# Soft Technology

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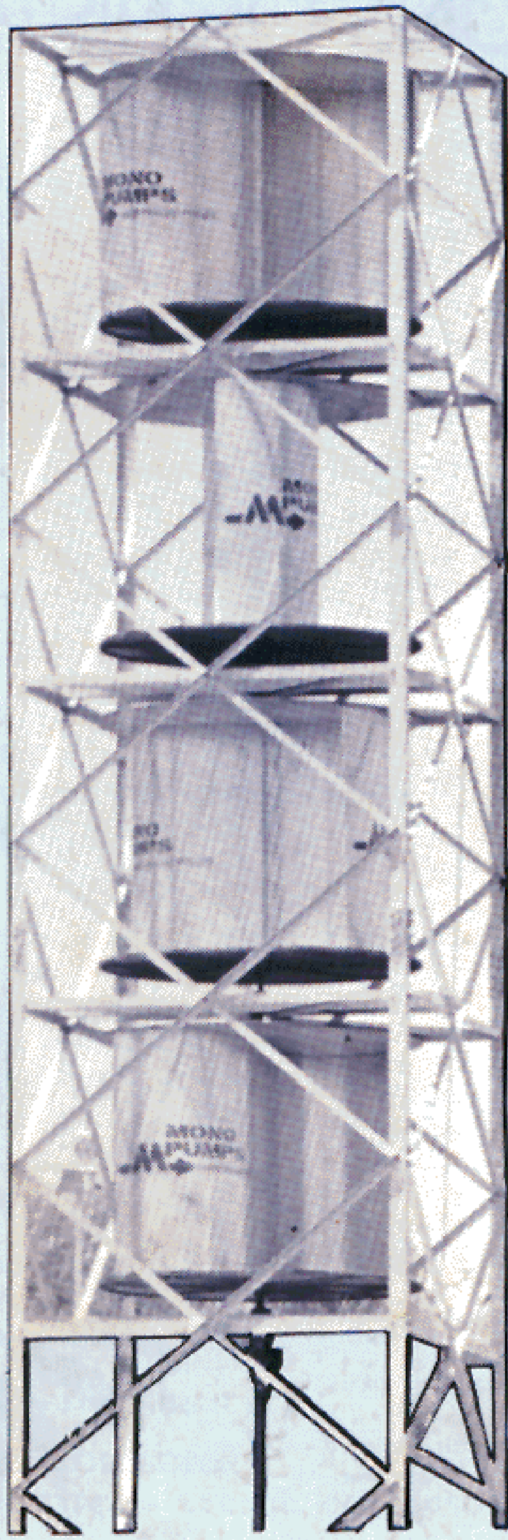
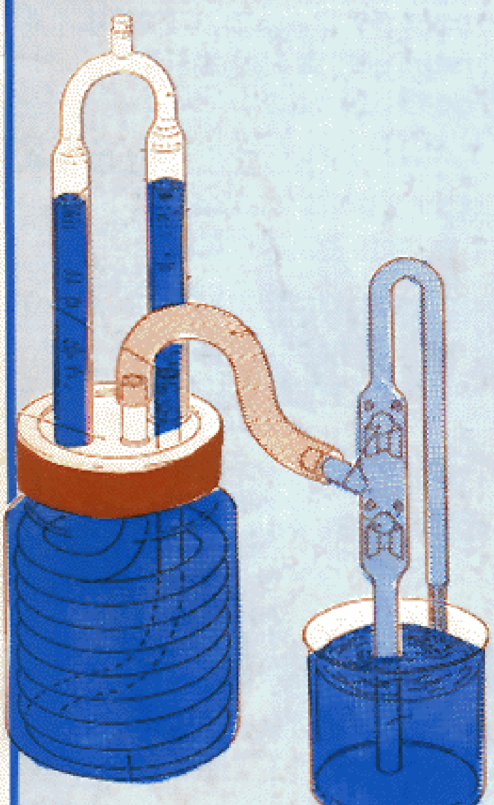



* MONO WIND PUMPS
* BASIC SOLAR ELECTRICS
* FLUIDYNE SOLAR PUMP



* SEPTIC TANK METHANE DIGESTER
* SOLAR ENERGY IN HOUSING
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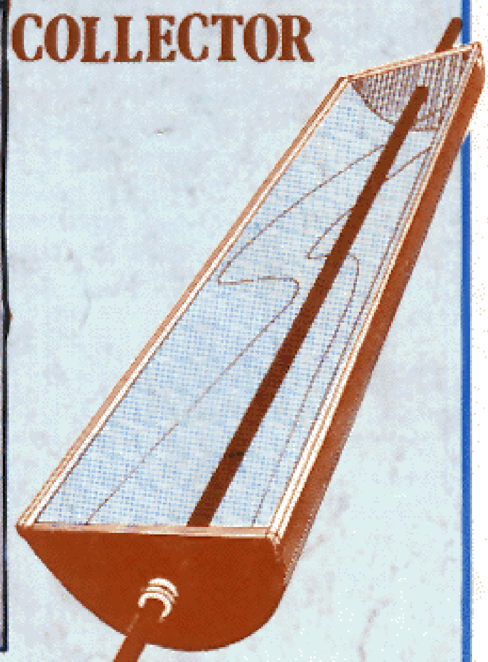

# Editorial

# THE LESSONS OF HISTORY

I have just finished reading a fascinating book, which really set me thinking. The book, entitled "A Golden Thread" is a history of solar architecture and technology.

To begin with I found the book humbling. If you're involved in the solar field professionally as I am and you discover that a patent was taken out in 1805 which essentially incorporated the basic principle that you are using, it knocks you down a rung or two. Although today we often have a better understanding of the physics and mathematics of the processes involved, it doesn't mean that our forebears didn't have GOOD IDEAS. How many of these ideas lie buried in the rubble of scientific history?

If you want further examples, the book is littered with them. For instance, an addition to the ancient Greek city of Olynthus, which was built in the fifth century B.C., was layed out to give every building good access to the sun. Today, town planning in the second century A.D. in Rome, a ruling in the courts defended householders rights to the sun. We, of course, are just getting around to such legislation

The historical ancestors of the solar pumps covered in the last two issues of Soft Technology go back a long way too. The first was built as a novelty device by Hero of Alexandria in the first century A.D., and the French Professor Augustin Mouchot took out a patent in 1861 on a solar pump which again used the principle of heated air expanding and exerting pressure on a body of water.

The other thing that struck me is how the fortunes of solar energy have been so bound up with the social and political events of the day. The Romans *were* forced to embrace solar architecture because of a fuel crisis. - Yes, even they had one! Fuel wood had to be imported almost 1000 miles by the first century B.C. and by the fourth, they even had an entire fleet of ships making wood runs from France and N. Africa,

Nearer our time, promising developments in solar power were abandoned because of the outbreak of World War 1, and the growing solar water heating industry in the U.S., with its peak around 1920 was checked by the discoveries of natural gas. Of course, the last fuel "scare" in 1973 initiated a frenzy of activity into renewables and unfortunately we again begin to see the reversal as complacency gathers strength. Fortunately, the A.T.A. seems to be growing - let's hope it continues against the tide.

Bob Fuller.

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This issue of Soft Technology was edited by Mick Harris with the help of Alan Hutchinson, Michael Gunter, Bob Fuller, Alan Leenearts, Ian Grey, Paul Marshall and Harry Michaels

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# Energy Flashes . . .

## VULCAN'S NON SOLAR COLLECTORS

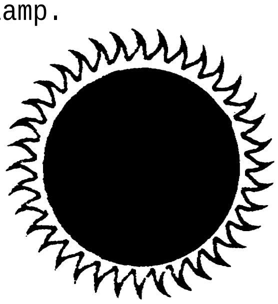
People traveling on the Hume Highway between Sydney and Melbourne may have noticed a large number of parabolic trough collectors on the roof of a service station near Wangarratta. The collectors which were manufactured by Vulcan are part of an experiment in solar heating and air conditioning.

The experiment is being conducted by ESSO and Vulcan with a financial assistance from the Federal government. However there seems to be some bugs in the system as in the years the collectors have been in place they have yet to work consistently as they are meant to.

The photo below shows the collectors in operation on one day when someone was going past, Note there seems to be some kind of tracking problem. These collectors are on top of motel type accommodation to the rear of the service station.

## SOLAR LIGHTING

Amtex Electronics in New South Wales is now marketing an external solar powered lighting kit which uses a high efficiency low-pressure sodium vapour lamp.



The equipment is provided in a kit comprised of an efficient low-pressure sodium light with cast aluminium housing and solar panels in 1 meter by 50 centimeter sizes. Each panel generates 40 watts and will run the light for four hours. Also included is a battery and control unit, (including timer).


# WIND GOING CHEAP

The Mod 1, 2 Megawatt wind turbine was recently auctioned off $51,600. The wind turbine originally cost $29 million to build, erect and test. The Mod 1 which was at one stage the world's largest wind turbine was beset with a number of problems until one of the blades suffered structural damage in January 1981. Rather than repair the turbine it was decided to auction it off.

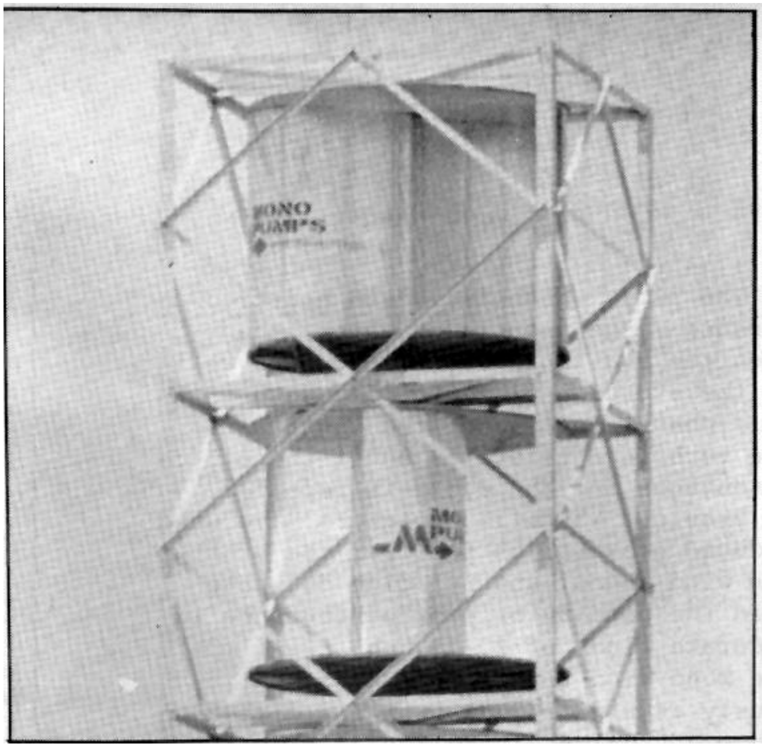
The 51:1 ratio, three stage gear-box and 2,225 KVA, 1,800 revolutions per minute synchronous generator will be used in a 100 year old hydro dam which is being restored. The 40 meter tower is going to be used by Georgia Tech in Atlanta.

# SUN POWERED RAILWAYS

American railways are now starting to use solar cells to provide power for lighting the tail lights on their trains. Solar cells are being used because they have been found to be a cheaper way of providing power to the lights.

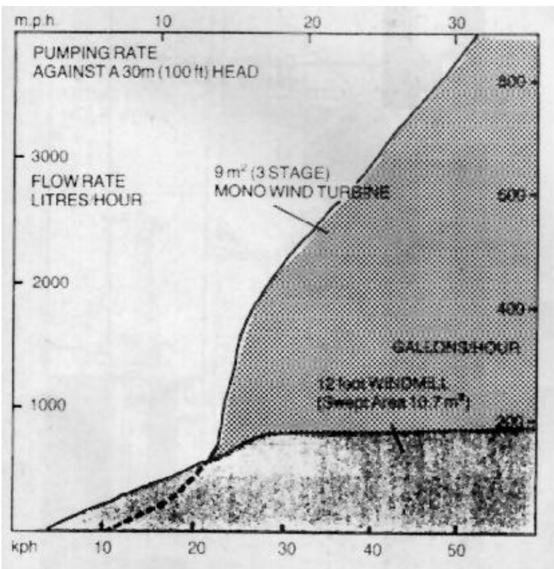
Photovoltaics are also being used increasingly for powering signal lights lights at railway crossings and a number of other applications.

# MONO WIND TURBINE



## A SAVONIOUS REDEVELOPED

Over recent years a number of new wind turbines have appeared on the Australian market. These new turbines have been attempting to move in on the water pumping market, an area which has been dominated by the classic multi-vane wind pumps. One of these turbines was the Cobden wind turbine with its characteristic jet engine type appearance,




The other wind turbine to appear was the Mono pump which is a development of the Savonius rotor type design.

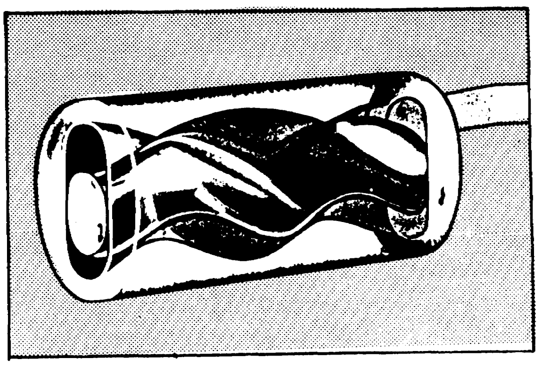
The manufacturers of these machines claim they have a higher efficiency with lower maintenance requirements. The S rotor design was selected after wind tunnel tests by a NSW University engineering team at Duntroon. Using a vertical axis rotor running on sealed bearings eliminates much of the machinery required at the tower head of existing mills and greatly reduces tower head maintenance.

A key component of the Mono pump is the clutch. The clutch has an "impulsive engagement" system which allows the drive to build up momentum at low wind speed. The clutch cuts in to allow pumping until the-momentum is used up, then cuts out while the rotors build up speed for the next input.

In winds between approximately 10-22 kph (643.5 mph), the turbine operates the pump in an intermittent manner. The cycle begins with the clutch disengaged. Without the drag of the pump the wind turbine stores the wind energy in its increasing rotational speed until it has sufficient speed to engage the clutch.

The pump, which is geared up to produce large amounts of water, then uses the available wind energy, as well as the stored energy, to pump water. In this phase, because of the light winds, the turbine decelerates until the clutch disengages and the cycle is repeated.

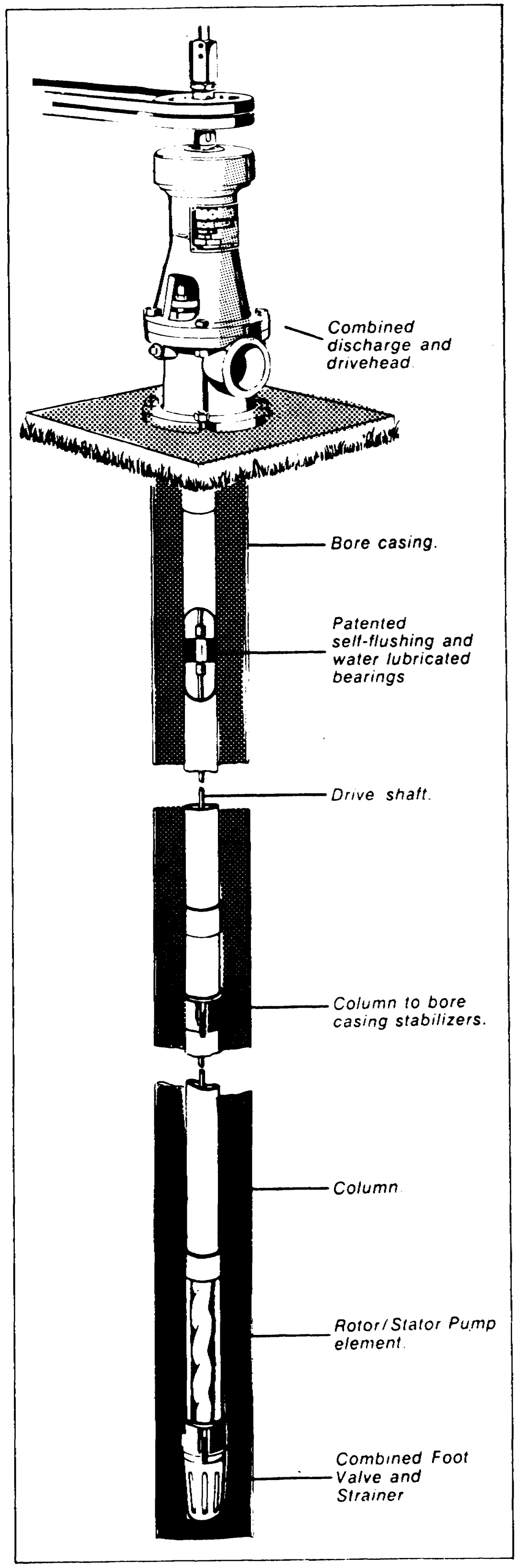
Previous windmill designers have used reduced gear ratios to lower the starting wind speed, and by doing so, have paid the penalty of poor performance in moderate winds of 20-46 kph (12-29 mph). The Mono Wind Turbine operates continuously at wind speeds from any direction above approximately 22 kph (1.5 mph).

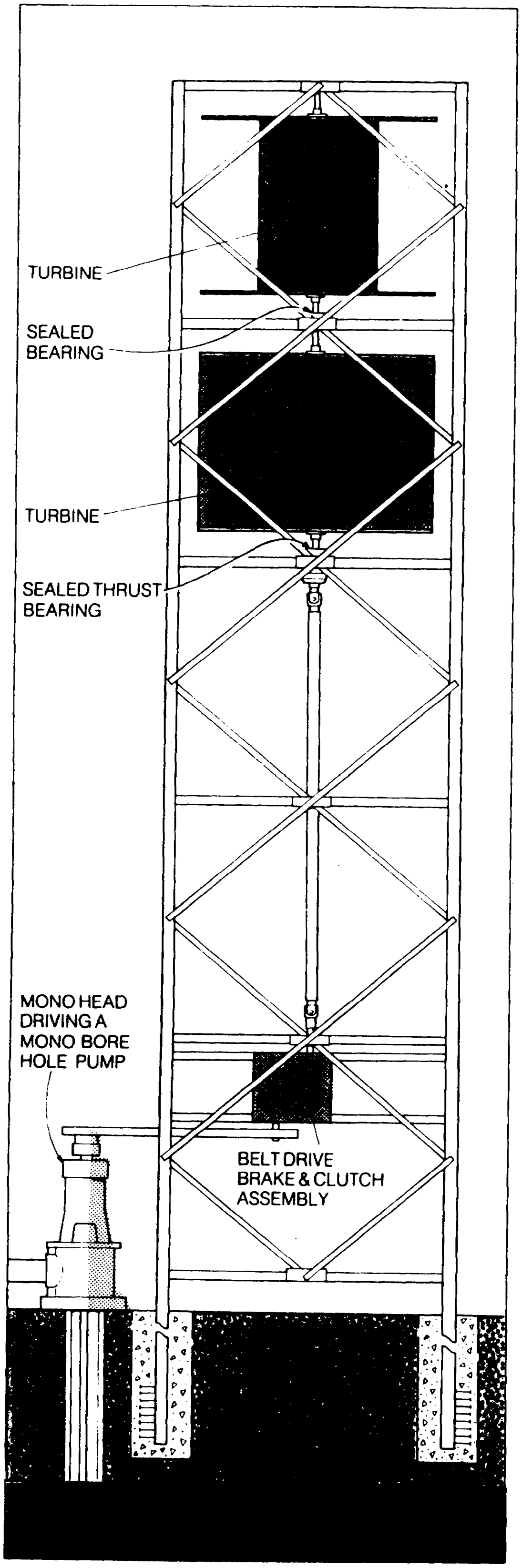


The Mono Pump has been designed to withstand wind gusts up to 160 kph (100 mph). A brake stops the wind turbine when sufficient water has been raised, or auxiliary power is required. During periods when more water is needed an auxiliary electric or diesel power source can be attached.

The Mono Pump uses a pump composed of a single helix metal rotor which revolves within a double helix resilient rotor. Rotor and stator are under continuous lubrication by the liquid being pumped. Because of the slow speed operation of the pump there is little wear and maintenance is minimized.

The manufacturers of the Mono Pump claim that their unit can pump more than twice the amount of water of a comparable multi-vaned unit.



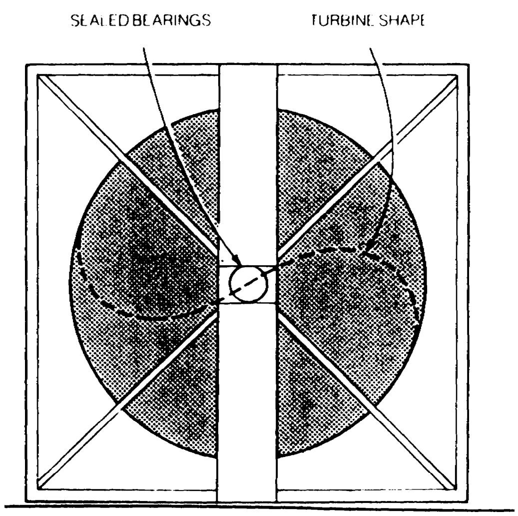



## The Costs and Disadvantages

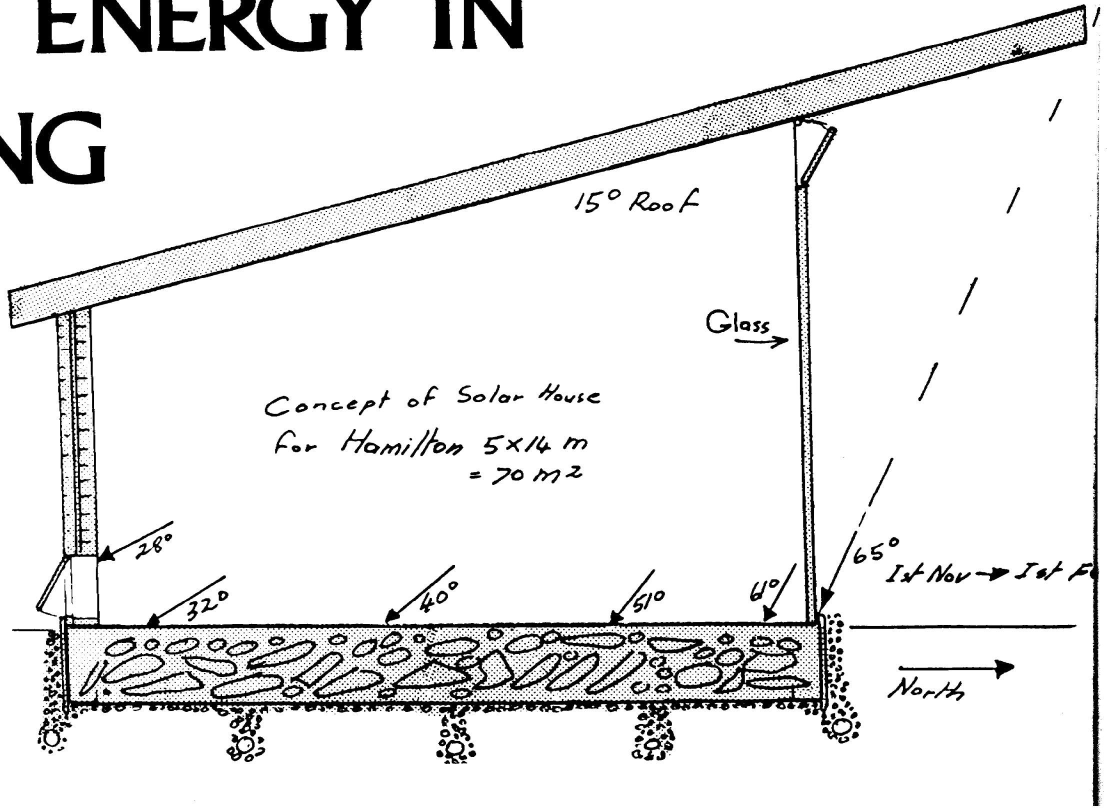
The biggest disadvantage of the Mono Pump is its cost. This can be close to five times the cost of a conventional multi-vaned wind pump. An installed Mono Pump with two tiers can cost $11,000 to $12,000 while an 8ft. wind pump would cost around $2,000. With this kind of price difference the Mono Pump has to be pretty good to beat the opposition.

Other questions can be asked about the claimed efficiency of the Mono Pump. The designers of the Mono Pump claim it uses the most efficient shape possible. However in the past all the available literature has stated that this shape is not the optimum. When Singurd J. Savonius of Finland invented the Savonius rotor, he conducted extensive tests on his design and found the optimum overlap for the rotor. This does not coincide with the Mono design.

Many of the Mono Pumps claims of improved design and greater efficiency will only be tested by time. Eventually we will know whether the claims are merely sales talk or true advances in wind water pumping technology. But the Mono Pump will have to be a lot more efficient and a lot easier to maintain if the added cost of the Mono Pump is not to be a disadvantage.



# SOLAR ENERGY IN HOUSING




## Back to Basics

The sun emits electromagnetic energy over a very wide range of wavelengths. What we see as light is just a fraction of that range of energy. The range of wavelengths we can use as "solar energy" is limited at one end by the filtering action of the atmosphere and, at the other end, by the material of the collector.

There is a wide range of usable wavelength apart from the visible range. So solar energy is available even in overcast conditions.

Solar energy can be measured in several ways. For convenience I will use the energy falling directly on one square metre of horizontal surface. I will measure the energy in watts.

For example, at noon on 22 December, 1000 watts is falling on our one square metre. Some other dates are listed below.

The first law of thermodynamics says, basically, "Energy cannot be made or destroyed."

When we consider the 1000 watts per square metre in terms of hectares, we get 10,000,000 watts or 10 megawatts per hectare or, if you prefer, 13,405 H.P. per hectare. Another way to express it would be 100 HP, per 75 square metres.

All this energy must go somewhere: it is turned into heat or used to build plants, via photosynthesis.

The heating of the surface of the earth is what drives the weather patterns of the planet. The temperature of the earth's surface is largely related to the amount of vegetation covering it. We all know how much cooler it is under a clump of trees on a very hot day and there is no doubt that clearing of trees affects the weather by causing more "highs" to develop over land.

## The Sun in the Home

The energy input needed to make a building comfortable is very much dependent on the design of the building.

Theoretically, a building could be constructed with a very large amount of thermal mass and near perfect insulation, that would require no energy input to maintain a comfortable temperature all year round. This is not practical because people like fresh air and daylight; both ventilation and windows cause energy movements.

As with most things, a balance has to be struck between cost and comfort.

There is plenty of solar energy to make buildings very comfortable for 99% of the year, for very little extra cost.

The temperature diagram shows the importance of thermal mass,

Thermal mass is anything that will retain heat for long periods, e.g. bricks, water. The mass absorbs heat during the day and radiates heat during cooler night hours, thus regulating day and night temperatures. Insulation also regulates by reducing heat gain during the day and heat loss at night.

The diagram demonstrates temperatures of a room -

A - with no thermal mass and no insulation

B - with thermal mass and no insulation

c - with thermal mass AND insulation

D - with insulation and NO thermal mass

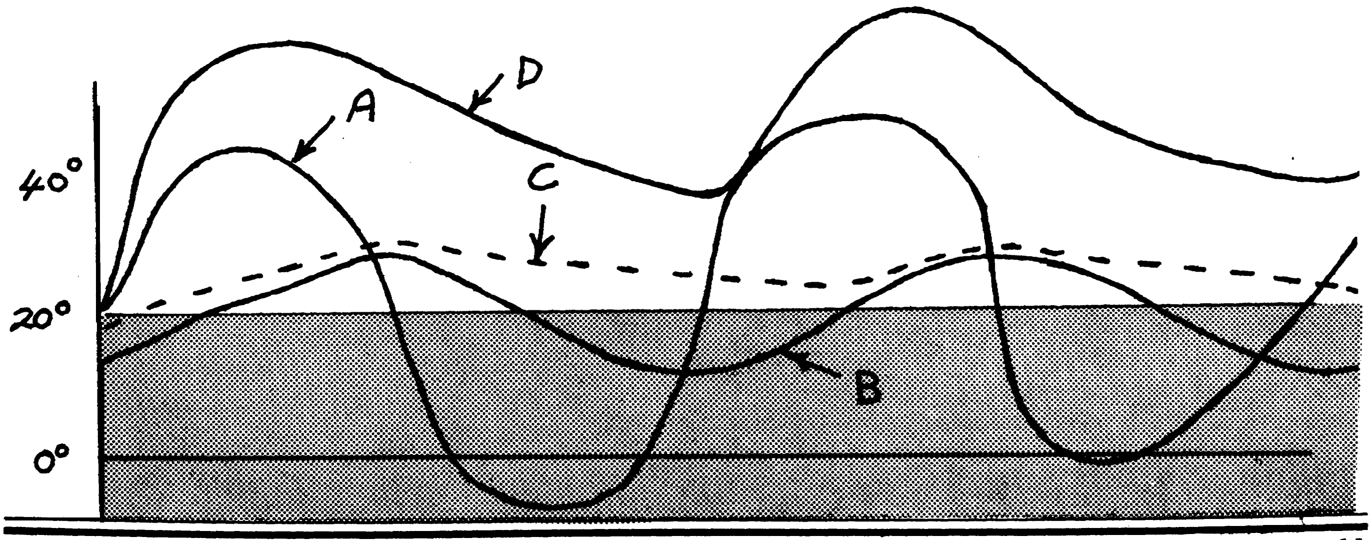
The dotted line "C" has the most stable temperature, staying around a comfortable 22°C. This is achieved by using both thermal mass and insulation.

**Solar Energy Gain Throughout the Year**

| Date | Watts at Noon | Total Watt/hrs/day |
|---|---|---|
| Jan 22 | 900 | 7000 |
| Feb 22 | 800 | 6200 |
| Mar 21 | 700 | 5000 |
| Apr 22 | 550 | 3900 |
| May 22 | 425 | 2400 |
| Jun 22 | 380 | 2000 |
| Jul 22 | 430 | 2000 |
| Aug 22 | 575 | 2400 |
| Sep 24 | 750 | 3900 |
| Oct 21 | 850 | 5000 |
| Nov 22 | 950 | 6200 |
| Dec 22 | 1000 | 7000 |

From the information in the table of solar *energy* gain, we can see what is available for use by all of us. We can see that during the colder months, the energy per square metre is less than in the hotter months. We cannot change that.

What we can change is the number of square metres we use to pick up the energy each month. The area of collection increases when the sun is closer to the horizon in winter, Therefore, the total direct solar gain increases in



winter. The chart shows this. The building cross-section diagram shows how this is achieved.

## Controlling the Sun

During the warmer months the sun is prevented from shining directly into the house. Because of this and the good insulation, the only energy inputs that can raise the temperature inside the house are indirect solar energy or entry of hot air.

Indirect or diffuse solar energy is the solar energy reflected by clouds, buildings or other objects. This reflected energy can be up to 15% of the direct energy. The deciduous trees or vines on the north sector are used to reduce this indirect heating, we don't want to stop this heat altogether as the house would be too cold in summer.

The entry of hot air is prevented by bringing all the incoming air in via the vegetation-in the shade house, provided the plants are kept well watered the incoming air will be considerably cooler and if you like perfumed as well by flowering plants in pots placed in the shade 'house.

Obviously for this to work the external doors of the house must be kept closed and the inside doors open. An internal toilet will be vented to an outside wall hence if the toilet door is left open the house ventilation would be affected. The toilet door must be closed by a spring.

Trees planted around the house reduce the wind velocity sufficiently to prevent the wind blowing the ventilation in reverse for extended periods. If the design rules are followed, air conditioning is not necessary.

Comfort in a building is determined mainly by air temperature, floor temperature, wall temperature or radiant temperature, and air movement.

We feel comfortable within a very small temperature range, approximately 18 to 24 degrees C. If the building temperature is hotter than 22°C we feel comfortable with an increase of air movement. The same air movement that cools us will cool the building. Thus if the building is designed to be a little hotter than we require when the air movement is stopped, the temperature can be adjusted down by increasing the air flow,

If we design a building with the following design rules in mind, we should have a building which will be comfortable 99% of the year, without any energy inputs other than solar. Informed use of the vents and curtains will fine tune the temperature.

## Basic Design Rules

1. The site must be selected such that, the northern sky would be visible from floor level inside the house, down to 20 degrees vertically and 120 degrees wide horizontally (60° - 300°).

2. The surface to volume ratio of the building should be minimised with the longest dimension east-west.

3. All or nearly all the windows must face north.

4. The south wall must be well insulated and any windows must be small and/or double glazed.

5. The east and west walls must be well insulated; any west windows must have movable opaque covers available.

6. The floor must have co considerable 'thermal mass (500 kg/m$^2$ is ideal) and must be covered by a dark thermally conductive material. The soil under the floor must be well drained, preferably dust dry. The edges of the floor must not be exposed to the outside elements.

7. The roof must be well insulated and

the north eave carefully dimensioned to cut off the summer sun from the north windows. This dimension is critical to success and varies with latitude.

8. The ceiling must be sloped to direct all hot air to a large adjustable vent at the highest point. The material of the ceiling must be airtight and carefully sealed at the edges.

9. Internal walls should run mainly north-south and have as much thermal mass as possible. A dark colour on the east faces would be an advantage.

10. A large adjustable vent or vents must be placed at floor level, preferably on the opposite wall to the high vent; shade loving plants can be placed outside this vent for cooling the incoming air. Automatic watering of these plants will prolong the cooling effect.

11. The wind speed across all glazed surfaces should be minimised. The use of vegetation and setting windows back in the wall, and using a large number of small panes, will all reduce wind losses.

12. If a fireplace is used, the grate must be able to draw air from outside the house and the chimney should have a method of closing off, The fireplace is best free-standing inside the house, rather than being part of an external wall.

13. Heavy drapes must be fitted to cover all large windows on cold nights; the drapes should be hung in close fitting pelmet boxes.

14. The toilet door should be spring loaded closed. If an exhaust fan is used in the kitchen, it should be the closing type.

15. Deciduous trees or vines can be planted, set back on the northern sector, and evergreen trees close in on the southern sector of the house.

Labour is by far the largest cost of this type of structure. If you build a house yourself, you can save on materials as well as labour costs. Costing of materials before designing is well worth the effort; for example, the availability of stone

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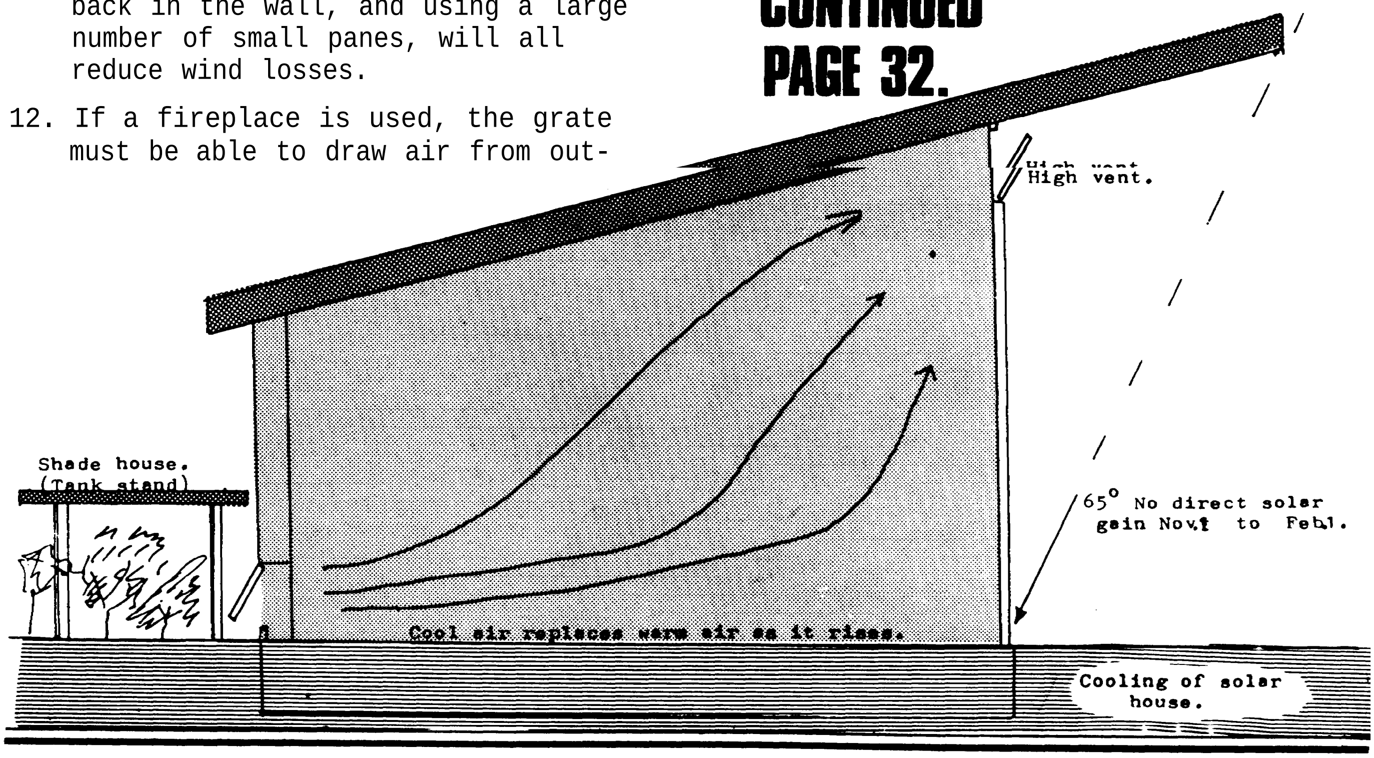


# SOLAR ELECTRICITY - Starting from the basics


Several years ago I got hold of some second hand Solarex solar electric panels and used them in putting together a small electric system for a friend's remote country weekend house. The house is located in the mountains in east Victoria. It is at the bottom of a valley with wind being out of the question as far as a power source. The sun generally only shines in the valley for about six hours of the day, however, this has still been adequate to keep the batteries charged.

The electrical system's major use is for lighting. Twelve volt lamps located in the major rooms of the house are used regularly even though most lighting is by the use of kerosene lamps. In addition to this the system is used to pump water from the nearby creek to water the garden in summer. The other use is for running a 12 volt car stereo system.

*The house that had its basic power needs supplied by solar electricty.*

In putting the system together a major consideration was doing it as cheaply as possible. The solar cell panels were bought second hand for $120 for the two, with most of the bits in the switch box scrounged for nothing or next to nothing. Initially the system was run with a second hand car battery even though this was to be replaced later with a proper deep cycle battery. The wiring in the house was already present so apart from a few new light bulbs there was no cost there.

The cost of the system worked out like this -

| | |
|---|---|
| 2 second hand Solarex panels @ approx. 10.5 watts each | $120 for 2 |
| solar charge regulator for switchboard | $ 24 |
| switches, fuses, wire and bits and pieces for switchboard | $ 23 |

light bulbs $ 8

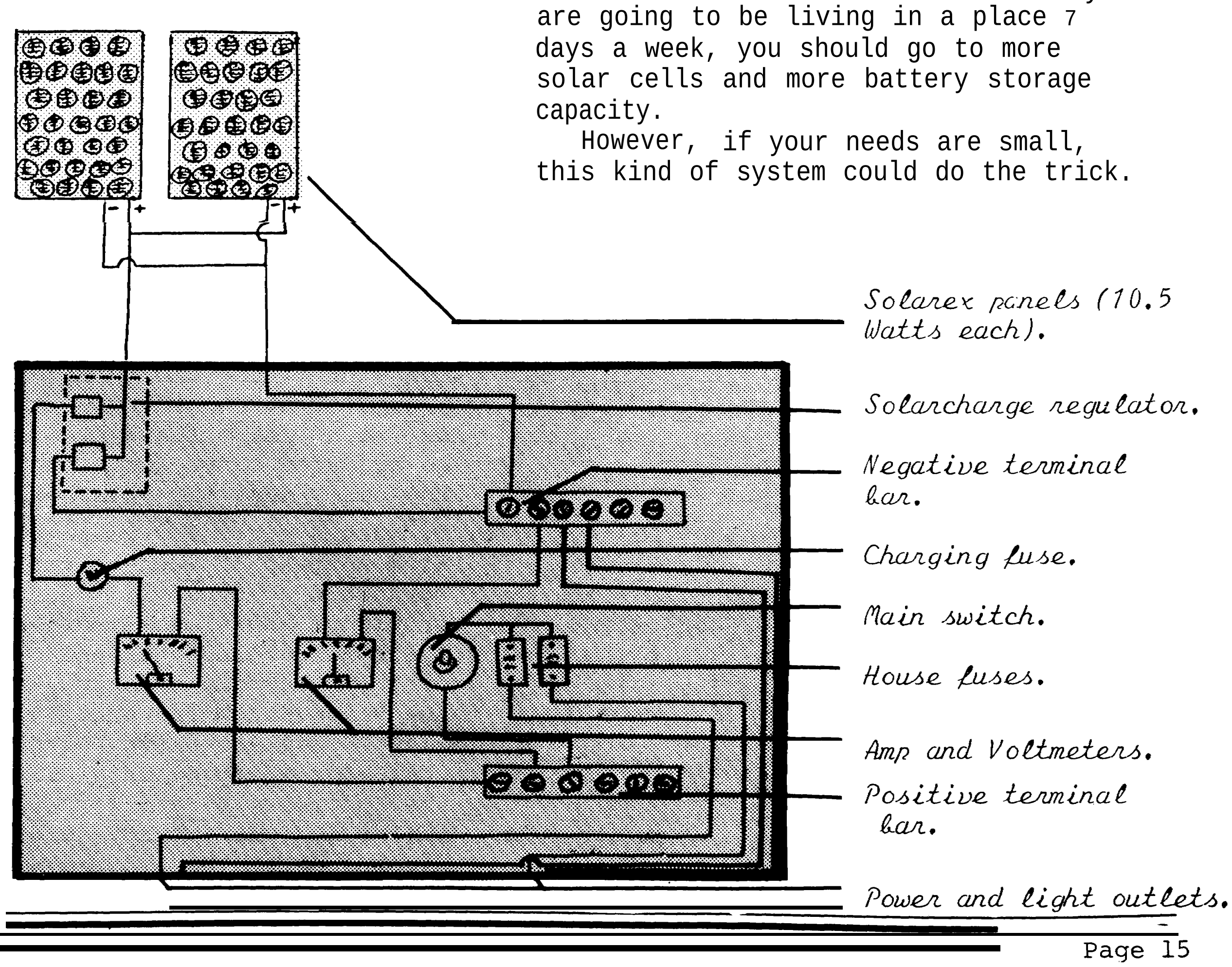
Total cost of system $175.00

The two solar cell panels were wired together in parallel and connected to the switchbox via some heavy wire. Because the owners were paranoid about the fire risk of leaving anything connected during the week while they were away, I put a fuse in the primary wiring circuit between the solar cells and battery. The regulator and ammeter were also in this circuit. The regulator, which was purchased complete from Solarcharge in Victoria, shorts the solar cells output if the battery becomes fully charged. This energy is dissipated by a heatsink. The rest of the wiring in the switch box and throughout the house could be isolated by the main switch. The voltmeter and

a separated fuse for light and power were included on this side of the circuit.

The system has been up and running for 2 or 3 years now with no problems. If you try setting up something like this for yourself, remember this is only adequate for a weekender. With this system, power is stored up over five days during the week and used on the two days of the weekend. If you are going to be living in a place 7 days a week, you should go to more solar cells and more battery storage capacity.

However, if your needs are small, this kind of system could do the trick.



# Simple solar projects

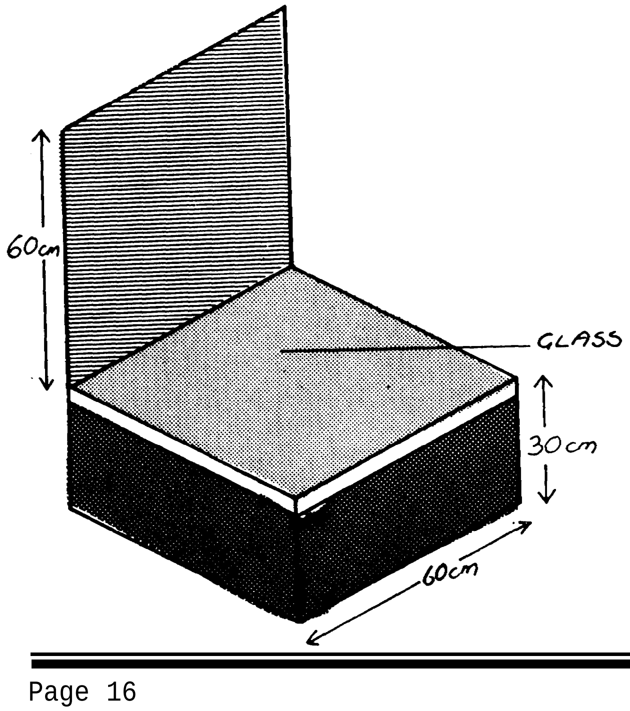
Over the years a massive number of simple solar experiments and construction projects have been printed in a large number of different books and publications. In this regular column we will be looking at the many practical ideas that are around from many sources. We will give the sources of these so people can get hold of the original source material.

## Solar Oven

Solar ovens are used in India, which is situated in the tropical region, to cook the mid-day meal. Although they are not as effective in our more temperate climate, you should be able to cook snacks on clear sunny days.

You will need :

o a strong corrugated cardboard box (or wooden box)




* a roll of aluminium foil
* 2 sheets of window glass
* polystyrene foam or newspaper
* a piece of corrugated cardboard or plywood.

Method of Construction

1. The box should be about the size shown in the diagram. It can be made from plywood or cut from a corrugated cardboard box and put together with adhesive tape.

2. Cut polystyrene foam or newspaper to fit snugly around the sides and bottom of the box. These materials keep in the heat - that is they insulate. The insulation should be 5 cm thick.

3. Cut a square of cardboard or plywood to be used to reflect the sun's rays into the box as shown in the diagram.

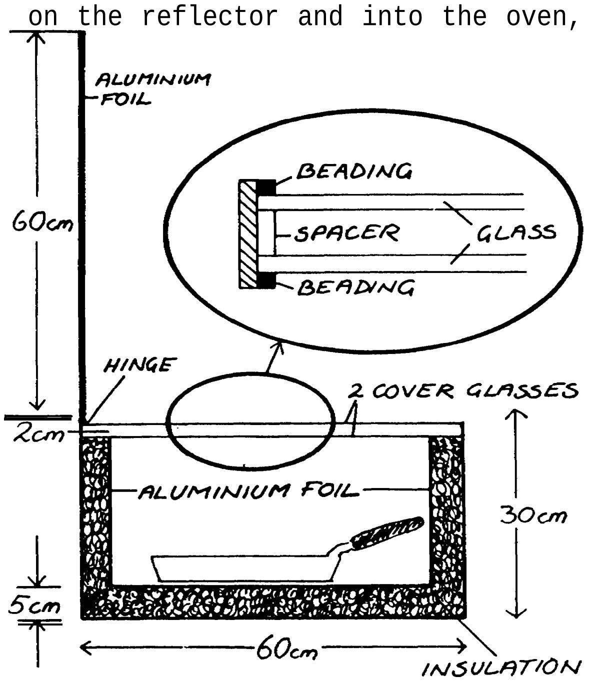
4. Cover the insulation and the reflector with aluminium foil. Make sure that it is smooth.

5. Fit the reflector edge to edge on one side of the box using hinges or pieces of strong adhesive tape to act as hinges. The reflector can be adjusted to an angle to reflect the sun's rays into the box.

6. To make a glass lid prepare a frame from a strip of wood or corrugated cardboard 3cm wide. The frame should be the same dimensions as the box. Around one inside edge of the frame fix a narrow ledge about ½cm. high for the glass to sit. Now place above the glass a 2cm. high strip on which to sit the top piece of glass. Now fix a ½cm. wide strip above the top glass sheet. The lid can now be hinged to the box.

7. Fit the reflector edge to edge on one side of the glass lid using hinges or pieces of strong adhesive tape to act as hinges. The reflector can be adjusted to reflect the rays of the sun into the box by using a stick as a prop.

8. Place the oven in the sun so that as much sunlight as possible falls on the reflector and into the oven,



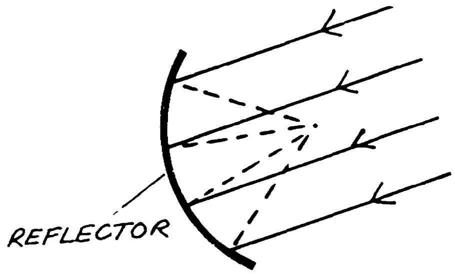

Place the frying pan in the box and put in it what you want to cook, perhaps an egg or a sausage.

# Reflective Cooker

A reflector cooker is more difficult to make, but they use the sun% rays more efficiently than the solar oven.

The sun's rays hit the curved surface and are reflected back to a small area where the cooking vessel is placed. Because the sunlight has been concentrated you must be careful not to let it fall directly on your eyes.

You will need:
* 2 large sheets of stiff cardboard.




* a large sheet of flexible cardboard
* string and pencil
* aluminium foil
* a Stanley knife

Method of Construction

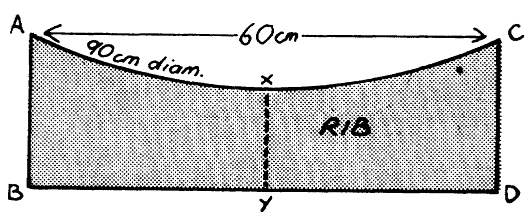
1. Using the string and pencil as a compass, draw an arc of a circle with a radius 45cm.
2. Cut this out in the shape of a 'rib' which has a base of 60cm. Repeat this process another 7 times but cut these other 7 ribs in half along the line xy as shown in the diagram.

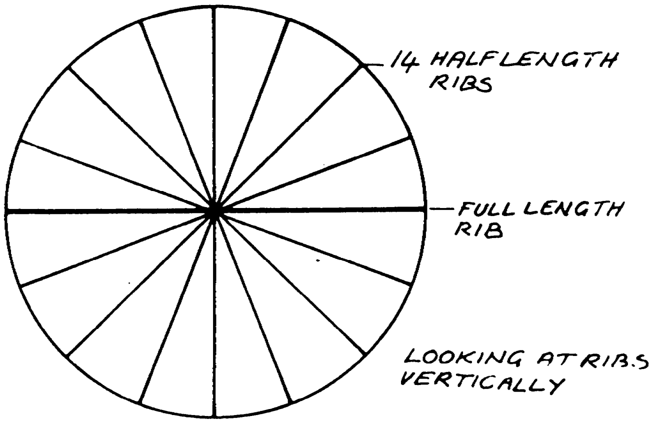
3. Cut one piece of stiff cardboard into a 60cm. diameter circle.

4. Glue the complete rib and the 14 half ribs on to the base circle. First place the complete rib vertically along a diameter and then the 14 half ribs vertically along radii, space at about 22½ degrees around the circle as shown in the diagram.

5. By this time you will have the shell of your reflector. But the ribs will need to be filled in with more flexible cardboard so that you will have a surface on which to glue your aluminium.

6. Carefully measure 16 pieces of flexible cardboard (like sections of a pie) to fit across the ribs. Curve the cardboard to fit the ribs by rolling the cardboard in the direction shown by the arrows in

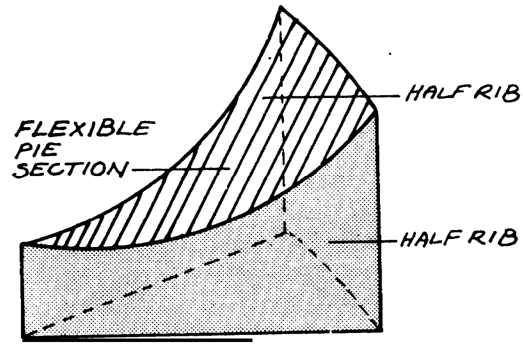





the diagram and then releasing it. Now cut and give a strip of card-board around the vertical edges of the ribs to strengthen the shell.

7. When the glue is dry cover the whole dish with aluminium foil. Make sure that it is very smooth.

8. Make a wooden stand to support the reflector. For cooking, place the reflector so as to catch as much sunlight as possible. You will need a post with an arm on which to hang a black billy-can to hold water or suspend a wire grill to cook,



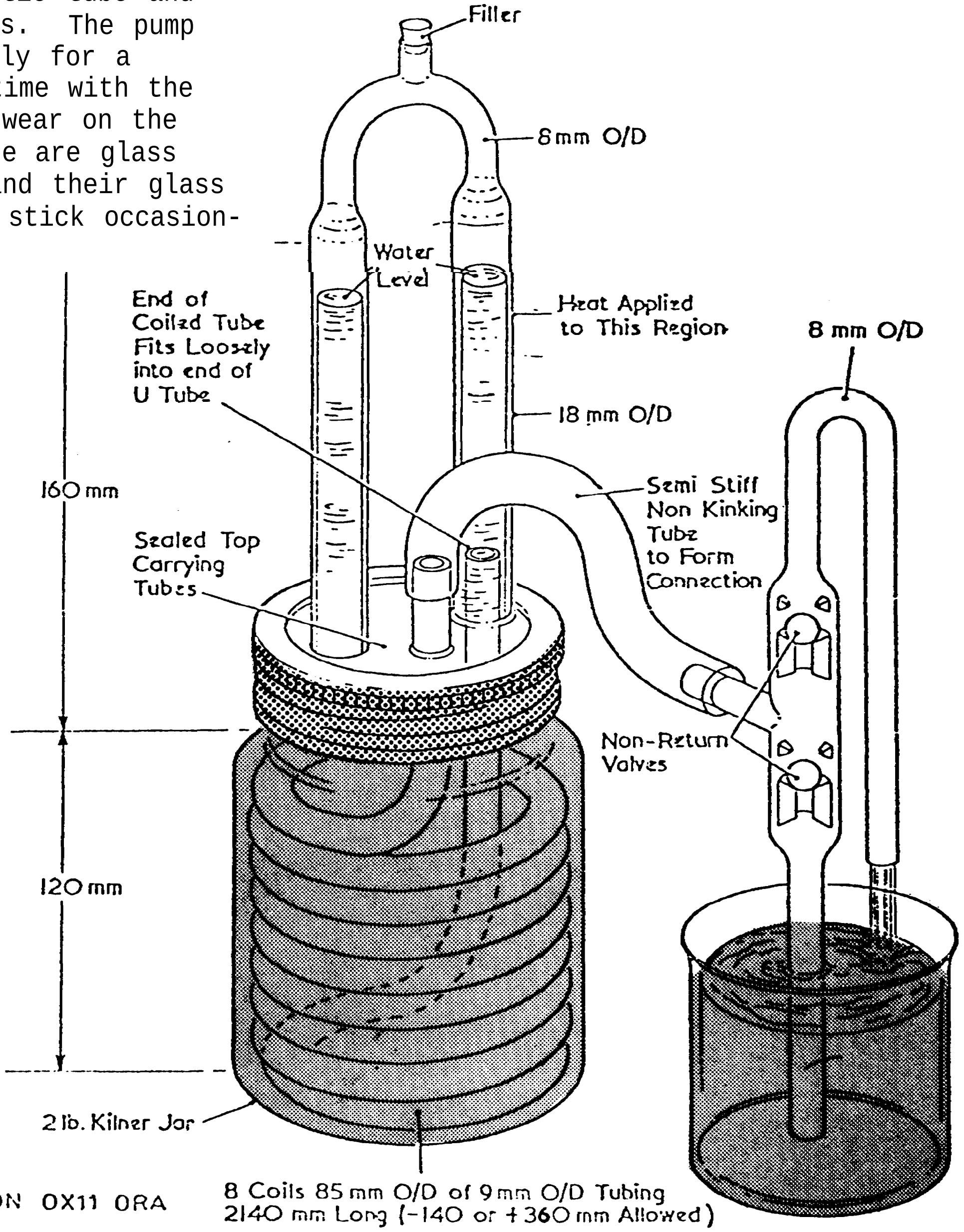

*This information came from the "Energy Resources Kit" produced by the Environment Action Centre. Copies available from F.O.E. and the Environment Centre, Victoria.*

# FLUIDYNE 3 Solar Pump

In issue No. 11 of "Soft Technology" we printed a letter from Ashley Campbell asking if we could find out anything about a solar pump called the "Fluidyne 3" We recently came across a small working Fluidyne Solar Pump at the CSIRO in Highett, Victoria. It is in their *'Science Education Centre** and interested readers should drop in for a look,

The pump is made from simple components, glass tube, plastic tube and a few other odds and ends. The pump has been running regularly for a considerable period of time with the only problem being some wear on the non-return valves. These are glass marbles and both these and their glass seats have worn and now stick occasionally.

The pump works simply by the heating of one side of the "U" tube (inverted) and the resulting change or air pressure causes the water in the output column to oscillate, forcing water through the outlet valve and drawing fresh water into the system through the inlet valve. As long as the heat is applied the pump will continue to oscillate at its resonant natural frequency.




Fluidyne 3 Pump

(Details For Home Construction)

For Further Information

contact

Dr. Colin West Bldg 152
A.E.R.E. HARWELL OXON OX11 ORA

# a septic tank m

The idea of taking a standard septic tank and turning it into a methane digester has a number of attractions. The big benefit is that if you have a house with a septic tank you virtually have the methane digester there and ready to go... just add a few modifications.

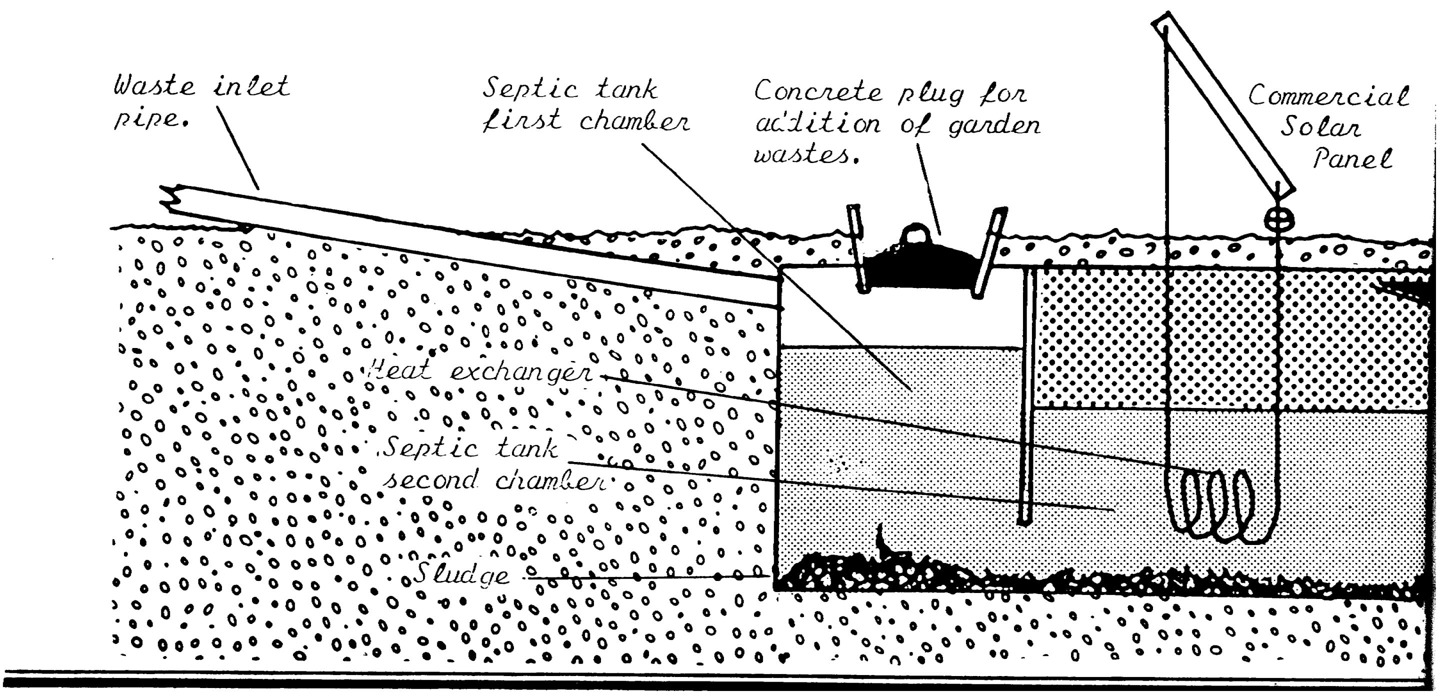
A methane digester is basically a container filled with organic waste and sealed from the outside air. A septic tank (once any air vents are sealed) can be an ideal digester. However, a number of modifications are necessary.

The major one of these is the addition of a gasometer to store the methane gas that is produced. This gas also has to be scrubbed (that is when the corrosive impurities are removed). The waste in the digester needs to be heated to a stable temperature. A stirrer and sludge pump should also be added to the digester. Once all these are connected to the septic tank the basic conversion to a methane digester has been completed.

Making it Work

Recently Ian Grey from Melbourne tried putting this idea into practice when he converted his septic tank into a methane digester. The first step involved insulating the tank with polyethylene foam. This was in the form of a 2 two-part mix which was prepared on site. As the digester has to be kept warmer than the surrounding earth insulation is essential if the energy needed to keep the digester warm is not to be excessive.

The original concrete plug was exposed and used to feed in plant and vegetable waste to supplement the mix. The tank was heated with a standard commercial solar panel -with the liquid being pumped through the panel to a heat exchanger in the tank by the use



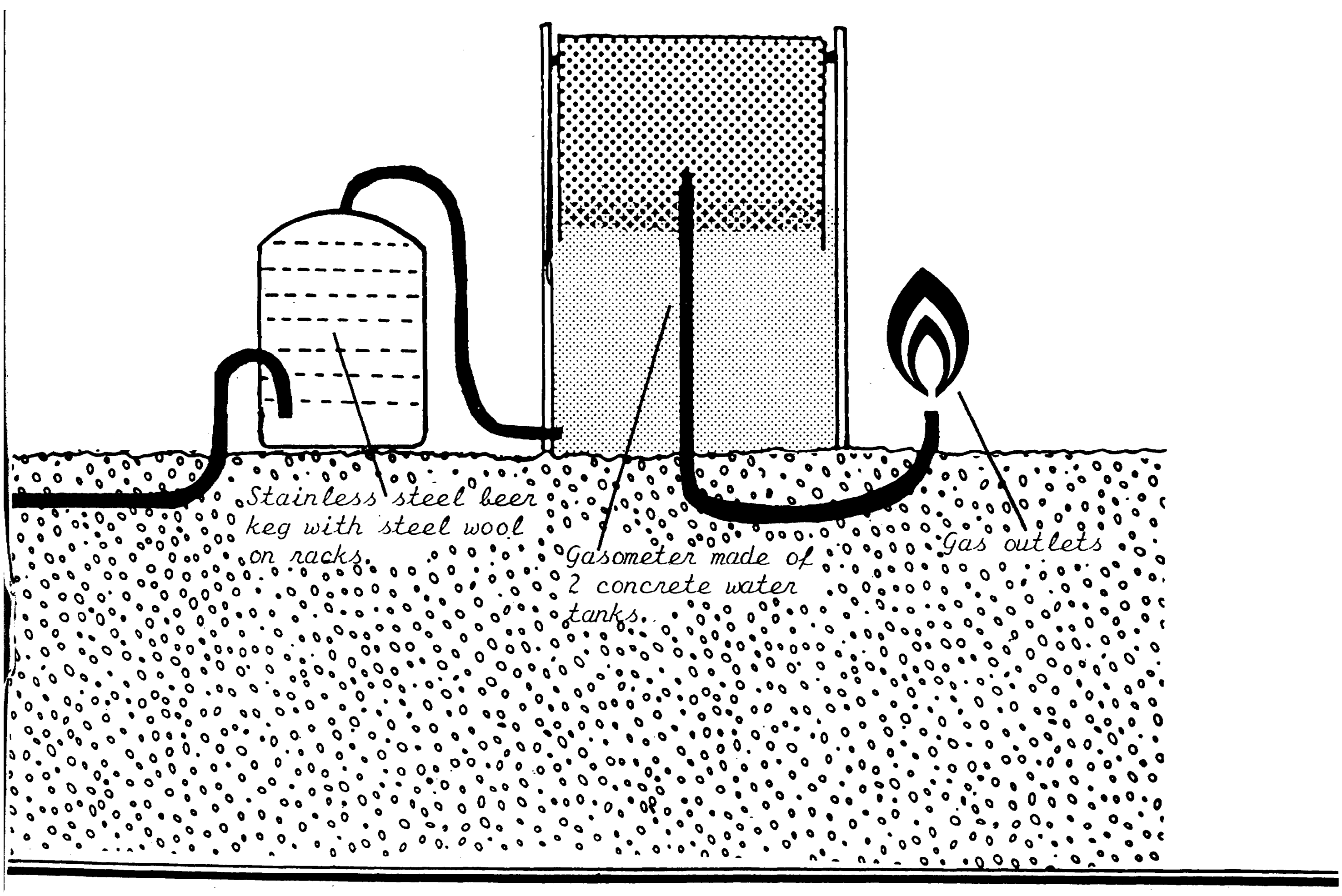
# ethane digester

of a small electric pump.

The septic tank has two compartments. In the first, the liquid level is high, close to the top of the tank. In this compartment, initial mixing and break down of waste occurs. Air is in contact with the liquid waste at the top of the tank in this compartment. In the second compartment, the pressure caused by gas production results in the liquid level being lower, The heat exchanger is located within this second compartment. Gas is drawn off from this compartment. A hand operated sludge pump was also fitted.

From the digester the gas goes to be scrubbed. This process removes the Hydrogen Sulphide ($H_2S$) which will corrode metal gas taps and burners. The scrubber was made from a stainless steel beer keg. Racks with steel wool were fitted to the keg. This works well at removing the hydrogen sulphide. The steel wool needs to be regenerated once every 3 or 4 months. This is simply done by heating the wool.

Next the gas passes into the gasometer, This was constructed from 2 500 gallon concrete water tanks, one inverted inside the other. Guide rails keep the upper tank in position, while water in the bottom tank stops



the gas in the top from escaping. An old V8 engine block was placed on the top tank of the gasometer to give a desired gas pressure of about 30 p.s.i.

Running the Digester

The digester was fed by the waste from four people, two adults and two children, food scraps which were broken up in a kitchen sink disposal unit, and by organic garden waste. Once the digestion was taking place the waste became quite warm. To help overcome the problem of the waste getting too hot an oven temperature control was fitted to the pump on the solar collector. This stopped the pump operating when the waste got too hot. Despite this the waste still got too hot and in the end the insulation on the top of the digester was removed. This was partly because the methanogenic bacteria in the digester is thermophyllic, that is bacteria which produce heat.

The digester worked reasonably well with the mix only going sour a couple of times. If the waste became too acid, lime was added followed by some grass. If the waste became too basic (alkaline) fowl manure was added.

Gas Production - the bad news

Everything written so far probably seems to indicate turning a septic tank into a methane digester is a great idea which "works". But there is one major problem; the gas production is not very great. The amount of gas produced by this digester was about 20 cubic feet a week. A conventional gas cooker can eat its way through this in about half an hour. This amount of gas could be useful for a single burner gas ring in a weekend holiday house. But beyond that it would not be of much use. The gas can be used for other applications of course. For example, the gas from this digester was used for welding.

Turning a septic tank into a methane digester is a realistic and possible thing to do BUT the limitations of gas production must be recognised. A larger methane digester is likely to be a more viable option, but you need much more waste and an easy method of feeding and maintaining the digester, which does not require so much work that the whole process becomes pointless.

Mick Harris

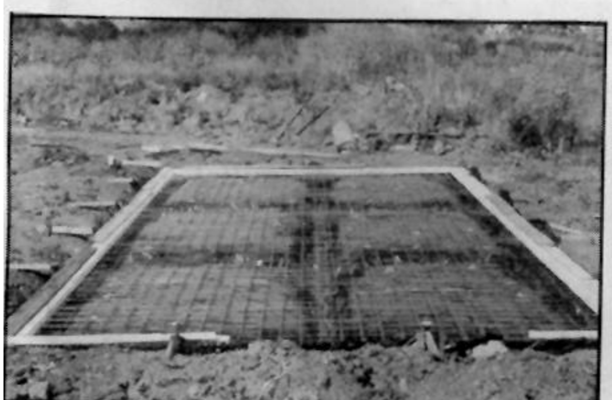
# THE ATA REPORT News, events and Activities of the Alternative Technology Assn.

After more than 18 months of planning preparation, and behind the scenes activity the workshop is now under construction. Late in March the massive concrete foundations were poured. A last minute near disaster nearly stopped us in our tracks when it was discovered that the newly prepared foundations were on an easement which was meant to be somewhere else,

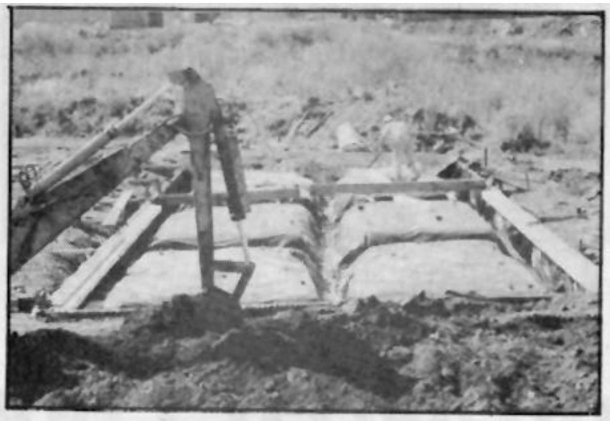
At first it seemed we were left with two alternatives; move the whole foundation or wait for months for an appeal to built on the easement. Both would have resulted in additional cost that could break the project. Fortunately there was another option which involved only moving a third of the foundation. This still cost nearly $1,000 extra, but with a bit of struggle we could just manage to afford it.

## A NEAR DISASTER

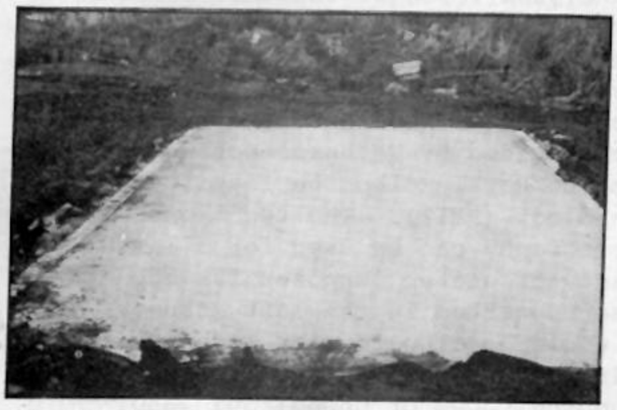
1). Digging the foundations for the workshop.



2). Plastic membrane, timber formwork and metal reinforcing in place. Ready for the concrete.



3). Disaster. We have to move it. Rip it up and start again.



4). Finished at last. All 25 cubic metres of it.

The workshop had an official launch on April 7th when the Mayor of Brunswick broke a bottle of champagne on the concrete slab and laid the first stone. The launch was followed by a celebration lunch and then the beginning of the construction of the walls. Working bees will be going on every second weekend until the building is completed. We plan to get the workshop to lockup stage in a maximum of 6 months.

We will be in need of roofing iron if anyone has some good quality second hand material they could donate.

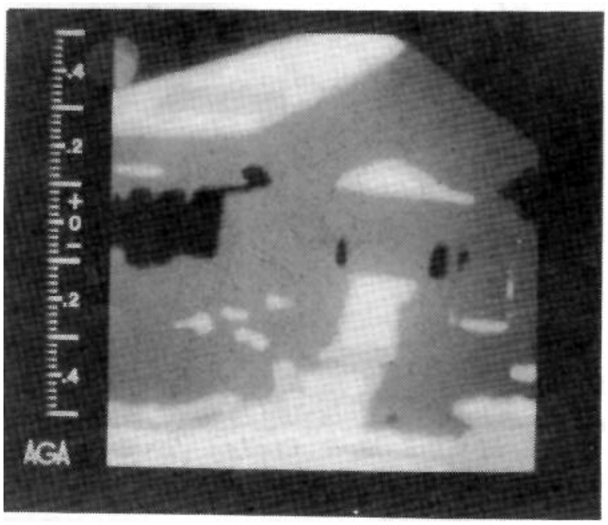
We have recently had an 8 foot parabolic solar collector donated to the project. We hope to experiment with producing a small amount of electrical power from this collector giving us our own mini solar power system.

The next 6 months will be a key time for the construction of the solar workshop. Everyone is welcome to be involved in this exciting event. It will also be a chance to learn about solar building, alternative energy systems, etc.

On other fronts the ATA set up its best display ever at "the today and tomorrow energy show" in Yarra Park, Melbourne. The display includes an electric truck, a 10 foot Savonious rotor, a solar computer as well as about a dozen other displays of various types.

# Infra-red Photos

In the last issue we included some infra-red photos of a retrofitted solar house. To give some more background the photos were taken with a technique called thermography. They were provided by Technisearch who work from the Royal Melbourne Institute of Technology (RMIT). The technique of thermography can be used for a large variety of useful purposes far beyond those suggested in the last issue. If you would like to contact Technisearch their address is 124 Latrobe Street, Melbourne, 3000 or phone: 341 2650, 341 2531 or 345 2822. The person to talk to is Lindsay Trigger.



# HOT WATER FROM DUNG

People who compost organic waste to make soil for the garden may have noticed that at some stages of the composting the material gets quite hot. In fact in large piles of organic waste you could get a nasty burn from the compost. The compost can even catch fire under the right conditions.

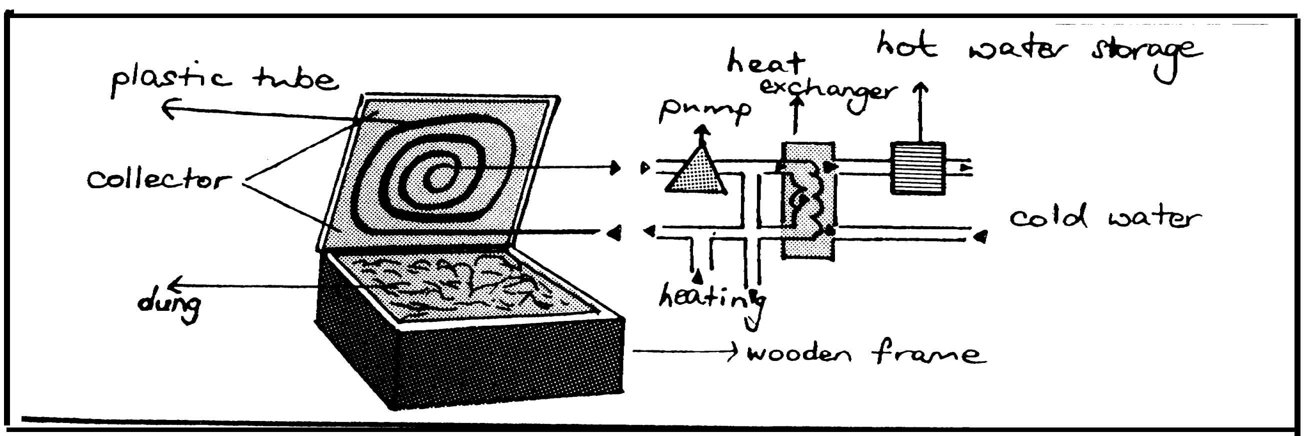
Heat from decomposing compost or animal waste can be used as a German farmer, Heinz Koch found several years ago when he invented a simple water-heating facility which was seen at an annual agricultural exhibition.

The system utilises the heat produced by the bacteriological processes which take place in dung; this heat can be stored and used for heating water.

The essential component in this system is the dung-collector, which is placed over the dung heap. It consists of a wooden frame, an insulating layer and plastic tubes through which water can flow. The average temperature in a dung-heap is 45°C, but when this collector is used, it can rise to 80°C. The heat then warms water which flows via a 20 watt exchange pump either to a heat exchanger or directly to an underfloor heating system.

Koch was granted support by the Department of Agriculture and has developed a research-model of his invention in order to obtain figures on costs and feasibility. It was found that a collector $20m^2$ produces 1,200 litres of water per day at 45°C. This is enough to heat a room $20m^2$ with a constant temperature of 21°C when the outside temperature is -15°C. A new layer of dung 30cm thick is required every seven to ten days. This is delivered mechanically and the collector itself has to be lifted up - also mechanically - for the new layer to be placed atop the existing dung-heap. Full heating capacity is reached again after five to eight hours, and the dung from fifty pigs is needed to drive the collector. Such a system is cheap and easily made.





# "Roughing it" with Solar Hot Water . ..

TWO FREE-STANDING HOT WATER SYSTEMS

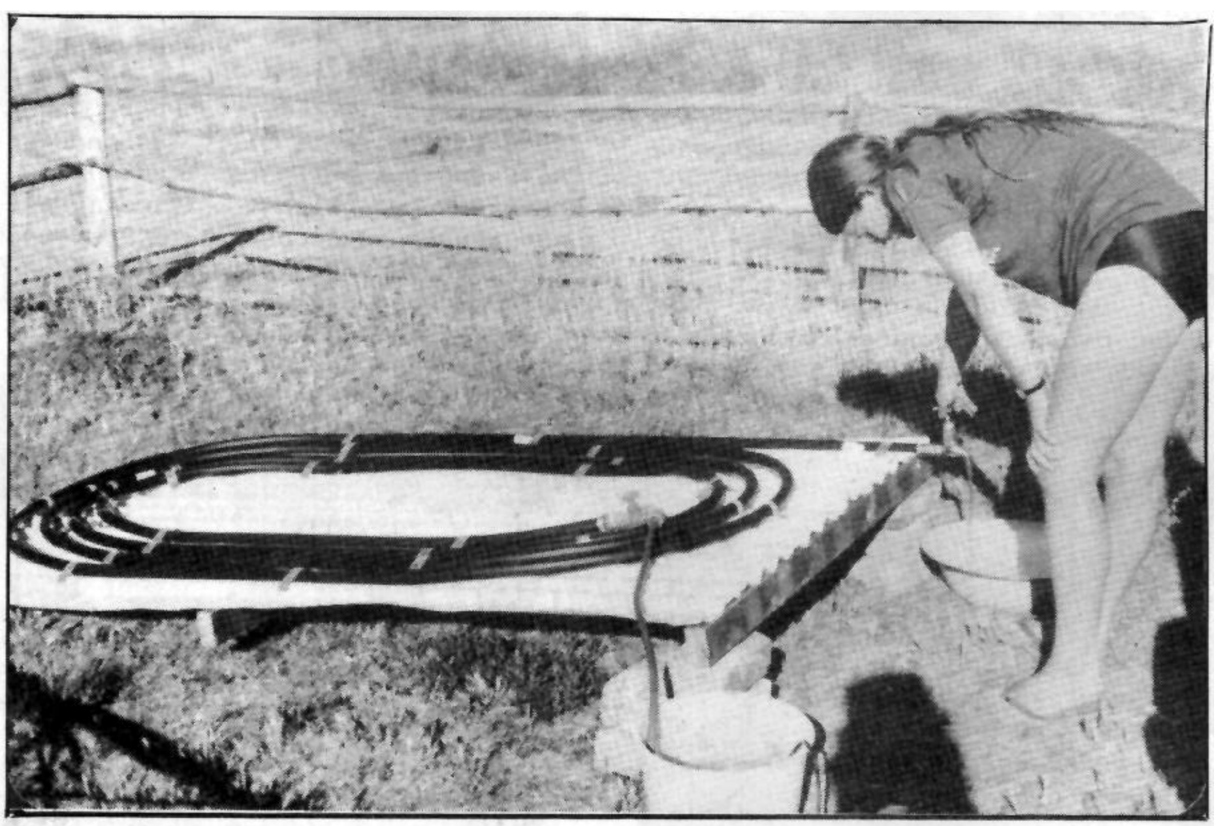
Four years ago we bought 5 acres of farming land in Central Victoria with the remains of a tiny stone house on it, The house had not been lived in for over 25 years and even then had never had any running water, electricity or sewerage. These days things are a bit better but the "services" are still elementary since other things always seem to take priority. This is acceptable since we generally only spend one weekend in two there.

We soon discovered that during the summer months, reasonable supplies of hot water could be obtained by using the sun, even though we didn't have a plumbing system.

The first system we used was what is often described as a "batch" water heater. It was basically just made from 25mm dia. black poly. pipe and corrugated iron.

A frame, approx. 2M X 1.3M was made from timber and this was then covered with corrugated iron. (Second-hand materials were used). The iron was then painted a gloss white and the poly pipe was fixed onto it in a huge coil using galvanised iron straps.

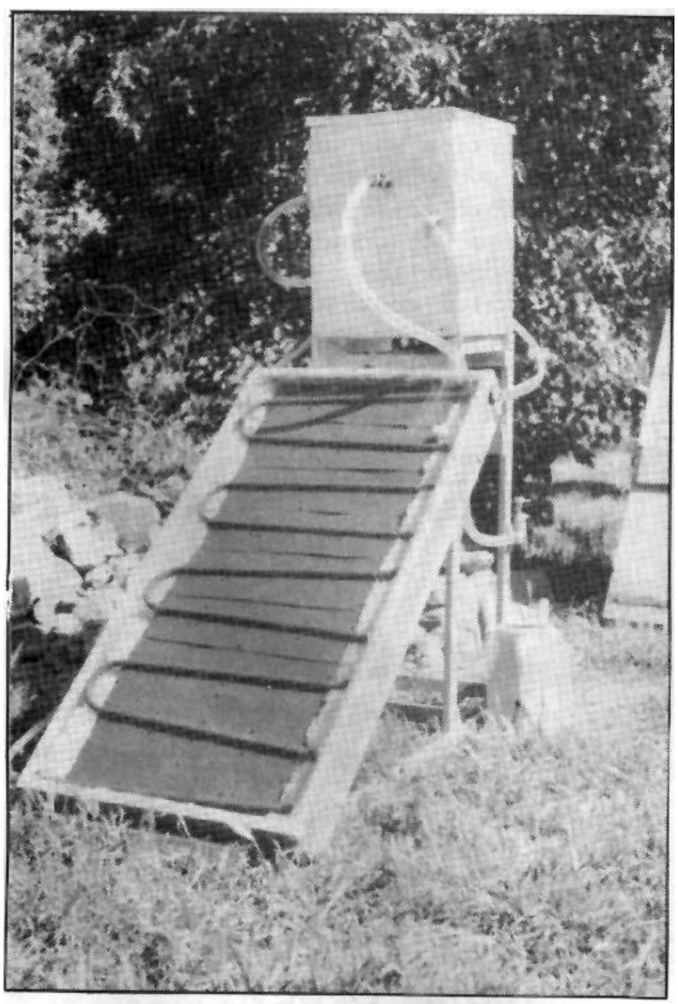
The exact length of pipe I used I can't remember but it contained about 2 gallons (a bucketful) of water so that means it was probably about 18 metres. A 25mm spacing was left between successive rings of the coil. A gas tap type valve was fixed onto one



end and a normal water tap onto the other.

The system operated as follows. The heater was propped up at a slight angle to face the sun, and a small, marine pump (12V D.C., cost $15) was then used to fill the coil from a bucket. The pump was operated from a car battery, Both taps were left open until the water flowed freely from the exit end to ensure all air had been expelled, Once this occurred, they were both quickly closed.

When hot water was required, a fresh bucket of cold water was pumped in at the inlet end and the hot water,



around 40°C (often needing a dash of cold) was collected in a bowl at the outlet. Simple yet effective. The picture shows the system in use.

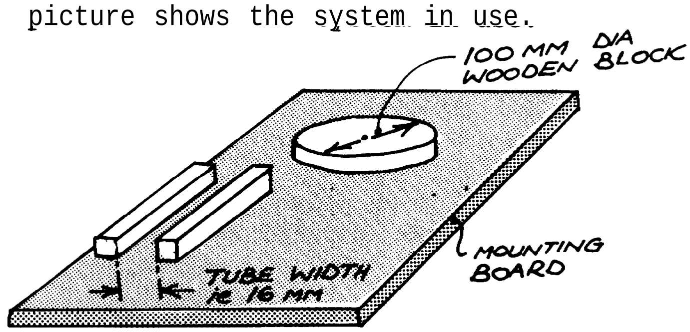



FIG 1

The second system which is still in operation is more sophisticated. It was developed to overcome the disadvantages of the "batch" heater, namely that there is no overnight storage and also electrical power is required. It is simply a free standing thermosyphon system with a homemade collector and storage tank.

The collector is all made out of aluminium, both the tube and plate. Since aluminium corrodes easily if copper ions are present in the water, it would be better to use old copper tubing, but I wanted to see how long it would last (it is still going after 2 years of weekend use).

The tubing was bent into a continuous serpentine using a simple jig shown in fig. 1.

The tube was filled with sand and corked at each end, This is to avoid, kinking the tube when bending. A slight angle is made between successive straight sections of the serpentine to avoid air locks forming in the tube (see fig. 2). About 7 metres of tubing was used in this collector.

The fins were made by beating a "dunk" or U shaped channel into strips of aluminium about 75mm wide. This was done using a 16mm dia. steel rod and a wooden half-round jig. The wooden jig was made by drilling 20mm dia. holes into small blocks of wood and then carefully cutting them in half. They were layed end to end on a base board until the required length was achieved,

A thermal paste (Selleys) was squirted into each "dunk", and tube pushed in -and covered by an aluminium strip, which was then pop rivetted into place.

The whole absorber plate (approx. 450 x 1300) was then painted matt black and placed in an insulated galvanised case. Wood, provided it was painted would be just as good. The two ends of the serpentine, top and bottom, have grommets around them to ensure rain doesn't get inside the casing.

The storage tank was a modified 5 gallon plastic container with 3 inlets provided (see fig. 3), 2 at the bottom and one at the top. These were made by using short lengths of threaded brass tube with homemade rubber washers on either side held in place by nuts. Silicone sealant was used to make sure no water could leak out . It was necessary to cut a hole (large enough for my hand) in the top

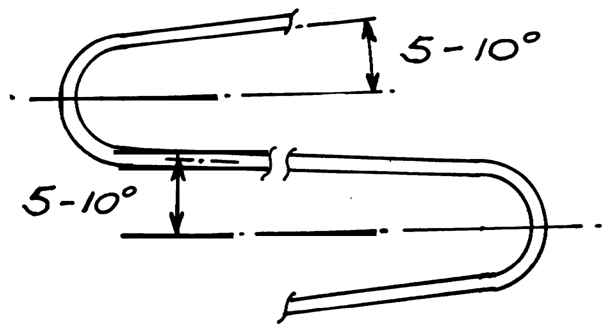



FIG. 2

of the container so that the internal nuts could be positioned. This hole was later covered with a plate and gasket.

The container was. then placed in an insulated casing - timber or galvanised sheet - with holes at appropriate places.

A simple timber stand was then made which held the collector at about 35°. The tank was positioned so that its bottom connection was about 300mm above the top of the collector. This is to make sure that reverse thermosyphoning does not occur at night.

A make-up tank (in this case, a cut away fruit juice container) was fixed onto the side of the tank casing, such that the tank would be full when the

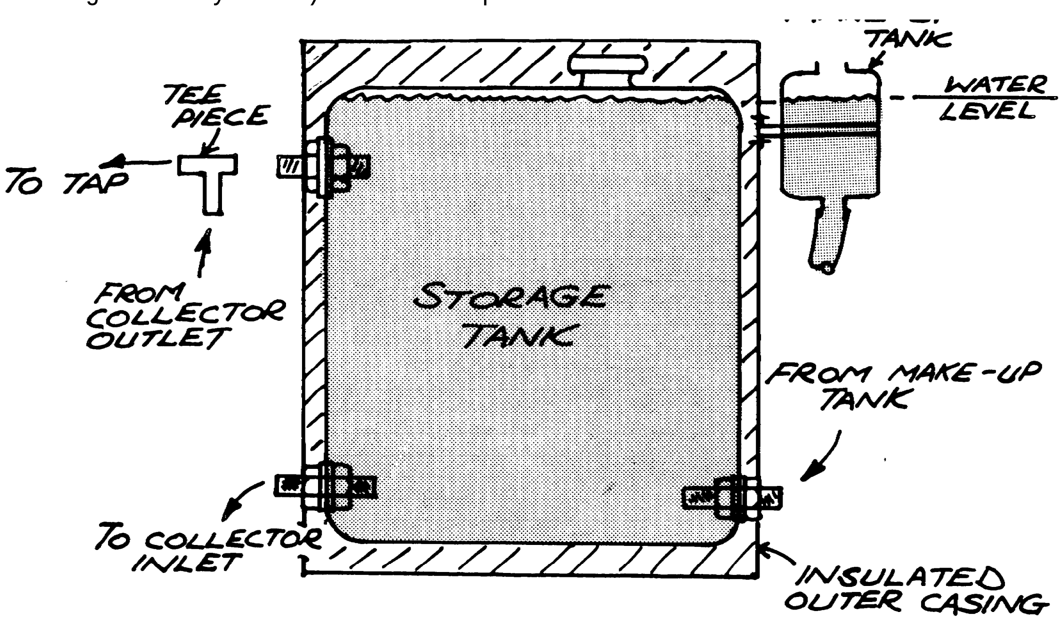



FIG 3

make-up tank was also just about full. A tap was fitted just above ground height to give a reasonable head and thus ensure a reasonable flow out of the storage tank. Clear plastic pipe was used to connect the whole system together.

## How it performs

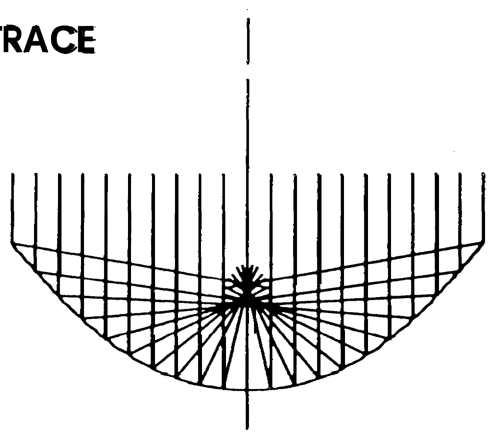
At the end of a good *sunny* day, the temperature probe in the tank often reads around 70°C. The system seems to be self regulating around this temperature. In the morning, the water temperature is usually around 45°C. This could probably be improved if the tank was better insulated. However, even as it is we now have hot water first thing in the morning and the system works quite adequately on its own requiring no power or attention.

Bob Fuller.

# A Parabolic Collector

One of the problems faced by people who want to build their own parabolic reflector is finding out and producing the correct parabolic shape. This problem was solved very simply when researchers from the University of Western Australia found that by bending a sheet of galvanised iron in a certain way the sheet would naturally take on a parabolic shape making a trough or linear focus concentrator,

**RAY TRACE**



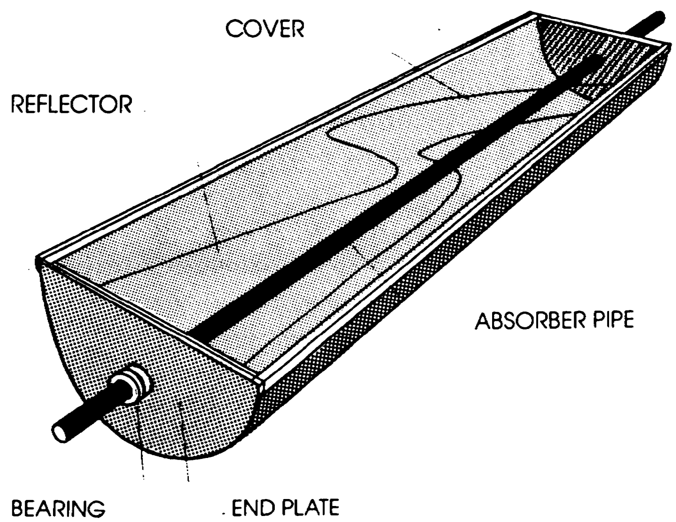
The thing about the design of these concentrators is that they are very easy for the do-it-yourselfer to build, and give you a way of producing quite high temperatures (up to 100°C).

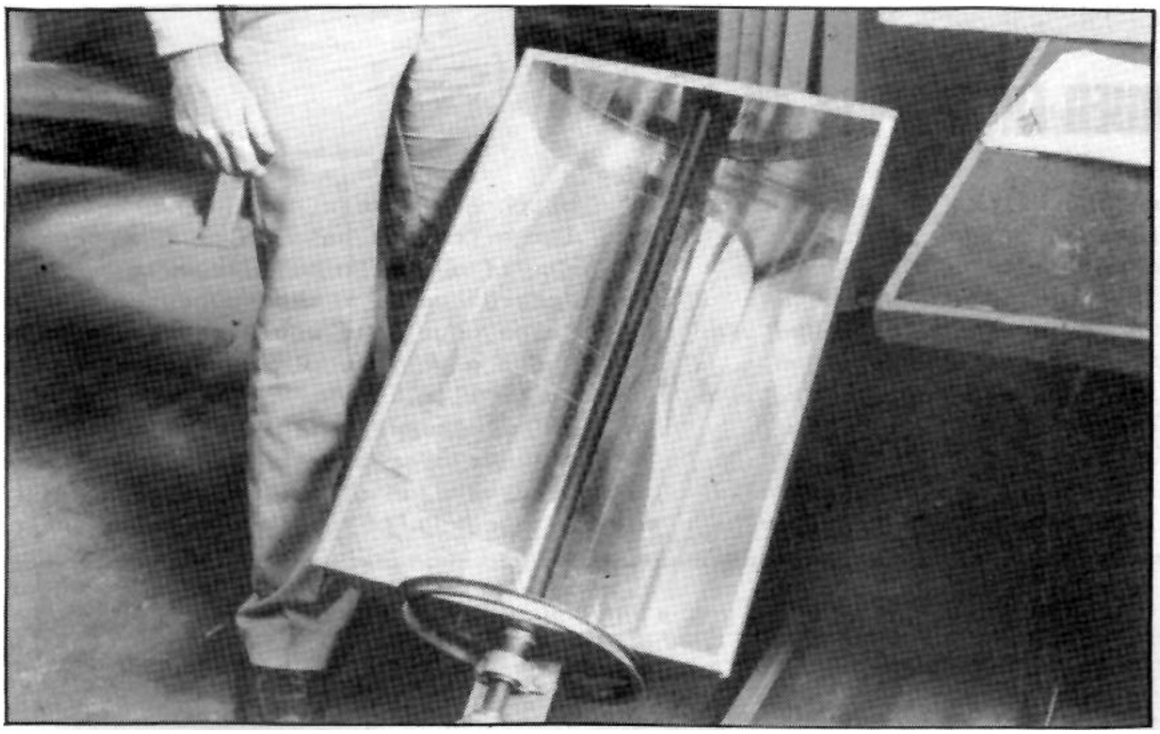
The major component of one of these collectors is a sheet of polished anodised aluminium or galvanized iron sheeting with aluminised polyester or aluminised acrylic laminated or glued to the sheet to give the reflective surface. The only other major component is a sheet of perspex (acrylic), with the edges of the sheet bent over to just past a right angle. The collector is then put together simply by bending the metal sheet and clipping the edges in under the corners of the perspex. This allows the sheet to form and maintain the natural parabolic shape.

Galvanised iron sheeting is cut to fit the open ends with a hole drilled in each of these ends for the bearing. Blackened steel or copper water pipe is passed through the length of the collector and the bearings fixed at either end. All joints are sealed and weather-proofed and you have a completed concentrator.

You now have a collector which will pivot around the central pipe. If you want to use the pipe to aim the collector at the sun then you fix the pipe directly to the ends of the concentrator. Don't forget to insulate the pipe so it does not come in contact with the metal at the collector ends.

If you find it difficult getting polished aluminium sheet or fixing a reflective film to your galvanised iron sheet, you could try lining it with mirror glass. You can buy sheets of roughly 1" square mirrorsfrom glass shops. These mirrors need to be removed from the backing material and then washed. This is because the backing material is water soluble and if you attach the mirror with this material





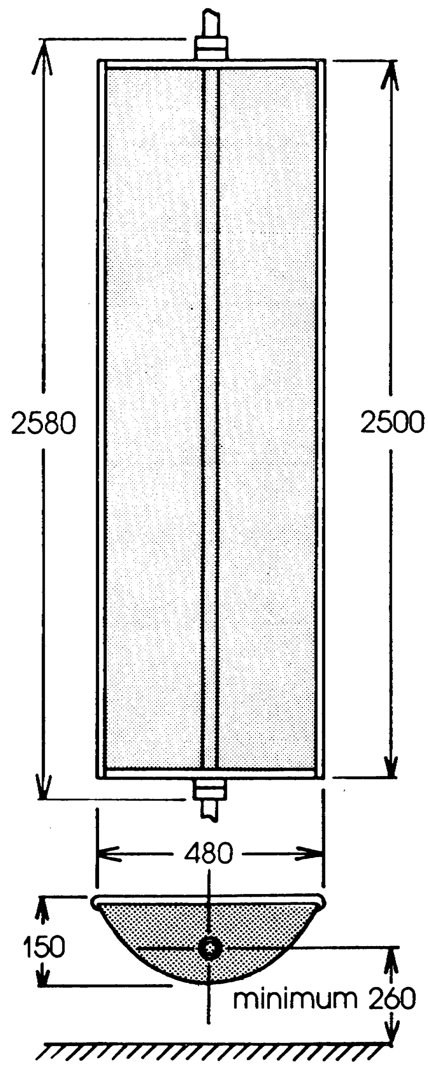
intact a bit of moisture will cause your mirrors to moult. Fix the washed mirrors with contact cement. If you are going to use a reflective film, the best way would probably be to use "Mylar" film fixed in place with a spray adhesive.

If you built a number of these collectors you can make them track the sun by fixing one corner of all the collectors to a common metal rod or strap. This is fixed to a tracking mechanism. As a result all the collectors track simultaneously and simply.

In Western Australia, these collectors have been used in a number of industrial applications. These include for an air conditioning plant and for heating propagating beds in a large nursery. They could also be used in food and beverage manufacture, mineral processing, textile manufacturing and laundering, chemical manufacturing and the accommodation industry.

For the do-it-yourselfer, the uses for these collectors are limited only by your imagination.

Harry Michaels.



CONTINUED FROM PAGE 13.

or second-hand bricks should be thoroughly examined before deciding on floor and wall materials.

The 35 cubic metres of thermal mass for a 70 square metre house can be stone, brick, *tile,* cast iron, capped with concrete and quarry tiles.

The bigger the building, the better, as far as heat losses are concerned. Public buildings usually contain large quantities of stone, brick and concrete, therefore a very large thermal mass.

If a public building was built in accordance with the suggested design rules, curtains would not be required and the vents could be electronically controlled. As the sun penetrates into our sample building for a distance of just over 5 metres, obviously some other system of sun penetration would be necessary in a larger building.

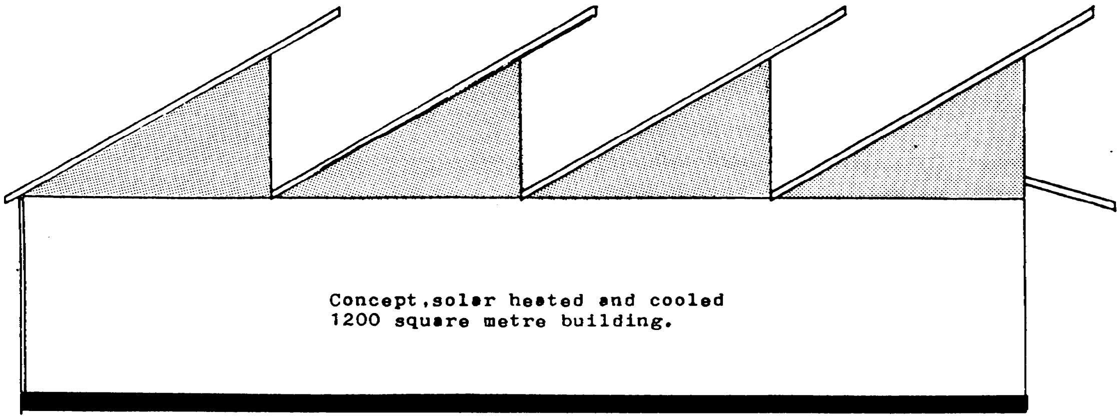
SOLAR HEATING FOR A $70M^2$ HOUSE IN HAMILTON

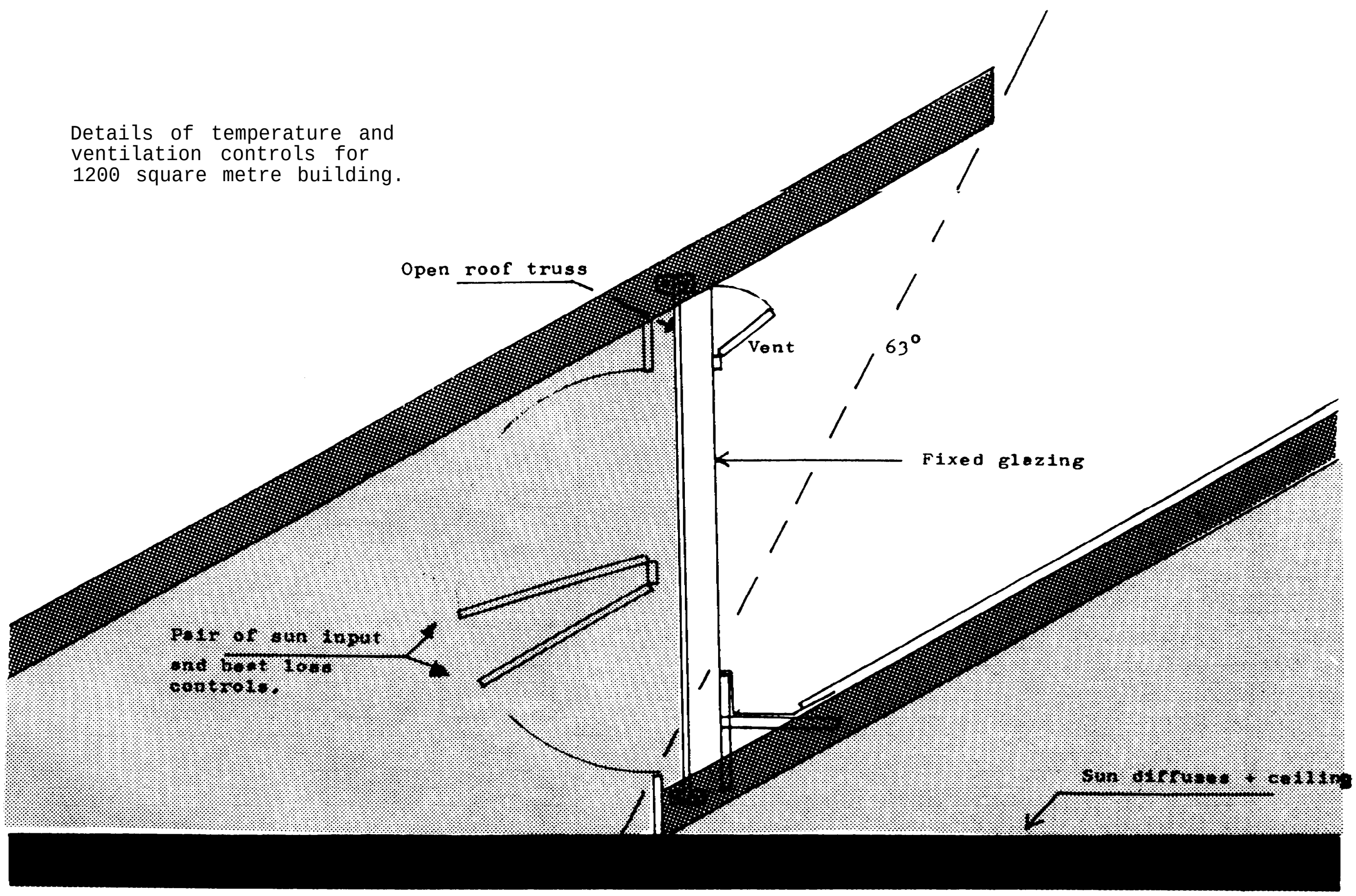
15° Roof Angle

| MONTHS | NOON SUN ANGLE DEG. | TOTAL DIRECT SOLAR GAIN KW/hrs/$M^2$ | HEATED FLOOR AREA AVERAGE $M^2$ | DAILY HEAT GAIN ON FLOOR SURFACE KW/hrs |
|---|---|---|---|---|
| January and December | 71 | 7.0 | 0 | 0 |
| February and November | 61 | 6.2 | 4.2 | 26.4 |
| March and October | 51 | 5.0 | 19.6 | 98.0 |
| April and September | 40 | 3.9 | 39.2 | 149.0 |
| May and August | 32 | 2.4 | 61.6 | 147.9 |
| June and July | 28 | 2.0 | 74.2. | 148.4 |

The attached drawing gives a suggestion. In theory it works!

Eric Dodge.




Details of temperature and ventilation controls for 1200 square metre building.

# BOOKS

TITLE: Handmade Hot Water Systems
AUTHORS: Art Sussman and Richard Frazer
PUBLISHER: Garcia River Press, 1978
PRICE: $6.50

Although this book has now been around for a few years it nevertheless deserves mention. If there is one word which best describes this book it would have to be the word "coils" In fact it's surprising just how much there is to copper coils which are used in water heating systems, Coils for pot bellies, 'coils for fireplaces, coils for wood stoves, coils for heat exchangers, all are covered and the differences of each discussed.

The other area in which the book excels is in what goes on the other end of the coil, that is in the plumbing and other components of water heating systems, This includes a very good section on getting hot water from wood burning stoves and fireplaces as well as hot water from the sun.

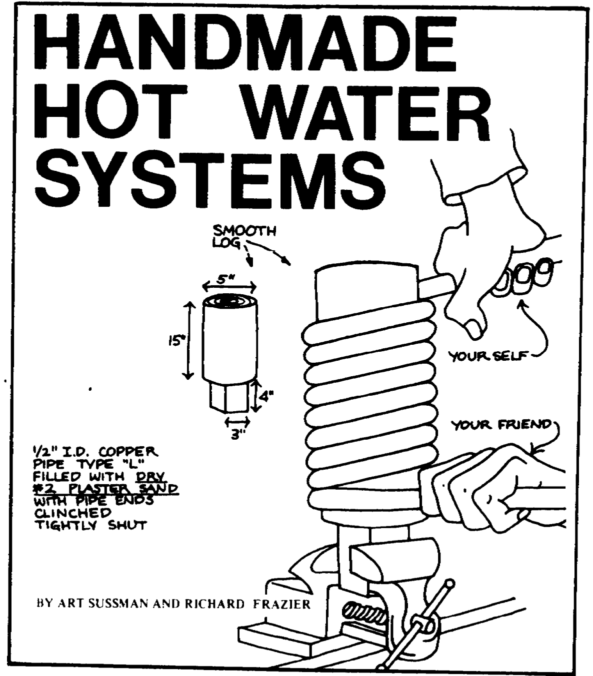
At the end of the book are a list of "recipes" on different plumbing set-ups. This includes a firebox coil, using a pump, an iron-pipe heat exchanger and a solar water heater.

Although the book is an American publication, this is not a disadvantage. Unlike many American books Handmade Hot Water Systems does not have tables or lists of supplies, sources of further information etc. Nor does the text make regular annoying references to materials only available in America.

This book is essential for anyone wanting to put together their own plumbing system for solar or wood. It has vital information that you wouldn't want to miss out on.

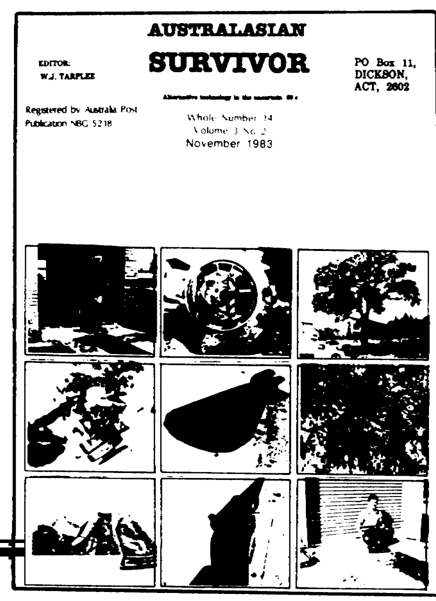
Copy supplied by Second Back Row Press.

Mick Harris




Australian Survivor Magazine
Editor: W.J. Tarplee
Address: P.O. Box 11, Dickson, ACT 2602.
Subscription: $10.00 for six issues.

This bi-monthly magazine is about what *is* broadly called "Survival". That is how you survive with limited resources in the great outdoors, It is an interesting mix of the more 'Grass Roots'ish type articles (for example one issue had items on food storage, grinding flour, and a useful tree) and the weapons type magazines, (the same magazine had information on home forged knives and the Naughton "Fieldman" rifle). Between these two categories there were items on rebuilding a 2 stroke engine, on a treadle operated grindstone, and a simple forge and anvil.



"Australian Survivor" is a good practical publication with useful in formation, but people with an aversion to weapons might find it a little hard to handle. It is different to Soft Technology in that while we tend to concentrate on energy self-sufficient it is more concerned with food self sufficiency and it is in this context that weapons are discussed,

The magazine is one some people might find philosophically (difficult, however it is practical and useful and for people who are living on the land or who plan to and see weapons as one of many tools they need it is likely to be well worthwhile.

# The Letters Page

Dear A.T.A-

Despite your difficulties with the "Electronics Australia" 300VA inverter kit, described in Soft Technology 18 months ago, I recently went out and bought one. Rod Irving Electronics are now quoting $195 for these kits, but I bought mine from All Electronic Components in Lonsdale St. where they charge $230. I thought at that price it would be a comprehensive package.

Alas, even when I bought it they told me there was a 240 volt socket and a flag heatsink missing. That was O.K. because they deducted the cost of those items from the price.

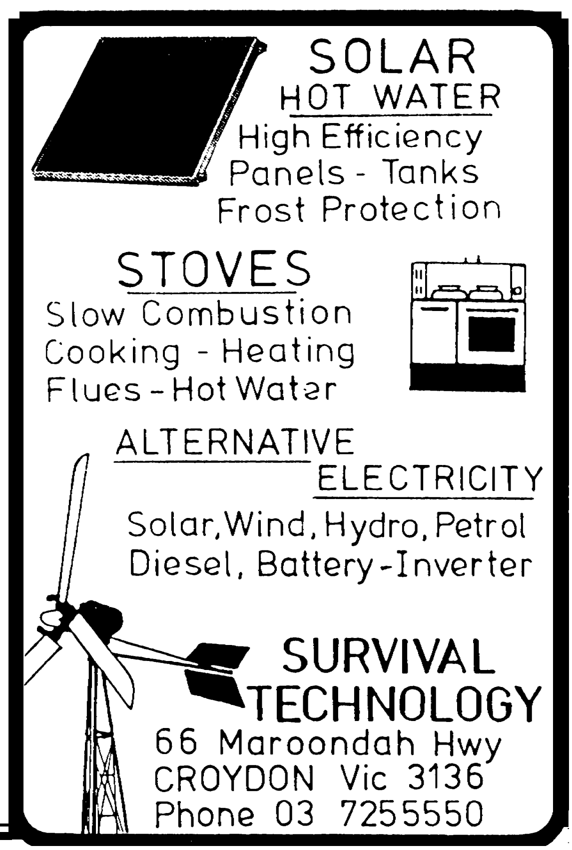
However when assembling it, there was also a diode and a tantalum capacitor missing, no heavy duty power switch and no heavy duty 30A fuse holder. Also the $1.5mm^2$ wire looked a bit thin for the job of heavy current drain.

When I went back and asked for the missing bits, I got the diode and capacitor without any problem, but they said the kit "doesn't include a switch because people don't usually need one" !! and "the porcelain fuses are out of stock". I eventually got a switch offered to me, but they didn't offer to discount the cost of the fuse holder.

On the brighter side, the transformer looks like a "brute" with very heavy duty primary windings, and when the inverter was switched on it worked straight away.

I think anybody else contemplating assembly of this inverter should demand the full kit as described in the original article of Electronics Australia, and not accept inferior component substitution.

Yours sincerely,
Michael Gunter.



The Alternative Technology Association is a group of people interested and involved in Alternative Technology. Our Activities include meetings, film nights, practical workshops and field trips.

MEMBERSHIP
Members receive Soft Technology and our newsletter six times a year which gives details of our activities.
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