Design of Transmission Device of Corn Threshing Machine

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Abstract

Most of the corn threshing in the main producing area of corn now depends on large machine, which is not environmental protection and labor consuming, aiming at the common deficiency to improve, and inventing a kind of corn threshing machine, which is commonly used in small families. The main design of transmission device, including the design of transmission belt and the design calculation of belt wheel, the advantage of corn threshing device after design is that it is not only small, but also electric energy driving environmental protection, high threshing efficiency, especially suitable for home use.

Keywords

Corn thresher, transmission belt, and pulley.

1. Design of Transmission Belt

According to the analysis of the actual situation, it was determined that V would be used as the belt for transmission. The belt is a belt with a high utilization rate in reality, because it has many advantages of its own, and it can reduce its vibration when it is impacted by external forces. Of course, everything has its shortcomings, the belt and wheel friction for a long time lead to very easy to break, but also need to take a look at time to make sure that there is no problem, but comprehensive advantages and disadvantages as well as the actual work needs to determine the V-belt as the driving belt.

1.1 Determination of Power

$$P_c = K_A \cdot P_{\mathrm{P}}$$

$$K_A = 1.0$$

$$P_c = 1.0 \times 5.5 = 5.5$$

1.2 Selection of V-Belt Model

Got the power P_c, I know the speed of the small belt wheel, which is as fast as the motor n_1 Read the textbook, fundamentals of Mechanical principles, and you will understand that the V-belt uses B-type belt when the belt is driven.

1.3 Determination of Reference Diameter of Wheel

(1) the reference diameter is the diameter of the driving wheel selected for the first time. Looking at the relevant textbooks, we can see that the 125mm as the reference principle of the driving wheel in the belt drive. $D_1 \geq 125\mathrm{mm}$.

(2) V-band velocity calculation: $v = \dfrac{\pi \cdot N_1 \cdot D_1}{60 \times 1000} = 7.5\mathrm{m}/s$

If the speed v is to be able to adapt to the intensity of the work, it has a range of V band velocities, which have to be 10 to 20 m / s, Calculation of Drive ratio of Motor and Spindle

$$i = n_1 / n_2 = 1440 / 750 = 1.92$$

(3) The calculation of the diameter of the moving Wheel $D_2 = \frac{n_1}{n_2} \cdot D_1 = 240\text{mm}$

The distance between the center and the length of the belt is determined. $0.7 \times (D_1 + D_2) \le a \le 2 \cdot (D_1 + D_2)$.

$$255.5\text{mm} \le a_0 \le 730\text{mm}$$

$$a_0 = 500\text{mm}$$

$$L_{d_0} = 2 \cdot a_0 + \frac{\pi}{2} \cdot (D_1 + D_2) + \frac{(D_2 - D_1)}{4a_0}$$

$L_{d_0} = 1463\,\text{Mm}$

$$L_{dd} = 1440\text{mm}\ \ L_i = 1400\text{mm}$$

$$a = \frac{2 \cdot L_d - \pi \cdot (D_1 + D_2) + \sqrt{[2 \cdot L_d - \pi(D_1 + D_2)]^2 - 8 \cdot (D_2 - D_1)}}{8}$$

$$a = a_0 + \frac{L_{dd} - L_d}{2}$$

$$a \approx 530\text{mm}$$

1.4 Checking Calculation of the Angle on the Top of The Driving Wheel

The package angle is calculated as follows:

$$\alpha_1 = 180^\circ - \frac{D_2 - D_1}{a} \cdot 57.3^\circ$$

$$\alpha_1 = 166.8^\circ \ge 120^\circ$$

1.5 Calculation of V Band Number

For the determination of the number of V-band roots, the following formula is also needed to obtain the normal number of belt roots: $Z = \frac{p_c}{(p_0 \cdot k_a \cdot k_l + \Delta p_0) \cdot k}$

$\mathrm{k}_\alpha = 0.98$, $\mathrm{k}_i = 0.93$, $\mathrm{k} = 0.75$,

$v = 15.2\,\text{m/s}$, $D_1 = 100mm$, $\mathrm{p}_0 = 1.95$, Eventually: $Z = 2.886$

According to the rounding principle: $Z = 3$

1.6 Determination of the Initial Tensile Force of the Belt

$$F_0 = \frac{500 \cdot P_C}{v \cdot z} \cdot \left(\frac{2.5}{K_\alpha} - 1 \right) + \mathrm{q}v^2$$

$$F_0 \approx 190\text{N}$$

1.7 Pressure Calculation on 8. Axis

When the real machine is running, we should also think of the belt moving and the force applied on the shaft, which is F_Q, The pull on either side of the belt can be determined.

$$F_Q = 2 \cdot Z \cdot F_0 \cdot \sin\frac{\alpha_1}{2}$$

$$F_Q = 644.7\text{N}$$

2. Design and Calculation of Belt Wheel

2.1 Determination of Wheel Material

The pulley can be obtained from the above calculation: v=7.5m/s, There is relatively low rotational speed and hardness of HT150 gray cast iron.

2.2 Determination of Wheel Structure

The design of the pulley is determined by the size of the reference diameter, the size of the groove and the selection of the pulley are also referred to some relevant books and data before the following design process.

he straight diameter of the main drive wheel is calculated according to the design above, which we have already got, the diameter of the motor shaft, $D_1 \geq (2.5 \sim 3) \cdot d_1 = 47 \sim 114mm \leq 300mm$, After the comparison of the final use of web-type belt wheel, so that it in the active wheel to play a certain role.

Table 1. Parameters of the belt wheel

Tape category	m	f	t	s	b_p	δ	ϕ	b
B	16	5	20	14	14	7.5	38	17.4

$$B = (Z-1) \cdot t + 2 \cdot S$$
$$B = 74\text{mm}$$

According to the drive wheel to determine from the wheel. The web type is designed for the active pulley in this machine, in which: $D_2 = 240mm$, By contrast, $D_2 \leq 300mm$, And the machine from the wheel its style choice is the same as the active wheel. The parameters of the belt wheel are obtained from the determination of each inch of the moving wheel: reference < Design Manual of the belt wheel, and the method of calculating the thickness of the moving wheel from these parameters is as follows:

$$B = (Z-1) \cdot t + 2 \cdot S$$
$$B = 60\text{mm}$$

3. Conclusion

According to the design of transmission shaft and nail rack of corn threshing machine, the expected effect can be achieved, and the shortcomings of current corn threshing machine can be greatly improved, and the threshing efficiency is high, which is especially suitable for home use.

References

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