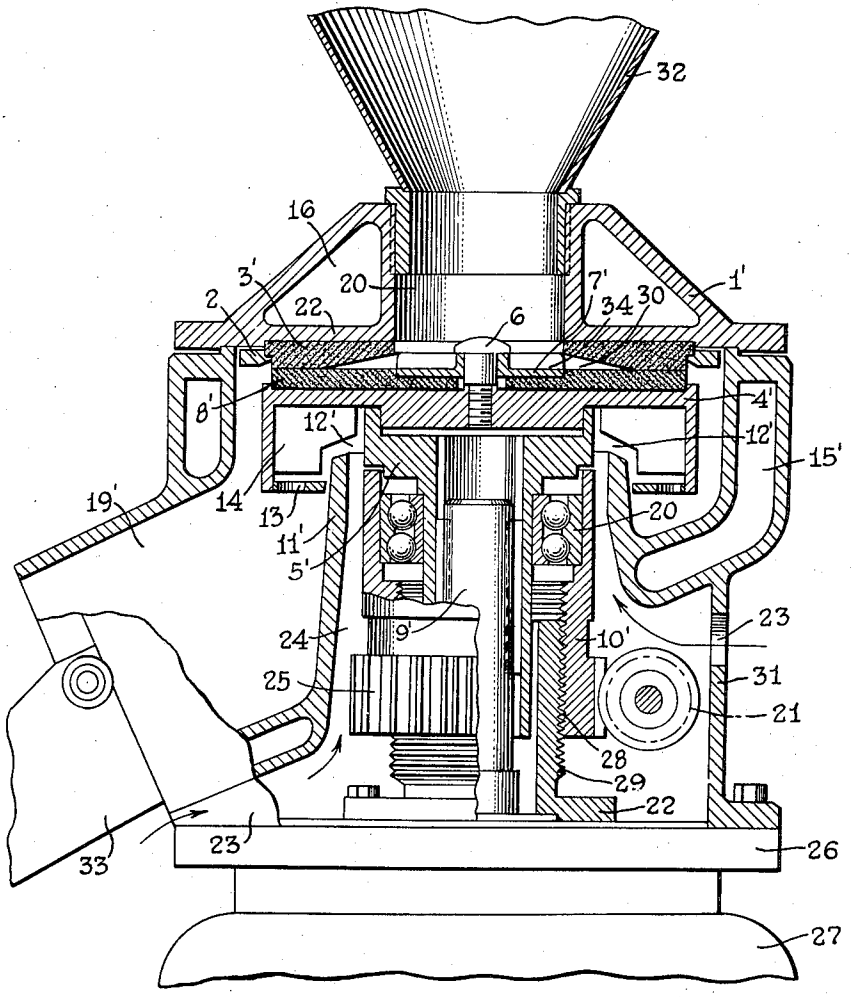
June 10, 1958 P. A. W. HAUSER 2,838,247

FINE GRAIN MILL

Filed May 1, 1956



INVENTOR

PAUL AUGUST WILHELM HAUSER

BY Richard Lynch Ag't

United States Patent Office 2,838,247 Patented June 10, 1958

2,838,247

FINE GRAIN MILL

Paul August Wilhelm Hauser, Rheinfelden, Baden, Germany

Application May 1, 1956, Serial No. 582,048

Claims priority, application Germany May 3, 1955

2 Claims. (Cl. 241—60)

The present invention relates to fine-grain mills or pulverizers, and particularly to a mill of the type in which a motor-driven millstone or grinding wheel is mounted so as to be adjustable relative to a stationary millstone or grinding wheel.

According to the invention it has been found that the high-speed mills of prior design in which a relatively small, thick grinding wheel usually revolves at a speed of about 3000 R. P. M. relative to a stationary wheel, produce such excessive heat during the grinding or pulverizing operation that many sensitive materials to be ground, such as, for example, cocoa, mustard, meat, fish, and other edibles, or even such materials as pigments, cleansing agents or the like, may be severely harmed or even ruined by such heat.

It has further been found according to the invention that in most cases the grinding efficiency of such high-speed mills of prior design is poorly utilized and that the material, after being finely ground, remains for an unnecessary length of time between the grinding wheels, and that, aside from thus unnecessarily increasing the length of the grinding operation, the finely ground material by thus remaining between the wheels will be unnecessarily and often excessively heated.

It is therefore the principal object of the present invention to provide a high-speed mill which is designed so as to eliminate such excessive heating of the material while being ground.

Another object of the invention is to provide a motor-driven mill with a pair of relatively thin grinding disks which do not have the tendency to retain the heat produced by the grinding operation as much as the thick grinding wheels or millstones previously used, and which, due to their thinness, may be cooled much more quickly and effectively than such thick wheels.

Another object of the invention is to provide a motor-driven mill of a very compact design with very efficient built-in means for cooling the grinding disks, as well as the material during the grinding operation thereof.

This object may be attained according to the invention by providing a combination of cooling means which preferably consist of an air-cooling and ventilating system within the machine which serves for the triple purpose of cooling the revolving grinding wheel, conveying the ground material from the wheel and to a point of subsequent treatment or use thereof, and cooling and aerating the material while thus being conveyed. This air-cooling system preferably cooperates with a water-cooling system which consists of a cooling jacket along the upper surface of the stationary grinding wheel, and an outer cooling jacket around the machine for carrying off the peripheral heat and cooling the conveying channel additionally from the outside.

A further object of the invention is to provide a mill with a pair of grinding disks which are made of a particular shape and are adapted to cooperate with other means so as to permit the material to be very finely and quickly ground between these disks, and after being ground to be very quickly conveyed out of and away from these disks so as to avoid any unnecessary heating of the ground particles.

More specifically, it is an object of the invention to provide a radially inner portion of the relatively thin grinding disks with an intermediate annular slot of wedge-shaped cross section which gradually decreases in width toward the outside, and within which the coarse material will first be preground before being finely ground or pulverized by the parallel portion of the grinding disks.

A further object of the invention is to provide on the revolving grinding disk a central centrifugal member which cooperates with the wedge-shaped pregrinding slot between the disks by conveying the unground material into such slot and between and through the grinding disks by centrifugal force.

A grinding mill designed as above described assures that the respective material will be finely and uniformly ground or pulverized, and that, due to the special centrifugal conveying action of the central revolving surface and the pregrinding operation within the wedge-shaped slot coupled with the efficient cooling action on the grinding disks and the speedy conveyance of the finely ground material through and away from the grinding disks, the material will remain at a relatively low temperature and not be harmed by the heat caused by the grinding operation as in the machines known prior to this invention.

Further objects, features, and advantages of the present invention will be apparent from the following detailed description thereof which is to be read with reference to the accompanying drawing in which the only figure is a central vertical cross section through a mill embodying features of my invention.

Referring to the drawing, the shaft **9'** of an electric motor **27** carries a bushing **5'** which is slidable thereon in the axial direction and has an inverted, substantially cup-shaped supporting member **4'** secured thereto which carries on its flat upper surface a grinding disk **8'** which is secured to supporting member **4'** by means of a central centrifugal disk **7'** and a mounting bolt **6**. Disk **7'** may also be provided with upper projections **34** to increase the centrifugal action of disk **7'**. Grinding disk **8'** has a central recess corresponding to the diameter and the thickness of centrifugal disk **7'** so that the upper surface thereof will be substantially level with the upper horizontal surface of grinding disk **8'**. The vertical position of slide bushing **5'** may be adjusted by a bushing **10'** which may be screwed upwardly or downwardly to adjust the position of grinding disk **8'** relative to disk **3'**. A plurality of vanes **14** is mounted on the inside wall of the cup-shaped supporting member **4'** which also encloses the vanes on the lower side so as to form an annular ventilating chamber **12'** which is provided with air outlet openings **13**. Thus, if the supporting member **4'** is rotated by the motor through shaft **9'**, air is drawn into the annular ventilating chamber **12'** through an air inlet sleeve **11'** and forced out through outlet openings **13** into the annular discharge channel **19'** which is surrounded by a stationary jacket **15'** through which a suitable cooling medium, for example, water, may be circulated.

The cover **1'** of the machine is secured to the stationary jacket **15'** and carries on its lower side the stationary grinding disk **3'** which is securely clamped thereto by a clamping ring **2**. Both grinding disks **3'** and **8'** are relatively thin so that the heat produced between them during the grinding operation will not accumulate therein, but will be carried off quickly. The stationary grinding disk **3'** is of annular shape with a large central opening in line with the large filling mouth **20** of cover **1'** through

which the material to be ground may be poured into the machine and upon the revolving centrifugal disk 7'. On its side facing toward the revolving grinding disk 8', the stationary disk 3' is provided with an inclined surface which together with the opposite horizontal surface of disk 8' forms a slot 34 of substantially wedge-shaped cross section within which the material will be preground. Around the inlet mouth 20, cover 1' contains an annular cooling jacket 16 with a relatively thin bottom 22 facing grinding disk 3', and an inlet and an outlet (not shown) through which the cooling medium, for example, water may be circulated. The inlet of cooling jacket 16 may also be connected by a hose with the outlet (not shown) of cooling jacket 15' so that the same water will first circulate through jacket 15' and then through jacket 16.

In the operation of the new mill, the material to be ground or pulverized will be poured through the filling mouth 20 upon the centrifugal disk 7' which forces the material by centrifugal action into the wedge-shaped slot 34 within which the material will be preground before passing under the same centrifugal force between and through the parallel grinding surfaces of disks 3' and 8' and outwardly therefrom into the annular discharge channel 19'. Upon arriving in this channel, the ground material is effectively cooled on both sides by the water or other cooling medium in jacket 15', as well as by the cooling air in ventilating chamber 12' which also cools the lower side of grinding disk 8'. This cooling current is then forced into channel 19', thereby aerating and cooling the material by direct action, and exerting an air pressure upon the ground material to convey the same through the discharge channel to the place of its subsequent treatment or use.

A roller bearing 20 supports bushing 5' so as to be easily rotatable within the bushing 10', the lower portion of which has internal screw threads 28 which engage with outer screw threads 29 on a bushing 22 which is rigidly secured to the flanged end portion 26 of the electric motor 27 which serves as a base of the mill. Bushing 10' further has a gear 25 rigidly or integrally secured thereto which engages with a worm 21 which is rotatably mounted in housing 31 of the mill and may be turned from the outside of the housing by any convenient means. Thus, if worm 21 is rotated, it will turn bushing 10' on screw threads 29 of the stationary bushing 22 and thus gradually screw bushing 10' upwardly and, through ball bearing 20, also move bushing 5' and grinding disk 8' toward the annular grinding disk 3' to reduce the distance between the two disks or to retract grinding disk 8' from disk 3'.

The central portion 7 of the grinding disk 8' is adapted to receive the material to be ground and to throw the same by centrifugal action against the conical inner wall of disk 3' and to force the material into and through the conical slot 30 between the inclined walls of the two grinding disks and then between the horizontal grinding surfaces thereof.

The peripheral outer edges of grinding disks 3' and 8' are further acted upon by a strong suction which aids in attaining the speed of the grinding operation of the mill according to the invention and materially assists in removing the ground material from the grinding disks. This suction is produced by an air current passing through a channel 23 into the annular chamber 24 within the machine housing 31 and then through the air inlet sleeve 11' and the annular ventilating chamber 12' into the annular discharge channel 19'. This housing 31 also contains the cooling jacket 15', already referred to, and it supports on its upper end the cover 1' on which the stationary grinding disk 3' is mounted and which carries a central hopper 32 through which the unground material is fed upon the centrifugal surface 7' of grinding disk 8' and into the conical slot 30. The aforementioned air current may be produced either by a suction fan connected to the outlet pipe or hose 33 of the machine which, in turn, is connected to discharge channel 19', or by vanes shown to be mounted on the inner wall of chamber 12', or by both. The air current passing through chamber 12' will also produce a strong cooling action upon the cup-shaped supporting member 4' and the lower grinding disk 8'. Apart from assisting in the quick removal of the finely ground material from grinding disks 3' and 8', this air current will also aerate and cool the material during such removal.

All the factors mentioned, i. e. the centrifugal action of surface 7' of grinding disk 8', the pregrinding operation within the conical slot 30 by both disks, the narrow width of the final grinding surfaces, the peripheral suction upon the finally ground material, and the cooling action of the cooling medium in jacket 15' and of the current passing through chamber 12', combine to produce the inventive effect of shortening the grinding operation to such an extent and to pass the material so quickly between and from the grinding disks that the heat developed by the grinding operation will be kept at an absolute minimum and any danger of overheating and harming the material through such heat will be avoided.

Since the mechanism for adjusting the rotary grinding disk 8' relative to the stationary disk 3', that is, the bushing 22 with bushing 10' screwed thereon, is preferably mounted on the flanged end portion 26 of the motor 27 and independently of the housing 31 of the mill proper, all the other parts of the mill may be easily removed after the respective bolts connecting the mill housing 31 to flange 26 and to the outlet pipe or hose 33 have been loosened, by lifting housing 31 in a vertical direction from flange 26. Such removal of the mill proper from motor 27 will therefore not require any removal of the adjusting mechanism from the motor.

Although my invention has been illustrated and described with reference to a preferred embodiment thereof, I wish to have it understood that it is in no way limited to the details of such embodiment, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A grinding mill comprising a stationary housing, a pair of horizontal grinding disks superimposed upon each other and each having a grinding surface substantially parallel to each other within said housing, the upper disk being annular, means for securing said upper disk to the upper part of said housing, the lower disk having an upper central receiving surface, said housing having a central filling opening therein for passing the material to be ground through the central opening of said upper disk upon said receiving surface of said lower disk, the inner peripheral surface of said upper disk being downwardly inclined to said grinding surface thereof and forming with the upper surface of said lower disk an annular slot of substantially wedge-shaped cross section, said central receiving surface of said lower disk when rotated being adapted to serve as means for centrifugally forcing the material in an outward direction into said annular wedge-shaped slot so as to be preground therein by said disks before passing between and along said parallel grinding surfaces thereof toward their outer edges, means for rotating said lower disk relative to said upper disk comprising a shaft, an inverted cup-shaped member having an upper surface supporting said lower disk, means for centrally securing said lower disk to said member, means for mounting said member on said shaft comprising a slide bushing mounted on said member and keyed on said shaft for sliding movement of said member and lower disk in an axial direction of said shaft, a second stationary bushing mounted within said housing and having outer screw threads thereon, a third bushing on said second bushing and having internal screw threads engaging with the threads on said second bushing for longitudinal screwing adjustment of said third bushing along

said second bushing, a ball bearing intermediate said first and third bushings for rotatably supporting said first bushing on said third bushing and for transmitting the movement of said third bushing in the axial direction to said first bushing and to said lower disk for adjusting said lower disk relative to said upper disk, a gear secured to said third bushing, a spiral gear rotatably mounted within said housing and in engagement with said first gear, and means for turning said spiral gear from the outside of said housing, an annular discharge channel within said housing and surrounding said grinding disks for receiving and conveying away the finely ground material, said cup-shaped member forming an annular chamber intermediate said first bushing and said discharge channel and having air intake and outlet openings, said outlet openings terminating into said channel, and a plurality of vanes within said chamber and mounted on the wall thereof for cooling said lower disk and the finely ground material received within said channel and for aerating said material and conveying the same through said channel.

2. A grinding mill as defined in claim 1, further comprising a motor connected to said shaft, said motor having a flange, means for mounting said housing on said flange, and means for mounting said second stationary bushing within said housing on said flange and independently of said housing so as to permit said housing with all the elements which are secured thereto to be removed from said flange without requiring the removal of said stationary bushing from said flange.

References Cited in the file of this patent

UNITED STATES PATENTS

237,120	Mills	Feb. 1, 1881
2,212,544	Lund	Aug. 27, 1940
2,296,564	Morehouse	Sept. 22, 1942
2,389,816	Richardson	Nov. 27, 1945
2,468,337	Lykken	Apr. 26, 1949
2,513,752	Shaw	July 4, 1950
2,580,579	Neenan	Jan. 1, 1952

FOREIGN PATENTS

13,214	Great Britain	May 29, 1914
406,331	Great Britain	Feb. 19, 1934
902,574	Germany	Jan. 25, 1954