A Review: Design and Analysis of Arm of Reaper and Binder Machine

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Abstract— The problem considered in this paper is on reaper and binder machine. It performs cutting and binding simultaneously. During operation in the field, we faced the problem of arm for binder which transmits the motion from the base mechanism to the fingers which collect the grass. We will carried out analysis for failure of arm and modify the design.

Key words: Reaper and binder machine, arm of binder part etc

I. INTRODUCTION

Harvesting is an operation carried out after the maturity of crop. It includes the cutting of crops and binding the straws. There are four types of technologies available for cereal crops in India. Traditional using hand tools like sickle, Using manual reaper, Self-propelled reaper and binder machine, Modern technology using combine harvester.

Reaper and binder machine is manufactured by BCS Company. The physical construction is divided into three parts: steering mechanism, Engine mounting and cutting and binder mechanism.

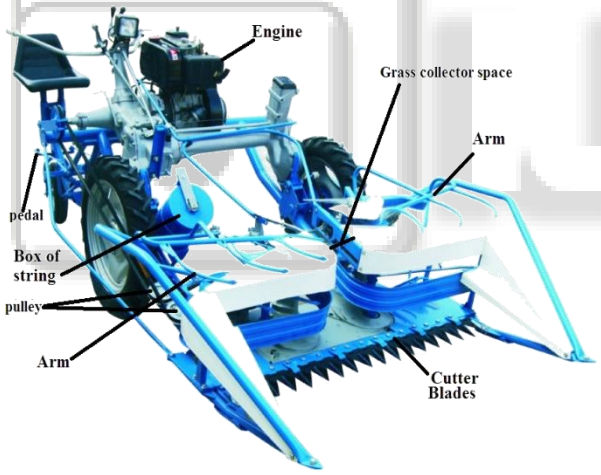

Fig. 1: Reaper and Binder machine

Steering mechanism: In this machine, steering or direction controlling of machine is done by foot, so its foot propelled machine. Paddle is provided to control direction.

Engine mounting: Chassis is provided to mount the engine of machine that engine is of 10 hp and 1440 rpm.

Header: Blades are mounted on the base and binder mechanism is provided to bind the cut straws by means of sting.

II. MACHINE SPECIFICATIONS

Component Name	Description
Engine	10 HIP or 7.5 KW
Type of fuel	Diesel
Width of cutter	4 feet
Gear	4 Forward and 1 reverse gear
Weight of machine	400 kg.
Dimensions (l * w)	360 cm * 150 cm
Type of clutch	Dry clutch
Binding height	28 cm

III. . LITERATURE REVIEW

Mahbubul Alam Zami1, Md. Altaf Hossain, M. A. Sayed, B. K. Biswas1 and M. A. Hossain [1] have represented a paper on comparison of Bangladesh reaper with chines reaper for performance evaluation for cost reduction of harvesting. They had concluded that for economic justification of machine application, the yearly field capacity of machine must not be less than 3 ha and 5 ha for BRRI reaper and Chinese reaper, respectively for profitable use.

Prof. P.B.Chavan1, Prof. D .K. Patil and Prof. D .S. Dhondge [2] have designed a small scaled reaper machine for experimental base. They have concluded that Based on analysis of results following conclusion are drawn: The Manual operated reaper is high labor saving equipment requiring only 20 man-hr/ha. The cost of harvesting with this manual operated reaper is 1250.4 Rs/ha and that with traditional method is 2000 Rs/ha. The negative point found are Based on analysis of results following drawbacks seen during operation: 1. It is not suitable for non-uniform land. 2. The power requirement is high due to its weight.

Laukik P. Raut, Vishal Dhandare, Pratik Jain, Vinit Ghike, Vineet Mishra[3] experimented that this machine targets the small scale farmers who have land area of less than 2 acres. This machine is compact and can cut up to two rows of soybean plant. They concluded that the cost of harvesting using this machine is considerably less as compare to manual harvesting. The harvesters available in market are suitable for large farms, so this can be the best machine for the farmers with small land.

Sharmin Alam Brishti, guided by Dr. Md. Ashik-E-Rabbani [4] studied that functional problem of reaper available in Bangladesh. A questionnaire was prepared involving specialists to acquire the primary data. About 93 numbers of reapers were found available in Bangladesh. They have estimated the problems like excessive vibration of the newly attached engine, poor quality guide spring used for throwing crop aside and the higher clearance used between the cutting blade and base plate. The forward speed was observed to be low. Most of the reapers have the same effective cutter bar width of 1.2 m. Among the imported reapers, Kubota show s the highest effective field capacity of 0.3 ha/hr with a field efficiency of 77.22 %. Labour requirement was 8.5 man-hr/ha and grain loss was 2.43%.

Nesar Mohammadi BANEH Hosein NAVID, Mohammad Reza ALIZADEH, and Hamid Reza GHASEM ZADEH [5] studies that a cutting head for a portable brush cutter was designed and for harvesting four Iranian rice varieties, two varieties of high yielding named Khazar and Fajr and two varieties from local varieties named Binam and

Hashemi. Cutting head consisted of a circular saw blade with 24 cm diameter and 2 mm thickness. Designed blade had 136 teeth with 0° rake angle, 30° clearance angle and 6 mm pitch. They designed blade was circular saw and had 24 cm diameter, 136 teeth with 0° rake angle, 30° clearance angle and 6 mm pitch and is proper for wooden material and straws during harvesting time. They compared the result and found that that losses of harvesting was lower than manual harvesting and operations was done faster since the field capacity of machine is 4.20 time faster than manual harvesting.

Ephrem Zeleke Kassa, Dr. Ing Zewdu Abdi [6] represented a research paper on deflection angle and deflection force acting on a bunch of crop stalk in the gathering operations of a combine harvester reel were analyzed. Mechanical crop model based on bending theory with regard to an elastic beam were applied in this analysis. In the model, the effect of flexural rigidity, crop weight and reel force on tef crop stalk in the angle of deflection. Mathematical relations derived from the model have been evaluated against empirical data that were acquired through calculation of the deflection of the stems of a tef crop and determination of number of tine bars on the reel.

S. Jarolmasjed , SH. Abdollahpour , T. Mesri Gundoshmian1 M. A. Ghazvini [7] represented a paper on harvest Loss is a type of loss that decreases final production performance. Combine harvester loss is divided to several losses; natural loss, header loss, threshing loss, separation loss and quality loss. The major loss is attributed to header loss. They have concluded that increasing combine harvester travel speed in a specific range, lead to header loss reduction, range of 0.8-2.4 km/h and header loss concluded that increasing travel speed up to 5 mile/h led to decrease in header loss

A. Conclusion from Literature Review:

Based on literature review, I have concluded that many have worked on comparison and performance evaluation of reaper machine on favour of manual harvesting, semi operated and automatic operated. But I did not found any work on arm of binder on which I am working.

We are operating reaper and binder machine of BCS-622 for our agriculture in our farm. We are facing problem related to failure of arm many times during operation.

B. Failure Observation of Arm:

Observed Detail of Arm Brakage									
Sr.No	Date of failure	Machine-1		Date of failure	Machine-2		Date of failure	Machine-3	
		Acker	Continue working hours		Acker	Continue working hours		Acker	Continue working hours
1	08/05/2015	18	19	09/05/2015	19	20	11/05/2015	19	20
2	13/05/2015	19	20	15/05/2015	21	22	18/05/2015	20	22
3	16/05/2015	18	20	18/05/2015	20	19	21/05/2015	18	19
4	20/05/2015	18	19	22/05/2015	18	18	24/05/2015	17	17
5	28/05/2015	17	18	28/05/2015	19	20	28/05/2015	19	20
6	31/05/2015	18	17	01/06/2015	20	20	05/06/2015	18	19
7	05/06/2015	20	19	05/06/2015	18	18	07/06/2015	20	21
8	09/06/2015	19	18	08/06/2015	19	18	10/06/2015	19	20
9	13/06/2015	18	17	11/06/2015	20	20	12/06/2015	20	21

Table 1: Failure observation data

IV. PROBLEM DEFINITION

As the power is transmitted by means of arms to tie collected the grains for bundling. By observation of three machines of BCS-622 available for our harvesting Failure of arm is happened at some interval of harvesting land.

V. EXISTING DESIGN OF ARM

Reaper and binder machine is performing reaping and binding simultaneously. As discussed earlier, Binding operation is done by the audible string. Arm is operated to have motion for the fingers of it to collect the grain.

Fig. 2: Arm Assembly Reaper and Binder machine

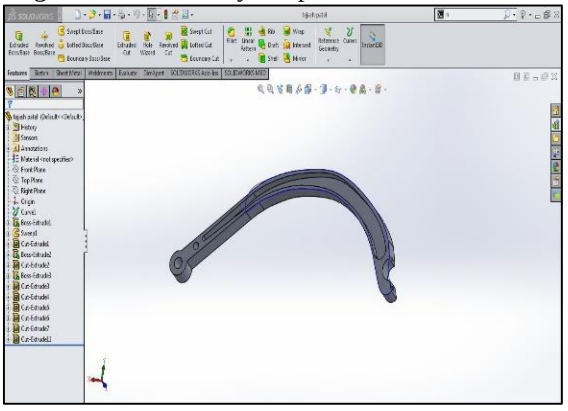

Fig. 3: 3D Model of Arm

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