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GRINDING IN TUBE MILLS AND THE LIKE

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Fig. 1.

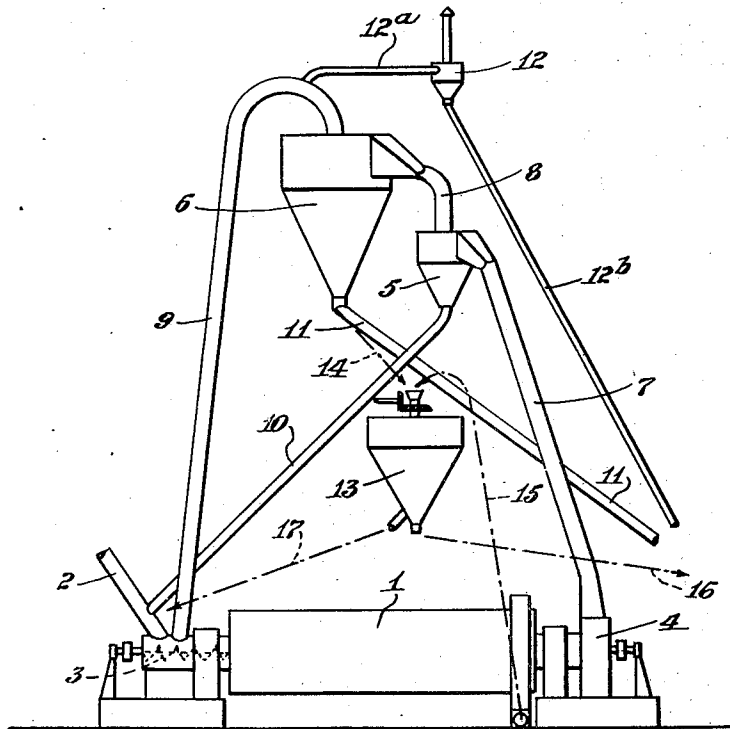
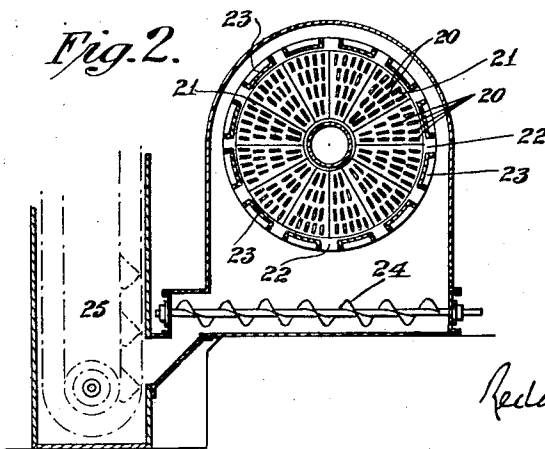


Fig. 2.



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GRINDING IN TUBE MILLS AND THE LIKE

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2 Claims. (Cl. 83—9)

This invention relates to the grinding of materials, such as cement materials, coal dust for fuel purposes, and the like, in tube mills or ball mills. In the grinding of such materials in such mills a separation of the coarser particles from the finer particles must be effected, it being well known that the efficiency of such a mill is impaired by the retention in the mill of the particles which have been reduced to the desired fineness. Efforts have been made to overcome this difficulty in one or the other of two ways.

In one of such ways all of the material which has passed through the mill, including both the finer material and the coarser material, is transferred from the mill to separators outside of the mill itself, the finer particles being carried on from the separator to the place of storage or use and the coarser particles being returned from the separator to the mill for further grinding. The trouble with this procedure is that the ground material, comprising both coarse particles and fine particles, is not quickly and thoroughly enough removed from the mill, the continued presence of the finer particles in the mill cushioning the grinding bodies and preventing them from operating efficiently on the remaining coarse particles.

In the other way, in the operation of what are known as air-swept mills, a current of air is caused to flow at all times through the mill, the intention being that the current of air shall carry away from the mill the finer particles, leaving the coarser particles in the mill to be ground further. The difficulty in this procedure is that if the current of air is too powerful it will carry away from the mill particles which are too coarse as well as the finer particles, while, on the other hand, if the current of air is not sufficiently powerful, as is usually the case, the finer particles will not be carried away completely, but will remain in the mill to cushion the action of the grinding bodies and so impair the efficiency of the mill.

The object of this invention is to overcome the difficulties incident to both modes of procedure and in accordance with the invention a current of air is caused to sweep through the mill at all times, carrying with it the finer particles, more or less admixed with coarser particles. The finer particles may be carried onward by the air current to be delivered at the place of use or storage, while all of the material, both coarse and fine, is subjected to the action of a separator from which the finer particles are carried onward to the point of discharge while the coarser particles are returned to the mill for further grinding. In con-

junction with such subsection of the material to the action of air currents, the material which in the mill has been reduced to such a degree of fineness as to pass through the apertures in the usual separator plate which holds back the grinding bodies and in the shell of the mill is transported by mechanical means to a separator from which the sufficiently fine particles are delivered to the place of use or storage while the coarser particles are returned at once to the mill for further grinding.

The invention will be more fully explained hereinafter with reference to the accompanying drawing—

Figure 1 of which illustrates in outline and somewhat schematically an embodiment of the invention, while Figure 2 is a detail view partly in transverse section illustrating mechanical means for transporting ground material from the mill to a separator.

In the embodiment of the invention illustrated in Figure 1 a grinding mill, which may be of any usual or suitable character and in the operation of which, as usual, the material being ground is carried onward from the feeding end of the mill to the other end at which it is discharged, is indicated at 1. The mill is charged, as usual, with grinding bodies which need not be shown. The material to be ground may be supplied to the mill in any convenient manner, as by a supply pipe 2, and a worm conveyor 3. At the discharge end of the mill is connected a suction blower 4 creating a current of air sufficiently powerful to remove from the mill the ground material, and deliver it through a conductor 7 to a separator 5, which may be of the usual cyclone type, from which the coarsest of the material is delivered, as by gravity, through a conductor 10 back to the feeding end of the mill, such conductor, in the arrangement shown, connecting the discharge of the separator 5 to the supply pipe 2. From the separator 5 the finer material, perhaps carrying with it some particles which are too coarse to be discharged and must be subjected to further grinding, is conducted further, still on the air current, through a conductor 8 which serves to connect the separator 5 with a separator 6, also preferably of the cyclone type, and in which the air is separated from the material. The separator 6 is connected by an air conductor 9 with the feeding end of the mill, a closed circuit for the air current being thus provided. From the separator 6 all of the material from which the air has been separated may be discharged, as by gravity,

through a conductor 11, to the place of use or place of storage, or the fine particles may be so discharged while the coarser particles still remaining are discharged through a conductor 14 to a separator 13, or, if conditions warrant, all of the material may be discharged through the conductor 14 to the separator 13. The particles which are not carried on from the mill by the air current but are fine enough to pass through the apertures 20 in the usual screen plate 21 and the apertures 22 in the shell 23 of the mill, having been separated from the grinding bodies which are retained by the slotted plate 21, are transferred to the separator 13 by mechanical devices such as a conveyor 24 and elevator 25. From the separator 13 such particles as have been reduced to a sufficient fineness are discharged, as by gravity, to be conducted away, as by a conductor indicated at 16, to the place of use or storage, while the coarser particles which are separated in the separator 13 are conducted, through a conductor sufficiently indicated at 17, back to the feeding end or other point of the mill to be subjected to further grinding. While there are illustrated in this embodiment of the invention a plurality of separators 5 and 6 it will be understood that only one such separator or no such separator may be employed, as indicated by the conditions of operation, the purposes of the invention being satisfied in part at least by the provision of a separator, such as that indicated at 13, to the action of which is subjected all of the material discharged from the mill.

There may also be provided, as at 12, a separator connected, as at 12^a, with the air conduc-

tor 9 for the purpose of taking from the air current such fine particles as might be carried over by it and delivering them, as by a conductor 12^b, to the place of use or storage.

It will be understood that the invention may be embodied in various other arrangements of apparatus suited to the materials being treated or to other conditions of use.

I claim as my invention:

1. The combination with a grinding mill, of means to induce a current of air through the mill, a separator, means to conduct particles on the current of air from the mill to the separator, a second separator, means to conduct the coarser particles from the first named separator to the second named separator, mechanical means to discharge particles from the mill and transfer them to said second separator, means to conduct away the finer particles from the second named separator, and means to return the coarser particles from the second named separator to the mill.

2. The combination with a grinding mill, of means to induce a current of air through the mill, a separator, means to conduct the particles on the current of air from the mill to the separator, means to conduct away the finer particles from the separator, a second separator, means to conduct the coarser particles from the first named separator to the second named separator, means to conduct away the finer particles from the second named separator, and means to return the coarser particles from the second named separator to the mill.

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