No. 726,535. PATENTED APR. 28, 1903.

J. A. HOLTHAUS.

SMOKE CONSUMING APPARATUS.

APPLICATION FILED OCT. 11, 1902

NO MODEL.

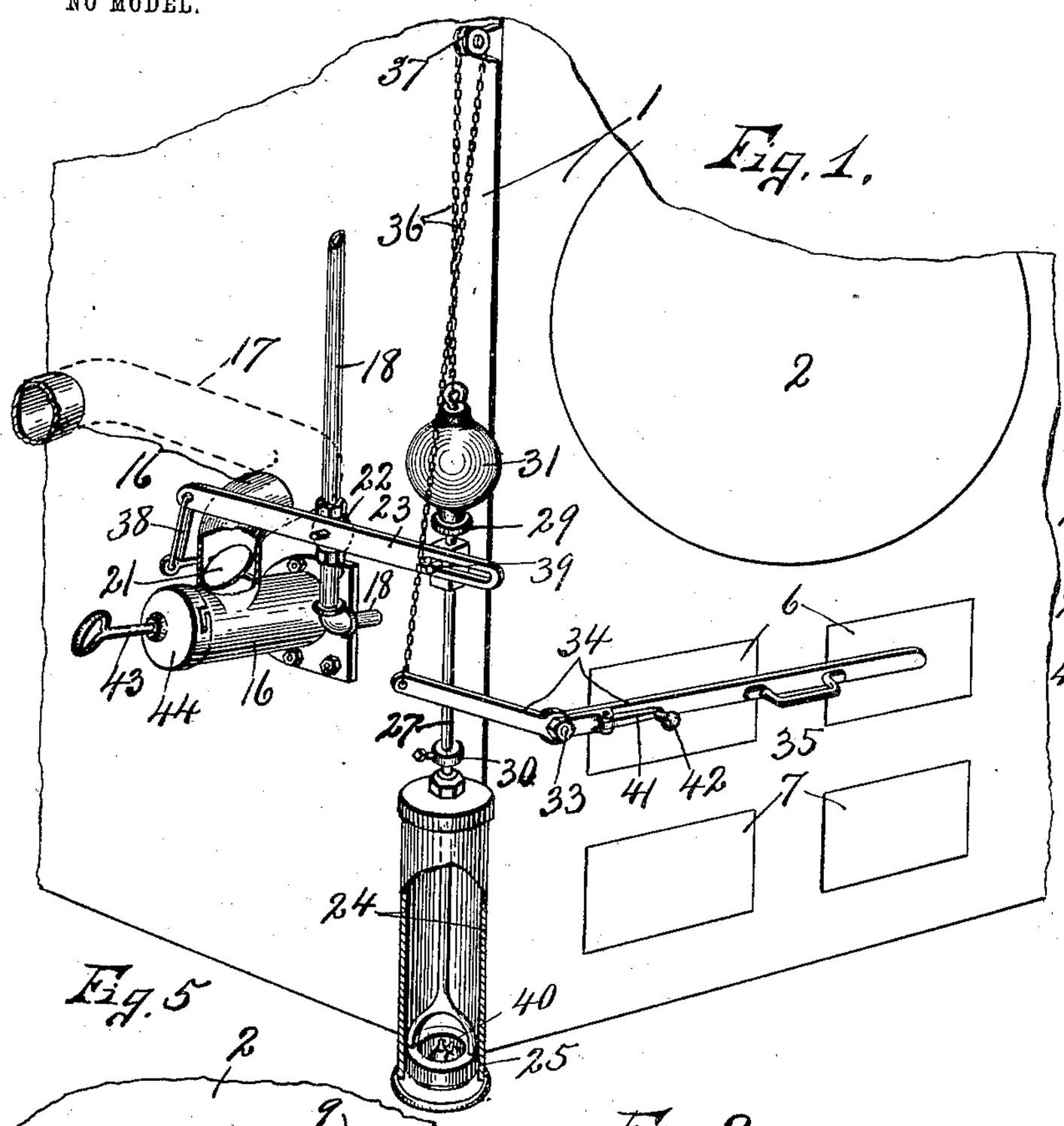

Fig. 1.

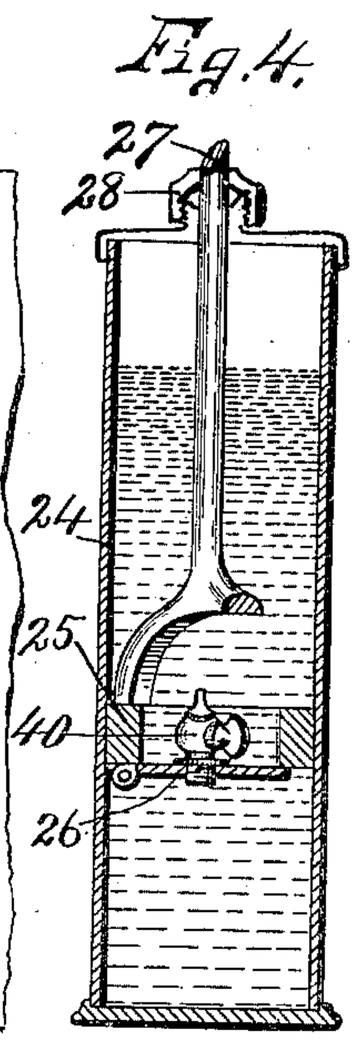

Fig. 4.

Fig. 5

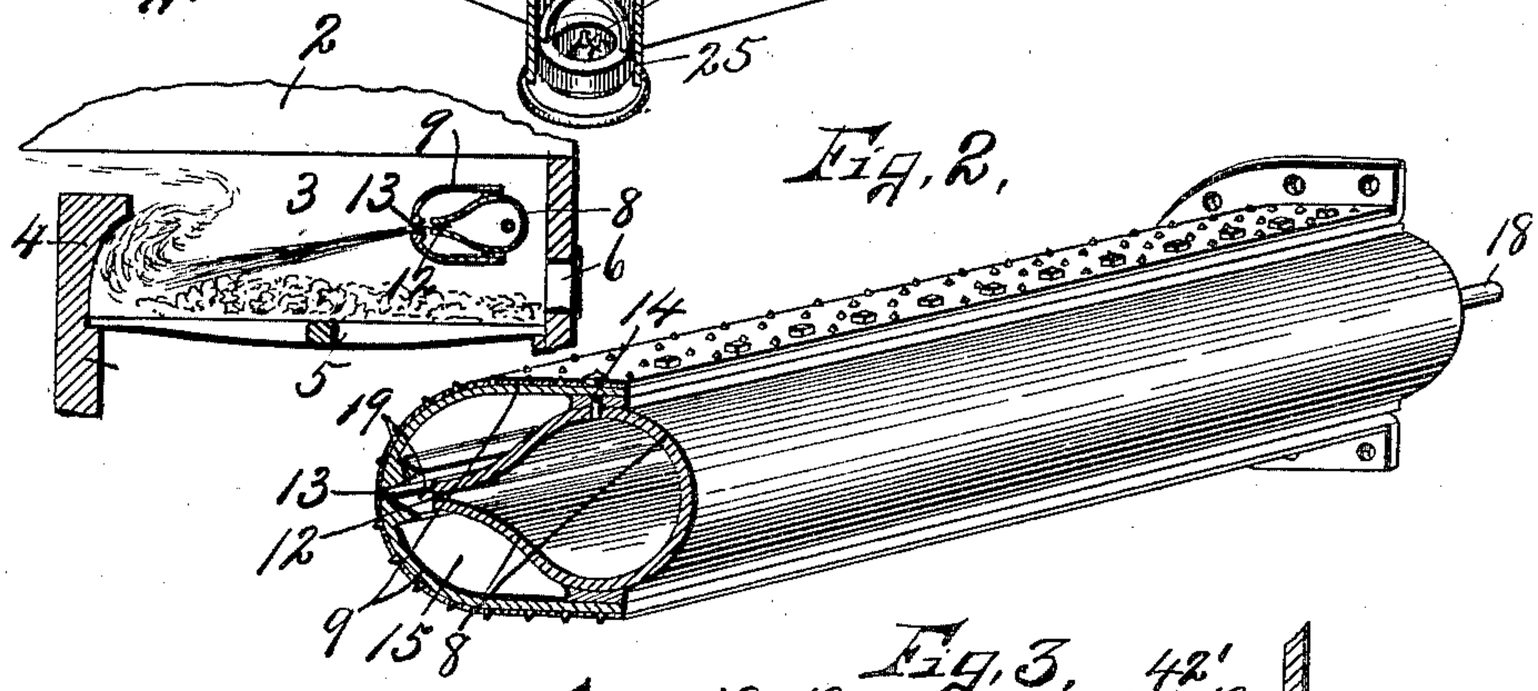

Fig. 2.

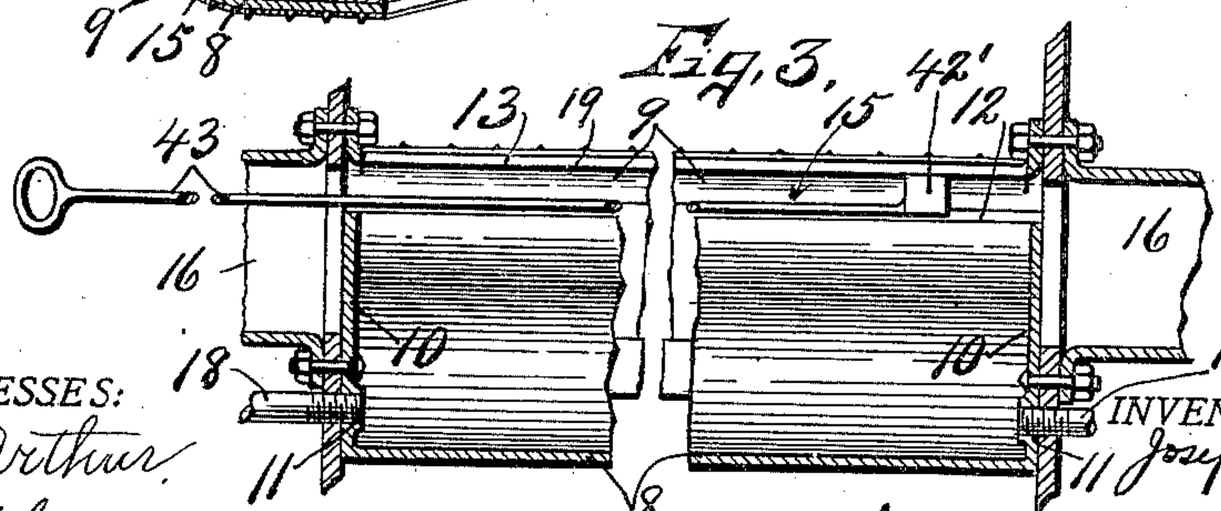

Fig. 3.

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SMOKE-CONSUMING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 726,535, dated April 28, 1903.

Application filed October 11, 1902. Serial No. 126,811. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH ARNOLD HOLTHAUS, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Smoke-Consuming Apparatus, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to apparatus for consuming smoke in the combustion-chamber of furnaces, and refers more particularly to that class in which steam and air are mingled with the products of combustion for the purpose of consuming the smoke.

The object of my invention is to inject mixed steam and hot air into the combustion-chamber in one continuous sheet, extending practically over the entire surface of the fuel, as distinguished from the introduction of the steam and air through a series of separate jets, the steam and air in my device being introduced in a finely-sprayed condition at practically the position where the smoke leaves the fuel and passes over the bridge-wall, the intention being to mingle a continuous sheet of mixed steam and hot air with the smoke where it is most dense.

Another object is to provide means whereby the inlet of the steam and air is controlled mechanically and is shut off automatically.

Further objects of my invention will appear in the description.

Referring to the drawings, Figure 1 is a perspective view of a portion of a furnace, showing the application of my invention thereto. Fig. 2 is a perspective view, partly in section, of the combined air and steam chambers, in which the steam and air are mixed and from which the mixture is discharged into the combustion-chamber. Fig. 3 is a horizontal sectional view, partly broken away, through the combined steam and air chambers, showing particularly the air and steam inlet openings and means for cleaning the slot or lengthwise passage through which the steam is discharged from the steam-chamber. Fig. 4 is a vertical section through the dash-pot or liquid-containing cylinder and the valve movable therein for automatically controlling the closing of the steam and air inlet passages. Fig. 5 is a lengthwise vertical sectional view, on a small scale, of a portion of a furnace, showing my steam and air mixing device in combination with a particular form of bridge-wall adapted to give the best results with the mixing device.

Similar reference characters indicate corresponding parts in all the views.

It is well known that if the smoke or gaseous carbon of bituminous or other coal is localized and subjected to a sufficient heat—as, for instance, the incandescence of fuel—the smoke, which is composed of carbon and an inflammable gas, may be almost entirely consumed within the combustion-chamber. It is also well known that the quantity of air admitted to the combustion-chamber by the ordinary draft which may be sufficient to produce perfect combustion is incapable of producing sufficient heat to consume the smoke or carbonaceous gases and that in order to accomplish this result it becomes necessary to introduce an additional supply of vital air into the combustion-chamber to mingle with the products of combustion, and I have discovered that by heating this air to a high degree without destroying its vitality and then introducing it into the combustion-chamber in front of the bridge-wall, or, more properly, where the smoke separates from the fuel, the smoke may be more readily and certainly consumed. I have also discovered that by the introduction of steam mingled with the heated air and introduced into the combustion-chamber in the mixed state a greater degree of heat or incandescence is produced at the surface of the fuel, where the smoke or carbonaceous gas is formed, the steam appearing to envelop and localize the smoke, while the oxygen of both elements greatly increases the combustion, and therefore destroys the gases and carbon of the smoke practically before passing over the bridge-wall, or, rather, within the combustion-chamber. I have also discovered that in order to obtain the best results it is necessary to introduce the mixed steam and hot air in proper quantities proportionate to the fuel-surface, and particularly to the quantity of carbonaceous gases liberated from the fuel. For example, if the volume of mixed vapor is insufficient

the smoke is only slightly consumed, whereas if the volume is in excess of what is required for perfect combustion of the smoke the effect is to produce imperfect combustion, and I have found by actual experiment that to introduce the steam and hot air in a mixed condition in the form of a thin sheet or spray a more perfect consumption of smoke is effected.

In the drawings, Figs. 1 and 5, I have shown a portion of the inclosing walls 1 of a furnace, in which is located a suitable steam-boiler 2, the front head of which is seen in Fig. 1 and a fragmentary portion of the same being seen in Fig. 5, said furnace being provided with a combustion-chamber 3, a bridge-wall 4, and suitable grates 5, the front wall of the furnace being provided with fuel and ash doors 6 and 7.

Extending transversely of the furnace through the side walls and front end of the combustion-chamber, between the boiler 2 and grate 5 and above the fuel-inlet openings, is my improved steam and air mixing device, which consists of inner and outer shells 8 and 9, the inner shell 8 being adapted to receive steam from any suitable source, as from the boiler 2, and is provided with opposite end walls 10, having suitable inlet-openings 11 for receiving the steam. This steam-receiving shell 8 is somewhat elongated transversely and preferably tapers rearwardly, said rearwardly-tapering portion being arranged within the shell 9, and is provided with an elongated outlet-passage 12 in its rear wall, which passage preferably extends continuously from one to the other end of the shell, or rather its length is substantially equal to the width of the combustion-chamber. The front portion of this shell 8 is preferably cylindrical in form, while the rear portion is contracted or tapered rearwardly and terminates in a plane in proximity to the inner wall of the outer shell 9. This outer shell 9 is of substantially the same length as the shell 8 and incloses the rear portion of the shell 8, the rear portion of the shell 9 being semicylindrical in form and is provided with a continuous lengthwise slit or outlet-passage 13 of substantially the same length as the passage 12 and alined therewith, the upper and lower walls of the shell 9 being extended forwardly above and beneath the upper and lower walls of the cylinder portion of the shell 8 and is secured thereto by suitable fastening means, as rivets 14. It is apparent from this description that the shell 8 forms a closure for the front open side of the shell 9. Owing to the fact that the rear side of the shell 8 tapers inwardly and that the outer shell is semicylindrical in form and incloses the contracted side of the shell 8 a chamber 15 is formed within the shell 9 and surrounds the inclosed portion of the shell 8. This mixing-chamber 15 is connected to an air-supply conduit 16, a portion of which, 17, (shown by dotted lines in Fig. 1,) is located within the combustion-chamber of the furnace, and it is thus apparent that the air is heated before entering the mixing-chamber 15.

Steam is supplied to the interior of the shell 8 through steam-pipes 18, which enter the inlet-openings 11 and may be connected to the boiler 2 or to any other source of steam-supply.

The passage 13 is provided with inwardly-diverging walls 19, extending above and beneath the plane of the passage 12 of the shell 8, whereby the steam discharged from the passage 12 is diverted to the passage 13, which latter passage communicates with the chamber 15, and it is obvious that when steam is discharged through the restricted passage 12 and outwardly through the passage 13 a quantity of air is drawn from the chamber 15 outwardly through the passage 13 and thus mixed with the steam before entering the combustion-chamber. The effect of this arrangement of the passages 12 and 13 is to introduce a thin sheet of mixed steam and air under pressure into the combustion-chamber of the furnace, and these passages are so arranged as to discharge the mixture over the surface of the fuel and against the base of the bridge-wall 4.

I preferably incline the front face of the bridge-wall 4 forwardly and upwardly over the rear portion of the fuel for the purpose of retarding the outward passage of smoke and causing the same to roll backwardly upon the surface of the fuel in such manner that the mixture of the steam and air discharged through the opening 12 practically envelops the smoke, and the increased combustion produced by the introduction of this mixture causes practically a complete consumption of the smoke. The principle of this is that the introduction of live steam and air upon the surface of the fuel produces a high degree of incandescence in proximity to the bridge-well, where the smoke is more or less retarded and thrown back upon the incandescent surface of the fuel, thus igniting the gases of smoke and burning up the carbon.

The air-conduit 16 and steam-pipe 18 are provided with valves 21 and 22, whereby the supply of air and steam to the chamber 15 and interior of the shell 8 may be regulated. I preferably provide means, such as the lever 23, for simultaneously opening and closing these valves.

When putting in a fresh supply of fuel through the fuel-openings 6, these valves 21 and 22 are open and are automatically held open for some time after each fire. When the fuel-doors are closed and in order that these valves may be automatically closed and at the same time to provide means whereby the operator may open the same, I employ a dash-pot or liquid-cylinder 24, in which is movable a plunger 25, having a flap-valve 26, opening outwardly, the plunger 25 having a large vertical opening therethrough and the valve 26 serving to close this opening, as hereinafter described. This plunger is provided with an

upwardly-extending stem 27, projecting through a suitable stuffing-box 28 in the upper end of the cylinder 24 and provided with upper and lower collars 29 and 30 and a weight 31.

Pivotally mounted at 33 upon the front wall of the furnace is a lever 34, having one arm normally extending in front of the doors 6 and provided with a handpiece 35, and its other arm is connected by a cable 36 to the upper end of the plunger-rod 27, the intermediate portion of said cable being mounted upon a suitable idler 37. The lever 23 is secured to the valve-stem of the valve 22, which forms a fulcrum for said lever and at the same time operates to open and close the valve 22. One end of this lever is connected by a link 38 to the valve 21 and its other end is connected at 39 to the plunger-rod 27, so that as the plunger is raised the valves 21 and 22 are opened and when the plunger is depressed said valves are closed.

The cylinder 24 contains a suitable liquid, and the valve 26 of the plunger 25 is provided with a petcock 40, whereby when the plunger is in its elevated position and the valves 21 and 22 are open the weight 31 tends to force the plunger downwardly, under which conditions the valve 26 automatically closes, and the petcock 40, which may be more or less open, permits the liquid to gradually and slowly ooze therethrough to a point above the plunger, which is gradually forced downwardly and automatically operates the lever 23 to close the valves 21 and 22.

In the operation of my invention when it is desired to introduce a fresh supply of fuel the operator engages the handle 35 of the lever 34 and rocks said lever upwardly upon its pivot 33 out of the path of the doors 6, thereby elevating the plunger 25 and simultaneously opening the valves 21 and 22. If for any reason the operator should fail to return the lever 34 to its normal position after thus firing the boiler and closing the doors 6, the petcock 40, which is open, permits the weight to force the plunger downwardly slowly and gradually, according to the degree of opening in the petcock, and to finally close the valves 21 and 22.

It is sometimes desirable to open the doors 6 without affecting the operation of the valves 21 and 22, and I therefore hinge the arm of the lever 34, having a handle 35 upon the pivot 33, separately from the other arm, so that the arm having the handle 35 may be readily rocked upwardly independently of the other arm. These arms are, however, usually locked to each other by a suitable locking member 41, having a pin 42 movable into and out of engagement with an aperture in the lever 34 at one side of its pivot.

In devices of this character it frequently becomes necessary to clean the discharge-openings, and I therefore provide a blade 42′, mounted upon one end of a suitable rod 43 and movable lengthwise within the slots 12 and 13, said rod 43 projecting outwardly through a cap 44, provided on the air-inlet conduit 16 at the outside of the furnace.

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

1. In combination with a furnace having a combustion-chamber, a steam-receiving shell extending transversely through the combustion-chamber and provided with a lengthwise slit extending from end to end of the shell, an air-receiving shell inclosing the portion of the former shell having a slit, said latter shell being also provided with a lengthwise-restricted passage alined with said slit, for the purpose set forth.

2. In combination with a combustion-chamber of a furnace, a pair of shells extending transversely through the combustion-chamber and provided with lengthwise passages extending substantially from end to end of the shells and alined with each other; a conduit for supplying steam to the inner shell, and a second conduit for supplying air to the outer shell, the second conduit having a portion thereof arranged within the combustion-chamber, for the purpose set forth.

3. In combination with a furnace having a combustion-chamber, an air-receiving shell extending transversely through the combustion-chamber and provided with a lengthwise slit in its rear face, a steam-receiving shell partially within the former shell and provided with a lengthwise slit alined with the former slit, a steam-conduit connected to the steam-shell and provided with a valve, an air-conduit connected to the air-receiving shell and also provided with a valve, means for simultaneously opening said valves, and additional means for automatically controlling the closing of said valves.

4. The combination with a furnace having a combustion-chamber, inner and outer shells extending transversely through the combustion-chamber and provided with lengthwise slits through their rear walls and alined with each other, a steam-conduit connected to the interior of the inner shell, an air-conduit supplying air to the outer shell, valves in said conduits, a lever for operating said valves simultaneously, a liquid-containing cylinder having a plunger provided with a valve and a petcock, for the purpose described, said plunger being connected to the lever, a weight operating to depress the plunger and the lever connected thereto, and means for elevating the weight, lever and plunger.

5. The combination with a furnace having a combustion-chamber, inner and outer shells extending transversely through the combustion-chamber and provided with lengthwise slits through their rear walls and alined with each other, a steam-conduit connected to the interior of the inner shell, an air-conduit supplying air to the outer shell, valves in said conduits, a lever for operating said valves simultaneously, a liquid-containing cylinder

having a plunger provided with a valve and a petcock, for the purpose described, said plunger being connected to the lever, a weight operating to depress the plunger and the lever connected thereto, a second lever composed of sections, one section being movable independently of the other, and the other section being connected to elevate the plunger, weight and former lever, and means to lock the sections of the sectional lever to each other.

In witness whereof I have hereunto set my hand on this 30th day of September, 1902.

JOSEPH ARNOLD HOLTHAUS.

Witnesses:
H. E. CHASE,
J. M. HAMMEKEN.