



THE ANAGI TRAY DRYER

Background

The Cashew nut is one of the most popular edible seeds in the world and can be enjoyed in many forms (raw, roasted, cooked etc.) Sri Lanka is home to some of the best varieties of cashew and cashew related activities are widespread. Cashew does not grow everywhere, but its processing activities can be done at any location. The initial processing (drying, decorticating- or removing outer shell, removing *testa*- inner shell) is done mainly by rural women. In order to make the removal of the outer shell more efficient, it is necessary to dry or *oven* the cashew nuts. In a traditional system, the “hot cupboards” or the ovens belong to the middlemen or the “*mudalalis*”. They sell the raw cashew to the women who decorticate them and bring them to the mudalali for ovening.

The hot cupboards need electricity, and a substantial quantity of cashew for ovening. The placement of the electric coil causes uneven heating which leads to irregular drying which causes some wastage in the drying process. These features make it uneconomical to micro scale cashew processors*.

A group of women who were involved in cashew processing requested Practical Action South Asia to develop a dryer that was suited for their purposes. The dryer was developed along with the inputs from these users.

The *Anagi* Dryer

This dryer comprises a drying chamber that includes six trays, a furnace, a heat exchange system and a lifting mechanism for the trays.

The drying chamber is made out of chipboard or timber planks (externally) lined with aluminium sheets both internally and externally. This arrangement reduces the heat loss and ensures that there is an even temperature inside the chamber.

It has a dome-shaped roof enhances the out flow of moist air.



Figure 1: The Anagi tray dryer. Photo: Practical Action South Asia

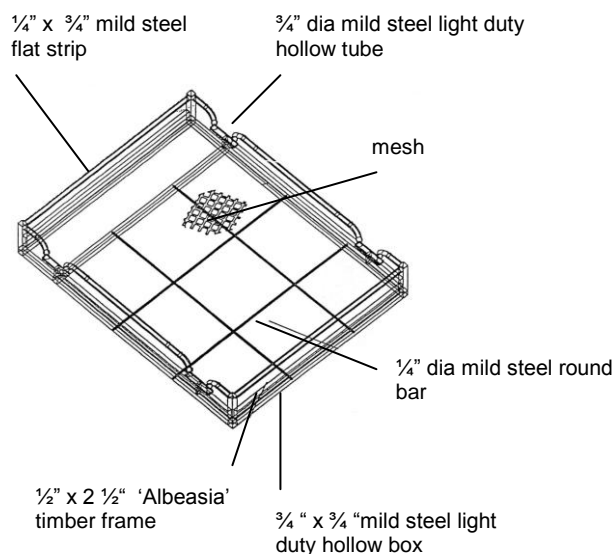


Figure 2: The tray

A removable dial thermometer is connected to the drying chamber.

There are 6 trays in the dryer.

The flue gas from the stove passes through a heat exchanger. The incoming air from the bottom of the dryer gets heated and moves upwards through the trays in the drying chamber. The dryer has been fitted with a lifting mechanism with which the trays can be easily loaded, unloaded and moved downwards. A simple mechanical jack system operated by a lever, controls the lifting and lowering of the trays. The cashew in the lowest trays dries faster than in the top trays.

The dryer can also be fitted with adjustable “flappers” on the top and bottom, to control the heat flow.

Advantages of the *Anagi* Dryer

- The *Anagi* dryer uses paddy husk or saw dust as an energy source and is freely available in rural areas and can also be used in places that do not have access to electricity.
- The uneven drying of cashew has been overcome because the heat flow can be controlled
- The dryer, which has a simple lifting mechanism, permits the removal of a tray and the loading of a new tray with fresh produce while the dryer is operational. This allows for higher output, higher quality, prevents over roasting and improved fuel efficiency.
- It is low cost, easy to operate and maintain and can be assembled in small workshops.
- Can be easily operated by women.

NOTE: The Practical Action South Asia dryer was initially introduced to a group of cashew processors who were mainly women. Upon the suggestions and comments of these women, the dryer was further modified to accommodate their needs. The present model - *Anagi*, is the product of their contribution and paid specific attention to the needs of women.

Technical Details

Construction

- The frame of the dryer is fabricated with 1 1/4"X1 1/4"X1/8" and 1"X1"X1/8" angle iron.
- The main body of the dryer is fabricated with 1" thick *albesia* timber planks or chip board lined both sides with gauge 21 aluminium sheets.
- The heat exchanger tubes are 125 mm in diameter and are fabricated from gauge 16 GI sheets
- A 425 mm diameter barrel is used for the hearth. The stove lid is made out of gauge 16 GI sheets.
- Tray frames are fabricated out of light duty pipes with a diameter of 20mm. These pipes are affixed to planks made out of 1" thick timber (*Albesia*). An aluminium wire mesh is used for the base of the tray.
- A screw type jack fitted to a hand wheel is used as the lifting mechanism.

NOTE: See diagrams for details.

Capacity

It is possible to produce 70-80 kg of nuts per day and will need 30Kg of fuel (saw dust or paddy husks).

Operation

- The furnace is filled with sawdust (about 30 Kg.). It is well compacted leaving a cylindrical opening at the centre (vertical) extending it horizontally at the bottom. This is done by inserting two GI pipes of 75mm diameter before packing with sawdust. Once the packing is complete the two GI pipes are pulled out carefully creating two tunnel-shaped openings.
- The furnace is ignited by a piece of coconut husk or a piece of wood dipped in kerosene oil, inserted through the bottom opening.
- Before firing, the lid of the furnace is closed and connected to the heat exchanger pipes. The furnace can supply heat to the dryer for about 6-8 hrs.
- There are 6 trays in the dryer. Once the trays are in position, the door of the dryer is closed.
- 2 ½ - 3 hours after the initial loading the bottom-most tray is removed and a new one is loaded at the top. After which this procedure is repeated every half an hour.
- The temperature must be kept below 80°C for cashew. Adjusting the ventilation of the hearth can control the temperature.
- Excessive heating inside the drier can be eliminated by controlling the airflow by using the flappers located above the heat exchanger coils. These flappers can be used to maintain a constant heat supply throughout the tray.
- The door of the dryer, has two flaps; one flap at the top to insert trays and another at the bottom to remove the trays.
- The lifting mechanism allows the removal of the lowermost tray when the cashew is dry. After the tray has been removed, the rest of the trays can be lowered and a new tray can be added at the top.

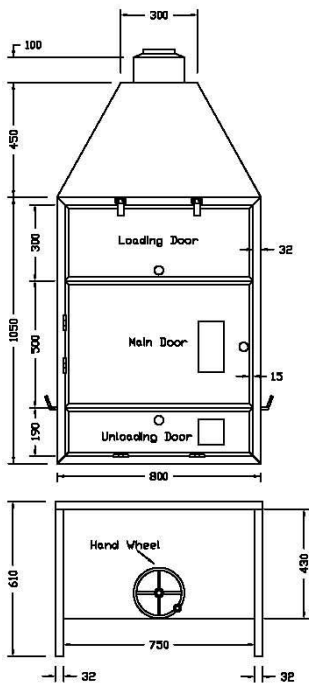
Maintenance

- The dryer needs to be cleaned daily
- The heat exchanger pipes need to be cleaned daily to avoid corrosion.
- The pipes and tubes need to be checked and replaced in 6 - 12 months.

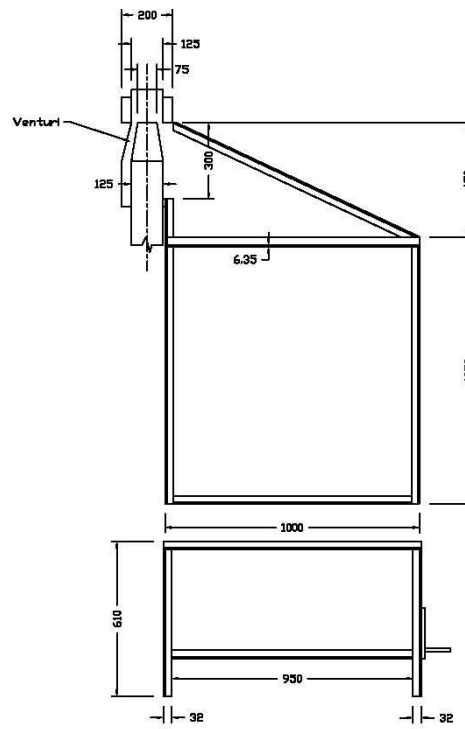
Cost

At present (2000) local fabrication costs is estimated between Rs 26,000 – Rs 28,000 (US\$ 380)

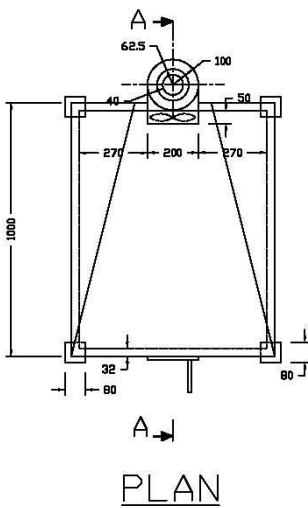
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FRONT ELEVATION

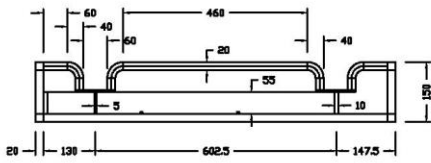


SECTIONAL END ELEVATION
ON A-A

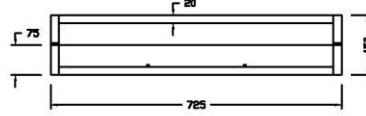


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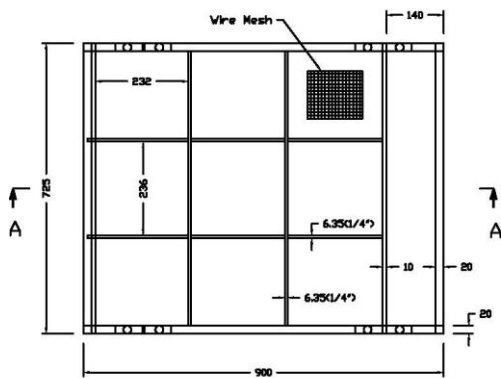
TRAY



FRONT ELEVATION ON A-A

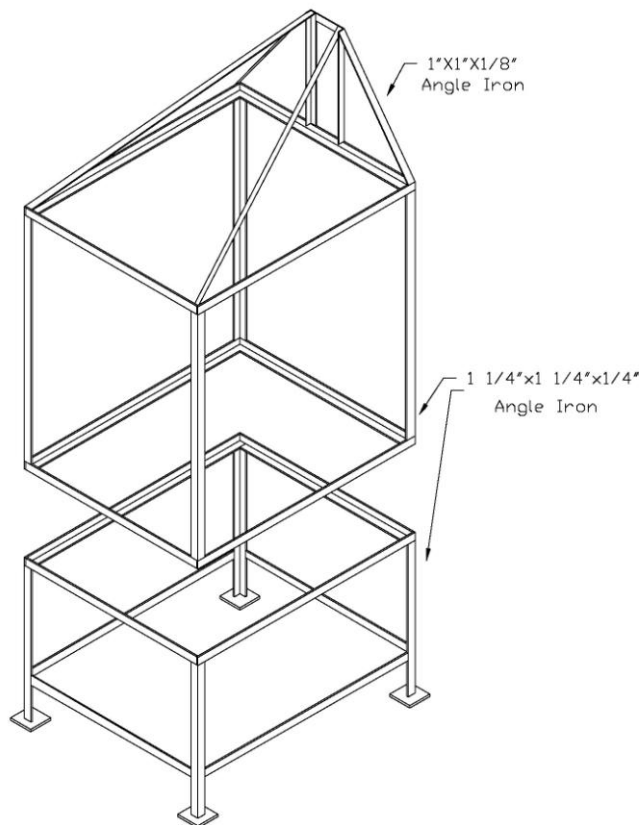


END ELEVATION



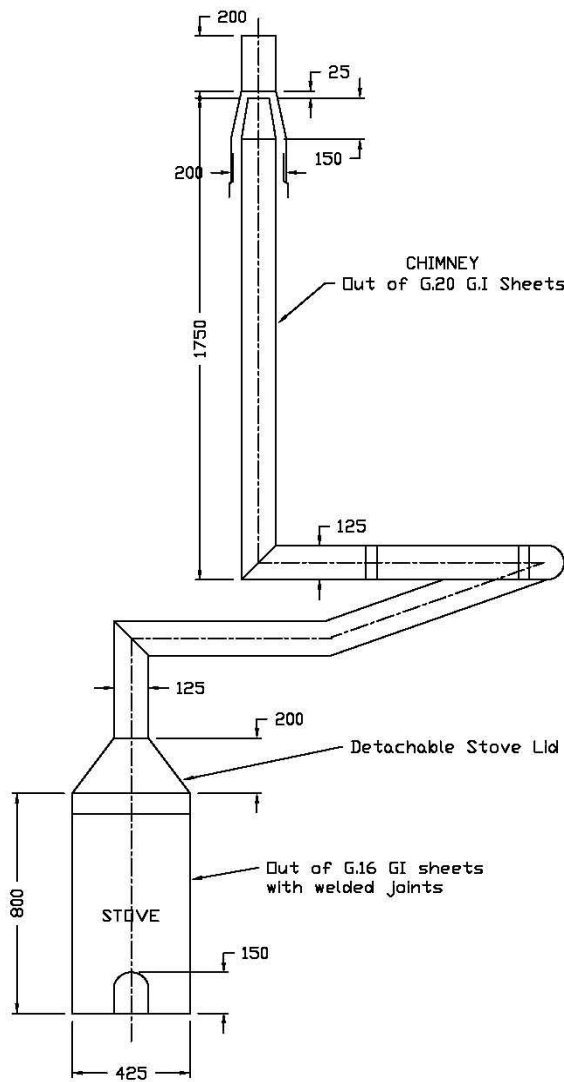
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STRUCTURAL STEELWORK OF THE DRYER

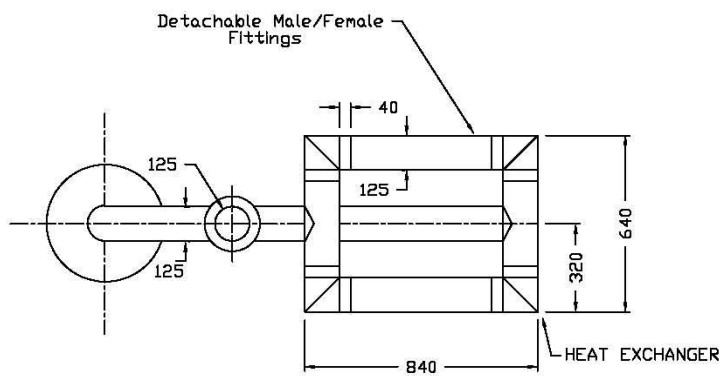


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STOVE, HEAT EXCHANGER AND CHIMNEY



END ELEVATION



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Manufactures

H.P. Thillekeratne
Galahanawatte
Dematagolla
Minuwangoda
Sri Lanka.

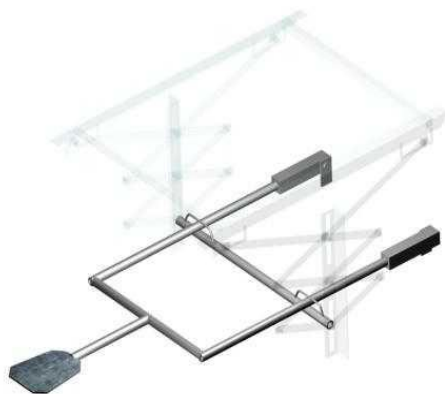
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LIFTING MECHANISM

Spring lifting mechanism



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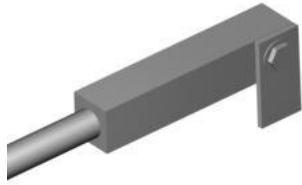
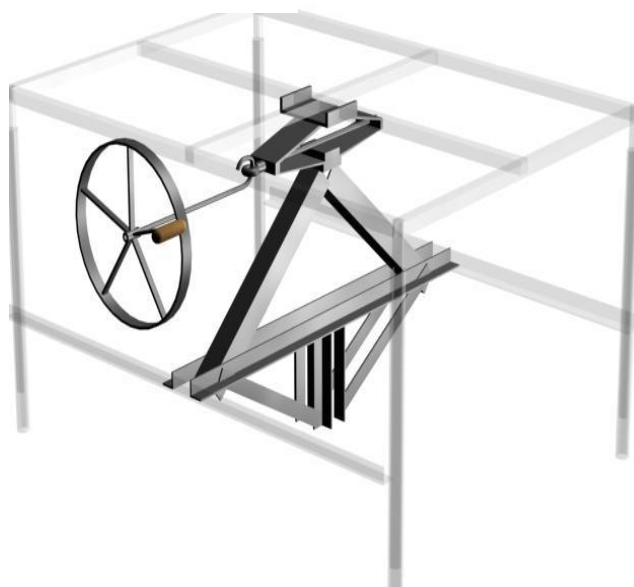


Figure 2: Screw jack type lifting mechanism



Images: Practical Action South Asia

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References and further reading

- *Cashew Nut Processing*, Practical Action Technical Brief
- *Drying of Food*, Practical Action Technical Brief
- *Drying Technologies*, Practical Action Technical Brief
- *Solar Drying*, Practical Action Technical Brief
- *Tray Dryers*, Practical Action Technical Brief
- [*Drying Food for Profit: A Guide for Small Businesses*](#), Barrie Axtell, Practical Action Publishing, 2002
- *Drying Foodstuffs: Techniques, Processes, Equipment*, Jean-François Rozis, Backhuys Publishers, 1997
- *Producing Solar Dried Fruit and Vegetables for Micro-and Small-scale Rural Enterprise Development: A Series of Practical guides*, Natural Resource Institute, 1996

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* *Micro scale cashew processors, are those that are involved in cashew processing as a home industry and in the case of cashew, they are mainly women. The middlemen collect cashew that is processed by these women and sell it to the exporters/buyers. In the larger scale the middlemen are seen as the small-scale cashew processors.*