April 25, 1944. J. J. BRADLEY 2,347,394

CHEMICAL APPARATUS

Filed Oct. 31, 1941

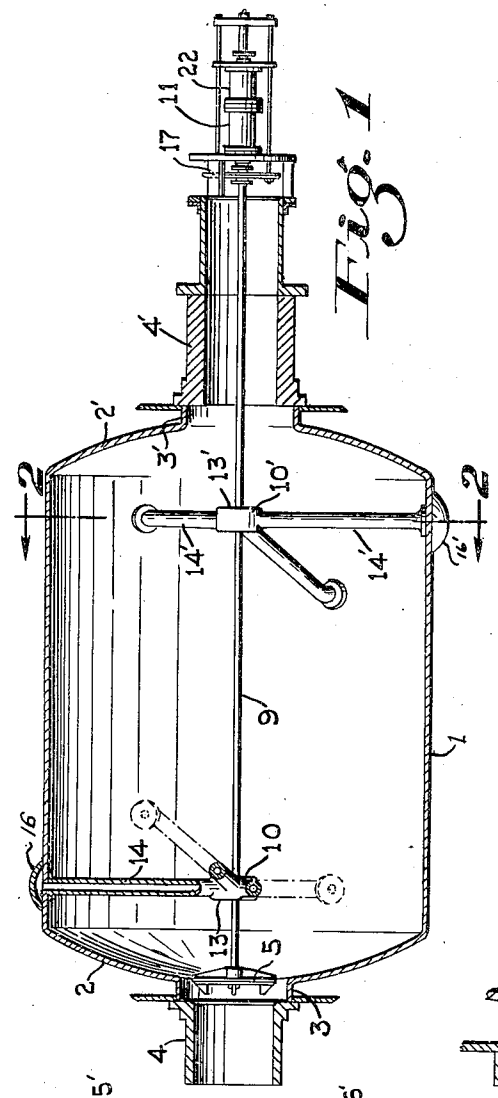


Fig. 1

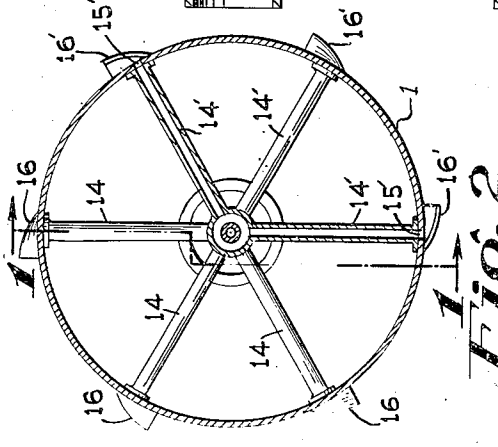


Fig. 2

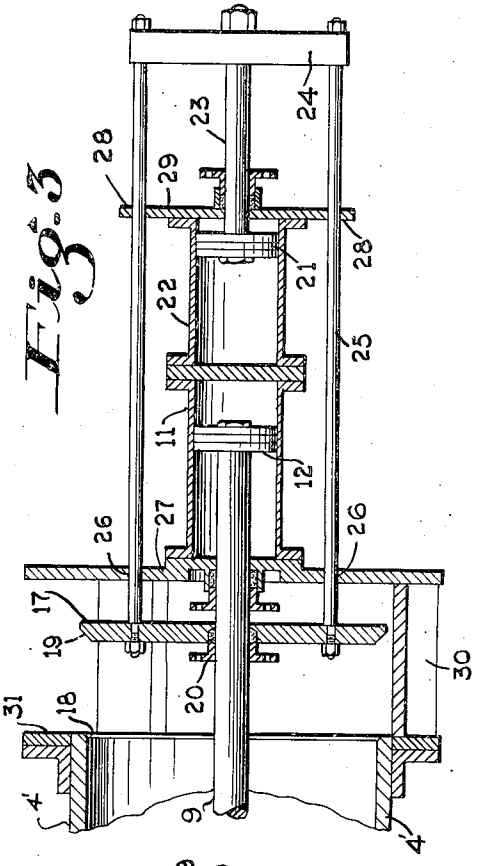


Fig. 3

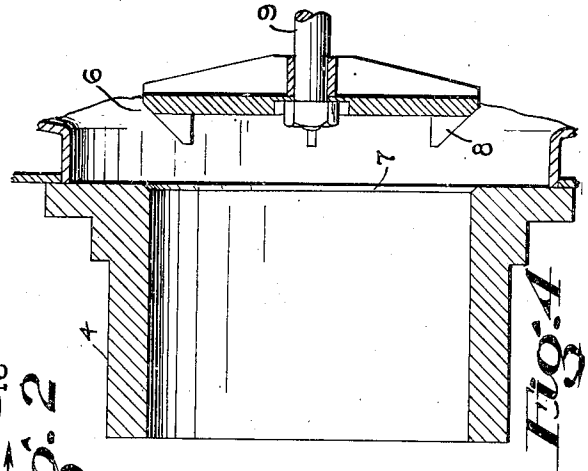


Fig. 4

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Patented Apr. 25, 1944

2,347,394

UNITED STATES PATENT OFFICE

2,347,394

CHEMICAL APPARATUS

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Application October 31, 1941, Serial No. 417,333

3 Claims. (Cl. 257—93)

This invention relates to chemical apparatus and is particularly directed to improvements in rotary heat exchangers particularly adapted to cooling hot sodium sulfide and to cooling or heating like chemicals subject to oxidation at elevated temperature.

Sodium sulfide is commonly manufactured by the reduction of sodium sulfate with coal, coke, or other reducing media. The reaction is a high temperature one. If the hot sodium sulfide is discharged in the atmosphere, as is frequently the case in connection with rotary furnaces, a reversal of the reaction takes place and sodium sulfate is formed. While the amount of sulfate thus formed normally is small nevertheless it interferes with and complicates subsequent processing of the crude sodium sulfide.

It is an object of the present invention to avoid the disadvantages of the prior art by providing simple and effective apparatus whereby the sodium sulfide and like chemicals may be cooled or heated out of contact with air. It is another object of the invention to provide means for excluding air from a rotary heat exchanger. It is another object to provide such means as will not be warped or buckled or thrown out of alignment by hot material in the heat exchanger. Other objects will appear hereinafter.

These objects are accomplished by the following invention, an embodiment of which is illustrated in the accompanying drawing in which Figure I is a section taken in elevation, Figure II is a section taken along lines 2—2 Figure I, and Figures III and IV are enlarged detail views of parts of Figure I.

As best seen in Figure I, the invention is concerned with rotary coolers of the axial charging and discharge type. Such coolers include a cylindrical shell 1 and suitable end closures 2 and 2' each of which is provided with an axial port 3 and 3'. Attached to each of these ports is a hollow trunnion 4 and 4' which serves as charging and discharging means as well as means for rotatably supporting the cooler in a horizontal position. In this position the cooler is adapted to be rotated about a horizontal axis while partially submerged in a cooling bath.

As best shown in Figure III, I have provided axially reciprocal closure means for the charging and discharge ports. In order to close the charging port I provide the closure 5 and means for thrusting it axially into closing position with respect to the hollow trunnion 4, the innermost edge of which is bevelled at 6 complementary with a corresponding bevel 7 on the closure plate 5. On the face of the closure 5 are provided correspondingly bevelled lugs 8 arranged about the periphery of the plate 5 which act to center the closure plate 5 in the charging opening with the complementary bevelled faces 6 and 7 in tight feeling contact.

The mechanism for operating the closure 5 consists of a long axially disposed shaft 9, supporting means 10 and 10', and an actuating cylinder 11. The latter may be of any conventional design and provided with suitable valves (not shown) for causing the piston 12 to move the closure plate 5 to and from closing position, as desired.

The supports 10 and 10' are specially designed in view of the rigorous conditions obtaining in the rotary cooler when freshly charged with hot sulfide. In order to prevent these rigorous conditions from warping the supports and throwing the shaft 9 out of line or causing it to bind in the journals 13 and 13' I have provided means for cooling the journals and the supporting legs 14 and 14'. To this end the supports are constructed in the nature of tripods, each leg of which is hollow and communicates between the exterior of the cylindrical shell 1 to the interior of the hollow trunnion 13 and 13'. This is best seen in Figure II where the supports 14 and 14' are shown to communicate through the apertures 15 with the exterior of the shell 1. About each of these apertures are located cups 16, so located as to scoop up water in the rotation of the cooler. In this manner cooling water is continuously circulated in and out of the supports 14 and 14' and in and around inside the journals 13 and 13'. Thus warping and binding of the supports is avoided.

The closure means for the discharge port is located exteriorly. It consists of the closure plate 17 which is reciprocally mounted on the shaft 9 so that it may be forced axially into engagement with the outer edge of trunnion 4' which is bevelled at 18 complementary with the bevel 19 on the closure plate 17 in order to provide an air-tight seal. For the same purpose the closure plate 17 is provided with a stuffing box 20 about its engagement on the shaft 9. The closure plate 17 is actuated by the piston 21 reciprocating in the cylinder 22. The piston rod 23 is provided with a crosshead 24 which is rigidly connected to the closure plate 17 by means of the rods 25. These rods are guided in apertures 26 in extended portions of cylinder head 27 of cylinder 11 and in apertures 28 in extended portions of cylinder head 29 of cylinder 22.

The closure operating mechanism is forced in axial alignment with the rotary cooler by means

of angle bars 30 which rigidly connect the cylinder head 27 with the flange 31 on the outermost edge of the trunnion 4'. Sufficient space is thus provided for the opening and closing of closure plate 17 and discharge of material.

The pistons 12 and 21 may be actuated by air or other fluid, connections being made with an external source through any suitable rotating valve (not shown). Any other suitable closure operating mechanisms and other motive devices may be used.

Thus it is seen that I have provided simple and effective means for obtaining independent closure of the charging and discharge ports. By the particular combination of an interior closure for the charging port and an exterior closure for the discharging port I have avoided all conflict with the usual screws required for charging and discharging rotary coolers of this type.

While I have illustrated my invention with reference to one particular embodiment thereof it will be understood that variations may be made without departing from the spirit and scope of the invention.

I claim:

1. In a rotary cooler provided with axial charging and discharge ports the combination comprising a closure means located interiorly of said cooler, means for causing said closure means to move axially into closing position with respect to one of said ports, said means comprising an axially disposed shaft connecting said closure means with closure operator means disposed exteriorly of said cooler and so arranged that the shaft extends through the other port, means for supporting said shaft in axial position comprising at least one tripod composed of hollow members, and means for introducing cooling fluid into said hollow members.

2. In a rotary cooler adapted to rotate partially submerged in a cooling bath the combination with axial charging and discharging ports in said cooler of closure means located interiorly of said cooler, means for causing said closure means to move axially into closing position with respect to one of said ports, said means comprising an axially disposed shaft connecting said closure means with closure operator means disposed exteriorly of said cooler and so arranged that the shaft extends through the other port, means for supporting said shaft in axial position comprising at least one tripod composed of hollow members, and means for introducing cooling fluid into said hollow members, said last named means comprising cups on the surface of said cooler in communication with said hollow members and so arranged as to scoop up cooling liquid in the rotation of said cooler.

3. In a rotary heat exchanger having axial inlet and outlet ports the combination of closure means disposed interiorly of said heat exchanger, means for supporting said closure means for axial movement to and from the inlet port including an axial reciprocable shaft extending from said closure means through said outlet port to a point exterior of said heat exchanger, a second closure means disposed exteriorly of said heat exchanger and journaled on said shaft and being free to move axially independently of said shaft, and means independently operable for axially moving said closure means to and from said ports.

JOHN J. BRADLEY.