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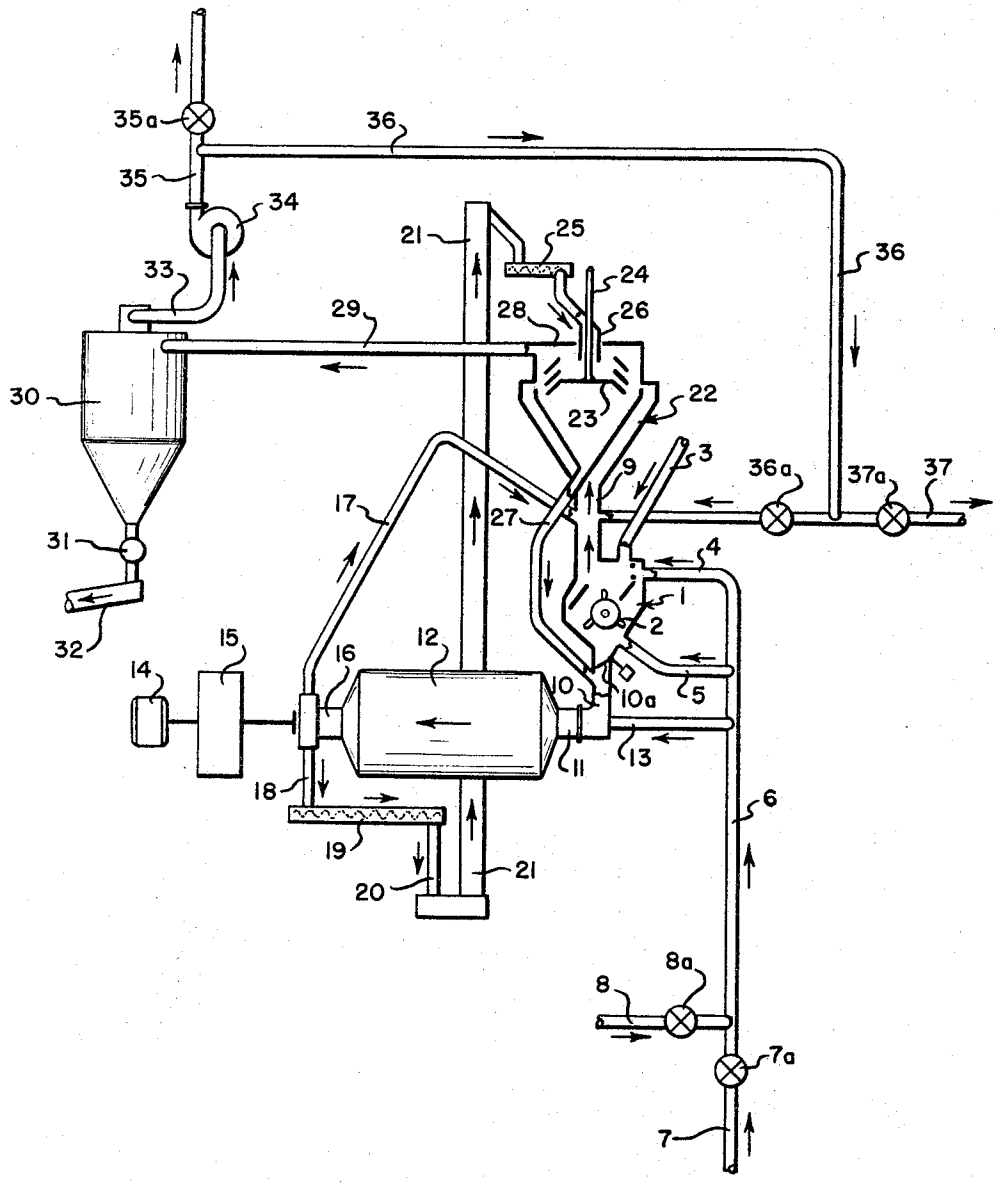


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# CRUSHING AND GRINDING PLANT

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This invention relates to plants for crushing and grinding raw material received from a quarry and is concerned more particularly with a novel plant containing a crusher and a tube mill, which is superior in performance to prior similar installations. The new plant is especially useful in the preparation of raw material in the manufacture of cement by the dry process and a form of the plant of the invention for that purpose will be illustrated and described in detail for purposes of explanation.

Crushing and grinding plants for preparing raw material in cement manufacture commonly include a preliminary crusher which is normally an impact mill or a hammer mill, and a tube mill receiving the crushed product from the crusher. When the crusher and the tube mill are air-swept, it has been the practice to pass a current of air through the two mills in series and the current carries the ground material to an air separator in which the material is separated into fractions according to particle size. The air stream ordinarily flows through the tube mill and the crusher in that order with the result that all the finished ground material from the tube mill passes through the crusher, which is disadvantageous. Also, in such installations, it has been necessary to provide a conveyor to convey the crushed material from the outlet of the crusher to the inlet of the tube mill.

In a crushing and grinding plant according to the invention, the disadvantages of the prior plant are overcome. The new grinding plant includes a crusher and a tube mill working in series and the crusher is preferably disposed directly above the mill so that the crushed product may be transferred by gravity from the crusher to the mill. The crusher and the mill are connected in parallel with respect to the air currents, by which they are swept, in that separate streams of air are supplied to the crusher and mill. The plant includes an air separator, to which the air streams from the crusher and mill are conducted, and the separator separates the material carried into it in suspension into fractions of different particle size. The coarse fraction produced in the separator is then returned to the mill for further grinding and the fine fraction is carried along in suspension to a second separator which may be of the cyclone type and separates the fine material from the air stream.

The raw material received from the quarry is usually moist and must be dried as well as ground. For this purpose, hot air is used to sweep the crusher and the mill in the new plant and such hot air may be obtained from a rotary kiln or a furnace. It may be discharged without being recirculated, although some of the air issued from the cyclone separator may be returned to enter the first separator, if desired.

The air for sweeping the mill is preferably introduced into the mill through the same inlet as the material from the crusher and, in order to prevent the air from traveling backward into the crusher through the connection between the crusher and the mill, the connection is provided with a valve which may be a loaded flap valve. Coarse material from the crusher accumulates on the valve and forces it to open when the accumulation is of sufficient weight.

For a better understanding of the invention, reference may be made to the accompanying drawing which illustrates diagrammatically a preferred embodiment of the invention.



The plant illustrated in the drawing includes a crusher **1**, which is illustrated as an impact mill having rotary impact members **2**. The raw material is supplied to the crusher through a pipe **3** and air for sweeping the crusher is suppplied through branches **4** and **5** of a pipe **6**. When the material is moist, the air for sweeping the crusher is heated air, which may be supplied to the pipe **6** through a pipe **7** from a rotary kiln, through a pipe **8** from a furnace, or from both sources. When air from both sources is employed, the proportions are controlled by the valves **7***a* and **8***a* in the pipes **7** and **8**, respectively.

The crusher has a top air outlet, from which a pipe **9** leads upwardly, and a bottom outlet for crushed product, from which a pipe **10** containing a valve **10***a*, preferably a loaded flap valve, leads to the inlet **11** of a tube mill **12**. The mill is preferably at a lower level than the crusher so that the crushed product may travel from the crusher to the mill by gravity through the pipe **10**. A connection **13** from the pipe **6** to the mill inlet supplies air for sweeping the mill. The mill is driven by a motor **14** through a reduction gear **15** and it has an outlet **16**, from which a pipe **17** leads to the pipe **9**. Fine material carried out of the mill in suspension travels through the pipe **17** while coarse material is discharged from the outlet through a pipe **18** and is conveyed by a screw conveyor **19** and discharged into a pipe **20** leading to an elevator **21**.

A separator **22** is disposed above the crusher and has a bottom inlet, to which the pipe **9** from the crusher leads. The separator illustrated is of the type having a rotary distributor **23** mounted on the lower end of a shaft **24** and material raised by the elevator **21** is discharged into a screw conveyor **25** and travels by gravity through a pipe **26**, which extends into the separator and discharges the material on top of the distributor **23**. The distributor produces a coarse fraction which is discharged through a bottom outlet and conducted through a pipe **27** into the connection **10** between the crusher and the mill. The separator has a top outlet **28** for air and the air stream with the fine fraction entrained therein, which issues from the outlet, is conducted through a pipe **29** to a separator **30**, which is preferably of the cyclone type. The separator **30** separates the material from the air stream and the material leaves the separator at the bottom through an airlock **31** and a pipe **32**. The air outlet at the top of the separator **30** is connected by a pipe **33** to the intake side of a fan **34**, from the outlet of which leads a pipe **35** containing a valve **35***a* and open beyond the valve to the atmosphere. If desired, the air traveling through the pipe **35** may be returned to the separator through a pipe **36** containing a valve **36***a* and connecting the pipe **35** in front of the valve **35***a* to the pipe **9**. If preferred, the air traveling through the pipe **36** may be conducted through a pipe **37** containing a valve **37***a* to a rotary kiln for use as secondary air of combustion.

Various modifications may be made in the plant as, for example, the air may be supplied to the crusher through a single pipe instead of through the pipes **4** and **5** and the crusher may be a hammer mill rather than an impact mill. The tube mill may be of the type, in which all the ground material is carried away by air flowing through the mill and, when such a mill is employed, the air separator **22** may advantageously be of the type, in which the material is introduced tangentially and not deposited upon a rotary distributor.

I claim:

**1.** A plant for grinding quarried material, which comprises a crusher having an inlet, and outlet for crushed material, and an outlet for air, means for supplying material from the quarry to the crusher, a tube mill having

an inlet and an outlet, a connection for the passage of material from the material outlet of the crusher to the mill inlet, means for supplying separate air streams for sweeping the crusher and the mill and carrying material therefrom in suspension, a separator for separating a coarse fraction from material entering the separator in suspension in an air stream, separate means for conducting air streams with material in suspension therein from the air outlet of the crusher and the outlet of the mill to the separator, and means for returning the coarse fraction from the separator to the mill inlet for further grinding.

2. The plant of claim 1, in which the crusher is disposed above the mill and material travels by gravity through the connection from the material outlet of the crusher to the mill inlet.

3. The plant of claim 1, which includes a second separator connected to the first separator to receive an air stream therefrom and separating from the stream material being carried in suspension therein.

4. The plant of claim 3, which includes a connection for returning to the first separator air issuing from the second separator.

5. The plant of claim 3, in which at least a part of the air issuing from the second separator is discharged into the atmosphere.



6. The plant of claim 1, in which the mill has a single inlet, through which the air stream and the material from the connection enter the mill, and there is a valve in the connection preventing the air stream from entering crusher through the connection.

7. The plant of claim 6, in which the valve is a loaded flap valve.

8. The plant of claim 1, in which the separator has a bottom inlet for air, a top inlet for material, and a rotary distributor below the top inlet, the mill has an outlet for air with material suspended therein and an outlet for coarse material, and conveying means convey coarse material from the coarse material outlet of the mill to the top inlet of the separator.

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