

Aug. 23, 1966

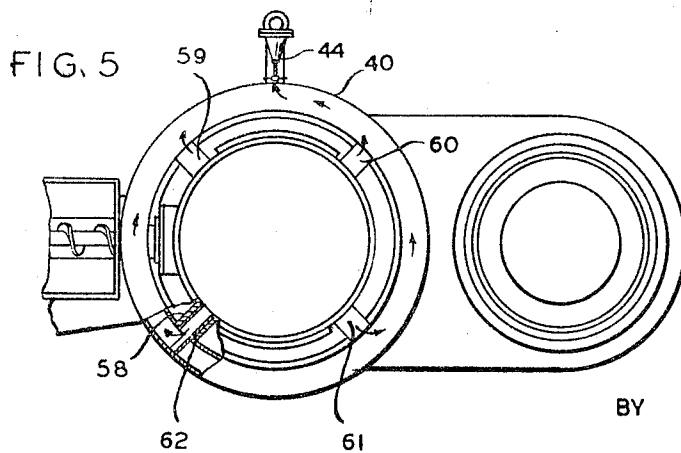
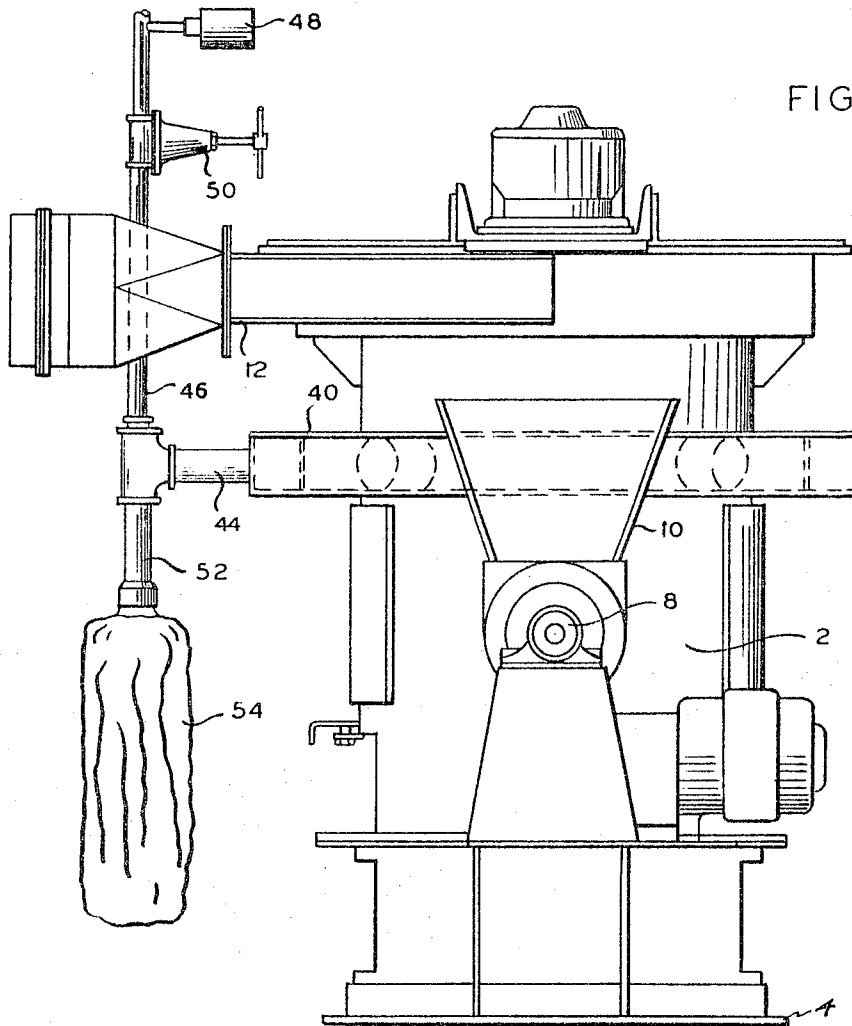
A. T. GLYNN ETAL

3,268,179

ROTARY PULVERIZER MILL WITH ASPIRATOR MEANS

Filed Sept. 9, 1963

3 Sheets-Sheet 1



INVENTORS

Henry S. Lisowski

Alfred T. Glynn

Ronald R. Saville

BY
Attorney

Aug. 23, 1966

A. T. GLYNN ETAL

3,268,179

ROTARY PULVERIZER MILL WITH ASPIRATOR MEANS

Filed Sept. 9, 1963

3 Sheets-Sheet 2

FIG. 2

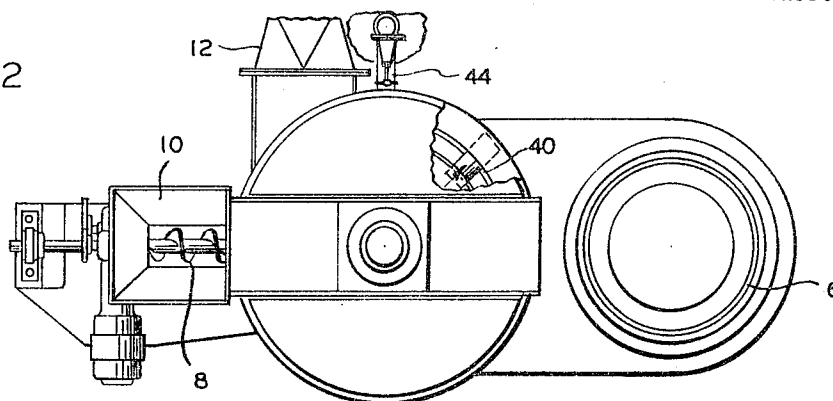
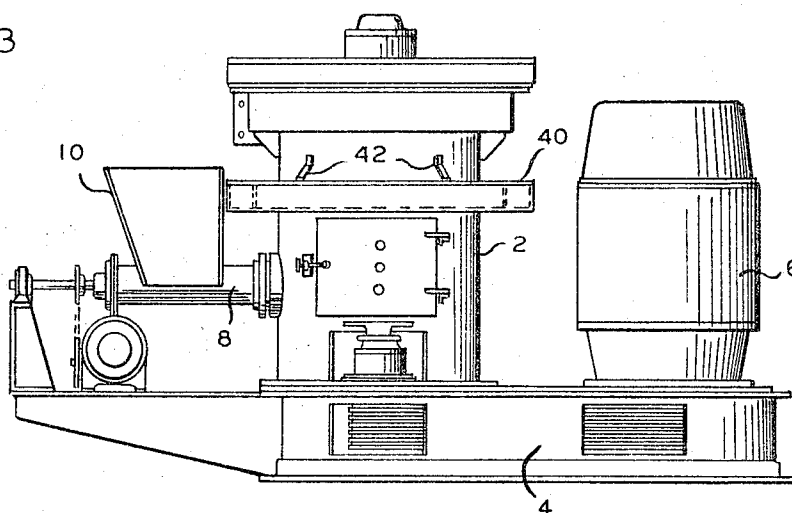


FIG. 3



INVENTORS

Henry J. Lisowski
Alfred T. Glynn
Ronald R. Paves
Maurice F. Hamilton

BY

ATTORNEY

Aug. 23, 1966

A. T. GLYNN ETAL

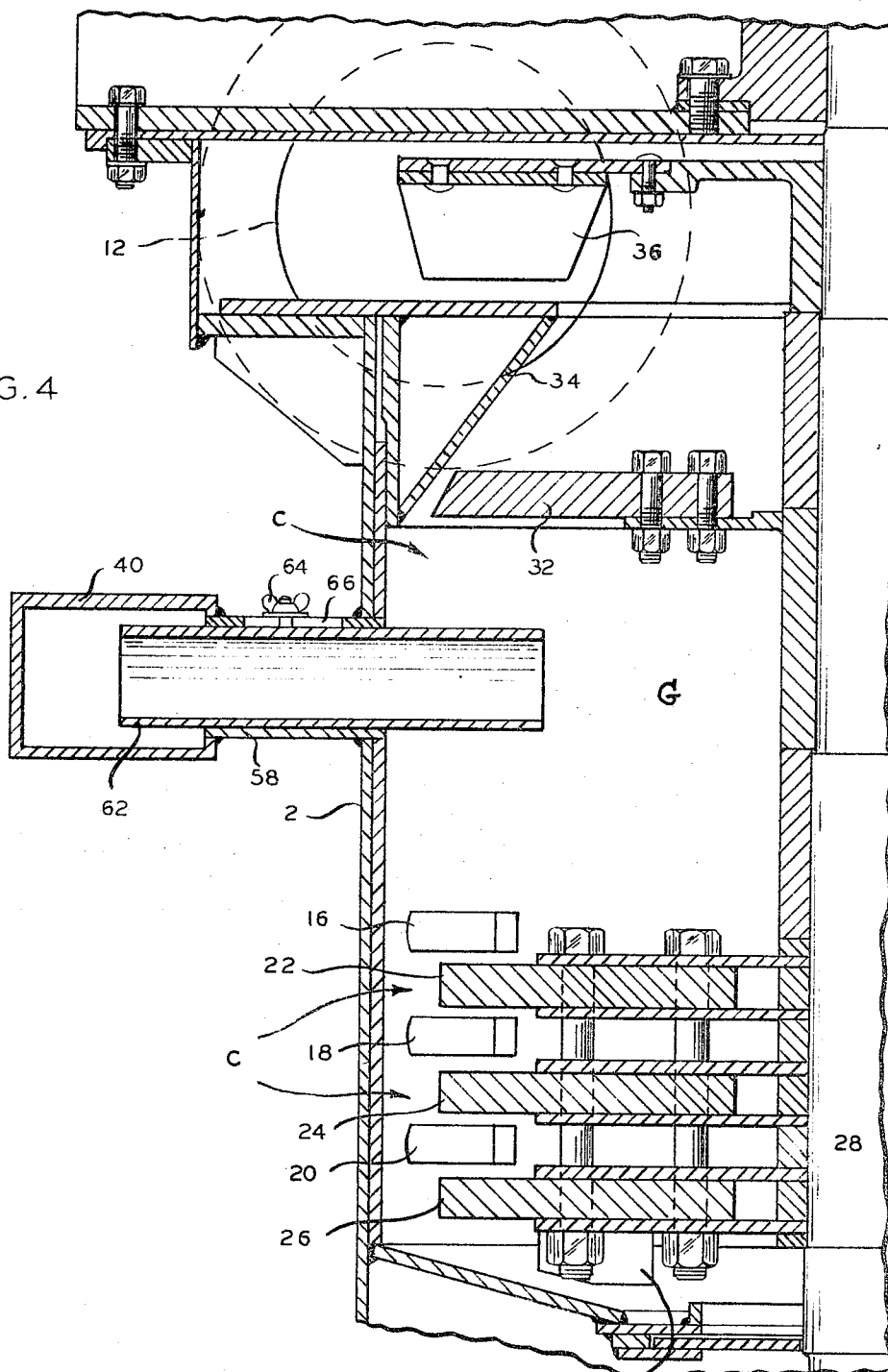
3,268,179

ROTARY PULVERIZER MILL WITH ASPIRATOR MEANS

Filed Sept. 9, 1963

3 Sheets-Sheet 3

FIG. 4



BY

INVENTORS
Henry J. Lisowski
A. T. Glynn
Ronald R. Powers
Attorneys
Hamilton

1

3,268,179

ROTARY PULVERIZER MILL WITH
ASPIRATOR MEANS

Alfred T. Glynn, North Quincy, Henry J. Lisowski, Dorchester, and Ronald R. Saverse, Jamaica Plain, Mass., assignors to Sturtevant Mill Company, Boston, Mass., a corporation of Massachusetts

Filed Sept. 9, 1963, Ser. No. 307,410

10 Claims. (Cl. 241-19)

This invention relates to a method and apparatus for grinding and classifying particles of material to provide a desired degree of subdivision with reference being had especially to processing of grains such as corn meal, soy bean meal and the like. More particularly, the invention is concerned with a novel aspirator type device for removal of excess particles from air classifying machines of the form having both an impact grinding zone and an air classifying zone. An example of this form of machine is a grinding mill manufactured and sold under the trademark "Pulver-Mill" by the Sturtevant Mill Company of Boston, Massachusetts, the assignee in the present application.

In processing grain materials such as soybeans, corn and other similar products of a relatively hard nature in a machine of the class indicated, there is ordinarily produced a fraction of relatively coarse particles which do not pass through the air classifying zone and hence tend to fall back into the grinding zone. Since some of these particles may resist reduction beyond a certain size, they tend to gradually accumulate in the grinding zone. As more and more rejected coarse particles collect in the grinding zone, this region gradually becomes saturated causing an increasing load on the driving motor. As a result grinding efficiency may be undesirably lowered.

It is a chief object of the invention to deal with the particle saturation problem in the grinding zone of a Pulver-Mill type of grinding machine and to prevent the accumulation of an excessive concentration of relatively coarse particles in the grinding zone by a controlled removal of some of the coarse particles during operation of the machine.

Another object is to provide an aspirator type control device which can be conveniently attached to an air classifying type grinding machine in a position to remove limited quantities of coarse particles which are moving in a helical stream in the grinding zone of the machine.

Still another object is to provide an aspirator type extractor device which can be regulated to provide for a variable extracting capacity of coarse particles at one point while a continuous removal of relatively finer particles is carried out at another point.

As one means of achieving these objectives, we have devised a particle extraction method based on the use of a novel aspirator type device. An independently supplied flow of compressed air is used to create a suction force. The suction produced by this air flow is selectively controlled to remove relatively coarse particles from specific areas of a whirling mass of particles without interference with the normal air classifying of required relatively small particles. Particles moving through the grinding machine are acted upon by this suction flow and also by two other separately induced air flows within the casing and each stream of air is controlled and regulated to accomplish a desired result without interference with the normal air classifying of the machine.

The nature of the invention and its objects will be more fully understood and appreciated from the following description of a preferred embodiment of the invention selected for purposes of illustration and shown in the accompanying drawings, in which:

2

FIGURE 1 is a side elevational view illustrating one preferred form of air classifier type grinding mill with which the aspirator controlled extractor apparatus of the invention is shown in a typical operative position;

FIGURE 2 is a plan view of the apparatus shown in FIGURE 1 and partly broken away at one point to indicate portions of an aspirator manifold structure of the invention;

FIGURE 3 is a front elevational view of the machine further indicating feed and drive mechanism;

FIGURE 4 is an enlarged fragmentary cross sectional view showing a portion of the inner grinding zone of the machine and illustrating the extractor tube means of the invention combined therewith; and

FIGURE 5 is a detail plan view of the aspirator manifold member with discharge pipe and extractor tubes indicated in dotted lines.

Broadly stated the method of the invention is based on the concept of inducing suction at an intermediate point in a grinding chamber where a whirling mass of ground particles is passing from a grinding zone upwardly into an air classifying zone. We have discovered that by selectively controlling the distance from the central axis of the whirling mass at which the suction force takes effect, a very desirable selectivity may be realized without loss of fine material. In carrying out the method of the invention the extraction of coarse particles is preferably performed at a plurality of points, and in the preferred form of extractor means shown in the drawings, we employ a continuous circular extracting manifold which has associated therewith a plurality of radially adjustable extractor tubes located at spaced apart points around the grinding zone and the grinding mill.

In general, the structure shown in the drawings comprises a conventional grinding and classifying machine of the Pulver-Mill type, a manifold body surrounding the grinding chamber of the machine, a plurality of extractor tubes adjustably connected into the grinding chambers and aspirator means for inducing a suction in the manifold in varying degree.

As shown in FIGURES 1 and 3, numeral 3 denotes a housing body which includes a base section 4 on which is received at either side of the housing a drive means 6 and a motor-driven screw conveyor 8 for advancing material from a hopper 10 through the housing into a grinding chamber G within the housing 2 (FIGURE 4).

In the lower wall portions of the grinding chamber G, are transversely located stationary grinding elements as 16, 18, 20 which cooperate with the rotating impactors as 22, 24, 26 fixed to rotatable shaft 28. Shaft 28 is driven by the member 6 and also supports at the bottom thereof revolving vanes 30 which tend to create a spiralling flow of air through the grinding chamber whereby the particles of material are carried upwardly and undergo impact grinding. The particles are further acted on by a second current of air induced by a fan 36 and tend to be drawn upwardly away from the members 16 and 22.

Secured to shaft 28 at a point above the rotating impactors are selector bars 32 which cooperate with a deflector wall portion 34 to reject coarse particles and regulate the size of particles which are carried upwardly and pass out through the exhaust fan 36 to a discharge outlet 12.

It will be apparent that as increasing quantities of rejected coarse particles are caused to accumulate around the intermediate chamber portion G, a point is reached at which the concentration of coarse particles place an excessive load on the power driving means and efficiency will tend to drop unless some of the coarse particles can be removed without interfering with the normal upwardly spiralling movement of relatively small particles.

3

It will also be observed that due to centrifugal forces present, particles of relatively coarser size will tend to move in a spiralling path which is located a greater distance from the control axis of the grinding chamber G than the path of spiralling travel of relatively finer particles. This condition is made use of in the invention method to continuously remove a fractional part of the coarse particles.

In removing this fraction of coarse particles from the region noted, we combine with the grinding and classifying parts described, a circular manifold member 40 which is supported on arms 42 in spaced relation around the housing 2 at a point approximately between the grinding and classifying zones as suggested in FIGURE 4. This manifold consists of a tubular body of rectangular cross section. At one point the manifold is connected to a conduit member 44 which in turn is connected to a vertical air supply pipe 46 through which a flow of aspirator air is supplied from an air compressor 48. The flow of air is controlled by a valve 50 and in one preferred arrangement passes downwardly through a lower conduit section 52 into a bag collector 54.

At spaced apart points around the inner peripheral surface of the manifold 40, as shown in FIGURE 5, are transversely disposed tubular portions as 58, 59, 60, 61, which slidably support respective extractor tubes, one of which is denoted by the numeral 62 in FIGURE 4.

The extractor tubes 62 are formed of a length such that they may, in one position, extend for a substantial distance into the zone of movement of a whirling mass of particles. As shown in FIGURE 4 an adjustment member 64 is fixed to the tube 62 and may be moved through a limited path of travel in a slot 66 in member 58. This arrangement may be employed to radially adjust each of the tubes around the manifold 40 in suitably spaced relation to the central axis of the chamber G.

It will be apparent that by operating compressor 48 to induce a flow of air of sufficient intensity downwardly through air conduit 46, it becomes possible to create a suction effect which is exerted at all points around the manifold 40 and likewise at the inner extremities of each of the extraction tubes 62 in very close proximity to coarse particles in zone G. As a result a fraction of coarse particles may be extracted in a controlled manner.

We have found that by varying the position of the inner extremities of the extraction tubes in relation to the speed of fans 30 and 36 and the upwardly spiralling flow of particles, we are enabled to regulate the size of coarse particles which can be drawn out of the whirling mass. The relatively finer particles are found to occur in a spiralling path of greatest concentration immediately surrounding the shaft 28. Relatively large particles tend to concentrate in spiralling flow in the region immediately adjacent to the casing wall 2. Thus, by adjusting the setting of each of the withdrawal tubes, and having regard for the size of small particles which are to be passed through the machine and the speed of operation of the machine, it is possible to prevent any appreciable accumulation of coarse particles in this intermediate region in the chamber and to constantly extract a small fraction of coarse particles which are passed to the collector 54.

It is further found that in dealing with grain particles of corn meal and soy bean meal in particular, a very large fraction of the material which ordinarily resists grinding beyond a point can be very effectively extracted by suction from the region of the grinding chamber occurring between the grinding means and the particle rejecting apparatus. As a result an important refinement of the grain particles can be carried out and effects of overloading are avoided with consequent increase in efficiency of the process.

Although the method and apparatus described are particularly suited to handling and classifying grains of the class noted above, it will be understood that the invention

4

may be employed in dealing with various other types of finely divided foods, minerals, pigments, and the like. It will also be understood that the invention may take other modified forms within the scope of the appended claims.

We claim:

1. Apparatus for grinding and classifying particles of material comprising an enclosure body having a chamber formed therein, said chamber including a lower impact grinding zone, an upper air classifying zone and an intermediate particle reject zone, an air inlet communicating with the bottom of said chamber and a particle discharge outlet extending from the top of said chamber, a fan member for moving a current of air through the air inlet and upwardly of the chamber in a spiralling path of flow, rotary impact grinding means mounted in the grinding zone of the chamber in the path of flow of said current of air, a particle feeding device for introducing material into the rotary impact grinding means, air classifying means mounted in the air classifying zone and including a rotary particle rejecting member for releasing coarse particles to the particle reject zone and an upper fan member for moving fine particles through the particle rejecting member and air classifying zones and out of said discharge outlet, a tubular suction device mounted externally of the enclosure body and having air conduit means located through the enclosure body and communicating with the said intermediate particle reject zone, and means for delivering a flow of compressed air through the tubular suction device thereby to induce a suction in the said air conduit means for removing coarse particles from the said intermediate particle reject zone.

2. A structure according to claim 1 in which the air conduit means is adjustable towards and away from the central vertical axis of the chamber to regulate the size and quantity of particles removed.

3. A structure according to claim 1 in which the tubular suction device comprises a circular manifold portion extending around the enclosure body and said air conduit means consists of a plurality of pipes located through said enclosure body at spaced apart points therearound.

4. A structure as defined in claim 1 in which the means for delivering a flow of compressed air includes a vertically disposed suction pipe and valve means for controlling the flow of compressed air in accordance with the speed of operation of the fans.

5. A structure according to claim 1 in which the tubular suction device is provided with bag collector means attached at a discharge side of the said device.

6. In a method of air classifying particles of material, the steps which include introducing particles into a confined space, grinding the particles in a lower section of the confined space to form a relatively coarse particle fraction and a relatively fine particle fraction, lifting the particles in an upwardly spiralling path of flow through an intermediate portion of the confined space in which the coarse particle fraction becomes displaced radially outwardly to a greater extent than the relatively fine particle fraction, subjecting the fractions to a particle rejecting treatment during which the relatively fine particle fraction is removed from the confined space and the relatively coarse particle fraction is returned to the said intermediate portion of the confined space to form a relatively concentrated whirling mass of the relatively coarse particles, continuously producing a high velocity flow of air externally of the confined space and subjecting the concentrated mass of relatively coarse particles to suction force which is localized in the spiralling path of flow to remove small quantities of the coarse particles from the said intermediate portion of the confined space thereby to control the concentration of rejected coarse particles accumulating in the intermediate zone.

7. A method according to claim 6 in which the suc-

5

tion force is exerted in a plurality of separated points in the said confined space.

8. A method according to claim 6 in which the total suction force exerted is regulated in accordance with changes in the speed of flow of the upwardly spiralling mass of particles.

9. A method according to claim 6 in which the relatively coarse particles removed by the suction force are collected in a suitable container.

10. In an air classifying machine which includes a casing body, a grinding apparatus in the casing and a fan driven air classifying and particle rejecting mechanism rotatably supported in the casing and separated from the grinding apparatus by an intermediate particle reject zone, the combination of a suction device constructed and arranged to remove particles passing from the grinding apparatus through the said intermediate reject zone, said suction device including a circular manifold, means for supporting the manifold in spaced relation around the casing body, sleeve means radially dis-

6

posed through the casing and communicating with the circular manifold, conduit means slidably received in the sleeve means and operating knob means for adjusting the position of the conduit means in the sleeve means in accordance with the speed of the air classifying and particle rejecting mechanism thereby to control the size of particles removed through the suction device.

References Cited by the Examiner

UNITED STATES PATENTS

1,748,050	2/1930	Harrington	241—56
2,100,734	11/1937	Crites	241—56 X
2,200,822	3/1940	Crites	241—19 X
2,552,565	3/1951	Les Veaux	241—53
3,110,447	11/1963	Boomer	241—58 X

LESTER M. SWINGLE, *Primary Examiner*.

ROBERT C. RIORDON, *Examiner*.

H. F. PEPPER, JR., *Assistant Examiner*.