SMART Centres

Simple,
Market based,
Affordable,
Repairable
Technologies

Making a SHIPO Drill set

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The **SMART** Centre Group

1 Copy right and disclaimer

SHIPO drilling looks , and is simple, but we have learned the hard way, “Simple is not easy”.
This drilling method has many details which can be best learned with practical training. Therefore it is strongly recommended to use this manual in combination with practical hands on training that can be provided by a SMART Centre in Tanzania, Malawi, Mozambique, Zambia and in the future in other countries.

Feel free to contact us via www.smartcentregroup.com

Version : 26 April 2019

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3 Introduction

The techniques for drilling a tube well (borehole) can be divided in two categories i.e. drilling with a machine or drilling manually. In general manual drilling is cheaper and less complex than machine drilling but is slower and limited to softer ground layers. Compared to digging wells by hand, the drilling of tube wells is less dangerous, can penetrate deeper into the aquifer and wells are more hygienic.

The SHIPO drilling combines sludging, percussion and jetting (see below). It includes aspects of Rotary jetting and of the Baptist drilling technique named after the Baptist Missionary, Mr Terry Waller who developed this technique. See also www.waterforallinternational.org. With the Baptist method, more than 4200 tube wells have been drilled in 27 countries with depths ranging from 10 to 60 meters or more. A first version of this manual was made in 2005 with support of John de Wolf of Connect International for the SHIPO SMART Centre in Tanzania. Later it was adapted by SMART Centres in Malawi and Zambia, especially by using metal drill pipes instead of plastic pipes and by using tungsten drill tips in the drill bits to make if fit for drilling in stony layers.

The SHIPO drill method can drill in non consolidated deposits of sand and clay, small gravel and weathered rock. Also hard layers can now be drilled with new drill bits with tungsten tips. For gravel or stones from 1 to 3 cm an open bit can be used combined with sludging by hand.

This manual is part of a range of manuals that include:
Wells & drilling

- Geology and site selection
- Well digging
- SHIPO drilling
- Making of SHIPO drilling set
- Mzuzu drilling
- Making of Mzuzu drilling set
- Rota sludge drilling

Pumps:

- Rope pump model 1 Standard model
- Rope pump model 2 Economy model
- Rope pump model 3 2 Pole model
- Rope pump model 4 1 Pole model
- Pump care taker training
- EMAS pump
- Storage tank
- Ground water recharge
- Water treatment
- Workshop skills
- Business, financial and marketing planning

4 Overview SHIPO drilling set

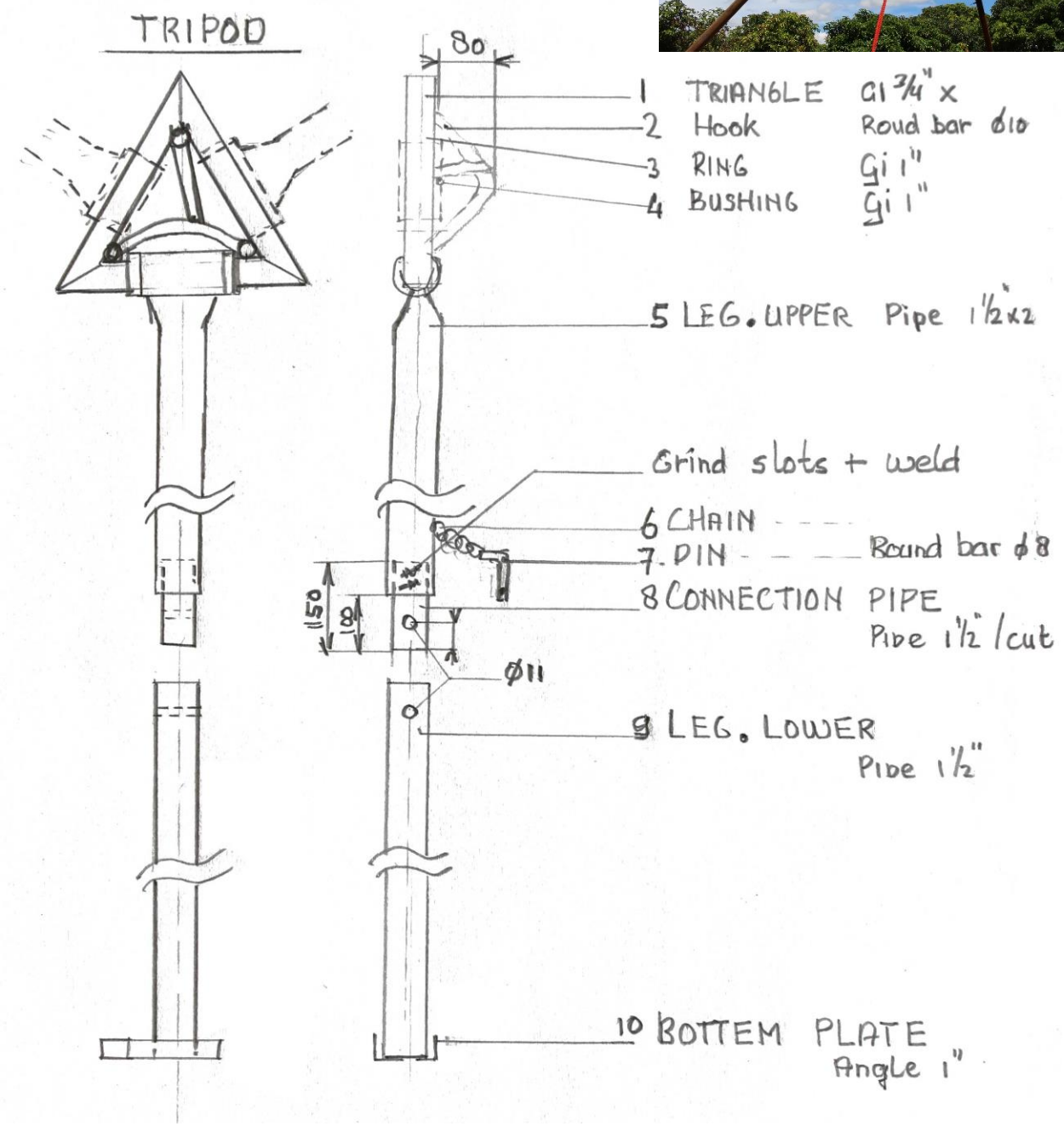
The SHIPO drilling set can be made with parts and materials that in general exist in the country.
The picture shows all parts of the SHIPO drill set with metal drill pipes.

4.1 List of parts, tools and materials

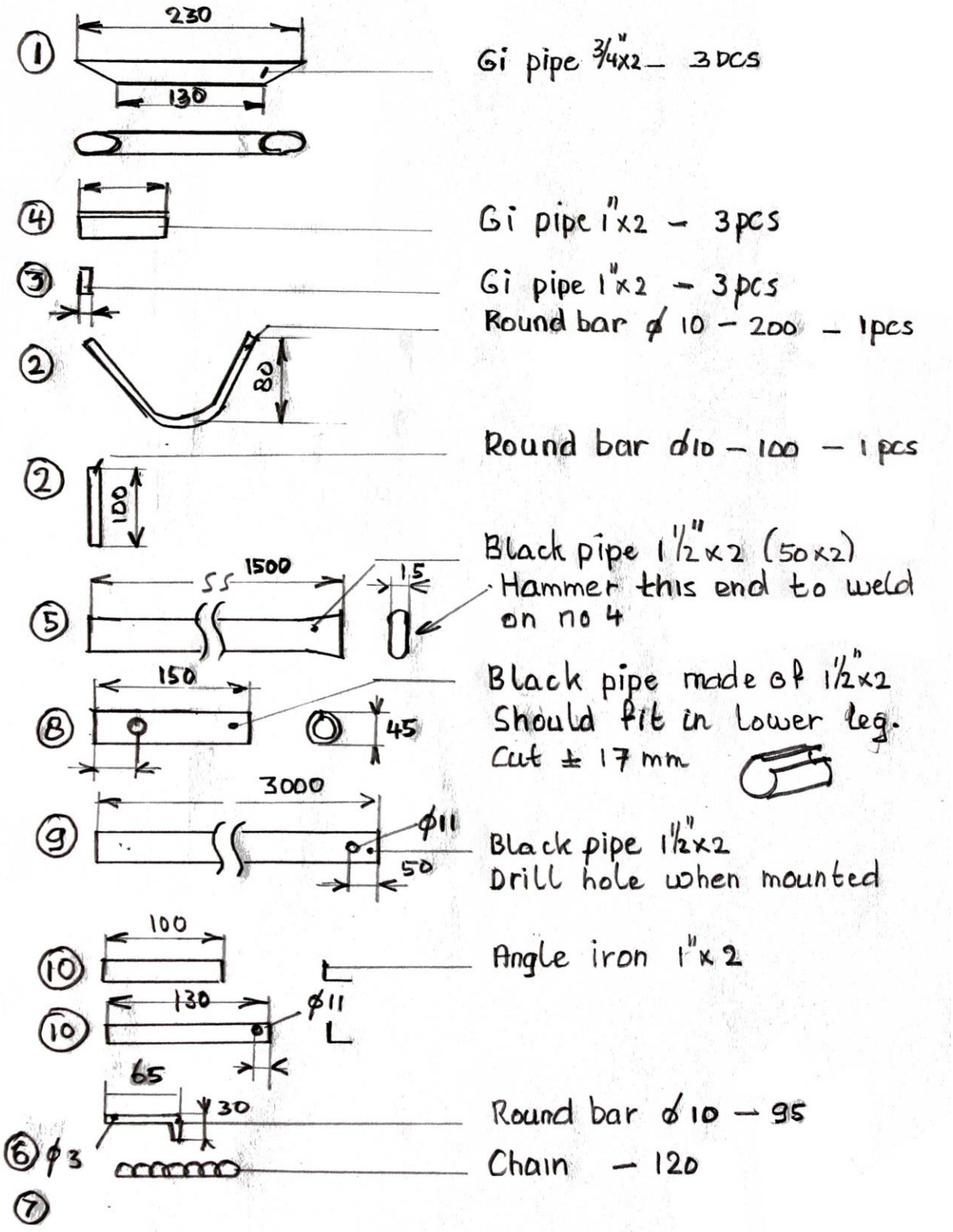
Item	Number	Observations
Stone punches and/or auger	1-2	Stone punch to make a start hole in stony layers. A core auger for softer soils
Tripod	1	Including anchor pins
Pulley, 4 or 5 Inch	1	
Rope (Nylon or PP). 10 or 12 mm	12 meter	
Drill bits (open bits) 2 , 4 and 6 inch	1 each	Spare bits recommended
Top valve	1	For sludging or when pump fails
Drill pipe (Heavy pipe), length 3 m.	1	The lowest pipe for impact. Steel 1¼" + 1½"
Drill pipes, length 3 meter	5 to 16	Depending on required depth
Drill pipe, length 1.5 meter	1	Spare recommended
Drill pipe support	1	To hold the drill pipes to add /remove pipes
Sprout and coupling 1 ¼" Union	1	
Fish tool	1	
Threading tool	1	In case of PVC drill pipes are used
Pressure hose, 40 mm or 50 mm	3m	Reinforced. 2 m for suction, 3 m for outlet
Engine petrol pump. 5 HP, 2 inch	1	With connections 1 ¼" Union x 2
Jerry can for petrol/ gasoline. 5 liter	1	
Oil 10W40 1 liter can	2	
Fine clay or Polymer	5 bags	For polymer no of bags is 5 times less.
Spade and hoe	1	
Screw driver	1	
Hammer	1	Heavy model, 2 kg
Hacksaw	1	Including 2 spare blades
Steel brush	1 or 2	To clean nipples and sockets
Pipe wrench, 12 or 14 inch	2	
Drums. 200 litres	1 or 2	
Buckets. 20 litres	4	Or more. Steel or strong plastic
Rubber strips	2 kg	
Spray bottles	3	Water bottle with a hole in cap
Spare seal for engine pump	1 or 2	
Protection disk, engine pump	1	Round metal sheet to protect pump house
Y-spanner 10, 12 and 14mm	1	To open pump house for maintains
Thin twine rope with weight	1	To measure water level and borehole depth
Casing pipe		According to agreement with client
PVC glue	1	Pot
Drill log form and pens	1	
Safety helmets	2	Or more
First aid kit	1	

5 How to construct

5.1 Tripod



5.1.1 Tripod parts



5.1.2 Points of attention for Tripod

Cut 3 hinge pipes according to drawing above. Use heavy ¾" and 1" GI pipe. Weld rings on each side of the bushings.

Cut legs for upper part of the legs (1500 mm), Hammer it partly flat on 1 side and grind the shape of the 1 inch bushing of the hinge. Do not weld yet!!!

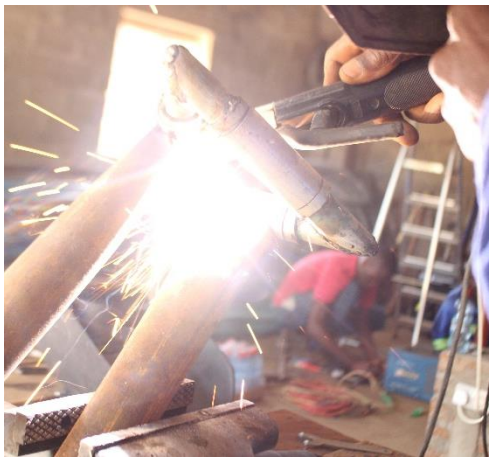
Make a pipe that just fits in the lower leg (3000 mm). You can use the same 1.5 inch pipe and cut a strip. The width of the strip to remove is calculated by: 3.14 X reduction in diameter. For example the pipe of the legs has 50mm outside diameter and 2 mm wall thickness. To fit a pipe inside you have to cut (50 – 46) is 4 x 3.14 = **12.5 mm.** In practice you have to remove a bit more, around 15 mm, so the small pipe fits in the 50 mm pipe.

Mount the reduced pipe into the end of the leg.

Make slots in the upper pipe so you can weld the two pipes together. Don't make the cuts to deep, no need to cut into the inner pipe.

Weld in the slots to join them.

Connect the lower legs (3000 mm) with the upper legs, and drill the holes for the connection pins. First drill 6 or 8 mm than 11 mm. Make pins of round bar 8 mm and put them in the hole



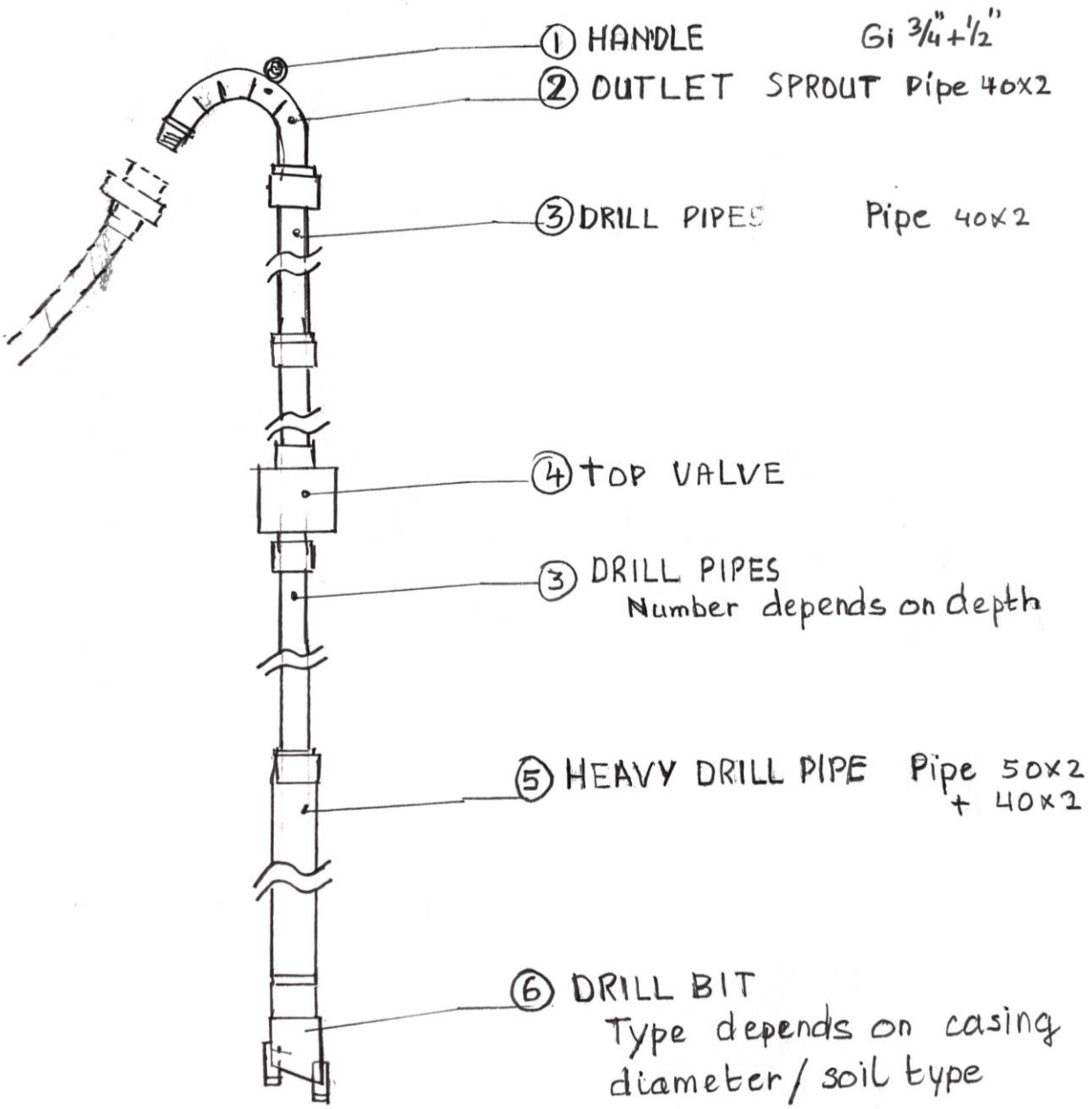
Now weld the upper legs to the hinges putting the pins parallel to the hinge pipe.

At the low end of the lower leg, weld angle irons of 25 or 30 x 3. See drawing. You can also use a plate To make a plate you can use a piece of pipe that is made flat. Partly cut the pipe so you can still hold it when you are hammering it flat.

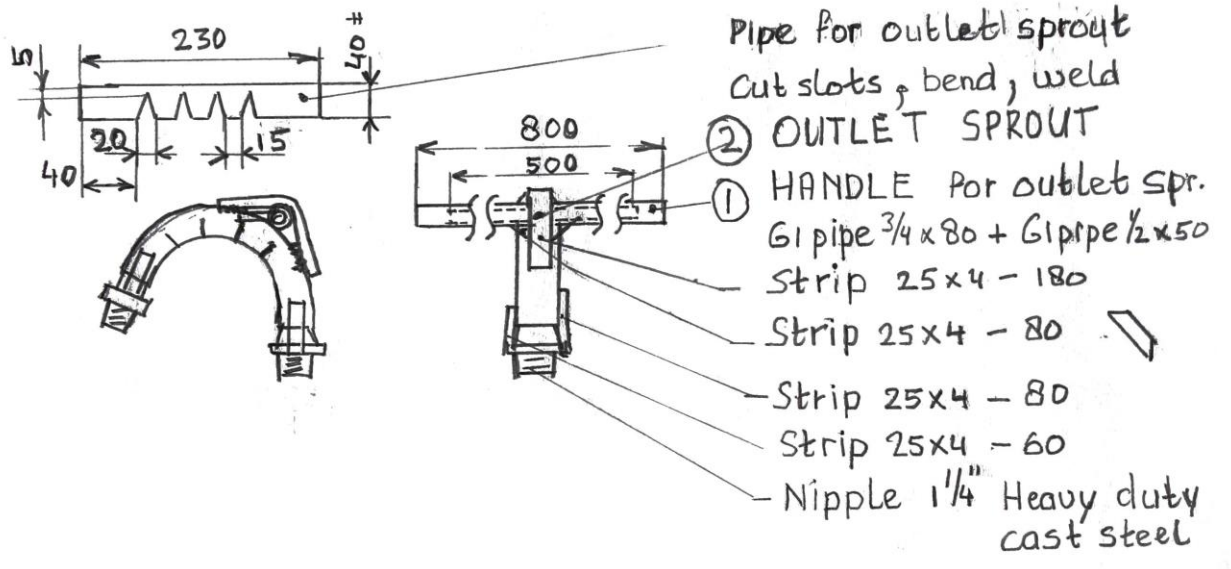
Make the anchor pin and weld the angle iron or plate in such a way that the pin can be hammered in the ground in an angle. See picture.

Weld the hook for the pulley inside the triangle

5.2 Sprout, drill pipes, top valve and drill bits

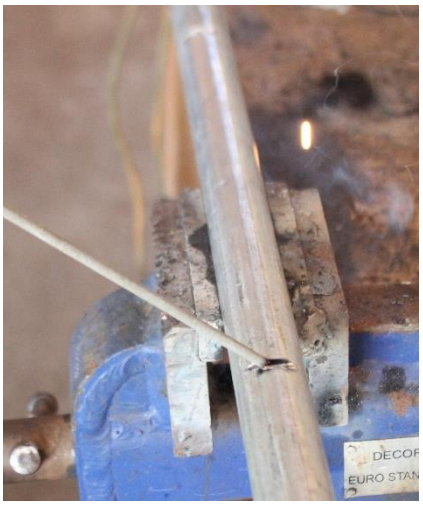


5.2.1 Sprout and handle



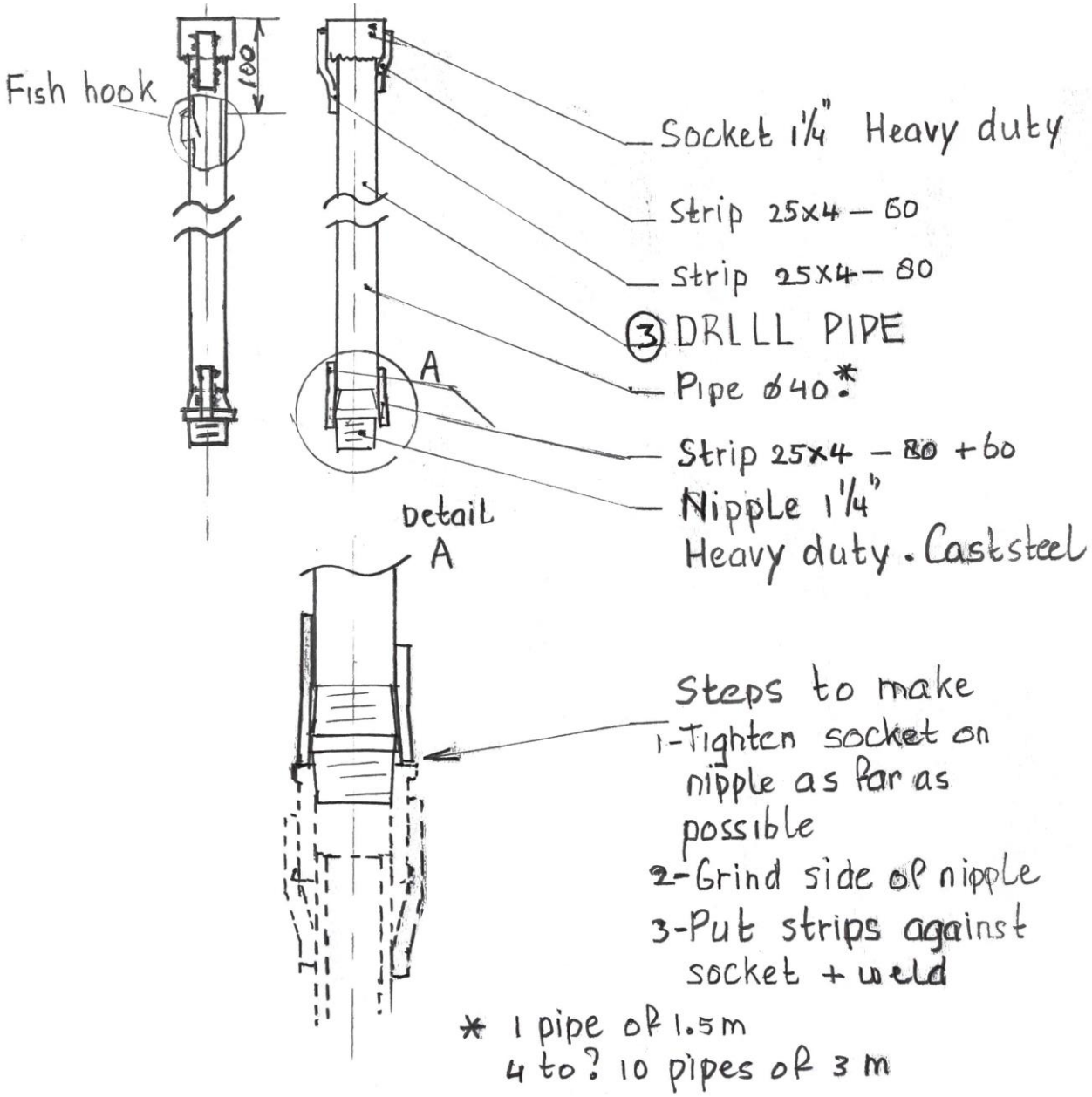
5.2.2 Points of attention for handle

In hard soils, the drillers might put a lot of force on the handle. Therefore, it is good to reinforce the handle by putting a ½"pipe inside. Connect them just like the pipes in the tripod, by making slots in the outer pipe and weld in the slots.



A strip is welded and bend around the handle. Bend and hammer the strip when it is hot.

5.2.3 Drill pipes



5.2.3.1 Points of attention for drill pipes

Make sure to weld nipples and sockets straight!!
Connect 2 pipes and look alongside of the pipes to see if they are in 1 line. Weld first on top and than on a side. If the pipes are straight weld on bottom and other side. This to avoid that the sockets or nipples bend when it cools down. Than all around. Keep pipe straight while welding!! You need to do this with 2 people. Make a spot weld at 90 degrees before welding it completely round. When using cast steel nipples and sockets, try to weld them as hot as possible. Don't put it in water after welding but let it cool down slowly.

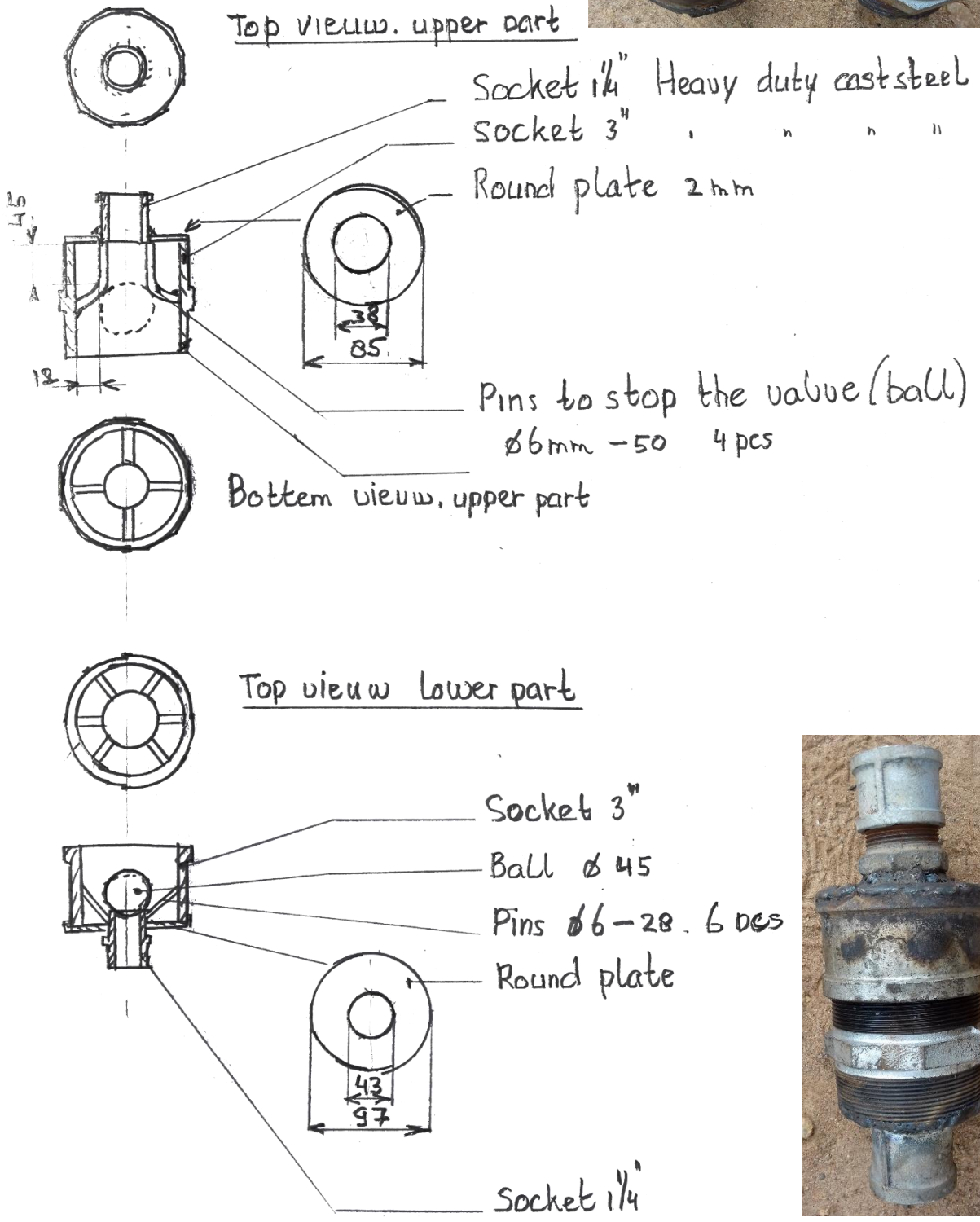
After welding a nipple, weld "stop strips". The function of these strips is to make sure that the force of drilling is on the socket and not on the thread. To weld the strips, tighten a socket as far as possible on a nipple, opening and closing it several times with oil and cleaning the nipple with a steel brush. Than grind the sides of the nipple so the strip touches the with the full thickness on the socket. (Very important!!.) Than weld strips of 25 x 4 mm with lenght of 6 cm on one side and 8 cm on the other side. One strip should be longer than the other to avoid that weldings (which are the weak points) are at the same position. A the low end of the heavy drill pipe , 4 stop strips are needed.

After each socket a fish hook should be made, to be able to fish out pipes in case of breakage. To make the fish hook, make a cut of 30 mm in the pipe at the side of the socket (female)

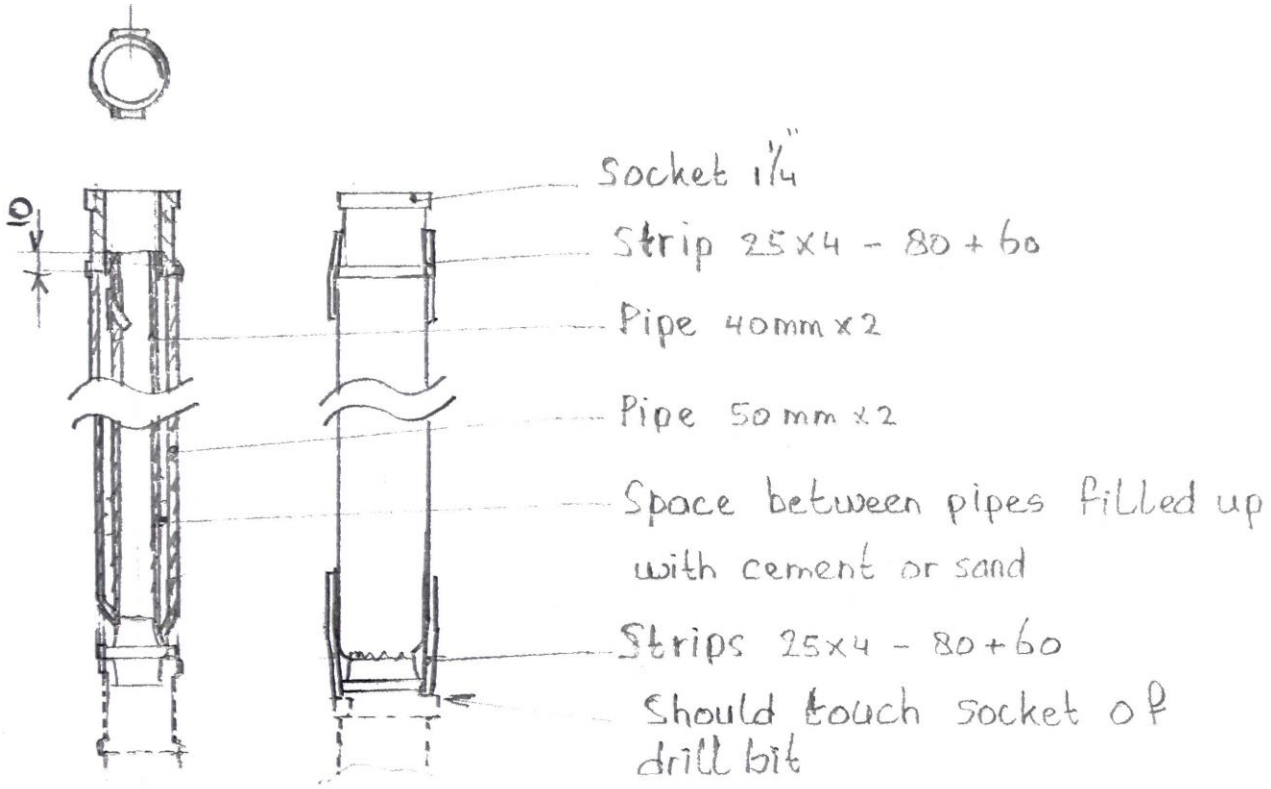
Hammer the socket side of the cut down ca 8 mm so the hook can connect. Do not hammer both sides!.

After testing with a fish tool, weld a piece of pipe of 30x30 mm to close the hole.

5.2.4 Top valve



5.2.5 Heavy drill pipe

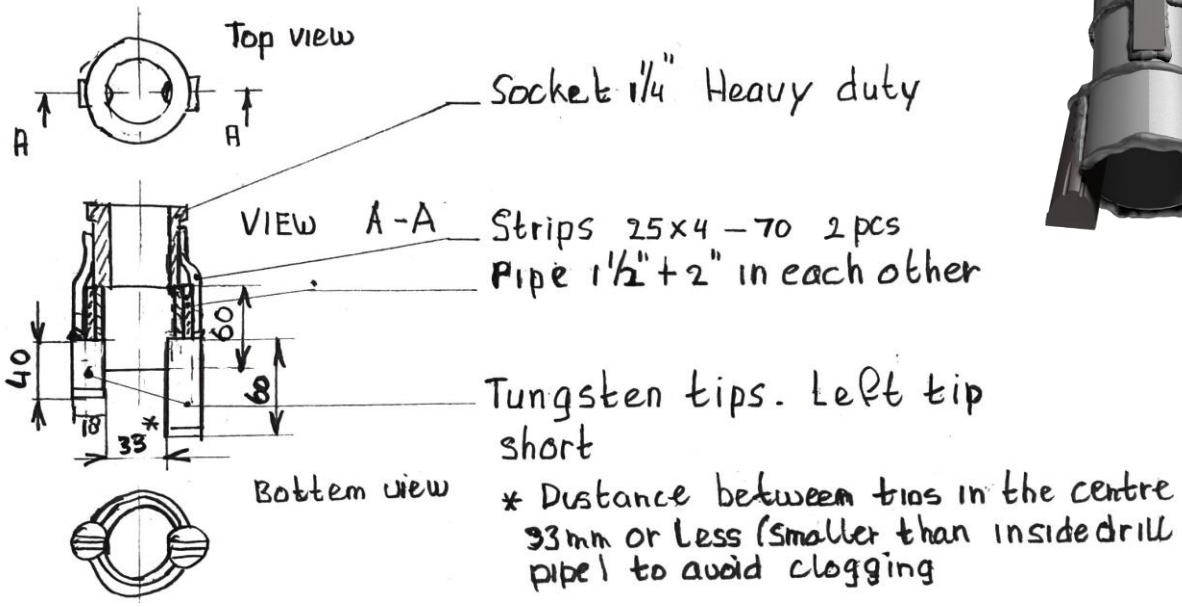


5.2.5.1 Points of attention for heavy drill pipe

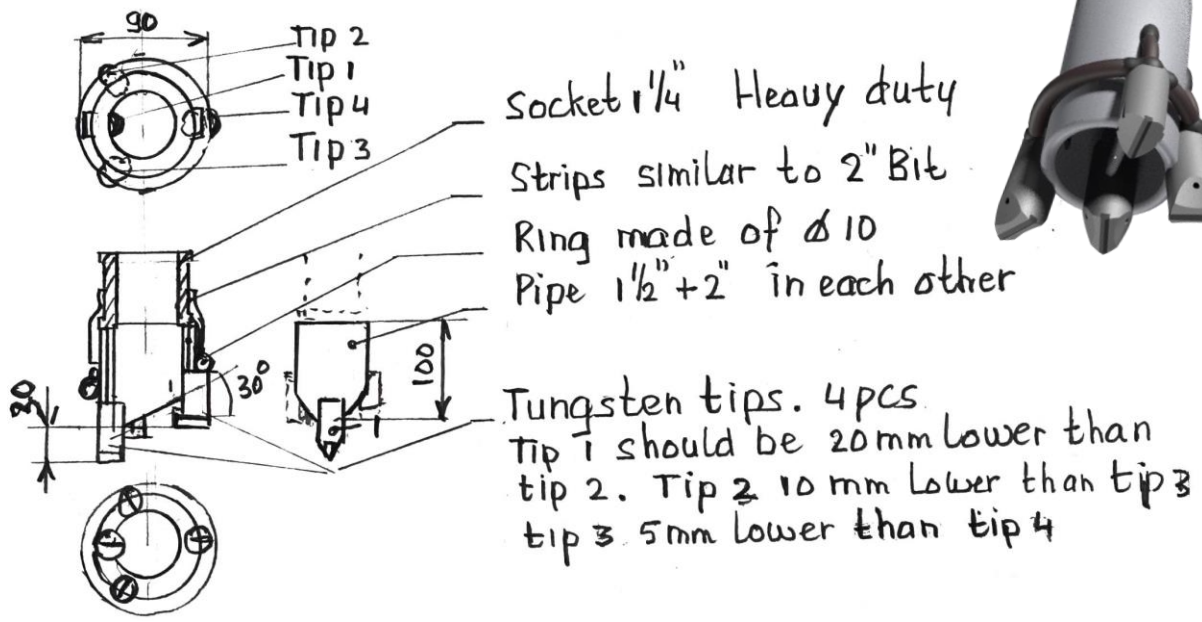
Fill the open space between the pipes with sand or cement before closing it.

Weld both pipes to the nipple and the socket. Reduce both ends of the outer pipe with some hacksaw cuts. Make sure the low end of the drill pipe, at the nipple, has 4 stop strips and the socket end has 4 strips to connect the pipe and the socket.

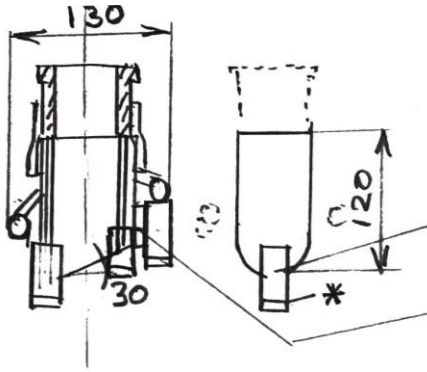
5.2.6 Drill bit 2”



5.2.7 Drill bit 5”



5.2.8 Drill bit 6”

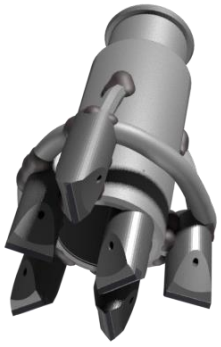


The 6" bit is similar to the 4" bit but larger diameter

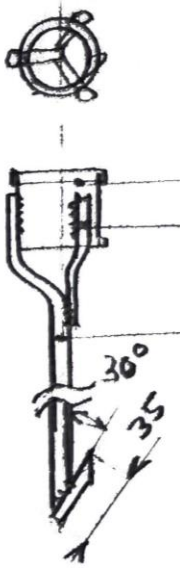
Tungsten tips. 4pcs

Round bar ϕ10–40

* Note. Cut with grinder



5.3 Fish pin



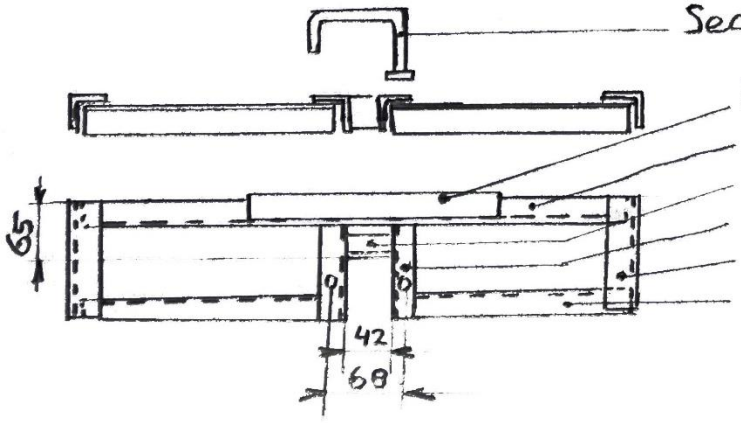
Socket 1¼"

Round bar ϕ10 x 100 2pcs

Round bar ϕ10 x 300

Piece of 35mm cut in 30°

5.4 Pipe support



Security pin ϕ8–190

Angle iron 25x3–200 1pcs

" " " –600 1pcs

" " " –40 1pcs

" " " –120 2pcs

" " " –150 2pcs

" " " –270 2pcs

5.5 Stone punch