DESIGN AND FABRICATION OF PNEUMATIC COTTON PICKER MACHINE

Rajkannan\textsuperscript{1}, Subin blessho\textsuperscript{2}, Mariselvam\textsuperscript{3}, Muthukumar\textsuperscript{4}

\textsuperscript{1}Student, Dept. of Mechanical Engineering, Kings Engineering College, Irungattukottai, sriperumbudur
\textsuperscript{2}Student, Dept. of Mechanical Engineering, Kings Engineering College, Irungattukottai, sriperumbudur
\textsuperscript{3}Student, Dept. of Mechanical Engineering, Kings Engineering College, Irungattukottai, sriperumbudur
\textsuperscript{4}Student, Dept. of Mechanical Engineering, Kings Engineering College, Irungattukottai, sriperumbudur

Abstract- In this paper we have design and fabrication of cotton picker machine, this machine is handy for harvesting cotton. Cotton plays a vital role in our lives, most of the things are made of containing cotton. Cotton is the most in large quantities produced natural fiber in the world. This machine will facilitate tiny range farmers for harvesting cotton, at the present time there are machines available in market which is extremely costlier, which tiny range farmers can't have enough money. But these machine undersized farmers can easily afford, and can execute harvesting. In India entire cotton harvesting is handpick by manual labor. There are globally available machine for cotton picking which is very expensive. By using the existing machines the strength of the cotton fiber is get reduced. In this machine the strength of the fiber will not be affected, and it will provide the human ease while carrying out cotton picking process and this machine will reduction the wastage of money for harvesting machine.

In this machine only the cotton boll is picked, which will not affect the cotton. As there are the machine in which along with the cotton, several undesirable material like burr, leaves, are get collected in collector tank. Nearly 1/3rd of the cotton manufactured in the world is automatically picked and about 2/3rd is picked by hand. This cotton picker machine is fully mechanically operated and save the budgets of small farmers.

Key Words: cotton fiber, Cotton harvesting, pneumatic cotton picking machine.

I. INTRODUCTION

Cotton defined as “A soft fibrous constituent which surrounds the seed of the cotton plant and is finished into textile fiber and thread for stitching”. It can be defined as “A crop plant with white hairs.

Cotton is greatest significant product in world and it is cultivated by large parts in India. Cotton picking is done mostly by human hand in India largely by women.

Commonly employees go to field in the sunrise to start picking and nonstop work till sunset. So our aim to employ the greatest awareness of science to plan such efficient machine. This can do accomplish work in field and reduces human pains. Historically there have generally been greater production problems for low micron ire cotton especially when grown in relatively short season production areas having a cooler and wetter finish to the season. The response by cotton breeders can be to select for a higher micron ire in parallel with high yield during cultivar development.

Given a negative association between yield and fiber fineness (Price 1990), such a breeding strategy could produce cultivars with coarse and immature fibers - exactly the opposite combination required by spinners. Thus although more difficult, it is clear the breeding strategy should be to ensure selection for intermediate micron ire with fine and mature fibers. Therefore separate measurement of fineness and maturity are important. These require specialized instruments.
Various researches conducted in the field of pneumatic cotton-picking machine for growing their efficiency in cotton boll quality numerous papers were published in the field of Development of cotton picker.

Nikhil Gedem and Prof A.K. Mahalle developed a machine which uses an IC-engine as a power source and an impeller coupled with the output shaft of the IC engine. The impeller runs at a speed of 3500rpm and its function is to create the required suction force to suck the cotton bolls. The bolls sucked are stored in a tank which is mounted above the IC engine on the frame.[2].

M. Muthamil Selvan, C. Divaker Durairaj, K. Rangasamy designed a pneumatic cotton picker which was cost efficient and can be operated by 2 people at the same time. They used a nylon filter mesh to prevent the cotton fibres to enter the impeller and the IC engine. The cost of picking the cotton/kg was around Rs.10/kg. It is cost, time and energy efficient machine. [3]

As extra money is mandatory in farm for labour effort and the harvesting of cotton is achieved in some breaks of time. This makes tiny range farmers to spend money on the workers for harvesting. Therefore this machine will protect the money of tiny range farmers; it will decrease the effort required will accomplishment the picking operations.

II. MATERIALS AND METHODS

The prime mover (5.900 kW, 6,500rpm) mounted with the aspirator directly on the shaft. A polypropylene container of 50 liter capacity fixed on the frame as the cotton collection drum. A circular cotton filter 180 mm diameter and 305 mm high, finished from nylon mesh, was attached inside the collection drum vertically on a suitable flange to control the admission of cotton inside the aspirator. 30 mm diameter Polyvinyl chloride hose fixed on top of the collection drum with a nipple. As picks up pipe for a length of 1,400 mm. The eye of the impeller connected with the bottom of the collection drum with a 90 mm diameter sealed duct. Drum with a tank nipple as picks up pipe for a length.

2.1. Working Principle

The fig.1 shows the prime mover that is, the IC engine coupled with the shaft of impeller.

The table-1 shows the specification of cotton picker machine.

![Fig 1. Front view of pneumatic cotton picker machine](image)

The engine which rotates the crank shaft. The output shaft rotates with high speed would rotate the impeller with same speed up to 7500rpm with output power of 7.856KW. The high-speed impeller would create the required suction pressure at the eye of impeller so that only cotton bolls would be plucked. The eye of the impeller will be connected to the suction duct, further goes to the storage tank. In the storage tank, the hose-pipe will be connected with the Nylon mesh filter which will avoid the cotton fiber to enter the aspirator (impeller). The inside pressure of tank would be maintained at the essential value. The air which is sucked inside would be blowed out by the centrifugal fan.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Particulars</th>
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<tbody>
<tr>
<td>Overall dimensions (l<em>b</em>h),mm</td>
<td>1500<em>500</em>600</td>
</tr>
<tr>
<td>Engine Power</td>
<td>7.86 kW</td>
</tr>
<tr>
<td>Type of aspirator</td>
<td>Centrifugal fan</td>
</tr>
<tr>
<td>Maximum speed of impeller, rpm</td>
<td>7500</td>
</tr>
<tr>
<td>Type of storage tank</td>
<td>Polypropylene</td>
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<tr>
<td>Capacity of tank</td>
<td>50L</td>
</tr>
<tr>
<td>Mounting pattern of tank</td>
<td>Vertical</td>
</tr>
<tr>
<td>Type of cotton filter</td>
<td>Nylon mesh</td>
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<tr>
<td>Mounting of cotton filter</td>
<td>Vertical</td>
</tr>
<tr>
<td>Dimension of cotton filter</td>
<td>200*400</td>
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<tr>
<td>Type of cotton suction pipe</td>
<td>PVC hose</td>
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<tr>
<td>Number of suction pipe</td>
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<tr>
<td>Diameter of suction pipe</td>
<td>30mm</td>
</tr>
<tr>
<td>Number of operator</td>
<td>2</td>
</tr>
</tbody>
</table>
2.2.1 Design of Impeller

Diameter of impeller eye $D_o$ is dependent on shaft

$D_H = \frac{5}{16} D_s + 1$

$D_H = 19.687mm$

Considering diameter of hub is

$D_H = 20mm$

Velocity of air in impeller $12.73m/s = V_o$

Discharge in impeller $(Q)$

$Q = V_o \left[ \frac{\pi D_0^2}{4} - \frac{\pi D_H^2}{4} \right]$

$D_0 = 0.06638m = 66.38mm$

Standard diameter $D_0 = 70mm$

2.2.2 Design Calculations

Cotton can be plucked by pneumatic force of 3.5 KN with discharge $0.04 m^3/s$ at a velocity of $30m/s$ with suction pipe diameter as $25mm$.

Engine Specification (Hero Honda Passion)

- $110cc$
- $P=5.736KW$
- $N=5500rpm0$
- $T=8.66Nm$

2.2.3 Diameter of shaft

$T = \frac{Pi}{16}d^3\sigma_T$

Selecting material C40

$Syt = 380N/mm^2$

$FOS = 3$

$\sigma_T = \frac{(380*0.5)}{3}$

$\sigma_T = 63.33N/mm^2$

(Substitute in 1)

$(8.66*103) = \frac{\pi}{16}d^3*63.33$

$d = 8.8639mm$

Increased by 50%

$d = 8.8639*1.5 = 13.2959mm$

Standard size of shaft $d = 15mm$

2.2.4 Velocity Diagram

The figure 3, shows the inlet velocity diagram at impeller

Inlet velocity at impeller

$U_1 = \frac{\pi}{16} \cdot 7500 \cdot 10^3 / 60$

$U_1 = 28.1$

$59m/s$.  

By inlet triangle

Let inlet blade vane angle be

$\Theta = 13$

$\tan \Theta = \frac{V_{f1}}{U_1}$

$V_{f1} = 4.6539m/s$

$V_{r1} = U_1 / \cos \Theta$
\[ V_{r1} = 20.689 \text{ m/s} \]

**Width of Impeller,**

\[ b = \frac{Q}{\pi \epsilon V_{f1} D_1} \]

\[ \epsilon = 0.85, b = 0.06598 \text{ m} = 41.807 \text{ mm} \]

Outlet Dia. 240mm = D2

\[ U_2 = \frac{\pi D_2 N}{60} \]

\[ U_2 = 81.115 \text{ m/s}. \]

**Normal Discharge angle 22 -28 deg.**

Outlet angle of impeller \[ \varnothing = 22 \text{ deg.} \]

\[ V_{f1} = V_{f2} = 5.6539 \text{ m/s}. \]

\[ \tan \varnothing = \frac{V_{f2}}{U_2 - V_{w2}} \]

\[ V_{w2} = 56.3285 \text{ m/s}. \]

Velocity angle at Outlet \[ \tan \beta = \frac{V_{f2}}{V_{w2}} \]

\[ \beta = 4.723 \text{ deg} \]

\[ V_{r2} = \sqrt{(U_2 - V_{w2})^2 + V_{f2}^2} \]

\[ V_{r2} = 18.607 \text{ m/s}. \]

**III. CONCLUSIONS**

Design and fabrication of cotton picker machine, is easy to handle and is easy to control also it has light weight it will decrease the money required harvesting cotton process. This cotton-picking machine would give a good quality of cotton when compared with the spindle type cotton picking machine. This machine would be less time consuming than the spindle type machine.

**IV. ACKNOWLEDGEMENT**

It is our privilege to express our gratitude to our guide Prof. Dr. A. Muniaraj, M.E., Ph.D., (Dept. of Mechanical Engineering) for his valuable guidance, encouragement, whole-hearted cooperation and constructive criticism throughout the duration of our project.

**V. REFERENCES**


