AN AUTOMATIC CONTROL METHOD RESEARCH FOR 9YG-1.2 LARGE ROUND BALER

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Abstract. *When manual or semi-automatic round baler working, the tractor driver have to frequently manual the machine according to the bale process at the same time of driving. The driver easily feel fatigue in this operating mode for a long time, so the consistency of the bale's density can not be guaranteed. And there may be wrong operation. In this article, we use the model 9YG-1.2 large round baler as a research prototype. We study the information collection and processing of the baler's key parameters. For example, the roller speed、bale density and the state of pick-up、dropfloor position、net wrap system、bale pusher etc. Based on the above, we study the method and theory of automatic operation control for round baler. The main content include the relationship between the pressure of the bale chamber closed cylinder and the density of the bales, the logical relationship between automatic net wrap system、unloading bales and closing tailgate, the necessary conditions for controlling the action of each part. In the end, the entire baling process is fully automated operated by the control system. In addition, when the machine opening and closing the tailgate, the switch storage time is longer and the efficiency is low. Therefore, we add a differential cylinder to improve the opening speed of the tailgate. The tailgate is operated through an independent hydraulic system. In order to simplify the hydraulic system, we integrate all the hydraulic systems of the bale chamber control system 、dropfloor system and pick-up system into only one hydraulic system, and this hydraulic system is controlled by a terminal computer. The experiments of 9YG-1.2 large round baler with the control system show that the driver only needs to manipulate the start and stop of the tractor according to the alarm，and can continuously bale the hey in equal density without any other operation. The control method not only reduces the strength of the driver, the work efficiency has also been increased at least 1.5 times.*

Keywords. *Big round baler, Information Collection, Control Method, Integrated control.*

INTRODUCTION

Straw is a renewable biomass resource with potential in the 21st century. Straw can be used to feed livestock, burn power generation, etc., but there are problems such as relatively loose density, limited crop harvesting time, storage and transportation difficulties, so effectively solving these contradictions is the key to improve the comprehensive utilization rate of straw. In the field, straw is directly tied, which not only solves the problems such as straw waste and local burning, but also promotes the large-scale use of straw resources and industrial use, and improves the comprehensive utilization rate of straw resources, which has significant economic and social benefits.

The 9YG-1.2 large round baler produced by Beijing XuanHe Agricultural Machinery Technology Co., Ltd. has a high degree of mechanization. The diameter of the bundle can be 1.2 meters. Each process of the bundle operation depends entirely on the driver's manipulation of the corresponding lever to achieve it. The corresponding information management and intelligent control system, although its performance is stable, However, the efficiency of the work is relatively low, and the quality of the bundling is not guaranteed due to factors such as personnel control.

METHODS

In order to improve the working efficiency and quality of large round baling machines, we need to study the information collection and processing of the baler's key parameters. We need to integrate machine, electrical and hydraulic technology and develop accurate and intelligent baling operation control systems to realize the automation and informatization of the operation of the large round baler. For the 9YG-1.2 large round baler lacks the supporting technology such as automation operation, electronic monitoring, hydraulic system and alarm system. We have designed the electronic control system scheme for the automatic baling operation of a large round baling machine. Through the pressure of the bale chamber closed cylinder, the density of the bale is perceived. The action of the wraping net is controlled by the electromagnetic clutch. Through the parameters such as the density of the bale and the state of the net to unload bales and closing tailgate. Finally, the entire baling process is fully automated operated by the control system.

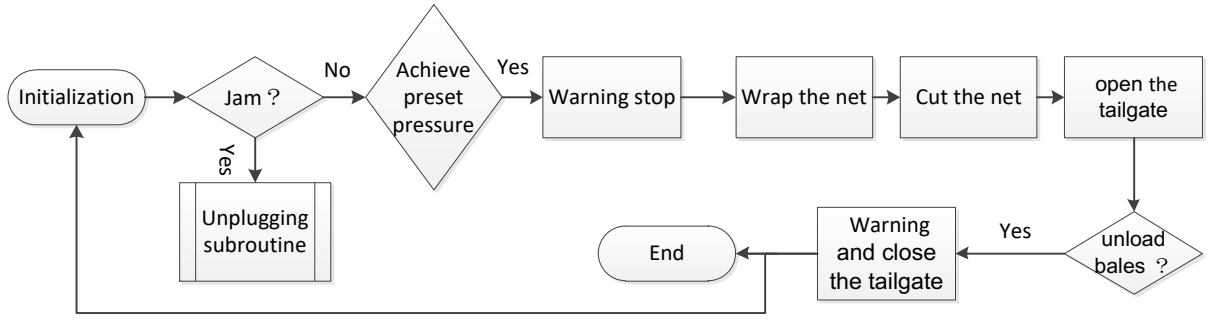

Fig 1. Automatic baling control process.

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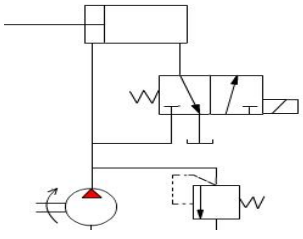

Fig 2. Principle of differential cylinder.

Conclusion

The 9YG-1 .2 large round bundle machine integrated with hydraulic electronic control system and remote supervision system has been tested and improved in Beijing, Tianjin, Hebei and other Province in China, and then conducted production experiments in Haerbin and Changchun, China. Figure 3 shows the corn stalks baling scenario and remote supervision of the prototype in Harbin, Heilongjiang Province in March 2018.

Fig 3. Baling scenario in Haerbin and the remote supervision system.

The results of the prototype's straw bale production assessment showed that the switching time of opening and closing the tailgate down from the original 14 seconds to 7 seconds, and the weight of the bale was above 200kg, which fully met the intended target. The experiments of 9YG-1.2 large round baler with the control system show that the driver only needs to manipulate the start and stop of the tractor according to the alarm，and can continuously bale the hey in equal density without any other operation. The control method not only reduces the strength of the driver, the work efficiency has also been increased at least 1.5 times.

In the future, we will continue to optimize the control system of large round baler. Large round baler will be smarter and more accurate. Large round baler will be more accurate and intelligent, and will allow online monitoring of dry moisture and weight of the bale.

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