July 23, 1935. H. S. REED ET AL 2,009,122

DISTILLING APPARATUS FOR COAL

Filed May 16, 1930 3 Sheets-Sheet 1

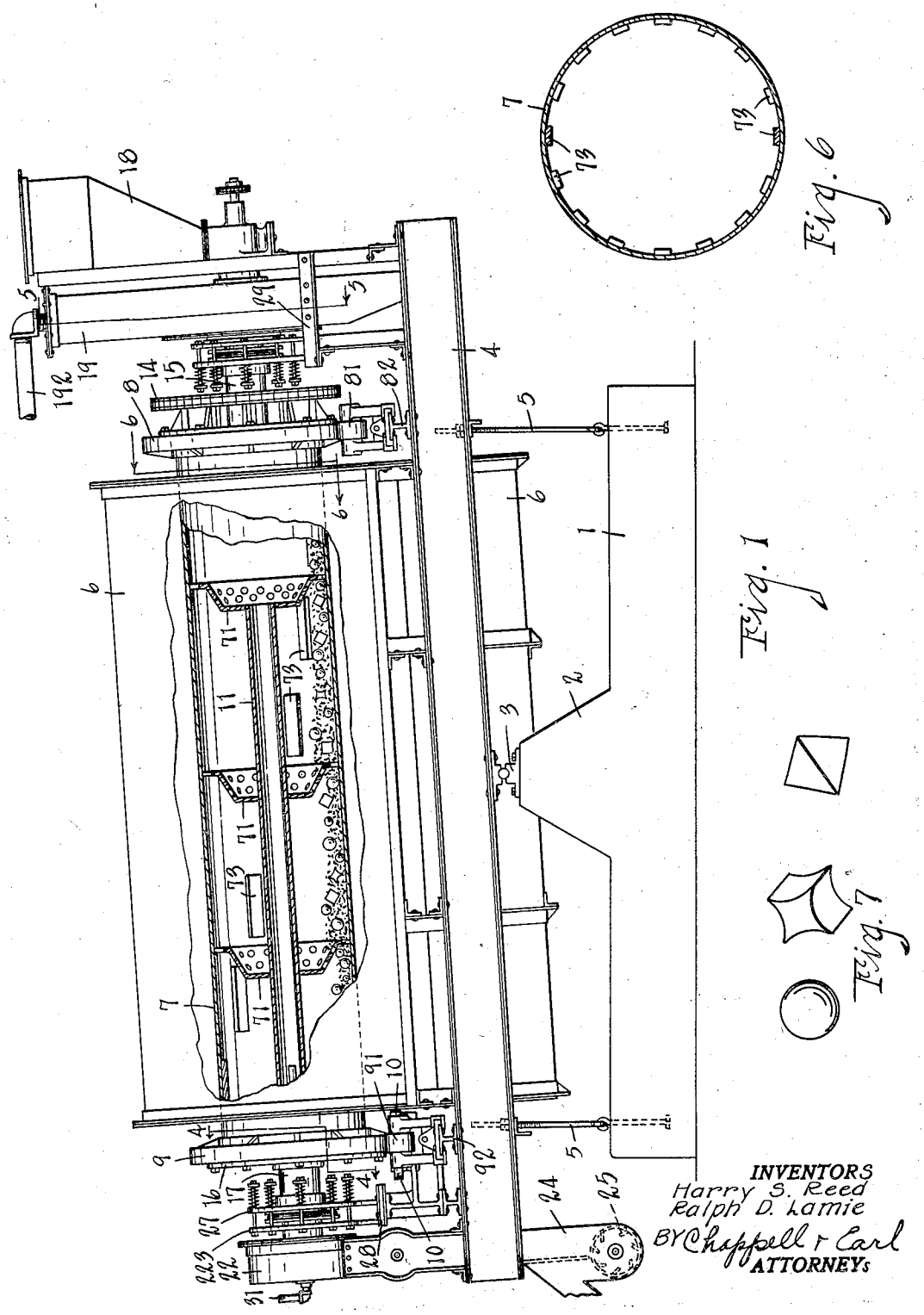

Fig. 6

Fig. 1

Fig. 7

INVENTORS
Harry S. Reed
Ralph D. Lamie
BY Chappell & Carl
ATTORNEYS

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DISTILLING APPARATUS FOR COAL

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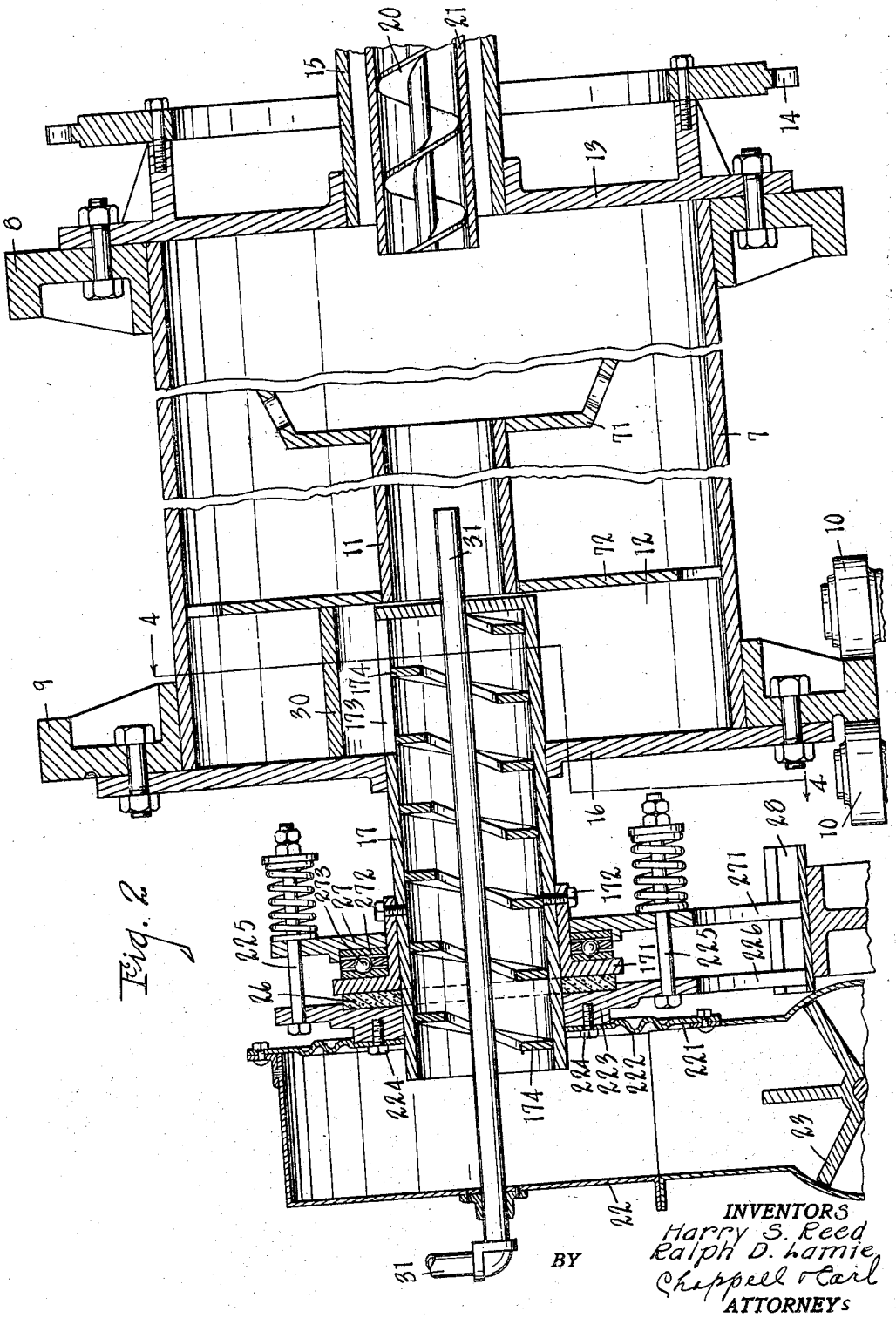

Fig. 2

INVENTORS
Harry S. Reed
Ralph D. Lamie
Chappell & Earl
ATTORNEYS

BY

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DISTILLING APPARATUS FOR COAL

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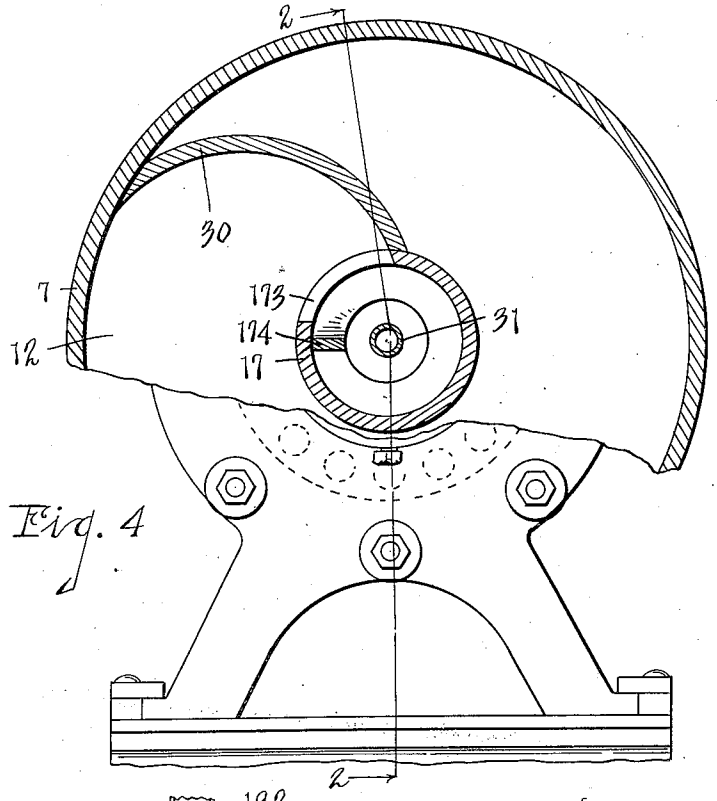

Fig. 4

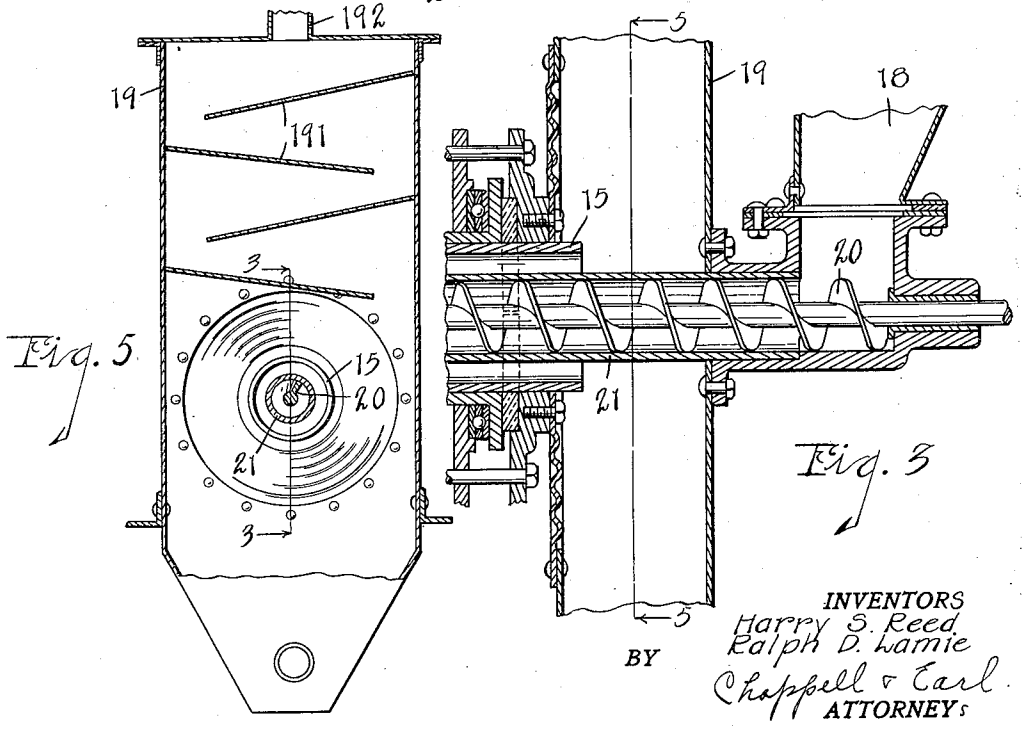

Fig. 5

Fig. 3

INVENTORS
Harry S. Reed
Ralph D. Lamie
BY
Chappell & Earl
ATTORNEYS

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DISTILLING APPARATUS FOR COAL

Harry S. Reed, East Lansing, and Ralph D. Lamie, Detroit, Mich.

Application May 16, 1930, Serial No. 452,879

6 Claims. (Cl. 202—218)

This invention relates to an improved retort and apparatus for low temperature coal distillation and treatment.

The objects of the invention are:

First, to provide an improved tumbling barrel retort with improved screen partitions therein.

Second, to provide such an improved tumbling barrel retort with means for distributing the load to secure even operation of the retort.

Third, to provide such a retort with an improved packing for the bearings.

Fourth, to provide improved gas sealing means at the delivery end of the retort where powdered fuel is delivered.

Fifth, to provide improved gas off-take for such a retort.

Sixth, to provide improved discharge means for the solids from such a retort.

Objects pertaining to details and economies will appear from the detailed description to follow.

A preferred embodiment of our invention is illustrated in the accompanying drawings, in which:

Fig. 1 is an elevation view of our improved retort apparatus, portions of the furnace casing and of the retort being broken away and shown on vertical central section to show details of construction.

Fig. 2 is an enlarged detail vertical section taken on line 2—2 of Fig. 4 through the retort shown in broken sections, showing the coal inlet and gas take-off connection and details of the powdered fuel discharge.

Fig. 3 is the enlarged detail in vertical section on line 3—3 of Fig. 5, of the coal intake hopper and the gas off-take chamber and bearing for the drum.

Fig. 4 is an enlarged detail sectional view taken on the irregular line 4—4 of Figs. 1 and 2, showing details of the powdered fuel discharge dipper and other details.

Fig. 5 is an enlarged detail vertical section on line 5—5 of Figs. 1 and 3, showing details of the gas off-take chamber with its baffles and of the corrugated flexible plate support of the bearing.

Fig. 6 is a detail transverse sectional view on line 6—6 of Fig. 1, showing the end view of the revolving retort drum with the partitions omitted, showing the circumferential position of the tumbling barrel flights.

Fig. 7 is a detail view showing the angular and spherical tumbling bodies or elements made use of in this behalf.

The parts will be identified by their numerals of reference which are the same in all the views.

1 is a concrete base with a center pedestal 2 supporting a pivot bearing 3. 4 is the general frame which is pivoted on the bearing 3 and is adjustable by the adjusting bolts 5, 5 to any inclination desired or required.

6 is a gas furnace substantially cylindrical in form and supported on the frame 4, the details of the burners being omitted. 7 is the tumbling barrel retort drum disposed longitudinally through the gas furnace and revolvable therein.

The retort 7 is provided with flanged heads 8 and 9 which constitute the rims on which the tumbling barrel retort 7 revolves. The rims are disposed and supported on pairs of rollers 81, 91 at each end. The rollers are carried by cross beam supports 82, 92, on the frame 4, see Fig. 1. The rim 9 at the discharge end is provided with thrust roller bearings 10, 10, see Figs. 1 and 2, which embrace the rim 9 and retain the same in proper position for support on the rollers 91. The drum 7 is divided into compartments by transverse partitions 71 each of which has a flat peripheral portion which is notched at the edge as seen in Fig. 1, within which flat portions is a portion like the segment of a cone suitably perforated and then a flat central portion at right angles to the axis of the drum. These partitions are a tight fit in the drum except for the notches and are provided with a central tubular support 11 which is welded or otherwise secured to the said partitions 71 and adds to the rigidity of the drum. A flat partition 72 with notched periphery separates the retort discharge chamber or compartment 12 from the rest of the drum.

The drum 7 is provided with a head 13 at the intake end which carries the sprocket wheel 14 for driving the drum and a central tubular journal shaft 15 for the coal intake and the gas discharge. The discharge end is provided with a head 16 which carries the tubular discharge journal shaft 17 for the discharge of the solid powdered fuel.

The drum is provided with spirally disposed angular projecting flights 73 which are disposed in stepped relation within each compartment or division of the drum and in continuous stepped relation to each other. They are disposed in pairs exactly opposite each other, the end arrangement of these flights clearly appearing in Fig. 6 where the drum cross partitions 71 have been omitted.

Within the drum are placed a quantity of angular grinding elements and ball grinding elements as seen in Fig. 7, preferably of chilled cast iron, these being preferably of graded size

in the different compartments. According to practice, about one-third of the weight of these grinding elements are ball shaped elements. These give mobility to the tumbling mass and insure the proper action of both the scraping elements and the ball elements as well.

The powdered fuel is discharged from the chamber 12 by the volute dipper 30, a port 173 being cut in the tubular journal 17 to receive the powdered fuel as this volute dipper revolves. The tubular discharge journal 17 is provided with integral spiral conveyor 174.

A pipe 31 is provided at the discharge end extending up centrally through the tubular journal shaft 17 to deliver steam or gas into the drum for flushing out the volatile products as soon as they have been liberated by the heat.

18 is the feed hopper for the coal. 19 is the off-take chamber for the gas provided with baffles 191 and discharging through the gas off-take pipe 192. The tubular intake journal 15 connects to the gas chamber 19. A spiral conveyor 20 receives the coal from the hopper 18 and conducts it through the central feed tube 21 into the retort, see Figs. 2 and 3.

22 is the discharge chamber for the powdered fuel and the tubular journal 17 delivers the powdered fuel through the side wall into the same.

The powdered fuel passes the star valve 23 which seals the outlet practically gas tight and the powdered fuel is finally discharged through the U-passage 24 by the revolving paddle wheel 25, see Fig. 1.

The tubular journals at both ends are provided with substantially identical expansion bearing joints, the description of one of which will be sufficient for both. Only one will be numbered, which is the one appearing at the discharge end. The journal 17 is provided with a flanged collar 171 secured thereto by suitable cap screws 172, see Fig. 2. A circular disk 221 forms the side wall to the discharge chamber 22 and the same is provided with concentric corrugations 222. In the center of this disk is the opening for the passage of the end of the hollow discharge journal 17. A bearing plate 223 is secured by cap screws 224 to the center of this corrugated disk. It is provided with a true bearing surface on the outside to correspond to the bearing surface on the flange 171. Between this bearing surface and the flange is disposed a graphite packing ring 26. A ring plate 27 surrounds the flange collar 171 and the same is forced yieldingly towards the plate 223 by the spring clamp bolts 225. Plates 223 and 27 have downwardly projecting supports 226 and 271, respectively, which rest upon the slides 28, which permit slight reciprocation of the parts under expansion. A bearing ring 272 and ball bearing 273 are between plate 27 and flange 171. The bearings at the opposite end of the drum travel back and forth on a shelf 29 as seen in Fig. 1.

From this description it will be readily understood that coal is introduced through the hopper 18 and is carried into the retort by the conveyor 20 through the tube 21. The coal drops into the first chamber of the retort and is immediately tumbled by the tumbling barrel so that the round and angular grinding bodies immediately act upon it, breaking some of it to fine powder and the remainder to comparatively coarse lumps.

The fine powder, due to the inclination of the drum, advances readily along the periphery and the coarser pieces tumble through the central screen into the next compartment where there are smaller grinding bodies which reduce these coarse pieces to a considerable extent and pass them to the next compartment and so on through, until at the final compartment they are passed through the notches in the periphery of the disk 72 into the retort discharge chamber 12.

In this chamber 12, all of the powdered fuel is gathered and accumulated by the volute dipper blade 30 and dropped into the tubular discharge journal shaft 17 where it will be conveyed on to the discharge chamber 22 by the spiral 174.

As the fuel is advancing, of course, it is being distilled and volatiles are being driven off. A current of steam or gas is introduced through the pipe 31 which quickly flushes the distilled gas and vapor into the off-take chamber 19 where the same are quickly cooled and passed on through the off-take pipe 192 to scrubbers and purifiers usually provided for such a purpose. Of course, the raw gas could be passed directly to a boiler and furnace and be burned. A part of it is preferably so utilized for running the gas furnace surrounding the drum.

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

1. In a distilling apparatus for coal, the combination of a sealed tumbling barrel ball mill retort having a sealed discharge outlet, means for heating the exterior of said retort, transverse partitions disposed across the tumbling barrel in the said retort dividing the same into compartments each partition consisting of a flat peripheral portion, and bulging perforated screen portion projecting toward the discharge outlet, and flights in stepped relation in each compartment of the retort and in continuous stepped relation therethrough.

2. In a distilling apparatus for coal, the combination of a sealed tumbling barrel ball mill retort, means for heating the exterior of said retort, transverse perforated partitions disposed across the tumbling barrel in the said retort dividing the same into compartments, opposed flights in stepped relation in each compartment of the retort and in continuous stepped relation therethrough, and angular and ball tumbling grinding bodies within the said retort.

3. In a distilling apparatus for coal, the combination of a sealed tumbling barrel ball mill retort, means for heating the exterior of said retort, transverse perforated partitions disposed across the tumbling barrel in the said retort dividing the same into compartments, opposed flights in stepped relation in the retort and in continuous stepped relation therethrough, and angular and ball tumbling grinding bodies within the said retort.

4. In a distilling apparatus for coal, the combination of a sealed tumbling barrel ball mill retort having a sealed discharge outlet, means for heating the exterior of said retort, opposed flights in stepped relation in the retort and in continuous stepped relation therethrough, and angular and ball tumbling grinding bodies within the said retort.

5. In an apparatus of the class described, the combination of a barrel retort having a circular head and means for mounting said retort for rotation on its axis including an axially disposed tubular bearing support, a chamber in proximity to said retort having a side wall comprising a concentrically corrugated circular plate open at its center for said tubular projection, a bearing flange having face bearings carried by said tu-

bular projection, a corresponding bearing plate carried by the center of said corrugated plate, packing means interposed between said bearing plate and said bearing flange, and a bearing ring carried by said corrugated plate having means for holding the same yieldingly against said bearing flange.

6. In an apparatus of the class described, the combination of a barrel retort having a circular head and means for mounting said retort for rotation on its axis including an axially disposed tubular bearing support, a chamber in proximity to said retort having a side wall comprising a concentrically corrugated circular plate open at its center for said tubular projection, a bearing flange having face bearings carried by said tubular projection, a corresponding bearing plate carried by the center of said corrugated plate, and a bearing ring carried by said corrugated plate having means for holding the same yieldingly against said bearing flange.

HARRY S. REED.
RALPH D. LAMIE.