VIBRA SCHULTHEIS

Natural Frequency Conveyors

for handling powdery or granular bulk material

- Long conveying distance per unit
- High specific conveying capacity

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Natural frequency conveyors
Technology

We manufacture natural frequency conveyors with a motor vibrator unit or an eccentric drive for long conveying distances and high conveying capacities.

Natural frequency conveyors consist of a trough or tube and a countervibrating frame that are elastically coupled via helical compression springs (working springs) and linkage springs and excited by a vibrator system (motor vibrator unit or eccentric drive).

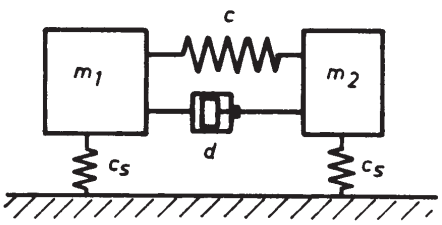

Fig. 2

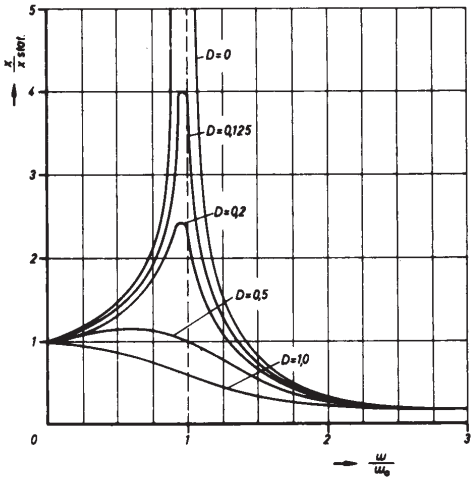

Fig. 3 Amplitude-frequency response

Schematically, the design is equivalent to a two-mass oscillating system (Figure 2), where the masses of the reinforced conveying trough and the countervibrating frame (m1 and m2) oscillate in approximately opposite phases at a given frequency. The supporting springs cs are extremely resilient, thus minimizing the dynamic force acting on the base structure.

The two-mass system is always excited near its natural (resonant) frequency, so that the mass and spring forces are effectively equal and only small driving forces are required to overcome the inevitable damping effects from the material and the product handled.

Compared with shorter conveyors driven electromagnetically or by motor vibrators, a lower operating frequency is generally used to make it easier to solve the dynamic stiffness problem encountered with long conveying distances. A low frequency typically offers advantages such as high specific conveying capacities and the ability to handle even lightweight bulk materials normally characterized by poor conveyability.

Cover photo:
Natural frequency trough conveyor, 1400 mm wide x 26 m long, for handling 100 t/h of sugar

Fig. 6

Fig. 4 Figures 4 and 6 show two natural frequency trough conveyors, 800 mm wide x 26 m long, for handling 50 m³/h of filler

Advantages of VIBRA SCHULTHEIS natural frequency conveyors

- **High specific conveying capacity**
- **Long conveying distance per unit**
- **High sanitary standard**
- **Extremely easy to clean**
- **Stable operation, even with batch feeding and a high concentrated load**
- **Practically no maintenance required in continuous duty**
- **Low operating costs**
- **Very smooth running**
- **Very low dynamic residual forces**
- **Variable conveying capacity**
- **Modular design, free choice of charging and discharging points**

Fig. 5 Trough conveyor, 300 mm wide x 10 m long

Fig. 7
The principle of the natural frequency system is also used to drive vibrating fluid-bed dryers

Design

The mechanical design based on the two-mass oscillating system ensures a vibration-proof structure, even with long conveying distances. The conveying troughs or tubes are made of C-steel, stainless steel, titanium or special materials depending on the application, and are available in an open, closed or gas-tight version. The countervibrating frames are manufactured from sectional steel.

The working springs mounted between the conveying trough or tube and the countervibrating frame are made of hardened and tempered spring steel. They are designed to endure continuous duty and are totally maintenance-free. The natural frequency conveyors are supported or suspended by means of highly resilient spring elements, which transfer only minimal – usually negligible – residual forces to foundations, platforms or ceilings.

Charging and discharge points with manual or remote controlled flaps or slides can be installed anywhere along the conveyor trough or tube.

Natural frequency conveyors are also particularly suitable for incorporating screening sections, heating or cooling zones, or dispensing devices.

A self-synchronizing twin motor vibrator system or an eccentric drive is fitted to the countervibrating frame as a drive unit to excite the vibration of the two-mass system.

The driving elements and the working spring stations mainly have a modular design. On the one hand, this makes them easier to manufacture efficiently while on the other, it gives them the high flexibility required to adapt to a variety of operating conditions. For more information, refer to page 8.

Fig. 8
Dust-tight handling of 30 m^3/h of dextrose over a distance of 13 m

Fig. 10
Natural frequency trough conveyors for handling 50 m³/h of potato chips

The kind of drive system is characteristic of the two series described below:

Series RR-DV natural frequency conveyors with motor vibrator unit and frequency converter

The self-synchronizing motor vibrator unit fitted to the end face of the countervibrating frame is operated by means of a frequency converter. It allows the vibration amplitude – and thus the mass flow – to be adjusted within a wide range. The machine can be optimally adapted to the properties of the product to be handled, for instance if the material to be transported is highly sensitive. The drive is additionally characterized by very smooth running and extremely quiet operation.

Series RR-SK natural frequency conveyors with eccentric drive

The eccentric drive with standard three-phase motor and V-belt drive fitted between the countervibrating frame and the conveying trough or tube is largely independent of variations in the superimposed load. It is consequently ideal for transporting materials with a high bulk density or if the product is not fed uniformly.

Fig. 9
Six natural frequency trough conveyors for transporting material between the silos and the loading station

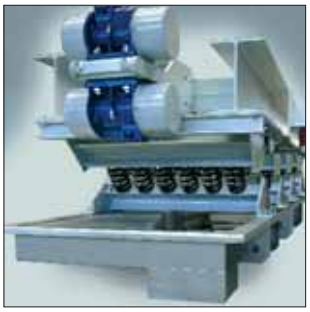

Fig. 11
Natural frequency trough conveyor with top counter-vibrating frame and drive

Sizes / main dimensions*

Series RR-DV

Tube conveyor

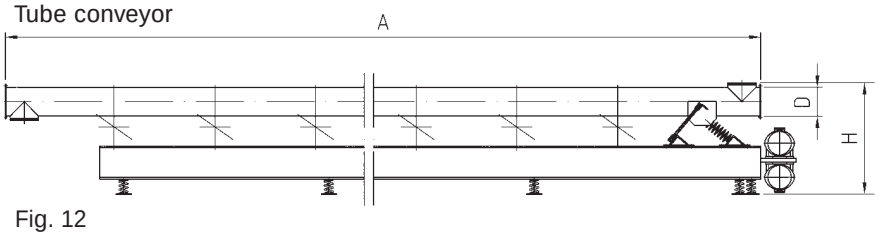

Fig. 12

Trough conveyor

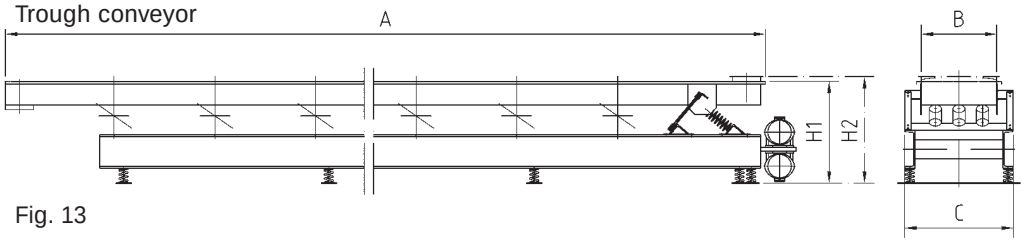

Fig. 13

Tube conveyor				Trough conveyor				
D ø	H	C	A	B	C	H_1	H_2	A
200	1080	560	8-25 m	400	750	920	970	8-25 m
250	1130	610	8-25 m	600	950	920	970	8-25 m
300	1180	660	8-25 m	800	1150	970	1020	8-25 m
350	1280	710	8-25 m	1000	1350	1020	1070	8-25 m

* Guide values

Fig. 14
Two natural frequency conveyors for handling 60 m³/h plastic pellets

Fig. 18
Assembly line for a vibrating conveyor for cereals with an overall length of 80 m

Series RR-SK

Tube conveyor

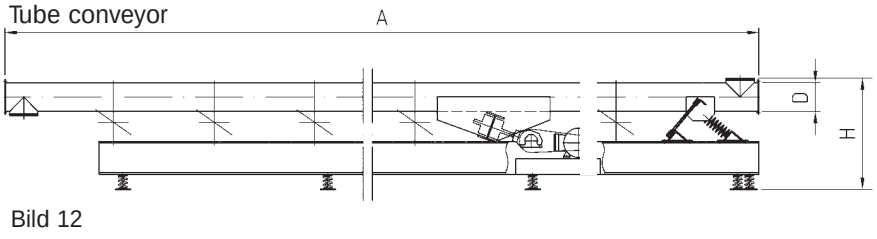

Bild 12

Trough conveyor

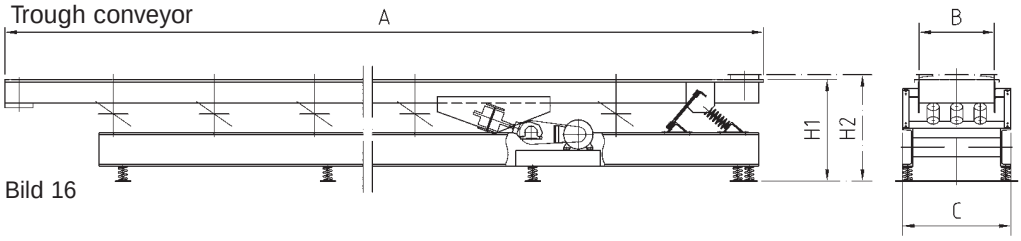

Bild 16

Tube conveyor				Trough conveyor				
D ø	H	C	A	B	C	H_1	H_2	A
200	1080	560	8-25 m	400	750	920	970	8-25 m
250	1130	610	8-25 m	600	950	920	970	8-25 m
300	1180	660	8-25 m	800	1150	970	1020	8-25 m
350	1280	710	8-25 m	1000	1350	1020	1070	8-25 m

Fig. 17
Part of a 200 m long conveyor system for glass fibers

Fig. 19
The modular design allows the conveying line to be subsequently extended if required

Modular design

In both the chemical and the food industries, vibrating conveyors are required to handle high conveying capacities – and often also long conveying distances – in connection with logistical tasks between the production and packaging lines. Freely configurable branching devices in the form of remote controlled slides, flaps, or diverters are necessary to achieve the desired distribution of the product stream between different packaging lines. Right from the outset, the conveyor is expected to be sufficiently flexible to adapt to extensions or new conveying distances depending on future requirements. These requirements are optimally met by natural frequency vibrating conveyors with a modular design, in other words with interchangeable drive, spring, and intermediate discharge units.

The working spring stations are implemented as standardized units. The linkage is integrated in the stations. Both the motor vibrator unit and the eccentric drive are supplied as preassembled units.

Fig. 20 Spring station

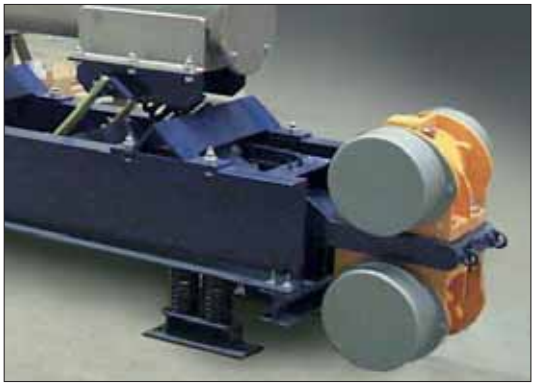

Fig. 21 Motor vibrator unit

Fig. 22 Eccentric drive

Fig. 25
Flap element flanged into the conveyor trough

Discharge elements

Standardized flap and slide mechanisms are used as discharge elements. The various possible types are illustrated and explained in Figures 23a to 23d.

Conveying direction →

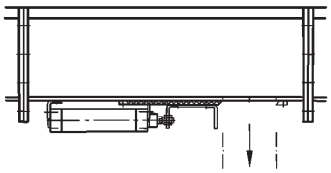

Fig. 23a:
Discharge slide – low-dust or dust-free, low overall height

Conveying direction →

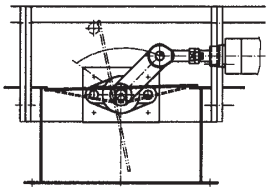

Fig. 23b:
Discharge flap - suitable for granular material, non-dust-tight

Conveying direction →

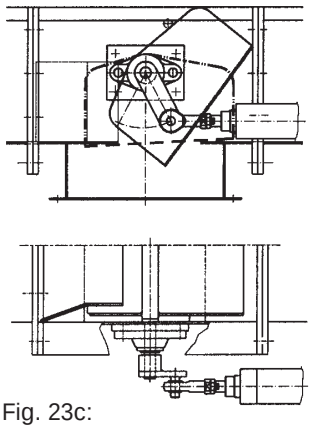

Fig. 23c:
Discharge flap - suitable for powdery or granular material, only fine dust is lost

Conveying direction →

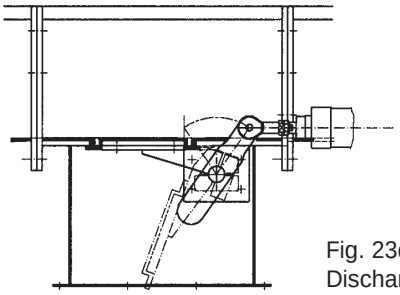

Fig. 23d:
Discharge flap - dust-tight

Fig. 24 Continuously adjustable, pneumatically operated weirs for lateral discharge

Fig. 26 Multiple-track trough conveyor with nine discharge flaps for feeding packaging machines

Fig. 27

Examples

Fig. 28 Figures 27 and 28 are partial views of a machine with water-cooled natural frequency trough conveyors for cooling 15 t/h of roasted product down from 800°C

Fig. 29
50 m³ of potato chips per hour are supplied to the packaging machines by means of a natural frequency system with an overall length of 120 m

Fig. 32
Conveyor for handling raw cherries in a cannery

Fig. 30 Discharging from silos

Fig. 31
20 m long natural frequency conveyors for handling 40 t/h of steamed rice

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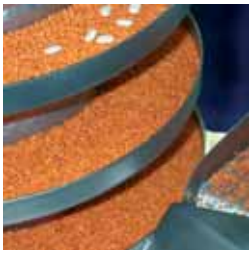


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