Oct. 8, 1946. E. W. SHALLOCK 2,409,072

IGNITION FURNACE

Filed Aug. 26, 1943 2 Sheets-Sheet 1

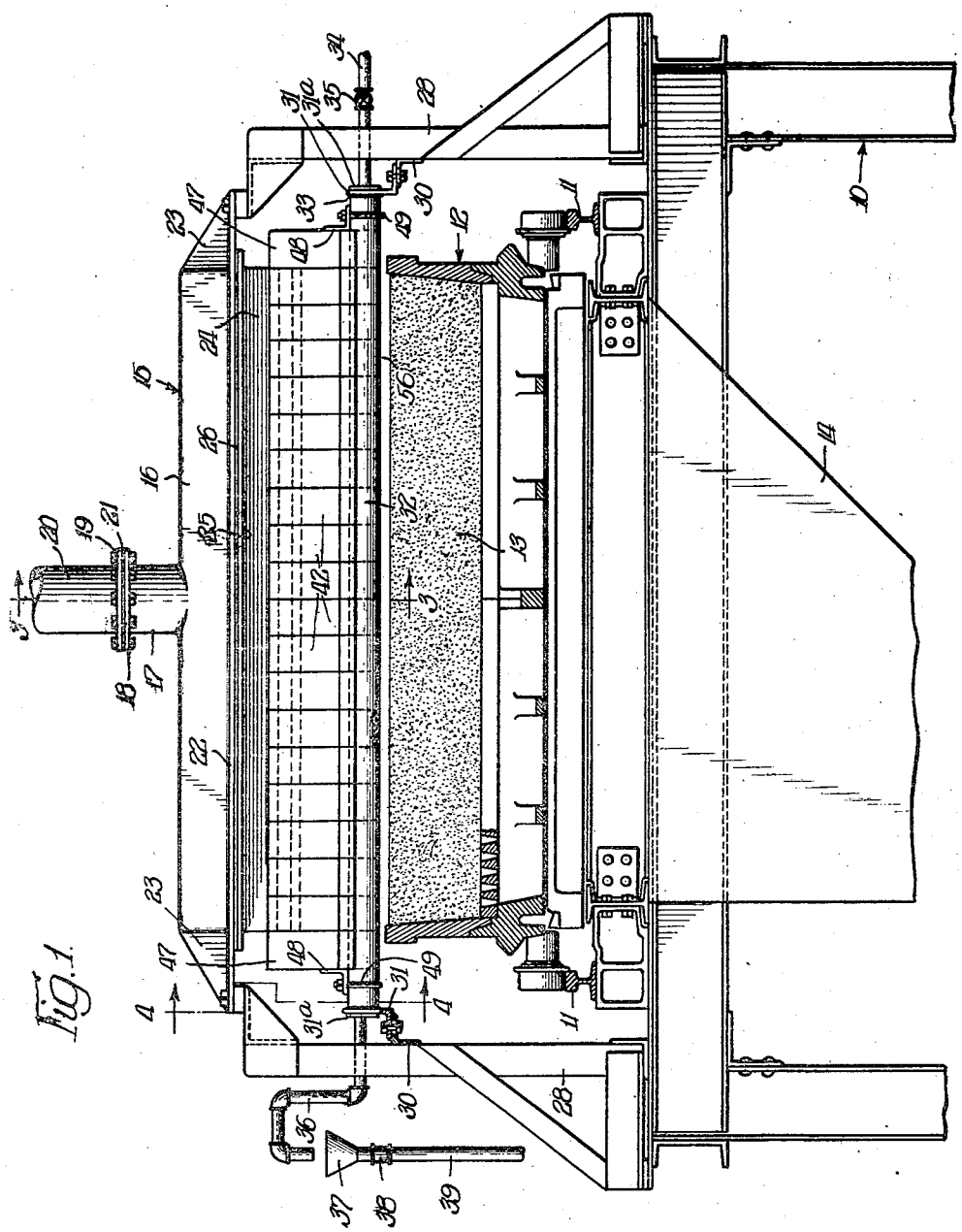


Fig. 1.

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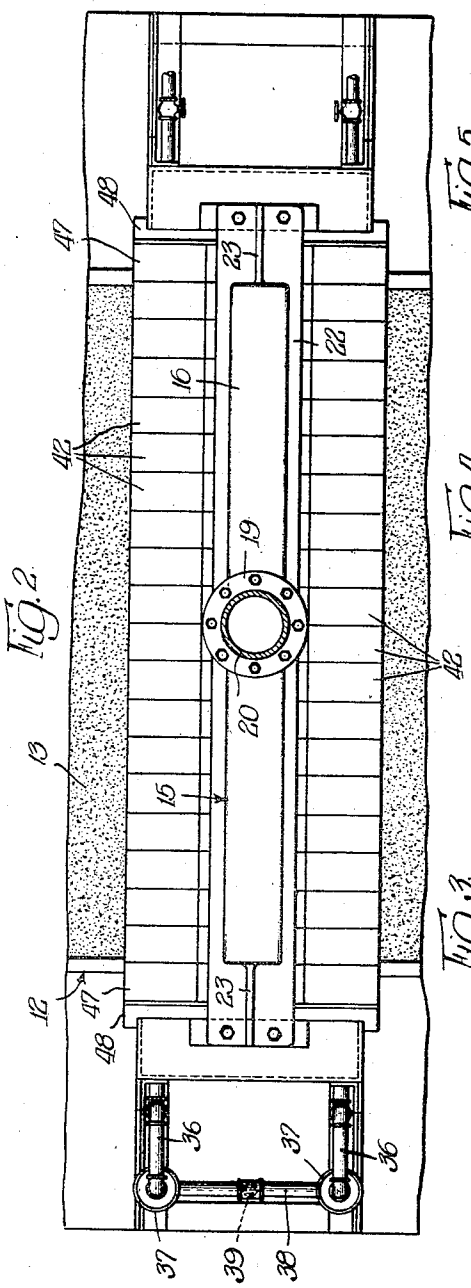


Fig. 2

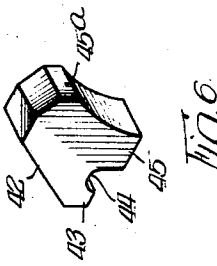


Fig. 5

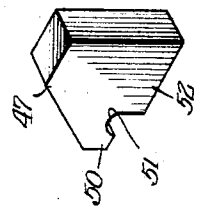


Fig. 6

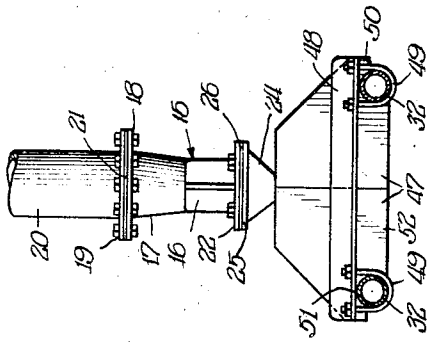


Fig. 4

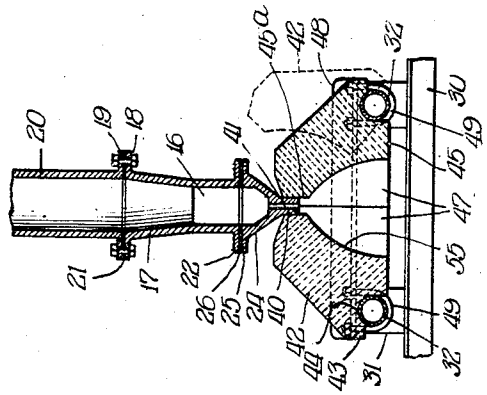


Fig. 3

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UNITED STATES PATENT OFFICE

2,409,072

IGNITION FURNACE

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Application August 26, 1943, Serial No. 500,075

8 Claims. (Cl. 266—21)

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This invention relates to ignition means, and has to do with an ignition furnace for use with sintering machines.

The ignition furnace of my invention is particularly suitable for use with sintering machines of the continuous type, in which a train of pallets disposed in endwise contact are propelled along the upper run of an endless track, where they are charged or loaded with a layer or bed of the material or materials to be sintered, the charged pallets then passing successively beneath an ignition furnace which ignites the bed of material at the upper face thereof, after which the pallets pass over wind boxes by means of which air is drawn downward through the bed of material, causing down combustion therethrough for effecting the sintering operation. After the sintering operation has been completed, the pallets pass about a return bend at the discharge end of the machine, where the sintered material is discharged, after which the pallets pass on to the lower run of the track and travel therealong to the return bend at the feed end of the machine, where they are elevated to the upper run and again charged, for repeating the operation. Continuous sintering machines of the type referred to are well known and need not be described here in greater detail.

Ignition furnaces commonly used in sintering machines of the type above referred to commonly comprise an elongated head or retort, as it is termed, having a lengthwise slot through which a combustible gas is discharged into a downwardly opening hood formed of refractory material, firebrick commonly being used. The gas is ignited within the hood, the interior length of which corresponds approximately with the interior width of the pallet transversely of the machine, so that the upper face of the bed of material is subjected throughout substantially its full width to the action of the flame of the burning gas within the hood. The gas is mixed with air in proper proportion to produce an intensely hot flame, assuring ignition of the bed of material at the upper face thereof throughout its full width. It is necessary, to assure proper ignition of the material, that the lower face of the hood be placed in proximity to the upper face of the bed of material, so as to prevent objectionable cooling by excessive cold air being drawn between the hood and the bed of material. As soon as the upper face of the bed of material is ignited, combustion thereof occurs by down draft, such combustion being rather rapid at the upper portion of the bed

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and resulting in the generation of intense heat. The lower portion of the refractory hood is thus subjected to intense heat, particularly at its lower face, by the burning gas within the hood and by the heat radiated from the burning bed of material. That results in the lower portion of the hood being quickly burned away so that it soon assumes an uneven or ragged condition, and the space between the lower face of the hood and the upper face of the bed of material is enlarged to an objectionable extent. That is objectionable for two reasons—the uneven or ragged condition of the lower face of the hood renders it difficult to obtain uniform ignition of the bed of material at the upper face thereof, with the result that uniform sintering is difficult to obtain, and, in addition, the enlargement of the space between the lower face of the hood and the bed of material permits entry therebetween of an objectionable amount of cold air, which renders it difficult, in extreme cases, to ignite the bed of material. In order to reduce the objectionable effects of the burning away of the lower portion of the hood, it is necessary frequently to renew the structure or firebricks of the hood. That is objectionable from the standpoint of expense, but is even more objectionable in that it necessitates shutting down the machine while the hood is being renewed, with resulting serious loss in production.

My invention is directed to providing an ignition furnace which avoids the above referred to objections to the ignition furnaces at present in use. More specifically, I provide an ignition furnace in which the hood portion comprises firebricks so supported as to be removed and replaced with expedition and facility, these bricks being effectively cooled at the lower portions thereof in a manner to prevent, or materially reduce, disintegration or burning away of the bricks at their lower portions by the intense heat to which they are subjected. I accomplish that result by supporting the firebricks of the hood on water conduits or pipes through which cooling water is circulated, so that the bricks, particularly the lower portions thereof, are effectively cooled in a manner to prevent objectionable heating and burning of such lower portions. In addition, the fire bricks are so mounted on the pipe supporting frame as to be readily removed and replaced thereon individually, so that selected ones of the bricks may be removed and replaced without disturbing the other bricks or the remainder of the hood structure. Further

objects and advantages of my invention will appear from the detail description.

In the drawings:

Figure 1 is a side view of an ignition furnace embodying my invention, applied to a continuous type of sintering machine of known construction and operation, above referred to, the sintering machine being shown fragmentarily in transverse section and one of the pallets being shown in section, certain parts of the machine being omitted for clearness of illustration;

Figure 2 is a plan view of the ignition furnace and the adjacent portions of the sintering machine of Figure 1;

Figure 3 is a central vertical sectional view of the ignition furnace taken substantially on line 3—3 of Figure 1;

Figure 4 is an end view of the ignition furnace taken substantially on line 4—4 of Figure 1;

Figure 5 is an isometric view of one of the firebricks used at the sides of the hood of the ignition furnace; and

Figure 6 is an isometric view of one of the firebricks used at the ends of the hood of the ignition furnace.

I have illustrated the ignition furnace of my invention as applied to a continuous type of sintering machine. This machine is of known construction and operation, described above, and a brief description thereof will suffice here. The machine comprises a suitable frame 10 carrying an endless track 11 upon which wheel-mounted pallets 12 travel. The pallets may be of any suitable known construction, but preferably are constructed similarly to the pallet, including the grate, disclosed in my Patent No. 1,722,344. The pallets 12, one of which is shown in the drawings, receive a charge, in the form of a thick layer or bed 13, of the material, or mixture of materials, to be sintered. After being charged, the pallets pass beneath the ignition furnace, as previously explained, at which time the pallet beneath the furnace is positioned above a wind box 14 through which air is drawn downward through the bed 13 for causing, in conjunction with the ignition furnace, ignition of the upper face of the bed, the pallet in its continued travel along the upper run of the track passing over successive wind boxes effective for drawing air downward through the bed 13 and causing downward combustion therein and resulting sintering of the bed of material. The construction and operation of the machine, as above briefly described, are well known and understood by those familiar with the sintering art, and further description of the machine is thought to be unnecessary except with respect to the ignition furnace, constituting my instant invention.

The ignition furnace of my invention comprises a retort 15 having a head 16 of generally elongated rectangular shape in plan provided, at its midlength, with an upwardly extending neck 17 having at its upper end an annular bolting flange 18. Flange 18 is bolted to a corresponding flange 19, at the lower end of a gas supply pipe 20, there being a gasket 21 disposed between the flanges 18 and 19 to assure a fluid-tight seal therebetween. Pipe 20 is connected to any suitable source of supply of a suitable combustible gas.

Head 16 is provided, at its lower end, with an outwardly extending peripheral flange 22 and, at each end, with a reenforcing rib 23 integrally connecting flange 22 and head 16. A nozzle member 24, provided at its upper end with an outwardly extending peripheral flange 25, is bolted to flange 22 of head 16, there preferably being a sealing gasket 26 interposed between the flange 22 of head 16 and flange 25 of nozzle member 24 to assure a fluid-tight seal therebetween. The head 16 and the nozzle member 24 together constitute a unit which is mounted on stands 28 suitably secured, as by bolting or welding, to frame 10 of the machine at the sides thereof. Conveniently, the end portions of head 16 are bolted to the upper ends of the stands 28, though the unit comprising head 16 and nozzle member 24 may be mounted in any other suitable manner.

An angle bracket 30 is secured to the inner side of each of the stands 28, conveniently by welding, and is disposed lengthwise of the machine frame 10 with its upper arm projecting horizontally inward from stand 28. A pair of angle plates 31 is disposed adjacent each of the stands 28, each with its lower arm extending horizontally outward toward the adjacent stand and seating upon the upper flange of the corresponding bracket 30, to which it is bolted. A plate 31a is welded to the outer face of the vertical arm of each of the angle plates 31. The angle plates 31 are disposed in pairs aligned transversely of machine frame 10 and the inner vertical arms of such pairs are connected by two tubular frame members 32, conveniently formed of steel piping of suitable length, the ends of which members 32 seat against the inner faces of the vertical arms of plates 31 and are welded thereto at 33. The members 32 and angle plates 31 together constitute frame members mounted upon the angle brackets 30 in position for supporting the refractory hood structure constituting the lower portion of the ignition furnace. The angle plates 31 and plates 31a, adjacent one of the stands 28, are suitably bored and tapped for reception of pipes 34 threaded therein, each provided with a suitable valve 35. The other plates 31 and 31a are also bored and tapped for reception of pipes 36 threaded therein, the pipes 34 opening into one end of the tubular members 32, and the pipes 36 opening into the other end thereof, as will be understood. Conveniently, the pipes 36, which are discharged pipes, have their outlet ends disposed above funnels 37 connected by piping 38 to a drain or discharge pipe 39 which may lead to waste. The pipes 34 are connected to a suitable source of supply of cooling water which flows through the tubular members 32, from which it is discharged through the pipes 36 into the funnels 37 and thence to waste.

The nozzle member 24 tapers downward in width, as shown more clearly in Figure 3, and is provided at its lower portion with a downwardly extending relatively narrow tip member 40 through which extends a downwardly flaring slot 41 for discharge therethrough of the fuel, conveniently gas. Firebricks 42, of generally triangular shape as shown in Figures 3 and 5, seat in sidewise contact upon the tubular members 32, as shown in Figures 1 and 2, each of these bricks being provided, adjacent its lower end, with a shoulder 43 in the lower face of which is formed an upwardly extending arcuate recess 44 conforming to the curvature of the upper portion of the tubular member 32. At its inner portion, each of the bricks 42 is provided with a downwardly projecting element 45 the lower face of which is substantially in the plane of the bottom of the associated tubular member 32. It will be

seen that the center of gravity of each of the firebricks 42 is disposed a considerable distance from the associated tubular member 32, in the direction of tip member 40, so that the firebrick tends to turn inward about the tubular member 32 so as to bring the flat inner face 45a at the upper inner end thereof in contact with the lateral face of tip member 40. In that manner the firebricks 42, each of which weighs approximately nine pounds, are held by gravity in position upon the tubular members or pipes 32, with their inner upper end surfaces 45a pressed against the exterior lateral surfaces of tip member 40. When it is desired to remove one of the firebricks 42, it may be swung about the associated pipe 32, from its full line position shown in Figure 3 to its dotted line position shown at the right of this figure, and may then readily be lifted from the pipe 32 and replaced by a similar firebrick. The end walls of tip member 40 are flat, and two end firebricks 47, formed as shown in Figures 4 and 6, are mounted upon the pipes 32 at each end of the tip member 40, the opposed faces of these firebricks 47 being flat and in contact, as shown in Figure 4. Angle retaining strips 48 extend between and above the pipes 32 adjacent the ends thereof, and are anchored thereto, conveniently by means of U bolts 49. The retaining strips 48 restrain the end bricks 47, and the intermediate bricks 42 therebetween, against movement endwise of the pipes 32, thus retaining the bricks in proper assembled relation. Each of the end bricks 47 is provided with an outwardly extending shoulder 50 provided with an arcuate recess 51 conforming in curvature to the pipe 32, for seating thereon, and has a downward extension 52 at the inner side of recess 51. These bricks are supported upon the pipes 32 in the same manner as the intermediate bricks 42, but have their opposed faces vertical and flat so as to seat one against the other, when the bricks 47 are mounted upon the pipes 32.

The inner faces of the bricks 42 are of parabolic curvature, as shown in Figure 3, and it will be seen that the bricks 42 at the opposite sides of the tip member 42 define a downwardly flaring combustion chamber 55 of parabolic cross section extending the length of tip member 40, with slot 41 opening into the top of this chamber, the ends of which are closed by the end bricks 47. The bricks 42 and 47, together with the frame structure comprising the pipes 32, constitute a refractory water-cooled hood for the ignition burner, the lower face of this hood being spaced a short distance 56 (Figure 1) above the upper surface of the layer or bed 13 of material to be ignited, in the pallet 12. Gas or other suitable fuel is admitted to the combustion chamber 55 through slot 41 of tip member 40 and is mixed with air drawn into the space beneath the hood by the action of the wind box 14, the mixture being ignited and providing a mass of flame filling the combustion chamber 55. This flaming mass serves to ignite the upper surface of the bed 13 in the manner previously described.

The pipes 32, in addition to supporting the bricks 42 and 47, also provide means for cooling the hood structure by circulating a cooling liquid, conveniently water, through the pipes 32. It will be noted that the pipes 32 are disposed at the lower portion of the hood structure, that is, adjacent the lower ends of the firebricks, and serve to cool the portions thereof subjected to the most intense heat, such cooling preventing or greatly reducing burning away of the lower portions of the firebrick. In that manner the lower faces of the bricks are maintained in an unburned and smooth and even condition, thus maintaining the space 56 between the bottom of the refractory hood structure and the upper face of the bed of material 13 in the pallets 12 substantially constant, which is conducive to uniform ignition of the upper face of the bed of material and assures maximum efficiency of the ignition furnace. The bricks of the hood structure may be removed and replaced as desired, or as may be necessary, in the manner previously described, and, ordinarily, without altering the positions of the angle retaining strips 48. Where desirable, either one of the strips 48 may be moved a short distance outward along the pipes 32, by releasing the U bolts 49, facilitating removal and replacement of the bricks, particularly the end bricks 47. While the pipes 32 of the hood structure preferably are disposed at the lower portion thereof, as shown and above described, they may be otherwise suitably disposed, within the broader aspects of my invention, which comprehends a hood structure provided with cooling means effective for preventing or reducing objectionable burning of the refractory of such structure. As above indicated, and as will be understood by those skilled in this art, changes in construction and arrangement of parts of my invention may be resorted to without departing from the field and scope thereof, and I intend to include all such variations, as fall within the scope of the appended claims, in this application in which the preferred form only of my invention has been disclosed.

I claim:

1. In an ignition furnace for sintering machines, a fuel supply retort having a downwardly extending tip member, a supporting frame disposed below said retort provided with substantially horizontal tubular members disposed at opposite sides of said tip member, said tubular members being adapted for circulation therethrough of a cooling fluid, refractory members seating adjacent their lower ends on the upper portions of said tubular members and seating adjacent their upper ends against the opposite sides of said tip member defining a downwardly opening combustion chamber, said refractory members being free from each other and from said tubular members and said tip member for individual removal and replacement, said tip member opening into said chamber for supplying fuel thereto, and refractory members mounted on said tubular members closing the ends of said chamber.

2. In an ignition furnace for sintering machines, a fuel supply retort, supporting means for said retort, a supporting frame mounted on said supporting means comprising substantially horizontal tubular members disposed below and at opposite sides of the retort, said tubular members being adapted for circulation therethrough of a cooling fluid, said retort having a downwardly extending nozzle member, refractory members seating at their outer lower portions on the upper portions of said tubular members with their upper end portions in contact with said nozzle member at opposite sides thereof defining a downwardly opening combustion chamber, said refractory members being free from each other and from said tubular members and said nozzle member for individual removal and replacement, said nozzle member opening into said combustion chamber, and refractory members

mounted on said tubular members closing the ends of said chamber.

3. In an ignition furnace for sintering machines, a pair of supporting stands, a substantially horizontal fuel supply retort extending between and supported by said stands, said retort having a downwardly extending nozzle member, a supporting frame mounted on said stands below said retort, said frame comprising substantially horizontal tubular members at opposite sides of the retort adapted for circulation therethrough of a cooling fluid, and refractory members mounted at their lower outer portions on the upper portions of said tubular members with their upper inner portions in contact with said nozzle member at opposite sides thereof, said refractory members defining a downwardly opening combustion chamber and said retort opening into said chamber for supplying fuel thereto, said chamber being closed at its ends.

4. In an ignition furnace for sintering machines, a pair of supporting stands, a substantially horizontal fuel supply retort extending between and supported by said stands, a frame supported by said stands below said retort comprising substantially horizontal tubular members at opposite sides of the retort adapted for circulation through them of a cooling fluid, and refractory members provided at their outer lower portions with recesses conforming to the upper portions of said tubular members, said refractory members seating on the tubular members with their upper inner ends in contact with the lower portion of said retort defining a downwardly opening combustion chamber, said chamber being closed at its ends and said retort opening into said chamber for supplying fuel thereto.

5. In an ignition furnace for sintering machines, a substantially horizontal fuel supply retort having a downward extension, substantially horizontal tubular members disposed below said extension at opposite sides thereof and adapted for flow therethrough of a cooling fluid, and refractory members seating at their outer lower portions on the upper portions of said tubular members extending therefrom upward and inward to said extension and seating at their upper ends against opposite sides thereof defining a downwardly opening combustion chamber, said extension opening into said chamber for supplying fuel thereto, said refractory members being free from each other and from said tubular members and extension for individual removal and replacement.

6. In an ignition furnace for sintering machines, a substantially horizontal fuel supply retort having a downward extension, substantially horizontal tubular members disposed below said extension at opposite sides thereof and adapted for flow therethrough of a cooling fluid, and refractory members seating at their outer lower portions on the upper portions of said tubular members extending therefrom upward and inward to said extension and seating at their upper ends against opposite sides thereof, said refractory members being disposed in sidewise contact and having their inner faces extending downward and outward from said extension defining a downwardly opening combustion chamber receiving fuel from said extension and being free from each other and from said tubular members and extension for individual removal and replacement.

7. In an ignition furnace for sintering machines, a substantially horizontal fuel supply retort having a downward extension, substantially horizontal tubular members disposed below said extension at opposite sides thereof and adapted for flow therethrough of a cooling fluid, and refractory members of generally triangular shape disposed in sidewise contact seating at their outer lower portions on the upper portions of said tubular members extending therefrom upward and inward to said extension and seating at their upper ends against opposite sides thereof defining a downwardly opening combustion chamber, said extension opening into said chamber for supplying fuel thereto, said refractory members being free from each other and from said tubular members and extension for individual removal and replacement.

8. In an ignition furnace for sintering machines, a substantially horizontal fuel supply retort having a downward extension, substantially horizontal tubular members disposed below said extension at opposite sides thereof and adapted for flow therethrough of a cooling fluid, and refractory members seating at their outer lower portions on the upper portions of said tubular members extending therefrom upward and inward to said extension and seating at their upper ends against opposite sides thereof, said refractory members being disposed in sidewise contact and having their inner faces of substantially parabolic curvature defining a downwardly opening combustion chamber of substantially parabolic cross section receiving fuel from said extension and being free from each other and from said tubular members and extension for individual removal and replacement.

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