HEB

Design and Fabrication of Portable Groundnut Thruster

CASS

P.SathiaPrathap[1*], K.Velmurugan[2*], M.SathishKumar[3*], T.KrishnaKumar[3*], V.S.K.Venkatachalapathy[2*]

[1*]Assistant professor, [2*]Professor,[3*]Student

Sri Manakula Vinayagar Engineering College, Puducherry.

Email ID: serviceheb@gmail.com

Abstract:

Portable groundnut thruster is a modified design of the groundnut shell remover but in a reduced scale. This portable groundnut thruster can be easily placed in any facility since the dimensions of this is very compact and effective. The main operation of this thruster is to remove the shell of the groundnut and leave only the seed as the output.

The groundnuts are poured into the dome which then moves into the crusher which crushes the shells without damaging the nuts. The nuts coming out from the crusher are then poured inside a bag and the broken shells are automatically collected in the wastage bag.

This type of portable groundnut thruster can be used in domestic kitchen in day to day life. The portable groundnut thruster is designed to fulfill the necessity of human comfort zone. Houses, catering company, hotels, restaurant etc., making use of groundnut is 9 out of 10 food items. Portable groundnut thruster without polluting the environment gives a comfortable way of removing the shells from the groundnut and ensures hygiene.

Keywords---dome; thruster; hygiene; compact.

Access this Article Online	Quick Response Code:
Website: http://heb-nic.in/cass-studies	
Received on 03/03/2020	
Accepted on 11/03/2020 © HEB All rights reserved	

I. INTRODUCTION

The portable groundnut thruster is designed to fulfil the necessity of human comfort zone. Houses, catering company, hotels, restaurant etc., making use of groundnut is 9 out of 10 food items. Portable groundnut thruster without polluting the environment gives a comfortable way of removing the shells from the groundnut and ensures hygiene.

India is the second largest producer of groundnuts in the world. Indian groundnuts are available in different varieties: Bold or Runner, Java or Spanish and Red Natal. The main Groundnut varieties produced in India are Kadiri-2, Kadiri-3, BG-1, BG-2, Kuber, GAUG-1, GAUG-10, PG-1, T-28, T-64, Chandra, Chitra, Kaushal, Parkash, Amber etc.

They have a rich nutty flavour, sweet taste, crunchy texture and over and above a relatively longer shelf life. Soil conditions in some producing regions are ideally suited for dry, clean and spotless Groundnuts in Shell.

Groundnut is the major oil seed crop in India and it plays a major role in bridging the vegetable oil deficit in the country. Groundnuts in India are available throughout the year due to a two-crop cycle harvested in March and October. Ground Nuts are important protein crops in India grown mostly under rain-fed conditions.

The awareness and concern for quality amongst the Indian groundnut sellers and processors are growing steadily. Multiple sorting and grading are fast becoming a norm. Indian manufacturer have the capability to prepare and supply edible peanuts conforming to highest standards.

Processed Peanuts: Apart from raw edible peanuts, India is also in a position to supply Blanched Peanuts, Roasted Salted Peanuts and Dry Roasted Peanuts and a variety of peanut based products.

II.GROUNDNUT SHELL REMOVING METHODS

A. Manual method:

With the help of hand

With the help of manually operated machine

B.Automatic method:

Ground Nut Decorticator with Inbuilt Blower

III.CONTRUCTION

1. Blower and Blower Housing

Frequency in Hz	50
Hose Diameter in mm	130 mm
Input Voltage (AC)	220 - 240 V
Item Weight	800 gm
Material Type	MILD STEEL
No Load Speed in RPM	1200 RPM
Power in Watt	400
Product Dimensions (LxBxH)	360 x 275 x 275 mm.

The casing that is given to protect the inner components of the blower and directs the flow of air.

2. Blower fan

An impeller is a rotor used to increase (or decrease in case of turbines) the pressure and flow of a fluid.

3. Spindle

This spindle is a prototype of the actual spindle used in the groundnut. This is the main operating part of the thruster which is responsible for the breaking of the shell.

4. Filter:

This part separates the nut from the broken shell and allows the nut to fall out from the holes and is collected using the collecting bags.

5. Drive shaft

As torque carriers, drive shafts are subject to torsion and shear stress, equivalent to the difference between the input torque and the load. They must therefore be strong enough to bear the stress, whilst avoiding too much additional weight as that would in turn increase their inertia. To allow for variations in the alignment and distance between the driving and driven components, drive shafts frequently incorporate one or more universal joints, jaw couplings, or rag joints, and sometimes a splined joint or prismatic joint.

6. Drive mechanisms

The fan drive determines the speed of the fan wheel (impeller) and the extent to which this speed can be varied. There are three basic types of fan drives.

i. Belt

A set of sheaves is mounted on the motor shaft and the fan wheel shaft, and a belt transmits the mechanical energy from the motor to the fan. The fan wheel speed depends upon the ratio of the diameter of the motor sheave to the diameter of the fan wheel sheave. Fan wheel speeds in belt-driven fans are fixed unless the belt(s) slip. Belt slippage can reduce the fan wheel speed by several hundred revolutions per minute (rpm).

ii. Variable

Variable drive fans may use hydraulic or magnetic couplings (between the fan wheel shaft and the motor shaft) that allow variable speed. The fan speed controls are often integrated into automated systems to maintain the desired fan wheel speed. An alternate method of varying the fan speed is by use of an electronic variable-speed drive which controls the speed of the motor driving the fan. This offers better overall energy efficiency than mechanical couplings, especially at greatly-reduced speeds.

iii. Bearings

Bearings are an important part of a fan. Sleeve-ring oil bearings are used extensively in fans. Some sleeve-ring bearings may be water-cooled. Water-cooled sleeve bearings are often used when hot gases are being moved by the fan. Heat is conducted through the shaft and into the oil which must be cooled to prevent overheating of the bearing. Since lower-speed fans have bearings in hard-to-reach spots, grease-packed anti-friction bearings are used. Many turbo blowers use either air or a magnetic bearing.

iv. Fan dampers and vanes

Fan dampers are used to control gas flow into and out of the centrifugal fan. They may be installed on the inlet side or on the outlet side of the fan, or both. Dampers on the outlet side impose a flow resistance that is used to control gas flow. Dampers on the inlet side (inlet vanes) are designed to control gas flow by changing the amount of gas or air admitted to the fan inlet.

Inlet dampers (inlet vanes) reduce fan energy usage due to their ability to affect the airflow pattern into the fan.

7. Fan blades

The fan wheel consists of a hub on which a number of fan blades are attached. The fan blades on the hub can be arranged in three different ways: forward-curved, backward-curved or radial.

Forward-curved

Forward-curved blades curve in the direction of the fan wheel's rotation. These are especially sensitive to particulates. Forward-curved blades provide a low noise level and relatively small air flow with a high increase in static pressure.

Backward-curved

Backward-curved blades curve against the direction of the fan wheel's rotation. Smaller blowers may have backward-inclined blades, which are straight, not curved. Larger backward-inclined/-curved blowers have bladed whose backward curvatures mimic that of an air foil cross section, but both designs provide good operating efficiency with relatively economical construction techniques. These types of blowers are designed to handle gas streams with low to moderate particulate loadings. They can be easily fitted with wear protection but certain blade curvatures can be prone to solids build-up. Backward curved wheels are often heavier than corresponding forward-curved equivalents, as they run at higher speeds and require stronger construction.

Backward curved fans can have a high range of specific speeds but are most often used for medium specific speed applications—high pressure, medium flow applications.

Backward-curved fans are much more energy efficient than radial blade fans and so, for high power applications may be a suitable alternative to the lower cost radial bladed fan.

Straight radial

Radial blowers have wheeled whose blades extend straight out from the Centre of the hub. Radial bladed wheels are often used on particulate-laden gas streams because they are the least sensitive to solid build-up on the blades, but they are often characterized by greater noise output. High speeds, low volumes, and high pressures are common with radial blowers, and are often used in vacuum cleaners, pneumatic material conveying systems, and similar processes.

8. Ratings

Ratings found in centrifugal fan performance tables and curves are based on standard air SCFM. Fan manufacturers define standard air as clean, dry air with a density of 0.075 pounds mass per cubic foot (1.2 kg/m³), with the barometric pressure at sea level of 29.92 inches of mercury (101.325 KPa) and a temperature of 70 °F (21 °C). Selecting a centrifugal fan to operate at conditions other than standard air requires adjustment to both static pressure and power.

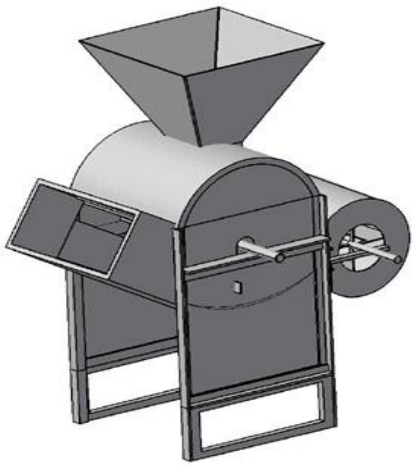
At higher-than-standard elevation (sea level) and higher-than-standard temperature, air density is lower than standard density. Air density corrections need to be taken into account for centrifugal fans that are

specified for continuous operation at higher temperatures. The centrifugal fan will displace a constant volume of air in a given system regardless of the air density.

When a centrifugal fan is specified for a given CFM and static pressure at conditions other than standard, an air density correction factor must be applied to select the proper size fan to meet the new condition. Since 200 °F (93 °C) air weighs only 80% of 70 °F (21 °C) air, the centrifugal fan will create less pressure and require less power. To get the actual pressure required at 200 °F (93 °C), the designer would have to multiply the pressure at standard conditions by an air density correction factor of 1.25 (i.e., 1.0/0.8) to get the system to operate correctly. To get the actual power at 200 °F (93 °C), the designer would have to divide the power at standard conditions by the air density correction factor.

9. Ducts

Ducts are used in heating, ventilation, and air conditioning (HVAC) to deliver and remove air. The needed airflows include, for example, supply air, return air, and exhaust air. Ducts commonly also deliver ventilation air as part of the supply air. As such, air ducts are one method of ensuring acceptable indoor air quality as well as comfort. A duct system is also called ductwork. Planning (laying out), sizing, optimizing, detailing, and finding the pressure losses through a duct system is called duct design.



IV. TYPES OF MATERIAL USED

Ducts can be made out of the following materials:

i. Galvanized steel

Galvanizedmild steel is the standard and most common material used in fabricating ductwork because the zinc coating of this metal prevents rusting and avoids cost of painting. For insulation purposes, metal ducts are typically lined with faced fiber glass blankets (duct liner) or wrapped externally with fiberglass blankets (duct wrap).

ii. Aluminum

Aluminum ductwork is lightweight and quick to install. Also, custom or special shapes of ducts can be easily fabricated in the shop or on site. The ductwork construction starts with the tracing of the duct outline onto the aluminum pre-insulated panel. The parts are then typically cut at 45°, bent if required to obtain the different fittings (i.e. elbows, tapers) and finally assembled with glue.

iii. Polyurethane and phenolic insulation panels

Traditionally, air ductwork is made of sheet metal which was installed first and then lagged with insulation

iv. Fiberglass duct board (pre-insulated non-metallic ductwork)

Fiberglass duct board panels provide built-in thermal insulation and the interior surface absorbs sound, helping to provide quiet operation of the HVAC system.

Flexible ducting

Flexible ducts (also known as flex) are typically made of flexible plastic over a metal wire coil to shape a tube.

Fabric ducting

This is actually an air distribution device and is not intended as a conduit for conditioned air. The termfabric duct is therefore somehow misleading; fabric air dispersion system would be the more definitive name.

Waterproofing

The finish for external ductwork exposed to the weather can be sheet steel coated with aluminum or an aluminum/zinc alloy, a multilayer laminate, a fiber reinforced polymer or other waterproof coating.

V.PRINCIPLE OF WORKING

The unit consists of a hopper, double crank lever mechanism, an oscillating sector with sieve bottom and blower assembly, all fixed on a frame. A number of cast iron peg assembled are fitted ion the oscillating sector unit. The groundnut pods are shelled between an oscillating sector and the fixed perforated concave screen. The decorticated shells and kernels fall down through the perforated concave sieve. The blower helps to separate the kernels from the husk and the kernel are collected through the spout at the bottom. The shells are thrown away from the machine.

Groundnut Sheller is operated on the shearing action blowering action and separating action. Firstly, the inputs i.e. the groundnut are fed to the machine through the hopper. Then groundnuts come in contact with the two members, one is semicircular net and another is roll shaft. Semicircular net is a stationary member while the roll shaft is rotating member.

When the groundnut comes in contact with these two members then the shearing action takes place here. Due to shearing action (crushing) the groundnuts get shelled and divided into two parts. i.e. in the peanut and outer shell of the groundnuts. There clearance is provided between the net and roll shaft. The clearance provided is depends upon the size of the groundnuts which is to be decocted. After shelling the groundnut, the peanut and shells of the groundnut gets dropped from the semicircular net, in downward direction then a centrifugal force is applied by a fan on the peanut and shell of the groundnut.

Due to more weight, the peanuts get moved downward and collected in the separator. But due to lighter weight the shell of the groundnuts is thrown outside the machine and which are collected from the backside of the machine. From the shelling chamber the unshelled groundnuts also get dropped in the tray (7% to 10%). This groundnut gets dropped from the clearance made among the grill. The three kinds of the nets can be used with different size of capsule slots, size vise small, medium and large for various size of groundnuts.

VI. CALCULATION AND MOTOR SELECTION

REQUIREMENT

Roller speed: 200- 300 rpm

Blower fan speed: 900-1500 rpm

PULLY SPECIFICATIONS

Roller pulley diameter: 15 Inch

Blower pulley diameter: 3 Inch

1. Trail 1

$$\frac{\text{Input Rpm}}{\text{Output Rpm}} = \frac{\text{Output Diameter}}{\text{Input Diameter}}$$

$$\frac{960}{O/P} = \frac{15}{2.5} = 160 \text{ rpm} \quad \text{Roller rpm}$$

$$\frac{960}{O/P} = \frac{4}{15} = 600 \text{ rpm} \quad \text{Blowler rpm}$$

CONCLUSION

This Motor With 960 Rpm Is Not Suitable.

2. Trail 2

$$\frac{\text{Input Rpm}}{\text{Output Rpm}} = \frac{\text{Output Diameter}}{\text{Input Diameter}}$$

$$\frac{1440}{O/P} = \frac{15}{2.5} = 240 \text{ rpm} \quad \text{Roller rpm}$$

$$\frac{240}{O/P} = \frac{3}{15} = 1200 \text{ rpm} \quad \text{Blowler rpm}$$

CONCLUSION

This motor with 1440 rpm is suitable.

CAPACITY CALCULATION:

16 kgof Ground Nut == 180 seconds

? == 3600 seconds

16 X 3600/180 == 320 kg/hours

(i.e.) For every hour 320kg of ground nut can be feed in the machine.

VII. OPERATION OF EACH PART

HOPPER

Groundnuts are put in this; it contains a small door which allows to control the flow of the groundnut into the neck of the hopper

INPUT DOME

Protects the shells and the nuts from going outside. It supports the roller and the blower housing.It also helps in mounting the motor on the bed.

ROLLER

Shells are pressed onto the filters using the roller. It rotates at a speed of 240 rpm.

SEPARATING TRAY

It helps in separating the shell from the nuts.It helps in keeping the waste from falling down

BLOWER HOUSING

Protects the blower fans Allows maximum air to flow into the blower pathway.

FILTER

Separatesvarious shapes of groundnuts according to their sizes. Helps in removing the shell.

VIII. FINAL ASSEMBLY

REFERENCE

[1] Optimizing the Performance of a Manually Operated Groundnut (Arachis hypogaea) Decorticator N. Gitau1*, P. Mboya1, B. N. K. Njoroge, M. Mburu.

[2] Design and Fabrication of Groundnut Sheller Machine Ashish S. Raghtate

[3] Journal of Agricultural Engineering and Technology (Jet) Professor A. P. Onwualu