

# THE EXPERIMENTALIST

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Women making biomass blocks. This photo is of the Democratic Republic of Congo.

**Comunidade:** The use of Biomass for Fuel

**Technology:** A Solar Dryer

**Construction:** How to make an Electric Bell

**World Technology:** Fingerprints

**Bicycles** - We would like to encourage our readers to build things, so we have supplied some pictures of very cheap bikes made of wood and bamboo. There are no instructions on how to do them, so just look closely at the photos if you want to try one. (See page 6) You may have better ideas.

Having a bike, even if it is not efficient, could be very useful. For example, to go to school. Bicycles are more efficient than walking, that is, they use less energy. You may have to push them up, but you can go down in neutral. Try one.

Can you read English?

For those who want to study science and technology, is very valuable to be able to read English, so (for help) I wrote an article in English and in Portuguese. Why?

- All the neighboring countries of Mozambique have English as their official language.

- Many important books of science and technology are not available in Portuguese.



- On the Internet, there is much more information in English than in Portuguese. For those of you who have access to a computer and the Internet can find information about almost any subject in the program 'Google'.

To get to Google, you need an Internet connection (ask your friends). So put in the address 'google.com' and type the desired subject.

The Editor

# The use of Biomass for Fuel

This article is a report on the work done by Spark Group on the production of solid biomass for use in the kitchen in Mozambique or any other country.

In Mozambique, cooking fuel is too expensive for most people, so in rural areas, women collecting firewood. Coal is expensive: a lot of that cost is for transportation.

Few people use oil stoves, coal, gas or electricity - all expensive fuels.

## Biomass

However, we are surrounded by potential fuel - leaves, grass, reeds, shrubs, agricultural residues, which go under the name of "biomass". It all contains thermal energy. You can get an idea of the great amount of heat that biomass has if you stand next to a campfire. However, it is in a useless form, because it is not very dense.



Some people twist bundles of dry grass to burn for cooking, but it is so loose and they always have to feed the fire. And because of its volume is very difficult to transport and store. If this biomass is compressed to make dense blocks, it is easier to use.



## Grass

In our experiments in KaTembe we made blocks of compressed grass because it is so common, but other leaves can be used.

The photo shows the blocks of grass compressed and dry. >>



First we allowed the biomass/grass to stand in water for a week, to rot. This loosens the fibers and transforms the material into a pulpy mass. The decomposition also releases a type of "glue" that helps to solidify the blocks when they are compressed and dried.



Then beat it hard in a mortar. This turns it into a semi-liquid mass, which is ready for pressing.

At this stage, we add something to the mix that will act as a glue, for example, banana peels. This makes the blocks stronger and makes the blocks more smoother when they leave the press.

Fig leaves are a possibility. You perhaps know other local fruits or leaves that are sticky and would be useful. Try them!

The picture shows blocks made without glue. The stems stick out.



One way to do blocks is just to compress the biomass between the palms to squeeze the water out. Then dry them in the sun.

The resulting blocks are not dense, and they break easily, but they burn very well. Because the blocks are not dense, larger stoves are necessary because the blocks have a larger volume than wood or charcoal.

## Presses

The best way to make blocks is to use a cylinder with biomass inside it and a piston pushing on it with a powerful force. The piston is a square block of wood.

First we made a small iron press. The piston is pushed down by a lever, which compresses the mass. The cylinder should have small holes for the water to run out.

The bottom of the cylinder has a hinge so that it can lie flat to allow the block to be pushed out.



This works very well, but the blocks are fragile.

The blocks made with this press burned more or less well in a common charcoal stove, but gave off a lot of smoke.



This was because the stove does not get enough air, but when we put them in a strong wind, it worked well without smoke. The blocks were burned but we had to add new blocks frequently. We should have used a larger stove that could contain more blocks.

Later, we realized that it would be better to make the blocks denser with a more powerful press and arrange it so that the blocks had a hole in the middle to allow air to reach them to facilitate drying.

So we made a big press, which pressed with a very great force on the biomass.



A lever presses down on top of another. This is iron but you can see the method of construction in the photos below (the wooden press).

The cylinder is an iron pipe. It has holes where water comes out. This cylinder has a tube in the middle so that the blocks come with a hole in the middle. The result is that the blocks are much denser than the blocks of the first press. Dry them on wooden racks in the sun.



The photo is of Alberto of the Spark Group.



The blocks burned well in the stove but it should be bigger so the blocks to burn for longer. The opening at the bottom should face the wind, to allow air to enter with force.

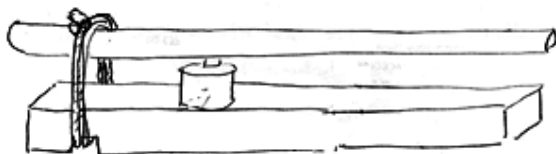
The iron press was expensive to build. It would be best to do it in wood.

Below are photos of a similar press but made of wood. Women do two blocks at once, separated by a plastic disc. These pictures are from the Democratic Republic of Congo.



Perhaps a simple heavy wooden press used for pressing olives could work well. The photograph is of an olive press Portugal. >>

The drawing is an idea for a press made of tree trunks.



## Selling the brickettes

This could be a lucrative job for unemployed persons. Various people could be collectors of leaves and grass and a family in a village could be manufacturers of blocks. This would be an income generating activity for thousands of unemployed people across the country. The whole process could be a small cottage industry in villages, with a family investing in the necessary equipment.

Perhaps the best method would be to exchange the finished blocks for bags of leaves. People collect leaves throughout the district and deliver them to the manufacturer, in exchange for blocks. They bring ten pounds of leaves and exchange them for five pounds of blocks. The manufacturer may sell the remaining five pounds of blocks as their profit.

The use of grass as a fuel in industry

In some countries, the grass is grown industrially in large quantities to provide fuel factories and power plants.

For example, a Brazilian company is investing \$80 million in a plant that uses grass as fuel. In their case, they make the grass into small brickettes before burning them to make steam.



Can you  
make a  
bicycle of  
wood?



# How to make a Solar Dryer

## Drying

Drying preserves fruit, even in the absence of cooling, and significantly increases its life. When fresh fruit is unavailable, cannot be obtained or is not in season, dried fruit is one alternative. It is often added to roasted nuts or mixed with cereals.

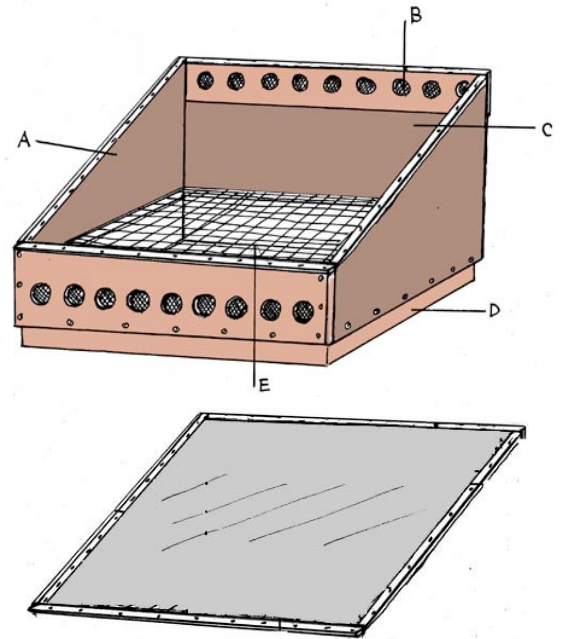
Examples of commonly consumed dry fruits are apples, apricots, figs, kiwis, mangoes, peaches, pears, pineapples and tomatoes.

## A portable solar dryer

A simple solar dryer is shaped like a box whose sides are made of wood or sheet metal. It has a thin plastic cover stretched over a thin wooden frame.

It has a tray inside (E) where fruits and vegetables are placed to dry. This tray can be made of bamboo, straw or wire; it must allow air movement. It must have large holes to allow air to pass.

Air enters through the holes (B) in front (the holes are below the level of the tray) and passes through the tray to dry the fruit. The fruit is heated by the sun. The air, hot and humid, goes out through the holes at the top. (Hot air rises.) You can paint the inside of the box black for the sides to absorb more heat and warm the inside of the box, but you must use paint that does not smell and is not toxic.



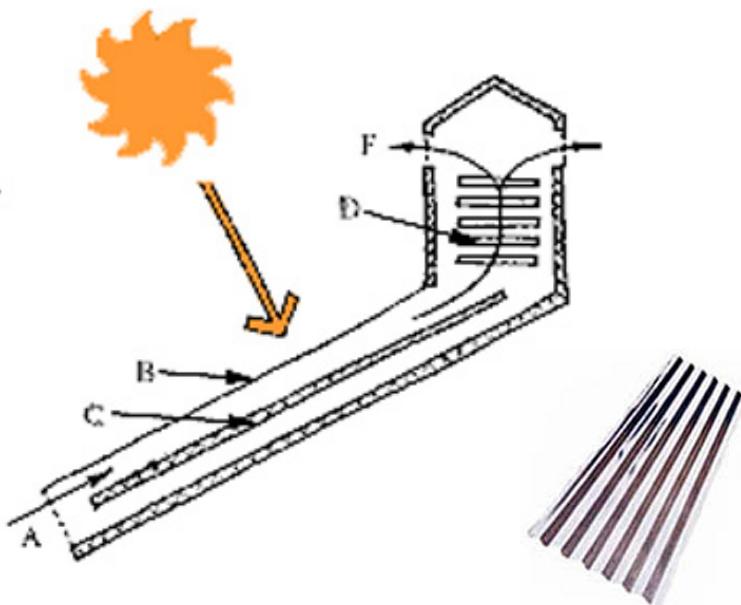
## An indirect dryer

An indirect dryer is a unit in which the sun's rays do not hit directly on the food to be dried. In this system, the sun's rays heat a black metal plate (zinc roofing sheet) (C) within a 'drying chamber' tilted, as shown in the photo and diagram.

The lid is clear plastic (B)

The drying chamber is constructed of wood 2 meters x 1 meter.

The zinc plate (C) is 5 cm below the plastic and 5 cm above the base of the camera.



The sun's rays heat the zinc. Zinc heats the air and the air heats the fruit. Thus, the sunlight does not hit the fruit (which can damage them).

Air enters (A) below the chamber and rises, passing in contact with both sides of hot zinc, and is heated.



Next, the hot air passes to a box that has shelves (trays) (D) where the fruits are put. This air dries the fruits. Finally the air exits through the openings (F) that have doors to control the air, and thus determine the temperature.

The trays that hold the food must allow air to get under and through the food.

Members of the Group Spark built the solar dryer.

P - Doors to control the air.



## Como Firme é Sua Mão? *How Steady is Your Hand?*

Saiba mais sobre um circuito eléctrico (e aprenda um pouco de Inglês).  
*Learn about an electric circuit (and learn some English).*

### O Jogo *The game*

Você passa um laço de fio ao longo de um fio em ziguezague, sem tocá-lo. Se o toque, uma lâmpada acende ou uma campainha toca.

*You pass a loop of wire along a zigzag wire without touching it. If the loop touches the zigzag wire, a lamp lights or a bell rings.*

7. Laço de arame galvanizado ou, melhor, cobre.  
*Loop of galvanized wire or, better, copper.*

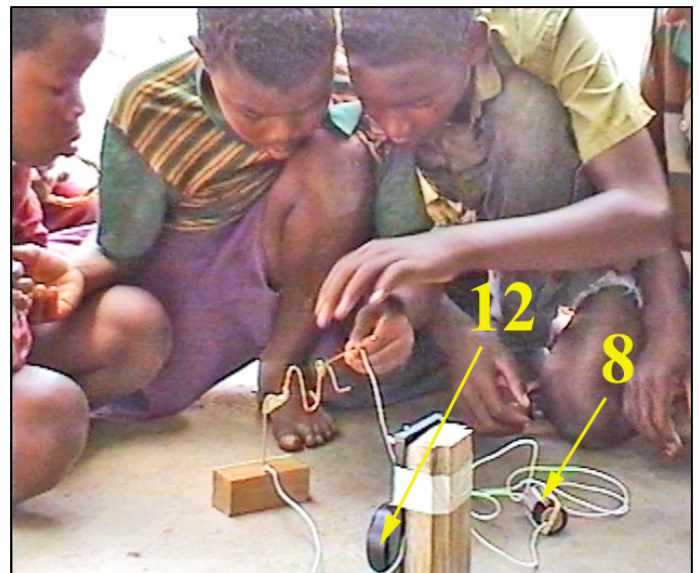
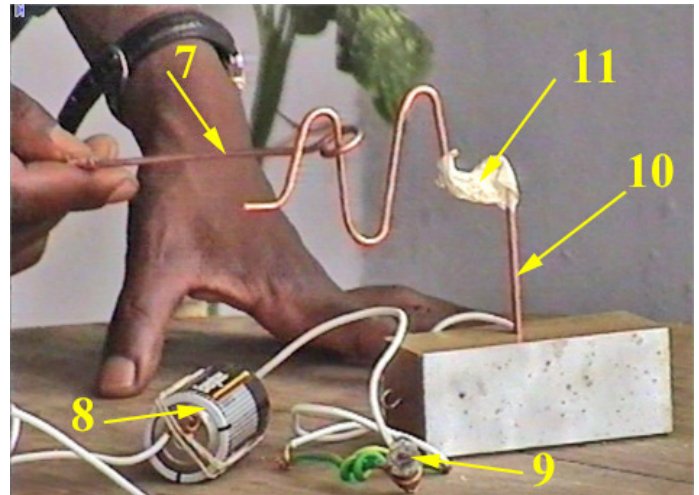
8. Pilha. *Battery.*

9. Lâmpada. Ou pode usar uma campainha eléctrica.

*Lamp. Or you could use an electric bell.*

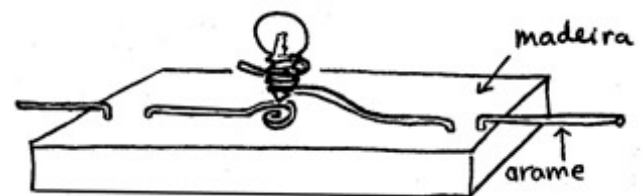
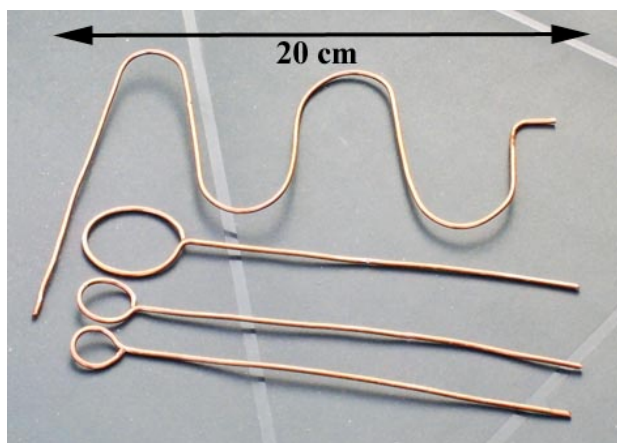
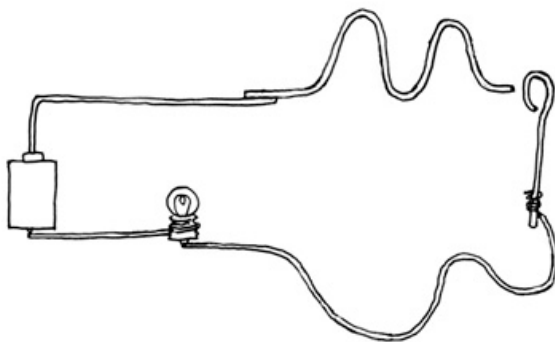
10. Arame ziguezague numa base de madeira.  
*Zigzag wire on a wooden base.*

11. Papel para isolar o laço quando não seja em acção.  
*Paper to isolate the loop when it is not being used.*



12. Campainha eléctrica. Ou pode usar uma lâmpada.  
*Electric bell. Or you could use a lamp.*

A foto mostra o ziguezague e laços de vários tamanhos.  
*The photo shows the zigzag and loops of various sizes.*



O diagrama mostra um método simples de fazer um suporte para uma lâmpada.  
*The diagram shows a simple method of making a support for a lamp.*

Em vez de uma lâmpada, você poderia usar uma campainha eléctrica

*Instead of a lamp, you could use an electric bell.*

## Como fazer uma campainha eléctrica.

### *How to make an electric bell.*

A foto principal na primeira página usa uma campainha comercial mas fazer uma versão “caseira” é simples.  
*The main photograph on the first page uses a commercial electric bell but it is easy to make a home-made version*

Tem uma base de madeira.  
*It has a wooden base.*

1. O "sino" é um copo quebrado suspenso de um prego.  
 Pode usar qualquer tipo de vidro. Você poderia até usar uma lata vazia, mas um copo

faz um som alto e agradável.

*1. The “bell” is a drinking glass suspended from a nail. You could use any kind of glass. You could even use an*



*empty tin, but a glass makes a louder and pleasanter sound.*

2. Mostra como a extremidade da tira de lata é dobrado e fixado por um parafuso à borda da base.

*2. Shows how the end of the tin strip is bent and fixed with a screw on the side of the base.*

3. Uma tira de lata (cortada de uma lata de leite condensado) é fixada paralela à base de modo que possa vibrar.

*3. A strip of tin (cut from a condensed milk tin) is fastened parallel to the base so that it can vibrate.*

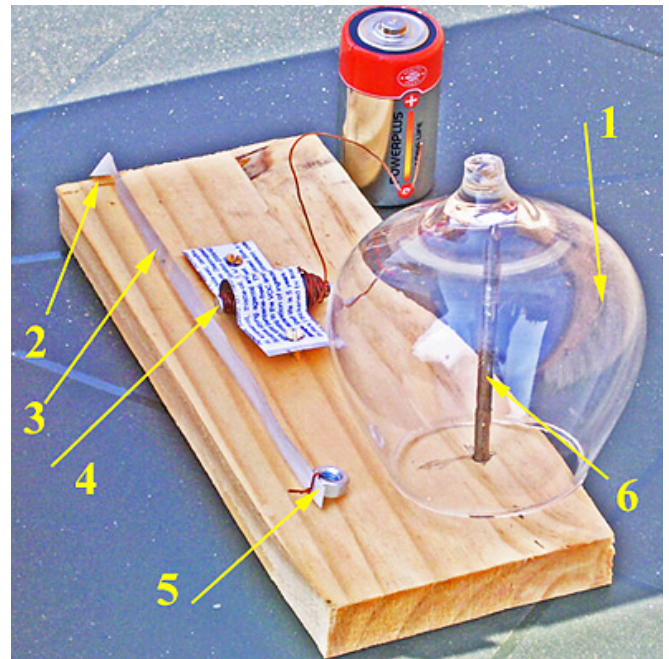


4. Um electroíman. Muitas voltas de fio enroladas em torno de um prego de ferro. É preso com uma tira de lata.

*4. An electromagnet. Many turns of wire wound round an iron nail. It is fastened down with a strip of tin.*

5. Na outra extremidade da tira é fixada um pedaço de ferro (uma porca). Quando a tira vibra, esta bate contra o vidro e produz um som.

*5. On the other extremity of the strip is fixed a bit of iron (a nut). When the strip vibrates, this hits against the glass and produces a sound.*



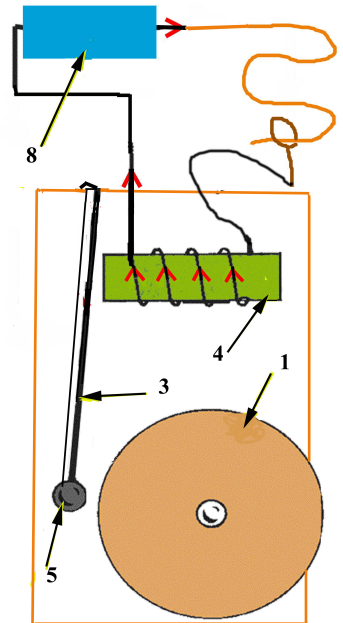
Aqui está um diagrama da campainha eléctrica. 1. Copo; 3. Tira de lata; 4. Electroímã; 5. Peça de ferro para bater o copo; 8. Pilha.

*Here is a diagram of the electric bell. 1. Glass; 3. Strip of tin; 4. Electromagnet; 5. Piece of iron (nut) to hit the glass; 8. Battery.*

Quando o laço faz contacto com o ziguezague, uma corrente eléctrica corre ao redor do circuito. A corrente flui ao redor do electroímã e torna-o um ímã. Isso atrai a tira, e a porca na extremidade da tira bate no vidro e faz um som.  
*When the loop makes contact with the zigzag, an electric current flows around the circuit. The current flows around the electromagnet and makes it a magnet. This attracts the strip, and the nut on the end of the strip hits the glass and makes a sound.*

Isso pode ser um jogo. Você paga algum dinheiro ao "banqueiro". Se você conseguir passar o laço ao longo do ziguezague sem tocá-lo, você ganha algum dinheiro. Se você usar um pequeno laço, você ganha mais dinheiro. Se perder, o dinheiro que você pagou fica com o banqueiro.

*This can be a game. You pay some money to the 'banker'. If you succeed in passing the loop along the zigzag without touching it, you win some money. If you use a smaller loop, you win more money. If you lose, the money you paid stays with the banker.*



## Fingerprints

A fingerprint is an impression made by the elevations of the skin present on the fingers, left on a smooth surface. Fingerprints are unique to each individual. This characteristic has made them useful as a way of identifying people for centuries.

Finger and the fingerprint, recorded on paper.



These designs are formed during pregnancy and accompany the person to death, with no significant changes. The fingerprint features characteristic points and formations that allow an expert to identify a person quite reliably. Such a comparison is also made by computer systems - called the Automated Identification System Fingerprint.



The photo shows a machine to take pictures of fingerprints. William Herschel, an Englishman, became known for being the first European on record that collected fingerprints for identifying people, especially for the purpose of authenticating documents and legal contracts.



Since he had had problems in the fulfillment of contracts made earlier, William Herschel demanded that a businessman put the entire impression of his hand on the back of the contract. The original idea was only impress the dealer. This gave the required result, since the contract was fulfilled.

Given the positive result, Herschel made a habit of it, requiring the printing of the palm (and subsequently only the impression of the middle finger) in all contracts from now on. With continued use of this practice,

the collection of fingerprints had been growing and Herschel began to note that, comparing impressions, he could actually prove or disprove the identity of people. Despite his experiences being limited, Herschel was convinced, correctly, that two equal prints did not exist and that these prints would remain unchanged over the years, which inspired him to expand the use. Herschel's technique was later perfected by the police for the detection and identification of criminals.



## How to make black ink for taking fingerprints

It is simple to make a good black ink. It consists of soot (smoke of a lamp or a candle), a little soap and water.

Take off the glass chimney of a lamp, light it and lift the wick until it has a flame that gives a lot of smoke.

Over the flame, hold an empty can and let the smoke deposited soot on the tin.

Scrape off the soot and let it fall into a saucer.



Scrape bits from a block of soap and stir them with a few drops of water to dissolve the soap. Do not use more water. It needs a sticky liquid.

Add this liquid to the soot in the saucer and stir well to make a sticky ink.



Spread a thin layer of ink on a piece of paper and lightly press your finger on it.

Now press your finger lightly on clean paper, thus leaving a fingerprint.

Be careful not to get the ink on your clothing.

