

Tubular drag conveying: A cost-effective, energy-saving alternative to pneumatic conveying

Krzysztof Matuszewski
Joe Zerbel

Harman Europe
Harman

A tubular drag conveyor can provide advantages over a pneumatic conveying system in many dry bulk solids handling applications. After describing the tubular drag conveyor's components and operation, this article details the conveyor's advantages and provides guidance in selecting the conveyor.

管式牵引输送机: 一个比气压输送廉价节能的选择在处理多种干颗粒固体材料时, 管式牵引输送机比气压输送机更优越。本文将介绍其优越性并提供其组成和操做的信息。

空気輸送装置に変わる経費効率の高い、エネルギー節減形のチューブラコンベヤ

チューブラコンベヤは乾バルクを扱う際、空気輸送装置に対し有利な点があります。この記事ではそれらの長所とチューブラコンベヤの構造とオペレーションについて説明しています。

Transport par convoyeur tubulaire de câble: une alternative au transport par convoyeur pneumatique permettant des économies d'argent et d'énergie

Un convoyeur tubulaire de câble peut présenter des avantages par rapport à un système de convoi

pneumatique dans de nombreuses applications de transport de matériaux secs en vrac. Cet article décrit ces avantages et fournit des informations sur les composants et le fonctionnement d'un convoyeur tubulaire de câble.

Cintas transportadoras tubulares: Una alternativa rentable y eficiente a las cintas transportadoras neumáticas

Las cintas transportadoras tubulares ofrecen ciertas ventajas sobre las cintas transportadoras neumáticas en la manipulación de muchos materiales sólidos. Este artículo detalla estas ventajas y proporciona información sobre las piezas y el manejo de una cinta transportadora tubular.

Röhrenförmige Schleppförderanlagen: Eine kosten effektive, Energie sparende alternative zur pneumatischen Förderung.

Eine röhrenförmige Schleppförderanlage kann bei vielen trockenen eststoffanwendungen, die in Massen gefördert werden, Vorteile gegenüber pneumatischen Fördersystemen haben. Dieser Artikel beschreibt diese Vorteile detailliert, und stellt auch Informationen bezüglich der Bauteile der röhrenförmigen Schleppförderanlagen und ihren Betrieb zur Verfügung.

Pneumatic conveying is often considered the standard solution for transferring materials in bulk solids plants. In many applications, however, a type of mechanical conveying — tubular drag conveying — can be a more cost-effective solution.

Like a pneumatic conveying system, the tubular drag conveyor (also called a *tubular drag chain conveyor*)¹ provides enclosed conveying and can be custom-designed to handle short or long conveying distances, multiple material feed and discharge points, and a range of material and process requirements. But the tubular drag conveyor has an important advantage: It requires far less energy than a pneumatic conveying system.

The tubular drag conveyor's lower electrical power consumption means it has much lower operating costs — and a much lower long-term ownership cost — than the pneumatic

conveying system. To understand this and other tubular drag conveyor advantages over pneumatic conveying, let's start by looking at the conveyor's components and operation.

How the tubular drag conveyor works

The tubular drag conveyor, as shown in Figure 1a, consists of a tubular housing that encloses a continuous chain mounted with circular discs called *flights*. The flights are attached to the chain at regular intervals, as shown in Figure 1b. The housing forms conveying and return legs that can be arranged in any of several configurations to suit your application. The conveyor can have one or multiple material inlets and outlets.

A drive sprocket inside a drive assembly engages the chain at the turn located at the conveying leg's end; a motor

Figure 1

Tubular drag conveyor**a. Example configurations****b. Flights on chain inside tubular housing**

with a variable-speed drive powers the drive sprocket. In a conveyor that has a complex layout with multiple bends, some bends can be equipped with turn assemblies.

In operation, material enters the inlet (or inlets) and, as the drive sprocket pulls the chain through the housing, the material is picked up and gently conveyed in the spaces between the flights. The conveyor can move the material in any direction, including horizontally, vertically, at any angle, and around corners. The material is carried to the outlet (or outlets), where it falls by gravity out of the conveyor. As the drive sprocket turns, the chain moves continuously through the housing, around the drive sprocket, and along the return leg. The chain provides high torque while moving at low speed, allowing it to operate with very little noise. The close clearance between the flight edges and housing walls prevents material from building up inside the conveyor.

More about the chain and flights. The chain and flights are available in various materials to suit your application. The chain can be constructed of carbon steel or stainless steel and is available in several types, including round-link, rivetless, seal-pin, and others. The flights can be made of ultrahigh molecular-weight polyethylene (UHMW-PE), polyurethane,

nylon, cast iron, ductile iron, stainless steel, and other materials. UHMW-PE flights are recommended for most applications because they're durable yet lightweight, they have a low cost, and they provide quick release of sticky materials, without wearing the conveyor bends and housing like steel or iron flights can.

More about the housing. The tubular housing can be made of carbon steel or stainless steel and is available in various diameters between 76 and 305 millimeters (3 and 12 inches). Which diameter best meets your needs depends on your required conveying capacity. Housing sections are provided in lengths to suit your conveyor's layout and have bolted and gasketed flanged ends to allow easy field installation and maintain the conveyor's tight seal.

More about conveying capacity. The tubular drag conveyor can move material at up to 1.416 m³/min (50 ft³/min). The conveying capacity depends on the tubular housing diameter, the distance between flights, and the chain speed. Average material conveying capacities are shown for each housing diameter in Figure 2. However, be aware that the recommended conveying speed for a given application varies with the material type, and this will affect the conveyor's actual conveying capacity.

Consuming far less energy

The tubular drag conveyor requires much less power, making it much cheaper to operate than a pneumatic conveying system. The pneumatic system has several components that require a large amount of electrical power. The large motor for the system's fan or blower consumes most of this power. If the system operates in dense phase, it has a pressure tank that requires a large amount of compressed air — another major energy draw. Motors for the system's rotary valves require additional power. More electrical power is drawn by the compressed-air system supplying filter-cleaning air to the system's filter-receiver.

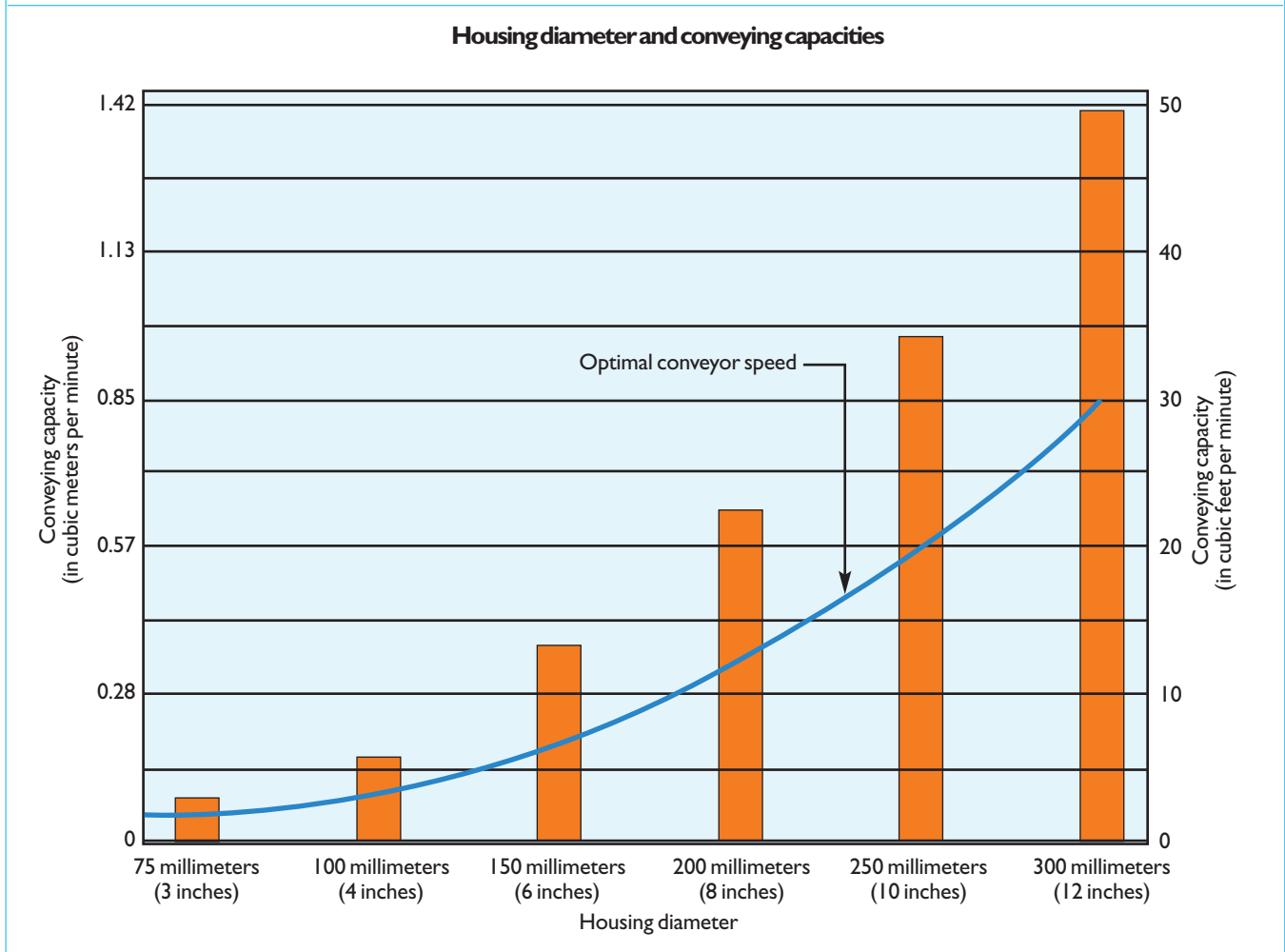
In contrast, the tubular drag conveyor typically has one small motor for its drive assembly. The motor's variable-speed drive also mitigates spikes in energy use, reducing the conveyor's overall energy requirement. As an example, the fan in a high-capacity pressure pneumatic conveying system can require a 100-horsepower motor, while the tubular drag conveyor's drive assembly would require only a 15-horsepower motor to provide the same capacity.

More advantages

Besides consuming less power, the tubular drag conveyor has other advantages over a pneumatic conveying system.

Slow, gentle handling. Material is moved more slowly in the tubular drag conveyor than in a pneumatic conveying system. Because the material is conveyed in the spaces between the flights, it's also handled gently. This slow, gentle movement keeps blended materials from segregating and prevents degradation of fragile or friable materials.

Figure 2



Tolerance for tough materials and fluctuating environmental conditions. Because the material is carried between the flights, it's much easier to convey sluggish, sticky materials and easily compacted materials in the tubular drag conveyor than in a pneumatic conveying system, where such materials can form plugs. Fluctuating temperatures and humidity also have less effect on the tubular drag conveyor's operation than on that of a pneumatic conveying system.

No filters. Very little air (or other gas) moves through the tubular drag conveyor, so it doesn't require filters. A pneumatic conveying system requires a filter-receiver and other filters at various points in the system.

Lower inert gas requirement. The minimal amount of gas moving through the tubular drag conveyor provides another advantage: In an application that requires blanketing a flammable or explosive material with an inert gas such as nitrogen, the tubular drag conveyor uses a fraction of the inert gas consumed by a comparably sized pneumatic conveying system.

Less noise. The tubular drag conveyor's small motor and slow conveying speed make it much quieter than a pneumatic conveying system. The pneumatic conveying system's large fan or blower motor and other motors produce a lot of noise. More noise is created by the intermittent blasts of compressed air for

the filter-receiver's cleaning system and, for a dense-phase system, compressor operation for filling the pressure tank.

Less maintenance. Because the tubular drag conveyor has far fewer components, it requires much less maintenance than a pneumatic conveying system. With the pneumatic conveying system, the system fan or blower, rotary valves, and filter-receiver (and its filter-cleaning system) all require regular maintenance. With the tubular drag conveyor, maintenance workers will need to replace the flights at intervals that depend on the application, and also minimize slack in the chain, ideally about once a month. (Be aware that while some tubular drag chain conveyor suppliers offer automatic chain-tensioning devices, tensioning the chain can accelerate flight wear and increase the conveyor's amp draw and power consumption.) The tubular drag conveyor's slow conveying speed also extends the conveyor life. Less maintenance means the tubular drag conveyor can operate more reliably with less downtime and lower labor costs.

Modular construction. Most tubular drag conveyors have modular construction with interchangeable components that allow the conveyor to be easily expanded or reconfigured to change the length, conveying path, and the number of inlets and outlets. Such changes are more complex and time-con-

suming with a pneumatic conveying system because it has many more components and more electrical connections.

Some selection guidance

For help choosing a tubular drag conveyor to handle your unique material and process requirements, partner with the conveyor supplier. You'll benefit from the supplier's many years of experience in designing tubular drag conveyors to handle a wide range of tough materials and operating conditions.

Start by providing information about your material's characteristics, especially particle size, bulk density, and flow properties. The supplier will also need to know application details such as your plant's available floor space and headroom, how your material will be stored prior to conveying, the distance your material will be conveyed, the available energy source, and similar information. A key part of this process is to have your material tested in a tubular drag conveyor in the supplier's lab. Based on the test results, the supplier can help you determine which conveyor components and options are right for your application.

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Reference

1. Other sealed tubular mechanical conveyors are also available, including tubular drag cable conveyors and aeromechanical conveyors. The tubular drag cable conveyor operates similarly to the tubular drag chain conveyor but uses a cable and flights rather than a chain and flights to move the material through the conveyor. The cable moves at a much higher speed than the chain, which can lead to degradation or segregation problems with some materials. The aeromechanical (or *aero*) conveyor also has a cable and flights and combines mechanical with pneumatic conveying features; the cable and flights move at high speed, fluidizing the material as aerodynamic effects and mechanical assistance from the flights help move the material through the conveyor. This conveyor is typically limited to use with fluidizable materials. For more information on these conveyors, see the following section, "For further reading."

For further reading

Find more information on tubular drag chain conveyors in articles listed under "Mechanical conveying" in *Powder and Bulk Engineering/International's* article index at PBE/I's website, www.pbeinternational.com) and in books available on the website at the PBE/I Bookstore. You can also purchase copies of past PBE/I articles at www.pbeinternational.com. Find additional mechanical conveying articles listed in *Powder and Bulk Engineering's* article index at www.powderbulk.com.

Krzysztof Matuszewski, managing director
Hapman Europe
Opole, Poland
+48 77 4743850
k.matuszewski@hapman.eu, www.hapman.eu

Joe Zerbel, product manager
for tubular drag conveyors
Hapman
Kalamazoo, MI USA
+1 269 343 1675, ext. 289
jzerbel@hapman.com, www.hapman.com