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GRINDING MILL

Filed Nov. 2, 1929

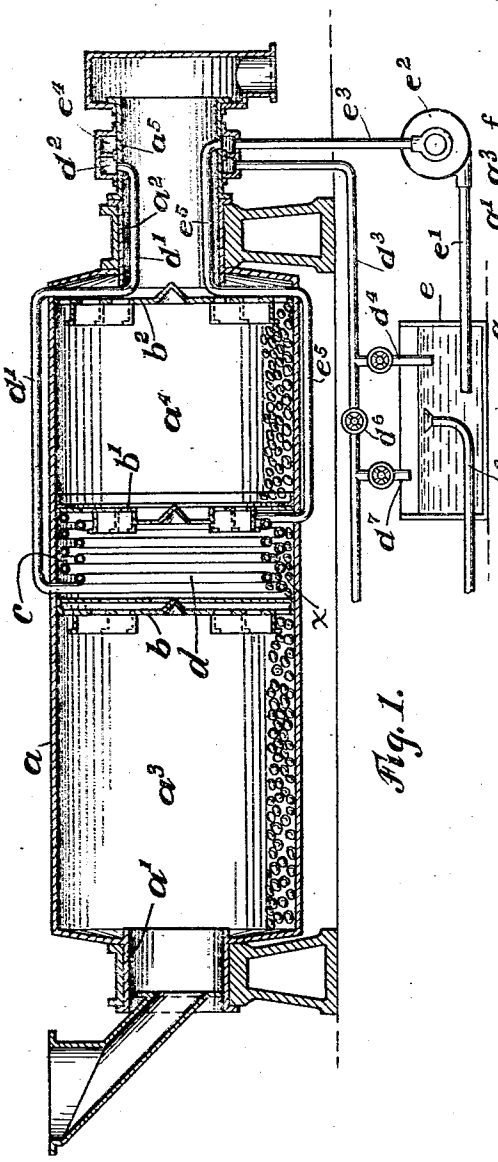


Fig. 1.

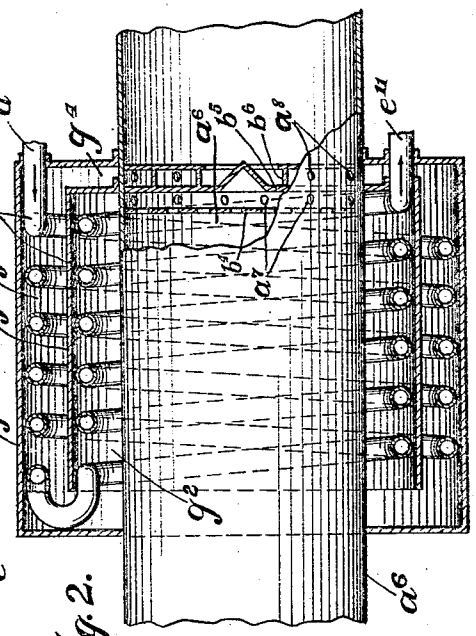


Fig. 2.

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UNITED STATES PATENT OFFICE

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GRINDING MILL

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In the fine grinding of cement raw materials required for the production of special Portland cement the development of heat is an unavoidable consequence. Such increase of temperature results in the tendency of the finely ground material to adhere to the inner surface of the grinding mill, whereby the efficiency of the mill is considerably reduced, and also sometimes in the undesirable conversion of the gypsum to plaster of Paris. Various means for reducing the temperature of the mill and its contents during grinding have been proposed and are used, such as a water-jacket applied to the mill, or the application of cold water to the outside of the mill, or the introduction into the mill of some substance which, by its evaporation, reduces the temperature. The object of the present invention is to provide improved means for cooling the contents of the mill during the grinding and in accordance with the invention there is applied to the mill, either within its shell or outside of its shell, a heat exchanger with which the material being ground comes in contact as it progresses through the mill, the heat exchanger being preferably tubular and supplied with a cooling medium, such as water, which is preferably caused to circulate under suction so that there can be no leakage of the cooling medium within the mill. The heat exchanger is located at some convenient point within the mill, preferably in a separate chamber between the preliminary or rough grinding chamber and the final or fine grinding chamber, such separate chamber being formed by perforated partitions to permit the passage of the material being operated upon while preventing the passage of the grinding bodies. The grinding bodies are preferably excluded from such separate chamber in order to prevent excessive wear of the heat exchanger, but loose bodies, not calculated to have any grinding action, may be introduced within the separate chamber for the purpose of preventing adhesion of the material to the exposed surface.

The invention will be more fully explained hereinafter with reference to the accompanying drawings in which it is illustrated, and in which:

Figure 1 is a view in longitudinal, sectional elevation showing a grinding mill equipped with a cooling device.

Figure 2 is a partial view in sectional elevation showing a modified embodiment of the invention.

The grinding mill a may be supported as usual by a trunnion a^1 at the feed end and by a trunnion a^2 at the discharge end. The mill may be of any suitable construction, the invention not being concerned with the particular construction except as hereinafter indicated. The preliminary or rough grinding of the material may be carried on in a chamber a^3 and the final or fine grinding in a chamber a^4. In the construction shown in Figure 1 partitions b and b^1 form between them and between the chambers a^3 and a^4 a separate chamber c in which may be located the heat exchanger to be described. The partitions b and b^1 are of ordinary construction, being adapted to permit and promote the passage of the material operated upon from the preliminary grinding chamber to the final grinding chamber while preventing the passage of the grinding bodies from the preliminary grinding chamber a^3 into the separate grinding chamber c and from the final grinding chamber a^4 back into the separate chamber c. The discharge end of the cylinder of the mill also receives a partition b^2 which in like manner permits and promotes the passage of the ground material while preventing the escape of the grinding bodies from the chamber a^4.

In the construction shown in Figure 1 the heat exchanger d is located within the shell of the mill and in the chamber c, being shown as a coiled tube, which rotates with the mill and with which the material being ground comes in contact as it passes through the chamber c giving up some of its heat. One end of the coil is shown as connected through a pipe d^1 with an annular, stationary channel d^2 which is mounted water-tight on an extension a^5 of the trunnion a^2, the pipe d^1 being carried through the trunnion to effect connection with a channel d^2. The channel

d^2 receives its supply of cooling medium, such as water, through a pipe d^3 and a branch pipe d^4 from a tank e, which is connected through a pipe e^1, a suction pump e^2 and a pipe e^3 with a stationary, annular channel e^4 mounted water-tight on the extension a^5 of the trunnion a^2. From the channel e^4 connection is made through a pipe e^5 with the other end of the pipe coil or heat exchanger d. By this means a constant circulation of the cooling medium between the exchanger and the tank is maintained under suction so that there shall be no leakage of the cooling medium into any part of the mill.

The pipe d^3 may be extended through a valve d^6 for connection to a supply of cooling medium and may be arranged to discharge the cooling medium into the tank e through a valved branch d^7, the branch d^4 being also valved. The flow of the water or cooling medium may thus be controlled at will. The tank e is shown as provided with an overflow, as at e^6.

Loose bodies, indicated at x, not having grinding efficiency, may be introduced into the chamber c for the purpose of preventing adhesion of the ground material to the surfaces exposed within that chamber.

In the embodiment of the invention illustrated in Figure 2 the heat exchanger is shown as a double coil f located outside of a shell a^6 of the mill within a jacket or housing g which is secured to the mill to rotate therewith and is provided with a partition g^1 the major part of which is extended between the parts of the double coil f. One end of the double coil f may be connected through a pipe d^{11} and the other end of the coil may be connected through a pipe e^{11} with the supply and circulating devices in the same manner as shown in Figure 1 and not necessary to be illustrated again in Figure 2.

The inner chamber g^2 of the housing g communicates with the interior of the mill a^6 through openings a^7 in the wall of the mill and the other chamber g^3 of the housing g communicates with the annular channel g^4, and with the interior of the mill through openings a^8. A perforated partition b^4 permits the ground material to reach the openings a^7 while preventing the blocking of the same by grinding bodies and a partition b^5 separates the openings a^7 from the openings a^8. In the operation of this embodiment of the invention the material being ground passes from the interior of the mill through the openings a^7 into the inner chamber g^2 of the housing in which the movement of the material toward the left-hand end of the housing is promoted by the spiral arrangement of the tube. From the chamber g^2 the material passes around the end of the partition g^1 into the chamber g^3 in which the movement of the material is promoted by the spiral arrangement of the tube therein. From the chamber g^3 the material passes through the annular channel g^4 and through the openings a^8 into the continuation of the mill to the right of the partition b^5 which may be provided as usual with lifters b^6 to promote the movement of the material.

It will be understood that various changes in details of construction and arrangement can be made to suit different conditions of use and that, except as pointed out in the accompanying claims, the invention is not limited to the particular constructions shown and described herein.

I claim as my invention:

1. In a grinding mill, the combination of a shell having a trunnion, partitions forming within the shell a preliminary grinding chamber, a final grinding chamber and a separate chamber, said partitions permitting the passage of the material being ground and preventing the passage of the grinding bodies, a tube coil located within the separate chamber for contact with the material being ground in its passage therethrough, stationary annular channels mounted water-tight on the trunnion of the mill, connections from the tube coil to said channels, respectively, and means to effect circulation of a cooling medium under suction through said annular channels and the tube coil.

2. In a grinding mill, the combination of a shell, partitions forming within the shell, a preliminary grinding chamber, a final grinding chamber, and a separate chamber, said partitions permitting the passage of the material being ground and preventing the passage of the grinding bodies, a tube coil located within the separate chamber for contact with the material being ground in its passage therethrough, and means to effect circulation of a cooling medium under suction through the tube coil such means including connections to permit the rotation of the shell independently of said supply means.

This specification signed this 1st day of November, A. D. 1929.

MICHAEL TRESCHOW.