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L. V. ANDREWS

PULVERIZING APPARATUS

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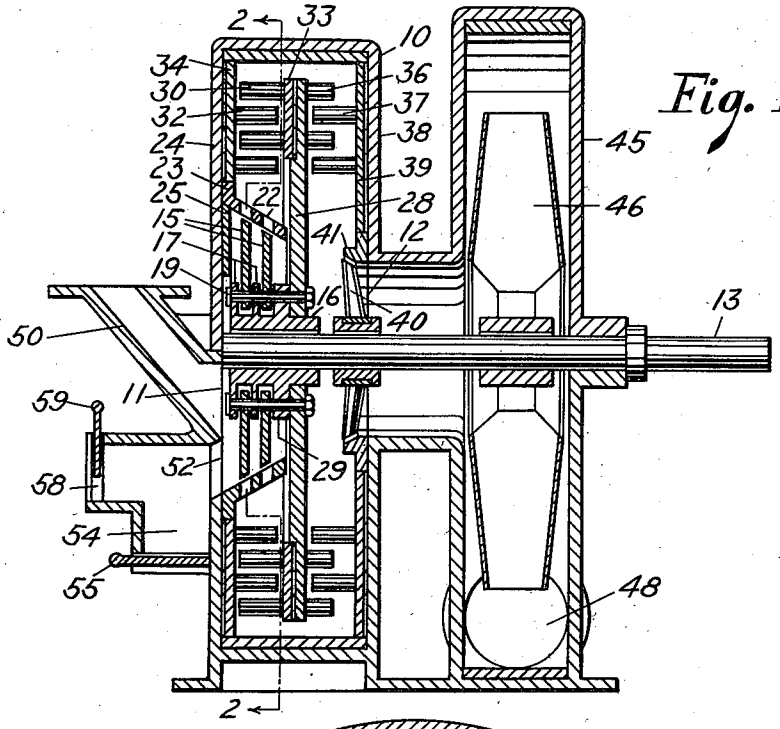


Fig. 1

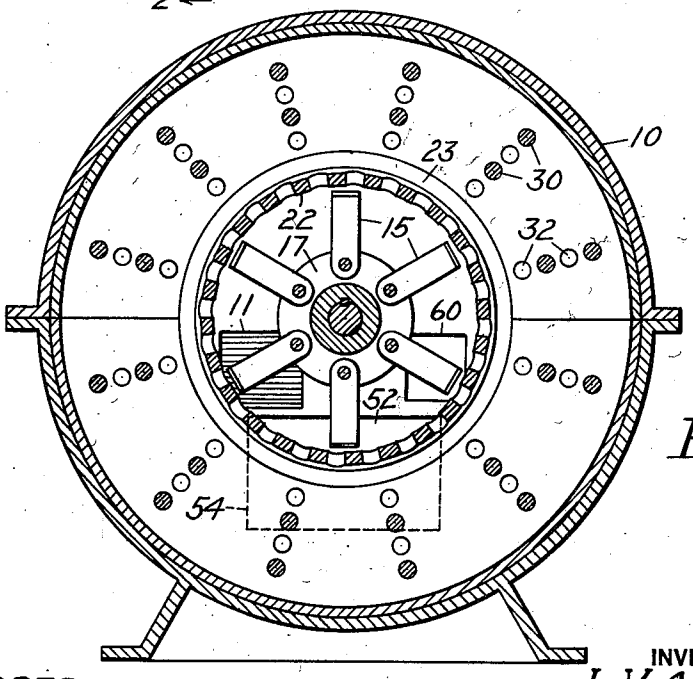


Fig. 2

WITNESSES

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UNITED STATES PATENT OFFICE.

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PULVERIZING APPARATUS.

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This invention relates to pulverizing apparatus and more particularly to pulverizers of the beater type in which material is broken by successive impacts of rapidly revolving beaters.

One type of pulverizer in common use comprises swing hammers revolubly mounted within and close to the peripheral wall of the casing. Difficulties have been met, in connection with such a construction, in the attempt to provide an efficient arrangement which permits the tramp iron or other hard foreign bodies to be safely separated from the material to be pulverized. Another proposed form of pulverizing apparatus comprises a set of revolving swing hammers arranged adjacent to the entrance for the material to be pulverized, which are surrounded by a perforated grid, and this in turn is surrounded by revolving beaters which finely grind the material as it passes towards an exit orifice. This arrangement does not provide for eliminating tramp iron, and such pieces as are small enough to get through the grid are likely to damage the beaters, and the larger pieces must stay in the preliminary breaking zone until ground small enough to escape through the grid.

It is accordingly the main purpose of my invention to provide a pulverizing apparatus which is so arranged that hard foreign bodies may be safely eliminated from the pulverizing zone, if they should enter it, without seriously damaging the beaters, and in general to provide an efficient and simply constructed and economically operated apparatus which will crush many kinds of coarse material to a desired and uniform degree of fineness.

With this and other objects in view as will be apparent to one skilled in the art, my invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

In accordance with my invention, I provide a pulverizing apparatus which has revolving impact members arranged to crush material against a stationary wall. Communicating through a side wall is a receptacle into which the hard foreign bodies, such as tramp iron, may be deposited. If desired, the stationary wall may be in the form of a ring or grid and this provided with apertures, and the material may be fed radially therethrough. If, in such cases, it is found advisable to provide means for further pulverization, revolving beaters, such as pegs, may be arranged in the path of the material and surrounding the ring. The preferred form of my invention comprises a two zone apparatus in which members, such as swing hammers, serve to crush the material preliminarily and feed it through a perforated ring to an annular space surrounding the hammers, which may contain revolving beaters, and from which zone the material passes through an annular passage to a second grinding zone containing revolving beaters, such as pegs, so arranged that the material must pass against the centrifugal action set up by the revolving beaters toward a centrally located outlet.

Referring to the drawings, I have there illustrated one embodiment of my invention which includes all of the above mentioned features, although it will be apparent from the following disclosure that a simplified apparatus may contain only the preliminary crushing members, or it may contain what is termed the first crushing zone of the apparatus described. In the drawings, in which like reference numerals indicate like parts:

Fig. 1 is a vertical section through the machine illustrated somewhat diagrammatically; and

Fig. 2 is a section on the line 2—2 of Fig. 1.

The embodiment of the invention illustrated in the drawings comprises a two zone apparatus. As illustrated, the casing 10 is of substantially cylindrical form, and has an inlet 11 located substantially at the center of one side and a centrally located outlet 12 on the opposite side. A shaft 13 is rotatably mounted in suitable bearings with its axis essentially concentric with the opening 12 and passing adjacent to the opening 11. Revolubly mounted on the shaft 13 are sets of heavy impact members arranged to give a preliminary crushing blow to the material entering through the opening 11, and these impact members preferably comprise swing hammers 15 arranged to yield slightly when they strike a hard foreign body. The hammers may be mounted in any suitable manner, which mounting as illustrated may comprise a sleeve 16 keyed to

the shaft 13 and provided with spaced flanges 17 thereon. The preliminary breakers 15, as illustrated, comprise separate bars of iron arranged in a number of sets side by side and so located as to sweep over substantially the entire width of the preliminary crushing zone. Two sets of these hammers are shown and they may be simply mounted by means of bolts 19 extending through the flanges 17 and passing through openings in the inner ends of the swing hammers.

Cooperating with the swing hammers is a perforated ring or grid 22 arranged concentric with and close to the outer ends of the hammers. This grid is provided with openings, which may be of suitable size depending upon the nature of the material to be crushed, through which the material may pass radially from the preliminary breakers to the space surrounding the grid. If the material to be crushed is coal, the openings may be about three-quarters of an inch in diameter, but they are shown in exaggerated size in the drawings for the sake of clearness of illustration. This grid which may be fashioned in separate sections, has a flange 23 thereon arranged for bolting the grid to the wall 24 of the casing. A liner plate 25 protects the inner surface of the casing wall from attrition.

Surrounding the grid are preferably arranged a set of revoluble beaters, which are shown in the form of pegs, and in order to revolve these pegs concentrically with the swing hammers I mount them on a disk 28 which is bolted to the flange 29 of the sleeve 16 by means of the bolts 19 as clearly shown. These beater pegs 30 are mounted in concentric circles on the face of the disk 28, and cooperating with these are sets of stationary pegs 32 attached to the side wall 24 of the casing. The pegs may be held in any suitable manner, but I prefer to mount them as shown in the patent to Riley, No. 1,576,472. In accordance therewith, flanges on the inner ends of the revolving pegs are clamped between the disk 28 and a removable annular plate 33, and the stationary pegs have their flanges clamped between the casing wall 24 and the removable liner plate 34.

In the embodiment illustrated, material passes from the first grinding zone, which comprises the parts heretofore described, around the periphery of the rotating disk 28 into the outer portion of the second grinding zone whence it must pass inwardly towards the outlet 12 against the centrifugal forces set up by a further set of revolving pegs 36 cooperating with stationary pegs 37. The pegs 36 and 37 are likewise mounted in the manner described with their heads clamped respectively between the disks 28 and 33 on the one hand, and the side wall 38 and a removable liner plate 39 on the other. A set of revolving rejector blades 40 is arranged to sweep across the exit opening 12 in such a manner as to hurl back into the second grinding zone the coarse particles which have not been pulverized, the outer ends of these rejector blades passing close to a ring 41 which is beveled on its inner face and arranged to throw the material back towards the disk.

Connected with the pulverizer casing 10 is a fan casing 45 carrying a fan 46 of suitable construction and preferably mounted on the shaft 13 to revolve therewith. This fan is arranged to draw a current of air through the pulverizer casing and out of the exit opening 12 and thence force it outwardly from the machine through the pipe opening 48. The material to be fed, such as coal, is introduced to the machine by means of a chute 50 communicating at its upper end with a suitable feeding apparatus. This chute 50 terminates in the opening 11 within the grid circle and adjacent to the swing hammers as illustrated clearly in Fig. 2.

Since the fuel introduced to the chute 50 may contain tramp iron or other hard foreign bodies and these may either break the swing hammers 15 or escape when partly broken through the openings in the grid circle and cause damage to the pegs, I so arrange the mechanism that such tramp iron as gets into the pulverizer will be safely eliminated. For this purpose I provide an opening 52 in the side of the casing and preferably adjacent to the lower portion of the grid 22 and this opening communicates with a tramp iron receptacle 54 provided at its bottom with a slide 55 or other suitable means for the removal of the tramp iron collected in the receptacle. In order to insure the foreign bodies being deposited in this receptacle, the grid 22 is preferably made in the shape of a frustum of a cone with its larger diameter adjacent to the wall 24. The swing hammers 15 are so constructed and arranged that the outer ones are longer than the inner ones and all of the hammers will sweep closely adjacent to the grid circle. This arrangement is such that any foreign body which gets into the preliminary crushing chamber will be automatically forced toward the outer wall 24 and thence through the opening 52 into the receptacle 54.

Since the tendency would be for the coarse material to pass outwardly through the opening 52 and fill the tramp iron receptacle full, I prefer to arrange an air inlet 58 in such a manner that the incoming air must sweep over the tramp iron pocket 54 and through the opening 52. The force of the incoming air serves to sweep the material back into the pulverizing apparatus and so tends to keep the space clear into which the tramp iron must fall. The amount of air introduced into the machine may be

suitably regulated, such as by means of a slide valve 59 arranged to adjust the outer opening of the inlet 58. Air may be introduced if desired through the coal chute 50 or through an auxiliary opening 60 arranged in the side of the casing, and such air may be used to supplement that fed to the air inlet 58 or to take its place. In the latter case, the tramp iron receptacle would fill full of the material being pulverized, but as will be understood any hard foreign body will become imbedded in this material and be gradually pushed by the hammers out of the preliminary breaking zone.

The operation of this device will be obvious from the above disclosure. Material is fed through the entrance chute 50 at a desired rate and a current of air is drawn into the preliminary breaking zone, carrying the material radially through the grid 22 into the path of the pegs 32, if these are present, and thence around the periphery of the disk 28 into the second pulverizing zone, whence it passes inwardly to the exit 12 and into the fan casing and thence through the outlet pipe 48. Any tramp iron or other hard foreign bodies are forced automatically through the opening 52 into the tramp iron pocket 54. The rejector blades 40, sweeping across the outlet opening, prevent coarse material from passing through it and so cause the material to be pulverized to a uniform and fine degree.

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

1. A pulverizing apparatus comprising a casing, beaters revolubly mounted therein, means forming a receptacle for hard foreign bodies arranged laterally of the revolving beaters and out of the direct radial path of the material hurled from the beaters, and means providing inlet and outlet openings for the introduction of material and the transportation thereof from the casing.

2. A pulverizing apparatus comprising a casing having a peripheral wall flaring outwardly towards a side wall of the casing, beaters revolubly mounted within the casing and arranged to cooperate with said peripheral wall to pulverize material fed thereto, means forming an opening in the side wall which communicates with the space adjacent to the beaters and through which hard foreign bodies may escape, and means permitting the introduction of coarse material into the casing and the crushed material to be transported therefrom.

3. A pulverizing apparatus comprising a casing having peripheral and side walls, beaters revolubly mounted therein, a perforated wall adjacent to the beaters through which pulverized material escapes radially, means forming a receptacle for hard foreign bodies which communicates through a side wall with the space adjacent to the beaters, and means for further pulverizing the material which passes through the perforated wall.

4. A pulverizing apparatus comprising a casing, beaters revolubly mounted within said casing, a perforated grid surrounding said beaters, means for feeding coarse material into the space within the grid, means communicating with the space outside the grid for finely crushing the material fed radially thereto through the grid, and means communicating through the side wall of the casing with the space within the grid into which hard foreign bodies may escape.

5. A pulverizing apparatus comprising a casing, beaters revolubly mounted therein, a perforated grid surrounding the beaters, a further set of beaters revolubly mounted outside of the grid and arranged to pulverize the material fed radially through the grid and directly thereto, means forming a pocket for hard foreign bodies which communicates through a side wall of the casing with the space within the grid adjacent to the beaters, and means permitting the material and air to be introduced into the space within the grid and transported from the casing after pulverization.

6. A pulverizing apparatus comprising a casing, swing hammers revolubly mounted within the casing, a perforated grid surrounding the swing hammers, beaters revolubly mounted outside of the grid concentric with the hammers and directly in the path of material fed radially through the grid, which are arranged to further pulverize said material, and means forming a pocket for hard foreign bodies which communicates with an opening in the side wall of the casing leading from the space within the grid adjacent to the swing hammers.

7. A pulverizing apparatus comprising a casing, a set of swing hammers revolubly mounted therein, a perforated grid shaped as the frustum of a cone which flares outwardly towards the side wall of the casing and cooperates with said hammers for preliminarily breaking the material fed thereto, revoluble beaters mounted concentric with and surrounding said grid and directly in the path of material fed radially through the grid, means providing a receptacle for hard foreign bodies which communicates through an opening in the side wall of the casing with a space within the grid and adjacent to the swing hammers, means permitting coarse material and air to be introduced into the space within the grid circle, and means for transporting the pulverized material from the casing.

8. A pulverizing apparatus comprising a casing having two pulverizing zones connected at their peripheral portions and having an inlet and an outlet located centrally of the casing, beaters in said second zone

arranged to pulverize the material fed thereto as it passes inwardly toward the outlet, swing hammers revolubly mounted in the first zone adjacent to the inlet, and means forming a receptacle communicating through an opening in the side wall of the casing with the space adjacent the hammers into which hard foreign bodies may escape.

9. A pulverizing apparatus comprising a casing having an air inlet in a side wall thereof, beaters revolubly mounted within the casing, and a receptacle in said air inlet so arranged that hard foreign bodies may escape from contact with the beaters thereto.

10. A pulverizing apparatus comprising a casing having an air inlet in a side wall thereof, beaters revolubly mounted in the casing laterally of the inlet, and means providing for the introduction of coarse material to the casing, said parts being so constructed and arranged that hard foreign bodies may escape from the casing through the air inlet and the incoming air will tend to prevent the escape of the material to be pulverized.

11. A pulverizing apparatus comprising a casing having an air inlet in a side wall, a perforated wall within the casing, beaters revolubly mounted within the casing laterally of the air inlet and adjacent to said perforated wall, and means forming a pocket adjacent to the air inlet so arranged that hard foreign bodies may escape thereto but the material to be pulverized will be held back by the entering air.

Signed at Worcester, Massachusetts, this 15th day of May, 1926.

L. V. ANDREWS.