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COOLING APPARATUS FOR PULVERULENT OR GRANULAR MATERIAL

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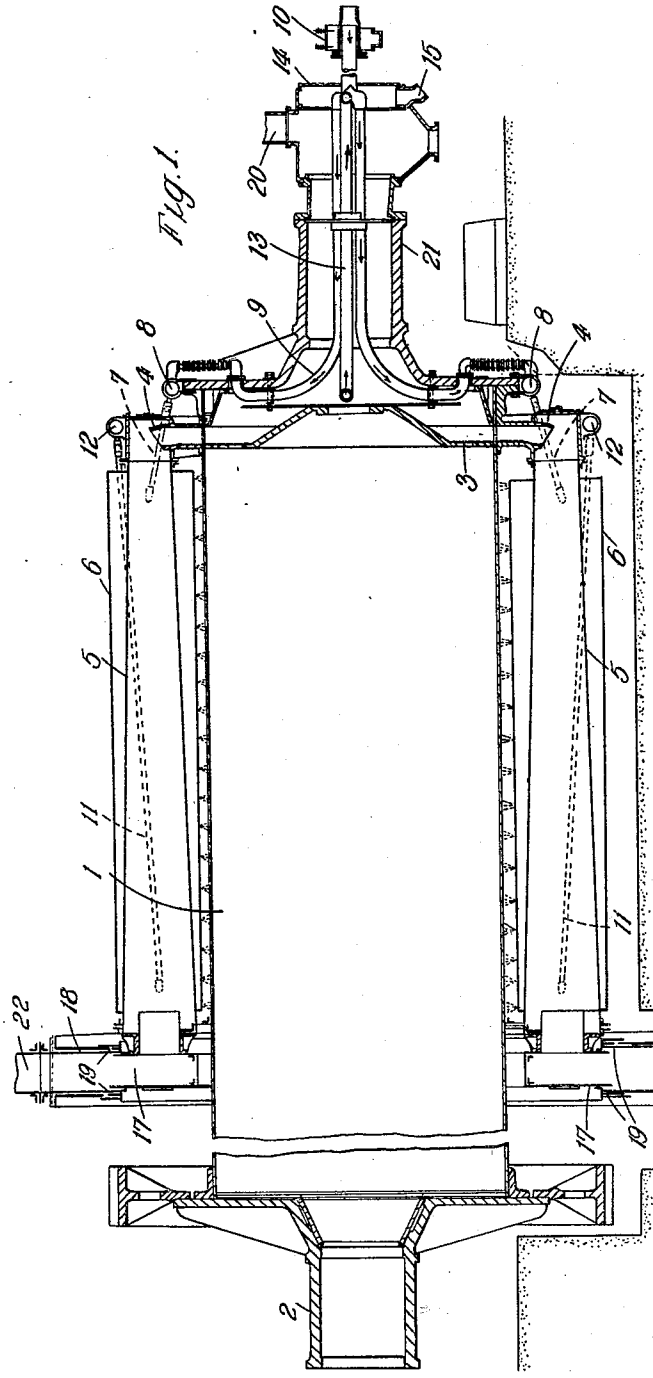


Fig. 1.

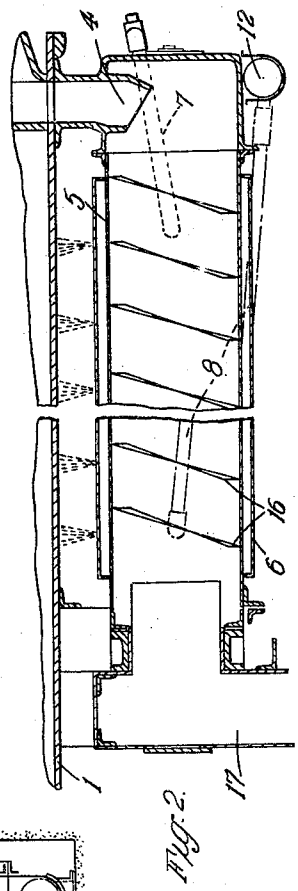


Fig. 2.

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UNITED STATES PATENT OFFICE

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COOLING APPARATUS FOR PULVERULENT OR GRANULAR MATERIAL

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The present invention relates to cooling apparatus for pulverulent or granular material and is particularly, although not exclusively, applicable in connection with the manufacture of cement. When grinding cement to a degree of fineness sufficient to ensure rapid-hardening qualities heat is evolved and it is necessary that the cement shall be cooled on its delivery from the grinding mill. Hitherto this operation has been performed by a cooler constituting apparatus distinct from the grinding mill. This, however necessitates a separate handling operation and requires the provision of increased space besides augmenting the cost, and it is the main object of the present invention to overcome these disadvantages by combining the necessary cooling apparatus with the grinding mill.

According to the invention the material to be cooled on delivery from the grinding mill is passed through a number of tubes, cylinders or chambers of any suitable shape, which are subjected to the action of a cooling liquid passed through a jacket or sprayed or otherwise applied to the external surface of each tube or chamber. The construction is such that the cooling tubes or chambers are attached to or associated with the grinding mill so that the whole constitutes a single piece of apparatus.

In order that the invention may be clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying drawing, which illustrates an example of apparatus in accordance therewith, and in which:—

Figure 1 shows in longitudinal section a grinding mill suitable for treating cement and fitted with cooling apparatus in accordance with present invention, and

Figure 2 is a detail sectional view showing a modification of the cooling apparatus.

In the form of the invention illustrated in Figure 1, the material to be ground is introduced into the mill, which may be of ordinary form constituted by a rotating chamber 1, through a trunnion 2 at one end, but instead of its being delivered, as is common practice, through a second trunnion at the opposite end it passes through a number of apertures 3 and conduits 4 into a series of tubes or cylinders 5, arranged around the external surface of the chamber 1, and substantially parallel thereto. These tubes or cylinders are provided with jackets 6 into which cooling water may be introduced by pipes 7 leading from a ring main 8 having inlet pipes 9 connected to a source of supply through a suitable seal 10. Outlet for the water may be by pipes 11 connected with a ring main 12 having an outlet pipe 13 adapted to discharge into a hood 14 fitted with a draining aperture 15. In addition or alternatively the cooling water may leave the jackets 6 through a series of apertures in such a manner as to impinge, as indicated, on the outer surface of the chamber 1, in which a cooling effect is thereby produced. Alternatively, instead of passing the cooling water through jackets it may be sprayed or otherwise applied to the external surfaces of the tubes through which the cement is passed.

In order to ensure that the cement shall pass in a steady stream through the tubes any suitable devices for this purpose may be employed; for example, each tube may be fitted with an internal helix in the form of an inwardly projecting flange 16, Figure 2, or with a sliding bar having inclined vanes or with a spindle having a series of paddles and adapted to be rotated by any suitable means. Instead of or in addition to the use of such devices, the action of gravity or vibration may be relied on, and in such cases the form of the tubes may be such as to promote passage of the cement through them, for example, as shown in Figure 1, they may be conical in shape, the larger diameter being toward the delivery end. The tubes 5 open into a common hood 17 rotating with them, a seal between this hood and a stationary hood or hopper 18 being provided by such means as floating rings 19. It will be seen that, as the cement is passed into the tubes 5 at the delivery end of the chamber 1, if each tube is constituted by one straight length in proximity thereto as shown in Figure 1, final delivery of the cement will occur in proximity to the feeding end of the grinding mill. If

it be desired that such final delivery shall occur near the delivery end of the chamber 1, a second series of tubes or cylinders may be fitted between those above referred to, the ends of these tubes in proximity to the feeding end of the grinding mill being respectively connected together in such a manner that the second series of tubes constitutes a return path for the cement, whereby delivery will take place in proximity to the delivery end of the chamber 1.

In order to prevent the cement from clogging the tubes due to reek or steam generated therein during the grinding process, an outlet 20 may be provided in proximity to the delivery end of the chamber 1 whereby, through a hollow trunnion 21, any vapour which has been generated may be extracted. Similarly the hood or hopper 18 into which the cement is finally delivered may be fitted with a vent pipe 22 for the purposes of drawing off vapour and maintaining the cement in a thoroughly dry condition.

What I claim and desire to secure by Letters Patent of the United States is:—

1. A grinding mill comprising in combination a grinding chamber, a number of cooling chambers separate from said grinding chamber, means for passing the material under treatment from said grinding chamber through said cooling chambers and means for applying a cooling liquid to the outer surface of said cooling chambers.

2. A grinding mill comprising in combination a grinding chamber, a number of cooling chambers separate from said grinding chamber, means for passing the material under treatment from said grinding chamber through said cooling chambers, a jacket surrounding each of said cooling chambers and means for circulating cooling liquid through each of said jackets.

3. A grinding mill comprising in combination a grinding chamber, a number of cooling chambers, means for passing the material under treatment from said grinding chamber to said cooling chambers, a jacket surrounding each of said cooling chambers and means for circulating cooling liquid through each of said jackets and for spraying said liquid on to said grinding chamber.

4. A grinding mill comprising in combination a rotatably mounted grinding chamber, a number of cooling cylinders in proximity to the outer surface of said grinding chamber, means for passing the material under treatment from said grinding chamber through said cylinders and means for applying a cooling liquid to the outer surface of said cylinders.

5. A grinding mill as in claim 4, including a hood, means whereby the material under treatment is delivered from each of said cooling cylinders into said hood, a stationary hopper in operative relation with said hood and a seal between said hood and said hopper.

6. A grinding mill comprising in combination a grinding chamber, a number of cooling chambers separate from said grinding chamber, means for passing the material under treatment from said grinding chamber through said cooling chambers, a jacket surrounding each of said cooling chambers, inlet and outlet mains respectively connected with each of said jackets and means for connecting said inlet main to a source of liquid supply and said outlet main to a discharge pipe.

7. A grinding mill as in claim 4, in which each cooling tube is provided with an inwardly projecting helical flange so located that, on rotation of the grinding chamber, the material within the tube is pushed toward the delivery end.

8. A grinding mill as in claim 1, in which a return series of cooling chambers is provided whereby final delivery of the granular material takes place in proximity to the delivery end of said grinding chamber.

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