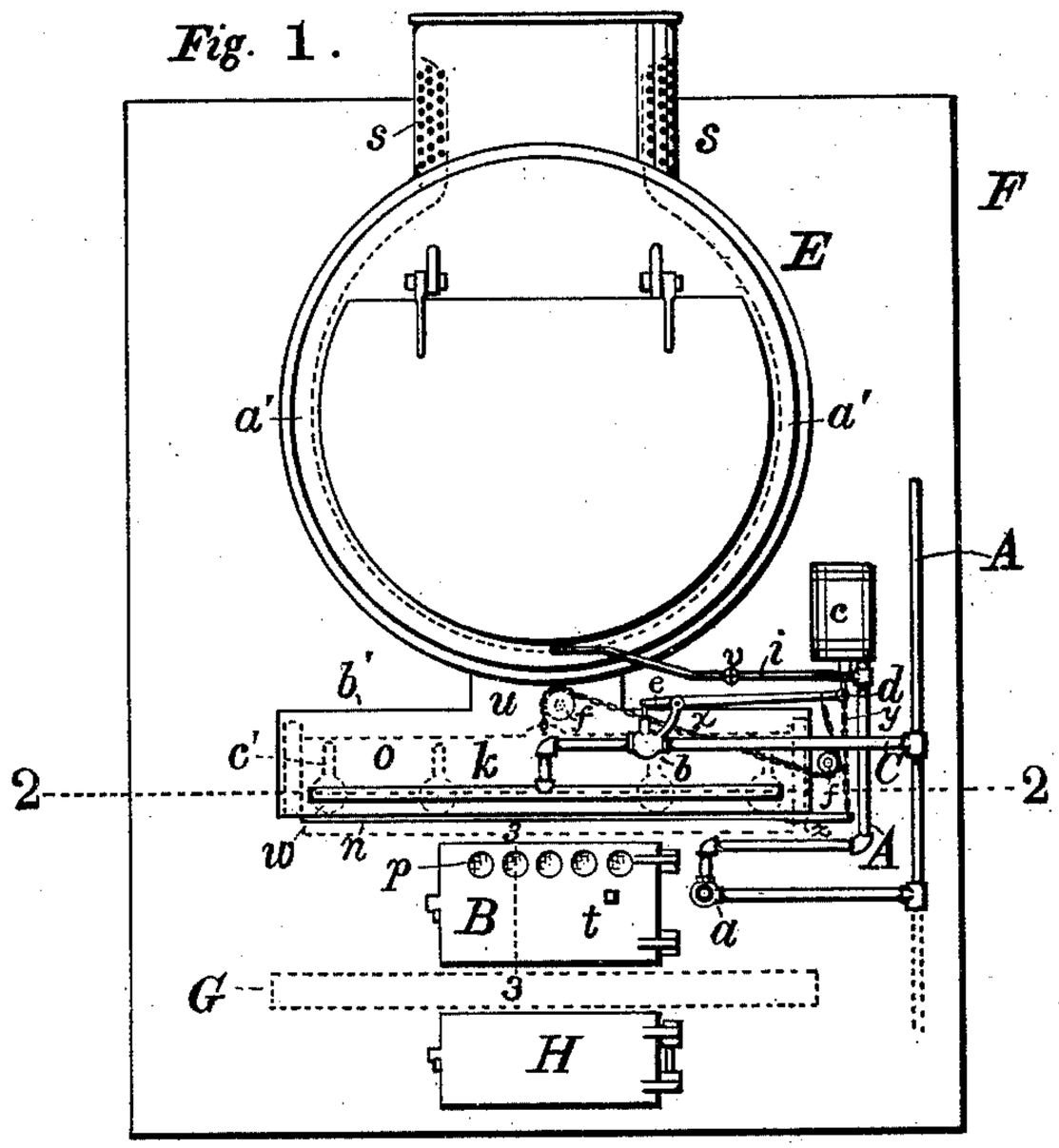


Fig. 3.

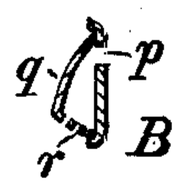
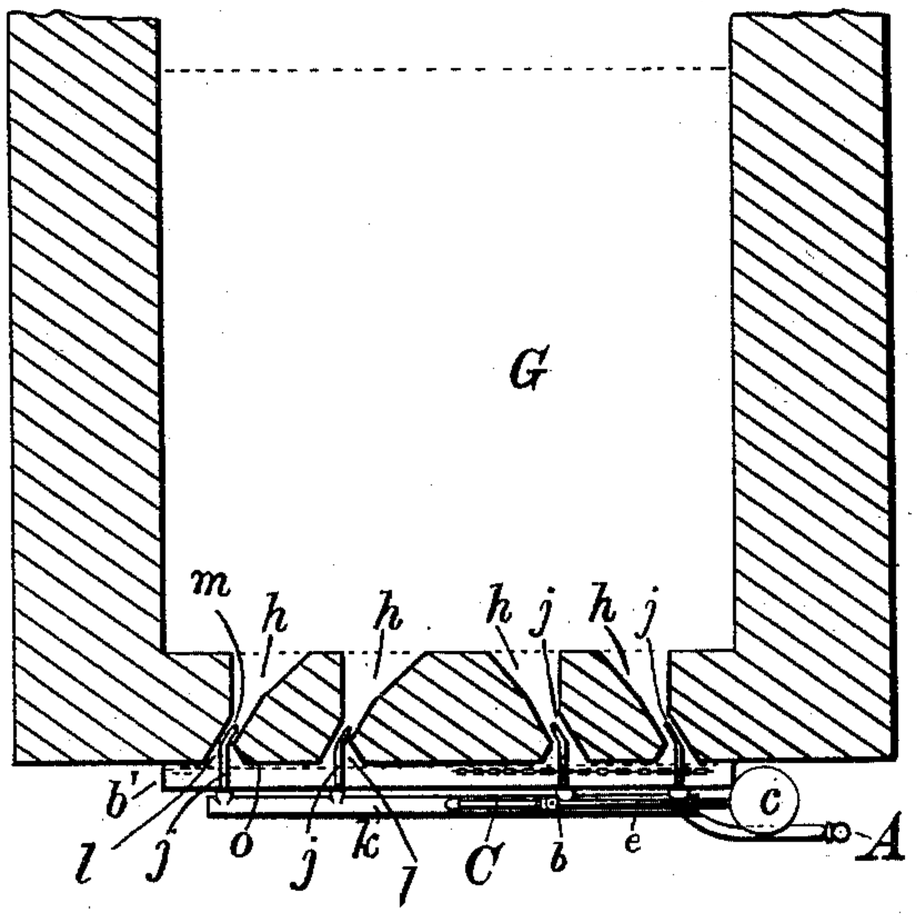


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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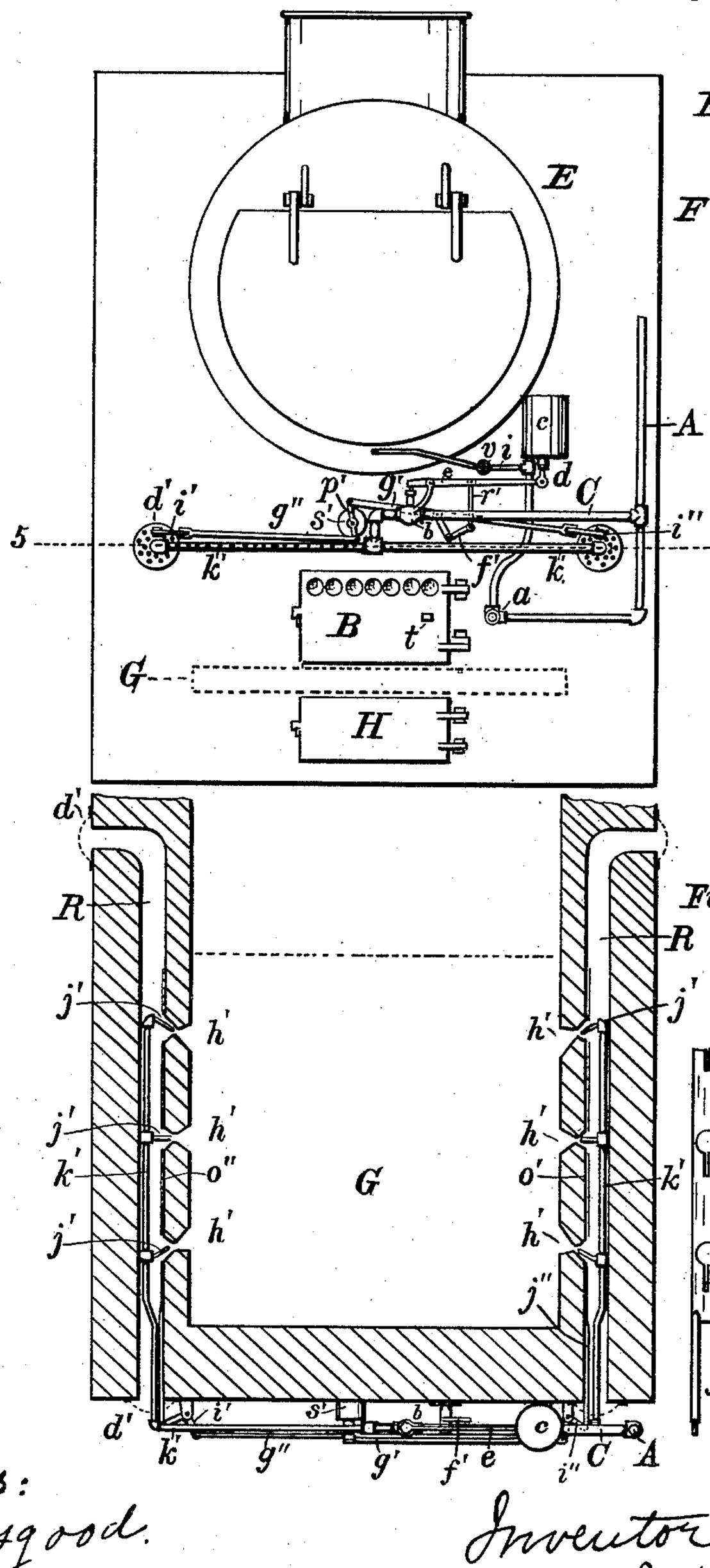

Fig. 4.

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

MICHAEL J. LYNN, OF ROCHESTER, NEW YORK.

AUTOMATIC SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 475,876, dated May 31, 1892.

Application filed September 23, 1891. Serial No. 406,577. (No model.)

To all whom it may concern:

Be it known that I, MICHAEL J. LYNN, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain Improvements in Automatic Smoke-Consuming Furnaces, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to certain improvements in smoke-consuming furnaces, having for its object the prevention of the production of smoke by the automatic discharge into the fire-chamber of currents of air for a limited period of time immediately after the introduction of each fresh charge of fuel.

My improvements are fully described and illustrated in the following specification and the accompanying drawings, the novel features thereof being specified in the claims annexed to the said specification.

My improvements are represented in the accompanying drawings, in which—

Figure 1 is a front elevation of a boiler to which my invention is attached. Fig. 2 is a horizontal section through the furnace on the line 2 2, Fig. 1, showing the automatic air-feeding mechanism in plan view. Fig. 3 is a vertical section through the furnace-door on the line 3 3, Fig. 1. Fig. 4 is a front elevation of a boiler, showing a modification. Fig. 5 is a sectional view of the same on the line 5 5, Fig. 4. Fig. 6 represents the sliding damper detached.

In the accompanying drawings, E represents the front of the boiler, which is set in any ordinary setting F.

B is the furnace-door, G the grate, and H the door of the ash-pit.

A is a steam-supply pipe through which steam is conveyed from the dome or the highest part of the boiler to the steam air-injecting devices at the time the furnace-door is open and for a period of time thereafter, the length of which is determined by the adjustment of the valve in the pipe *i*, Fig. 1, through which the steam escapes from the cylinder *c*, the piston of which actuates the valve which controls the supply of steam to the air-injectors.

The steam-supply pipe A is provided with a self-closing valve *a*, arranged in such relation with the furnace-door B that it is opened by the door itself or a projection *t* thereon coming in contact with the stem of the valve, while it closes automatically when the furnace-door is closed as soon as the steam escapes from the cylinder *c*. The stem of the valve *a* is provided with a spring or weight for closing it, or it may be arranged to close from the pressure of the steam itself. The pipe A is bent or otherwise arranged so as to bring the valve *a* in the proper relation with the furnace-door.

The steam-cylinder *c* is supported from the front of the boiler or the setting in any suitable manner. The cylinder *c* is provided with a piston, which is moved in one direction by the pressure of the steam and in the other direction by a spring or the force of gravity. The piston is provided with a rod sliding through a stuffing-box on the cylinder-head and which is pivoted at *d*, Fig. 1, to one end of a lever *e*, which opens and closes the valve *b* in the pipe C, through which steam is delivered to the air-injectors *j*, Fig. 2.

In Fig. 2 the steam-jets which inject the air into the fire-chamber above the fire are represented as arranged in the front of the boiler-setting, while in Fig. 5 they are arranged at the side of the furnace.

Fig. 2 represents the preferable arrangement of the jets for a battery of boilers.

Referring to Figs. 1 and 2, the air which is injected into the furnace receives a preliminary heating from being caused to pass around the base of the smoke-stack or other heated part of the boiler or its attachments. In the arrangement shown in Fig. 1 the air enters through the perforated jacket *s*, surrounding the base of the chimney, and thence circulates around the smoke-arch in the passage *a'* and enters the casing *b'* through the passage *u*. The casing *b'* is attached to the front of the boiler in any suitable way, being open on the rear side or being provided with openings arranged opposite the air-inlet passage *h*, into which the steam-jet pipes *j* project. The steam-jets *j* are attached to a pipe *k*, arranged outside the casing *b'*, and which pipe receives steam from the pipe C through the valve *b* when the latter is opened by the movement of the piston in the cylinder *c*. It will be observed that the passages *h* consist of an

outer tapering or conical portion *l*, a restricted portion *m*, and an inner tapering or flaring mouth which opens into the fire-chamber. The steam-jets *j* open into the restricted portions *m*, which are arranged at angles with the axis of the jet-pipe, so that the air-currents are discharged into the fire-chamber in an angular direction, which has the effect of causing the air and gases to circulate around, thus promoting their complete combustion. The passages *h* are formed either directly in the walls of the boiler-setting or they may consist of hollow metallic castings inserted therein. Any suitable number of jets and inlet-passages may be employed, according to the size of the boiler.

The lever *e* is preferably pivoted to an arm on the valve *b* or the pipe C to prevent any trouble arising from the expansion of the parts when heated.

The furnace-door B is provided with a series of openings *p* for the admission of air. To the inside of the door is fastened a lining *q*, Fig. 3, having a curved form and provided at its lower part with a series of perforations *r*, so that the air is discharged in a number of small streams near the grate.

The steam-cylinder *c* is provided with an outlet or exhaust pipe *i*, Fig. 1, which is preferably arranged to conduct the steam into the smoke-stack. The pipe *i* is provided with a glove or other valve *v*, which may be set so as to cause the steam to escape very gradually from the cylinder *c*, thereby regulating the period of time during which the valve *b* remains open, and consequently the time during which the air is injected into the furnace by the steam-jets.

In order to prevent the excessive heating or burning of the steam-jets from the fire in the furnace when the steam is not passing through them, I provide within the casing *b'* a damper or protector *o*, which is arranged to slide up and down, being controlled by the movement of the piston in the cylinder *c*. The damper *o* is provided with a series of slots *c'*, through which the points of the steam-jets pass when the damper is down, at which time the hinged or flap valve *n* at the lower part of the casing *b'* is open, so as to permit air to pass upward through the casing *b'* and passages *u a'* to keep them cool. The slide or damper *o* is arranged to move in suitable guides or ways. Its movements are controlled from the lever *e* or the piston of the cylinder *c* in any suitable manner—such, for instance, as the chain *x*, Fig. 1, passing over the pulleys *f* and attached at one end to the lever *e* and at the other end to the damper. The valve *n* is operated from the lever *e* by the chain *y*.

In the adaptation of my improvements to a single boiler the steam-jets *j'*, Fig. 5, are arranged on the opposite sides of the furnace, so as to direct the air-currents therein through the passages *h'*, the air being received through the passages R, formed in the side walls of the setting and in which the air is heated before being injected into the furnace. The arrangement of the steam-supply pipe A, the valve *a*, furnace-door B, and the steam-cylinder *c* remain the same as before; but the other parts of the apparatus will require to be modified in certain respects. Thus the pipes *k'*, which convey steam when the valve *b* is open to the steam-jets, is bent and led into the passage R on each side of the furnace. The entrances into the passages R are protected by perforated plates *d'*. The steam-jets *j'* and air-inlet passages *h'* are arranged to direct the air into the furnace in angular directions, as before described. Slides *o'*, which protect the steam-jets, when not in use are arranged to be shifted lengthwise in the passages R by any suitable mechanism operated by the piston in the cylinder *c* simultaneously with the valve *b*. The slide *o'*, with the openings *w'* and the slots *c'*, are represented in Fig. 6. In order to operate the slide from the lever *e*, I employ the link *r'*, Fig. 4, bell-crank lever *f'*, the rods *g' g''*, and the bell-crank levers *i'* *i''*. The bell-crank lever *f'* is pivoted on a stud inserted in the front of the boiler, and it is connected at one end to the lever by the link *r'*. At the other end it is pivoted to the rod *g'*, which is connected by the bell-crank *i''* with the stem *j''* of the slide *o'*. The rod *g'* transmits motion in the proper direction of the rod *g''* through the rock-lever *p'*, the axis of the said lever being provided with a coiled spring inclosed within a drum *s'*, if desired. The rod *g''* operates the slide *o''* through the bell-crank lever *i'*, which is pivoted on an arm extending outward from the boiler-front.

The operation of my improved smoke-consuming furnace is as follows: Every time the fireman opens the furnace-door the door opens the valve *a*, which admits steam to the cylinder *c*, the piston of which is forced upward, and this opens the valve *b* and admits steam to the air-injecting jets *j* and moves or raises the protector *o* and closes the damper *n*. The fuel is then introduced into the furnace and the air is injected by the steam, not only while the door is open, but for a period of time after the door has been closed, the length of which is determined by the adjustment of the valve *v* in the escape-pipe *i*, by which the steam is allowed to escape more or less gradually from the cylinder, permitting the return movement of the piston, which closes the valve *b*, operates the protector, and opens the damper *n*. The injection of air is preferably continued for a period of five or ten minutes after closing of the furnace-door. It is obvious that the piston of the cylinder *c* might be operated by air or water pressure instead of steam. Steam should, however, be used for injecting the air, and preferably dry or superheated steam, to impart heat to the air, which assists the combustion. The angular position of the inner ends of the jets and of the air-passages causes a circulation of the air and gases in the fire-chamber and detains them in the chamber, so as to effect their complete com-

bustion. The jets may be all arranged at angles in the same direction and part in an opposite direction, as thereby the intermingling of air and gases is promoted and the combustion rendered more perfect.

My improved furnace not only effectually prevents the dense black smoke which ordinarily accompanies the use of soft coal, but it also produces a considerable economy in the combustion of the gases, as I have demonstrated by a practical trial extending over a considerable period of time.

It will be understood that the exhaust or outlet valve *v* remains partially open all the time the apparatus is in use, its area being so much smaller than that of the supply-pipe that sufficient pressure is secured in the cylinder to raise the piston and open the valve in the pipe which conveys the steam to the injectors. The steam continues to escape through the valve *v* after the valve *a* has closed, thereby permitting the piston to descend much quicker than it would do if the steam were simply allowed to condense in the cylinder. The time occupied by the discharge of the steam and the descent of the piston may be regulated by the amount of opening given the valve *v*, which may be so set as to reduce the pressure much more rapidly than would occur in an apparatus employing condensation, and consequently to correspondingly shorten the interval of time in which steam or hot air is admitted into the furnace, a proceeding which is beneficial under some circumstances and with some kinds of fuel. The piston in the cylinder is tight, so that the steam-pressure can only be reduced by condensation or by discharge through the exhaust valve and pipe. It will also be observed that owing to the particular arrangement of the valve *a* relatively to the door the door can be opened full without opening the valve, which allows the engineer to cool off his furnace and reduce the production of steam, if he so desires, and also to draw the fire and make temporary repairs to grates or other part of furnace which might become disarranged during working hours without waiting to make disconnection of the apparatus.

I claim—

1. The combination, with a furnace provided with air-injecting devices, of a steam-supply pipe having a valve arranged to be opened by the opening of the furnace-door, a steam-cylinder having a piston and a connection by which the movement of the piston operates a valve in the pipe which supplies steam to the air-injecting devices, and an outlet-passage connected directly to the cylinder and provided with a regulating-valve, whereby the steam-pressure in the cylinder is reduced before the steam can condense, substantially as described.

2. The combination, with a furnace, of steam air-injecting devices, means for heating the air before it arrives at the injectors, and mechanism consisting of a steam-cylinder, piston, and supply-pipe provided with a valve arranged to be operated by the opening of the furnace-door, a suitable connection and valve whereby the supply of steam to the air-injectors is controlled, and an outlet-passage connected to the cylinder and provided with a regulating-valve, whereby the steam is gradually discharged, substantially as described.

3. The combination, with a furnace, of the furnace-door B, the steam-supply pipe A, provided with self-closing valve *a*, arranged relatively to the door so as to be opened only by the full opening thereof, the air-inlet passage or passages *h*, and steam jet or jets *j*, steam-pipe C, provided with valve *b*, steam-cylinder and piston *c*, and a suitable connection between the piston and the valve *b*, and the outlet-pipe *i*, provided with regulating-valve *v*, substantially as described.

4. The combination, with a furnace, of steam air-injecting devices, mechanism consisting of a steam-cylinder, piston, and supply-pipe provided with a valve arranged to be operated by the opening of the furnace-door, a suitable connection and valve whereby the supply of steam to the air-injectors is controlled, and an outlet-passage provided with a valve, whereby the steam is gradually discharged from the cylinder, and the air-heating conduit consisting of perforated jacket *s*, passage *a'*, and casing *b'*, substantially as described.

5. The combination, with a furnace, of the air-passages *h*, steam-jets *j*, the movable protector *o*, provided with opening *w* and slot *c*, and suitable connecting piping and valves arranged to be operated by the opening of the furnace-door to automatically deliver steam to the said jets for a limited period of time after the opening of the door, substantially as described.

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