Design of Spiral Conveyer in Silo

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Abstract

In order to improve the performance of the dry jet machine and improve the production efficiency, the design is based on some traditional domestic dry jet machines, and some foreign dry jet machines are designed. The labor intensity of a person. Finally, we set up a three-dimensional model, finally realized the optimization of the mechanism of the dry jet machine, reduced the volume and weight of the dry jet machine, extended the service life, and improved the working efficiency and performance of the jetting machine.

Keywords

Dry shotcreting machine, screw conveyance, hydraulic circuit,hydraulic motor.

1. Introduction

The development of screw conveyor can be divided into two types: axial screw conveyor and shaft less screw conveyor. The shaft screw conveyer is composed of screw, U type material slot, cover plate, inlet, feed outlet and driving device. It is generally divided into three types: horizontal, tilted and vertical, while the screw free conveyor changes the screw into a non axis spiral, and it can replace the liner in the U groove. The structure is simple and the material is pushed through the inlet of the feed through the screw. Output from the discharge port, the entire transmission process can be carried out in a sealed slot. But for many difficult materials, people have been seeking a reliable delivery method, and the non - axial screw conveyor is a better solution [1].

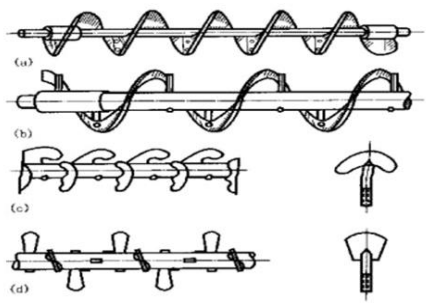
2. Type of Spiral Transport

(1) the types of screw conveying are horizontal fixed transportation and vertical spiral conveying.

(2) the spiral blade of spiral conveying mechanism has three types: solid spiral face, belt spiral face and blade spiral face, as shown in Fig.1. In the process of transportation, the mixing and mixing processes are completed at the same time. The spiral pitch is about 1.2 times [2] of the diameter of the spiral blade.

(3) helical blades of screw conveyor are divided into two kinds of directions, left and right.

(4) the spiral outlet of the screw conveyor shall be equipped with 1/2 to 1 circles of reverse spiral plates to prevent powder from blocking the ends of bearings, and no spiral parts on the upper end of the outlet pipe.



(a) solid spiral faces; (b) band spiral faces; (c) and (d) blade helical faces.

Fig 1. Form of spiral blade

3. Main Structure of Spiral Conveyer

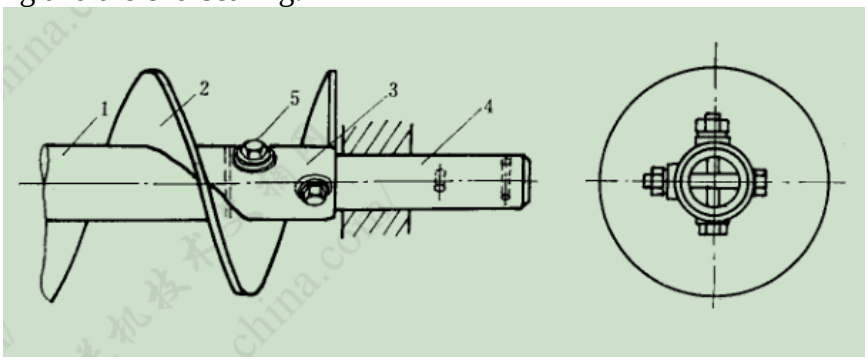
3.1 Spiral Blade

The helicoid is the main component for conveying material at the bottom spiral conveying mechanism of silos.The horizontal spiral conveyor for conveying materials should first consider the standard form of the right-handed single screw [3].

The solid spiral face is the most commonly used form, suitable for good fluidity, dry, small particles or powdery materials; If the horizontal screw conveyor has the technological requirements for mixing and loosening the material, it should consider the selection of the helical face type of the blade or tooth. To sum up, the spiral mechanism of this design adopts solid helical [3].

3.2 The Connection of The Spiral Shaft

The spiral shaft is usually connected by different sections of 2m to 4m, Figure 2 shows a common way of connecting a tube shaped spiral shaft. Each segment is connected by an inner liner and a circular shaft through a penetrating bolt, in which the circle section is just as a journal of the middle suspension bearing and the end bearing.



1-Tubular helix shaft; 2- helical blade; 3- bolt; 4- inner bushing; 5- round shaft segment.

Fig 2. Connection of each section of a tube shaped spiral shaft

3.3 Bearing Bearing

The screw shaft of the horizontal screw conveyor is installed in the feed trough through the first and the end bearings and the intermediate bearings. The first end refers to the movement of the material at the end of the front. Thrust bearing shall be used in the first end bearing (Fig. 3), so as to bear the axial force caused by the resistance of the material movement and make the screw shaft fully stretched only. The end bearing is only subjected to radial load. Radial bearing is used.

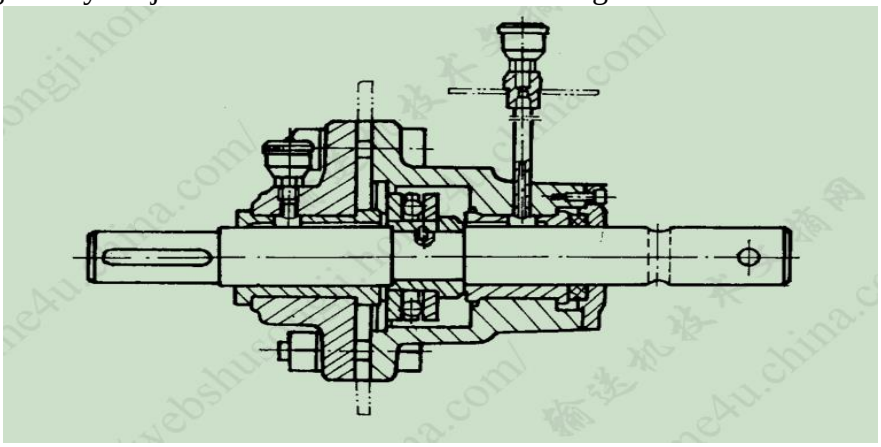


Fig 3. Head thrust bearing

3.4 Grooves

When the screw diameter is small and the material is small, the thickness of the slot is 2mm-3mm; when the screw diameter is large and the material is large and polished, the thickness of the material is 6mm-8mm.

The inner diameter of the semicircle bottom of the material trough should be slightly larger than that of the spiral diameter, and the gap between the two shall be 5mm-10mm. When the diameter of the spiral is small and the particle size of the material is small, the gap between the spiral wall and the slot wall is smaller. When the manufacturing accuracy and assembly accuracy of the spiral and groove are high, the gap can be smaller [4].

4. Design and Calculation of Horizontal Spiral Conveyer

4.1 Transportation Calculation

Conveying capacity is an important index for measuring the capacity of screw conveyor. It is usually given according to production needs, but it is closely related to other parameters. Therefore, the material transport of the screw conveyor can be roughly pressed.

$$Q = 3600 \cdot F \cdot V \cdot \lambda \cdot \varepsilon \tag{1}$$

Q--Conveyer of screw conveyer (t/h);

F--Cross section area of material layer in slots(m2);

λ--Unit volume quality of material(t/m3), It is related to the type of raw materials, humidity, the length of cut, the way of purification, the effect and so on;

ε--The inclined transport coefficient, taking into account the influence of the helical conveyor's sloping layout on the material delivery.

4.2 Rotating Speed of a Spiral Shaft

From the above formula, we know that the rotation speed of the screw shaft has a great influence on the conveying capacity. Generally speaking, within a certain speed range, the speed of the screw shaft is accelerated, and the capacity of conveying raw materials is increased. When the material particles located at the outer diameter of the helix do not produce radial motion perpendicular to the direction of transport, the maximum value of the inertial centrifugal force is related to its own gravity as follows:

$$n = A / \sqrt{D} \tag{2}$$

In the form of A--The comprehensive characteristic coefficient of material.

4.3 Spiral Diameter and Pitch

The pitch not only determines the lift angle of the spiral, but also determines the sliding surface of the material running under a certain filling coefficient, so the size of the pitch directly affects the material transport process. When the conveying volume is Q and the diameter D is constant, the slip surface of the material changes with the change of pitch, which will lead to the change of material movement velocity distribution(Fig.4). Usually, the pitch should meet the following two conditions: the most reasonable pitch size is determined considering the friction relationship between the spiral surface and the material and the proper distribution of the velocity components between the two conditions.

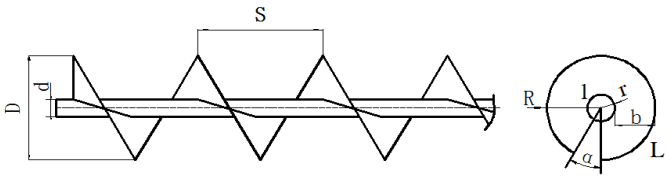


Fig 4. Spiral blade

4.4 Spiral SHAFT DIAmeter

The relationship between screw diameter and pitch should be the relationship between conveying function and structure, so as to meet the requirements of transportation and make the structure compact as far as possible. Because the filling coefficient of the screw conveyor is low, the material

near the outside of the blade has a larger axial velocity and the axial velocity is larger than the circumference speed. General axial diameter calculation formula: d=(0.2-0.35)D.

4.5 Spiral Blade Diameter

The diameter of the spiral blade is usually made of standard series, D=100, 120, 150, 200, 250, 300, 400, 500 and 600mm, which are now developed to D=1000mm, up to 1250mm. In order to limit too much confusion, the international standardization organization has formulated a draft standard for the screw conveyor on the basis of systematic research and test, and stipulates that the spiral straight warp adopts the basic series of R10 series.

5. Conclusion

The design of the feeding mechanism draws on the design experience of the screw conveyor, and designs the screw conveying mechanism deployed at the bottom of the bin. The spiral conveyer is widely used in the important machinery equipment which is indispensable in modern production and logistics transportation. In this chapter, cement, sand and seed are used to carry out the related structure and main parameters of the screw conveying mechanism. then optimize the design of the main parts of the screw conveyor, and then determine the optimal design scheme, save the cost, improve the efficiency of the whole machine, the design structure is reasonable, the cost performance is high. A spiral conveyer.

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