R. E. H. POMEROY.

DRY PULVERIZING APPARATUS.

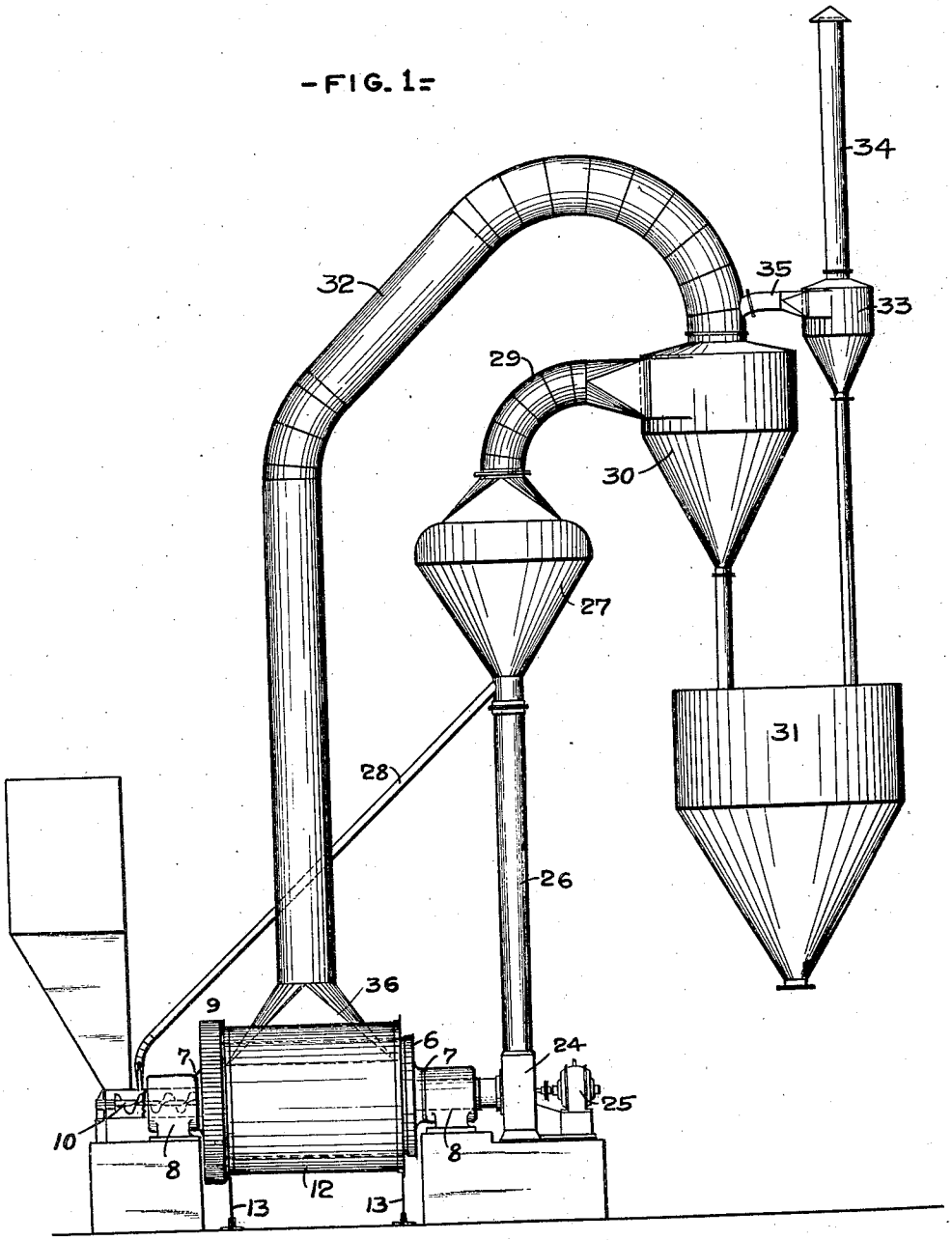
APPLICATION FILED JUNE 30, 1920.

1,427,322.

Patented Aug. 29, 1922.

2 SHEETS—SHEET 1.

-FIG. 1-



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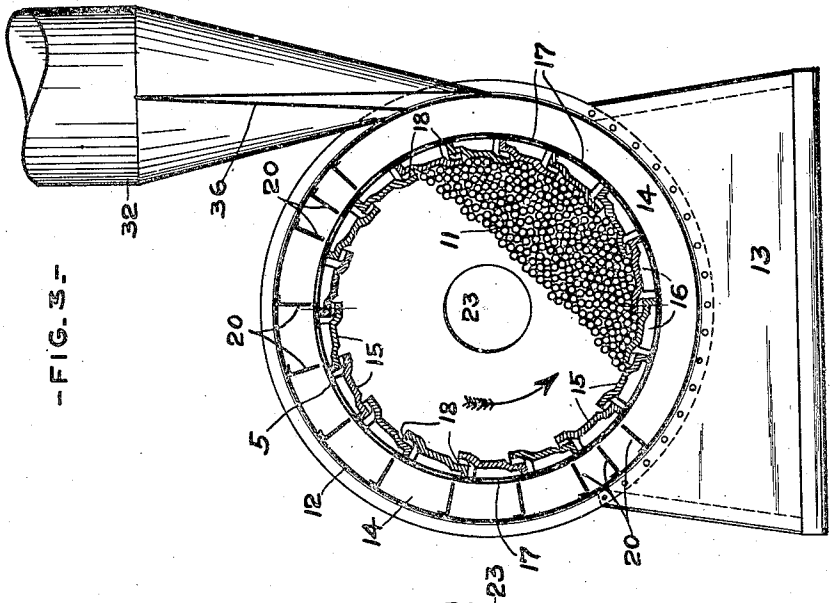
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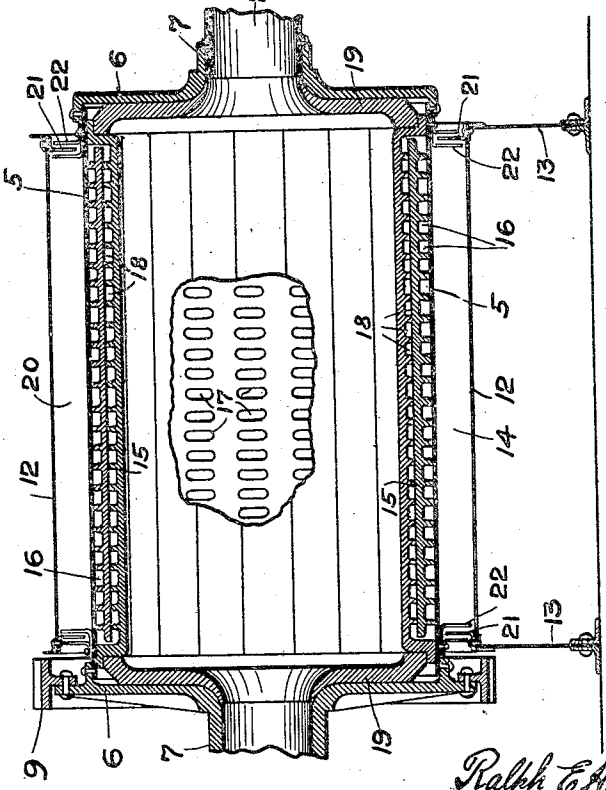
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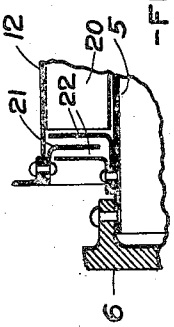
2 SHEETS—SHEET 2.



-FIG. 3.-



-FIG. 2.-



-FIG. 4.-

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UNITED STATES PATENT OFFICE.

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DRY-PULVERIZING APPARATUS.

1,427,322. Specification of Letters Patent. Patented Aug. 29, 1922.

Application filed June 30, 1920. Serial No. 393,147.

To all whom it may concern:

Be it known that I, RALPH E. H. POMEROY, of Canton, in the county of Stark and State of Ohio, have invented a certain new and useful Improvement in Dry-Pulverizing Apparatus, of which improvement the following is a specification.

This invention relates to apparatus for dry pulverizing of various materials, such as cement, lime, plaster, coal, clinker, ores, minerals, phosphate rock, paint, pigment, hard rubber, etc., the object being to provide an improved means for grinding the material and at the same time conducting a current of air or gas through the material to carry off the lighter portion as the same becomes pulverized.

My improvement is particularly adapted to be used in connection with grinding or pulverizing mills of the type in which the material is introduced into a movable casing, such as a rotatable shell, along with a mass of loose unattached tumbling devices, such as balls, pebbles, blocks, rods, bars, or other grinding devices of iron, steel, or other material of greater hardness than the material to be ground, and adapted to be tumbled about during the movement of the shell to effect the grinding or pulverizing action upon the friable material to be pulverized.

According to one of the features of my improvement, a current of air is conducted through the mass of material and tumbling devices during the operation, for carrying off the finer particles, the air being admitted through perforations or openings in the periphery of the rotatable shell. The air current may then be passed through a separator, where the heavier particles are taken out and returned to the mill, while the air current laden with the lighter pulverized portion of material is passed through a dust collector where the pulverized material is deposited and the air liberated or returned to the mill.

In this cycle of operation, an exhaust fan may be employed for inducing the current of air, and in order that the suction may be sufficiently strong to draw the air through the mass of material and tumbling devices, with the desired force or velocity, the fan is located in the discharge pipe, between the mill and the separator, preferably in close proximity to the mill. The current of air may, however, be produced in various other ways, if preferred.

In the accompanying drawings: Figure 1 is a diagrammatic view, in elevation, showing the several parts of a pulverizing apparatus embodying my improvement; Fig. 2, a vertical longitudinal section of the improved pulverizing mill; Fig. 3, a transverse section of the same; and Fig. 4, a detail view, in section, showing the air seal between the fixed casing and the rotatable shell.

According to the preferred design, the improved pulverizing mill comprises a rotatable shell, 5, preferably cylindrical and connected to suitable end heads, 6, having hollow extension trunnions, 7, rotatably mounted in fixed bearings, 8, supported upon suitable bases. Any suitable or preferred means may be employed for imparting rotary motion to the shell, as for instance, a driving gear, 9, which may be attached to one of the heads, 6, and adapted to engage with other power driven gearing, not shown. A feeding mechanism, such as conveyor screw, 10, is employed for introducing the material to be pulverized through one of the hollow trunnions into the shell. The chamber within the shell is also partly filled with loose grinding devices, 11, such as balls, pebbles, rods, or bars, of hard material, adapted to be tumbled about with the material to be pulverized which is broken up and crushed by the grinding action of these devices during the rotation of the shell.

In order to carry off the finer portion of the material as it becomes sufficiently ground, a current of air is employed, and in accordance with my improvement, this air is introduced through peripheral openings in the rotating shell, and into and through the mass of material within the shell, and in this instance passes out through the hollow trunnion opposite the feeding-in mechanism. For the purpose of admitting the air, I have shown a stationary casing, 12, completely surrounding the rotatable shell and carried by independent supports, 13, thus forming an annular space or chamber, 14, outside of the shell, 5. The interior surface of the shell is protected from wear and abrasion by a series of metal liners, 15, which are formed with an open air space, 16, communicating through slots, 17, in the shell, with the annular air chamber, 14, and through openings,

18, into the interior of the mill. End liners, 19, of metal, are also provided for protecting the end heads, 6.

While the lining for the shell may be constructed in various ways to attain a similar result as to the admission of air through the same, I prefer to form the liners, 15, of a series of longitudinal sections, each overlapping and interlocking with adjoining sections, as indicated in Fig. 3, whereby the lining is keyed together in a circular arch, and may be retained in place without bolts or other fastening means. The end liners may also be fitted to interlock with the side liners, as shown in Fig. 2, thereby serving as additional keys for locking the same in place.

It will be seen that the raised or inwardly projecting portions of the liner sections, through which the air inlet ports, 18, are formed, constitute longitudinal ribs upon the interior surface of the mill, which construction serves to protect the inlet ports, 18, as these are directed at a more or less tangential angle into the mill. By this means, the mass of material and balls, rolls, or tumbles downward over the ribbed surface as the casing revolves, thus constantly falling away from the port openings, 18, while the air currents are directed inward through said openings in substantially the same tangential direction so that there is no tendency for the tumbling mass to choke the air openings or restrict the incoming currents of air. While the direction of the air currents at the inlet ports, 18, is described as substantially tangential, it is understood that this line may be inclined somewhat in the direction of a segmental chord to the casing.

When the shell is partly filled with the material and the tumbling devices, 11, and rotating in the direction of the arrow indicated in Fig. 3, the mass of material assumes a position in a segmental portion at the lower right hand side of the shell, as shown, and in order to force most of the air in through the mass, and prevent its free passage around the annular chamber, 14, and through the liner sections at the other side of the shell, I provide a series of longitudinal radial partitions, 20, attached to the outer casing, 12, and extending into close proximity to the rotatable shell, 5, which partitions effectively obstruct this passage. By this means, the major portion of the air current is compelled to pass through the mass of balls and material where the grinding action is performed. The ends of the annular air chamber, 14, are closed by the overlapping annular flanges, 21 and 22, attached, respectively, to the fixed casing, 12, and the rotatable shell, 5, as shown more in detail in Fig. 4. The stationary flange, 21, is located between the rotating flanges, 22, and although there is a slight clearance, they form a sufficiently tight air seal for the operation of the mill.

The air, after passing through the mill and becoming loaded with the fine material in suspension, is drawn out through the pipe, 23, of the hollow trunnion by an exhaust fan, 24, which may be driven in any suitable manner, as by a motor, 25, and is then forced through the discharge pipe, 26, into the coarse material separator, 27, which may be of any desired or well known construction. Here the coarser particles of the suspended material, which are not sufficiently fine for the finished product, are separated and returned to the feeding mechanism and the mill, by the return coarse material pipe, 28, for further grinding. The air with the finer pulverized material still in suspension, passes through pipe, 29, into the cyclone dust collector, 30, where the bulk of the pulverized material is removed from the air and passes down the fine material pipe into a storage bin, 31. The air which is relieved of the major portion of its burden of pulverized material, passes away from the dust collector, which may be of the usual well known construction, through the return air pipe, 32, and re-enters the annular chamber, 14, around the rotatable shell of the mill. If desired, a smaller separator or cyclone collector, 33, having a vent pipe, 34, leading to the atmosphere, may be connected by a branch pipe, 35, to the air return pipe, 32. This return pipe, 32, is preferably attached to the casing, 12, by a flaring connection, 36, extending substantially the full length of the shell, whereby the air may be admitted under a substantially uniform suction throughout the length of the chamber, and at the side of the shell next to the material so that the air may have a direct path through the perforations into the mass of material.

The fan operates to create a continuous circulation of the air current, drawing the air from the chamber, 14, through the openings, 17, in the shell, cavities, 16, in the liners, and openings, 18, into the mass of tumbling devices and material which is being ground, where it takes up a cloud of the finely divided material, and carries the same in suspension out through the fan to the separating and collecting devices, where the pulverized portion is deposited, and the air current returned to the chamber, 14, as before described. It will be noted that the fan operates to create a strong suction from the chamber, 14, through the rotating shell, and out at the hollow trunnion, whereby all of these parts of the mill are operated under a partial vacuum or at a pressure slightly below that of the atmosphere. This has the advantage of preventing any leakage of pulverized material outward into the surround-

ing atmosphere, and produces an entirely dustless operation of the mill.

While there is shown and described in this application a construction in which an exhaust fan draws air loaded with the fine material in suspension from the pulverizing mill and discharges the same under pressure into a coarse material separator or grader in which the coarser particles are separated out and returned to the mill for further grinding, while the current of air with the finer material in suspension passes on to a collector, it will be understood that this comprises no part of my present invention, and no claim therefore is made in this application.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A pulverizing apparatus, comprising a rotatable casing having air inlet openings in its periphery, and a feeding inlet for the material an outlet for the air and pulverized material, mechanism for rotating said casing, and means for producing a current of air inward through said openings and outward through said outlet for carrying off the pulverized material.

2. A pulverizing apparatus, comprising a rotatable casing having air inlet openings in its peripheral wall, a separate outlet for the air and pulverized material, mechanism for rotating said casing, and means for producing a current of air inward through said openings, and outward through said separate outlet for carrying off the pulverized material.

3. A pulverizing apparatus, comprising a rotatable casing, having air inlet openings in its peripheral wall, and having a separate feeding inlet for the material, an outlet for the air and pulverized material, mechanism for rotating said casing, and means for inducing a current of air inward through said openings and for maintaining a partial vacuum within said casing.

4. A pulverizing apparatus, comprising a rotatable casing having hollow trunnions, and air inlet openings in its peripheral wall, means for feeding the material through one trunnion, mechanism for rotating said casing, and means for producing a current of air inward through said peripheral openings and outward through the other hollow trunnion.

5. A pulverizing apparatus, comprising a cylindrical casing rotatably mounted on a horizontal axis and having air inlet openings in its cylindrical wall an outlet for the air and pulverized material, mechanism for rotating said casing, and means for simultaneously producing a current of air inward through said openings, and the mass of material at the lower side of the cylinder, for carrying off the pulverized material.

6. A pulverizing apparatus, comprising a rotatable casing having air inlet openings in its periphery, mechanism for rotating said casing, an air chamber outside of and adjacent to the periphery of the rotatable casing, a feeding inlet for introducing material into said casing an outlet for the air and pulverized material, and means for producing a current of air inward from said chamber through said openings and outward through said outlet to carry off the pulverized material.

7. A pulverizing apparatus, comprising a rotatable casing mounted on a substantially horizontal axis and having air inlet openings in its periphery an outlet for the air and pulverized material, mechanism for rotating said casing, whereby the material occupies a segmental portion at the lower diagonal side of the shell, an air chamber located outside of and adjacent to the periphery at said lower diagonal side of the rotatable casing and communicating with said air inlet openings, and means for producing a current of air from said chamber through said openings to carry off the pulverized material.

8. A pulverizing apparatus comprising a rotatable casing having air inlet openings in its periphery, a quantity of loose grinding devices therein, means for rotating said casing, means for creating a current of air inward through said openings, and means for restricting the admission of air to substantially that portion of the periphery of the casing occupied by the tumbling mass.

9. A pulverizing apparatus, comprising a rotatable casing having air inlet openings in its periphery, a quantity of loose tumbling devices contained therein for grinding the material, a stationary air chamber outside of and adjacent to the periphery of the rotatable casing, and means for creating a current of air from said chamber inward through said openings and the mass of tumbling devices and material within the casing.

10. In a pulverizing apparatus, the combination of a rotatable shell having perforations in its periphery, a quantity of loose tumbling devices in said shell for grinding the material, an air chamber inward around said shell, and means for creating a current of air from said chamber through the perforations and the mass of tumbling devices and material in said shell.

11. In a pulverizing apparatus, the combination of a rotatable shell having perforations in its peripheral wall and mounted on hollow trunnions, a quantity of loose tumbling devices in said shell, means for feeding material in through one hollow trunnion, and means for creating a current of air through said perforations, the mass of material within the casing and out at the other hollow trunnion.

12. In a pulverizing apparatus, the combi-

nation of a rotatable shell having perforations in its peripheral wall, a stationary casing containing an air chamber surrounding said shell, and means for creating a current of air from said chamber through the perforations and the interior of the shell for carrying off the pulverized material.

13. In a pulverizing apparatus, the combination of a rotatable shell having perforations in its peripheral wall, a stationary casing containing an air chamber surrounding said shell, deflecting partitions in said air chamber for directing air through the perforations at one portion of the shell, and means for creating a current of air from said chamber through said perforations and the interior of the shell for carrying off the pulverized material.

14. In a pulverizing apparatus, the combination of a rotatable shell having perforations in its peripheral wall, a casing containing an air chamber at the outside of the shell, a lining for said shell containing cavities communicating with said perforations and having openings leading into the interior of the shell, and means for creating a current of air from said chamber through said lining and the interior of the shell.

15. In a pulverizing apparatus, the combination of a rotatable shell having perforations in its peripheral wall, a casing containing an air chamber at the outside of the shell, liners for the shell containing passages communicating with the perforations in the shell, and a fan for creating a current of air from said chamber through the liners and the interior of the shell.

16. In a pulverizing apparatus, the combination of a rotatable shell having perforations, hollow liners having openings communicating with said perforations and formed of interlocking sections arranged in a circular arch within the shell, and means for creating a current of air through the lining and the interior of the shell.

17. In a pulverizing apparatus, the combination of a rotatable shell having end heads, hollow liners having openings communicating with said perforations and formed of interlocking sections arranged in a circular arch, end liners engaging therewith, and means for creating a current of air through the hollow liners and the interior of the shell.

18. In a pulverizing apparatus, the combination of a rotatable shell having peripheral perforations, a stationary casing having an air chamber surrounding the shell, overlapping annular flanges attached to the shell and to the casing, respectively, for closing the end of said chamber, and means for creating a current of air from the chamber through the interior of the shell.

19. In a pulverizing apparatus, the combination of a rotatable casing having air inlet openings in its periphery, said openings discharging in a substantially tangential direction into the interior of the casing, said casing having an outlet for the air and pulverized material, mechanism for rotating the casing, and means for producing a current of air inward through said tangential openings and outward through said outlet for carrying off the pulverized material.

20. In a pulverizing apparatus, the combination of a rotatable casing having its interior peripheral surface provided with longitudinal ribs and substantially tangential air inlet openings adjoining same, said casing having an outlet for the air and pulverized material, mechanism for rotating the casing, and means for producing a current of air inward through said tangential opening and outward through said outlet for carrying off the pulverized material.

21. In a pulverizing apparatus, the combination of a rotatable shell having perforations in its peripheral wall, a lining for said shell having air spaces communicating with said perforations, and substantially tangential air inlet ports from said spaces through the lining into the interior of the mill.

22. In a pulverizing apparatus, the combination with a rotatable shell having perforations in its periphery, of a lining formed in removable sections having air spaces communicating with said perforations, and air inlet ports leading from said spaces through the inner face of the sections.

23. In a pulverizing apparatus, the combination with a rotatable shell having perforations in its periphery, of a lining formed in removable longitudinal sections, each having an air space communicating with said perforations, and air inlet ports leading from said spaces through the inner face of the section.

24. In a pulverizing apparatus, the combination with a rotatable shell having perforations in its periphery, of a lining formed in removable longitudinal sections, each having an air space communicating with said perforations, and air inlet ports leading from said space through the inner face of the section, and end plate liners interlocking with said longitudinal liners.

25. A lining for rotary pulverizing mills, comprising a series of metal sections adapted to fit together, said sections having air spaces and a plurality of air inlet ports or passages leading therefrom through the inner face of the sections.

In testimony whereof I have hereunto set my hand.

RALPH E. H. POMEROY.