United States Patent

Zimmermann

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[54] APPARATUS FOR HANDLING AND PROCESSING CURRENTS OF GAS-BORNE DRY SOFT POWDERS

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[52] **U.S. Cl.** .....**302/64,** 51/163, 117/71 R, 117/77, 117/95, 117/133, 117/160 R, 161/159, 161/221

[51] **Int. Cl.**.....**B65g 53/58,** B65g 53/04

[58] **Field of Search** .....117/95, 72, 71, 77, 133, 160 R, 117/13, 163, 164; 302/37, 64; 161/159, 221

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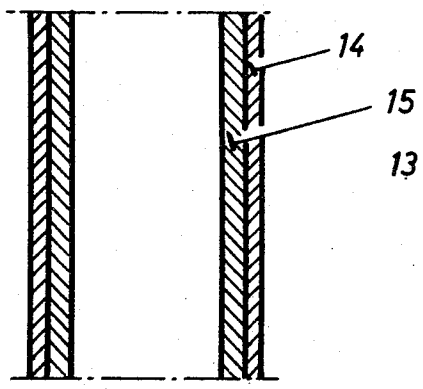
[57] **ABSTRACT**

Solid coatings are disclosed that are particularly useful for lining or application to the inner walls of processing equipment, for preventing the formation of deposits from currents of gas and soft powders. The coatings are especially suited for use in mills, particularly baffle rimmed grinding track mills, classifiers, sifting rotors, cyclones, and piping, more particularly in bends. Apparatus is disclosed provided with linings of soft elastic material having a hardness within the range of 10 to 50 Shore, such as rubber foam, and in some instances the soft elastic material is coated with a wear-resistant cover layer, such as natural rubber.

6 Claims, 6 Drawing Figures



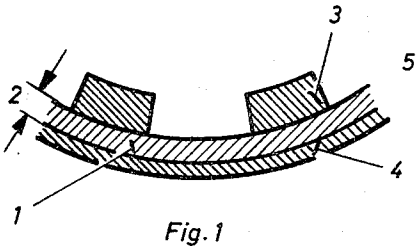


Fig. 1

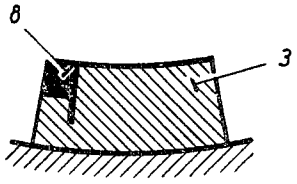


Fig. 3

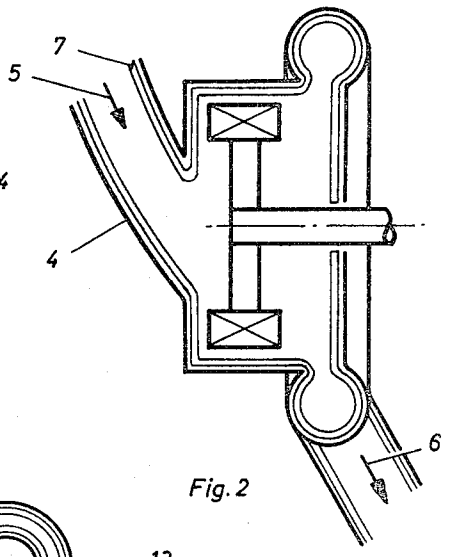


Fig. 2

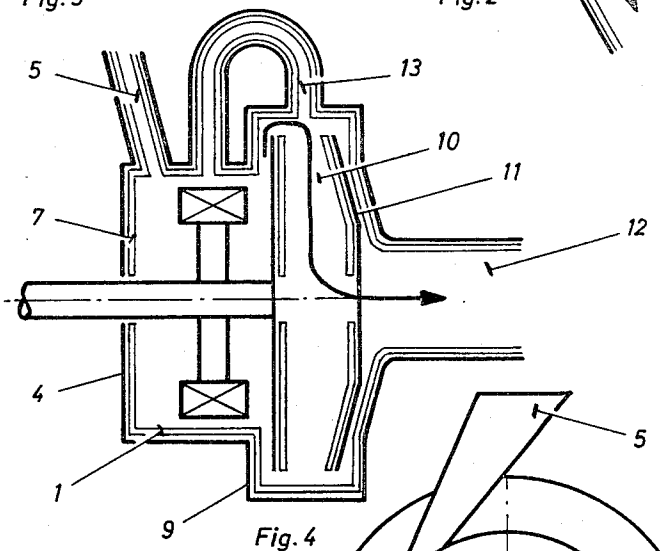


Fig. 4

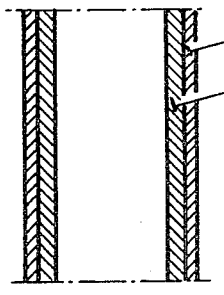


Fig. 6

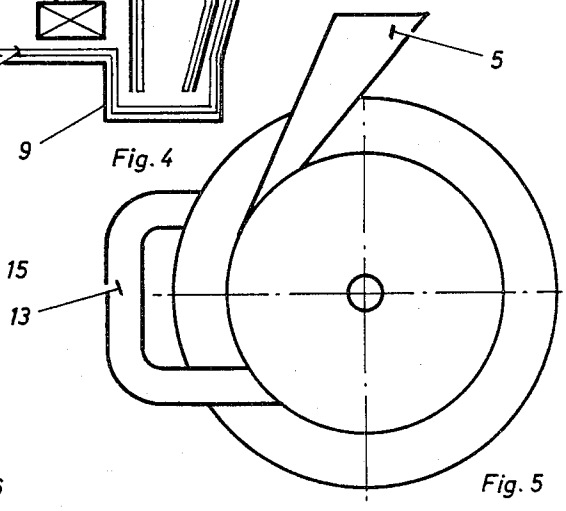


Fig. 5

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APPARATUS FOR HANDLING AND PROCESSING CURRENTS OF GAS-BORNE DRY SOFT POWDERS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application corresponds to German application, Ser. No. P 15 07 464,3, filed Apr. 6, 1966, on which no patent has issued.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention concerns a coating on or for inner walls of processing equipment that are impacted by gas or airborne soft powders that have atendency to settle out for form crusts in process equipment, such as grinding mills, more especially baffle ribbed grinding track mills, classifiers, sifting channels of classifying rotors, cyclones, pipelines, particularly bends in piping and other equipment. The primary feature of the invention relates to the particular design of the coating that aims at preventing powders from forming deposits in equipment in which they are formed, processed or transported.

2. Description of the Prior Art

The settling down of crusts on the inner walls of process equipment presents, as generally known, vital difficulties and problems. In a grinding mill, e.g., the grinding conditions are altered with the increasing build-up of deposits and hence the end fineness of the product changes so that more or less frequent stoppages are necessary for cleaning work. Extremely stubborn materials are so resistant to size reduction at all that the mill clogs up after a few minutes' service time. Also in classifiers, cyclones and other process equipment such incrustations are detrimental and interfere with their operation.

Various provisions, more or less aiming at eliminating the source of the sedimentation or deposition phenomena, are already known, such as modifications to the grain size composition of the powders, introduction of inert additives, cooling and drying of the powders and, furthermore, the use of smooth surfaces and linings that have little benefit against powder adherence, as well as parts which are put in motion by mechanical and hydraulic means. It is furthermore usual to counter-act sedimentation by means of swing-type inserts hung in, such as so called "flutter-shirts" and "bumper aprons," both moved as a whole.

All these provisions aimed at preventing the formation of crusts, involve more or less drawbacks, for they require either a large expenditure of money and means or they are only partially successful.

The object of the present invention is to provide the coating referred to for the prevention of deposits and to design it so that it counteracts and prevents the formation of appreciable interfering crusts of powder, in equipment of the type described.

SUMMARY OF THE INVENTION

The inventor has recognized that this purpose will be accomplished if said coating is made from very soft and elastic material, the hardness of which ranges between **10** and **50** Shore, such as rubber foam and which is characterized by a thickness that enables it to be compressed by the impact forces which vary according to place and time, to a degree that alters at the different spots, said coat changing thereby the shape of its surface, thus preventing the powders from settling down or forming encrustations in the equipment.

The choice of the material, within the range specified, and of the thickness of the coating is decided by the nature of the powder and the impact forces initiated against the respective inner wall.

The inventor has, furthermore, found that rubber foam, hitherto completely rejected as a protective coating on inner walls which are subject to the impact by current entrained powders, is in many cases extremely suitable for a sediment-free coating in pipelines through which powders are carried, also in bends, if provided in a thickness of at least 3 mm, preferably, however, 5 to 10 mm. Natural rubber has proven its efficiency as a coating on a baffle ribbed grinding track and other interior walls, acted upon by stronger impact forces. Contrary to expectation, the wear and tear on soft coatings is slight only.

If strongly adhering powders are handled such as, e.g., certain insecticides and coloring pigments, it is advantageous to provide the supply and exhaust systems and piping of the processing and handling equipment with a coating of the kind contemplated by the present invention. If a powder mix is blown against a coating of the kind contemplated by the present invention, it is subjected to compression and shearing forces. These forces are not, however, stationary, but they change magnitude and direction due, on the one hand, to the impacting powder volume that varies according to place and time and, on the other hand, to the turbulence of the current.

The compression sustained by the soft-elastic surface of the coating is subject to considerable alterations at the different spots. Thus the formation of crusts is entirely prevented or, if any should occur, they will be broken up and detached by the shearing forces of the coating. These changes in the shape of the surface are initiated only if the impact forces and the flexibility of the surface, which are decided by hardness, elasticity, thickness and shape, are high enough. The coating as a whole is not put in motion, but only its surface.

The conditions largely deviate from those obtained with the known swinging insects that are hung in, such as "flutter shirts" and "bumper aprons" which are put in motion as a whole. Even with the known wear-protecting devices, with a hardness of over 50 Shore, no deformation of the surface is obtained that would in any way be comparable with that obtained with the coatings of the present invention, or be efficient enough to avoid the formation of deposits.

With the known ball mills fitted with linings made from natural rubber, in which the only self-cleaning of the inner walls is brought about by the falling balls, the forces initiated by the fluid current through the mill are not, contrary to the features of the present invention, utilized for the purpose of preventing incrustations in the mill.

Where rubber foam or foam rubber is used, a choice can be made between a thickness of at least 3 mm and a preferred one ranging from 5 to 10 mm. Where abrasive powders are handled, it is preferable to use a coating composed of two layers, i.e., a thicker, particularly soft substratum, e.g., of rubber foam and a thinner, wear-resistant inner layer, e.g., of natural rubber. Such a two layer coating is, e.g., suitable for application on the grinding track of an impact mill.

The coating can be obtained by gluing or cementing on strips or flat pieces or, in case of piping, by inserting and pasting or cementing together tubular parts.

In many cases it is preferable to provide the coating with a metallic ply reinforcing, e.g., where a baffle ribbed grinding track is to be protected. With an impact mill it is advantageous to apply this coating according to the present invention, not only on the baffle ribbed grinding track, but also on the inner faces of inlets and outlets and on the interior of the mill housing. A highly wear-resisting armouring strip consisting of thin metal can be provided over the coating of the parts of a baffle ribbed grinding track that are largely exposed to wear and tear, such as angles and surfaces and, more especially, on the ribs.

BRIEF DESCRIPTION OF THE DRAWING

The drawing illustrates schematically and by way of example different embodiments of the invention. In the drawing:

FIG. **1** is an enlarged broken view of a part of a baffle ribbed grinding track in crosswise section to the axis of a grinding mill;

FIG. **2** is a diagrammatic view showing an axial section through an impact grinding mill;

FIG. **3** is an enlarged cross sectional view through one rib of the impact grinding track of FIG. **1**;

FIG. 4 is a diagrammatic view showing an axial sectional view through a classifying mill;

FIG. 5 is a diagrammatic elevational view of the classifying mill according to FIG. 4; and

FIG. 6 is a longitudinal sectional view through part of a tubing.

The baffle ribbed grinding track 1 shown in FIG. 1, is made from rubber, with a thickness 2 of 2 to 4 mm., and is fitted with cemented on baffle ribs 3. The baffle rib grinding track 1 is cemented to the inner wall 4 of the mill housing.

In the impact mill represented in FIG. 2, not only the baffle ribbed grinding track (FIG. 1), but also inlet 5, outlet 6 and inner wall of mill housing 4 are protected by means of a soft-elastic coating 7.

Baffle rib 3, FIG. 3, is provided with an armouring 8 of highly wear-proof material on the points particularly exposed to wear and tear.

In the classifying mill, represented in FIGS. 4 and 5, inlet 5', inner wall — of the mill housing 4' and of the classifier housing 9, sifting channels 10 of the classifying rotor 11, fines channel 12 and channel 13 for the oversize material returning from classifier housing 9 into mill housing 4', are covered with a rubber foam coating 7', whereas the baffle ribbed grinding track 1' is also clad with a natural-rubber wear-resistant lining 8 on the rubber foam coating 7'. In piping 14, FIG. 6, a tubular part 15, made from rubber foam, is inserted and cemented or glued to the inside pipe 14.

I claim:

1. An apparatus for handling and processing currents of gas-borne dry soft powders that have a tendency to settle on and form deposits on portions of the interior surfaces of the walls of apparatus in which such currents are processed, said apparatus including rigid walls and having a structure for preventing the formation of such deposits comprising a lining of soft elastic material having a hardness within the range of from 10 to 50 Shore covering and firmly secured to the interior surfaces of said rigid walls, said lining being of such softness and of such thickness that the impact forces of the currents of the gas-borne powders pressing against and acting upon the inner surfaces of the lining cause the lining and its surfaces to vibrate and change shape considerably thereby preventing caking on said lining and the formation of appreciable powder deposits on the interior of said apparatus by the currents of gas-borne powder streaming along in contact with said lining of soft elastic material.

2. An apparatus according to claim 1, wherein the lining comprises rubber foam having a thickness of at least 3 mm.

3. An apparatus as claimed in claim 2, wherein the rubber foam has a thickness of from 5 to 10 mm.

4. An apparatus according to claim 1, wherein the lining is comprised of two layers, a relatively thick, particularly soft substratum and a thinner, more wear-resistant cover layer.

5. An apparatus as claimed in claim 1, wherein the lining comprises pieces of resilient material cemented to interior of rigid portions of the apparatus.

6. An apparatus for handling and processing currents of gas-borne dry soft powders that have a tendency to settle on and form deposits on portions of the interior surfaces of the walls of apparatus in which such currents are handled or processed, said apparatus including rigid walls and having a structure for preventing the formation of such deposits comprising a lining of soft elastic material having a hardness within the range of from 10 to 50 Shore, said lining comprising a relatively thick soft layer responsive to variations in the current of gas and soft powder brought into contact therewith and being of such softness and of such thickness that the impact forces of the currents of the gas-borne powders acting upon the surfaces of the lining cause the lining to vibrate and change shape considerably thereby preventing caking on said lining and the formation of appreciable powder deposits on the interior of said apparatus.

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