

**Rota Sludge
&
Stone Hammer drilling**

Part two
Production Manual



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This part two describes the production of the components for the Rota sludge and Stone-hammer manual drilling equipment as developed by PRACTICA foundation. For the correct use of the equipment please refer to part one, the Drilling Manual.

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1. Introduction

The Stone-hammer and Rota-sludge manual drilling methods were developed by Practica in India and Nicaragua respectively. With these methods manual drilled wells can be made, or be made easier and cheaper, than was previously possible. The equipment is simple to use and to produce. The required materials and workshop facilities are such that in most developing countries local production should not be a problem.

This manual describes step by step what materials are necessary, what equipment is required, how to make the different components and for each component the specific attention points.

For operation the equipment (drilling) please refer to the "Drilling manual".

This manual is meant to provide sufficient information for NGO's, development agencies or local contractors to have the necessary equipment for manual drilling locally produced.

Disclaimer

Practica nor ETC cannot be held responsible for any accidents or damage resulting from the production of the equipment as described in this manual.

2. The Rota sludge drilling equipment

Required machinery for manufacture

The Rota-sludge equipment consists of parts which can be constructed simply in a basic workshop.

A basic workshop is considered to be one which contains the following machines:

- Arc welding unit
- Drilling machine
- Metal cutting machine (hack saw or gas)
- Angle grinder
- Pipe thread cutter (up to 2inch)
- Basic tools like spanners, wrenches, hammer, etc.

Overview of the components

For Rota sludge drilling, the following parts have to be made:

- Drill bit
- Weighted drilling pipe
- Arm
- Cross bar
- GI coupling pipe 1.5 metres
- GI pipes of 3 metres

NB: The text will refer to the construction drawings in appendix I.

Manufacturing of the components

The drill bit

(Drawing 1)

This is in fact a two step drill bit because it consists of two drills: one for actually drilling and one for reaming the drilling hole to the desired diameter of 5 inches.

Material requirements:

- (car)Spring steel:
- Strip 8mm thick by 60mm wide, 120mm in length.
- Strip 12mm thick by 70mm wide, 80mm in length.
- GI Pipe 2", wall thickness minimum 3,2mm, 250mm in length, provided with thread on one end
- GI Pipe 3", wall thickness minimum 3,2mm, 50mm in length

Construction

Cut the teeth into the spring steel to the correct width, using an angle grinder

Cut the teeth into the spring steel to the right width

7 teeth at 15 mm wide. (Strip 8mm thick)

4 teeth at 18 mm wide. (Strip 12mm thick)

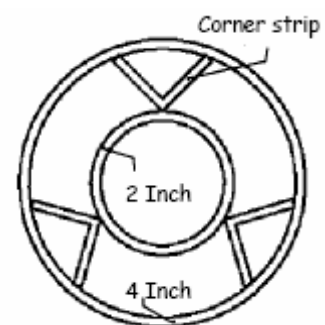


Fig. 1, drill bit

Now weld the teeth on, keeping an equal distance between them, at an angle of 70 degrees. (see drawing 1)

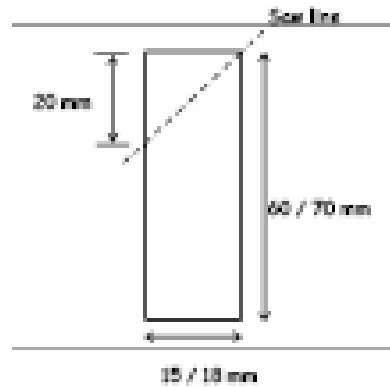
NB! Ensure that the teeth have a contact surface of 50% of their total length with the bit. Weld all around the tooth.

Use angle irons to centre the 2" pipe

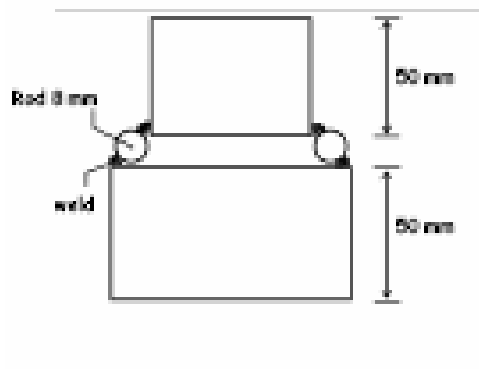


- Now the teeth should be provided with points.

Draw the angle on the flat part of the tooth and saw this off using the cutting machine.

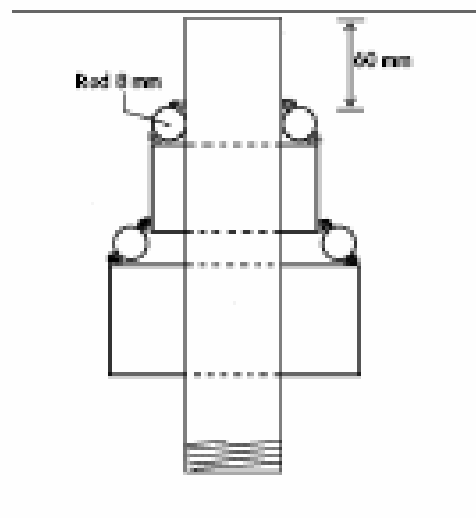


- Now sharpen the points with the grinding machine.



- Now weld the 3" pipe at right angles on to the 4" pipe. Using the iron rod, construct a ring to guarantee a good weldable joint between the pipes.

- The 2" pipe is now welded on so that it sticks out 60mm under the 3 inch pipe.



Weighted drill pipe



Requirements:

- 2 inch GI pipe 1.5 metres. provided with thread on the two ends
- Round bar , 18mm in diameter, 18,2 metre in length.
(1300mm per length, per weight +/- 14 lengths.)

- Cut the round bar in pieces of 1300 mm length
- Keep the pipe 100mm free at both ends and weld the bars lengthwise around the GI pipe.
- Smooth down the ends of the bars to avoid them scraping the wall of the bore while drilling

NB! Extra weight may be necessary. This can be decided in consultation with the driller.

Arm

(Drawing 2)

The arm consist of the handle and the clamp

Requirements:

- GI pipe $\frac{3}{4}$ " , 160mm.
- GI pipe 1" , 900mm
- GI pipe $1\frac{1}{4}$ " , 580mm
- GI pipe 2" , 60mm
- Iron strip, 5 mm thick, 30mm wide, 120mm in length
- Iron rod, 6mm in diameter, 700mm in length
- Nut and bolt, diameter 10mm,60mm in length
- Steel chain, 3 links (6mm thick, each link approximately 20mm in

Cut the materials to size, using a hacksaw.

- $\frac{3}{4}$ " : 160mm.
- 1" : 2 pieces of 5mm, and one piece of 75mm and 800mm each.
- $1\frac{1}{4}$ " : 2 pieces 5 mm, one piece of 150mm and 2 pieces of 200mm.
- 2" : 60mm
- Iron rod: 4 pieces of 60mm
- Iron strip: 2 pieces of 60mm



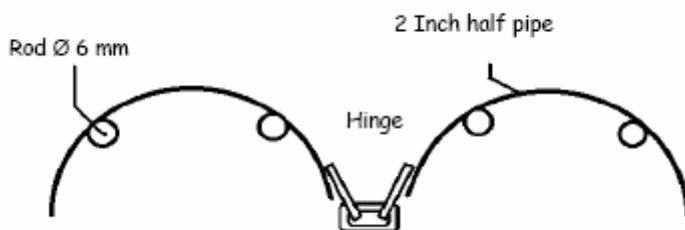
Fig. 3, the complete arm

The clamp is discussed below.

The other parts are is easy to make using drawing 2.

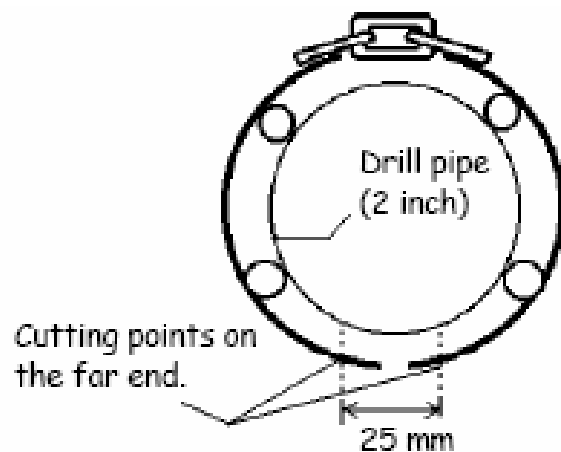
- Saw the 60mm 2" pipe into two, creating two half pipes. These parts are connected with a three links of a chain which functions as a hinge. The outside links of the chain are welded onto the two pipe parts while the middle link is free to move.
- Weld the 4 6mm rods lengthwise in the half pipes. These will increase the grip preventing the arm from slipping when turned.

The clamp



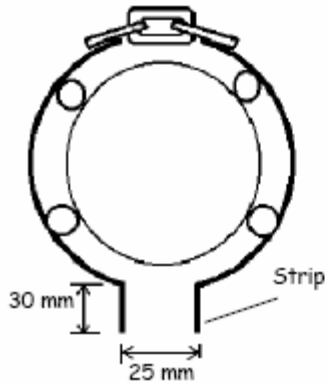
Clamp in open position

- This clamp is now fitted round a 2" drilling pipe. Ensure that, by shortening the pipe's far end, the two far ends have a distance of 25 mm.
- Drill two holes into the centre of the iron strips. (diameter 12mm)
- Once again, fit the clamp onto the 2" drill pipe and weld the strips, parallel to each other, on to the far end.



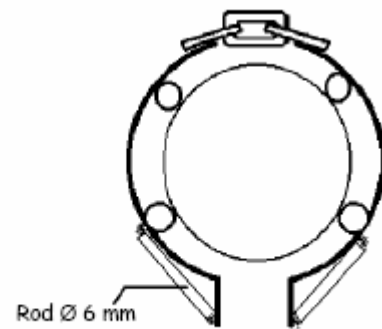
Clamp in closed position

NB. The holes should be drilled opposite each other so that the bolt can be fitted more easily. Attach the four far ends of the strips to the pipe by using 6 mm round bar. This prevents warping whilst the bolt is being turned

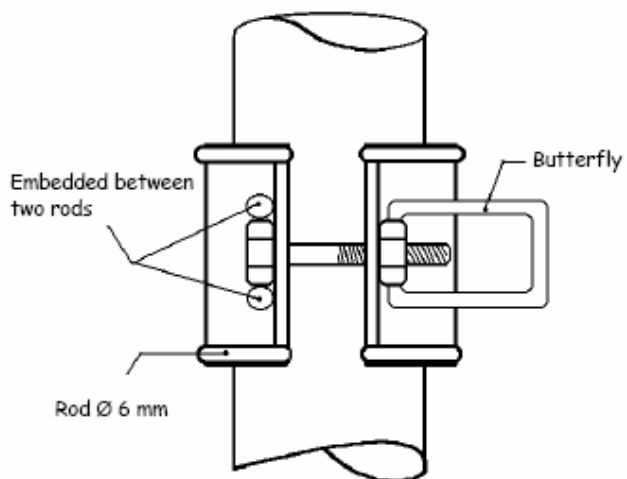


- Once again, fit the clamp onto the 2" drilling pipe and weld the strips, parallel to each other, on to the far end.

NB. The holes should be drilled opposite each other so that the bolt can be fitted more easily. Attach the four far ends of the strips to the pipe by using 6 mm rods. This prevents warping from occurring whilst the bolt is being turned



- Now weld the various components as shown in drawing 2..



Tip: To prevent the bolt from turning, it is embedded between two welded rods (6mm diameter). At the same time the nut is provided with so called butterfly. All of this makes it easier to turn the nut.

The handle (Drawing 2)

A short length of 1¼" pipe (200mm) is slid over the end of the 1" pipe, the so-called handle. The handle is held in place by rings welded on to the arm (5mm round bar). The handle can thus move freely and is more comfortable to operate.

Cross bar (figure 4)

Requirements:

- Round bar, 30mm in diameter, 500mm in length.
- Round bar, 10mm in diameter, 500mm in length.



Fig.4, Cross bar

- Cut the 10mm round bar in 4 pieces of 100 mm length and bend them to rings which can be slid over the 30mm bar.
- Weld the two rings at 70 mm from the two ends of the 30mm round bar and then the next two at 10 mm.

2" GI Coupling pipe (1.5 metres)

This is a 1.5 metre pipe which is threaded at both ends. Only one is required. On one end a socket is fitted and welded on to the pipe.

2" GI Pipes (3 metres)

These are 3m pipes, threaded at both ends. The number of pipes depends on the depth which has to be drilled. A socket is welded onto one end of each pipe.

NB! GI pipes should have a minimal wall thickness of 3.2mm.
In some cases American thread is used which occurs in Central America. In contrast to English threads, these have are cut deeper, rendering the pipe very weak in these places.
A solution was found by welding on a thicker end piece (GI pipe with a wall thickness of 5mm and 15cm in length), on which the thread can be cut without any problems.



Fig. 5, 2"pipes

3. The Stone-hammer (Drawing 3)

Required equipment for manufacture

It is not possible to construct the entire stone hammer in a basic workshop as some of the parts need to be made with a lathe.

Overview of the components and the material requirements

For the Stone-hammer, the following parts have to be made with a lathe:

- Stuffing box housing
- Buffer ring
- Stabilisation rings

The following parts can be made in a basic workshop:

- The chamber (with the floor and the drain plug)
- Connecting rod
- The drilling bit
- Pulley and the cross bar



Fig. 6, Stone-hammer

Manufacturing the Stone-hammer

Stuffing box packing, buffer ring and the stabilization rings

(Drawing 4)

Material requirements:

- Stuffing box packing
- Buffer ring
- Stabilisation rings
- GI Pipe 4", wall thickness > 3,2mm, 300mm in length
- GI Pipe 3", wall thickness > 3,2mm, 2740mm in length
- GI Pipe 1½", wall thickness > 3,2mm, 1200mm in length
- GI Pipe 1¼", wall thickness > 3,2mm, 1200mm in length
- Iron rod, 8mm in diameter, 320mm in length
- Solid iron rod, 70 mm in diameter, 1500mm in length. (The weight)
- Solid iron rod, 80 mm in diameter, 50mm in length. (The bottom)
- Solid iron rod, 18 mm in diameter, 70mm in length. (Locking pin)
- (car)Spring steel: Strip 12mm thick by 80mm wide, 320mm in length.
- Bolt (2) diameter 8mm, 30mm in length (drain plug)
- Bolt, (2) diameter 8mm, 35mm in length (Stuffing box packing)
- Nut and bolt, diameter 18mm, 100mm in length (locking bolt)



Fig.7, Stuffing box parts

The stuffing box (figure 7) consists of the box and the ring. Because they have to fit together precisely and the water tightness depends on this, they are made in a lathe. The buffer ring and the stabilisation rings are also made in a lathe.

The chamber with the floor and the drain plug

- A 3" pipe is sawn off to a length of 140mm. A solid floor with a thickness of 5cm is welded into this pipe. The floor is welded at respectively 1 and 8cm from the far end of the pipe.
-
- The bore for the drain plug valve is drilled, after which the thread is tapped.
- Drill the holes for the locking bolt.
- Saw the 3" pipe to a length of 2600mm and drill 4 holes (12mm) round it at 25mm from one end of the pipe.

NB. The floor also serves to keep the water out so it has to be welded leak free..

NB: weld the "shallow" end of the floor pipe on to the part of the pipe without holes!

The weight with the connecting rod

- The 1¼ inch and the 1½ inch diameter pipes are slid together and welded together at each end.
- The hole is drilled for the locking pin.
- The bolt for the drain plug is welded on.
- The sharp edge of the weight is chamfered. This only has to be done at one end.
- When there is too much gap between the weight and the chamber, stabilisation rings should be added. (minimum clearance 1 mm).

NB! Ensure that a gap of 20mm is created in these rings for the water to pass.

- The buffer ring is welded on to the centre of the weight.
- Connect the connecting rod to the weight and fasten the locking pin.
- Now place the weight in the chamber.

The stuffing box

(Drawing 4)

- Slide the stuffing box over the connecting rod and slide them into the chamber until they protrude 10mm above the chamber. Weld around the box to secure it and weld the 4 holes to close them.

NB! Once again ensure that the construction is watertight.

- Slide the stuffing box ring over the connecting rod.
- Finally, now make the eye for the connection with the rope and the stabilisation ring.

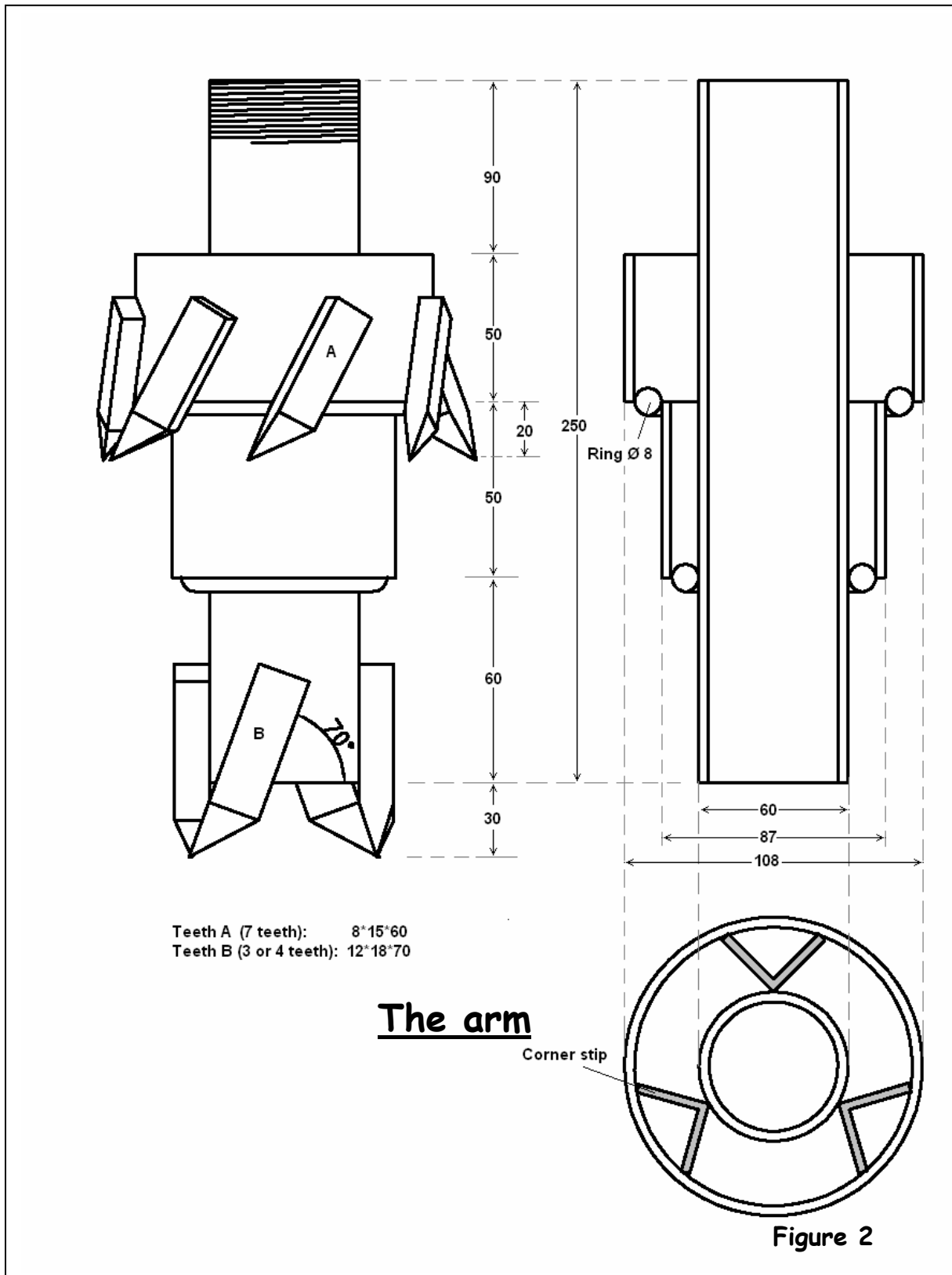
The drill bit for the hammer

(Drawing 5)

The drill bit is constructed from a 4" pipe and a spring steel head as per attached drawing nr. 5.

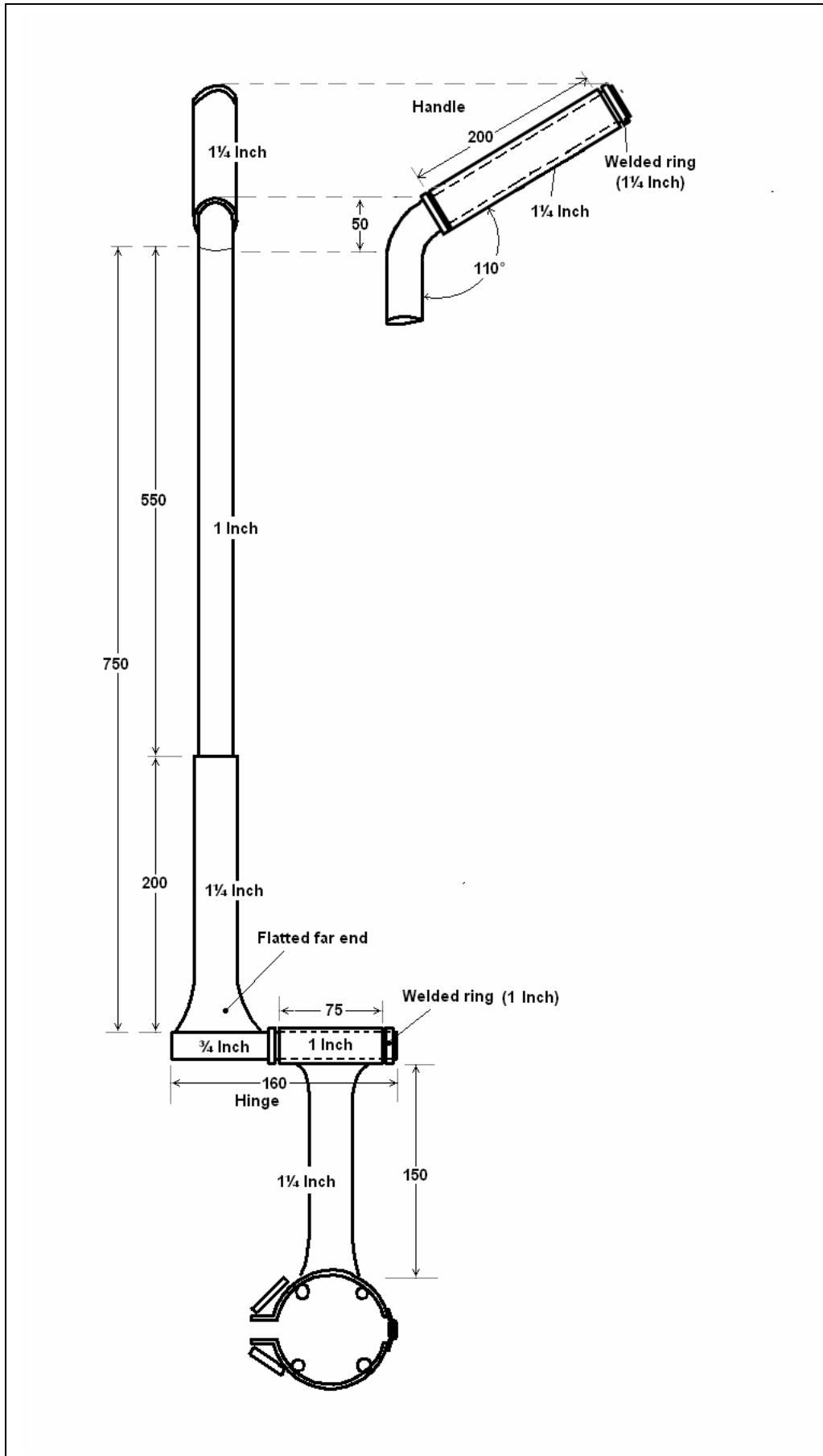
Drawing 1

Drill bit for Rota sludge



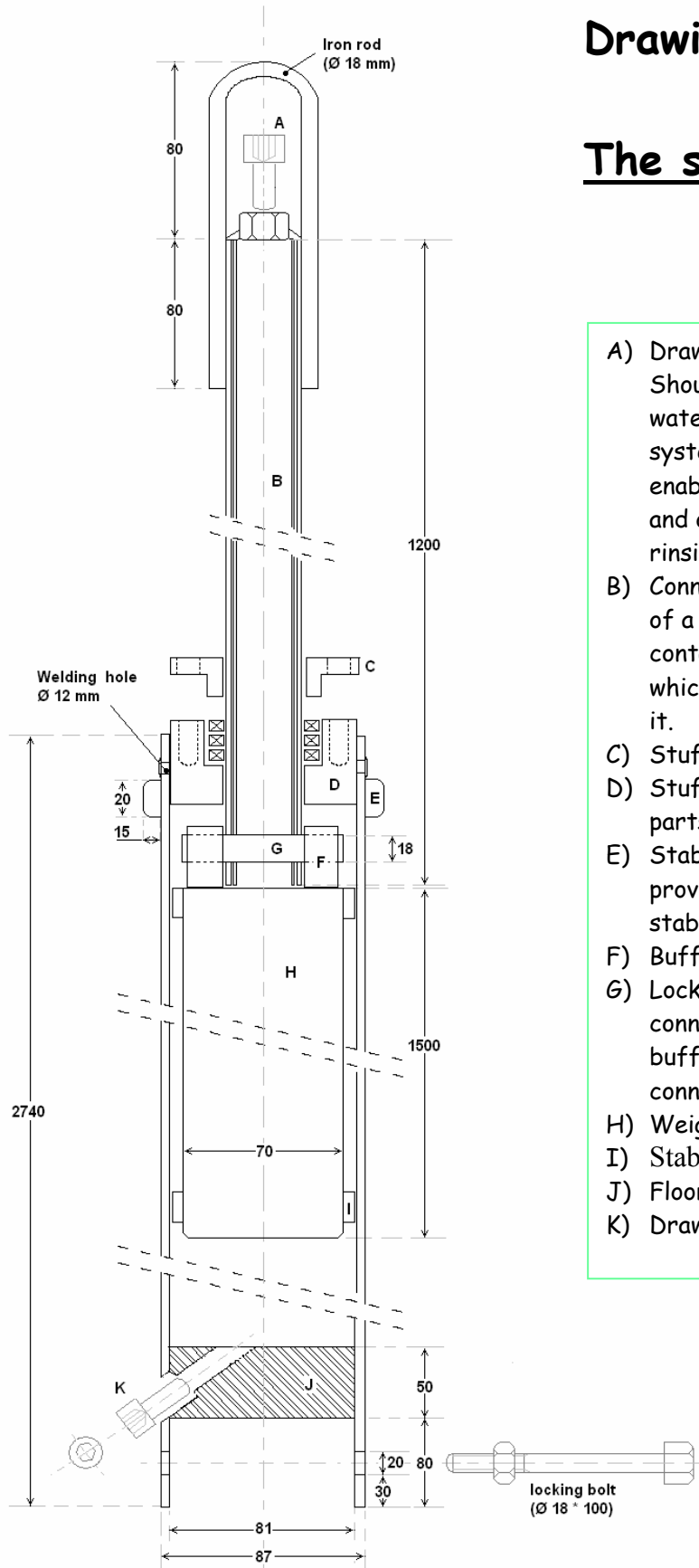
The arm

Drawing 2



Drawing 3

The stone hammer



- A) Draw-off valve (bib-valve). Should leakages occur, dirty water will flow through the system. The draw-off valve enables the water to drained and offers the possibly of rinsing the system.
- B) Connecting rod. This consists of a $1\frac{1}{2}$ inch GI pipe which contains a $1\frac{1}{4}$ inch GI pipe which serves to strengthen it.
- C) Stuffing box ring.
- D) Stuffing box. For detailed parts see Diagram 4.
- E) Stabilisation rings. These provide vertical stabilisation.
- F) Buffer ring
- G) Locking pin. Provides the connection between the buffer ring and the connecting rod.
- H) Weight
- I) Stabilisation rings.
- J) Floor
- K) Draw-off valve

Drawing 5

Stone-hammer bit

