PROGRAMME FOR INTEGRATED DEVELOPMENT OF ARTISANAL FISHERIES IN WEST AFRICA

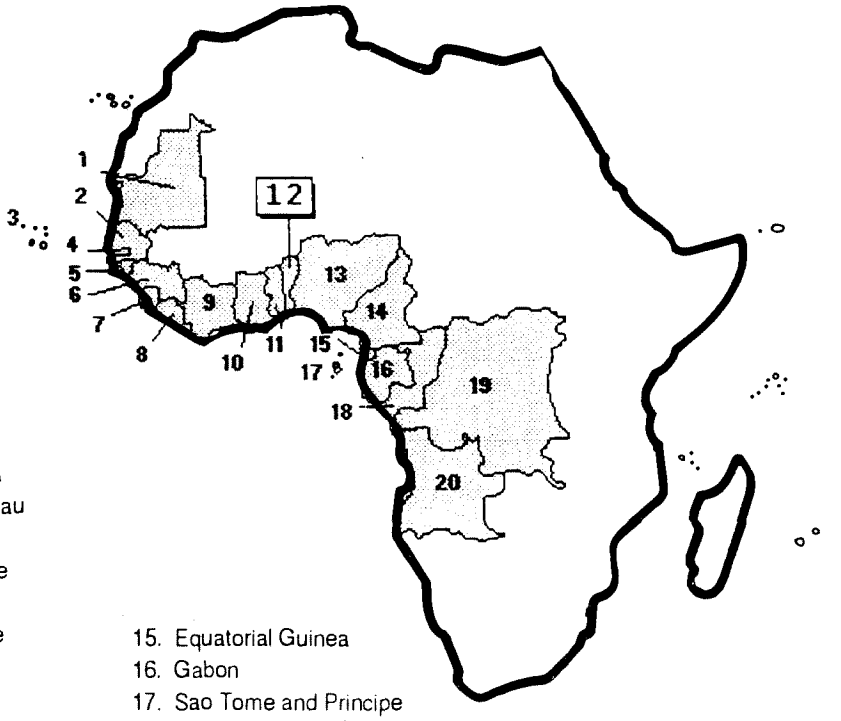
IDAF PROGRAMME

Technical Report N° 136 November 1998

Construction Manual

For

Capstans and Transportable Slipways



1. Mauritania
2. Senegal
3. Cape Verde
4. The Gambia
5. Guinea Bissau
6. Guinea
7. Sierra Leone
8. Liberia
9. Côte d'Ivoire
10. Ghana
11. Togo
12. **Benin**
13. Nigeria
14. Cameroon
15. Equatorial Guinea
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18. Congo
19. Zaire
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DANIDA DEPARTMENT OF INTERNATIONAL DEVELOPMENT COOPERATION OF DENMARK

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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Construction Manual

For

Capstans and Transportable Slipways

by

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IDAF

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Cotonou, November 1998

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THE VISION FOR IDAF PHASE III

INTRODUCTION

Development strategy during the 1960 and 1970s was based on the philosophy that developing countries lacked improved technology and capital for speeding up their development. Industrialization was promoted in order to capitalize on the abundant fish resources. However, the anticipated expansion of the economy did not happen and the development approach shifted towards an integrated rural strategy where emphasis is put on the community as a whole to upgrade incomes and the quality of life through technical assistance and the active participation of fisherfolk and the community.

In this context, emphasis was initially placed on the Community Fishery Centre (CFC) concept as a means of promoting artisanal fishery development. But it became apparent that the presence of a complex of facilities and services tailored to meet local needs was no guarantee that the structures/facilities would be used or that development would occur. The active participation of fisherfolk and the mobilisation of local and community resources was imperative in order to assure sustainability of initiatives undertaken by development projects and/or the community.

So far and in general terms, the IDAF Programme has worked under the context of abundant or seemingly adequate fishery resources with moderate population pressure. The scenario is however changing (and very fast for that matter) and we would soon face the triple constraints of reduced or depleting fish stocks, degrading environment and increasing population pressure. Like in other sectors, it must be anticipated that just to survive, parts of the population surplus in the fishing communities will enter the artisanal fisheries, which will increase the competition for the resources among the small scale fisherfolk in addition to the prevailing competition between the artisanal and industrial fisheries, with their attendant effect on the environment.

This scenario calls for a continuation of the integrated participatory strategy which remains relevant to the development of artisanal fisheries in West Africa. However, the emphasis needs to be placed on the elements and mechanisms that favour the sustainability of initiatives: responsible fishing, the empowerment processes that ensure the devolution of major resource management and development decisions to the local community, the strengthening of national human and institutional capacities at all levels for a sustainable and equitable fisheries resources management and development, as well as in the follow-up and consolidation of past achievements

DEVELOPMENT OBJECTIVE

Thus the development objective of the Programme in the present phase III which started on 1 July 1994 is to ensure twenty coastal West African countries a sustainable development and management of their artisanal fisheries for maximum social and economic benefit of their fishing communities in terms of employment, proteins and earnings. This will be done through an integrated and participatory approach in which emphasis will be laid on equity, gender issues, the transfer of technology for development, environment protection, as well as the strengthening of human and institutional capacities.

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1. INTRODUCTION

For several decades, attempts have been made to improve the hauling of artisanal canoes in developing countries, especially on beaches difficult to approach, where landing sites are traditionally occupied by fishing communities.

Despite the efforts, the problem of an easy landing and hauling of canoes on the heavy surfing beaches is yet to be solved, especially in small scale fisheries in which the working tool is mainly small and fragile open dugout or planked canoes.

Motorization of canoes started in West Africa about forty years ago. As a result, the length and therefore the weight of the canoes increased considerably. It is now common to see dugout canoes with 16 metres overall length, as well as planked canoes like the Senegalese type reaching 22 metres with a weight of 6 tons when empty. These big open canoes are propelled with 40 horsepower outboard motor.

Landing of canoes on these dangerous surfing beaches often results in capsizing when crossing the surf with an overloaded canoe which is not always easy to manoeuvre.

Futhermore, the swell often prevents quick hauling of the canoe. This results in significant damages to the hull because of repeated shocks due to bad grounding.

2. PREPARATION OF THE PRESENT MANUAL

Due to the curiosity and real interest shown for the hauling devices by the people trained as well as the users, the present publication was prepared to supply the potential builders who are the small welders and mechanics operating in the coastal villages of West Africa with a practical working document. Fisheries administrations, mainly extension services should also benefit from it.

In knowing that artisanal mechanics and welders concerned have limited knowledge on reading technical plans, and the sketches are not to scale, it was considered more convenient to directly mention on each drawing or sketch the maximum of quotations. The user will therefore directly observe the drawings and work immediately with the different elements used in the construction of a manual capstan or a transportable slipway.

Refer to Table 2 and 3 for the designation of the parts needed for the construction of a capstan or slipway. For example, if one needs the dimensions of Figure 10, the reference is in Table 2 ; giving information on the number of requested pieces, type of material used, dimensions in millimetre, unless otherwise specified , and the remarks.

3. IDAF ACTIVITIES ON HAULING DEVICES

Taking into account the difficulties in landing an artisanal canoe on these coastal areas with predominant heavy swell and the tidal waves phenomenon, IDAF, in collaboration with Departments of Fisheries of countries concerned, trained small artisanal mechanics and welders on the construction of manual capstans and transportable slipways for the quick hauling of artisanal fishing canoes.

The construction of manual capstans and transportable slipways and the training of mechanics and welders were carried out in four countries ; The Gambia, Senegal, Ghana, and Benin.

In the Gambia where the first capstan was built in 1996, IDAF constructed the equipments, demonstrated and trained beneficiaries on the use of a wooden base frame capstan of the FAO/BOBP type. The reference model was conceived by G. Pajot, Senior Fishing Technologist of BOBP (Bay of Bengal Programme for Fisheries Development).

At least ten were introduced in several member countries of the Bay of Bengal Programme (BOBP/WP/71). These capstans were very much appreciated and are still in use after nearly ten years.

The steel base frame of the capstans and the slipways have been conceived and designed by the IDAF Programme in Cotonou, Benin.

In 1997, IDAF constructed a manual capstan (FAO/BOBP type) with a wooden frame in Kayar, Senegal. It also conducted demonstrations and trained the users.

It should be noted that the wood used, mahogany, which was more expensive than the steel frames, was replaced after a year because of its destruction by insects, inspite of tar coating. This wooden frame was substituted by a steel frame made from angle iron 60 x 60 x 6, similar to the steel frames of the capstans built in Benin and Ghana .

In Kayar, which has one of the most important artisanal fishing fleet in Senegal, six transportable slipways were introduced in 1998.

In 1997/98, the programme built a manual capstan with steel frame and four transportable slipways at Cotonou-Port, Benin. The users were also trained through demonstrations.

The Programme also trained welders and constructed and demonstrated the use of a manual capstan at the Integrated Centre for Inland Fisheries at Yeji, Ghana.

4. CONSTRUCTION COSTS

The cost of these hauling devices varies according to the country, the year of construction and the price of the material. It should be noted that all the steel parts were purchased in scrap metal shops in order to decrease the construction costs. Indicative costs for the construction of the hauling devices are shown in table 1.

Table 1 - Construction costs for different hauling devices for artisanal canoes (in US $).

Country	Year	Hauling devices	Cost per unit	Total cost
Gambia	1996	1 capstan FAO/BOBP style	823	823
Senegal	1997	1 capstan FAO/BOBP style	1 353	1 353
Benin	1997	1 capstan with steel frame	1 200	1 200
Benin	1997	4 slipways	230	920
Ghana	1998	1 capstan with steel frame	1 250	1 250
Senegal	1998	6 slipways	250	1 500

5. SPECIFICATIONS AND RECOMMENDATIONS

The weight of the capstan, with wooden frame or steel frame is almost the same, that is around 145 kg together with 100 metres of 14 mm steel wire coiled on drum.

Life span of the capstan is about ten years when maintained by greasing the drum's pivot and all articulated parts twice a year. When constructing, the capstan should receive at least two coats of red oxide plus two coats of tar . One should repeat the tar application every year.

The drum capacity is 165 metres of manually coiled 14 mm steel cable type 6 x 7 (6/1) . When coiling, a good greasing of the cable must be done.

Cleaning the cable of sand after each use is highly recommended . To get a steel cable life span of the steel cable of about four years is possible with a good maintenance and if steel cable is reversed from time to time.

If constructed according to the recommended dimensions and materials, the transportable slipway weighs 112 kg. When carried by 6 people, the distributed weight becomes 18.6 kg per person, which is lighter to transport on the beach.

The transportable slipways are also coated with two coats of red oxide after construction.
To get a life span of about eight years, it is recommended to apply a coating of red oxide and a coat of tar once a year. These products are readily available in many shops along the fishing villages.

After every use of the slipways, the fishermen should clean the axles and axle holders of sand with a bucket of water.

Every month, the users should also lubricate the axles with black oil to maintain a good motion of the rollers, and prevent deterioration of the axle shape.

6. List of tools needed for the construction of manual capstans and transportable slipways.

A minimum of tools is required for the construction of hauling devices, whatever the device ; either a capstan or a transportable slipway. They are :

1 tape measure

1 pencil

3 metallic try squares graduated up to 20 cm

1 spirit level

1 hacksaw

20 hacksaw blades of good quality

1 wooden hand saw, in case of choosing a wooden frame for capstan

1 hammer (about 500 grams)

1 combination pliers (6 inches)

1 adjustable spanner (10 inches)

2 flat spanners for bolts of 12mm

1 hand drill, (better an electric drilling tool able to use drill bits of 13mm as a minimum).

1 drill bit of 12 mm

1 electrical grinder

2 cutting disks for the grinder

2 metal polishing disks for the grinder

1 arc welding machine with a minimum capacity of 30 amperes, able to use welding rods of Ø 3.2 mm

2 packs of welding rods of Ø 3.2 mm (for one capstan).
(If a slipway is to be constructed, one should consider the use of 1,5 pack of welding rods of Ø 3.2 mm (for 1 slipway).

4 paint brushes (2 inches wide)

2 litres of thinner

2 kg of grease for one capstan (greasing the hub of the drum and the fairled)

1 kg of grease for two slipways (initial greasing of the rollers 'shafts and inside the shafts' holders.

Table 2 - Designation of the parts needed for the construction of a manual capstan

Figure of reference	Description	Quantity	Material	Dimensions in mm	Remarks
Figure 2	Global view of a manual capstan of the FAO/BOBP type				
Figure 3	Steel base frame	2 steel angle	steel	1 x 2700	
Figure 3	Steel base frame	1 steel angle	steel	1 x 2150	
Figure 3	Plate preventing the device to sink into the sand	1 plate	steel	500 x 350 x 6	
Figure 3	Front reinforcement triangles	2 pieces	steel	30 x 30 x 34 x 4	
Figure 3	Back vertical fitting plates	2 pieces	steel	180 x 140 x 95 x 10	to be adjusted
Figure 3	Front vertical fiting plates	2 pieces	steel	170 x135 x 10	to be adjusted
Figure 3	Triangle supporting front vertical plates	2 pieces	steel	160 x 195	to be adjusted
Figure 4	Wooden frames (front part)	1 piece	mahogany	600 x 75 x 75	
Figure 4	Wooden frames (front part)	1 piece	mahogany	2150 x 75 x 75	
Figure 4	Wooden frames (lateral plate	2 pieces	mahogany	2700 x 150 x 75	
Figure 4	Hauling removable bars	4 tubes	galva.steel	Length : 3500, Ø 75 mm	
Figure 5	Fairled (see figure 5 for dimensions)				
Figure 6	Drum support (see figure 8)				
Figure 7	(See the figure for the details on making the pawl)				
Figure 8	Top drum fitting bolt	1 piece	steel	Length : 75, Ø 25 mm	For the washers see figure 8
Figure 8	Tube used as drum's pivot	1 piece	steel	Length : 260 mm	Ø to be adjusted according to drum's inner Ø
Figure 8	Longitudinal element (U Beam)	1 piece	steel	Length : 800 x 200 x 75 x 8	
Figure 8	Transversal element (U Beam)	1 piece	steel	Length : 800 x 150 x 65 x 7	
Figure 8	Anchoring chain's retainer	3 pieces	steel		(see figure 8)
Figure 8	Supporting plate for the drum's pivot	1 piece	steel triangle	160 x 100 x 6	
Figure 9	Drum's top flange	1 piece	steel	550 x 550 x 12	
Figure 9	Handle fixtures		steel plates		(see figure 8 for the dimensions)
Figure 10	Inferior drum's rachet flange	1 piece	steel plate	550 x 550	To be cut as per figure 10
Figure 10	Ratchet	1 piece	steel		For the brake, select either this model or as on figure 7
Figure 11	Elevation view of the capstan's drum				Strictly respect the dimensions as on figure 11
Figure 11	Detail of the parts for the handle fixtures fabrication				Strictly respect the dimensions as on figure 11
Figure 12	Drum completed				Weld an iron rod of Ø 8 mm between the ratchet flange and the hub to be used as a cable fixture
Figure 13	Anchoring point for the capstan				Strictly respect the dimensions as on figure 13

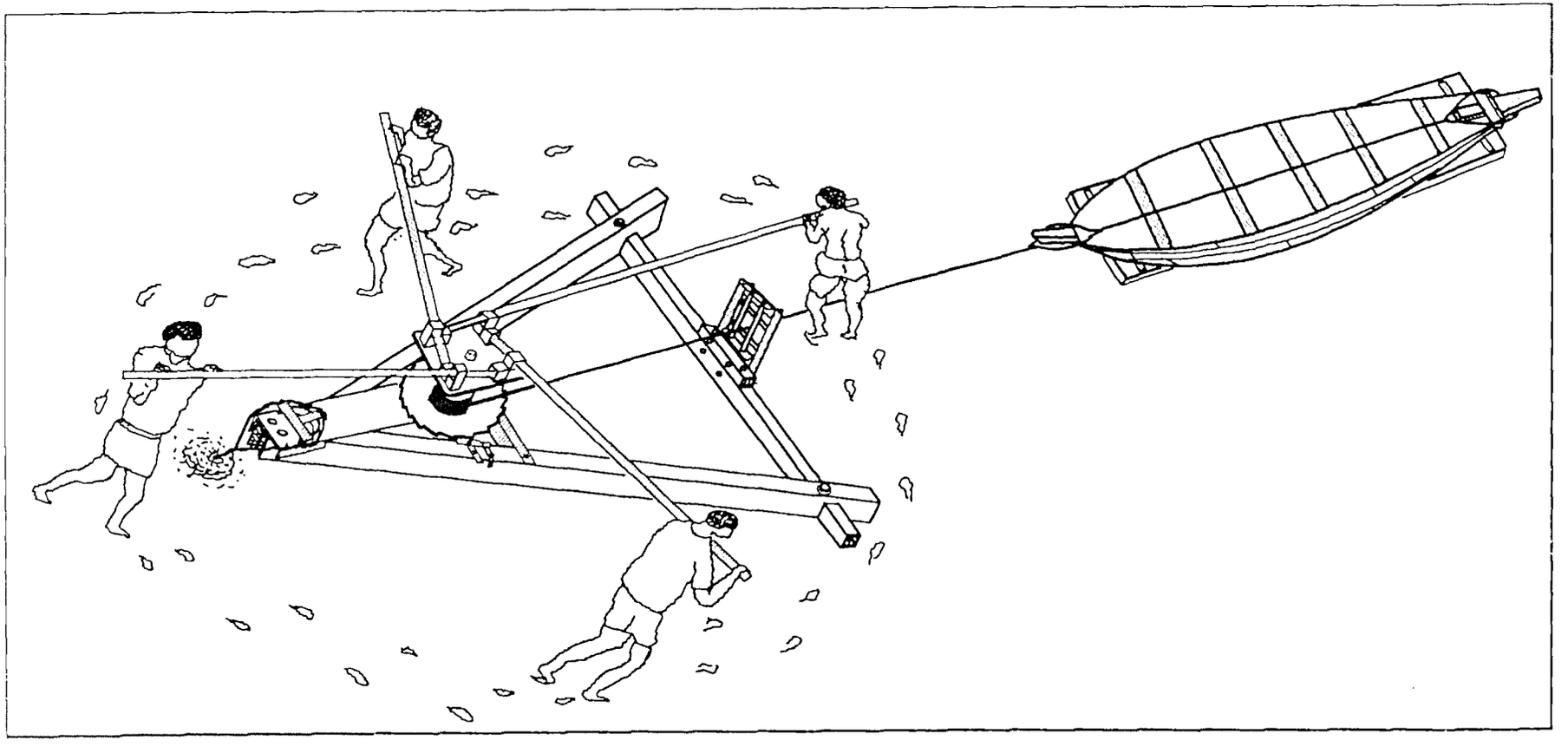
Table 3 - Designation of the parts needed for the construction of a slipway

Figure of reference	Description	Quantity	Dimensions in mm	Material	Remarks
Figure 14 /18	Longitudinal I Beam 80 x 42 x 3,9	2	3000 x 2	I Beam	
Figure 14 /18	Transversal I Beam 80 x 42 x 3,9	4	1000 x 4	I Beam	See figures 14 and 18 for cutting the transversal I Beam and their insertion inside the longitudinal ones. Outside corners to be rounded.
Figure 15	Cutting of a I Beam 80 x 42 x 3,9 for the fabrication of an axle holder	6 per slipway	Length: 250	I Beam	Respect strictly the dimensions of figure 15
Figure 16	An axle holder completed with holder axle tube and supporting square	6 per slipway	Length: 250	I Beam	Axle holder tube of 110mm long, Ø 63/53 (respect all dimensions).
Figure 17	Détail of the fabrication of the rollers	6 per slipway	Length : 750, Ø 114/110 (minimum)	Steel tubes of the non welded type for general purpose	Don't go below these dimensions for a safe hauling of the 6 tons canoes.
Figure17	Plain steel shaft for the fabrication of the axles	6 per slipway	6 x 110, Ø 45	Steel	Minimum Ø to be respected. Weld strongly the axles on both sides after being inserted into the circular edge tapes as per figure 17
Figure17	Circular plate tapping the edge of the tubes. The axles will be inserted into it	2 per tube	Ø 110, thickness : 10	Steel	To be cut preferably with oxyacetylene torch
Figure 18	Top view of a slipway		Overall dimensions : 3000 x 930		The 6 transport handles made of iron rods of Ø 12 mm must be welded as on figure 18
Figure 18	Triangles preventing the device to sink into the sand	4 per slipway	300 x 300 x 430 x 4	Steel plate	To be welded under the outside corners of the slipway's frame as per figure 18
Figure 19	Top view of the tool used to better position the axles		See figure 19		This tool must be fabricated from scrap of I Beam 80 x 42 x 3,9 and small flat steel sheets. The tool will permit one to get a better position of the axle in comparison with the outer part of the tube at the moment of welding.
Figure 20	Elevation view of the positionning tool		See figure 20		

Figure 1 – HAULING AN ARTISANAL CANOE USING A CAPSTAN OPERATED BY FISHERMEN.

The idea is to decrease the effort exerted by fishermen when they return from sea. Even when exhausted, they should be able to contribute physically to the hauling of their canoe. To carry out this activity, the fishermen go through several difficulties which increase their strenuous effort. These include waves crushing the beach and quicksands that make the hauling of canoes tremendously difficult without rail planking or appropriate rollers. Sometimes the fishermen use branches or paddles as wooden railing on which to place rollers cut out from coconut or palm trees approximately 20 – 30 cm in diameter. This traditional hauling system for artisanal canoes is in use within the West African artisanal fisheries in several landing sites throughout the twenty member countries associated with IDAF (from Mauritania to Angola).

The introduction of capstans and the transportable slipways should decrease a great number of problems related to the pulling ashore of the big artisanal fishing canoes in West Africa.



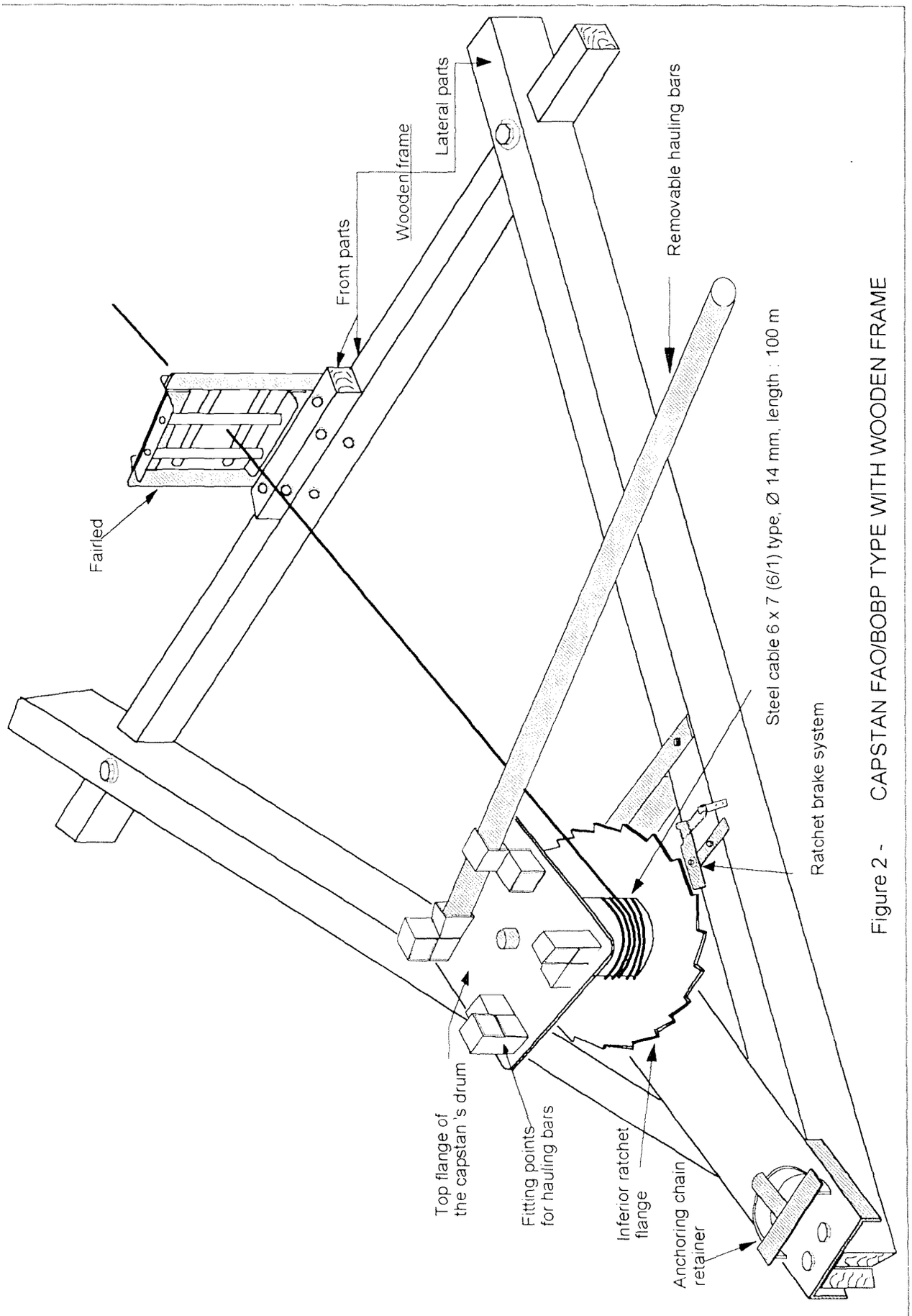


Figure 2 - CAPSTAN FAO/BOBP TYPE WITH WOODEN FRAME

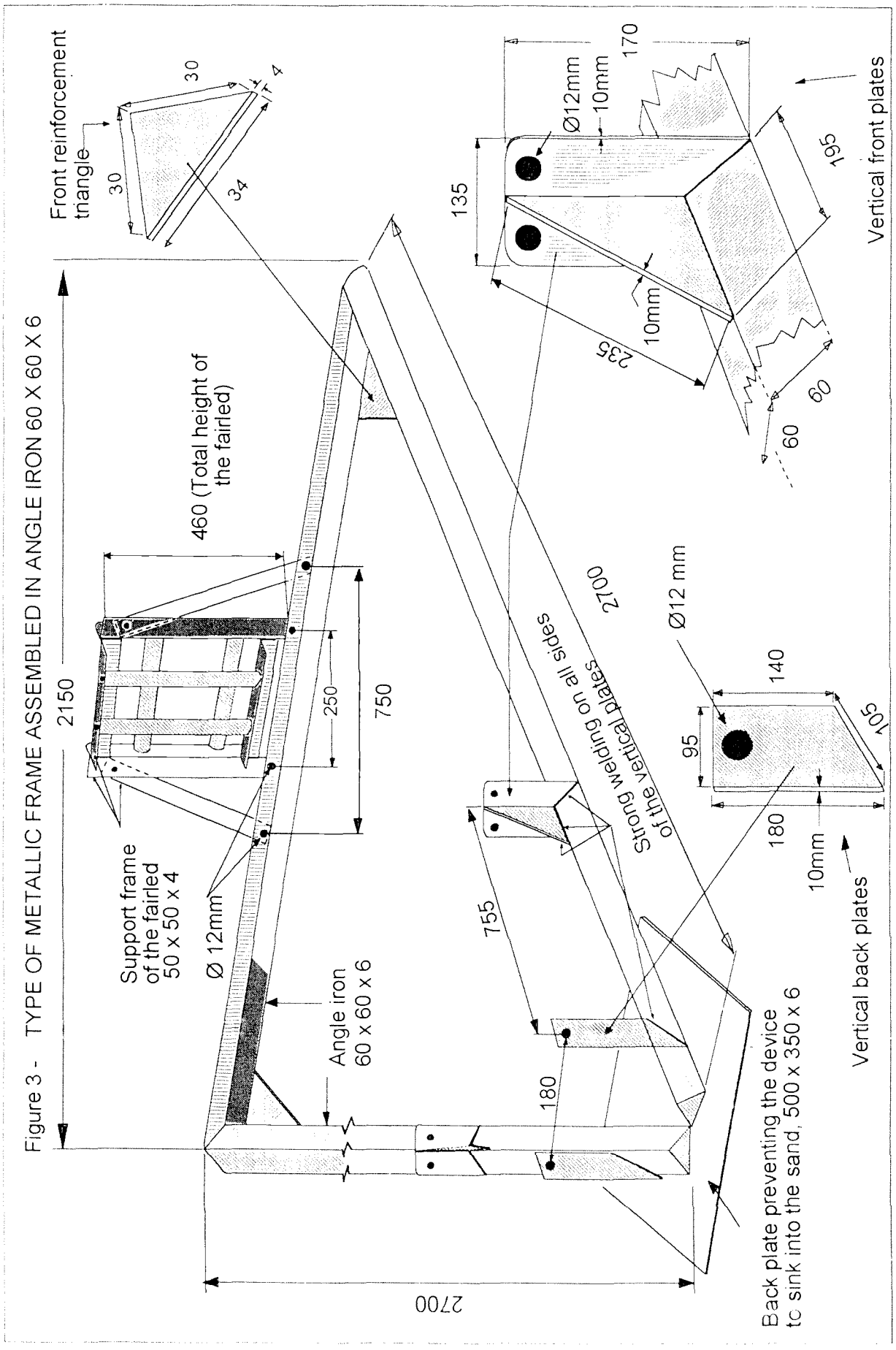


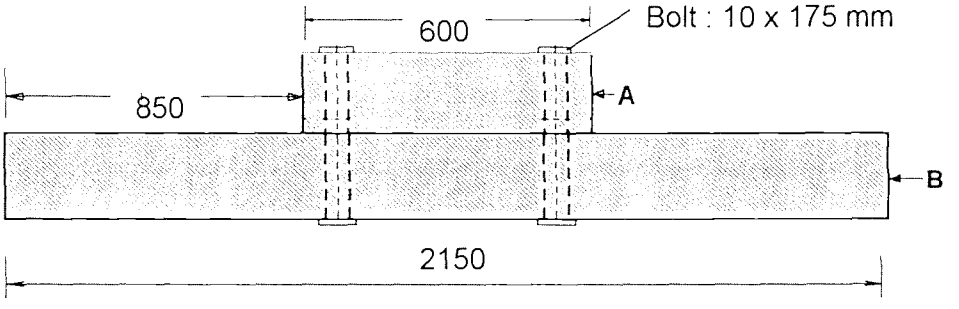
Figure 3 - TYPE OF METALLIC FRAME ASSEMBLED IN ANGLE IRON 60 X 60 X 6

Figure 4

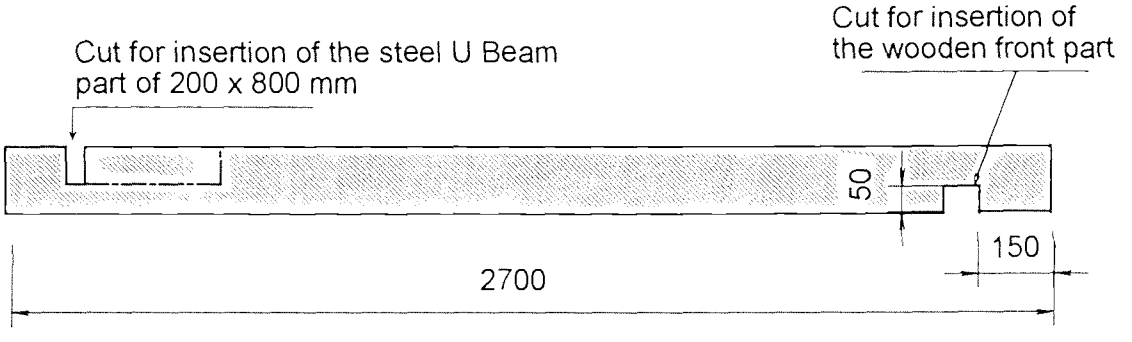
ELEMENTS OF THE WOODEN SUPPORT FRAME AND THE HAULING BARS

A : An element of 600 mm long

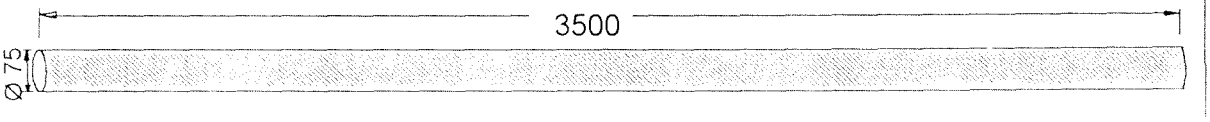
B : An element of 2150 mm long



C : Wooden frames (lateral parts, 2 elements), 150 x 75 x 2700 mm

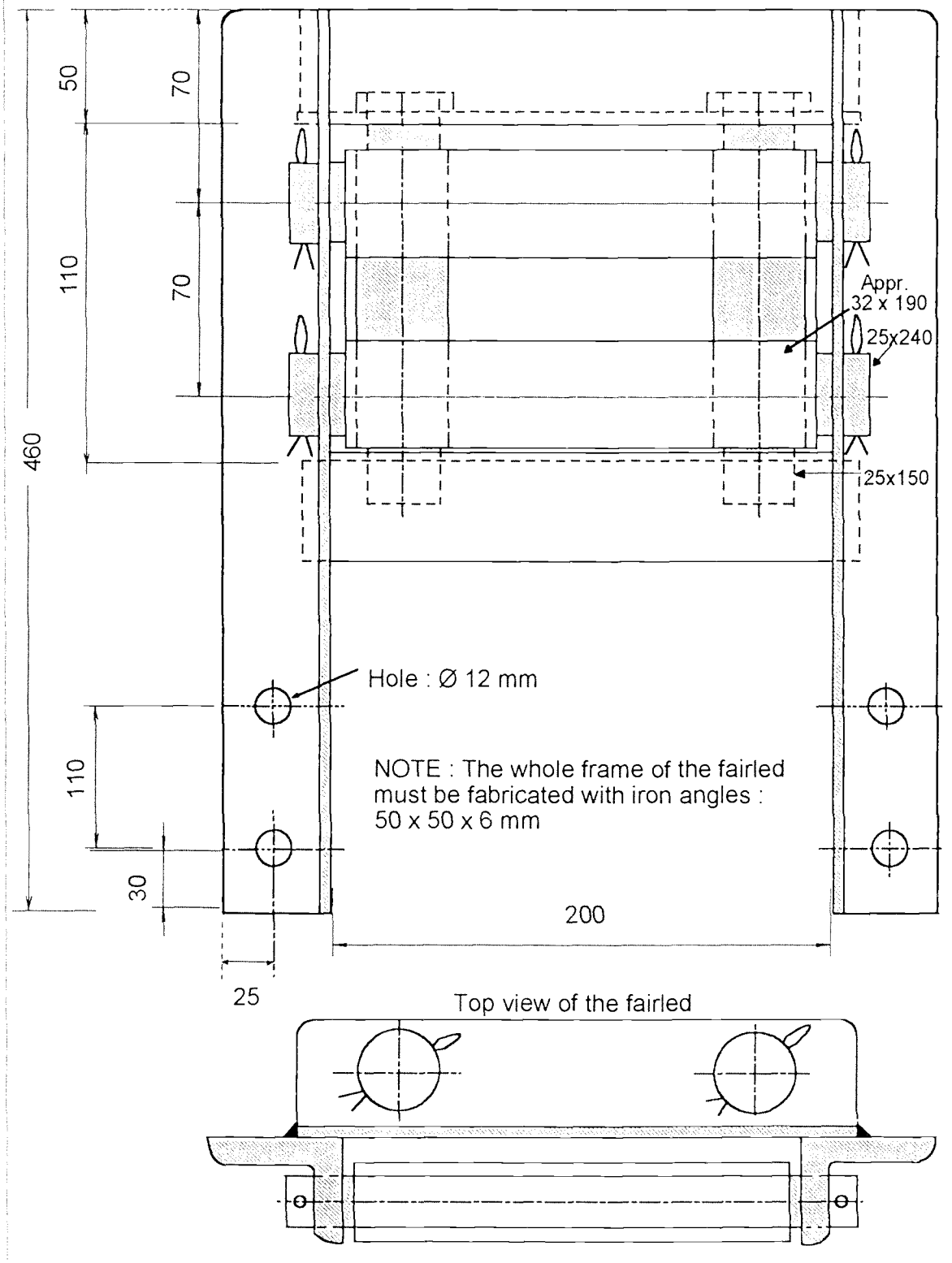


HAULING BARS



4 galvanized steel tubes with 75 mm in diameter

Figure 5 - FAIRLED



The tubes of galvanized iron must freely move within each other

Figure 6 - THE FRAME SUPPORTING THE DRUM READY TO BE BOLTED ON THE STEEL BASE FRAME

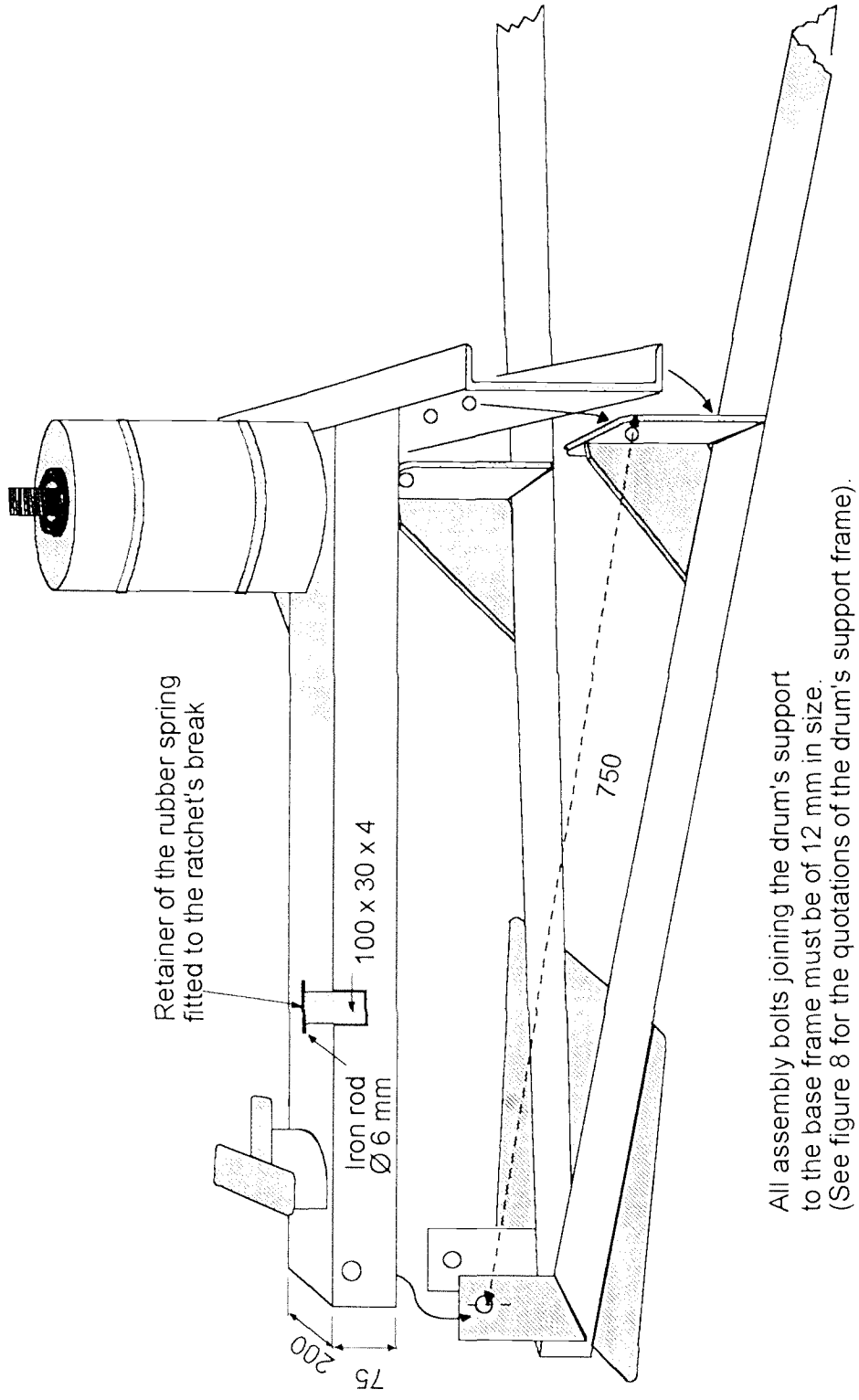


Figure 7 - THE DRUM'S SUPPORT FRAME INSTALLED ON THE METALLIC BASE FRAME

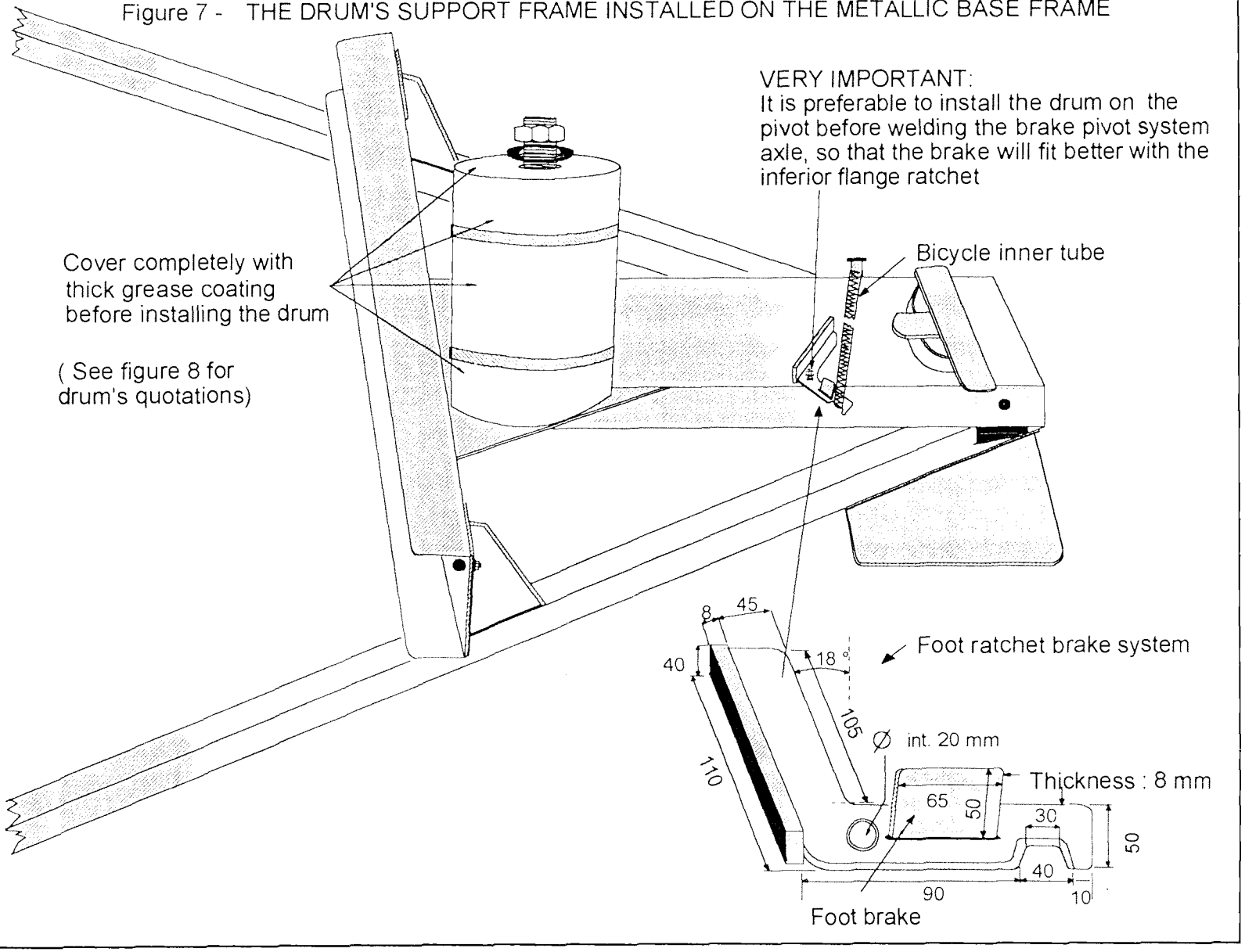
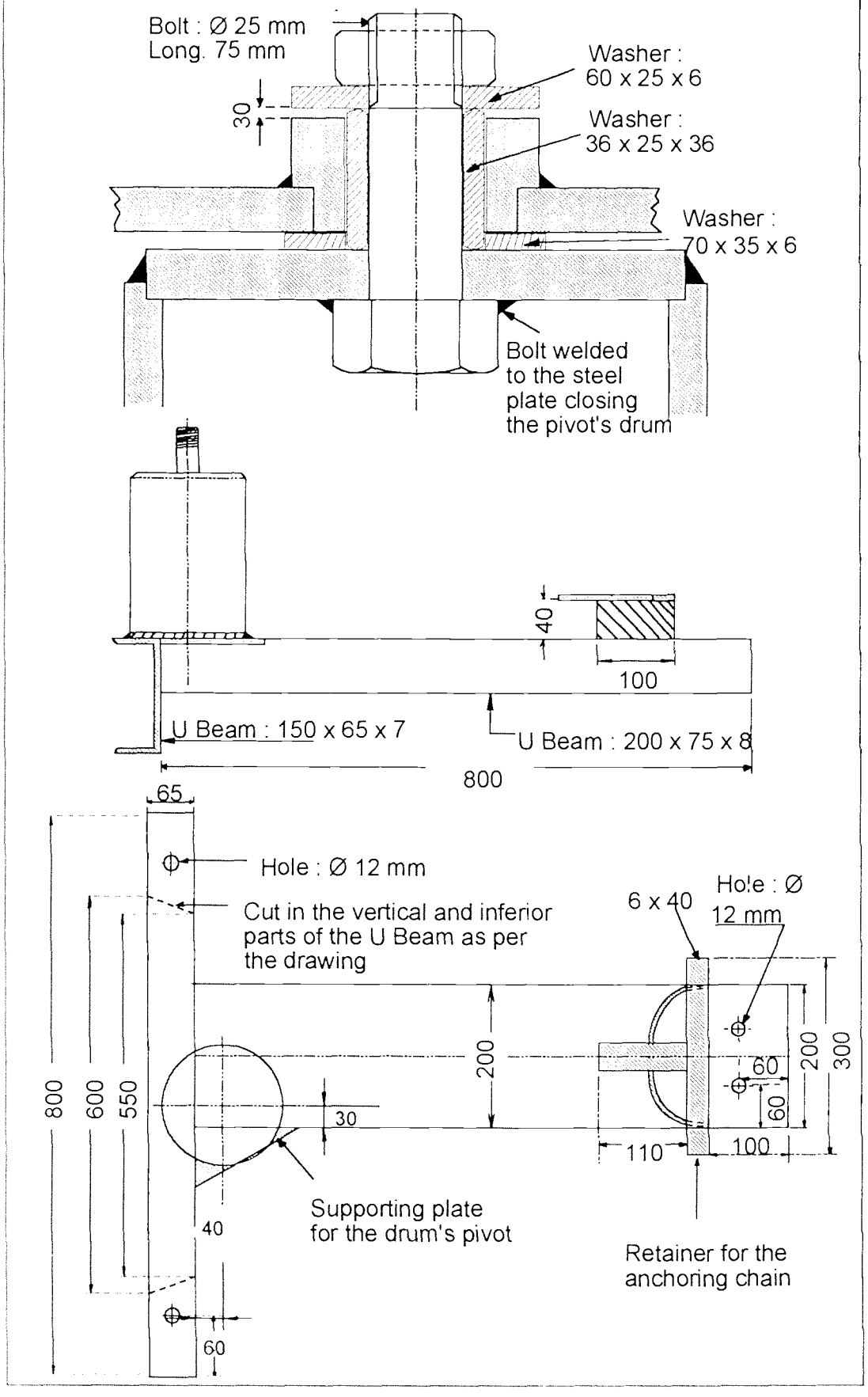


Figure 8 - DETAIL OF THE PARTS OF THE DRUM'S SUPPORT FRAME



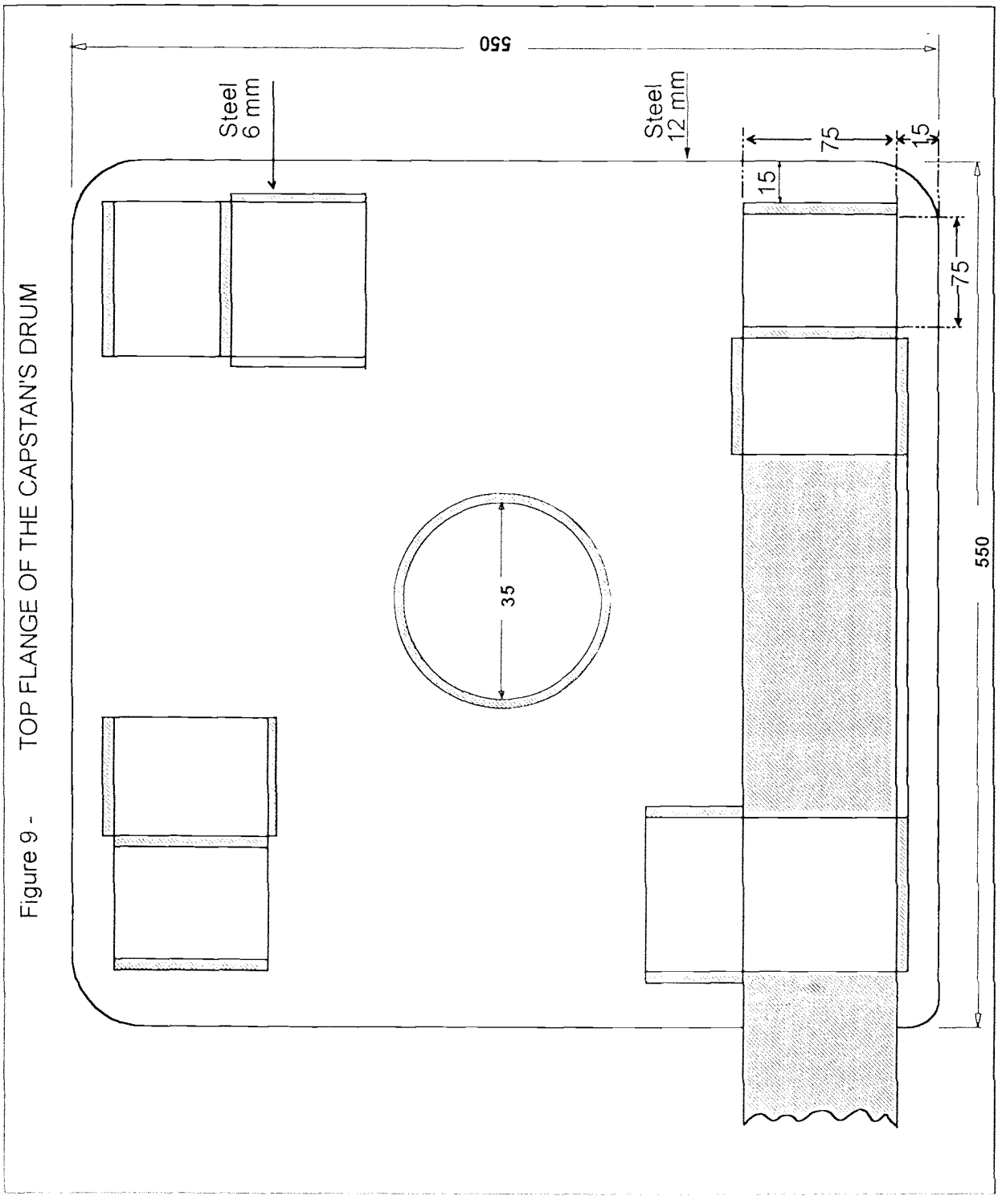


Figure 9 - TOP FLANGE OF THE CAPSTAN'S DRUM

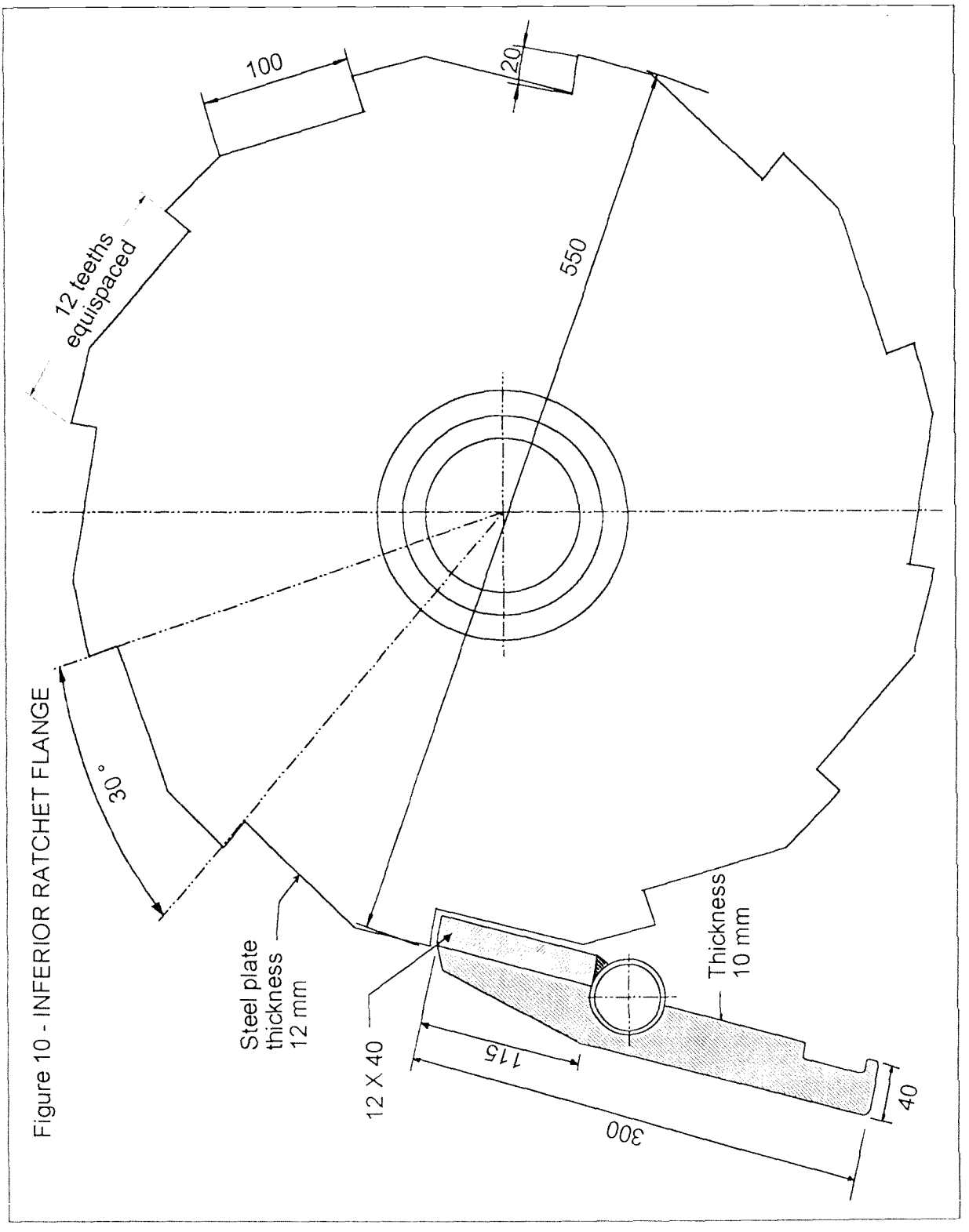


Figure 10 - INFERIOR RATCHET FLANGE

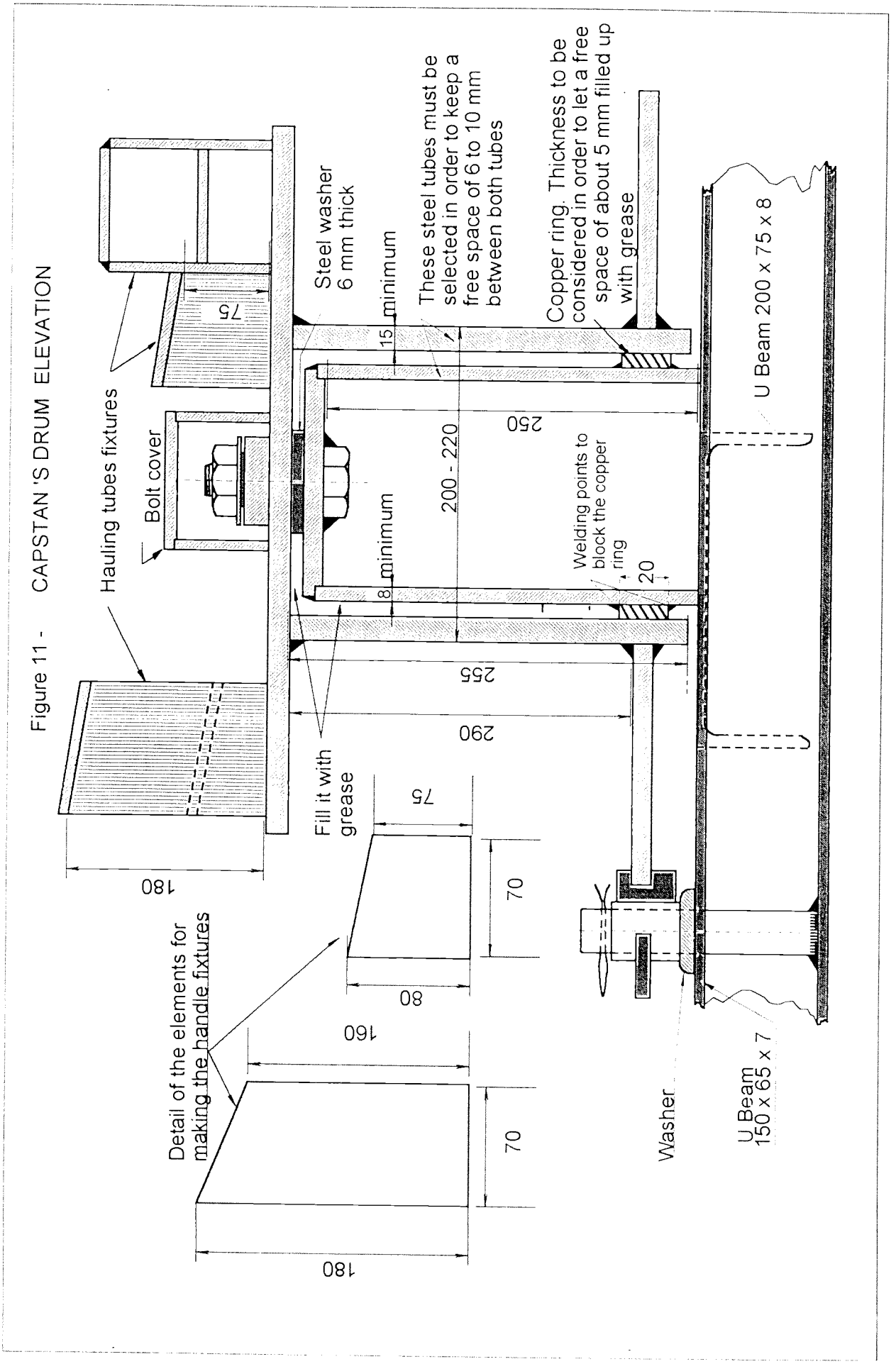


Figure 11 - CAPSTAN 'S DRUM ELEVATION

Figure 12 - THE CAPSTAN'S DRUM COMPLETELY ASSEMBLED

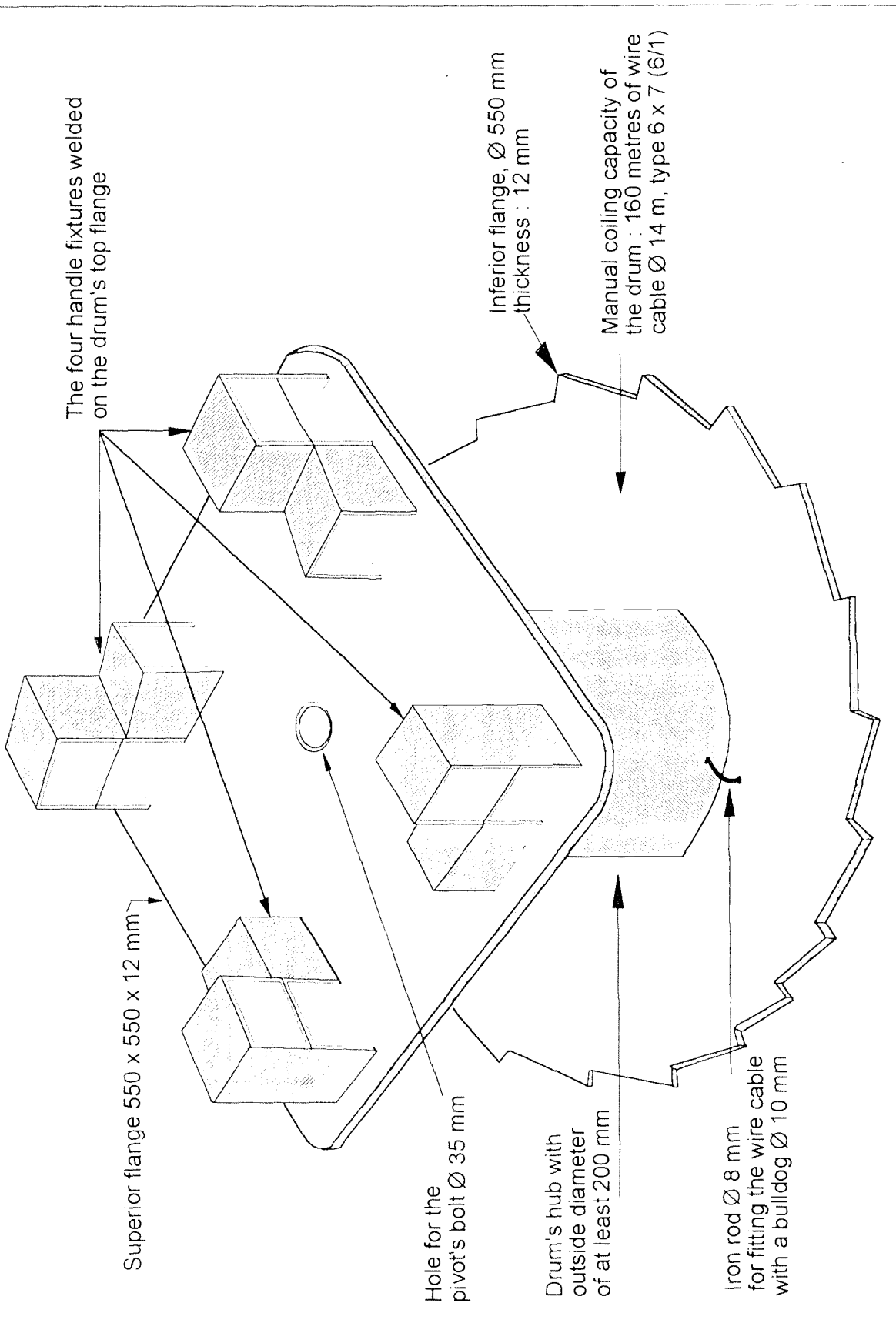


Figure 13 - FITTING POINT OF THE CAPSTAN

The anchor is made of a second hand tyre filled up with concrete cement and buried at a depth of 1.20 metres as a minimum. The anchor should be covered with sand mixed up with stones and compacted by foot while using some water to help the compacting work. This will increase the weight of the anchor(s) point(s).

NOTE :
To be able to obtain a good compacting work of the anchor point, wait for two days before using the capstan for the first time

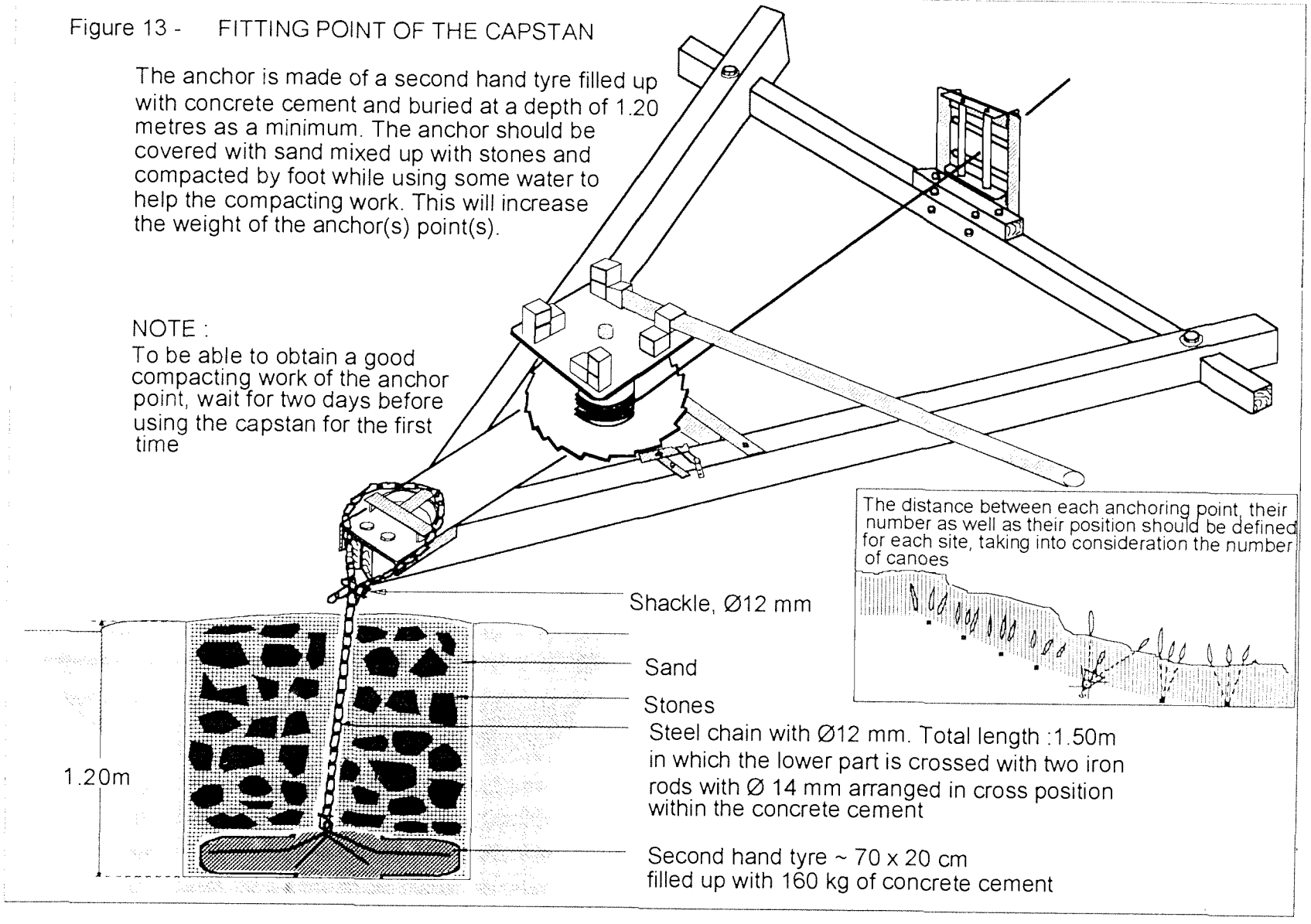


Figure 14

Perspective view of a slipway frame completely assembled. The axle holders are positionned but not welded in order to facilitate the insertion of the rollers into the axle holders. One should consider to use try squares and spirit level to obtain the best perpendicularity during the welding of the axle holders to the frame.

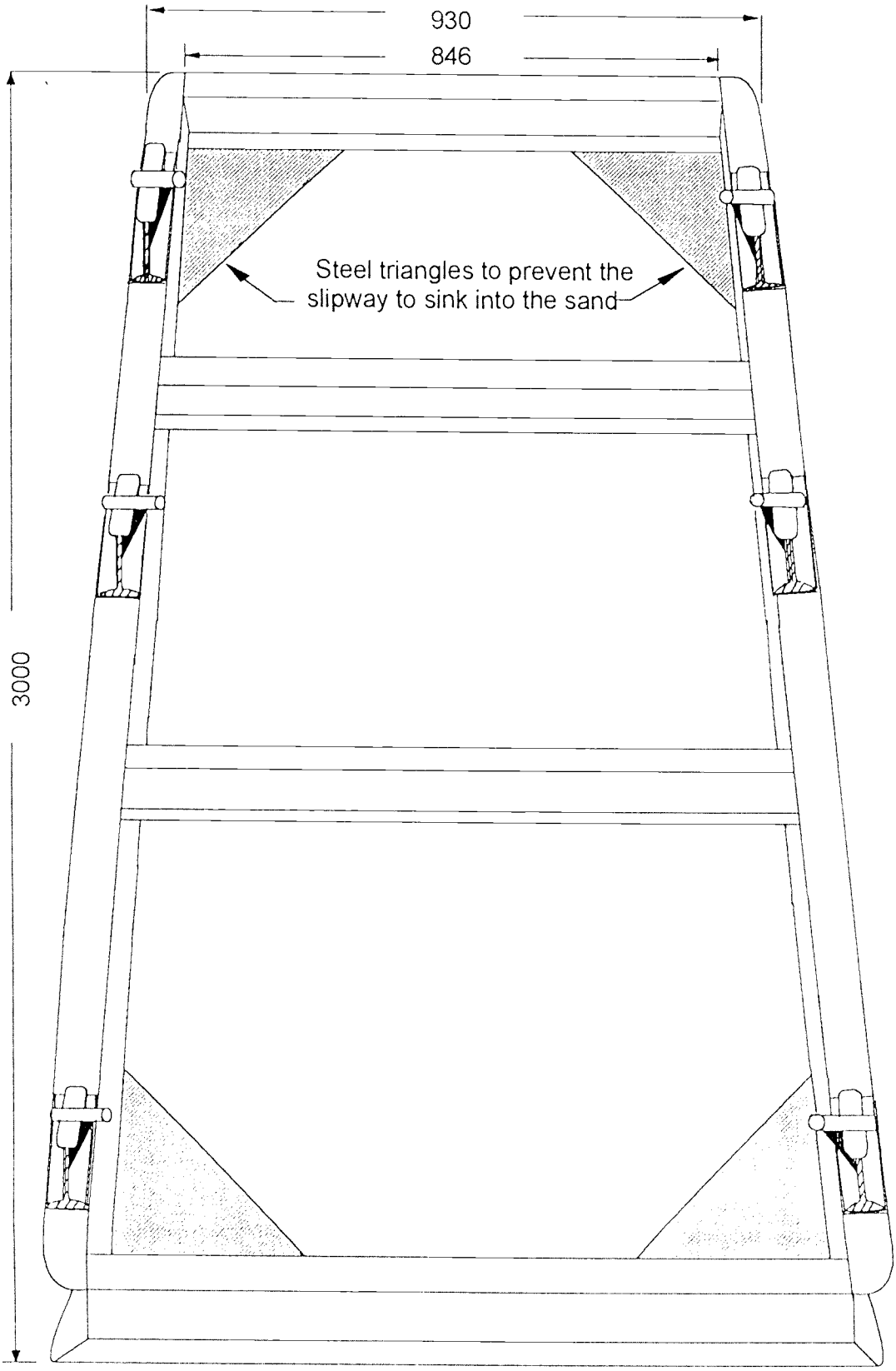
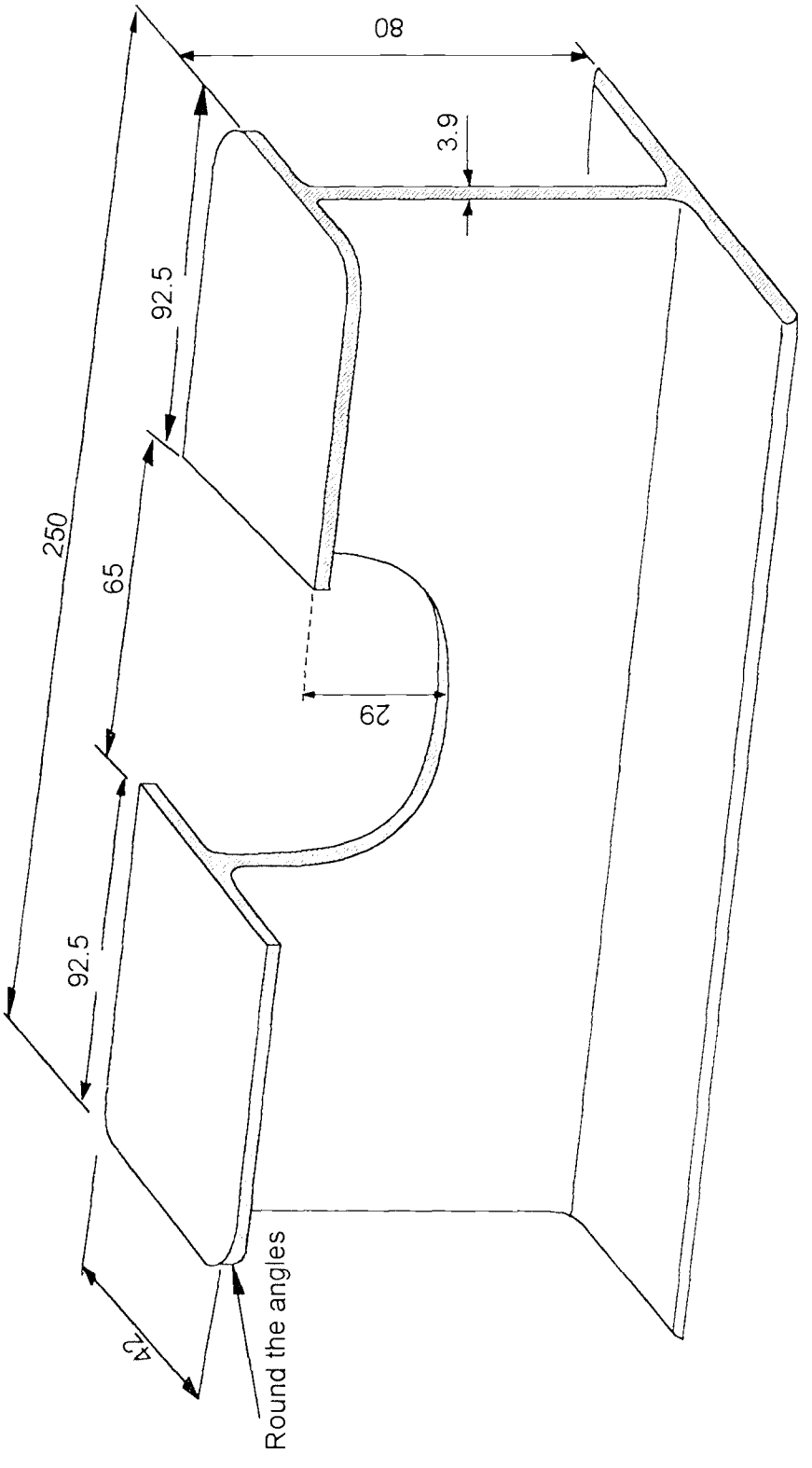


Figure 15 - A PIECE OF I BEAM 80 X 42 X 3.9 CUT IN ORDER TO INSERT THE AXLE HOLDER TUBE WITH DIAMETER 63/53 IN 110 MM LONG



(See figure 17 for the axle holder assembly)

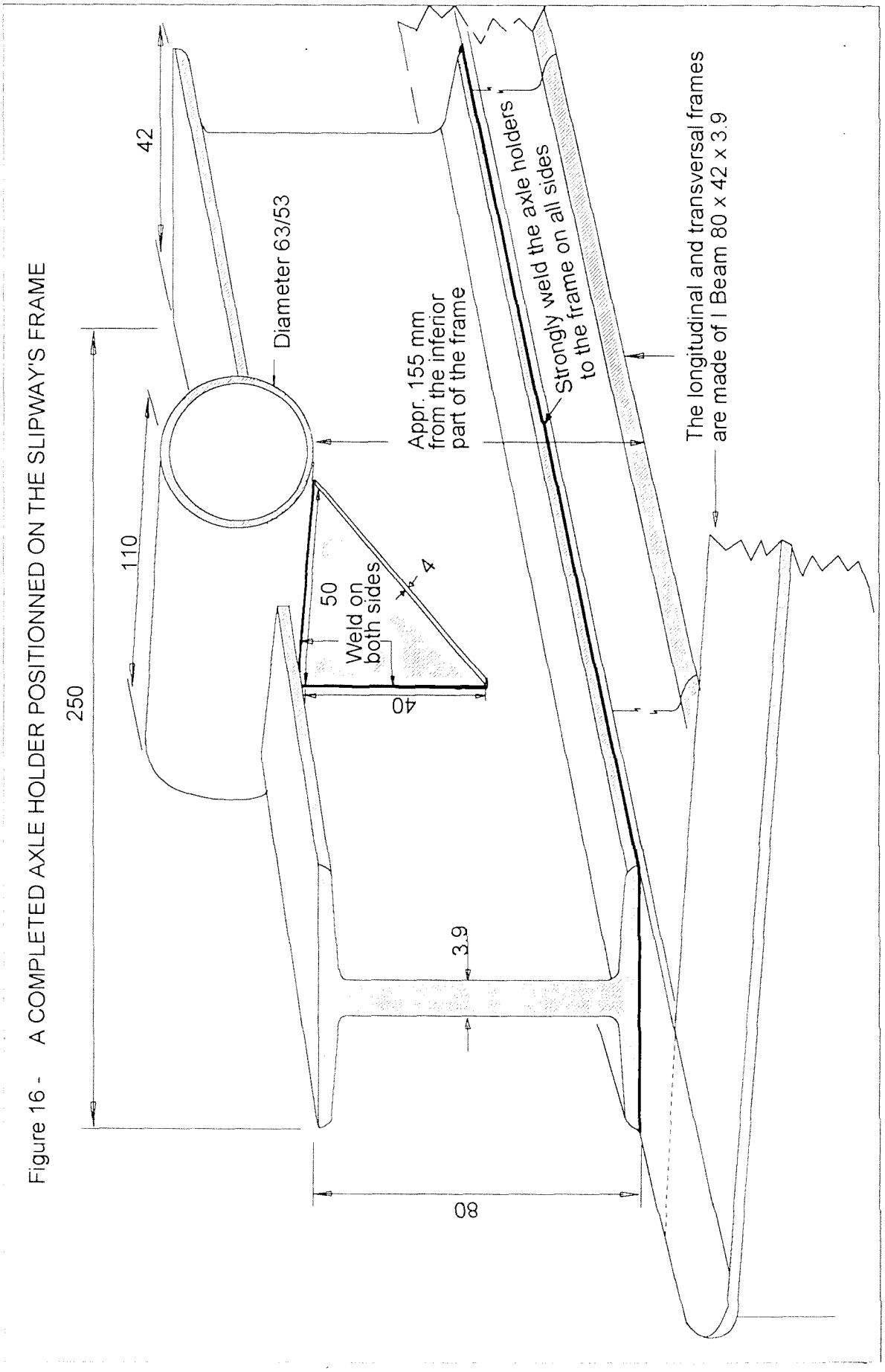
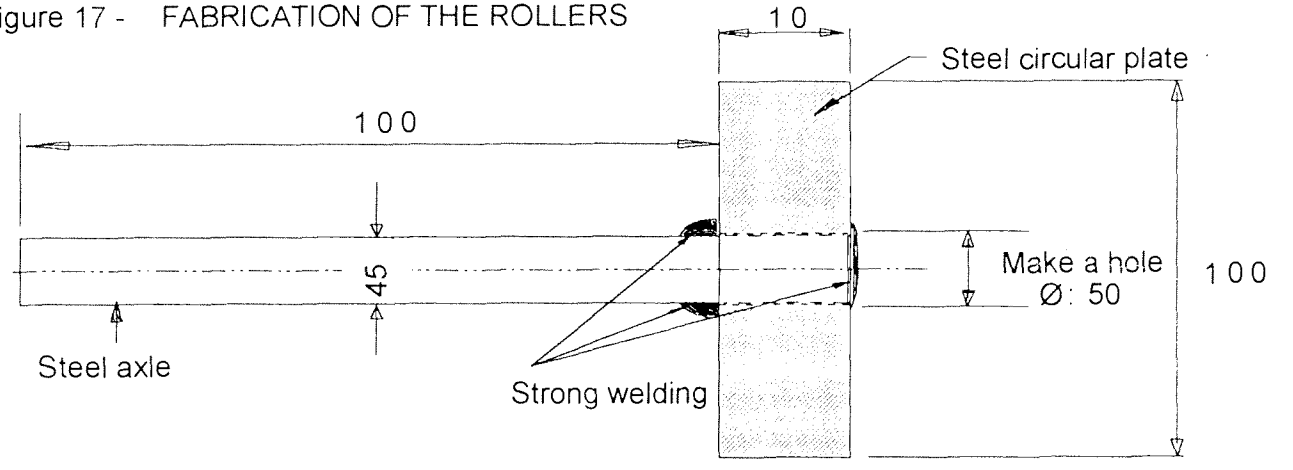


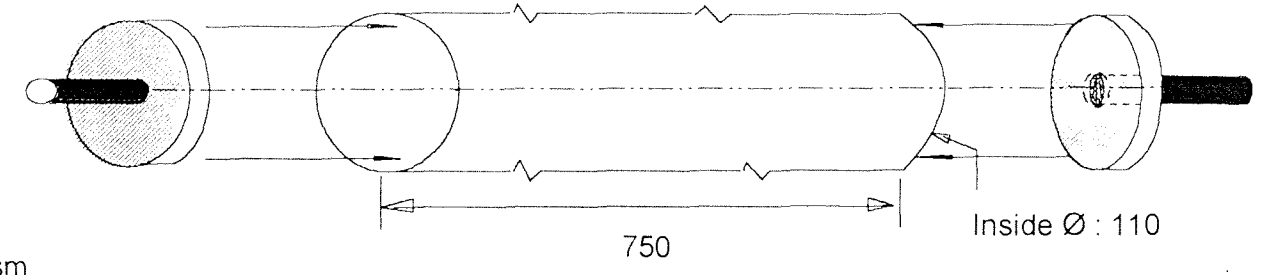
Figure 16 - A COMPLETED AXLE HOLDER POSITIONNED ON THE SLIPWAY'S FRAME

Figure 17 - FABRICATION OF THE ROLLERS

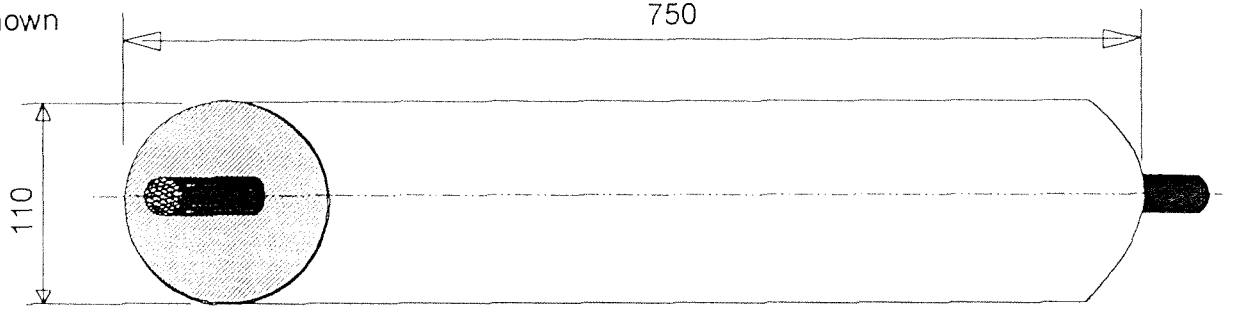
Detail of the axle fitting on a steel circular plate to be inserted at both edges of the roller



Insert the circular steel plate in the edge of the tube on the whole thickness of the plate (=10mm) to keep the same roller's length

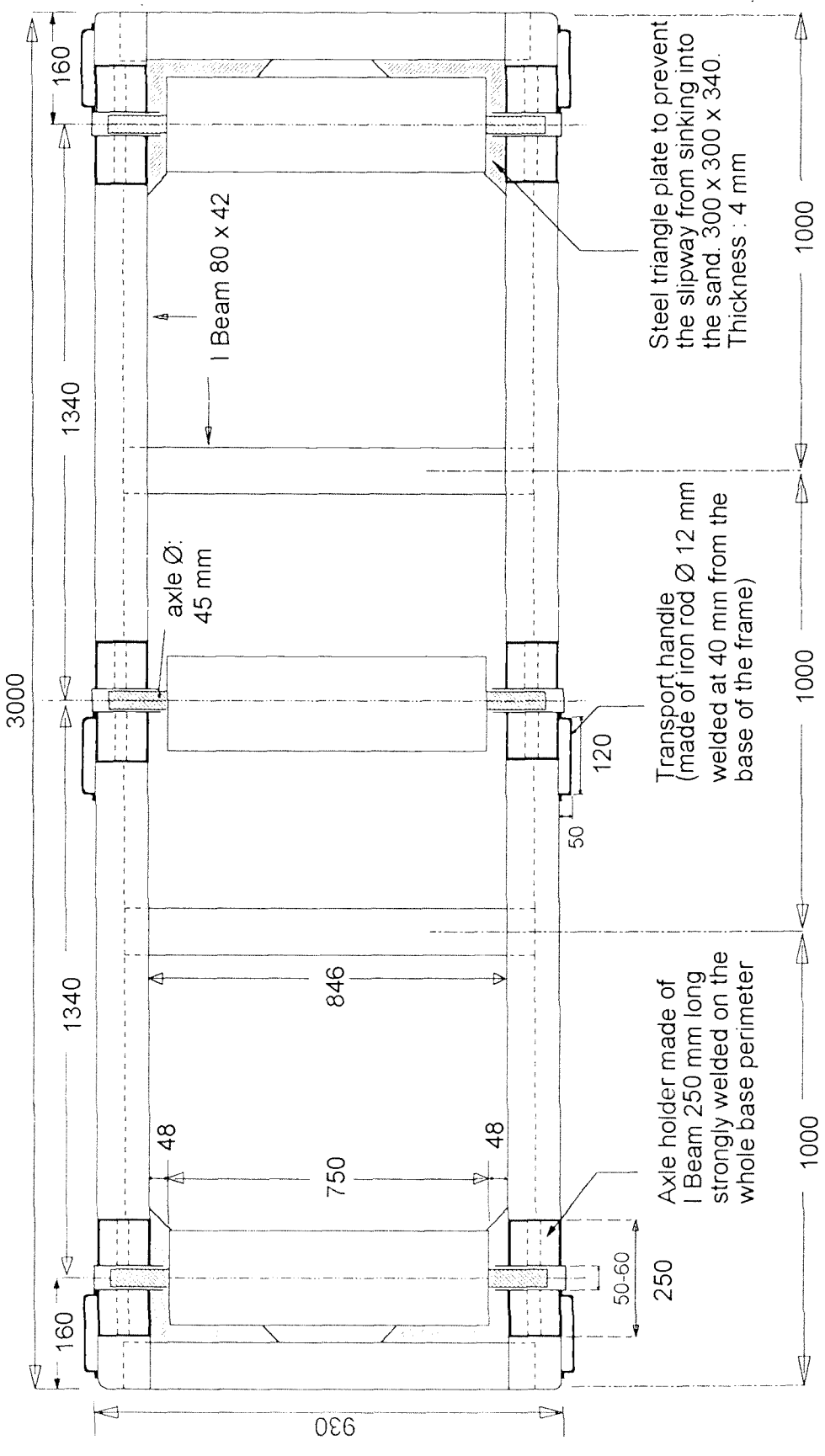


Before welding, check the parrallelism of the axles in relation to the outside of the tube, to get a correct motion of the rollers once fitted. (Use the device shown on figures 19 and 20).



A roller assembled, ready to be mounted on the axle holder

Figure 18 - TOP VIEW OF THE SLIPWAY



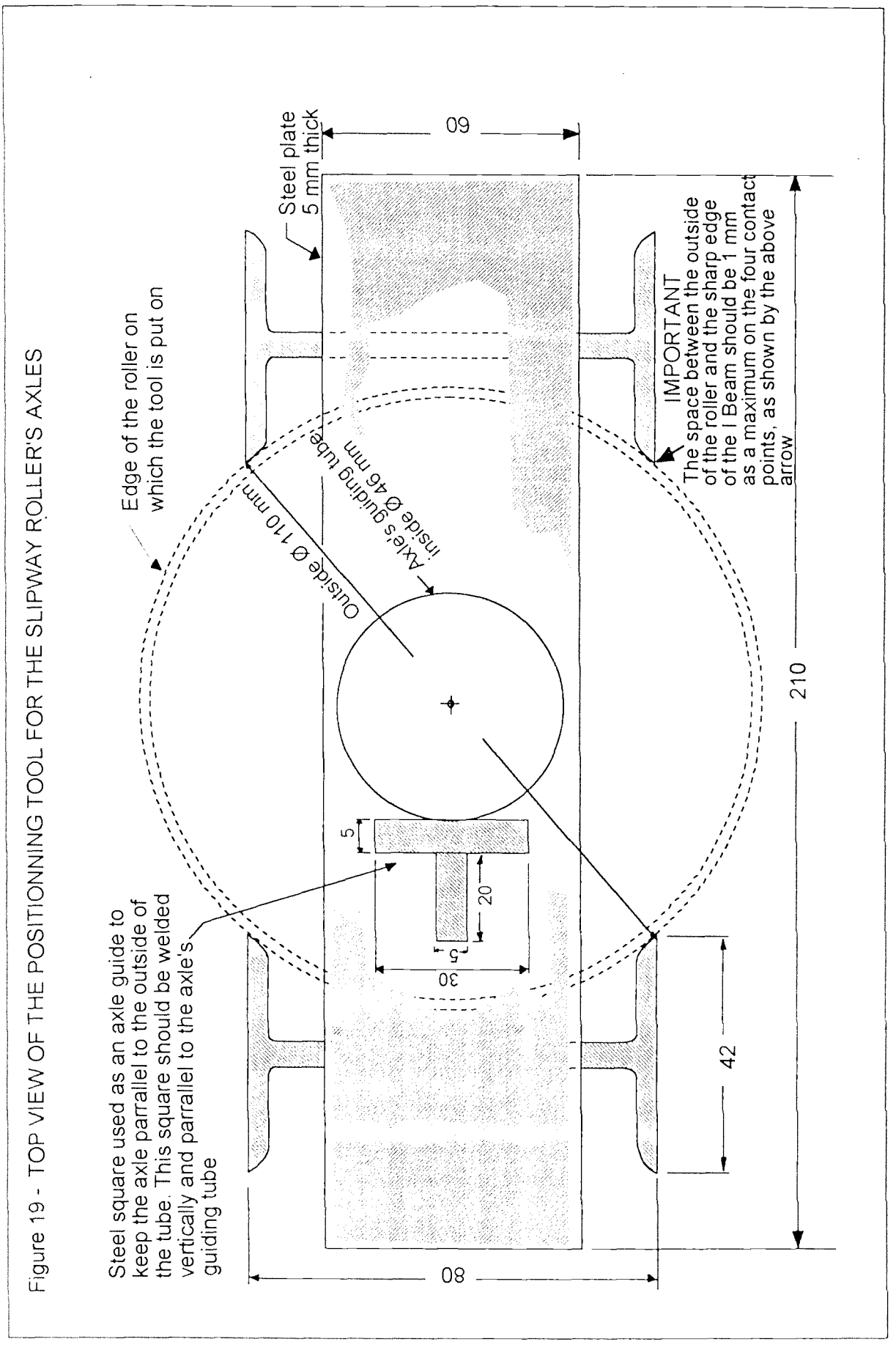


Figure 19 - TOP VIEW OF THE POSITIONNING TOOL FOR THE SLIPWAY ROLLER'S AXLES

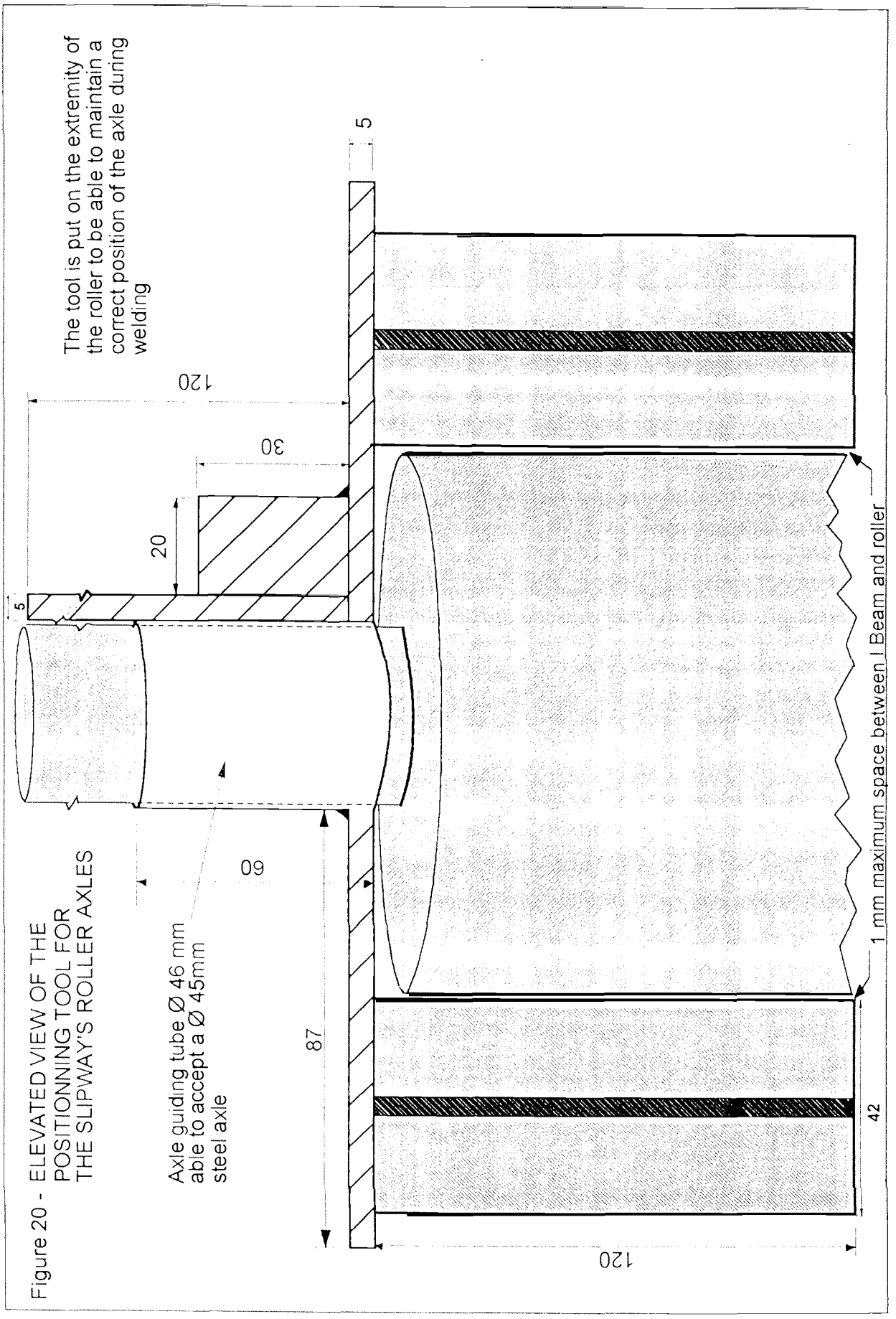


Figure 20 - ELEVATED VIEW OF THE POSITIONNING TOOL FOR THE SLIPWAY'S ROLLER AXLES