The Fitzpatrick Company

A Tradition of Innovation in Particle Forming Technology

Since the 1930's, Fitzpatrick has been pioneering the development of particle forming technology. With the development of the Chilsonator® Roll compactor in the late 1950's, Fitzpatrick has been constantly improving this dry agglomeration technology. Both improving existing processes as well as opening up new and difficult applications to the many cost and processing benefits of dry agglomeration, Fitzpatrick continues to uphold their tradition of innovation.

Pharmaceutical, chemical, food, plastics and other industries utilize a wide range of Fitzpatrick machines, including FitzMill® Comminutors, Chilsonator® Roll compactors, FitzAire® fluid bed dryers, Malaxators®, Homoloid® machines and pre-breaking equipment. Each unit is built to stringent quality standards to operate under the most demanding manufacturing conditions.

The Fitzpatrick Company maintains manufacturing facilities, test laboratories, and service and support offices in Elmhurst, Illinois; and additional testing and support services are provided from our offices in South Plainfield, New Jersey and Sint-Niklaas Belgium.

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Roll Compaction

The Fitzpatrick Company

Who is Fitzpatrick?

The Fitzpatrick Company is a manufacturer of stainless steel, sanitary process equipment, used by the Food, Chemical and Pharmaceutical Industries.

The FitzMill® Comminuting Machine, initially developed in the late 1930's is recognized world-wide as a standard machine for a multitude of processes requiring controlled particle reduction. Over the years the FitzMill® has been joined by...

FITZAIRE® FLUID BED DRYER, a process we introduced to the Pharmaceutical Industry some 20 years ago.

MALAXATOR®, a continuous blender-heat processor for high viscosity products.

GUILORIVER®, GUILOCUTTER® and other pre-breaking equipment for frozen products, bales and other agglomerated materials.

The most notable has been the CHILSONATOR® ROLL COMPACTOR for size enlargement. Through a constant process of improvement, the Chilsonator has become widely used in pharmaceutical and chemical production since the late 1950's and is recognized throughout the world.

The Fitzpatrick Company is a fully integrated company prepared to under-take all phases of equipment design and manufacturing, as well as product and process development. We welcome unique problems and designs and have made every effort to remain flexible enough to undertake solutions to customer's processing problems in the areas of our experience and technical capabilities.

Selection of Equipment and Components of Systems Often Begins With Testing.

Our staff and laboratories in Elmhurst, Illinois, South Plainfield, New Jersey and Sint-Niklaas, Belgium are available for testing of your product to establish the equipment configuration necessary to achieve your product specifications. By relating these results to your process equipment, our Sales Engineers select the model and components required to suit your individual application.

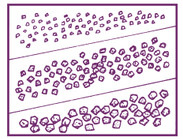
What is Compaction?

Fine powders can be processed into densified sheets in the Chilsonator® by the use of mechanical pressure exerted on two compacting rolls. The densified sheets can then be granulated to any desired mesh size.

WHY COMPACTION?

TO PRODUCE UNIFORM BLENDS OR MIXTURES

Mixtures of various discrete particles tend to classify in transport or handling because of differences in particle size, shape and density. The Chilsonator can produce granules of uniform consistency which eliminates segregation and facilitates consistent analysis.



TO PRODUCE A UNIFORM PARTICLE SIZE RANGE

The particle size range of the product can be selected to suit individual requirements and varied according to individual needs.

TO CONTROL DUST

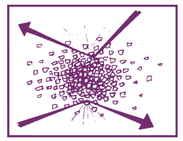
Dust is generally a wasteful and obnoxious form to handle. Cross contamination and product loss can be eliminated.

TO ADJUST FLOW PROPERTIES

Granular materials flow more easily and resist bridging and caking. Higher flow rates and more even fill can be achieved in many cases.

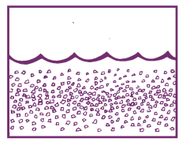
TO CONTROL BULK DENSITY

Increased bulk density may be desirable for storage, transport or packaging. Marked increases in bulk density can usually be achieved and controlled within certain limits.



TO CONTROL PARTICLE HARDNESS

The characteristics of particle hardness can sometimes be adjusted to suit the product needs. Crush strength and disintegration can be important properties brought under more rigid control.



TO IMPROVE SOLUTION OR DISPERSION RATES

Granular materials absorb liquids more readily than do many powders. Therefore, granular materials will dissolve or disperse more easily and quickly. Under proper conditions, some materials can also be adjusted to sink or float as desired.

Principles of Compaction

The basic concept, as illustrated in Figure 1, is to force fine powders between two counter rotating rolls. As the volume decreases through the region of maximum pressure, the material is formed into a solid compact or sheet.

Some of the factors controlling the compaction process are roll surface, diameter, peripheral speed, separating force or pressure capabilities, feed screw design and basic compaction characteristics of material being processed.

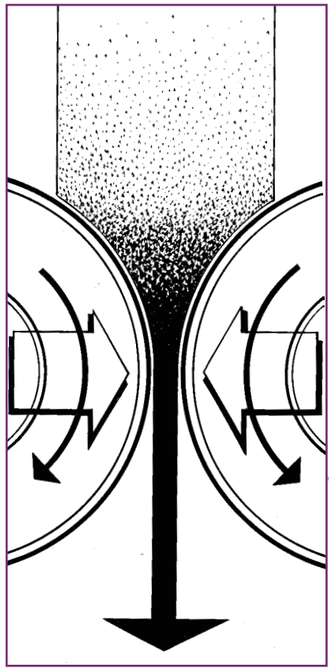


Fig. 1 BASIC CONCEPT OF ROLL PRESSING

The geometry of this densification process is shown in Figure 2. As the rolls turn towards each other, the material in the slip region is moving downward at a rate less than the surface speed of the rolls.

In the nip region, the material is caught or trapped by the rolls and is moving at the same speed as the roll surface. This forces the material through the region of maximum pressure, which is on a line between the centers of the two rolls.

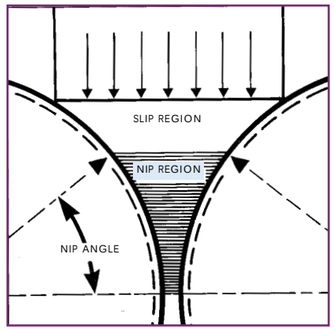


Fig. 2 GEOMETRY OF ROLL PRESSING

Maximum density will usually approach, but not reach the theoretical density of the material, as shown in Figure 3.

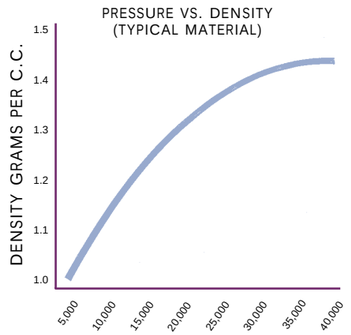
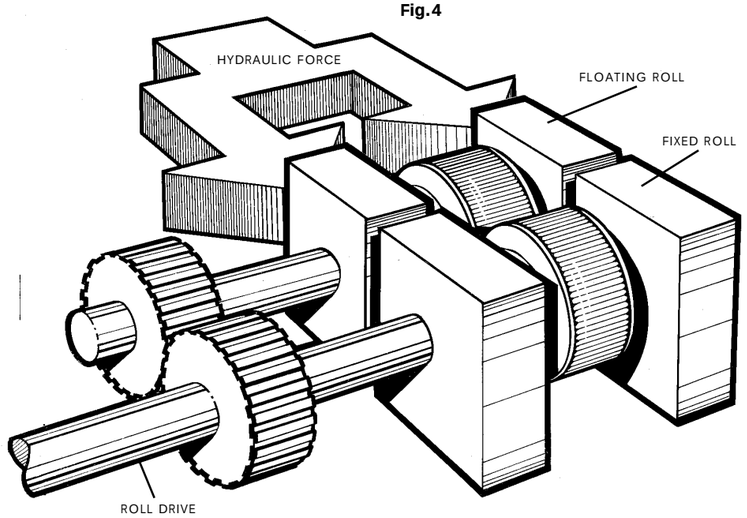


Fig. 3 PRESSURE LBS. PER SQUARE INCH

The consolidating force on the material between the rolls is supplied by a hydraulic cylinder. This cylinder acts upon the floating roll which can move horizontally depending upon the volume of feed and the pressure being applied. Figure 4 illustrates the basic concept.

Fig. 4



Roll Surfaces

Roll surface textures and configurations have a marked effect on the efficiency and production rates in the compaction of powders. A variety of configurations are commonly used. There are two basic types: smooth or circumferential corrugations; and pocket indentations or corrugations in the axial direction across the width of the roll.

The selection of the roll surface for a specific application will depend upon the compaction characteristics of the material. Powders that tend to stick or cling to the roll surface must be scraped clean with each revolution dictating the use of smooth or circumferential grooved surfaces. Compacted products that release cleanly from the roll may be pressed with one of the pocketed design or grooving in the axial direction. Finely ground powders of low permeability that are readily fluidizable require the use of axially grooved rolls.

In some cases any one of several designs will be satisfactory. A selection is usually made by Fitzpatrick after testing the product or by previous experience.

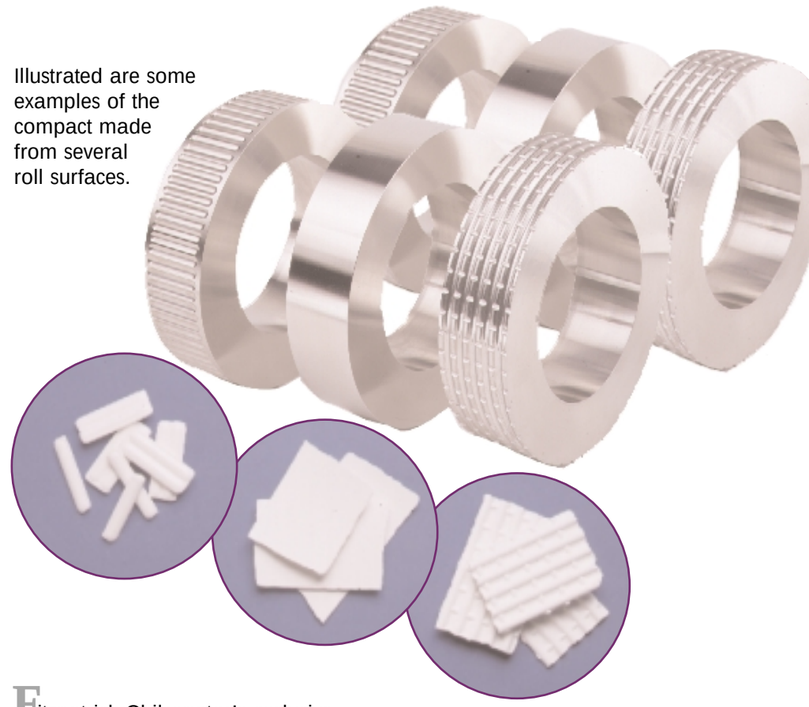
Feeder Design

Looking back at Figure 2, it can be seen that the downward force on the material fed to the rolls, can change the nip angle and nip region by changing the slippage between material and roll surface.

The greater the downward force, the larger the volume of material that can be compacted.

The efficiency of the compaction process is primarily a function of its feed system and the method by which the downward force is generated is a very important part of the compactor design.

Illustrated are some examples of the compact made from several roll surfaces.



Fitzpatrick Chilsonator's exclusive feeder design, shown schematically in Figure 5, utilizes a horizontal metering screw and a vertical deaerating, precompression screw.

The feeder can be used, without change in the screw design, on a wide variety of materials, ranging from very light or fluffy, to dense, heavy powers.

Variations in the design of the horizontal screw and its hopper permit handling powders with very poor flowing characteristics.

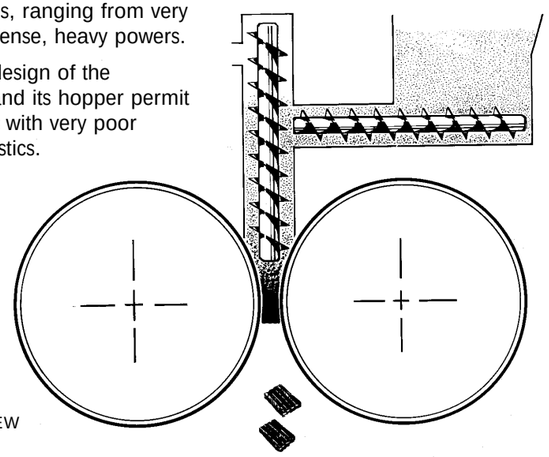


Fig. 5
DOUBLE FEED SCREW

Granulation

In most applications, the product compacted by the Chilsonator® must be granulated to a uniform particle size distribution. This can be most efficiently achieved with a FitzMill® granulator, a machine which embodies more than 50 years of Fitzpatrick experience in size reduction.

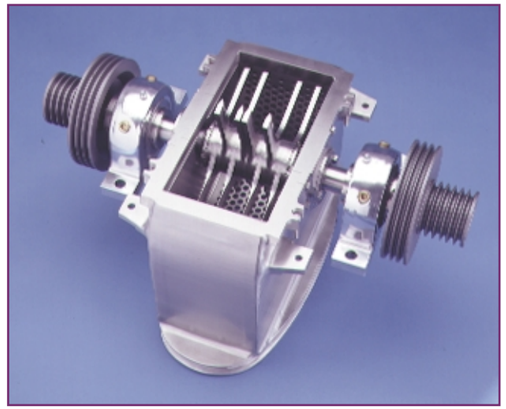
The FitzMill granulator is designed with maximum flexibility enabling the processor to control the size reduction of the compact with predictable and repeatable results. The three main variables are: blade shape, rotor speed and screen opening size.

Shown in the photograph of the mill's chamber are blades with a knife edge for coarse or large particles, and flat or impact edge for finer particles. The rotor is reversible, allowing double blade usage.

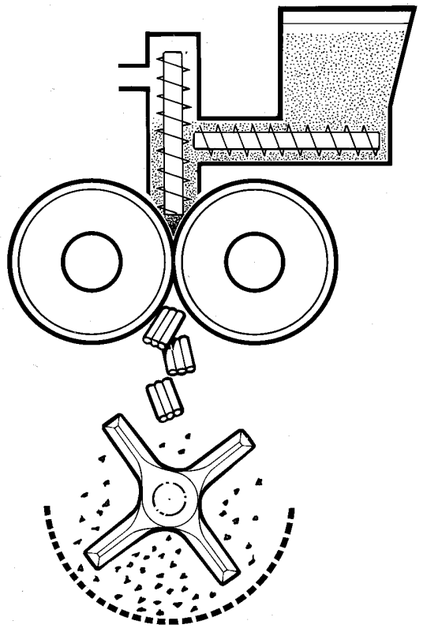
The selection of pulley diameter, on both the rotor and the motor on a belt drive unit will fix the speed. A stepped pulley or frequency inverter can also be provided for variable speed. High speed is used for fine grinding, slow speeds for coarser particles.

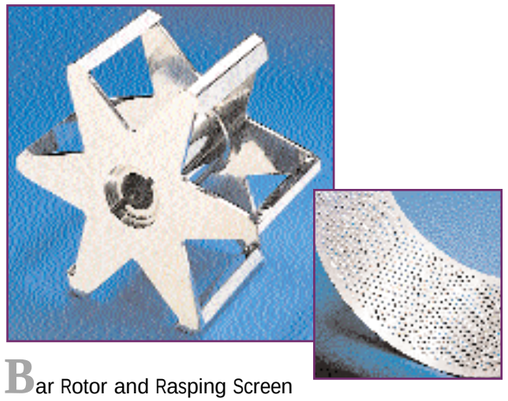
The screen shown in the open chamber is a perforated metal plate, shaped to fit the contour of the chamber. A wide range of perforated, mesh rasping, and other special screens are available for various process needs.

The FitzMill® granulator has a very high capacity for its overall size and therefore can easily be incorporated into a system directly beneath the Chilsonator compactor. It can also be used for smaller volume production as a manually fed granulator, in a two-step process.



FITZMILL® CHAMBER



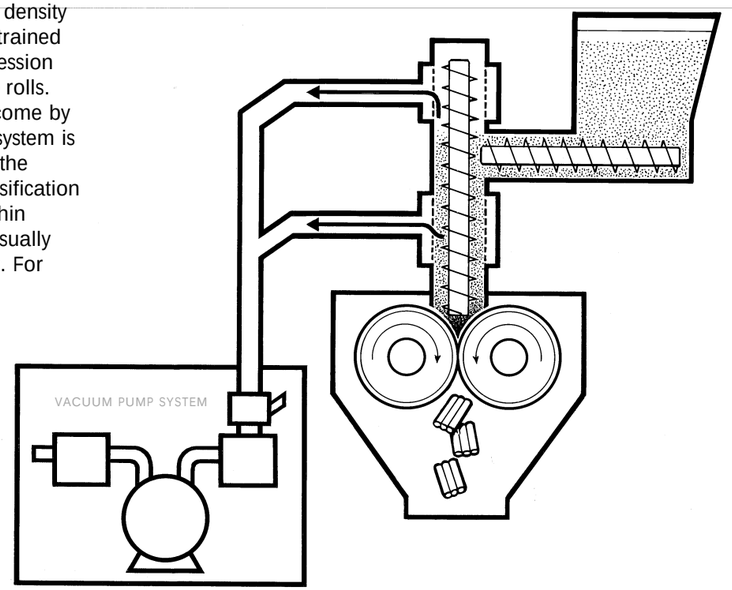


Bar Rotor and Rasping Screen

As an alternative to the traditional sharp blade rotor, the FitzMill can be equipped with a bar rotor. The Bar Rotor operates at a lower RPM than the traditional rotor creating a sifting action close to the FitzMill screen without actually making contact. The bar rotor is often used in conjunction with a rasping screen which in many applications serves to cut the compacted material directly into size. This gentle cutting action greatly reduces the number of fines and in certain cases eliminates the need for recycle.

Vacuum Deaeration

Often times compaction can be made difficult by a material with a low bulk density. A low bulk density material will have a tendency to hold air entrained inside of it and thus will resist the precompression that is required in order to pass through the rolls. This vexing problem can very often be overcome by the Vacuum Deaeration System. A vacuum system is applied to the vertical feed screw section of the Chilsonator® and provides improved predensification by forcibly removing entrained gas from within the product. Process improvements, which usually include increased capacity, can be dramatic. For example, a Vacuum Deaeration System in some cases, has increased Chilsonator capacity by up to 9 times and improved compaction efficiency by up to 40%.

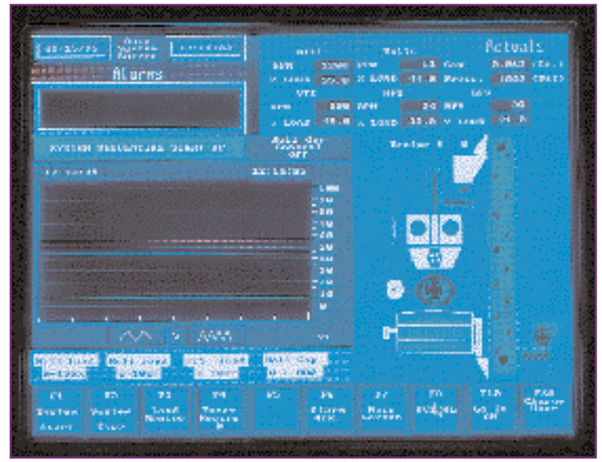


Automation

The Chilsonator Automated Control System is designed to provide optimum process control with excellent operator interface and data monitoring. The system includes a Programmable Logic Controller which is connected to an Operator Interface Station.

The operator interface utilizes a CRT screen for display. The operator is able to view all of the instrument measurements and machine status information in picture form on the screen. Features of the Chilsonator Automated Control System include:

- Operator Interface
- On-Line Help and Diagnostic Functions
- Restricted Access of Various Functions
- Maintenance Screen
- Calibration Screen
- Roll Gap Control
- Programmable
- Historical Trending
- Report Generation
- Alarm Management

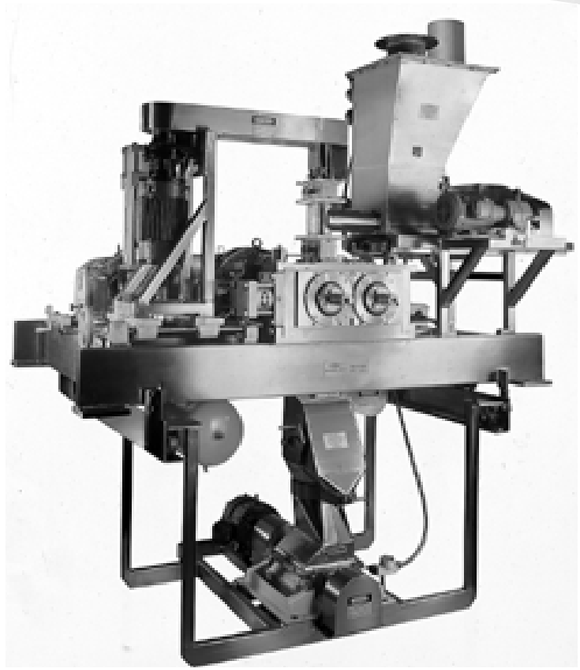


Compactors...Laboratory to Heavy Duty Production

A full range of Chilsonator® Roll Compactors and Compaction/Granulation Systems is available to meet production requirements from laboratory scale up to 25 tons per hour. Construction can be suitable for rigid sanitary requirements, and materials are selected for the highest degree of corrosion and abrasion resistance.

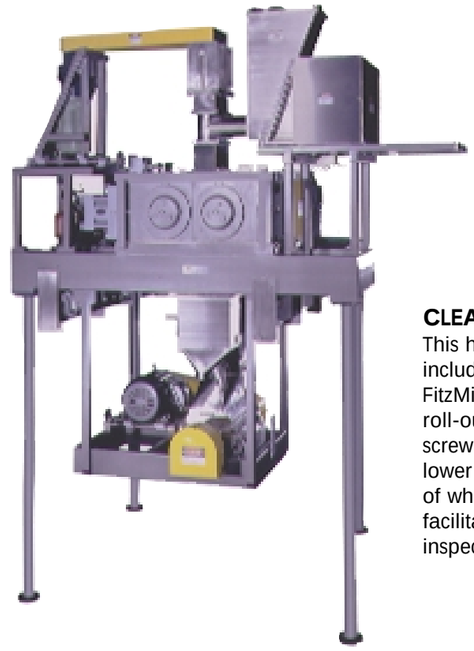
MODEL IR 520
This Chilsonator with its cantilever roll design is configured to separate the process area from the technical area. The elements of the process area including the rolls can be easily disassembled for cleaning, inspection or exchanged with other components.

MODEL 12LX16D
This medium capacity 12LX16D Chilsonator includes all of the exclusive cleanability features along with a complete PLC, SCADA control system.

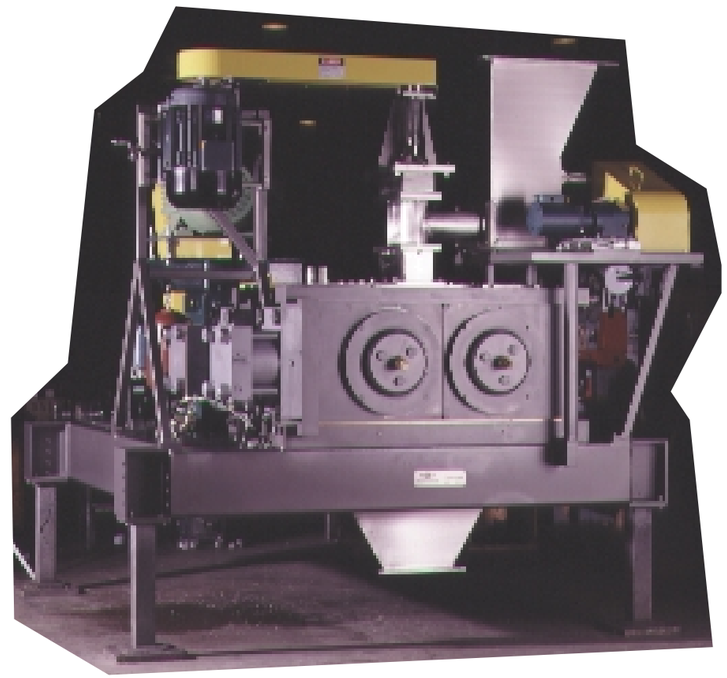


TOTALLY ENCLOSED CHILSONATOR®
This 7LX10D, constructed completely of stainless steel, is designed to provide a completely sealed process which makes nitrogen blanketing possible and protects operators and the environment from harmful or hazardous materials.

MODEL 12LX20D
This model is used for larger production rates and is equipped with vacuum deaeration along with hard facing and special component materials. This Chilsonator is well suited for highly abrasive applications.



CLEANABILITY
This high capacity 16LX20D includes a roll-out HAS030 FitzMill® Comminutor, a roll-out horizontal feed screw and a swing-down lower process housing, all of which are designed to facilitate cleaning, inspection and adjustment.



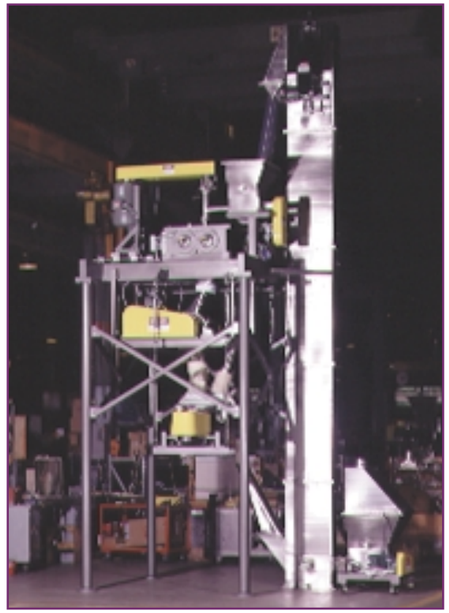
Compaction / Granulation Systems

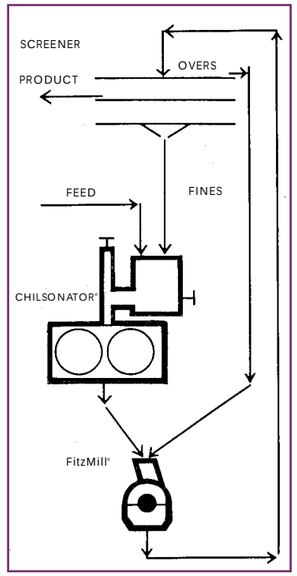
Compactors are seldom used alone, being generally combined with other processing and auxiliary equipment to form a system.

The Fitzpatrick Company designs and builds custom-engineered systems to meet not only the specific requirements of each product, but also the overall requirements of integrated production lines.

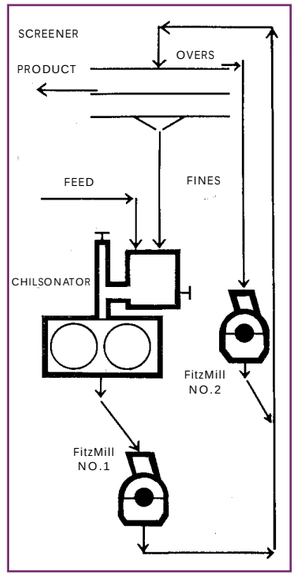
Most Chilsonator® systems are configured vertically, however this system carried with it the requirement that it fit into a room with limited vertical space; thus a new horizontal Chilsonator system was created.

Continuous compaction/granulation systems with screening and recycling (See Systems 1 schematic)

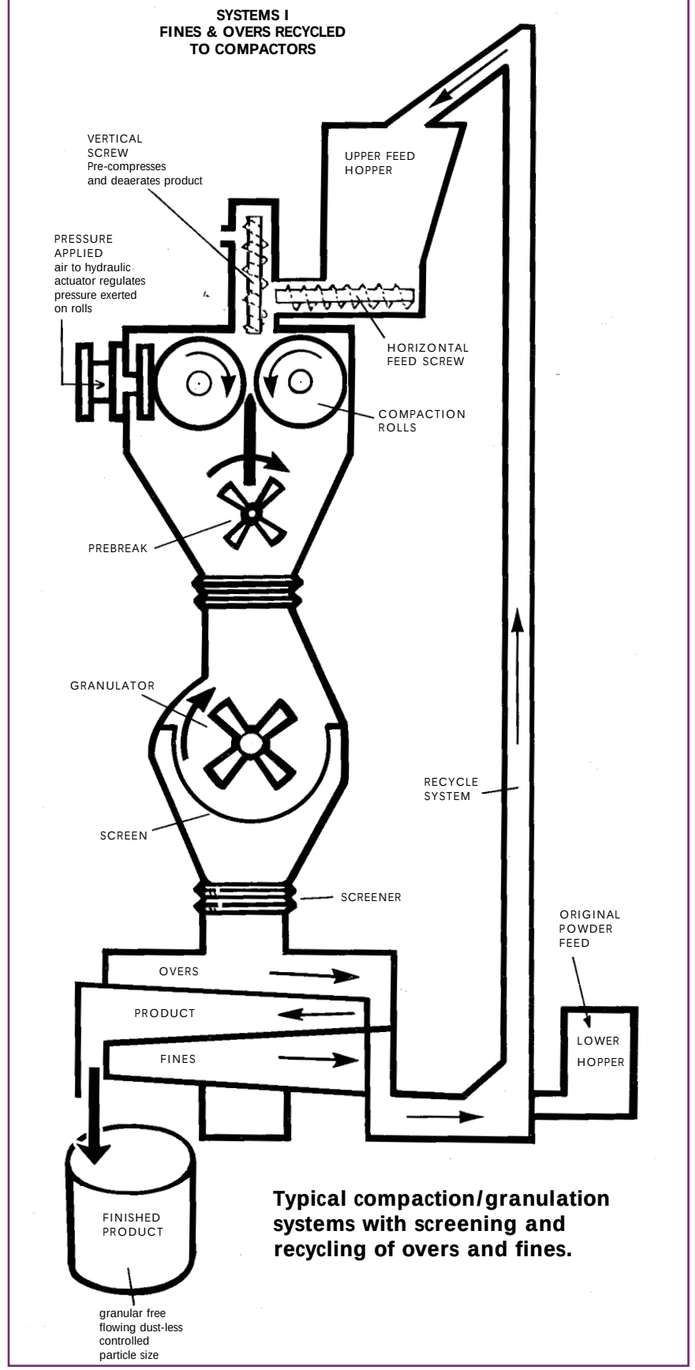




SYSTEMS II
FINES RECYCLED TO COMPACTOR
OVERS RECYCLED TO MILL



SYSTEMS III
FINES RECYCLED TO COMPACTOR
OVERS RECYCLED TO 2ND MILL



Typical compaction/granulation systems with screening and recycling of overs and fines.