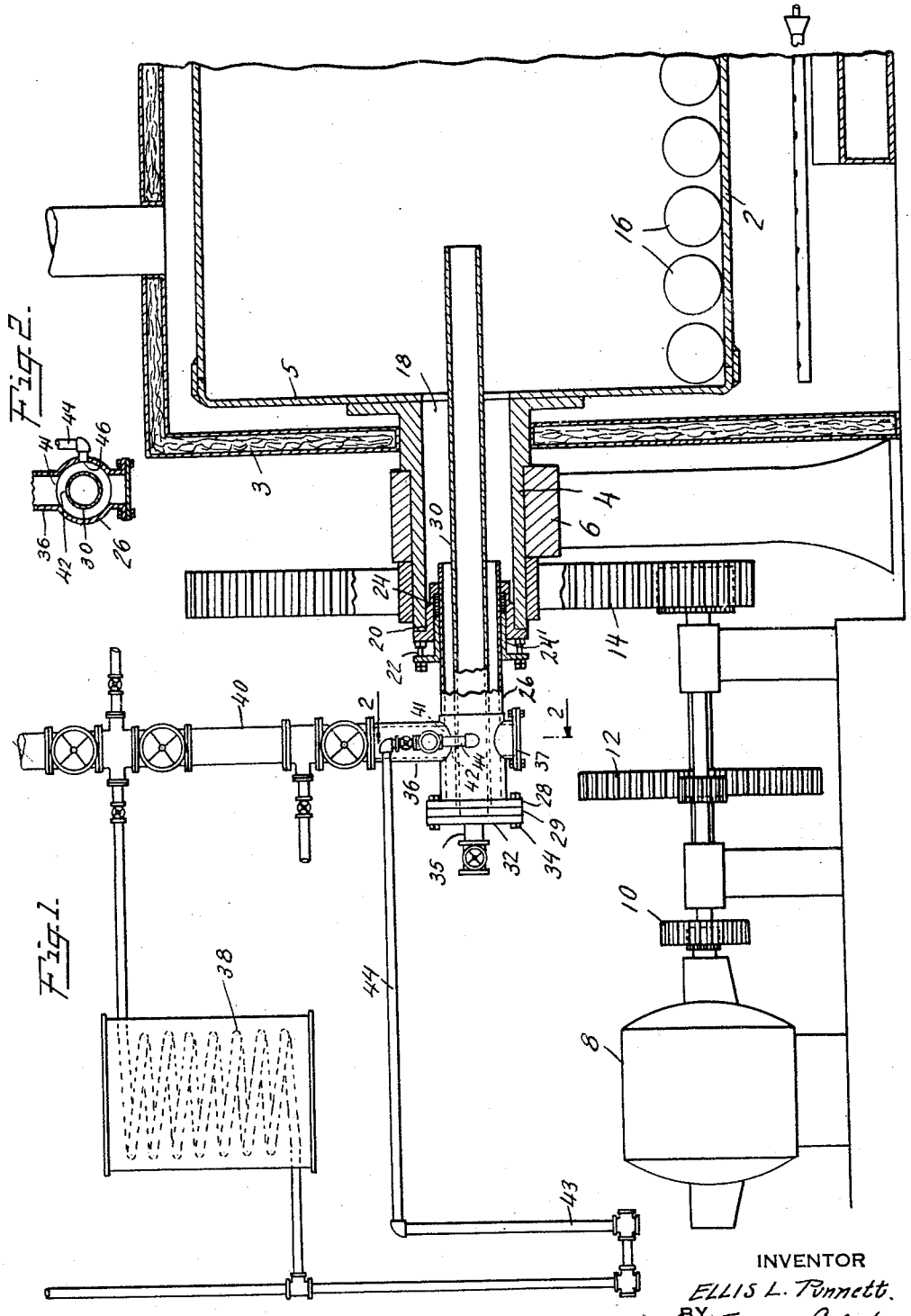
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BALL MILL

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BALL MILL

Application filed September 12, 1930. Serial No. 481,460.

My invention relates to apparatus for treating materials and particularly to apparatus of the ball mill type, such as thionators, adapted for carrying out reactions in the nature of sulfur fusions.

Sulfur fusions are accompanied by an excessive gas liberation in the early stages of the reaction, resulting in a violent ebullition or foaming of the mass and in the latter stages by a viscous condition of the mass which finally hardens. The evolution of gases during operation necessitates a vent or outlet for the gases which will not become clogged by the material contained within the apparatus. Apparatus of this type is shown and described in the application of A. F. Wendler, Serial No. 109,067, filed May 14, 1926, provided with an outlet for the gases evolved in treating materials in the apparatus and means for returning to the apparatus condensate from the gases leaving the apparatus through the outlet. My invention is an improvement or modification of the type of apparatus disclosed in the Wendler application.

Among the objects of the present invention are to provide apparatus of this type in which the outlet for the gases evolved during operation will not become clogged with material, to prevent the passage of solid material from the walls of the apparatus into the outlet for the gases and to provide means to allow ready inspection and cleaning of the outlet and associated parts of the apparatus without stopping the operation of the device. These and other objects and features of the invention will be apparent from the following description of the preferred embodiment of my invention illustrated in the accompanying drawing, in which;

Fig. 1 is a vertical sectional view through a portion of a thionator embodying my invention, and

Fig. 2 is a sectional view of a portion of the apparatus shown in Fig. 1 taken on the line 2—2.

In the form of the invention illustrated in the drawing, the apparatus comprises a drum 2 rotatable about a horizontal axis within a suitable enclosure 3 provided with heating and cooling means for controlling the temperature of the material being treated. The drum or casing 2 is provided with a trunnion 4 located axially on one end 5 of the casing and resting upon bearing 6 to allow rotation of the casing. A gear 14 is mounted on the hollow trunnion 4, and the casing is rotated by means of a motor 8 and intermediate gears 10 and 12 operatively connected to gear 14. Balls or other suitable agitating or crushing bodies 16 are located within the casing and are preferably of sufficient size and weight to project above the material being treated and to crush the material as it hardens during the latter stages of the reaction.

The outer end of the trunnion 4 is provided with a stuffing box 20 extending into the opening 18 in the trunnion 4, and is secured in position by the bolts 22. A tube 26 extends through the stuffing box 20 and into the opening 18. The packing 24 in the stuffing box 20 is compressed by a packing gland 24′ to form a gas tight connection between the trunnion 4 and tube 26. The tube 26 is held stationary with respect to the rotatable drum or cylinder 2 and trunnion 4.

The outer end of the tube 26 is provided with a flange 28 engaged by a similar flange 29 on outlet conduit or pipe 30. The outlet pipe 30 extends axially through the tube 26 and the opening 18 in the trunnion 4, and projects into the casing beyond the end wall 5 thereof. The outer end of the pipe 30 is provided with a closure plate 32 secured to the flange 29 of the pipe 30, and the flange 28 of the tube 26, by means of the bolts 34. The pipe 30 is thus spaced from the tube 26 and from the walls of the casing so that any material which may run down the end walls of the casing or fall from the upper portions thereof will not collect within the outlet pipe 30.

The pipe 30 can thus be removed from the apparatus for cleaning or inspection without disturbing the packing gland 24′ between the trunnion 4 and the pipe 26. The closure plate 32 can also be removed to allow inspection or cleaning of the pipes 26 and 30 thus providing an arrangement which can be quickly and easily assembled and disassembled. The

closure plate 32 is also provided with a valved pipe 35 to permit inspection and cleaning of the pipe 30 without removing the same.

The tube 26 is provided with a side arm 36 intermediate the ends thereof, and is connected to a reflux condenser 38 by means of the pipe 40. The outlet tube 30 is provided with an opening 42 (Fig. 2) in position to direct gases from the tube 30 into the tube 26 and through the outlet 41 therein into the side arm 36 and pipe 40 leading to the reflux condenser. Also, gases may pass through the opening 18 into the tube 26 and through the outlet 41 therein into the side arm 36 and pipe 40. Thus the pressures within the drum 5, the tube 30 and the tube 26 being equalized, there is no tendency to force the reaction material into the opening 18 or tube 30. An opening 37 and a closure therefor are also provided in the tube 26 in line with the side arm 36 to permit access to the vertical portion of the side arm and pipe 40 for cleaning, etc., when the pipe 30 is removed from within the tube 26.

Gases passing into the pipe 40 are conducted to a reflux condenser 38, from which any condensate formed is returned through the trap 43 and pipe 44 into the tube 26 through the inlet 46, flushing the tube 26 to remove any solid material which may have collected therein and returns it to the casing again to take part in the treatment of the material. Condensate may also be passed from the reflux condenser to the pipe 26 through a suitable opening in the pipe 26 if desired.

In operating the apparatus described, the cylinder 2 is rotated by the motor 8 and the gears 10 and 12 meshing with the gear 14 secured to the trunnion 4 on one end thereof supporting the cylinder 2. The material being treated is heated to the desired temperature by any suitable means in the enclosure 3. The balls 16 in the casing 2 gravitate as the cylinder is rotated acting upon the material within the casing and aiding in the liberation of gases therefrom. The gases evolved during operation pass from the casing through the outlet pipe 30 and the opening 42 into the pipe 40 leading to reflux condenser 38. Gases may also pass through the opening 18 in the trunnion 4 and through the tube 26 and opening 41 to the pipe 40 leading to reflux condenser 38. The distillate produced in the reflux condenser collects in the trap 43 and passes through the pipe 44 into the tube 26 through the inlet 46, thus flushing the tube 26 and carrying the solid matter which may have collected in the tube and in the opening 18 in the trunnion 4, back into the casing to take part in the reaction. If it should be desired to inspect or clean the pipe 30, the valve in pipe 35 may be opened and suitable means inserted for removing foreign material from the pipe 30. If it should become necessary to clean the tube 26 or opening 18 in the trunnion 4, the bolts 34 may be removed and pipe 30 withdrawn from within the tube 26. Any suitable means may then be inserted through the end of the tube 26 to remove material from the tube 26 and the opening 18 within the trunnion 4. When the parts have been cleaned or inspected they may be quickly and easily replaced by again inserting the pipe 30 within the tube 26 and securing the bolts 34 in place.

Although I have illustrated and described a preferred embodiment of my invention, it is not intended that the invention should be limited to the specific construction shown and described, except as defined by the claims.

I claim:

1. Apparatus for treating materials comprising a casing rotatable about a horizontal axis, a trunnion for said casing secured axially on one end thereof and provided with an opening extending therethrough, a stationary tube communicating with said casing through the opening in said trunnion, and a stationary pipe located within said tube and communicating with said casing.

2. Apparatus for treating materials comprising a casing rotatable about a horizontal axis, a trunnion for said casing secured axially on one end thereof and provided with an opening extending therethrough, a stationary tube communicating with said opening, a packing between said trunnion and tube, and a stationary pipe positioned within said tube and communicating with said casing.

3. Apparatus for treating materials comprising a casing rotatable about a horizontal axis, a trunnion for said casing secured axially on one end thereof and provided with an opening extending therethrough, a stationary tube communicating with said opening, a packing between said trunnion and tube, and a stationary pipe secured to said tube and removable therefrom without disturbing said packing.

4. Apparatus for treating materials comprising a casing rotatable about a horizontal axis, a trunnion for said casing secured axially on one end thereof and provided with an opening extending therethrough, a stationary tube communicating with said opening, a packing between said trunnion and tube, a stationary pipe secured to said tube and removable therefrom without disturbing said packing and means for closing the ends of said tube and pipe.

5. Apparatus for treating materials comprising a rotatable casing, an outlet for gases evolved in the casing extending into said casing and spaced from the walls thereof, a reflux condenser connected to said outlet, and separate means for returning condensate from said reflux condenser to said casing.

6. A thionator comprising a rotatable cas-

ing, an outlet for the gases evolved in said casing located axially in one end of the casing and spaced from the walls thereof, a reflux condenser communicating with said outlet and means surrounding said outlet and connected to said reflux condenser for returning condensate from said condenser to said casing.

7. A thionator comprising a cylindrical casing rotatable about a horizontal axis and supported on one end by a trunnion having an opening therethrough communicating with the casing, a stationary fixed tube communicating with said opening, packing between said tube and trunnion, and a stationary outlet pipe for gases evolved in said casing projecting through said tube and opening, said outlet pipe extending into said casing and being spaced from the walls thereof, a reflux condenser connected with said outlet and means for returning condensate from said reflux condenser to said casing.

8. A thionator comprising a cylindrical casing rotatable about a horizontal axis, means for rotating said casing, a trunnion on one end of said casing having an opening therethrough, a stationary tube communicating with said opening, packing between said trunnion and tube, a stationary outlet pipe for gases evolved in the casing removably secured to said tube and extending through said tube and opening into said casing and spaced from the walls thereof, a reflux condenser connected to said outlet and means for returning distillate from said reflux condenser to said tube to flush the same and return solid material in said tube to said casing.

9. A thionator comprising a rotatable drum, a trunnion at one end thereof having a vent therein in communication with the interior of the drum for the passage of gases therethrough, a stationary tube projecting into said vent spaced from the walls thereof and terminating short of the drum end for conveying gases from said vent, a second tube projecting through said first mentioned tube spaced from the walls thereof and extending at one end past the drum head into the drum for conveying gases from said drum, and communicating means exteriorly of the drum for conducting gases from said latter tube into the first mentioned tube.

10. A thionator comprising a rotatable drum, a trunnion at one end thereof having a vent therein in communication with the interior of the drum for the passage of gases therethrough, a stationary tube projecting into said vent spaced from the walls thereof and terminating short of the drum end for conveying gases from said vent, a second tube projecting through said first mentioned tube spaced from the walls thereof and extending at one end past the drum head into the drum for conveying gases from said drum, a packed connection between said trunnion and said first mentioned tube to prevent the escape of gases therebetween, communicating means exteriorly of the drum for conducting gases from said latter tube into the first mentioned tube, and means for conducting gases from said first mentioned tube.

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