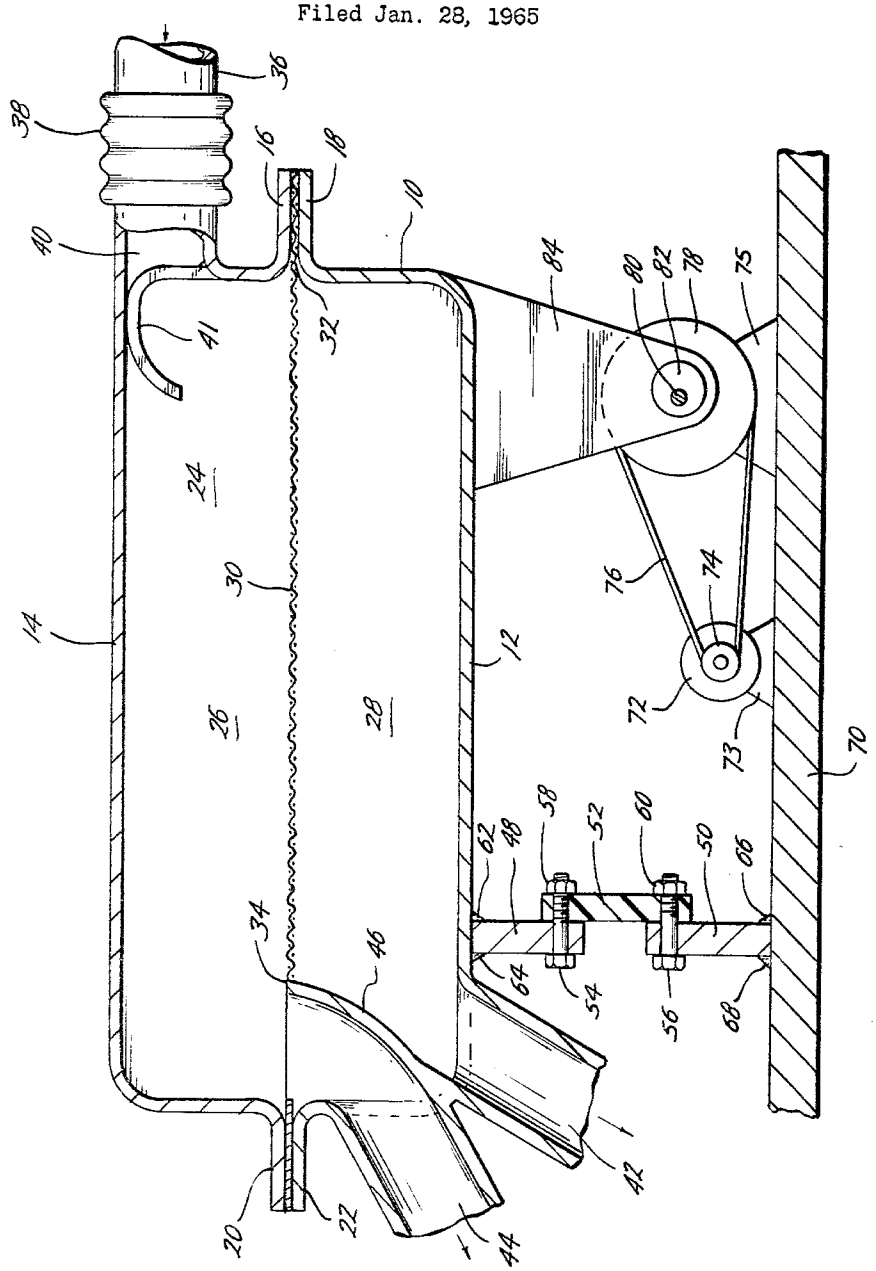
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LINE SIFTER

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LINE SIFTER

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This invention pertains generally to classifying apparatus and methods and particularly to an improved vibratory sifter and methods utilized therein, and is a continuation in part of my application, Serial No. 207,190, now abandoned, filed July 3, 1962.

Various types of sifting or classifying apparatus and methods have been developed for handling pulverized or powdered substances such as flour. In particular, reciprocating or vibratory sifters of various types have been used extensively in prior art devices. For example, United States Patent 3,021,952, issued on February 20, 1962, to K. R. Powell, United States Patent 3,021,953, issued February 20, 1962, to W. A. Brastad et al. disclose sifters or classifying apparatus wherein a reciprocating or vibratory movement is utilized.

Although many of the prior art devices have proven to be satisfactory in some respects, such prior art devices leave much to be desired in the way of optimum design and performance to assure rapid and effective classifying of solid particles having various sizes. Prior art classifiers have been large since the inputs to the classifiers must be diverted from the in-line path of the incoming material. Also known classifiers have not been pressure tight thereby requiring terminating and air separating means at the input to the classifier and an air-lock feeder at the output of the classifier whereby the material is introduced into another air stream for distance conveying.

Thus, an object of the present invention is to provide an improved reciprocating, classifying apparatus and to provide improved classifying methods.

Another object of the present invention is to provide apparatus and methods of classifying solid particles wherein such solid particles are conveyed by the velocity of a source of air under pressure into a pressure tight classifying or vibratory apparatus, the air serving as a conveyor and yet not forcing the solid particles through the sifting screens.

Yet another object of the present invention is to provide improved classifying or vibratory apparatus and methods which are characterized by simplicity, economy, and effectiveness of operation inasmuch as conventional air separation at the entrance to the classifying apparatus is eliminated as well as recombining mechanism at the discharge of the classifying apparatus.

Still another object of the present invention is to provide improved classifying or vibratory apparatus and methods wherein solid particles are conveyed by the velocity of a source of air under pressure through an input into a pressure tight chamber having an outlet for those particles which have not been screened or sifted in the chamber and another outlet for those particles which have been sifted or screened in the chamber, with only one air source serving as a conveying media into and out of the classifying apparatus.

In the drawing, FIGURE 1 is a partial-sectional, elevational view of apparatus which incorporates the present invention.

Briefly stated, the invention provides apparatus and methods for effectively classifying solid particles which have been conveyed by the velocity of a source of air

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under pressure into a pressure tight chamber. The chamber has a deflection member or baffle at the input and screening means through which particles of a maximum size are sifted or screened as the chamber is motivated by means which cause such chamber to vibrate or oscillate. The chamber has two outlets therein, one for removal of particles which were not sifted or screened and one for removal of particles which have been sifted or screened. Of course a plurality of sifting screens may be utilized, perhaps with a separate exit for each strata, as desired. The same conveying media which brought material into the chamber is used for removing the unsifted material from the chamber.

Referring now to the drawing in detail, a pressure tight chamber **10** is shown comprised of a plurality of sections which may be identified as a bottom **12**, top **14**, and members **16** and **18** which comprise one end of the chamber. At the opposite end of the chamber are members **20** and **22** which form the other end of the chamber. Side **24** is disposed between the bottom **12** and top **14** and inasmuch as a section view is shown, another side is required to complete the chamber configuration. Although a preferred type of chamber is shown in the drawing it is to be understood that any suitable configuration of chamber may be utilized without departing from the spirit of the invention, so long as such chamber is pressure tight. The internal pressure within chamber **10** is substantially uniform throughout.

Chamber **10** is divided into an upper portion **26** and a lower portion **28** by a screen or a sifting member **30**. The screen or sifting member **30** has a plurality of apertures therein. The size of such apertures is dictated by the maximum size of particles to be passed through such apertures into the lower portion **28** of chamber **10**. Screen or sifting member **30** is positioned at one end of the chamber **10** at point **32** between members **16** and **18** and the opposite end of the screen member **30** is positioned on member **46** at point **34**.

The chamber **10** is coupled to a suitable pipe or duct **36** through a flexible coupling **38**. Flexible coupling **38** is attached to duct section **40** of the chamber **10**. A source of solid particles is fed through pipe **36** into the chamber **10**, and deflected downwardly by baffle **41** onto the screen **30**. However, it should be noted that inasmuch as it is undesirable, with respect to the sifting of certain commodities, for example, flour, production being in accord with appropriate Federal Regulations, for the air to materially assist the solid particles in passing through screen **30**. Said particles pass through said screen by the vibration imparted to member **10** and/or by gravity flow. Thus the incoming air-particle mixture should be directed in such as manner as to not forcefully impinge on the screen with sufficient force to blow said particles through said screen. In this embodiment, baffle **41** serves as the directional medium, or force deflector. The solid particles may be of the powdered type developed in various processes during the milling or conveying of flour for example. The solid particles are combined with a source of air under pressure (not shown) so that a combination of air and solid particles are brought into the chamber **10** by the velocity of the air under pressure. The pressure at which the particle-air combination is passed into the chamber **10** may be varied for particular requirements but a satisfactory velocity has been obtained with a pressure of about five pounds per square inch.

Discharge outlets **42** and **44** are used for removing the sifted or screened particles and the unsifted particles in a

manner to be explained subsequently. Curved member **46** acts as a divider for the discharge outlets **42** and **44**.

The chamber **10** is supported near the end having the discharge outlets by a member **48** coupled through a flexible coupling to member **50**. Member **48** may be welded to the chamber **10** by welds **62** and **64**. Member **50** may be welded to a platform or base **70** by welds **66** and **68**. The flexible coupling which joins member **48** to member **50** may be constructed of any suitable material such as a flexible nylon sheet **52**. The flexible coupling should be rigid enough to support the chamber but also flexible enough not to break during vibratory movement of the chamber. Sheet **52** may be coupled at its upper portion to member **48** by bolts similar to bolt **54** which passes through member **48** and sheet **52** and is threadedly coupled to a nut **58**. The lower portion of sheet **52** may be coupled to member **50** by bolts similar to bolt **56** which passes through member **50** and sheet **52** and is threadedly coupled to a nut **60**.

Disposed at the end of chamber **10** opposite the discharge outlets **42** and **44** is a member **84** which is fixedly coupled to the chamber **10** in any suitable manner. Member **84** is coupled to an eccentric **82** which is driven by a shaft **80**. Shaft **80** is coupled to a member **78** which is concentric to shaft **80**. Member **78** is coupled through suitable coupling means such as a belt **76** to a motor **72**. Motor **72** has a sheave member **74** coupled thereto on which belt **76** is movably attached. Motor **72** and member **78** may be positioned on platform **70** by suitable means **73** and **75**, respectively.

Thus during operation of the apparatus, motor **72** is driven by a suitable energy source such as electric power. The motor drives the eccentric means to cause oscillation or vibration of the chamber means. Provision may be made to vary the motor speed thereby varying the oscillation period of the chamber means. The positioning of flexible sheet **52** prevents the oscillatory movement of chamber **10** from being substantially retarded. As the chamber means is oscillated or vibrated, the selected maximum particle size of the solid particles being fed into the chamber means are passed through the sifter or screen member **32** and into the lower portion **28** of chamber **10**. Inasmuch as the solid particles are brought into chamber **10** by the velocity of the air under pressure, the reciprocating movement of chamber **10** causes the same particles to be sifted and to continue movement toward exits **42**, **44**. These sifted particles are called throughs and are discharged from discharge outlet **42**. The solid particles which are too large for passing through the sifter or screen member **30** (also called overs) are discharged through discharge outlet **44** at the end of chamber **10** opposite the inlet **36**. Since the chamber is pressure tight, and the pressure substantially uniform throughout member **10**, the volume of air under pressure serves as a discharge media as well as an input media thereby eliminating an air separator at the input and eliminating mechanism for recombining the particles and air at the output.

The present invention overcomes many of the difficulties encountered previously in sifting apparatus and methods inasmuch as in the present invention the solid particles are combined with air under pressure to provide a combination of air and solid particles as an input to the chamber means. The chamber means is oscillated or vibrated by oscillating means which includes eccentric means well known in the art. The sifting is accomplished by such vibration, in that the incoming air-particle mixture is deviated from directly flowing toward the screen. If the inlet conduit did directly lead toward the screen, the air, under pressure, would exert significant force on the particles and thereby assist the particles, and associated foreign matter, in passing through the screen. Flexible couplings allow means to drive the chamber means in an oscillating or vibratory manner. Discharge means are provided for the particle-air combination which is passed through the sifting means in the chamber means and for discharging the particle-air combination which did not pass through the sifting means. The same source of air velocity serves as a conveying media for discharging particles as well as introducing particles into the chamber means. Turbulence in the lower portion of the chamber means is maintained at a minimum thereby preventing "blow-back" of the sifted particles.

Hereinafter follows a brief explanation of the advantages of the air conveyor operation. It has been mentioned that vessel **10** is intended to have substantially uniform pressure throughout. Through duct section **40** enter the air-particle mixture, having a certain velocity. Directional means, herein shown as baffle **41**, is provided for the purpose of assuring that the particle mixture will not be forced by air velocity through the fine mesh, but will pass therethrough by virtue of reciprocation and gravity flow. Inasmuch as the air will still have a force vector direction or velocity after entering the chamber, this velocity will be sufficient to again permit the "overs" and "throughs" to rejoin the air carrier in either of ducts **42**, **44**. By the means of said air-conveyor the overs and throughs, or coarses and fines, may, after sifting, be conveyed to remote points for further operations.

Although a preferred embodiment of the invention has been shown and described, the scope of the invention is defined by the following claims. Although such claims may be presented in indented format to facilitate reading and understanding thereof, such indented format is not intended as a structural or functional limitation of any of the elements or steps recited in the claims.

We claim:

1. Apparatus adapted for separating particles, said apparatus including in combination: Chamber means being pressure tight and having screen means positioned interiorly of said chamber means, said chamber means having uniform pressure therethrough; conduit means coupled to one end of said chamber means permitting a pressurized mixture of air and solid particles to enter said chamber means; means directing the flow of said pressurized mixture into the interior of said chamber in such a manner that said air portion of said pressurized mixture does not materially force said solid particles to pass through said screen means, said directing means being positioned adjacent the juncture of said chamber and said conduit; oscillating means coupled to one end of said chamber means to cause preselected particles to be sifted through said screen means; first and second discharge means coupled to said chamber means, said discharge means being so positioned with respect to said conduit means as to permit pressurized exiting of a mixture of said pressurized air and unsifted particles through one of said discharge means conjointly with pressurized exiting of a mixture of said pressurized air and sifted particles through the other of said discharge means; said oscillating means includes a platform, a motor mounted on one end of said platform, eccentric means coupled to said motor and to said chamber means, and a flexible coupling at the other end of said chamber means connecting said platform to said chamber means thereby permitting said chamber means to move in response to rotation of said eccentric means.

2. A method for continuously providing, sifting and exiting an air-particle mixture to and from a pressure tight chamber comprising the steps of:

retaining the internal pressure within said pressure tight chamber substantially constant during operation;

causing a pressurized mixture of air and solid particles to be directed into said chamber;

deflecting said air-particle mixture from its line of entry into said chamber so that the force with which said particles strike internal screening means within said chamber is insufficient to cause said particles to pass through said screening means;

mechanically reciprocating said chamber to cause fine portions of said particles to pass through said screening means;

exiting, under force, coarse portions of said particles from said chamber through an outlet, by means of a current of air which formed a portion of the initial air entering said chamber; and

exiting, under force, said fine particles from said chamber through a further outlet, by means of a current of air which formed a portion of the initial air entering said chamber, whereby by virtue of the force attributable to said air current, said fine particles may be moved a substantial distance from said chamber.

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