No: DIPAS/TTD/SHD(Bukhari)/3/2017

Technology Transfer Document
&
Specifications of
Space Heating Device (Bukhari)

(Patent No: 230107)

Defence Institute of Physiology & Allied Sciences
(DIPAS)
DRDO, Ministry of Defence,
Timarpur, Delhi-110054

Foreword:

These specifications have been prepared by the Director, Defence Institute of Physiology & Allied Sciences (DIPAS), DRDO, Ministry of Defence, Timarpur, Lucknow Road, Delhi-110054 and are based on the studies done by the lab on Improved space heating device (Bukhari). These specifications will be used for tender enquiry, procurement, manufacture and quality assurance of the improved space heating device (Bukhari). Quality assurance authority (ASHP) for this store is Director, Defence Institute of Physiology & Allied Sciences (DIPAS), DRDO, Ministry of Defence, Timarpur, Lucknow Road, Delhi-110054.

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Confidential Disclosure Statement

The information contained in this regulatory document entitled "Specifications of Improved Space Heating Device (Bukhari) for Cold Conditions" No: DIPAS/Specifications/Improved SHD (Bukhari)/3/2017 developed by Biomedical Instrumentation Division of DIPAS Delhi have been compiled from the results of extensive studies carried out by this research laboratory. It is exclusively for the internal use and for the use of Improved Space Heating Device (Bukhari) technology holders (TOT Holders) for commercial exploitation and information contained in this report should not be shared or reproduced in fragments or in any other form without written permission from the undersigned.

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Specifications of
Improved Space Heating Device (Bukhari)
For Cold Conditions

No: DIPAS/Specifications/Improved SHD (Bukhari)/3/2017

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These specifications are liable to amendment at any time and therefore is applicable only to specific enquiry made any time. For any specific enquiry, a fresh copy of specifications is to be obtained.

Director, Defence Institute of Physiology & Allied Sciences (DIPAS), DRDO, Ministry of Defence, Timarpur, Lucknow Road, Delhi-110054 is the Authority Holding Sealed Particulars (AHSP) and is the competent authority to grant any concession, if any in respect of any clause contained in these specifications.

This is a restricted document and therefore should not be communicated to anyone who is not authorized to receive it.

The store must conform in all respects with these specifications and other particulars issued with it.

Responsibility of safety: Nothing shall relieve the manufacturer of his responsibility for the safe custody of specifications issued to them for particular contract till the contract is completed. Manufacturer will also be responsible for maintenance of secrecy of the information contained in these documents.

Unauthorized departure from these specifications may involve rejection of the stores which will be inspected during and after manufacturing and will be subject to testing for final approval of AHSP.

Upon issue of amendment or introducing modifications and alteration to design, the controller will incorporate such changes into current production within a period to be agreed upon by the manufacturer or his authorized representation and the contractor.

In case of any ambiguity/doubt the sealed sample held with ASHP is to be verified.

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Specifications of Improved space heating device (Bukhari) for cold conditions

Introduction

Bukhari or the space heating device is the basic requirement in the cold conditions at high altitude. Army has provided kerosene based bukharis to soldiers deployed in cold areas. These bukharis consist of a barrel and a burner but have low operating efficiency and are safety hazards. The burner is only a metal plate and the fuel is gravity fed to the burner by a tank placed at a height. The fuel falls on the preheated plate, vaporizes and is burnt. Because of the improper fuel combustion there is generation and accumulation of deadly carbon monoxide (CO) gas in the room.

The exhaust system is usually a simple pipe which opens outside the roof bent at right angle. The winds are intense in these locations and suddenly change direction. The high wind velocity induced backdraft extinguishes the flame in the Bukhari. The flow of the fuel continues and vapour generated by red hot plate results in reignition and a sudden blast. These bukharis give out only radiative heat and a lot of heat goes waste in the form of exhausted hot flue gases.

In some of the Army units, imported kero-heaters have also been provided. These kero-heaters do not have any exhaust pipe. Any CO produced by these heaters remains in the room and ultimately CO level in the room can go considerably high.

An improved space heating device (bukhari) and burner has been developed taking into consideration all the problems mentioned above. The salient features of these devices are:

1. Bukhari is two chambered structure, one for heating air and other for flue gases so that there is no mixing of harmful flue gases in the air circulated in the room. The CO level in the room remains below the detectable level.

2. It has been designed for maximum extraction of heat so that there is minimum wastage at the exhaust level.

3. There are three level protections from the back draft, so no chance of blast or fire.

4. For better efficiency it is having both convective as well as radiative type of heating. For convective heating, air flow is maintained with the help of a DC fan resulting in uniform heating of room for better comfort.

5. To operate the fan a charge controller has been provided which supplies 6 V DC and gets charged with the main supply. For remote areas where power supply is not available, 12V, 20W solar panel has been provided to charge the battery. The charged battery provides backup for about 8 hrs after the sunset.

6. An improved backdraft proof exhaust vent has been developed as an additional safety measure. It works on Bernoulli's principle and does not allow the air to come down. It is not having any moving part and is thus maintenance free. This system can be used even with the existing bukharis and can make them safe by preventing the back draft mediated blasts.

7. The stove is a multiple wick, triple burner that is separate from the shell of the bukhari. The stove burns fuel by wicking action hence once extinguished there is no spontaneous re-ignition and no chance of explosion ever.

8. The tank of the burner has been specially designed to keep the oil temperature low.

9. . The burner is efficient and consumes only 500 ml/hr of kerosene oil. Being separate from bukhari shell, it can be used for heating of food also. For cooking or heating food a specially designed stand has been provided.

Specifications of Improved space heating device (Bukhari)

Bukhari Shell:

1. It will have double chamber design as shown in the attached diagram. There should be no leakage of gas in between the two chambers.

2. The diameter of outer chamber will be 355 mm and inner chamber will be 230 mm.

3. The diameter of air outlet pipe will be 76 mm. The diameter of exhaust pipe will be 101 mm which will be fitted at an angle of 45° to allow the free flow of flue gases. Three horizontal plates will be fitted between outer and inner chamber to extract the heat and break the impact of the air. These plates will have alternate cuts as shown in the diagram.

4. The inner cylinder will have diameter of 101mm and height of 390 mm. It will have three cuts of 75 mm x 35 mm at the lower edge for the free flow of air on the base plate. A cone of 170 mm diameter and 75 mm height will be fitted on the top of this cylinder.

5. Paint will be black and heat resistant.

6. Legs will be detachable. Height of the leg will be 228 mm and there will be three slots on the lower side of shell to fix the legs. Leg will be made up of 25mm x 25mm square pipe having shape as shown in the diagram.

7. A DC fan of 6V will be fitted on the top for the air movement in the inner chamber which will operate by a charge controller unit. This unit will be charged both by mains supply as well as by solar panel. The fan assembly will be covered by a wire mesh.

8. A stand will be provided as shown in the diagram which will be used with burner for cooking or warming of food.

Pipes:

1. The outer diameter of the pipe will be 101 mm.
2. Total length will be approx. 9 ft in three pieces of 964 mm each.
3. Each part will have collar of 100mm length for overlap on the other segment to avoid leakage. The outer diameter of collar will be 106 mm.
4. One elbow joint with same diameter and collar size will be provided to fix the pipe through window hole. Detailed specs as per diagram.

Back Draft Protector:

1. Will have diameter of 104 mm and collar for fitting on the top of exhaust pipe.
2. Detailed design as per diagram.

Material to be used:

For all the parts i.e. bukhari shell, pipes and backdraft protector mild steel sheet of 20 SWG will be used except for the base plate exactly above the burner which will be of 16 SWG.

Triple Burner stove:

1. It will be wick based stove having three heads as shown in the diagram.
2. Each head will have 10 wicks of 20 inch length. Each wick should have about 140 -150 threads and should fit in a pipe of 7mm diameter. The diameter of outer pipe will be 9.5mm
3. Kerosene tank capacity should be approx. 6 Litres.
4. Will have knob to control the level of wicks.
5. Gaskets should be of silicon.
6. Should have metallic fuel gauze to check the level of oil inside tank.
7. The sheet thickness will be 22 SWG with chrome plating on all the parts except two meshes which will be made up of 30 SWG MS. The size of mesh holes will be 1.6-1.7 mm.
8. Detailed dimensions should be as per attached diagram.

Stand for cooking food:

1. Should be able to withstand weight up to 20 kg.
2. Will be made up of square pipe of 25 mm and will be foldable.
3. Details dimensions as shown in the diagram.

Charge controller and fan assembly:

1. It will have a female input sockets for solar panel connector (6.5 mm mono jack) and a lead for 220V main supply.
2. Will have SMF battery of 12V, 7.4 Ah.
3. Output voltage will be 6V 500 mA DC to operate the fan.
4. It will have indicators for AC charging, Solar panel charging and low battery. Should have provision for auto cut off after full charging.
5. Box should be metallic and painted.
6. Fan motor should be sturdy and capable of tolerating temperature upto 100° C. Fan wire should be 1.5 meters long, double core 1mm and pure Teflon coated, capable of tolerating temperature from -20°C to + 400°C. Whole fan assembly will be covered by SS mesh.

Solar panel:

1. It will have capacity of approx 20 W.
2. Should have lead of 4 meters and connector (6.5 mm mono jack) for connection to charge controller.

Spares

1. 3 Extra set of wicks for three burners
2. Funnel for filling oil. The plastic should be of fine quality to withstand the extremely low temperature at high altitude.
3. Device for igniting and putting off burner
4. Spanner for tightening legs and fan nuts

Packaging: Heavy duty box constructed using 7 ply, 22BF cardboard to be used for packaging. Thermocoal sheet or bubble packing should be provided wherever necessary for the protection of equipments. A metal plate with engraved DIPAS logo to be fitted on each bukhari shell. The packaging box box should have details about manufacturer's address, date of manufacturing and serial number.

Pre-inspection by the manufacturer:

Manufacturer/ contractor must satisfy themselves first by carrying thorough inspection of each lot that the stores manufactured are in accordance with contract and fully confirm to the specification requirements, before tendering to QA officer nominated under the terms of contract.

A declaration by the contractor that necessary pre- inspection/tests have been carried out on the stores tendered and the same are fit for inspection and test shall be rendered along with the challan.

If the Quality Assurance Officer finds that pre-inspection of the consignment as required above has not been carried out, the consignment is liable for rejection.

Quality Assurance

For quality assurance samples will be picked randomly to conform the requirements laid down in the specifications.

Manufacturer/ contractor should get the approval for the raw material from the ASHP before proceeding for the fabrication to ensure quality of stores.

The supplier will provide the stores serially numbered and arranged in such a way that the entire lot is easily accessible to the sampling officer. The randomly selected Bukhari, burner, charge controller, solar panel and complete set will be checked for following points.

Points of inspection in bukhari

Overall dimensions
Welding quality
Paint quality
Sheet thickness
Checking of leakage or gap in the welding using light
Any noise during fan operation
Proper fitting of legs
Proper overlap of collar in exhaust pipe and exhaust vent

Points of inspection in burner

Overall dimensions
Leakage of oil from tank and from gasket
Proper blue flame
Proper fitting of both the meshes (Jalis)

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Points of inspection in burner

Overall dimensions
Leakage of oil from tank and from gasket
Proper blue flame
Proper fitting of both the meshes (Jalis)

Proper movement and functioning of control knob

Points of inspection in charge controller

Overall dimensions

Ruggedness of body and switches

Battery quality

Proper functioning of all the indicators

Proper charging and discharging cycle

Proper output voltage and operation of fan

Charging with mains and solar panel

Proper length and quality of input and output leads

Points of inspection in solar panel

Overall quality

Proper fitting of frame

Wattage

Proper charging

Quality of lead and sockets

Points of inspection during testing of complete set:

Heat generation i.e air temperature at outlets should be around 80-90°C

There should not be any smell in the room i.e oil or paint burning smell

Oil consumption should be around 500-700 ml/hr

Warranty

Except as otherwise provided in the invitation to the tender, the contractor/manufacturer hereby declares that the goods, stores articles sold/supplied to the purchaser under this contract shall be of the best quality and workmanship and new in all respects and shall be strictly in accordance with the specifications and particulars contained /mentioned in the contract.

The contractor/seller hare by guarantee that the said stores would continue to conform to the description and quality aforesaid for a period of 24 months from the date of delivery to the purchaser. During the aforesaid period of 24 months the said stores if found not to conform to the description and quality aforesaid and not having satisfactory performance or have deteriorated; the decision of

the purchaser in that behalf shall be final and binding on the contractor/seller to rectify/replace by acceptable stores.

Terms and conditions: DRDO TOT holders of Improved Space heating device (Bukhari) are only eligible to participate in the tender.

Technical Specifications

Sheet thickness (Mild steel)	20 SWG, Base plate 16 SWG
Height of the bukhari	445mm
Height of the legs	228 mm
Total height	765 mm
Outer Diameter	355 mm
Diameter of inner chamber	230 mm
Diameter of inner cylinder	101 mm
Height of inner cylinder	390 mm
Diameter of exhaust pipe	101 mm
Total length of exhaust pipe	964 mm
Length of Collar	100 mm
Diameter of Collar	104 mm
Diameter of air outlet pipes	76 mm
Diameter of fan blades	150 mm
Motor rating	6V 600 mA
Solar panels	12 V 20 W
Charge controller Batteries	12 V 7 Ah
Output	6V
Charging time	10 -11 hrs
Backup time	8-10 hrs
Capacity of the burner tank	6 liters
Oil Consumption	500 -700 ml/hr
Overall weight including burner	Approx. 23kg (excluding oil)
Room Volume for max efficiency	1000-1200 cu ft

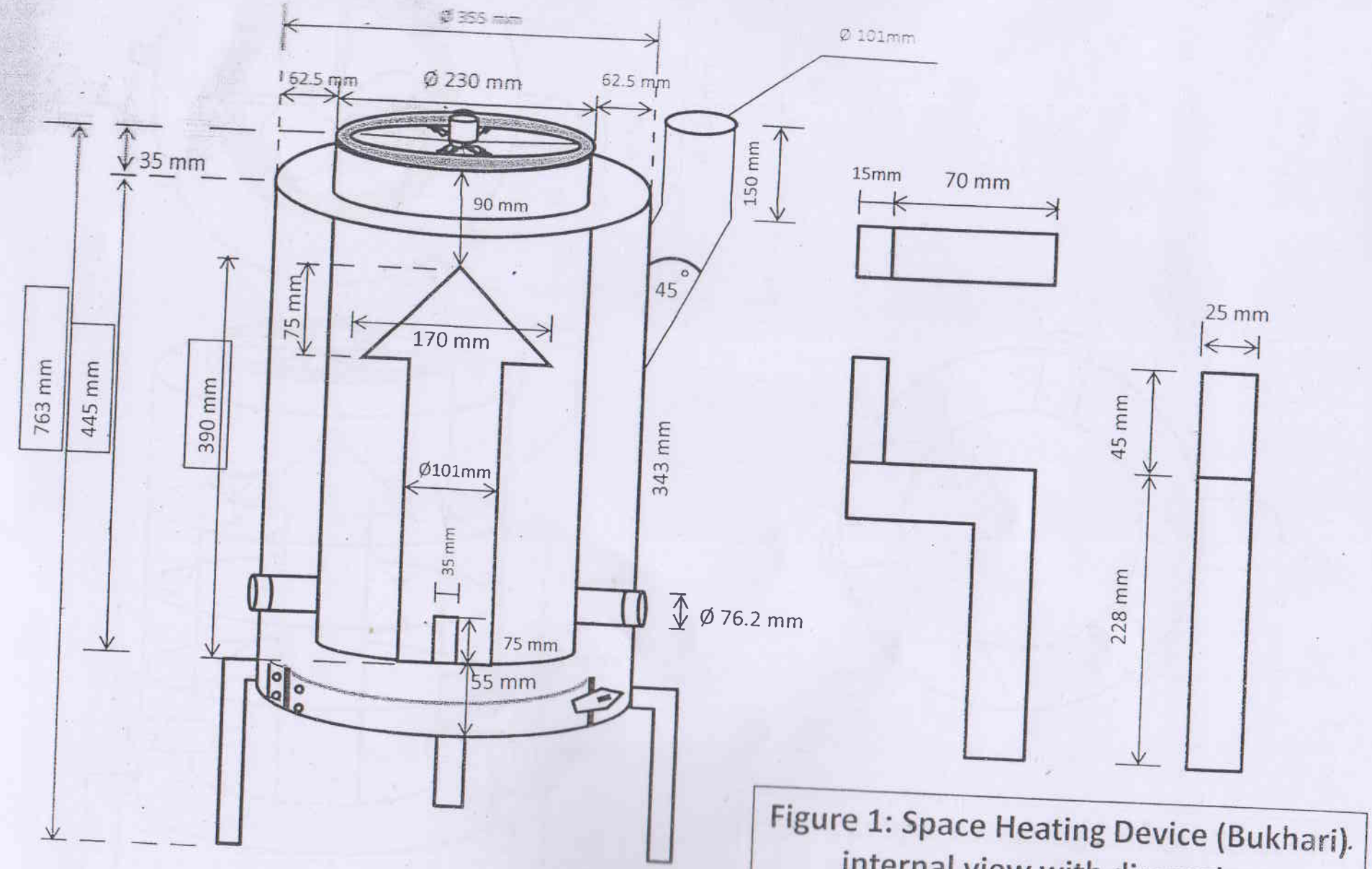
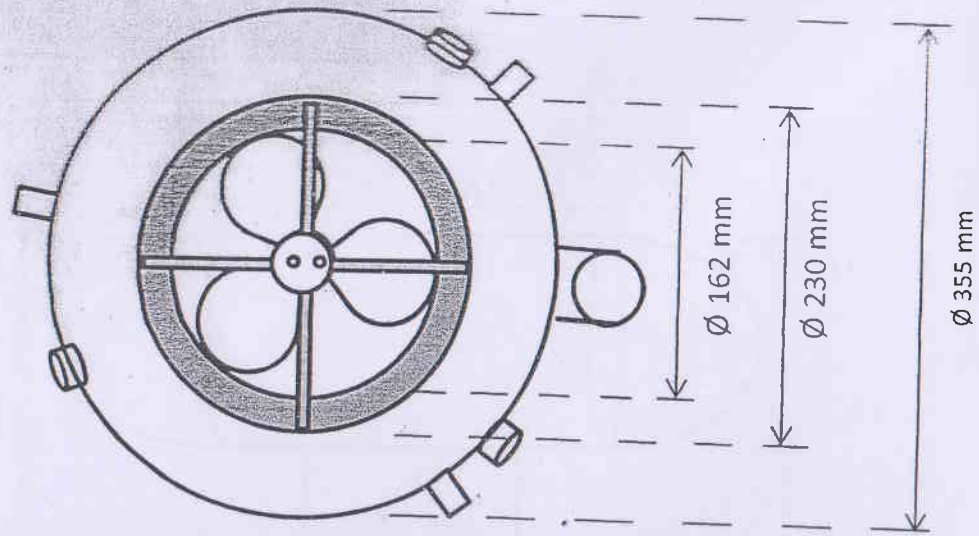
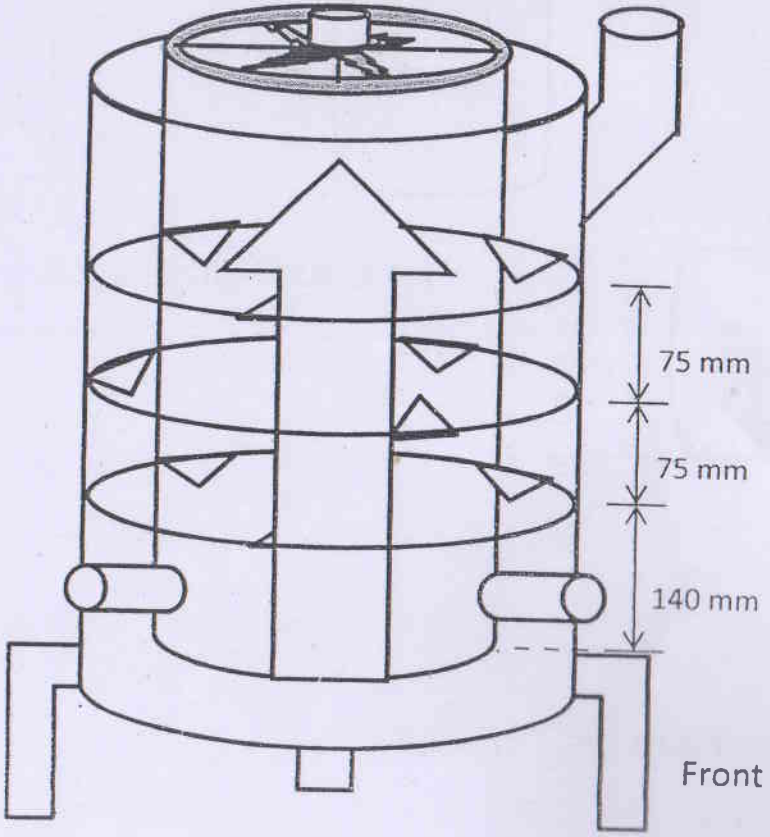
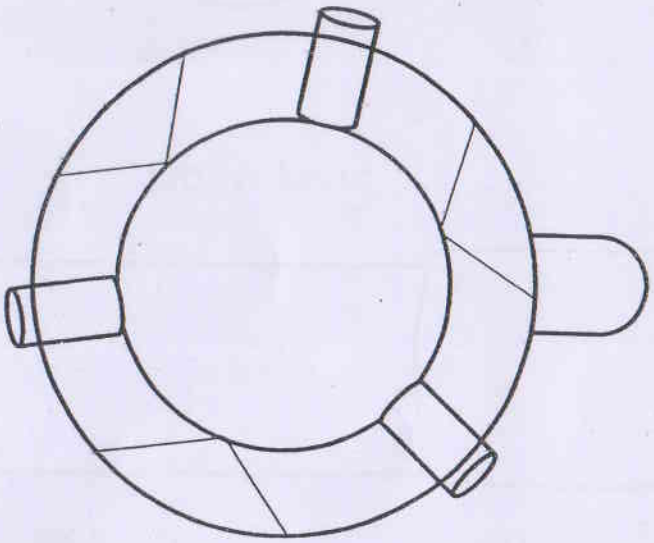


Figure 1: Space Heating Device (Bukhari). internal view with dimensions





Front view



Bottom view

Figure 2: Space Heating Device (Bukhari) internal view with dimensions

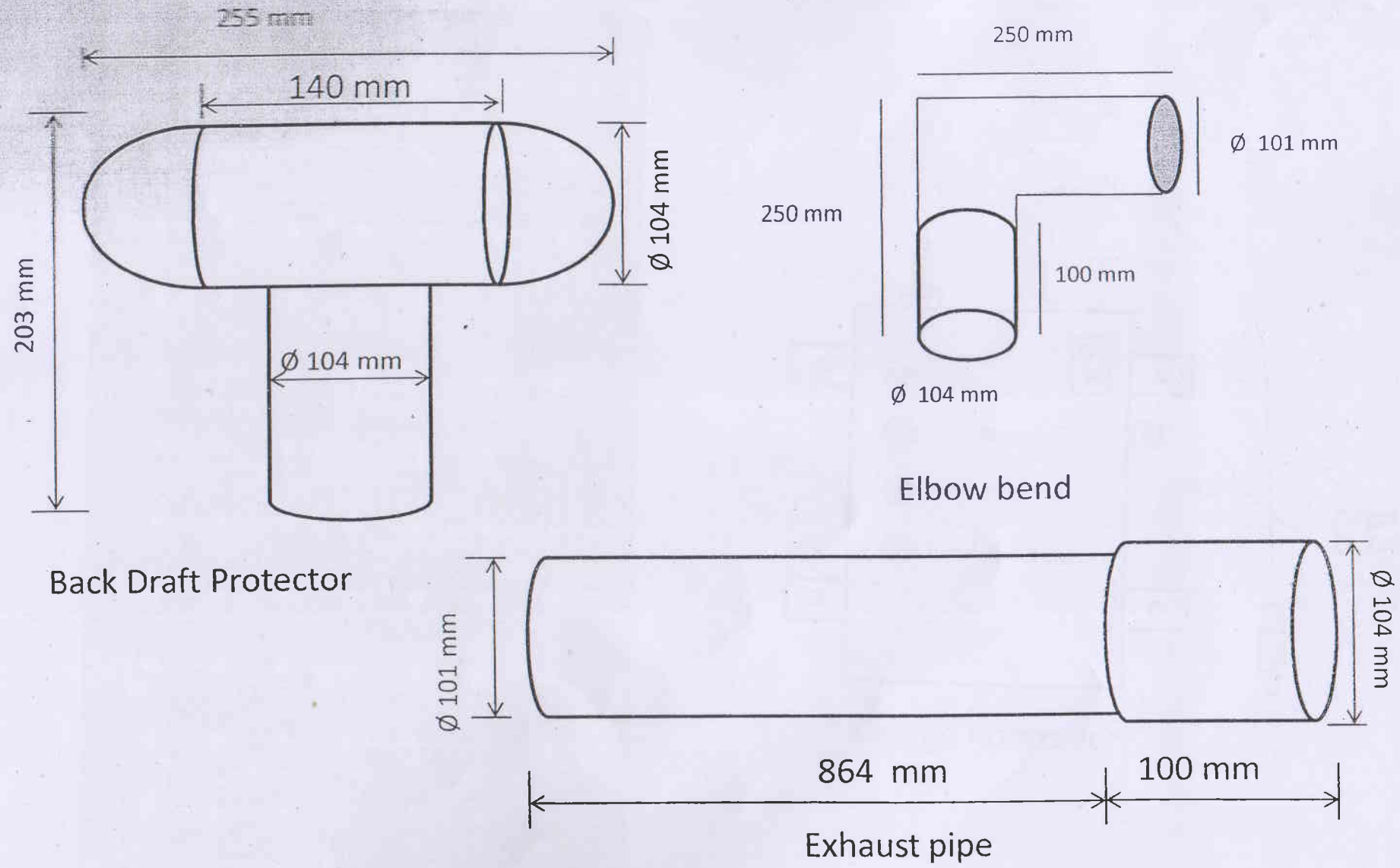
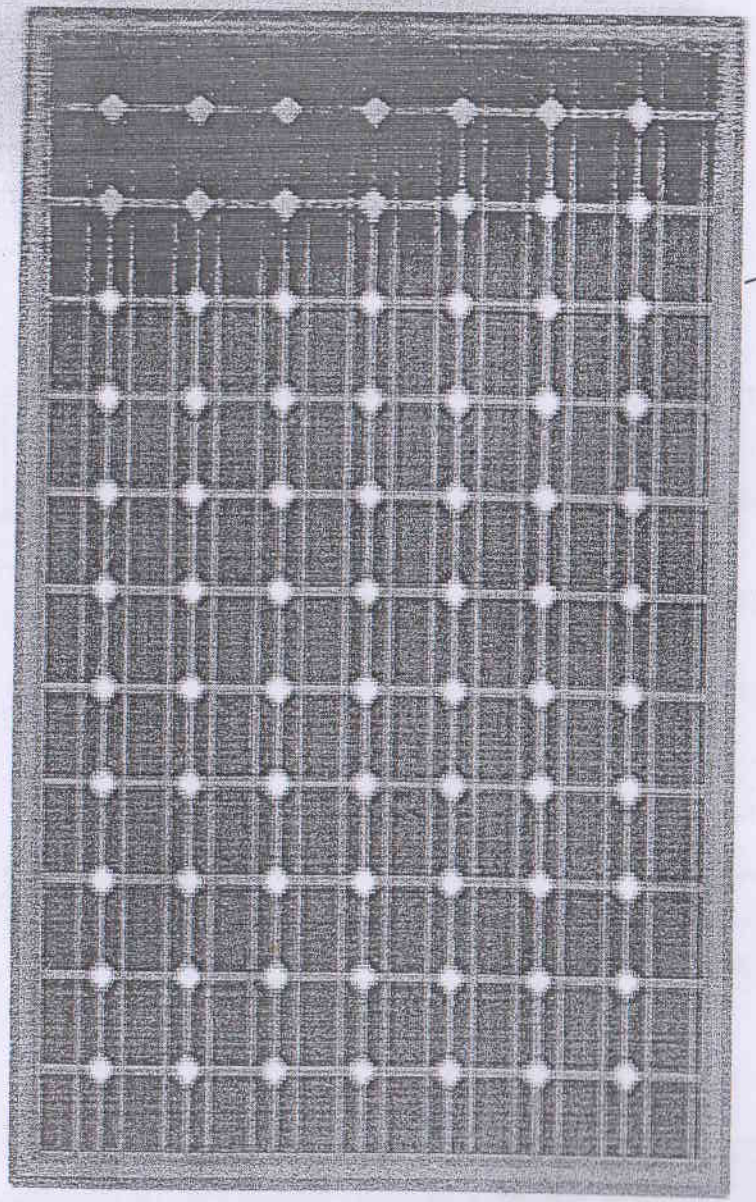
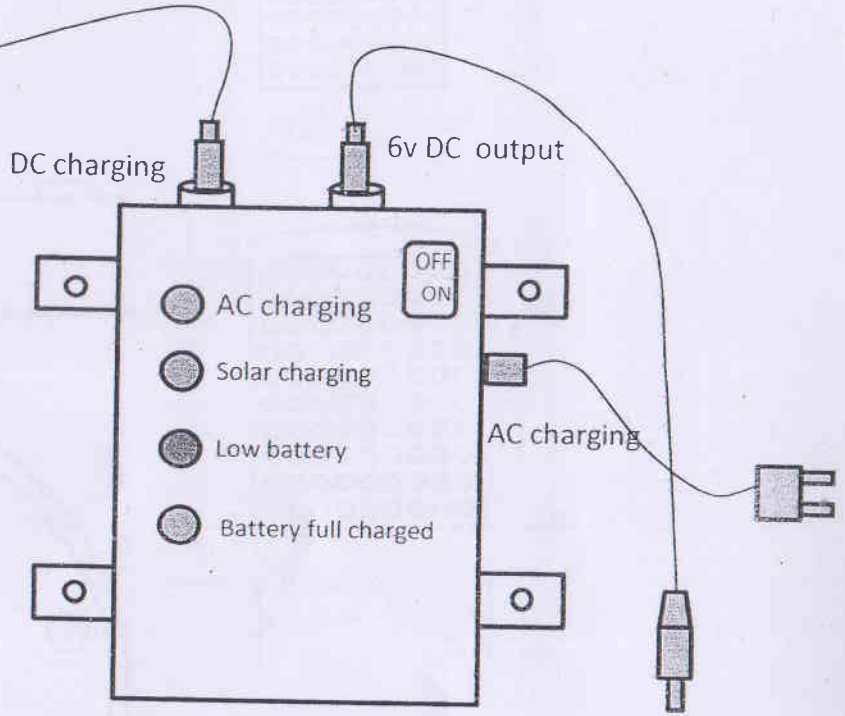


Fig. 3: Backdraft protector, elbow bend and exhaust pipe

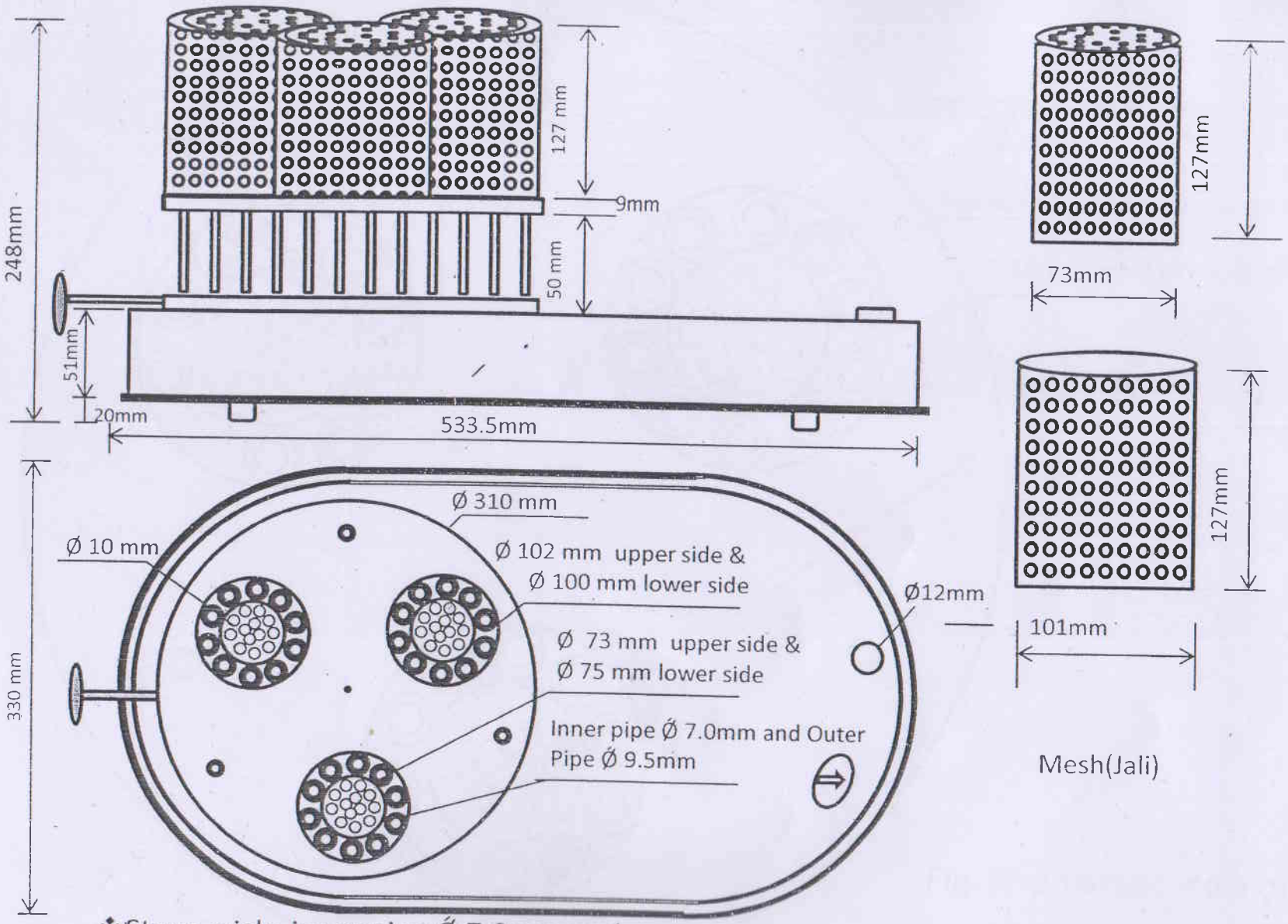


Solar Panel



Charge Controller

Fig. 4



❖Stove wicks inner pipe Ø 7.0mm and Outer pipe Ø 9.5mm

Fig. 5: Kerosene Burner with dimensions

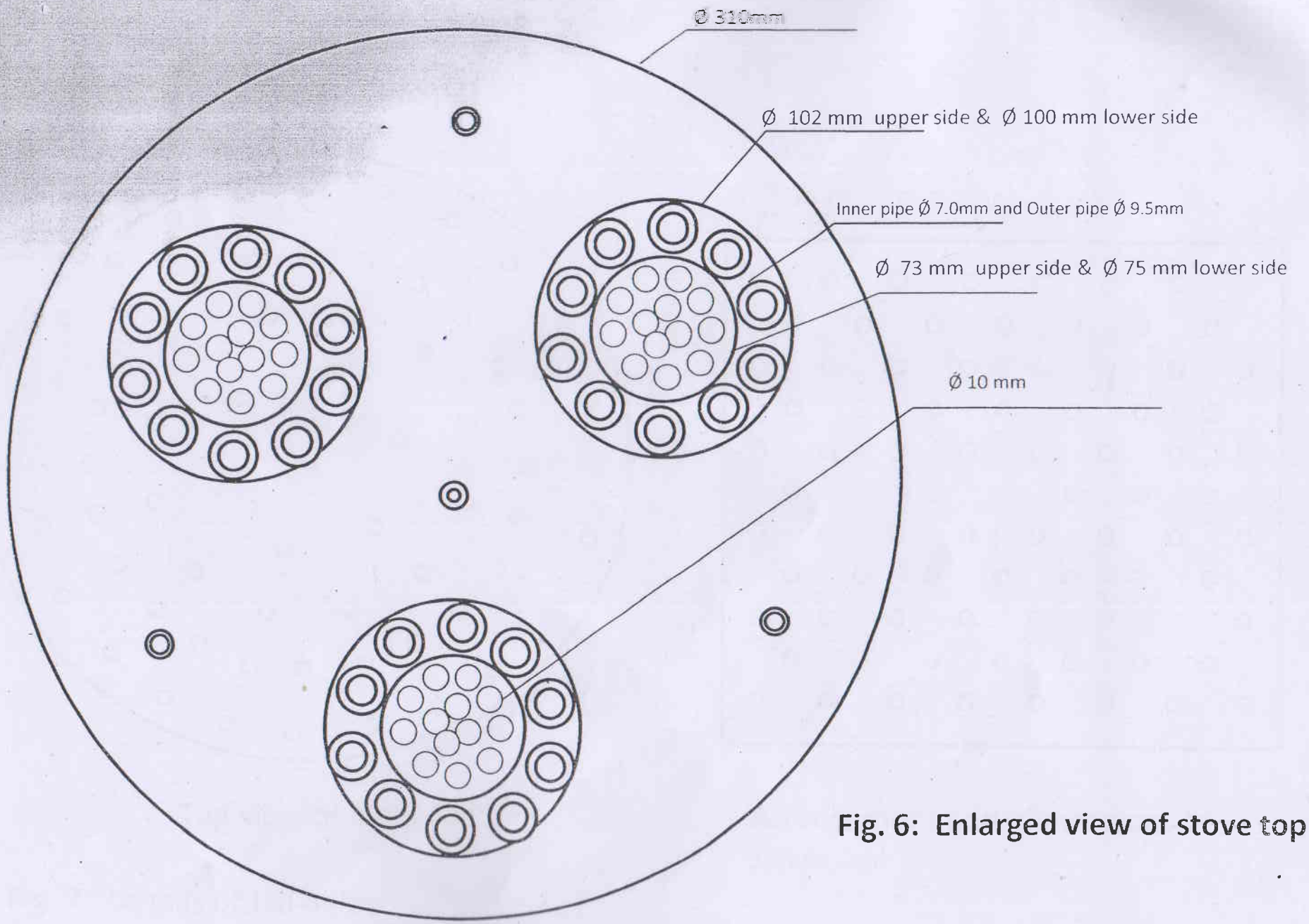
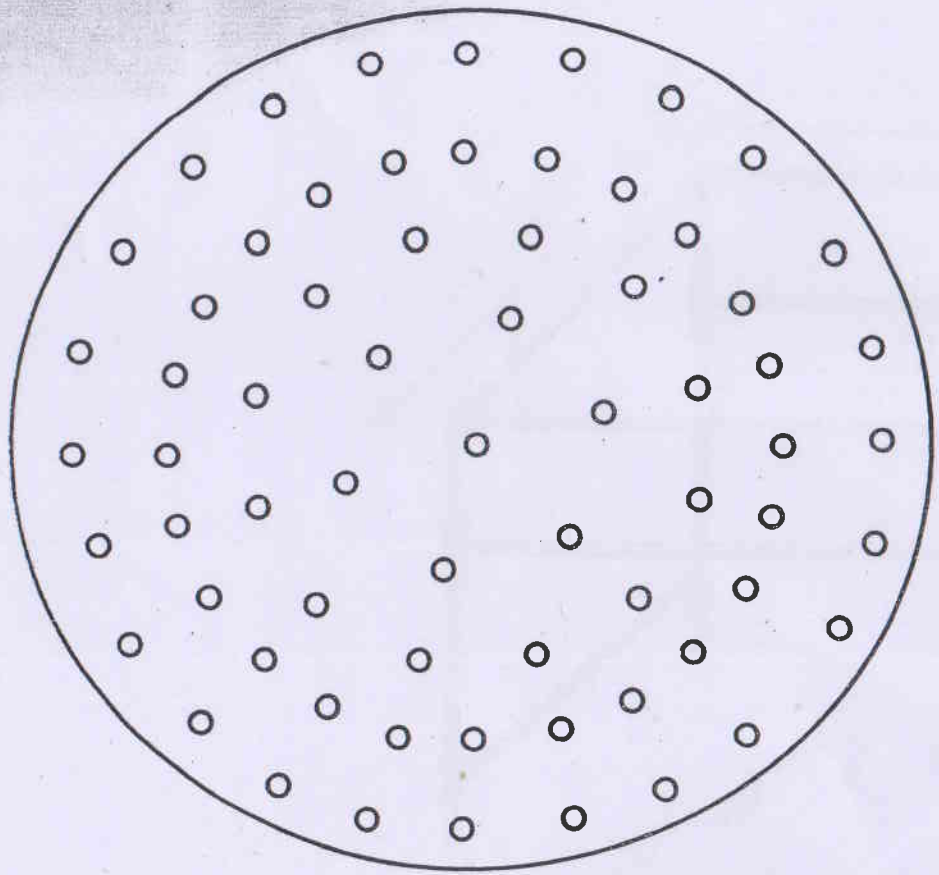
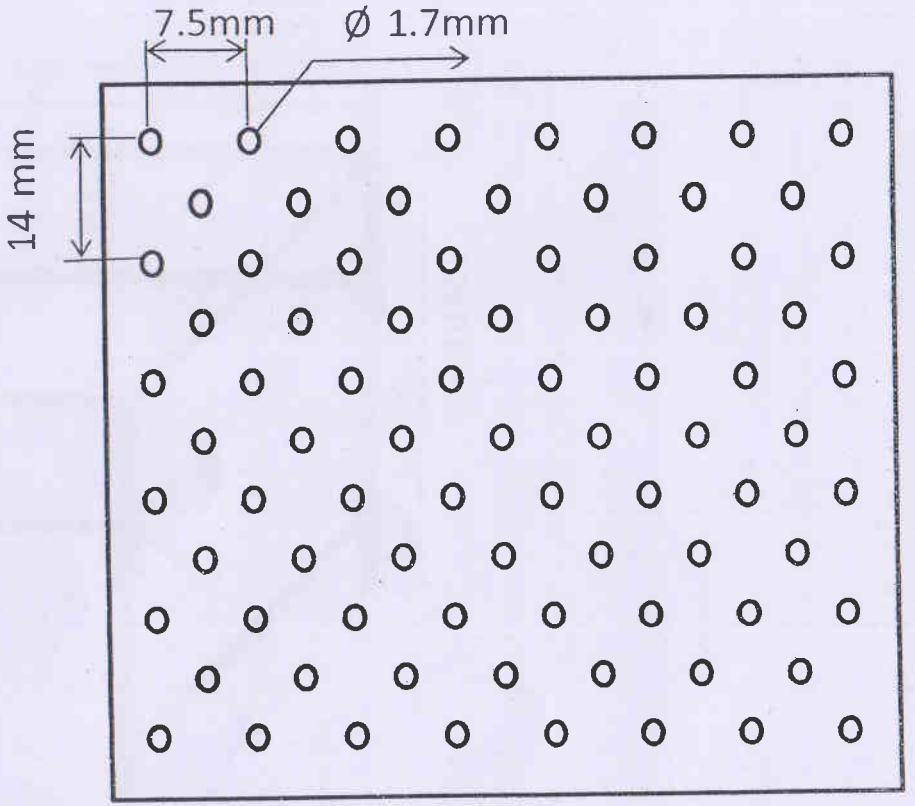


Fig. 6: Enlarged view of stove top



Top view of inner Jali



Arrangement and dimensions of Jali holes

Fig. 7: Details of Jali holes

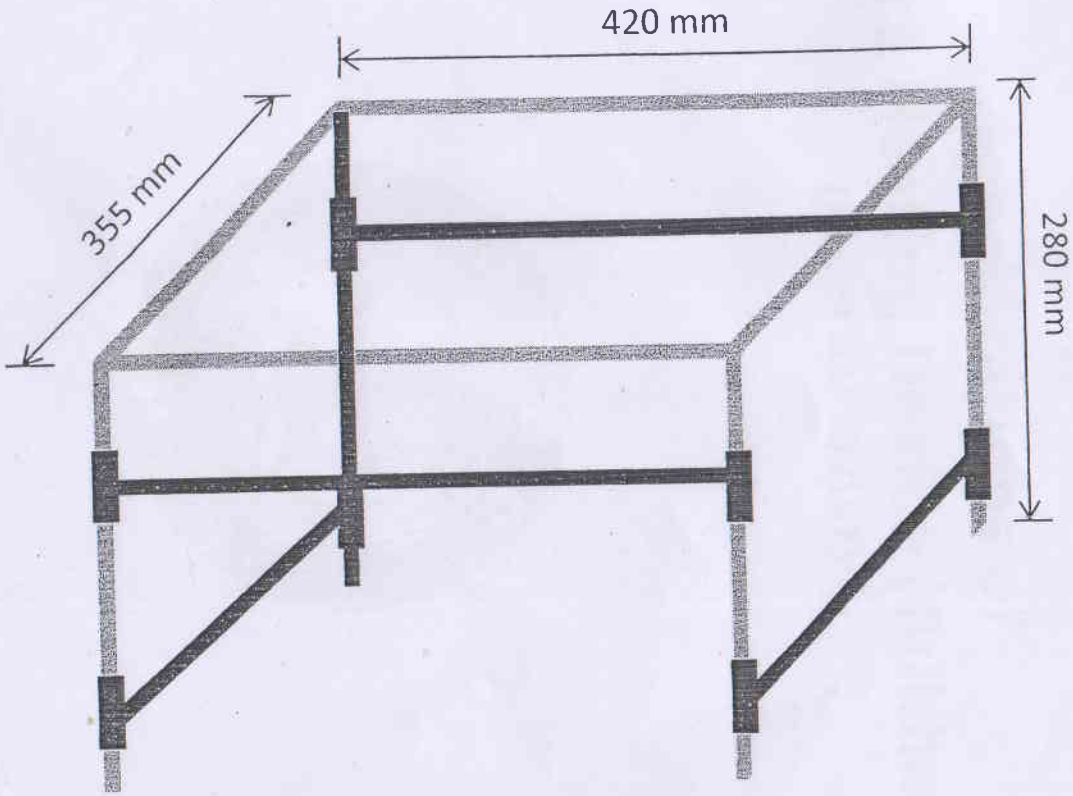


Fig. 8: Stand for cooking