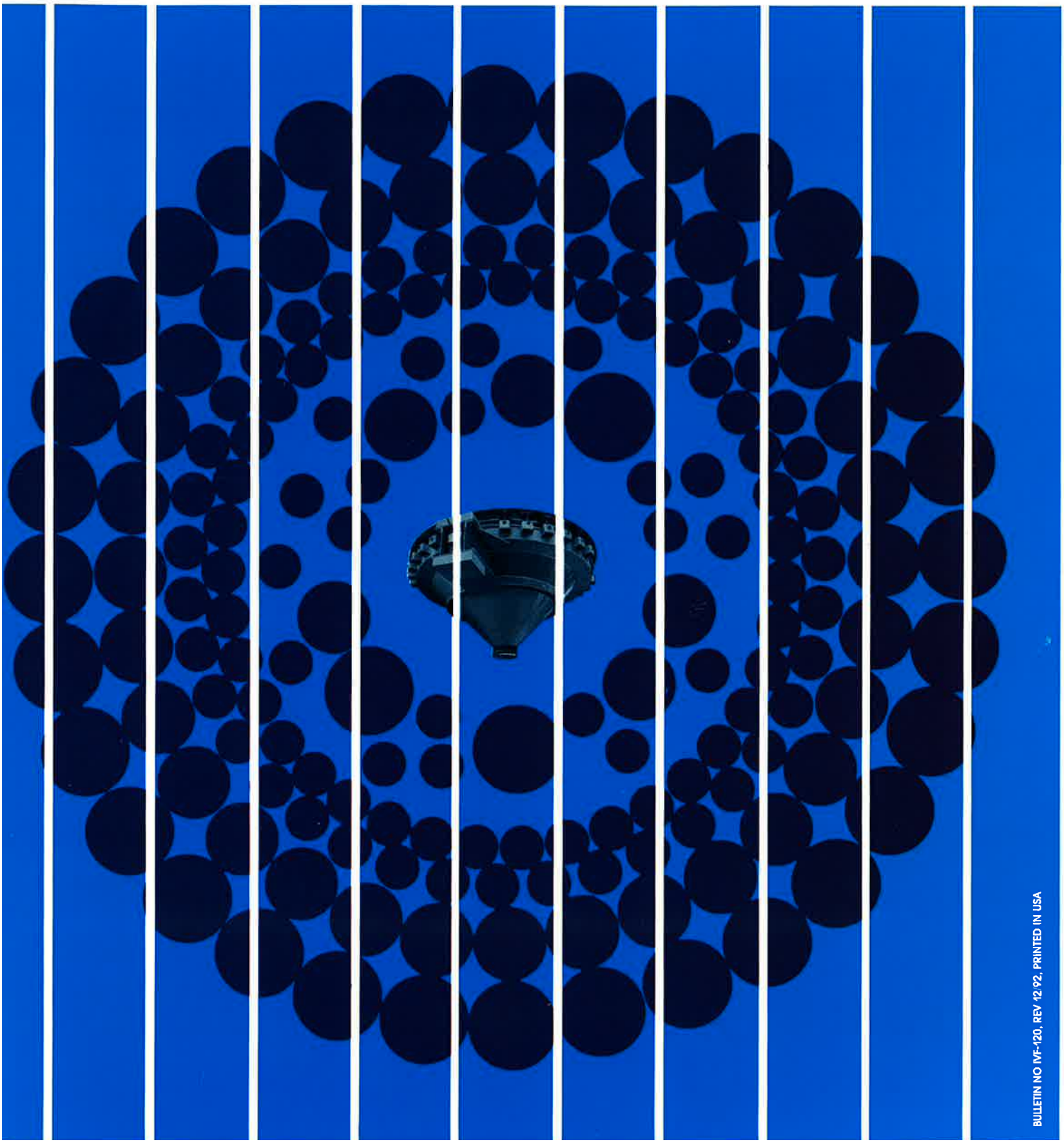
Induced
Vertical Flow

Bin Activators Utilize the "Natural Flow" Pattern to Discharge Stored Bulk Solids

Kinergy
Corporation



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How to Make Bulk Solids Flow From Bins and Silos

The "Bin Activator" came into being in 1962 as one of the near desperately needed answers to a very nagging question of the time. Namely, "How do you make bulk solids flow from Bins and Silos?" The success of this vibratory machine over the years became the basis of the "Induced Vertical Flow" concept. That's because it "induces" the stored contents to flow instead of "forcing" it. "Discharging" is its only function. Therefore, it can be specifically designed and operated to "induce" the stored bulk solid to vertically flow in a symmetrical and concentric pattern from the Bin or Silo.

Evaluating Stored Bulk Solids

There is virtually a myriad number of different bulk solids. To better understand their vertical flow characteristics, they can be classified as either a "Flake", "Floodable", or "General" type. Some other peculiarities associated with storing the material must also be noted.

Fig. 1: Wood bark typifies "Flake" type particles.

"Flake" type materials are flat shaped or stranded particles. The length is much greater than the thickness, and they are "compressible". This kind of bulk solid will "interlock" its particles and form secure bridges when placed in storage. Examples would be wood bark (Figure 1), fiberglass insulation, spent film, "RDF", and whole green beans.

"Floodable" bulk solids have a moisture content of less than 2% and a particle size smaller than 100 mesh. Their easy aeration is the basis for calling them "Floodable" (Figure 2). Lime, fly ash, kaolin clay, carbon black, stucco, and powdered milk are of this type.

Fig. 2: "Floodable" materials are very fine and dry.

Fig. 3: A granular texture, usually with lumps, denotes a "General" type bulk solid.

"General" type bulk solids do not qualify as being either a "Flake" or "Floodable". They are granular in texture and often have lumps (Figure 3). Examples would be coal, limestone, gypsum, sawdust, bottom ash, salt or soybean meal.

Other peculiarities must be recognized as they will be encountered with some bulk solids. They are:

"Set" or consolidation is the fusion of the particles when they are left in a dormant or non-flowing state for a period of time. The pressure to prompt this bonding is caused by the material's own "head load". Waste coals, sodium chlorate, fly ash, or freshly ground soybean meal are materials that will take a strong "set".

Abrasion: "Impact" wear should be differentiated from "sliding". Impact abrasion can be minimized by not striking an exposed metal surface, such as an empty bin being refilled. Sliding abrasion can be minimized by the proper design of the storing and discharging means. Sometimes abrasiveness is coupled with corrosion. When it is, a "sealed" liner should be utilized over surfaces needing protection.

Cohesion and Adhesion: Ordinarily, these are important considerations. However, adhesion and cohesion have not been detrimental to the performance of Bin Activators unless they are excessively vibrated.

Thixotropic: This unusual peculiarity is possessed by certain General or very wet materials that would otherwise be Floodable. They have a high moisture content combined with extremely obstinate flow characteristics under static conditions. When a repetitive dynamic force is applied, such as vibration, it will transform into a "jelly" type texture and more readily move. Barite's "gumbo mud", chrome ore, and some sludges typify this trait. It will "ooze" or extrude like toothpaste from the outlet when it is being discharged.

Conceptual Comparison

There are three recognized methods for discharging stored materials from Bins or Silos. They complement each other. When one or even two are not appropriate for a given application, the other usually is.

The purpose of any of these methods is to avoid "coring" (rat-holing), bridging, and to correct for any of the "inherent practical considerations" that are normally encountered with any Bin or Silo.

"Impelled Retrieving" essentially conveys and sometimes "forces" the bulk solid from the Bin or Silo. It achieves the most amount of storage in the least amount of height.

"Static Design" technology defines a material's vertical Flow Properties by means of a "shear tester". It relies upon the "forces of gravity" to prompt the flow. At times, "flow assist" devices such as air permeation, high frequency bin vibrators, and air cannons are used in conjunction with it. The vertical flow patterns that earmark this approach are diagrammed in Figure 4. If the bulk solid is within the capabilities of this method, it should be pursued.

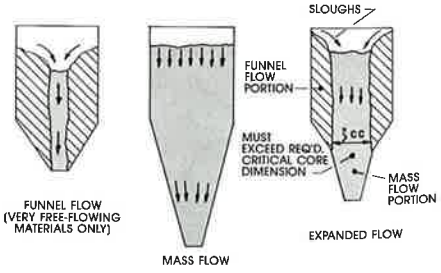


Fig. 4: The three vertical flow patterns using "Static Design" Technology

Inherent Practical Considerations

The "Induced Vertical Flow" of a Bin or Silo by means of a Bin Activator is used when "Impelled Retrieving" cannot be justified, or the bulk solid to be stored is beyond the practical limits of "Static Design" technology. This usually occurs when one or all of the following are a factor:

1. The overall height of the Bin or Silo must be reduced.

2. The vertical "flow properties" of the bulk solid vary too much.

3. The material takes on a strong "Set" or Consolidation.

4. The material qualifies as a "Flake".

The Inherent Practical Considerations

When discharging a Bin or Silo, there will be some added practical considerations that are virtually inherent in the application.

Segregation: When a Bin or Silo is filled, the larger particles tend to roll to the outer periphery and the smaller size will innately congregate in the center (Figures 5 & 6). This phenomenon is more pronounced with "General" type materials, but it occurs with the others to a lesser degree.

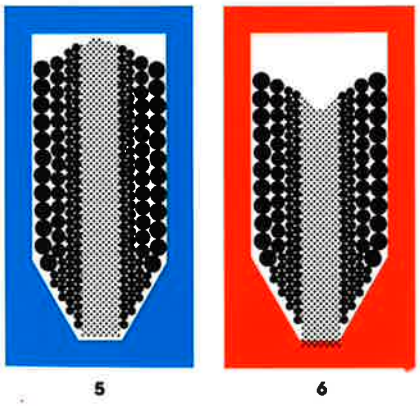


Fig. 5: Segregation of coarse and fines

Fig. 6: First favored flow stream can be fines only.

Vertical Flow Pattern: The sole objective is for the bulk solid to uniformly flow in a symmetrical and concentric vertical flow pattern. Ideally, the top layers of the stored material should drop evenly like water.

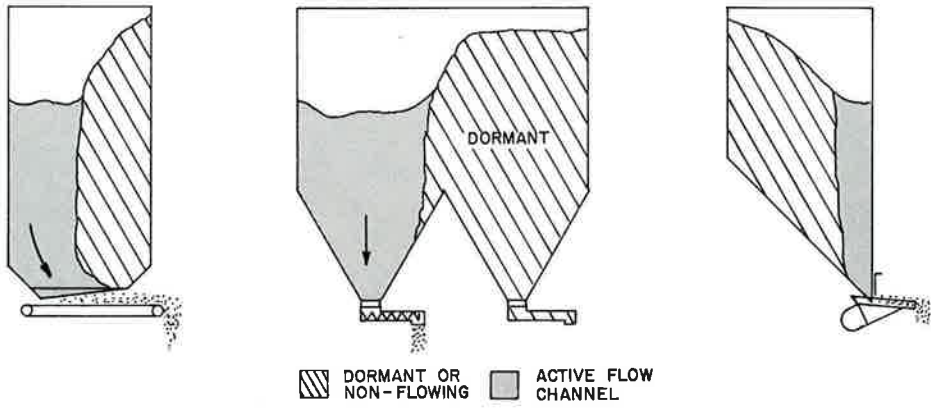


Fig. 7: Eccentric or "off center" vertical flow patterns should be avoided.

Eccentric or off-center vertical flow patterns should always be avoided (Figure 7). This kind of flow will cause added stresses in the Bin or Silo side walls and at its foundation.

"Coring" or "rat-holing" is not wanted because part of the material remains in the Bin or Silo. Consequently, storage capacity is lost (Figure 8).

Conical Transition: Usually, the Bin or Silo has one. Its slope is preferred to be 60° from the horizontal. Steeper slopes can be used if they are needed. When the slope is more shallow, a larger Bin Activator than ordinarily used will most likely be required.

"Open Drop" Discharge: This is when the bulk solid can flow freely from the outlet. Examples are discharging into a box, truck, or rail car. There is nothing at the outlet to disrupt the vertical flow pattern in the Bin above.

Effects of Vibration: Vibration is beneficial to discharging a bulk solid provided it can move or flow. If it is dormant and cannot move, any excessive vibration inherently tries to densify or pack its particles. For some "Floodable" bulk solids, this densification is gainful because it releases entrained air. For many "Flake" or "General" kinds of materials, it may not be a good situation. Particularly, if they happen to be adhesive and cohesive. Therefore, any time the stored bulk solid adversely reacts to excessive vibration, the method of applying it becomes very important.

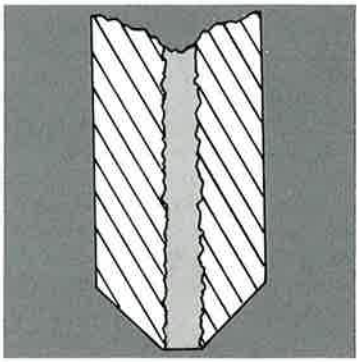


Fig. 8: Coring or rat-holing is not wanted.

Inlets of Feeders: Any feeder installed under the outlet can have a favored "inlet flow stream". This peculiarity can ultimately affect the entire vertical flow stream in the Bin above (Figure 9). By proper "interfacing", its unwanted effects can be minimized.

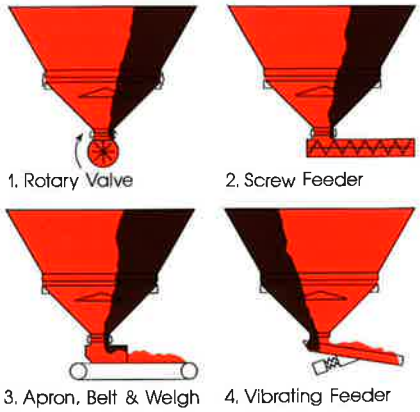


Fig. 9: Flow (light area) favors upstream edge in 1, 2 & 3; downstream edge in 4. (Dark areas are dormant.)

Kinergy Bin Activators Outperform all Others

The generated vibratory action markedly reduces the stored material's "interparticle" friction, combined particle shear strength, and wall friction. Therefore, it vertically flows from the Bin or Silo in conjunction with the forces of gravity.

The Design of the Bin Activator

As the factors of design are reviewed, notice how each one is specifically directed to successfully contend with the anticipated application characteristics of the stored material. The resulting design is one of the primary reasons Kinergy's Bin Activators outperform all others.

Uniform 45° side wall slope: In essence, the slope is steep enough to ensure flow, but still conserves head room. Since it is continuous, it caters to the natural preference of the bulk solid flowing inside by avoiding any change in direction.

Over the years, it has not been prone to have internal wear even though very abrasive materials are being discharged. It is reasoned a relatively thin layer of material innately protects the surface of this slope. Therefore, any abrasive action is minimized or eliminated by the bulk solid sliding over its own particles.

Of course, if the Bin Activator is often run empty and refilled, it would be subjected to impact abrasion from the material initially striking the exposed surfaces.

A 60° slope will be provided when it is specified.

Internal Baffles: For the majority of applications, an inverted cone is the internal baffle. Its slope usually doesn't vary with different applications because the stored material inherently forms its own image of a cone above it.

One of its functions is to ensure the "first favored vertical flow stream" from the bin above expands outward to at least equal the unit's inlet diameter. If this baffle were omitted, then this active flow stream would only be equal to the Bin Activator's outlet, which is much smaller.

Another purpose of this type of baffle is to correct for the inherent "classification" or separation of the particles that occurred when the bin was initially filled. The inverted cone causes the "fines" to move outward from the center so they can flow around its periphery. At the same time, the aggregate or larger size particles are flowing inward from the Bin's outer periphery. As a result, the two are re-blended as they pass around it. Consequently, the material flowing through the Bin Activator's outlet has been essentially "remixed" with respect to its particle size distribution.

It also acts as a crude scalping means. Particularly, when bulk solids with a severe "set" characteristic are being induced to flow. Any large chunks which break loose when the "set" is shattered are held on top of this internal cone. They cannot pass until they eventually break down to a smaller size. Therefore, the outlet below is continually protected from a blockage by an oversized, formed lump.

Sometimes, two internal baffles are utilized in larger Bin Activators.

When discharging difficult "Flake" type materials, such as refuse derived fuel or long pieces of wood bark, the patented stub baffle is used.

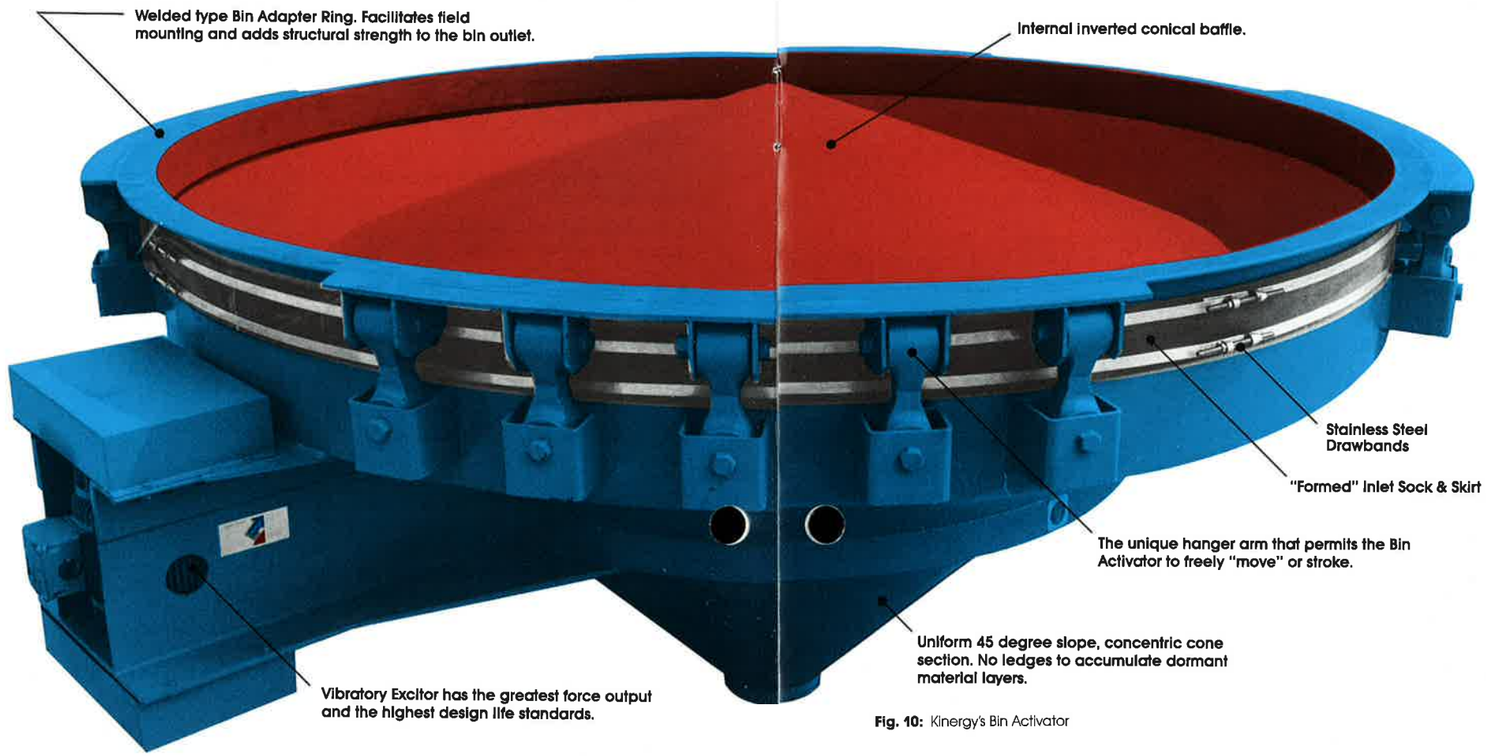


Fig. 10: Kinergy's Bin Activator

Unique Hanger Arm: When Bin Activators were first placed in service in the 1960's, their isolating hanger arm configuration was "in line" with rather small rubber bushings. From field experience in discharging materials which take on a high degree of "set" or "interlock", it was realized a stronger stroking action was needed to get them to vertically flow. With this type of hanger, the Bin Activator's movement was inherently restricted. Consequently, the 90° twisted type configuration was conceived with a large rubber bushing pressed inside as pictured in Figure 11. The bushing has an internal metal sleeve to act as a shaft opening for its oversize bolt. The combination has the primary advantage of allowing the unit to have an "effective stroke action". In other words, the Bin Activator is more free to move. This simple improvement enables the Bin Activator to shatter strong "set" and to unlock interlocked particles by being able to freely move in response to a high input force from the motor.

Fig. 11: The 90° twist and the large rubber bushing make this hanger arm the best available.

Another aspect of the isolators is their need to have an "exponential spring rate". This means they depress more easily the first 1/8" and less the next. Bin Activators are one of the few vibratory machines that encounter a marked change from "No Load" to "Full Load". This unusual loading requirement was taken into account when this hanger arm was designed.

The cast metal portion of the hanger arm will successfully contend with a vertical tensile load of at least 200,000 lbs. without failure. Weighing 29 lbs., the design of this unique hanger arm is the most "robust" of any used to support Bin Activators.

Dynamic Force Input: The generated force input to the Bin Activator is the largest amount available. This force capability goes up to 60,000 lbs. for the largest machine offered. Sometimes, all of this dynamic force is not needed, but it is there to be tapped when it is.

In addition to uniformly vibrating the Bin Activator as a complete entity, this high force output is what "shatters" the fused bonding of particles which have taken a very strong "set". It also unlocks the interwoven mesh of Flake type particles.

This high dynamic force input would not be practical unless the unit's hanger arm or isolation mount permitted it to move or stroke in response to it. Otherwise, the supporting mounts could try to oppose or restrain the Bin Activator's movement generated by this force. Consequently, they would prematurely fail.

Stroke & Frequency: The actual stroke is governed by the amount of input force required. Usually, the peripheral stroke of the unit is a nominal 1/8" at 1710 CPM. Sometimes, when the stored bulk solid is of a resilient type "Flake" material, the operating frequency will be reduced to 1140 CPM with peripheral amplitudes of about 1/4". In either case, the generated vibratory action will penetrate deep into the mass of the stored material.

The stroking path is "orbital" and moves essentially in the horizontal plane.

Operating Flexibility: All of Kinergy's Bin Activators can be vibrated continuously if that method of operation is appropriate.

Whenever it is advantageous to do so, the Bin Activator can be changed to a "cycle type" of operation without detriment to the unit or its vibratory drive system. The operating cycle can be accomplished by means of a timer, starve switch installed in the inlet of the feeder below, or a combination of both. Even though the Bin Activator is being automatically turned on and off, the flow of material down through the Bin Activator's outlet will be continuous.

▶ Adapter Ring

▶ Flexible Connections

▶ Vibratory Drive

▶ Quiet Operation

Fig. 12:
A "bolted" adapter ring.

Adapter Ring

This is a structural ring that more readily adapts the Bin Activator to the upper bin. It can be of the bolted (Figure 12) or welded type. In addition to making the upper bin peripherally stronger at its outlet, it facilitates the combining of the Bin Activator with it. That is, it makes the field assembly much easier.

In actual practice, the welded type adapter ring is often sent to the bin fabricator for shop mounting. Consequently, the bin adapter ring is already mounted on the Bin for the faster field erection of the Bin Activator.

Flexible Connections

At the unit's inlet and outlet, flexible connections are necessarily utilized. Usually, they are made of a high grade elastomer and secured by hoop type bands pulled in tension.

Wrap-around Type: This design with formed ridges has the advantage of easy replacement (Figure 13). In many instances, the outer "sock" can be changed while the Bin is filled with material. The sock wraps around either the inlet or the outlet, and it has a portion that "overlaps".

This type of flexible sock is ordinarily used when "General" or "Flake" type bulk solids are being stored. By utilizing the proper caulking compound when installing the sock, a good seal can be made around its periphery and at its "overlap".

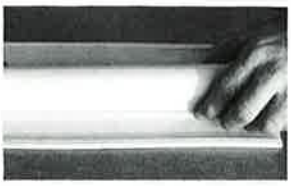


Fig. 13: "Formed" outer sock.

Fig. 14: An "endless" sock with sealed edges.

Endless Sock: This flexible connection has sealed ends (Figure 14). It is available in various thicknesses to 3/8" as a standard. When "Floodable" type materials are being stored, it is recommended even though it is more difficult to install, and the Bin must be empty to replace it.

Inlet skirt: This is an option that usually combines with the "wrap-around" type of flexible connection. The upper portion of the skirt attaches to the outlet of the Bin above. It dangles down into and through the inlet of the Bin Activator below. The skirt acts as a shield and provides added protection for the flexible sock installed on the outside.

Materials: As a standard, these flexible connections are at least 1/8" thick EPDM, which is a very high grade neoprene. It is a long lasting elastomer with temperature capability to 300° F. All are purposely "formed" with peripheral edges or ridges to make them more secure in their installation. They can successfully contend with internal pressures to 5 PSI. Other materials such as FDA approved white EPDM, silicone rubber for temperatures to 500° F., FDA approved white Nitrile, and Viton are also available. Other materials for higher temperatures, higher pressures, or vacuums are by special order.

Drawbands: To secure the flexible connections, flat metal strips with bolted ends are supplied as "drawbands" as pictured in Figure 15. As a standard, they are made of SS-304 and so are the mating tubes and bolt ends. The circular tube's configuration assures an innately formed seal at the bolting point of the band.

Fig. 15: The drawbands and their bolted connections.

Vibratory Drive System

In reality, the vibratory action of the Bin Activator supplements the forces of gravity. Since gravity is doing most of the work, the electrical power demand on the vibratory drive arrangement is relatively low in comparison to the function being accomplished.

The "two bearing, single shaft" version of the "Single Input" type of vibratory drive system is utilized. This is more commonly known as "Brute Force". It utilizes a special motor specifically designed for vibratory use (Figure 16). Double extended

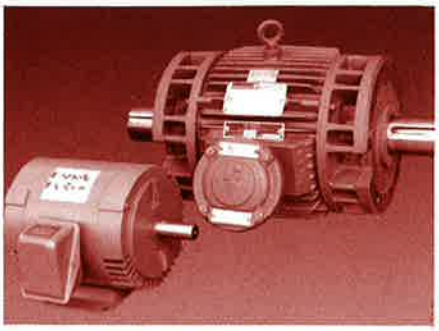


Fig. 16: A "standard" A-C squirrel cage motor compared to the Bin Activator's vibratory exciter. Both have the same HP rating.

shafts rotate eccentric weights that are mirror images of themselves on the top and the bottom of the motor. It is very compact and husky, and it has the needed characteristic of being able to endure a high degree of load abuse without detriment to the driving arrangement.

When it is necessary, the motor can be stopped and restarted up to five times per minute without accumulating an excessive amount of internal heat. This is important for those applications that require a highly repetitive "cycle".

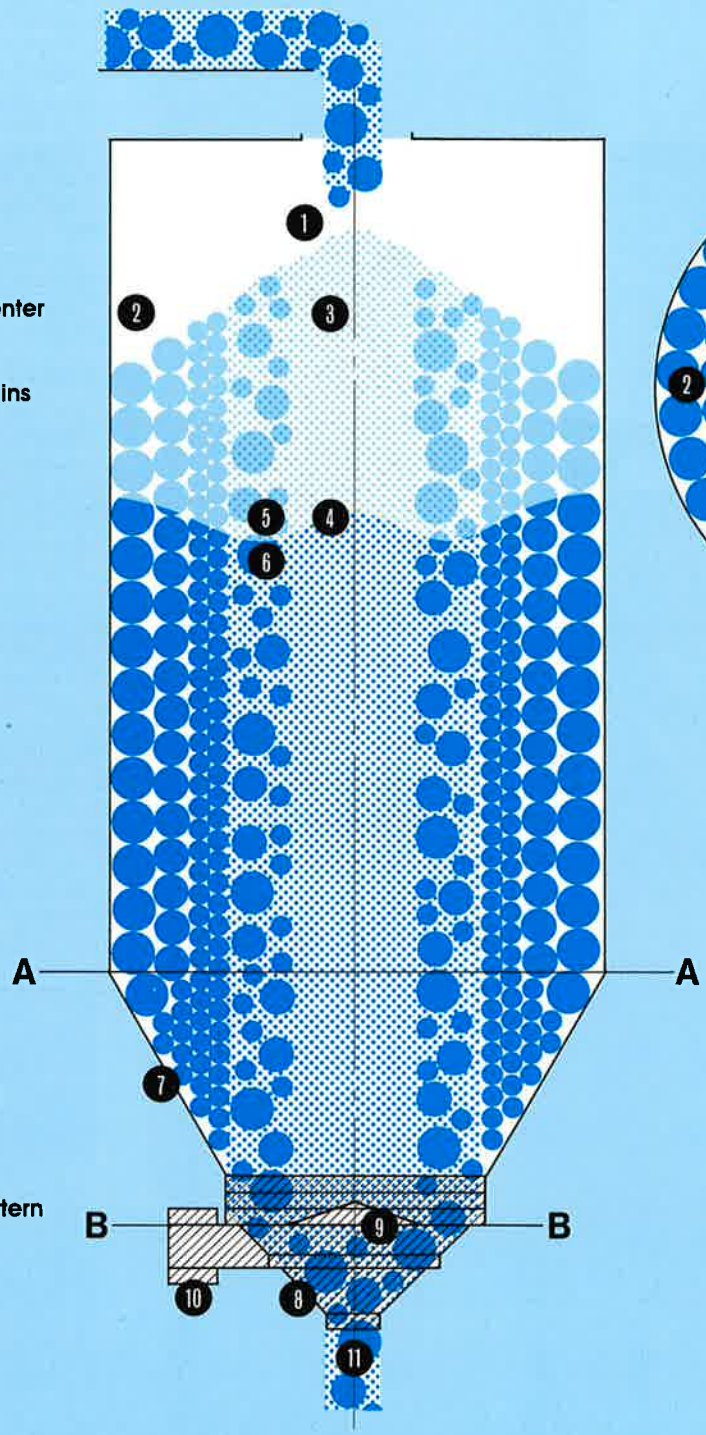
Quiet Operation

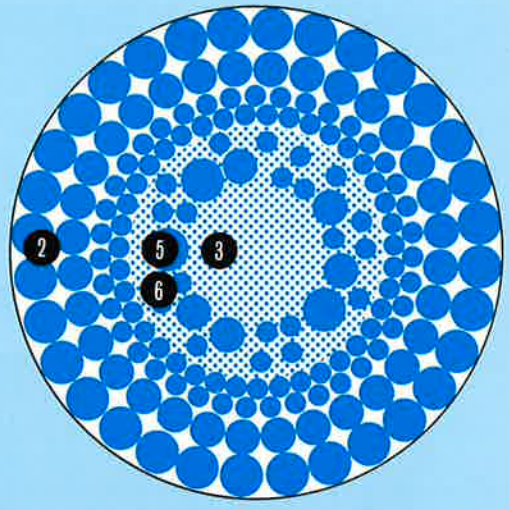
All Kinergy Bin Activators will operate very quietly when they are either empty or in the fully loaded condition. The operating sound level will always be less than 80 dBA and most likely, about 55 dBA.

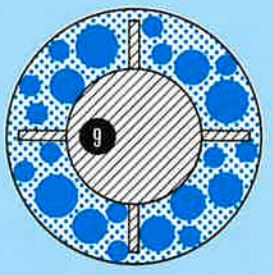
Its quiet operation is a tribute to the entire assembly vibrating as a complete entity and its method of support allowing a smooth motion.

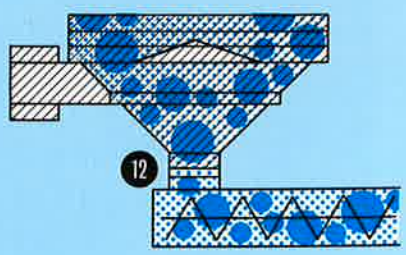
The Goal: Symmetrical and Concentric Vertical Flow and the Re-Mix of Segregated Particles

1. Original Fill Line of Bin
2. Large Particles Settle to the Sides
3. "Fines" Congregate in the Center
4. Typical, Top Level of Material After Discharge Begins
5. First-Favored Annular Flow Stream
6. "Fines" and Large Particles Re-Mix in First-Favored Flow Stream
7. Bin's Conical Transition, 60 Degree Angle
8. Bin Activator with its 45 Degree Continuous, Concentric Slope
9. Internal Conical Baffle
10. Vibratory Exciter with High Force Output
11. Outlet with "Open Drop" Discharge
12. Outlet with Feeder May Need "Cycling" of the Activator
13. Cross Section of the Bin Showing the Annular Flow Pattern
14. Inlet of Bin Activator. The Re-mixed Material Flows Around the Internal Baffle









▶ Easy Start-up

▶ Minimal Maintenance

Mounting Arrangement

Almost always, the Bin Activator is supported from the upper bin by means of hanger arms.

The only exception is when the Bin Activator is larger than 8 ft. in diameter, the stored material is known to take on a severe "set" with dormant time in storage, and the density of the bulk solid is 50 PCF or more. Whenever this strong "set" is anticipated, the Bin Activator is recommended to be supported from underneath on compression springs which are usually solid rubber.

This same type of undersupport will be utilized whenever it is impractical to suspend the Bin Activator from the upper bin for some other reason.

Available Sizes

From its inception in 1962 until 1978, the range of Bin Activators offered was 2 through 12 ft. inlet diameters. In 1979, Kinergy introduced the 15 ft. diameter unit. When a larger one was needed in 1985, Kinergy was asked to supply the first 18 ft. diameter machine. It is appropriately called the "Big Act" (Figure 17). Since then, more of that mammoth size have been placed in productive use.

Therefore, the current Bin Activators available are from 2 ft. to 18 ft. inlet diameters.

Their materials of construction can vary from ordinary mild steel to the alloys such as stainless steel. If aluminum fabrication is a must, it will be given consideration at the time of the application.

Fig. 18: Bin Activators usually are not readily accessible for maintenance.

Minimal Maintenance

Virtually all components of the Bin Activator are necessarily of a "special" design. There are two reasons for this. One is the fact that they must vibrate. Most standard or readily available components are not designed to withstand a vibratory action over the long term. Thus, they fail prematurely. The second is the practical realization that the Bin Activator will probably not get much routine maintenance attention. That is understandable when it is noted the storage areas are usually removed or remote from the more highly active production areas. For example, the Bin Activator will probably be suspended from a Bin or Silo which often puts them high above and not easily accessible (Figure 18). Over the years, all of the essential components have been gradually designed to successfully contend with the vibratory service requirements. The result is the longest possible service life with minimal or actually no maintenance attention. The only preventive maintenance required is the occasional greasing of the vibratory motor. Fortunately, this component design improvement has been accomplished without causing a marked increase in the Bin Activator's cost.

If they are wanted and specified, Kinergy will provide standard "off the shelf" components such as a conventional foot-mounted motor with a vee belt and a jackshaft. In so doing, Kinergy respectfully declines the responsibility for any added maintenance they may require.

Easy Start-up

Over the years, the design of the Bin Activator has not only been improved, but so has the ability to predict the requirements of a given application. Consequently, all internal baffles are "fixed" and no longer need any adjustment. A specific direction of rotation by the motor is not essential. The required "input force" by the motor is usually pre-set at the Factory. If, by chance, it needs to be changed, it can be altered by simply adding or subtracting eccentric weight wafers which bolt to either shaft end of the vibratory motor (Figure 19). If the unit needs to be "cycle type" operated and a timer is utilized to accomplish it, it may need some minor adjustment.

With these few adjustments in mind, the successful start-up of Kinergy's Bin Activator can be easily accomplished with minimal effort.

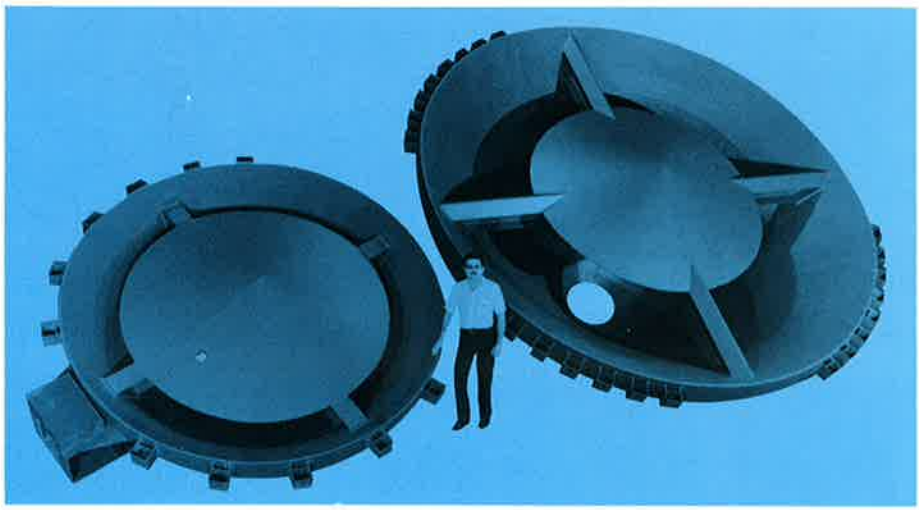


Fig. 17: The 12 ft. dia. unit pictured on the left was the largest built from 1962 to 1978. In 1979, Kinergy pioneered the 15 ft. dia. Bin Activator. Progressively, the huge 18 ft. unit shown on the right was roduced in 1985.

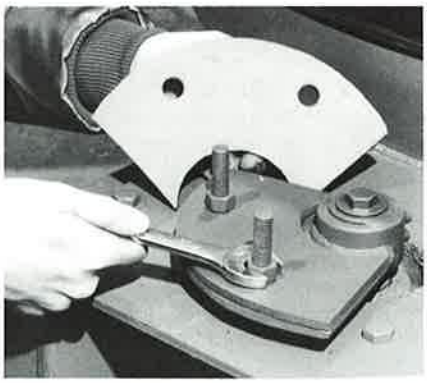


Fig. 19: Easy adjustment of the eccentric weights.

▶ Sanitary Designs

▶ Polished Finishes

Liners

A liner to enhance the vertical flow of the stored bulk solid through the Bin Activator is usually not needed. Over the years, it has been proven that wear liners for discharging abrasive type particles are normally not needed when only "sliding" type abrasion is the consideration. However, stainless steel liners to contend with corrosion are definitely recommended. Usually, 1/8" is adequate, but they can be supplied with any thickness wanted.

If specified, UHMW type polyurethane, abrasion resistance steel, ceramic brick for very high temperatures, or any special paint type coated liners are also available.

Outlet Gates

Various types of gates can be utilized at the outlet of the Bin Activator.

When a feeder with internal moving parts is located below the Bin Activator's outlet, a simple, inexpensive type of manual slide gate is recommended (Figure 20). The slide can be inserted into its mounting frame whenever maintenance is required by the feeder below.

When air-operated gates are mounted at the outlet, their actuators will probably require support from the Bin Activator. For this reason, they are recommended to be of the "Butterfly" type with an integral actuator. This suggestion is made because the actuator is tangent to the gate and relatively easy to secure to the Bin Activator. Air-operated "slide" gates can also be mounted at the outlet provided their projected operating mechanism is properly reinforced from the Bin Activator above. Otherwise, that mechanism could "whip" laterally and prematurely fail because of the vibratory action.

Of course, any air-operated gate could be mounted stationary and immediately below, but adjacent to the Bin Activator's outlet.

In any event, these gates should be fully open or closed. The Bin Activator should not be operated with a partially opened gate.

Sanitary Designs and Finishes

Along with the appropriate type of flexible connections, the smooth, clean lines on the outside of the Bin Activator lend it to a sanitary design as shown in Figures 21 and 22.

The internal supports for the inverted cone type baffle are made self-cleaning. The underside of this internal cone can be sealed with a flat plate. Another option is the addition of a second conical shape on its underside, which makes the baffle a "diamond" shaped configuration. Whenever it is needed, a second baffle is supplied, but it will be "fixed" and it will not require adjustment in the field.

Virtually any internal or external finish can be provided. The welds can be "power tool cleaned", "ground smooth but not flush", or "ground smooth and flush" with a polished uniform width stripe with a specified grit such as 150. The surfaces can be hand polished to say, a No. 4 finish. So called "Dairy" finishes or the 3-A sanitary standards which combines the USDA, the manufacturer, and the end user, can also be provided.

When painted coatings are wanted, essentially any type can be provided in the minimum thickness which is usually 4 mils.

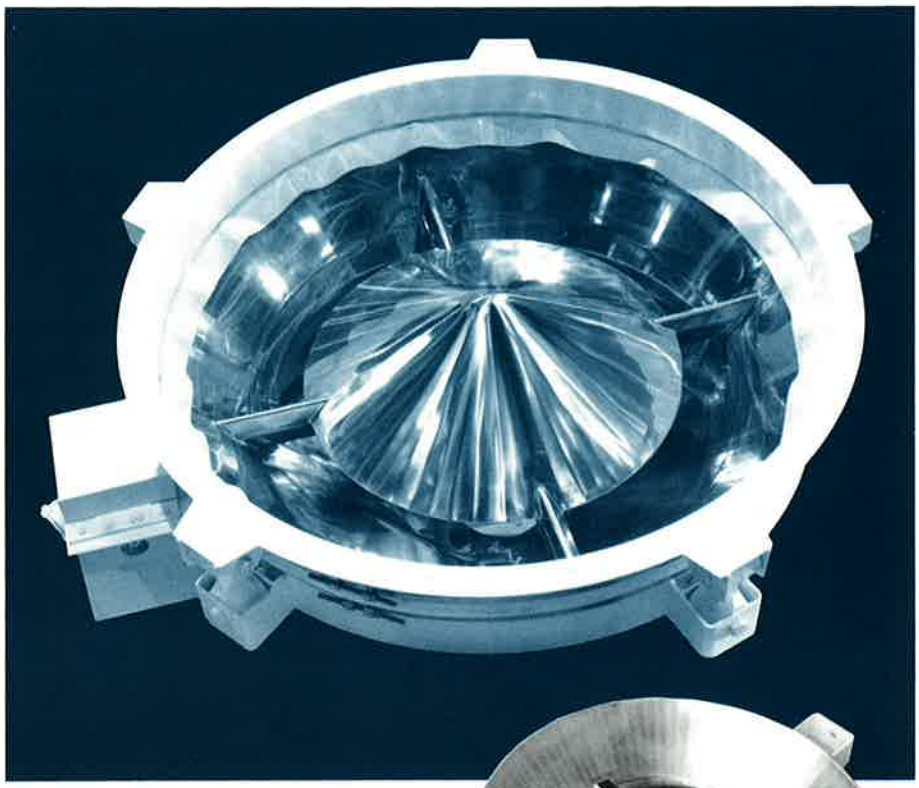


Fig. 21: A sanitary unit with a polished finish on the inside. The white "skirt" projects inside the inlet of the Bin Activator.

Fig. 20: A manual slide gate.

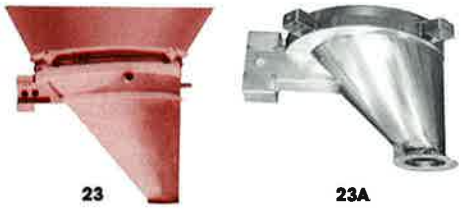
Fig. 22: Virtually any type of polished finish is available.

▶ Other Designs

▶ Applications

Eccentric Design

The Bin Activator's conical shell is normally built symmetrical and concentric to encourage the wanted vertical flow pattern. If it is necessary, they can be of the "eccentric" design. When they are, the internal baffle configuration is changed to ensure the stored material above the Bin Activator still flows in a symmetrical and concentric pattern even though the outlet below is offset.



23 23A

Fig. 23: This eccentric unit induces wood chips to flow from a bin. The pipes on the side wall are inlets for steam which help to pre-condition the chips for digester downstream.

Fig. 23A: This unit is constructed entirely of SS-304 with polished surfaces.

Other Designs

Instead of driving the Bin Activator with only one motor, two can be used. The motors are mounted directly across from one another and "tilted" in opposite angular directions. The result is a circular conveying action imparted to the contained material. This type of design is utilized in two different situations. They are:

1. Whenever the stored material is extremely obstinate to vertical flow. A good example is for discharging "thixotropic" type materials from a conical shaped Bin Activator.

2. To further reduce vertical space requirements, the "low profile" type of Bin Activator is utilized. It is cylindrical in shape with essentially a flat bottom to save head room. This is also a favored design when the Bin Activator needs to have "multiple outlets" that are to be discharged in various combinations. That is, all the outlets discharging simultaneously to the extreme of only one.

Sometimes, the "steaming" of wood chips or other heat transferring functions are needed. When they are, they can be provided. This includes equipping the outside surface of the Bin Activator with electrical strip heaters and an appropriate layer of insulation.

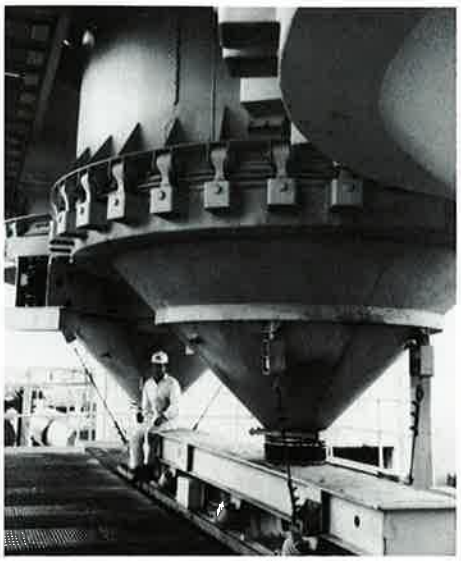


Fig. 24: Discharging sodium chlorate which takes a very strong "set"

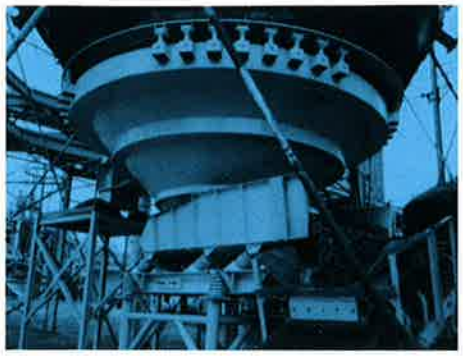


Fig. 25: Inducing the vertical flow of wood chips from a large silo.

Typical Applications

The Bin Activator will be needed in any industry that stores bulk solids that are obstinate to vertical flow.

More specific examples of the industry and the typical materials induced to vertically flow would be:

Aluminum Industry: Bauxite ore, alumina silica

Ammunition Industry: Ammonium nitrate and other oxidizing materials for explosives.

Cement Industry: All the raw materials such as shale, dolomite, and clay that are provided to the downstream process.

Chemical Industry: Potash, titanium dioxide, diatomaceous earth, calcium chlorate, lead oxide, soda ash, polyethylene flakes, calcium carbonate, and carbon black.

Detergent Industry: The "cycle type" method of operation is beneficial because it prevents making unwanted "lumps" in the stored and discharged detergent.

Fertilizer Industry: Herbicides and pesticides.

Food and Grain Industry: Oat flour, spent grain, starches, soybean meal, corn meal, rolled oats, salt, powdered milk, rice hulls, various brans, wheat germ, whey, and spices.

Foundry Industry: Bentonite, fine silica, plus the various "make up", and sometimes the shakeout sands. The collected "dust" is also discharged.

Glass Industry: Silica sand, cullet, and fiberglass.

Gypsum Industry: The raw and calcined gypsum, plus "stucco" which is extremely floodable.

Kaolin Clay Industry: "Floodable" type kaolin clay is more densified as it is being discharged.

Mineral Beneficiation: The various raw materials and the resulting ore concentrates.

Pharmaceutical Industry: Adipic acid, penicillin, Vitamin "C", bisphenol, riboflavin, and ascorbic acid.

Power Plants: Coal and waste coals. The lime, limestone, FGD gypsum to control air pollution, plus the fly ash and any bottom ash. When they are burned, all the waste type fuels such as wood bark, organic plants, and "RDF".

Waste Water Treatment Plants: The various types of "lime" that are needed, and some of the resulting "sludges".

Wood Industry: Sawdust, wood chips, shavings, and wood bark. Bin Activators have replaced many "rotary tables" which were previously installed under large silos, but were removed because of high maintenance.

Operating Method: The Difference Between Success and Failure

Method of Operation

To have a successful Bin Activator application, the conscientious design of the unit will usually be only part of the assignment. The other aspect will depend upon how the unit is operated.

In general, whenever a continuous vibration is not adverse to the stored material, this is the operating method to employ. However, if too much vibration has a detrimental effect on the bulk solid in the Bin or Silo, the operating procedure should be changed.

Bulk solids favorably respond to a vibratory action provided they can move or flow. When they cannot, the vibration will inherently densify or pack the particles. This well known phenomenon is the basis of all the different types of vibratory "Densifiers".

If Bin Activators are arbitrarily vibrated continuously, they can cause "cores" to develop up through the material stored in the bin above. These are commonly known as "rat-holes". Another is the Bin Activator shifting to one side and straining its hanger arm suspension. Very thick particle build-up on the internal surfaces of the Bin Activator walls can also occur. This unwanted coring, the Bin Activator shifting from its vertical axis, or the material build-up on its internal side walls, happens because over-running or too much vibration by the Bin Activator is adversely affecting the stored material. To correct for this unwanted condition, the Bin Activator should be placed on an operating cycle. A typical one would be 3 to 5 seconds "on" every 2 minutes. Even though the unit is being automatically turned "on" and "off", the material flow down through its outlet will still be continuous.

Said differently, do not aggravate the stored material with too much vibration. Instead, let it remain in its natural state and "nudge" it occasionally to keep it flowing.

"Flake" and "General" type bulk solids which are obstinate to vertical flow are more susceptible to excessive vibration than are others. Particularly, if they are adhesive and cohesive. Therefore, they most likely will require a "cycle type" operation.

Conversely, "Floodable" type bulk solids and those of the "General" type which are marginally free flowing, will usually respond favorably to a very small input force on a continuous basis. In other words, the Bin Activator can be steadily vibrated. However, if these materials are also associated with a high degree of "set", then they too will most likely require "cycle type" operation.

Therefore, the method of operation of the Bin Activator is very important. **It can make the difference between success and failure of a Bin Activator in any given application.** This could occur even though the Bin Activator had been endowed with the very best design engineering available.

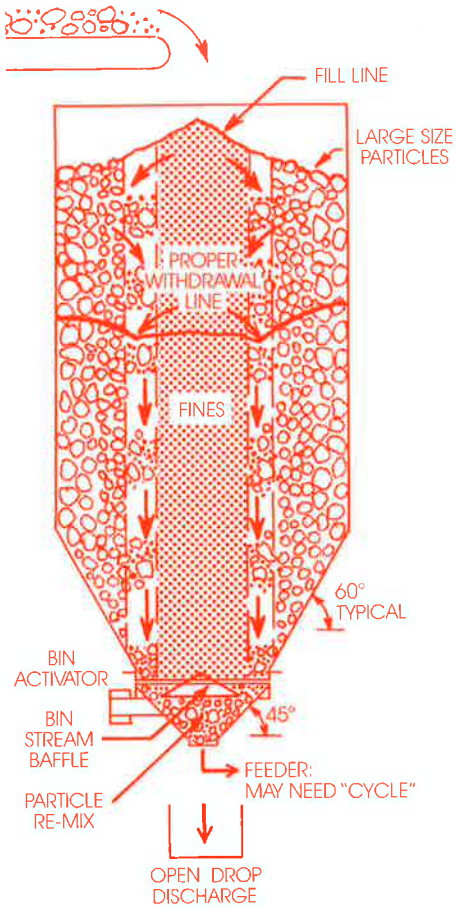


Fig. 26: The reward for a conscientiously designed Bin Activator combined with its appropriate method of operation. The Induced Vertical Flow pattern is symmetrical and concentric, plus the previously segregated particles are "remixed"

Conserving Energy

Whenever a Bin Activator is vibrated continuously, the force input is relatively small. Therefore, the power required will be minimal.

For those applications that require a large force input, it almost always will be "cycle type" operated. When it is, the "Root-Mean-Square" or RMS power consumption is surprisingly low.

In either situation, energy is being conserved by operating the Bin Activator in agreement with the stored material's "natural" vertical flow pattern.

Experience

The Engineers of Kinergy have been intimately involved with the design, application, and operation of the Bin Activator since its inception in 1962. Therefore, no supplier has more experience in this specialized field. Kinergy is responsible for formulating the "Induced Vertical Flow" concept, which is now recognized as the acceptable alternative to "Impelled Retrieving" or "Static Design" technology for discharging bulk solids from various types of storage means. The success of thousands of units in daily productive use discharging all kinds of bulk solids, confirms all the attributes of Kinergy's vibrating Bin Activators.

How to Apply Bin Activators:

For the selection of the proper Bin Activator for a given application, refer to the publication entitled "The 'Induced Vertical Flow of Bins and Silos".

Fig. 27: A Bin Activator complete with adapter ring and a flexible inlet sock and skirt.

Kinergy Corporation
7310 Grade Lane
Louisville, Kentucky 40219
Phone: 502/366-5685
Fax: 502/366-3701

Kinergy's Many Vibratory Machines

The most complete line of vibratory machines for "inducing" bulk solid materials to vertically flow or convey.

Induced Vertical Flow Units

The vibration supplements the forces of gravity.

Induced Conveying Machines

The vibratory action produced by the versatile and energy efficient Kinergy Drive System is the prime mover of the bulk solid or unit pieces.

Induced Vertical Flow

Discharging: Symmetrical and concentric vertical flow patterns are the objective.


Bin Activator


Activated Bin


Container Activator


Sanitary Finishes


Storage Pile Discharger


Rail Car Discharger

Densifying: Achieving "Inherent Densification" at the point of loading.


Tables


Container


Vertical Face


Rail Car Densifier

Kinergy Driven Units:

For the first time in the history of "Induced Conveying" machines, all these different units of various functions are powered by the same type of drive.


Conventional Feeder

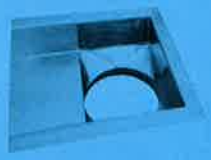

Dust-Tight Feeder


Sanitary Designs


The "Kinergy King"
World's largest Feeder.
It consumes less than 10 HPI


Long Dust-Tight Feeder


Extra-Heavy Duty "Grizzly" Feeder


Polished Finishes


Conveyor


Circular Conveyor


"Sizing" Screen


De-Liquefying Screen


Screen with
Drive on One End


Fluid Bed Cooler or Dryer


Shakeout Feeder


Shakeout Table


Attrition Mill


Spiral Elevator