

Chapter 4

CONTINUED FROM LAST ISSUE.

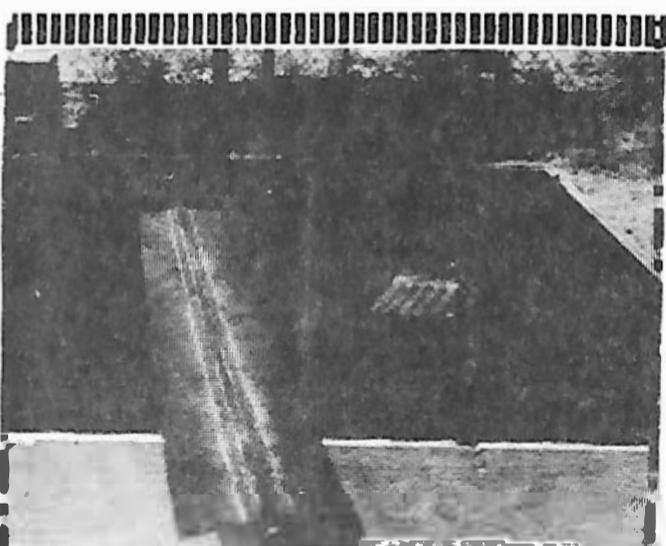
(Serialization of a new book by Steve Baer on Solar Energy)

FLAT PLATE COLLECTORS

NON FOCUSING HEAT COLLECTORS

In the past three articles I have mentioned heat collectors and stressed the efficiency of the window or skylight as a heat collector. In solar engineering these two are not usually spoken of as heat collectors. The term is usually reserved for panels, in which a liquid or a gas flows to pick up the heat. These panels are called flat plate collectors. The most common form of flat plate collector consists of a flat sheet of metal facing the sun with tubes bonded to it by solder, welding or other means. Liquid is pumped or flows by natural convection through the tubes.

The sun warms the plate, the plate warms the tubes, the tubes warm the liquid. Heat only flows from warmer to colder, therefore, we can back track through the argument - the pipe is hotter than the liquid, the plate is hotter than the pipe and the farther a portion of the plate is from the pipe the hotter it is. After sunshine falls on the plate it either finds its way into the liquid or escapes from the collector out the front through the glazing, through the back, or through the sides. A collector is a heat trap. If we put a pane of glass over the



Flat plate collector consisting of 1/2" black pipe with 16 gauge hot rolled sheet metal strips welded to it. Steel is a relatively poor conductor of heat compared to copper or aluminum, but it is inexpensive, easy to fabricate and a collector such as this is virtually indestructible. Lying on top of the collector is a sample pipe with its fins and also a section cut from a refrigerator heat exchanger - this small sample is also made of iron - two skins .02" thick bonded together. The header and channels are evidently all formed at once. There is little danger of the black iron rusting out since the liquid that circulates through the system is always the same. In a closed system the appetite of the liquid to corrode the metal is usually quickly satisfied and rust and corrosion stops soon after it starts.

front this makes the heat we have caught less likely to escape once it is trapped, but it cuts down by about 10% the amount of energy that reaches the collecting surface. Usually this is worth it. An ideal way to collect energy is at a low temperature - if possible at a temperature below air temperature - in this case you would not want any glass over the collector because the air movement across the collector which the glass prevents would be bringing new heat to the collector rather than taking it away. This situation often occurs with swimming pool solar heaters.

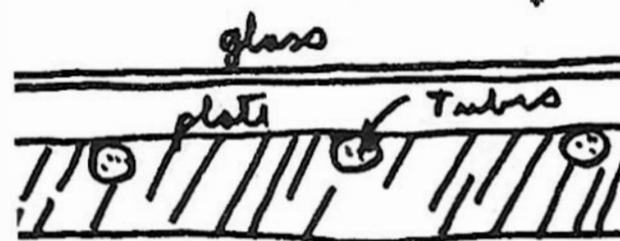
SWIMMING POOL HEATERS

A pool may be uncomfortably cold during warm weather because it is cooled by evaporation and/or chilly nights. Pool temperatures can be raised considerably by covering them with a sheet of plastic when they are not in use. The plastic prevents all evaporation - changing a wet sweating surface to a dry plastic skin. Paul Sturges in New York has made several swimming pool heaters which are not exposed to the sun and also have no heating elements.

They are exactly like car radiators - the pool water flows through the radiator - a fan blows the warm afternoon air through the radiator, the water is warmed by the air. Such a device collects solar heat from the entire neighborhood...where the air has been warmed. It, of course, only works when the air temperature is above the pool temperature, but at such times a pool left alone may actually be losing heat by evaporation especially in places like Albuquerque with low humidity. The wet bulb temperature in Albuquerque (the temperature a moist surface will reach) is almost always below 70 degrees F. even during the hottest days of the summer.

SOME COLLECTOR COMPARISONS

--Figure 1--



(Note: all drawings are cross sections)

(1) & (2) (2) is better than (1) because the tubes are more frequent and the heat does not have so far to travel to reach the liquid.

--Figure 2--

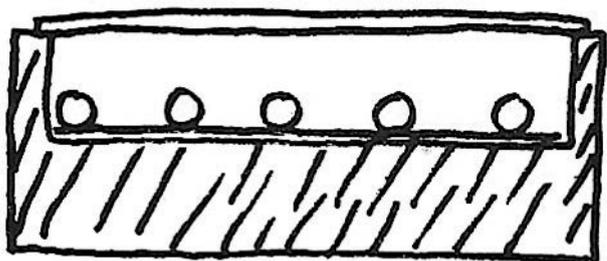


(2) & (3) (3) is better than (2) since the tubes in this case are placed in front, directly in the sun and thus some of the heat needn't take the detour through the plate.

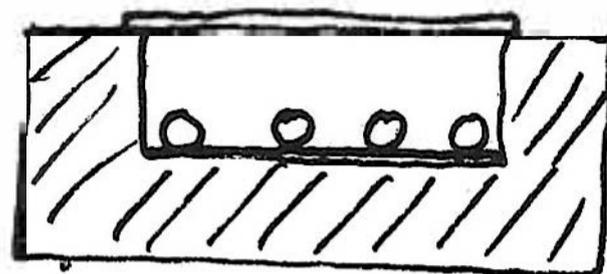
--Figure 3--



--Figure 4--

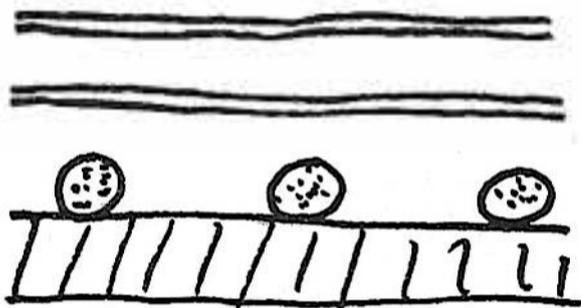


--Figure 5--



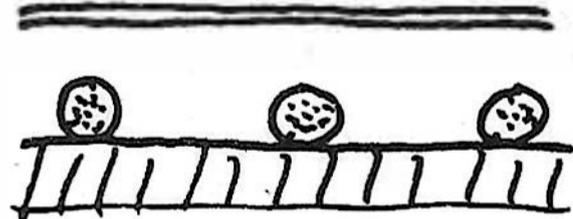
(4) & (5) If you are exposing a certain area to the sun it is best to make the side insulation thin, perhaps 1", rather than thick since the area is more useful in picking up heat itself rather than protecting the loss of heat picked up somewhere else.

--Figure 6--

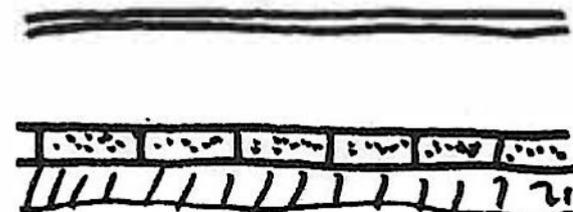


(6) & (7) Sometimes (6) is better than (7) sometimes (7) is better than (6). Generally, if the collector temperature is more than 100 degrees F, hotter than outside (6) double glazing is best.

--Figure 7--



--Figure 8--

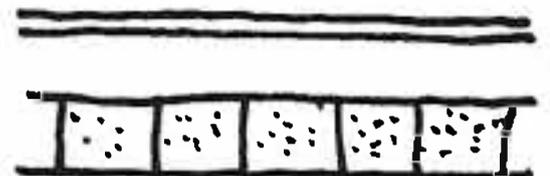


(8) & (7) Generally (8) is better than (7) since there is liquid circulating directly behind the collecting plate everywhere.

--Figure 9--



--Figure 10--



(9) & (10) Generally (9) will be a better collector than (10). This is because collectors grow cold or fall asleep when the sun goes behind a cloud or during the night. A heavy collector with a large mass of water has a great deal of heat to lose as it assumes the temperature of the air around it. Then when the sun comes up it takes a long time to wake up, for its mass must be warmed up above the useful collecting temperature before you circulate the liquid through it.

Each layer of water 3/16" thick weighs approximately 1 lb. If a collector has much more mass than this it is probably too heavy to be effective on days when the sunlight is intermittent.

In trying to decide the best kind of heat collector to use all this advice may be wisely disregarded if a collector that does not follow these lines is cheap and/or easy to build.

TOOLS, GOD, LIFE

In science fiction stories a common theme is the revolt of the machines against their masters.

What if life as we know it today - man, plants, animals, bugs - were at one time the hand tools and production tools of an entirely different kind of life form. Today we have tools that are evolving at an extraordinary rate. What if we are from an earlier family of such tools who revolted against this different life form? If our tools and machinery today did revolt and over-powered us, do you imagine they would think about us after they got busy with whatever pliers, axles, ball bearings would do on their own? Would metal things with electric circuits and atomic energy sources even notice weak fleshy animals?

People interested in wind generators, solar heatings, organic gardening, are often suspicious of recent technology. To what lengths must you go to free yourself from dependence on new technological devices that have been introduced. When are you free from such devices? When they are not visible? Underground wiring as a solution to the problem of electrical generation?

Is it possible to achieve a great independence from the horrors of modern industrial society by selecting certain of this horrible society's products and using them to your advantage to set up an independent homestead? What if you decided that copper is a material best left in the ground - can you use steel instead of copper even after you are informed by the steel producers that they could not run their mines, smelters, etc., without themselves using copper?

We have produced a great appendage to the natural world about which we expend a great deal of an essentially new kind of concern, for now, apparently, it is under our control.

One certain filter to insure against the presence or dependence of something felt to be dangerous or lethal in the makeup of an item is to go back in time before the suspect item was invented and only use things constructed before that time.

How much more exciting it is for someone today to come upon designs that answer needs that have existed a long time, but which could have been explained to and implemented by someone in one day in 1850: Something someone could have produced in an existing shop then! Unfortunately today this is not a very widespread opinion - most innovations are judged by how many other innovations they are dependent on. The more they buttress or hang on one another the more their creators assure one another of their value.

"bring in some cyclotrons, computers and satellites and we'll check this baby out."

It would be interesting to date the earliest appropriate date for a technological idea - where it could have appeared as the next step. Such recent innovations as microcircuits for computers and other electronic equipment clearly could not have occurred in the last century for they are absolutely dependent on the technology which immediately preceded them. Another fairly recent idea - the vise grip pliers - could have been made and appreciated 100 years ago after a few moments demonstration and explanation.

How deep into history could you carry an idea and have those who saw it say, "of course, why didn't I think of that."

This kind of emphasis would dampen the enormous rush into new scientific fields where people rightly expect the pickings in new ideas will be easy and would encourage contemplation of older more basic problems.

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