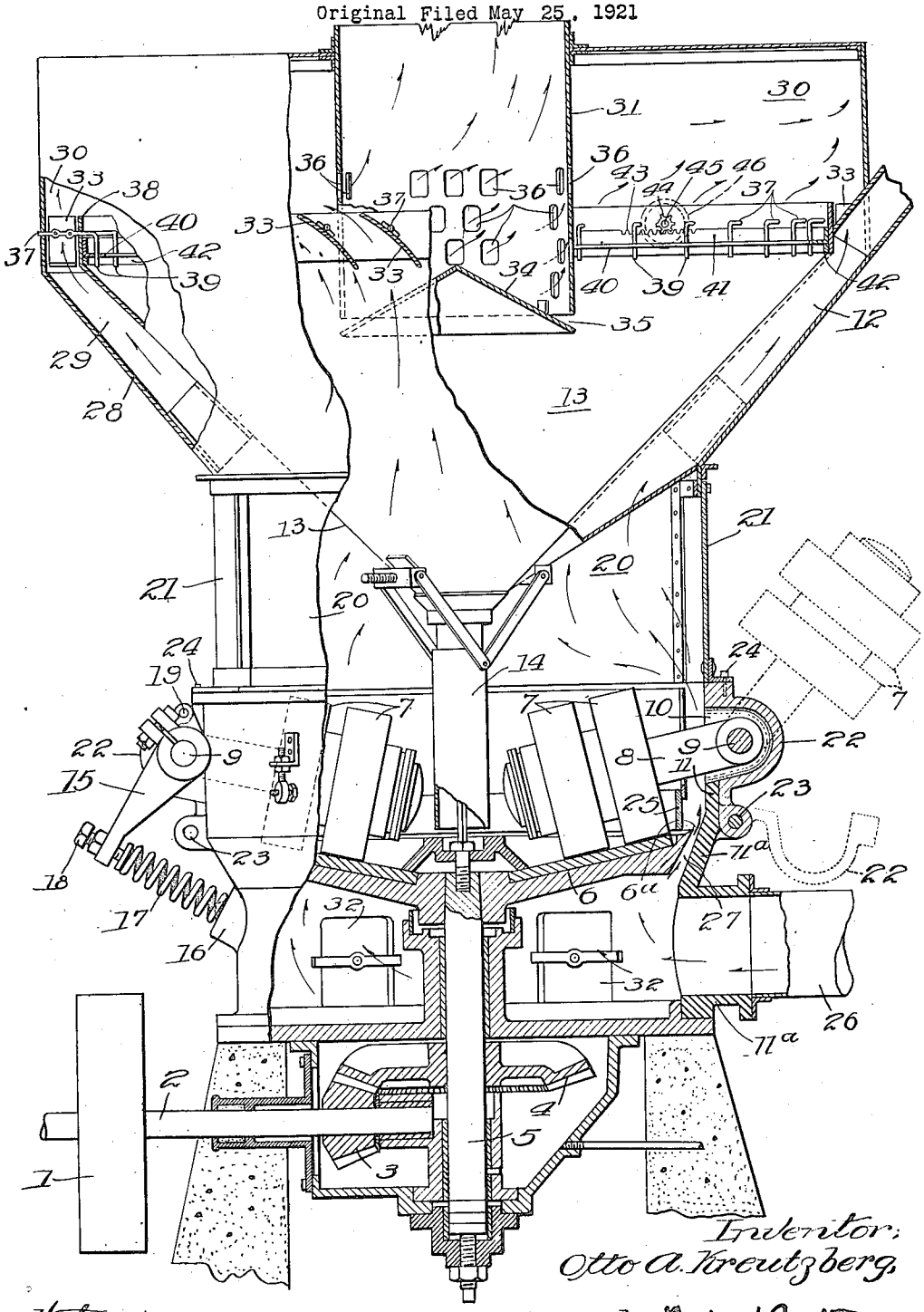
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PULVERIZING APPARATUS

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Inventor:
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Witness:

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PULVERIZING APPARATUS.

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To all whom it may concern:

Be it known that I, OTTO A. KREUTZBERG, a citizen of the United States, residing at Lake Bluff, in the county of Lake and State of Illinois, have invented certain new and useful Improvements in Pulverizing Apparatus, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

This invention relates to pulverizing machines in which the crushed and powdered material delivered from the pulverizing mechanism is carried off by means of an air current and in which such air current is so controlled and directed as to effect a separation of the finer material from the coarser particles requiring further treatment. It consists of the features and elements of construction and their combination as hereinafter described and shown in the drawings and as indicated by the claims.

The drawing is an elevation of a pulverizing machine embodying this invention but with a large portion of the exterior broken away so that the view is principally a medial vertical section.

So far as the grinding mechanism is concerned this machine is quite similar in construction to that shown in my pending application, Serial No. 452,986. The present invention is concerned largely with the enclosing casing for the grinding rolls and with the air conduits through which the pulverized material is carried off. Power is furnished to the pulverizer through a pulley, 1, on a shaft, 2, carrying a bevel pinion, 3, which drives a bevel gear, 4, on the vertical shaft, 5. The pulverizing table, 6, mounted on the upper end of the shaft, 5, co-acts with grinding rolls, 7, whose radially disposed spindles and axles, 8, are hinged on trunnions, 9, carried in lugs, 10, which are formed integral with the casing wall, 11, which surrounds the grinding mechanism. Material to be pulverized is fed to the table, 6, and rolls, 7, through a feed chute, 12, discharging into a conical hopper, 13, which is fitted with an adjustable feed pipe, 14, terminating over the center of the table, 6.

Yielding contact between the table, 6, and the rolls, 7, is maintained by making the trunnion, 9, of each spindle, 8, rigid with the spindle and applying a rocker arm, 15, thereto between the outer end of which and the boss, 16, there is interposed a compression spring, 17, provided with means for adjusting the pressure which it exerts. When it is desired to swing the rolls, 7, off the table, 6, and out of the housing for renewing their grinding tires or for other attention, the spring adjustment screw, 18, may be released and the spring, 17, removed, allowing the rolls to stand as shown in dotted lines. As more fully described in my earlier application, a catch or dent, 19, is provided for holding the parts in this position. To permit such movement the drum or housing, 20, which surmounts the casing, 11, is provided with removable door plates, 21, positioned above the roll spindles, 8, and the casing, 11, has caps or covers, 22, hinged to it at 23 for enclosing the lugs, 10, and trunnions, 9, but adapted to swing clear upon removal of their locking pins, 24.

It may be understood that the material pulverized on the table, 6, is discharged therefrom by centrifugal force at the peripheral portion of the table and to control the rate of discharge a vertically adjustable annular partition, 25, is supported just above the outer edge of the table, 6. From this point the pulverized material is picked up by a current of air, preferably created by suction acting at the discharge end of the pulverizing machine. The air supply enters through any suitable form of conduit, 26, connecting with an intake, 11^a, formed in the lower portion of the casing, 11, below the table, 6. From a space under the table the air is drawn through a relatively narrow annular passage, 27, between the edge of the table and the wall, 11, passing upwardly between said wall, 11, and the partition, 25, into the drum, 20. The drum or housing, 20, is surmounted by a conical shell, 28, spaced away from the hopper, 13, to form an annular passage, 29, for the air, said passage opening into a dome or chamber, 30, extending over the upper opening of the hopper, 13, and communicating with a discharge conduit, 31, suspended centrally in the chamber, 30, and leading from the pulverizing machine to any suitable form of suction fan and receiver for the pulverized material such as the so-called "cyclone" which need not be further described.

The edge of the table, 6 is purposely thickened as shown in the drawing to increase the length of the annular passage, 27, so that the condition of high velocity resulting from

the restricted nature of this passage as compared with the intake chamber below it will obtain for a sufficient distance below the discharge edge of the table to prevent the larger and heavier particles from falling through the space, 27, into the lower chamber of the casing, 11. If any material does fall into this space, it may be removed through the clean-out doors, 32, but by this extended restricted passage, 27, the quantity of such material is reduced to a minimum and the work of rehandling it for further pulverization is almost entirely eliminated. To further insure the upward discharge of the material from the table the extreme edge thereof may be formed with an up-turned lip, 6^a, tending to direct the material upwardly against the upwardly inclined surface, 11^a, of casing, 11, so that it may be more readily picked up by the upwardly flowing current of air. The cross section of the annular passage formed between the petition, 25, and the casing wall, 11, is not effectively much greater than that of the passage, 27, being only enough larger to accommodate the quantity of pulverized matter which will be carried by the air current through this space.

Above the rolls, 7, the drum, 20, provides an expansion chamber for the air permitting of a sudden reduction in velocity to allow the heavier particles to fall back onto the table, 6, for further treatment. The finer matter remaining in the air current is then carried upward through the space, 29. The cross section of this passage being less than that of the drum, 20, produces an increase in the velocity of the air and the distance between the conical walls of the shell, 28, and the hopper, 13, is narrowed upwardly to compensate for the increasing circumference of the walls so that the effective capacity of the passage, 29, is substantially uniform.

At its upper end, the passage, 29, discharges into a second expansion chamber formed by the dome, 30, for the purpose of again dropping out the heavier and larger particles so that only the finer material will pass out through the discharge conduit, 31. The conduit, 31, having only a fraction of the cross-sectional area of the chamber, 30, creates an increase in the velocity of the air and exerts a strong pull on the air current emerging from the passage, 29. To retard the flow through the chamber, 30, and allow ample time for the heavier particles to fall into the hopper, 13, for return to the table through the feed tube, 14, I find it of great advantage to mount in the hopper discharging opening of the passage, 29, a plurality of inclined and preferably curved vanes, 33, which deflect the upwardly flowing air giving it a circumferential motion in the drum, 30, while the inward radially acting pull of the suction from the conduit, 31, results in a spiral path of travel of the air so that the material carried by it may circle several times around the central discharge pipe, 31, before actually entering it. The lower end of the pipe is fitted with a conical shield, 34, to prevent picking up any material from the central portion of the hopper, 13, and the air current therefore enters through the annular space at 35 between the lower edge of the pipe, 31, and the shield, 34, and also through a number of openings, 36, which may be distributed as desired in the lower portion of the side wall of the pipe, 31. The provision of these several small openings, 36, instead of a single large intake mouth further tends to retard the powdered material as it impinges against the outer wall of the pipe, 31, in its swirling motion toward the openings, 36, and only the finer material which the air current continues to carry in opposition to this friction is actually drawn into the discharge pipe 31.

As a result of the double rarification of the air in the chambers, 20 and 30, and the retarded swirl produced in the latter chamber by the vanes, 33, the output of the pulverizer will be found remarkably uniform and the proportion of extremely fine material may be made very high.

For governing the quality of the output as may be desired I prefer to mount the vanes 33, adjustably as by means of rock shafts, 37 journaled in the cylindrical wall of the chamber, 30, and the cylindrical rim, 38, of the hopper, 13. Rocker arms, 39, on the inner ends of these shafts may be all engaged in the flange, 40, of an angular adjusting ring, 41, slidably mounted on a ledge, 42, applied to the inner surface of the wall, 38. At any convenient point the ring, 41, is provided with rack teeth, 43, meshing with a pinion, 44, on a shaft, 45, which extends through the outer wall, 30, for manipulation as by means of a hand wheel, 46, indicated in dotted lines. Thus the vanes, 33, may be tilted at any desired angle to the perpendicular so as to cause greater or less deflection of the upwardly traveling air current and thus vary the nature of the swirl produced in the chamber, 30. I find that this adjustment alone will vary the proportion of moderately fine material which is discharged into the conduit, 31, through a wide range.

I claim:—

1. In combination with pulverizing mechanism designed to co-operate with an air blast moving upwardly past the discharge outlet of the pulverizer, an annular conduit for said blast opening upwardly and surmounted by an expansion chamber together with an air outlet remote from the upper end of the conduit and inclined deflector vanes in said upwardly open conduit.

2. In the combination defined in claim 1,

said deflector vanes being distributed at substantially equal intervals around the annular conduit and being all similarly inclined for producing a whirling motion of the air in the expansion chamber.

3. In combination with pulverizing mechanism designed to co-operate with an air blast moving upwardly past the discharge outlet of the pulverizer, an annular conduit for said blast opening upwardly but not laterally into an expansion chamber having an air outlet centrally located with respect to said annular conduit, and inclined deflector vanes in said conduit adjacent its upper opening for giving the air current a whirling motion around the central outlet of the chamber.

4. In the combination defined in claim 1, the air outlet for the expansion chamber comprising a pipe or conduit disposed centrally therein with respect to the annular conduit and having a plurality of intake openings distributed vertically through a range extending above and below the level of the upper opening of said annular conduit.

5. In the combination defined in claim 1, an air outlet for the expansion chamber comprising a pipe or conduit disposed centrally therein with respect to the annular conduit and having a plurality of lateral intake openings, together with means nearly closing the lower end of said pipe to provide only restricted inlet thereto.

6. In the combination defined in claim 1, the air outlet for the expansion chamber comprising a pipe or conduit disposed centrally therein with respect to the annular conduit and having a plurality of lateral intake openings distributed through a range extending above and below the level of the upper end of the annular conduit, the vanes in said conduit being all similarly inclined for producing a whirl of air in a spiral path from the opening of the annular conduit toward the intake openings of the outlet.

7. In combination with pulverizing mechanism designed to co-operate with an air blast moving upwardly past the discharge outlet of the pulverizer, a conical feed hopper surmounting the pulverizer, and a conical shell built around said hopper and spaced therefrom to form an annular conduit for said blast, said shell being surmounted by a cylindrical expansion chamber and the hopper terminating upwardly in a vertical cylindrical rim within said chamber, an air outlet centrally located in the chamber and a plurality of inclined deflector vanes disposed between the cylindrical wall of the chamber and the cylindrical rim of the hopper on pivotal mountings to permit adjustment of their angularity.

8. In a pulverizing machine comprising a grinding table mounted for rotation about a vertical axis and grinding rolls journaled to co-operate therewith, means for controlling an air blast directed upwardly past the edge of the table for the removal of ground material discharged therefrom comprising a casing within which the table revolves provided with an air inlet below the table, the vertical wall of the casing forming with the edge of the table a restricted passage for the upward travel of the air past the edge of the table, said edge being designed for the purpose of vertically extending such restricted space to insure a high velocity of air below the edge of the table,

9. In the combination defined in claim 8, the extreme edge of the table being formed with an upwardly curved lip for deflecting material discharged toward the path of the air blast.

10. In a pulverizing machine comprising a grinding table mounted for rotation on a vertical axis and co-operating grinding rolls carried on axles which overhang said table, a casing enclosing said mechanism and lugs on said casing with trunnions pivotally carried in said lugs and supporting the outer ends of said axles together with a hinged cover fitted over the pivotally carried axle ends for closing the casing but adapted to swing outwardly away from said trunnions to permit the roller axles to swing out of the casing.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 18th day of May, 1921.

OTTO A. KREUTZBERG.