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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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WOODWORKING INDUSTRIES

DP/CMR/87/005

THE REPUBLIC OF CAMEROON

Technical report: Assistance in sawdoctoring & tool maintenance*

Prepared for the Government of the Republic of Cameroon
by the United Nations Industrial Development Organization,
acting as executive agency for the United Nations Development Programme

Based on the work of G. A. Woods
Sawdoctoring and Tool maintenance Expert

Backstopping Officer : Antoine V. Bassili,
Industrial Management and Rehabilitation Branch

United Nations Industrial Development Organization

Vienna

* This document has not been edited.

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TABLE OF CONTENTS

1. INTRODUCTION

1.1 Geoffrey A. Woods, a sawdoctoring expert undertook a one month mission to Cameroon (from 16 January to 15 February 1989) under the UNDP/UNIDO project 'Industrie du bois' (DP/CMR/87/005). His brief was to survey the needs in the Republic of Cameroon in sawdoctoring and tool and cutter maintenance for the sawmilling and secondary wood processing industries with the emphasis being placed on the tool and cutter maintenance for the furniture and joinery industries. The counterpart government department was the National Centre for the Development of Forests (CENADEFOR) with the practical work being carried out at their workshop just outside Yaoundé at Nkolbisson.

1.2 The expert sees the work best split into several parts:

a) the upgrading of the equipment at the CENADEFOR workshop,

b) the upgrading of skills in sawdoctoring and tool maintenance of the existing staff at the CENADEFOR workshop,

c) investigating the need for a service centre for saw and tool maintenance in the Yaoundé area,

d) investigating the need for and the feasibility of improving the skills of other workers employed in the private sector in and around Yaoundé or indeed for the whole country.

1.3 It should be pointed out that the work of the sawdoctor and that of the toolroom technician often overlap especially today when wide bandsaw blades are used on resawing machines in factories and timber supply merchants where woodworking machines have other tools besides saw blades to be maintained. In fact it was found that the CENADEFOR workshop has a band resawing machine and therefore needs all the equipment for sawdoctoring as well as machines for sharpening the various tools for machine woodworking processes and of course all the necessary skills without which the machines are useless.

1.4 The Republic of Cameroon is one of the Central African countries which has large tropical forests yielding many species of trees which on conversion produce various coloured hardwoods most suitable for the manufacture of furniture and high class joinery. This has been known for many years and has been exploited mainly in the form of exporting logs to other countries. In this way the minimum value is being realized for such a valuable resource and it is not surprising that the Government wish to change the situation by encouraging the logs to be processed within the country thereby creating more employment and adding value to the natural resource.

1.5 Unfortunately most of these beautiful hardwoods which are suitable for the manufacture of furniture, high class joinery and shop fitting are extremely hard and often also abrasive leading to rapid blunting of the cutting tools used in the sawing and manufacturing processes. Because of this ordinary carbon saw and tool steels have had to be replaced with harder materials such as tungsten carbide, stellite and even diamond for the tips of saw teeth and edges of cutting tools. In consequence all the tooling has become much more expensive even in the countries where they are manufactured and in Cameroon prices given the expert were approximately six to ten times that of similar tooling in Europe.

Four things lead on from this :

i) The skills of the sawdoctor/toolroom technician have had to be improved.

ii) In consequence, even in the developed countries, the training period has had to be extended for those who maintain the full range of tooling.

iii) More and often expensive machinery and ancillary equipment is needed to sharpen and repair these new saws and tools.

iv) Finally the work of the sawdoctor/toolroom technician is now more vital than ever before if sawmills and factories are to function efficiently.

2. CENADEFOR WORKSHOP

2.1 When the expert first visited the workshop of the National Centre for the Development of Forests (CENADEFOR) he was pleased to find that the workshop was quite well equipped with a good number of machines and ancillary equipment most of which were purchased about 1971. The equipment was mainly still in fairly good condition not having had too much use since it had mainly been used to sharpen saw blades and tools used in the CENADEFOR workshop only. However one machine had been damaged during transportation from W. Germany to Cameroon and one of the electric motors with all its mounting brackets etc has gone missing and will need replacing. In addition an important cast iron bracket will have to be repaired but this can be carried out locally maybe even in the CENADEFOR workshop, provided that the expert supervises the work.

The repair of this machine is well worth while since it is a major item of machinery and also that its condition remains as new since it has not been used at all because of the breakages and missing electric motor.

2.2 Annex I only shows the main items of equipment, small ancillary equipment has not been included, and it can be seen that most maintenance processes can be undertaken with this equipment. However some of the equipment is used for outdated processes and needs to be updated with new. This is especially true in the joining of both narrow and wide bandsaw blades the equipment for which is for the old method of brazing. Of course the existing equipment can be used for training purposes, for brazing is still used in some establishments, but it is recommended that more up to date welding equipment is purchased which will enhance the training facilities and also make the joining of both wide and narrow bandsaw blades as used in their own workshop much easier and effective.

2.3 One major item of equipment for the repair of Tungsten Carbide Tipped (TCT) circular saw blades will be needed. This is the Side Grinding machine used to grind the sides of replaced broken tungsten carbide tips. The machine is not very expensive and will greatly increase the capabilities of the workshop in being able to repair these expensive blades for both CENADEFOR and perhaps also for the local industry.

2.4 The toolroom at the CENADEFOR workshop although fairly well equipped was very neglected with all kinds of spare parts and junk such as old fridges lying around everywhere. Few if any of the machines seemed to be wired up correctly often with long trailing leads just plugged into the wall. Of course one reason for many of the items which were lying around was that the toolroom is also the general maintenance workshop and the same staff also carry out that work. This is all right but if the toolroom is to become a training centre and maybe a servicing centre then the whole space will be required for this purpose and all the spare parts and accessories for the general woodworking machinery etc. should be rehoused in a separate store. This has already been agreed to and was implemented within the first ten to fourteen days of the mission.

2.5 Actually the fact that the machines are wired up in such a temporary manner was helpful because the expert has been able to rearrange the machinery in more suitable positions without too much trouble.

Machine cleanliness was not very bad but does need improving and at least one machine has suffered and needs new parts to replace worn parts simply because abrasive dust has been allowed to remain on moving parts. Cleanliness is absolutely vital in a workshop where there is grinding dust otherwise the abrasive dust will very quickly wear away any exposed moving parts. Because of this the expert arranged for all the machines to be thoroughly cleaned starting immediately.

3. WORKSHOP BUILDING AND EQUIPMENT LAYOUT

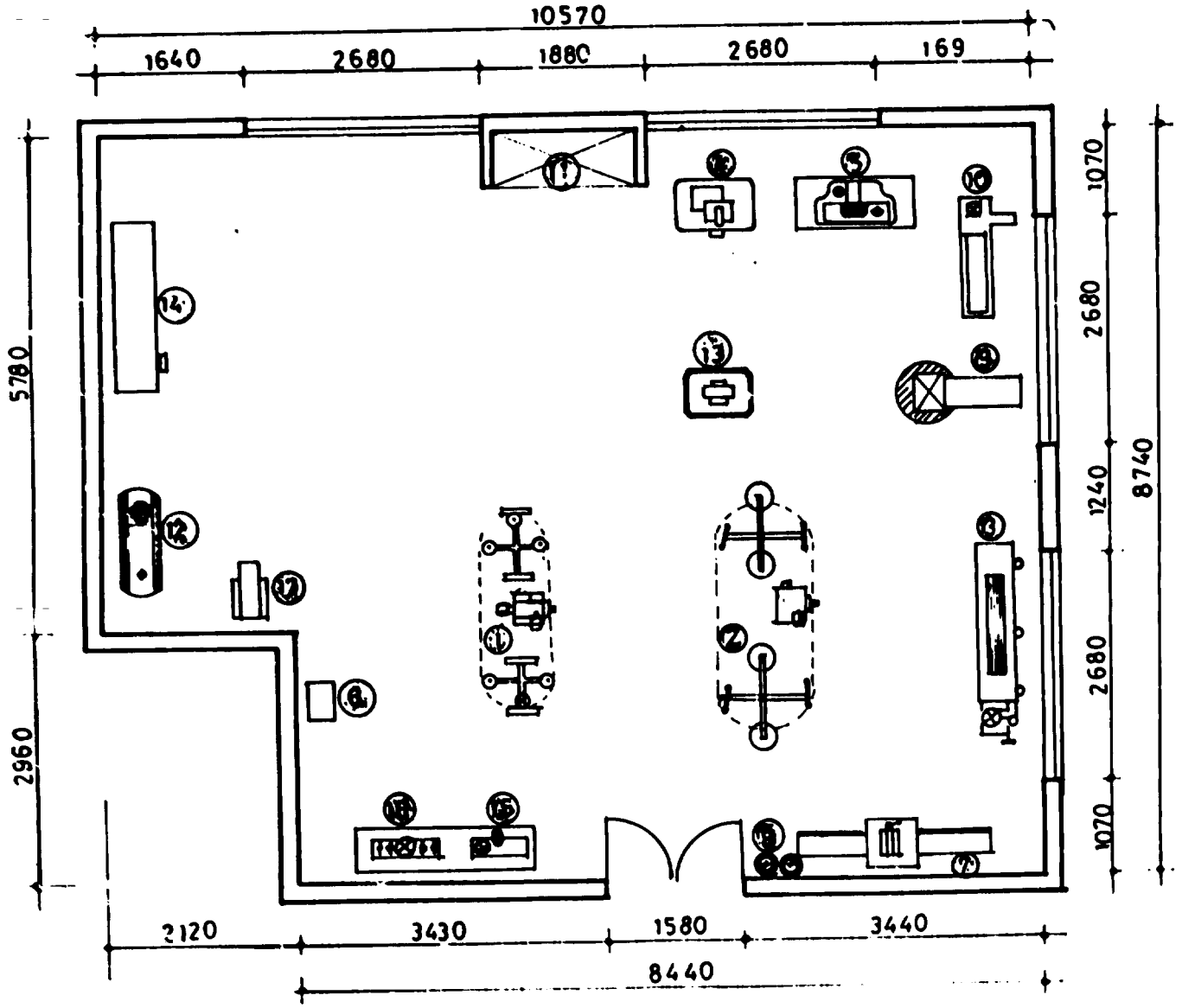
3.1 The size of the CENADEFOR sawdoctor's workshop is quite adequate for its immediate needs and also to undertake a considerable amount of servicing for local private industry. Some individual training could be carried out but if group training were to be envisaged then more space and more equipment would be necessary.

3.2 Some of the machines have not been placed in the best positions to take advantage of natural light from windows and there seems to have been no thought as to the best positions for each machine and movement and storage of blades. Luckily none of the machines were bolted down nor were they wired up in any permanent way. One of the reasons for this is that during heavy rains it would appear that the rain blows into the workshop and onto the machines, obviously something will have to be done to prevent this so that a proper layout can be prepared and machines positioned correctly.

3.3 To this end a drawing has been prepared showing a new layout suggested by the expert so that this can be implemented if necessary after the expert has left although a start was made during the first week. The new layout is shown in a plan included on page 4.

4. INDUSTRIAL SURVEY

4.1 The expert together with government counterpart Mr. Paul Lefaix visited a number of sawmills and furniture factories during his stay to asses the needs of the private sector. See Appendix VI for details. In the sawmills visited the saw servicing equipment, although far from perfect, seemed to be adequate



1 Vollmer C.S.B.+W.B.B. sharpener
2 Lorock W B B sharpener
3 W.B.B. tensioning bench
4 C.B. universal tool grinder
5 Lorock " — " — " —
6 Lorock N.B.B. sharpener
7 Welding clamp
8 Gas bottles
9 C.S.B. anvil
10 Straigth knife grinder
11 Tool cupboard
12 Air compressor
13 Hand tool grinder
14 Work bench
15 W.B.B. lap grinder
16 W.B.B. brazing clamp
17 Pillar drill

TOOL MAINTENANCE
WORKSHOP PLAN

ECH. 1/50e

PLAN DE LA SALLE D'AFFÛTAGE
ATELIER C.P.B. CENADEFOR.

with some quite new, good quality, items installed. It was the skills that were lacking even though some staff had been to France for training. This lack of skill resulted in many cracks in the wide bandsaw blades being much in evidence. As is usual the world over, lack of tensioning skills were the main cause of the problem and this can only be corrected by intensive training followed by a long period of practice under strict supervision.

4.2 During our visits to the sawmill of the Société Africaine des Bois (SAB) Mr. Yves Mary the General Manager was most helpful and on one occasion gave us some special welding rods which we had not been able to find in the shops with which to repair the broken machine. In turn the expert spent some time pointing out the reasons for faults in their large 250mm wide bansaw blades which were cracking and gave them drawings of a steel framed tensioning bench which they could make to replace the old wooden bench which was partly to blame for the cracks and other faults in their bandsaw blades.

4.3 On visiting SCIB a very small sawmill in Yaoundé which had only one C D 6 horizontal bandsaw the expert was told that the bandsaw blades were only lasting a few months instead of several years. Certainly he could not find any worn down blades but did find many short pieces of almost full width blade which would confirm what he was told. This is a very expensive problem and it seems that there were two reasons for it. The first and root cause was that blades were cracking because of very worn pulleys on the CD 6 machine. Second was that they could not weld repair the cracks either because they did not know how or because they did not have the equipment and the expert suspects that it could be for both reasons i.e. lack of knowledge and equipment. Actually even the better sawmills did not appear to know how to weld cracks correctly for there were many very poor samples to be seen. Even in the plywood factory's sawmill, which was otherwise very well equipped, they had no welding clamp and welding was poor.

4.4 The problem of not being able to repair cracks by welding appeared time and time again, not one welding clamp was seen in all the visits and where welds had been done using brazing clamps to hold the blade skill in welding was poor. Even the best maintained blades and sawmill machinery will not stop some cracks developing occasionally therefore it would seem that welding training should be one of the priorities with a local engineering company manufacturing the special clamps.

4.5 The visit to COCAM the government's plywood factory and sawmill was interesting with the sawdoctoring workshop being well equipped and the staff doing quite a good job of work. The bandsaw tooth shapes were not correct and he explained how they could be improved. Again welding and tensioning needed improving. On walking through the plywood factory it was quite clear that the recovery rate would be as low as 20% at best, for peeler logs which had been on the lathe then rejected with little or no veneer being recovered because of large splits in the logs were lying around all over the yard. The expert suspects that the main cause for this sorry and expensive waste of logs is mainly because the logs are allowed to dry out in the heat sun whith no attempt to keep them wet. Logs for peeling should be kept in water either in a river next to the plywood plant or in a man-made log pond if a river sited factory is not feasible. Unfortunately one can get bogged down in high technology and miss the simple common sense practices such as this. In addition extremely large driving spurs on the lathes meant that again good

logs could only be peeled down to about 300mm diameter. Presumably this very large driving spur size is because of the very large and heavy logs, however at least if one of the lathes were fitted with smaller diameter driving spurs then small logs and the cores from the other machines could be peeled down to say 150mm thereby increasing recovery once again.

4.6 The furniture factories visited had almost no sharpening facilities and relied on the services at the CENADEFOR workshop or had to send blades and tools to be sharpened 250 km to Douala and for repair to France. One owner complained that the services of the CENADEFOR workshop could not be relied upon because they claimed to be busy with servicing their own tools.

4.7 The expert stated at the begining that the emphasis should be placed on the maintenance of tools for the secondary wood processing industries and in particular for furniture factories. It may seem on reading the report that apart from the CENADEFOR workshop he has been more involved with the sawmills and this in fact did occur. The reason though is quite simple, first he only found three furniture factories in the area although there are perhaps hundreds of craftsmen at the side of the road or in back alleys making furniture and second they had little or no servicing equipment. Because of this the only help which can be recommended is to set up a servicing centre at CENADEFOR for the Yaounde area.

4.8 Finally the expert would like to thank Mr. M. Konaré and all the UNIDO staff for all their help especially in typing the report. He would also like to thank Mr. Paul Lefang who has accompanied him on all the visits and most of all I should like to thank all those who have worked to move, repair and clean machinery, prepare drawings etc. at the CENADEFOR workshop without whom he would not have been able to achieve what he did in such a short time.

5. EXPERT'S FINDINGS AND RECOMMENDATIONS

5.1 As stated earlier it was found that the CENADEFOR workshop was fairly well equipped but needed a good tidy up, machines rearranging and wiring up correctly. Some machines and bandsaw blade stands need bolting down to the floor. In addition to this some repairs are needed to two machines and some new equipment is required to enable T.C.T. circular saw blades to be repaired and both narrow and wide bandsaw blades to be made from strip steel and repaired more easily and in a superior way than is possible now.

5.2 Some training of sawdoctors has been carried out in France for periods not exceeding six months. This would be satisfactory if those given this basic training could be supervised in their work for a further three to four years. Unfortunately they are then thought to be fully trained and are left to gain experience all on their own and consequently often evolve unsatisfactory methods of working.

5.3 There are no short cuts to training a fully qualified sawdoctor and a period of four years is about right. The best way to reduce this period is to train semi-skilled people in only one aspect of the work so, for example, one person learns how to sharpen blades and another learns how to repair say T.C.T. circular saw blades and earns his living doing only that type of work.

5.4 This leads to modular training best carried out in a training centre where trainees can, if they need to, return to take and learn the skills of another module or aspect of their work.

5.5 Training programmes have to be completely flexible so as to be capable of supplying the needs of trainees who are complete beginners or to satisfy the needs of a person who may have had many years experience.

5.6 In addition to this, because sawdoctoring and tool maintenance equipment is so expensive, group training must be limited to small numbers so that they can receive adequete supervision whilst working on different machines. It is not, for example, feasible to purchase and install say 20 sharpening machines so that 20 trainees may learn to sharpen say circular saw blades all at the same time as is possible with say carpenters learning to make joints in wood.

5.7 It is certainly clear that some facilities for training in the country itself would be extremely beneficial to industry. During the survey the expert found that the Canadian Government (through CIDA) have been considering establishing a training sawmill which has had some set-backs but which is now being reviewed and may be implemented in the near future. If this project does go ahead then perhaps they could cater for the training needs of the sawdoctors and the CENADEFOR workshop could concentrate on the needs of the toolroom technicians for the woodworking factories. In this way duplication of equipment would be avoided and each centre could be better equipped.

5.8 Whoever may set up a training centre for sawdoctoring and sawmill maintenance should include the machine for pulley grinding for it would seem that there is no equipment for this unless it is owned by the larger sawmills who may well feel that it is not in their interest to loan it out to other sawmills. The machine is not very expensive and again it could be run as a servicing business i.e. two trained persons and a van going around grinding pulleys and changing bearings for the sawmills. As pointed out elsewhere in the report worn pulleys are a major cause of bandsaw blades cracking and the fault can only be corrected by grinding the pulleys to the right shape. Again it is suggested that the best place for this would be at the CIDA training sawmill where mill alignment and general sawmill maintenance could be best demonstrated.

Obviously a little training can be done on the existing and new equipment during the second two month phase of the three month mission of the expert but it is such a short period that the training will almost certainly have to be limited to the existing sawdoctor/maintenance staff at the CENADEFOR workshop.

5.9 It was found that many accessories such as grinding wheels are available locally. If the prices given to the expert are correct then grinding wheels are not too expensive and compare with buying single wheels in Europe although, in Europe prices could be halved if purchased in quantities of around 36 wheels of the same type. On the other hand small machines such as simple bench grinders were found to be very expensive being roughly four times that of European prices.

5.10 Although specific items such as tungsten carbide tips would have to be imported, it seems quite feasible that a servicing centre could function quite easily since the tool merchants are catering for the sawmilling industry with such things as strip steel for bandsaws, circular saw blades, etc. all being available and what is more important being available in local currency.

5.11 A servicing centre for the private sector might work at the CENADEFOR workshop but clearly some way of motivating management and staff would have to be found because given the will to do the work there is no reason why it should not have been functioning since 1971 when the machinery was first installed. In other words they have the machinery and there are grinding wheels etc. are available in the local shops. These could be purchased with monies earned by servicing for industry thereby ensuring that the operation of the servicing centre be self supporting.

5.12 It may be that a simple bonus scheme might solve the motivation problem but it would have to be run as a proper business with clear duties defined for those involved and proper records kept of all financial matters. The largest portion of the revenue would return to Government to finance the servicing centre and perhaps help to provide revenue for other things with a smaller portion going to provide the incentive bonuses.

5.13 The following is a list of recommended work to be carried out before the second phase of the project :

i) Change all tooth shapes on the circular plate blades which are in use at the CENADEFOR workshop from the existing shape, which is a very weak shape and one that will blunt quickly, to two different shapes one for cross-cut blades and another for ripping blades. Sketches of good shapes as well as instructions on how to adjust the machine correctly to provide the desired shapes are given on page 9.

ii) Purchase two lengths of steel tubing on which to fit adjustable end rollers on the STENNER Tensioning bench. The tubes may be welded or preferably secured to the other upright tubing with U-bolts.

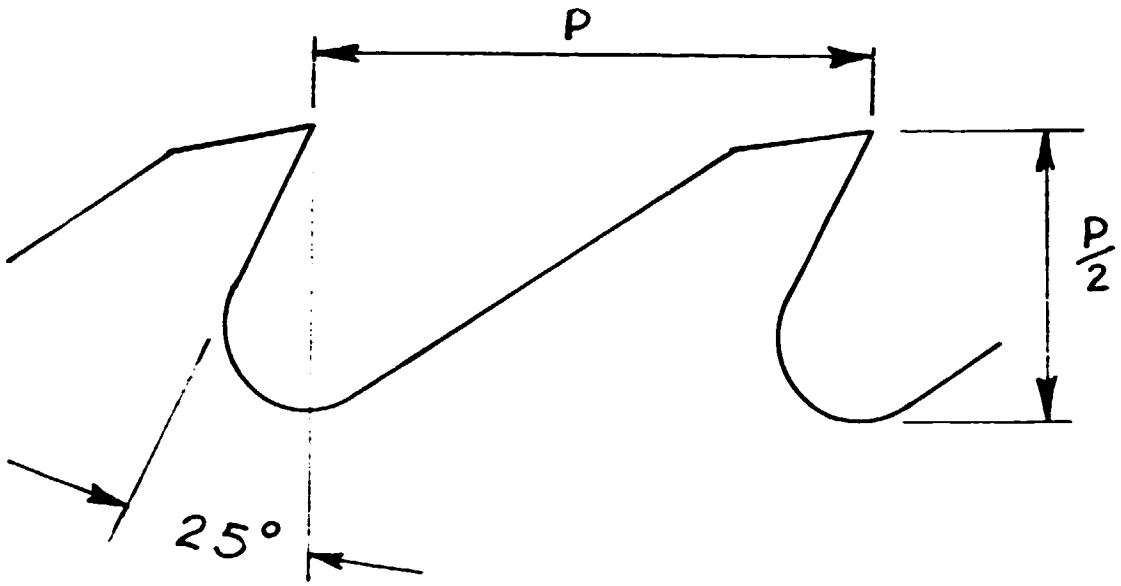
iii) Make two extra wooden rollers and steel brackets to fit to each end of the tensioning bench.

iv) Replace the plastic guides on the aluminium disc on the RYE four edge tenoning machine before the disc becomes worn and has to be replaced.

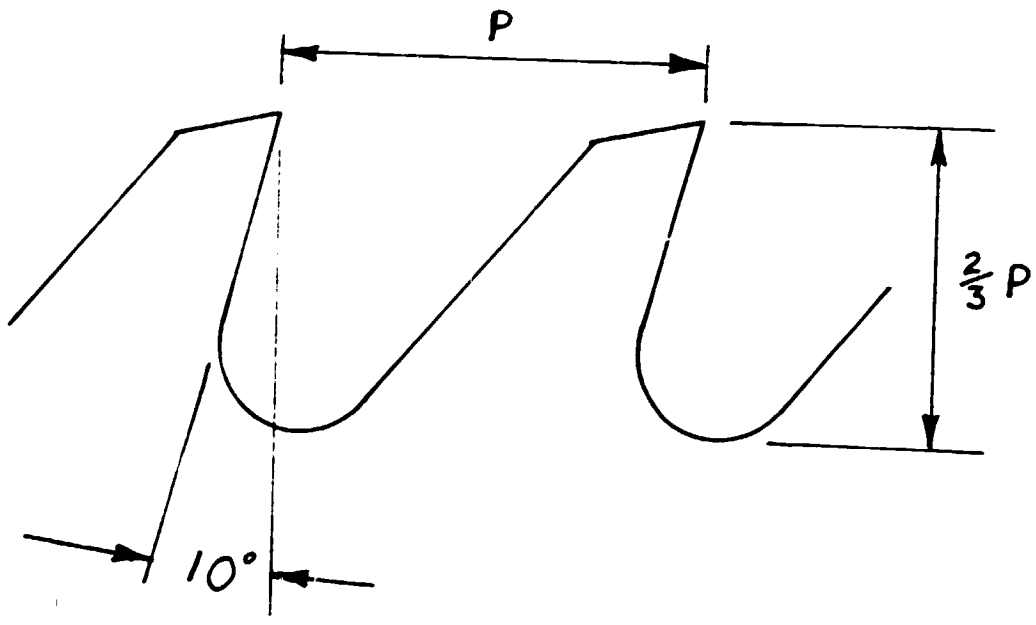
v) Bolt down Vollmer and Loroch bandsaw blade support stands direct to the concrete floor or screw to a wooden false floor if it is decided to provide this around the bandsaw work area.

vi) Any spare time should be spent cleaning the machines to look like new. The cleaning carried out during the expert's stay has left them about 80% clean.

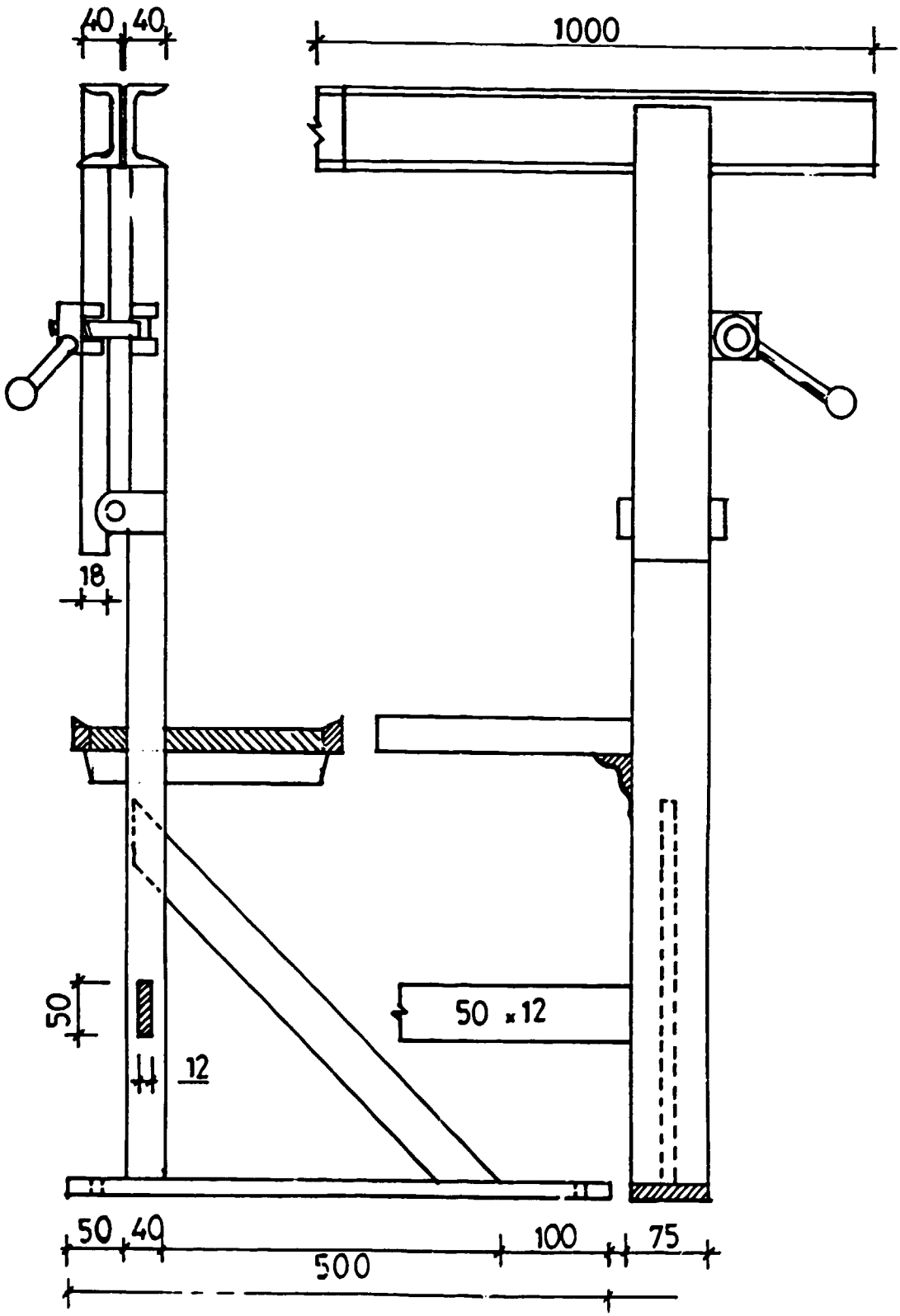
vii) Supervise the completion of one of the two sets of equipment being made locally that was not completed before the expert's departure. Test and install this equipment at the CENADEFOR workshop. The swinging clamp (pages 10 and 11) will need to be fitted to the floor behind the Loroch bandsaw, sharpening machine at the west end and will need a bench making for it preferably a mobile one as in the drawing provided on page 12.



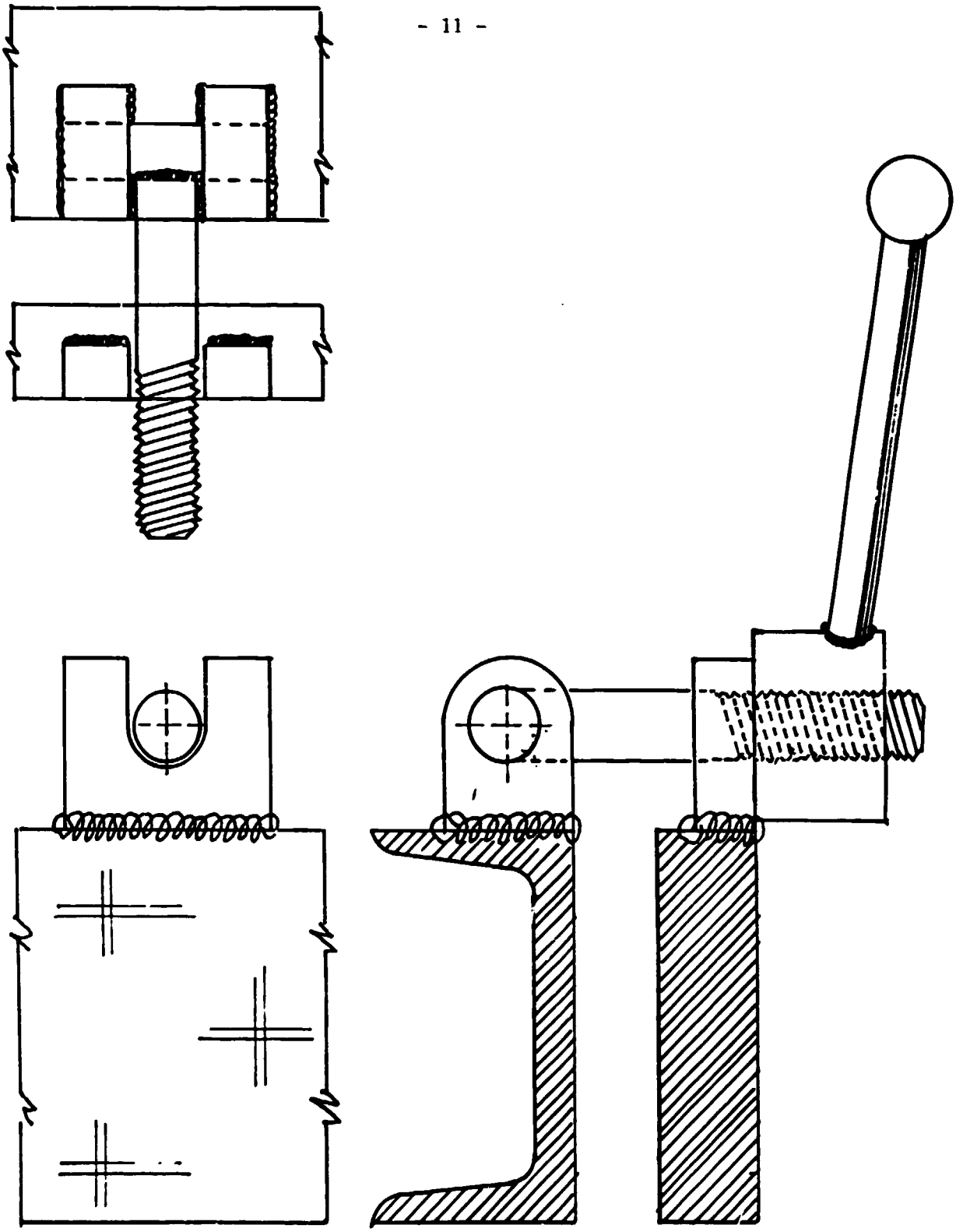
ALL RIPPING TEETH



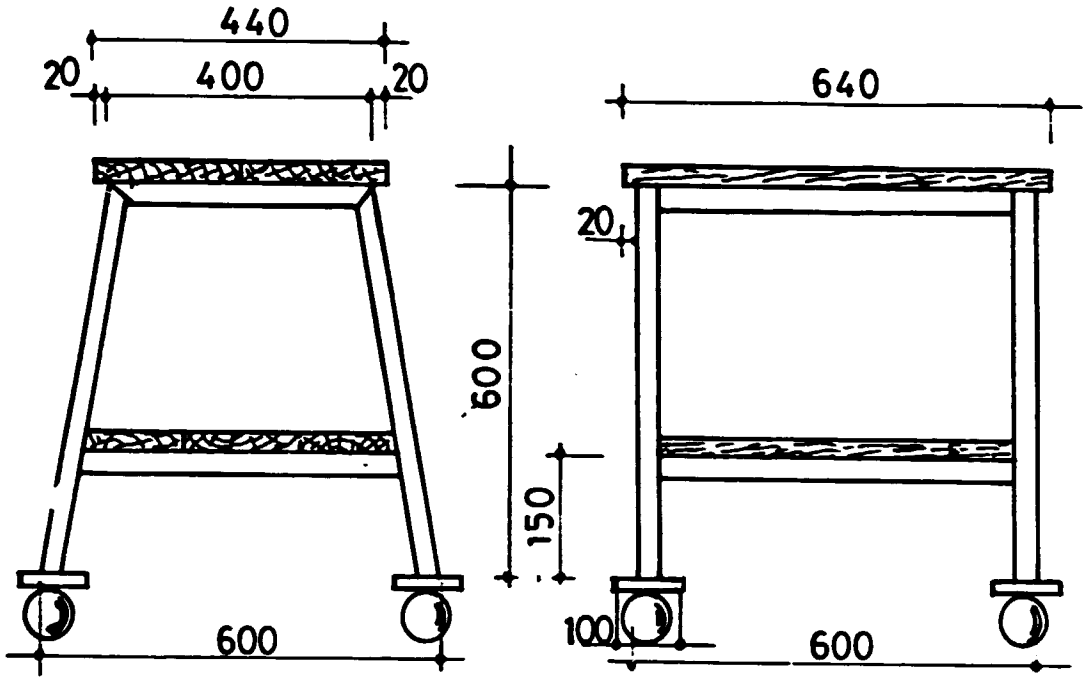
ALL CROSS-CUT TEETH

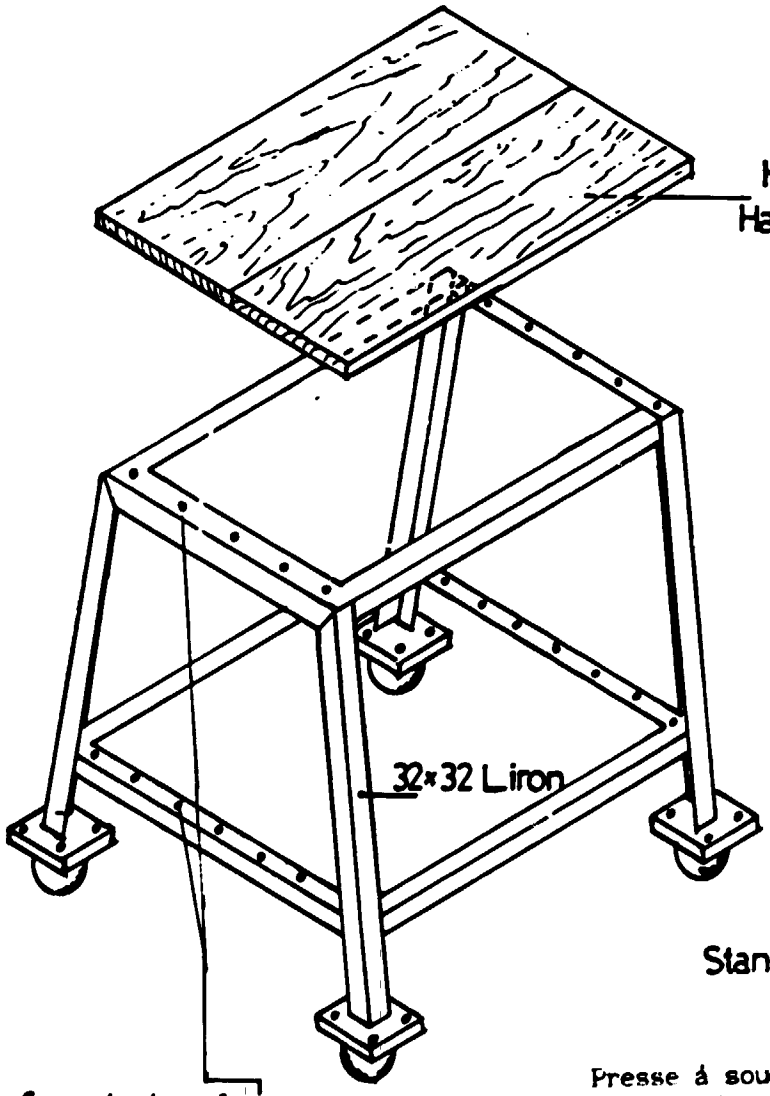


Etau pour écraser les G.S.F.
Wide Bandsaw blade swaging clamp
Réf. No. X. 1171



Etau pour écraser les G.S.L.
Wide Bandsaw blade swaging clamp
Ref. No. N. 11/2





Stand for W.B.B. Welding clamp

Presse à souder pour lames de scie à ruban
Wide bandsaw blade welding clamp
Ref. No. N.12/6

viii) Try to obtain two or three longer and wider bandsaw blades for training use. (About 150mm wide and 7-8 metres long). These could be scrap blades from a sawmill such as COCAM. In addition to complete blades or long lengths to make up complete blades, also try to obtain some shorter pieces for welding practice.

6. LOCALLY MANUFACTURED EQUIPMENT

6.1 Two of the new items of equipment recommended by the expert are a Wide bandsaw blade Welding Clamp and a Wide bandsaw blade Swaging Clamp and these can be made locally to drawings of the items designed by the expert (see pages 14 to 18).

6.2 The saving on importing these items should be considerable and making them locally will also create a little employment.

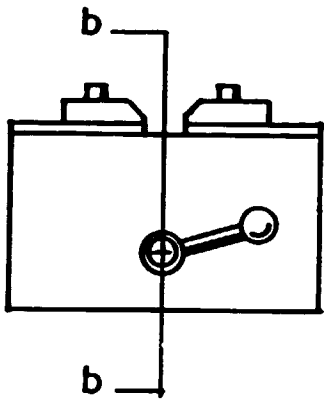
6.3 Actually it is hoped that one of the items at least can be made by and with the co-operation of the "Centre Pilote d'Artisanat de Yaoundé" which is an Italian project for training local people in woodworking and metalworking skills.

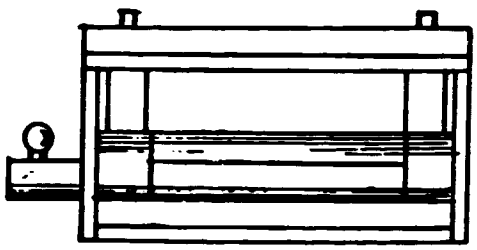
6.4 In this way a further saving in labour costs will be achieved and some additional experience will be provided for the trainees with material only being provided by the UNIDO project.

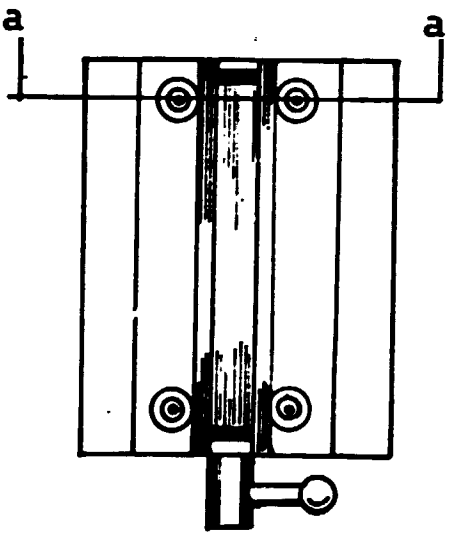
6.5 During the search for a good engineering workshop capable of manufacturing the welding clamp Mr. KONARE the region's SIDFA made a most useful suggestion which was to try the CAPME Engineering centre which was originally a German aid project training centre for training mechanical engineers. This proved to be excellent and after some discussions with their workshop supervisor Mr. P. M. SIGALA he agreed to work out a price for the item. Unfortunately the sizes of steel required were not available so we lost a few days were lost then the item had to be redesigned around some other size material which was available.

6.6 By the beginning of the fourth week he was able to collect the swaging clamp made at the Italian project's workshop. Sincere thanks must be expressed to the project manager and especially to Mr. BUZZI Enzo who made an excellent job of the piece of equipment and in record time.

6.7 The two production managers of the plywood factory COCAM visited CENADEFOR's workshop the day following of his visit to them requesting the drawing of the welding clamp. This is very encouraging and he expects to get many requests for the two items once visitors see them in use. Perhaps CENADEFOR could produce full size drawings which would be easier to follow.



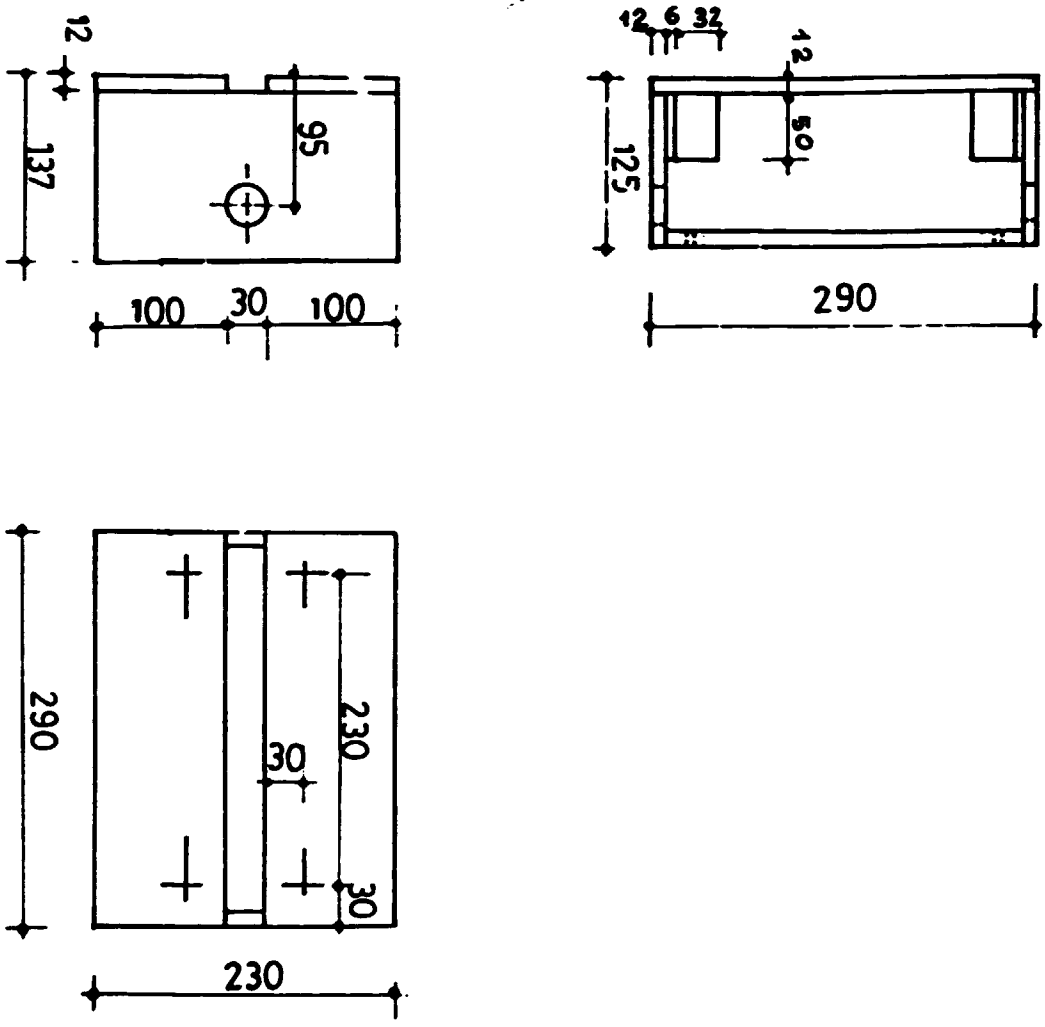




Complete clamp

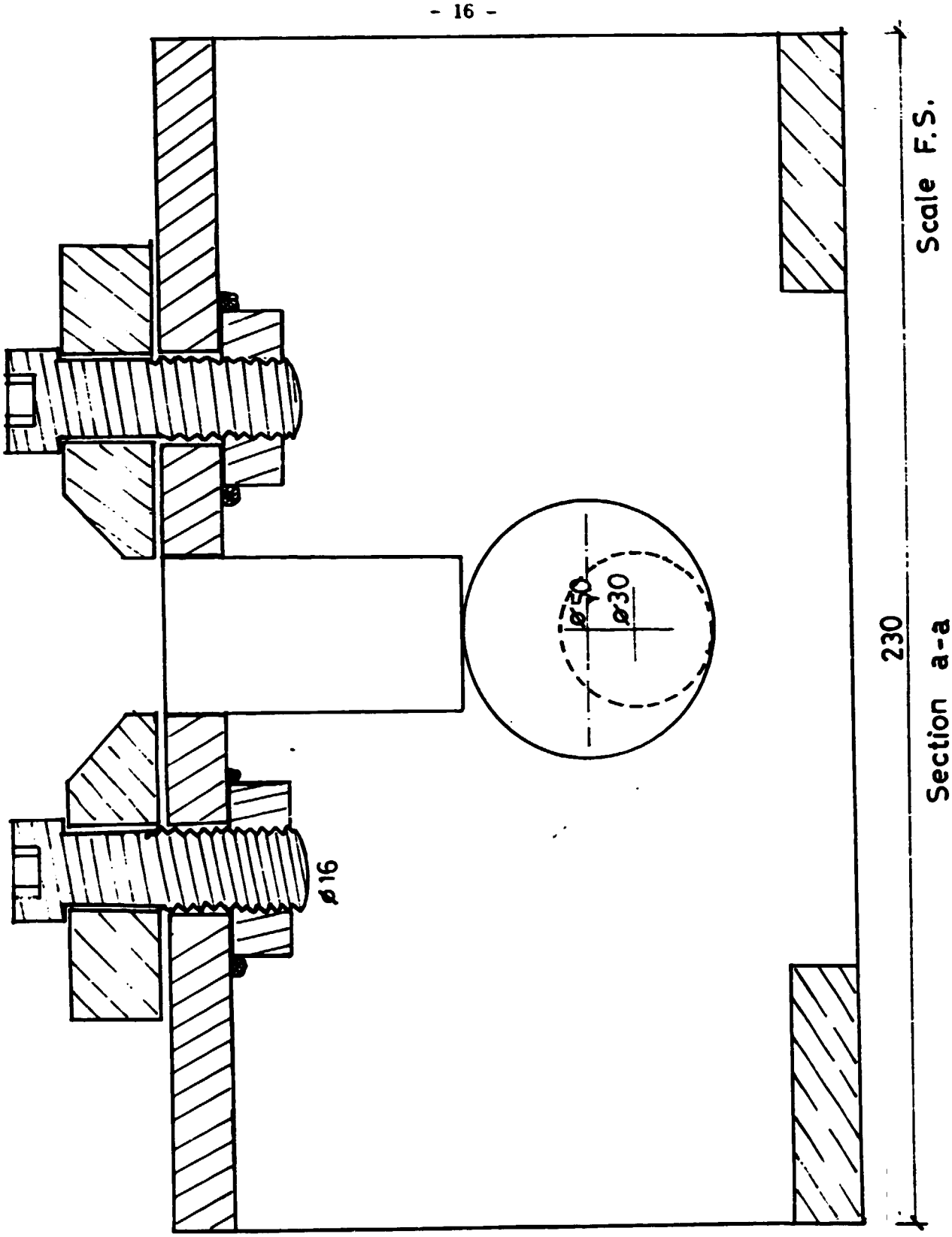
Scale 1:5

Presse á souder pour lames de scie á ruban
Wide bandsaw blade welding clamp
Ref. No. N.12/1



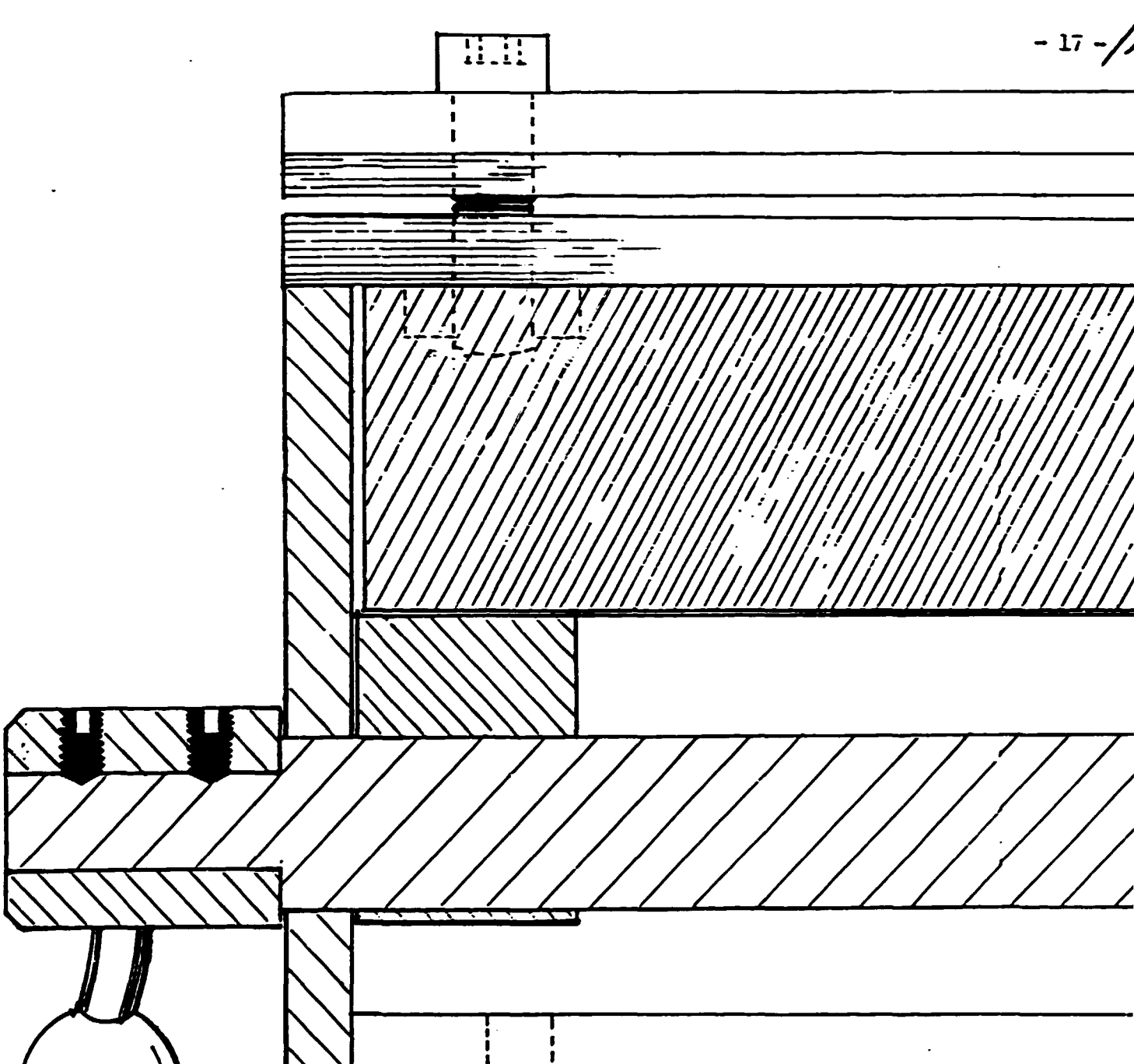
BASIC FRAME Scale 1/5

Presse á souder pour lames de scie á ruban
Wide bandsaw blade welding clamp
Ref. No. N.12/2



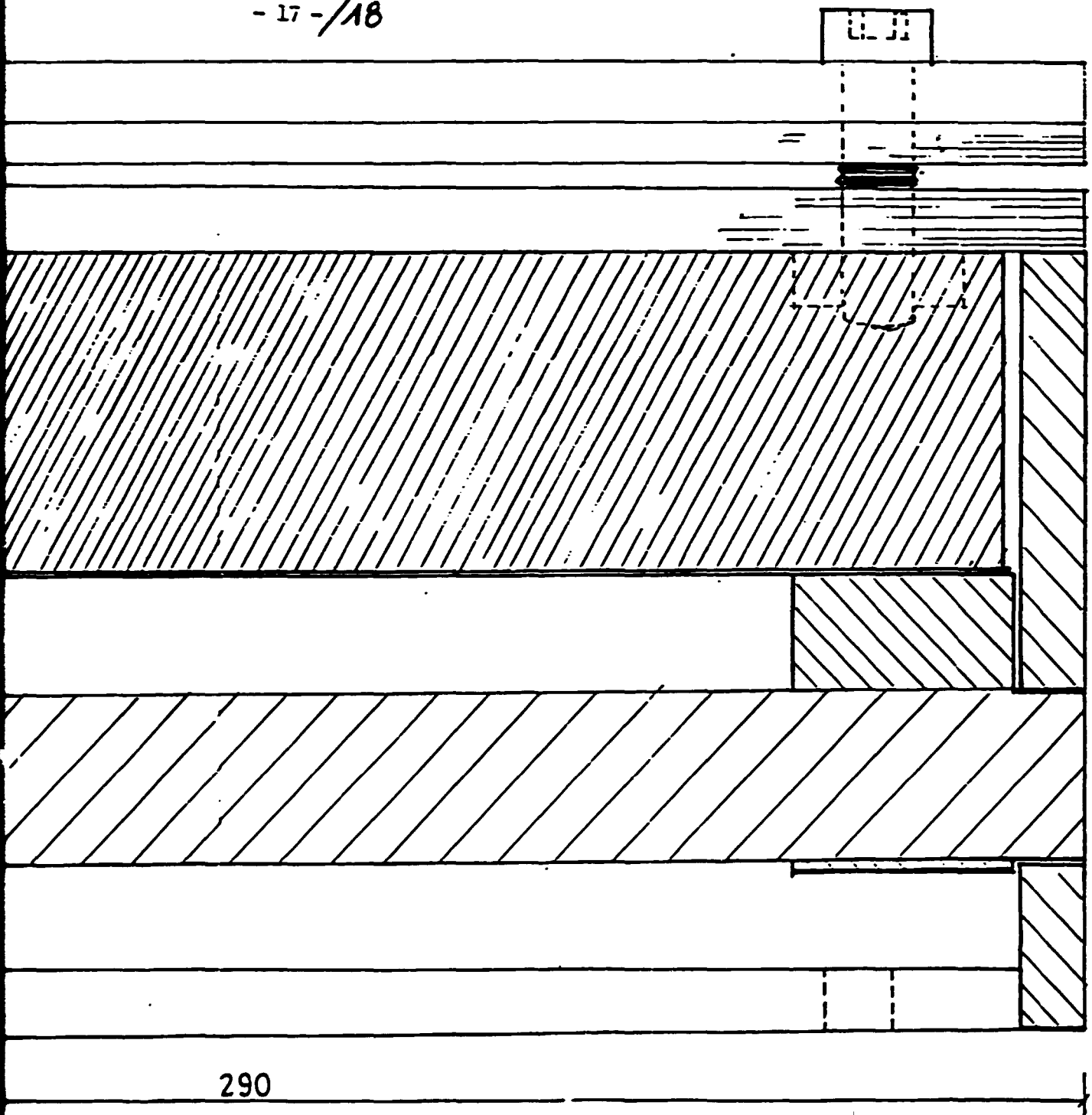
Presse á souder pour lames de scie á ruban
Wide bandsaw blade welding clamp
Ref. No. N.12/3

SECTION 1



Section b—b

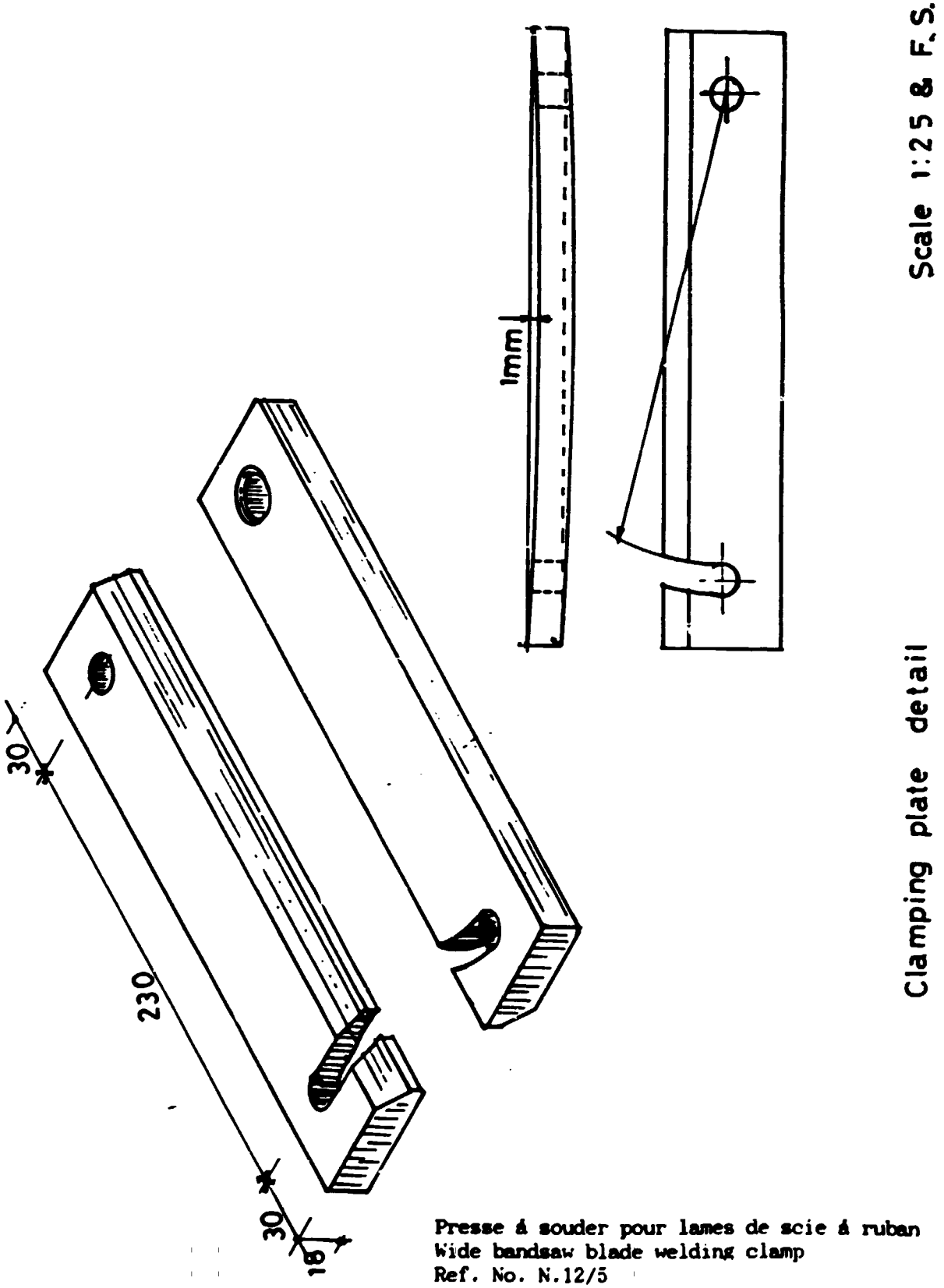
SECTION .2



Section b—b

Scale F.S.

Presse á souder pour lames de scie á ruban
Wide bandsaw blade welding clamp
Ref. No. N.12/4



Clamping plate detail

Scale 1:2 5 & F.S.

Presse á souder pour lames de scie á ruban
Wide bandsaw blade welding clamp
Ref. No. N.12/5

7. SUMMARY OF ACHIEVEMENTS FIRST PHASE AND PROPOSED WORKPLAN FOR SECOND PHASE

A. Achievements

i Manufactured locally two new items of equipment namely the bandsaw blade swaging vice and welding clamp. reference number N.11 & 12.

ii Repaired two existing machines namely the Loroch bandsaw blade sharpening machine and the Stenner stretcher roller, reference E.1 and E.9.

iii Cleaned all existing machinery.

iv Removed all rubbish, spares for vehicles, woodworking machinery etc. out of toolroom and into new store.

v Moved into more efficient positions nearly all the existing machinery.

vi Moved into toolroom disused hand tool grinding machine and modified grinding wheel arbors to fit worn out wheels from knife grinding machine.

vii Rewired more safely about 50% of the machines.

viii Bolted down both bandsaw sharpening machines plus their blade stands.

ix Made several racks for tools and storage of blades together with three cupboards with worktops for convenient storage of machine spanners, grinding wheels to be sited next to the machines.

x Made the backboard and hammer rack ready for the circular saw blade tensioning anvil.

xi Provided two sawmills with working drawings of equipment which can be made locally.

xii Assisted two sawmills with problems.

xiii Spent last two days repairing a previously scrapped wide bandsaw blade as a training exercice plus some other training on existing equipment.

B. Proposed workplan for next phase:

i Install and test new machinery and equipment.

ii Train CENADEFOR's staff on the use of the new machines and the correct use of the previously existing machinery and equipment. In particular the following urgently required skills should be treated as priorities in the short time available.

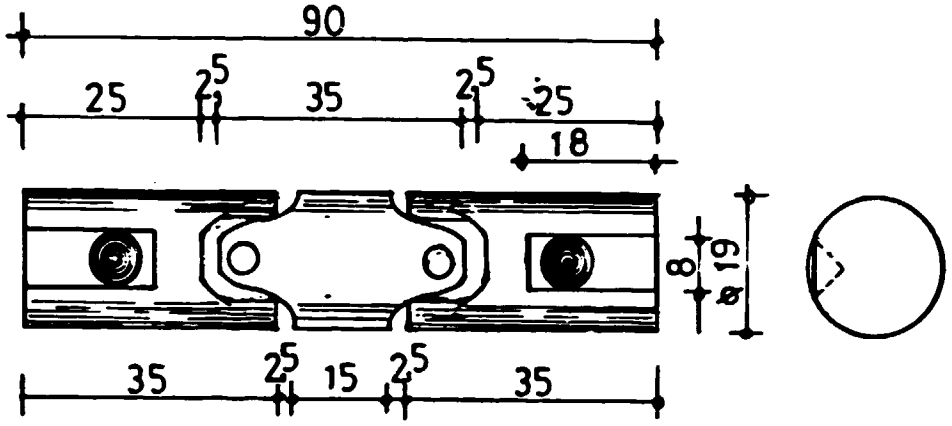
(a) Weld joining of wide bandsaw blades;
(b) Repair of cracks in wide bandsaw blades by welding;
(c) Butt weld joining of narrow bandsaw blades;
(d) Levelling and tensioning of wide bandsaw blades;
(e) Swaging and side dressing of wide bandsaw blades;
(f) Sharpening of wide bandsaw and circular plate blades;
(g) Sharpening of tungsten carbide tipped (TCT) circular saw blades including side grinding of new replacement tips after repair;
(h) Removal and replacement of damaged TC tips;
(i) Levelling and tensioning of circular plate and TCT blades.

iii Conduct one or more one day workshops on the above skills during the second half of the mission for personnel outside CENADEFOR. It should be pointed out that because equipment is very limited numbers invited to these workshops should not exceed four persons.

ANNEX I

LIST OF EXISTING EQUIPMENT AT CENADEFOR WORKSHOP

REF NO.	ITEM	MAKE	TYPE	NUMBER	YEAR	REMARKS
E.1	Automatic Wide Bandsaw Blade Sharpening Machine	Loroch	JLM	22555	1970	Damaged in shipping Needs parts otherwise as new
E.2	Automatic Band and Circular Saw Blade Sharpening Machine	Vollmer	Cng	21400	1970	Some parts need replacing
E.3	Automatic Narrow Bandsaw Blade Sharpening Machine	Loroch	HH	14300	1970	Good condition
E.4	Automatic Straight Knife Grinding Machine	Bauerle	AHS/A Series C	62[illegible]	1971	Good condition
E.5	Universal Tool & Cutter Grinding Machine	Ogier Bouhoul Cie	LST 71-70	C65:15		Good condition
E.6	Universal Tool & Cutter Grinding Machine	Saturn	FKS 450	55[illegible]	-	Has only one attachment for solid profile cutter-blocks
E.7	Wide Bandsaw Blade Lap Grinding Machine	Alli-gator	150mm capacity	1547	-	Good with spare wheels
E.8	Wide Bandsaw Blade Brazing Clamp	Alli-gator	150mm capacity	-	-	Good condition
E.9	Wide Bandsaw Blade Tensioning Bench	Stenner	200mm capacity	-	-	Complete but small part on roller broken (see drawing on next page)



Scale F.S.

Couplage flexible pour rouleau de tendeur RT/S
Flexible coupling for stretcher roller RT/S
Ref. No. FS

ANNEX II

NEW MACHINERY AND EQUIPMENT RECOMMENDATIONS

Ref. No.	Qty		Approximate cost US $
E.1	1	Electric motor with all fixings for Loroch automatic wide bandsaw blade sharpening machine	800
None	-	Spare parts for swaging and side dressing tools	300
E.2	1	Spare parts to replace worn parts for Vollmer automatic circular saw blade sharpening machine	25
E.3	2	Flexible couplings for stretcher rolling machine	15
E.1 E.2 E.3		Spare grinding wheels	600
N.1	1	Side grinding machine for Tungsten carbide teeth	4 500
N.2.	1	Electric Butt Welding machine for narrow bandsaw blades	2 800
N.3.	2	Lightweight Angles grinders with grinding discs	400
N.4	1	Anvil and set of hammers for tensioning circular saw blades	1 800
N.5	1	Setting machine for narrow bandsaw blades	1 200
N.6	1	Drill Chuck 19 mm capacity with N/S/ 3 Morse taper mandrel	75
N.7	1	Micrometer 0-25mm capacity	50
N.8	2	Dial gauge type set gauges	80
N.9	200 each size	Tungsten carbide tips in six sizes to repair T.C.T. circular saw blades	240
N.10	2/100g tubes	Silver solder/flux in the form of paste for for brazing on above tips	75
N.11	1	Wide bandsaw blade swaging clamp made locally to expert's design	150
N.12	1	Wide bandsaw blade welding clamp made locally to expert's design	45
		TOTAL	12 [illegible]

NOTE : See Annex III for detailed specifications
E = Existing equipment item number 1 and 2 in list
N = New equipment numbered for cross reference with specifications

ANNEX III

SPARE PARTS SPECIFICATIONS FOR EXISTING EQUIPMENT

Ref No.	Qty		Estimated cost US $
E.1		Loroch automatic bandsaw sharpening machine type JLM-V n/x/ 22555 1970	
	1	Electric grinding head motor 380 v.50 cycles complete with :	
	1 No.	V45 motor shoe (Schleifmotorkonsole)	
	1 "	V186 pivot rod (Lagerbolzen f. Schleifmotor)	
	1 "	Z194 circlip (Seeger Sicherungsring)	800
	1 "	Z29 grease nipple (Schmiernipple)	
	4 "	Z207 round headed bolts (Zylinderschraube)	
	1 "	X99 tension spring (Schenkelfeder)	
	1 "	Z195 Drive belt (Keilriemen) 13mm x 1700mm	
	1	Z177 " " " 10mm x 600mm	
E.2		Vollmer automatic band & circular saw blade sharpeing machine type Cng. n/x/21400 - 1970	
	1	Circular saw blade mounting cone	
	1	Feed arm bushes (Lagerbuechse)	250
	1	Feed arm bolt (Vorschubbolzen)	
E.9		Spear & Jackson stretcher rolling machine size 9 inch Type RT/S	
	1	Top roller drive flexible coupling see drawing on page 22 for detail	150
		Spear & Jackson stretcher swaging and side dressing tools spare parts :	
	2	No.28 clamp screw right hand	
	2	" 31 " " left	
	2	" 38a " " loose end	
	2	" 18 swaging die	
	4	" 35 anvil	300
	1	" 10 sharper die right hand	
	1	" 11 " " left "	
	2	" 12 R and L hand screw for dies	
E.1 & 2		Aluminium oxide grinding wheels suitable for saw sharpening. Size 200x13x31.75	
	40	but supplied with plastic reducing bushes for 20mm and 25mm say 10 of each	400
		Specification MA 46/60 - M 7 1/2 - V	
E.3		Aluminium oxide non-reinforced cut-off	
	40	wheels. Size 200 x 3 x 31.75	200
		Specification A60-R-B	
		Recommended supplier	
		Acrafact Sheffield England U.K	

ANNEX IV

SPECIFICATIONS FOR NEW RECOMMEND EQUIPMENT

REF NO.	QTY	
N.1	1	Manual T.C.T. circular saw blade side grinding machine for blade diameters 100-600mm. The machine should be bench mounted and have a built-in pump to supply coolant for wet grinding. Blade mounting cones or bushes should be provided for 25, 30, 32, 40mm metric bore sizes and 1" 1 1/4" 1 1/2" and 1 3/4" imperial bore sizes. Electrical supply 380 volts 50 cycles. Expert's recommendation : 'AUTOOL' Model TCT/19
N.2	1	Narrow bansaw blade butt welding machine for welding woodcutting and metal cutting carbon steel blades. Capacity: Woodcutting 3-32mm, capacity metal cutting 3-25mm. Shears and grinder not required. Electrical supply 220 volts 50 cycles. Expert's recommendation : 'Ideal" Butt welding machine Type B.S.1.
N.3	2	Lightweight angle grinders size to take 100mm or 115mm Discs. Each grinder should be supplied with a rubber backing disc to take paper backed sanding discs. Discs for the machines as follows :
	20	Aluminium oxide 36 grit grinding discs for metal grinding.
	100	Aluminium oxide 60 grit paper backed sanding discs for metal polishing. Electrical supply 220 volts 50 cycles. Expert's recommendation : Black & Decker, Makita, Bosch, etc
N.4	1	Saw makers anvil size 10 inch by 8 inch 10 inches high. with one face hardened and ground slightly convexed.
	1	Dog head hammer 4 lb weight
	1	Cross face hammer 4 lb weight Expert's recommended supplier Amstrong U.S.A.
N.5	1	Narrow bandsaw blade setting machine to set blades from 6 - 32 mm wide. Should be capable of leaving a Raker tooth not set, i.e. one left, one right one centre. The machine should preferably be motor driven but a manual machine would be acceptable. If electric powered then should be for 220 volts 50 cycle supply. Expert's recommendation : Italian machine such as made by CIT Meccanica or Natale machine.

N.6 1 Any good quality machine drill chuck with a capacity of 6 - 19mm. Must be fitted with a number 3 Morse taper mandrel.

Expert suggests purchase from Jos Loroch with other spare parts then shipped together to save freight charges.

N.7 1 Any good quality micrometer with 0-25mm capacity
Supplier as above N.6

N.8 2 Dial type set gauger for measuring the set on saw teeth also supplied by Loroch

N.9 200 of each size Tungsten carbide tips suitable grade of each size to cut very dense hardwoods in six sizes.

Type AI - III

200	x 9.0 x 2.8 x 2.7
"	x 9.0 x 3.2 x 2.7
"	x 9.0 x 3.5 x 2.7
"	x 10.7x 3.7 x 3.5
"	x 10.7x 4.0 x 3.5
"	x 10.7x 5.0 x 3.5

Expert's recommended supplier
Dansk Haardmetal Ges.m.b.H.

N.10 2/100g Tubes Silver solder brazing paste for brazing the above T.C.Tips to saw blades such as 'EASYFLOW 3'

Expert's recommended supplier Johnson Mattney Metals or again may be available from the tip supplier or from Jos. Loroch.

Note: from experience Johnson Mathey seems to be reluctant to supply such small quantities but larger quantities deteriorate unless used.

ANNEX V

LIST OF MANUFACTURER'S NAMES AND ADDRESSES

1. Jos Loroch, GmbH & Co, Postfach 1249
   D-6942 Moerlenbach
   Federal Republic of Germany

2. Vollmer Werke, Maschinenfabrik GmbH. & Co.
   Postfach 1760
   D-7950 Biberach/Riss 1
   Federal Republic of Germany

3. Electro-Apparate-Bau Jungeblodt
   Bunsenstrasse 1
   D-4780 Lippstadt
   Federal Republic of Germany

4. Automatic Grinding Machine & Engineering Co. Ltd
   Padiham Road
   Sabden Blackburn BB6 9EW
   United Kingdom

5. Spear & Jackson
   'Elect Works'
   Sheffield
   United Kingdom

6. Amstrong MFG. Co. Inc.
   2135 N. W. 21st Ave.
   P.O. Box 3008
   97208 Portland (Oregon)
   U.S.A.

7. Dansk Haardmetal Ges.m.b.H.
   Grundauerweg 4-6
   2500 Baden bei Wien
   Austria

8. CIT Meccanica Srl
   Via Genova 14
   I-41012 Capri/Mo
   Italy

9. Natale Maccine
   Viale Industria 10
   P.O. Box 33
   20010 Pregnaiva Milanese (Milano)
   Italy.

10. Johnson Matthey Metals Ltd.,
100 High Street
Southgate
LONDON N14 6ET
United Kingdom

11. Abrafact Ltd.
Beulah Road,
Sheffield. 56 2AR
United Kingdom

ANNEX VI

SAWMILLS, FACTORIES & OTHER ESTABLISHMENTS VISITED

SAWMILLS	Contacts
1. SAB (Société Africaine de Bois)	Mr. Yves Mary
2. Travaux Généraux R.C. CORON	Mr. R.C. CORON, Owner, Mr. LIBON, Works Manager
3. SCIB (Société Camerounaise des Industries du Bois)	Mr. F.R. EKOUMOU , Owner
4 EFEK (Entreprise Forestière Elie KHOURY)	Mr. E. KHOURY, Owner
5. SOFONY (Société Forestière du Nyong)	
6. COCAM (Les Contreplaqués du Cameroun)	Mr. J.B.A. ONDOUA, Production Manager Mr. ESSOMBA Isidor. Sawmill Manager

FURNITURE FACTORIES

1. Etablissements Nansi	Mr. NANSI, Owner
2. La Libampoa	Mr. Elie KHOURY, Owner
3. Etablissements NOUSSI	Mr. F. Joseph, Commercial Director
4. Collége d'Enseignement Technique Industriel Mt Fébé	Père Gerold Neff

ANNEX VII

LIST OF MAIN SAWMILLS (PROVIDED BY CENADEFOR)

A- PROVINCE DU LITTORAL

1. ACIC - Scierie (Agence Commerciale Industrielle Camerounaise)
2. ALPICAM
3. CFA (Compagnie Forestière Africaine)
4. DESIGN
5. EGPA (Exploitation Générale des Produits Africains)
6. PROPALM - Bois
7. SIFCCA (Société Industrielle Forestière Commerciale Camerounaise)
8. Sté KIEFFER et Cie
9. Scierie d'Edéa
10. Scierie SONGUE
11. Scierie de l'Ouest PIWELE
12. SEFHN (Société d'Exploitation Forestière du Haut-Nkam)
13. SDG (Sciage Débitage des Grumes)
14. SNC-Bois (Société Nationale Camerounaise - Bois)
15. UNALOR
16. SCTB (Société Camerounaise de Transformation du Bois.

B- PROVINCE DE L'EST

1. CPM (Compagnie Pernollet de Moanz)
2. EFC (Entreprise Forestière Camérounaise)
3. FOBER (La Forestière de Bertoua)
4. FORET (La Forestière de l'Est Camerou.)
5. GRUMCAM (Grumes du Cameroun)
6. SARL PALLISCO
7. SCPL (Société Camerounaise Pierre Lemonier)
8. SEBC (Société d'Exploitation du Bois du Cameroun)
9. SEFAC (Société d'Exploitation Forestière et Agricole du Cameroun.
10. SIBAF (Société Industrielle des Bois Africains)
11. SFID (Société Forestière et Industrielle de la DOUME)
12. SFIS (Société Forestière et Industrielle de la SANGHA)
13. SOCAFI (Société Camerounaise Forestière et Industrielle)
14. SOFIBEL (Société Forestière et Industrielle de BELABO)
15. SOTREF (Société Tropicale d'Exploitation Forestière)

C. PROVINCE DU CENTRE

1. CIFOA (Compagnie Industrielle Forestière de l'Ouest Africain)
2. COCAM (Les Contreplaqués du Cameroun) Plywood Mbalmayo
3. ECAM-PLACAGE (Entreprise Cameroun de Placages)
4. Entreprise Forestière Khoury Miguel
5. Exploitation Forestière Paul KHOURY
6. J. PENANT
7. SAB (Société Africaine de Bois)
8. SABM (Société Africaine de Bois du MBAM)
9. SCIB (Société Camerounaise des Industries du Bois)
10. SEFE (Société d'Exploitation Forestière d'Eséka)
11. SINTRABOIS (Société Industrielle de Transformation du Bois)
12. SOFECAM (Société d'Exploitation Forestière du Cameroun)
13. Travaux Généraux R.C. CORON
14. CAFIN
15. CCIF (Cie Camerounaise et Industrielle Camerounaise)
16. Les Bois du Cameroun (Redémarrage imminent)
17. EFEK (Entreprise Forestière Elie Khoury)
18. SOFONY (Société Forestière du Nyong)

D. PROVINCE DU SUD

1. BEhOL
2. CFK (Compagnie Forestière Kritikos)
3. CFK (Compagnie Forestière Kritikos)
4. DN Karayannis
5. EFC (Entreprise Forestière Camerounaise)
6. La Forestière de Campo
7. Scierie de la Kienke
8. SFDL (Société Forestière du DJA et Lobo)
9. SFIL (Société Forestière et Industrielle de la Lobe)
10. VALBOIS
11. WIJMA.

E- PROVINCE DU SUD-OUEST

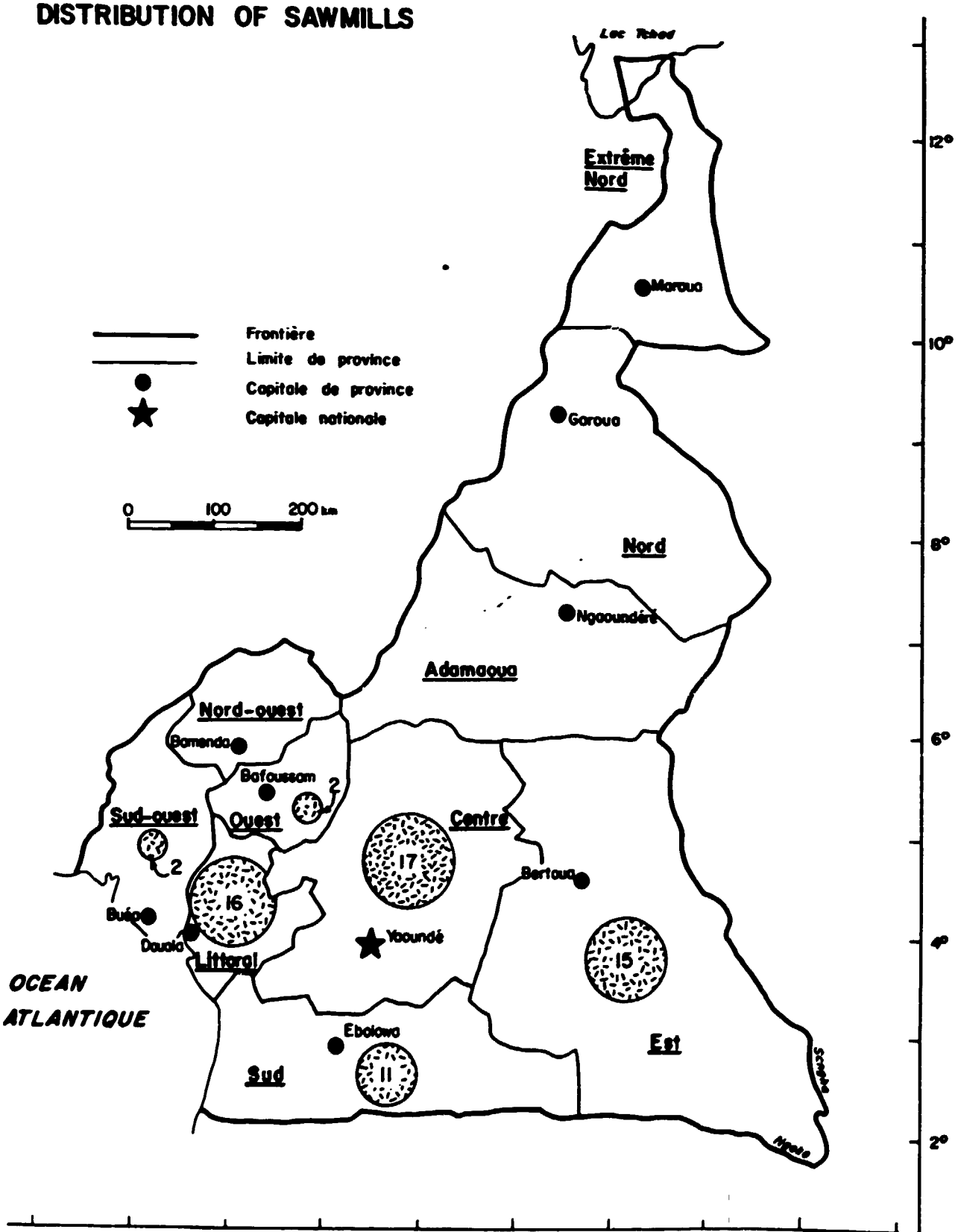
1. CIF (Cameroon Industrial Forest)
2. Timber Industries Limited (TIL)

F- PROVINCE DE L'OUEST

1. SFFN (Société d'Exploitation Forestière du Noun)
2. Petit Guot.

ANNEX VIII

REPARTITION DES SCIERIES
DISTRIBUTION OF SAWMILLS



Réalisation SCCV, DIA CENADEFOR Février 1987