hence causes an increase in the condensation rate.

Also the results show that the distilled water output in the case with fan and without insulating the air channel is 55.6% (15622 ml/day where 5611.5 ml/day is from the air channel) higher than the case of the conventional design. This considerable increase is due to the mentioned factors plus the effect of the condensation inside the air channel.

Figure 3. shows the temperatures of ambient, water and glass temperature for the case of conventional still and the case of fan without insulation. The results show that for the non conventional still the water temperature and the glass temperatures are higher nearly before 1 P. M. time and lower after nearly 1. P. M. compared to the conventional still. This is because in the period of the increase in solar rediation the evaporation is due to the effect of air motion and the solar radiation which increase the vapour and then the water and glass temperature increase. But in the period of the decrease in solar radiation the effect of air motion which causes a decrease in the water and glass temperatures.

Also this figure shows that the difference between the water and glass temperature is higher before 1. P. M. in the case of fan existance than the case of conventional still.

This causes part of the increase in the stilled water output in the case of air motion.

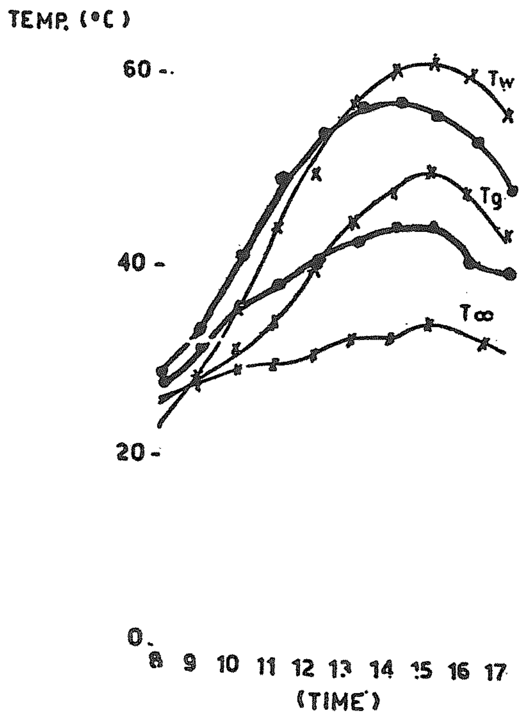

Fig. 3. Water, Glass Ambient Temperatures x——x Conventional Design, o——o Fan with Non-Insulated Air Channal.

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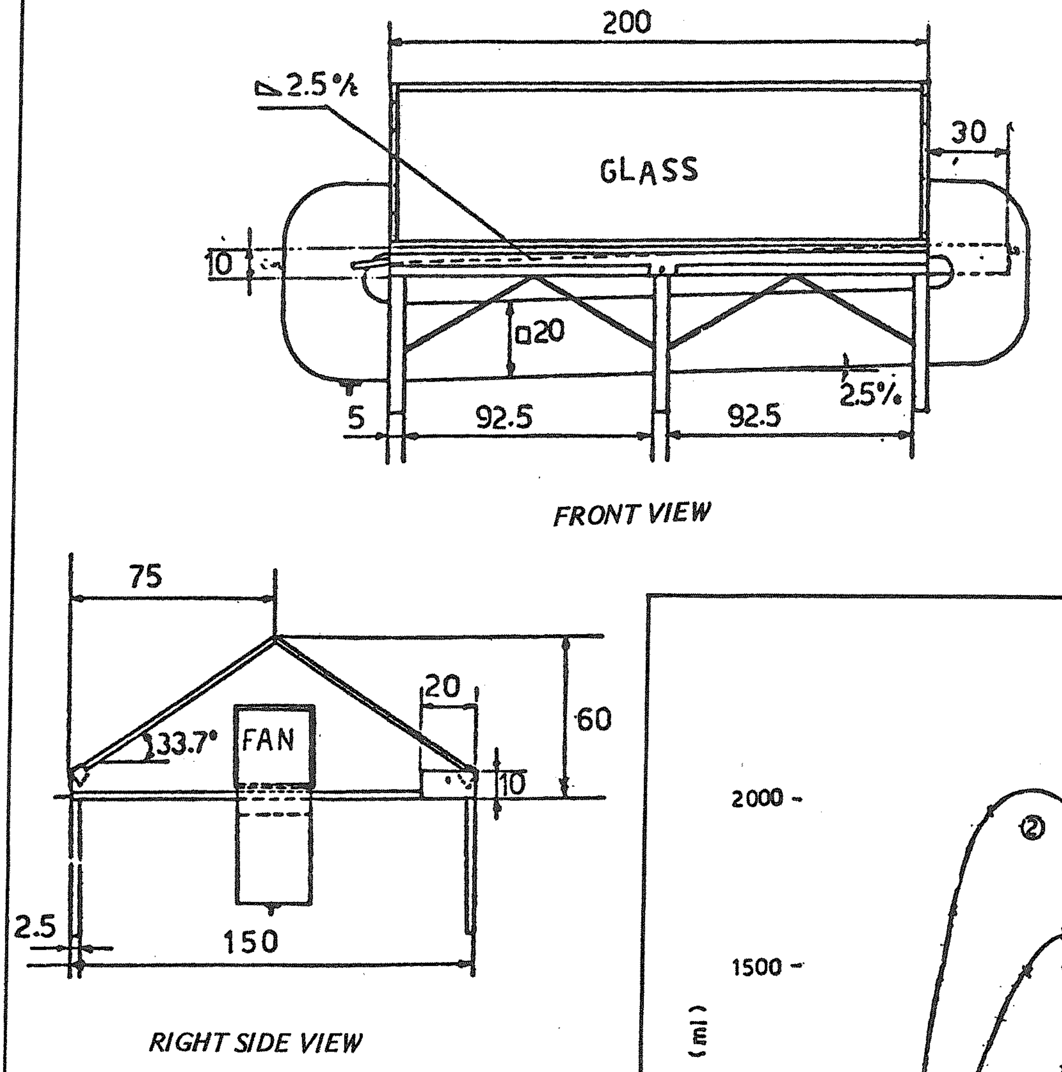

Fig. 1. Layout of the Experimental Solar Still.

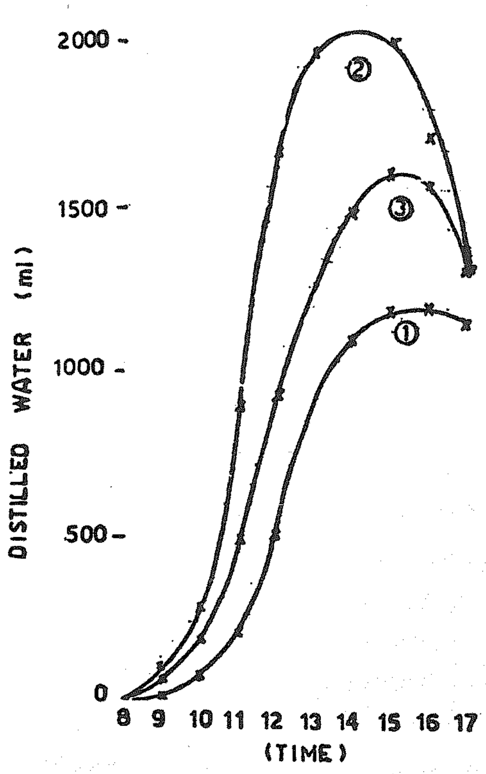

Fig. 2. Hourly Distilled Water Produced from the Solar Still.

1: Conventional Design

2: Fan with Non Insulated Air Channal.

3: Fan with Insulated Air Channal.

the efficiency of solar still is studied using the effect of air motion inside the still on the performance of the solar still. For this purpose a solar still of 3 m^2 area is constructed with a modification in the conventional design. The air is allowed to circulate in the still using fan, insulated and un insulsted channel—Connecting the two sides of the still. The effect of the insulation of the channel is also studied and all the results are compared with the case of conventional solar still.

EXPERIMENTAL

The experimental set up, as shown in figure 1, is consisted of a solar still with an effective area 3 m^2, made of Galvanized Iron. A 8 mm glass cover was placed in tilted angle on the basin using frame. The whole assembly was made air tight with the help of rubber gasket. The water enters the basin through a small galvanized Iron box welded to the basin where the surface level of water in the box and then in the basin is controlled using a float. Controlling the surface level of the basin water using a float in a box outside the basin has advantage of preventing the problem of out of work of the float due to the salt crystallisation. the air is allowed to move inside the still by placing a fan on one side of the still connected to Aluminium channel to the other side of the still. The channel is tilted so that the condensed water can be accumulated in one point in the channal be withdrawn to the outside by the outlet tube from this point.

The condensed water on the inner surfaces of the glass cover is accumulated outside the still from two outlets in one side of the still connected to channeles at the bottom of the galss cover. An insulation of 5 cm. thickness glass wool is used to insulate the sides and bottom of the still, and also to insulate the air channel. The experiments are done first with non insulated air channel with a fan, second with insulated air channel and third without fan as a conventional solar still.

The tests are done in outside door and during each test the temperatures of basin water, glass, inlet water, air inlet, air outlet, ambient and solar radiation are measured.

RESULTS AND DISCUSSIONS

Figure 2, shows the distilled water output at each hour during the day hours from 8 A. M to 17 P. M., for three cases: conventional design solar still, solar still with fan and with insulating the air channel and solar still with fan without insulating the air channel.

The results show that the distilled water output in the case with fan and with insulating the air channel is nearly 29.7% (13030 ml/ day where 511.5 ml/day is from the air channel) is higher than the output from the conventional design (10045 ml/day). The reason for insulating the air channel is to prevent condensation of the vapour in the air channel and hence the effect of the air motion inside the still on the distilled water output in the case of fan with insulating the air channel is due to the following reasons:

1— The air motion flutting the water surface and hence in creasing the evaportive area.

2— The turbulent eddies of the air affect the diffusion coefficient and also incrasing the mass transfer coefficient, (6).

3— The air motion reduce the surface tension of the water, hence increasing the evaporation rate.

4— The vapour velocity inside the still reduce the thickness of the condensate layer so that causing an increase in the heat transfer coefficient and hence increasing the condensation rate (7).

5— The vapour velocity inside the still cause an increase in heat transfer coefficient due to the forced convection, hence increasing the condensation rate.

6— The vapour velocity reduces the accumulation of the noncondensable gas hence incresing the condensation rate, (7).

The vibration of the glass sheet due to the fan motion probably causes dropwise condensation and

Experimental Study on the Air Motion Effect Inside the Solar Still on the Still Performance

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ABSTRACT

A conventional solar still can be used for producing fresh water in a rid areas especially in a small scale production which is around 3 liter per day in yearly average. So that a modification in the design probably can develope the performance of the system. The velocity of the desalinated water on the inner surface of the glass and also the velocity of the air attached to the saline water surface affect on the amount of the desalinated water. Hence the effect of air motion inside the solar still is studied experimentally. For this purpose a solar still of 3 m^2 area is constructed with a modification in the conventional design, so that air is allowed to move inside the still using a fan. The system performance is tested in outdoor testing and is evaluated by comparing it with the case without air motion. The results show that a significant increase in the desalinated water productivity is achieved when the air is allowed to move inside the solar still.

INTRODUCTION

The solar stills have been used long time ago by the Muslim alchemists (1). The solar energy is considered as an alternative way to the distillation process of the saline water by fossile fuels, especially in the remote aride Zones where the fresh water is not available. But large areas is needed for solar distillation to produce the same amount of fresh water by other methods of desslination. This is due to the low efficiency of the solar distillation. Also the solar distillation may be considered as the only alternative for water production in remote aride Zones where no fresh water is available.

From the economical point of view it was found that if a community needs 25000 gpd, the solar stills is considered the best way for water distillation. This economical analysis was done before 1970, i. e., bfore the oil prices crises. The economical situation is now different and it is in favour of solar technology (1). The high price of large quantity of solar distilled water is due also to the low efficiency of the conventional solar stills.

Many valuable efforts have been done by scientists to increase the solar stillsefficiency.(2–5).

In thisexperimentalstudy a new way for increasing