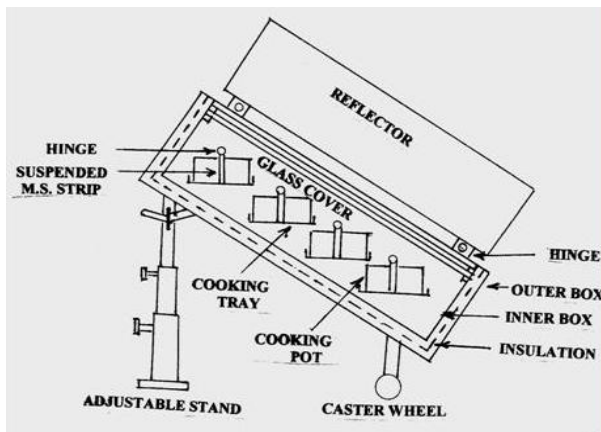


**TWO NEW TYPE SOLAR COOKERS FROM  
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**Inclined Box Solar Cooker-** The key feature of the new cooker is that, it is designed to tilt towards the sun so that direct radiation is perpendicularly accessible to increase solar irradiance on the cooker face. Two foldable mirror reflectors are conveniently attached at both longer sides of the cooker at an angle of 115 degree with cooker face to boost up the energy collection. The new cooker allows the user to cook more meals as the cooker still works when the sun is somewhat low in the sky.

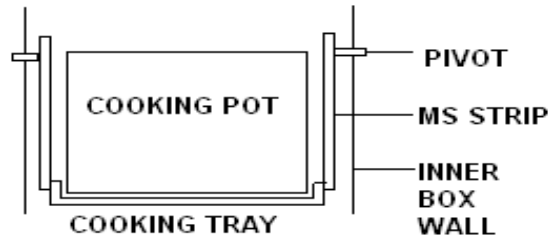


**FIG-1**

During use, the cooker is to be placed facing sun keeping longer side vertically inclined position and this inclination can easily be changed up to 45 degree with respect to the ground by the adjustable stand attached at the backside of the cooker box. (If inclination is more than 45 degree, the cooker may 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). Adjustable stand is rectangular in shape exactly like the back support of old pattern canvas easy chair. Standpipes are made of lightweight MS round pipe. Cooker inclination can be varied by changing the relative position of two rectangular support frames with respect to each other and thereafter held fixed by the help of slots formed by series of long studs.

During reorientation of the cooker, apart from changing of inclination of cooker box, the whole cooker can be rotated in the ground at desire position by the help of caster wheels attached to the bottom but the position of reflectors remain unchanged throughout the working period.

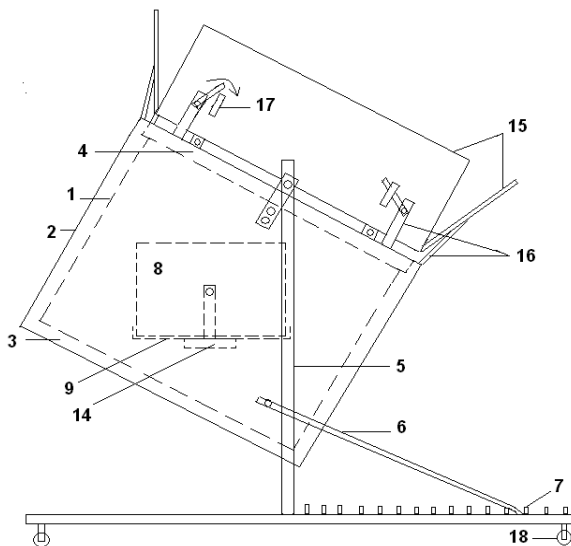
Four number cooking pots, capacity of each is 1.25 litres, painted dull black by automobile muffler paint, are placed side by side at the longer side of the cooker on cooking trays. Each cooking tray is suspended from two pivots fixed in sidewalls of the inner box through MS strips. Length of these strips is equal to the cooking pot height. During changing of cooker inclination cooking pot maintains horizontal position for its own weight. The arrangement is shown in FIG-2.



**FIG-2**

Constructional features of the cooker are similar to conventional box type cooker. The shape of the cooker box is however different from a common type. The width and depth of the present cooker are nearly same and the length is about three times of its width. Cooker box length, width and depth are 860mm, 300mm and 260mm respectively. Outer box is made of 1mm thick GI sheet; inner box is fabricated by 0.5mm thick aluminium sheet. 50mm thick layer of glass wool is applied for insulation. Two panes of 3mm thick plain glass are used as top cover. The frame of the glass cover is hinged with cooker box. The pot is to be placed inside of oven by opening of glass cover. Cost of the cooker is Rs.2000 approximately.

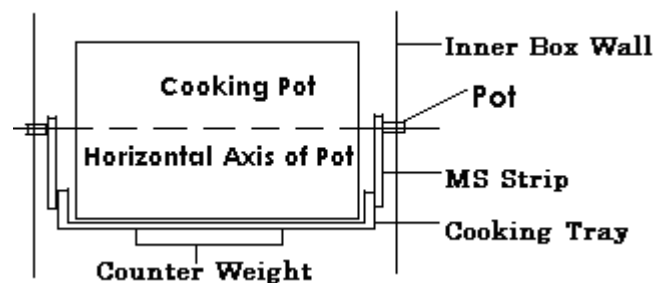
**Suspended Box Solar Oven (Patent filled. No- 639 KOL 2006)** – This new oven can be easily adjusted from 5 degree to 70 degree with respect to the ground by simply swing the suspended oven box and thereafter positioning of rectangular support frame (6) in desired slot (14 such slot) formed by series of long studs (7), provided in inverted “T”-shaped main frame (5) from which the oven box is suspended. The frame is made of lightweight MS square and round pipes. The whole arrangement is clear from the photograph.



**FIG-1**



The ingenious supporting system permits easy adjustment facility 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. The safe limit of oven inclination actually depends on the shape of the oven, which is observed 30 degree in this cubic shaped oven.



**FIG- 2**

In this oven, only one cooking pot(8) 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 (9) for cooking pot is shown in the FIG-2. 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 (14) 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. Further drawback of simply suspended tray is that, during solar noon when oven position is nearly horizontal then distance of the pot from glazing will be more (for the rotation of pot towards the bottom of inner box) in compare with the distance of the pot in presently designed tray holding arrangement and so, inclination angle of the reflectors with oven face will have to be reduced to direct the reflected rays on the pot and thus aperture area of the oven will decrease in spite of the same dimensions of the reflectors and oven box of these ovens in compare with presently designed oven.

Size of the foldable mirror reflectors (15) 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 (16) and holding clips (17) 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(18) 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 as like as usual box type cooker. The oven box (2) is made of 1 mm thick GI sheet; 0.5mm thick aluminium sheet is used for the fabrication of inner box (1). The space maintained in between two boxes is 50 mm, which is filled with glass wool insulation (3). Upside of the oven is covered by two layers of 3 mm thick plain glass (4) 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 440mm, 440mm and 360mm respectively. Diameter of the cooking pot is 230mm and height of the pot is 115mm. 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- 18<sup>th</sup> April-2006, from 9-00am to 12-30pm, Jalpaiguri, W.B.  
Ambient temperature- 24 degree Celsius.  
Average intensity of solar radiation during test period- 0.53 Kw per sq.mt.

Peak temperature of the lid of empty cooking pot:

Inclined Box Cooker- 140 degree Celsius.  
Suspended Box Oven- 172 degree Celsius.

Test date and time- 19<sup>th</sup> April-2006, from 10-30am to 12-10pm  
Average intensity – 0.54 Kw per sq.mt.

Time taken for 1kg.of water for attainment of 97 degree Celsius from 23 degree Celsius initial temperature:

Inclined box cooker- 100 minutes.  
Suspended box oven- 80 minutes.

Test date and time- 21<sup>st</sup> April-2006, from 10-30am to 12-20pm  
Average intensity – 0.54 Kw per sq.mt.

Time taken for cooking 1.5kg of rice (1.5kg weight after preparation) in suspended box oven- 110 minutes.

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