

July 31, 1923.

H. M. NOBIS

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METHOD OF AND APPARATUS FOR SMOKE PREVENTION

Filed Feb. 6, 1922

2 Sheets-Sheet 1

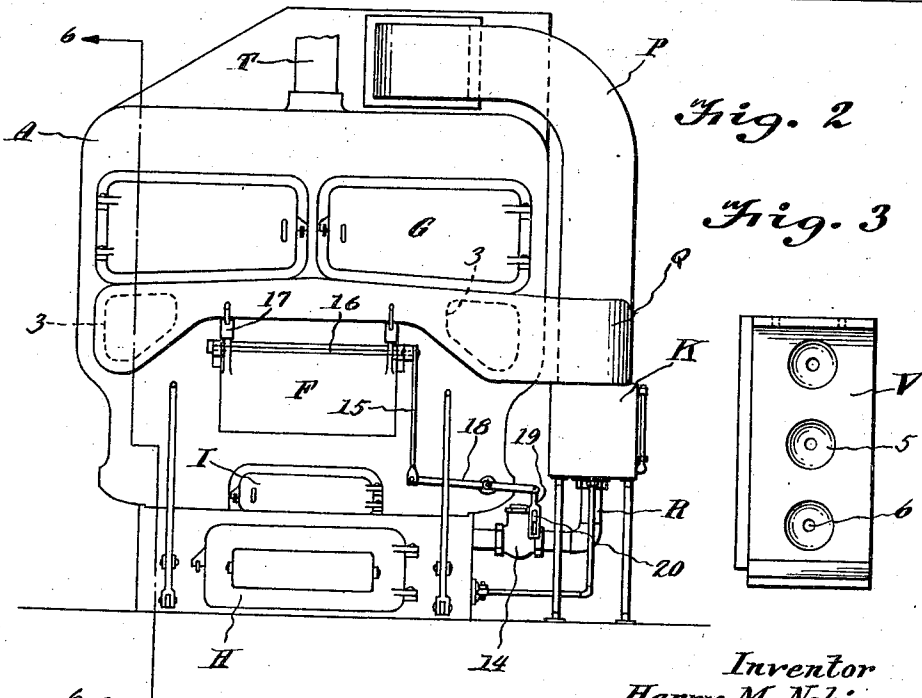
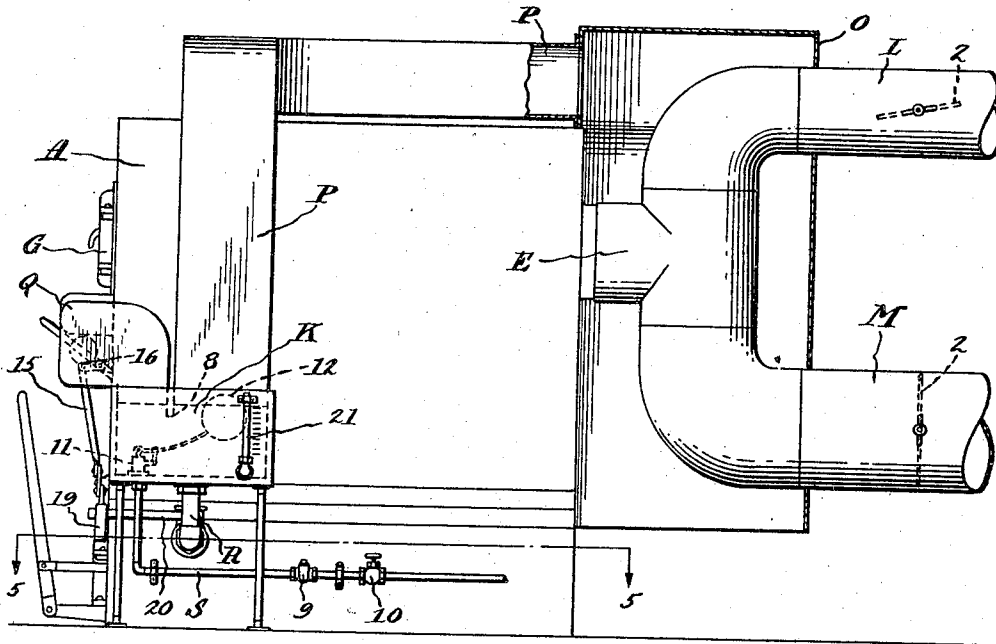


Fig. 2

Fig. 3

Fig. 1

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2 Sheets-Sheet 2

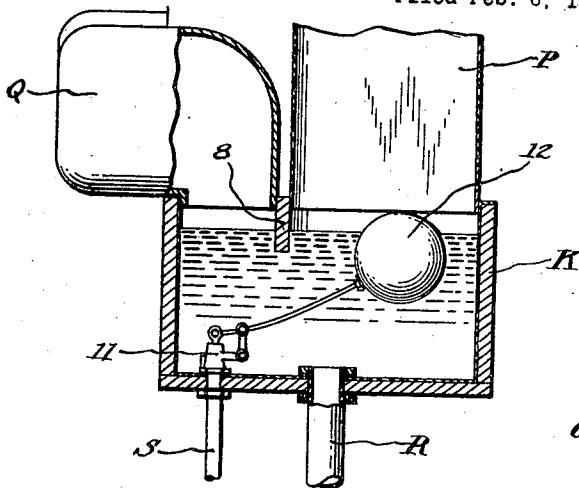


Fig. 4

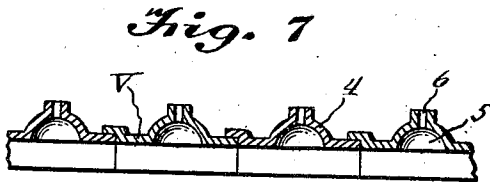


Fig. 7

Fig. 5

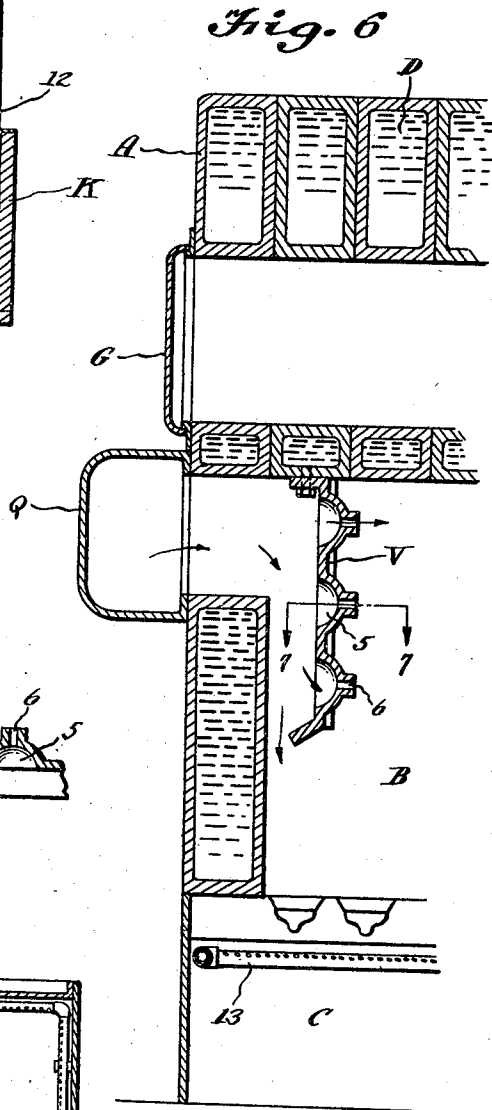
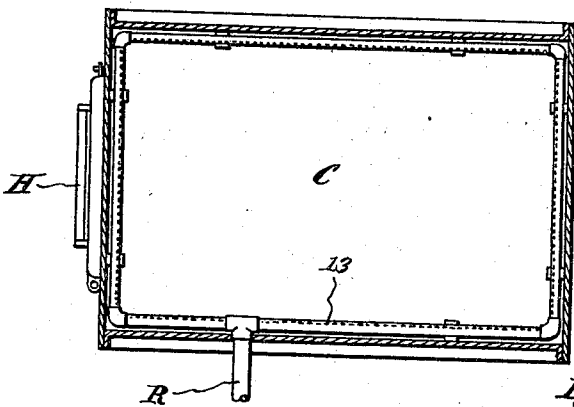


Fig. 6

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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR SMOKE PREVENTION.

Application filed February 6, 1922. Serial No. 534,366.

To all whom it may concern:

Be it known that I, HARRY M. NOBIS, residing at East Cleveland, in the county of Cuyahoga and State of Ohio, and a subject of the British Empire, have invented certain new and useful Improvements in the Methods of and Apparatus for Smoke Prevention, of which the following is a specification.

The objects of this invention are to provide a method and apparatus for prevention of the very imperfect combustion of fuel at the time of stoking and the consequent issuance of black smoke from the flues of furnaces at such times. This problem of smoke prevention has become more and more acute in cities having large industrial centers, the matter of unnecessary smoke concerning both the property owners of these buildings in which the great fuel waste occurs, but the general public as well who must breathe the smoke-laden air in such locations.

It is a particular object of my invention to solve the problem above stated by pouring a stream of fresh oxygen-laden air into the fire pot for the period immediately following the feeding of fresh fuel upon the fire, as it is observed that this is the interval when the greatest issuance of smoke takes place due to the lowering of the temperature of the chamber below the limit of perfect combustion by the fresh fuel last deposited on the fire, and also to the temporary closing of the openings through the fuel and grate from below by such fresh fuel.

It is a further object of this invention to regulate this period during which the fresh air is being poured into the fire pot by limiting the time of said flow so that such special provision of oxygen fluid will be shut off when no longer needed, the latter condition being reached when the fresh fuel is heated up to the point that the ordinary draft provision is sufficient.

A further object is to provide a control of this pouring of fresh air upon the fuel actuated by a liquid trap mechanism so that when the liquid, such as water from the ordinary city water supply, is poured out of the trap box or tank, the said air flow will at once begin to function, and when the

liquid again rises in the tank to the predetermined height the flow of said fresh air will cease.

A further object is to provide a control of the fresh air upon the fire pot, such as by means of the flushing tank above mentioned, which will be automatically actuated, as by the swinging of the fuel door.

A further object is to provide such a trap box for water control of the fresh air stream to be poured on the fire pot wherein the liquid released from the tank will be poured out over the ashes in the ash pit. Another object is to provide for pre-heating the air which is to be poured upon the fuel, and this can be done by utilizing for such pre-heating purpose heat from the chimney flue thus further providing economy in fuel.

A still further object is to pour the pre-heated air over the fresh fuel in small jets, by dividing the large stream of air forcing it through small apertures in metal plates which are continuously heated by their position immediately over the fire.

Other objects of my invention will be seen as the description of the structure in which it is embodied proceeds, and as the parts of said structure are explained as illustrated in the accompanying drawings, wherein—

Figure 1 is a front view of a furnace to which my invention is applied;

Figure 2 is a side view of the same with parts of the pre-heating hood broken away;

Figure 3 is an elevation of the plate having the heating pockets for the in-pouring air as seen from the inside of the furnace looking out;

Figure 4 is a side view of the flushing tank, certain walls being broken away;

Figure 5 is a horizontal section on the line 5—5 of Fig. 2, looking down as indicated by the arrows;

Figure 6 is a vertical section taken on the line 6—6 of Fig. 1, looking in the direction of the arrows; and

Figure 7 is a sectional view taken on the line 7—7 of Fig. 6.

In said drawings in which similar reference characters indicate corresponding parts, the furnace is designated generally by A having the upper clean-out doors G, fuel door F, draft door I and ash door H. B

represents the fire pot and C the ash pit. E represents the smoke pipe which leads into the smaller pipe L or larger pipe M, the former being used when it is desired to provide a strong and direct draft temporarily, as in starting a fire, and the latter being ordinarily used when the fire is well started, and it is economical to use a more indirect escape for the smoke. These pipes may be used selectively by operating the dampers 2 as will be obvious.

My invention is designed for application to any kind of furnace burning solid fuel, and is not restricted to steam or hot water heaters but may be used for heating any conducting agent. For the purpose of description, however, it is shown as applied to a steam heating furnace. As illustrated D designates the water chambers of a boiler and T a steam pipe leading therefrom. To provide for pouring fresh air over the fuel in the fire pot when fresh fuel is fed into the furnace, the pipes or ducts P and Q are directed to the front of the furnace and are arranged to pour air into the latter through openings 3 therein and from there directed over the fuel requiring oxygen for perfect combustion. In flowing to the location desired this air, preferably preheated by means to be later described, is super-heated by contact with the plate V (shown in Figs. 3, 6 and 7).

This plate V is made up of a number of sections 4 comprising a number of pockets 5 terminating in nipples 6 having small apertures through which the air is conducted and thereby super-heated as the said plate is suspended from the metal roof of the main fire pot B and directly over the fire at all times. If the pressure in the pipe Q is too great to permit of flowing through the said nipples fast enough, the residue of such air will be directed downward by said plate and heated in its descent by the walls of the chamber before reaching the fuel as indicated by the arrows in the drawings in Fig. 6. It will thus be seen that the air is raised to a very high temperature before reaching the fuel, whatever path it follows.

The pipes P and Q really form a continuous tube for preheating the air thus fed into the furnace at intervals. This preliminary heating is accomplished by enveloping the Y-connection of the pipes L and M with the smoke pipe E by a hood O from which the pipe P conducts the heated air forward.

The means illustrated for controlling the feeding of the preheated air into the furnace will now be described: A flushing tank K is provided at a convenient location at the side of the furnace, preferably near the front thereof and above the ashpit C. Pipes P and Q enter said box or tank but are separated from each other by a partition 8 which

is positioned below the top of said box. From this construction it will be seen that if the said box is filled with liquid, the pipes P and Q will not communicate with each other, but that when the level of the liquid falls below the said partition, air may pass from pipe P to pipe Q and thence into the furnace opening as before explained. It is to be especially noted that in the entire passage through the said pipes P and Q their contents are being heated more and more by the various parts of the furnace until finally the air enters therein.

The rise and fall of the liquid in the box K is effected and controlled by the following mechanism and arrangement of parts: The bottom of the said water box opens into two independent pipes R and S, the latter leading to some convenient city water supply or to some other source of liquid under pressure, and having two valves 9 and 10 one of which 9 may be set for a desired speed of flow usually adjusted by the engineer of a building at a determined rate depending on the time it is desired that the fresh air shall be fed in. The valve 10 is provided for wholly closing the pipe S when it is desired for any purpose, as in repairing the plumbing. The opening leading from the box into the pipe S is also controlled by another valve 11 actuated by the common form of hollow floating sphere 12 seen on the ordinary form of flushing tanks.

The pipe R leads to the ash pit C where it empties into a perforated pipe 13 which surrounds the said pit on all sides and sprays the water over the ashes therein when the pipe R is open. The latter pipe has a valve 14 for controlling the flushing of the tank K through the said pipe R. This valve may be operated manually if it is desired, or may be as here illustrated connected with the fuel door F for automatic actuation thereby. This latter connection involves provision of crank arm and link 15 arranged for operation by the rotation of the pivot shaft 16 of said door F. Suitable weights 17 are mounted to normally close the said door. Link 15 operates lever 18 and thereby the link 19 which is slotted to receive therein the actuating arm 20 of the said valve 14. By this arrangement it is seen that an opening of the door F for a small arc will not lift the lever 20, but that a further opening will engage said lever 20 by the link 19 and open the valve 14 and empty the contents of the tank K over the ashes in the pit. The ball 12 then falls and opens the valve 11 whereby liquid flows in from the pipe S until the rise of the ball 12 closes the valve, by which time there will no longer be need for the special provision of outside air above the fire and the pipes P and Q are disconnected by the rise of water above the lower edge of the partition 8 until the valve 14 is again opened

as by opening of the door F again wide enough to actuate the arm 20. A scale 21 indicates the level of the liquid in the tank.

It is to be noted that the structure described is not only advantageous in providing a quantity of hot but fresh air rich in oxygen above the fire when it is needed most (just after stoking), but that the utilization of the water flushing mechanism for the purpose is further beneficial in spraying the ashes with water which in the opinion of competent heating engineers is of great value in preventing the formation of hard clinkers upon the grate just above the pit. The said water tank control of the air supply for prevention of unnecessary smoke from the chimney has therefore a double function.

The operation of the mechanism has been partly explained as the structure was described. It may be said, however, in recapitulation that the valve 9 in the pipe S may be adjusted to fill the tank K in from two to eight minutes during which period a flow of heated air will be poured upon the fire to render more perfect the combustion of the fuel in the pot; that the apparatus illustrated by the drawings in which the principle of my invention is disclosed serves to pre-heat the air to be poured in, first by the hood O and again by super-heating by contact with the plate V before final entrance into the furnace chamber proper; that the air is finally fed in upon the coal in a manner designed to spread the same over the surface of the fire by means of the nipple construction 6; and that finally the tendency to prevent clinkers is obviated by the spraying of the water over the ashes below the fire at very suitable intervals.

While my invention is described as embodied in the particular structure illustrated, it is to be especially understood that I am by no means limited to said construction, as it is obvious that many changes therein will suggest themselves to the skilled mechanic with the disclosure herein before him. For example, the apparatus here shown may be applied to any furnace feeding solid fuel with advantage, whether the heat is used for heating boilers, such as in water or steam heat, or for hot air furnaces as well. Further, applicant is by no means to be confined to the particular type of hood for the initial heating of air to be supplied to the furnace. Many types of pre-heaters may be used for the purpose. Neither is it essential that the air be pre-heated as shown, as a great advantage will result from the provision of fresh air by my pipes controlled by my flushing apparatus whether heated or not. Then, the use of the hood arrangement may be used whether or not the plate V and its pockets 5 are used for super-heating, though the described combination is regarded as unique and very practicable.

Also, the valve 14 for opening the flushing pipe R may be used without any special means for connecting the same with the door F.

It will be observed that the air inlet mechanism disclosed may be applied to furnaces already installed and having originally no provision for smoke prevention by feeding fresh air at the time of feeding fresh fuel. It will ordinarily require merely the mounting of the pipes 13 in the ash pit and the pipe Q for registering with the openings 3 in the front of the furnace, as the latter openings are usually in most types of furnaces of standard make. If the plate V is to be used, it can well be installed by riveting to the roof of the fire pot, and since it is in sections, its size can be regulated to fit the furnace to be improved by my structure.

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

1. The method of firing a furnace comprising stoking the furnace at intervals, directing fresh air over the fuel in the fire pot immediately after stoking, using water to control the supply of air so directed, and sprinkling into the ash pit water so used.
2. The method of firing a furnace comprising pre-heating air, stoking the furnace, directing the pre-heated air over the freshly fed fuel, using water to control the air so directed, and sprinkling into the ash pit water so used.
3. The method of firing a furnace comprising utilizing the waste products of combustion to pre-heat air; heating a solid body over the fuel and within the fire chamber, stoking the furnace, super-heating the pre-heated air by contact with said heated solid body, directing the super-heated air over the freshly fed fuel, using water to control the air so directed, and sprinkling into the ash pit of the furnace the water so used.
4. In a furnace, a perforated plate suspended over the fuel and near the front of the fire chamber, a chamber surrounding the smoke outlet, a duct leading from the last said chamber to the fire chamber in front of said plate, a flush tank, an outlet from the flush tank discharging into the ash pit of the furnace, and means for interrupting the flow of air in said duct by the rise of water in said flush tank.
5. In combination with a furnace having openings in its walls near the fuel door, an air pipe leading into said openings, a flushing tank mechanism having pipes for conducting liquid thereto and therefrom and a partition projecting down from the top thereof so as to divide the air space thereof when liquid rises in said tank, a hood enveloping the chimney flue of said furnace, pipes leading from the said hood to one side

of the partition in the said tank and from the other side of the partition to the said openings, and means for controlling the rise and fall of the liquid in the tank, substantially as described.

6. In combination with a furnace, a flushing tank mechanism having pipes leading thereinto for carrying liquid and a partition so positioned therein as to divide the space thereof when liquid rises in the tank, a hood enveloping the chimney flue of the furnace, a pipe leading from the hood to one side of the partition in the tank, another pipe leading from the other side of the partition in the tank to the fire chamber so that air will enter said hood at its lower end, become heated in passing through the same, pass through the said air pipes and tank and enter the fire chamber above the fire therein, and means connected with said liquid pipes for controlling the rise and fall of the liquid in the tank, substantially as described.

7. In combination, a flushing tank mechanism including a tank, an inlet pipe leading into the tank from a source of water under pressure, a float valve controlling said inlet pipe, an outlet pipe leading from said tank to the ash pit of the furnace, a valve for the outlet pipe, connections between the outlet valve and the door whereby the opening of the door opens said outlet valve, an air pipe leading to the fire chamber over the fuel, and means whereby the rise of water in said tank interrupts the flow of air in said air pipe.

8. In combination, a flushing tank mechanism including a tank, an inlet pipe leading into the tank from a source of water under pressure, a float valve controlling said inlet pipe, perforated pipes connected together and passing around inside the walls of the ash pit of the furnace, an outlet pipe leading from said tank to said pipes in the ash pit, a valve for the outlet pipe, connections between the outlet valve and the door whereby the opening of the door opens said outlet valve, an air pipe leading to the fire chamber over the fuel, and means whereby the rise of water in said tank interrupts the flow of air in said air pipe.

9. In combination, a furnace, a sectional metal plate located in the fore part of the furnace chamber and having a plurality of pockets therein terminating on its rear face in small nipples having small apertures therein so that air entering said chamber may enter said pockets and leave said apertures in jets of super-heated air which spread out over the fuel, air ducts leading to the furnace chamber in front of said plate, and automatic means set in operation by the opening of the furnace door for opening said air ducts for a limited time.

10. In combination, a furnace, a metal

plate having pockets therein terminating in nipples having small apertures issuing therefrom, said plate being suspended from the roof of the fire chamber in a vertical plane near the fuel door and directly over the front part of the fire, a chamber surrounding the smoke flues of the furnace and air duct mechanism conducting a current of air from the last chamber to the chamber in front of said plate.

11. Means for super-heating air entering the fore part of a furnace chamber consisting of a sectional plate positioned over the fire near the front, the same being suspended from the roof of the fire chamber in a vertical plane and having therein a series of pockets terminating on the back side in apertured nipples, substantially as described.

12. Smoke prevention mechanism for furnaces comprising air ducts leading to the fire chamber, flushing tank mechanism for controlling the current of air in said ducts, pre-heating means including upper and lower flues connected selectively with the common smoke flue forming a Y-connection and a hood enveloping the said Y-connection of the several flues, being open at its bottom and leading to one of said air ducts, and means in the fire chamber for super-heating the hot air entering from said ducts, substantially as described.

13. A pre-heating mechanism for air ducts leading to a fire chamber of a furnace for the prevention of smoke at the time of stoking, consisting of smoke flues connected selectively with a main flue directly issuing from the furnace, one of which is the smaller and arranged at a higher level than the main flue to create a strong direct draft when needed and another of which is the larger and arranged on a much lower level than such main flue, there being convenient dampers for determining the flue to be used and all the flues leading to the common chimney, and an enveloping hood about the several flues at their common connection open at its bottom and leading to the said air ducts, substantially as described.

14. Smoke prevention mechanism for furnaces comprising air ducts leading to the fire chamber, flushing tank mechanism for controlling the current of air in said ducts including a common tank whose top is in communication with one air duct leading thereto from outside air and another duct leading therefrom to the fire chamber, a partition which shuts off communication between said ducts when the liquid rises in the tank and opens the same when the liquid falls, a water pipe entering said tank from a source of water under pressure, another water pipe conducting liquid from said tank to a point just above the ashes in the ash pit, a valve mechanism actuated by the rise of water in the tank

to close the leading-in pipe, a valve normally closed for controlling the escape of water from the tank through the pipe leading to the ash pit and having an actuating arm for opening the valve, a shaft rotating with the door when the latter is opened and having an arm fixed thereto, link

and lever means connected to said valve arm and shaft arm so that the swinging door will actuate the said arm to open the valve, substantially as described. 10

In testimony whereof I hereunto affix my signature.

HARRY M. NOBIS.