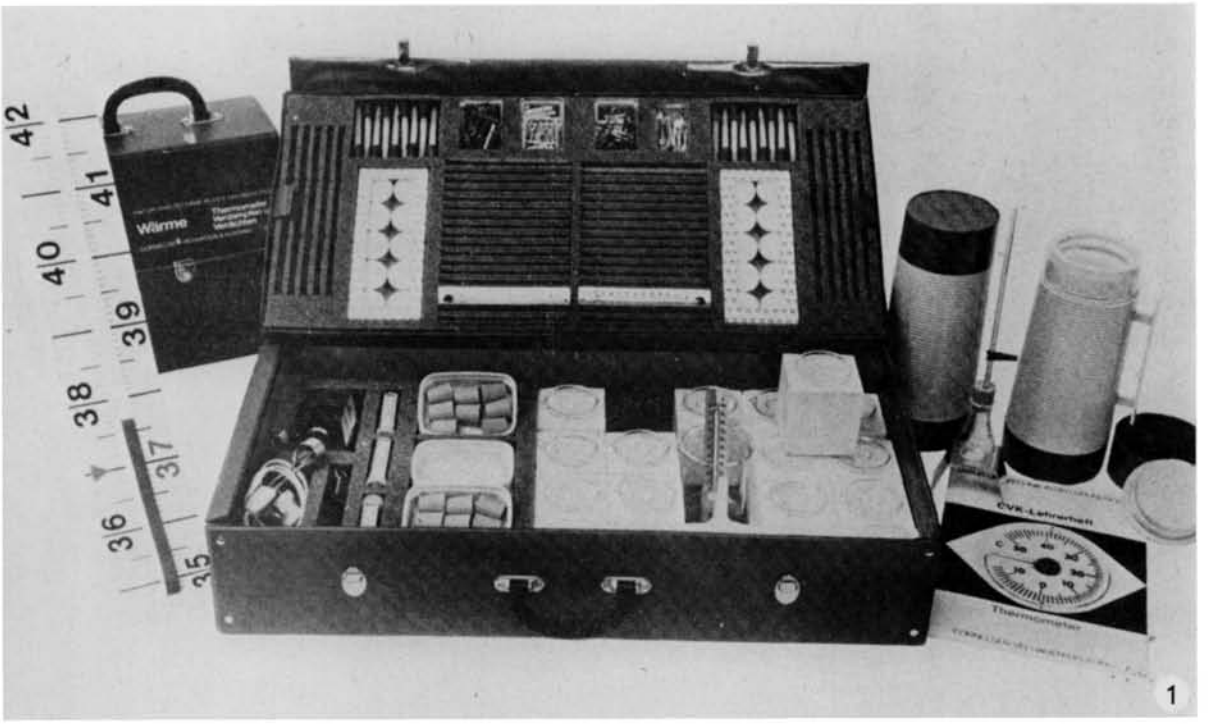
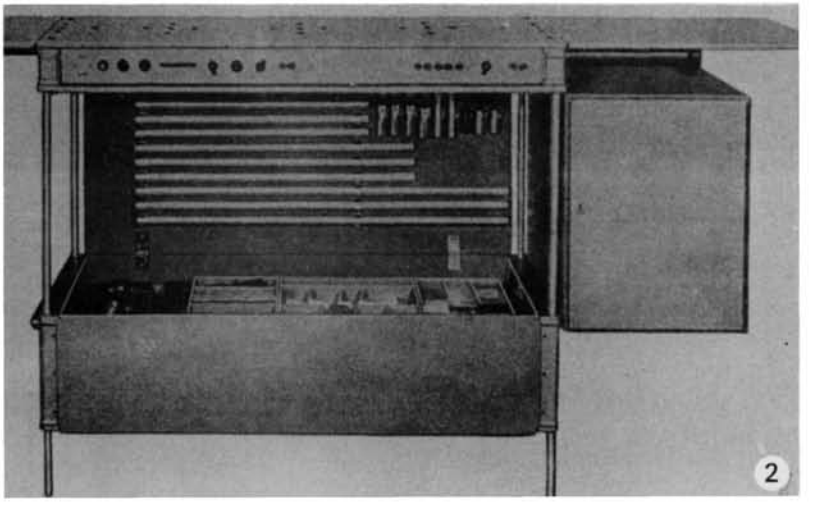
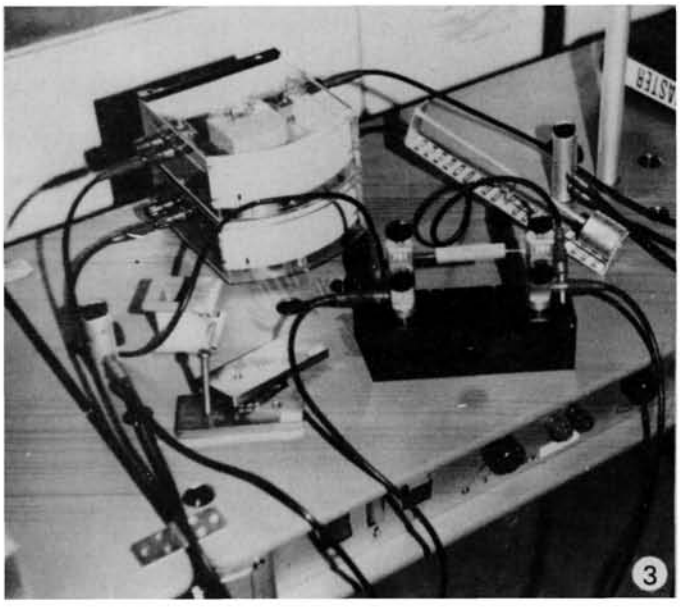




1 Primary school kit produced by Cornelsen, Velhagen and Klasing of Berlin

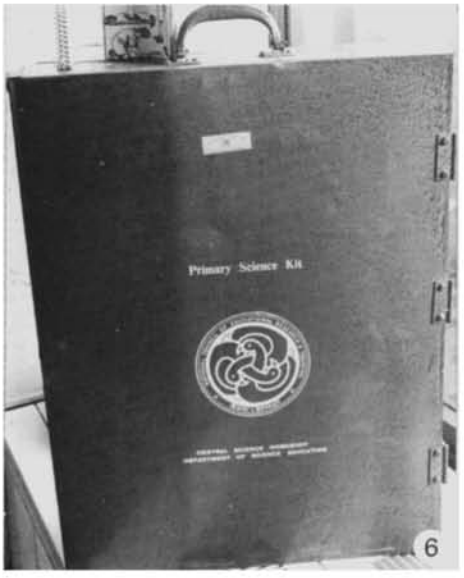
2 & 3 A 'universal' science teaching kit, made in Europe

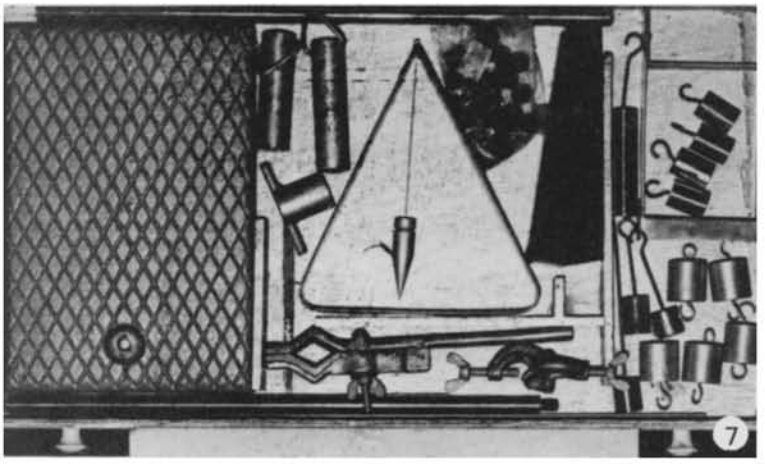


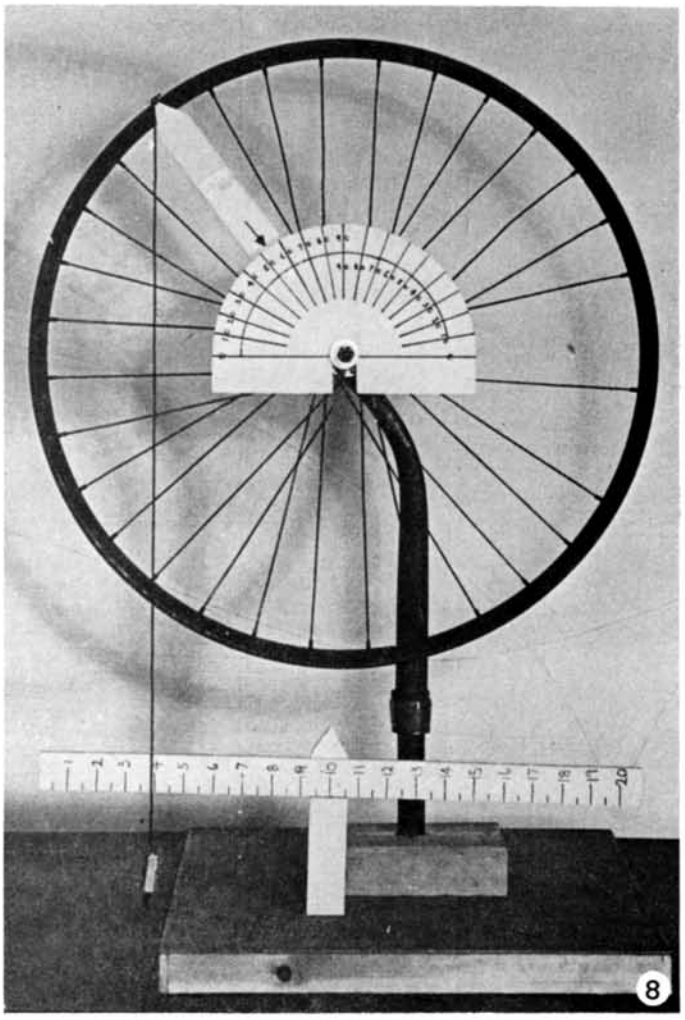
4 A Bengal village school—typical of situation in which many children in the world are taught, and into which teaching apparatus must fit

5 An itinerant tinker's tools—an example of local repair facilities in a Bengal village

6 & 7 A kit can be in a box which serves as a storecupboard for the items in the classroom







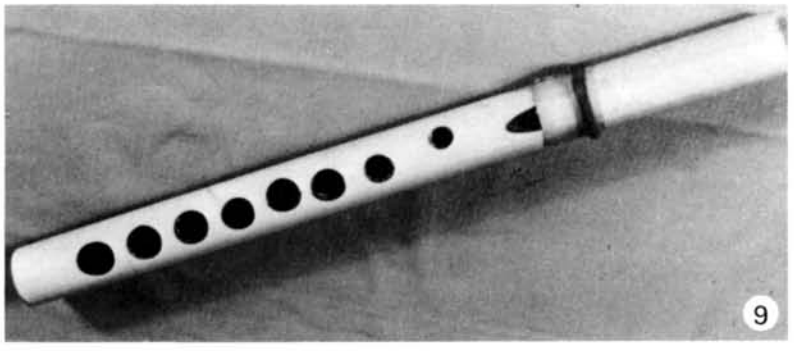
8 Bicycle wheels can be used to teach mathematics

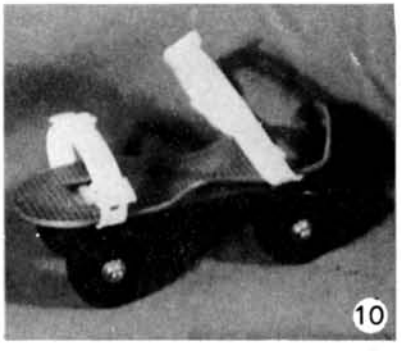
9 A Burmese flute—a local source of sound to replace a tuning fork

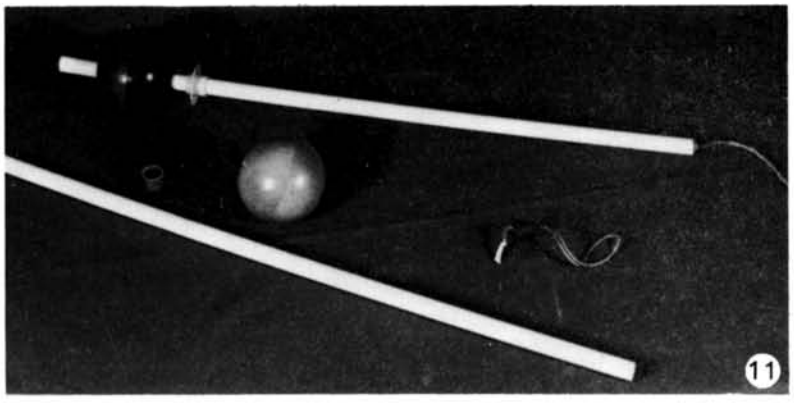
10 A plastic roller skate can, for some purposes, replace a dynamics trolley

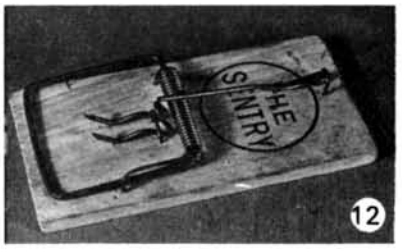
11 'Flikball'—a toy which can be used to teach

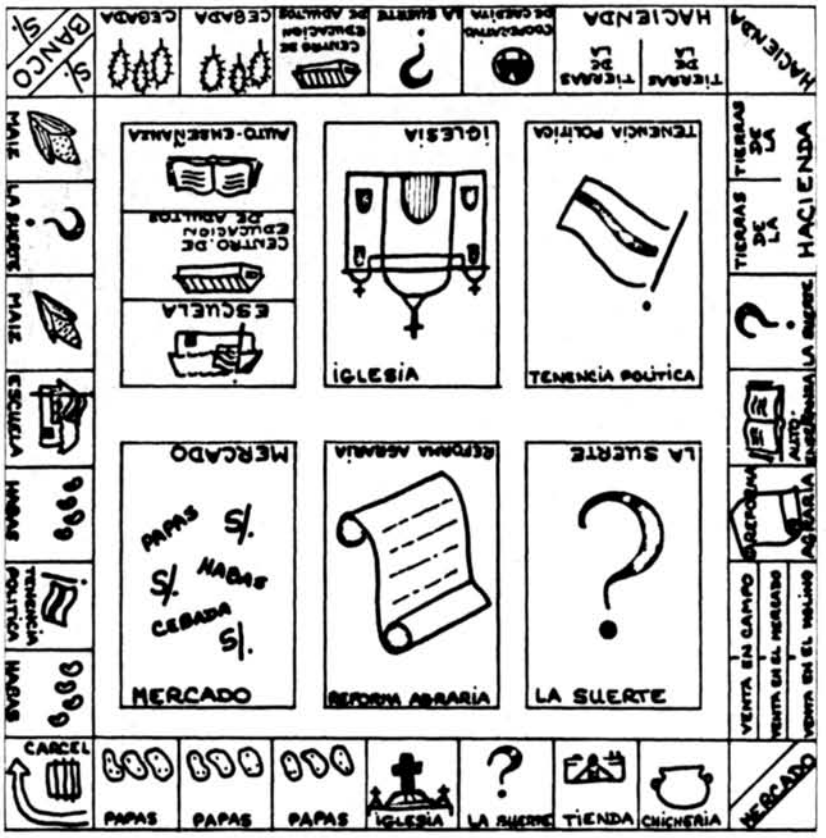
12 Simple objects such as a mousetrap may be used to teach





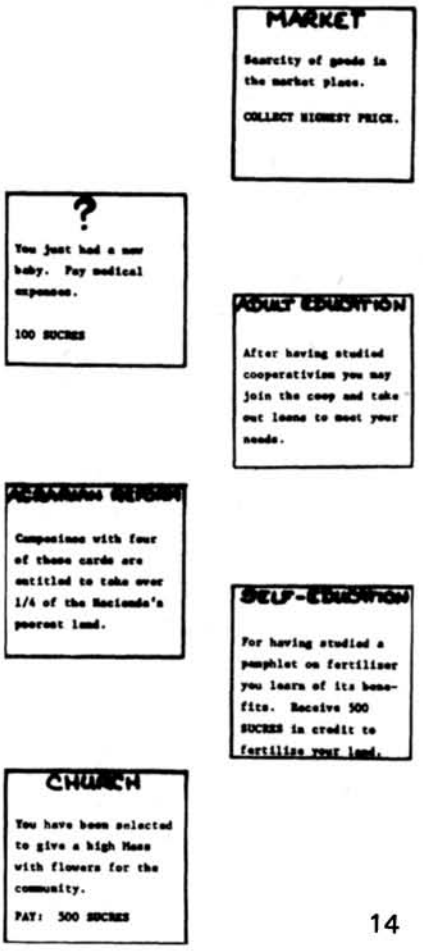






HACIENDA

13



14

13 & 14 Gameboard and sample cards from 'Hacienda', a teaching game simulating the economic and social realities of the Ecuadorian sierra

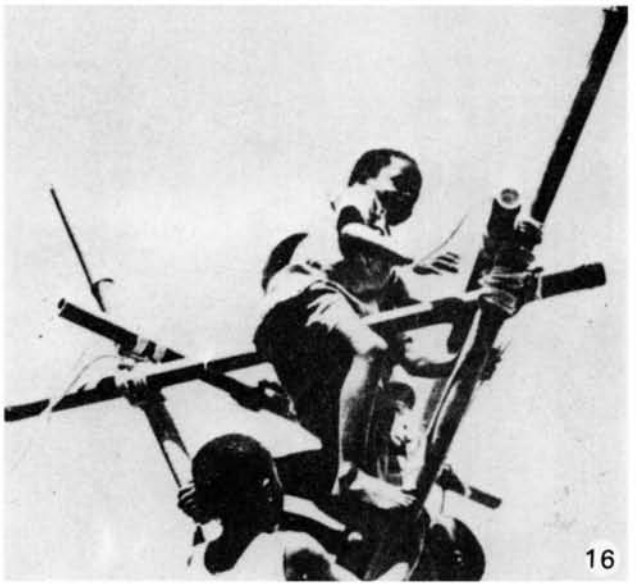
15 The Advisory Centre for Education makes use of games based on Ludo and others well-known to English children

Science Education Project in Africa

16 Bamboo and rope make an exciting tower

17 Seeing the world from a moving system

18 Sample page from the Teachers' Guide



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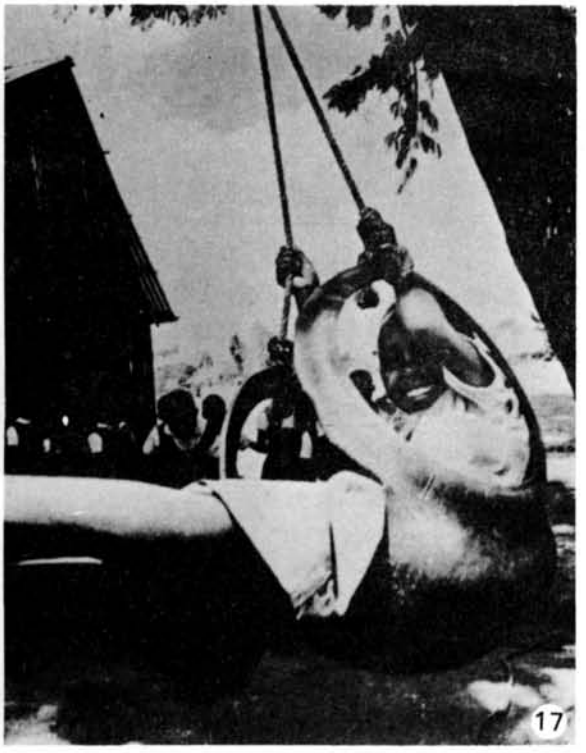
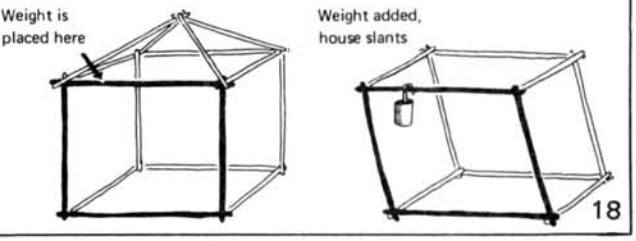


17

Or they put several tins in one spot.

As your pupils place the tins of sand at different parts of their houses, they may not pay much attention to what is happening. Each time they put a tin on one of the grasses, the grass will bend in a certain way. To prevent it from breaking, children usually add many more pieces of grass. Encourage them to be more methodical. For instance, sometimes when pupils hang a tin on their house, it bends in certain places, slants in one direction, or even tips the whole house over. In the following illustration, consider the solid lines only.



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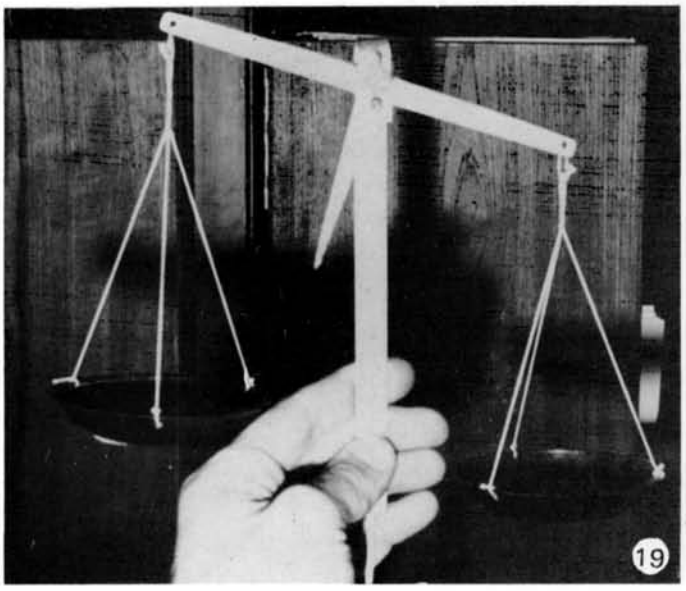
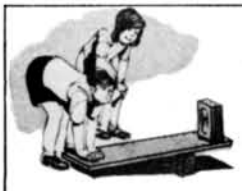




Let us find out

Take a brick. Lift it up in your hand. You will find that it is quite heavy. Now take a short plank. Place it over another brick as shown. Put the first brick on one end of the plank as shown. Now press down the free end of the plank. Is it hard to lift the brick or is it easy ?

The see-saw on which you may have played, is a lever. Sometimes you may have been able to lift a boy or a girl much heavier than yourself on the see-saw.

How did you do this ?

Let us find out

Go out to the field. Select a large rock which you cannot easily lift. Take a long plank and push one end towards the rock. Place another small stone below the plank as shown. Now press down at the free end of the plank. Can you move the rock easily ?

With this lever you were able to apply on the rock a large force which could move it. You could not do this with bare hands. The lever did not do any work itself. It only helped you to do the work more easily.

The pan-balance is another example of a lever. It is used for weighing many things, such as corn, pulses, rice and wheat.

How do you buy kerosene and milk ? Do you buy it by weight ? Can you buy a kilo of kerosene ? No, kerosene is sold by volume.

What is volume ?

Let us find out

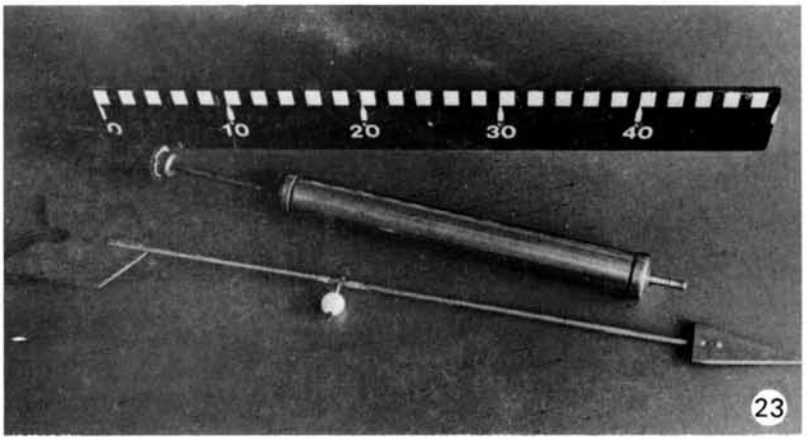
Take an empty kerosene bottle. Fill it with water to the top. How much water have you in the bottle ? How can you find out ?

21

NCERT, India

19 & 20 Items from the primary science kit

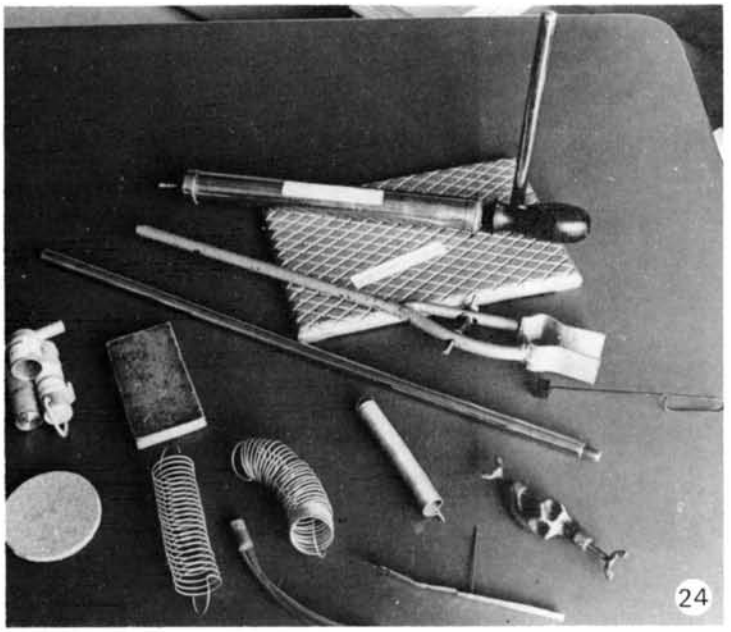
21 A page of pupil's text

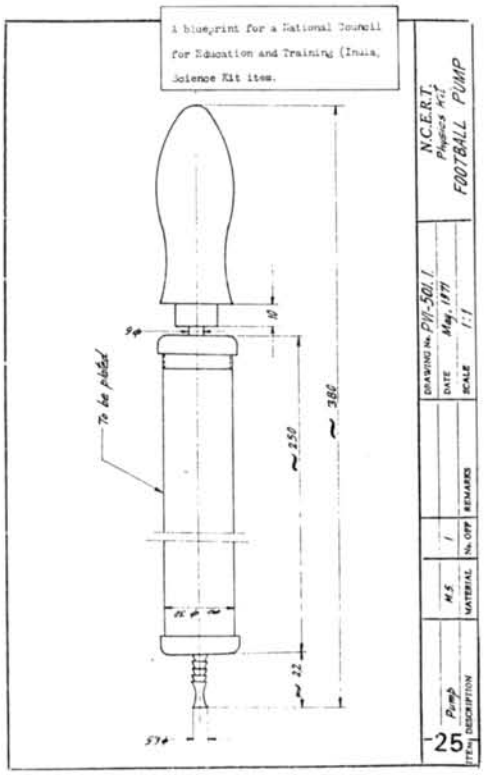


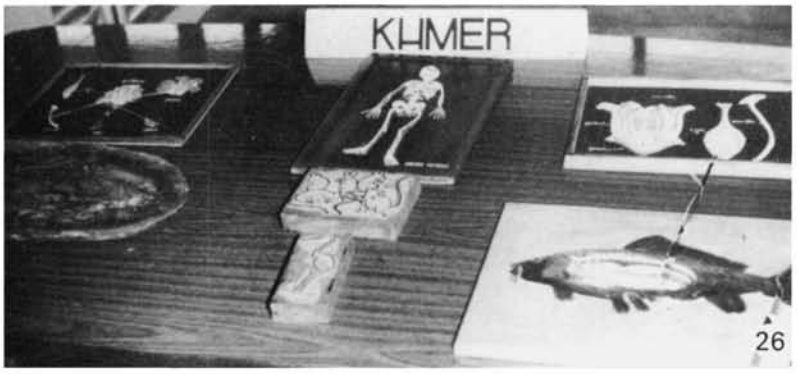
NCERT, India

22, 23 & 24 Items from the primary science kit

25 Dimensional drawing for the kit





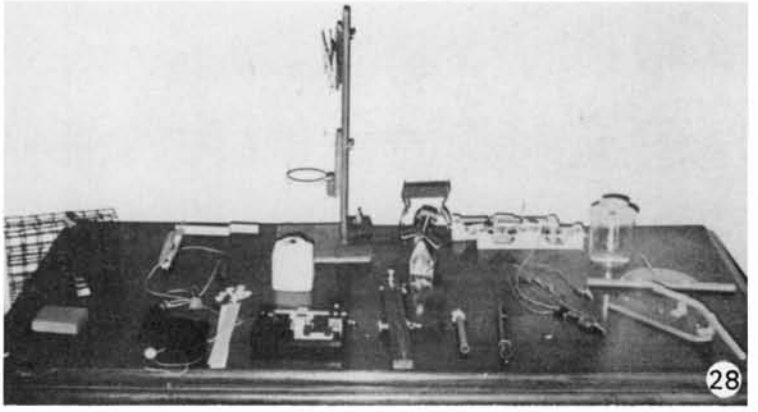


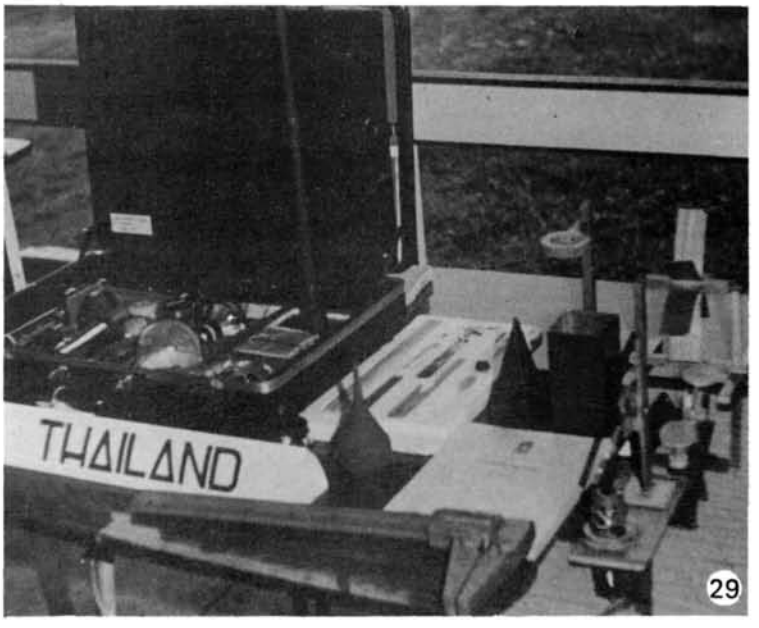
26 Some papier-mâché models and lino-cut blocks from Khmer

27 Examples of science teaching apparatus from Malaysia

28 Some secondary apparatus, IPTST Programme, Bangkok

29 Elementary science kit designed for Thailand





FORCES

PHASE IIIA
NO. 19

ORGANIZATION

Groups

LET'S FIND OUT HOW TO USE A PULLEY

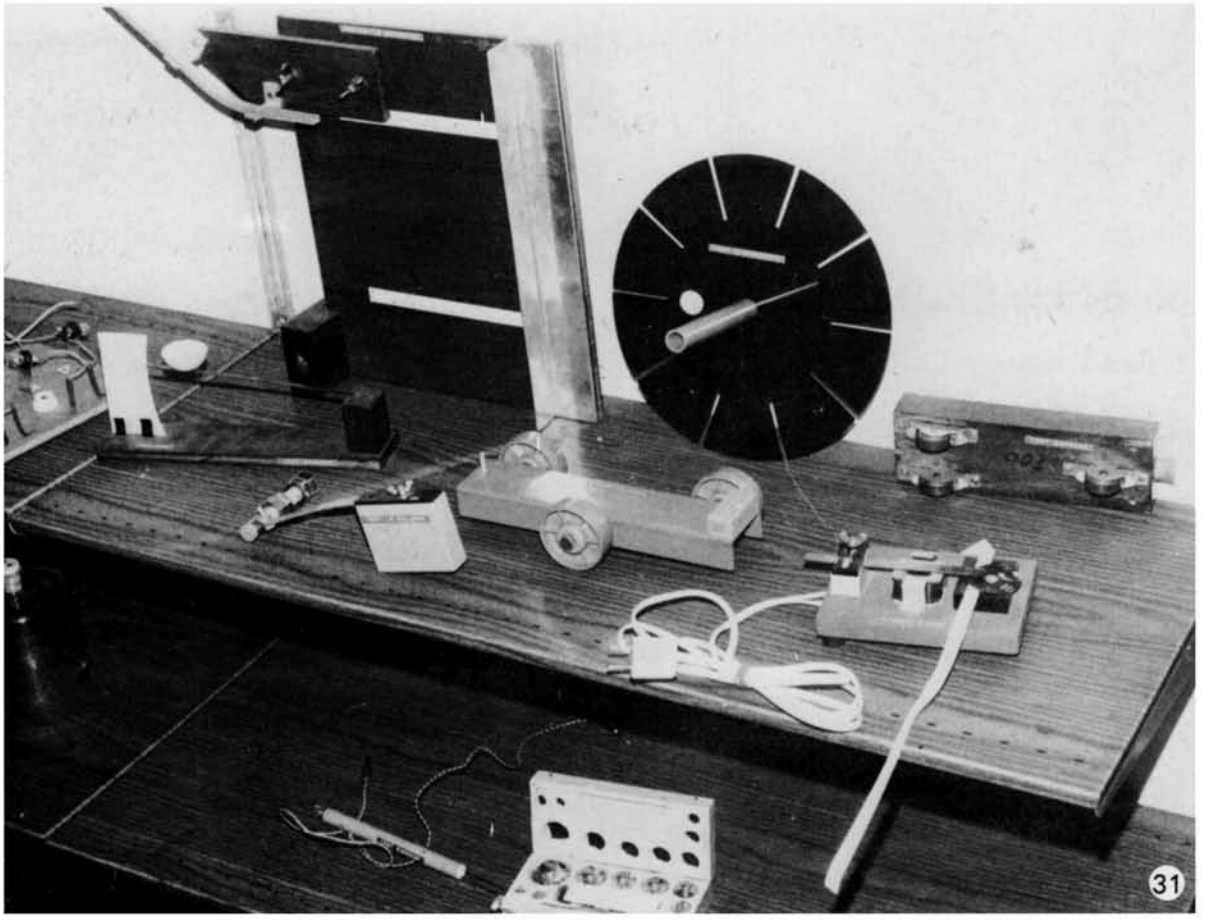
You will need:

- 1 ball of string.
- 10 *small* cartons, chalk boxes or plastic bags of sand (loads).
- 10 pulleys.

Do this:

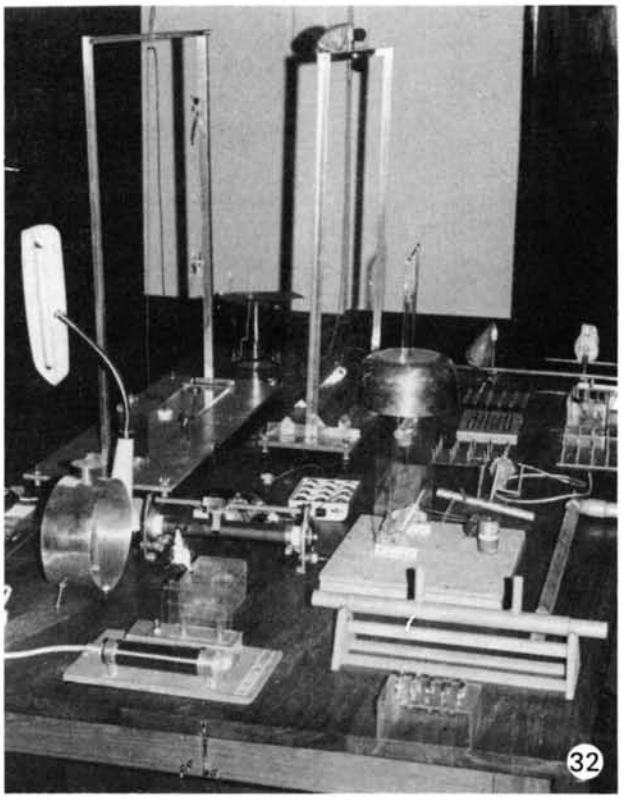
1. Group leaders collect 3 metres (10ft) of string and bag or carton of sand.
2. Tell the children to tie the load to the string and pull the load to a new position on their desks.
3. Give the children this problem. "See if you can find a way to move the load *away* from you by pulling the string". (This can be done if a pencil is held by another child at one end of the desk and the string passed around the pencil.)
4. Ask successful groups to show how they managed.
5. Give out a pulley to each group. Tell the children to use the pulley instead of the pencil and try again.
6. See if the children can suggest a way of lifting the load above their heads using the string and pulley.
7. Tie the pulleys to a beam across the classroom, and tell the children to pull up their loads using these.
8. Tell the children to make a record of what they have done in their note books. A drawing will be sufficient.

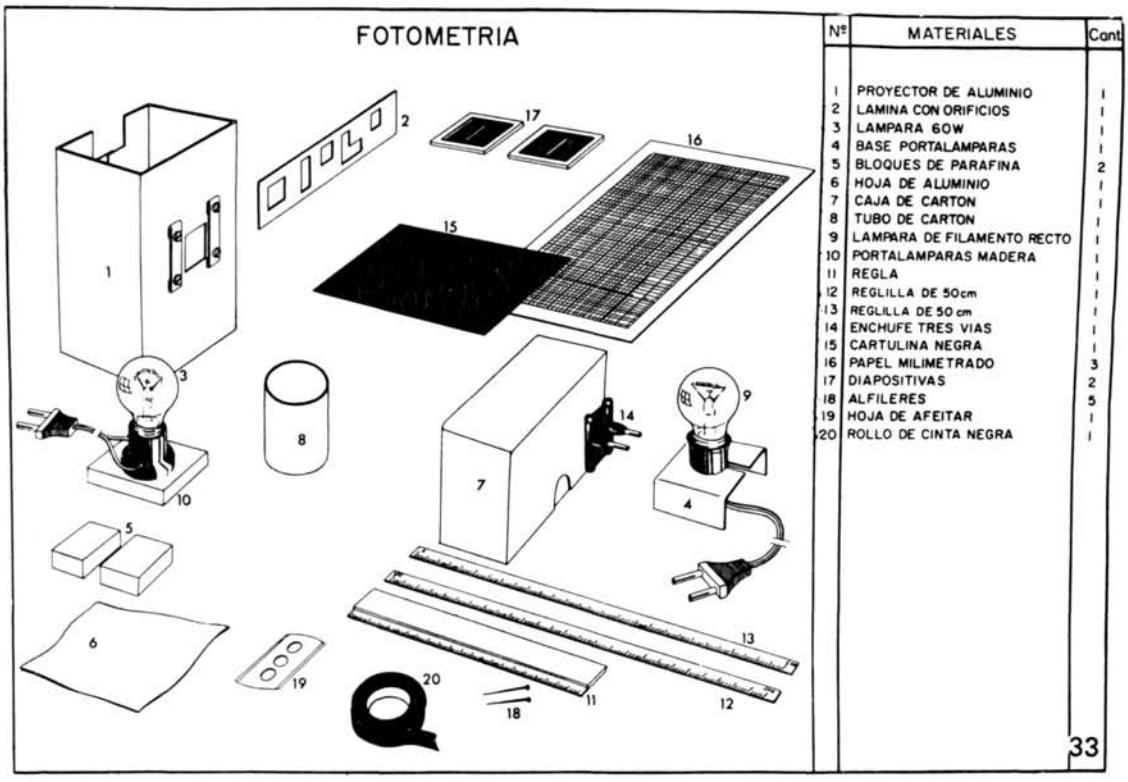
30 A sample workcard from the Papua New Guinea Primary Science project

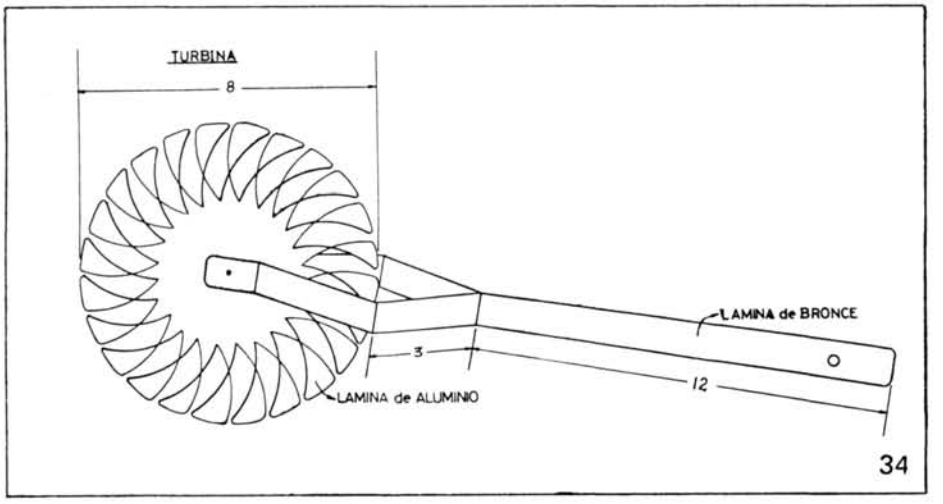


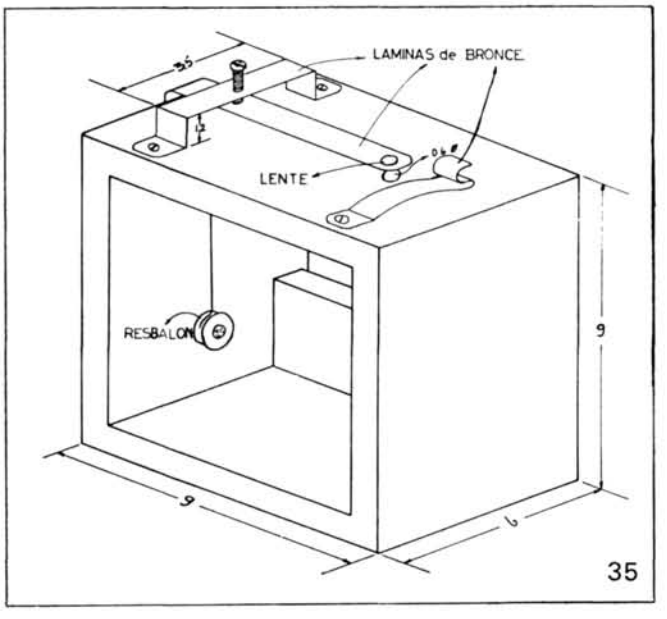
31 Some secondary apparatus, IPTST programme, Bangkok

32 Equipment largely for the training of technicians, Bangkok – prior to IPTST



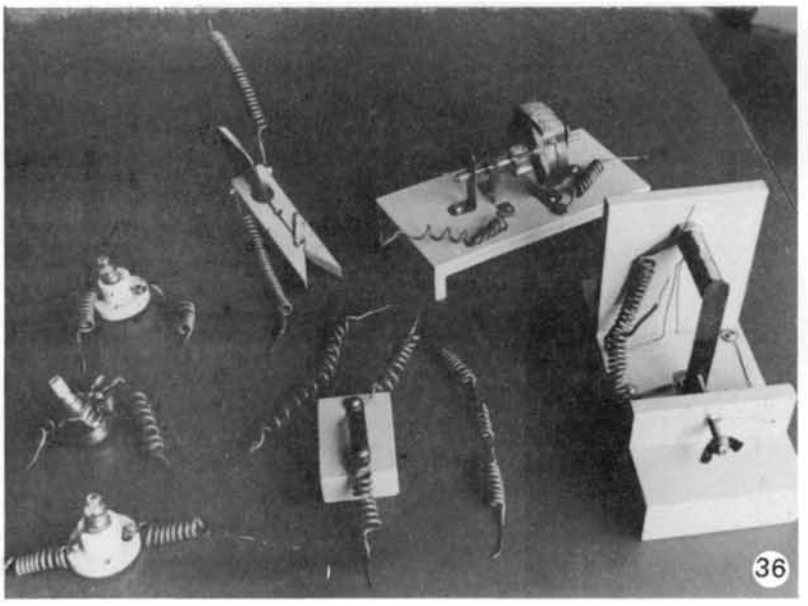


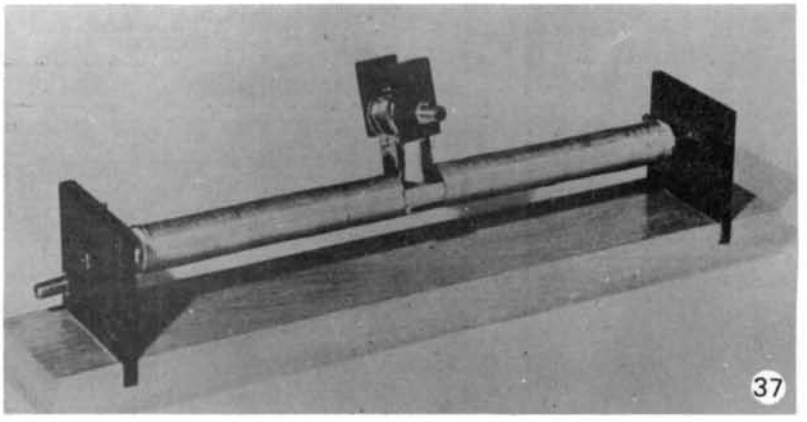




33 A Sao Paulo project kit

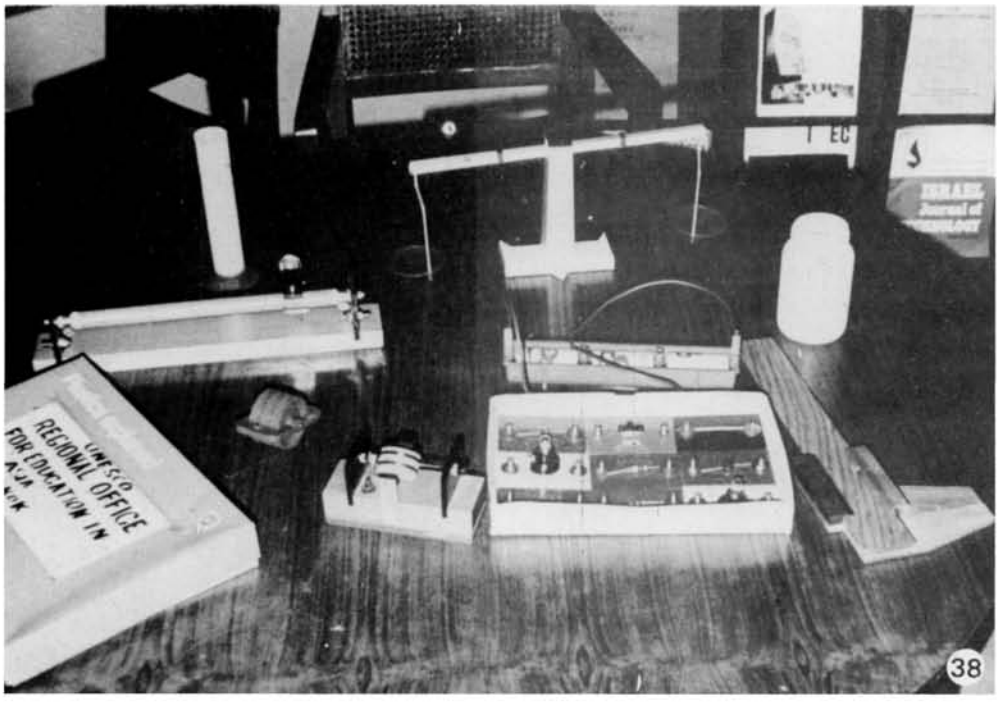
34 & 35 Dimensional drawings from Costa Rica





36 Some prototypes of science teaching equipment from Costa Rica

37 & 38 Items manufactured by Or & Kol, Israel



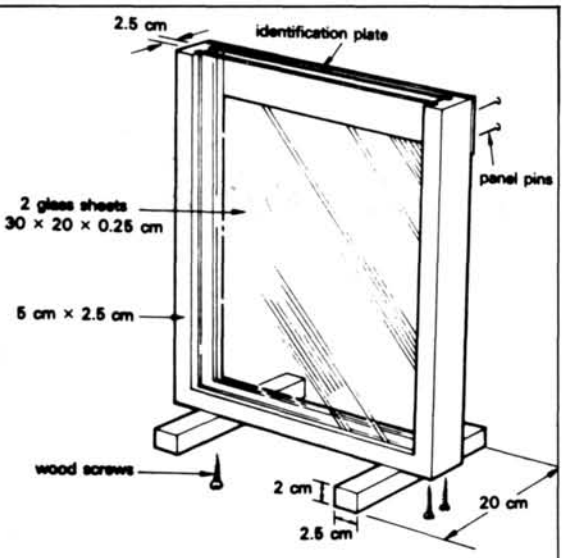


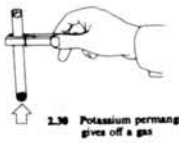
Diagram 91
Wormery (Rothamstead pattern)
Field of study 6.2

The frame is made of ready grooved wood and is cut to fit around the glass. The frame should be glued and screwed together, ensuring that the glass can still be removed. If the feet are attached by one screw only, they can be turned to lie in line with the base for easier storage. In use the glass sheets are covered with a sheet of cardboard to exclude the light and the soil is covered with a strip of polythene.

39 Dimensional drawing from Nuffield Apparatus Guide'

40 Example from the UNESCO 'Source Book'

41 Example from 'Guidebook to constructing inexpensive science teaching equipment'



2.30 Potassium permanganate gives off a gas

B. Try heating copper carbonate in the same way. Does this lose mass? Where has the mass gone?

2.31 *Some substances neither gain nor lose mass when heated*
Heat dry zinc oxide in a test-tube in the same way as in the last experiment. Is something lost or something gained?

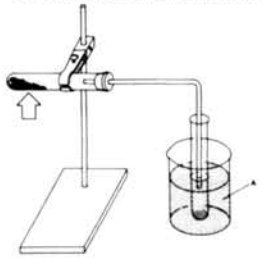
2.32 *Observing the effect of heat on copper sulphate crystals*
Crush some blue copper sulphate crystals and put them into a dry test-tube to a depth of 4 cm. Arrange as shown in the diagram. Heat the tube gently. What can pupils observe? Vapour collecting on the cooler parts? Change of colour from blue to white? Liquid collecting in the receiving tube? Can the identity of the liquid be established by finding out the boiling point? When all the copper sulphate crystals have changed to white and the tube has cooled, hold the tube in your hand and pour the liquid back on to the white crystals. Is the blue colour restored? Is any heat given back again? One way of recording what has happened is to write :

blue copper sulphate crystals + heat ⟶ white (anhydrous) copper sulphate + water

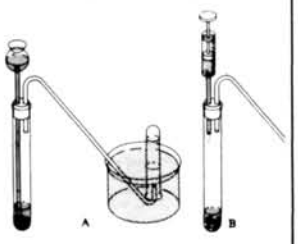
This is a reversible change. Pupils might discuss whether the previous experiments on heating substances were reversible changes.

Preparing, collecting and testing some gases

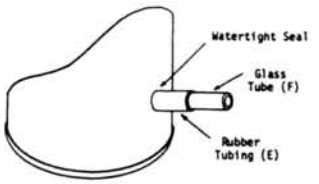
2.33 *Hydrogen*
A. Place a few pieces of granulated zinc or zinc foil from the casing of an old dry cell in a boiling tube; add 2 drops of copper sulphate solution and assemble the apparatus as shown in the diagram. An alternative to the thistle funnel at A is a syringe as shown at B. Syringes may be obtained as used rejects from hospitals and clinics. Pour enough molar sulphuric acid (see Chapter One) down the thistle funnel on to the zinc to cover the



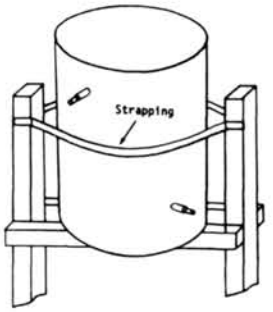
2.32 Collecting the product of heating copper sulphate crystals
A cold water in a beaker



2.33 Collecting hydrogen gas



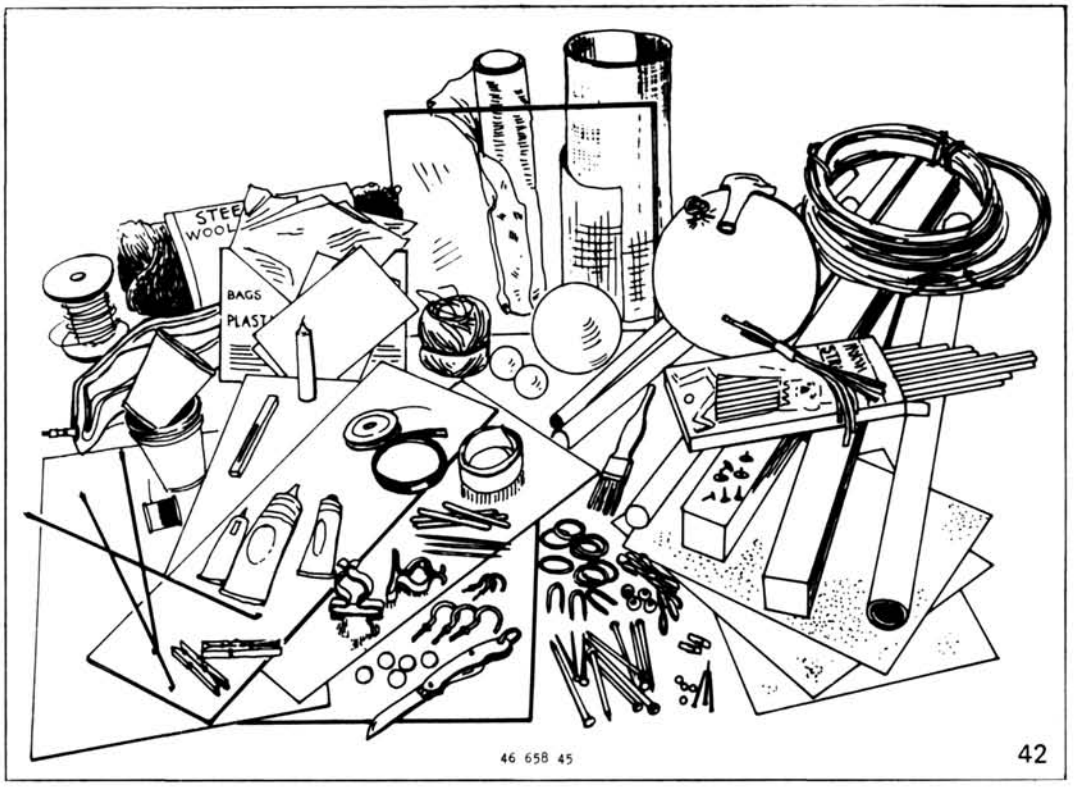
Insert each short piece of glass tubing (F) into a short piece of rubber tubing (E). Insert each rubber tube into one of the two small holes in the can. If the rubber tubes do not fit snugly by themselves, make a watertight seal with candle wax or epoxy resin.

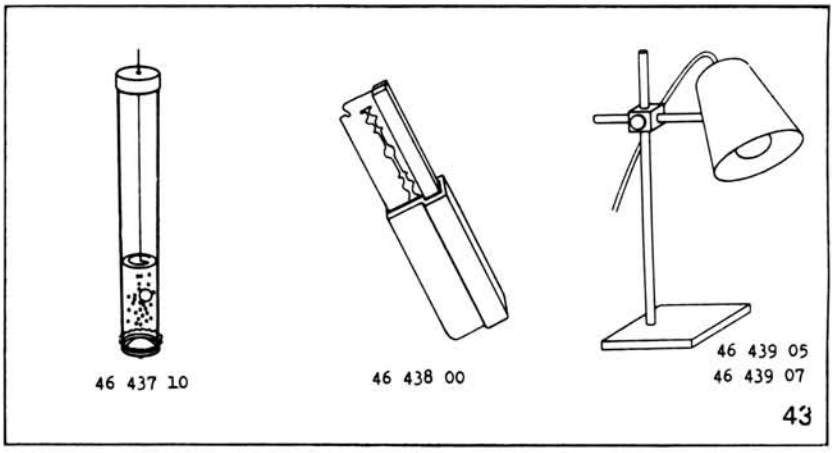


Set the can in place in the frame support. To secure it in position, nail two pieces of strapping (C) to the frame support, one on each side of the can.

(3) Condensing Pipe

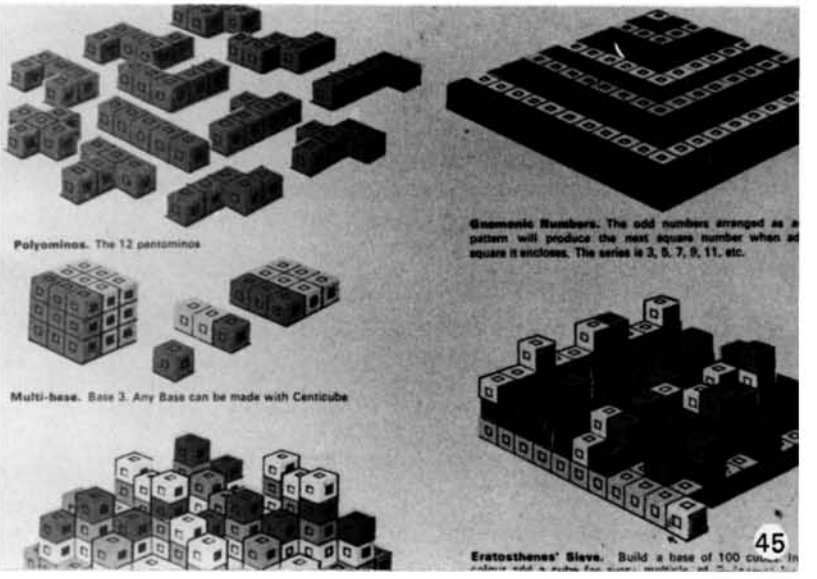
Choose a one-hole rubber stopper (H) that tightly seals the hole in the bottom of the water jacket can. Insert a short piece of glass tubing (I) part way through the stopper, from the large end. Insert the copper pipe (G) into the stopper from the other end.

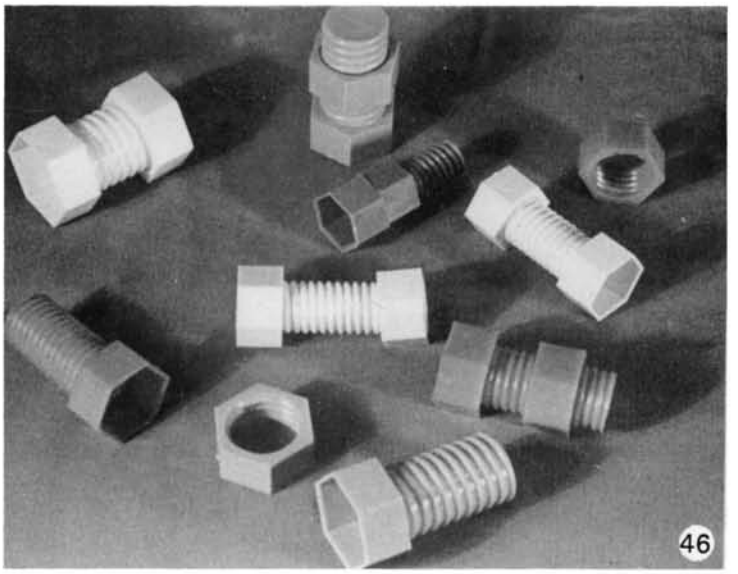




42 Resource materials kit, 'EVE' catalogue

43 Other items in 'EVE' catalogue are shown and listed separately

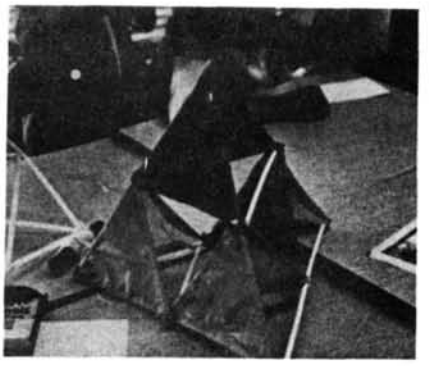




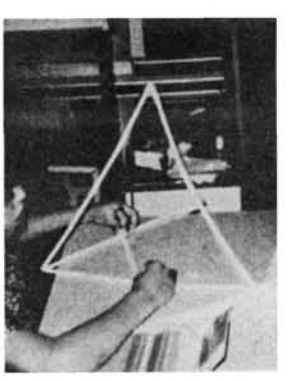
44 Practical work from 'Elementary Science Study' series

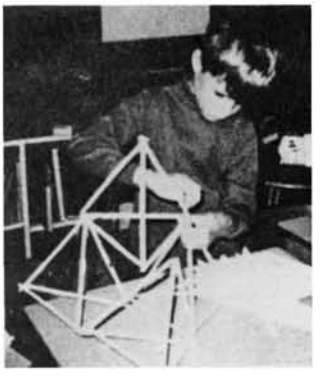
45 Centicubes

46 Plastic nuts and bolts kit



This is a model of Bell's structure which was presented to the students as their single source of information. With no assistance, each student was to reconstruct the model using 8-inch straws, pins, and paper.





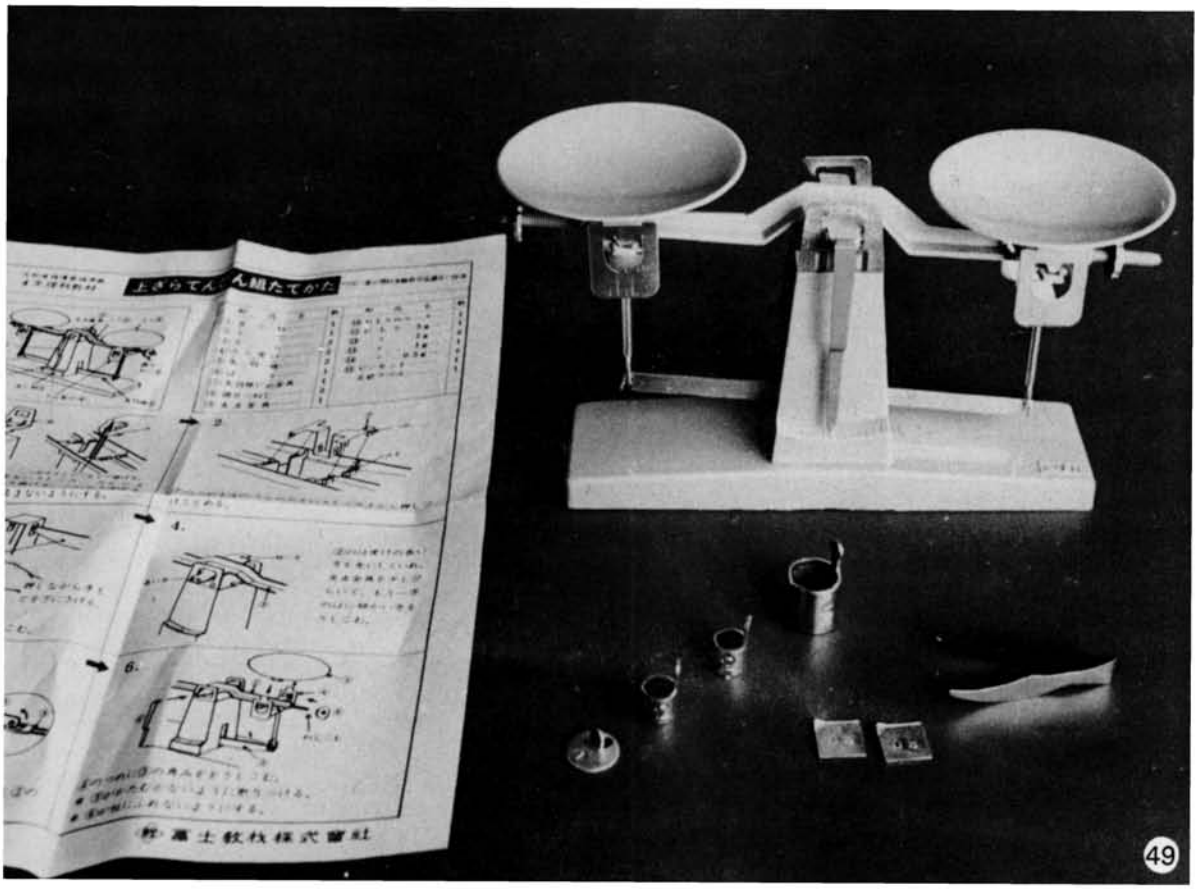
And so they did.

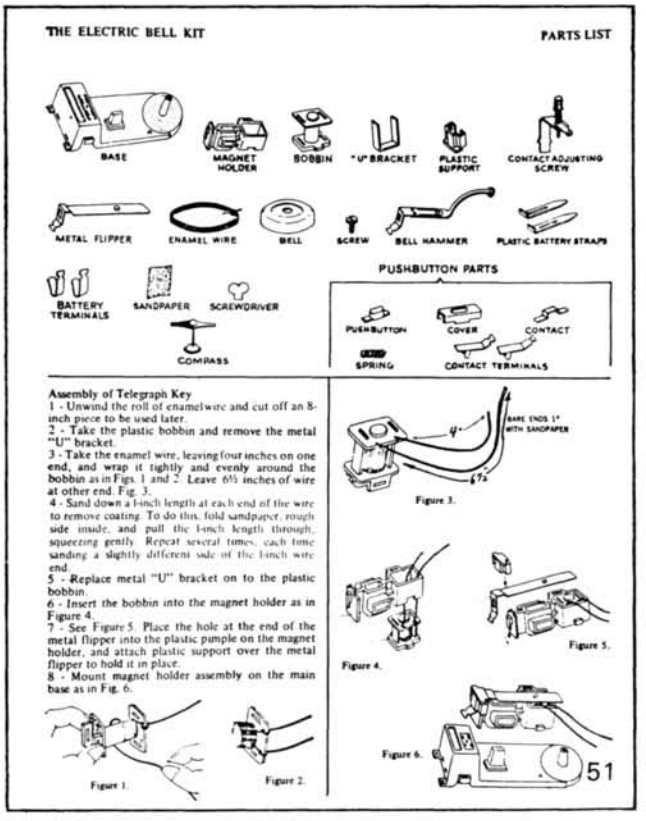
47

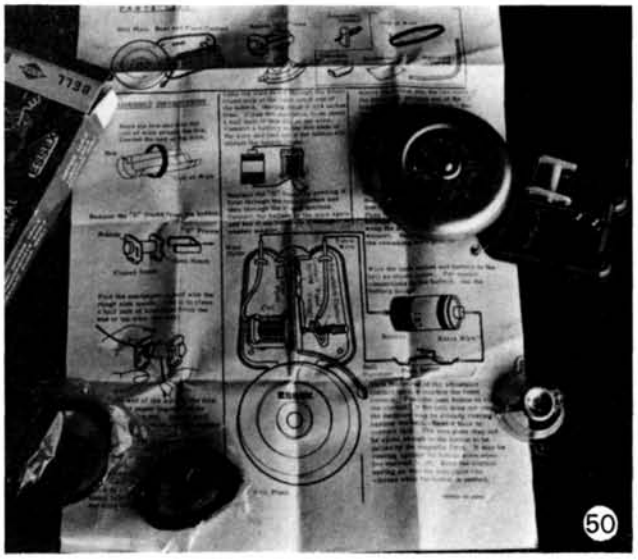
47 An example from 'Elementary Science Study' series

48 Some items from the kit compiled by Dr Simpson of Hong Kong

48





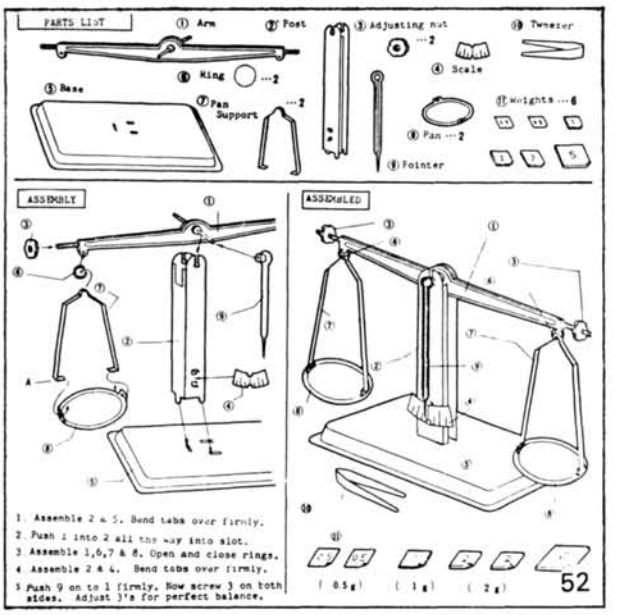


Japanese plastic mini science kits

49 Scales

50 Electric bell kit

51 Parts lists for electric bell kit



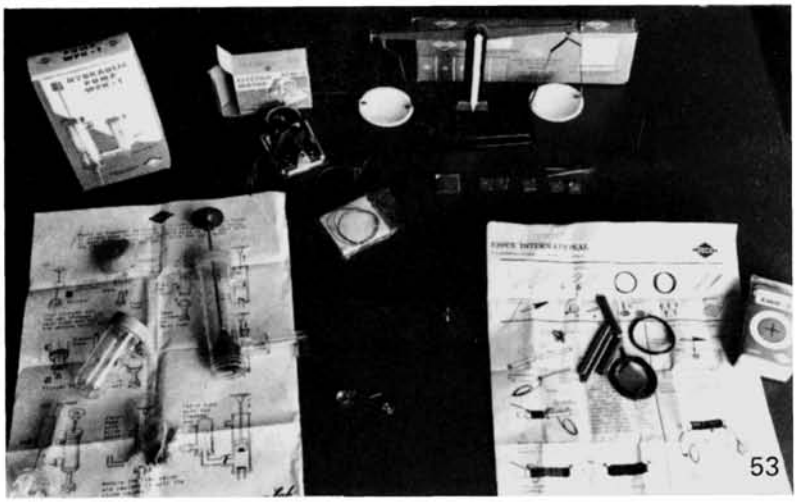
Japanese plastic mini science kits

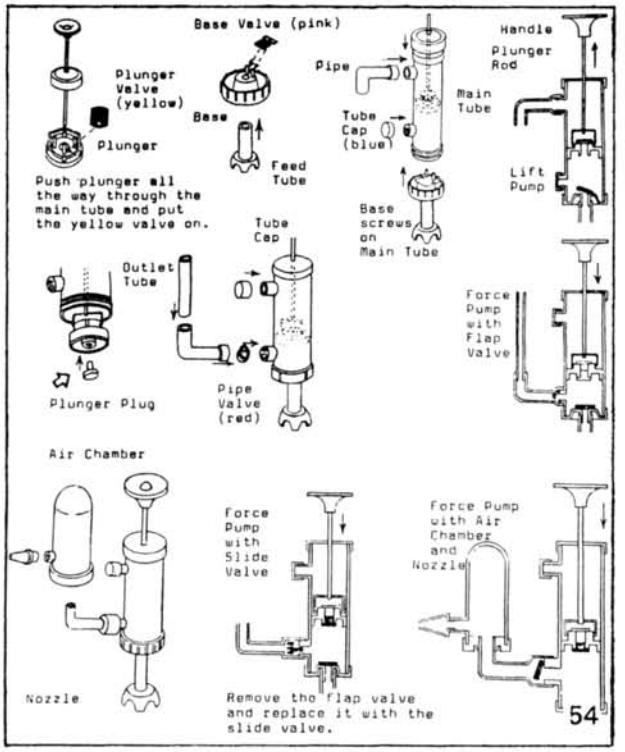
52 Parts list for balance

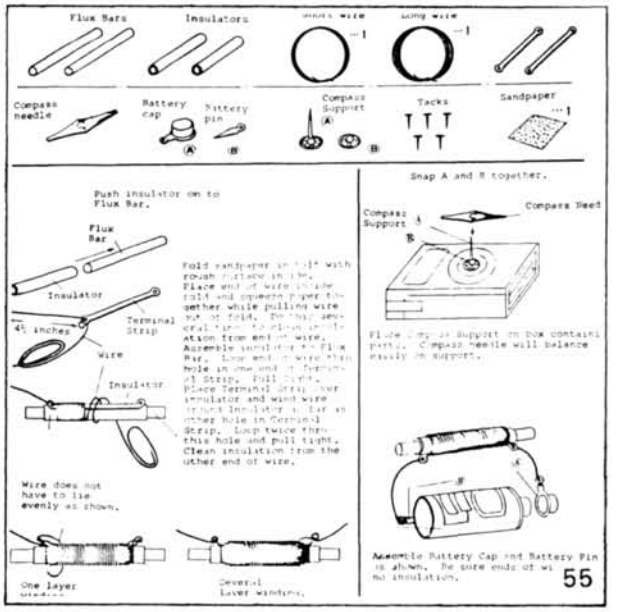
53 Kits for pump, balance and electro-magnet

54 Parts list for hydraulic pump

55 Parts list for electro-magnet

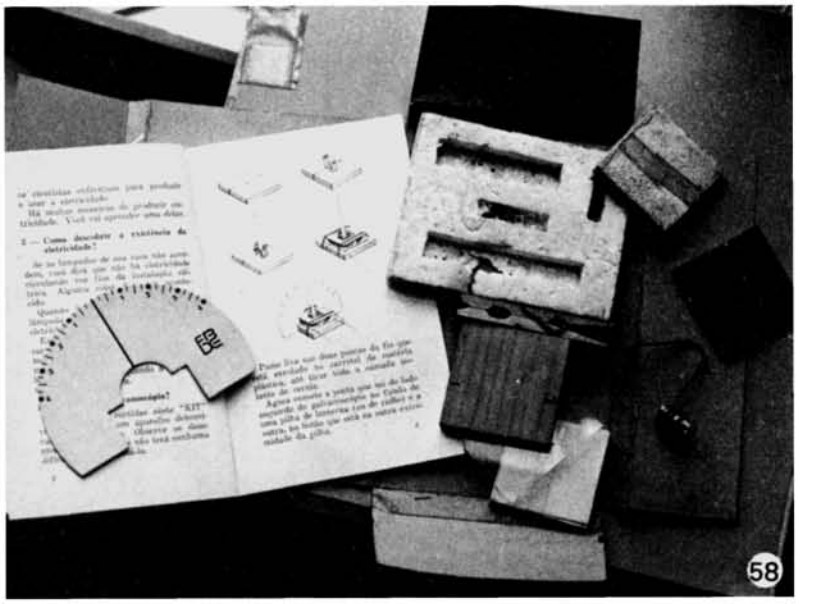






56 & 57 Kits from Precision Jigs Co. Ltd.

58 A sample kit from FUNBEC



59 & 60 Kits from the Advisory Centre for Education (ACE)