

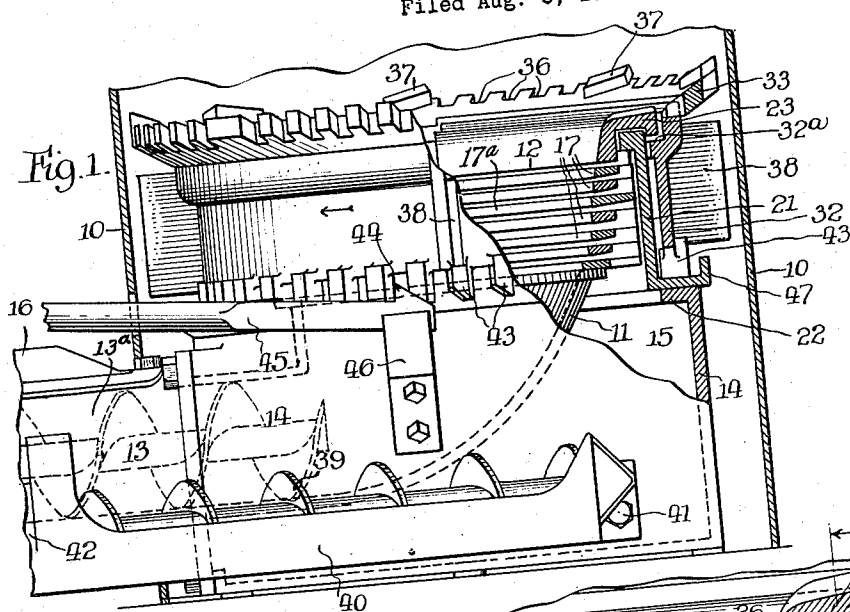
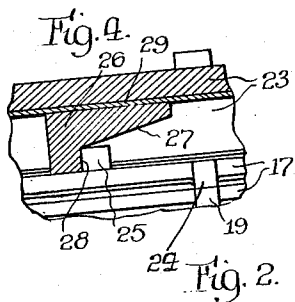
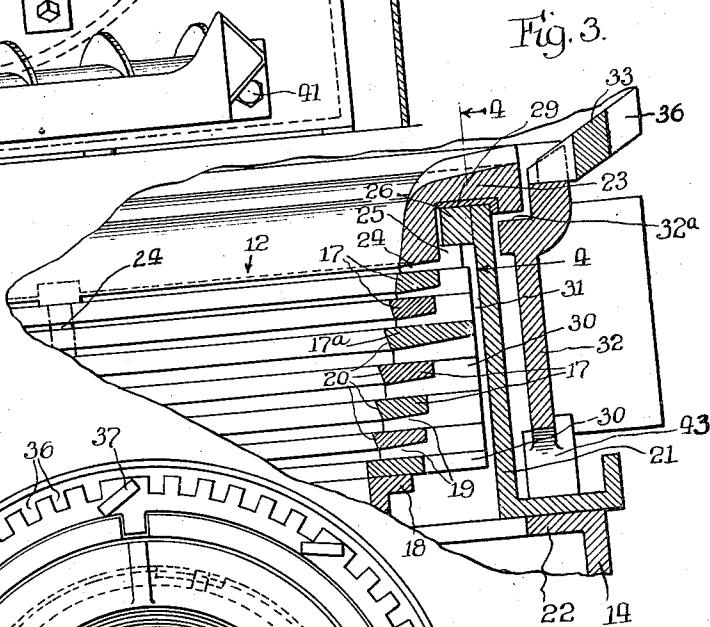
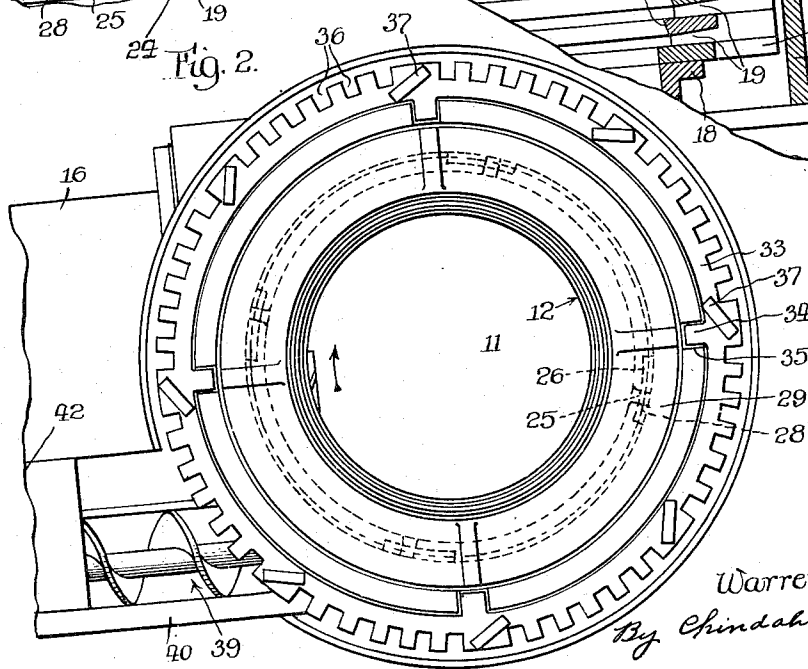
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STOKER

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STOKER

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The invention relates generally to mechanical stokers, and is particularly applicable to stokers of the underfeed type.

A general object of the invention is to provide a new and improved structure of this character which is sturdy and simple in construction, is adaptable for operation with all types of fuel, and which efficiently produces total combustion of the fuel.

Another object of the invention is to provide in a machine of this character means for efficiently supplying a large volume of air for combustion without producting what is known as "fly-ash". This fly-ash is the light, powdery particles of ash which, in stokers supplied with air under pressure for combustion purposes, is apt to be blown from the fire pot. Heretofore, fly-ash has been partially controlled by limiting the pressure of the air supplied for combustion, which method is obviously inefficient.

A further object of the invention is to provide a tuyère structure which, in construction, is divided into zones of high and low air pressure, and which embodies an arrangement of parts whereby air under the highest pressure to be used may be supplied to the tuyère zone of high pressure, while a portion of such air is reduced in pressure and is diverted to the tuyère zone of low pressure. The advantage of such a structure is that the stoker may be operated under greater pressure than could heretofore be employed, thereby insuring faster and more complete combustion of fuel while fly-ash is substantially, if not entirely, eliminated.

Another object of the invention is to provide, in a stoker, a movable member surrounding the upper rim of the fire pot and corresponding to a "dead plate", which member is arranged to facilitate the discharge of ashes and embodies a means for preventing the discharge of unburned particles of fuel therewith.

In conjunction with the foregoing, an object of the invention resides in the provision of a movable member of this nature which may be readily removed from the structure for repair or for replacement by another member which may be of different character to adapt the device for operation with a different fuel.

A further object of the invention is to provide a new and improved means for removing ashes from the retort as they accumulate, which means includes a feed screw so arranged with respect to the retort that gases or the like cannot escape past or through said screw.

Other objects and advantages will become apparent in the following description and from the accompanying drawing, in which:

Figure 1 is a view in elevation of a retort embodying the features of the invention, parts thereof being shown in central vertical section,

Fig. 2 is a plan view of said retort.

Fig. 3 is a fragmentary vertical section on an enlarged scale taken centrally of the retort.

Fig. 4 is a fragmentary section showing a detail of construction and is taken on the line 4—4 of Fig. 3.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawing and will herein described in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

While the present invention is illustrated and will be described in connection with a stoker of the underfeed type, it will be understood that many of the features of the invention are applicable to types of stokers other than the underfeed type. With particular reference to the drawing, 10 designates the walls of a furnace or the like within the lower portion of which the stoker is located. In this instance, the stoker is circular in shape and embodies a central fire pot comprised of a trough 11 and a tuyère structure 12 superimposed thereon. In operation, fuel is supplied to the fire pot through the trough 11 by a suitably driven feed screw 13 turning in a conveyer duct 13^a. A supply hopper or the like (not shown) delivers fuel to the feed screw at some point remote from the retort. The lower portion of the fire pot, which in the present form includes substantially all of the trough, is enclosed by a surrounding vertical wall 14 spaced from the trough and providing an air distributing chamber 15 thereabout. Air under pressure is supplied to this chamber from any suitable source (not shown) through an air duct 16.

The tuyère structure 12 is supported largely by the trough and also by the wall 14. In construction, the tuyère structure comprises a number of annular tuyère rings 17 of gradually increasing diameters arranged to be mounted one upon the other with the lower ring resting upon an out-turned flange 18 (Fig. 3) provided on the rim of the trough. Each ring is supported in spaced relation to the next lower ring by such means as a number of substantially equidistant lugs 19 whereby tuyère openings are provided between the rings through which air is delivered to the fuel within the fire pot. In cross section, each ring (except the lowermost one) increases in thickness from outer to inner diameter, with the slope occurring on the bottom face of each ring. This provides a restricted tuyère opening or air passageway between adjacent rings. The inner faces of the rings are preferably beveled from top to bottom as at 20 so that the tuyère

openings in cross section are generally Venturi-shaped and have substantially the effect of a venturi on air passing therethrough. Thus, complete diffusion of air throughout the fuel mass is obtained.

The wall 14 supports, on its upper edge, a cylindrical frame member 21 which extends upwardly above the position occupied by the upper one of the tuyère rings. The frame member 21 is roughly L-shaped in cross-section and is supported on the wall 14 through an abutment of the horizontal leg of the frame with an intumed horizontal flange 22 formed on the wall 14. Suitable securing means (not shown) may be employed rigidly to unite the parts.

One purpose of the frame 21 is to support and maintain the tuyère rings in place. To this end, an annular member 23 constituting the rim of the fire pot is provided, which rim is channel-shaped. The inner side of the rim is of substantial width, provides a continuation of the tuyère structure, and is spaced from the upper tuyère ring by lugs 24 (Fig. 3) to form another series of tuyère openings between the rim and the upper ring. The rim straddles the upper edge of the frame member 21 and is secured thereto to hold the parts rigidly together. Preferably, the rim and the frame member are secured together in a manner which permits the rim to be readily removed from the assembly.

A preferred form of securing means comprises the following structure: The rim 23, at spaced intervals about the inner leg thereof, has a plurality of integrally formed lugs 25 (Figs. 3 and 4) thereon which extend horizontally into the channel of the rim. The frame 21, adjacent its upper edge, has a corresponding number of bosses 26 formed on the inner surface thereof. The bosses 26, as may be clearly seen in Fig. 4, are of substantial length and at one side are cut away to form a sloping surface 27 which terminates abruptly at a shoulder 28. This arrangement of parts allows the rim 23 to be properly located with respect to the tuyère rings and the frame 21, after which a slight rotation of the rim brings the lugs 25 thereon into engagement with the tapering surfaces 27, which engagements lock the rim and frame together. This rotational locking engagement is, as may be seen in Fig. 4, limited by the engagement of the lugs 25 with the shoulders 28. If desired, a layer of sealing material 29 may be interposed between the abutting surfaces of the rim and frame.

Each of the tuyère rings 17 is provided with a number of outwardly and radially extending bosses 30 which preferably constitute continuations of the spacing lugs 19 and extend substantially into abutment with the frame 21, thereby to prevent lateral displacement of the tuyère rings.

It will be evident from the foregoing that, when air under pressure is supplied from the conduit 16 to the distributing chamber 15, the air may pass upwardly to the tuyère openings through the passageway defined by the frame 21 and the tuyère rings. Heretofore the pressure under which the air may be admitted has been limited by the amount of fly-ash produced thereby. This fly-ash, of course, is produced only from the upper surface of the fuel bed where the air blast encounters the entirely consumed and light particles of ash. The present invention eliminates the production of fly-ash by providing a means associated with the tuyère structure which provides a zone of high air pressure throughout the

lower portion of the tuyère structure and a zone of low air pressure throughout the upper portion of the structure.

With reference to Fig. 3, an intermediate one of the tuyère rings, which ring is herein indicated as 17^a, is of such width that the ring extends to a point adjacent but slightly spaced from the frame 21. This ring, therefore, prevents the free passage of air to the tuyère openings above the ring 17^a. The clearance 31 between the outer periphery of the ring 17^a is predetermined to allow a proper amount of air to pass therebetween to the upper tuyère openings, the pressure of the air, of course, being reduced by the restricted opening. Moreover, the size of the tuyère openings above the ring 17^a is smaller than that of the other openings to further restrict the flow of air into the fuel bed. As a consequence, the tuyère openings below the ring 17^a are supplied with air under full pressure and constitute a zone of high air blast, while the tuyère openings above the ring 17^a receive air under lower or reduced pressure and form a zone of low air pressure. Thus, air under a greater pressure than could normally be used, may be supplied to the lower portion of the tuyère structure to insure a complete and efficient combustion of the fuel, while the injection of air under low pressure throughout the upper portion of the tuyère structure provides an ample quantity of air for combustion purposes while substantially eliminating or, at least, reducing to a minimum the creation of fly-ash.

The present device embodies an improved means for discharging ashes from the fire pot and for removing such discharged ashes from the retort. As shown in Fig. 3, the frame 21 is encircled by a concentrically arranged ring 32, the lower edge of which is loosely supported by the horizontal portion of the frame 21. The ring extends upwardly into a position adjacent the upper portion of the rim 23 and has an upwardly facing shoulder 32^a underlying the outer leg of the rim 23 to maintain the ring in place. An annular grate member 33 is mounted upon the upper edge of the ring 32 for detachment therefrom as by means of a plurality of lugs 34 (Fig. 2) formed on the grate 33 and engaging recesses 35 provided in the edge of the ring 32.

The outer periphery of the grate 33 has a series of notches 36 formed therein to facilitate the discharge of ash over the edge of the grate. The upper surface of the grate carries a plurality of peripherally spaced elongated ribs 37 (Figs. 1 and 2) disposed angularly with respect to the radius of the grate and extending substantially from the outer to the inner margins thereof. The grate, which is rotatably driven by means to be hereinafter described, carries the ribs 37 therewith, which ribs act to engage and break up the upper portion of the bed of coals and ash issuing from the fire pot over the rim 23. Further, the angular relationship of the ribs is such that, in the rotation of the grate, the larger particles of the material, which contain substantially all of the unconsumed fuel, are engaged thereby and are moved toward the center of the fire pot. The action of the ribs in both breaking up large particles of material and moving the larger particles inwardly produces an efficient operation of the device in that practically no unburned fuel can be discharged with the ashes. By locating the walls of the furnace closely adjacent to the periphery of the grate, the size of the particles of ash which can be discharged over the grate may be limited and further eliminate the possibility of

the passage of unburned particles of fuel from the fire pot.

As ashes are discharged from the grate, they fall into the space provided between the walls 10 of the furnace and the wall 14 of the air chamber. These ashes are allowed to accumulate in this space until substantially all of the wall 14 is covered, so that the ashes form a seal about the lower portion of the retort to prevent the escape of gases therefrom.

For removing an excess of ashes from within the furnace, the following structure is provided. The ring 32 carries a plurality of radially and outwardly extending plates 38, the outer edges of which are positioned adjacent to the walls 10 of the furnace. As the ring 32 and grate 33 are rotated, these plates 38 engage the excess of ashes and convey them to a common removal point. This removal point is herein designated by an ash conveyer screw 39 (Fig. 1) of customary construction, which is journaled for rotation with one end of the conveyer screw extending into the furnace and located in the space between the wall 10 and the opposed wall 14. The inner end of the conveyer screw is disposed in an upwardly opening trough 40 which, for convenience, may be secured as at 41 to the wall 14. Ashes delivered to the conveyer screw by the plates 38 will be removed thereby from the furnace through a conveyer duct 42 to a disposal point. The conveyer screw is driven in any suitable manner (not shown). By locating the conveyer screw externally of the retort structure itself, the natural draft of the burner will prevent gases from escaping from the furnace through the ash conveyer screw, this effect being amplified by the sealing action of the ashes throughout the lower portion of the furnace.

While any suitable means for rotating the grate assembly may be employed, that which is shown in Fig. 1 is preferred. A series of enlarged spaced heads 43 are formed on the lower portion of the ring 32 and extend outwardly from the vertical plane of the ring. These spaced heads constitute ratchet teeth and are engageable by a pawl 44 carried by the end of an arm 45 to which reciprocating motion is imparted by any suitable means (not shown). A bracket 46 carried by the wall 14 supports the pawl 44 for engagement with the heads 43. The horizontal leg of the frame member 21 is cut away adjacent the pawl end of the arm to allow the pawl to engage the teeth and these parts are preferably located over the trough 40 so that ashes falling onto the horizontal leg will be carried by the ratchet teeth and deposited, through the cut-away part, in the trough. Reciprocation of the arm 45 will, therefore, produce intermediate rotary movement of the ring 32 and grate 33 about the fire pot. Preferably, the outer end of the horizontal leg of the frame 21 has a short, upwardly extending flange 47 providing a guide for the ring 32.

The direction in which the rim 23 is rotated, in order to effect the interlock thereof with the frame 21, is preferably determined by the direction in which the grate rotates. That is to say, if the grate is driven in a clockwise direction, as indicated by the arrows in Figs. 1 and 2, the rim 23 will be rotated in the same direction or clockwise in order to effect the interlock of the lug 25 with the boss 26. Hence, in operation, rotation of the grate has a constant tendency to drive the lug 25 toward the shoulder 28, or to maintain

engagement of these parts after it has once been effected.

It will be apparent from the foregoing that a structure has been provided which is exceedingly simple and which may be readily disassembled for inspection, replacement, or repairs. By simply turning the rim to release the interlock, the rim may be removed after which the entire tuyère structure is accessible for removal. The grate 33 may be removed by simply lifting it from its engagement with the ring 32. This permits the grate to be readily replaced by another of the same size or, if deemed desirable due to a change in fuel, a grate of greater or lesser width may be substituted. The advantages of the simple construction, coupled with the advantages of the tuyère structure, produce a stoker which is efficient and economical in operation.

I claim as my invention:

1. In a tuyère structure for a stoker, the combination of a plurality of annular sections arranged one upon the other, means for supporting said sections in vertically spaced relation to each other to provide air emission openings therebetween, means defining an encircling passageway for delivering air to said openings, and means extending laterally substantially across said passageway intermediate the upper and lower ends of said tuyère structure to restrict the flow of air through said openings on one side of said last mentioned means.

2. In a tuyère structure for a stoker, the combination of a plurality of annular sections arranged one upon the other, means for supporting said sections in vertically spaced relation to each other to provide air emission openings therebetween, a wall encircling said sections and spaced therefrom to provide a passageway for delivering air through said openings, one of the intermediate sections being of such width as to extend closely to said wall whereby to define a restriction in said passageway to limit the volume of air flowing to the openings on one side of said widened intermediate section, and means for delivering air under pressure to the passageway on the opposite side of said section.

3. In a stoker, the combination of a vertical tuyère structure having an annular and separately formed rim at the top, a wall encircling said tuyère structure and underlying a portion of said rim to support said rim in place, and a rotating member supported by a flange formed on said wall and closely encircling said rim, said rim and wall having complementary interlocking members thereon engageable by rotation of said rim relative to said wall in the direction of rotation of said rotating member.

4. In a stoker of the underfeed type, the combination of a stationary vertical tuyère structure through which fuel is fed upwardly, an annular rotating grate closely encircling the upper portion of said structure and adapted to receive ashes from said structure and to discharge such ashes from its outer periphery, and means on said grate adapted to prevent the movement of large particles of material from said structure outwardly over said grate.

5. In a stoker of the underfeed type, the combination of a tuyère structure through which fuel is fed, a rotating grate encircling the upper portion of said structure and extending outwardly therefrom, and angularly inclined ribs on said grate arranged to engage large particles of material moving from said structure and return said particles thereto.

6. In a stoker, the combination of a fire pot, a rotatable member encircling said fire pot and having a peripheral edge over which ashes discharged from said fire pot may fall, an enclosing wall spaced about the lower portion of said fire pot and said member and providing therewith a compartment to receive ashes falling over said edge, ash removing means located at one side of said fire pot between said fire pot and enclosing wall, and means carried by said rotatable member and facing said wall for conveying ashes which have fallen into said compartment to said ash removing means.

7. In a stoker of the underfeed type, the combination of a feed trough, a fire pot surmounting said feed trough, a wall enclosing said fire pot and said trough and defining an air chamber, a rotating grate encompassing said fire pot and arranged to discharge consumed residue over the outer peripheral edge thereof, a furnace wall enclosing said retort, said grate having a plurality of closely spaced notches formed in said edge and facing said wall, said furnace wall being spaced from said first mentioned wall to provide an ash receiving compartment underlying said edge of said grate, plates movable with said grate and arranged to engage an excess of ashes accumulating in said compartment, and means located in said compartment for removing ashes therefrom as said ashes are delivered thereto by said plates.

8. In a stoker of the underfeed type, the combination of an upwardly opening fire pot, the upper peripheral edge of said pot having an external flange, a plurality of vertically superimposed rings mounted on said flange and defining tuyère openings, said openings converging in size toward their outlets, an annular rim resting upon the upper one of said rings and defining a plurality of tuyère openings therewith, a base wall encircling said fire pot, a cylindrical wall mounted on said base wall and encircling said rings, said walls defining an air chamber in communication with said openings, the underside of said rim being formed with an annular groove receiving the upper edge of said cylindrical wall, and a grate structure mounted for rotation about said rim and extending upwardly and outwardly therefrom.

9. In a stoker of the underfeed type, the combination of an upwardly opening fire pot, the upper peripheral edge of said pot having an external flange, a plurality of vertically superimposed rings mounted on said flange and defining tuyère openings, an annular rim resting upon the upper one of said rings and defining a plurality of tuyère openings therewith, a base wall encircling said fire pot, a cylindrical wall mounted on said base wall and encircling said rings, said walls defining an air chamber in communication with said openings, said rim resting on said cylindrical wall, a grate structure mounted for rotation about said rim and extending upwardly and outwardly therefrom, and a plurality of elongated ribs on the upper face of said grate structure, said ribs being angularly disposed with respect to the radius in a direction to return unconsumed fuel from said grate structure to said rim.

10. In a stoker, in combination, a centrally located fire pot, a tuyère structure mounted on said fire pot, a wall encircling said tuyère structure and defining an air chamber thereabout, said wall

being formed with a peripheral flange on the exterior defining an upwardly opening track, a cylindrical member loosely encircling said wall and rotatably mounted in said track, and a plurality of peripherally spaced radially extending paddles on the exterior of said cylindrical member.

11. In a stoker, in combination, a centrally located fire pot, a tuyère structure mounted on said fire pot, a wall encircling said tuyère structure and defining an air chamber thereabout, said wall being formed with a peripheral flange on the exterior defining an upwardly opening track, a cylindrical member loosely encircling said wall and rotatably mounted in said track, a plurality of peripherally spaced outwardly extending paddles on the exterior of said cylindrical member, and an ash ring encircling the upper portion of said tuyère structure and extending upwardly and outwardly therefrom, said ring being mounted on and rotatable with said cylindrical member and overlying said paddles.

12. In a stoker of the underfeed type, the combination of an upwardly opening fire pot, a plurality of vertically superimposed rings mounted on said pot and defining tuyère openings, an annular rim resting upon the upper one of said rings, a base wall encircling said fire pot, a cylindrical wall mounted on said base wall and encircling said rings, said walls defining an air chamber in communication with said openings, said rim resting on said cylindrical wall and projecting outwardly beyond said wall, interlocking means for detachably securing said rim to said cylindrical wall, said cylindrical wall being formed about its outer periphery with an outwardly opening annular track, a cylindrical member loosely encircling said cylindrical wall and rotatably mounted on said track, said cylindrical member partially underlying the outer peripheral edge of said rim, and a plurality of ash paddles on the exterior of said cylindrical member.

13. In an underfeed stoker, the combination of a vertically disposed tuyère structure comprising a plurality of superimposed rings defining a plurality of annularly and vertically spaced air inlet openings, said rings in the lower portion of said structure defining relatively large air inlet openings and in the upper portion of said structure defining relatively small air inlet openings, means defining an air chamber about said structure in communication with said openings, an air flow restriction in said chamber between said upper and lower portions of said structure, and means for supplying air under pressure to said chamber below said restriction.

14. In a fire pot for a stoker of the underfeed type comprising, in combination, a trough having an annular upwardly opening face, a tuyère structure supported by said trough above said face and comprising a plurality of superimposed ring sections, a vertical annular wall encircling said tuyère structure and extending above said structure, an annular rim supported on the top of said wall and extending at its inner periphery into the upper end of said wall into cooperative relation with the top of said tuyère structure, and complementary interengaging means formed on said rim and the interior of said wall and operable upon relative rotation to detachably secure said wall and said rim together.

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