

# An Improved Method of Air Layering Tropical Hardwoods for Forestry, Fruit and Ornamental Nurseries



**Joe DeFrank - UH-Manoa  
Tropical Plant and Soil Science**



**Tropical Plant & Soil Sciences Department**  
University of Hawaii at Manoa

# Topics Covered

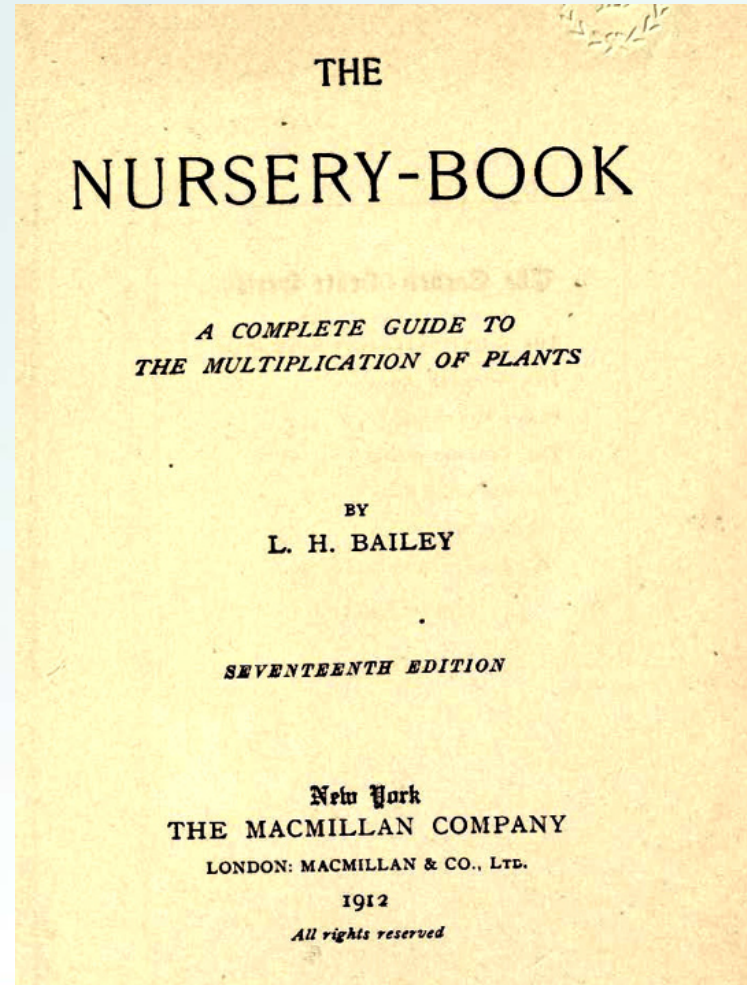
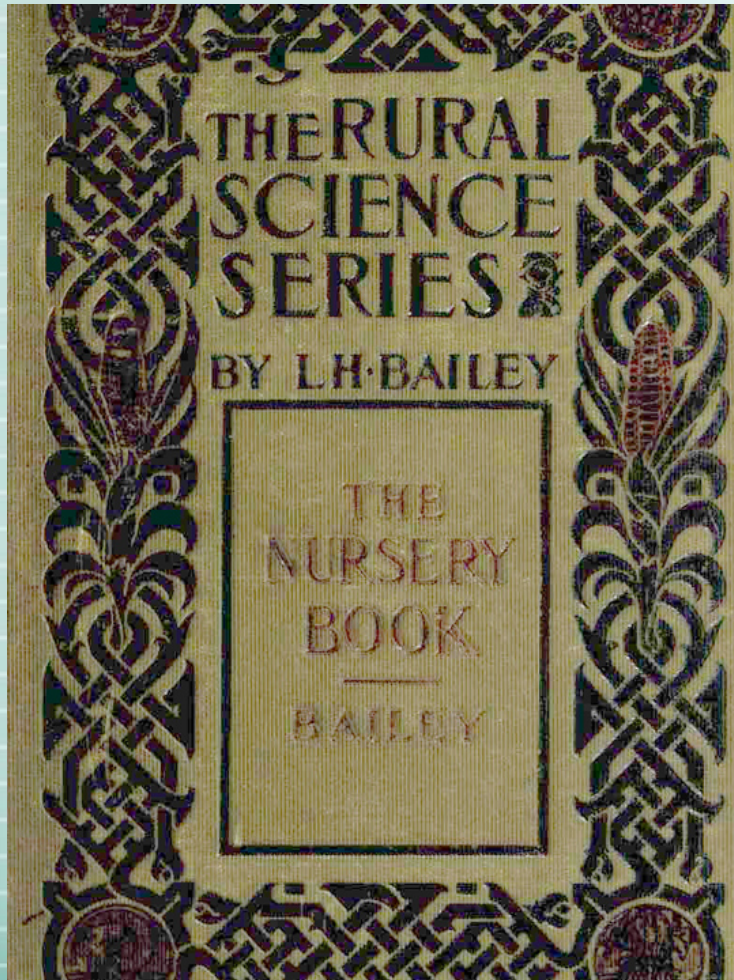
- **What is air-layering**
- **Review of air layer art in patent records**
- **Study species for improved air layer method**
- **Details of improve air-layer method**





# What is Air-layering

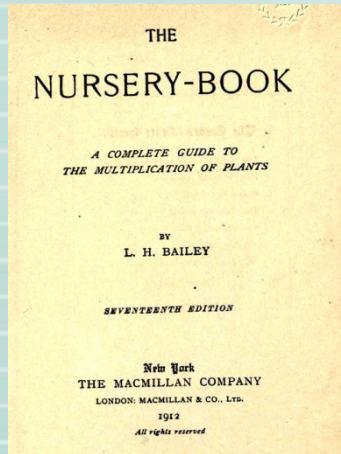
Liberty Hyde Bailey – 1858 - 1954



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# What is Air-layering

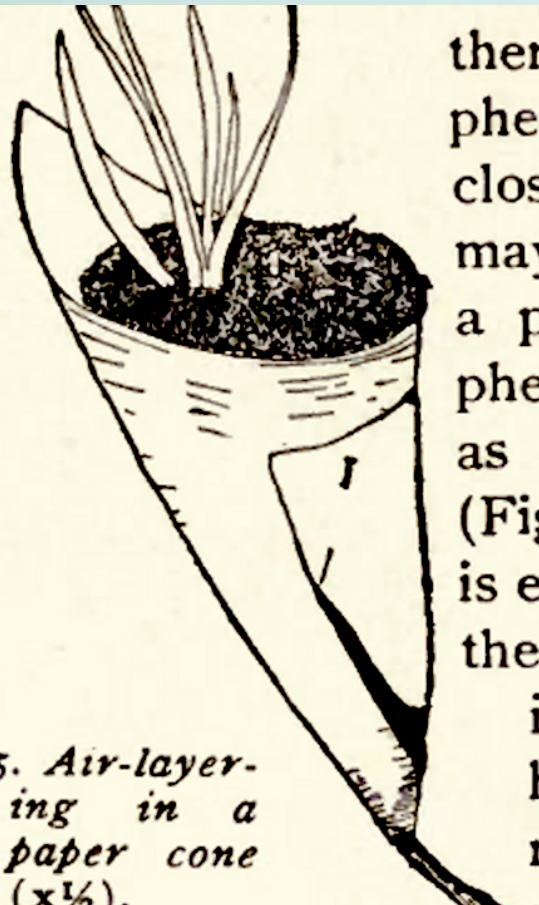
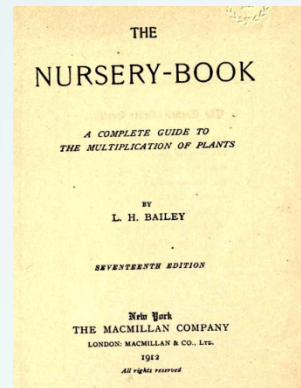


*Pot-layering, circumposition, air-layering and Chinese layering* are terms applied to the rooting of rigid stems by means of surrounding them, while in their natural position, with earth or moss, or similar material. The stem is wounded—commonly girdled—and a divided pot or box is placed about it and filled with earth (Fig. 34). The roots



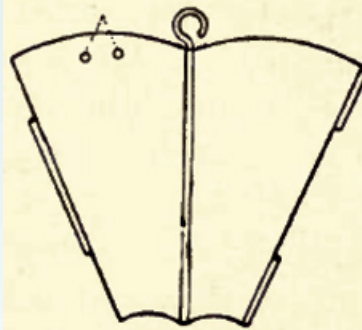


# What is Air-layering

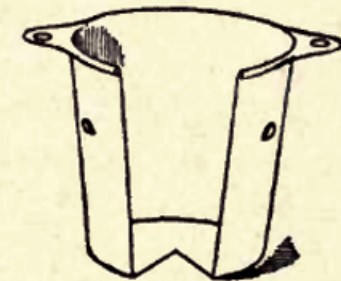


and after roots have formed abundantly the top may be cut off and potted independently, the old stump being discarded.

The French have various handy devices for facilitating pot-layering. Fig. 36 shows a layering-pot, provided with a niche in the side to receive the stem, and a flange behind for securing it to a support. The



pot shown in Fig. 33 is a similar device. Fig. 37 represents a layering-cone. It is made of zinc or other metal, usually 4 or 5 inches high, and

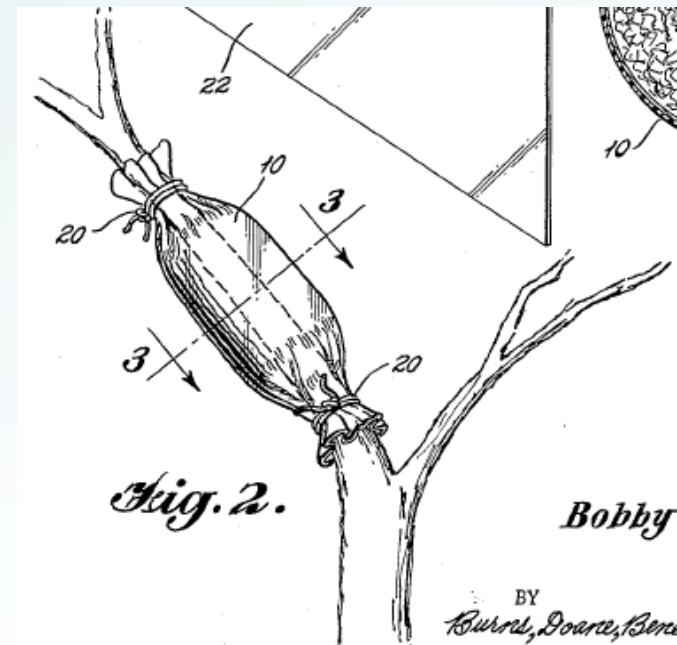
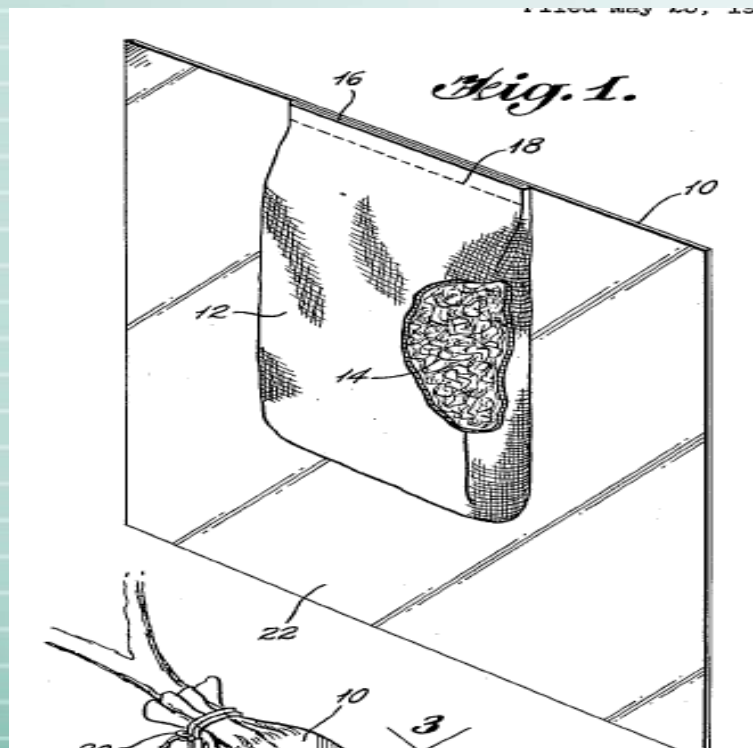


# Review of air layer art in patent records

## Report-Ashmar Tech-08/05/2010

**Patent #: US3110128-05/23/1962**

**Cotton gauze bag attached to clear plastic sheet**



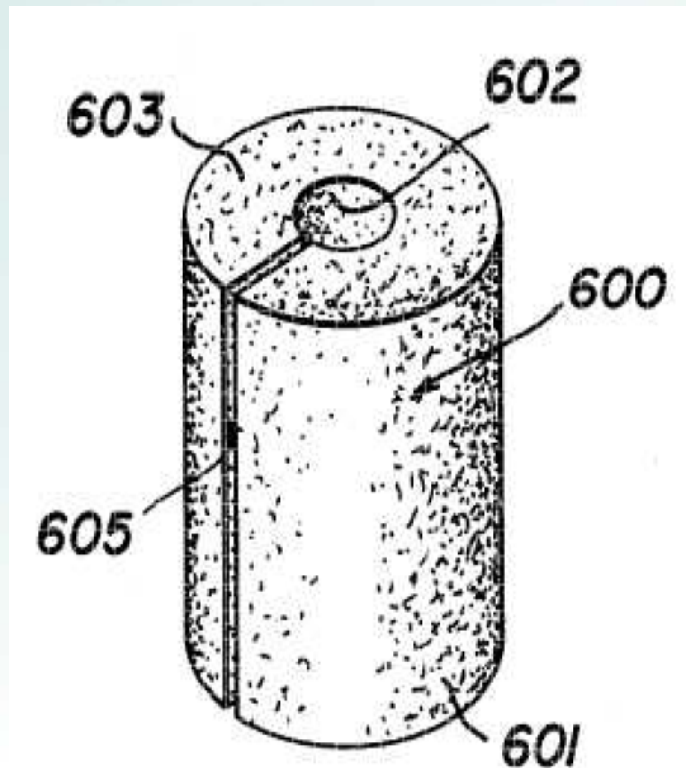


# **Review of air layer art in patent records**

## **Report-Ashmar Technology-08/05/201**

**Patent #: US4175355-07/07/1978**

**Slit tube of hydrophilic polymer with growth media**

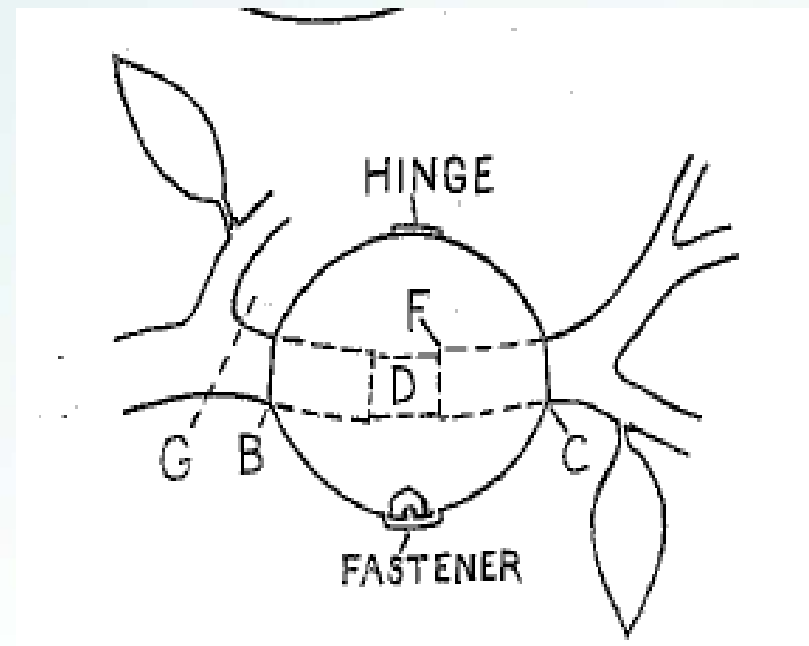
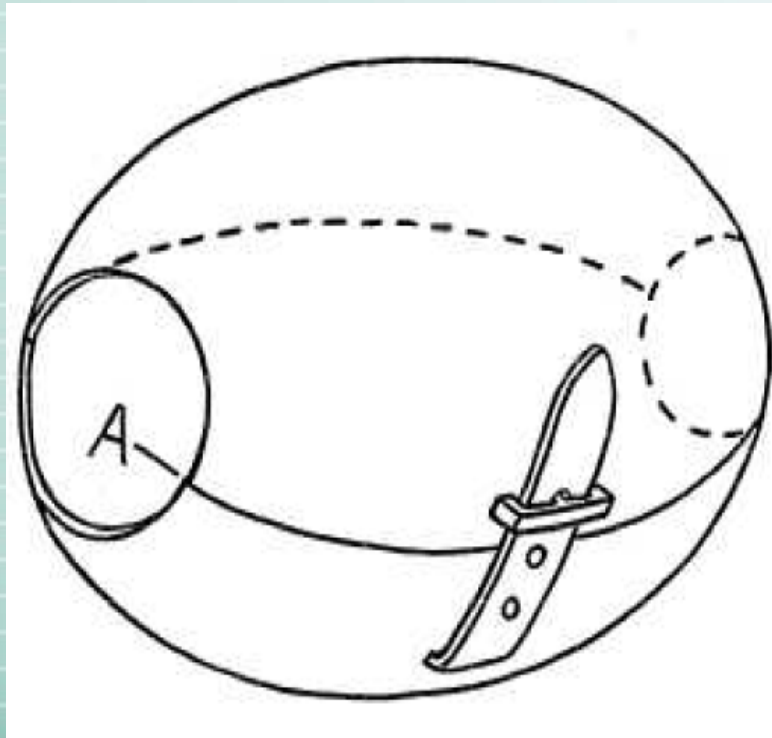


# Review of air layer art in patent records

## Report-Ashmar Technology-08/05/201

**Patent #: GB2057234-03/08/1979**

**Football-like shell with clasp filled with growth media**



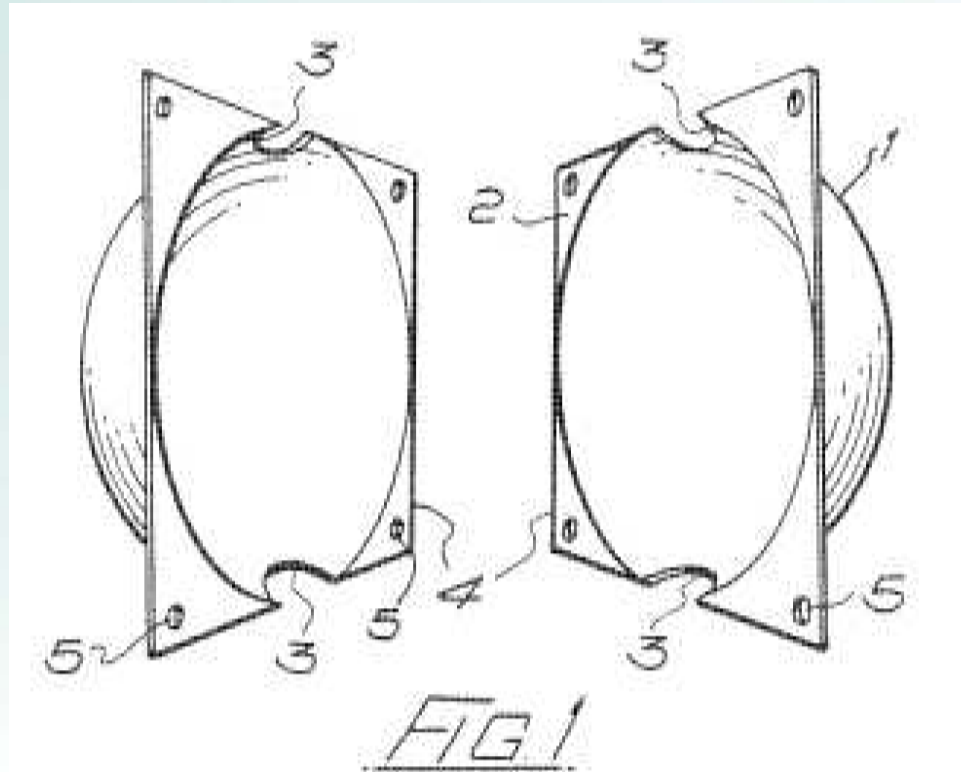


# Review of air layer art in patent records

## Report-Ashmar Technology-08/05/201

**Patent #: GB2108813-01/10/1982**

**Hollow round shell with clasp filled with growth media**

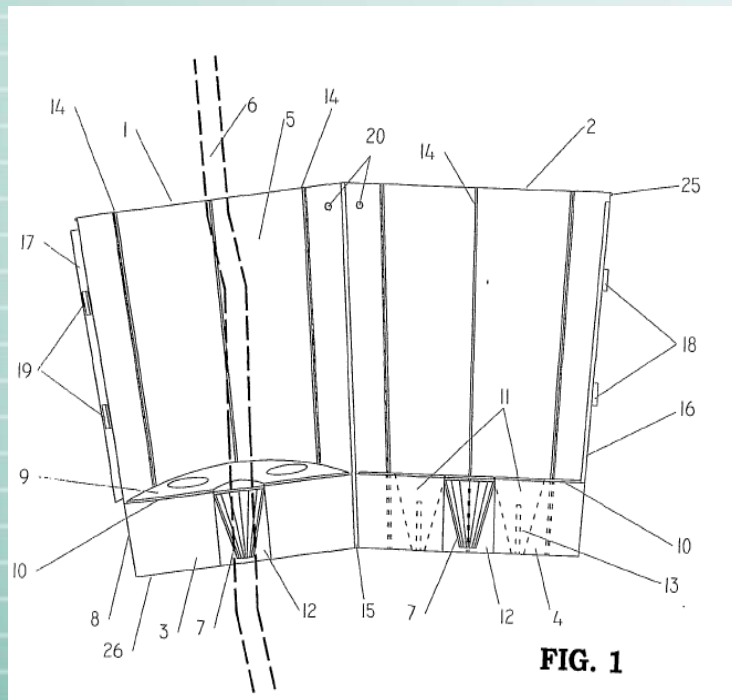


# Review of air layer art in patent records

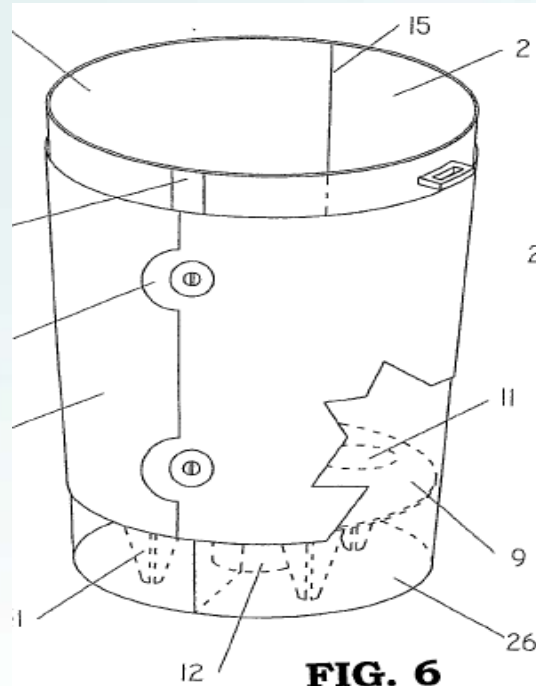
## Report-Ashmar Technology-08/05/2010

**Patent #: WO 0243471-11/27/2001**

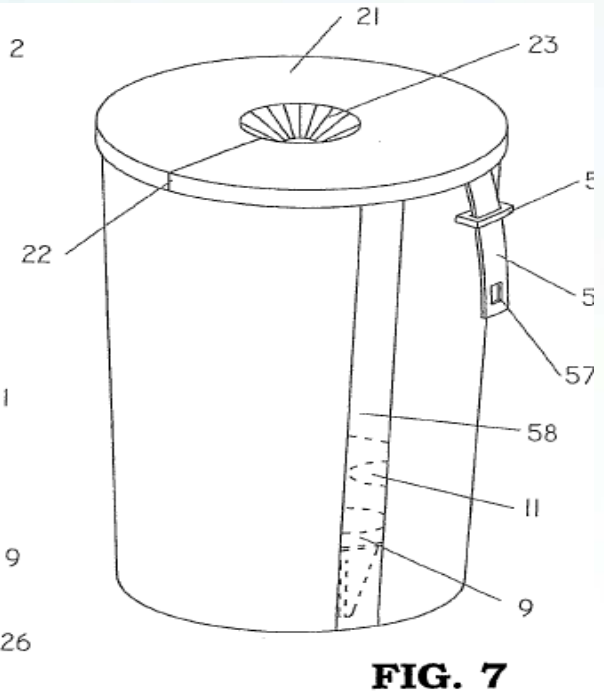
**Hinged cone with water reservoir below media chamber**



**FIG. 1**



**FIG. 6**



**FIG. 7**





# Local air layer method with media in bags

Images courtesy Dr. Ken Leonhardt-UH TPSS



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# Study species – *Cassia x nealiae* Irwin & Barneby

## A hybrid of *C. javanica* L. x *C. fistulosa* L.

F. Vrugtman, 1994. HortScience:29(9) 970-971.



Crosses made 1910-17 by David Haughes in Honolulu, selected 1917-20



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# Study species – *Cassia x nealiae* Irwin & Barneby

*C. fistulosa* L.- male parent



Origin: India  
In HI for 160+ yrs.

## Heavy pod production





# Study species – *Cassia x nealiae* Irwin & Barneby

*C. javanica* L. – female parent



Origin: Java & Sumatra, Indonesia





# Study species – *Cassia x nealiae* Irwin & Barneby

## cv. *Wilhelmina Tenney*

Official Street Tree of Honolulu - 1965



## cv. *Queen's Hospital White*



## cv. *Lunalilo Yellow*

F. Vrugtman, 1994. HortScience:29(9), 970-971





# Improvement to existing air layer systems



**Girdle > callus formation > hormone + sphagnum moss + plastic film**



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# Improvement to existing air layer systems



**Girdle > callus formation > hormone / sphagnum moss + plastic film**



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# Improvement to existing air layer systems



## Problems

1. Time consuming to prepare moss on film strips
2. Sealing ends w/string caused failures due to constriction above root formation zone
3. Ants invaded moss and caused rots
4. Opaque film = Uncertainty of root formation
5. Working off the ground, hard to apply film wraps





# Improvement to existing air layer systems

Improvements to reduce time and improve % rooting

1. Best time of year in HI: Sept to Nov.
2. Insure active growth and barks slips off easily
3. Latex paint with insecticide for ants
4. Fill net sack with sphagnum moss, for hands free film application
5. Shrink wrap for easy sealing and viewing root formation
6. Wrapping procedure to prevent constriction above root zone
7. Incorporate drainage for work in higher rainfall areas



# Insure active growth and barks slips easily



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# Insure active growth and barks slips easily

Remove  
cambium to  
prevent  
reestablishment  
of phloem





# Insure active growth and barks slips easily





# Insure active growth and barks slips easily



**0.8% Indol -3- butyric acid (Hormodin 3)**



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# Latex paint with insecticide for ants

## Permethrin SFR or Tengard Termiticide/Insecticide



### Ornamental

**Plants**, foliage and flowering plants, evergreens, woody and herbaceous non-edible ornamentals and non-bearing plants of fruiting species in landscaped

Ants  
Aphids  
Bagworm  
Beet Armyworm  
Birch Leafminer

4 to 8  
Fluid Ounces  
Per  
100 gallons  
-- or --

**Application:** Apply as a pinstream, as a fine/coarse, low pressure spray (20 psi or less) as a spot treatment or with a paintbrush Treat where



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**Fill net sack with sphagnum moss allows for hands free film application**



**Long media sack for branches of various sizes**



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**Shrink wrap secures media for strong root growth**



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# **Improvement to existing air layer systems**

**Improvements to reduce time and improve % rooting**

- 1. Best time of year in HI: Sept to Nov.**
- 2. Insure active growth and barks slips off easily**
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**Opening at top side requires ant control and drainage**



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## Prolific root growth allows for direct field plantings





**Removed from mango 03/18/11**

**Estb. 07/07/11**



**Estb. 07/07/11**



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**Flowers that emerge  
during air layer  
establishment, can be  
used in tree breeding**



# **Improvement to existing air layer systems**

**Improvements to reduce preparation time and improve % rooting  
Dr. D's Wrap**

- 1. Media in long net bags for branches of various sizes**
- 2. Hands free attachment of media allows for easy film application**
- 3. Loose wrap at top side prevents constriction above root zone**
- 4. Insecticides keep out ants other pests**
- 5. Drainage system essential for high rainfall areas**
- 6. Tight fitting wrap helps with strong root development**
- 7. Wrap keeps roots safe for transportation off site and ideal for soilless shipment to address phytosanitary restrictions.**





# For more information on topics covered

Contact

Dr. Joe DeFrank

3190 Maile Way Rm. 102

Honolulu, HI 96822

Email: [defrenk@hawaii.edu](mailto:defrenk@hawaii.edu)

Ph: 808-956-5698

FAX: 808-956-3894



