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Chapter 4

CONTINUED FROM LAST ISSUE.

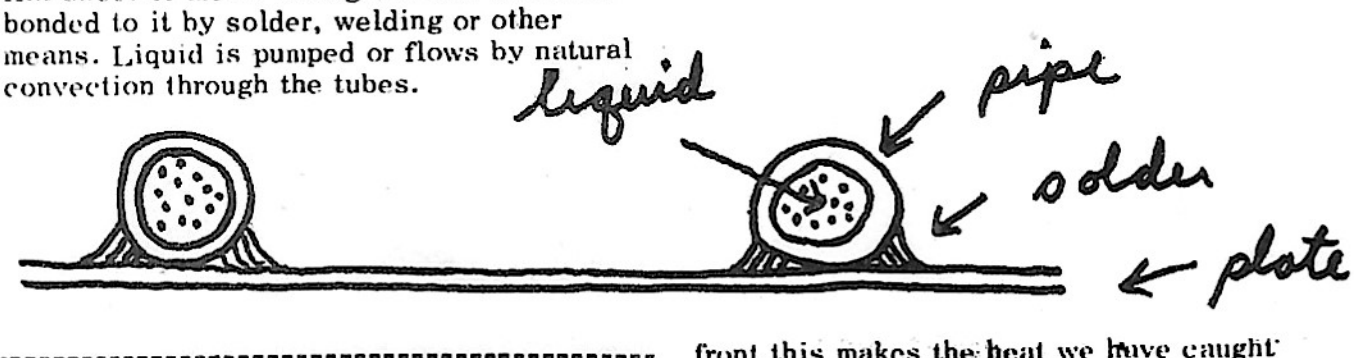
(Serialization of a new book by Steve Baer on Solar Energy)

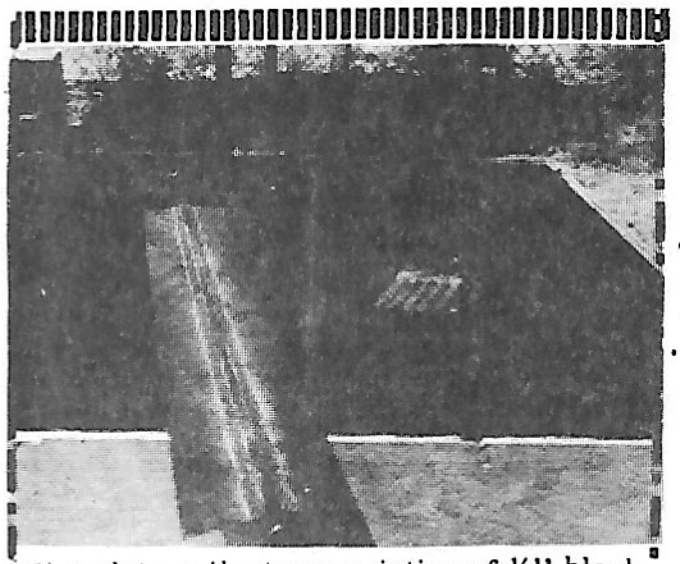
FLAT PLATE COLLECTORS

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 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.





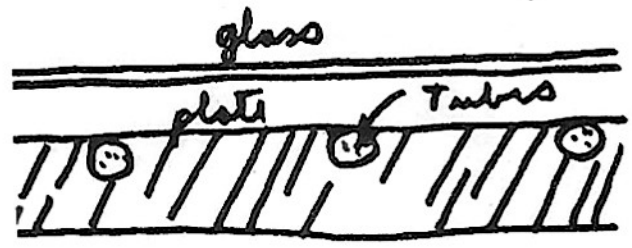
Flat plate collector consisting of ½" black pipe with 16 guage hot rolled sheet metal strips welded to it. Steel is a relatively poor conductor of heat compared to copper or aluminum, but it is inexpensive, easy to fabricate and a collector such as this is virtually indestructible. Lying on top of the 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.

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 loosing 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--