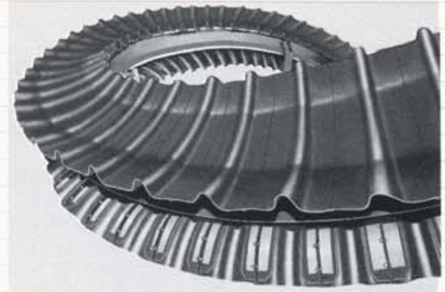
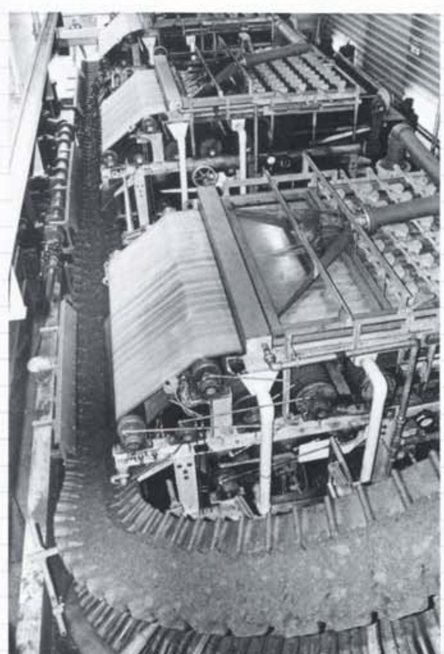


Technical Report
#T-1

Continuous Path Conveying



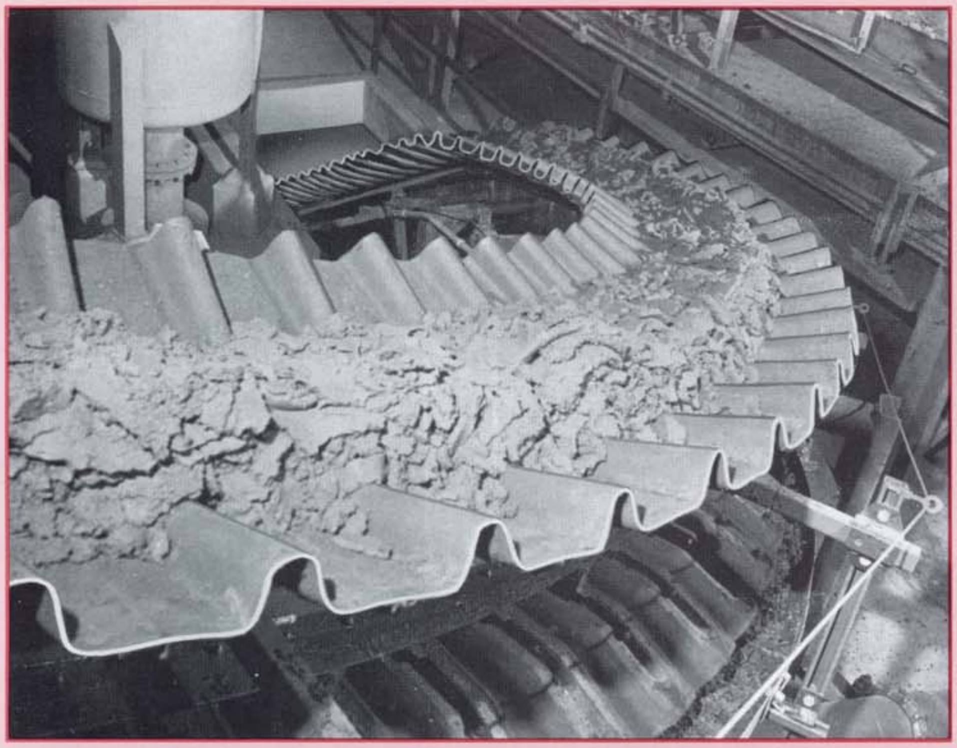
SERPENTIX CONVEYOR CORPORATION

Birth Of Continuous Path Conveying Came With Introduction Of Convoluted Belt/Track Guidance System

Engineering Innovations Possible With Three Dimensional Conveying Capability Greatly Alters Plant Layouts And Designs

Transporting bulk materials by conventional conveying methods experienced a technological advance in America in the late 1960s with the introduction of a convoluted conveyor belt capable of transporting material over a single, continuous path by making horizontal, helical or vertical turns. Combined with unique guided track systems, these new Continuous Path Conveyors — for the first time in history — gave engineers the ability to design plants using mechanical belt conveyors capable of operating in three dimensions.

Because of their turning and climbing abilities and the ability to convey material ranging from near liquid to large, irregular solids, Continuous Path Conveyors are rapidly replacing the need for most conventional belt conveyors. One of the reasons for this trend is that the elimination of multiple conveyors sharply decreases the number of transfer points, resulting in cleaner, safer plants. Other benefits, to both municipalities and industry, include sharp reductions in energy requirements and maintenance costs, and greater utilization of plant space, resulting in lower costs for both new plant construction and facility retrofits.

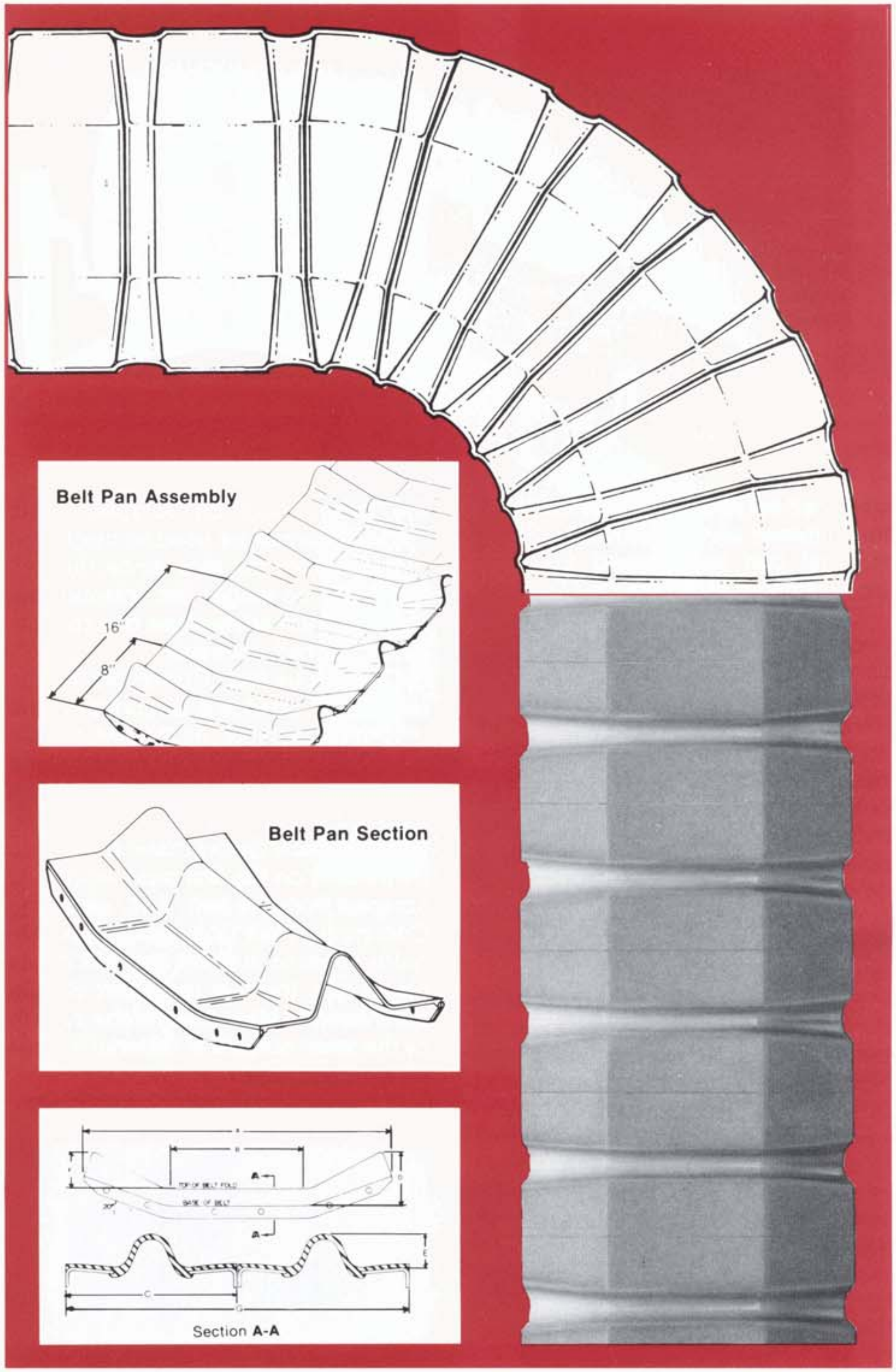


The convoluted belt principle relates to mechanical belt conveying much the same as the helix principle - developed 2,200 years ago by Archimedes - related to the screw conveyor.

History traces conveying of material on a belt back to the days of ancient Egypt. From that point until the mid-1900s, different types of conveyors used to transport bulk materials proliferated. Over the centuries, some 80-odd conveyor types came into popular use. A few of the generic types used for transporting bulk materials include the apron, drag, flight, oscillating (vibratory), screw, bulk-flow, pneumatic, and the mechanical belt.

Most of these could only convey in a straight line, and some could even elevate material by simply raising one end of the conveyor higher than the end being loaded. True two-dimensional conveying came into being when some innovative individual "snugged" down a section of a mechanical belt conveyor to provide a flat belt surface for loading. The conveyor's frame was then bent, forming a vertical curve, to provide an incline over which the belt could carry its load to another level.

However, the flat belt conveyor's utility for two dimensional use was limited because the movement of most materials on inclines exceeding 18 degrees could not be controlled. Sliding of the material was countered by attaching cleats, flights and sidewalls to the belt. But, the solution presented a new problem. Since the belt no longer had a flat surface, most material could not be removed from it. Also, the age old problem remained. Since conventional



RUBBER CONVOLUTIONS IN the lightweight belt of all Serpentix Continuous Path Conveyors allow horizontal, vertical and helical turning. In addition, they permit self-cleaning of the belt and prevent excessive movement of products being conveyed despite belt speed, angle of incline or the degree of turning. Horizontal and helical turning of the belt is made possible by the convolutions. In turns, the convolutions on the inner side of the belt compress while those on the outer side expand.

conveyors cannot turn horizontally, even minimal changes in the path of travel demanded termination of the run and transfer of its load to a second conveyor.

Belt conveyors that could turn corners, spiral and make climbing helical turns became possible in the 1950s when the convoluted belt and its track guidance system was invented. The introduction and subsequent widespread use of this new type of conveyor in Europe and Asia marked the start of three dimensional conveying.

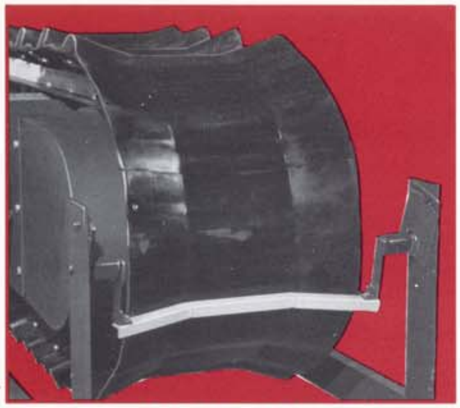
However, this new breed of conveyor achieved its present worldwide dominance in the mechanical belt conveying field when Serpentix Conveyor Corporation established its marketing and manufacturing headquarters for the system in Denver, Colordo in 1969. Innovations since then have included the addition of new models and new track guidance systems designed expressly for the industrial and municipal markets.

The first use of a Continuous Path Conveyor in the United States was at a brick manufacturing plant in Denver in 1970. There are now more than 500 major installations throughout the U.S., Canada, Mexico and South America. In addition, there are more than 900 in Europe and Asia.

The convoluted Serpentix belt is common to all Continuous Path Conveyors manufactured. The lightweight belt is assembled from modules which, when bolted together, provide an endless series of shallow pans which form a watertight conveying surface. Made of melt processable rubber (MPR), each module has a permanently molded 1.5-inch high rubber convolution. Stiffeners in each module provide a flat surface on either side of the convolution and a permanent 20-degree troughing angle to both sides of the belt module. Flanged edges run parallel to the flat surface on either side of the transverse convolution. When the flanged edges are bolted together, a continuous belt surface is formed. This open conveying surface has a series of rectangular compartments with sloping ends, formed by the belt's troughed sides and transverse convolutions. The belt pans prevent excessive movement of products being conveyed despite belt speed, angle of incline or the degree of turning.

The belt's flexible, transverse convolutions permit it to make horizontal and helical turns. In turns, the convolutions on the inner side of the belt compress while those on the outer side expand. The convolutions also aid in self cleaning. Passing over the conveyor's discharge terminal, the rubber convolutions allow the belt to be

NATURAL CRADLES (PANS) are formed between the convolutions and 20-degree angles imparted to each side of the belt by stiffeners.



CONVOLUTIONS FLATTEN AS the belt passes over the drive terminal, permitting sticky material to be scraped from the surface.

stretched flat so dry material falls from the flattened surface naturally. Sticky material can be scraped from the tough, smooth surface of the MPR belt.

Continuous Path Conveyors won't necessarily spell the end for conventional belt conveyors. They supplement and broadly expand the "tools of transportation" available to engineers and other plant personnel. The competition hardest hit by the convoluted belt conveyors are the conventional flat belt (or, troughing) units. Driven by pulleys, the conventional conveyors employ the traditional, endless belt supported on the carrying side by trough idlers and on the return side by return idlers.

Attempts to overcome the limited two dimensionality (18 degree inclining) of belt conveyors led to variations of this type. Troughing of the belt was reduced or eliminated, and a variety of attachments were added to enable the belt to exceed 18 degree inclining. Cleats or cross-flights were attached to prevent material movement on inclines. Also, corrugated side walls were attached to prevent material from falling from the sides of the flattened belt. All three devices, in certain cases, do increase inclining capabilities. Very serious drawbacks, however, include the increased maintenance and repair necessary as a result of their use. The most serious drawback though — since the cleats and cross-flights added to the belt all remain vertical — is that the belt cannot be scraped. Also, "plows" cannot be used to discharge material from the side since the belt surface is no longer flat; this cancels one of the few advantages of a conventional flat belt conveyor.

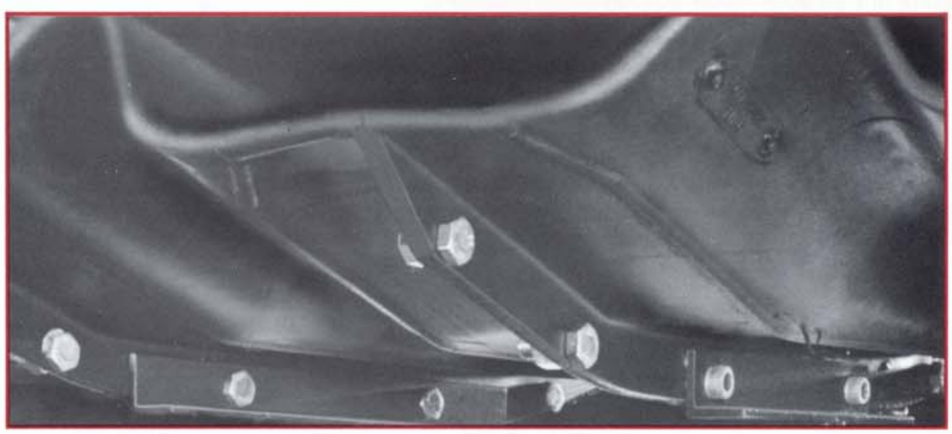
Continuous Path Conveyors, on the other hand, provide a flat surface at the discharge terminal. As the belt passes over the terminal, the convolutions permit it to be stretched flat. Dry material will fall naturally from the flattened surface. Sticky material — up to 99 percent on the first pass — can be scraped from the belt. And, since the Continuous Path Conveyors do not require idlers to support the belt on its return run, there is no threat of contamination to other parts of the system by the small amount of material missed on the first pass.

Other variations utilizing the conventional belt type conveyor include a take-off on the old European double belt elevator. Essentially, this is one conveyor on top of another with the facing belts of each sandwiching the material in the middle. Once it is sandwiched between the facing belts, special tensioning rollers on each side compress the belts to hold the material in the center. In this manner, this type of system seeks to attain vertical and horizontal capabilities. Another variation is one in which a cleated flatbelt with rigid sidewalls and a similar conveyor (without cleats) form a "sandwich" to obtain maximum vertical lift for bulk materials. Both of these variations suffer from all of the faults of conventional flat belt conveyors, faults which include leakage and contamination of return idlers.

Continuous Path Conveyors — in those applications fitting their speed and load capacities — hold a commanding edge over other types, or combination of types, of conventional conveyors. This is due primarily to the horizontal turning capabilities which give them full three dimensional conveying capability.

The present maximum load capacity for Continuous Path Conveyors is approximately 400 tons per hour. Maximum speed is approximately 100 feet per minute. Lengths range up to 500 feet with standard belt widths of 20″, 26″ and 32″. ■

EIGHT-INCH BELT PANS are formed by bolting together individual modules, each having a 1.5-inch high rubber convolution.



The World Leader In Continuous Path Conveying

SERPENTIX®
CONVEYOR CORPORATION
9085 Marshall Court • Westminster, CO 80030
303/430-8427 • FAX 303/430-7337