

## Funnel concrete cooker



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The whole set of the concrete funnel cooker is composed by: a black pot, two glass vessels, a main piece in concrete and glass mirrors with a funnel shape, a rotating concrete piece in middle and a basement. 4 wheels can be adapted in the basement piece for displacement of the cooker in case of need. Fig A and Fig B show, respectively, the front and back sides of two cookers working in a Portuguese home since 2007. The middle piece enables the easy rotation of the cooker over the basement fixed piece.



Fig. A – Two concrete funnel cookers, front view

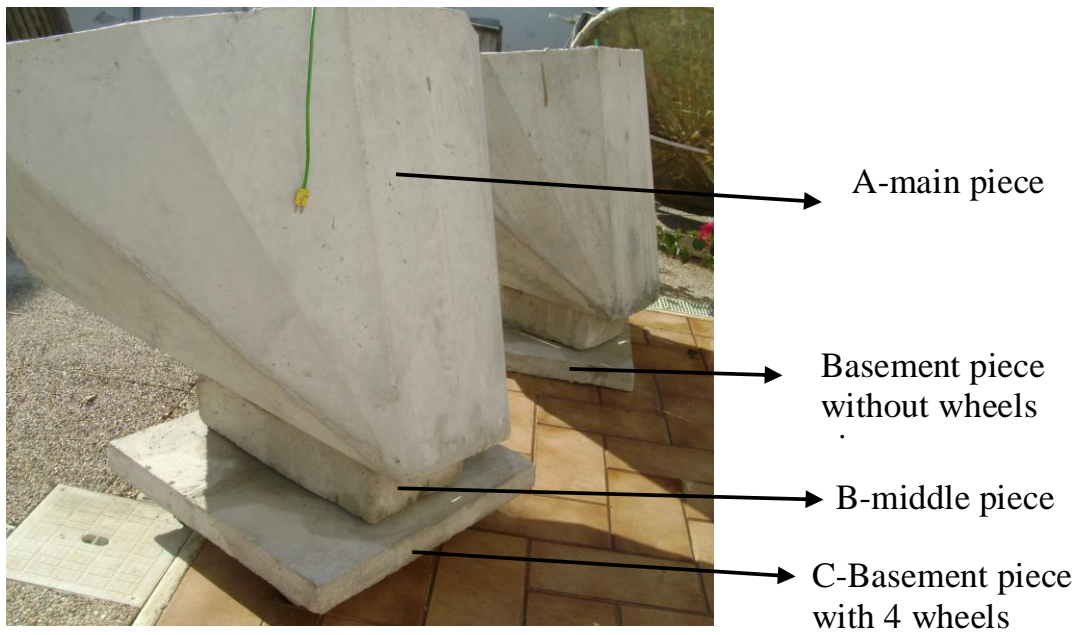


Fig. B – Two concrete funnel cookers, back view

The Fig. C shows the 3 pieces A, B and C after taking off the molds and after several days drying.



a)



b)



c)

Fig. C – Concrete pieces: a) main piece, b) middle piece and c) basement.

A-How to make the concrete funnel shown in Fig 1. See figs. 1a to 1h and figs 2a to 2d and figs 3a and 3b and guidelines



Fig 1- Funnel in concrete

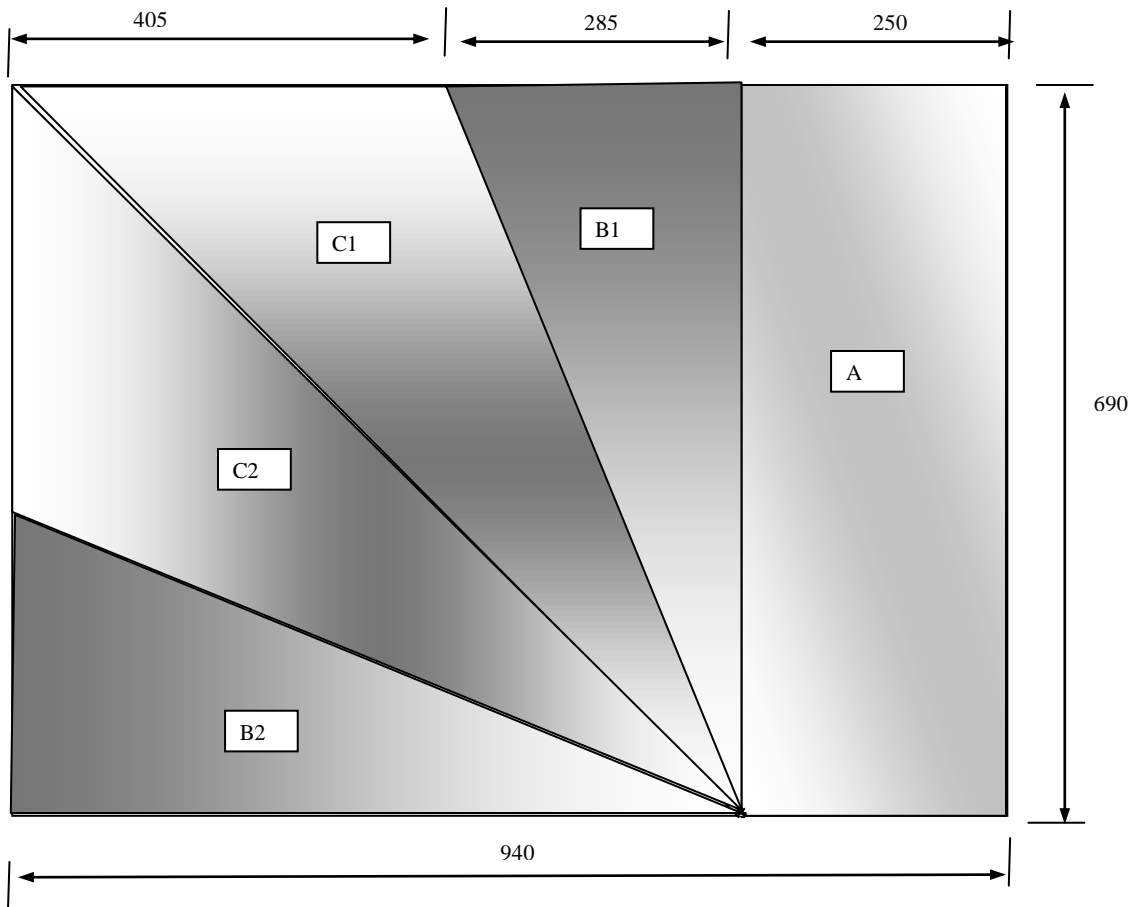


Fig 1a- Dimensions (in mm) of one half of the funnel in steel sheet with thickness of 2mm or between 2 and 3 mm. Folding process can be done in precise folding machine or manually. If it is done manually I suggest to make a rip in each folding line by using a rotating disk cutting machine with an appropriate rule for doing a right line. The rip must be not very deep. As suggestion half of the thickness seems well.

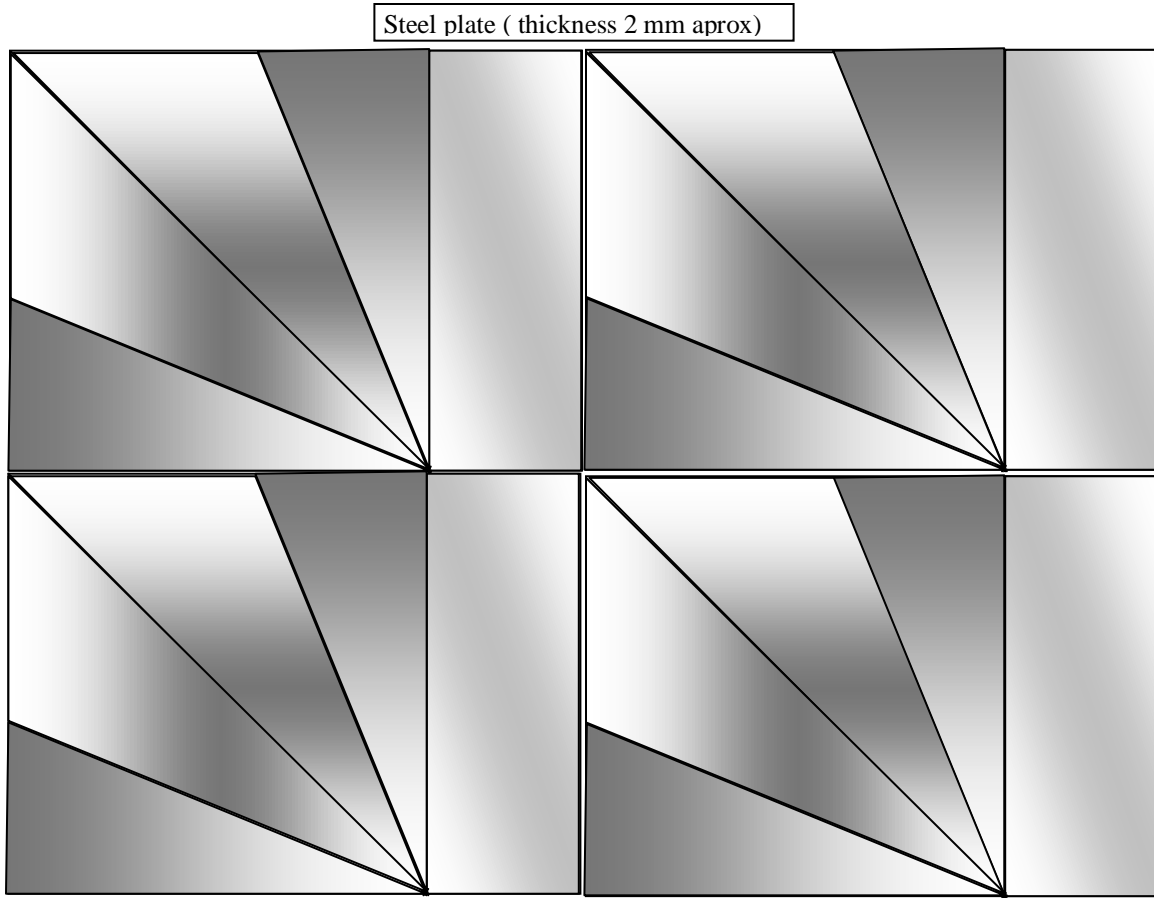


Fig 1b- Arrangement of the 4 halves to be cut from a large plate

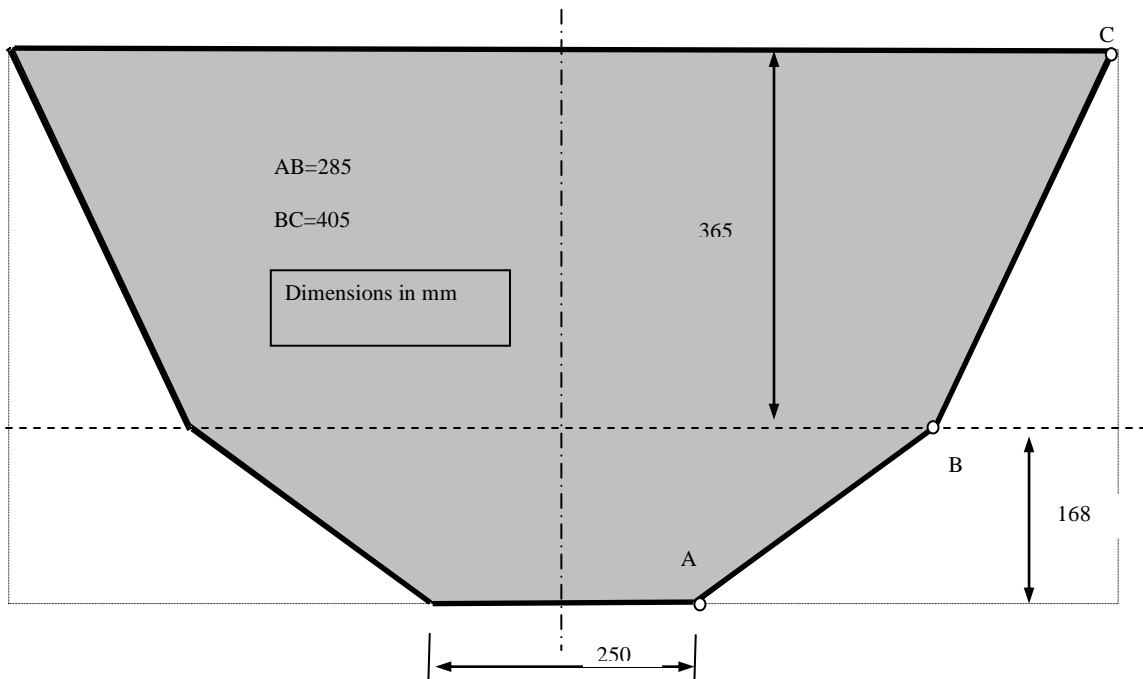


Fig 1c- Schema of auxiliary pieces in cardboard ( or wood plate or metallic thin plate) to better control the folding process



Fig1d. Interior and exterior funnels

1 exterior funnel and 1 interior funnel in steel sheet thickness: 2 mm  
 Note: other thickness values can be adopted . I recommend a value between 2 and 3 mm.  
 Each funnel is constructed with two halves parts. Each half part has length of 940 and width of 690 mm.

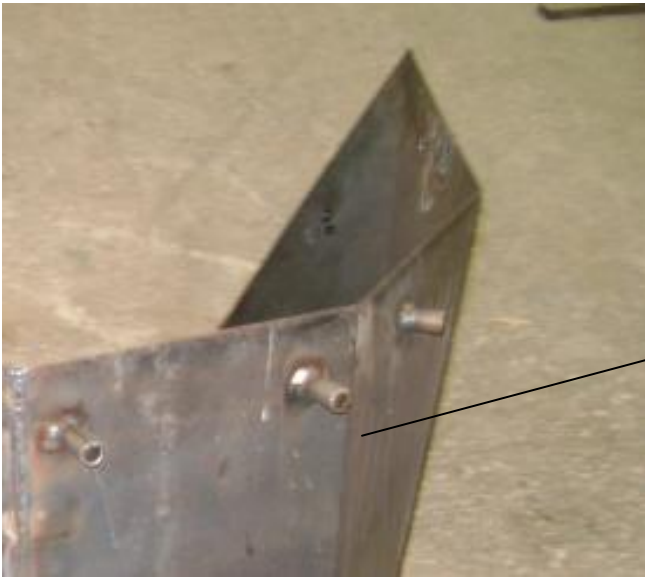


Fig 1e-Interior funnel and spacers

16 small tubes ( nominal size  $\frac{1}{4}$ " ; 8 mm; outside diameter 13.7 mm, inside diameter 9.2 mm)  
 Length 30 mm;

Note:  
 These tubes are used as spacers between the interior and exterior funnel pieces.  
 Each tube is welded in the interior funnel piece, holes with 9 mm diameter in funnel mould can be done after wedding the tubes. Use screws and nuts M8 with hexagon head).



16 small bars  
 Length 72 mm;  
 width 30 mm;  
 thickness 5 mm  
 diameter of the hole: 9 mm

Note:  
 These tubes are used as spacers between the interior and exterior funnel pieces.  
 Each bar is welded in exterior funnel.

Fig. 1f- Exterior funnel and bars with hole



16 screws and 16 nuts M8  
Length 60 mm;

Fig1g. Detail of joining interior with exterior funnels



1 bar for reinforcement and for helping when taking out the interior mold  
Length 1000 mm;  
width: 30 mm  
thickness: 10 mm  
Note: other width and thickness values can be adopted.

This folding line in yellow (only one) must be totally cut for taking out the exterior mould easily

Fig1h. Interior and exterior funnels joined and ready to be filled with concrete mass



It is a tray made in steel sheet of 2 mm thickness. The exterior dimensions of the tray are  
Length: 242 mm  
Width: 235 mm  
Height: 32 mm

Two holes for fixing the tray to the exterior mold by using two screws.  
Hole diameter: 9 mm  
Screws and nuts M8  
Screw length: 15 mm

Fig2a. Mold of the rectangular hole in the funnel concrete cooker

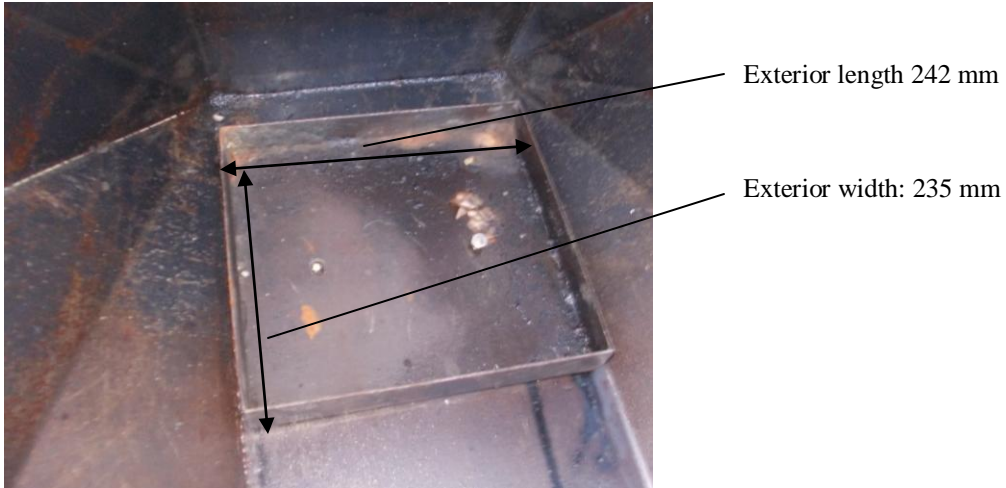


Fig2b. Mold of the rectangular hole in the funnel concrete piece

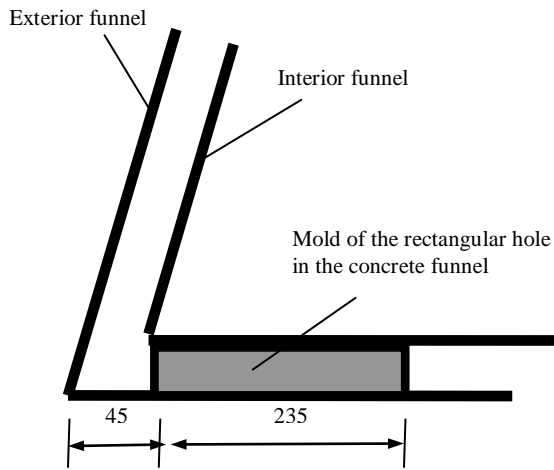


Fig2c. Location of the piece defining the cavity in the funnel concrete cooker



Fig2d. Mesh between the two funnel. It must not cover the mold of the rectangular hole



Fig3a. Concrete preparation. A volume of about 50 liters of concrete is required.



Fig3b. Mold filled. This was the first filling experience without using the bar for reinforcement shown in Fig 1h



B-How to make the middle piece shown in Fig 4. See figs. 4a to 4e.

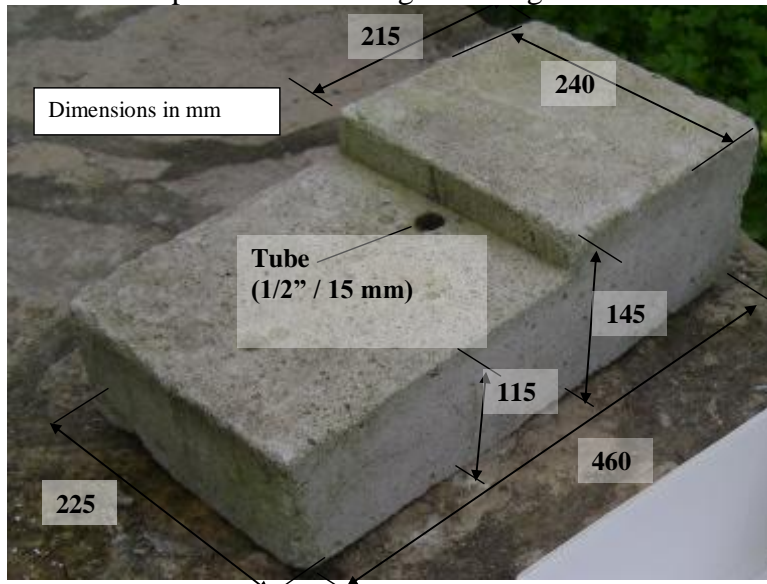


Fig 4- Dimensions of the middle piece. The concrete piece has a tube in its rotation axis. The tube can be metallic or plastic. This tube belonging to the concrete piece is inserted in the vertical tube shown in figure 4a before filling the mold with concrete mass. The nominal size of the tube is  $\frac{1}{2}$ " (15 mm), outside diameter is 21.3 mm and inside diameter (standard size) is 15.8 mm. the height is 110 mm.



Fig4a. Box with tilted walls (vertical slope 7.5mm/115 mm. Bottom 460mmx225mm, top 475mmx240mm, height 145 mm. Height of the tube 110 mm. The nominal size of the tube is  $\frac{1}{4}$ " (8 mm), outside diameter is 13.7 mm and inside diameter (standard size) is 9.2 mm. The tube is centered. Bottom and walls of the box are made in steel sheet with 2 mm thickness or between 2 and 3 mm.



Fig4b. Partial top cover. It is a tray that enters the box as the mold to make the step shown in fig 4. Dimensions of tray are length 260 mm, width 240 mm, high 30 mm. Four holes , 6.5 mm diameter, in the box and the tray must be done. By using two long cylinders with a diameter of 6 mm and length 300 mm the cover is kept fixed to the box. Before fixing the cover tube shown in fig 4 should be inserted in the central vertical tube shown in figure 4a.



Two plates in the bottom for reducing friction when rotating the cooker for tracking the sun. Length of plate 220mm, width, 100 mm. thickness 2 mm or between 2 and 3 mm.

Fig4c. Detail showing two plates wedged in the basement of the mould. This small detail can not be seen in the basement of the concrete piece shown in fig 4 as it was required for better understanding of this functionality.



Fig4d. Box and top cover of the mold



Fig4e. Fixing the top cover with the box

The concrete volume is about 16 liters. Before filling the mold, insert the tube shown in figure 4 in the central vertical tube axis shown in fig 4a. **Insert some metallic mesh inside the box** well distributed, which actuates as strength element of the final product. Insert the top cover and fixed it. Fill the mold.

C-How to make the basement piece shown in Fig 5. See figs. 1a to 1h and figs 2a to 2d and figs 3a and 3b and guidelines

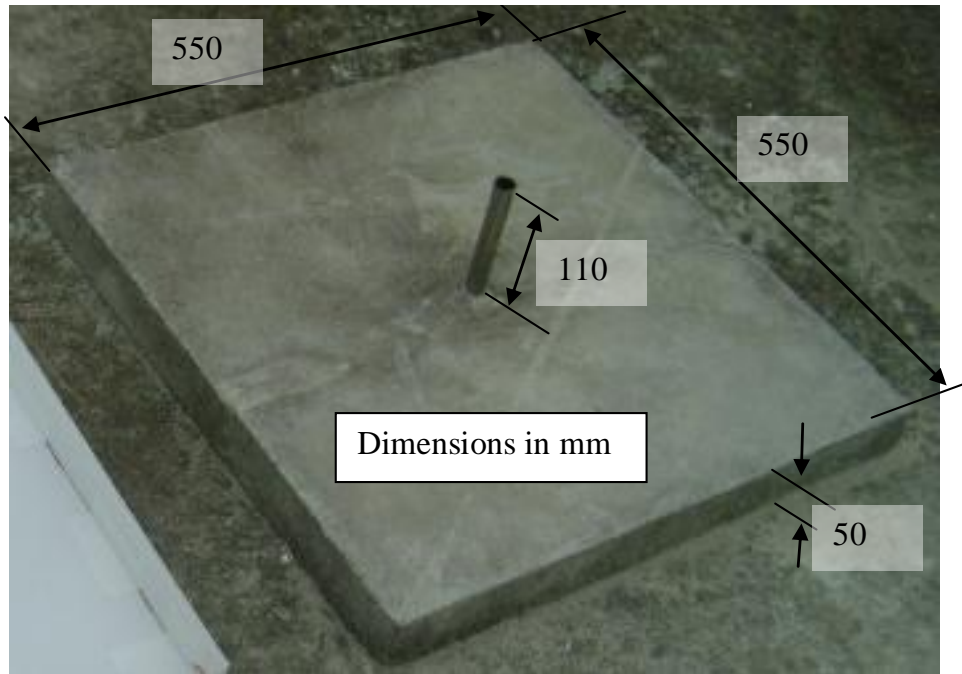


Fig 5- Dimensions of the basement piece. The shown tube is the axis of the systema and is illustrated in fig 5b. The nominal size of the tube is 1/4" (8 mm), outside diameter is 13.7 mm and inside diameter (standard size) is 9.2 mm. The tube is centered with help of tube wedged to the mold shown in fig 5a.



Fig5a. Mold of basement piece with guiding axis tube shown in fig 5b. Walls of the mold are bars with 50 mm, thickness 4 mm. the square bottom is 550mmx550 mm and the square top is 555 mm. The guiding tube is center and it is welded to the bar in the middle with thickness 4 mm, with 35 mm and length 550 mm. Nominal size of the guiding tube is 1/2" (15 mm), outside diameter 21.3 mm and inside diameter (standard size) 15.8 mm and height is 100 mm.

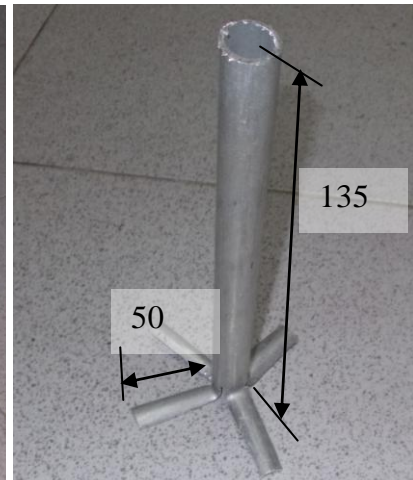


Fig5b. Axis tube. Fig shows an aluminium, but tube steel tube is appropriate option, better option is inox stainless with similar outside diameter. The total length of the tube is around 185 mm. Tube is cut to make 4 bended legs as illustrated.

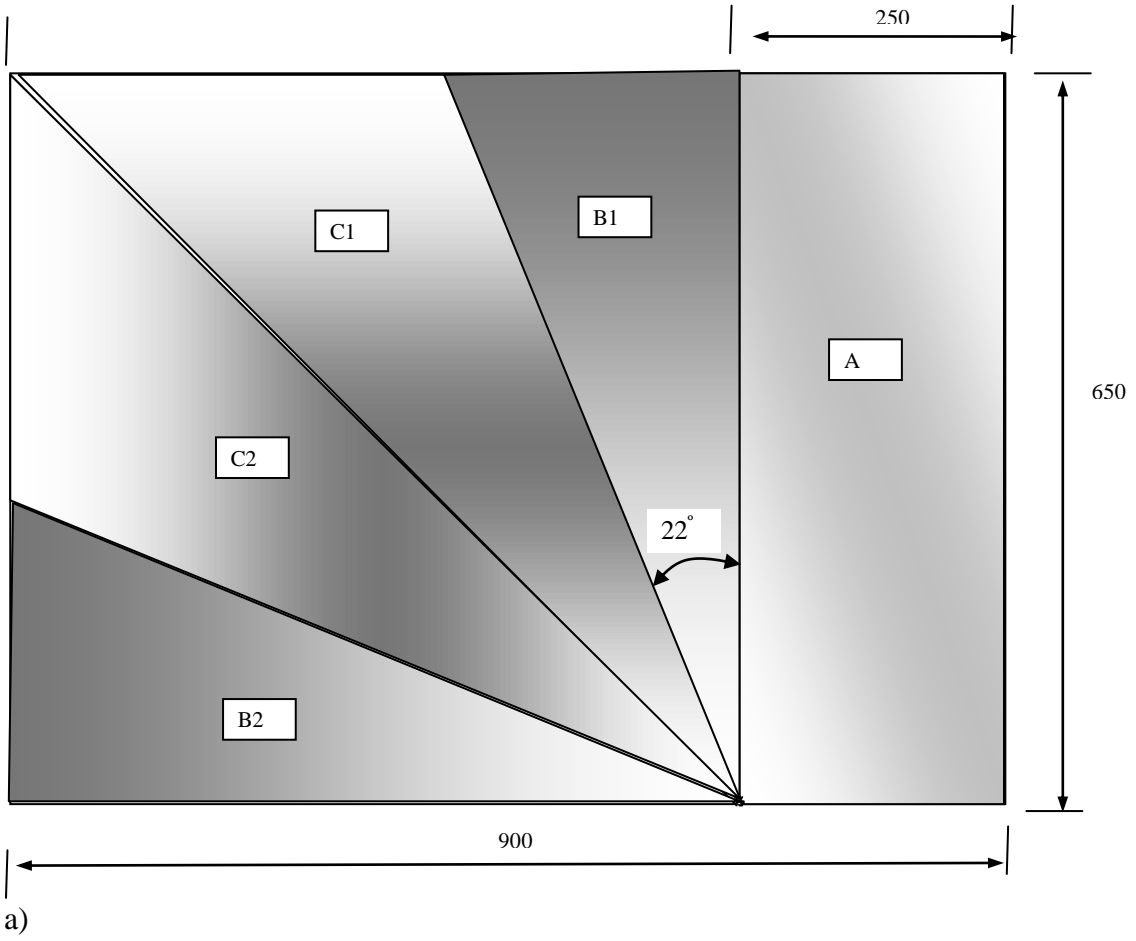


Fig5c. Mold of basement piece with guiding axis tube and inserted axis tube.

The concrete volume is about 15 liters. Before filling the mold, put it over a plastic sheet in a flat horizontal floor. Insert some metallic mesh inside the mold well distributed, which actuates as strength element of the final product. Insert the tube as shown in figure 5c. Fill the mold with concrete mass. Upper surface must be flat with negligible roughness.

Total concrete volume for making the three concrete pieces is about 80 liters. Before filling the molds, they should be greased with used engine oil ( clean oil would be better than used oil). The concrete mass should be a little liquid for better filling and to avoid air spaces inside the molds. Use a hammer to vibrate the filled concrete, impact should not be done directly in the mold. A piece of wood should be used to transmit the impact of the hammer to the mold. In this way the mold is not damaged.

At the middle of second drying day, the interior part of the funnel mold can be taken out to increase the speed of drying process without risk of damaging the piece of concrete.



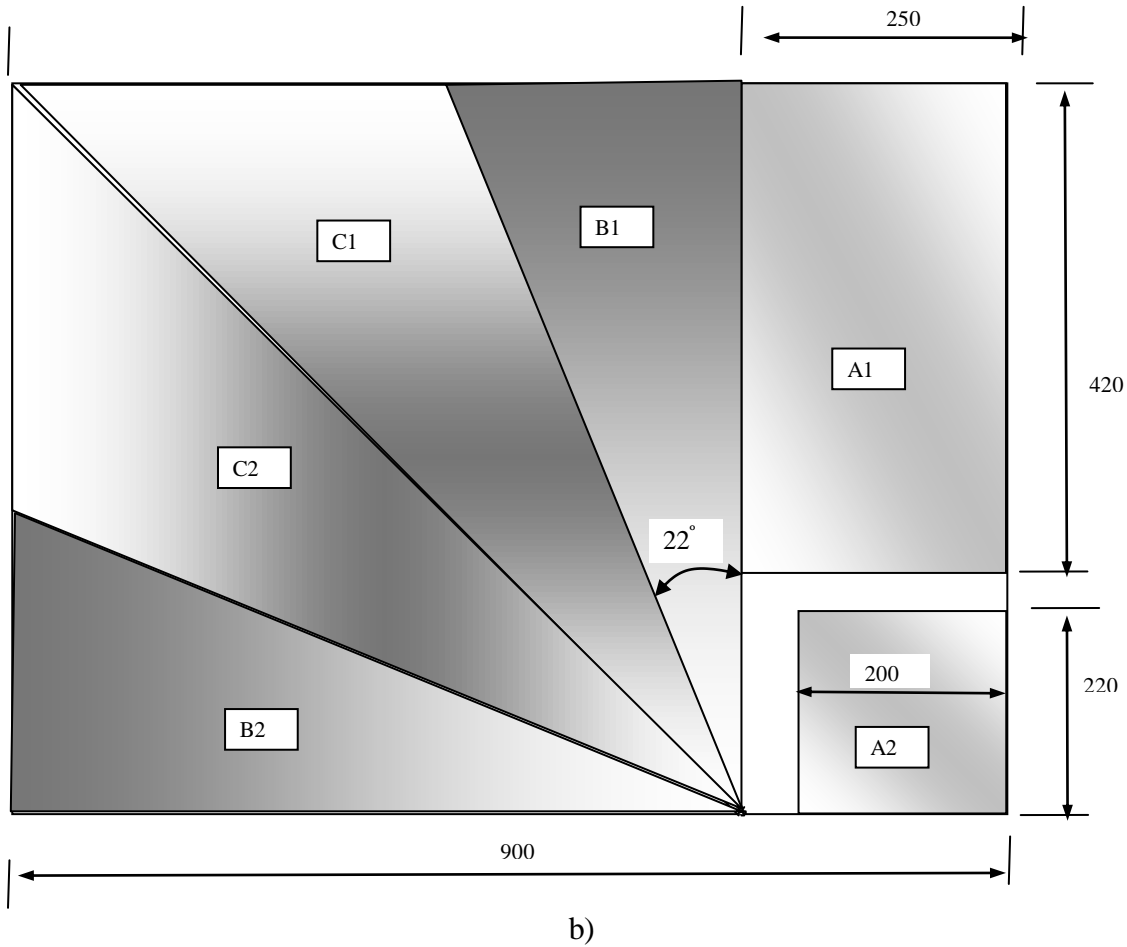


Fig 6- Dimensions (in mm) for cutting the mirror pieces :a ) one half part and b) other half part.

I suggest new or recycled mirror with thickness of 3 mm. Aluminum of parabolic cookers could be also an interesting alternative to be tested. Piece A2 is glued on upper flat rectangle of middle piece shown in fig 4.

When re-using used glass mirror or remains of glass mirrors or remains of reflector aluminium sheet (same quality used in parabolic cookers) in pieces with dimensions smaller than rectangle 900mmx650mm it is suggested to join the available pieces to make the complete rectangle and then glue adhesive tape in backside face of the mirror to keep all pieces as one complete set. Then line marks must be done as shown as example in fig 7.

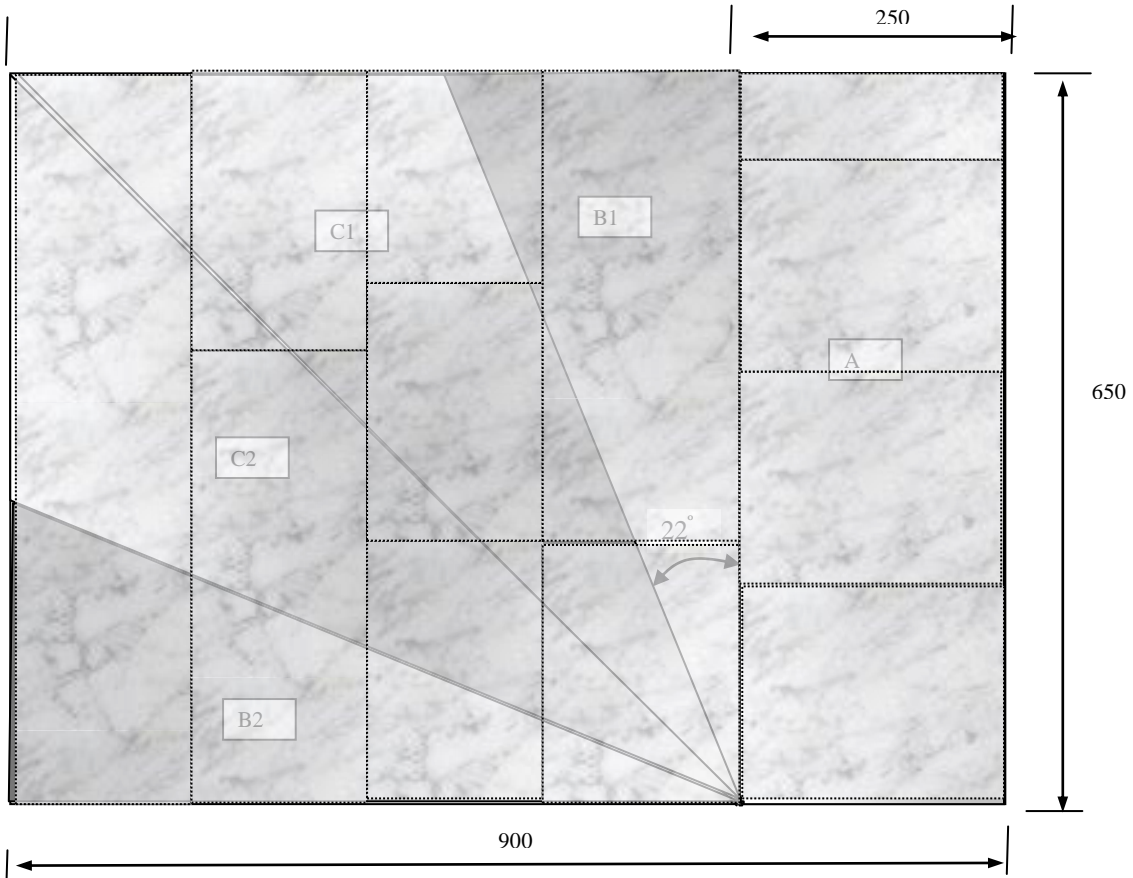


Fig 7- Example of arrangement of 12 remains of different sizes of mirror or of aluminium sheet for line marking and cutting process.

Examples of mirror adhesives:

[http://www.loctiteproducts.com/p/pl\\_ca\\_mirror/overview/Loctite-PL-520-Mirror-Adhesive.htm](http://www.loctiteproducts.com/p/pl_ca_mirror/overview/Loctite-PL-520-Mirror-Adhesive.htm)

<http://mirro-mastic.com/products/mirro-mastic/>