Chapter Four

Solar Collectors

4.1 Classification of solar collectors

Solar collector is the device responsible on converting the incident solar radiation into useful thermal energy that can be carried out of the collector by passing a working fluid. Solar collectors can be classified according to the type of the working fluid into two main types: −

Water Collectors: In this type pure water or water−based mixtures is circulated in the collector. They are usually used in solar water heaters and heating systems incorporated in air conditioning and industrial applications.

Air Collectors: In this type atmospheric air is circulated in the collector and incorporated then in drying processes of food materials or in warming residential spaces.

Solar collectors can also be classified into: −

Non−concentrating Collectors: In this category the incident solar radiation is directly collected without being focused or concentrated. These type are used in low to medium temperature applications (less than $100^{o}C$)

Concentrating Collectors: In this category the incident solar radiation is focused into a smaller intercepting area by the use of reflecting surfaces. Extremely high temperatures can be obtained by this category reaching $1000^{o}C$ or more.

The common types of solar collectors are: −

Flat−Plate Collectors

Evacuated Tube Collectors

Non−concentrating, using water or air

Parabolic Trough Collectors

Compound Parabolic Concentrators

Dish Collectors

Concentrating, using water, oil or liquid metal

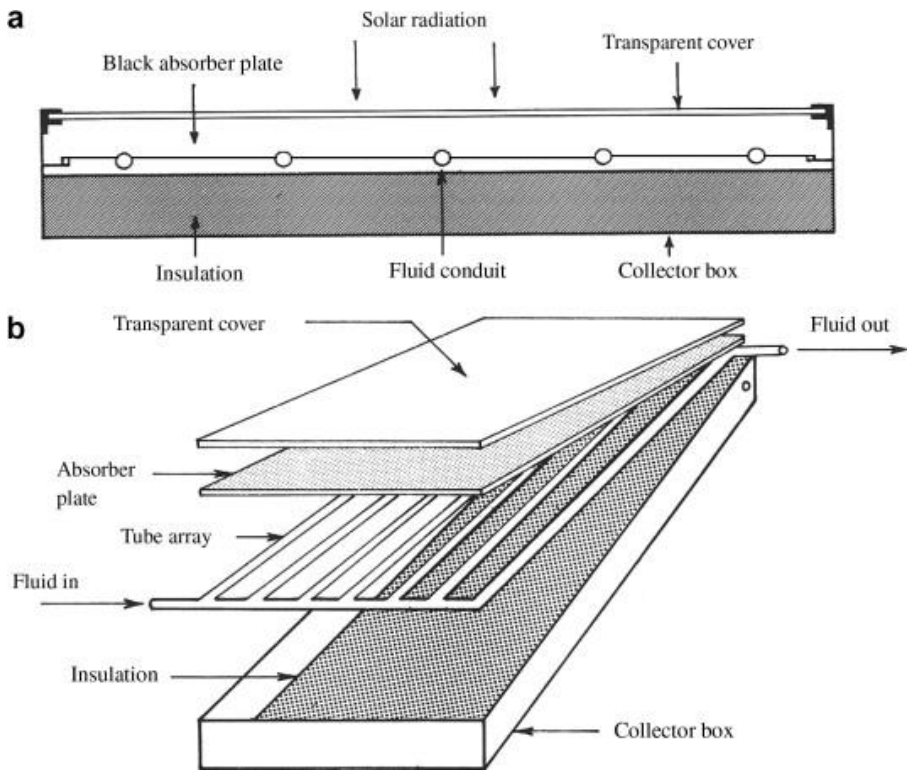

Fig. (4.1): A flat−plate solar collector with dissembled parts.

Fig. (4.2): Solar water heater incorporating a flat−plate collector.

Fig. (4.3): A huge parabolic trough used for power generation.

Fig. (4.4): A solar dish concentrator.

Fig. (4.5): Solar water heater incorporating evacuated tubes.

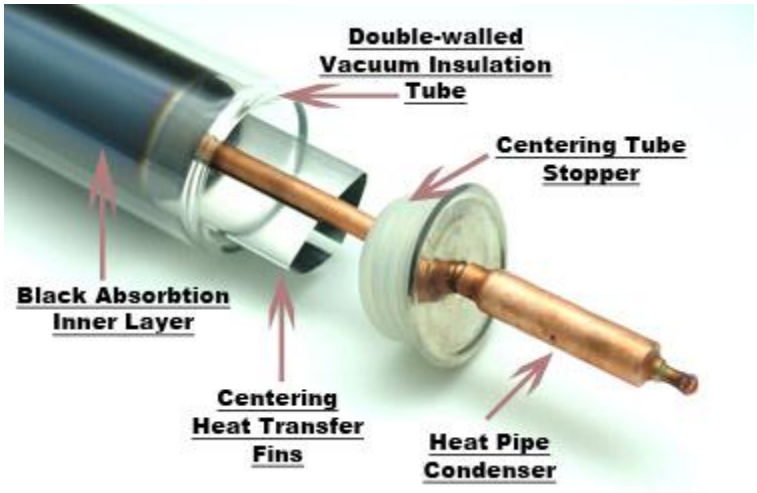

Fig. (4.6): An evacuated tube equipped with a heat pipe.