March 4, 1958 F. BENOIT-CATTIN 2,825,293

REVOLVING-GRATE FURNACE

Filed March 21, 1955 2 Sheets-Sheet 1

Fig. 2.

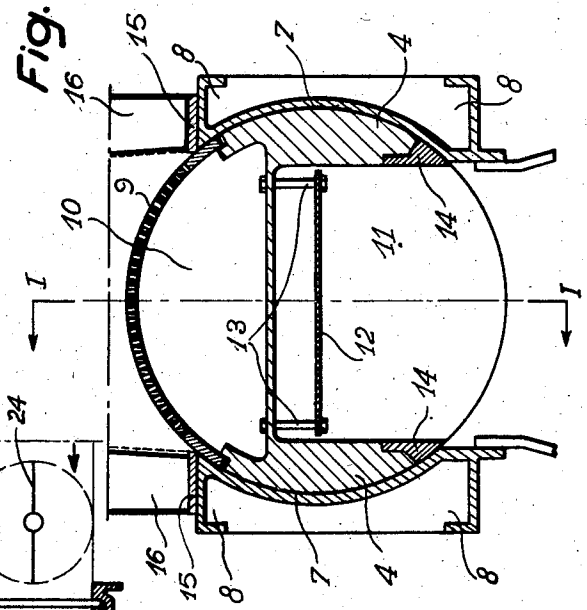
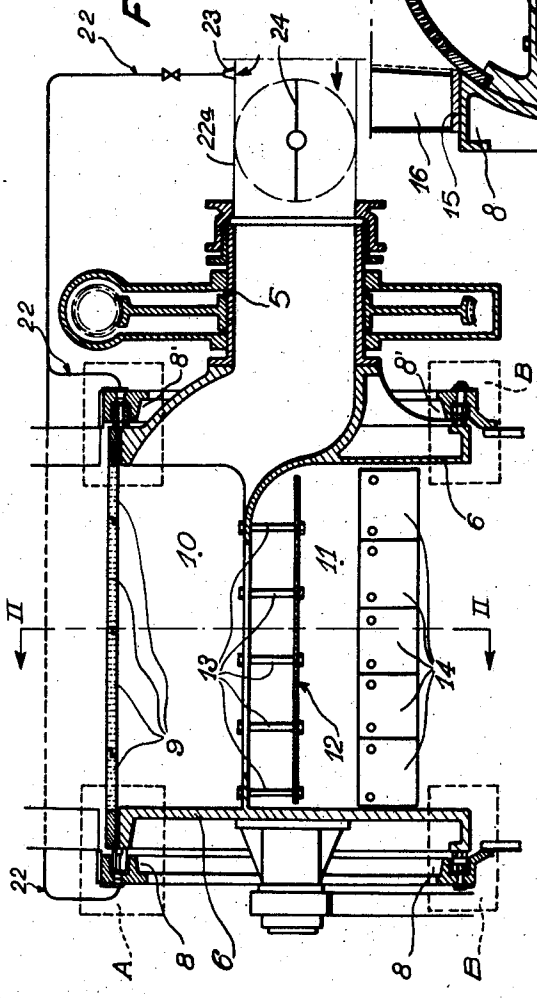


Fig. 1



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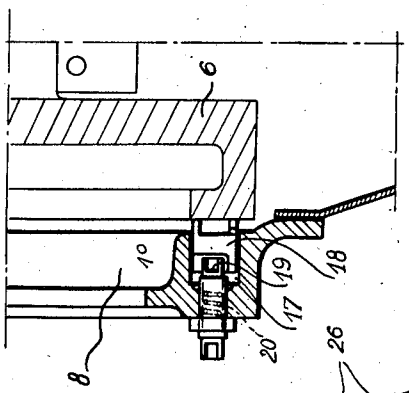


Fig. 4

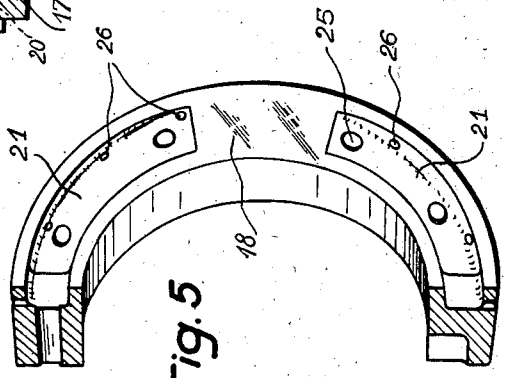


Fig. 5

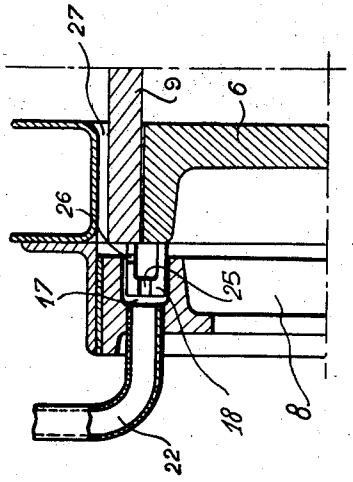


Fig. 3

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REVOLVING-GRATE FURNACE

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Claims priority, application France March 25, 1954

10 Claims. (Cl. 110—35)

This invention relates to revolving-grate furnaces, particularly of the type used for burning low-grade fuels such as domestic refuse and the like.

One existing type of such revolving-grate furnace has a fixed furnace structure that generally comprises four upstanding walls defining a rectangular enclosure, and formed of refractory masonrywork, preferably water-jacketed, and a revolving grate in the form of a part-cylindrical surface revoluble about its horizontally extending axis, and so positioned as to have an uppermost arcuate portion of the cylindrical surface projecting up between said walls to define the floor or bottom of said enclosure. The revolving grate includes a perforate arcuate section extending over part of its circumferential extent to constitute the actual grate, and to either side of this section there are two solid sections which are diametrically opposed to each other, and are interconnected by a flat web across the cylinder. The remainder of the cylindrical surface is open, so as to define a slagging cavity. The chamber defined between the perforate grate section and the transverse web constitutes a blast chamber, and opening into it through one of the two end flanges which seal the opposite ends of the cylindrical structure is a conduit through which blast air is delivered into the blast chamber.

The structure just described is mounted for rotation about its axis so that it can be made to assume either of two operative positions, respectively constituting a firing and a slagging position. In the firing position, the perforate grate section is uppermost; this position obtains during the actual periods of combustion; during these periods blast air is being discharged into the blast chamber. This air is then discharged through the spaced perforations into the combustion chamber overlying the grate and ensures a substantially uniform combustion throughout the body of fuel despite the large differences in permeability which will generally be present between different areas of the body of fuel due to the character of the low-grade fuel contemplated herein. In order further to reduce the effect of such differences in permeability and draft, fuel is supplied to a considerable depth over the grate and this necessitates the use of high blast pressures. This in turn increases the liability of leakage occurring through the spaces between the grate structure and the furnace walls. Such leaks are particularly obnoxious owing to the high content of dust and ash in the fuel, which dust and ash is discharged with the leakage air causing damage to mechanical parts, as well as being highly detrimental to sanitary conditions.

After combustion has proceeded a sufficient length of time so that a considerable amount of ash and slag is present over the perforate grate, the grate assembly is rotated about its axis so as to bring the slagging cavity uppermost between the furnace walls, at which time the perforate grate will be directed downwards. The ash and slag is thus allowed to drop into the cavity which becomes filled with a body of slag. As the rotation of the grate assembly is continued this body of slag is

allowed to drop into a suitable container or other means of disposal, and the perforate grate section is returned to its uppermost position. However it often occurs that the body of slag and ash filling the cavity may include various hard objects, such as pieces of metal or rock or building material or other rubbish, and this can interfere with the rotation of the grate assembly. Should this condition occur, the grate assembly is usually rotated a slight amount in the reverse direction so that any hard object which may have become jammed against the periphery of the slagging cavity is released and falls into the cavity, whereupon normal rotation of the assembly can generally be resumed. However, the necessity of such reverse rotation constitutes a drawback in operation of the furnace and does not always succeed in averting damage to the assembly from objects becoming wedged between the grate and furnace walls.

Another difficulty attending the use of the known type of revolving-grate furnace now being discussed arises out of the fact that different low-grade fuels may differ in the ash content thereof. Thus domestic refuse usually has a lower ash content than do shales. When a lower-ash fuel is being burned the time interval between successive slagging operations will usually be longer than when burning fuels having a higher ash content, in order to fill the slagging cavity to capacity. As a result, with a grate assembly in which the capacity of the slagging cavity is predetermined for high-ash fuel, the mass of slag which is allowed to collect between slagging operations when a lower-ash fuel is being used, will be so large and compact as to prevent satisfactory draft conditions from being maintained.

It is a general object of this invention to provide an improved furnace particularly designed for burning low-grade fuel, such as domestic refuse, shales, and the like.

Another object is the provision of an improved revolving grate assembly for such a furnace.

A further object is to minimize leakage in a rotary-grate furnace of the type described, and particularly to prevent or minimize the discharge of ash and dust, especially in cases where low-grade fuels having high ash and dust-contents are being used. In this connection it is an important object of the invention to improve the sanitary conditions accompanying the operation of furnaces burning very low-grade fuels.

Yet a further object is to improve the operation of such rotary-grate furnaces as regards the possibility of hard objects interfering with the rotation of the rotary-grate assembly, thereby facilitating the operation of the furnace and increasing the service life of the constituent parts thereof.

Another object is to provide means whereby a rotary grate assembly for a furnace of the type described will be adapted for burning fuels differing widely from one another in ash content, while permitting optimum operating schedules for each type of fuel. In this connection, it is an object to provide a rotary grate assembly of the kind specified, wherein the capacity of the slagging cavity is adjustable.

Yet a further object is the provision of such a grate assembly which is relatively simple and economical to construct and operate and wherein the parts subjected to severe wear and tear are readily replaceable.

The above and further objects and advantages of the invention as well as the characteristic features thereof will appear from the ensuing disclosure made with reference to the accompanying drawings, wherein one exemplary embodiment of the invention is diagrammatically illustrated for purpose of disclosure but not of limitation. In the drawings:

Fig. 1 is a longitudinal sectional view of an improved

revolving grate furnace in accordance with this invention, and taken along the line I—I of Fig. 3;

Fig. 2 is a cross sectional view of the improved furnace taken along the line II—II of Fig. 1;

Fig. 3 is a large-scale view of the detail enclosed in block A in Fig. 1;

Fig. 4 is a similar view of detail B of Fig. 1; and

Fig. 5 is an isometric perspective view of one of the seal ring members used according to the invention, broken away on a diametric plane of the ring, and with the ratio of the cross-section of the ring to the diameter of the latter being considerably exaggerated for purposes of clarity.

As shown in the drawings, and particularly in Figs. 2 and 3 thereof, a cylindrical grate according to this invention comprises a recessed cylindrical body **4** formed as an integral casting, with a pair of end plates or flanges **6**. The outer surface **7** of the grate body is preferably machined or ground to moderately close tolerances to reduce the amount of clearance space required between the body of the revolving grate and the stationary structure **8** of the furnace.

The actual grate section **9** is formed from one or more removable elements as shown in Fig. 1, shaped as an extension of the cylindrical surfaces **7** and interconnecting these surfaces on one side of a complete cylinder. On the opposite side the cylindrical surface between the surfaces **7** is allowed to remain open, thereby defining a slag cavity **11**. An integral transverse web or wall of the body **4** separates this slag cavity **11** from a blast chamber **10** defined in the other side of the cylinder internally of the grate section **9**. Moreover, the slag cavity **11** is provided with a false bottom formed by a sheet element **12** secured to the above mentioned transverse web in spaced relation therewith by means of posts such as **13**. Desirably these spacer posts **13** may be readily removed and replaced with spacer posts of different sizes so as to adjust the capacity of the slag cavity in accordance with the ash content in the particular type of fuel used.

The grate body is fitted with removable cutter blade members as illustrated at **14**, which are adapted to cooperate with backing members **15** inserted as shown between the water-jacketing **16** (which may be replaced by an ordinary refractory lining if preferred), and the stationarily supporting structure **8**. The cutter members are made of hard steel or other suitable alloy possessing high hardness at elevated temperatures, and high resistance to wear and corrosion.

Means are provided according to the invention for minimizing the leakage apt to occur from the ends of the revolving-grate cylinder and for ensuring that any leakage there occurring will be limited to pure air rather than heavily dust and ash-laden smoke as would otherwise be the case.

For this purpose, the stationary structure **8** is formed at each end with an annular groove **17** (see Fig. 4) in which is received a seal ring **18** having a rectangular cross sectional shape, such that the ring is freely movable in a direction parallel to the axis of rotation of the cylindrical grate. As shown in Fig. 1 such a ring is provided at each end of the grate cylinder. Each ring is applied against the adjacent end face of the grate cylinder body by a set of presser members or pistons **19** subjected to the action of springs **20**. The number of presser members and springs in each set depends on the diameter of the grate so that the spacing between consecutive presser pistons will in each case be small enough to prevent objectionable distortion of the seal rings.

Each ring **18** is laterally provided with an arcuate groove **21** extending over a major part of the periphery of the ring, though said groove may be interrupted in one or more areas, as shown (Fig. 5), to provide thickened reinforcing sections.

A blast conduit **22** tapped from the main blast delivery line **22a**, at a point **23** ahead of the control valve **24**, connects with the end wall of the groove **17** as shown in Fig. 3. The air blast delivered by pipe **22** flows through a plurality of holes such as **25** formed through the ring **18** to issue therefrom into the groove **21**. The ring **18** is moreover formed with a further set of small orifices or ducts **26** extending radially of the ring through the outer wall of the groove **21**. The air issuing out through these ducts acts to prevent the outflow of leakage gases which otherwise would tend to leak out through the gap **27** between the grate cylinder body and the stationary furnace structure; leakage of combustion gas is thus prevented at the cost of only an insignificantly small loss of blast air.

It will be understood that many modifications can be made in the details of the specific embodiment of the invention illustrated and described in detail herein without exceeding the scope of the invention. It will be appreciated that while the various improved features described may be applied separately within the scope of the invention, the combination of said features in a revolving grate furnace achieves a greatly improved unit in which the combustion capacity and efficiency, as well as the labor conditions attendant on the operation thereof, are greatly improved over comparable furnaces of the prior art.

What I claim is:

1. In a furnace of the type described, the combination of stationary structure including means defining two spaced side furnace walls and two spaced end furnace walls, a revolving grate assembly comprising a body including two spaced symmetrical elements having outer surfaces defining diametrically opposite arcuate surface portions of a common cylindrical surface having a horizontal axis, a flat web interconnecting said elements and defining a plane parallel with the geometrical axis of the cylindrical surface, perforate grate means connected with both of said elements and defining an arcuate surface portion of said cylindrical surface between said opposite surface portions to one side of said web, the space defined between said grate means, said elements and said one side of the web providing a blast chamber, blast conduit means connected with said chamber for discharging blast air thereinto, the space defined between said elements and the other side of the web being left open to provide a slag cavity oppositely related to said grate means, means mounting said assembly for rotation with respect to said furnace walls about said axis between a firing position wherein said grate means lies uppermost between said walls and a slagging position wherein said slag cavity lies uppermost between said walls, a pair of end flanges for said grate assembly in adjacent relation to said respective end walls and defining therewith a pair of leakage spaces out of said blast chamber, each of said end walls having an annular circumferential groove therein facing the peripheral portion of a related one of said end flanges, a ring member received in each groove for limited axial sliding movement towards and away from said related peripheral end flange portion, means resiliently urging said ring members against said peripheral end flange portions, and conduit means connected with an axially outer end surface of each groove and adapted to be connected with a source of pressure air, said ring members having orifices therein for discharging through and out of said leakage spaces the pressure air fed to said grooves by way of said conduit means.

2. In a furnace the combination as claimed in claim 1, wherein said resilient means urging the ring members includes a plurality of piston like members slidably mounted in each said end wall for engagement with the axially outer surface of the related ring member in angularly equispaced relation around said ring member and springs associated with said piston members for urging the latter against said ring members.

3. In a furnace the combination as claimed in claim 1, wherein each ring member has an arcuate recess in the

axial end face thereof directed towards said related end flange, and said orifices are defined by longitudinal ducts formed through said ring member and opening into said recess, and transverse ducts formed through a radially outer side of said recess and opening into said leakage space.

4. In a furnace the combination as claimed in claim 1, wherein said rotational mounting means comprise end journal means for said assembly, at least one of said journal means having a recess communicating with said blast chamber, and wherein said blast conduit means is connected with said recess in the journal means.

5. In a furnace, the combination as claimed in claim 1, wherein said assembly further comprises a flat member defining a false bottom for said slag cavity, and interchangeable means supporting said flat member in parallel spaced relation to said web within said slag cavity.

6. In a furnace, the combination as claimed in claim1, further comprising cutter blade means removably secured to said elements of the assembly at the respective sides of said slag cavity and having cutting edges lying along said cylindrical surface, and backing means supported by said furnace side walls in a position for cooperating with said cutter means on rotation of said assembly to and from said slagging position.

7. In a furnace of the type described, the combination of fixed structure defining furnace walls, a revolving assembly defining a part cylindrical surface including a first arcuate section defining a perforate grate and two diametrically opposite solid arcuate sections connected with opposite arcuate ends of said first section, a flat transverse web interconnecting said solid sections and defining a blast chamber with said first arcuate section, blast conduit means connected with said chamber, means for mounting said assembly for rotation about a horizontal axis coaxial with said cylindrical surface between a firing position wherein said first grate section is uppermost between said furnace walls and a position wherein said first section is lowermost, end flanges for said assembly in sealed relation with said first arcuate section and said solid arcuate sections, said end flanges being positioned adjacent to, and defining leakage spaces with, respective end ones of said furnace walls, a ring member received between each end wall and the adjacent end flange for limited axial movement therebetween, said ring members having apertures therein, and means for discharging blast air through said end walls and said apertures in the ring members into said leakage spaces.

8. In a furnace of the type described, the combination of fixed structure defining furnace walls, a revolving grate assembly defining a part cylindrical surface including a perforate arcuate section providing a grate and two diametrically opposed solid arcuate sections connected with respective ends of said perforate section, a flat transverse web interconnecting said solid sections and defining a blast chamber with said perforate section, blast conduit means connected with said perforate section, blast conduit means connected with said blast chamber, means for mounting said assembly for rotation about a horizontal axis coaxial with said cylindrical surface between a firing position wherein said perforate section is uppermost between said walls and a slagging position wherein said perforate section is lowermost, end flanges for said assembly in sealed relation with said perforate section and said solid sections, said end flanges being positioned adjacent to, and defining leakage spaces with, respective end ones of said furnace walls, each end furnace wall having a circumferential groove therein facing the related end flange and communicating with the related leakage space, a ring member positioned in each groove for limited axial movement therein towards and away from said end flange, means resiliently urging said rings against said end flanges, said ring members having apertures extending therethrough, and means for delivering blast air into said grooves for discharge through said apertures into said leakage spaces.

9. In a furnace, the combination as claimed in claim 8, wherein said means urging the rings includes a plurality of spring-pressed piston-like members slidably mounted in each end wall for engagement with a surface of said ring in angularly equispaced relation therearound, and arranged for urging said ring members towards said end flanges.

10. In a furnace, the combination as claimed in claim 8, wherein each ring member has an arcuate recess in the axial end face thereof directed towards the related end flange, and each ring member has longitudinal ducts extending through said ring member and opening into said recess, and transverse ducts extending through a radially outer side of said recess and opening into said related leakage space to define said apertures.

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