ANALYSIS OF SOLAR COLLECTOR-CUM-STORAGE WATER HEATERS

by

NARESH K. DHIMAN

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In the ever-inspiring memory of

MY HUSBAND

C E R T I F I C A T E

It is certified that the thesis entitled 'Analysis of Solar Collector-cum-Storage Water Heater' being submitted by Naresh K. Dhiman is worthy of consideration for the award of the degree of Doctor of Philosophy and is a record of the original bonafide research work carried out by her under my guidance and supervision. The results contained in this thesis have not been submitted in part or full to any other University or Institute for award of any degree or diploma.

G.N. Tiwari

(Dr. G.N. Tiwari)

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(NARESH K. DHIMAN)

SUMMARY

The present thesis encompasses the basic thermo-physical aspects of collector-cum-storage systems which use solar radiation as the heat source, operate in low-temperature range and combine collection and storage of heat into single unit. These systems, in general, use the high thermal capacity materials such as ground, sand or water for the storage of heat. The use of these materials also substantiates the diurnal variation of temperature. Closed analytical solutions are obtained in the thesis for various designs of these systems; analytical models are validated against the experimental results of earlier workers. Various options of reducing heat-losses from these systems to the surroundings are studied in detail and appreciated by the numerical calculations. The studies show that the methods like movable insulation used at the top of the system during off/low sunshine hours, the use of thermal trap material as the top cover, the use of baffle plate in the water tank etc. are quite effective for the aforesaid purpose. It is also seen that the insulation cover can be replaced by a reflecting sheet when it is maintained at a distance of 0.05 m from the surface.

Another field which exploits the storage potential of earth is the greenhouse systems. In the present thesis an analytical model of a greenhouse whose top surface is covered by a solar still, is developed. The model also incorporates the effect of the ventilation on the system performance. It is seen by the numerical calculations carried out for a typical set of data that north wall loses more heat than what it gains if it is made up of transparent material.

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