

CHAPTER 3-B

(Continued from last week)

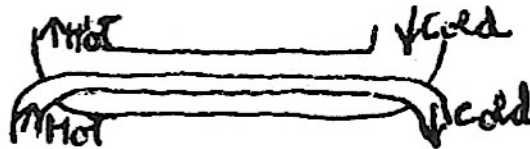
HEAT EXCHANGERS

7 & 8 LIQUID-LIQUID

Here are a bundle of steel pipes which once passed through a tank of liquid. The pipes themselves had liquid pumped through them to heat or cool the liquid in the tank. In solar heating water the problem of water freezing in flat plate collector necessitates liquid to liquid heat exchangers. A flat plate collector as shown in Photo 11 has anti-freeze flowing through it during the day. The hot anti-freeze passes through a liquid to liquid heat exchanger where it heats water. At night the flow of anti-freeze stops, since convection ceases, and although the flat plate collector may reach temperatures below freezing the pipes are safe from damage. Photo #11 shows a very simple liquid to liquid heat exchanger - a conventional hot water tank placed within a 55-gallon drum which is connected to the heat collectors - the anti-freeze flows in the drum and outside the hot water tank.

This is a section through a liquid to liquid heat exchanger - the two tubes are copper and the space between has a toothed plastic strip spiraling to increase turbulence.

The two liquids in this heat exchanger - which I picked up a couple of years ago at the Zia junkyard at Los Alamos probably flowed in different directions making what is called a counterflow heat exchanger.



At one end a hot liquid enters and another liquid, almost as hot, leaves. At the other end a cold liquid enters and the other almost as cold leaves. The longer the counterflow heat exchanger the closer the temperatures of the two liquids flowing past each other are to being the same.

Some birds have counterflow heat exchangers in their legs. Their legs are long and naked and have no protection against the cold and yet they must expose their legs all night long while they roost. The bird could not afford to throw away heat through its naked legs all night. There are counterflow heat exchangers in their legs which warm up the cold blood on its way back from the legs towards the heart and thus cools the warm blood before it even reaches the bird's foot. Some fish have similar mechanisms to protect them from the cold water through which they must swim.

9, 10, & 11 RADIANT-LIQUID

A close-up of a heat collector for heating hot water. Anti-freeze circulates through these tubes, where it is heated by the sun, and then through a heat exchanger where it heats the water. The small tubes are $\frac{1}{2}$ " and the large heads 1". They are copper as is the .020" thick sheet they are soldered to. The tubes are spaced 6" apart. The tubes are large because the liquid is moved through them by convection which provides only a slight head. The advantage of using convection is that it saves the cost of a pump and it shuts itself off at night.

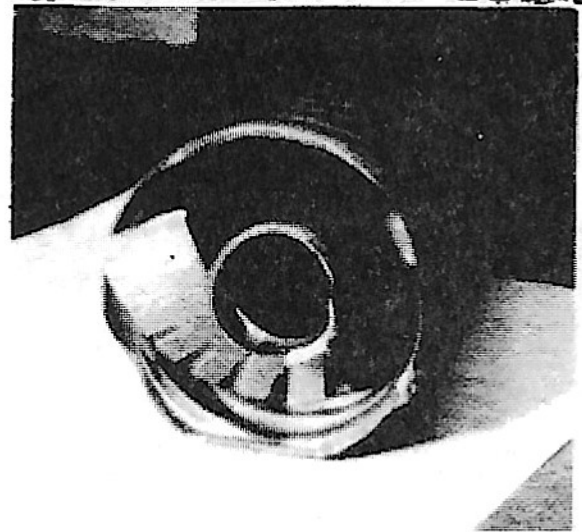


Photo #9

View of a hot water heater being installed. The 55-gallon drum on the right has a 42-gallon water tank inside of it. The water tank within the drum is connected to the 80-gallon water tank on the left. There is storage for 122 gallons of hot water. The heat collectors have anti-freeze flowing through them by convection. They both connect to the 55-gallon drum. The heat collectors can be tipped back in the summer to catch the overhead sun and leaned forward in the winter to get the low winter sun.

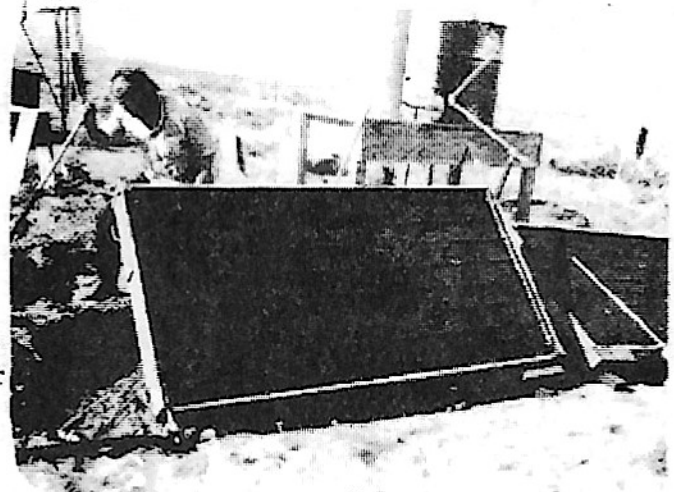


Photo #10

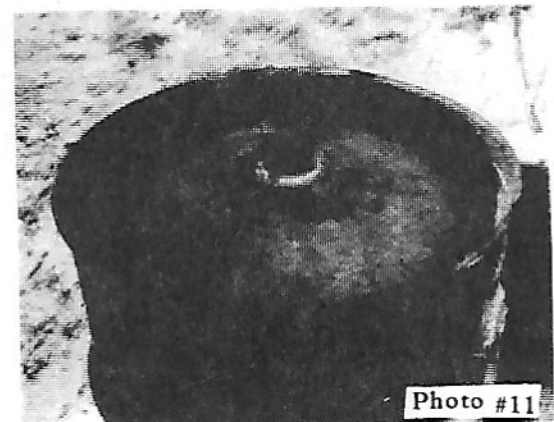


Photo #11

Photo #7

Another radiator amid engine blocks and other junk.

Photo #8