



Precision Conveyance

Providing precise product placement
with the ease and cost effectiveness
of a belt conveyor

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By:

Michael Hosch, P.E.

Director of Product Development

Dorner Manufacturing Corp.

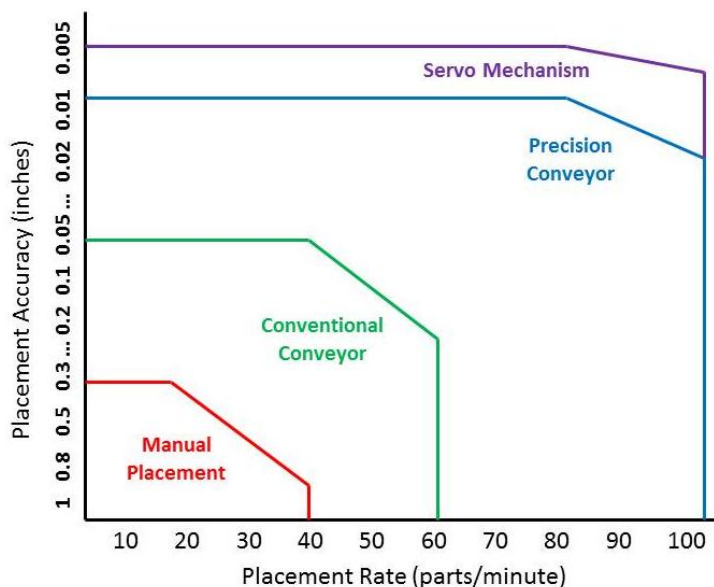


Precision Conveyors are a new category of belt conveyors used in applications when precise product movement or placement is required. Examples of these applications include; wide or sheet part handling, product elevation, robotic picking / box filling and automated assembly. Precision Conveyors are a significant technology advancement in the belted conveyor industry providing a low cost alternative to complex placement systems.

The need for precision in automation varies dramatically on the process to be performed. Hence the tool or device to perform that operation has various degrees of precision that are required. Certainly it then makes sense that a mechanism that is required to be less precise would also be less costly to purchase and implement then a mechanism that is required to be more precise.

The following chart illustrates the methods of product positioning and the associated precision or repeatability that can be accomplished at a specific cycle time. For example the least precise method of product positioning is manual part placement. With manual product placement you can expect on average a $\pm 1/2"$ repeatability with a cycle time of about 30 parts/min. The most precise method is a servo mechanism or pick and place. With the servo driven mechanism you can achieve on average $\pm 0.010"$ repeatability with a cycle time of 100 parts/min or more.

Product Positioning Accuracy by Various Technologies:



There are other technologies/methods available providing an increasing capability of product placement accuracy along with a varying cost to implement and operate. The technologies include a conventional industrial conveyor, a metal belt precision link conveyor, and the newest technology, a precision belt

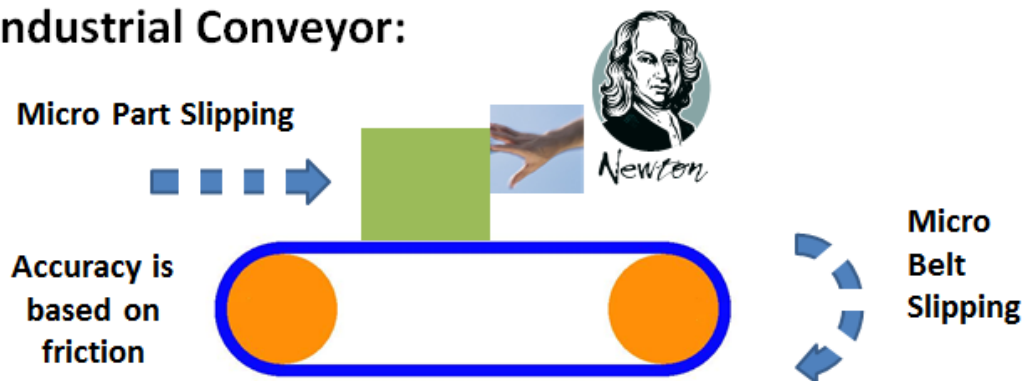


conveyor. With a precision belt conveyor you can achieve placement accuracies of 0.020" at a rate of 100 parts/min. This new technology provides the benefit of accuracy without the cost or complexity of a robotic system or precision metal belt. In addition, it greatly opens up the capability versus a traditional industrial belt conveyor. Detailed application information is provided below, but first let's look at what makes a Precision Conveyor different.

How is a Precision Belt Conveyor Different?

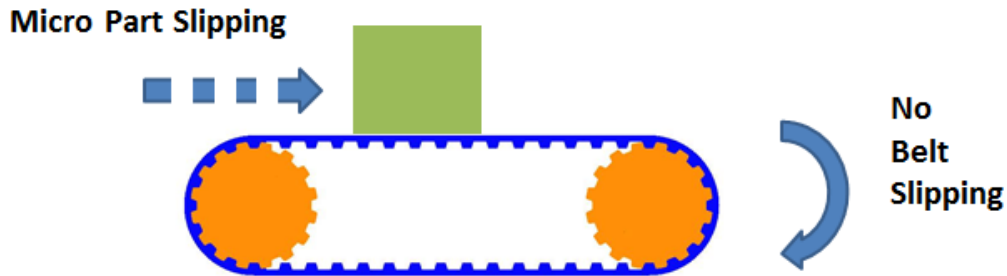
To understand the improvements of a Precision Conveyor you need to look first at the shortcomings of an industrial belt conveyor. An industrial belt conveyor is driven entirely by friction. The drive roller moves the belt by friction and the product moving on the belt also is held in place by friction. Due to these limitations when using these conveyors in an indexing or positioning application there can be micro slipping at both points. This slipping is caused by the inertia of the conveyor belt and product itself along with the application of Newton's second law, "Objects at rest tend to stay at rest." This slipping then causes inaccuracies in product location which limits its use for indexing applications.

Industrial Conveyor:



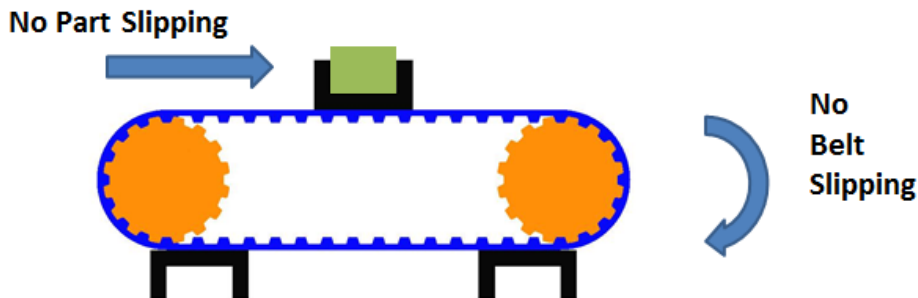
A Precision Conveyor eliminates the conveyor belt slippage by using a positive drive toothed conveyor belt (shown below) to effectively lock the belt position to the end rollers. The base version of a Precision Conveyor still uses a conventional friction surface to locate the product to be moved. As a result, there still exists micro slipping that can take place between the product and the belt but half of the inaccuracies have been removed versus an industrial belt conveyor. Typical placement accuracy of +/- 0.020" can be achieved with a base version of a Precision Conveyor.

Precision Conveyor:



The second platform of precision conveyance is Precision Conveyor with Fixtures. This platform contains moving fixtures or pockets added to the conveyor belt, as illustrated below. These pockets hold the product in place to eliminate any slipping that may occur between the conveyor belt and product. In the Precision Conveyor with Fixtures, both points of inaccuracies when compared to an Industrial Conveyor are eliminated. Yet the base technology cost increase is not overwhelming. It is still a base industrial conveyor design with the addition of high performance timing belt and the conversion of friction drive rollers to timing belt sprockets. The typical placement accuracy of $\pm 0.010''$ can be achieved with a fixture version of Precision Conveyor.

Precision Conveyor With Fixtures:



Precision Conveyor Applications:

Precision Conveyors excel at applications where traditional industrial conveyors fall short. The majority of these applications require precision belt movement to ensure products move evenly, stay in place, or spread out by use of speed changes. The most common use of a Precision Conveyor is a common drive arrangement, where two or more parallel conveyors are driven by one motor and are spread apart to allow access to the center of the product. This is used in wide part handling, sheet handling, inspection, bottom labeling and assembly automation applications.



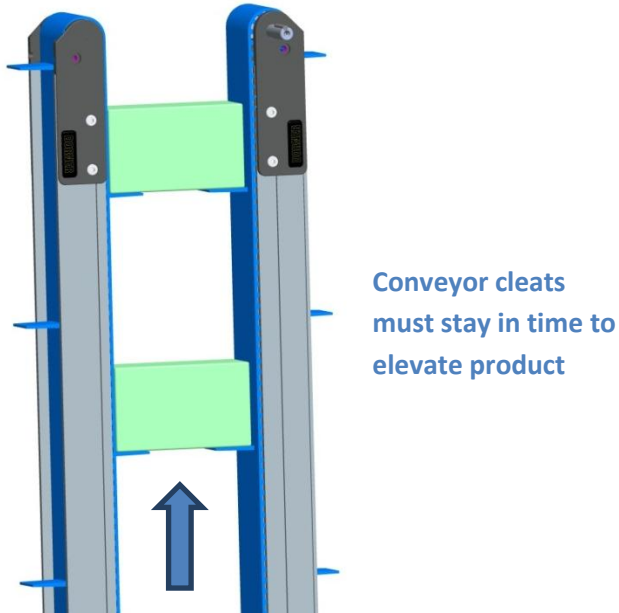
Precision Conveyor Common Drive:



The problem with using Industrial Belt Conveyors in this application is there is no way to ensure that the two belts are running the same speed and it is possible for the product to skew as it runs down the length of the conveyor. With Precision Conveyors the belts are positively driven and you are ensured that they will stay in time and at the exact same speed.

Another application for Precision Conveyance is pocket timing or elevation. In this application you also have two conveyors but they are vertical and spaced apart for the elevation of product. The conveyors have cleats or flights attached to the belts. These flights need to stay in time to accurately and evenly elevate the product. This is a space saving and cost effective means of elevating product from one level to another. It can also be used for product storage / buffering.

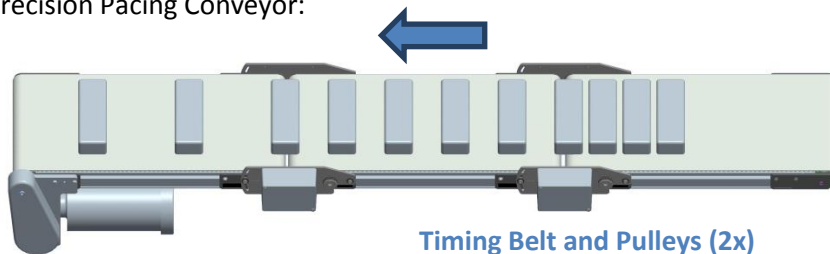
Precision Cleated Elevation Conveyor:



To perform this application with a traditional belted conveyor would be very costly. Complicated timing electronics and programming would be required. This application is easily and cost effectively done with a Precision Conveyor. No added electronics or timing verification is needed. By common driving the conveyors off of one motor the positive drive belting will ensure that the cleats stay in time and level within the given accuracy of the system.

The final example for Precision Conveyors is also driving multiple conveyors with one motor but in this application they are be driven end to end versus side by side. This is called slave driven conveyors. In a slave driven application you get the cost benefit of one motor to drive multiple conveyors. Also by connecting each conveyor through a timing belt and pulleys you can achieve different belt speeds on each conveyor. This creates a pacing conveyor as shown below using just 1 motor. A pacing conveyor takes product in on the first conveyor and through changes in belt speed separates the product with precise gapping.

Precision Pacing Conveyor:





An Industrial belted conveyor cannot be effectively used for this application because in each case you are attempting to drive the second conveyor off of the idler end of the first conveyor. The friction nature of the industrial unit will make this very inconsistent and sensitive to belt tension. The positive drive of the Precision Conveyor eliminates that concern as the precision conveyor belt is capable of transmitting power at both the drive and idler sprockets. The Precision Slave Driven Conveyor eliminates extra drive components significantly reducing complexity and saving cost.

Precision Conveyor with Fixtures Application:

The Precision Conveyor with Fixtures provides the greatest degree of accuracy capable in a belted conveyor. It combines an accurate timing conveyor belt with an attachment system to locate fixtures along the length of the belt (see image below). The timing belt has virtually no stretch (less than 1 mm per meter of length), and the attachment system uses the tooth technology to provide placement accuracy of 0.005". This belt system is controlled by conveyor end sprockets and an integrated servo gear motor. The combined system accuracy of the components along with the response time of the controller achieves a full package accuracy of ± 0.020 " at 100 indexes per minute.

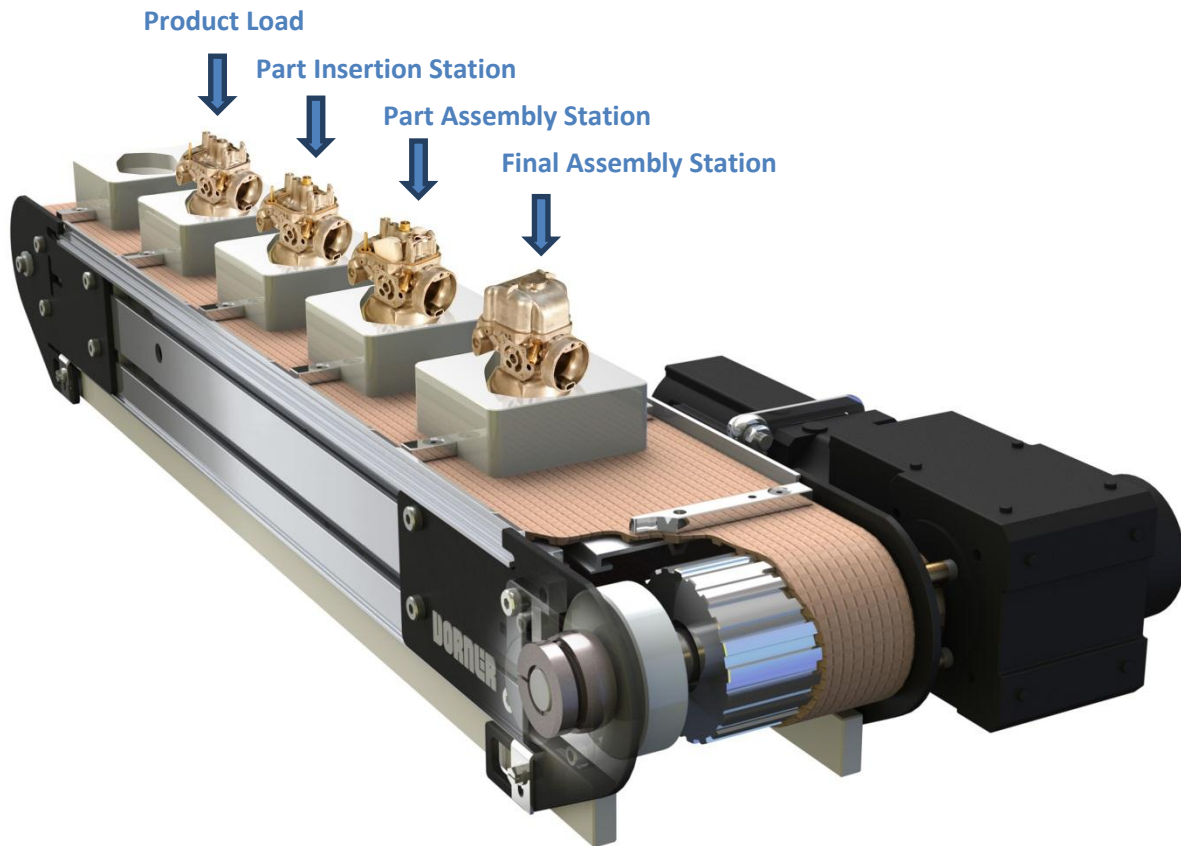
Fixture Attachment System:



The high degree of accuracy along with the flexibility of the conveyor provides a platform that is well suited for automated assembly applications. In these applications multiple operations are taking place on a given product to generate the final assembly. These operations may include; robotic product loading, fastening, labeling, gluing, ultrasonic welding, wiring and testing. The operations are performed in a synchronous manner with a given distance between assembly stations. The Precision Conveyor indexes from station to station and is required to maintain a high degree of accuracy to work along with the assembly operations. At the last station a robot or operator removes the product from the fixture and the empty fixtures go back to the first operation attached to the return belt.



Precision Conveyor with Fixtures Example:



In today's manufacturing environment the need for precision and flexibility is key. Product life cycles are shorter and the varieties or sizes of a given product are often many. Running multiple product types/sizes through an automated assembly machine is a given. The design of the Precision Belt provides the flexibility to make this possible. Fixtures can be easily removed and exchanged for other product sizes. Multiple fixture locations can be provided on the belt giving flexibility of multiple fixture locations and varying index distances.

The advancement of belt and conveyor technology has generated a new class of belted conveyor, Precision Conveyance. This conveyor platform allows an economical belt conveyor technology to solve once difficult movement and placement problems.



For more information on Precision Conveyance, contact Dorner Mfg Corp or visit www.dorner.com and

see the  web page.