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J. A. BALMER
HOPPER BOTTOM FURNACE

2,503,148

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2 Sheets-Sheet 1

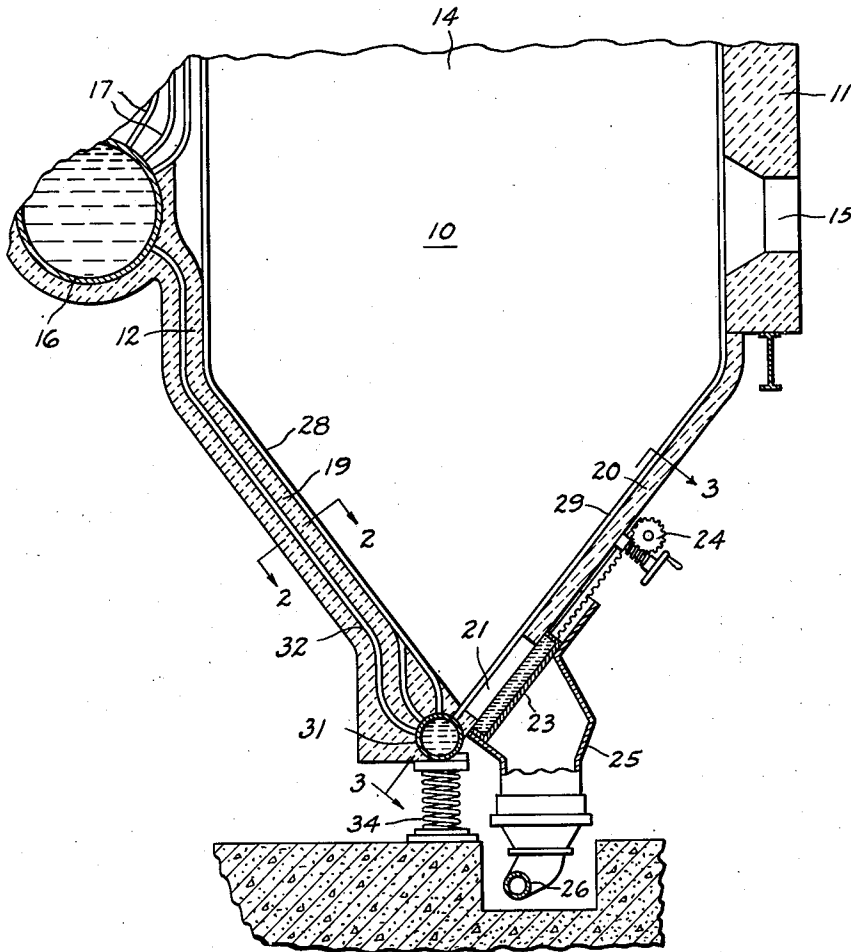


Fig. 1

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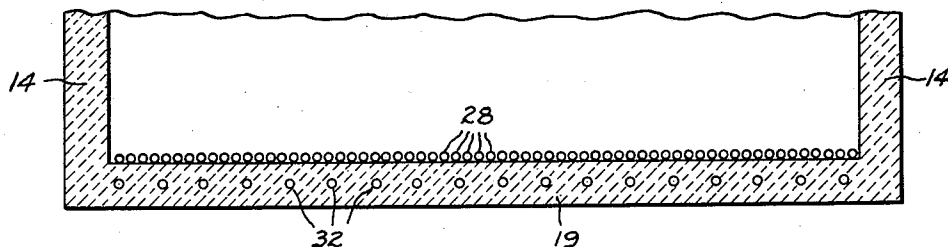


Fig. 2

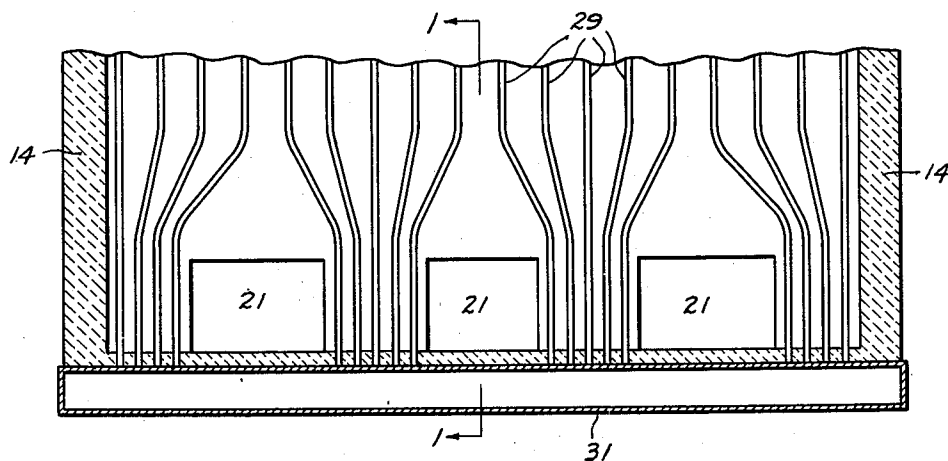


Fig. 3

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UNITED STATES PATENT OFFICE

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HOPPER BOTTOM FURNACE

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This invention relates to hopper bottom furnaces, and more particularly to furnace bottoms of the type comprising metal tubes through which water is circulated to cool the tubes and generate steam.

Hopper bottom furnaces as ordinarily constructed include two bottom walls which slope downwardly from the front and rear respectively toward an ash discharge slot located beneath the central portion of the furnace. A separate set of water tubes is associated with each of these walls. An ash hopper is installed beneath the discharge slot to receive ashes which fall therethrough, and this hopper is provided with doors to permit periodic dumping of the accumulated ashes into a sluiceway or other ash-conveying apparatus. These prior furnaces are very expensive and they occupy a considerable amount of valuable space. Separate headers are required to supply water to the lower ends of the two sets of water tubes, and both of these headers must be suitably connected to the boiler to receive water therefrom. The ash hopper is a bulky and costly device, and it adds greatly to the basement headroom required.

It is accordingly the main object of the invention to provide a water cooled hopper bottom furnace which will be comparatively inexpensive to manufacture, and which will require considerably less space than prior constructions.

It is a further object of the invention to provide a relatively simple and inexpensive water cooled furnace bottom in which ashes may be allowed to accumulate and from which the accumulated ashes may be freely discharged by gravity at intervals.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawing illustrating one embodiment of the invention, and in which like reference numerals indicate like parts,

Fig. 1 is a longitudinal section through a water cooled furnace bottom, taken on the line 1—1 of Fig. 3;

Fig. 2 is a section taken on the line 2—2 of Fig. 1; and

Fig. 3 is a section taken on the line 3—3 of Fig. 1.

The embodiment illustrated comprises a furnace or combustion chamber 10 having a front wall 11, a rear wall 12 and opposed side walls 14. The front wall 11 is provided with one or

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more openings 15 through which pulverized fuel may be introduced in known manner for combustion in suspension within the furnace 10. At the rear of the furnace there is located a transverse horizontal water drum 16 from which a bank of water tubes 17 extends upwardly, the drum and tube bank forming a portion of a steam boiler of known construction.

The bottom of the furnace 10 is closed to provide a hopper within which ashes may be allowed to accumulate and from which they may be freely discharged by gravity. For this purpose a wall 19 slopes downwardly and forwardly from the rear wall 12, and a wall 20 slopes downwardly and rearwardly from the front wall 11. These converging walls meet beneath the center of the furnace to provide a V-shaped hopper bottom, the walls being so steep throughout that the hopper is self-discharging by gravity. To insure such self-discharge of the ashes, each of the walls 19 and 20 is preferably inclined at an angle of more than forty-five degrees. As illustrated, both walls have substantially the same inclination. Adjacent the junction of the two inclined walls the front wall 20 is provided with one or more openings 21 for the discharge of accumulated ashes, the number of openings depending upon the width of the furnace. Each opening 21 is controlled by a door 23 which is slidable in the plane of the wall 20 and arranged to be actuated by any suitable operating mechanism 24. Beneath each opening 21 and connected thereto is a funnel shaped dust-tight casing or chute 25 leading downwardly to a suitable ash conveyor, such as a sluice pipe 26.

The two inclined hopper bottom walls are protected from excessive heat by means of water tubes adapted to serve as steam generating elements. As shown, a row of water tubes 28 is associated with the rear bottom wall 19, and a row of water tubes 29 is associated with the front bottom wall 20. Preferably the rear tubes 28 are closely spaced, whereas the front tubes 29 are more widely spaced and bent laterally to avoid interference with the ash-discharge openings 21, as best shown in Fig. 3. The lower ends of the tubes 28 and 29 are connected to a common transverse horizontal header 31 which is supplied with water from the drum 16 by means of a row of downcomer tubes 32 located beneath the tubes 28. The header 31 is located adjacent to the junction of the two walls 19 and 20, and it is supported by means of coil springs 34. The tubes 28 and 29 extend upwardly along the furnace walls 12 and 11 respectively, and they are

suitably connected at their upper ends in known manner to the steam boiler to provide a complete path for the circulation of water through the tubes.

In the operation of the invention the closely spaced water tubes 28 will protect the walls 12 and 19, which are exposed to intense radiant heat, and the more widely spaced water tubes 29 will protect the walls 11 and 20, which are exposed to radiant heat of somewhat less intensity. The ash resulting from the combustion of the pulverized fuel will fall on the walls 19 and 20, sliding down these walls by gravity and collecting directly above the doors 23. When these doors are opened by sliding them upwardly the accumulated ashes will drop through the openings 21 into the casings 25 and the sluice pipe 26. Thus the discharge of ashes will take place by gravity alone, no hoeing or raking being required, and since the casings 25 are attached to the wall 20 around the openings 21 there will be no escape of dust into the room. The furnace bottom itself forms a hopper in which the ash may accumulate, no additional ash hopper being required. Consequently the cost of the apparatus and the space required are greatly decreased.

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

1. A hopper bottom furnace comprising two oppositely disposed inclined walls which converge and meet beneath the central portion of the furnace to form a V-shaped hopper bottom within which ashes may be allowed to accumulate, the walls being sufficiently steep to ensure self-discharge of ashes therefrom by gravity, one of said walls having an ash discharge opening therethrough adjacent the junction of the walls, a door to close the opening, a horizontal header adjacent the junction of the walls, and two separate rows of water tubes extending upwardly from the header and along the respective inclined walls, the tubes adjacent the opening being spaced apart to allow ashes to pass through the opening under the influence of gravity when the door is opened.

2. A hopper bottom furnace comprising two oppositely disposed inclined walls which converge and meet beneath the central portion of the furnace to form a V-shaped hopper bottom within which ashes may be allowed to accumulate, the walls being sufficiently steep to ensure self-discharge of ashes therefrom by gravity, one of said walls having an ash discharge opening therethrough adjacent the junction of the walls, a door to close the opening, an ash conveyor beneath the opening, a dust-tight casing connecting the opening with the ash conveyor, a horizontal header adjacent the junction of the walls, and two separate rows of water tubes extending upwardly from the header and along the respective inclined walls, the tubes adjacent the opening being spaced apart to allow ashes to pass through the opening under the influence of gravity when the door is opened.

3. A hopper bottom furnace comprising inclined front and rear walls which converge and meet beneath the central portion of the furnace to form a V-shaped hopper bottom within which ashes may be allowed to accumulate, the walls being sufficiently steep to ensure self-discharge of ashes therefrom by gravity, the front wall having an ash discharge opening therethrough adjacent the junction of the walls, a door to close the opening, a horizontal header adjacent the junction of the walls, a row of relatively closely spaced water tubes extending upwardly from the header and along the rear wall, and a row of relatively widely spaced water tubes extending upwardly from the header and along the front wall, the last-mentioned tubes being bent laterally to avoid interference with the opening.

4. A hopper bottom furnace comprising two oppositely disposed inclined walls which converge and meet beneath the central portion of the furnace to form a V-shaped hopper bottom within which ashes may be allowed to accumulate, the walls being sufficiently steep to ensure self-discharge of ashes therefrom by gravity, one of said walls having an ash discharge opening therethrough adjacent the junction of the walls, a door to close the opening and slidable upwardly in the plane of the corresponding wall to permit the discharge of ashes through the opening by gravity, an ash conveyor beneath the opening, a dust-tight casing connecting the opening with the ash conveyor, a horizontal header adjacent the junction of the walls, and two separate rows of water tubes extending upwardly from the header and along the respective inclined walls, the tubes adjacent the opening being spaced apart to allow ashes to pass through the opening under the influence of gravity when the door is opened.

5. A hopper bottom furnace comprising two oppositely disposed inclined walls which converge and meet beneath the central portion of the furnace to form a V-shaped hopper bottom within which ashes may be allowed to accumulate, the walls being sufficiently steep to ensure self-discharge of ashes therefrom by gravity, one of the walls having an ash discharge opening therethrough adjacent the junction of the walls, a door to close the opening, and water tubes extending along the said walls and so disposed as to allow ashes to pass through the opening under the influence of gravity when the door is opened.

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