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APPARATUS FOR CONTROLLING COATING DEPTH IN A BALLING DRUM

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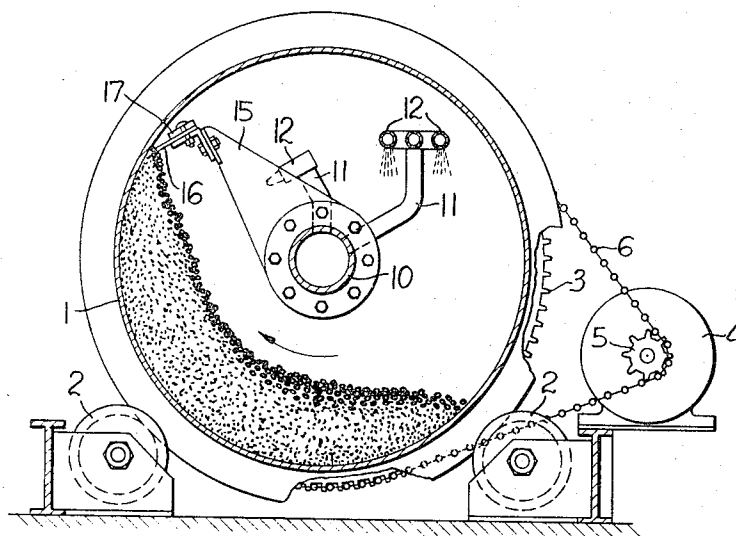


Fig. 1

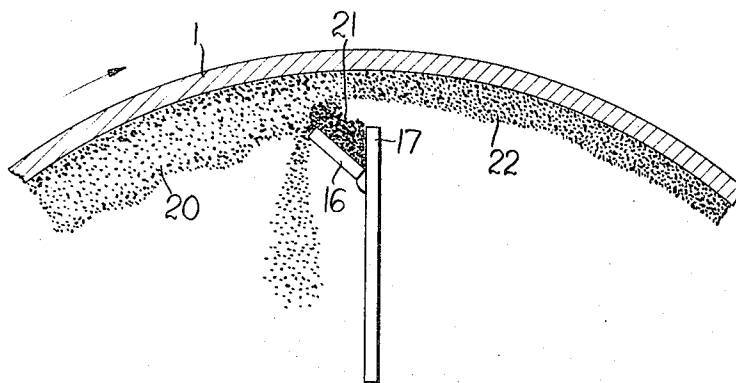


Fig. 2

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APPARATUS FOR CONTROLLING COATING DEPTH IN A BALLING DRUM

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ABSTRACT OF THE DISCLOSURE

A rotating drum for rolling finely divided material into balls within the drum, and a pair of scraper blades for controlling the thickness of a coating of the finely divided material on the inner surface of the drum. The blades are connected together to define an acute angular space between two diverging blade edges both aimed at and spaced from the surface of the drum. A quantity of material is collected by the blades from the inner surface of the drum and held between the blades with a portion of the collected quantity of material projecting slightly beyond the blades toward the coating. The thickness of the coating is controlled by the rubbing of the coating on the inner surface of the drum against the portion of coating material held by the blades and projecting slightly beyond the blades toward the coating.

This invention relates to the materials handling arts that include such as making small balls from finely divided material. The material may be, for example, beneficiated concentrates of iron ore.

The equipment used to make balls from finely divided material usually includes a drum or pan. Either of such devices may be rotated about a slightly inclined axis and partly filled with pulverized concentrate. Drops of water are sprayed on the material to form tiny balls which grow as they are tumbled in the pulverized material. A binder is normally mixed with the concentrate to increase the stickiness of the concentrate and give the balls sufficient strength so they can be handled.

The thickness and surface contour of concentrate that adheres to and coats inner surfaces of such balling devices are important factors in determining both the character and size of the formed balls. If such a surface coating is too thick or irregular, large lumps will break loose and fall from portions of such surfaces as they rotate upwardly about the inclined axis, to thereby produce irregular masses of material that are undesired sizes and shapes. Furthermore, when such lumps fall on well formed balls many are broken to form more undesired shapes and sizes.

The prior art has provided devices that are essentially scrapers or cutters mounted to remove material when it builds up to greater than desired thickness and in the course of such cutting or scraping to leave a remaining coating with a smooth surface. Some materials, however, such as pulverized taconite concentrates, are very abrasive and cutters or scrapers are quickly worn to a degree that requires them to be replaced.

It is therefore a principal object of the present invention to provide a new and improved method and means for controlling the thickness and character of the surface of material adhering to the internal surfaces of balling devices, that will subject such devices to less abrasive wear.

According to the present invention the foregoing object is accomplished by collecting a portion of the pulverized material being balled, and then holding and rubbing this portion of collected material against material coating balling device surfaces. Thus scraping is not achieved solely by a metal blade cutting and/or scraping an abra-

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sive material but by rubbing a collection of grains against another collection of grains of the same material. Abrasive wear is therefore minimized to such means as collect and hold a portion of the material used to rub the coated surface because contact between such structures and the abrasive material is minimized.

Other objects and how they are achieved will appear from the following description with reference to the accompanying drawing, in which:

FIG. I is a sectional view of a balling drum embodying the present invention; and

FIG. II is an enlarged fragmentary view of a balling device and showing another embodiment of the present invention.

Referring to FIG. I the reference character 1 designates the shell of a balling device which may be a drum or pan. The shell 1 is supported for rotation about a central axis by means which may be such as roller assemblies 2. To rotate the shell 1, a ring gear 3 may be secured about the outer circumference of shell 1 and a motor 4 may be provided with pinion gear 5 to drive the ring gear 3 by direct engagement or, as shown, through a chain 6.

A water delivery conduit 10 is shown centrally located within shell 1. The conduit 10 is provided with branches 11 each of which terminate with a spray nozzle 12.

A scraper carrier 15 is shown mounted on conduit 10. The carrier 15 projects two scraper blades 16, 17 in close proximity to the internal wall surface of shell 1. With shell 1 rotating in the direction indicated by the arrows blade 16 leads and blade 17 trails, relative to contact made with material adhering to the internal surface of shell 1. Blades 16 and 17 may be bolted together and to carrier 15, with both blades at an acute angle to the internal surface of shell 1 as shown in FIG. I. FIG. II shows another embodiment in which blades 16 and 17 are welded together and blade 17 is normal to the internal surface of shell 1. In both figures, however, the lead blade 16 and the trailing blade 17 define a pocket between them.

The manner in which the described apparatus, constructed according to the present invention, operates to perform the method of the present invention will now be described.

Referring to FIG. II, material adhering to the internal surface of shell 1 initially has an irregular thickness, surface contour and density, and such material is identified in FIG. II by the reference character 20. As shell 1 is rotated the material 20 is first contacted by lead blade 16. Some of the material striking blade 16 falls away as shown. Other material, however, rolls past blade 16 and into the pocket defined between blades 16 and 17. Blades 16 and 17 act to collect a portion of material therebetween. Continued operation for a short period of time causes the collected portion to become packed into a portion 21 that projects radially a slight distance beyond blades 16, 17. The collected and packed portion 21 is then rubbed upon oncoming material 20 to reduce the lining of material to a lesser thickness as indicated at 22. Still further rotation of shell 1 brings material 20 to blades 16, 17 before the thickness indicated at 22 increases sufficiently to bring very much material in contact with the lead blade 16. Thus most of the work of scraping the lining of the thickness at 20 down to the thickness at 22 is done by rubbing the material collected at 21 against the lining of the same material and abrasive wear to blade 16 is reduced to significantly extend its useful life. While the rate at which material builds up from the minimum thickness at 22 depends upon the character and moisture content of material being balled, these factors also similarly effect the build-up of material portion 21

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between blades 16, 17. If the character of material being balled begins to build up a little faster from the minimum at 22, the portion collected at 21 will likewise pack faster and greater, and the material 21 will tend to dig a little deeper into the material at 20 thus balancing these factors to at least some extent so that in any such event blade 16 will not have to dig as deeply into the material as it would if it were not followed by a second blade 17 to collect a portion of the material. Thus the extended blade life that has been achieved can be expected with material of different and even variable character. The thickness of portions 20, 21 and 22 in FIG. II have been exaggerated in their relationship to each other and relative to the thickness of shell 1 for the sole purpose of more clearly showing how the reduced abrasive wear on a scraper blade is achieved.

From the foregoing it will be understood that the present invention is possessed of unique advantages. However, such modifications and equivalents of the disclosed concepts such as readily occur to those skilled in the art are intended to be included within the scope of this invention and thus the scope of this invention is intended to be limited only by the scope of the claims such as are, or may hereafter be, appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an apparatus for rolling pulverant material into balls on an internal surface of a cylindrical shell and having said surface coated by a layer of the pulverant material, means for controlling coating depth on said surface, comprising, a pair of scraper blades connected together and diverging from each other in a direction toward said coating on said surface to define therebetween an acute angular space having its apex pointed away from said surface, support means connected to said scraper blades and holding said blades against said layer but spaced from said surface, and driving means connected to said shell for rotating said shell about a central cylindrical axis of said shell to provide relative movement

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between the coated surface and scraper blades to scrape some of the coating off of the surface.

2. In an apparatus for rolling pulverant material into balls on an internal surface of a cylindrical shell and having said surface coated by a layer of the pulverant material, means for controlling coating depth on said surface, comprising, a pair of scraper blades connected together and diverging from each other in a direction toward said coating on said surface to define therebetween an acute angular space having its apex pointed away from said surface, support means connected to said scraper blades and holding said blades in a fixed position and against said layer but spaced from said surface, and driving means connected to said shell for rotating said shell and surface about a central cylindrical axis of said shell for rubbing the surface coating upon the scraper blades to scrape some of the coating off of the surface.

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