

FIRE BUG KILNS

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Kilns to your design



Low cost firing

Portable

Lower cost

LPG

Variable atmospheres (oxidation and reduction)

WARNING

Ceramic fibre blanket is composed of compressed fibres of alumina and silica.

During the making of this design kiln the blanket will release a certain amount of fibre and dust **which can be harmful** especially to those with respiratory problems and/or sensitive skins.

I **strongly** recommend the use of a good quality respirator, clothing that covers all skin, and rubber gloves at all stages of construction. Eye protection and ear protection **must** be worn whilst using an angle grinder.

DECIDING ON SIZE OF YOUR KILN

The kiln design is based on the size of shelves that you decide to use.

A decision must be made at this point to the uses or capabilities of the kiln in regards to the size and type of work to be fired.

ITEMS TO BE MADE BEFORE STARTING

There are a few items that you will need to make yourself such as:

- specialised ceramic forms (see appendix)
- buttons to hold the fibre in place
- flue manifold,
- spy hole surround and bung
- burner port
- thermocouple surround

All made from equal amounts by weight of Grog, Kaolin, Fire Clay.

TOOLS REQUIRED

- Angle Grinder
- Welder (MIG or electric arc)
- Hacksaw
- Needle nose pliers

MATERIALS LIST

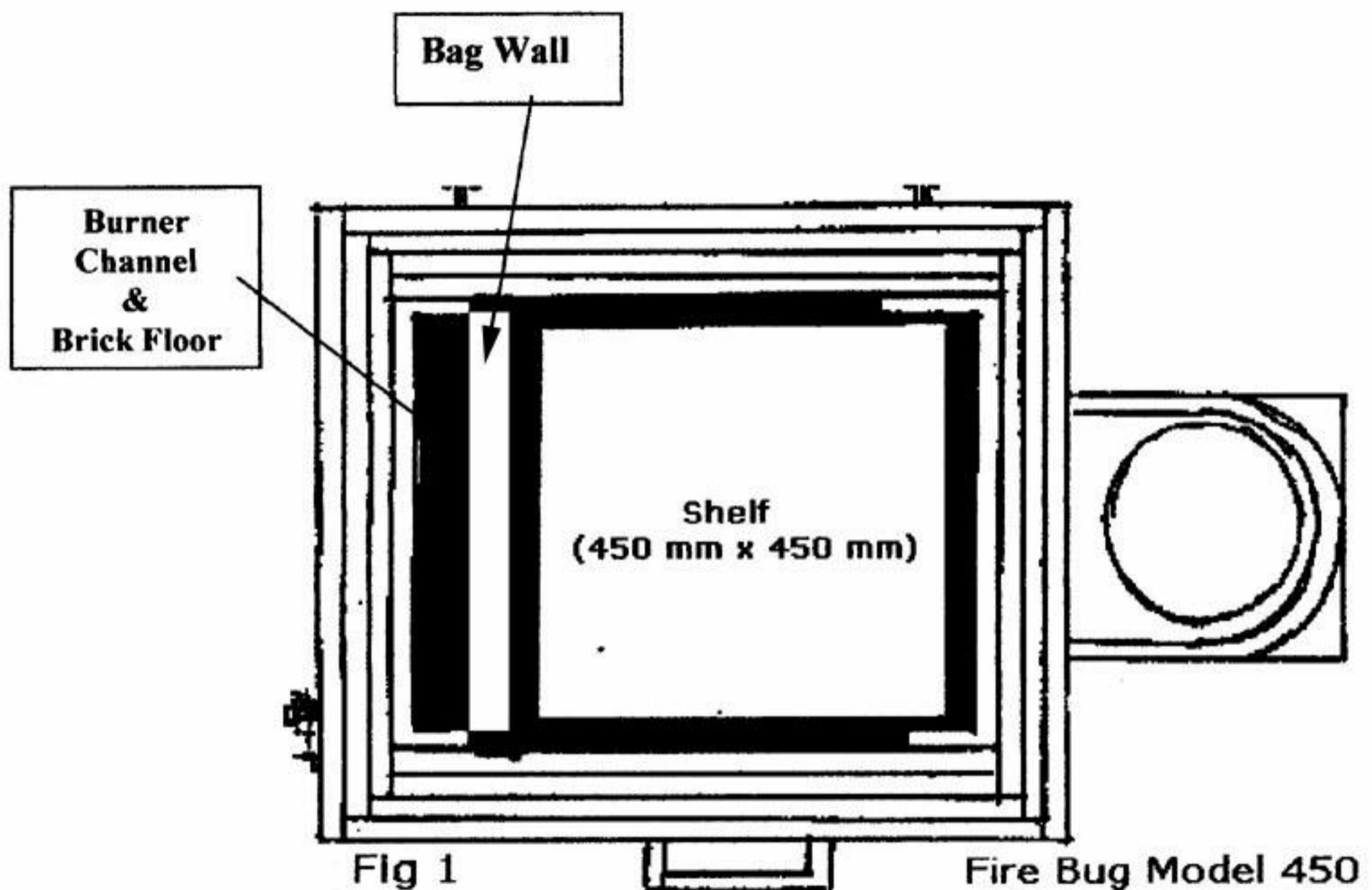
- 50 x 50 x 3 galvanised angle (or similar)
- 45 x 60 galvanised mesh (or similar)
- 50 x 6 flat bar
- Compressed cement board
- Bricks refractory type
- Aquidhere***" (glue)
- Aluminium foil
- Fibre Blanket 280 kg per cubic metre standard
- Fibre Blanket 280 kg zirconia (hot face only)
- Buttons, spyhole, burner port, thermocouple hole, manifold: these items made from Fire Clay, Kaolin, Grog (ref. Pg. 13)
- Nichrome Wire
- PVC Pipe aprox. 10 cm diameter
- Sodium Silicate
- Flue pipe
- 2 Bolts and nuts 10 x 20
- Sheetmetal side and top protectors (optional)
- Handle for Door (25 x 25 RHS)
- Burner set up: burner, needle valve, safety cut-out valve, thermocouple, 3m high pressure hose, regulator, pig tail, burner stand
- Pyrometer and probe
- Bagwall, shelves, props

Construction

DETERMINING THE FRAME SIZE

The size of the frame is determined by the maximum size of the base shelf.

For example the Fire Bug 450 model has a base shelf size of 450 by 450 mm.



I have started with a 450 mm x 450 mm square shelf.

Added around this 40 mm all round for air circulation. In my design, the burner fires from the front left, so 25 mm is added for a bag wall then 100 mm is added for the burner channel.

What you now have is the inside dimensions of the kiln. Another 100 mm is added around all sides. This allows room for the fibre. You can add on the thickness of the angle yet it is negotiable. You should now have the outside measurements of your kiln.

DETERMINING THE HEIGHT OF THE KILN

To find the height, I start at the bottom and work up.

I allow 3 mm for angle iron; add 6 mm for compressed cement board to place bricks upon, the thickness of bricks which can be placed on their flats which will require you to add 80 mm or placed on their sides is what I prefer, giving better insulation properties: add 110 mm, then add 600 mm for the height of the fibre blanket. This will give you the height of the kiln.

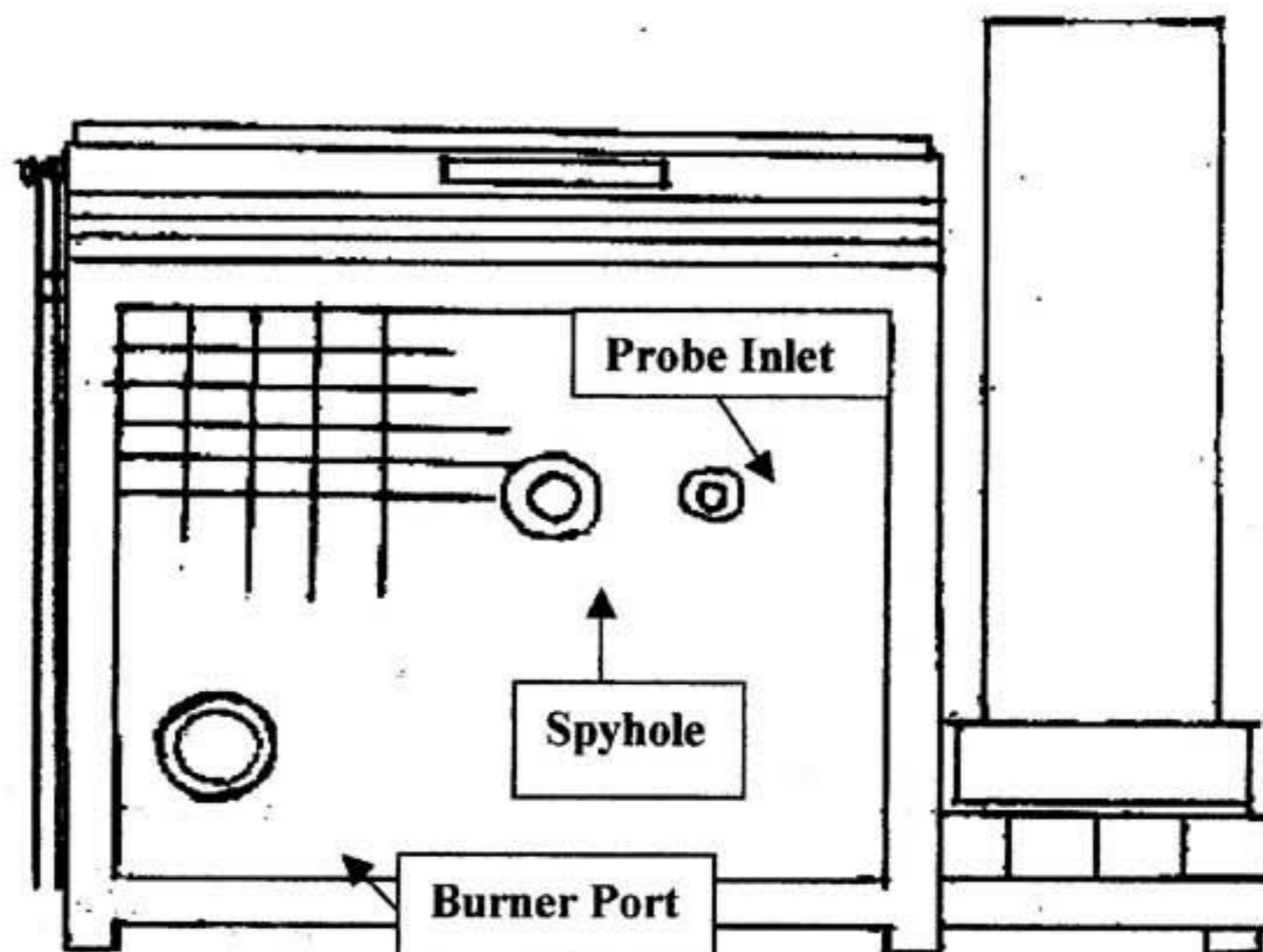


Figure 2
Fire Bug Model 450

You could go higher if you want, but

- the fibre comes only in 600 mm widths;
- there will be a lot more cutting and wastage with a greater height;
- you have to remember if the kiln is a top loader, leaning into it should not be too deep to be uncomfortable or dangerous for your back;
- the more joins in the fibre allows heat loss and should be kept to a minimum

The door/lid is the same dimensions as the outside of the kiln (FIG 1). The lid may twist with heat distortion after mesh is welded in and cross bracing may be necessary on top of door corner to corner to straighten or prevent this.

FRAME BUILDING



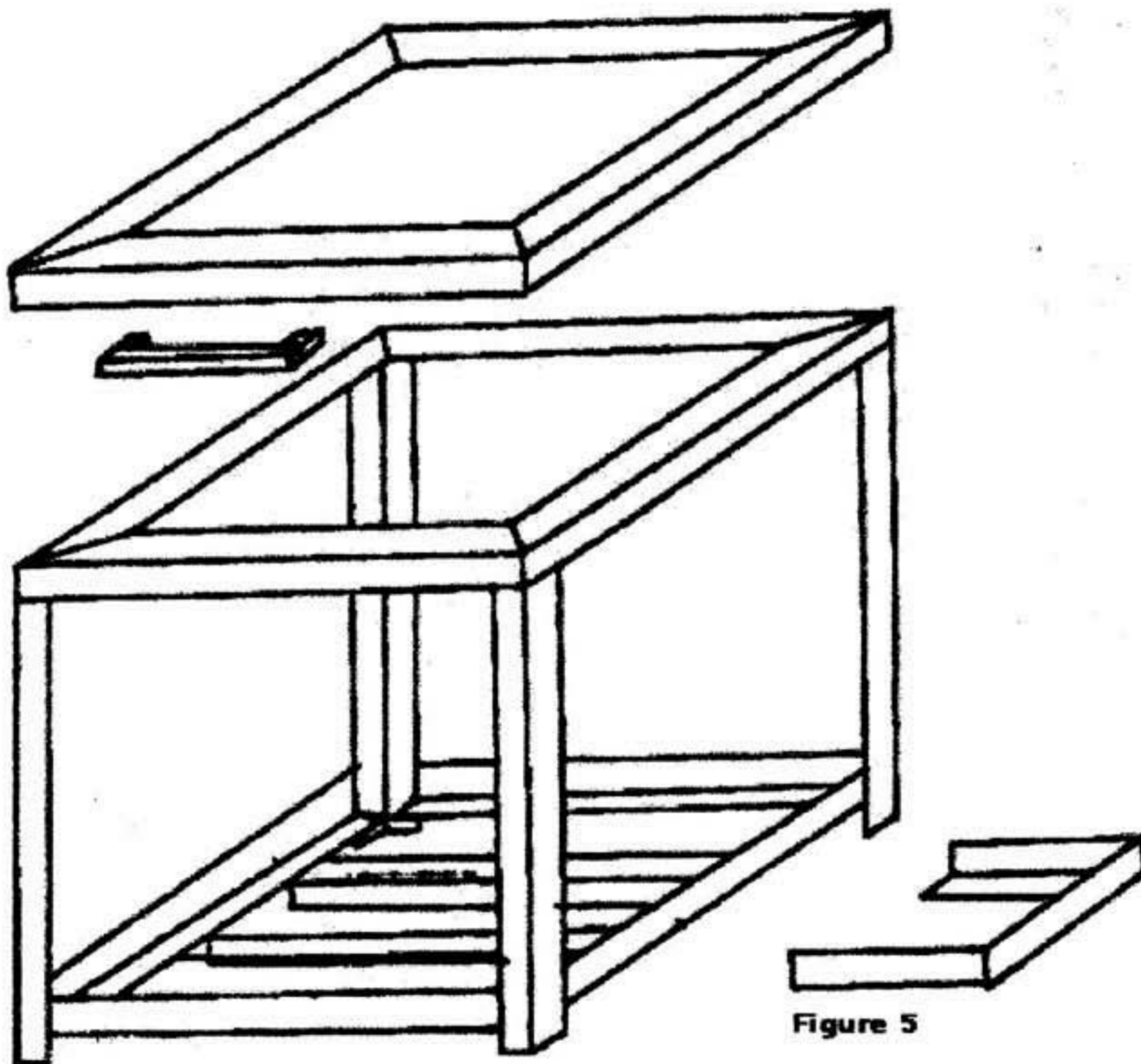
Process:

Cutting sizes – I build the frames in nine (9) processes.

1. Make door and the top of the kiln first. Both these items are the same size, so build the door first and use this as a template to make the top of the kiln.
2. The sides and legs are in one piece, welded to the underside of the top of the frame on each corner.
3. The base angles are welded in next – 50 mm from the base.
4. Cross bracing for strength in the floor (see Fig 3 or Fig 5) is welded in.
5. Flue angle welded to the centre right hand side of the kiln frame. 50 mm piece of angle under flue section for weight support.
6. Mesh cut and welded to angle frame. This can be welded so as it sits flush with outside of frame or cut to a slightly larger size than internal angle dimensions and welded on top. Either is acceptable.

7. Door is placed on top of frame lifted to the level it will finally sit 75 mm spacers can be used (blocks of timber) and hinge plats welded into place.
8. A handle made from 25 mm x 25 mm RHS (square tube) is cheap and neat welded on to front of frame.
9. Last but not least ,a nut welded onto the right side of the lid (see picture page 18) to affix the bar/rod to hold the door open when loading/steaming.

Paint frame in black or a heat resistant paint to give a professional appearance – also stops areas of bare metal from rusting.



COMPRESSED CEMENT BOARD

Simply cut compressed cement board so as it fits into base of kiln.

Also, a piece of compressed cement board is needed for the flue area. Compressed cement board should be at least 6 mm in thickness. This is here so that bricks can be laid on floor and it also has some insulation properties.



FIBRE BLANKET

There are a few rules that should be followed when installing the fibre blanket. First, respiratory equipment, skin covered (arms, legs, hands), wear gloves. That's the Occupational Health and Safety side covered. Remember joints should be staggered not placed on top of each other, to reduce heat escaping from kiln and saves energy. The fibre blanket to be used is the 280 kg per cubic metre for the first three (3) layers.

The first section of fibre will be the bottom layer – the same height as the bricks which is 80 mm on their flat or 110 mm high, the same as I do it. A 600 mm side section is placed above this.



Start with the shortest side first then the longer side. On the fibre you will see that on one side small pin holes, this faces to the outside of the kiln.

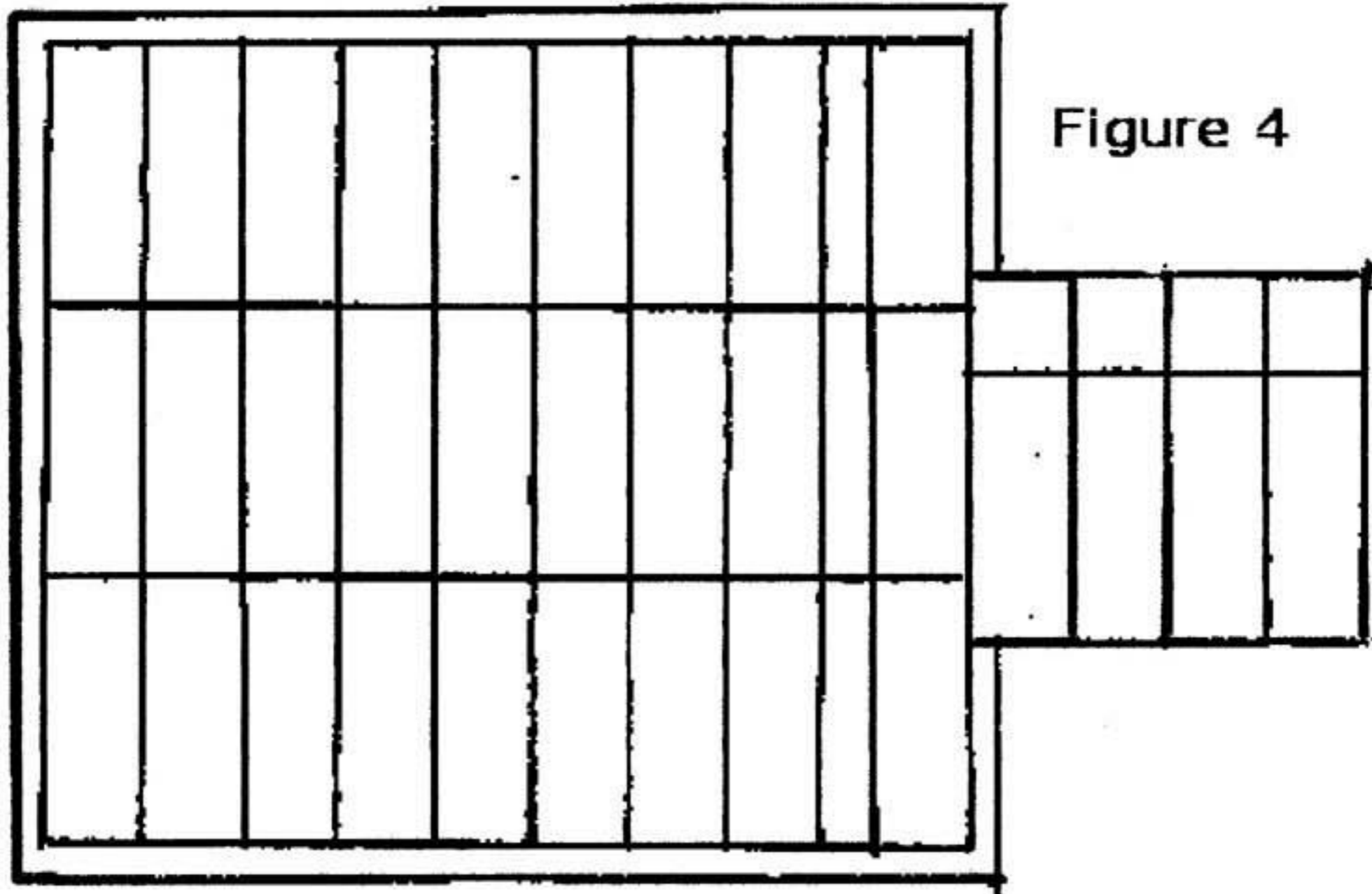
To flatten out the blanket and not to compress it too much, a square piece of flat board can be pushed against the fibre. A board approximately 500 mm x 500 mm will do the job.

The next layer is the same process as the first layer except first to be put in is the 600 mm high section short side first then longer side then the small 110 mm or 80 mm strip at the top.

This then to be slightly compressed with your piece of board. Now you have two layers completed and starting to look like a kiln.

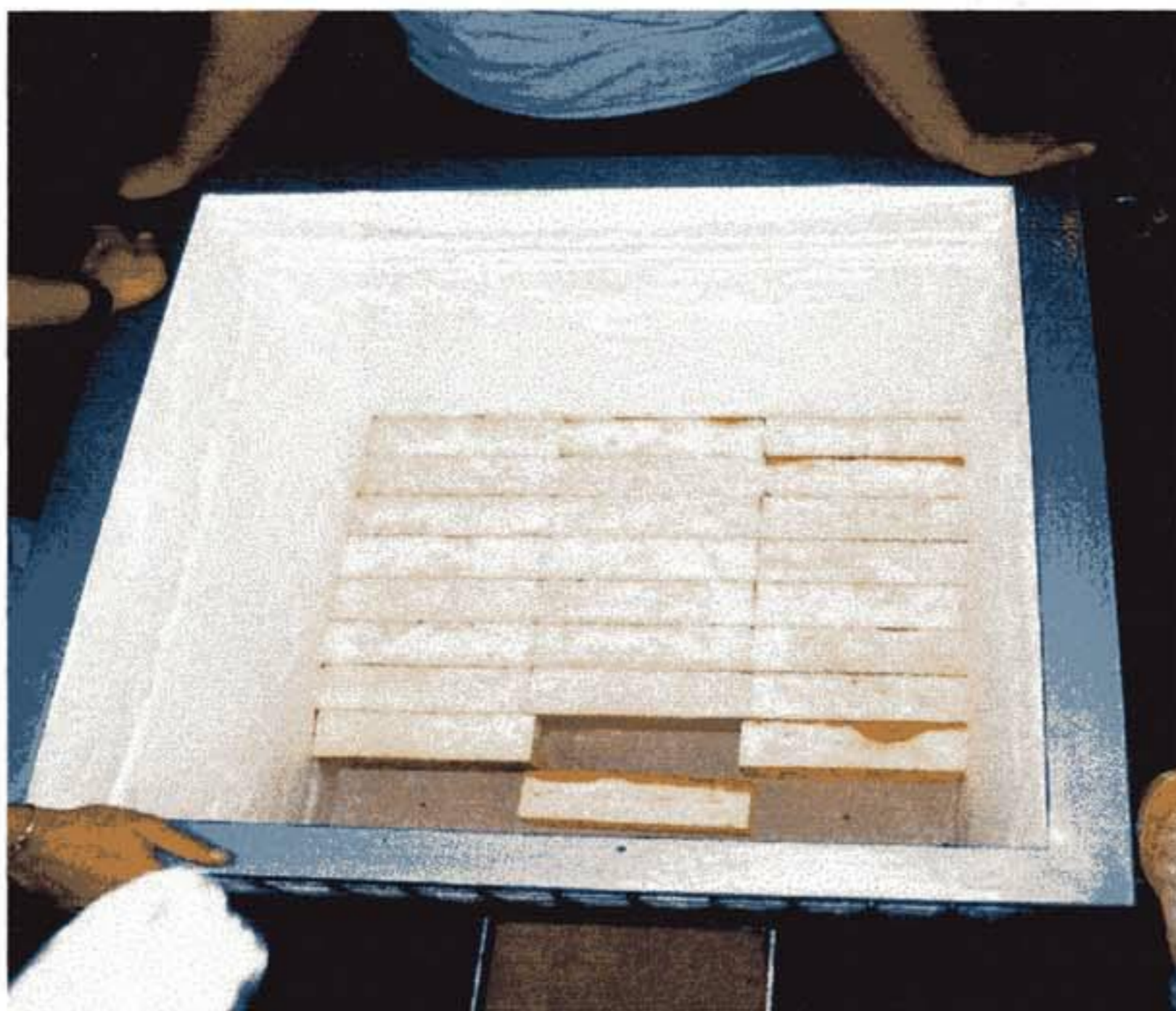
INSTALL BRICK FLOOR

You have by now decided on what configuration you want your bricks to sit, whether you want them flat to reduce the number of bricks, or on their side as in FIG 4.



You start at the corners and place the bricks in until you can't fit a full sized brick.

Compress the fibre to about half the size – 25 mm or near there. Measure the cut brick to give you a tight compression and slowly slide this brick into place. Be patient – it does not have to be super tight, don't risk breaking the bricks.



The flue base is slightly different. The bricks need to be placed in along side the angle and notch out the brick where the angle is going into the kiln so as there is no gap in between the inside of the kiln floor to the flue area, as to minimise heat escape, and better fuel consumption.

INSTALL ALUMINIUM FOIL



Ordinary aluminium foil is used here to cover all the previously fibred area. It is simply applied with wood glue, Aquadhere with 50 mm overlapping areas. The foil will help stop the kiln from venting where not wanted, therefore, having better control over the atmosphere within the kiln.

INSTALL NEXT FIBRE LAYER

The next fibre layer is as the same as previous: 280 kg per cubic metre blanket. This is an easier layer to install due to it only being 600 mm in height. As before, start with the shortest side then the longest and compress with the 500 x 500 board.

INSTALL HOT FACE LAYER

This is the other blanket you have bought and the more expensive 280 kg per cubic metre Zirconia blanket. Virtually same as before yet start with the longer side (See FIG I page 4). The shorter side, the last side is slightly different.

You have to measure the blanket so as it can go around the corner of the inside of the kiln.

Allow at least 200 mm or so extra, the edges or ends that remain after fitting can help hold the bag wall in its place. When fitting this layer, take specific care to compress the corners into place as the kiln gets fired the fibre over time shrinks and you don't want the corners to round off.

Use the board to compress the corners as tight as possible.

That's it – the main body of the kiln is completed.

Repeat these steps from the first fibre layer, remembering that layers have to be staggered to the foil layer and another 280 kg per cubic metre to the hot face layer, 280 kg per cubic metre Zircon on the door.

If you want another layer of blanket can be added to the door, if you want. This is not compulsory, yet I do this as heat rises and the top cannot help but benefit from this extra refractory help.

INSTALL BUTTONS

Buttons are made from equal amounts of Kaolin, Fire Clay, and Grog by measurement weight. I roll slabs of the made clay and cut them out with an egg ring. This seems to give a nice size and add a lug of the same clay to the back of the buttons to fasten the Nichrome wire (see FIG 6).

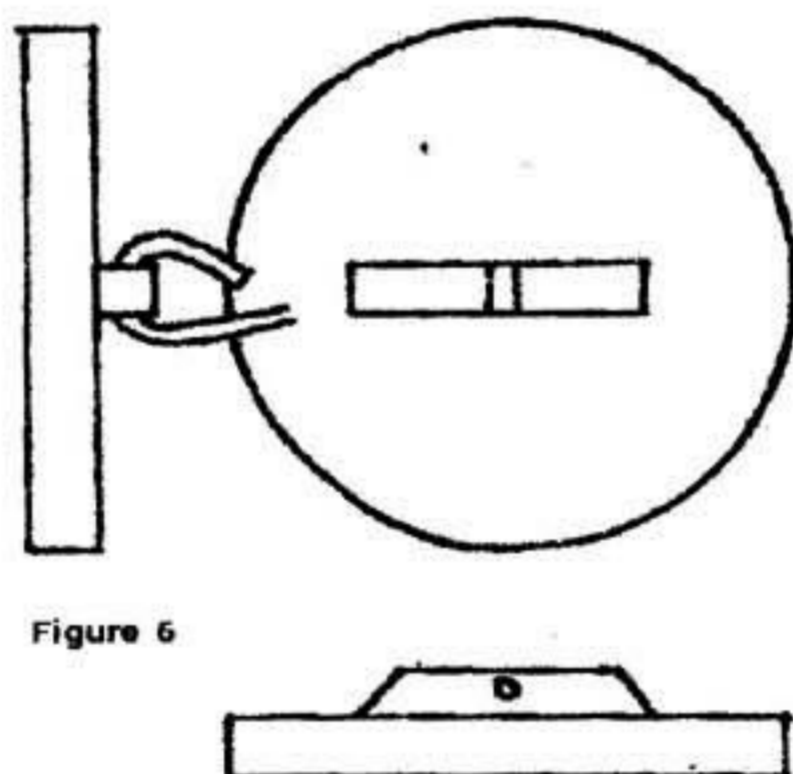


Figure 6

On the door/roof, the buttons should be fastened at 150 mm. centers and walls at 200 centers. Before fitting to kiln, the button should already be fired to stoneware temperatures cone 9.

The Nichrome wire can be cut to lengths of approximately 150 mm. One end is fastened to the button with a simple U shape and slightly closed (FIG 6).

The inside of the kiln is marked out to where the buttons will be placed. The wire is pushed through the fibre to the outside of the kiln as close as possible to the mesh. The wire is then fastened/rolled around mesh. The buttons need not be too tightly fastened, only tighten them

so that the face of the button is flush with the hot face. Do not tighten the buttons so as the inside of the kiln looks like the buttons on a leather lounge. Continue until all buttons are in place.



GASKET FITTING

The gasket is fitted to the top of the kiln body.

The gasket is there for a few reasons:

- (1) to create a good seal for kiln door;
- (2) is an easily replaced wearing surface; and
- (3) makes overall look of the top of the kiln neat and tidy.

The gasket is approximately 120 mm wide cut to length and glued on with sodium silicate. Brush sodium silicate at least 10 mm away from hot face as sodium silicate melts at a low temperature, and will drip down the hot face and removal will cause damage to hot face.

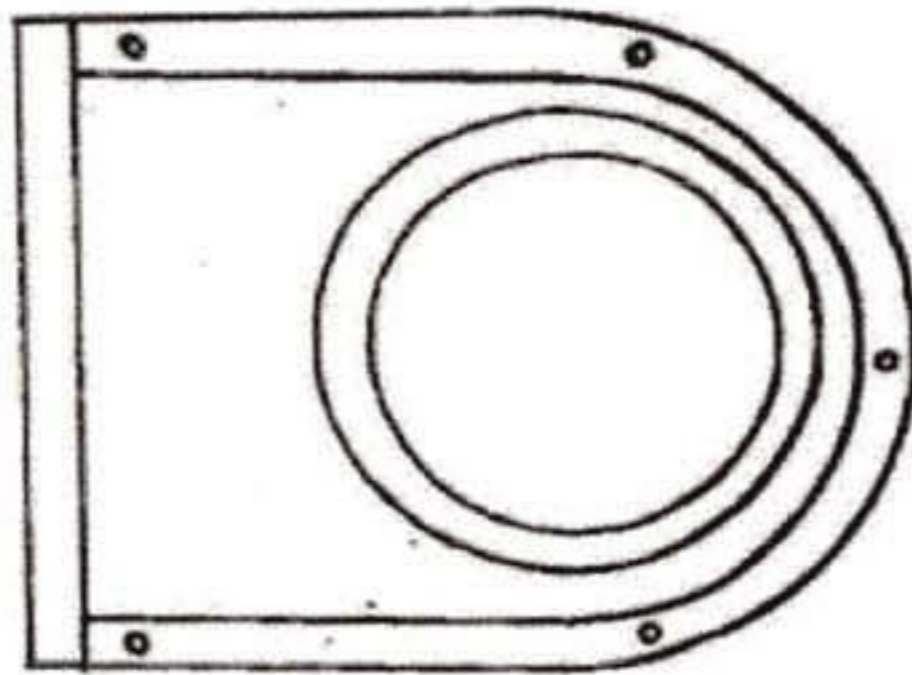
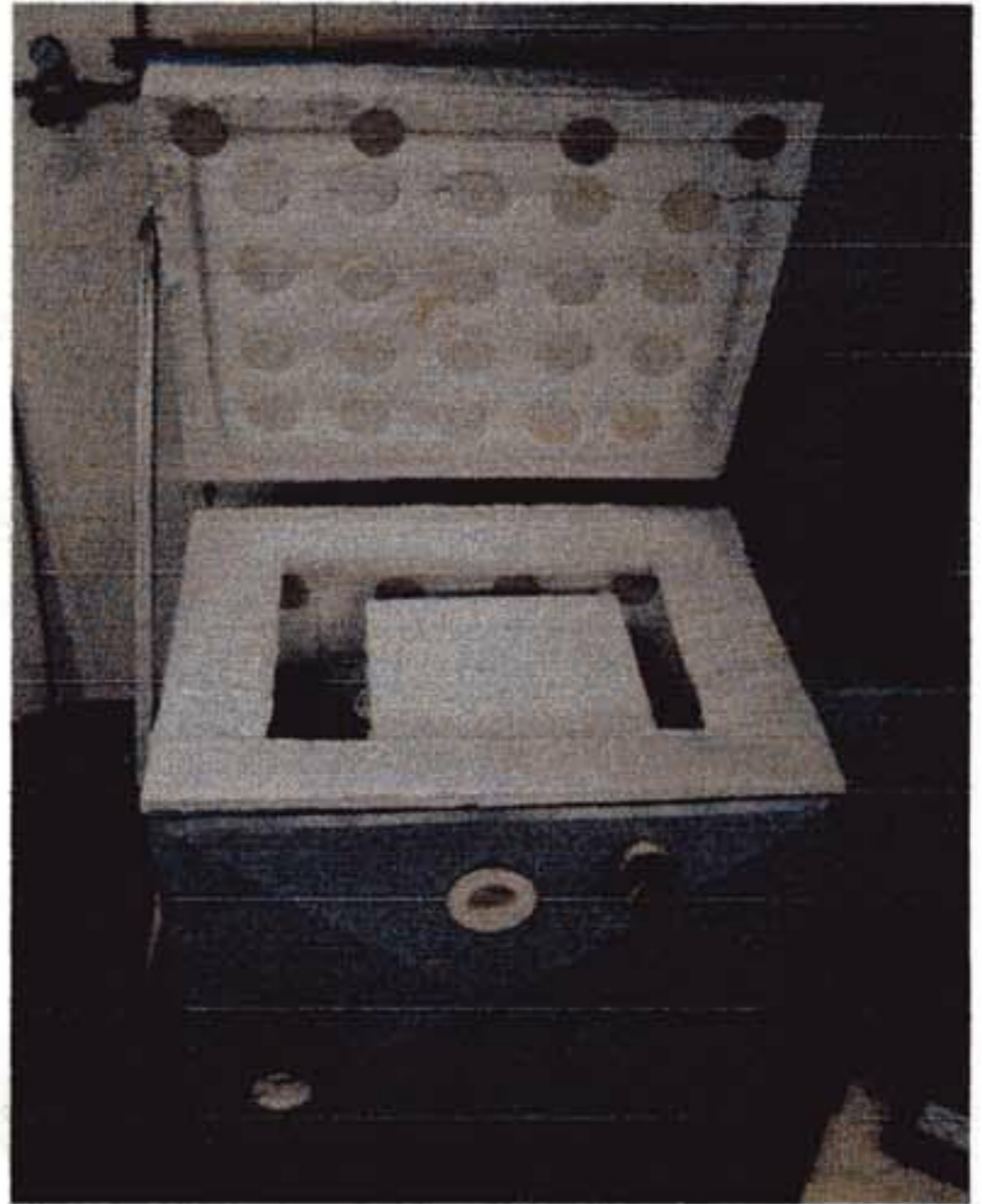
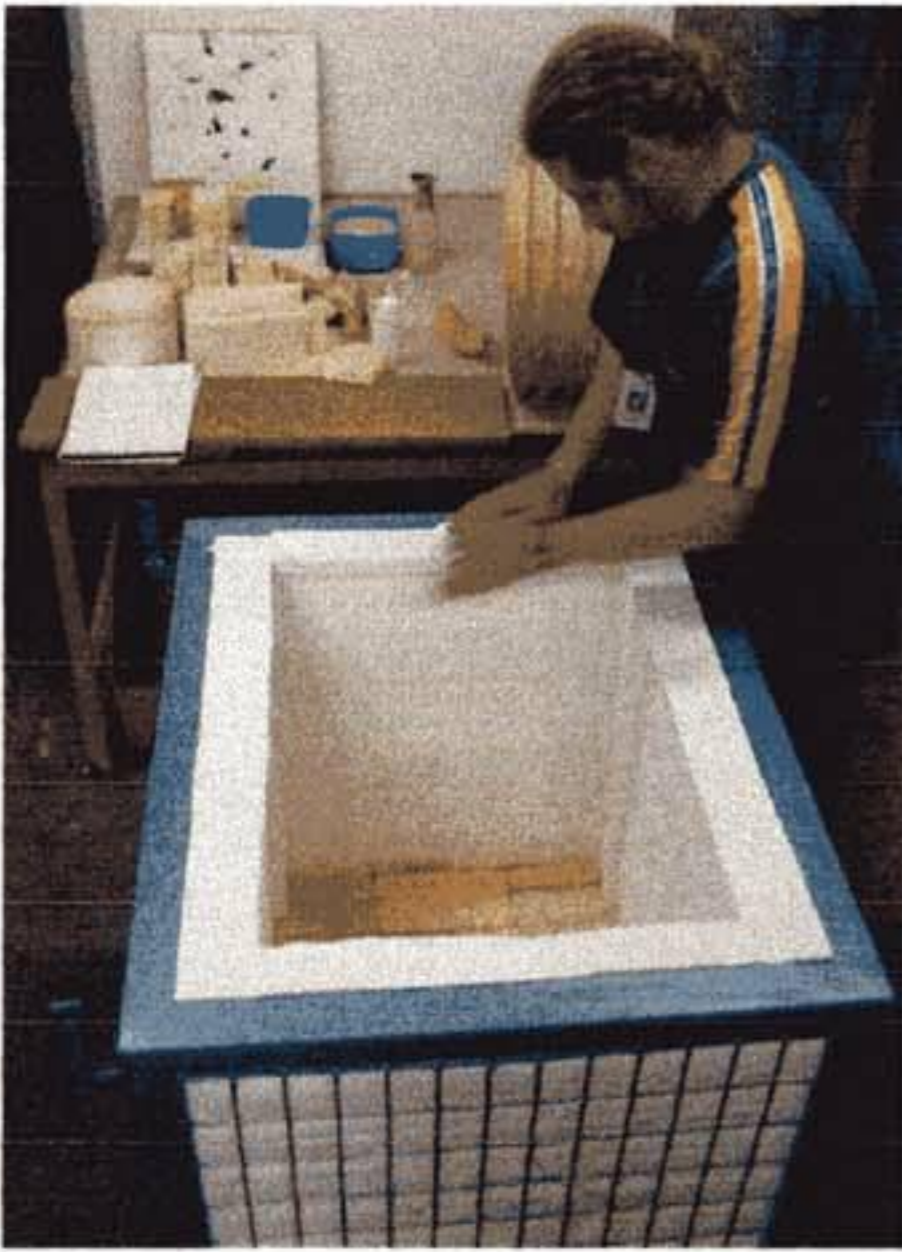
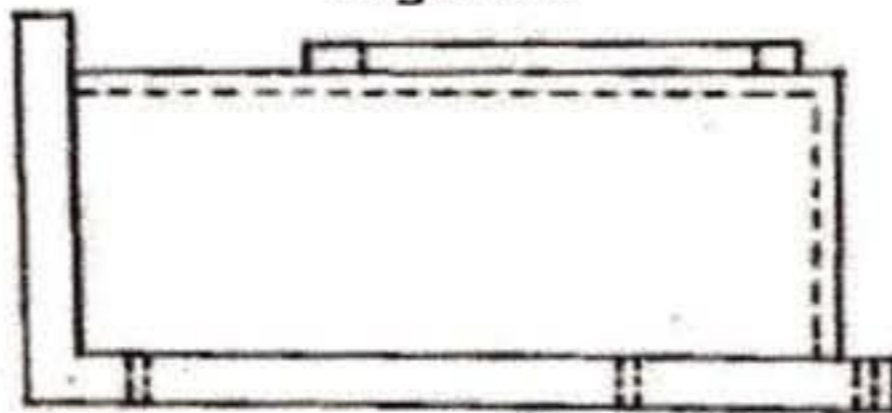


Figure 7



Manifold drawings are in FIG 7. The minimum flue exit size is 3% of the floor area of the kiln, including burner channel. Fibre is marked and cut with a knife from inside of kiln. A hole is also required in the mesh. This can be cut with an angle grinder with a cutting disk. The manifold now may be fitted.



A small gasket between the kiln and manifold will make a good seal. The manifold can be wired onto the mesh with Nichrome wire or as I have done, small pieces of mesh were cut like nails and the manifold pinned to the bricks by first drilling holes into the bricks in required places and pins inserted and manifold will stay in place.

Flue is then placed on top of manifold and brackets used to hold this in place or you can use the system that utilises the sheeting (refer to photo or sheeting procedure).

FIXING DOOR

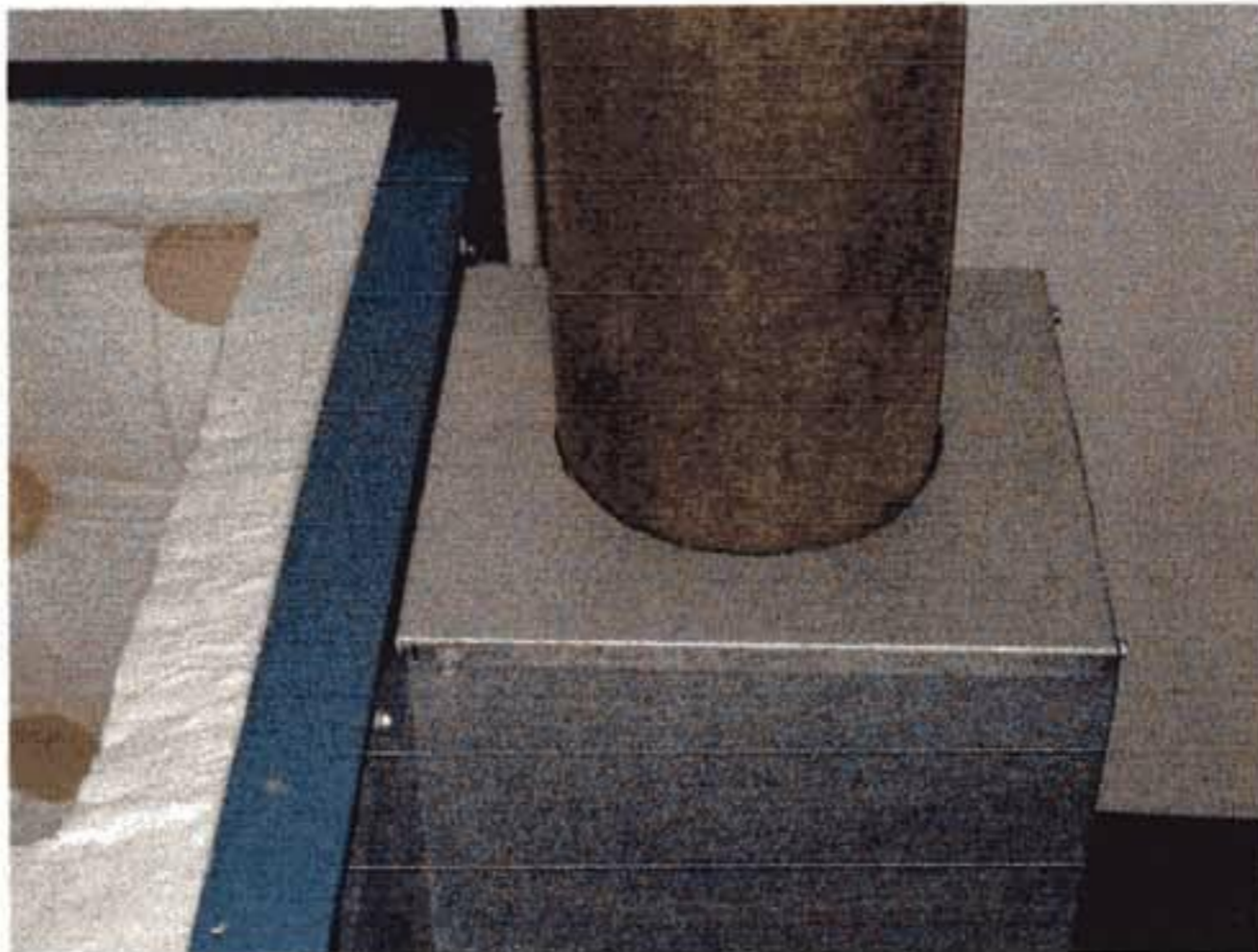
Place the door into position. The hinge brackets should line up with each other. Drill 12 mm hole in centres then place bolts and nuts in holes. Do not do these up tight as will hinder door opening and also wear brackets unnecessarily. Now you should be able to open your kiln door.

ROD TO HOLD DOOR OPEN

This is not a necessary piece on the kiln, but a very useful one.

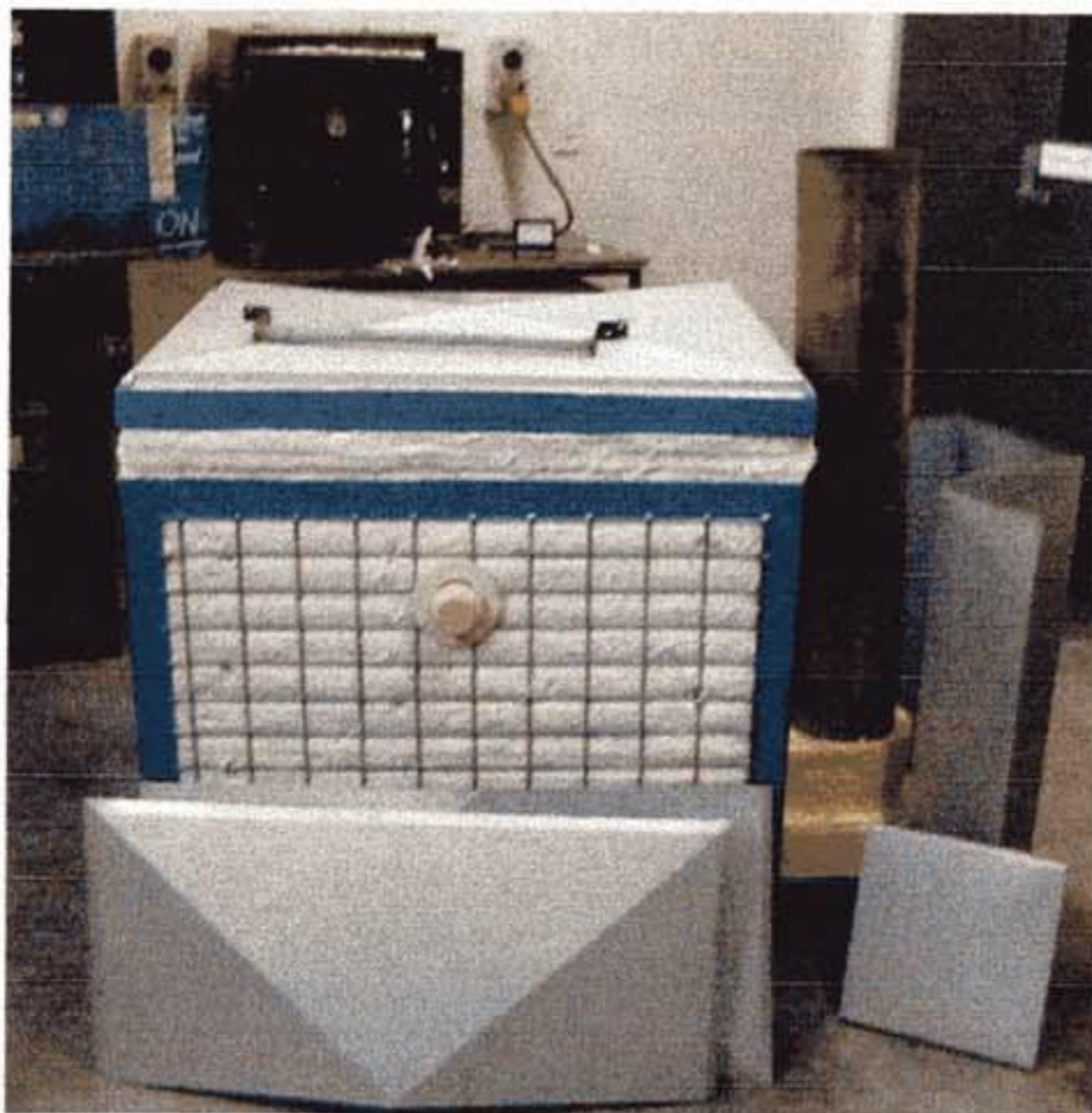


This bar/rod can hold the door open when loading instead of leaning it against a wall, also the door can be slightly ajar when steaming all by simple notches in the bar that lock into a small piece of angle that is attached to the side of the kiln. Refer to photo.





COVERING WITH SHEETMETAL



The sheet metal covering is for a number of reasons. It is not a necessary item, yet if it is fitted, it will protect the fibre from abrasion, dust/dirt, helps keep fibre from becoming

airborne, keeps outside of kiln cooler and looks better aesthetically. To manufacture these you will need access to a guillotine and a folder. Refer to drawings for notching and folding instructions. Panels are fixed to kiln with tech screws.

SPYHOLE, BURNER PORT, THERMOCOUPLE INLET

These items are made of Kaolin, Grog and Fireclay in equal parts by weight. Make this mix into clay wet enough to throw. Make these items as per picture then fire to stoneware.

To fit these items into the kiln you will need a piece of PVC pipe the same size as your



burnerport, outside dimensions, and a piece of PVC pipe the same size as your spyhole outside dimensions. Cut small V-shape notches in the end of the PVC pipe like a hole saw. Use these to drill holes through the fibre from the inside of the kiln. Cut through mesh with angle grinder with cutting disk.

You can now wire in the spy hole, burner port, thermocouple collar in place, or if you are going to use sheetmetal panels cut holes in panels so as these ceramic items fits snugly so as there is no need for wiring.

ACCESSORIES

- Full burner set up –
- venturi burner
- safety cutout valve
- thermocouple
- needle valve
- 3m high pressure hose
- regulator
- pigtail

- burner stand

Others –

Bagwall, shelves, props, pyrometer and probe.

The Finished Kiln firing.

