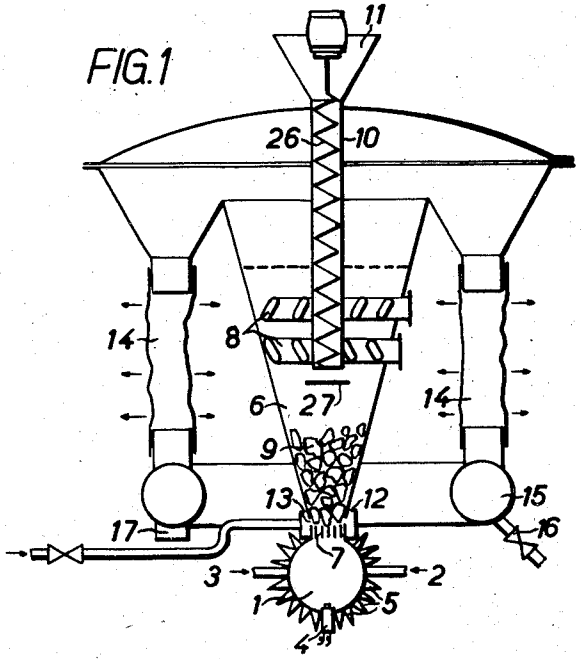
March 11, 1958 A. HALTMEIER 2,826,369

COMMINUTION BY SUCCESSIVE EXPLOSIONS

Filed Feb. 16, 1953

FIG. 1



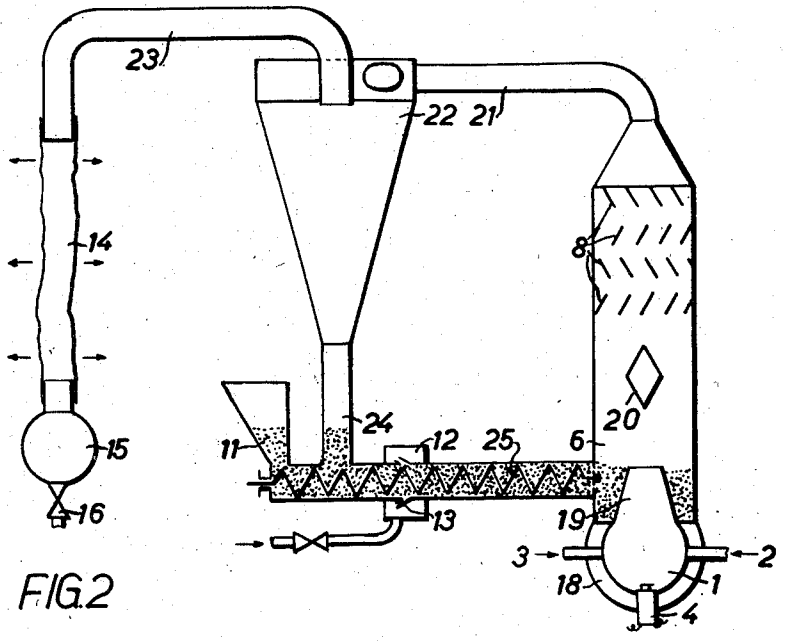


FIG. 2

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United States Patent Office 2,826,369 Patented Mar. 11, 1958

2,826,369

COMMINUTION BY SUCCESSIVE EXPLOSIONS

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Application February 16, 1953, Serial No. 337,166

Claims priority, application Germany February 19, 1952

10 Claims. (Cl. 241—1)

The present invention relates to a method of, and apparatus for, pulverizing materials of all kinds in a container.

Formerly, the rubbing action and the impact effect of surfaces were utilized in pulverizing practice. Attempts have been made to obtain improved results by the action of fast, turbulent flows of gases, and this method is gaining more and more importance. Suitable devices for this purpose are, for instance, "Micronizer" mills and other jet mills, for instance those using circulating gas.

It is an object of the present invention to provide a new method of pulverizing materials of all kinds in a container with the aid of explosions. Other objects will become apparent as the following description proceeds.

The objects of the invention are accomplished by causing mixtures of combustible gases, which may, for instance, be produced by vaporization or the finest carburation of liquid fuels, to explode with oxygen or air by means of an ignition device. The materials pulverized by the explosion waves are passed off preferably together with the explosion gases and the gases used for cleaning and then separated from these gases by conventional methods, for instance in cyclones, separators, or filters.

The apparatus in which the material is comminuted by explosions may consist of an upright, preferably conical or cylindrical, container to the lower end of which is connected an explosion chamber with feed pipes for fuels and oxygen or air and the scavenging gases as well as an ignition device and to the upper part of which is connected a dust removing appliance in which the pulverized material is separated from the explosive gases and any other gases.

To increase the turbulent motions of the explosive gases, the upright container may be equipped with assemblies causing turbulence, for instance grates or cascades. The container may further be charged with grinding elements, preferably of spherical shape, which are flung upwardly by the explosions and drop down again. A grate may be inserted at the lower part of the pulverizing container as termination against the combustion chamber. If the heat evolved in the combustion of the explosive gases is detrimental to the material to be ground, the combustion chamber may be cooled for instance by means of a cooling jacket through which a liquid can flow, or by cooling ribs.

Two embodiments of the invention are illustrated by way of example in the accompanying diagrammatic drawing.

Fig. 1 shows an apparatus comprising a combustion chamber **1** with connections **2** and **3** for the supply of explosives and scavenging gases. The apparatus also has a spark plug **4** and cooling ribs **5**. Between the combustion chamber **1** and a pulverizing container **6** is a grate **7**. The pulverizing container **6** may have installations **8** causing turbulence, preferably in the form of cooling pipes. If the pulverizing action of the gas flow is not

strong enough, grinding elements **9** may be charged in the pulverizing container. The materials to be pulverized are supplied, if necessary after preliminary breaking, into the pulverizing container **6** and through a charging hopper **10** having a filling funnel **11**: the charging hopper is provided with a filling screw conveyor **26**. A reflecting plate **27** is arranged in front of the mouth of the feeding screw conveyor **26**. As long as the pulverization has not resulted in the desired final fineness, the particles drop down again after each explosion and are whirled high again and again. The particles which have the desired fineness are taken, along with the explosion waste gases and the scavenging gases, fed through an annular duct **12** with bores **13**, and separated in a hose valve **14**, from the carrying gases which escape through the filter areas. These particles are collected in a collecting duct **15** and can be discharged through a discharge pipe **16**. To increase the flow of the end product, the collecting duct **15** may be provided with a vibrator **17**.

Fig. 2 shows a pulverizing device with explosion action: the material is classified by means of a cyclone. The combustion chamber **1**, the connections **2** and **3** for the fuel gas and air or oxygen and the scavenging gases, and the spark plug **4** are surrounded by a cooling jacket **18**. The combustion chamber **1** is connected, through a nozzle **19**, to the pulverizing container **6** in which are arranged a baffle **20** and installations **8** for causing turbulence.

The mixture of dust and gas formed in the pulverizing operation passes through a pipe **21** into a cyclone **22** in which the coarse particles are separated by centrifuging whereas the fine particles are carried along with the gas stream through a pipe **23** into the filter hose **14** in which they are separated from the gases and drop into the collector **15** from which they can be removed through the discharge pipe **16**. The coarse particles separated in the cyclone **22** drop down within the pipe **24** and are led back into the pulverizing container **6** by the conveyor screw **25** the action of which can be enhanced by the scavenging air ring **12** with bores **13**. The material to be pulverized can, for instance, be supplied through the feeding hopper **11** mounted on the jacket of the conveyor screw **25**.

I claim:

1. A process for pulverizing solid materials, which comprises explosively igniting an explosive mixture in an explosive zone, allowing the explosion waves formed to pass upwardly in disintegrating contact with a solid material in a disintegrating zone, substantially continuously repeating the operaton whereby said solid material is repeatedly propelled upwardly by said explosion waves and thereafter repeatedly allowed to fall downwardly due to the force of gravity causing a disintegration in particle size thereof, and recovering pulverized material.

2. A process according to claim 1, which includes after said igniting and prior to the next explosive igniting passing a scavenger gas through said explosive zone and said disintegration zone, passing pulverized material along with exhaust explosion gases and scavenging gases into a separation zone, and separating said pulverized material from said gases in said separation zone.

3. A process according to claim 2, in which the pulverized material is subjected to a coarse-fine separation in said separation zone, and including the recycling of the coarse particles of said material into said disintegration zone for further action therein.

4. An apparatus for pulverizing solid materials, which comprises an explosion chamber, means for passing an explosive mixture into said explosion chamber, ignition means for successively igniting explosive mixtures in said chamber, a disintegration chamber directly above the ex-

plosion chamber connected to said explosion chamber for the upward passage of explosion waves from said explosion chamber into said disintegration chamber, means for passing material to be pulverized into said disintegration chamber and directly adjacent the explosion chamber for disintegrating contact therein with said explosion waves, and means for recovering pulverized material.

5. An apparatus according to claim 4, which includes means for passing a scavenging gas into said explosion chamber, a separation chamber, and short conduit means connecting said explosion chamber with said separation chamber, whereby disintegrated material along with exhaust explosion and scavenging gases pass through said conduit means into said separation chamber for separation therein.

6. Apparatus according to claim 5, which includes turbulence-producing means positioned in said disintegration chamber.

7. Apparatus according to claim 5, which includes

grinding means positioned in said disintegration chamber.

8. Apparatus according to claim 5, which includes grate means positioned in between the explosive chamber and the disintegrating chamber.

9. Apparatus according to claim 5, which includes cooling means positioned about said explosion chamber.

10. Apparatus according to claim 5 in which said means for passing the explosive mixture into said explosive chamber is means for passing a gaseous mixture.

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