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B. SCHERBAUM

2,211,518

GRINDING MILL

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Fig. 1.

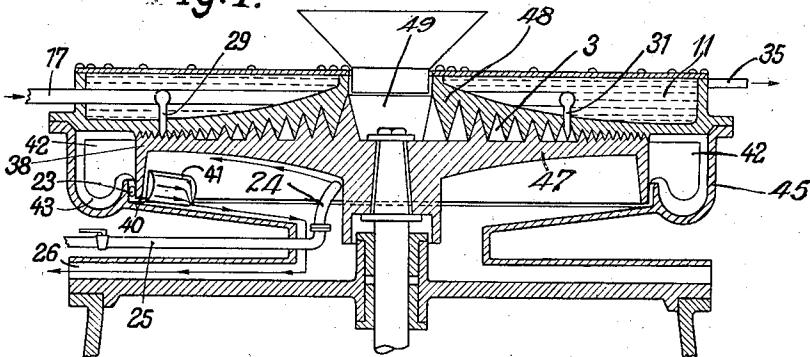


Fig. 2.

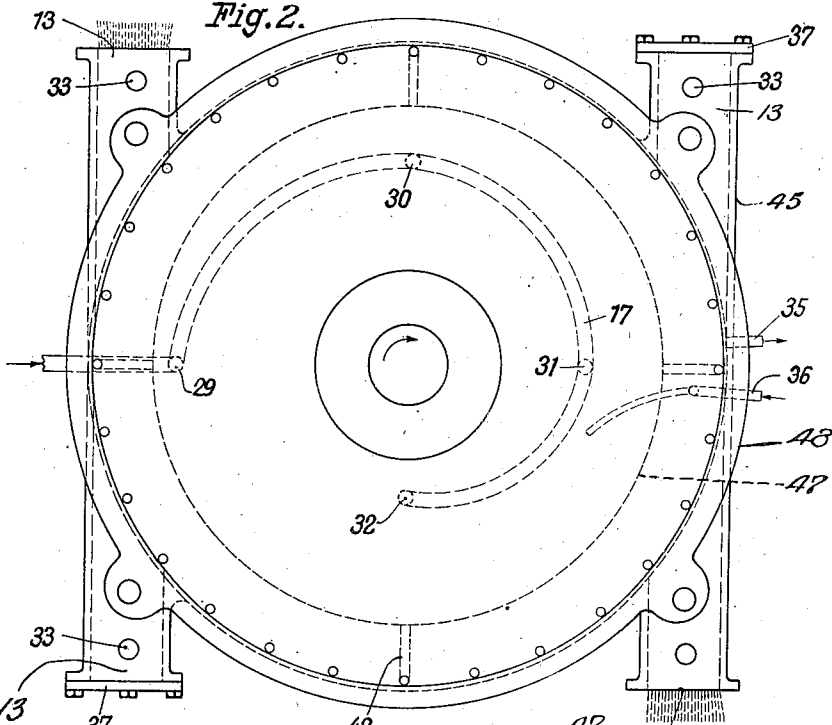


Fig. 3.

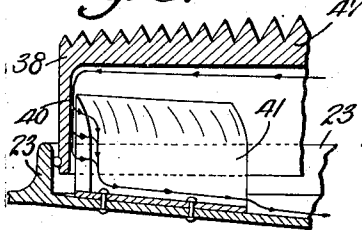
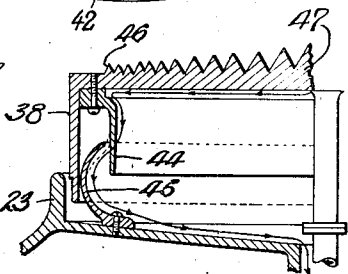


Fig. 4.



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UNITED STATES PATENT OFFICE

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GRINDING MILL

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3 Claims. (Cl. 83—7)

This invention relates to the cooling of disc-like grinding bodies, their grinding instrumentalities and the ground material. Disc mills provided with teeth, pins and the like are known per se. The grinding instrumentalities either engage one another or slide past and above one another. These mills have either a stationary disc and a rotary disc or two rotary discs. The grinding instrumentalities of both discs are usually arranged in concentric rings about the centre of the discs and provided with interdental spaces. The ground material is fed through an inlet to the centre of the discs, then passes through the grinding instrumentalities and on reaching the periphery of the discs enters a delivery channel through which the ground material passes into a storage container.

This grinding operation is performed both in disc mills with a vertical shaft and in disc mills with a horizontal shaft.

The efficiency of such mills, that is the quantity and the degree of grinding to fragments, coarse grain, grits, fine and the very finest flour is to a large extent dependent on the effective cooling of the disc bodies, the grinding instrumentalities and the ground material itself during the grinding operation. The grinding systems heretofore known in grinding with disc bodies are insufficient in their effect because the grinding instrumentalities are insufficiently cooled.

In such mills the grinding instrumentalities are heated a short time after starting to such an extent that continuous running is impossible; consequently the efficiency is unsatisfactory. With such insufficient cooling the ground material is damaged so that for example in grinding india rubber the latter is rendered useless by heating. The heating of the disc bodies and of the grinding instrumentalities causes marked expansion and thereby increased friction which results in heavy wear of the grinding instrumentalities and in a high power consumption.

The invention has for its object to obviate these drawbacks. This object is realised by the provision of a disc mill with cooling of the disc bodies by liquid or gaseous cooling media, which is characterised by cooling devices so formed that the disc bodies in the region of the grinding instrumentalities and in the region of the channel for delivery of the ground material are effectively cooled both as a consequence of the quantity of the cooling medium and as a consequence of the mode of directing the cooling medium.

A disc mill constructed according to the invention permits the grinding of all kinds of material. The material may either be fed in dry condition to the mill and ground in dry condition or in certain cases liquid may be fed to the mill during grinding so as to effect so-called "wet grinding."

For example, pigments with the addition of oil, certain fats and kinds of flesh, hides, fish bones, bones, etc., with the addition of water, may be ground. The new mill is adapted also for grinding of all elastic and of those materials which generate a high degree of heat on grinding and which are sensitive to temperature.

By means of a mill according to the invention all kinds of soft and hard rubber can be ground to any granular size up to the finest. The mill is also adapted for grinding crude rubber with the addition of water. If elastic materials such as, for example, soft or hard rubber are to be ground, the grinding discs of the mill may be provided with teeth which besides the usual impact and cutting action crush and rub the material during rotation. Such mills have tapering teeth. In this case the method of cooling according to the invention is especially efficient in a direct cooling of the teeth.

By the new method of cooling the heat set up in the grinding instrumentalities is led off as far as possible so that not only the material comminuted in the grinding chamber but also the material delivered through the delivery channels is effectively cooled.

Further characteristics of the invention will be understood from the following description and the claims as also from the accompanying drawing.

In the drawing the invention is illustrated in several embodiments.

Figure 1 is a vertical section through a disc mill having a vertical shaft in which the bottom of the disc is cooled by water.

Figure 2 is a plan view of the mill shown in Figure 1.

Figure 3 illustrates on a larger scale the outer edge of the rotary disc and the bottom of the casing in section with a stripper plate.

Figure 4 also shows on a larger scale the outer edge of the rotary disc and the bottom of the casing in section with a resilient sealing device.

In Figure 1 the vertically movable shaft is mounted vertically in the casing and carries the rotary disc which is provided with a downwardly projecting water-intercepting ring. This ring is loosely sealed against the annular ridge provided in the mill casing. Into the cavity formed by the intercepting ring, the outer face of the rotary disc and the prolongation of the boss there projects an exchangeable nozzle. This nozzle may be formed as a jet nozzle or as a sprinkler or otherwise, there being preferably used a short rubber tube which conducts the cooling medium directly against the boss and the outer side of the disc. The nozzle conducts cooling medium, e. g. water, supplied by a pipe, in controllable quantity, to the outer side of the rotary disc. The cooling water runs on

the outer intercepting ring 38 downwards, impinges on the outer edge 40 of a stripper plate 41, which, in consequence of its scoop-like formation, directs the water towards the interior of the casing whence it leaves the mill in the direction shown by the arrow at 26.

This arrangement and the construction of the stripper plate 41 is shown on enlarged scale in Figure 3. The stripper 42 for the ground materials which, in this case are arranged externally of the water ring, project as usual into an annular channel 43 and, on rotation, expel the ground material thrown out from the largest tooth ring through the discharge openings from the mill.

Fig. 4 illustrates a further form of construction for sealing the cooling water chamber of the rotary disc from the annular channel 43 for the ground material. In the corner between the under face of the disc 47 and the water-intercepting ring 38 there is arranged a rubber ring 44 projecting over the entire circumference of the disc. This ring is of angular section, the angle being approximately 90°. The outer face of the depending part of this ring extends almost perpendicularly downwards, the cross-section diminishing in downward direction. On the floor of the casing there is secured a second rubber ring 45 which also extends over the entire periphery of the disc. This second ring is of sickle form in cross-section, the concave face being directed inwards. The ends of the edges of these rings 44 and 45 overlap. The edge of the sealing ring 45 is at a slight distance from the outer face of the depending part of the rubber ring 44.

The mode of operation of this sealing arrangement is as follows:

The cooling water coming from the nozzle 24 passes in the direction of the arrows centrifugally to the outer face of the rotary disc 47 and flows along the latter outwards. On impinging on the upper rubber ring 44 the cooling water is deflected downwards and acts by its centrifugal action on the upper rubber ring which it presses outwards against the edge of the lower ring 45.

The edge of the upper ring 44 is pressed so close against the edge of the lower ring 45 as to form a complete seal so that the cooling water cannot pass outwards. In Fig. 4 there is shown in dotted lines how the upper edge of the rubber ring 44 bears against the rubber ring 45. When the seal is complete, the cooling water flows in the direction of the arrow along the lower rubber ring and is deflected thereby and finally is discharged from the mill. The sealing effect obtained by the construction and arrangement of the rubber rings according to the invention is further increased by the centrifugal action of the rotary disc exercised on the lower part of the upper rubber ring 44.

The outer tooth ring 46 of the disc 47 preferably stops at about the point where the cooling water stream is deflected downward.

Fig. 2 shows the mill casing 45 of Fig. 1 with four outlets 13 of which upon rotation to the right of the rotary disc (see the arrow in the inlet 49) the left-hand upper outlet and the right-hand lower outlet are opened and the left-hand lower outlet and the right-hand upper outlet are each closed by a flange with cover 37 from the annular channel. The outer contour of the rotary disc 47 is indicated with its four strippers 42 in dotted lines. 48 is the stationary disc with flange. From the spiral tube 17 there

lead downwardly into the interdental spaces of the stationary disc the nozzles 29 to 32 which being located at different radial distances from the center of the disc and uniformly distributed circumferentially conduct air in adjustable quantity into the grinding chamber 3. The cooling medium for the cooling chamber of the stationary disc enters by way of the connection 36 and leaves the mill at the outlet connection 35. For controlling the temperature at which the strip of the finished ground material is effected each outlet has a closeable opening 33 for a thermometer. The number of nozzles is not restricted to four.

All of the cooling air led to the grinding chamber by way of the inlet or the nozzles and whether mixed or not with water, talc or the like, is thrown out from the mill in a strong centrifugal flow admixed with the ground material.

If it is desired to dry certain materials in their passage through the mill, a warmed medium may be passed through the cooling device or cooling chambers of the mill.

In a disc mill constructed according to the invention care is taken that all those parts of the mill which are strongly heated in the grinding operation are effectively cooled. This effect is obtained not only by the particular formation and dimensioning of the requisite cooling chambers but also by the cooling devices which bring the cooling medium used into intimate contact with the surfaces of the disc bodies to be cooled and with the intercepting device for the ground material.

With a mill according to the invention there may be used cooling media of different natures, for example liquid and gaseous media separately or conjointly, or, as shown in Fig. 1, the cooling device 17, 29 may be mounted in one cooling chamber 11, so that the cooling medium fed by this cooling device is itself cooled.

I claim:

1. In a grinding mill the combination of a stationary disc and a cooperating rotary disc positioned in a dish-shaped casing, said discs being provided with individual grinding instrumentalities distributed over substantially all of their confronting faces adapted to engage one another, means for positively guiding a liquid cooling medium over the outer surfaces of said grinding discs within substantially the whole region of said individual grinding instrumentalities, the peripheral edge of said rotary disc being provided with a water-intercepting ring, the casing of the mill being provided with an annular ring overlapping and disposed closely adjacent said water intercepting ring, said rings, said outer surface of the rotary disc and the part of the casing of the mill inward of the intercepting ring forming a cavity and a nozzle projecting into said cavity and delivering said liquid cooling medium in controllable quantity to the inner walls of said cavity.

2. A grinding mill according to claim 1, in which overlapping yielding packing rings are arranged in the cavity formed by the intercepting ring, the outer side of the rotary disc and the bottom of the casing.

3. A grinding mill according to claim 1 wherein the outer surfaces of the water intercepting ring and upstanding portion of the dish-shaped casing form a delivery channel for the material ground.

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