Analysis and Re-Design of De-Fibering Machine

A PROJECT REPORT
SUFMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF
BACHELOR OF ENGINEERING
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By

T. Shankar
G. Kalaichelvan
K. V. Ramasubramanian

Guided By

Mr. P. Suresh Prabhu, M.E.

Department of Mechanical Engineering
Kumaraguru College of Technology
Coimbatore-641 006

1990 - 91

Department of Mechanical Engineering

Kumaraguru College of Technology

Coimbatore-641 006

Certificate

This is to certify that the Report entitled

Analysis and Re-Design of De-Fibering Machine

has been submitted by

Mr. ....

in partial fulfilment for the award of
Bachelor of Engineering in Mechanical Engineering Branch
of Bharathiar University, Coimbatore-641 046
during the academic year 1990-'91

.... 20-2-91
Guide

....
Head of the Department

Certified that the candidate was Examined by us in the project work Viva-Voce Examination held on .... and the University Register Number was ....

....
Internal Examiner

....
External Examiner

ANALYSIS AND RE-DESIGN OF DE-FIBERING MACHINE

CONTENTS

Chapter

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T. Shankar

Coimbatore-6

G. Kalai chelvan

Date : 20th Feb, 1991

K.V. Rama Subramanian.

SYNOPSIS

De-fibering machine is the one which separates the dry cocoanut husks into individual fibres. The individual fibres obtained from this machine pass thro' a series of process such as screening, beating, drying etc., Hence the product is ready for manufacture of mats, ropes, etc.,

The project chosen is to analyse and redesign the same so as to overcome all the defects observed and faults experiencd.

The thorough and detailed investigation was conducted on the original de-fibering machine. For ease, convenience and efficiency the redesigning of some of the major components is done. These are provision of chain to transmit the power from the gear box to drum wheels, shock absorbers and conveyor belt arrangement to handle the fibers.

For analysis, twenty de-fibering factories were visited during different shifts. The defects observed in these factories have been noted in detail. They were analysed suitably. The remedial steps for each and every stage were suggested.

Not only the management but also the workers welcomed the suggestions given and they are carried out. By this, the productivity obviously, increased; in turn, the profit raised. Also, the cost of the product as well as fatigue of the worker are reduced.

INTRODUCTION

The Cocoanut consists of two parts. They are :- i) the shell situated at the centre and ii) the surrounding raw green husks.

The De-fibering machine is one which separates the raw green cocoanut husks into individual fibres. It combs out the husks, separates fibre and removes a major portion of the pith, short fibres and foreign matter.

De-fibering units are usually situated in places where there is an abundant number of cocoanut trees. The green husks of the cocoanut go as a waste. These green husks are utilized for making ropes, mats etc.,

Once the cocoanut has been removed, it is observed that the green husks are compacted thus hard. These compacted husks are separated into individual fibres and cleaned for obtaining quality fibres. This process of obtaining individual fibres is called as DE-FIBERING.

Then the fibres are sent through a number of machines such as the screener, beater etc., This is done for removing the foreign matter as well as for shining appearence.

De-fibering units can be very well started along the coastal area as the sea-shore is the native for cocoanut trees. Pollachi is one such place suited for de-fibering units due to the existing of abundant cocoanut trees.

DE-FIBERING PROCESS

The Cocoanut shell is surrounded by a compact layer of fibers. These compacted fibers are called "husks". The husks are of two varieties.

(1) Green husks.

(2) Dry husks.

PROCESS INVOLVED IN DE-FIBERING OF GREEN & DRY HUSKS.

1. GREEN HUSKS :-

The raw green husks are to be softened before feeding into the de-fibering machine. So, a crusher is used for crushing the husks. Even after being crushed in the crusher, the husks are bonded under pressure. In order to reduce bonding, water soaking process is carried out. Soaking takes place in a tank of capacity one thousand husks.

These soaked husks are fed in the de-fibering machine. Here, short fibres and foreign matter are removed. And the required fibre obtained from the de-fibering machine is passed through the rotating screener. The fibre undergoes sieving process in the screener.

The screened fibre then are thrown into the Beater. A final separation of the fibre is done at this stage in the beater. It is then transfered for drying. The fibres are dried in the sun for about 2-3 hours. Now, the dried fibre is ready for baling.

Short fibres are also present in the De-fibering machine. During de-fibering process these short fibres are screened separately. They aare beaten in the Beater to get pure fibres. These pure short fibres can also be baled and sold as "Short fibres".

When mixed fibre is required the combed fibre from the machine and the short fibres from the drums can be mixed separately. They can then be fed into the beater to get the resultant mixed fibre.

2. DRY HUSKS :-

The dry husks are more compact and harder than the green husks. So, an effective softening should be done by feeding it in the crusher. They are soaked in water for a day and fed for a second time. To get better quality fibres, the husks are crushed in between two pairs of spiked rollers. This provides effective crushing and thus the necessity for big water tanks.

In some cases, the raw material available may be abundant. If so, the production can be doubled if the following process is followed.

One more de-fibering M/c is added to the unit along with the existing de-fibering machine. Addition of one more beater is also advisable. The rest of the machines will be capable of meeting the requirements as such.

COMMON DE-FIBERING PROCESS

1. CRUSHING :-

This is the first stage of de-fibering operation. The husks are hard and compact. They have to be softened before feeding the de-fibering machine using a crusher. The crusher consists of four crushing rollers. They roll in opposite directions. These rollers consist of a number of small spikes on their rolling surfaces. The green husks are fed in between these rollers. The spikes present in the rollers will crush the husks by piercing them. The crushing effectiveness depends on the sharpness of the spikes. When the raw material available is less, the crusher can be run with only two rollers. Two persons are required for this operation.

2. SOAKING :-

The crushed husks are then soaked in a tank full of water. Soaking of the husks is done for about 5-10 minutes. During this process, the husks will absorb water and will become soft. This enables the de-fibering machine to work with ease. Dry husks are soaked for about 1-2 days. The main requirement for soaking is abundant quantity of water. Two persons are required for this operation.

3. DE-FIBERING :-

This is the main operation of the de-fibering unit.

The de-fibering machine consists of two drum wheels rotating in opposite directions. A Ring is provided eccenttric to the first drum wheel. The soaked husks are placed one by one in the space in between the ring and the first drum. So, the husks find the path in between them. At the bottom, there are a number of needle bars arranged in a conical fashion. They rotate in a direction perpendicular to the rotation of the drum wheel. A number of needles protrude in these needle bars. The husks pressed in between the ring and the 1st drum wheel come in contact with these needles in the needle bars. As a result, the needles pierce one of the husks and this half is separated into loose fibres.

These are dragged by the 2nd drum wheel. There the remaining half of the husk is pierced by the other set of needles. Thus the whole husk is converted into individual fibres. The resultant fibres are fed to the delivery roller. Four persons are required for this operation.

4. SCREENING :-

The fibre obtained from the de-fibering machine consists of a number of impurities such as dust, foreign matter, etc., They have to be removed because they will affect the quality of the fibre. So, the fibre is fed into a revolving screener. This screener has a number of sieves. Hence the sieving is carried out in the screener. Two persons are required for screening operration.

5. BEATING :-

Even after the screening process, the fibre will consist of some short fibre, foreign matter, etc., Further, very small waste products may be present in the fibres. The beater is used for the total separation of the fibre. This is done by removing minute waste products. A series of beating-knives do this work of beating. From the central shaft project a number of beating knives. A motor drives the shaft of the beater. The beating knives beat the fibres sufficiently to yield pure fibres. The number of persons required for beating process is two.

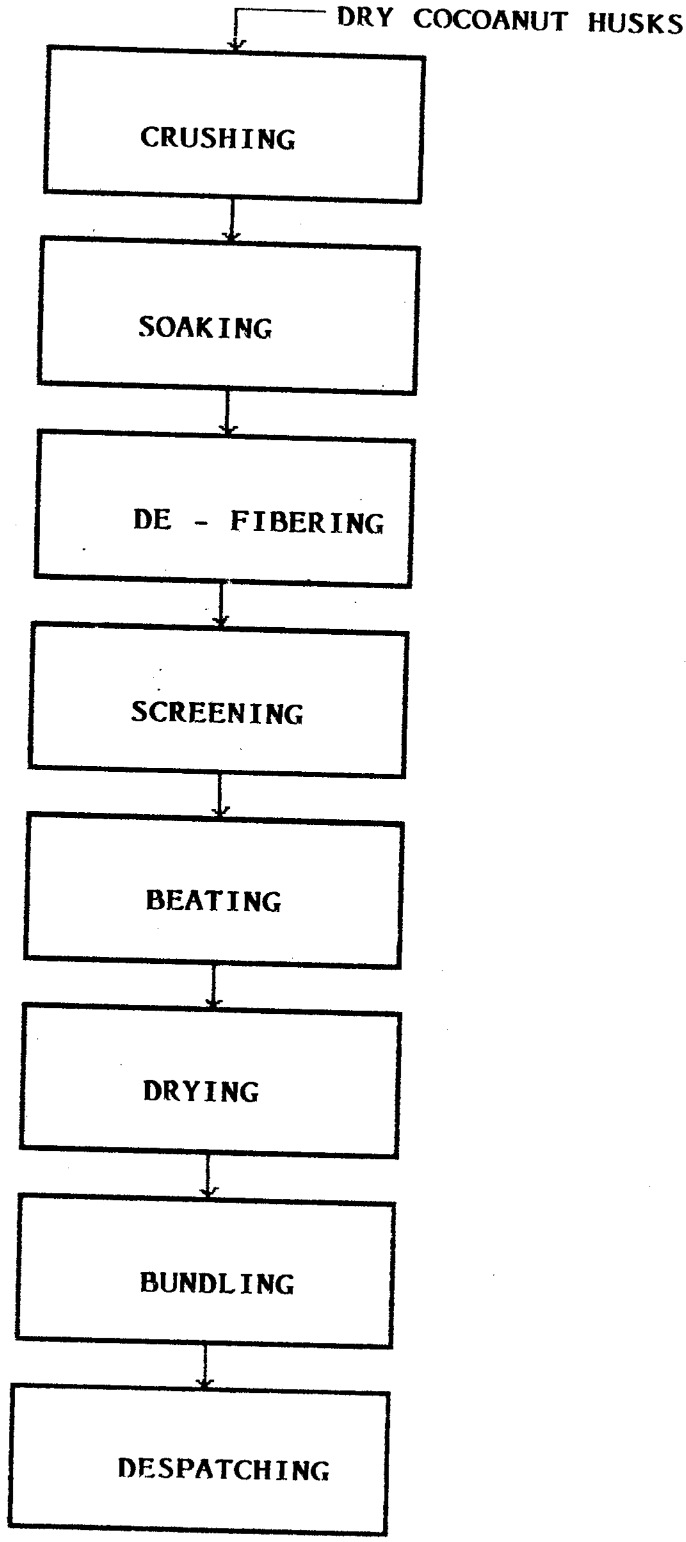
6. DRYING :-

Having undergone a series of processes such as crushing, soaking, de-fibering, screening, and beating, the fibres ought to be dried in the sun so that the moisture content is removed. If they are not dried properly, they stick to each other. So, the fibres are dried for about 2-3 hours. Unskilled women, about 5 to 10, separate the fibres and spread them in open yard in the hot sun. The place where the fibres are dried should be clean and dry. Usually a large area is alloted for drying the fibres.

7. BUNDLING AND DESPATCHING :-

Drying of fibres continues for 2-3 hours. Then the fibres are bundled and despatched. The bundles are in the form of Bales. One bundle consists of 35kg of pure fibre and it is referred to as One bale. About 24 bales are prepared in one shift of 8 hours. The same persons who were employed for drying can be employed here also.

PROCESS FLOW CHART



MACHINES INVOLVED IN DE-FIBERING

The machines involved in the de-fibering process are four. They are :-

(1) Crusher,

(2) De-fibering Machine,

(3) Revolving Screener, and

(4) Beater.

DESCRIPTION OF MACHINES INVOLVED

1. CRUSHER :-

Usually, heavy duty crushers are used for crushing the cocoanut husks because the husks are hard. These crushers have four crushing rollers. The rollers are equipped with anti-friction ball bearings. A Gear system is also provided. The entire driving arrangements and bearings are protected in a dust proof chamber. The rollers are provided with spikes. The machine is equipped with a reduction gear box to transmit functioning loads. The four rollers are placed in a manner such that even if the first two rollers fail to crush the husks properly, the next two rollers will help.

Production capacity of the crusher is 15,000 husks/8 hours. The power required to run the crusher is obtained from a 10 HP motor with a speed of 900rpm.

2. DE-FIBERING MACHINE :-

It is a heavy duty machine of vertical type. It is provided with a reduction gear box. There are two 6mm thick wheel drums made of mild steel. Chain arrangement is provided for Tension rollers, delivery rollers and Take off rollers. The wheel drums run on complete Ball bearings with dust proof protection. Zinc sheet doors cover the entire machine. A feeding guide is provided around the 1st drum wheel. This helps the husks to enter into the gap in between the ring and the drum.

The production capacity of a de-fibering machine is 8,000 husks/8 hours. 3 motors provide the power required to run the machine.

(i) 1 No. - 7.5HP Motor (1440 rpm)

(ii) 1 No. - 5 HP Motor (1440 rpm)

(iii) 1 No. - 2 HP Motor (1440 rpm)

The 2HP motor is used to transmit power to the drum wheels via the reduction gear box. The 5HP motor is used to transmit power to the needle bar on top of the second drum wheel.

The 7.5HP motor is used to transmit power to the needle bar at the bottom of the first drum wheel. Belt guards are provided wherever power is transmitted from the motor.

3. REVOLVING SCREENER :-

The Screener used is large. The main shaft at the centre is encircled by a sieve arrangement. Anti-friction ball bearings are provided for the efficient revolving. The driving arrangement is thro' a reduction gear box.

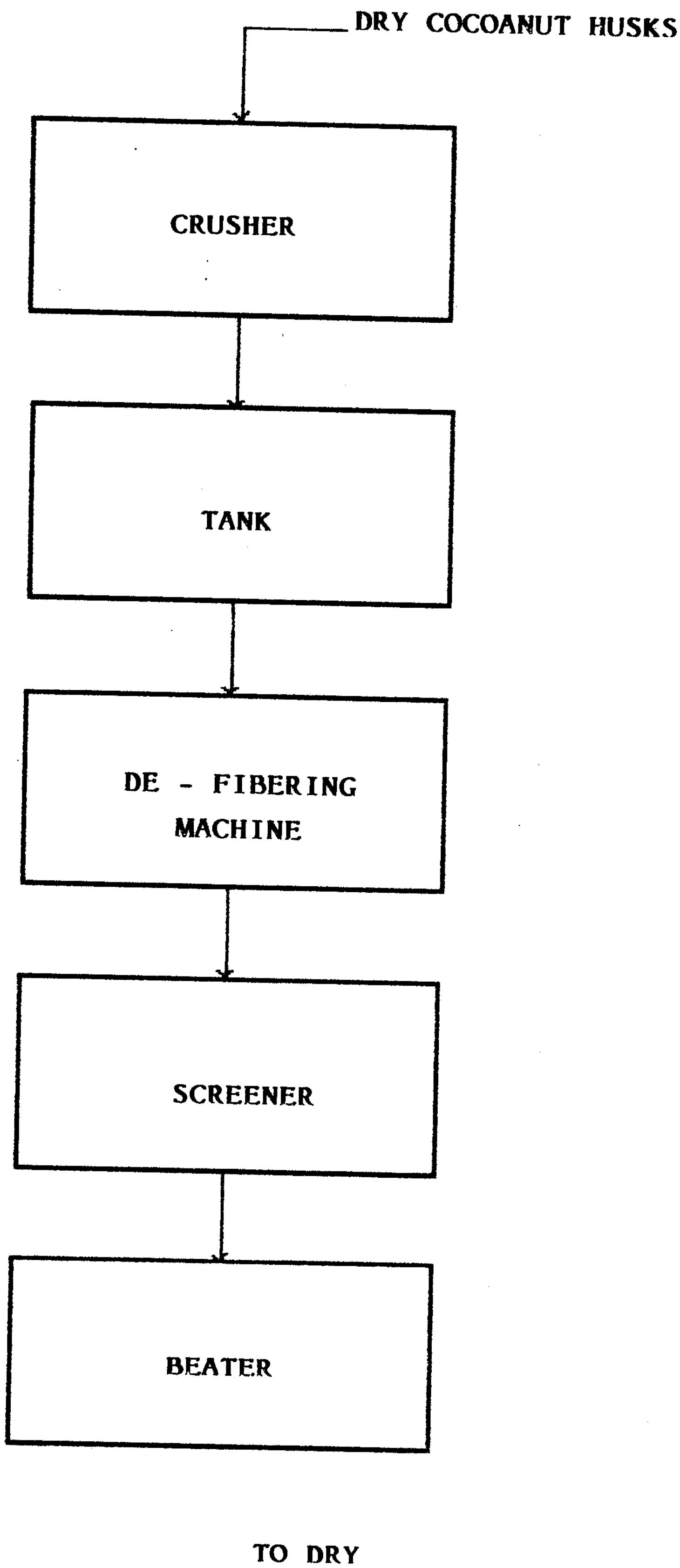
The production capacity of the screener is 1400kg of fibre/hour. Power is got from 0.5HP motor whose speed is 1440rpm.

4. BEATER :-

The Beater has a central shaft on which a number of beating knives are provided. The whole arrangement is enclosed by a sieve. The beater is of 30" diameter and 60" length. The main shaft is driven by means of pulley arrangement. Anti-friction ball bearings are provided for smooth running of the main shaft. The beating knives are placed at an angle of 45° to the vertical so that no fibre is left unbeaten.

The production capacity of a Beater is 1400kg of fibre/hour. The power required is got from a $\frac{1}{2}$HP motor with a speed of 1440rpm.

MACHINERY FLOW CHART



REDESIGN OF SOME COMPONENTS OF DE-FIBERING MACHINE

CHAIN DESIGN :-

The belt used to transmit power from the Gear box to the drum wheel results in a number of problems. The most important one is shippage and its efficiency is very low.

So, Chain drive is preferred replacing the Belt drive. Chain drives have the following advantages.

(1) These are empoyed for both long as well as short centre distances (maximum distance may be about 8 metres).

(2) These provide positive non-slip drive.

(3) One chain can be arranged to drive more than one shaft.

(4) Efficiency is very high (upto 98%).

(5) Maintenance is low if drive is properly selected, installed and lubricated properly.

(6) These produce less loads on shafts compared to belt drives.

(7) These transmit more power than the belt drives, occupy less space and thus are more compact compared to belt drives.

(8) These can be operated under adverse temperature and atmospheric conditions.

(9) These permit high speed ratio upto 8 in one step.

Main types of chains used to transmit power are

(1) Roller Chain

(2) Bushed Chain

(3) Inverted tooth Chain.

Roller Chain is the most widely used of the various types of Chain power drives.

We know,

Centre distance, a = 1120 mm.

From Page 7.74 PSG Design Data Book,

Optimum centre distance, a = (30 to 50)p;

Where $p = \text{pitch}$

$$\therefore p = \frac{a}{40}$$

$$= \frac{1120}{40}$$

$$= 28 \text{ mm.}$$

Speed of rotation of pinion, $n_1 = 150$ rpm.

Speed of rotation of wheel, $n_2 = 30$ rpm

$$\therefore \text{Transmission ratio, } i = \frac{n_1}{n_2} = \frac{Z_2}{Z_1}$$

$$= \frac{150}{30}$$

$$i = 5$$

Assume,

number of teeth on sprocket

pinion, $Z_1 = 25$

$\therefore$ number of teeth on sprocket

wheel, $Z_2 = i \times Z_1$

$$= 5 \times 25$$

$$= 125$$

$$\text{Chain velocity, } v = \frac{\pi d_1 n_1}{60}$$

where d_1 = dia of pinion.

$$= \frac{\pi \times 0.012 \times 150}{60}$$

$$= 0.0942 \text{ m/sec.}$$

Calculation of Service factor, Ks:-

Load factor, K_t:-

Load with mild steel shocks, K_1 = 1.25

Factor for distance regulation, K_2:-

For fixed centre distance, K_2 = 1.25

Factor for centre distance of sprocket, K_3 = 1

Factor for the position of the sprockets, K_4 = 1

lubrication factor, K_5:-

For drop lubrication, K_5 = 1.0

Rating factor, K_6:-

For double shift of 16 hours a day, K_6 = 1.25

$\therefore K_5 = K_1 \times K_2 \times K_3 \times K_4 \times K_5 \times K_6$

$= 1.25 \times 1.25 \times 1 \times 1 \times 1 \times 1.25$

$= 1.953$

Calculation of Breaking load, Q :-

From page No:- 7.77 PSG Design Data Book,

$$N = \frac{Q.v}{75n\ K_s}$$

Where N is power transmitted = 2 HP.

and n is allowable factor of safety = 7.8.

$$\therefore Q = \frac{2 \times 75 \times 7.8 \times 1.953}{0.942}$$

$$Q = 24,257 \text{ kgf.}$$

Calculation of projected Bearing Area, A :-

From PSG Design Data Book, Page No :- 7.77

$$N = \frac{\sigma AV}{75K_s}$$

Where σ = allowable bearing stress = 315 kgf/cm^2

$$\therefore A = \frac{2 \times 7.5 \times 1.953}{315 \times 0.0942}$$

$$A = 9.87 \text{ cm}^2$$

From PSG Design Data Book, Page No :- 7.72

Using projected Bearing Area and Bearing load, we find out,

Type of Chain	= DR 120
Weight per meter, W	= 10.80 kgf
Bearing load, Q	= 25,400 kgf
Pitch, P	= 38.10 mm.

Checking :-

$$[n] = \frac{Q}{\Sigma P}$$

where $\Sigma P = P_t + P_c + P_s$

where $P_t = \frac{75 \times N}{0.0942}$;

P_t = tangential force due to power transmission

$$= \frac{75 \times 2}{0.0942}$$

$$= 1592 \text{ kgf.}$$

$$P_c = \frac{wv^2}{g} \;;$$

P_c = centrifugal tension

$$= \frac{10.80 \times (0.942)^2}{9.81}$$

$$= 0.0097 \text{ kgf.}$$

$P_s = k.w.a$; P_s = tension due to sagging of chain.

Where, k = Coefficient of sag = 2 (Page 7.78 PSG Design Data Book)

$P_s = 2 \times 10.80 \times 1.12$

$P_s = 24.192$ kgf.

$\therefore$ $P = 1592 + 0.0097 + 24.192$

$= 1616.2$ kgf.

Actual factor of safety, [n] $= \frac{25,400}{1616.2}$

$= 15.7$

As actual factor of safety is greater than allowable factor of safety.

i.e., $15.7 > 7.8$

Hence the design is safe.

Specification of the Chain :-

Type of Chain = DR 120

Pitch, P = 38.1 mm.

Bearing Area, A	= 7.86 cm^2.
Weight/meter, w	= 10.80 kgf.
Breaking load, Q	= 25,400 kgf.
No. of teeth on sprocket pinion, Z_1	= 25
No. of teeth sprocket wheel, Z_2	= 125

DESIGN OF SPRING FOR THE SHOCK ABSORBER

A spring is an elastic member used to connect two bodies or two parts of a machine.
The functions of a spring are :-

(1) To cushion, absorb or control the energy either due to shock or vibrration. e.g. springs in railway wagons, automobiles, shock absorbers, flexible couplings.

(2) To exert force

(3) To measure forces

(4) To store energy.

Helical springs are made up of round or rectangular wire wound to form a helix. Its Advantages are :-

(1) Simplicity in manufacture

(2) Wider range

(3) Variable characteristics

(4) More reliable

(5) Spring rate remains constant.

So, Helical springs are preferred for shock absorbers. Let us design such a helical spring.

Design of helical spring includes the designing of

(i) Pitch Diameter (or) Mean coil diameter (D)

(ii) Size of the wire (d)

(iii) No. of Coils (n)

(iv) Free length (l).

<u>Selection of material</u> :- (from the table of spring materials)

Material :- Brass

Yield shear stress, T = 8.1 kg/mm^2

= 810 kg/cm^2

For continuous service, a factor of safety of 1.5 may be selected. So,

Design stress (T) = (810) x 1.5)

= 1215 kg/cm^2

Axial load acting on the spring

P = 150 kgf.

Now,

Mean coil diameter, D is fixed on the basis of space limitations.

D = 7 cm.

∴ Size of the wire, d = ?

From Page, 7.100 PSG Design Data Book,

$$T = K_s \frac{8PD}{\pi d^3}$$

Where,

K_s = Wahl stress factor;

C = Spring Index = $\frac{D}{d}$

$$\therefore d = \sqrt[3]{\frac{8PD}{\pi (T)}} \qquad \text{(Assume } K_s = 1\text{)}$$

$$d = \sqrt[3]{\frac{8 \times 150 \times 7}{\pi \times 1250}}$$

$$= 1.28$$

$$\therefore C = \frac{D}{d}$$

$$= \frac{7}{1.28}$$

$$= 5.4$$

Now,

$$K_s = \frac{4C - 1}{4C - 4} + \frac{0.651}{C}$$ (from Page 7.100 PSG Design Data Book)

$$= \frac{4(5.4) - 1}{4(5.4) - 4} + \frac{0.651}{5.4}$$

$K_s = 1.28$

$\therefore$ Revised dia of wire, $d = \sqrt[3]{\frac{8PD \times K_s}{\pi \times (T)}}$

$$= \sqrt[3]{\frac{8 \times 150 \times 7 \times 1.28}{\pi \times 1250}}$$

$= 1.39$

$\therefore C = \frac{7}{1.37}$

$= 5.035$

$= 5.$

for d = 1.39, from Page 13.1 (PSG Design Data Book)

SWG = 17

we standardise, d = 1.42 cm

Now,

assume deflection of the spring = 4 cm.

From Page 7.100 (PSG Design Data Book)

$$y = \frac{8PD^3n}{GD^4}$$

where n = no. of active coils

G = modulus of rigidity, kgf/cm²

and $G = 0.37 \times 10^4$ kg/mm²

$= 37 \times 10^9$ N/m².

$$\therefore n = \frac{yGd^4}{8PD^3}$$

$$= \frac{0.04 \times 37 \times 10^9 \times 0.0142}{8 \times 1500 \times (5)^3}$$

n = 14 turns

<u>End condition</u> :- (from Page 7.101)

Type of end :- Squared

Total Coils = n + 2

= 14 + 2

= 16 coils

Taking 1 mm clearence between adjacent coils,

Free length of spring = Solid length + Compression + Clearence between adjacent coils

$= (n \times d) + y + (16 - 1) \times 1$

$= (14 \times 14.2) + 40 + (15) \times 1$

= 253.8 mm

= 25.38 cm

Pitch of Coil $= \frac{\text{Free length}}{(16 - 1)}$

$= \frac{253.8}{15}$

$= 16.92$ mm

Check :-

From page 7.100,

Actual shear stress T $= K_s \frac{8PD}{\pi d^3}$

$= 1.28 \times \frac{8 \times 150 \times 7}{\pi \times (1.42)^3}$

$= 1195$ kgf/cm².

As 1195 kgf/cm² $<$ 1215 kgf/cm²,

i.e., actual stress is less than the designed stress.

so, the design is safe.

Specification :-

i)	Pitch Diameter, D	= 70 mm
ii)	Size of wire, d	= 14.2 mm
iii)	No. of Coils, n	= 16 coils.
iv)	Free length of spring, Lf	= 253.8 mm.
v)	Pitch of the Coil	= 16.92 mm.

CONVEYOR SYSTEM

The cocoanut fibre which are got from the de-fibering M/c has to be manually handled to be taken to the screener. Since this takes time and isn't Cost effective, conveyors can be used.

There are many type of Conveyors. They are

1) Wood slat and chain Conveyor
2) Steel slat or apron Conveyor
3) Gravity roller Conveyor.
4) Mono rail chain Conveyor
5) Belt Conveyor.

Of these, the Belt Conveyor is preferred since it needs less amount of power to be driven. Advantages of Belt Conveyors are :-

i) This system requires very little power to opperate due to which its operating cost is lowered.

ii) Since the quantity of material which is to be transferred is very less in weight, Belt Conveyors are preferrable.

iii) Compared to other conveyors, it is lighter in weight.

The belt conveyor consists of a belt which runs over a pair of end drums. The belt is supported at intervals by a series of rollers known as idlers. The idlers are supported by the Conveyor frame. The return idlers support the return side of the belt. They are plain rollers and are spaced at larger spacing than the idlers.

Specification for rubber conveyor have been standardised and are given in IS:1891-1961. These standards are summarised below.

1. GRADE :- The belting shall be of three grades, namely Grade A, Grade B and Grade C, according to the quality of rubber used for the cover.

2. Construction :- The belting shall cosist of plies of woven cotton canvas impregnated with a rubber compound and having a rubber cover, the whole being valcanised together in a uniform manner.

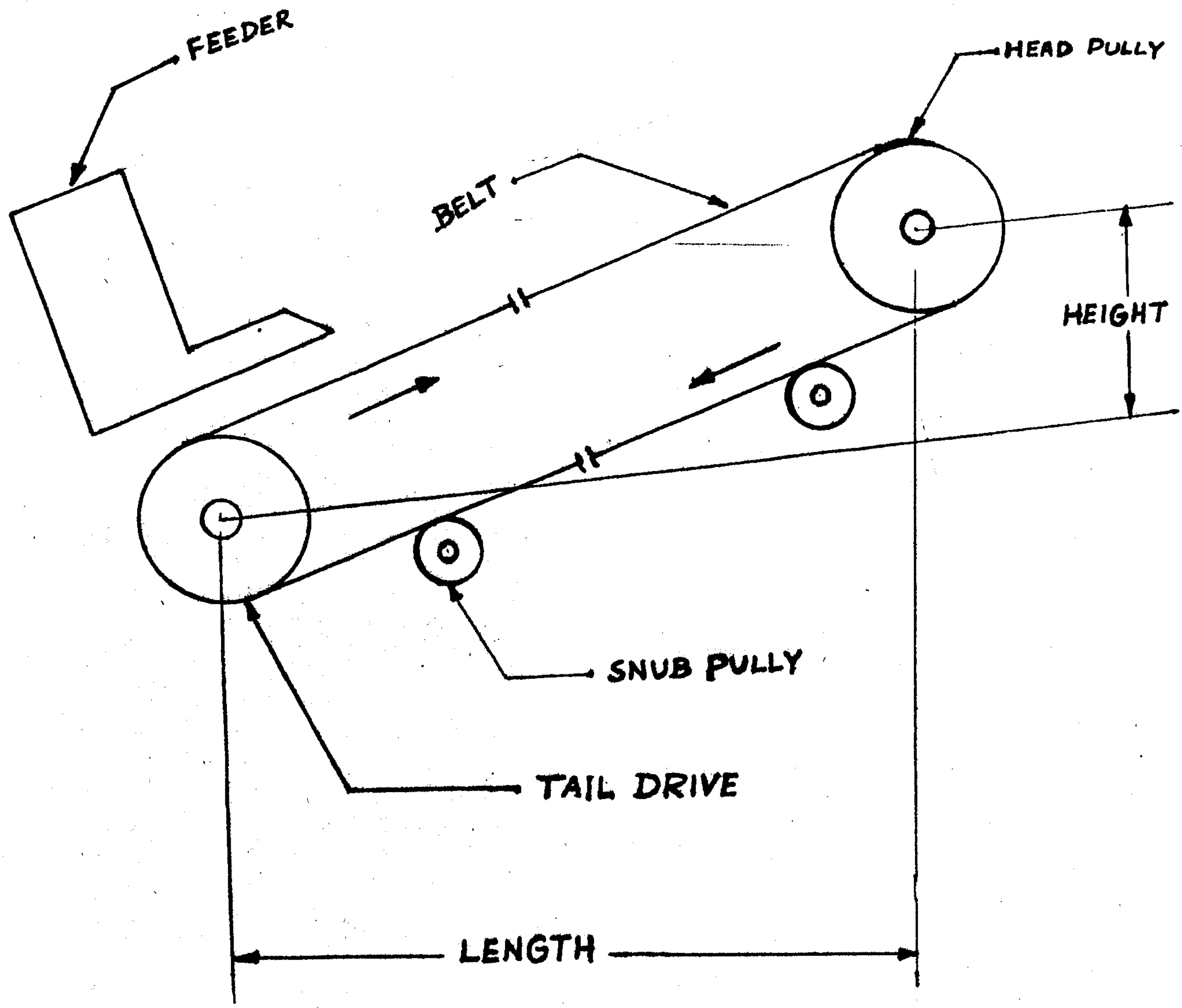
3. FABRIC:- The cotton canvas used in the manufacture of conveyor belting shall be evenly and firmly woven, and shall be as free from foreign matter and defects, as is normal in the best

troughing. these consist of rollers and brackets.

The Idlers rest on bearings and they are lubricated through high pressure grease fittings. The rollers are made of steel tubing. They are generally covered by rubber covering to protect the belt against the damage due to impact. These rollers have diameters varying from 5 to 15 cm.

The Idlers are spaced in such a way that deflection of the loaded belt is prevented. Their spacing therefore depends on the load carried and varies from 10 to 15cm for a 35cm wide belt. For the return portion of the belt the return idlers provide the required support for the empty belt.

CONVEYOR SYSTEM.



ADDRESSES OF DE-FIBERING UNITS

The analysis is conducted in the following factories.

1) M/s Kwality Fibres,
Kinathukkadavu,
Pollachi.

2) M/s Kannan Fibres,
Gomangalam Pudur,
Pollachi.

3) M/s Chitra Fibres,
Nallampalli,
Pollachi.

4) M/s Balamurugan Coir Industry,
Nallampalli,
Kolarpatti Post,
Pollachi.

5) M/s Vasavi Fibre Industries,
Kolarpatti (Sungam),
Pollachi.

6) M/s Thai Mookambikai Fibres,
Thippambatti,
Pollachi.

7) M/s Amman Annai Fibres,
Thippambatti,
Pollachi.

8) M/s Karthikeya Coir Fibre Industries,
Kanjampatti,
Pollachi-54.

9) M/s Sri Raagam Fibres,
Kanjampatti,
Pollachi-54

10) M/s Sri Malayandisamy Fibres,
Kanjampatti,
Pollachi.

11) M/s Kalanithi Fibre Industries,
Ponnegoundenur,
Pollachi.

12) M/s Venkatesa Fibres,
Seelakkampatti,
Pollachi.

13) M/s Barani fibre products,
Kondegoundampalayam,
Pollachi.

14) Saravana Coir Factory,
Rangampudur,
Negamam.

15) M/s New India Fibres,
Pollachi Palladam Main Road,
Pollachi TK.

16) M/s Sri Murugan Fibres,
Kettimalpudur,
Ahilandapuram Post,
Pollachi.

17) M/s Barathi Coirs,
61, Main road,
Kinathukadavu,
Pollachi.

18) M/s Aliyar Fibre,
Kottur Malaiyandipattanam,
Pollachi.

19) M/s Sri Krishna Coir Industries,
Kanakkampatti,
Negamam.

20) M/s Sreenivasa Fibres,
69, Meenkarai Road,
Pollachi-2.

ANALYSIS CONDUCTED IN TWENTY DE-FIBERING UNITS

Twenty De-fibering units in and around Pollachi were analysed. The details of the de-fibering units are tabulated in the subsequent pages.

The details tabulated are our observations during the first shift as well as the second shift in each of the unit mentioned in previous pages. Thus the different actions and activities were observed in the same machines with two different group of employees. Finally, everything is consolidated to arrive at a common conclusion.

The production is expressed in terms of bales. A bale weighs 35kg. The husks required for preparing a bale is 320 Nos. Hence the husks required to produce 1kg of fibre is ten numbers.

OVERALL DETAILS OF FACTORIES UNDER ANALYSIS

S.No	FACTORY NAME	STAFF (ADMINISTRATION & SUPERVISORY)	WORKERS Shift -1 (10 A.M. to 5. P.M.)			WORKERS Shift -2 (10 P.M. to 6. A.M.)			Total Employees	Production per Shift (1 Bale = 35 Kg.)
			Skilled	Semi Skilled	Un Skilled	Skilled	Semi Skilled	Un Skilled		
1.	M/s Kwality Fibres	2	6	6	8	6	6	8	42	25 Bales
2.	M/s Kannan Fibres	2	-	-	-	6	3	3	14	17 Bales
3.	M/s Chitra Fibres	1	-	-	-	5	3	6	15	17 Bales
4.	M/s Balamurugan Coir Industry	2	-	-	-	7	3	7	19	20 Bales
5.	M/s Vasavi Industries	3	5	6	8	5	6	8	41	25 Bales

S.No	FACTORY NAME	STAFF (ADMINISTRATION & SUPERVISORY)	WORKERS Shift -1 (10 A.M. to 5. P.M.)			WORKERS Shift -2 (10 P.M. to 6. A.M.)			Total Employees	Production per Shift (1 Bale = 35 Kg.)
			Skilled	Semi Skilled	Un Skilled	Skilled	Semi Skilled	Un Skilled		
6.	M/s Thai Mookambikai Fibres	2	-	-	-	5	3	8	18	20 Bales
7.	M/s Sri Amman Anni Fibres	2	-	-	-	6	4	7	19	21 Bales
8.	M/s Karthikeya Coir Fibre Industries	4	4	2	4	6	3	11	34	20 Bales
9.	M/s Sri Raagam Fibres	3	3	2	3	4	2	3	20	12 Bales
10	M/s Sri Malayandisamy Fibres	2	6	3	8	6	3	8	36	20 Bales

S.No	FACTORY NAME	STAFF (ADMINISTRATION & SUPERVISORY)	WORKERS Shift -1 (10 A.M. to 5. P.M.)			WORKERS Shift -2 (10 P.M. to 6. A.M.)			Total Employees	Production per Shift (1 Bale = 35 Kg.)
			Skilled	Semi Skilled	Un Skilled	Skilled	Semi Skilled	Un Skilled		
11.	M/s Kalanithi Fibre Industries	2	5	5	5	3	7	10	37	20 Bales
12.	M/s Venkatesa Fibres	2	6	3	8	6	3	8	36	21 Bales
13.	M/s Barani Fibres	3	5	3	9	-	-	-	20	22 Bales
14.	M/s Saravana Coir Factory	2	3	6	10	-	-	-	21	25 Bales
15.	M/s New India Fibres	2	4	5	8	3	4	8	34	19 Bales

S.No	FACTORY NAME	STAFF (ADMINISTRATION & SUPERVISORY)	WORKERS Shift -1 (10 A.M. to 5. P.M.)			WORKERS Shift -2 (10 P.M. to 6. A.M.)			Total Employees	Production per Shift (1 Bale = 35 Kg.)
			Skilled	Semi Skilled	Un Skilled	Skilled	Semi Skilled	Un Skilled		
16.	M/s Sri Murugan Fibres	2	6	5	8	6	5	8	40	23 Bales
17.	M/s Barathi Coirs	1	-	-	-	4	3	12	20	22 Bales
18.	M/s Aliyar Fibre	2	-	-	-	2	5	9	18	20 Bales
19.	M/s Sri Krishna Coir Industries	2	5	6	7	4	3	8	35	21 Bales
20	M/s Sreenivasa Fibres	2	4	5	9	3	7	9	39	24 Bales

From the analysis made, we conclude that atleast 22 employees (Direct and Indirect labour) are required for the low-cost functioning of a de-fibering unit.

i.e.,

Manager (administrative)	1
Supervisor	1
Skilled labourers	6
Semi-skilled labourers	6
Un-skilled labourers	8
Total	22

The production per day is maximum if the above system is adopted.

i.e., 22 employees, Direct and Indirect, for one shift can produce 26 bales of good quality fibres.

DEFECTS ANALYSED :-

1) The belt which transmits power from the reduction gear box to the drum-wheel slips very often. This is a burden to the workers because eveery time they have to re-position the belt. To avoid this a chain design is thought of and the desing of the chain is done. A very good positive drive can be obtained with the chains.

2) The rollers supporting the ring are subjected to shocks and vibrations. In due course, the rollers fail to function because they cannot withstand the shocks for a long time. We are forced to design a shock absorber. The roller rolls on top of the shock absorber. Shocks and vibrations are overcome by the spring of the shock absorber.

3) All the De-fibering units have the common problem of "Wastage disposal". The pith, foreign matter and short fibres coming out are wastes. They can be vanished by burning the same. But as their calorific value is low, the burning will not take place properly. The trials are on the way to use the waste fibres as an alternate fuel.

4) The crushed and soaked green cocoanut husks cross through the two needle bars. One is at the bottom of the 1st drum wheel while the other is at the top of the 2nd drum wheel. The needles in the needle bar pierce the green cocoanut husks. Because of the impact, the needles will get bent or damaged after sometime. Those needles which are made of mild steel have to be sharpened at the end of each shift. So,

EN36 after hardening can be made use of as the needle material. But it is costly when compared to mild steel. EN8 can be used in hardened condition as it is cheaper. It can also withstand heavy impact loads.

5) The Tension roller is situated at the top fo the assembly. It provides tension to the chain so that the husks are firmly held along with the 2nd drum wheel. The Take off roller is situated at the place where both the drum wheels come in contact with each other. This roller helps in taking off the husks from the 1st drum wheel and transfering it on to the 2nd drum wheel. The delivery roller is situated at the exit of the de-fibering machine. It delivers the fibres from the above machine to the next machine, viz. the screener.

The chain which passes through all these three rollers may get loosened after some time. Because of the bonded condition of husks and due to pressure, the husks suddenly tilt to right angles from the normal position. This leads to damage, bulging, twist and breakage of the sprockets of the chain.

For this, the suggested remedies are :-

(i) The chain should be greased periodically and checked often.

(ii) Only properly soaked husks should be fed for processing.

COST ANALYSIS

The total cost involved in manufacturing a De-fibering machine is analysed below:-

1) Frame (C.I.)

Material Cost	Rs.15,000
Labour Cost(Welding,etc.,)	Rs. 7,000

2) Drum Wheels (C.I.)

Material Cost	Rs. 3,500
Labour Cost(Turning, Milling, Grinding, etc.,)	Rs. 2,000

3) Ring (M.S.)

Material Cost	Rs. 756
Labour Cost(grinding, polishing, facing)	Rs. 100

4) Needle Bar Arrangements (M.S.)

Material Cost (Needles&Needle Bars)	Rs. 4,800
Labour Cost (Turning, groove cutting, etc.,)	Rs. 1,600

5) Motors (2 HP, 5 HP, 7.5 HP)

Bought out components	Rs.25,000

Total	Rs.91,556
Distributor's Commission 10%	Rs. 9,155
Grand Total	Rs.1,00,711

PROFITABILITY REPORT

COST OF THE PROJECT :-

1) Land 1 Acre	Rs. 25,000.00
2) Building 1500sq. feet	Rs. 75,000.00
3) One set of Machines & Electrical Motors	Rs.2,75,000.00
4) Electrical Installations, starters & switches	Rs. 25,000.00
5) Working capital required for 1 month	Rs. 50,000.00
	Rs.4,50,000.00

COST OF PRODUCTION :-

(Based on 25 working days at 8000 husks/day)

Raw material 2 lakh husks (Rs.200 per 1000 Husks)	Rs. 40,000.00
Labour charges	Rs. 5,000.00
One supervisor and one clerical staff	Rs. 1,000.00
Repairs, and maintenance & stores	Rs. 3,000.00
Electricity charges	Rs. 3,000.00
	Rs. 52,000.00

SALES VALUE :-

Production of fibre for 2 lakhs husks (Based upon out turn of 100 kgs/1000 husks) Sale valu of fibre Rs.4/kg (Mixed fibre)	Rs.80,000.00

LESS :-

Depriciation of building 10%	Rs.	625.00
Depriciation for M/c 20%	Rs.	4583.00
Interest on Capital 4.5 lakhs 15%	Rs.	5625.00
	Rs.	10,833.00

NOTE :-

The profitability report of the unit at various locations will vary direct in proportion to the cost of land, building, raw material and wages structure prevailing at the factory. The model report shown above is marked out based on the working of de-fibering units at Pollachi, Coimbatore district, and calculated for single shift. If the factory runs more than one shift profit will increase accordingly.

Net Profit/Month = Sales cost - (Production cost + Depreciation and Interest on Capital)

= 80,000 - (52,000 + 10,833)

= 17,167.00

CONCLUSION

De-fibering Machine is profitable for both the seller and the buyer of the machine.

Though all the parts are huge, rigid and sturdy, the total cost of the machine works out to nearly half the selling price. Hence there is high profit for the dealer of the machine.

The de-fibering operation cost and profit is shown in the previous pages. This gives a clear picture of high profit made by the owner of the de-fibering plant.

Inclusion of shock absorber at the bottom of the ring and replacement of the belt by a chain drive have been suggested and desinged. A conveyor system has also been suggested for the transportation of the fibres from De-fibering machine to screener.

All faults, defects and other problems are viewed thoroughly and remedial steps are suggested so as to have optimum efficiency and maximum profitability with improved working conditions.

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ESSENTIAL TERMINOLOGY

1) HUSK - compact and hard fibre surrounding the cocoanut shell

2) CRUSHER - machine used for crushing the husks

3) DE-FIBERING - separating the husks into individual & pure fibres.

4) SCREENER - machine used to remove waste and foreign matter from the fibres.

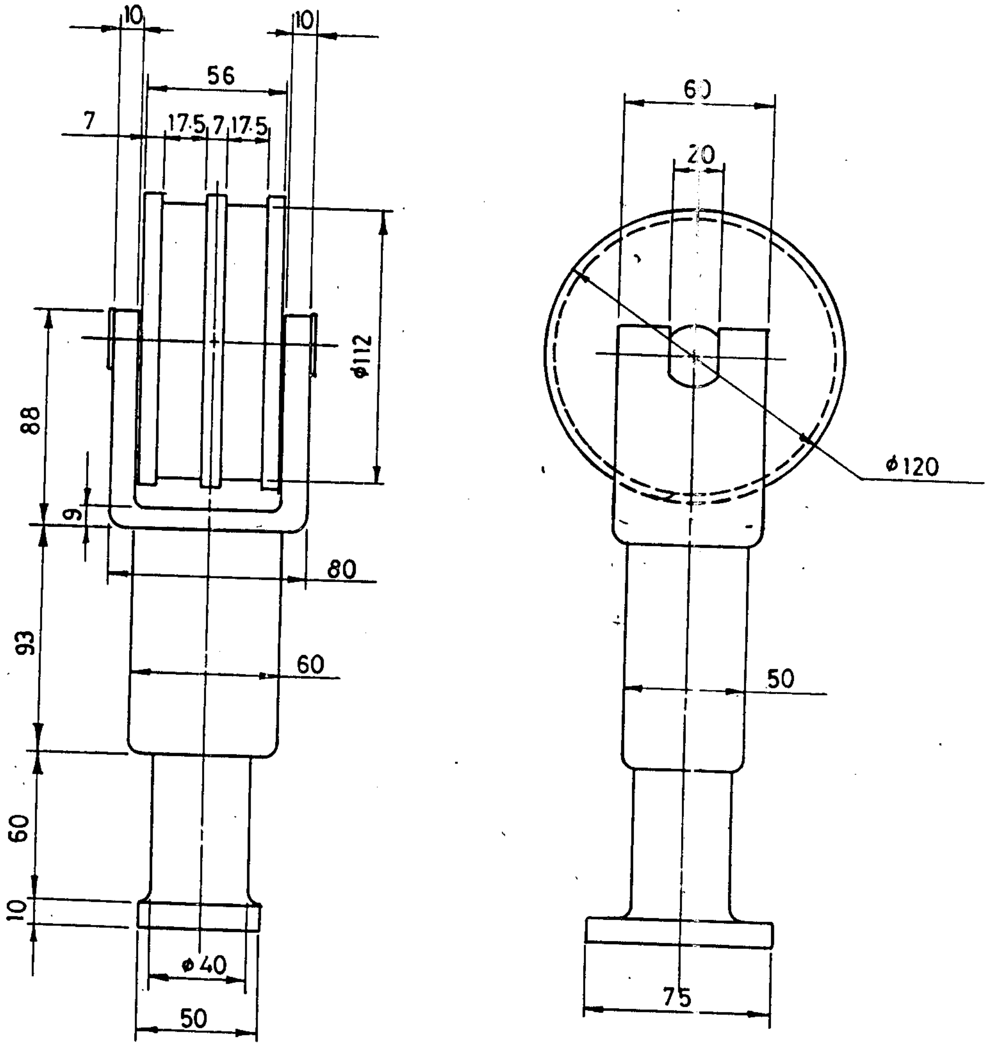
5) BEATER - machine used for final removal of small wastes.

6) BALE - Bundle of fibres weighing 35 kg.

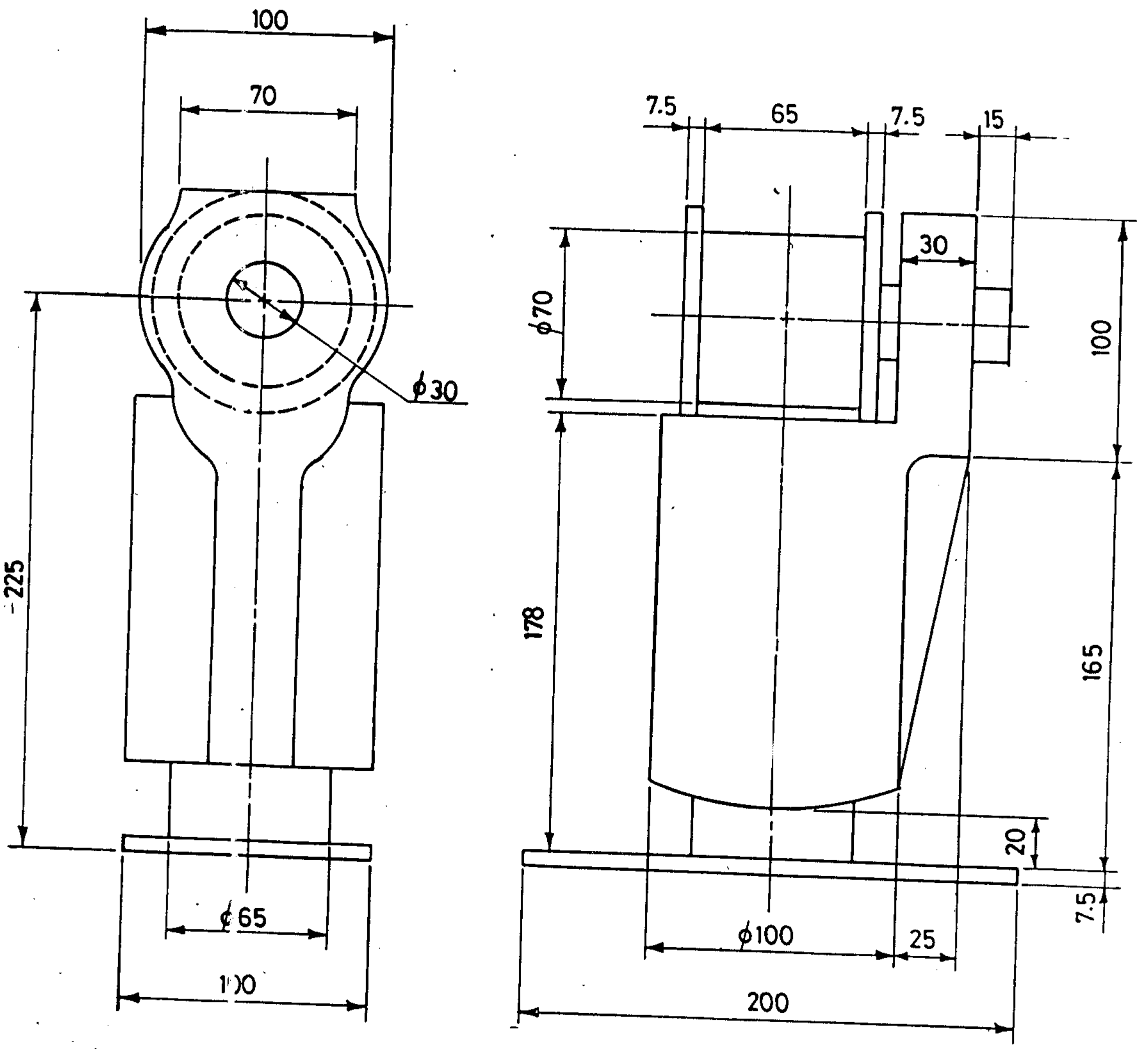
7) CONVEYOR - a system used for transporting fibres from the de-fibering machine to the screener.

CHAPTER 13

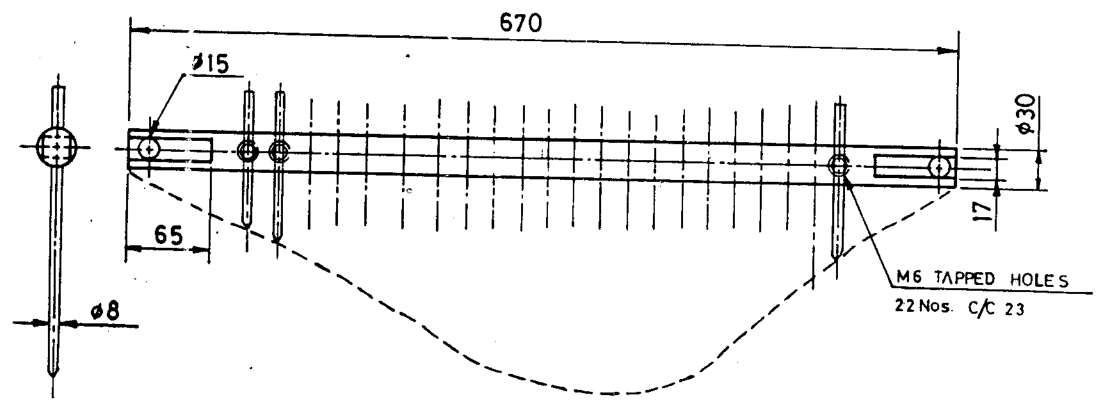
Part Drawings



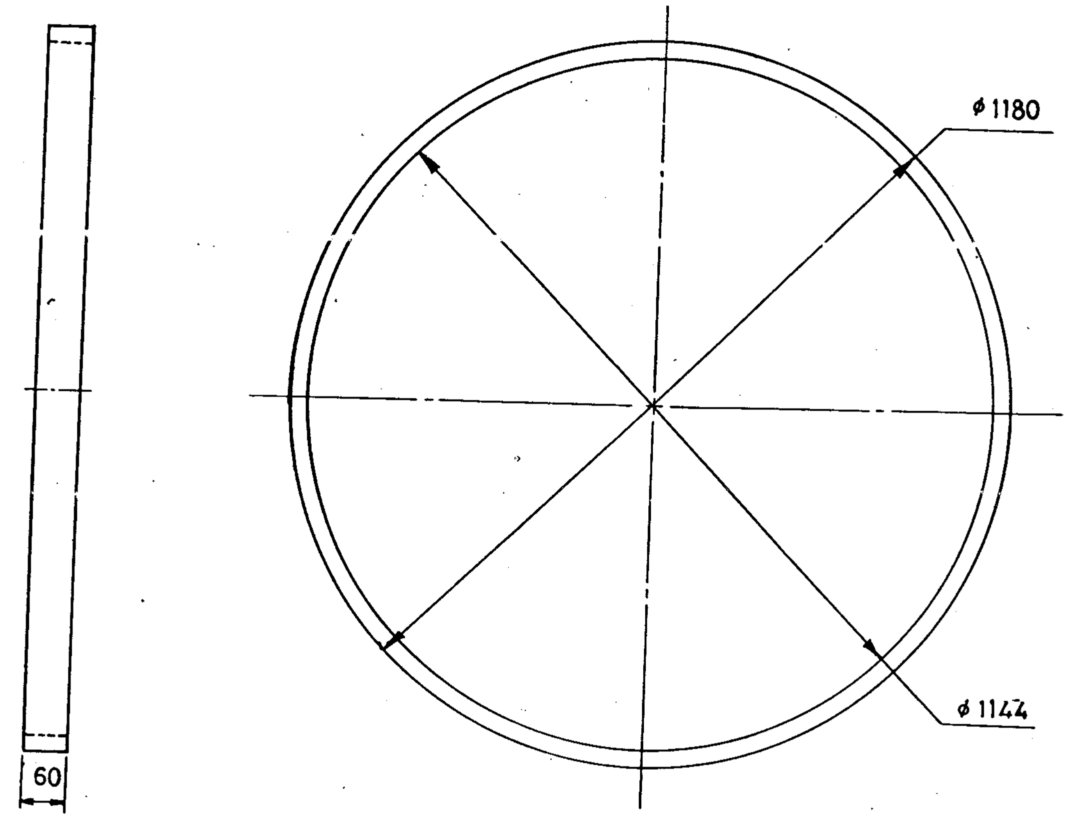
ALL DIMENSIONS ARE IN mm		PROJECT WORK
SCALE 1 2·5	TITLE	
	CHAIN ROLLER	
MATL C.I.		
QTY 2	DE-FIBERING MACHINE	
PROJECTION	KUMARAGURU COLLEGE OF TECHNOLOGY COIMBATORE	



ALL DIMENSIONS ARE IN mm		PROJECT WORK
SCALE 1: 2.5	TITLE SHOCK OBSØRBER	
MATL C.I.		
QTY 3	DE-FIBERING MACHINE	
PROJECTION	KUMARAGURU COLLEGE OF TECHNOLOGY COIMBATORE	



ALL DIMENSIONS ARE IN mm		PROJECT WORK
SCALE 1:5	TITLE NEEDLE ARRANGEMENT	
MATL M.S.		
QTY 12	DE-FIBERING MACHINE	
PROJECTION	KUMARAGURU COLLEGE OF TECHNOLOGY COIMBATORE	



ALL DIMENSIONS ARE IN mm	PROJECT WORK
SCALE 1:10	TITLE RING
MATL M.S.	DE-FIBERING MACHINE
QTY 1	
PROJECTION	KUMARAGURU COLLEGE OF TECHNOLOGY COIMBATORE