Design of hydraulic corn picking device

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Abstract. In order to realize the stepless speed change and the adjustable picking roll gap during corn picking, in order to adapt to various varieties of corn picking, this paper designs a hydraulic corn picking device [1], which is characterized by the stepless rotation speed of the picking roller. Speed regulation, while hydraulically adjusting the gap between the picking rolls. The reverse connection of the hydraulic motor makes it possible to pick up the two rotations of the picking rolls, and at the same time, the reverse rotation of the picking rolls can effectively remove the blockage between the two rolls.

Introduction

The production of corn occupies a very important position in the national economy [2]. Its high-yield, stable and nutritious characteristics have become an important raw material for China's food industry, light industry and animal husbandry [3]. The variety of corn is different, and the thickness of the stem is different [4]. The picking device is one of the main working parts of the corn harvester [5][6], and the picking roll gap and the picking roll speed are the main influencing factors of corn ear damage during corn harvesting, which directly affects The quality of harvest [7]. Most of the existing picking roll gap adjustments are manually adjusted or cannot be adjusted. The same machines have different harvesting efficiencies for different varieties of corn, and the old-fashioned picking device is prone to blockage and inconvenience maintenance during picking [8]. The transmission ratio is fixed, the speed of the picking roller is fixed, and the adaptability is low. In view of the above problems, this paper proposes the hydraulic stepless speed regulation of the picking device [9], the reversal of the picking roller and the hydraulic adjustment of the picking roller gap, and the hydraulics to realize the power and adjustment of the picking device to improve the working capacity of the small corn harvester.

Overall Structural Design

Overall Structural Design of Hydraulic Corn Picking Device. The structure of the hydraulic corn picking device studied in this paper is shown in Figure 1. The hydraulic corn picking device is mainly composed of power source, hydraulic system and picking mechanism. The electric motor provides power and is transmitted to the picking mechanism through the hydraulic system, and the picking operation is completed by the picking mechanism, the reversal of the picking roller and the gap adjustment of the picking roller. The head of the picking roller is in a spherical connection with the piston rod of the cylinder. The output shaft of the motor is connected to the input shaft of the transfer case via a coupling.
Working Principle. When the hydraulic corn picking device starts working, the engine is first started, so that the power of the engine is sent to the hydraulic pump via the transfer case, and the hydraulic pump then transfers the high-pressure oil through the oil pipe through the hydraulic valve to adjust the pressure and then to the hydraulic motor. And the hydraulic cylinder, so that the hydraulic motor rotates relative to each other and the rotation speed is the same, so that the piston rod of the hydraulic cylinder can reciprocate, and the picking roller enters the working state.

The operator adjusts the rotation speed and clearance of the picking roller according to the actual growth condition of the corn plant during the operation. When the corn stalk is thick, the handle of the reversing valve II can be pulled to increase the gap to prevent the stem from being crushed and fractured; on the contrary, when the corn plant with thin stems is harvested, the gap can be reduced by the manipulation handle. Reduce straw slip. The operator can adjust the flow rate of the variable pump by observing the corn ear injury at different rotational speeds to change the speed of the picking roller to a suitable state. When a blockage occurs, the handle of the reversing valve I can be pulled in reverse to reverse the picking roller to remove debris.

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Design of Hydraulic System for Corn Picking

In the corn picking system in this paper, the hydraulic system is the main structure, and its design is shown in Figure 2. The hydraulic system mainly consists of the reversing part of the picking roll and the adjusting part of the picking roll gap. The control of these two parts is realized by the reversing valve. The stepless speed regulation of the picking roller is realized by a variable pump directly connected to the transfer case. The reversing valve of the reversing part of the picking roller and the hydraulic motor are connected through the synchronizing valve to ensure the synchronism, and the hydraulic motor is connected in reverse connection to ensure the relative rotation of the two picking rollers. The reversing valve of the picking roll gap adjusting portion is connected with the oil cylinder through the one-way valve, and the one-way valve can lock the hydraulic cylinder, and the adjusted gap is unchanged.
Principle of Work.
The forward and reverse parts of the picking device are transmitted by the electric motor to the variable pump, and the flow rate is controlled by the variable valve to control the rotation speed of the picking roller, and is transmitted to the reversing valve I through the check valve I, thereby controlling the reversal of the picking roller, and then passes through the synchronizing valve to the hydraulic motor, which is synchronously rotating in the same direction. The gap adjusting portion of the picking roller is transmitted by the electric motor to the hydraulic pump and is transmitted to the reversing valve II through the check valve II, whereby the reversing valve II controls the movement of the piston rod of the cylinder to adjust the gap of the picking roller.

Picking Mechanism Design

The operation part of this paper is mainly completed by the picking mechanism. The picking mechanism is composed of the picking roller and the oil cylinder, and its structure is shown in Fig. 3. The hydraulic motor output end of the hydraulic system is connected to the picking roller of the picking mechanism, and the head of the picking roller is spherically connected with the piston rod of the oil cylinder.

During the operation, the two picking rollers are relatively rotated by the hydraulic motor to pull the corn stalk downward [10]. When it is clogged, the picking roller rotates in the reverse direction to discharge the jammed debris. When adjusting the clearance, the piston rod of the cylinder acts on the head of the picking roller. Since the hydraulic motor and the picking roller are connected by the ball, the purpose of adjusting the gap of the picking roller can be achieved.
Conclusions

1) The design adopts hydraulic transmission to achieve stepless speed regulation of the picking roller speed, and hydraulic adjustment of the gap between the picking rolls to ensure good productivity and production quality under different harvest conditions.

2) The design adopts the reverse connection of the hydraulic motor, which can realize the picking up of the two picking rolls in the opposite direction of rotation, and also realize the reverse rotation of the picking rolls to effectively remove the blockage between the two rolls.

3) In the design, when adjusting the gap of the picking roller, the operator can directly control the state of the oil cylinder through the handle, thereby realizing the gap control of the picking roller in real time, which is simple and quick.

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References


