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Design of Manual Operated Oil Extraction Machine

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Abstract: ***This paper aim on design and Development of pedal operated Seed oil extraction machine. The machine is portable which makes it light in weight and can be used for small scale industries and for Household and Pure oil extraction. Since this machine requires less space to move, it can be used in a more versatile manner as compared to heavy powered machines that are mounted on heavy and large industries. This machine can be efficient and easy to operate and maintain. The oil extracted has various applications in food, medicine, and industry (1). This paper is also aim on Literature Sur-vey on various mechanism used by top Universities professors According to the Need.***
Keywords: Expeller, Design, Chain, Speed, Seeds, Oil.

I. INTRODUCTION

Expeller presses (also called oil extractors) are a mechanical method for extracting oil from raw ma-terials. The raw materials are squeezed under high during a single step. When used for the extraction of food oils, typical seeds such as flex, mustard, and peanut which are supplied to the press in a continuous feed. As the seeds is pressed, friction causes it to heat up; in the case of harder nuts (which require higher pressures) the material can exceed temperatures of 140 °F (60 °C). Oil expeller may be a device which may produce pressure by rotating feed to expeller screw manually or automatically. Screw press method for oil extraction may be a mechanical method for extracting oil from raw materials. Oil extracted by screw pressing is employed either as a foodstuff or as an indus-trial product. Food products include raw oil in dressings and made up to vegetable oil, groundnut oil, rice bran oil etc. For this heat generation it faces some common problem including overheating, excessive thermal stress, dimensional stability and other thermal related factors. By analysing through simulating software design verification of parts used in screw presser can be modified and increase performance efficiency (2). Locally available material low-carbon steel was utilized in construction of the oil expeller. In the construction of oil expeller firstly it had been designed and validity of stress checked in Ansys. After constructing the oil extraction barrel rectangular bars were placed surrounding it as it permits the passage of oil only and helps to create pressure inside the barrel. The choke mechanism was set in the screw at the outlet of extraction barrel. It was adjusted accordingly to regulate the output of wastage and to extend and reduce pressure accordingly. A reducing gear was used to reduce the rpm of the motor and to increase the energy in the screw shaft (3). Power is transmitted by using pedal which is maintained at gear ratio 18:44 which is for smaller and larger sprocket respectively. The gearbox is connected at output of smaller sprocket shaft. The gearbox used is worm and pinion gearbox which rotates the lead screw at 140 rpm.

II. DESIGN CALCULATION

A. Chain Drive

The speed of the larger sprocket is equal to speed of the rotation of the pedal.

No.of teeth on larger sprocket = 44

No.of teeth on smaller sprocket= 18

Let,

The speed of rotation of Larger sprocket = N_1

The speed of rotation of smaller sprocket = N_2

Therefore,

The relation between the rotations of the two sprocket is

$$\frac{N2}{N1} = \frac{44}{18}$$

Therefore,

The gear ratio of power transmission of chain drive is 2.4

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B. Velocity Ratio of Chain Drive

$$\text{Velocity ratio (VR)} = \frac{N_1}{N_2} = \frac{T_2}{T_1}$$

Where,

N1 = Speed of rotation of smaller sprocket in rpm
N2 = Speed of rotation of Larger sprocket in rpm
T1 = No.of teeth on the smaller sprocket.
T2 = No.of teeth on the larger sprocket.

N1 =?

N2 = 100 rpm (approximately)

T1 = 18

T2 = 44

$$VR = \frac{T_2}{T_1}$$

$$= \frac{44}{18}$$

$$VR = 2.44$$

Now,

$$VR = \frac{N_1}{N_2}$$

$$N1 = 2.44 \times 100$$

$$N1 = 244$$

N1 = 244 rpm.

The revolution of smaller sprocket will be 244 rpm.

Take N_3 = Speed of revolution of bicycle rim.

As the bicycle rim and sprocket is mounted on the same shaft

$$\therefore N_2 = N_3$$

The average velocity of chain is given by,

$$V = \frac{\pi DN}{60} \text{ m/s}$$

Considering the diameter and revolution of larger sprocket
D = 177.8 cm
N1 = 100

$$V = \frac{\pi \times 177.8 \times 10^{-3} \times 100}{60}$$

V = 0.9309 m/s.

C. Length of Chain and its Centre Distance

The open chain containing the two sprockets as on

T1 = No. of teeth on smaller sprocket

T2 = No.of teeth on larger sprocket

P = pitch of chain

X = Centre distance

The length of chain is given by

L = K.P

Where,

K = no of chain drive links and

P = pitch of chain.

The no of chain links (K) is given by

$$K = \frac{T1+T2}{2} + \frac{2X}{P} + \frac{[T2-T1]^2}{2\pi} + \frac{P}{X}$$

We have, Centre distance = X = 34''

X = 863.6 mm

= 0.8636 m

$$K = \frac{T1+T2}{2} + \frac{2X}{P} + \frac{[T2-T1]^2}{2\pi} + \frac{P}{X}$$

$$= \frac{18+44}{2} + \frac{2(863.6)}{12} + \frac{[44-18]^2}{2\pi} + \frac{12}{863.6}$$

= 175.17

K = 175 Nos

∴ The length of chain is given by

L = K.P

= 2100 mm

= 2.1 m

∴ **The total length of chain is 2.1 m**

D. Gearbox Selection

The speed of rotation of smaller sprocket N1 = 244 rpm.

The gear ratio of the gearbox = 1: 15 = 0.6

∴ The output of the gearbox in rpm will be

= 244 × 0.6

= 146.4 rpm

Therefore, we use worm and pinion gearbox.

III. APPROXIMATE EFFICIENCY

Efficiency, percentage of the oil obtained from the extraction machine Extraction efficiency E,

E = Y/Co x 100%

Where

Y = oil yield in percentage.

Co = oil content of Seeds/Nuts/Copra

The oil yield Y is calculated from Y = (W1 - W2)/ W1 x 100%

Where

W1 = Initial weight of seeds (Before extracting)

W2 = weight of cake (after extracting)

1) Considering Value of peanut Table 1

W1 = (150 – 86)/ 150 x 100 = 42%

Efficiency of the machine is

E = Y/Co x 100 = (0.42/0.49) x 100 = 85% ['Co' for peanut is 45 – 50%]

2) Considering value of flex seeds from Table 1, W1 = (150 – 95.5)/150 x 100 = 36%

Efficiency of the machine is E = Y/Co x 100 = 0.36/0.47 x 100 = 76% ['Co' for flaxseeds is 45 – 55%]

3) Considering value of mustard from Table1, W1 = (120 – 51)/120 x 100 = 57.5%

Type	Feed rate (gm/min)	Pressing Time	Initial weight of seed (gm)	Final weight of seed (gm)	Yield of oil (gm)
Peanut	6	25	150	95.5	56.30
Flex seeds	5	30	120	51	68.5
Mustard	6	25	150	86	80

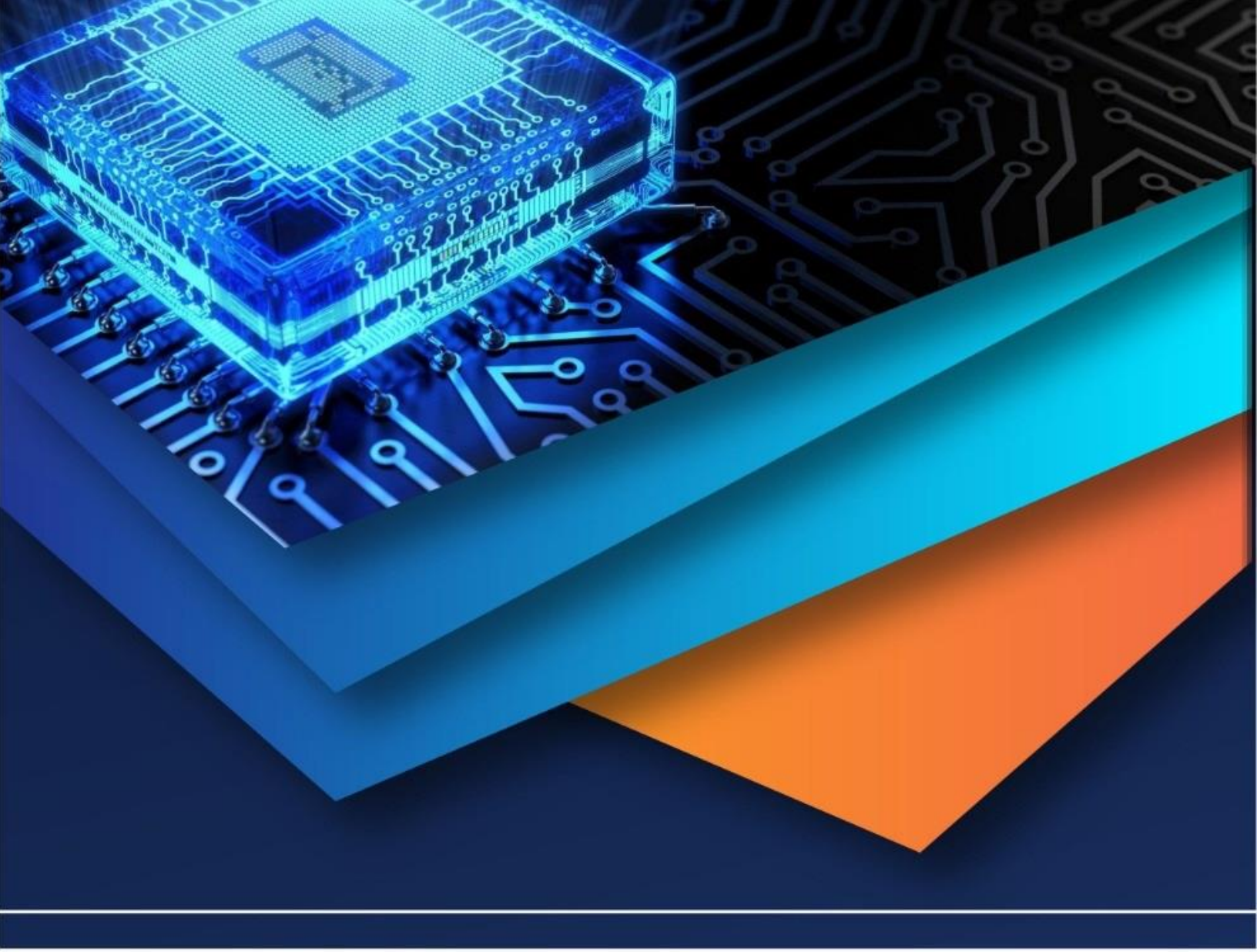
IV. CONCLUSION

The gear ratio of the chain drive will be 2.44, the velocity of chain drive will be 0.9309 as we taken the speed of the revolution of larger sprocket N1 = 100 rpm. It can be increased by increasing the power output of the chain drive. Therefore we use worm and pinion gearbox which is connected directly to the main shaft of the lead screw, the gear ratio of the gearbox will be 0.6 which gives the output of 146.4 rpm. The length of the chain will be 2.1 m which will be open and connected to the input shaft of the gearbox in the end.

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