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CENTRIFUGAL IMPACT MILL

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6 Claims

ABSTRACT OF THE DISCLOSURE

A centrifugal impact mill is shown wherein material processed by a high speed rotor is flung outwardly toward a surrounding gas-permeable wall member. To prevent adhesion of the material to the wall member, the latter is surrounded by a chamber to which air or other gas is fed under pressure. The gas is forced through the pores of the wall member toward the interior of the apparatus thereby tending to dislodge any material sticking to the inside surface of the wall member or tending to repel such material before adhesion to the wall member. Means are provided within the apparatus for drawing off the gas from the interior.

This invention relates to a mill and in particular to an improved centrifugal impact mill for use in processing somewhat adhesive substances.

Centrifugal impact mills, such as the one shown in U.S. Patent 3,102,781 issued to Robert J. Hoskins, et al., are well known in various industrial arts. They have been used as a preferred way of destroying insect infestation in grains such as flour, etc. They have also been used to comminate various types of materials such as abrasive cleaners, pigments, certain metals, synthetic materials including plastics, etc. They have also been used to blend two or more pulverulent materials.

Their use in certain applications has been limited somewhat by the fact that the materials being processed after they have been flung outwardly under the influence of centrifugal force, have adhered to inner wall surfaces of the machine. The material thus accumulates there in increasing amounts and this tends to impair the efficiency of the machine and may prevent sanitation and clean-up problems. An example of this occurs when a centrifugal impact mill is used to process, for example, a cake mix or to process certain plastic materials which become softened and somewhat sticky under the influence of the heat generated in the milling process.

It is therefore among the objects of this invention to provide a centrifugal impact mill in which build-up of somewhat sticky materials on surfaces on which the processed materials impinge is prevented.

Another object of the invention is to provide an improved centrifugal impact mill which facilitates the cleaning of the mill after processing of certain sticky materials.

Another object of the invention is to provide an improved centrifugal impact mill whose efficiency is not impaired by adhesion of sticky materials on its inside surfaces.

Another object of the invention is to provide apparatus having a wall member so constructed as to prevent adhesion thereon of material normally directed thereat.

Still another object of the invention will be apparent to those skilled in the art upon perusing this specification including the drawings and claims.

In accordance with our invention we provide apparatus having a wall member toward a first portion of which material is normally directed. The wall member is made of a gas-permeable material such as certain metals. A gas under pressure is applied to a second portion of said member so that this gas permeates said wall member and exits therefrom at said first portion. Consequently, depending upon a number of factors including the pressure, material directed toward said first portion is repelled before impingement thereupon or is dislodged by said gas after impingement thereupon.

FIGURE 1 is a sectional elevational view of part of a centrifugal impact mill which incorporates the present invention.

FIGURE 2 is a partly sectional view of part of the apparatus shown in FIG. 1 taken along the section line 2—2 in the direction indicated.

FIGURE 3 is a sectional view of a portion of the apparatus depicted in FIG. 2 taken along the section line 3—3.

Centrifugal impact mills are well known in the art. One example of them is shown in the aforementioned U.S. Patent, that example showing its use with particular reference to insect infestation. Such mills ordinarily include a driving means such as a motor which may be belt-coupled for example, to a sheave mounted on a rotor shaft, similar to the shaft 7 shown in FIG. 1. The shaft passes through an aperture in a casing 4. A hopper 20 is suspended tightly below casing 4. This suspension may be accomplished, for example, by means of a number of clamp assemblies indicated generally at the numeral 14. Each comprises a horizontal bifurcated portion 14a, attached to the outside of casing 4, through which a horizontal pin passes. This pin also passes through an aperture in a pivoting member 14b which, in the position shown in FIG. 1, has its lower portion passing through another bifurcated portion 14c which is attached to the hopper's exterior at its upper edge. A nut 14d is screwed tightly against washer 14d onto the threaded free end of the member 14b to keep the hopper 20 pressed tightly upward against sealing ring 21.

Mounted on the lower end of the rotor shaft 7 by means including a retaining nut 9 is a rotor 8 having a hub 8a. Toward the periphery of the rotor 8 there is a circular row of vertical impactors 10 spaced from one another. The impactors 10 support an annular member 11 whose inner circular edge is close to the outer surface of a distributor ring 12. The distributor ring 12 helps to channel the incoming material to be processed onto the upper surface of the rotor 8 whence it is flung outwardly with great force against the impactors 10 and thence toward wall 25. A chute 5 is formed in the rotor casing 4 and has an interior channel 6 through which the material to be processed is applied to the impact mill.

Conventionally, surrounding the impactors 10 there was a wall assembly known as a "liner" which sometimes was smooth and sometimes corrugated. Sometimes it also included additional impacting targets or elements against which the processed material was flung.

Even in cases where the liner was smooth, there often resulted a build-up of certain materials thereupon. This was the case when the materials processed in the mill were somewhat moist or adhesive such as cake mix or certain types of plastics which became soft and sticky because of heat imparted to them during the centrifugal impact milling process. This build-up of material impeded the free flow of the material through the mill. It also presented sanitation and cleaning problems.

In accordance with our invention we provide that the wall toward which the processed material is directed by virtue of the applied centrifugal force is gas-pressurized. That is to say, the wall is made of a material which allows a gas to pass through it. Gas is applied to the outer side of the wall under pressure so that it is forced through the
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If the pressure of the gas is high enough it may be sufficient to repel the material so that it never even lands on the inner side. If the gas is not under sufficient pressure the material may stick to the inner side of the cavity. This is accomplished by the circular, gas-permeable vertical wall 25 which is mounted between two annular rings 19 made of a plastic such as Neoprene. The wall 25 may be made of, for example, so-called "Feltmetal," a trademarked material produced by the Huyck Metals Department of the Huyck Corporation, Milford, Conn. This material is made of a randomly interlocked structure of metallic fibres which have been sintered together. Because these fibres are spaced from one another, there are a number of pores or internal channels extending from one side of the metal to the other. Of course other porous gas-permeable metals, plastics or vitreous materials such as glass or ceramic composites may alternatively be used.

The rings 19 are positioned against the inner surface of the vertical portion 17a of a generally C-shaped assembly 17. A number of threaded vertical apertures are formed at a number of points in the portion 17b, the apertures being aligned with similar apertures in the rings 19. A generally L-sectioned ring 18 is clamped against the lower edge of the portion 17a by means of a plurality of bolts 26. These bolts pass through respective apertures in the member 18, these apertures being aligned with those in the rings 19. The bolts are screwed into the apertures in portion 17b.

The permeable metallic wall 25 is supported and braced at its rear by a number of U-sectioned members 27 welded or otherwise connected to the outer side of the wall 25. Each of the bolts 26 passes through one of these supporting members.

The pressurized wall assembly consisting of the wall 25, rings 19 and members 17 and 18 is supplied with a gas such as air under pressure. There is formed in the wall portion 17a a projecting tubular part 17d having a passageway 17c communicating via opening 17i in wall 17a with the space between the wall 25 and portion 17a. The projecting tubular portion 17/d projects through a cutout portion 4a in the casing 4. Air or any other desired gas from an appropriate source is fed into this space or plenum. The wall 25 might be, for example, one-sixteenth of an inch, 30% dense and be made of Type 302 stainless steel "Feltmetal," Type A Fibre. The air is fed in at a pressure of 2 psi and has an air flow rate of 250 cu. ft. per minute per square foot. The air or gas source might be a blower powered by the same power source used for the main motor shaft 7, if desired, or from an independent source. The gas applied to the outside of the wall 25 might be different from the one fed into the casing via chute 5 under certain circumstances.

The pressurized wall assembly includes an outwardly projecting L-sectioned ring 17c which fits over the upper edge of the hopper 20, a resilient sealing ring or gasket 20a being positioned in between. The clamp assemblies 14 support the hopper in tight abutting relation to the casing 4 and the pressurized assembly, as previously explained.

By this pressurized assembly, the inner surface of the wall 25 maintained free of sticky substances adhering thereto and hence its cleanliness, efficiency, and sanitation may be more easily maintained.

Of course, different methods of mounting the pressurized plenum assembly may be employed and different shapes of gas-permeable walls 25 may be utilized. It is not necessary that the entire portion of the wall 25 be permeable but it is necessary that at least the portion of it against which the processed material is directed be porous and that another portion thereof allow the application of the pressurized gas thereto. The invention is also applicable to forms of apparatus other than centrifugal impacting apparatus. It may be used, for example, with other types of rotary processing apparatus or any apparatus in which there is a wall against which material is directed with considerable force, which wall is to be maintained substantially free of said material.

Other applications and modifications of the illustrated apparatus, which do not depart from the essence of the present invention, will occur to those skilled in the art. Consequently, we desire our invention to be limited solely by the claims which follow.

We claim:

1. In rotary processing apparatus, (a) a wall member toward one side of which material processed in said apparatus is directed, said wall member being gas-permeable, and (b) means for applying a gas under pressure on the other side of said wall member which permeates said wall to said one side thereof thereby tending to prevent passage of said material through said wall and adhesion of said material to said one side.

2. In rotary processing apparatus, (a) a wall member on the inner side of which material processed in said apparatus tends to impinge, said wall member being gas-permeable, and (b) means for applying a gas under pressure at substantially all points on the outer side of said wall member, said gas thereupon permeating said member to the inner side thereof thereby dislodging said material which adheres to said other side, said pressure being sufficiently high relative to the pressure of gas on the inner side of said wall member as to prevent passage of said material through said wall.

3. In rotary processing apparatus, (a) an encompassing generally circular wall member toward the inner side of which material processed in said apparatus is directed, said wall member being gas-permeable, but not permeable by any of said materials and (b) means for applying a gas under pressure at substantially all points on the outer side of said wall member which permeates said member to the inner side thereof, thereby tending to repel said processed material and prevent it from impinging on said inner side.

4. In rotary processing apparatus, (a) a generally cylindrical wall member surrounding a rotary processing member toward which somewhat sticky material processed in said apparatus is normally directed by centrifugal force and to which said material tends to adhere, said wall member having pores therein which are gas-permeable but impermeable to said material, and (b) means for continuously applying a gas under pressure substantially at all points on the outer side of said wall member, said gas permeating said wall member and moving inwardly thereof thereby tending to repel said material and prevent it from impinging on and first portion, and (c) means for withdrawing said gas from inside said wall.

5. In rotary processing apparatus according to claim 4 wherein said (b) means includes a chamber on the outer side of said wall and wherein said gas is applied to said chamber tangentially and further wherein said (c) means includes a hopper disposed below said wall member and said chamber.

6. In a centrifugal impacting apparatus which includes a rotor disposed for rotation within a housing, a hopper connected to said housing, and means for applying a material to be rotated through said housing onto said rotor, the combination including: (a) a pressurized wall assembly mounted within said rotor housing, said assembly including a gas-permeable wall member in the path of material processed by said rotor, and (b) means for applying a gas under pressure on the
outer side of said wall member which permeates to the inner side thereby tending to prevent adhesion of said material to said inner side, and
(c) means including said hopper for enabling withdrawal of said gas on the inner side of said wall member.

References Cited

UNITED STATES PATENTS

3,299,477 1/1967 Gunkel 241—60, 186

3,452,937

2,474,314 6/1949 Koehne 241—51 X
2,325,886 8/1943 Sisulak 241—60 X
1,937,413 11/1933 Roth 241—47 X
1,624,435 4/1927 Redus 241—47 X
3,102,781 8/1963 Hoskins 241—61

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