VIBRA SCHULTHEIS

Vibrating Spiral Conveyors

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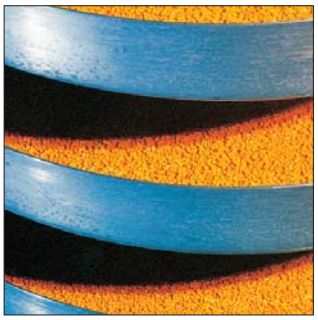


Vibrating spiral conveyors

General

The vibrating spiral conveyors that are increasingly used in mechanical and thermal processes convey bulk material upwards on an inclined plane by means of micro-throws. In contrast to linear vibrating conveyors, the product on the transport track of a spiral conveyor follows a helical path.

The main advantages of vibrating spiral conveyors are related partly to the ease of cleaning and hygienic mode of operation and partly to the simplicity with which processing effects can be integrated into the conveying process. The long conveying distances and the correspondingly large surface area that is in contact with the transported material permit high heat exchange values within a very small floor space. This means that other functions such as

cooling, drying, heating, and humidifying

can also be carried out by the spiral conveyor as the product is conveyed.

In most cases, conveying takes place from the bottom towards the top, though in special cases the direction can also be inverted.

The decks can be manufactured with a variety of cross-sectional shapes in order to meet the requirements of the most diverse applications.

Spiral conveyors with heat exchanger decks can be cooled with air, water, or brine or heated with steam or thermal transfer oil, depending on the design.

Type of construction

Vibrating spiral conveyors basically consist of a central tube to which a spiral trough of stainless steel, C-steel, titanium, or another material has been welded. The drive usually takes the form of a pair of maintenance-free vibratory motors, whose unbalance can be continuously adjusted and which are mounted on vibration-resistant brackets at the top or bottom. The spiral column and the vibrator head or base are always joined together by flanges. Support is provided by highly resilient, helical compression springs with good insulation properties. Locating the drive at the top permits a very low feeding height but requires a standpipe inside the central tube to hold the supporting springs at its top end.

Dustproof or gas-tight versions feature metal, rubber, or plastic covibrating jackets. Stationary housings, on the other hand, combine dust protection with effective noise insulation.

Design

The dimensions of the unit depend on the required mass flow, the specific properties of the material being transported, the required heat exchange surface for those applications where this is relevant to the process, and the height necessary or available to lift the material. The design of highly stressed parts is verified with the aid of computerized stress analyses according to the finite element method.

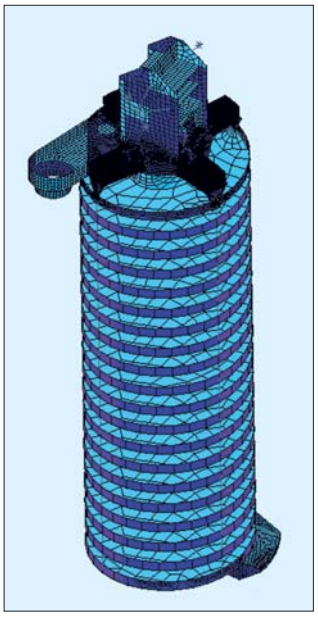


Fig. 4
Structural model of a spiral conveyor

Fig. 5
Our robust DV Series vibrating motors, which are suitable for continuous operation, are used for the drive.

Conveying capacity

The conveying capacity (mass flow) depends on the vibration data (working frequency, vibration amplitude, vibration angle), the geometry of the transport track, and the specific properties of the material being transported. The wide range of potential uses means that the initial calculated design is to some extent based on assumptions, so that for new applications it is frequently verified by means of trials. A number of trial spiral conveyors are available for this purpose at our pilot plant and can also be used for trials carried out by our customers.

The average conveying capacity for different spiral trough widths is given in Table 1, in which it is assumed that the bulk material is easy to convey.

Table 1

Trough width b (mm)	50	145	200	300	400
Conveying capacity Q (m^3/h)	0.5-1.2	2-3.5	3-7	6-14	15-30

Trough sections

The most important cross-sectional shapes of the spiral decks are illustrated in Figures 6 and

Fig. 6: Cross-sectional shapes of the spiral decks

15.
Cross-sections I and III are suitable for simple conveying tasks. Section II is required for heat exchange on drying and cooling spiral conveyors. Section IV is used in special cases, such as when very low mass flows must be conveyed under gas-tight conditions.

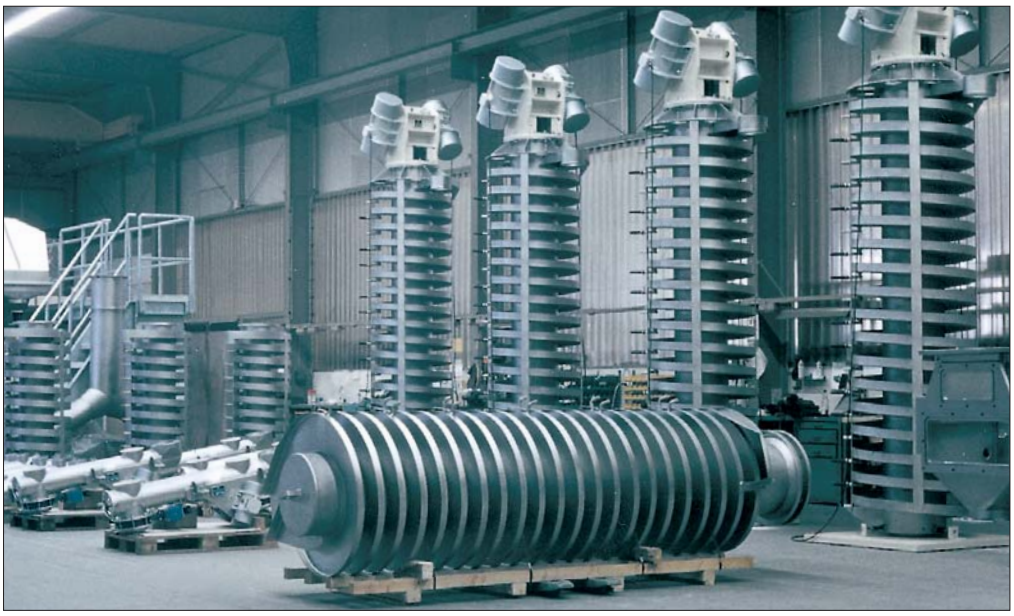


Fig. 7: Final assembly of a spiral conveyor

Fig. 12

Spiral conveyors for cooling and drying tasks are fitted with heat exchanger decks (see page 8)

Dustproof and gas-tight versions

Depending on the specific project requirements, either covibrating dust jackets made of EPDM, neoprene, Perbunan, polyurethane, or stainless steel or stationary housings with or without thermal insulation are offered. The various types of construction are shown in the photographs below.

Fig. 8: Removable dust protection jacket made from stainless steel plate

Fig. 9: Stationary dust protection housing

Fig. 10: Dust protection jacket made from natural rubber

Fig. 11

Spiral conveyor with transparent dust protection and noise insulating housing. The housing consists of two movable halves suspended on rails that can be moved apart for cleaning

Fig. 13
Cooling spiral conveyor, suitable for forklift transport

Sizes and dimensions

Each spiral conveyor is designed in accordance with the technical parameters of the conveying and process task, taking account of the properties of the product, the operating conditions, and the space available for installation. The dimensions quoted here should therefore be considered merely as guide values.

The design of the inlets and outlets is generally adapted to the situation on site. Open chutes or feed plates are commonly used in addition to the inlet connections shown in the dimension drawings.

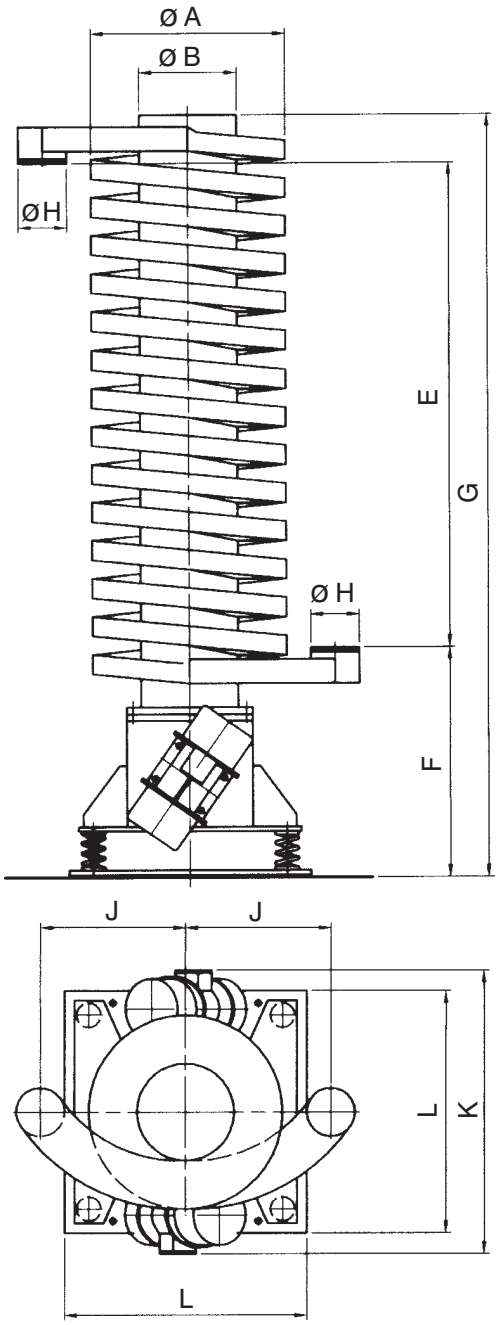


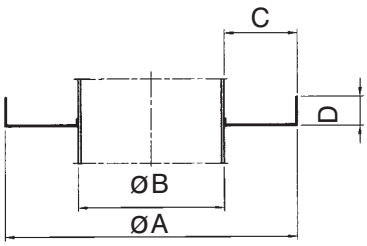
Fig. 14: Spiral conveyor with base mounted drive

Base mounted drive

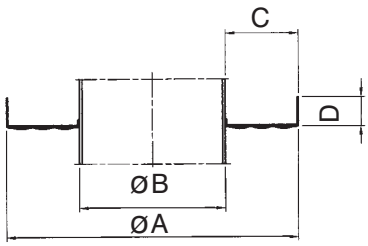
Table 2

A	550	630	700	700	800	900	1000	1100	1200	1400	800
A_1	-	-	-	-	-	-	-	-	-	-	630
B	260	300	300	400	400	400	500	500	600	600	300
C	145	165	200	150	200	250	250	300	300	400	165+85
D	60	80	80	80	80	80	100	100	100	100	80
E	Conveying heights up to 8 m available										
F	750	800	850	950	950	1000	1100	1200	1500	1600	950
G	E+F+150	E+F+150	E+F+200	E+F+200	E+F+200	E+F+200	E+F+250	E+F+250	E+F+250	E+F+300	E+F+200
H	150	150	200	150	200	250	250	300	300	300	x
J	450	500	550	550	600	650	750	800	850	950	600
K	950	1000	1100	1200	1300	1400	1500	1500	1600	1700	1300
L	750	800	900	900	1000	1100	1250	1250	1400	1500	1000

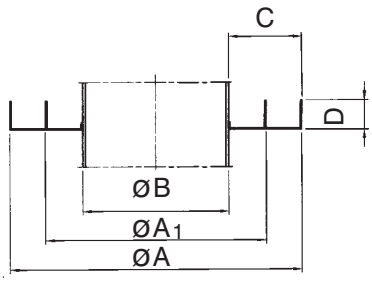
x = As required



Section I

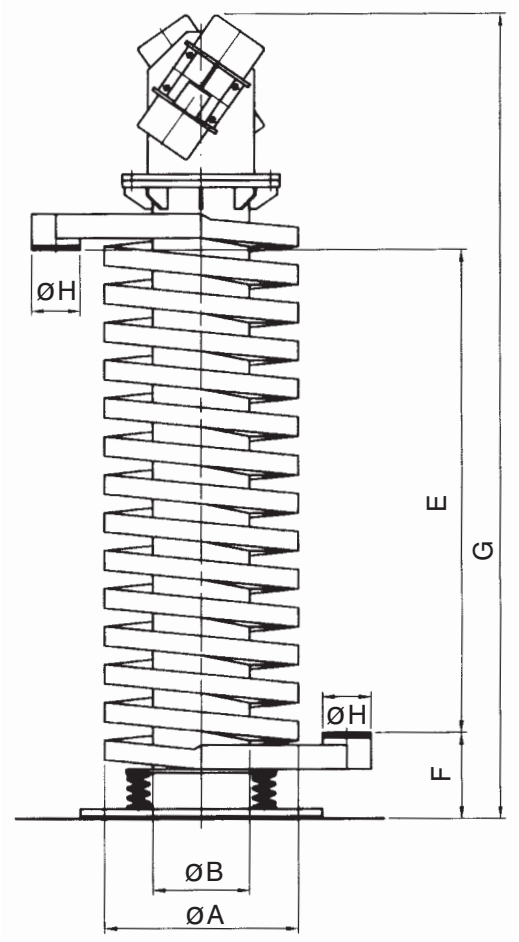


Section II



Section III

Fig. 15: Cross-sectional shapes



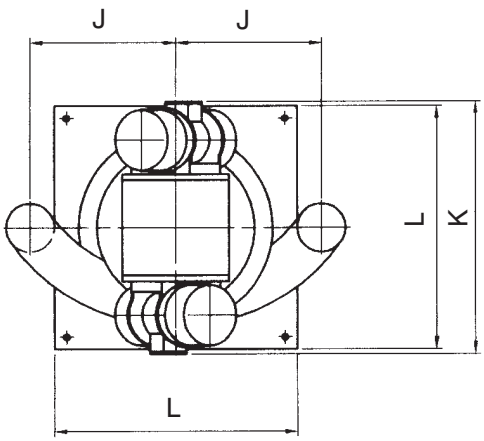


Fig. 16: Spiral conveyor with top mounted drive

Fig. 17
Spiral conveyor with screwed, wear-resistant shells

Top mounted drive

Table 3

A	550	630	700	700	800	900	1000	1100	1200	1400	800
A_1	-	-	-	-	-	-	-	-	-	-	630
B	260	300	300	400	400	400	500	500	600	600	300
C	145	165	200	150	200	250	250	300	300	400	165+85
D	60	80	80	80	80	80	100	100	100	100	80
E	Conveying heights up to 8 m available										
F	300	300	350	350	350	350	350	350	400	400	350
G	E+F+850	E+F+850	E+F+1000	E+F+1100	E+F+1100	E+F+1100	E+F+1250	E+F+1300	E+F+1400	E+F+1600	E+F+1100
H	150	150	200	150	200	250	250	300	300	300	x
J	450	500	550	550	600	650	750	800	850	950	600
K	950	1000	1100	1200	1200	1200	1250	1250	1300	1400	1200
L	750	800	900	900	1000	1100	1250	1250	1400	1500	1000

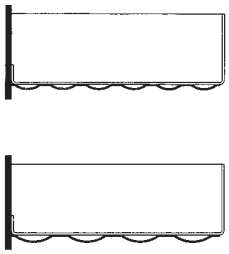
x = As required

Fig. 18
A very low feeding height is possible if the drive is located at the top

Vibrating spiral conveyors as heat exchangers for cooling and drying

To facilitate indirect heat exchange if bulk material has to be cooled or dried during the conveying process, the spiral conveyor is fitted with vibration-proof and pressure- resistant heat exchanger decks for the passage of the cooling or heating medium (Fig.19). If only minimal cooling is necessary, the central tube of the spiral conveyor can be pro-vided with air slots through which cooling air is blown onto the product stream (Fig. 20).

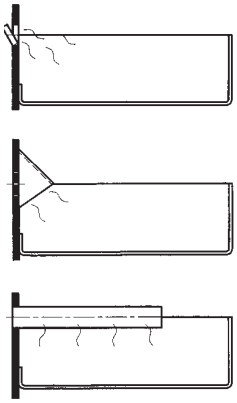
Fig. 19
Water cooling



19.1 Laser-welded heat exchanger deck bowed out to a cushion by hydraulic pressure

19.2 Resistance-welded heat exchanger deck

Fig. 20
Air cooling



20.1 Air slots in the central tube

20.2 Air slots covered over

20.3 Air slots with very good air distribution but restricted accessibility for cleaning

The heat exchanger decks are normally manufactured from two sheets of different thick-ness, which are joined by laser weld points that form a grid pattern. The lower sheet is bowed out to the shape of a cushion by applying high pressure hydraulically to the intermediate space. This creates a pressure-resistant channel through which the heat transfer medium can be guided.

Resistance-welded heat exchanger decks can also be used for special tasks.

Depending on the intended application, water, steam or thermal transfer oil is generally chosen as the heat transfer medium.

Fig. 21
Cooling spiral conveyor, 1400 mm diameter, during manufacture

The **cooling** water is usually supplied by means of feed and return pipes that are fixed to a stand mounted parallel to the spiral column. Specially shaped, highly elastic hoses are employed to make the connection between the pipes and the conveyor.

Fig. 22
Cooling spiral conveyor for plastic pellets

Fig. 23
Cooling water supply for a water-cooled spiral conveyor

Fig. 24
Cooling spiral conveyor for blanks

Natural-frequency spiral conveyor with motor vibrator drive

Fig. 25

Products that are difficult to convey, such as rubber crumbs, can be efficiently handled by special spiral conveyors designed as a natural-frequency system that operates with a large vibration amplitude and a low vibration frequency. These conveyors have two frequency-controlled motor vibrators and manage without any driving elements like gearing, a slider crank, a coupling, or a belt drive. Their main advantage compared to classic systems is the simplified design of the motor vibrator drive. Since they are operated near the natural frequency, they are also distinguished by a very low driving force in relation to the excited mass. A comparatively small motor vibrator size is therefore sufficient.

The spiral conveyor shown in Figure 25 has a diameter of 1500 m and a height of 6.5 m.

Cooling spiral conveyor for pharmaceutical applications

Specially designed vibrating spiral conveyors are ideal for cooling and vertically conveying extruded preliminary products in the pharmaceutical industry.

Fig. 26.1

Fig. 26.2

The all-stainless steel machine shown here (Figures 26.1 and 26.2) consists of a cooling spiral conveyor and two enclosed vibrating trough conveyors for feed and discharge on a shared, mobile base frame.

The machine is completely dustproof. The conveying troughs can be uncoupled from the mounting plates for cleaning in a matter of seconds. The spiral decks are likewise readily accessible for cleaning by removing the jacket. The cooling water connections are positioned such that they do not obstruct the cleaning process. The feeding trough is equipped with a reversible vibrator to enable wasted batches to be removed.

Fig. 27
Trial assembly of spiral conveyors with a stationary dust protection housing

Examples

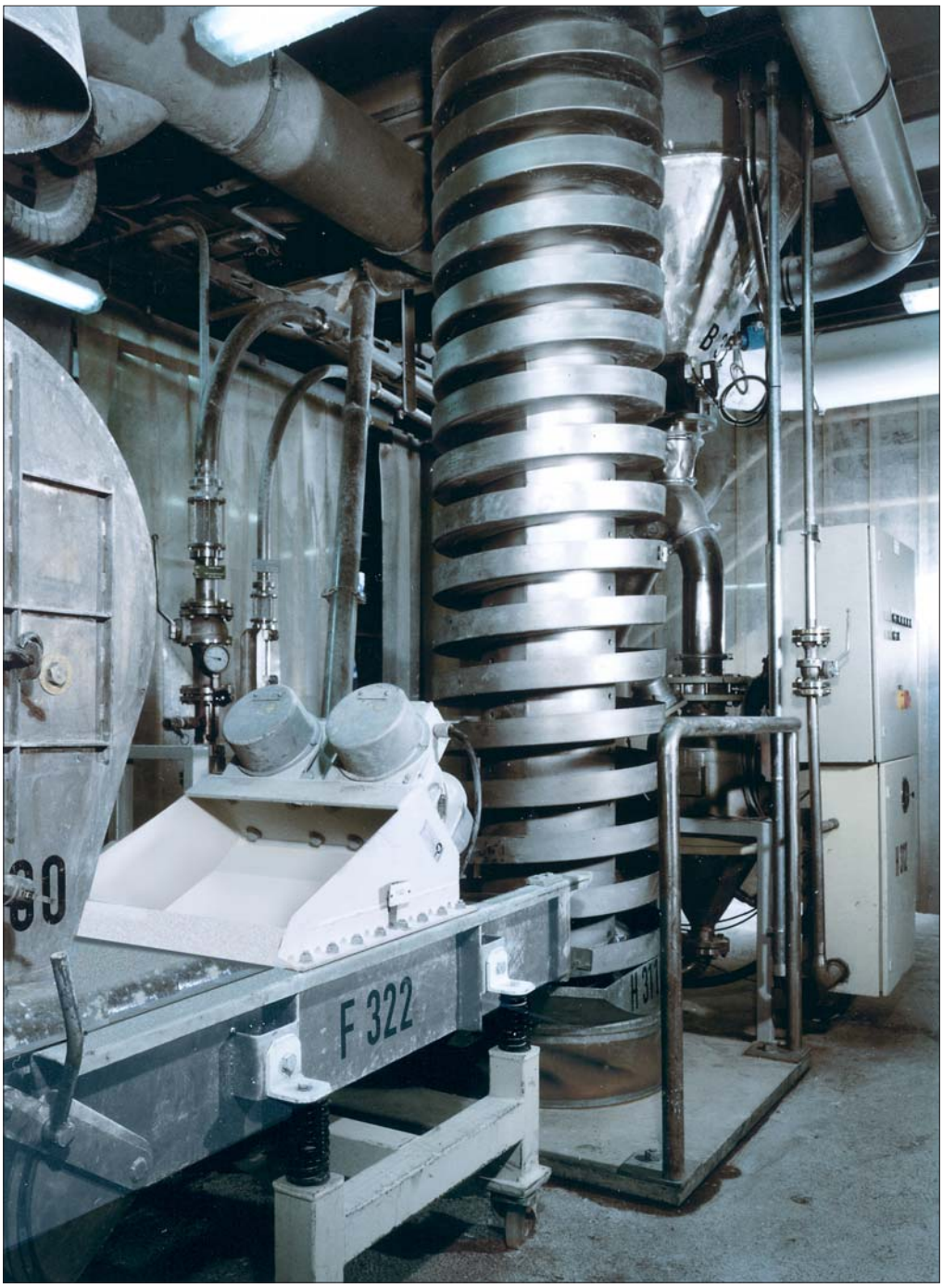


Fig. 28
Cooling spiral conveyor in a chemical plant

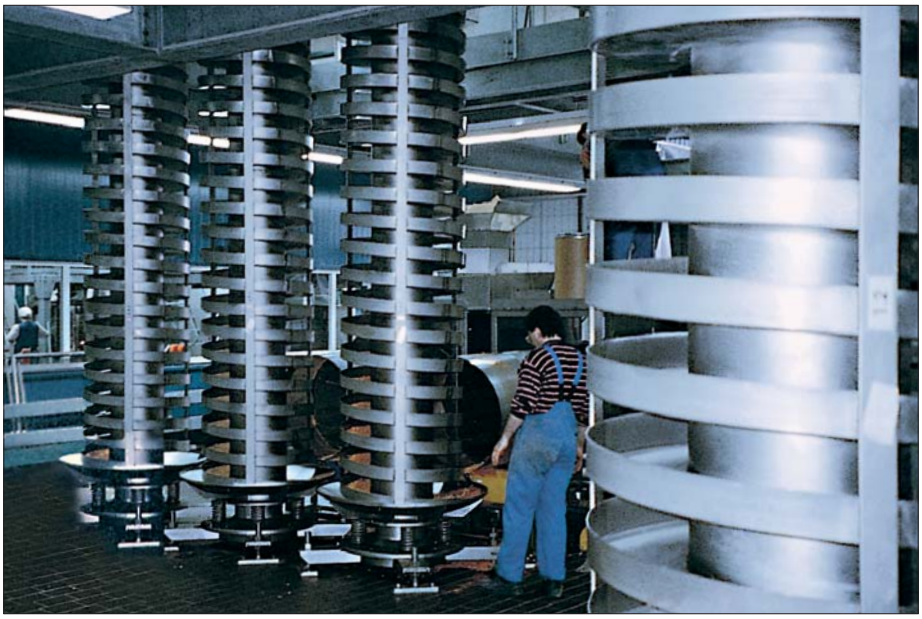


Fig. 29: Four spiral conveyors in a food processing plant

Fig. 31

Spiral conveyor with a stainless steel dust protection jacket

Fig. 30: Eight cooling spiral conveyors in a plastics processing facility

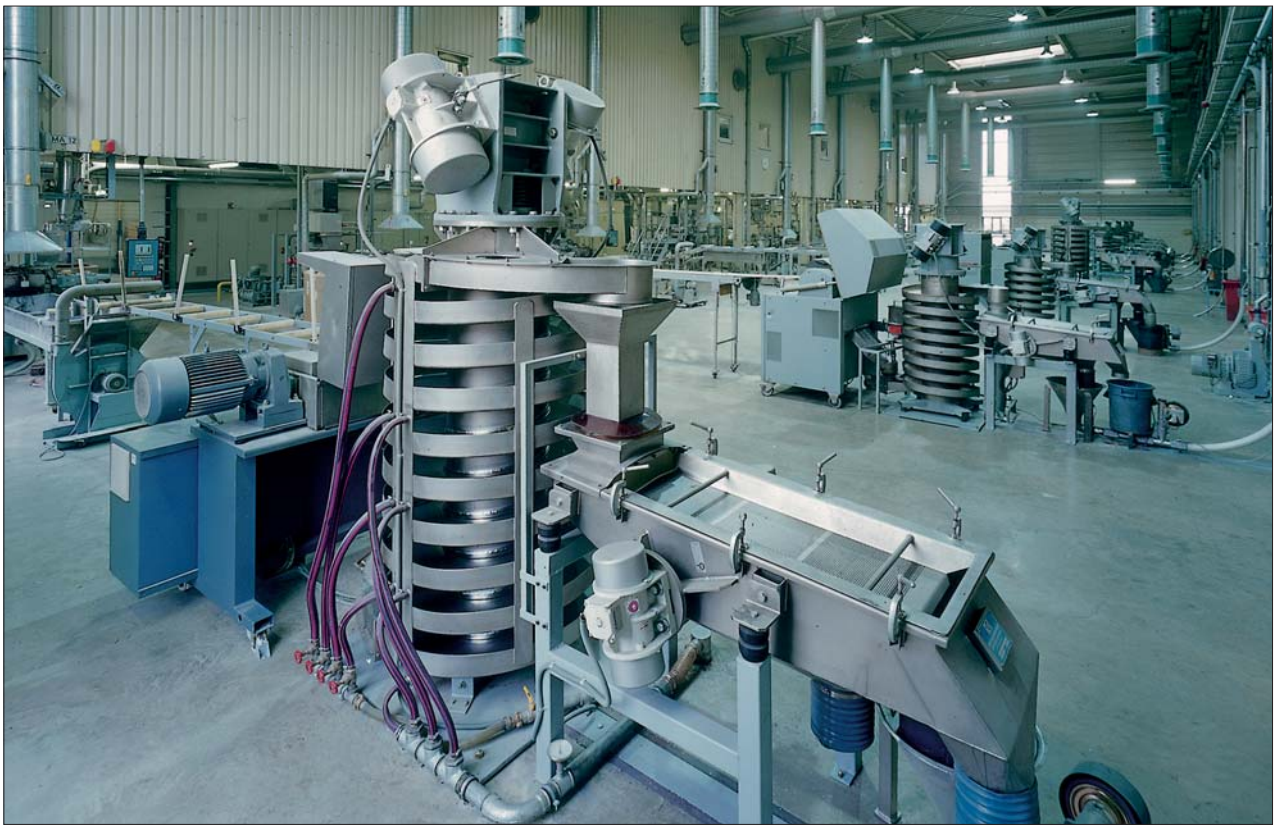


Fig. 32

Spherical products like fried batter balls for adding to soup can also be conveyed to a great height

Fig. 34

Figures 33 to 37 show just a few of the many possible types of construction. All the designs are customized for specific applications but built with standard components such as central tubes, spiral decks, springs, and vibrators.

Fig. 35

Fig. 33

Fig. 37

Fig. 36

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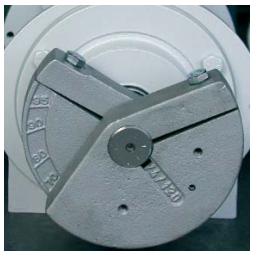




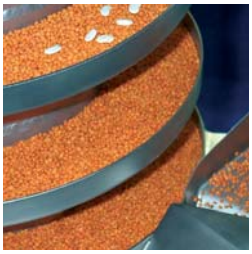


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