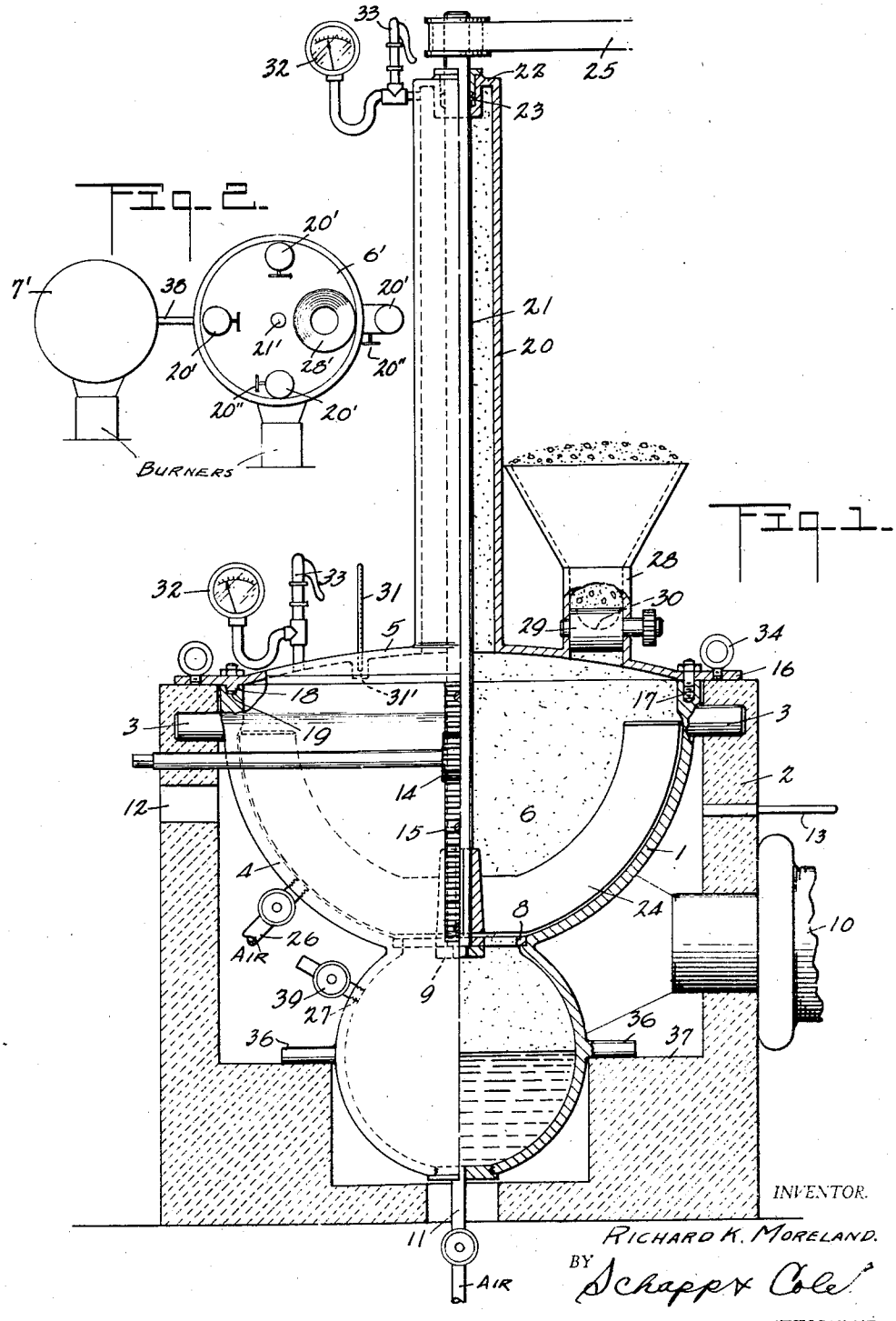
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ORE REDUCTION OR DIGESTING APPARATUS

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ORE REDUCTION OR DIGESTING APPARATUS

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The present invention relates to improvements in ore reduction or digesting apparatus and its principal is to provide an apparatus of the character described in which materials or substances are treated for the purpose of decomposing, transposing, dissolving, internally rearranging the same or for rendering them soluble.

A further object of the invention is to provide an apparatus of the character described in which the material is treated in a closed vessel at high temperatures.

A further object of the invention is to provide means in an apparatus of the character described for automatically reducing the pressure in the closed vessel without any loss of the material or substances contained therein.

A still further object of the invention is to bring about reduction of pressure by condensing a certain portion of vapors produced by the heat and by feeding the condensed vapors back to the material contained in the vessel.

It is further proposed to provide an apparatus of the character described in which the reaction in the material takes place in the presence of acid fumes and in which the acid fumes are formed in a separate vessel or in a separate chamber of the vessel.

It is further proposed to provide suitable agitating means for the material contained in the vessel and to provide certain structural improvements for simplifying the construction of the apparatus.

Further objects and advantages of my invention will appear as the specification proceeds.

The preferred form of my invention is illustrated in the accompanying drawing in which—

Figure 1 shows a central vertical section through the preferred form of my apparatus, and

Figure 2 a plan view of a modified arrangement.

While I have shown only the preferred form of my invention I wish to have it understood that various changes or modifications may be made within the scope of the claims hereto attached without departing from the spirit of the invention.

Referring to the drawing in detail, the vessel or pot 1 is revolvably mounted in the furnace 2 by means of trunnions 3 projecting from the vessel and having bearing in the wall of the furnace. The vessel comprises a body section 4 and a removable top 5. The body section comprises two compartments, an upper compartment 6, and a lower compartment 7, the two compartments being formed integral with one another.

The upper compartment is intended to contain the material to be treated. The lower compartment is intended to hold the acid used in the treatment of the material and it is separated from the upper compartment by means of a grate 8 which is supported on a transverse bar 9 arranged on top of the lower compartment. The grate may be formed integral with the vessel, if desired.

A burner 10 of any suitable construction is provided for heating the two compartments. The products of combustion are discharged through the vent 12. A pyrometer 13 indicates the temperature in the furnace.

For discharging treated materials from the vessel the latter may be tilted by any suitable means as by the pinion 14 engaging with a rack 15 formed on the outside of the vessel. The furnace is arranged in a conventional manner, with a removable wall to permit of the tilting movement of the vessel.

The top 5 has a flange 16 bolted to the upper edge of the body section as at 17 and the connection is made gas tight by means of a tongue and groove arrangement 18 with an interposed washer 19. The flange 16 also rests on the top edge of the furnace to serve as a closure for the same.

The top 5 has a vapor tube 20 projecting therefrom and this tube is of considerable height, preferably 12 to 15 feet, and some 8 to 10 inches in diameter. These dimensions are, of course, subject to change, provided that they are proportioned to accomplish the object of the vapor tube, namely, to condense vapors rising thereinto and to feed the condensed vapors back into the main body of the vessel. The tube is preferably made of heat conducting material and does not need any insulating lining, although, of course, such lining may be provided for protecting the material of the tube or for lessening or regulating the condensing effect.

It will be noted that the condensing and the feeding back of the products of condensation tend to keep down the pressures prevailing inside the vessel and thus constitute an automatic control for such pressures. It is apparent that the tube may be designed, relative to the size of the vessel, the quantity of material to be treated therein and the normal intensity of heat applied to produce, under given conditions, a desired result and a desired condensing effect for maintaining a desired pressure in the vessel.

To render the operation more flexible, a plu-

rality of vapor tubes **20'** may be substituted for the single tube of Figure 1, as shown in Figure 2, and such tubes may rise from the top or from the side of the vessel, as indicated, and some or all of them may be provided with valves for rendering some active and some inactive depending upon the condensation effect desired.

In Figure 1 the tube is shown as rising from the center of the top, and if it is mounted in this position, it may be used as a supporting medium for the agitator shaft **21**, the lower end of which may take bearing on the bar **9** or on the grate **8**, if the latter is formed integral with the vessel, while its upper end extends through the closed end **22** of the tube, suitable packing being provided as at **23**.

The shaft is formed with propeller blades **24** of any suitable type which are preferably formed to scrape the wall of the vessel and to have a general lifting effect. The shaft may be rotated by any suitable means as by the belt **25**.

The agitator may be omitted where its function is not necessary or not desired and any other agitating means may be substituted, as for instance, air agitation through connections indicated at **11** and **26**.

The acid may be fed into the lower compartment through the aperture **27**, normally closed by a valve **39**; and the material to be treated may be passed into the upper compartment through the chute **28** which is controlled by a rotary feed valve **29** which is cupped as shown at **30** to feed the material in measured quantities while maintaining a perfect seal for the vessel.

A thermometer **31** may be mounted on top of the vessel in a well **31'** and suitable pressure gauges and relief valves **32** and **33** may be mounted on top of the vessel and at the upper end of the vapor tube.

Eye bolts **34** are provided on the top to permit the latter, with the tube and the attachments to be lifted from the vessel. The lower compartment is formed with projecting lugs **36** which come to rest on the foundation **37** when the vessel is in normal working position.

Figure 2 diagrammatically shows certain modifications of the arrangement of the main figure. It shows a plurality of vapor tubes **20'**, which may emanate from the top of the vessel or from the side thereof and which may be provided with cut-off valves **20''**. It also illustrates an acid chamber **7'** mounted separately from the main chamber **6'** and suitably connected thereto by a conduit **38** through which the fumes are discharged into the main vessel. The agitator shaft **21'** is here shown as being separate from the vapor tubes.

In operation, a suitable quantity of acid is poured into the lower compartment. Heat is applied through the burner **10** and, as the vapors of the acid rise into the upper chamber, the material is fed into the latter in measured quantities by means of the rotary valve **29**. The agitator may be used as desired. The fumes from the acid thus mix with the material to be treated and the latter is now subjected to a digesting process in the presence of the fumes.

On account of the high temperatures used which should be at least equal to or in excess of the boiling point of the acid, hot vapors are formed which increase the pressure within the vessel and this pressure would become excessive, which means, that it would become greater than is required for the digesting process and would call for much stronger construction than is desirable, if it were not for the vapor tube or tubes. The latter, however, permit the vapors to rise therein and to condense whereby excess pressures are avoided. The condensed vapors are fed back into the vessel so that there is no loss or waste.

I claim:

1. A digesting apparatus comprising a furnace having steps in the bottom thereof, a vessel having an upper chamber and a lower chamber, the upper chamber being semi-spherical and the lower chamber being joined thereto so as to present a restricted neck portion between the same, stub shafts projecting from the upper chamber and being journalled in the wall of the furnace to permit the vessel to be tilted on the axis of the stub shafts, lugs projecting from the lower chamber so as to rest on the steps of the furnace when the vessel is in the normal suspended position, a rack formed on the periphery of the upper chamber, a pinion in engagement with the rack and means for rotating the pinion for tilting the vessel.

2. A digesting apparatus comprising a furnace having steps in the bottom thereof, a vessel having an upper chamber and a lower chamber, the upper chamber being semi-spherical and the lower chamber being joined thereto so as to present a restricted neck portion between the same, stub shafts projecting from the upper chamber and being journalled in the wall of the furnace to permit the vessel to be tilted on the axis of the stub shafts, lugs projecting from the lower chamber so as to rest on the steps of the furnace when the vessel is in normal suspended position, heating means mounted in the furnace wall to direct heat at the neck section for heating both chambers simultaneously, a rack formed on the periphery of the upper chamber, a pinion in engagement with the rack, and means for rotating the pinion for tilting the vessel.

3. A digesting apparatus comprising a furnace, a vessel mounted therein with freedom of tilting motion, a cover for the vessel having a vapor tube projecting therefrom, a shaft extending through the cover and having agitating blades within the vessel, means for removably securing the cover upon the vessel and means for lifting the cover with the tube and the shaft as a unit for clearing the vessel for tilting operation.

4. A digesting apparatus comprising a furnace having steps in the bottom thereof, a closed vessel having an upper chamber and a lower chamber, the upper chamber being semispherical and the lower chamber substantially spherical and the two chambers being joined so as to present a restricted neck portion between the same, stub shafts projecting from the upper chamber and being journalled in the wall of the furnace to permit the vessel to be tilted on the axis of the stub shafts, lugs projecting from the lower chamber so as to rest on the steps of the furnace when the vessel is in normal suspended position, a removable cover assembly for the upper chamber including a lid, an elongated vapor tube rising from the lid, a shaft having agitating blades mounted thereon in the upper chamber, and a hopper formed on top of the lid and having a valve therein for discharging material from the hopper into the upper chamber in measured quantities, a grate between the chambers supporting the lower end of the shaft, heating means mounted in the furnace wall to direct heat at the neck section for heating both chambers simul-

taneously, means for admitting an acid into the lower chamber, means for removing the cover assembly as a unit, a rack formed on the periphery of the upper chamber, a pinion in engagement with the rack and means for rotating the pinion for tilting the vessel.

5. A digesting apparatus comprising a furnace having steps in the bottom thereof, a vessel having an upper chamber and a lower chamber, the upper chamber and the lower chamber being joined together so as to present a restricted neck portion between the same, stub shafts projecting from the upper chamber and being journalled in the wall of the furnace to permit the vessel to be tilted on the axis of the stub shafts, lugs projecting from the lower chamber so as to rest on the steps of the furnace when the vessel is in the normal suspended position, and means for tilting the vessel.

6. A digesting apparatus comprising a furnace having steps in the bottom thereof, a vessel having an upper chamber and a lower chamber, the upper chamber and the lower chamber being joined together so as to present a restricted neck portion between the same, stub shafts projecting from the upper chamber and being journalled in the wall of the furnace to permit the vessel to be tilted on the axis of the stub shafts, lugs projecting from the lower chamber so as to rest on the steps of the furnace when the vessel is in the normal suspended position, heating means mounted in the furnace to direct heat at the neck section for heating both chambers simultaneously, and means for tilting the vessel.

7. A digesting apparatus comprising a furnace, a vessel, mounted within the furnace having an upper chamber and a lower chamber and a reduced neck portion between the chambers, a grate in the neck portion, a cover for the upper chamber having a vapor tube rising therefrom, a shaft extending through the cover, an agitator in the upper chamber operated by the shaft, and a bearing arranged in the grate and having the shaft journaled therein.

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