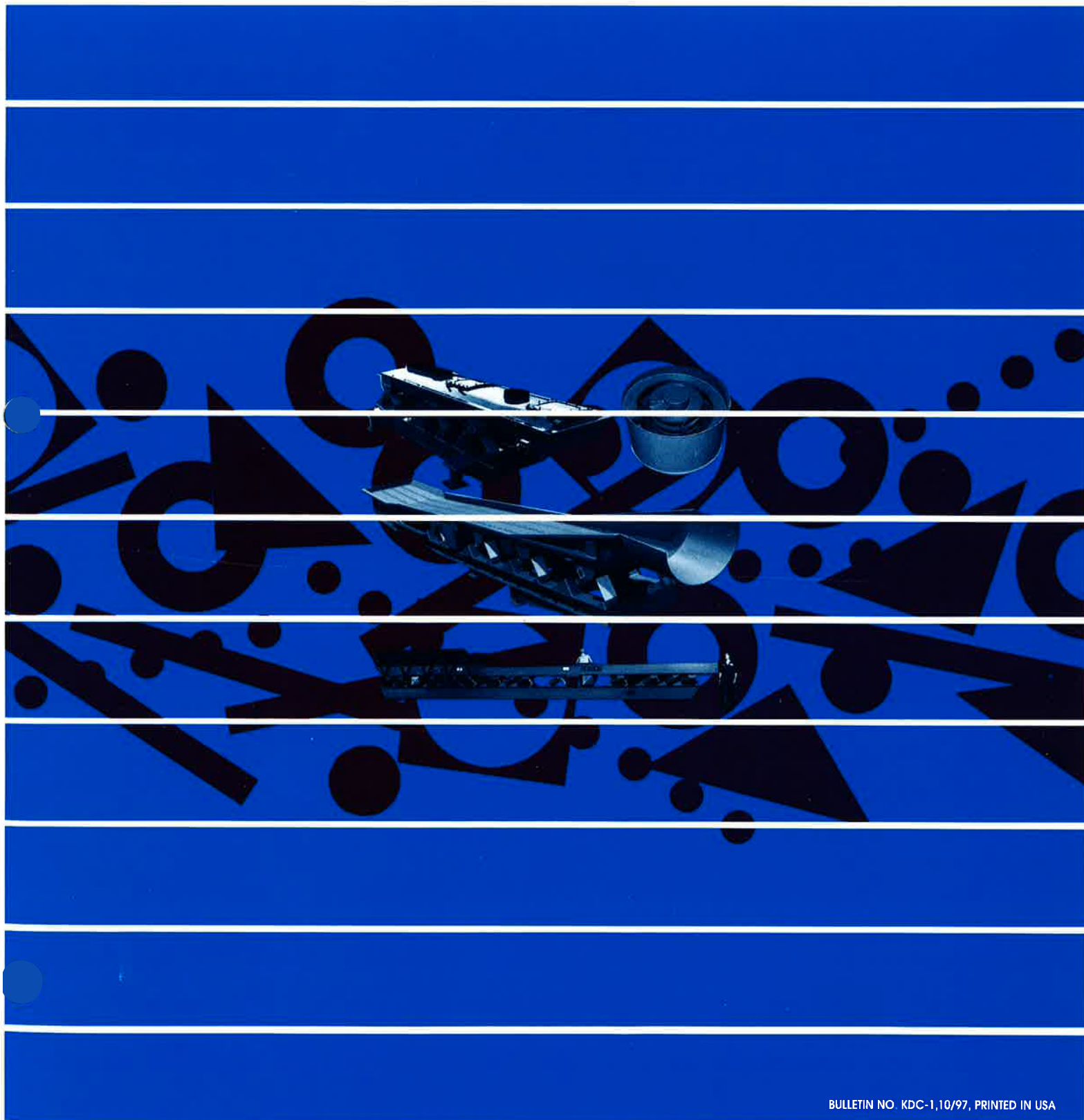


**Induced
Conveying**

Kinergy Driven Vibrating Conveyors

**Kinergy
Corporation**



► Materials Moved

► Benefits of "Induced Conveying"

Bulk solids or unit pieces can be **carried** on belts, aprons, skip hoists, and tramways. They can be **impelled** to move by augers, drag-flights, and rotary vanes. **Sliding** them over reciprocating troughs or slats and being **pneumatically** transported are other choices.

"Induced Conveying" is another alternative and it is accomplished by a vibratory action moving the load. The result is a conveying motion that is "induced" instead of being "forced". It usually is a very gentle type of movement. When it is wanted, a very sharp reacting type of vibration can be produced by using a more steep stroke angle.

Since vibrating conveyors depend upon the vibratory action to do the needed work, they should be "energy efficient". This is one of the reasons the Kinergetics Drive System was adapted to them in 1978. Consequently, vibrating conveyors can now fully utilize the "Kinergetics" produced by the drive springs. As a result, the motor turning relatively small eccentric weights only has to provide the required heat energy to sustain the vibratory motion. This relatively new kind of conveyor drive also allows the conveying rate to be adjusted by a simple method of electrical control.

For powering vibrating conveyors, it has proven to be the most versatile and "energy efficient" drive system known.

The Materials Moved

The typical materials moved on vibrating conveyors are either "unit pieces" or bulk solids.

Unit Pieces: These are whole solids that are a "complete entity". Examples would be bolts, fasteners, castings, filled bags, metal stampings, briquettes, or wooden logs. Others are whole batteries, rubber tires, green beans, cherries, tomatoes, beets, potatoes, apples, or nuts. More entities include wooden board scraps, "french fry" slices of potatoes, fish scraps, or anything similar (Figure 1).



Fig. 1: Scrap steel is an example of "unit pieces".

Bulk Solids: This kind of material is made up of "particles". Since there are a myriad number of different bulk solids, they are classified into three groups to better understand their conveying characteristics.



Fig. 2: Wood bark typifies "Flake" type particles.



Fig. 3: "Floodable" bulk solids are very fine and dry.



Fig. 4: A granular texture, usually with lumps, denotes a "General" kind of bulk solid.

"Flakes" are flat shaped particles or strands. They will compress when an external force is applied, such as squeezing them by hand (Figure 2).

Wood bark, shavings, or chips are examples. Others are glass fibers, polystyrene film, refuse derived fuel (RDF), wood waste, shredded rubber tires, metal turnings, brass needles, rock wool insulation, peanut shells, fresh spinach leaves, tobacco, or the like.

Floodable: When the particles are very "fine" and dry, they easily aerate so they are said to be "Floodable". The name calls attention to their being able to flow uncontrolled unless precautionary measures are taken. A particle size smaller than 100 mesh and less than 2% moisture content more specifically describes a bulk solid that is "Floodable" (Figure 3).

Hydrated lime, fly ash, kaolin clay, pesticides, virtually all the different "dusts" from collectors, acetylene black, gypsum stucco, bentonite, talcum powder, diatomaceous earth, cement, ink dyes, carbon black, powdered milk, dextrose, powdered sugar, or anything similar exemplify bulk solids that are "Floodable".

General: This type of bulk solid does not qualify as being either a "Flake" or "Floodable". They are granular in texture and often have lumps in their particle size distribution (Figure 4).

Typically, coal, limestone, gypsum, sawdust, bottom ash, rice grits, salt, bone meal, corn gluten, soybean meal, granulated sugar, fertilizer beads, molding sands, and potash denote the "General" classification of bulk solids.

Benefits of "Induced Conveying"

"Induced Conveying" is accomplished by imparting a proper stroke, which is preferably linear, at the needed frequency, to the material. The applied vibration inherently reduces the "inter-piece" or "inter-particle" friction of the moved material. Since the motion is "induced", not forced, it usually has the advantage of being a very "gentle" type of conveying. Conversely, when it is needed, a very abrupt or "sharp" reacting type of linear stroke can be produced by utilizing a more steep drive angle.

In comparison to other material moving methods, "Induced Conveying" by a vibrating conveyor has many benefits (Figure 5). Some of them are:

Conveying Methods					
THE METHODS:	"CARRIED"	"IMPELLED"	"SLIDING"	"PNEUMATIC"	"INDUCED"
PRACTICAL EXAMPLES:	Belts, Aprons, Tramways & Skip Hoists	Augers, Drag Flights & Rotary Feeders	Reciprocating troughs or slats	Dilute or Dense Phase	Vibrating Feeders, Conveyors, Screens, Spirals, Fluidized Beds, and Foundry Units.

Fig. 5: Bulk solids or unit pieces can be moved by various methods. They can be "Carried" on belts, skip hoists, and tramways or "Impelled" to convey by augers and drag-flights. "Sliding" over reciprocating surfaces or being "Pneumatically" transported are other choices. Another alternative is "Induced Conveying".

The Conceptual Alternative Conveyor



Fig. 6: Conveying abrasive rocks without excessive wear.

Minimal Abrasion: Highly abrasive materials can be transported with very little wear on the conveying trough surfaces. The gentle "pitch and catch" movement makes this possible (Figure 6).

"Sliding" abrasion needs to be differentiated from "impacting". Sliding abrasion is encountered while the load is being conveyed. Vibrating conveyors rank as one of the best for minimizing this type of wear. Conversely, impact abrasion occurs when the incoming material strikes an exposed surface. If that cannot be prevented, the vertical "free fall" should be minimized by the use of, say, a sliding chute. Otherwise, an appreciable amount of impact type abrasive wear will take place in that localized section. If this happens at the inlet of a vibrating conveyor, it is equipped with the appropriate liner to protect it.

Dust-Tight Construction: By applying trough covers and suitable flexible connections, a vibrating conveyor can be completely sealed or made "dust-tight" (Figure 7).



Fig. 7: Vibrating conveyors can be enclosed or made "dust-tight". Flexible connections are needed at the unit's inlet and outlet.



Fig. 8: The "self-cleaning" aspect of vibrating conveyors is an often wanted virtue.

Self-Cleaning: All vibrating conveyors or any other "Induced Conveying" units are inherently self-cleaning of the moved material (Figure 8). This makes them desirable for sanitary applications or when material contamination is to be minimized.

Minimal Attrition or Degradation: The vibratory conveying action can be a very gentle, "induced" movement. For example, light bulbs can be conveyed without damage to their highly fragile, internal filaments. Therefore, particle to particle "degradation" and "attrition" of the moved material is minimized or virtually eliminated.

Wide Temperature Ranges: Extremely cold or hot (to 3500° F) bulk solids or unit pieces can be successfully moved on vibrating conveyors. Modified trough designs may be required, but the ability to deal with a wide temperature range of materials is a basic benefit of any "Induced Conveying" unit (Figure 9).



Fig. 9: Conveying "frozen" french fried potatoes to moving hot foundry castings (as shown) reflects the ability to move very cold to extremely hot bulk solids or unit pieces

No Return: Vibrating conveyors do not have any "return" element such as would be encountered with a belt, apron, or drag-flight conveyor. Thus, nuisance "tailings" from these returns are eliminated.

Multi-Function: By using trough dividers, more than one material can be conveyed or moved in a single unit. Employing trough diverters or discharge gates, multi-point distribution and discharge can be accomplished on a common unit. Leaching, screening, heat transfer, lifting, lowering, feeding, or "shaking out" molds are examples of other functions that can be simultaneously accomplished while conveying.

When the vibrating conveyor has an electrically adjustable conveying speed, even more versatility in its application can be realized.

The Conceptual Alternative Conveyor

Before the Kinerky Drive System was adapted to vibrating conveyors in 1978, the conceptual unit available was the so-called "Natural Frequency" type. It is available from many different manufacturers that are very reputable.

This kind of vibrating conveyor was introduced around 1950. At that time, a "shock absorber" or dash pot was coupled with an eccentric crankarm to enable it to be combined with relatively stiff "drive springs" spread across the width and along the length of the conveying trough. This unique mechanical type of vibratory drive system boldly took advantage of the "Natural Frequency" of the trough mounted stiff springs. Therefore, the driving forces were "distributed" and not concentrated as they had been with the other two known drives. They were the "Electromagnetic" or the "Single Input" type of that era. Thus, for the first time, both length and width restrictions were lifted from vibrating conveyors. Technically, it is called the "Natural Frequency tuned springs combined with an eccentric crankarm" type of vibratory drive system.

The initial designs were not counter-balanced, which required the conveyor to be rigidly secured to a supporting structure (Figure 10). This limited their application. More versatility was added to the "Natural Frequency" conveyor by the advent of dynamic "counterbalancing" in 1953 (Figure 11).

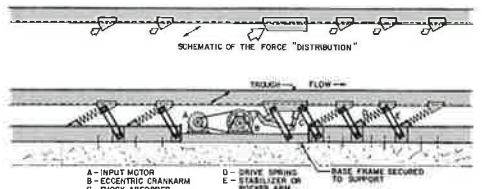


Fig. 10: "Natural Frequency" springs combined with an Eccentric Crankarm Drive System. It is shown in the "Non-Balanced" design.

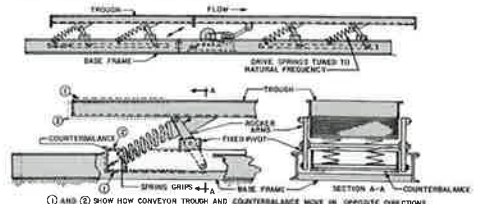


Fig. 11: Typical "Counterbalanced" design for the drive system shown in Figure 10. When the unit is mounted on a neutral beam, it becomes the "counterbalanced" and isolated design.

► The Conceptual Alternative (Continued)

► The Kinergy Drive System

These two complementary developments, namely the use of the shock absorber in conjunction with the eccentric crankarm and the needed dynamic counterbalancing, made wide and long vibrating conveyors practical.

Perhaps of equal significance, it illustrated the deliberate use of "Natural Frequency" in a mechanical form without the self-destruction of the machine. Until then, any operation at the point of resonance was a condition feared by machine designers, so it was adamantly avoided. While it was a very progressive advancement for its day, this kind of vibratory drive has some limits. For example, the drive system does not lend itself to an electrically adjustable output (Figure 12). It should not be applied to wide load swings, shock loads, or high headloads. Therefore, it is necessarily limited to relatively steady state, constant rate loading applications. This is why it is only used to drive vibrating conveyors.

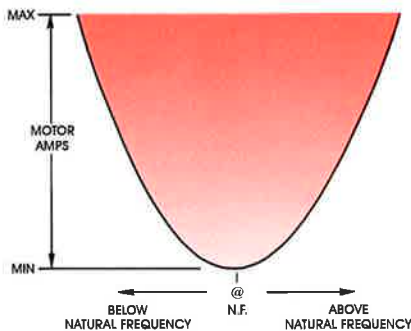


Fig. 12: The motor's load curve for a Natural Frequency conveyor when its speed is changed. The amps drawn by the motor are at a "minimum" when the conveyor's drive springs are operating at their "Natural Frequency". The stroke remains essentially the same throughout the speed change.

A "Free Force" Input Versus a "Crankarm"

The vectorial "Drive vs. Load" analysis developed in 1964 enables any vibratory machine to be analyzed. Eventually it revealed that for a vibratory drive to take full advantage of the principle of "Natural Frequency", a "free-force" type of input power means is needed instead of a "crankarm" because:

1. When it's necessary, the drive can innately and temporarily "yield" to marked changes in the load's Mechanical Impedance. This means the drive springs must be "sub-resonant" tuned. The practical read out is the ability to tolerate severe "load abuse" or high headloads.

2. It maximizes the "effective" use of Kinergy, which is the non-heat energy output of the drive springs. This is mandatory for achieving the highest level of energy efficiency.

3. An electrically controlled, adjustable output is possible because the motor's heat energy input will "maximize" at the point of resonance instead of being at a "minimum".

4. The motor's eccentric weights can accelerate independently of the stiff drive springs. This eliminates the detrimental "force fights" within the machine itself during starting or stopping.

5. It allows the choice of any stroke angle even though it is very steep. This adds even more versatility to the unit's application.

Therefore, a "free force" input easily out-performs a "crankarm" as an input power means. The challenge is to be able to use the "free force" input and still maintain the required operating stability that is essential for any driving method. This is accomplished by having absolutely stable, energy producing drive components. Only constant, reactive power producing drive springs can be used. They must be able to contribute the same amount of power even though ambient temperature or environmental conditions are constantly changing. This is the reason steel coil drive springs are used instead of, say, rubber. The conveying trough should be of adequate weight as compared to the mass of the load moved. This ensures the proper amount of drive spring power. Although the input motor is essentially a standard A.C. squirrel cage type, it must have an appropriate speed-torque characteristic that adds stability to the drive system. The motor should not exceed a given maximum speed, regardless of the method of the electrical adjustment. When the "Variable Voltage" type of controller is used, this is innately accomplished by the "regenerative braking" that is inherent in the A.C. motor. This means it cannot rotate any faster than approaching its synchronous speed. When the electrical "Adjustable Frequency" controller is used, this is the reason it has to be limited to a maximum of 60 hertz to avoid unnecessary difficulties.

The Kinergy Drive System

Combining a "free force" input from an A.C. type electric motor with the output of "sub-resonant" tuned springs describes the Kinergy Drive System. When the applied load increases, the springs inher-

ently drive harder. Stated differently, relatively small rotating eccentric weights installed on the extended shafts of a motor sustain the vibratory motion of the reactive power producing drive springs. Its output can be electrically controlled over a very broad range (Figure 13).



Fig. 13: The Kinergy Drive System has only three component parts. The steel coil drive spring that produces "Kinergy", the stabilizer to guide it, and the motor that supplies the needed heat energy to sustain the vibratory motion.

The "free force" input by means of rotating eccentric weights allows the full use of "Kinergy". It is defined as the kinetic energy developed by a spring's motion during the drive portion of its cycle. Since the Kinergy vector is much larger than the one for the motor, it is commonly called the "Kinergy Drive System", and vibratory machines using it are said to be "Kinergy Driven".

For powering vibrating conveyors or any of the other "Induced Conveying" machines, it has proven to be the most versatile and "energy efficient" drive system known.

Circular or Unidirectional Conveying

Vibrating conveyors most often convey "unidirectionally". This means the material is being moved in a single direction (Figure 14).



Fig. 14: A "unidirectional" conveyor, which conveys in a single direction.



Fig. 15: A "circular" conveying unit.

Circular conveying units develop a helical stroke action which moves the material around in a circle in the horizontal plane (Figure 15). When a lifting or lowering of the material is also needed, the conveying unit is designed similar to a Spiral Elevator or the trough winds around a vertical centerline.

The Theory of Vibratory Conveying

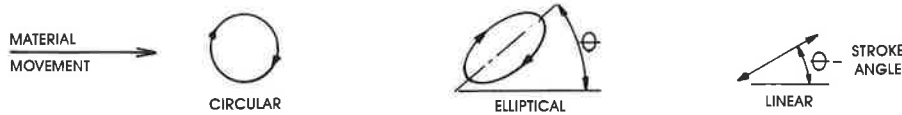


Fig. 16: Of these stroke patterns, the "linear" one as shown on the right is the most efficient for accomplishing vibratory conveying.

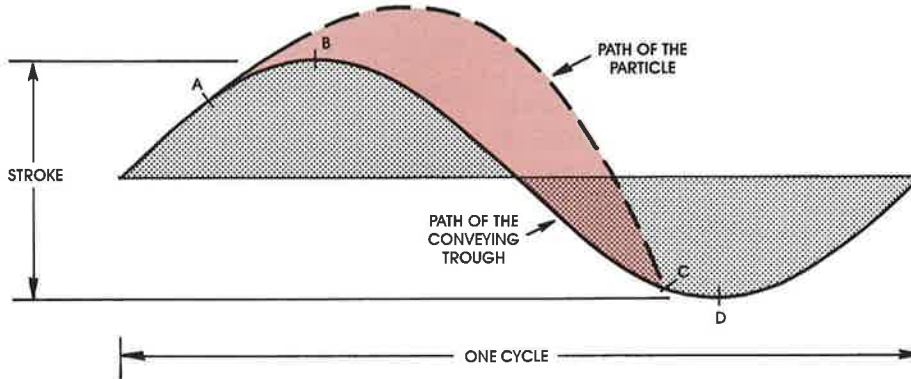
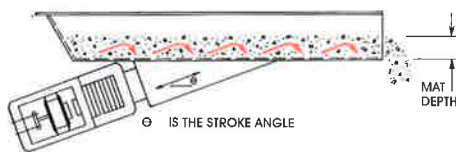


Fig. 17: The wanted path of a particle being moved by vibration. The particle leaves the trough at point "A". It follows a free projectile path and then re-engages the trough at point "C". The extremes "B" and "D" represent the maximum amplitude of the unit's stroke.

Fig. 18: A particle or "unit piece" can be vibrated and conveyed over a surface by means of a series of repetitive "hops". It is nearly the same as a grass-hopper's consecutive jumps, or likened to a child advancing on a "pogo stick". Each "hop" is a cycle.



The distance "hopped" is directly related to the unit's stroke length and the angle at which it is applied. The "hops" per unit of time is the operating frequency which is usually expressed in "cycles per minute" or CPM.

The principle of "Induced Conveying" is not limited to vibrating conveyors. For example, it also applies to the Electromagnetic type of vibrating feeder illustrated at left. When a vibratory machine moves its material load by vibration, it is utilizing the principle of "Induced Conveying". All vibrating feeders, conveyors, screens, heat transferring units, attrition mills, or the like, have this in common.

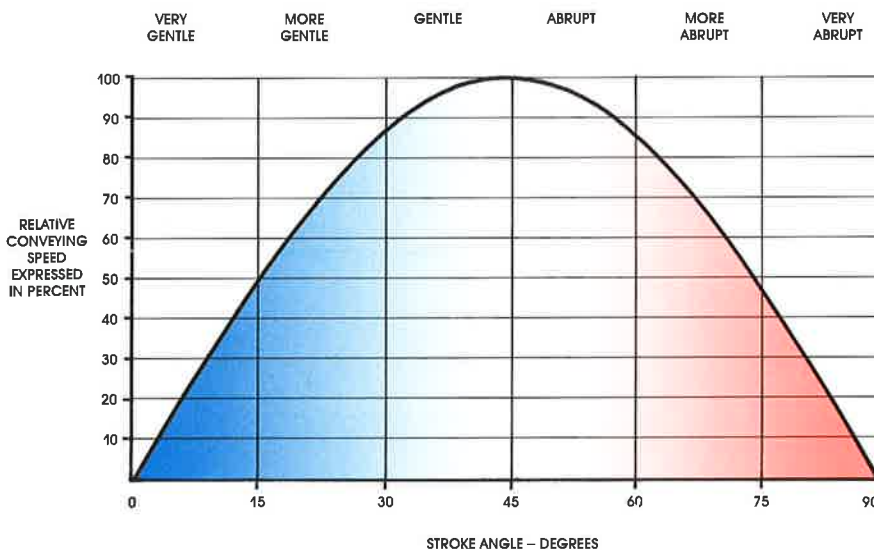


Fig. 19: This curve shows the resulting vibratory action and unidirectional conveying speed for the various stroke angles. The conveying force is held constant at 3.5 "Gee's". When the linear stroke is less than 45°, the vibratory movement is "gentle". For stroke angles above 45°, it is more abrupt or "sharp" reacting as it conveys.

- By reducing the vibratory force or "Gee's" the conveying speed reduces and the movement becomes more "gentle" for all the stroke angles.
- By increasing the vibratory force or "Gee's", the conveying speed increases and the resulting action is less gentle or more sharp in its abruptness.

The Vibratory Conveying Action

The stroke pattern for all Kinergy Driven Unidirectional Conveyors is uniformly "linear" or a straight line (Figure 16). Circular units have a uniform "linear" stroke around their periphery. For a given stroke length and frequency, this kind of vibration has the same amount of acceleration in both directions of its "back and forth" motion (Figures 17 and 18).

The stroke angle will vary from being shallow to one that's very steep as required by the application (Figure 19). The resulting conveying "Gee" force is directly proportional to the length of the stroke and the "square" of the operating frequency.

A high frequency, short stroke type of vibratory action generates an intense "surface" action, but sacrifices "mass penetration". This is the reason Electro-magnetic units do not have high conveying capacities. Their high frequency vibratory action cannot fully penetrate a deep mat depth. Whereas, a much lower frequency, longer stroke vibration has the advantage of penetrating a very deep mat depth, but it has a lesser "surface action" which is normally not of consequence when conveying. From this guideline, most operating frequencies of Kinergy Driven Conveyors are in the lower range or 570 CPM in order to move larger quantities of materials. When it is more appropriate, other frequencies with their corresponding strokes are used (Figure 20).

Frequency: (CPM)	Stroke: (inches)	(mm)
3420	0.021 (1/50)	0.53
2850	0.030 (1/32)	0.76
1710	0.084 (3/32)	2.1
1425	0.121 (1/8)	3
1140	0.190 (3/16)	4.8
950	0.273 (1/4)	6.8
855	0.337 (5/16)	8.5
713	0.485 (15/32)	12
684	0.527 (17/32)	13
570	0.759 (3/4)	19
488	1.035 (1)	26
400	1.541 (1-1/2)	39
300	2.74 (2-3/4)	69

Fig. 20: Examples of the various combinations of frequencies and strokes that develop 3.5 G's of Vibratory Force to accomplish the "Induced Conveying" of Unit Pieces or Bulk Solids.

Conveying Speeds

The more "rigid" and dry the particles of a bulk solid or units pieces are, the better they will react to the vibratory conveying forces.

Liquids such as water won't convey at all by a vibratory action, but they will "implode", which is why "leaching" can

Applying Vibrating Conveyors

be done on a conveyor. This means any material that is heavily moisture laden will probably be difficult to move on a vibrating conveyor. Consequently, at least a slight decline of the trough will probably be required to allow the excess liquid to flow.

"Unit pieces" will usually convey very well because they are often rigid and dry.

"General" type bulk solids readily respond to vibration because they are normally rigid in particle texture.

The "Flake" kind of bulk solids are resilient so they will convey a little slower.

"Floodable" bulk solids easily aerate, consequently they will be the more difficult to move in large quantities.

Horizontal Conveying: To establish a reference "standard", most use very dry silica sand because its particles are rigid and it is of the "General" classification. It will convey at a rate of 100 FPM horizontally, with about 3.5 Gee's of conveying force applied at a stroke angle of 45 degrees. This is normally regarded as the best that can be achieved and the material is near "ideal".

For practical reasons, a horizontal conveying speed of 60 FPM is used for relatively dry unit pieces or "General" type bulk solids. When they are above 4% moisture, the rate is reduced to 45 FPM.

"Flakes" will usually convey horizontally at 45 FPM if they have some rigidity. When they don't, the speed used is 25 FPM. Many "Flake" particles can gain in moisture without reducing their conveying speeds.

Floodable bulk solids will range from 10 to 30 FPM even though they are dry. When they are much less than 100 mesh in particle size and dry, the slower they move. If "Floodables" gain in moisture beyond 2% without becoming overly wet, their conveying speed increases because they are now in the "General" group.

Conveying Uphill: "Unit pieces" can go up inclines of 15° and a few can be conveyed up a 45° slope provided they have a flat side and are not spherical in shape. "Flakes" will easily go up 10° inclines and some can go up 20°.

"General" bulk solids can readily convey up a 7.5° slope, but only a few can climb up inclines of 15° because of their lesser "dynamic angle of slide". "Floodables" will most likely struggle to move up a 5° slope.

Decline: When any unit is declined, the material load is easier to move because the forces of gravity are helping. When the material is excessively wet, and a vibrating conveyor is needed, it is almost always declined at least 2 degrees. This prompts the excess liquid to move.

Conveying Capacity

The volumetric capacity of a vibrating conveyor is directly related to its conveying speed combined with the width and depth of the material being moved, which is called "mat depth".

Kinergy Driven Conveyors can carry more "load" than the previously known unit. Therefore, the material's mat depth can be deeper. Its maximum depth will only be restricted by how effectively the material conveys at a given stroke and frequency. For this reason, the required width of a Kinergy Driven unit will most likely be less when the conveying capacity is the only consideration in the application.

The conveying capacity can be calculated by the following equation:

$$\text{TPH Output} = \frac{\text{MD} \times \text{W} \times \text{D} \times \text{V}}{4800}$$

To select a vibrating conveyor's needed width when TPH is known:

$$\text{W} = \frac{4800 \text{ TPH}}{\text{MD} \times \text{V} \times \text{D}}$$

where:

TPH = The conveyor's capacity in tons per hour

MD = The conveyed material's mat depth in inches. When this is not known from previous experience, use these nominal depths:

1. Unit Pieces: Use 10 times the thickness to a maximum of 12".
2. Flakes: Use 24" as a maximum.
3. Floodables: Use 3" as a maximum.
4. General: Use 18" as a maximum.

W = The conveying trough width in inches

D = The density of the material being moved in lbs. per cubic ft.

V = The conveying velocity in ft./min. When this is not known from previous experience, use these nominal speeds:

1. Unit Pieces: Use 60 FPM
2. Flakes: Use 40 FPM
3. Floodables: Use 15 FPM
4. General: Use 50 FPM

Many times, the application of vibrating conveyors is not dictated by the volumetric conveying rate. For example, the physical size of a unit piece to be moved could dictate the needed width. On occasion, the load being conveyed is slowly moved to permit it to either cool or dry by being exposed to the surrounding air.

Counterbalancing

When it was introduced years ago, the initial design of the so-called "Natural Frequency" conveyor required it to be securely anchored to its support. Later, a method of counterbalancing this type of vibratory drive system was developed. This practical situation initiated the format of offering vibrating conveyors to industry as either "non-balanced" or "counter-balanced". While virtually limited to vibrating conveyors, this practice still continues to this day.

"Non-balanced" conveyors have the advantage of a slightly less initial cost (Figure 21). The disadvantage is the potential transmission of nuisance vibration to the vicinity surrounding the unit's installation.



Fig. 21: A "Non-Balanced" Kinergy Driven Conveyor. Its support must absorb its dynamic reaction.

While Kinergy will provide non-balanced conveyors when they are specified, it is always recommended that they be counterbalanced.

Since Kinergy Driven Conveyors have a "free force" input instead of a crank-arm, their method of counterbalancing has been markedly simplified. A reaction member is introduced on the other end of the drive springs and it moves as the dynamic equal to the conveying trough. In turn, it is supported by very soft isolation springs, which are usually of the steel coil type, at mounting points along its length. When the vibrating conveyor shifts from the "no load" to "full load" conditions, the level of force isolation actually improves. This is emphatically demonstrated by primary crusher feed-conveyors and noting the severe load abuse they endure.

For all Kinergy Driven Conveyors, the standard method of counterbalancing reduces any transmitted forces to the support structure by at least 90% (Figure 22).

► Load Abuse Capability

► Adjustable Conveying Rate



Fig. 22: A typical "counterbalanced" conveyor. Note the relatively light support structure which has the needed lateral truss members.

For a slight increase in cost, and using the same counterbalance configuration, a force isolation level of 95% can be achieved.

When extremely heavy and high stroking conveying troughs are required, a "neutral" member can be introduced. This markedly adds to the unit's cost. When it is utilized, the vibratory force isolation improves to the 97 to 98% range (Figure 23). This relatively small gain reflects the



Fig. 23: Soft mounting springs support the longitudinal "neutral" member of this unit's counterbalance. This elaborate configuration is only considered when extremely heavy and high stroking conveying troughs are required, such as for the moving of large volumes of the waste fuel known as "RDF". Otherwise, it is seldom used because it usually isn't needed.

asymptotic relationship of vibratory force isolation. Said more practically, the point of diminishing returns is being reached.

While the vibratory dynamic forces can be "isolated" to a high degree, their operating frequencies will not be. This is why a nearby entity, such as a handrail or light weight structural member, may sympathetically vibrate with the conveyor while it is operating even though the unit is counterbalanced.

If non-balanced conveyors are utilized, they should be limited to the ground floor level. Any vibrating conveyor installed in the upper floors of a building should be counterbalanced. If the conveyor is to be suspended by cables, it must be counterbalanced.

Location of The Drive Assembly

It is interesting to note that other than the conveying trough, the remainder of any vibrating conveyor is made up of its drive configuration.

The Kinergy Drive System can be located on the unidirectional conveying trough's underside, on top of it, or on one end.

Underside: The drive system is installed underneath the conveying trough (Figure 24). This is the preferred drive location for all Kinergy Driven Conveyors.

Top Drive: The drive system is mounted above the conveying trough (Figure 25). While slightly more expensive, this drive arrangement allows the bottom of the conveying trough to be fully accessible for various discharge ports.

End Drive: The drive system is mounted on either end of the vibrating conveyor. It has the advantage of a "low profile" type of design which minimizes head room requirements. Sometimes the lengths of these units are limited (Figures 26 and 27).

Non-Balanced Conveyors: These units almost always have an underside drive arrangement with the motor mounted on either the inlet (preferred) or outlet end.

Load Abuse Capability

One of the major attributes of a Kinergy Driven Conveyor is its inherent load abuse capability. The "free force" input by means of relatively small rotating eccentric weights and the "sub-resonant" tuned drive springs make this possible. Keep in mind, this same vibratory drive system is used to power primary crusher feeders which repeatedly endure some of the most severe impact or shock loadings.

Adjustable Conveying Rate

All Kinergy Driven Conveyors can have an adjustable output by a simple method of electrical control.

By adding a "Variable Voltage" type of controller, the operating stroke and frequency of any Kinergy Driven Vibrating Conveyor can be simultaneously changed (Figure 28). Therefore, the unit's conveying speed can be adjusted from "zero to maximum". Automatic and abrupt "pulsing" is also possible. It is the temporary application of a longer stroke, at a higher frequency, to either clean the conveying trough surface or to repetitively move the



Fig. 24: The Kinergy Drive System and its counterbalance is underneath the conveying trough.



Fig. 25: The drive and the counterbalance are above the conveying trough. The unit's support is from its counterbalance.



Fig. 26: The drive system is located at the inlet end. Note the substructure that is required if the unit is supported from above.

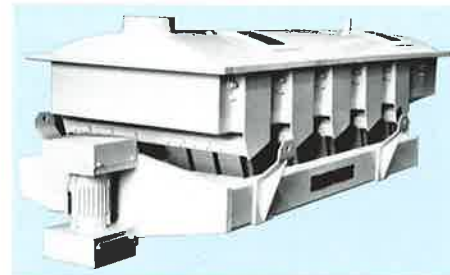
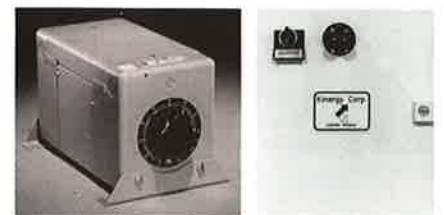


Fig. 27: Another alternative to reduce the conveyor's height is to put the motor only on one end.



Manual Variable
Auto Transformer

Silicon Controlled
Rectifier (SCR) Unit

Fig. 28: The "Variable Voltage" controls for manually or automatically adjusting the unit's conveying speed.

► Added Functions Accomplished While Conveying

load in short, incremental distances.

The controller can be a manual auto-transformer, but it usually is an SCR (Silicon Controlled Rectifier) because it has more operating flexibility. For example, the SCR control permits the conveyor to automatically follow, say, a 4 to 20 ma command signal. Either has an A.C. input and output, so there isn't any D.C. power involved.

Added Functions

While the bulk solid or unit pieces are being conveyed, some added functions can be performed.

De-wadding, De-clumping, or Fluffing: Many "flake" type materials are compressed into bales to lower their shipping costs. At the receiving point, these bales may need to be "broken apart" and separated into smaller sections.

Either circular or unidirectional vibrating conveyors with the proper trough configuration can "de-wad" or de-clump the bales and "fluff up" the previously compressed material.

Feeding: Vibrating Conveyors usually perform a "transporting" function. Sometimes the conveying trough becomes a storage means. When they do, they can also perform as feeders (Figure 29).

Whenever the conveying unit is combined with a storage hopper, bin, or silo, it should be properly interfaced. (Figure 30)



Fig. 29: This conveyor feeds bark and waste wood to a "hog".

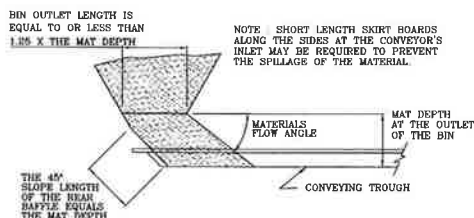


Fig. 30: Interfacing with the outlet of a storage bin at the conveyor's inlet.



Fig. 31: A "Flattener" for filled bags of material.

Flattening: Prior to being palletized, bags filled with a bulk solid need to be "flattened" (Figure 31). Inclined conveyors do this as they move the filled bag uphill.

Leaching: Conveying materials through a chemical liquid bath will usually accomplish soluble "leaching". An example is the recovery of the "spent uranium" trapped inside small pieces of pipe like "cores" that have been discarded by nuclear power plants.

Mixing: By utilizing the attributes of circular conveying, a unique "mixing" action for the combining of different bulk solids can be readily achieved. Two spiraling troughs lift the lower layers of the material upward and spread it over the top portion. One is wrapped around the unit's centerpost and the other winds around the inside of the periphery. Vertical standing baffles introduce turbulence to the material as it passes them while being circularly conveyed in the horizontal plane



Fig. 32: A "Mixer" for bulk solids that utilizes circular conveying.

(Figure 32). The result is an efficient and thorough mixing of two or more bulk solids into one that's homogeneous. Sometimes, this unit is used with a vapor spray so it can "moisturize" materials.

Presently, it is a "batch" type unit, but effort is being exerted to adapt it to a "continuous" kind of operation.

Orienting: Many unit pieces can be "oriented" while they are conveyed. Special trough configurations will most likely be needed.

Removing Ferrous Metal: By installing an electro-magnet directly over the conveying trough, unwanted pieces of ferrous metal can be extracted from the mat depth of material being conveyed below. To ensure the extraction of the metal, the material's conveyed mat depth is purposely limited. The portion of the conveying trough that is directly under the electro-magnet is constructed of non-magnetic stainless steel. When it is wanted, a formed fiberglass trough section can be provided. By end flanges, it bolts to the remainder of the trough length (Figure 33).

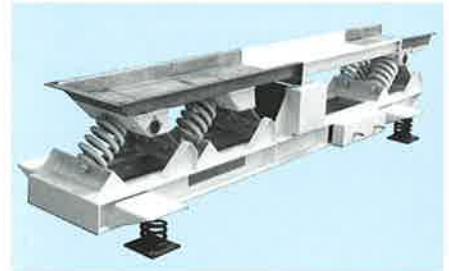


Fig. 33: A section of this trough is made of fiberglass to facilitate an electro-magnet removing ferrous metal from the conveyed material.

Screening: Some screening functions can be achieved while conveying. However, the needed "degree of screening efficiency" will actually determine the design of the unit.

Cleaning: Most "cleaning" functions can be achieved provided the screening surface is long enough.

Sizing: If the screening efficiency is not overly important, then it can be done on a vibrating conveyor. Conversely, if a high degree of screening efficiency is

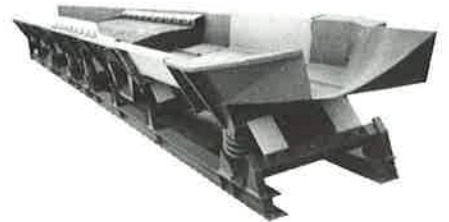


Fig. 34: Note the "screening" section and the downstream trough section for an electro-magnet to be mounted above it. This unit supplies wood scraps to a hog or chipper.

► Functions (continued)

► Trough Configurations

► Liners

► Corrosion

required, the conveying unit will be designed as a vibrating screen (Figures 34 and 35).



Fig. 35: This unit breaks up lumps as it conveys foundry sand.



Fig. 36: A water "drainage" screen can be seen in this conveyor.



Fig. 37: A Foundry Mold Shakeout.

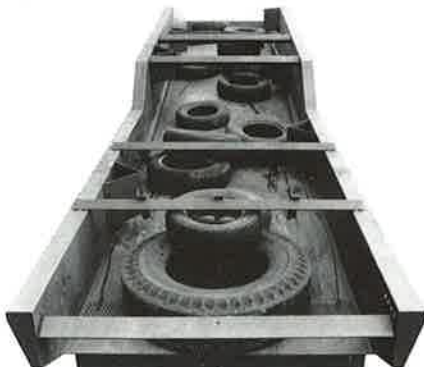


Fig. 38: "Singulating" whole rubber tires.

Deliquefying: If the liquid is to be "drained", it can be accomplished (Figure 36). When the conveyed material is to be reasonably deliquefied, the unit's design would be in agreement with a vibrating screen.

Shaking Out Molds: Vibrating conveyors can "shake out" molds while they are moving the sand and casting. When this is specifically wanted, the conveying unit should be designed for that purpose, namely, as a "shakeout" (Figure 37).

Singulating: After accepting a cluster dump of unit pieces, the conveyor "singulates" them. Consequently, they are discharged one at a time (Figure 38). Quite often, a vibrating feeder will be required upstream from the Singulating Conveyor.

Spreading: The inlet end of the conveyor is relatively narrow. While the material is being unidirectionally conveyed, its mat depth reduces as it "spreads" across a larger width prior to being discharged.

Sub-dividing the Conveyed Material: By means of vertical trough dividers, the incoming supply of material can be sub-divided into a number of reasonably equal flow streams (Figure 39). By the use of manual or air-operated gates installed at the outlets, the conveyed contents can be discharged at various points along the unit's length.



Fig. 39: This unit sub-divides and spreads a thin layer of ferrous gravel to permit the scanning for precious plnk diamonds in its conveyed contents.

Transferring Heat: If this function is not overly demanding, ordinary vibrating conveyors can be used. An example would be "accumulating" conveyors for hot castings in a Foundry (Figure 40) or the water "quenching" of hot glass. Whenever the cooling or heating is more critical and a specific amount of heat transfer is to be accomplished, the unit should be appropriately designed for that purpose.



Fig. 40: A typical "Accumulating" Conveyor.



Fig. 41: Liquid sprays can "wash" the conveyed material.

Washing: Materials can be "washed" while they are being conveyed. Liquid sprays are mounted above the conveying trough (Figure 41). The sprays can be water, chemical solutions, liquid detergents, or the like. Usually, a screen medium will be needed in the conveyor's trough.

This kind of cleansing should not be used when the sprayed liquid can freeze and adhere to the unit's conveying trough as a result of low ambient temperatures.

Trough Configurations

Various trough configurations are available. They can be tubular, rectangular, flared, partitioned, fitted with rails, telescopic sections, or ceramic lined for conveying very hot materials.

Liners

The conveying troughs can be lined with abrasion resistance (A.R.) plate, other alloy steels, stainless steel, ceramic brick, rubber, or polyurethane UHMW.

Corrosion

When the conveyed material is corrosive, the trough construction or a fully sealed liner will be required to protect surfaces that would be attacked. When corrosion is coupled with sliding abrasion, the potential of the abrasive wear compounding the corrosive action needs to be taken into account. It would be the same as continually rubbing the rust off a corroded pipe. Therefore, when the material is both abrasive and corrosive, the latter dictates the trough construction or liner selection and not the former.

- **Discharge Gates**
- **Ambient Temperatures**
- **Pressure or Vacuum**
- **Method of Support**
- **Testing**

Discharge Gates

For intermediate discharge ports, manual or air-operated gates can be provided. Usually, they are of the moving slide, flip-flop, plunger, butterfly, or diverter type (Figure 42).

When used, these gates should almost always be mounted on the vibrating conveyor's trough.

Other trough outlet configurations are available such as "side discharges".

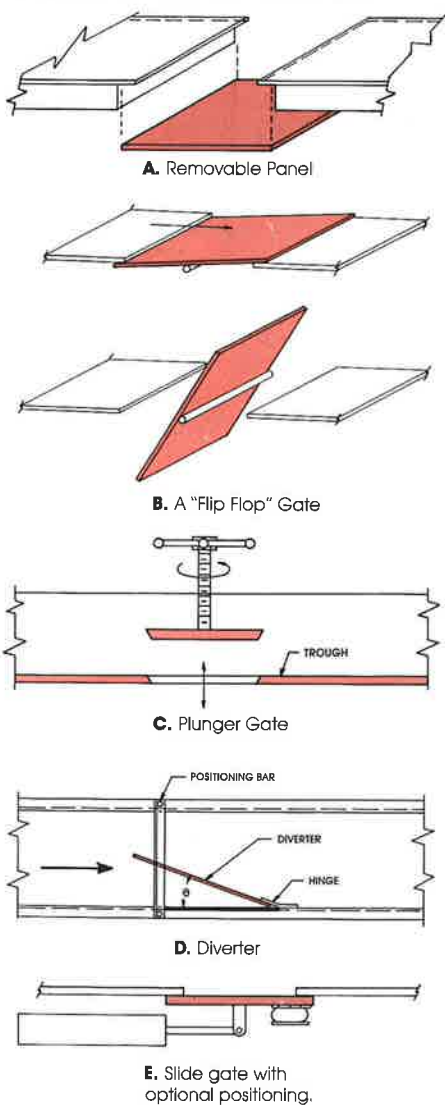


Fig. 42: Some of the different types of discharge gates that can be used at the outlets of the vibrating conveyor. Butterfly valves are not shown, but they are also used.

Ambient Temperatures

Kinergy Driven Conveyors can operate in low or high ambient temperatures. Even so, the effects of these conditions on the material being moved should also be conscientiously taken into account.

Sub-Freezing Conditions: "Space heaters" may be required in the vibratory motor and flat bar steel could replace the fiberglass used in the stabilizers. The steel coil drive springs, as well as the same type of isolators, would still be used.

If the material entering the conveyor is already frozen, it will move without difficulty. Conversely, when it is not frozen and contains excess moisture or some water droplets are present, it will most likely "build up" a frozen layer on the conveyor's trough surface over a period of time. Therefore, if this freezing condition can't be avoided, an alternative method of conveying should be considered. Of course, the freezing temperature of the liquid could be decreased by adding, say, chemicals to it or the ambient temperature increased by heating the trough or the enclosed building to permit the use of a vibrating conveyor.

Hot Temperatures: By changing the stabilizers from fiberglass to flat metal bars and force cooling the vibratory motor, ambient temperatures to 450° F. can be endured by Kinergy Driven Conveyors.

The anticipated material load needs to be reviewed to confirm these higher temperatures will not have any adverse or unwanted effects that could affect its conveyability.

Pressure or Vacuum

When the internal pressure is 3 PSI or less, the dust-tight conveyor design is basically used with adequate flexible connections.

If the pressure is higher or a vacuum is required, the conveying trough usually becomes a "tube" with the appropriate

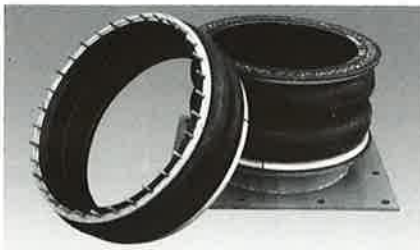


Fig. 42A: Typical bolted flexible connections that probably will be needed when a high pressure or vacuum is encountered.

end covers when the conveyor is of the "unidirectional" type.

Circular conveyor designs are usually more adaptable to pressures and vacuums.

Most likely, bolted type flexible connections as shown in Figure 42A will be required.

Method of Support

Even though many conveying units have a "steady state" loading, they are always recommended to be supported from underneath. When there is no other alternative, they can be suspended from above by steel cables connected to their counterbalances (Fig. 43). If they are, safety stops or another set of non-vibrating cables should be rigged.

Unidirectional units with an "end drive" configuration will require a sub-structure under the vibrating conveyor when overhead suspension is required.

Whenever high shock or impact loading is expected, conveyors must be supported from their underside.

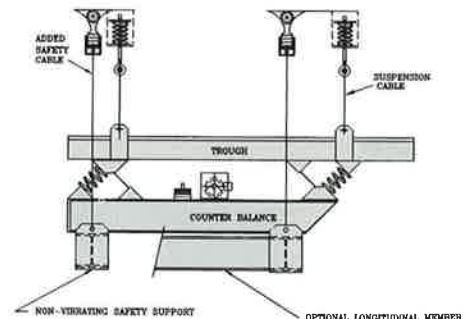


Fig. 43: This conveyor is suspended by steel cables.

Testing

For most vibrating conveyor applications, testing is not required. The years of experience in applying these units make this possible. When this is done, all the details of the application need to be clearly and fully stated so the appropriate unit can be recommended.

When some "Floodable" type bulk solids are to be moved, conveying tests may be required. When "Flake" or "General" materials are to be conveyed uphill, their actual conveying speeds may need to be confirmed by testing.

The Advantages of Kinergy Driven Vibrating Conveyors

The Advantages of Kinergy Driven Vibrating Conveyors

After the Kinergy Drive System was adapted to vibrating conveyors in 1978, a long list of advantages began to be realized.

Energy Efficiency: The power consumed will be about one-third of that needed to power the so-called "Natural Frequency" conveyor performing the same function (Figure 44). This reduces operating costs. To calculate the money saved, use a nominal \$300.00/HP per year or more appropriate amount for the location of the unit.



Fig. 44: This 24" wide x 75 ft. long Kinergy Driven Conveyor moves and cools hot bricks. It consumes 2 HP, which is being very energy efficient.

Quite often, a "cash rebate" will be granted by the local electrical utility for the use of a Kinergy Driven Vibrating Conveyor because it makes a marked reduction in the amount of power being consumed for a given conveying function.

Inexpensive Counterbalancing: Its configuration is not complicated. It is easy to construct, which makes it less expensive.

Repetitive Starts and Stops: The rotating eccentric weights on the motor accelerate independently of the drive springs. Consequently, repetitive starts and stops are permissible. They can be up to 5 per minute.

Shock Loads, Load Variation, and Headload Capability: The "sub-resonant" tuning and the "free force" input combine to make this possible (Figure 45).

The Simple "Look and Listen" Maintenance Principle: Just listen for any extraneous noise and check the unit's stroke. Other than greasing the motor about once every four months, this is all that's required for the maintenance of the conveyor.



Fig. 45: Large rocks that are called "Rip-Rap" fall down into this conveyor. Its discharge is "picked up" by a loader.

Quiet 80 dBA (Or Less) Operating Sound Level: Any noise means something is wrong. Its source should be traced and eliminated. Usually, it will be found to be a loose bolt on one of the drive springs.

If the material makes excessive noise while being conveyed, electrically adjust its speed or add an appropriate liner.

Less Cost: Kinergy Driven Conveyors are the least expensive to manufacture. Therefore, they can be very competitively priced.

Interchangeable Drive Components: Quite often, the drive springs, stabilizers, and vibratory motor of the drive system would be interchangeable with other Kinergy Driven Units. This could include Feeders, Conveyors, Screens, Heat Transfer Units, Spiral Elevators, or the like.

Maintenance personnel like the commonality of the Kinergy Drive System on all their needed "Induced Conveying" machines.

Adjustable Conveying Rate from Zero to Maximum Speed: This feature is inherent in the Kinergy Drive System. Just add the "Variable Voltage" control at any time.

Operating Versatility: The adjustable conveying speed can be coordinated with a computer monitoring the entire material handling system. The conveyor will automatically slow down or speed up in response to its commands. By taking advantage of the inherent adjustable output, the conveying unit can have its operating stroke and frequency automatically "pulsed". This is used to minimize, say, adhesion to the conveying trough. It can also move the load forward in short "spurts".

Minimal Components: Flat bar type stabilizers, steel coil drive springs, and the vibratory motor are the only three components that make up the Kinergy Drive System. On some light weight designs, even the steel coil type drive springs are omitted.

Any of these components can be changed in less than one hour by two mechanics possessing reasonable skills. This minimizes the down time in that regard.

Consequently, the "rocker arms" and the many parts associated with the crank-arm mechanism needed by the "Natural Frequency" type of conveyor have all been eliminated.

Reducing Wear: The "linear stroke" accomplishes this benefit because this kind of vibratory action reduces this type of abrasive wear.

Easy "Start-Up": Each vibrating conveyor is factory tested in the "no load" condition prior to shipment. Aside from confirming the motor's rotation at start-up, usually nothing further needs to be done. If, by chance, mechanical field tuning is required, it only amounts to adjusting the motor's rotating eccentric weights and the bolted tuning plates or possibly adding or subtracting a drive spring when the machines are relatively heavy (Figure 46).



Fig. 46: If mechanical adjustments at "start-up" are needed, they are easy to do. The bolting of "turning plates" to the frame or adding eccentric weights to the motor are readily accomplished.

"Simply the Best": With no more than three component parts, the design of the drive system is about as "simple" as it can be.

The optimum stroke angle, smooth and quiet operation with only minimal maintenance, less abrasive wear, adjustable conveying speeds which also enables "pulsing", and the highest degree of energy efficiency, combine to assure the "best" performance level.

Coupling this "simple" design with the "best" performance makes Kinergy Driven Vibrating Conveyors "simply the best".

Sanitary Designs

**Ammunition/Cosmetics/Food/
Pharmaceutical**

In addition to taking advantage of the "self-cleaning" feature, many times the conveyor needs to be of a "sanitary" design. The entire unit has a smooth and plain appearance and it is essentially free of dirt collecting pockets or crevices. The complete unit can be "washed" down with a water hose and none of the component parts are adversely affected. This includes the TENV motor.

These light weight conveyors are available from 2 to 72 inches in width in standard designs. The lengths are as

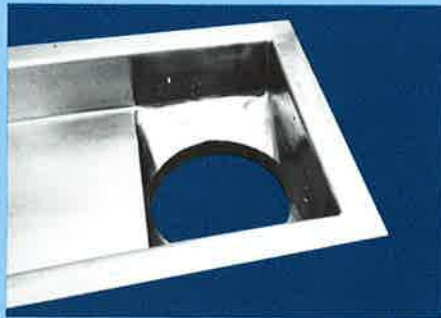
required. The troughs are typically made of No. 12 to 7 gauge stainless steel.

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 stripe with a specified grit, such as No. 150. The surfaces can be hand polished to, say, a No. 4 finish. So-called "Dairy" finishes or the 3-A sanitary designs which combine the USDA, the manufacturer, and the end user, can also be provided.

When they are objectionable, the steel coil drive springs are omitted and the remaining flat bar type springs serve

their purpose. Sometimes solid rubber isolators are required and they replace the steel coil compression springs that are normally used.

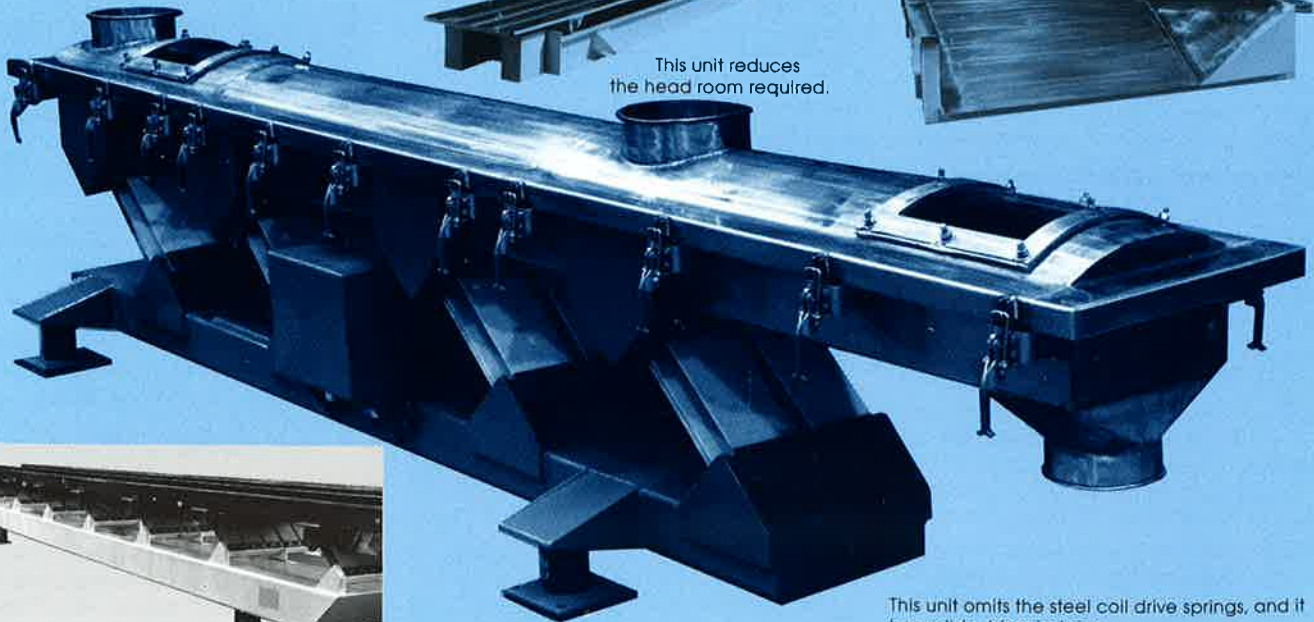
The unit's paint coating will most likely be "FDA" approved or some other particular type. Conveyors with sanitary designs are used routinely in ammunition, cosmetic, food, or pharmaceutical processes. They will usually be of the "Light Duty" type, but occasionally, a "Standard" or even a "Heavy" Duty rating may be needed. By adding a "Variable Voltage" controller, the unit's conveying speed can be adjusted.



This unit reduces the head room required.



This conveying trough has multi-compartments.



This unit omits the steel coil drive springs, and it has solid rubber isolators.

Light Duty Conveyors

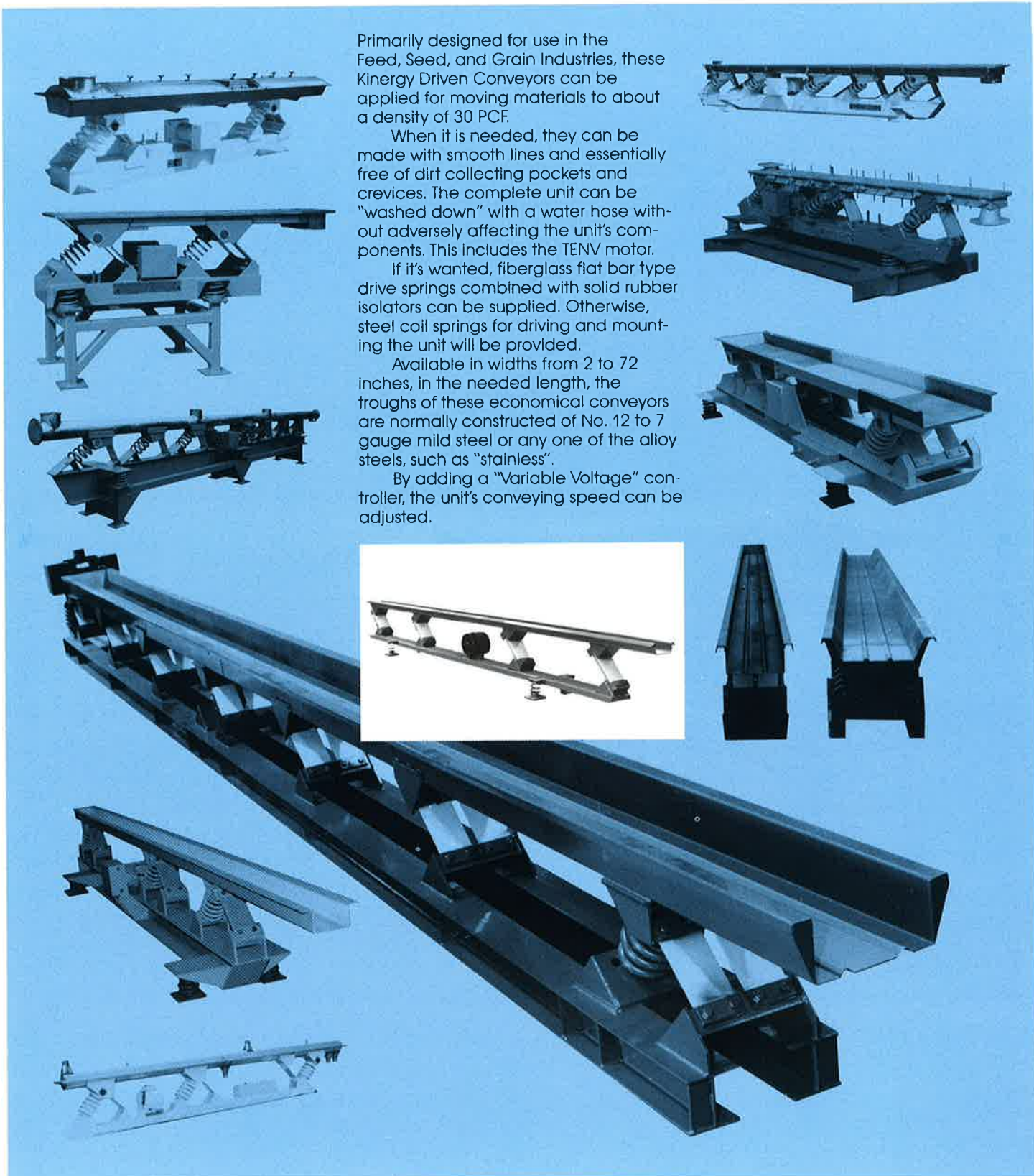
Primarily designed for use in the Feed, Seed, and Grain Industries, these Kinery Driven Conveyors can be applied for moving materials to about a density of 30 PCF.

When it is needed, they can be made with smooth lines and essentially free of dirt collecting pockets and crevices. The complete unit can be "washed down" with a water hose without adversely affecting the unit's components. This includes the TENV motor.

If it's wanted, fiberglass flat bar type drive springs combined with solid rubber isolators can be supplied. Otherwise, steel coil springs for driving and mounting the unit will be provided.

Available in widths from 2 to 72 inches, in the needed length, the troughs of these economical conveyors are normally constructed of No. 12 to 7 gauge mild steel or any one of the alloy steels, such as "stainless".

By adding a "Variable Voltage" controller, the unit's conveying speed can be adjusted.



Standard Duty Conveyors

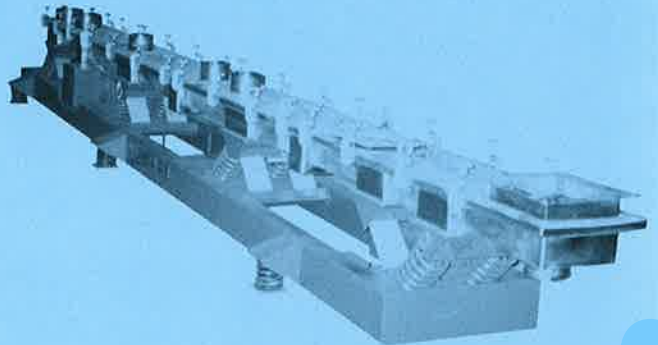
Apply these units for conveying aluminum cans, chemicals, metal stampings or turnings, plastics, wood scraps, wood chips, sugar, or similar materials that have a density to 50 PCF.

When they are used as "picking" conveyors or "inspection" tables, their material mat depths are purposely limited to a lesser amount.

The standard widths range from 12 to 96 inches with the lengths as required. Trough construction will be $\frac{1}{8}$ " to $\frac{5}{16}$ " thick mild steel or one of the alloy steels, including "stainless". Any suitable liner is available and they can be made "dust-tight" with the proper inlet and outlet connections.

The steel coil drive springs, which are guided by the fiberglass stabilizers, combine with the enclosed motor to power the conveyor.

By adding a "Variable Voltage" controller, the unit's conveying speed can be adjusted.





Heavy Duty Conveyors

These units are applied when a more rugged construction is needed for the anticipated loading which may be abusive. Examples would be the moving of hot materials such as sand and castings in Foundries. Conveying wood logs, boiler bottom ash, scrap steel, or large quantities of wastes such as raw MSW or shredded RDF.

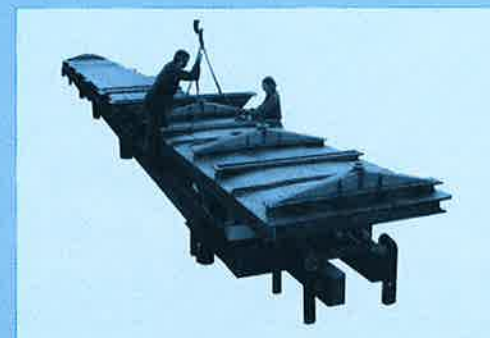
These conveyors are available in widths from 12" to 12 ft. and in the lengths required. Various trough designs can be supplied including those for high temperature applications. Many different types of trough liners can be supplied if they are required.

Since this kind of conveyor will be carrying heavy loads, it is always recommended to be supported from underneath.

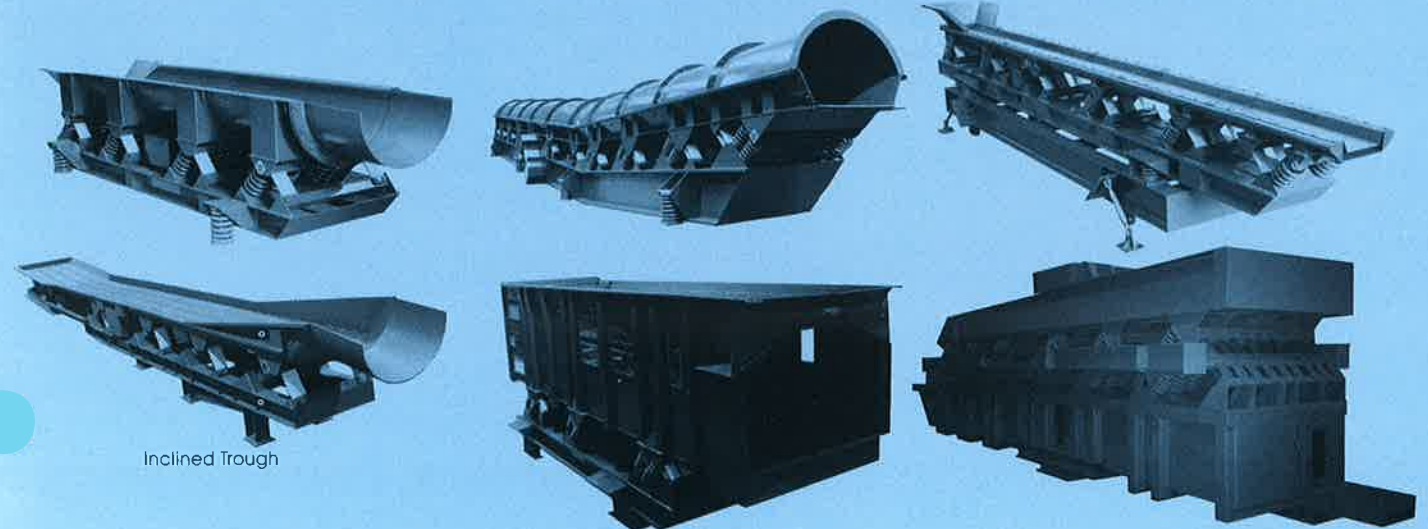
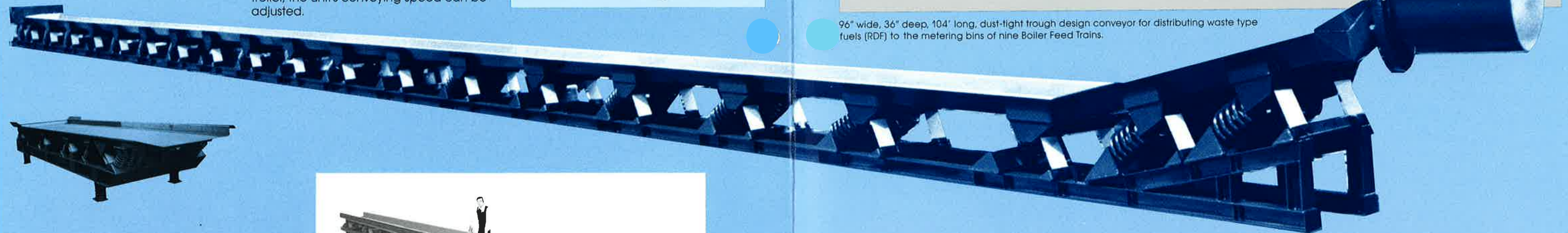
By adding a "Variable Voltage" controller, the unit's conveying speed can be adjusted.



Non-Balanced Unit



96" wide, 36" deep, 104' long, dust-tight trough design conveyor for distributing waste type fuels (RDF) to the metering bins of nine Boiler Feed Trains.



Inclined Trough

Extra Heavy Duty Conveyors

Since an attribute of the Kinery Drive System is its "load abuse capability", very husky and extremely rugged vibrating conveying units are now practical.

Normally, their application contends with materials in excess of 80 PCF and its physical size is stated in "feet" instead of "inches". Other uses are for moving heavier materials that require mat depths of 36" or greater.

They are available in widths from 36" to 12 ft., and in the lengths required. Thick metal trough construction, which can include the various liners, is the basic design theme. Mild steel or any of the alloy steels, including "stainless", can be provided.

These robust conveyors are a dramatic testimonial for the stable counterbalancing of the Kinery Drive System as they are observed shifting from the "no load" to the very massive

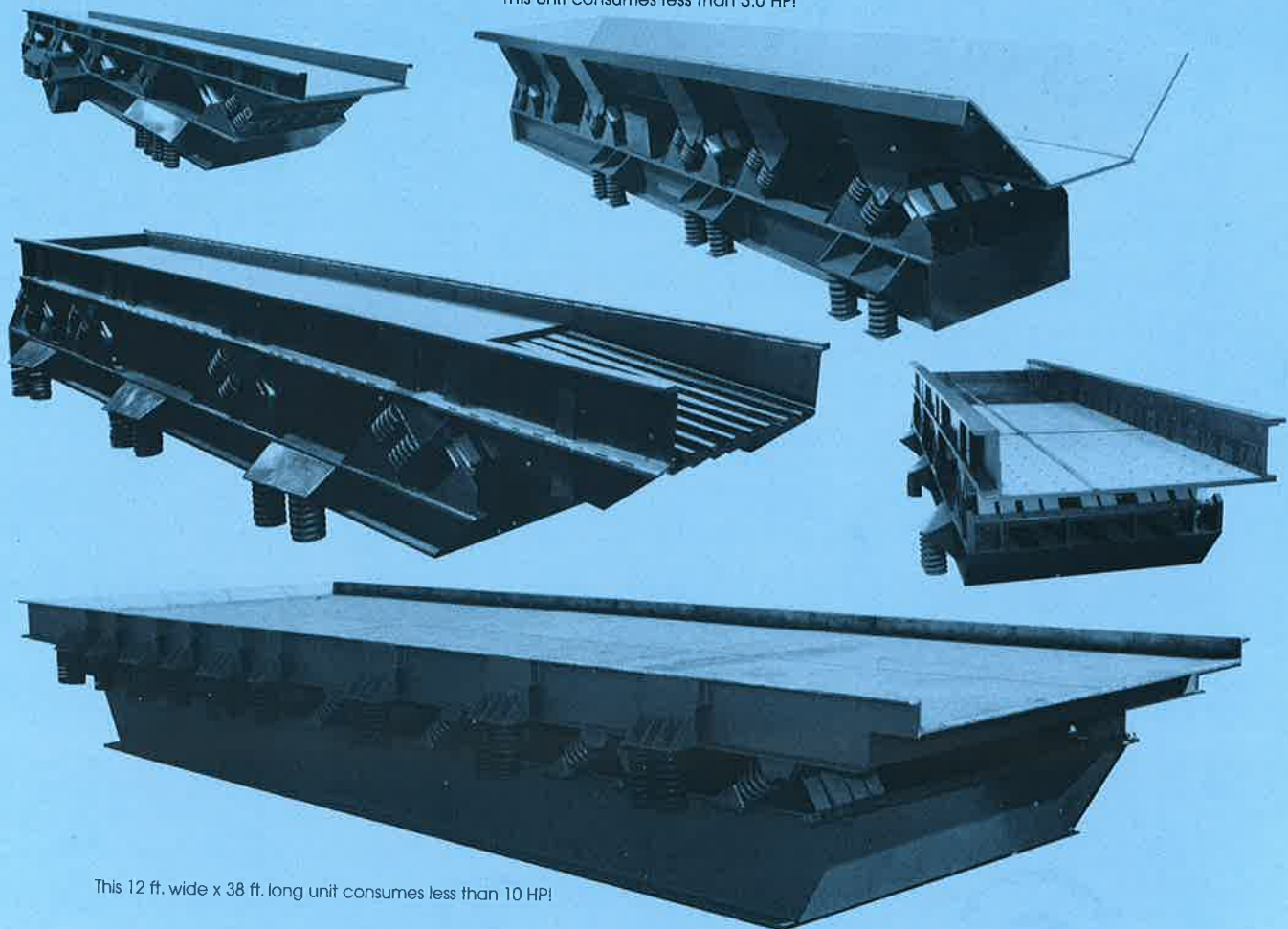
and heavy "full load" conditions in a time period that is often measured in seconds.

Since these units normally endure a high shock or impact loading, they should be supported from underneath.

By adding a "Variable Voltage" controller, the unit's conveying speed can be adjusted.



This unit consumes less than 3.0 HPI



This 12 ft. wide x 38 ft. long unit consumes less than 10 HPI

► Circular Conveyors

► References

Circular Conveyors

All circular conveyors are supplied with the drive system on the bottom (preferred), top, or around the vertical side wall's periphery. They all develop a helical type stroke. Depending upon the application, the linear stroke angle around the circumference of the unit will vary from shallow to being very steep. Units are available with the diameter of the conveying troughs as required (Figure 47). They should be used when unidirectional advancement is not wanted, a long conveying path is needed in a limited space, or more retention time in conveying is beneficial. When lifting or lowering is also required, the unit will be designed similar to a Spiral Elevator (Figure 48) or a winding trough.

Light Duty: Economical, light weight conveyors which have a reasonable conveying speed. They are used to convey bulk solids or unit pieces to about a 30 PCF density.

Standard Duty: Circular conveyors which have a reasonably high conveying speed. The material being conveyed should have a density of less than 50 PCF.

Heavy Duty: These are rugged conveying units for handling bulk solids or unit pieces in excess of 50 PCF density. Their conveying speeds are relatively high.

Extra-Heavy Duty: Since the Kinergetics Drive System can tolerate a high impact, shock type loading, extra-heavy duty circular conveyors are now available. They should be used whenever an application justifies this heavier construction.

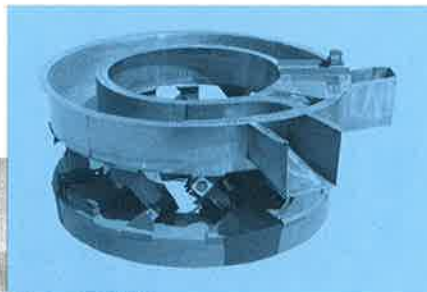


Fig. 47: A circular conveying trough.

Fig. 48: A Spiral Elevator that "lifts" the conveyed material the needed vertical height.

References

A "vibratory machine" is defined as any unit intentionally or purposely vibrated in order for it to perform useful work or some beneficial function.

"Induced Conveying" units primarily depend upon the generated vibratory action to move the material load. This factor differentiates them from the "Induced Vertical Flow" group of vibratory machines which all have the forces of gravity as the prime mover of the contained material.

To further qualify or substantiate this text, the following references are cited:

1. For a more detailed explanation of the Kinergetics Drive System, please see Bulletin KDB-1, which also shows it applied to all of the other "Induced Conveying" machines. Attention is called to the included chart which candidly compares the various kinds of vibratory drives available.

2. The "Variable Voltage" type of adjustable stroke and frequency controller for any Kinergetics Driven unit is further described in Bulletin ES-KD-1 entitled "Electrical Control Characteristics and Schematics".

3. If guidance on "interfacing" conveyors with a storage means is needed, please see Kinergetics Bulletin IL-KDF entitled "Interfacing Vibrating Feeders".

4. For an explanation of how and when the various types of vibratory drive systems were developed and their respective characteristics, please refer to the technical paper entitled "The Evolution of the First 'Universal' Vibratory Drive System for Moving and Processing Bulk Solid Materials", 1984.

5. For "How to Analyze Any Vibratory Machine", please see "Power Analysis Reveals a 'Common' Drive for Vibrating Equipment", International CHISA Conference, Prague, Czechoslovakia, 1987.

The intent of the text of this bulletin is to be professionally informative. Any suggestions or constructive criticism to improve it are invited. Please write:

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Typical Applications

Typical Applications

Kinergy Driven Circular or Unidirectional Vibrating Conveyors have been successfully applied for moving Flake, Floodable, or General type bulk solid materials and various unit pieces. These applications include the following:

Ammunition Manufacturers: "Self-cleaning" and non-contamination are the wanted features.

Briquettes: Gently conveying the freshly made briquettes is the primary purpose.

Cement Plants: Since it is so abrasive, conveying clinker is the application (Figure 49). Sometimes, it will be very hot.

Ceramic Industry: Conveying the highly abrasive materials without excessive wear is the benefit.

Chemical Plants: Moving the various chemicals without causing degradation or attrition to the delicate particles.

Fertilizer Plants: After the small fertilizer pellets are made, they need to be conveyed without their surfaces being disturbed. Dust-tight troughs will probably be needed.

Fisheries: Conveying the whole fish or their sliced members.

Food Processors: The "self-cleaning" feature of vibrating conveyors combined with their sanitary designs and the proper polished surface finish make Kinergy Driven Vibrating Conveyors almost ideal for the transport of vegetables, fruits, cereals, potato chips, nuts, or other foods.

The adjustable conveying rate makes them ideal for "inspection" or "picking" stations.

Foundries: Vibrating Conveyors are the "work horse" in Foundries. They move the mold shakeout sand, castings, or the return sand (Figure 50). Other functions, such as de-spruing and cleaning the castings are also accomplished.

The adjustable conveying rate is used to convey different size castings, to reduce conveying noise, or to control the material flow in the handling circuit.

Glass Industry: Conveying glass cullet and sometimes adding water quenching (Figure 51).

Grain Processing Plants: The very light weight, economical vibrating conveyors can readily move the grain (Figure 52).



Fig. 49: Collecting and conveying clinker from the coolers of a cement plant.



Fig. 50: Conveying hot mold dump sand and castings in a Foundry.



Fig. 51: Moving glass cullet with a multi-conveying trough unit. Note the "Imploded" liquid in the left trough section.



Fig. 52: Conveying clean wheat grains.

Grinders: Moving the abrasive materials needed for the making of grinding wheels, grinding paper, or abrasive saw blades.

Machining Operations: Collecting and conveying the scrap metal turnings.

Material Recovery Facilities: The adjustable rate feature of Kinergy Driven Conveyors makes them ideal for the "picking" stations.

When scrap wire or metal is being recovered, vibrating conveyors will move the entangled mass.

Metal Stampings: The stampings or the scrap from it is moved.

Pasta Makers: Gently conveying noodles, shells, macaroni, or the like.

Pelletizing: Conveying the recently made pellets without disturbing their surfaces.

Pharmaceutical: Conveying tablets and capsules. Polished finishes and sanitary designs will be required.

Picking and Sorting: Needed in Recycling and Resource Recovery Facilities. Foundries use them to separate the castings from the gates and sprues.

Potato Processors: Conveying Potato Chips and French Fries are the popular applications.

Power Plants: Distributing the fuel to the boiler feed trains (Figure 53). This is particularly so for the shredded waste type fuels.

When conveying excessively wet bottom ash, the conveyor is declined 2 or 3° to move the water.

Recycling: Separating the waste with "Picking and Sorting" Conveyors.

Refuse Derived Fuel (RDF): Acting as the fuel distribution conveyor from the source of supply to the line up of metering bins of the boiler feed trains below.

Rubber Manufacturers: The so-called "crumb rubber" needs to be conveyed without contamination.

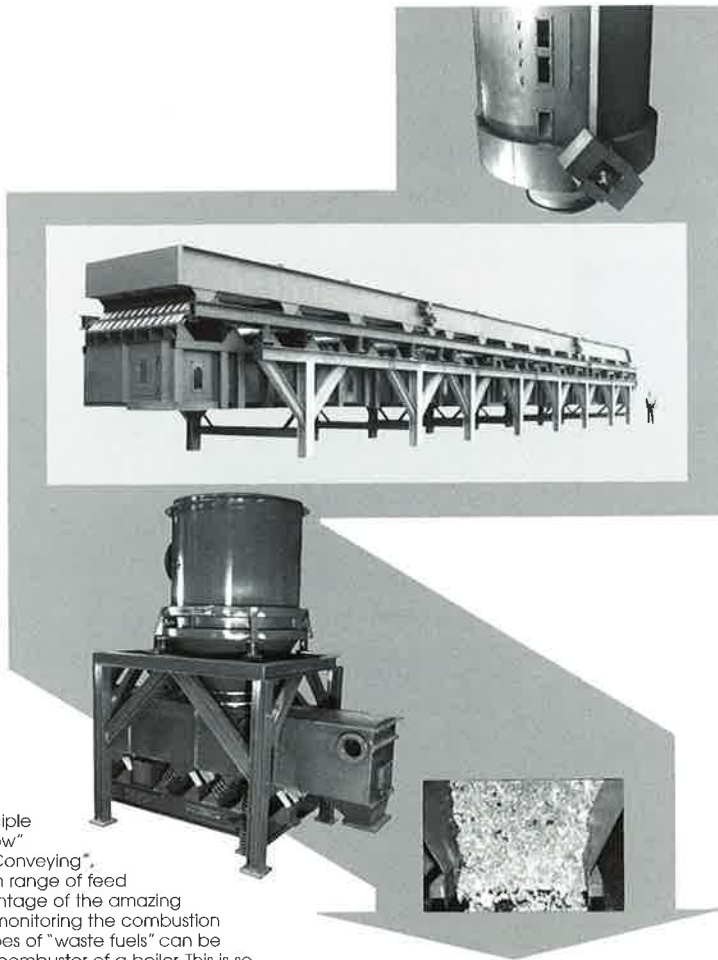
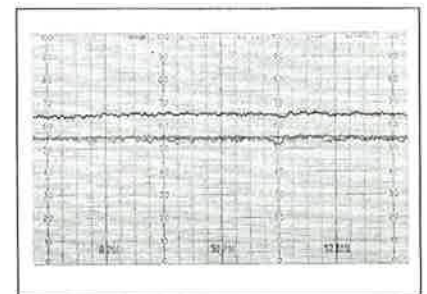
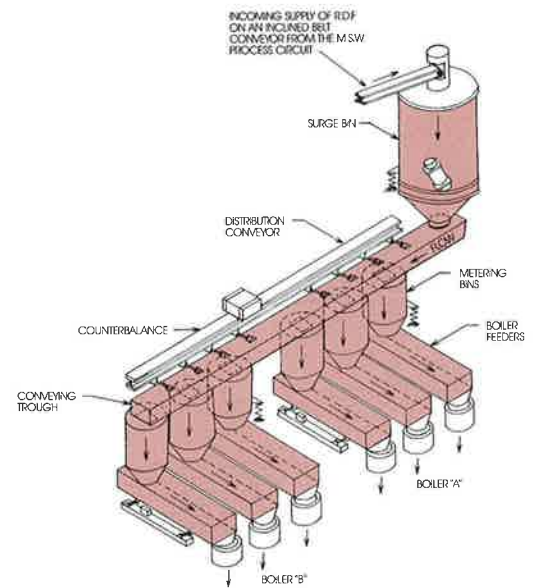


Fig. 53: Storing, Distributing, and Feeding Waste Type Fuels to a Boiler

By combining the principle of "Induced Vertical Flow" with that of "Induced Conveying", which has the optimum range of feed rates, and taking advantage of the amazing speed of a computer monitoring the combustion process, the various types of "waste fuels" can be successfully fed to the combustor of a boiler. This is so even though the fuel's physical properties and its amount of heat content are continuously and simultaneously varying.

Protected by Patent Nos. 4,774,893 4,899,669, 4,844,289. Other applications pending.



This strip chart shows the steadiness of the steam flow, total air flow, and steam pressure with this type of Boiler Feed Circuit.

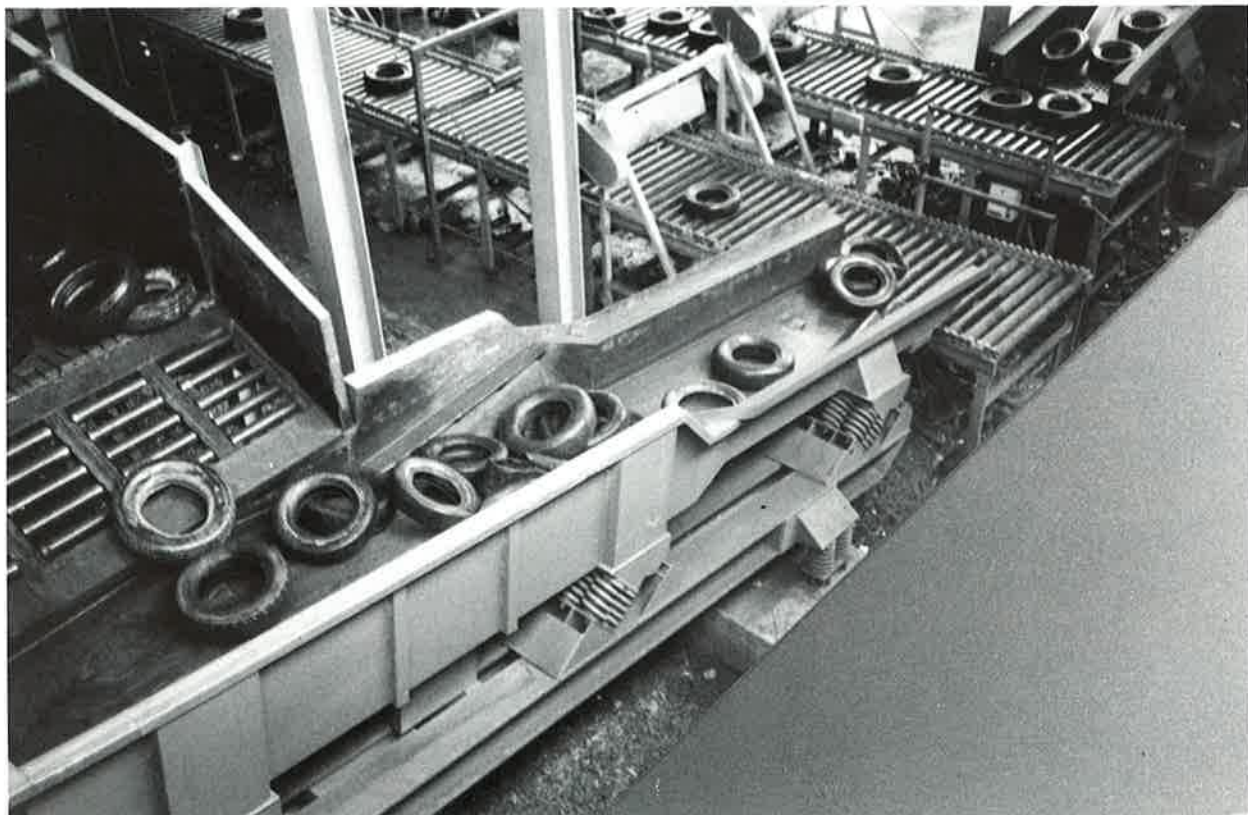


Fig. 54: Singulating whole rubber tires.

Typical Applications

(Continued)



Fig. 55: Feeding wood scraps to a "hog" at a saw mill.



Fig. 57: Supplying large pieces of scrap steel to a "shearing" machine.

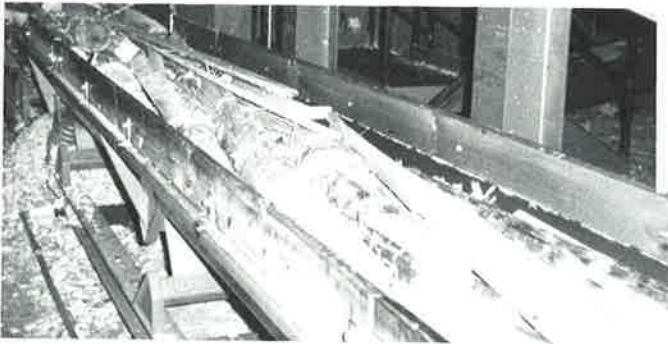


Fig. 56: Moving wood logs.



Fig. 58: Moving "cleaned" castings in a Foundry.

Saw Mills: Collecting and conveying the wood scraps derived from the "sawing" operation (Figure 55)

Shredded Rubber Tires: The vibration moves them even though they have projected wires.

Shredding Operations: The conveyor receives the shredder's output and moves the material out from under it.

Singulating whole rubber tires or other unit pieces. (Figure 54)

Tobacco Plants: Leaf and shredded tobacco is conveyed. It is often moved up inclines.

Wood Yards: Accepting loader dumps of logs and conveying them into a hog or chipper. (Figure 56)



Fig. 59: Non-Ferrous Metal is being removed from this 48 in. wide by 98 ft. long "Picking and Sorting" Conveyor in a Recycling Facility. Requiring 3 HP, the Conveying Rate of the Scrap Metal is 50 TPH.



Fig. 60: These four photos show vibrating conveyors being used in a Resource Recovery Facility.



Fig. 61: Wood chips are being moved.



Fig. 62: Moving hot sand and casting in a Foundry.



Fig. 63: Placing scrap metal on a rubber belt conveyor.



Fig. 64: Wet bottom ash is being conveyed. These units need to be declined at least 2 degrees.



Fig. 66: Recycling by the shredding of discarded automobiles.

- A. Conveying the material out from under the shredder. It is being dewatered while being conveyed.
- B. After most of the ferrous metal has been removed, the resulting "fluff" passes through this "squeezer". It is then transferred to a belt conveyor.
- C. After screening by trommels, an electro-magnet makes another pass at removing the ferrous metal.

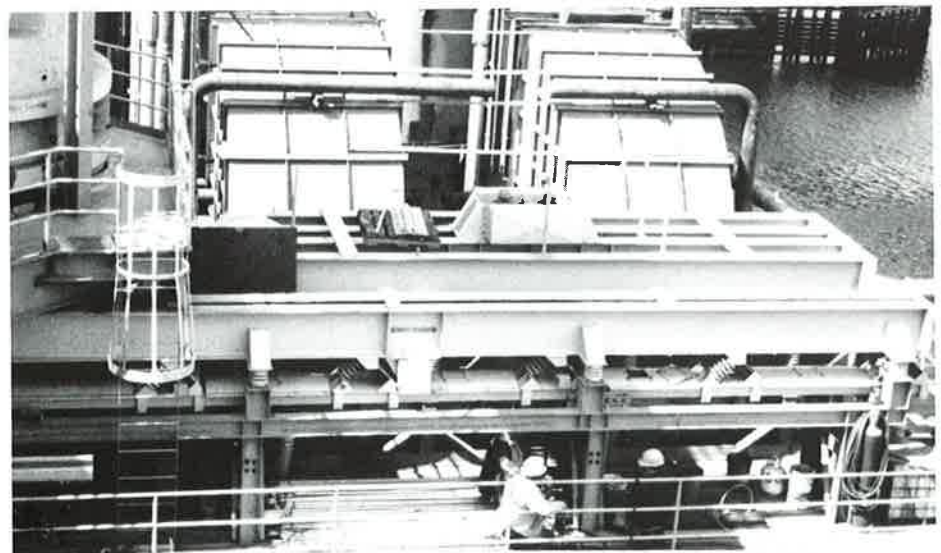


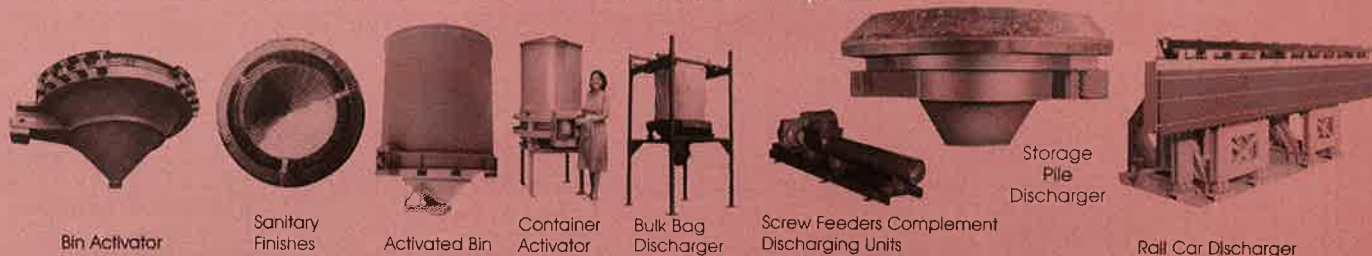
Fig. 65: A Boiler Feed Circuit that supplies either RDF or wood waste or any combination thereof. Protected by patent Nos. 4,774,893 4,899,669 4,844,289. Other applications pending.

Kinergy's Many Vibratory Machines

The most complete line of vibratory machines for "inducing" bulk solid materials to either Vertically Flow or Convey.

Induced Vertical Flow: The vibratory action supplements the forces of gravity.

Discharging: The objective is a uniform, symmetrical and concentric vertical flow pattern.



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



Induced Conveying: The intentional vibration is the prime mover of the bulk solid or unit pieces.

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 which inherently includes a full range of adjustable output by a simple method of electrical control.

