W. E. McGRAW.

SMOKE PREVENTER FOR FURNACES.

APPLICATION FILED FEB. 28, 1908.

1,002,725.

Patented Sept. 5, 1911.

2 SHEETS—SHEET 1.

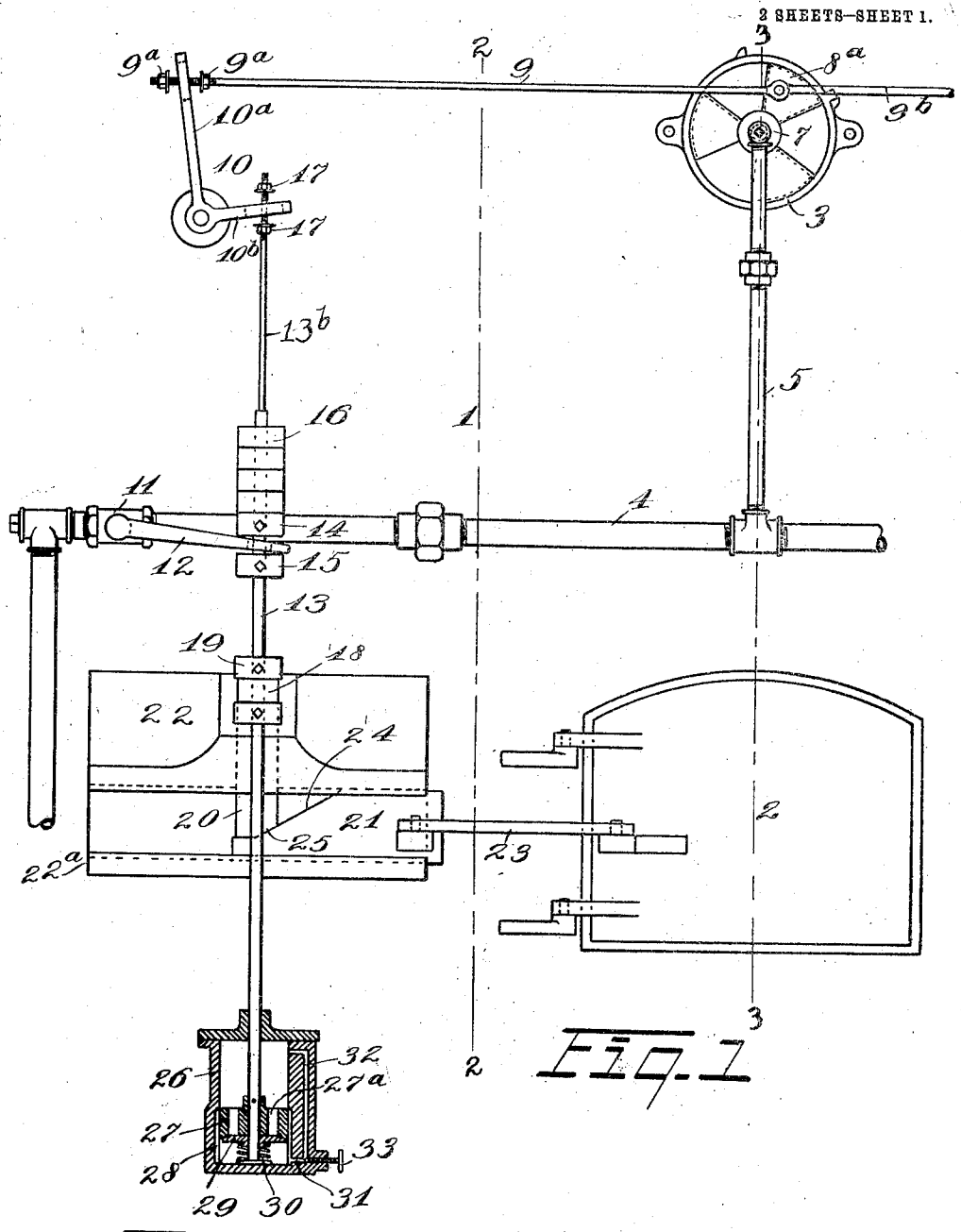

Fig. 1

Witnesses:-

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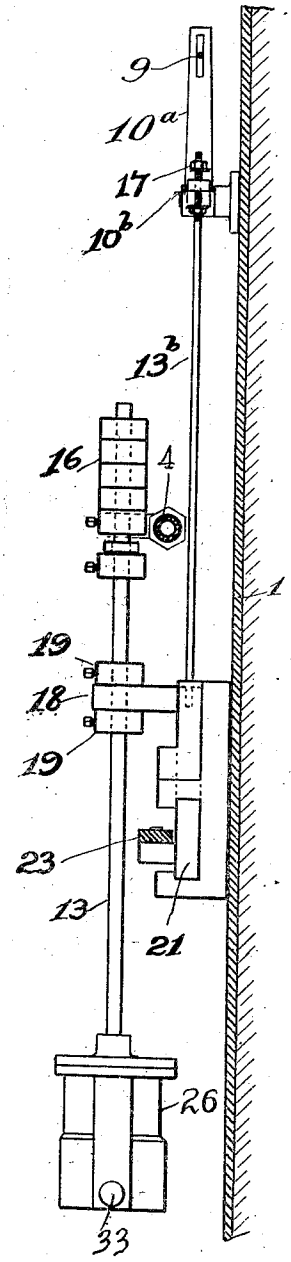

Fig. 2

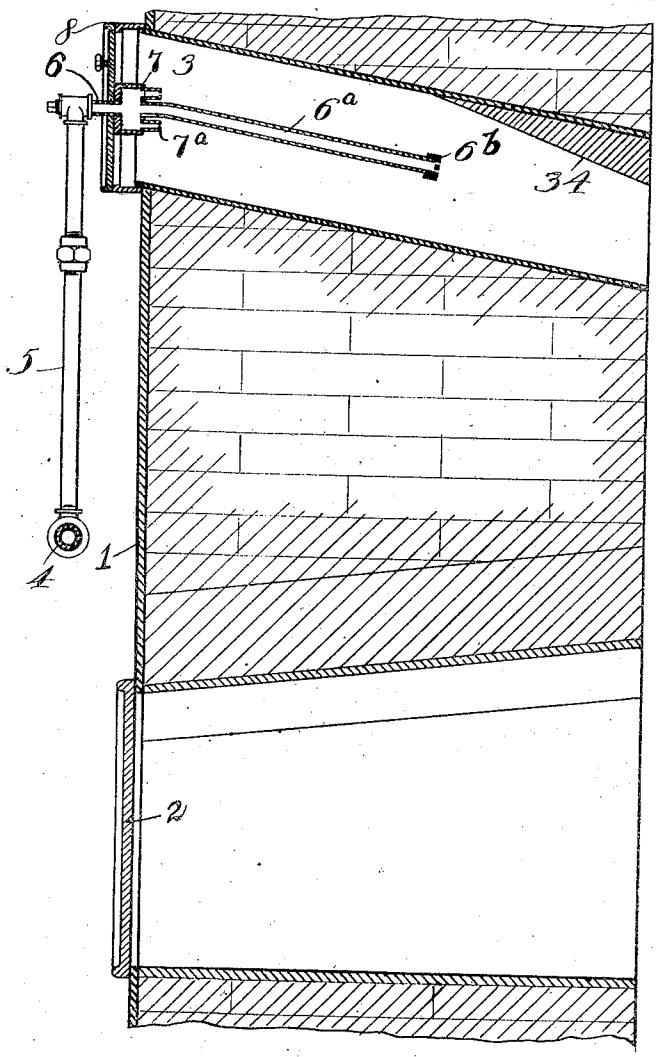

Fig. 3

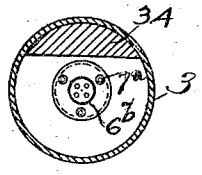

Fig. 4

Witnesses:

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UNITED STATES PATENT OFFICE.

WILLIAM E. McGRAW, OF CLEVELAND, OHIO.

SMOKE-PREVENTER FOR FURNACES.

1,002,725. Specification of Letters Patent. Patented Sept. 5, 1911.

Application filed February 26, 1908. Serial No. 418,211.

To all whom it may concern:

Be it known that I, WILLIAM E. McGRAW, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Smoke-Preventers for Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to devices employed for the purpose of preventing the liberation of smoke from furnaces during the operation of stoking and for a short time thereafter, such devices being known generally to the trade as "smoke consumers," and has for its object to provide an effective construction whereby air may be injected into furnaces at the time that the door is opened for the purpose of stoking or firing and to cause the supply of such air for a predetermined length of time after the closing of the door.

Further objects of the invention are to provide means whereby the supply of the injecting fluid and the air may be quickly cut off at such time as the injecting fluid becomes materially reduced in pressure or "wire drawn."

Further objects are to simplify and improve the construction of the operating connection between the furnace door and the air-supplying means, the regulator by means of which the length of time that the air supply shall operate is controlled, and generally to improve the construction of the means for supplying the air to the furnace.

Generally speaking, the invention may be defined as consisting of the combinations of elements embodied in the claims hereto annexed and illustrated in the drawings forming part hereof, wherein—

Figure 1 represents a front elevation of my apparatus showing the same applied to the front of a furnace; Fig. 2 represents a sectional view on the line 2—2 of Fig. 1, the furnace wall being shown in section; Fig. 3 represents a transverse sectional view through the front of the furnace on the line 3—3 of Fig. 1; and Fig. 4 represents a sectional view near the inner end of the port through which air is injected into the furnace.

Describing the various parts by reference characters, 1 represents the front wall of a furnace, said wall being provided with a furnace door 2, and with a sufficient number of tubular ports 3 extending therethrough for the supply of the air necessary to support combustion at, and for a short time after, the operation of stoking.

4 denotes a pipe through which the injecting fluid, preferably steam, is supplied to the furnace. This pipe has connected thereto a suitable number of branches 5, each provided at its upper end with an injecting pipe 6 projecting into a port 3, the injector pipe projecting into the hub 7 of the inner fixed member of a rotary damper by means of which the pipe is supported and centered within the port 3.

8 denotes the outer rotary member of the air damper. Members 7 and 8 are provided with segmental slots separated by correspondingly shaped solid members whereby, by rotation of member 8, air is permitted to flow through the segmental slots in member 7 or to be cut off from said slots in a well known manner.

9 denotes a link which is pivotally connected to one of the segmental plates 8^a of member 8, the opposite end of said link projecting through an elongated slot in the vertical arm 10^a of the bell-crank lever 10. The end of link 9 which projects through said bell crank lever is threaded and is provided with a pair of nuts 9^a which may be adjusted along the threaded end of the link to form a lost-motion connection between said link and lever 10. 9^b denotes a second link by means of which another damper (not shown) may be operated by movement of damper 8.

Pipe 4 is provided with a valve 11, which may be of the "butterfly" type, said valve being provided with an operating handle 12. The outer end of handle 12 is slotted for the reception of a valve operating rod 13, which rod is provided with a pair of collars 14 and 15 located respectively above and below said lever. Collar 14 supports a number of removable weights 16 which may be applied to the rod 13 for a purpose to be described hereinafter.

13^b denotes an offset extension of rod 13 which is threaded and projects through an elongated slot in the lower arm 10^b of lever 10 and is provided with a pair of nuts 17 located above and below said arm and forming a lost-motion connection between rod 13 and lever 10. Rod 13 projects through an aperture in the forwardly projecting portion

18 of an L-shaped operating member, being adjustably connected to said member by means of collars 19 applied to said rod above and below such projection. The lower end 20 of the other portion of such L-shaped member is adapted to be operated by a slide 21 mounted in a horizontal guideway 22^a formed on a plate 22 and the said slide is connected by means of a link 23 with the furnace door 2. Slide 21 is provided with an inclined surface 24 adapted to engage a correspondingly inclined portion 25 at the lower end of member 20. 13^b is carried by the above-described L-shaped member, as will appear from Fig. 2.

The lower end of rod 13 projects downwardly into the cylinder 26 of a dash pot and is connected to the piston 27 thereof. This dash pot has at the lower end thereof a plurality of ports 28, which ports extend from the bottom of the cylinder upwardly a distance greater than the depth of piston 27. Piston 27 is provided with a plurality of ports 27^a and has its lower surface constructed to form a seat for a frustro-conical valve 29 mounted on a flexible spring 30 which spring is secured to the lower end of the rod 13.

31 denotes a lateral port communicating with the bottom of the cylinder chamber and 32 a port which extends vertically from port 31 and communicates with the upper end of such chamber. At the angle between ports 31 and 32, there is applied a valve 33, which is carried by the cylinder and by means of which the flow of liquid in the dash pot from bottom to top thereof may be regulated.

As will appear by reference to Fig. 3, the port 3 is inclined downwardly and the injector is correspondingly inclined. This pipe is provided at its discharge end with a cap 6^b having a plurality of perforations therethrough.

The impingement of the steam and air injected through the ports 3 upon the boiler has been found to be greatly detrimental to the boiler. For the purpose of preventing such impingement, I provide port 3 with a deflector 34, which extends from a point adjacent to the discharge end of pipe 6 to the end of the port, being inclined downwardly or toward the center of such port from about the end of the pipe 6 to the discharge end of the port. The lower flat surface of 34 provides a deflecting surface which causes the steam and air supplied to the furnace to be directed downwardly, thereby preventing the impingement of the same against the boiler.

With the parts arranged as described, the operation will be as follows: When the furnace door 2 is opened, slide 21 is moved by link 23, lifting the L-shaped member, through its downwardly projecting arm 20, and with it rod 13, and extension 13^b. The upward movement of the rod and its extension rotates valve 11 and permits the steam or other injecting fluid to flow through pipe 4, branch 5, and injector 6. Through bell-crank lever 10 and link 9, the movable member of the air damper is rotated to permit air to be injected by the steam through the ports 3. The ports 27^a in piston 27 permit this elevation of rod 13 without any material obstruction by the dash pot. When the furnace door is closed, weights 16 cause rod 13 to descend, such descent being retarded by the dash pot. The length of time required for the lowering of rod 13 and the closing of valve 11 will be determined by the weights 16 and the restriction of flow through port 32 by valve 33. By reason of the lost-motion connection between rod 13 and bell-crank lever 10 and between said lever and stem 9, rod 13 can descend for a predetermined distance, with a predetermined closing of the steam valve, before the air valve will begin to close. Thereafter, there will be a proportional supply of air and steam up to the final closing of the air and steam valves. By means of a suitable number of links 9^b, any desired number of air valves may be similarly and simultaneously operated by the dash pot and furnace door. After the steam flowing through the pipe 4 has been cut down by valve 11 so that its pressure is comparatively light, any further operation of the injectors is detrimental rather than otherwise, as it causes steam and air to be supplied under such conditions as will not only fail to facilitate the combustion in the furnace, but, on the other hand, will interfere with the regular drafts through the furnace. To prevent this action, I have provided the ports 28, above referred to. When the top of piston 27 reaches the top of these ports, the pressure on both sides of the piston is at once equalized, and the rod 13 drops to its lowermost position, quickly cutting off the supply of steam through valve 11. As previously pointed out, spring 30 is a flexible spring which holds valve 29 in engagement with its seat, but permits such valve to open as the piston moves upwardly to equalize the pressure on both sides thereof.

From the foregoing description, it will be apparent that I have provided a particularly simple and efficient construction for supplying air to furnaces to promote combustion therein and for automatically cutting off the supply of the said air and the injecting fluid at such time as will render the operation thereof most effective. By the lost-motion connection between the steam valve and the air damper, air may be supplied through the air damper when open to its full extent, both by the action of the steam injector and by the draft through the

furnace at a time when the maximum supply of air is desirable.

By reference to Figs. 3 and 4, it will be seen that the steam injector is not a single continuous pipe, but comprises two parts, 6, 6ª, connected respectively with the outer and inner faces of the hollow hub 7. This hub is provided with discharge nipples 7ª corresponding in position and number with the slots through the inner member of the air damper. The purpose of this construction and arrangement is to facilitate the supply of air through the air port by means of the injector. Owing to its length and to the limited area covered by the injector pipe 6ª in its operation, air may not be supplied in sufficient quantities through the damper. By locating the nipple 7ª closely adjacent to the inlet end of port 3 and opposite the air slots in the inner member of the damper, air may be supplied to the furnace in ample quantity by the action of the injector as a whole.

Having thus described my invention, I claim:

1. The combination with a furnace having a door, of means for supplying a fluid thereto to promote combustion, said means comprising a pipe for supplying such fluid, a valve in said pipe to regulate the flow of fluid therethrough, a nozzle connected with the said pipe, a port in the furnace into which the nozzle projects, a valve controlling the admission of air to said port, a lost motion connection between the last mentioned valve and the former valve, and means operative upon the opening of the furnace door to open the valves, and means operative when the furnace door is closed to cause the valves to close, and when nearly closed to quickly complete the closing.

2. The combination with a furnace having a port for the admission of air, and a furnace door, of a fluid supply pipe, an injector carried by said pipe and projecting into said port, a valve in said pipe, a valve for said port, a bell crank lever, a link connected at one end to the said air port valve and at its opposite end having a loose connection with one arm of the bell crank lever, stops upon the said link and upon opposite sides of the arm of the bell crank lever with which said link engages, a connection between the second arm of the bell crank lever and the fluid supply valve whereby the valves may be operated simultaneously, and means for operating said valves.

3. The combination with a furnace having a port for the admission of air, and a furnace door, of a fluid supply pipe, an injector carried by said pipe and projecting into said port, a valve in said pipe, a valve for said port, a link connected thereto, a bell crank lever having one arm connected to said link, a second link operatively connected to the fluid supply valve and having loose connection with an arm of the bell crank lever, stops upon the link and upon opposite sides of the bell crank lever, arms with which the said link engages, and means for operating said valves.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

WILLIAM E. McGRAW.

Witnesses:
J. B. Hull,
W. Henry Pae.