(No Model.) 2 Sheets—Sheet 1.

J. MILTON.

SMOKE CONSUMING FURNACE.

No. 506,128. Patented Oct. 3, 1893.

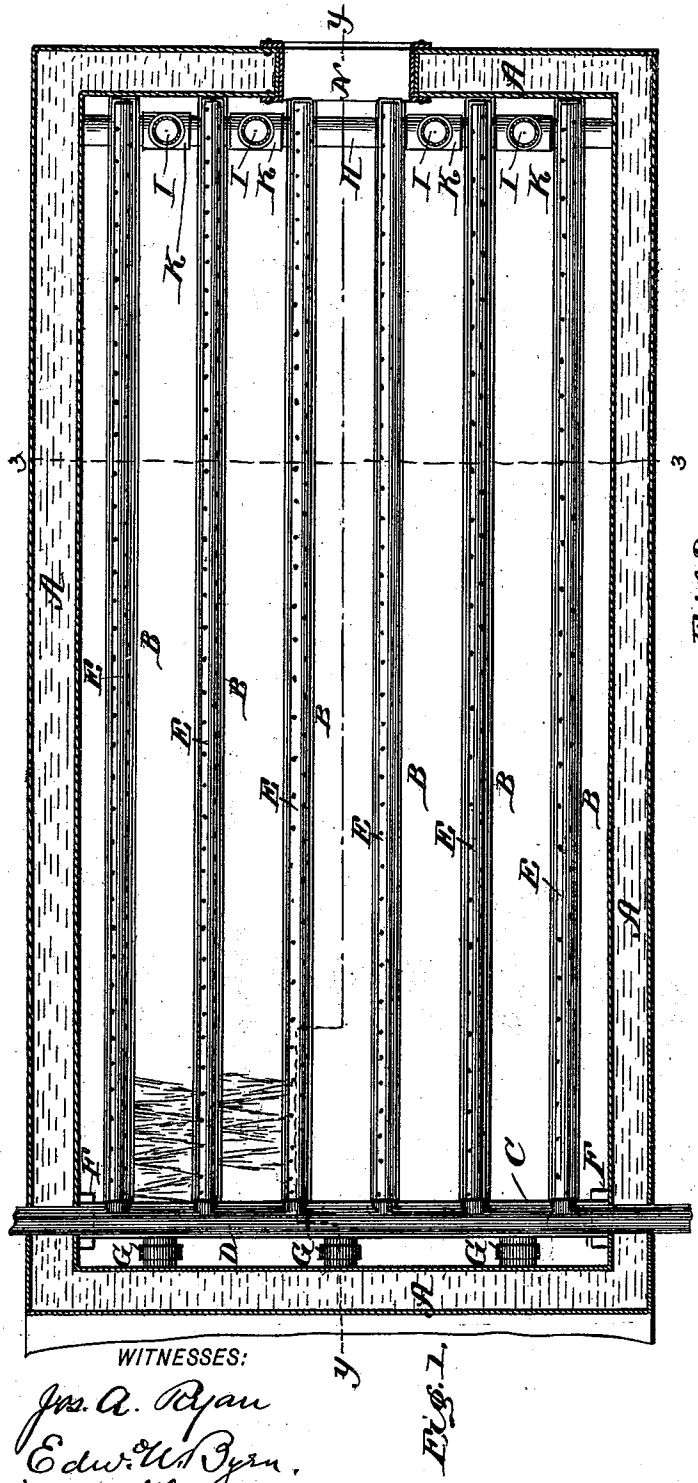

Fig. 1.

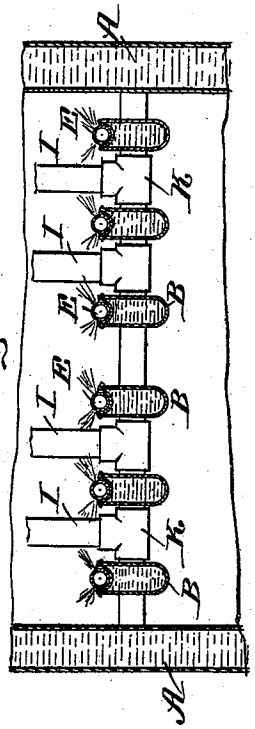

Fig. 3.

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Edw. W. Byrn.

INVENTOR

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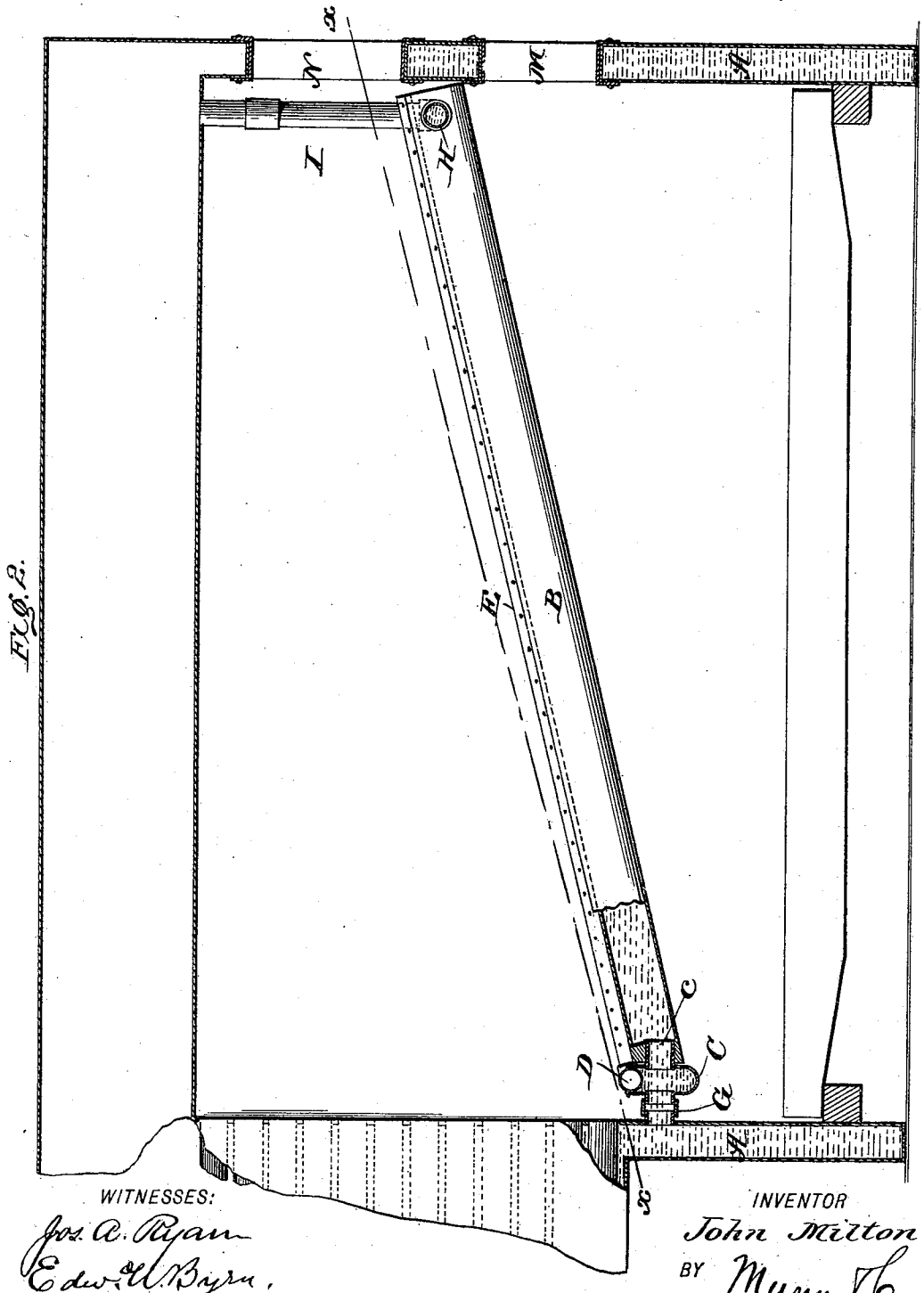

Fig. 2.

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UNITED STATES PATENT OFFICE.

JOHN MILTON, OF ALEXANDRIA, VIRGINIA, ASSIGNOR OF THREE-FIFTHS TO ALBERT F. KINGSLEY, OF WASHINGTON, DISTRICT OF COLUMBIA.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 506,128, dated October 3, 1893.

Application filed September 16, 1892. Renewed August 29, 1893. Serial No. 484,297. (No model.)

To all whom it may concern:

Be it known that I, JOHN MILTON, of Alexandria, in the county of Alexandria and State of Virginia, have invented a new and useful Improvement in Smoke-Consuming Furnaces, of which the following is a specification.

The object of my invention is to provide for, and accomplish the perfect combustion of the smoke in furnaces which in escaping unconsumed involves not only a serious loss of fuel but is also objectionable on account of the dirt which it makes, as well as the contamination of the air.

My invention proceeds upon the well known principle of feeding air to the gases in the combustion chamber, in order to effect their complete oxygenation and combustion; and it consists in the peculiar construction and arrangement of devices for accomplishing this result in a way that secures two prime essentials; the first of which is that the air should be evenly distributed throughout the body of the combustion chamber with a forced feed; and the second of which is, that the air ducts shall be so protected from the intense heat as not to be destroyed thereby, but shall possess an endurance sufficient to insure a longevity that affords practical results.

With these ends in view my invention consists, first, in the peculiar arrangement of the air delivery grating with reference to the fire box and draft flues; second, in the means hereinafter described for protecting the air delivery grating from the intense heat generated in the fire box; and, third, in the details of construction and arrangement hereinafter fully described for securing the results aimed at by the first and second parts of my invention.

In the drawings Figure 1 is a horizontal section of a boiler furnace on line *x*—*x* of Fig. 2 showing arrangement of protected perforated air pipes and connections constituting my smoke and gas consuming furnace. Fig. 2 is a vertical longitudinal section of the same on line *y*—*y* of Fig. 1, and Fig. 3 is a transverse section showing the pipes in position in the channelled upper edge of the water guards in which the air pipes are protected from burning. In Fig. 1, A A A A show the water space of the boiler around the fire box.

B B B B B show the longitudinal water guards connected with the transverse water guard C at the forward end by short nipples *c*. The transverse guard C rests at the ends on lugs fastened to the sides of the fire box as shown at F F. This water guard is also connected with the boiler at G G G by unions or short nipples to permit the water to pass into it freely. The longitudinal water guards are connected with each other at the rear end by nipples with right and left screws or unions. These pipes or connections are shown at H H H. They are also connected with the crown sheet of the boiler by pipes shown at I Fig. 2, and T's shown at K Fig. 1. By this arrangement a perfect circulation and scouring of water through the guards is insured while the pipes I compensate for or permit expansion and contraction of the pipes E and B without rupture of the boiler. The longitudinal air pipes E E E E E and the transverse air pipe D rest in the channels of the water guards as in Fig. 3 with slightly less than one half their diameter extending above the edges of the channels of the water guards. The air pipes are perforated with small holes in their sides about three or four inches apart and in such direction that the escaping air will be thrown out slightly above a horizontal line. The holes in the pipes should be so arranged that they are half way between rather than opposite the holes in the contiguous pipe. It is evident that with this arrangement the escaping air will cover with a thin sheet the entire surface of the fire box. The air pipe D D is connected at both ends preferably with pipes leading to a reservoir under the boiler similar to that used in connection with air brakes. This reservoir may be connected with the air brake reservoir by a pipe and check valve, receiving from it the air that is now wasted. Should this be found insufficient, a special air pump may be used of sufficient capacity or the air may be supplied in case of locomotive while running by funnels conveniently placed.

The water guards B B serve a triple purpose. They add considerably to the heating surface of the boiler and increase the steaming capacity; secondly, they act as a protection to the air pipes against burning, and

thirdly they concentrate the smoke and gases into the spaces between the pipes, thus bringing them into close contact with the currents of air which may be less forcible or of less pressure because of the slight distance to which it must be forced in reaching the gases.

M is the usual door for fuel and N is a door opening above the air pipes for observation purposes and cleaning.

With this plan of furnace and air pipes I have found by repeated experiments that every particle of smoke and gas is easily and certainly consumed, and a very intense heat generated. This effect is produced by the fact that the air delivery device, which constitutes a sort of grating, being arranged above the fire or grate surface of the furnace, with one end above the door and the other end below or on about a line with the lowest draft flues, all the smoke and gases generated by combustion must in their flight to the draft flues pass through the film of air supplied by the air grating and mingling therewith become in a condition to readily ignite and consume. This incline arrangement of the air grating is essential for two reasons: first, to form a perfect bridge between the grate surface of the fire box and the draft flues, and, second, in order that the purpose and capacity of the stoking door of the furnace shall not be interfered with.

The air delivery device constituting as it does, a grating with the air delivered each side of the center of the air conduits, not only furnishes the air in a thin film or layer, but the relations of the tubes are such that the smoke and gases in their transit toward the flues necessarily become separated and divided, and consequently the air more readily attacks and commingles with the same. I have found also that a natural draft of air is entirely insufficient for complete combustion, and always uncertain of effecting combustion at all because for well known reasons natural air currents often become sluggish and sometimes, owing to a change of direction of the wind, they entirely cease, when of course there would be no combustion at all. I have found also by experiment that to effect combustion of smoke and gas there must be an admission of fresh air above the fuel; that it must be uniformly distributed, and that if the quantity of air, is excessive there follows the lowering of the temperature of the furnace, and loss of power. I have found that air pipes or chambers placed within a furnace without protection from the fire will within a few hours become warped, twisted, and burned, and entirely worthless.

Attempts have been made to obviate the burning of the air pipes by embedding them wholly within a water jacket formed by another larger pipe or outer casing which completely envelops the air pipe, the air being taken through the water jacket by means of hollow bolts, as shown for instance in expired patent to Pierce, No. 234,490, dated April 5, 1859. The difficulties here met with are that it is not possible to tightly and securely fasten the inner ends of the hollow bolts on account of their inaccessibility. A further difficulty in the construction referred to exists by the fact that the air delivery pipes being arranged on each side of the fire box and near the walls thereof and leaving the draft uninterrupted, the additional supply of air merely tends to increase the draft, and consequently the smoke and unconsumed gases are hastened in their exit. Furthermore the differential expansion and contraction between the large outer tube, which is exposed to extreme heat, and the inner smaller one that is kept comparatively cool, soon tears loose the connections of the hollow bolts so that they leak under the steam pressure. All these objections are overcome in my construction, in which the air pipe simply lies in the trough of the water bed and is not covered on its upper side, so that the air does not have to pass through the water jacket. There is no practical difficulty in building this construction. It is accessible and open to inspection always, and there is no differential strain of expansion and contraction, and yet the air pipe is sufficiently protected from below, and on its sides, while at the upper side or top it does not need such protection for the reason that this side is on the lee side of the draft, and is furthermore protected by the issuing current of air.

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

1. In combination with the fire box and draft flues of a furnace, a set of air delivery pipes arranged in an inclined position separated from each other vertically, and provided with lateral air ducts and interposed between the grate surface and the draft flues, and suitable means for supplying air to the air delivery pipes, whereby the smoke and gases generated by the combustion of the fuel are intercepted and supplied with air to secure perfect combustion, as hereinbefore set forth.

2. The combination with a fire box in a furnace; of a set of air pipes arranged in the fire box above the grate and provided with perforations or outlets, and a corresponding set of subjacent water beds or guards forming a protective bed for the bottom and sides of the air pipes against the intense heat, but leaving their upper sides exposed, and connected with the water space of the boiler for a circulation of water therethrough, thereby protecting the air pipes from burning and also increasing the steaming capacity of the furnace substantially as shown and described.

3. The combination with the fire box in a furnace; of a set of parallel perforated air pipes placed across the fire box above the grate bars, and subjacent water guards arranged beneath the air pipes and without inclosing the same substantially as shown and described.

4. The combination with the fire box in a furnace; of a set of parallel perforated air pipes arranged in the fire box above the grate bars, and a corresponding set of subjacent trough-shaped water beds or guards; the air pipes being laid within the trough-shaped spaces but wholly outside the water space substantially as shown and described.

5. The combination with the fire box in a furnace; of a set of perforated air pipes, and subjacent water guards arranged in the fire box above the grate, the said water guards being connected at one end to the water space of the boiler by couplings, and being connected at the other end with the water space of the boiler by vertical pipes I substantially as and for the purpose described.

6. The combination with the fire box in a furnace; of a set of perforated air pipes and subjacent water guards formed of two round sections of metal riveted together and concave upon the upper side and convex upon the lower side substantially as and for the purpose described.

7. The combination with the fire box in a furnace; of a series of parallel perforated air pipes E E arranged longitudinally and having connected at their forward ends the inlet air pipe D; the corresponding subjacent water guards B B C forming a bed for the air pipes, and connected with the water space of the boiler at their front ends by couplings, and the pendent vertical water tubes I extending from the crown sheet to the rear ends of the water guards and supporting the same substantially as shown and described.

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Witnesses:
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EDWD. W. BYRN.