Dec. 20, 1927. 1,653,472

B. SCHERBAUM

PULVERIZING OR GRINDING MILL

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Fig. 1

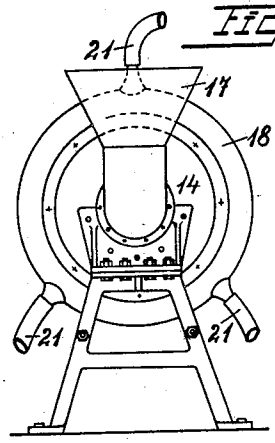


Fig. 2

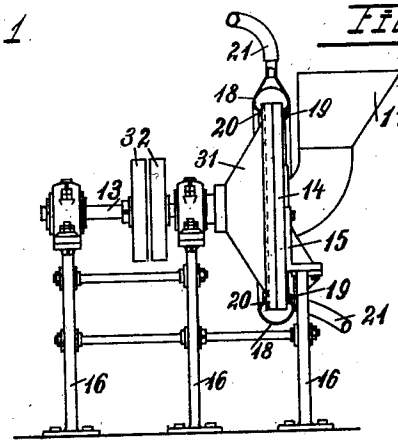


Fig. 3

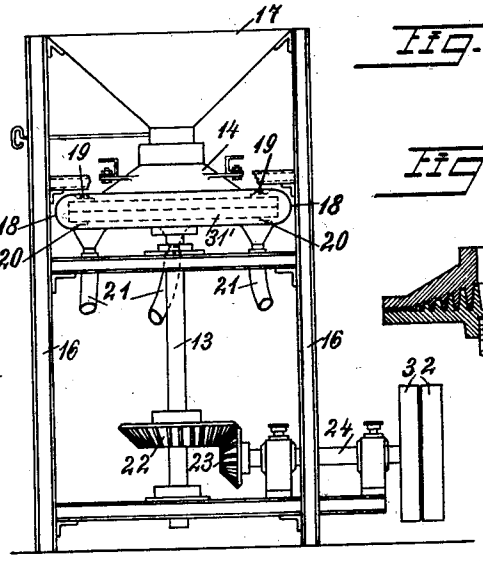


Fig. 4

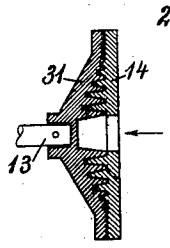
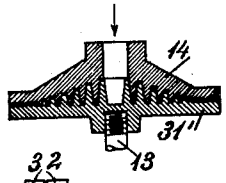


Fig. 5



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Fig. 6

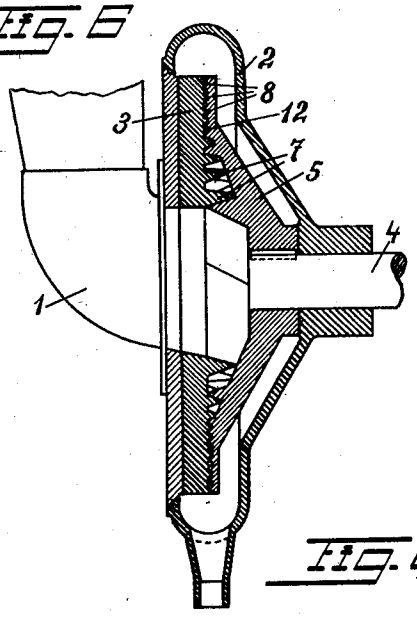


Fig. 7

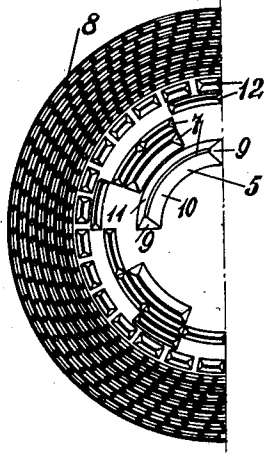


Fig. 8

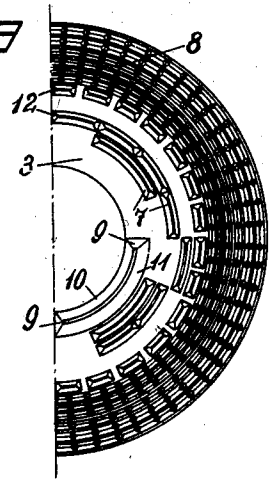
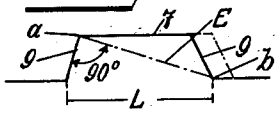


Fig. 9



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UNITED STATES PATENT OFFICE.

BERNHARD SCHERBAUM, OF WEDEL, GERMANY.

PULVERIZING OR GRINDING MILL.

Application filed December 17, 1925, Serial No. 76,069, and in Germany December 24, 1924.

The invention relates to a pulverizer having two pulverizing discs, the teeth of which mesh with one another and are preferably so formed that they serve partly for effecting the preliminary breaking up and partly for the fine grinding of the material which is fed centrally, that is, preferably having the form shown in German Patent No. 326,110. The invention is, however, applicable to other forms of the grinding discs.

The invention resides in this that only the outer periphery of the grinding discs, which otherwise are exposed to the air, is surrounded by a casing which is maintained under a negative pressure and serves for removal of the material treated and which passes out from the peripheral slit.

This construction is in many cases advantageous particularly because the grinding discs are continually cooled, not only on the exterior by the atmosphere but also over their grinding surfaces by the air drawn therethrough. Injury to the material being treated, due to the heat generated by friction, is thus more or less avoided. This is a matter of importance not only in grinding meal but also in grinding other sensitive materials such as casein or the like. By the heat due to friction the metal of the grinding discs expands so that the mill must ordinarily be more coarsely set as the temperature rises. This difficulty is dispensed with by cooling in the manner described.

Moreover the invention permits of connecting directly to the annular housing air filters for the material ground, or of conveying the material by means of an air stream, which is important in pulverizing coal and in supplying powdered coal to a pulverized fuel furnace.

One embodiment of the invention applied to pulverizing devices constructed in accordance with German Patent No. 326,110 is illustrated in the accompanying drawing, in which

Fig. 1 is an end elevation of a pulverizing mill having vertical discs,

Fig. 2 is a side elevation of the arrangement shown in Fig. 1,

Fig. 3 a similar view of a pulverizer having horizontal discs,

Fig. 4 a section through the discs shown in Figs. 1 and 2,

Fig. 5 a section through the discs shown in Fig. 3.

Fig. 6 being a vertical section through the grinding discs and the housing.

Fig. 7 a plan view of half of the rotatable disc,

Fig. 8 a plan view of the associated half of the fixed disc, and

Fig. 9 a diagrammatic elevation of a tooth.

According to Fig. 6 the material to be grounded is fed to the mill centrally through a hopper 1 in known manner, by way of the disc 3 fixed in the housing 2. With the teeth of this disc engages a rotatable disc 5 mounted on the shaft 4. In the embodiment illustrated the discs are provided with a series of preliminary breaking teeth 7, which decrease in height and increase in number towards the periphery, and several annular rows of fine grinding teeth 8 of equal height.

As experiments have shown, such an arrangement is suited for pulverizing the most varied materials, including both soft and also extremely hard materials, for example, corn, casein, soft and hard rubber, leather, coal, sandstone, glass, emery, carborundum, cement, clinker and so on, as also wood, straw, paper, etc.

As will be clear from the drawing all the teeth taper towards their ends. In treating very hard materials, therefore, a special regard must be paid to the shape particularly of the largest breaking teeth or of the rough grinding teeth 12 located between them and the fine grinding teeth 8, if the teeth are to serve their purpose and not to break off in a short time. Extensive investigations have shown that the matter of most importance is the size of the angle formed by the tooth flanks 9, disposed radially of the centre of the discs, with the bottom surfaces of the teeth.

For further explanation reference is directed to Fig. 9 in which a breaking tooth 7 is illustrated in side elevation. The radial flanks 9 of this tooth must form such an angle with the disc, and the length L of this tooth must be so selected, that, as shown in Fig. 9 a plane E at right angle to the plane of the flank 9 extending through the edge *a* of each of these tooth flanks intersects the bottom edge *b* of the opposed tooth flank,

or, as shown in dotted lines at the right hand side of the tooth represented in Fig. 9, the said plane E intersects the base of the tooth within its material portion at least within the first one-third thereof.

With tooth flanks so formed, even in grinding the hardest material the teeth do not break off. Should they be steeper, or should the teeth be shorter, they break off immediately. If they are more inclined or if the teeth are longer, with a coarser setting of the mill the material becomes jammed between the sides of the teeth so that considerably more power is required.

The position of the tooth flanks 10 and 11 is also of importance and the angle which the tooth flank 10 makes with the surface of the rotating disc is smaller than the angle between the tooth flank 11 and the disc. The tooth flank 11 is thus steeper than the flank 10. In the fixed disc 3, Fig. 8 the relation is reversed.

It is, however, also important that the large teeth of both discs, as shown in the drawing, should be offset in relation to one another in such manner that the material to be ground in its passage from the centres of the discs to the periphery is forced to take a zig-zag path, and the large part of the material is only gripped at a time by one tooth ring. As a result a saving in power and a regulated supply is obtained and stoppage prevented. The smaller material can nevertheless flow off laterally and pass from the breaking teeth into the rough grinding teeth. Large material is thus suitably treated by a tooth scraping on its lower face.

In the example illustrated, in addition to three rings of breaking teeth there are provided two rings of rough grinding teeth 12, which form a bridge between the breaking teeth and the fine grinding teeth 8. The innermost breaking tooth is mounted on the rotating disc.

The fine grinding teeth are also arranged in a particular manner, i. e. in such manner that the gaps between the fine grinding teeth 8 of the one (fixed) disc lie on straight line radii, while the gaps between the fine grinding teeth of the other (rotatable) disc 5 lie on curved lines.

This arrangement has many advantages. First, it prevents the coarse-grained material from being thrown outwards. Secondly it considerably increases the quantitative efficiency of the device in the direction of rotation of the arcuate blank, and thirdly, on rotation in the opposite direction it facilitates particularly the fine grinding of all materials. If the grinding discs are constructed in accordance with the above conditions, it is possible to make them from gray cast iron, without adversely affecting their strength in any way.

In the embodiment shown in Figs. 1 and 2 the movable grinding disc 31 is mounted on the shaft 13 which is driven by a belt pulley 32, while the stationary disc 14 is secured to an angle bracket 15 on the frame 16. The material to be ground is fed through the hopper 17. The shape of the teeth of the discs will be clear from Fig. 4, in which the bottoms of the teeth of the rotatable disc 13 lie on a hollow conical surface, and the points or ends of the teeth of the fixed disc 14 lie on a conical surface corresponding to the hollow conical surface. The teeth thus diminish in height from the centre to the periphery, adjacent which there are provided rows of teeth of equal height which serve for fine grinding.

The periphery of the two discs 31 and 14 is embraced by an annular housing 18, which, for example, consists of a resilient steel sheet and is secured by means of studs 19 to the fixed disc 14, while it bears resiliently and tightly on the rotatable disc 31 through the medium of an annular strip 20. To the ring housing 18 are connected at three points hose or tubular connections 21, which permit of maintaining the interior of the annular housing 18 under a negative pressure so that the material being ground can be drawn off from the peripheral gap between the two grinding discs 31 and 14. The inner faces of the grinding discs are thus continuously cooled by the suction air, while their outer surfaces are also cooled since they are in contact with the atmosphere. If desired a fan might be fitted which would discharge a current of air against the outer surfaces of the discs.

The embodiment shown in Fig. 3 differs from that in Figs. 1 and 2 only essentially in this that the grinding discs are supported horizontally in the frame 16. Accordingly the shaft 13 of the rotatable disc 31′ is driven preferably by a pair of bevel pinions 22, 23, from the auxiliary shaft 24, which in turn is driven by the belt pulley 32.

The form of the teeth of the grinding discs is illustrated in Fig. 5, from which it will be clear that in this construction the arrangement is the reverse of that illustrated in Fig. 4, namely the bottom portions of the teeth of the fixed disc lie on a hollow conical surface and the points or ends of the teeth of the rotating disc lie on a conical surface similar to the hollow conical surface. Obviously the teeth in both arrangements may be so formed that the outer surfaces of both grinding discs are conical.

I claim:

1. A grinding mill comprising a fixed and a rotatable grinding disc, said disc formed with inter-engaging teeth, a centrally disposed inlet opening for the material to be ground, and a housing embracing the peripheral portions only of said discs, said housing secured to the fixed disc and press-

ing on the rotatable disc, substantially as and for the purpose set forth.

2. A grinding mill comprising in combination with a pair of grinding discs formed with inter-engaging teeth and a centrally disposed inlet for the material to be ground, a housing embracing only the peripheral portions of said discs, the teeth on said discs tapering towards their ends in all directions and increasing in number and decreasing in height towards the peripheral portions of the discs, and the tooth flanks so shaped that a plane through the edge of one flank and at right angles to the plane of said flank intersects at least the bottom edge of the opposite tooth flank of the same tooth and means for maintaining said housing under negative pressure.

3. A grinding mill comprising in combination with a pair of grinding discs formed with inter-engaging teeth and a centrally disposed inlet for the material to be ground, a housing embracing only the peripheral portion of said discs, the teeth on said discs tapering towards their ends in all directions and increasing in number and decreasing in height towards the peripheral portions, and the tooth flanks so shaped that a plane through the edge of one flank and at right angles to the plane of said flank intersects at least the bottom edge of the opposite tooth flank of the same tooth, and the inwardly directed flanks of the teeth of the one disc making a smaller angle with the plane of the disc than the outer tooth flanks and means for maintaining said housing under negative pressure.

4. A grinding mill comprising in combination with a pair of grinding discs formed with inter-engaging teeth and a centrally disposed inlet for the material to be ground, a housing embracing only the peripheral portions of said discs, the teeth on said discs tapering towards their ends in all directions and increasing in number and decreasing in height towards the periphery of the disc, and the tooth flanks so formed that a plane through the edge of one flank and at right angles to the plane of said flank intersects at least the bottom edge of the opposite tooth flank of the same tooth, said teeth including breaking and fine grinding teeth, said breaking teeth at least being offset in relation to one another, substantially as and for the purpose set forth and means for maintaining said housing under negative pressure.

In testimony whereof I have signed my name to this specification.

BERNH. SCHERBAUM.