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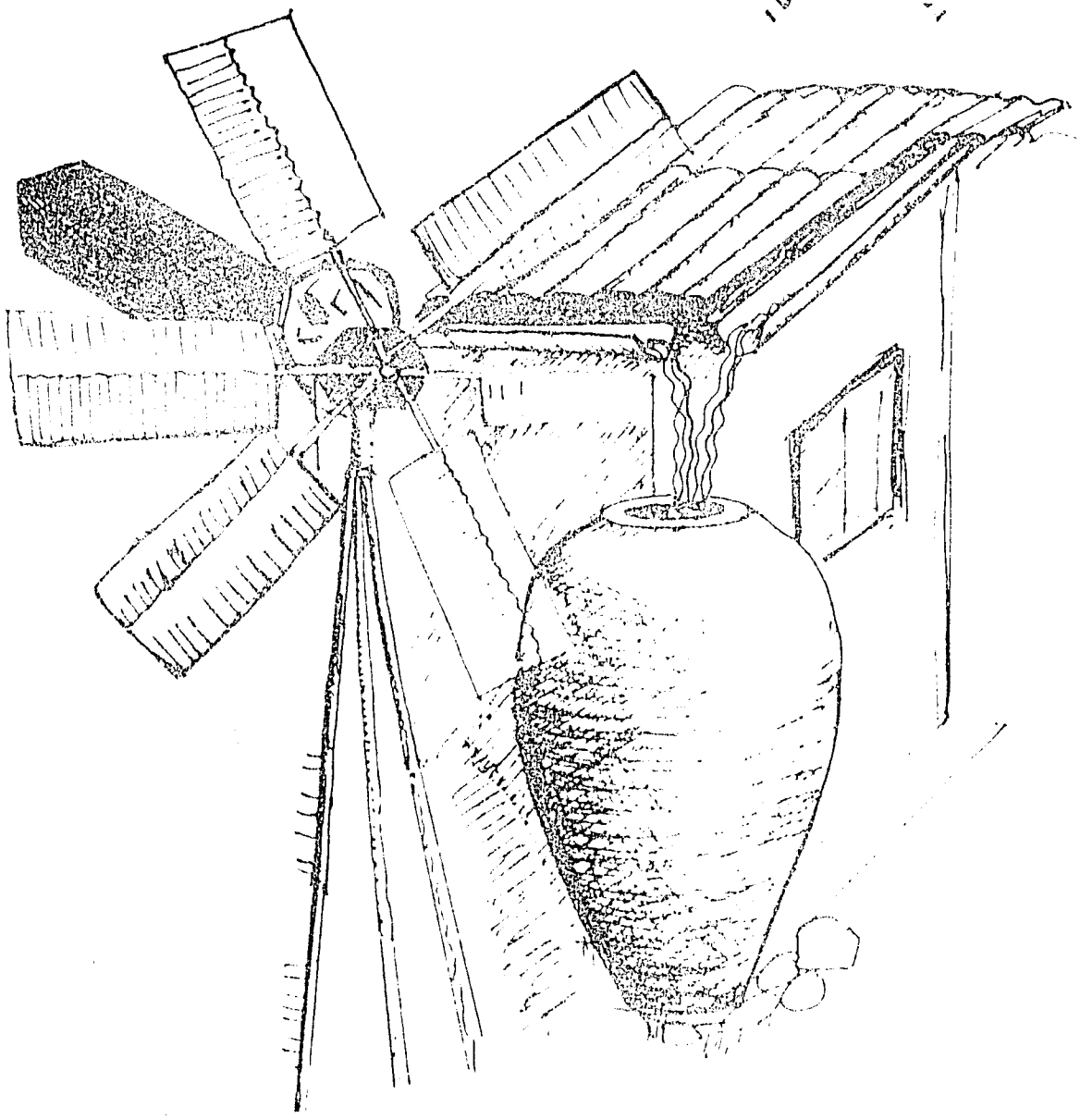
SCOUTING, DEVELOPMENT AND APPROPRIATE TECHNOLOGY



PART 2 – "HOW TO..." SCOUT PROJECTS Nos. 1-6

(Cement Jar, Sand Filter, Cooking Stove, Solar Food Dryer, Maize Store, Solar Still)

SCOUTING, DEVELOPMENT AND APPROPRIATE TECHNOLOGY

SUMMARY

PART 1. - UNDERSTANDING THE PROBLEM - WHAT SCOUTS CAN DO

Part 1 is a simple outline of the problems and possibilities of technology in the process of community development. It discusses how the right kind of technology can improve the standard of living in the community. It shows also what Scouts can do to make the community aware of more appropriate technology, and to develop and utilize it themselves.

PART 2. PART 3. - "HOW TO..."

Parts 2 and 3 provide technical descriptions for several simple projects that Scouts could work on in their communities. They include projects to make water cleaner, to preserve food longer, and several others. You will need to choose the ones most appropriate to your situation.

HOW TO USE THESE BOOKLETS

These booklets are written for National Scout Associations, Scout leaders and other interested organizations. They can be used :

(a) in regular Scout leader training meetings and Scout activities,

(b) in workshops on community development and appropriate technology,

(c) as a basis for producing material on appropriate technology in other languages,

(d) as a manual for appropriate technology projects.

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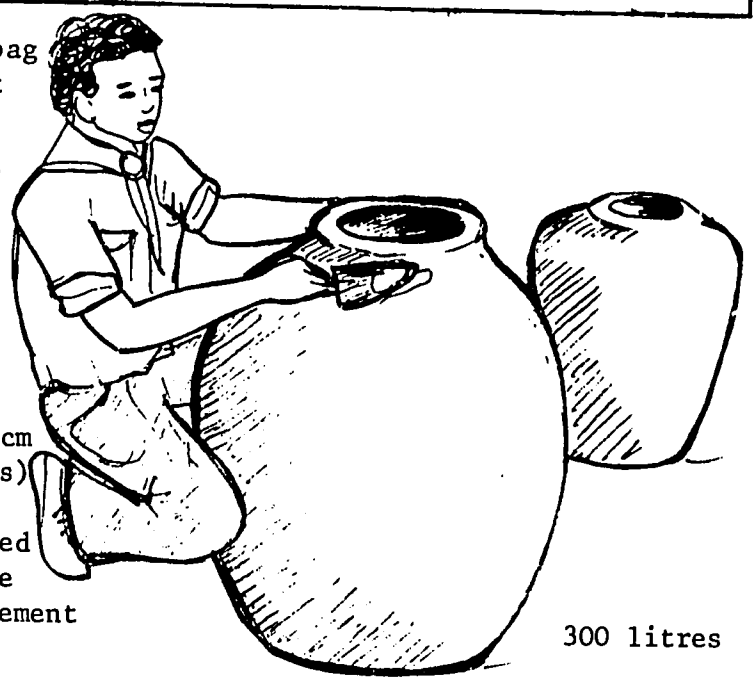
PROJECT 1. A CEMENT JAR

INTRODUCTION

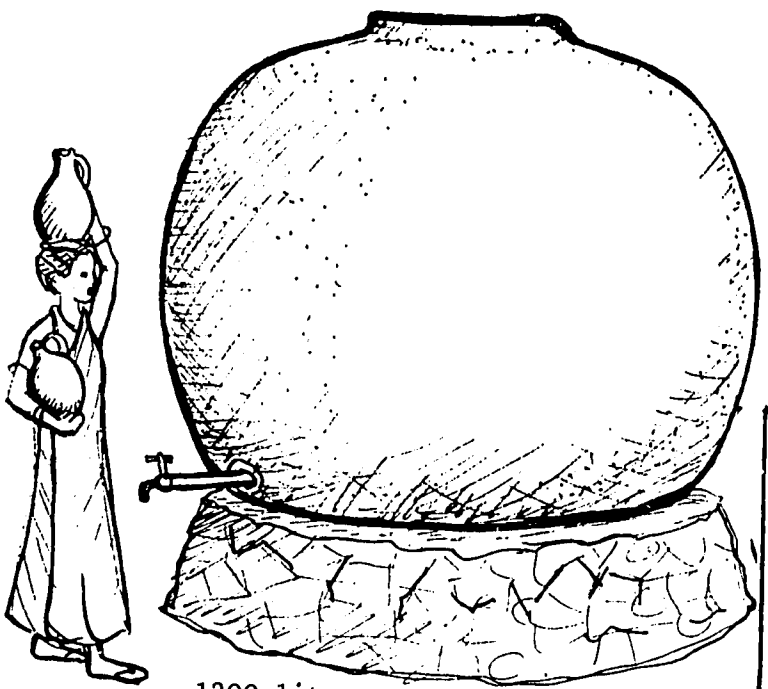
Much disease is caused by drinking polluted water. Also women have often to walk very far to collect the water for the family. An iron rain tank is expensive, and may not be available.

This cement jar is used in Kenya and can be used to collect rainwater, but also to store grain. It makes the water more accessible. It is cheap and simple to build and by keeping it covered the water can be kept pure.

1. This jar is made from a large bag made out of coarse cloth or out of several sacks.
2. The bag is packed with any convenient material, e.g. grass, leaves, chaff, sand, wood-shavings. A circular object is put in the neck of the bag to leave a large enough opening.
3. The bag is moistened with water and a thin layer of cement (2,5cm thick for the jar of 1200 litres) is plastered over the outside. Chicken mesh and wire are wrapped around the bag on the top of the cement; another thin layer of cement is then applied.



300 litres



1200 litres

4. When the cement is dry, the bag and contents are carefully removed.
5. The jar is then plastered inside with waterproof mortar and left to cure for 10 days.
6. The jar can be made on the ground or placed on a raised platform so that a pipe and tap can be fitted to enable water to be easily removed.

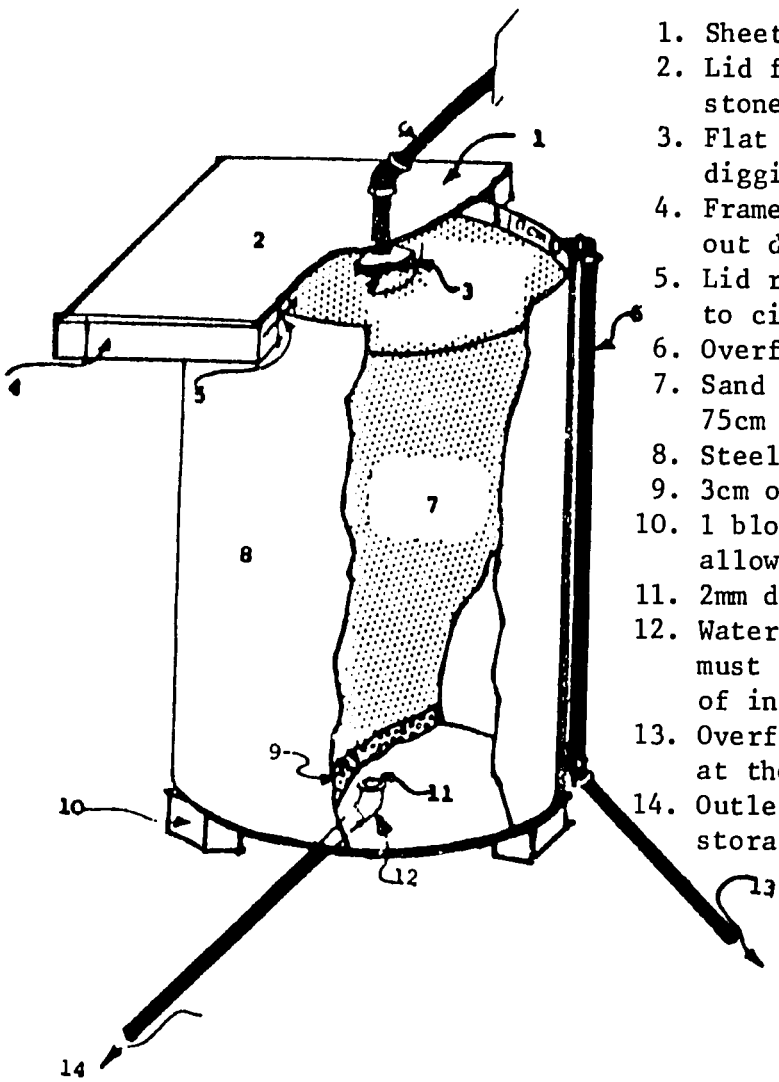
Materials for a small jar of 300 litres:
3 metres of coarse cloth, 1/3 bag cement, fine river sand, string, needle and thread, water

(More quantities of everything as well as chicken mesh and wire for the bigger jar. Also piping and a tap.)

PROJECT 2. A SAND FILTER

INTRODUCTION

Water from streams is often contaminated with leaves and other things. This gravity sand filter can remove most of this material, but it will always let some bacteria pass through. It may still be necessary, therefore, to boil the water after it has been filtered.



1. Sheet metal roofing.
2. Lid fits tight or weighted with stone to prevent blowing off.
3. Flat stone prevents water from digging crater in sand.
4. Frame overhangs at least 2cm to keep out dust and rain from filter.
5. Lid rests on nail which allows air to circulate over sand.
6. Overflow pipe to drain area.
7. Sand depth 60cm minimum, preferably 75cm or more.
8. Steel drum.
9. 3cm or more of pea-sized gravel.
10. 1 block or more, high enough to allow pipe or container underneath.
11. 2mm diameter hole.
12. Water collection pipe or container must fit close to prevent entrance of insects or dust.
13. Overflow drain should be screened at the point of discharge.
14. Outlet to further treatment and storage.

1. This sand filter should deliver 1 litre of clear water per minute.
2. A continual flow should pass through it.
3. After a while a biological growth forms in the top 7cm of sand. This makes the filter more efficient and should always be covered by water. It should never dry out.
4. The sand should be clear and very fine.
5. The filter should be covered so that it is perfectly dark to prevent the growth of green algae. But air should circulate above the sand.
6. When the flow becomes too slow, clean off the top 1cm of sand and scratch the surfaces lightly. It should not be cleaned more than once every few weeks.
7. All pipes should have a diametre of at least 1cm, should have no sharp bends and not be too long. The entrance pipe should be screened to prevent leaves from entering. It should also be flexible enough to allow for the removal of the lid.

PROJECT 3. IMPROVED COOKING STOVES

INTRODUCTION

In many communities firewood is increasingly in short supply, and yet it is the basic fuel for cooking for the majority of families in the world.

To collect enough firewood, villagers may have to go as far as a day's journey. This leaves less time for other productive or recreational activities.

Furthermore, as the trees are cut down, there is more and more chance of soil erosion occurring. This makes it more difficult to produce enough food for the basic needs of the communities.

It is also a problem for people living in towns, as the price of firewood is increasing very quickly.

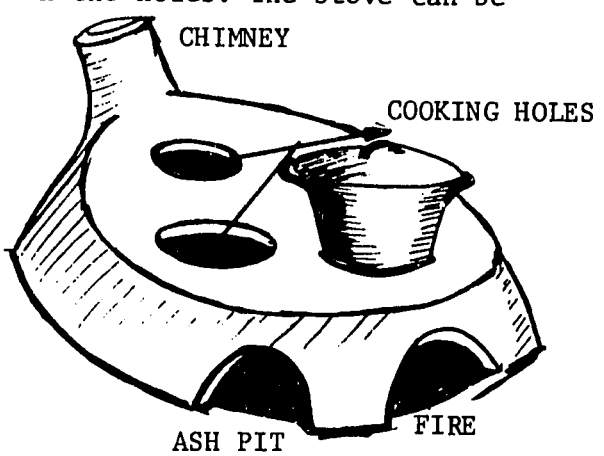
Three important ways of fighting this problem are :

(a) to encourage adequate reforestation programmes by the communities,
(b) to encourage families to use more efficient stoves for cooking,
(c) to develop other sources of fuel.

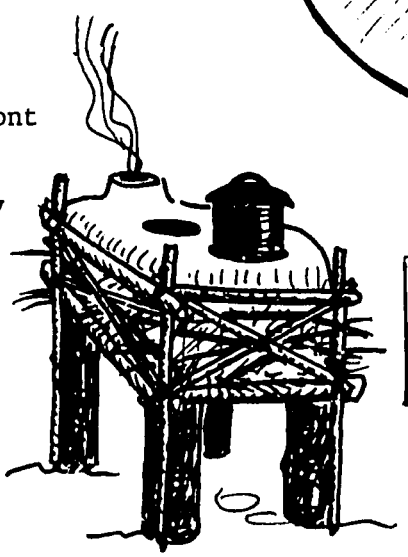
PROJECT 3A. A CLAY STOVE

This is an improved cooking stove which can be made from mud. It works on wood, charcoal or cowdung, uses very small amounts and burns without smoking.

The stove is made from a large block of clay out of which cooking holes are cut and passages are made to connect the holes to an opening at the front. A small fire is lit in this opening, and hot streams of air pass along the passages to the cooking holes, heating cooking pots placed on the holes. The stove can be easily constructed needing no special skills.



1. The holes and passages are cut out while the clay is wet, and the passages are supported, until dry, by pieces of wood.
2. A cooking pot is pressed into each cooking hole while still wet, so that a steady base is formed for the pot.
3. A hole for the chimney is made at the back of the cooker, and one at the front for an ash pit.
4. The cooker is dried slowly to avoid cracks.
5. The cooking holes should be kept covered when the stove is not in use, or if only some of the holes are being used for cooking.
6. The ash pit should be emptied periodically.

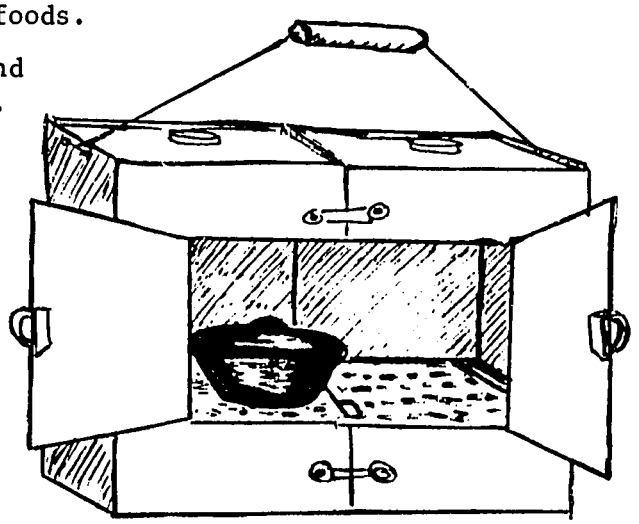


A rough guide to materials:

- *5 baskets of clay,*
- *Short pieces of wood*

PROJECT 3B. AN OIL CAN OVEN

This is an oven made from two kerosene tins. It can be placed directly on a fire, and successfully bakes and roasts most foods.



1. The tins are cut out on two sides, and doors are made from the cut out tins.
2. The two tins are then joined, using bolts or rivets. No soldering is required.
3. The doors are attached to the oven by small hinges and fitted with catches for closing.
4. Shelves are made from the remaining cut out tins.
5. A layer of dry, clean sand is placed on the bottom of the oven.

When placed on a fire, the sand heats, and so heats the oven. If greater heat is required, burning charcoal can be piled on top of the oven. The original holes for pouring out the oil can be used to ventilate the oven and keep it from becoming too hot. The oven is light and easily transportable.

A rough guide to materials:

2 kerosene oil cans,
2 pairs of small hinges (made from the oil cans),
About 24 bolts, rivets or nails, sand

PROJECT 3C. A SMOKELESS STOVE

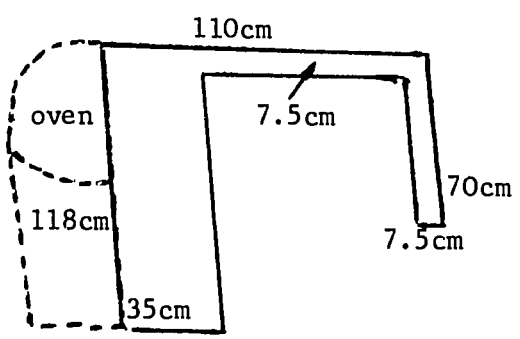
This stove was designed to be used in villages in Ghana (contact Department of Social Welfare and Community Development, Accra - Ghana).

Many families use open-wood fires. But in many places wood is becoming more scarce and expensive. Also many eye defects are caused by smake and hot debris. Accidents are common.

This stove can be made from a mixture of clay. It includes an oven and a drying store for the wood. It is cleaner than the open fire, makes better use of the fuel and reduces health hazards. It can be controlled and the entire meal can be cooked at the same times.

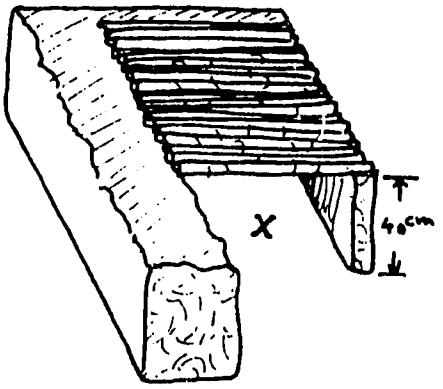
Step 1.

Select the site carefully to allow for the discharge of smoke from the chimney, and for the convenience to the food preparation area, etc.



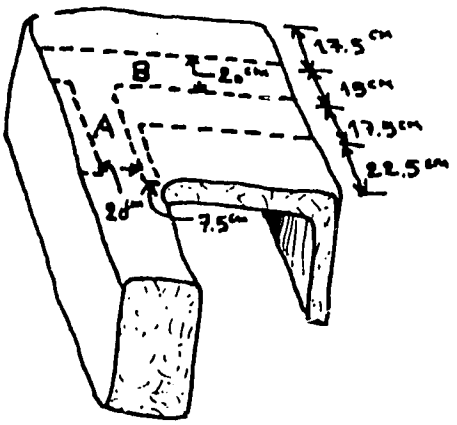
Step 2.

Build the base walls to a height of 40cm. Blocks may be used, or a clay mixture.
Place bamboo or bush sticks over the storage area X.



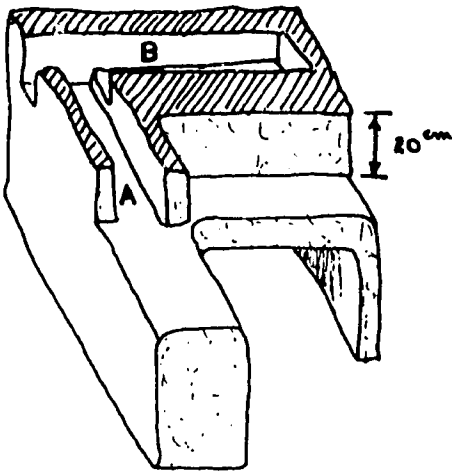
Step 3.

Cover the bush sticks with clay and continue to build up the foundations to a height of 50cm. Mark out the upper walls, the fire chamber walls (A) and the heating chamber walls (B).



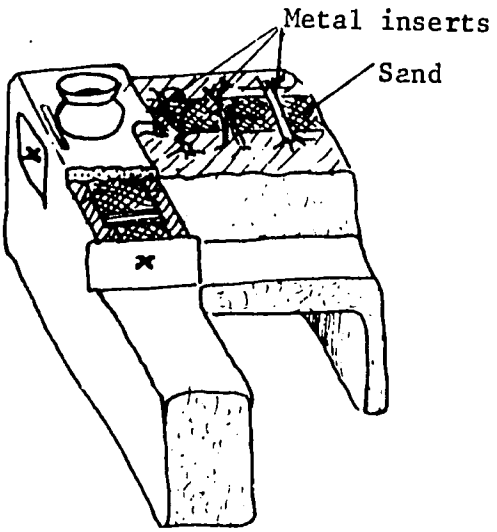
Step 4.

Build up the fire chamber walls (A) and heating chamber walls (B) for a further 20cm.
Build up the floor of the heating chamber by 5cm, and make sure it slopes upwards towards the chimney.



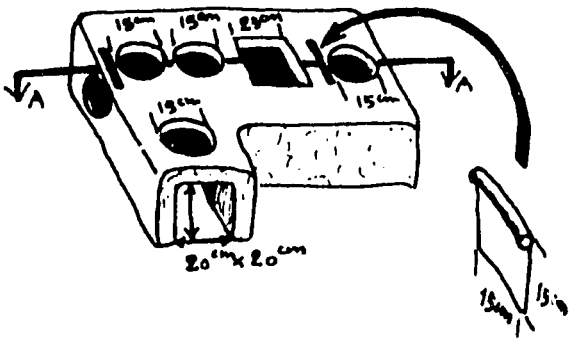
Step 5.

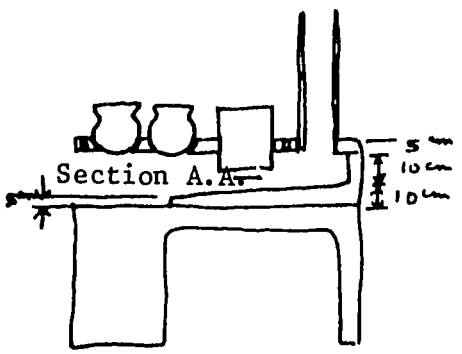
Place cardboard or board at positions market X. Fill fire and heating chambers with sand or dry earth. This is done to support the stove top during the next steps in the construction.
Next, place pieces of rod, metal bars or wire across the chambers in between each cooking place. These reinforcing metal inserts will strengthen and support the clay top. Set pots or pans on the sand and mould the clay stove top around the pot to get a proper fit.



Step 6.

This is a suggested detail of the stove design. Change opening sizes to fit pots or pans as desired. The suggested square opening is for water heating in a kerosene tin. A round pot may be substituted. Caution: if large pots are to be used, care should be taken that the heating chamber passage does not become blocked by the pot. Allow adequate space under the pot bottom for the hot gases to pass into the chimney (see Section A.A.). The control doors as indicated in the insert (Section A.) are made of scrap tin or iron sheet. They should have one rolled edge to serve as a handle. The fire control doors fit into the control slots, one just before the chimney opening, the other just at the oven opening.





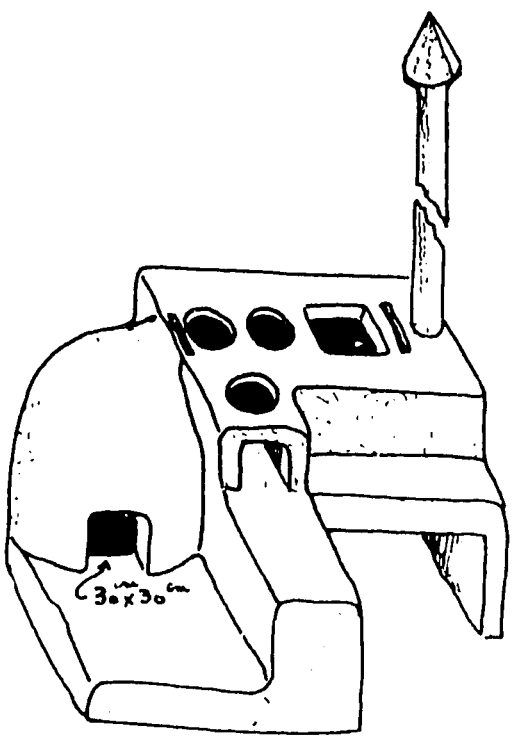
Step 7.

The Oven

Build up the oven platform 15cm. high and 50cm wide and lay out oven area as indicated. Start building a 10cm thick wall straight up and gradually form the dome as shown on the right. Build the wall without an oven door; then before the clay is set hard, cut out a section for the door. If difficulty is encountered in forming the oven, the inside volume may be filled with sand or dry earth as the oven wall is progressively built. The dry middle core will support the wall and dome during building. The sand may be taken out through the oven door after the walls have hardened.

The Chimney

The chimney is most important to the success of the stove. It must not be too short nor too small in diameter. Minimum height should be about 2 metres. The diameter should be at least 15cm. It is possible to build the chimney of clay, asbestos water pipe, or a metal pipe. Cover the chimney outlet with a cowl to prevent rain from falling inside.



PROJECT 4. A SOLAR FOOD DRYER

INTRODUCTION

Food preservation is important because :

- it can help a family provide itself with a more sufficient supply of food during the months of shortage before the harvest, or during the years of drought;
- it can help people preserve their crops long enough to take them to market.

It means that a farmer does not have to sell all his crops immediately after harvest when the prices are at their lowest. Instead he can sell them several months later when the prices have risen again.

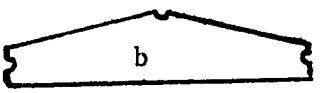
This solar food dryer is used in Tanzania. It is easy to build and costs little. It uses the power of the sun.

Successful food preservation depends on the selection of good raw food. It can be meat, fish, vegetables, fruits or a cash crop like coffee. Cleanliness is very important, and methods must be followed precisely, or the preserved food may be dangerous. You can seek advice from the Agricultural or Health Officer of your district.

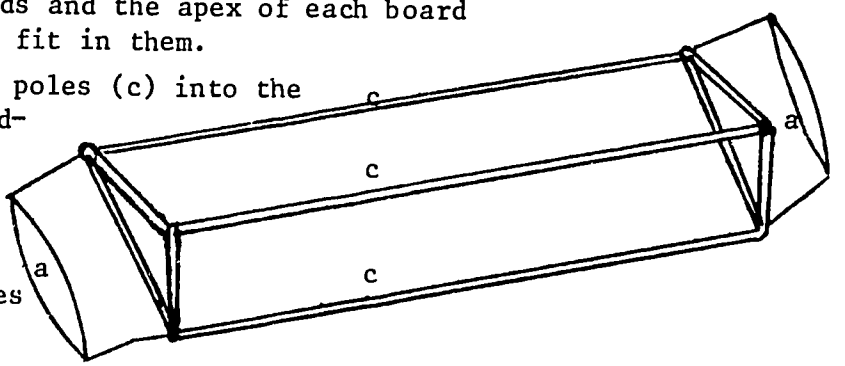
This dryer is rainproof, requires little attention, and protects the food from dust and birds. Any insects in the drying crop will be killed by the high temperatures.

A. The COVER

1. Cut the two end pieces (b) to this shape to fit into the polythene sleeve (a).



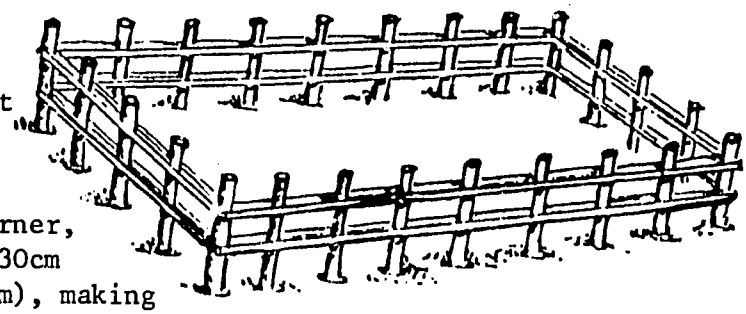
2. Cut notches in the two ends and the apex of each board so that the poles (c) may fit in them.
3. Fit the ends of the three poles (c) into the prepared holes in each end-board to make a frame and nail in place. Check that it will fit into the sleeve before nailing. Make smooth any sharp edges in the wood.



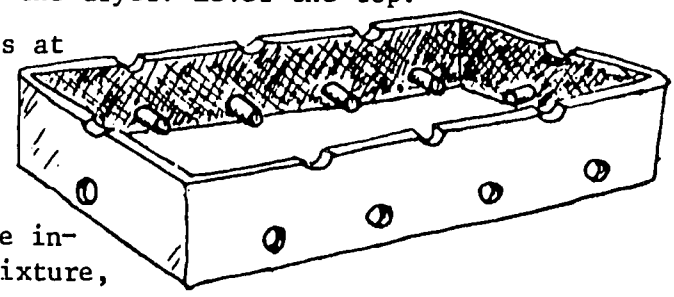
4. Fit the frame carefully into the polythene sleeve.
5. Place a thin stick under the end of the sleeve, fold 2,5cm of the sleeve under at each side and roll up the polythene sleeve tightly around the stick to ensure the sleeve will be rain-proof. Do the same with the other end. Tie each end tightly with string.

Materials needed: (measurements are approximate only)
(a) A polythene sleeve (3 metres X 1,20 metre)
(b) Two pieces of board (1,15 metre X 10 cm)
(c) Three straight poles (2,50 metres X 5 cm)
(d) Eight nails (7· cm)

B. THE DRYER

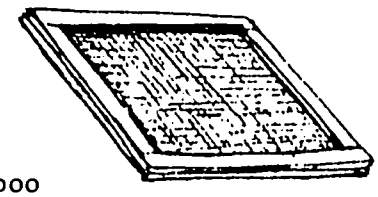


1. Clean and level the site. Mark it out accurately. Each angle must be 90°.
2. Dig holes (30cm) deep at each corner, and along each side and end, at 30cm intervals. Insert the poles (60cm), making sure they are straight and of equal height above the ground.
3. Link the poles together at two levels above the ground, using reeds or twigs or sisal pole splits to make a frame. Do this inside and outside the frame.
4. Mix the clay (or other material) and stuff it into the spaces between the inside and outside linking strips of reeds. Cover the frame completely, making an even wall not too thick, all round the dryer. Level the top.
5. Insert the bamboo tubes for air inlets at 60cm intervals in the sides and ends of the frame near the bottom at the same level.
6. Mix some mud with powdered charcoal until it is black in colour. Cover the inside walls and the bottom with this mixture, to accelerate heat absorption.

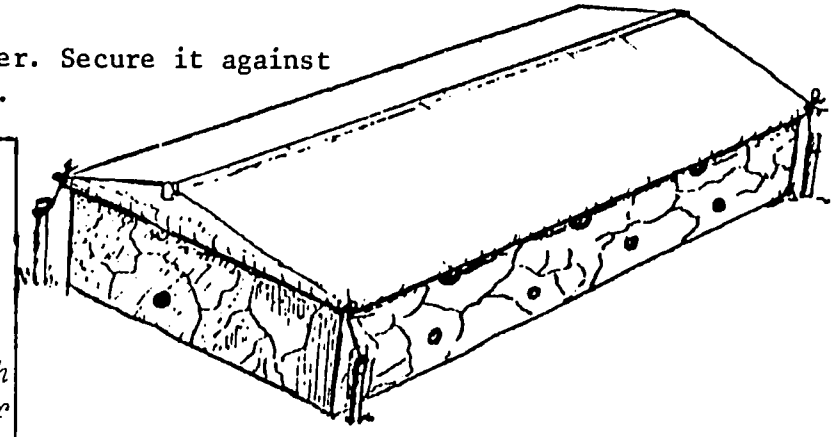


Materials needed:
(a) 24 poles (60cm X 5cm)
(b) Sisal pole splits or thin reeds or twigs
(c) String
(d) Powdered charcoal
(e) 10 pieces of hollow bamboo (30cm long)

C. THE TRAYS



1. Nail the 8 poles to two rectangular frames.
2. Tie or nail the mats, stretched, to the frames and nail supporting poles along the sides to hold the mats tight in place.
3. Place the frames inside the dryer, supported by the bamboo air inlet tubes.
4. Close the dryer with the cover. Secure it against the wind by tying it to pegs.



Materials needed:
(a) 8 poles (1,10m X 1,5cm)
(b) 8 poles (1,20m X 2,5cm)
(c) 2 loosely woven mats (1,10m X 1,20m)
(d) A large needle and string
(e) Clay soil or out hill earth for the walls and muman for the base. Cowdung or lime or cement (1:16) if the soil is loose or sandy.

PROJECT 5.

A MAIZE STORE

(Storage Unit)

INTRODUCTION

This maize store is used in Tanzania. It can be used also for storing grain. Up to thirty percent of a farmer's grain harvest is often lost to rats, insects or mould. This kind of store is an improved traditional one, and can enable a farmer to store his harvest better. This will bring him more food that he can use at those periods when food is short. As food prices are high at those periods, it will bring him more income. But there are certain conditions for success :

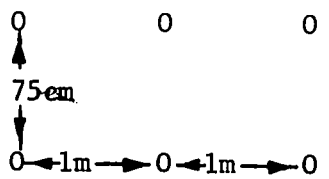
- The crop must be harvested at the correct stage of ripeness.
- Storage facilities must be kept clean.
- The crop must be properly dry before it is stored.

Materials needed: (measurements are approximate only)
(bamboo or poles)

(a) 3 vertical supports (3,50m)
(b) 3 vertical supports (3,00m)
(c) 2 horizontal roof supports (2,50m)
(d) 2 horizontal platform supports (2,50m)
(e) 6 vertical supports (1,50m)
(f) 3 cross supports (70cm)
(g) 25 platform pieces (95cm)
(h) 8 wall supports (2,25m)
(i) 8 wall supports (1,00m)
(j) Strong slats can be used for the side walls. Tie them together as a mat about 6m long to reach right round the outside of the store.
(k) 3 horizontal roof members (3,25m)
(l) 3 cross roof members (1,00m)
(m) 2 braces (1,00m)
(n) 7 purlins (3,25m)
(o) Mats or grass for thatch and front loading cover
(p) Vine or sisal

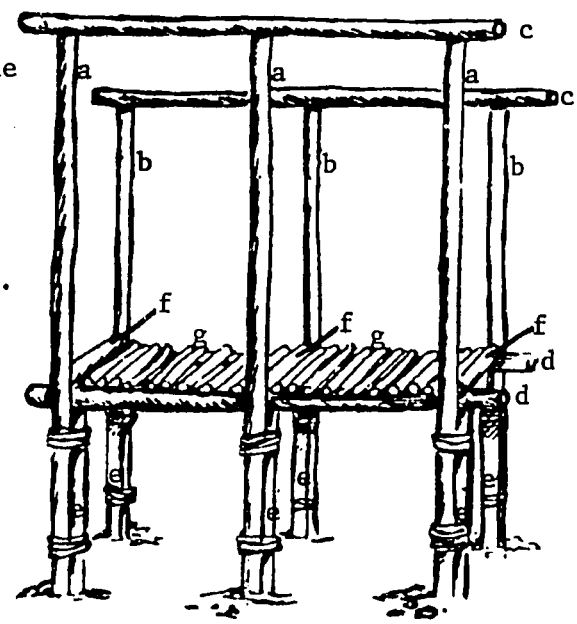
Step 1.

Mark out places for six vertical supports (a and b) and dig holes for each - 50cm deep.



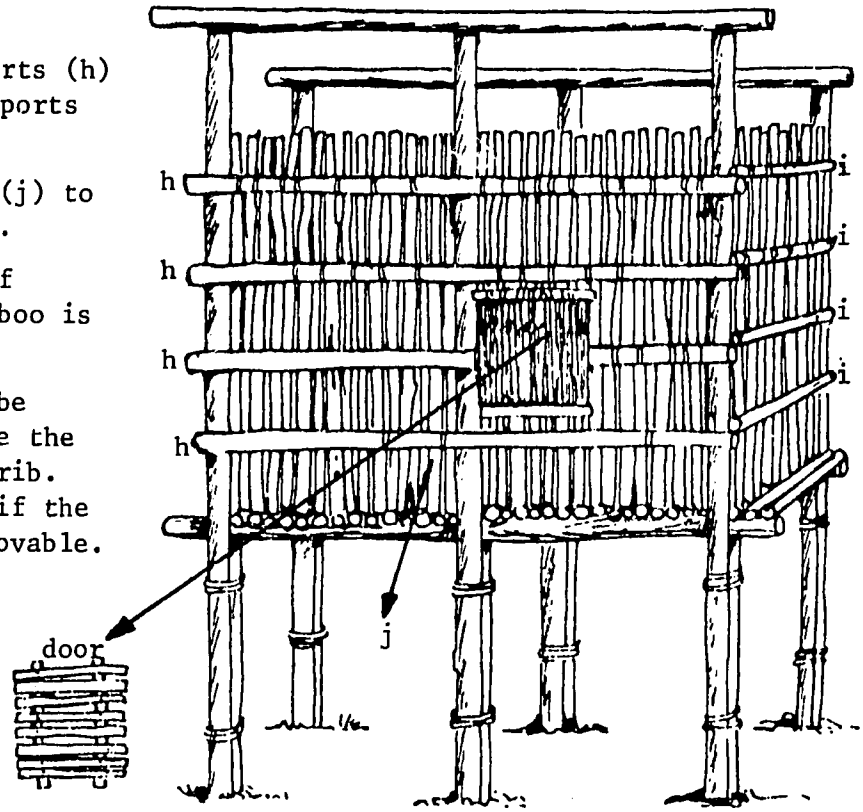
Step 2.

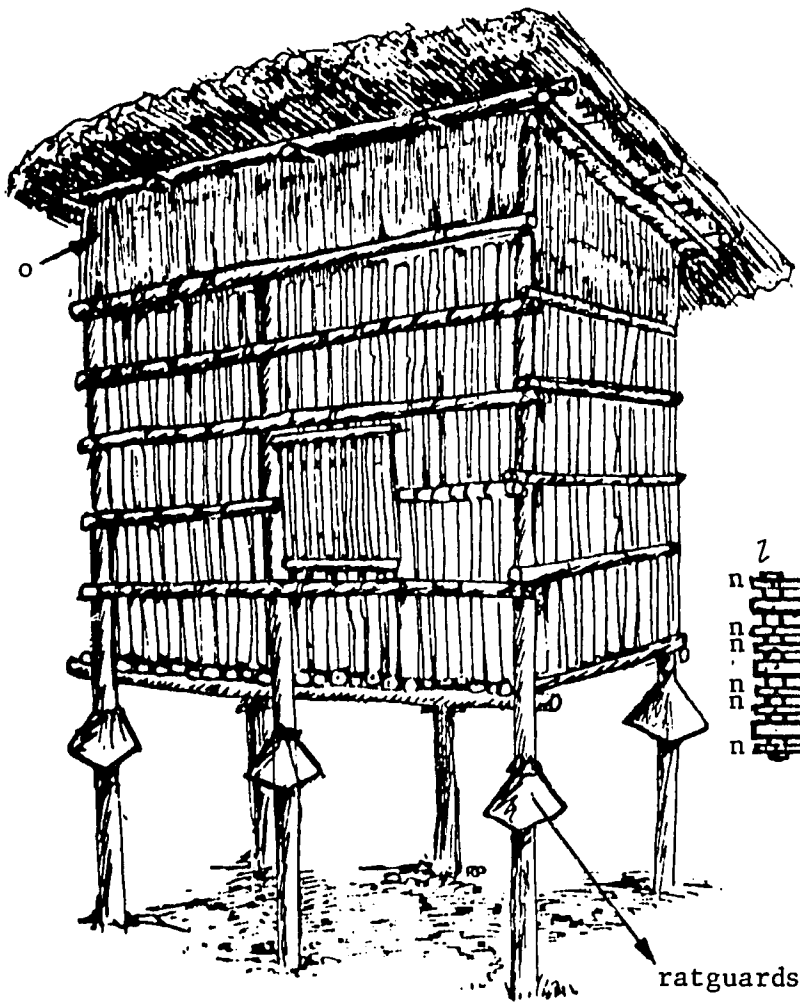
1. Nail the horizontal roof supports (c) to the vertical supports (a and b) and place them in the holes.
2. Place the vertical platform supports (e) in the holes on the inside of the legs.
3. Place two horizontal platform supports (d) in "V"-notches in the vertical supports (e).
4. Fasten three cross supports (f) between the vertical supports.
5. Nail platform pieces (g) to horizontal supports (d). (Or you may leave them loose so that they can be pulled out to release the cobs onto the ground.)



Step 3.

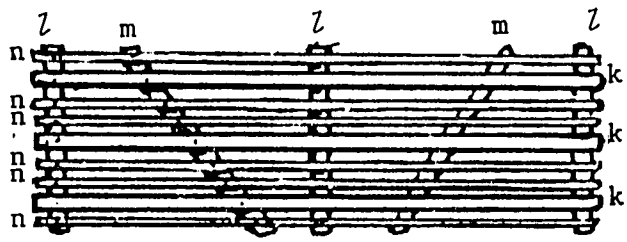
1. Lash or nail wall supports (h) and (i) to vertical supports (a and b).
2. Lash or nail side wall (j) to wall supports (h and i).
3. Fit ratguards to legs if material other than bamboo is used.
4. Make a door which will be nailed or tied on before the crop is placed in the crib. The door is not needed if the platform pieces are removable.





Step 4.

1. Lash or nail cross roof members (*l*) to horizontal roof members (k).
2. Lash or nail braces (m) to horizontal roof members (k).
3. Lash or nail purlins (n) to cross roof members (*l*).
4. Lash or nail thatch in overlapping layers to roof frame. Trim. Fix on the grain store.



5. Lash or nail thatch curtain (o) to roof (k) to form front loading cover and to cover gaps at the top of the back sides.

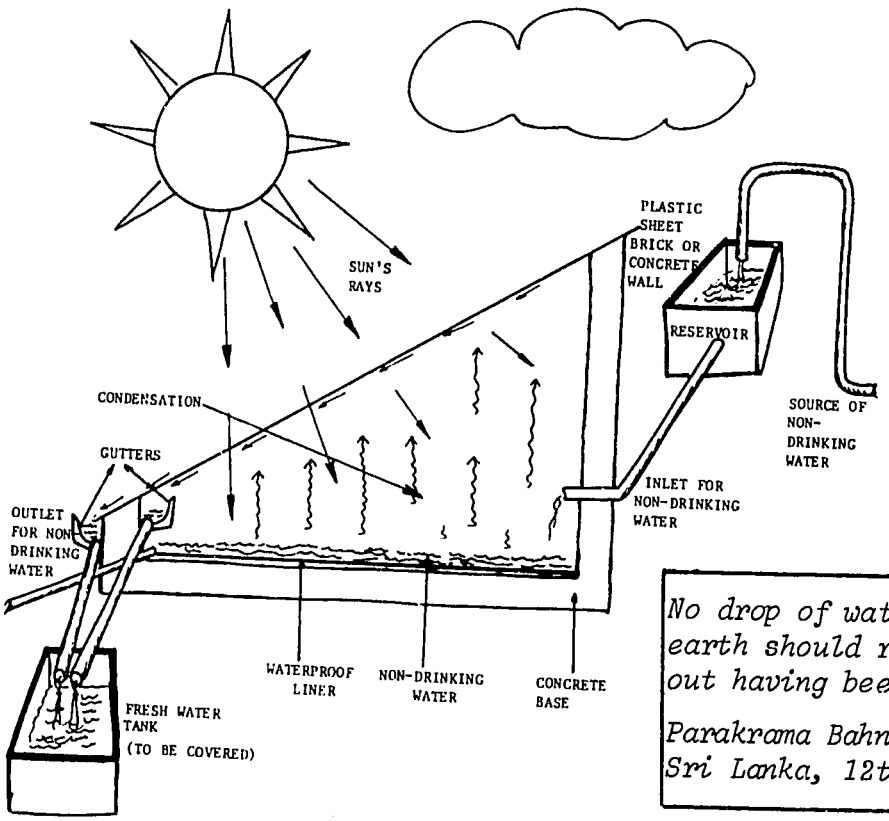
PROJECT 6. A SOLAR STILL

INTRODUCTION

This solar still can convert brackish or salt water into drinking water. A pan of non-drinking water is enclosed by a transparent cover. This traps solar energy which heats up the water. This causes evaporation and condensation on the inner face of the sloping transparent cover. This "distilled" water is drinkable.

This still can be built with bricks and plastic. An area of 2 square metres will produce 4 litres a day. It will operate for long periods in isolated locations without attention. Note that rainwater can also be caught by the plastic sheet and collected in a covered freshwater tank.

This solar still can produce enough water for a family or a village, depending on the number of units built.



No drop of water which falls on the earth should return to the sea without having been of service to man.

Parakrama Bahn, The High King of Sri Lanka, 12th Century

1. Selection of site is important. It should be on firm, well-drained, level land, open to the sun, and close to the water source.

2. To prepare the site the ground should be levelled and all vegetation removed.

3. To prepare the foundations the basin should be laid out with the sloping plastic facing the sun at midday (north or south). The foundations should be deep and firm to avoid subsequent cracking. The size of each basin will depend on the size of the plastic sheet available. Several basins can be made next to each other.

4. To make the solar still:
   (a) The floor of the basin should have a very slight slope so that the impure water can be flushed out every morning and the basin refilled.
   (b) The walls can be made of cement blocks.
   (c) The plastic sheet can be stretched on a wooden frame, if necessary.
   (d) The piping can be made of bamboo or steel.