

SUSPENDED BOX SOLAR OVEN

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A suspended box solar oven with four number foldable mirror reflectors is presently designed and fabricated. It can be easily adjusted from 5 degree to 70 degree with respect to the ground by simply swing the suspended oven box and thereafter positioning of rectangular support frame in desired slot (14 such slot) formed by series of long studs, provided in inverted "T"-shaped main frame from which the oven box is suspended. The whole arrangement is clear from the photograph.



The ingenious supporting system permits easy adjustment facility without lifting of oven against its weight directly during reorientation as faced in case of provision with typical back stand. The new support enabling the oven to collect direct radiation perpendicularly almost throughout the day which is especially advantageous during summer for solar cooking because in India during summer intensity of radiation is still high when sun is low in the sky. With conventional stand at backside of the oven it is impossible to follow the sun at right angle throughout the day. Because in that case, after certain angle of inclination, the oven will be turned over in front for the weight of heavy glass reflectors and also for the rotation of line of action of the cooker box weight towards

front. Use of lightweight aluminium reflectors enables oven inclination by another few degrees. The safe limit of oven inclination actually depends on the shape of the oven, which is observed 30 degree in this cubic shaped oven.

In this oven, only one cooking pot is used mainly for rice cooking because generally in most locality of India peoples are not habituated to take boiled food except rice. The holding arrangement of tilting tray for cooking pot is shown in the Figure-1. In other ovens, cooking tray hangs from two pivot points so that gravity keeps it level. In the new oven, however cooking tray is suspended as usual through M.S strips from pivots fixed in the sidewalls of inner box but these pivots are aligned with horizontal axis of the cooking pot. For the stability of the pot counter weight is attached at the bottom of cooking tray. During changing of oven inclination the tray along with pot rotates at its horizontal axis and maintains constant horizontal position to avoid spilling over of food item. This tray holding arrangement is designed for proper utilization of top and bottom reflectors at every inclination of oven box which is not possible in simply suspended tray arrangement for shifting of pot location from the central position of the inner box due to the rotation of pot around pivots. The arrangement also reduced the size of the oven as in simply suspended design; more space is required for the rotation of pot around pivots in oven interior. Another reason for designing the rotation of pot at its horizontal centre is that, in case of simply suspended tray, during solar noon when pot position is nearly horizontal with the ground then distance of the pot from glazing will be more than the distance of the pot from glazing in the present design and so inclination angle of the reflectors with oven face will have to reduced to direct the reflected rays on the pot and thus aperture area of the oven will decrease in spite of same dimensions of the reflectors and oven box of presently designed oven.

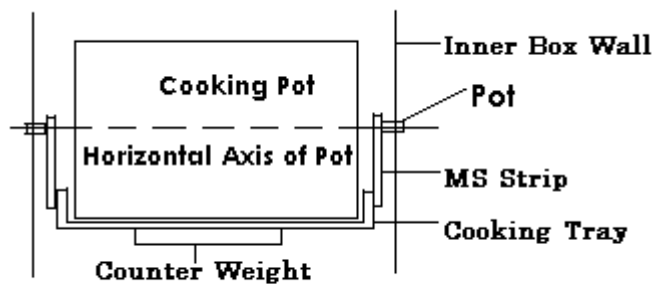


FIG.1



Size of the glass reflectors is equal to the top glass cover and these are hinged with oven face at four sides of the glass cover. The reflectors when opened held fixed at an inclination of 115 degree with the oven face by the help of reflector supports and holding clips provided at the backside of the reflectors. During reorientation of the oven, apart from changing of inclination of the oven box, the whole oven can be rotated in the ground at desire position by the help of caster wheels attached to the bottom of main frame base but the position of reflectors remain unchanged throughout the working period.

Constructional features of this solar oven are similar to the conventional box type cooker. The oven box is made of 1 mm thick GI sheet; 0.5mm thick aluminium sheet is used for the fabrication of inner box. The space maintained in between two boxes is 50

mm, which is filled with glass wool insulation. Upside of the oven is covered by two layers of 3 mm thick plain glass keeping a gap 20 mm in between and the frame of the cover is hinged with oven box. The pot is to be placed inside of oven by opening of glass cover. Length, width, and depth of the oven box are 40mm, 14mm and 35mm respectively. Total aperture area including reflectors is 0.25 sq.mt. Diameter of the cooking pot is 22mm and height of the pot is 10mm. Counter weight of 2 kg attached at the bottom of the cooking tray. Interior of the oven and cooking pot are painted dull black with automobile muffler paint. Approximate Material and fabrication cost of the oven is Rs 1800.

TEST RESULTS: (Reorientation is done at every 15 minutes interval during test)

Test date, time and location- 18th April-2006, from 9-30am to 12-30pm, Jalpaiguri, West Bengal, India.

Ambient temperature- 28 degree Celsius.

Average intensity of solar radiation during test period- 5.4 Kw per sq.mt. (Measured by Pyrheliometer available in local Engineering College).

Peak temperature of the lid of empty cooking pot- 170 degree Celsius.

Test date and time- 20th April-2006, from 10-30am to 12-30pm.

Average intensity – 5.3 Kw per sq.mt.

Time taken for 2kg. of water for attainment of 96 degree Celsius from 26 degree Celsius initial temperature (Total aperture area including reflectors- 0.25 sq.mt.)- 120 minutes.

Test date and time- 21st April, from 10-30am to 12-10pm.

Average intensity – 5.4 Kw per sq.mt.

Time taken for cooking 1 kg. of rice (1 kg weight after preparation)- 100 minutes.