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DEVELOPMENT OF SECONDARY WOOD PROCESSING INDUSTRIES

DP/GUY/86/005

THE REPUBLIC OF GUYANA

Technical report: Assistance in sawdoctoring and tool maintenance\*

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

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## INTRODUCTION

1. 1           On arrival at the Guyana Forestry Commission's Products Development Workshops, the expert found that there already existed a considerable amount of new and used sawdoctoring equipment. Some of this equipment was clearly evident being located in the building set aside for tool maintenance, but many new or little used items were found in locked up stores sometimes hidden under piles of other machine parts and it needed an expert eye to identify them as being whole items or parts of sawdoctoring machinery and ancillary equipment.
1. 2           Fortunately, most new items were protected against rusting by the manufacturers grease, but some that had been used or were not adequately protected were rusting away in the very humid climatic conditions. For example, two brand new back gauges still packed in-between wooden protecting strips were completely rusted away at one end where they were stood upright on an sixth floor.
1. 3           Although one can be appalled to find such valuable and much needed equipment lying around as so much scrap iron, one must realise that to both Local Management and Workers these items could have been parts of a tractor for all they knew, infact we did find when looking for some missing parts of machinery some valuable bandsaw shaping tools inside a cut down 50 gallon oil drum in the motor vehicle workshop. This coupled with the fact that even the new equipment dates back an estimated 10 years at least and the used equipment 20-30 years, is an accumulated legacy left to present management which now have the opportunity to put to excellent use.
1. 4           Two things arise from the expert unexpectedly finding all this existing machinery and equipment which is listed in Appendix I and is estimated to be worth over \$54,000 US.
1. 5           First the proposed Sawdoctoring Tool and Cutter Maintenance Training and Servicing Centre will be able to have better facilities than first envisaged, which of course is excellent news, but secondly it does mean that there has to be compiled an accurate list of spare parts required to rehabilitate the existing machinery for which catalogues and prices are not available here in Guyana.

1. 6                    At first it was thought that finding this extra equipment would ease the budget situation and that there would be ample funds to set-up the envisaged Sawdoctoring Tool and Cutter Maintenance Service and Training Centre. But as well as ever increasing prices there are two other factors which have stretched the resources again.

1. 7                    First, two of the required machines need to be superior models than those budgeted for namely the Automatic Straight Knife Grinding Machine which needs to be a much bigger capacity machine if it is to cope with the industries' blades as a service and not just for training, then the Narrow Bandsaw Blade Butt Welding Machine for technical reasons needs to be a much more sophisticated model if it is also required for servicing and not just for training.

1. 8                    The second reason is, that unfortunately, the pieces of equipment found are mainly odd items needing other items to complete an aspect of sawdoctoring, or have parts missing which we could not find, such as the anvil for the Armstrong welding clamp.

Pieces of equipment were being found well into the second week of the expert's two week visit. This did not help the compiling of the report, which was mainly to recommend the best way to spend the equipment budget, and details had to be changed several times. For example, finding of an attachment for sharpening a framesaw blade on Tuesday 2nd June, did influence the expert to try to get drawings prepared for a framesaw blade Tensioning Bench. This would ensure that all aspects of framesaw blade maintenance could be taught during the second phase of the assignment.

## INDUSTRIAL SURVEY

- 2.1 The expert visited a number of sawmills and secondary wood processing factories producing furniture doors etc. and apart from the Government Sawmill Complex, Demerara Woods Ltd., at Mabura some 275 kilometers from Georgetown, which had excellent sawdoctoring facilities and a small amount of tool and cutter maintenance equipment. The remaining establishments visited had in general very poor and often non-existent saw blade, tool and cutter maintenance equipment. This resulted in low output of poor quality products needing far too much time and effort to finish by hand sanding etc. This coupled with the inevitable damage to the cutting agents used is a very serious problem facing the industry.
- 2.2 The use of Tungsten Carbide Tipped (T.C.T.) cutting agents especially circular saw blades was in little evidence, which in one way is surprising when so many of the local tropical hardwoods are indeed hard and often have a high silica content, but on the other hand, when T.C.T. circular saw blades have been tried the tools have soon become useless since misuse and ordinary wear caused blunting and often damage to the carbide tips which could not be repaired or even sharpened locally.
- 2.3 The expert did not have to go far to find that the 600mm capacity Straight Knife Grinding Machine proposed in the project document would be too small, for the workshop at the Guyana Forestry Commission have a large panel planing machine which has blades 920mm (36 ins) long which have had to be cut in half to enable them to be sharpened at all.

- 2.4 Other factories also have large capacity planing machines with longer than 600mm blades, therefore a larger capacity Straight Knife Grinding Machine is necessary and could be fully utilised to service many of the industries blades for which at present there are no proper sharpening facilities.
- 2.5 During the visit to Precision Woodworking Limited, on the outskirts of Georgetown, one of the few companies which realised that they would need some sharpening facilities and had purchased several small toolroom machines, the expert realised that there are big problems even with a commonly used item such as Narrow Bandsaw Blades (N.B.B.) and this was backed up in the other factories visited. Even though Precision Woodworking Limited had purchased a brand new Butt Welding Machine of top quality, costing approximately \$2,000 US, their lack of knowledge had caused them to burn and damage in the first week the all important clamping jaws which pass the electric current to the blade to melt it and thus make the weld, thus making the new machine useless.
- 2.6 The expert did of course spend some time with them to carefully clean the clamping jaws and then demonstrate the correct use of the machine. But the problems do not stop here, for in all the establishments visited, the blades themselves were a mixture of both wood and metal cutting bandsaw steel. This difference is important when welding, and local management and staff could not tell the difference or even know it existed and so would never be able to set the machine's various dials to the correct settings to produce good welded joints.
- 2.7 Infact, if the service centre is to cater for the needs of all the small furniture and joinery manufacturing establishments, which are glad to get hold of and want to fully utilise any type of narrow bandsaw blade they can, a more universal and consequently more expensive welding machine will be necessary to cope satisfactorily with the variety of blades which might be brought in for repairs than that which was tentatively proposed in the project document.
- 2.8 Wherever the expert visited the situation regarding consumable items such as grinding wheels and spare parts was probably the worst he ever encountered, the reasons given were extremely high cost if paid for in local currency but more importantly the often complete lack of foreign currency by individual companies, thereby making the placing of orders directly abroad impossible. Because of this, a generous supply of such items as grinding wheels tungsten carbide tips for saw blades will be necessary to ensure that the equipment will continue for sometime to be fully utilised, hopefully by which time something will be done to alleviate the problem in the country.

### LOCALLY MANUFACTURED EQUIPMENT

- 3.1 During past projects the expert has designed and supervised the manufacture of ancillary items of sawdoctoring equipment to be made locally, thereby generating work for local entrepreneurs and effecting a saving for the UNDP Budget. In this instance, however, most of these items have been found at the Guyana Forestry Commission i.e. Wide Bandsaw Blade Welding Clamp, W.B.B Swaging Vice and Circular Saw Blade Filing and Setting Vice, which, apart from small jigs, covers all the main items except for W.B.B. Tensioning Benches.
- 3.2 Because the necessary steel is both scarce and extremely expensive if purchased locally and in any case funds from the present budget have been used up on the machinery recommended so far. The steel constructed Wide Bandsaw Blade Tensioning Benches designed by the expert will have to wait for another phase when everything can be considered then in the light of money available to see if imported benches or locally made steel or even wood benches most suit the funds and situation at that time.
- 3.3 Another factor against manufacturing locally is that the expert would not be available to supervise the construction to ensure the end results would be satisfactory. This he has been able to do in the past when assignments were for much longer periods.
- 3.4 Three items, however, have been designed and hopefully will be made out of mainly timber before the return of the expert to install the new equipment.
- These are:
- (a) A Wooden constructed Framesaw Blade Tensioning Bench
  - (b) A Wide Bandsaw Blade Welding Clamp Trolley
  - (c) A Wide Bandsaw Blade Cleaning and Stelliteing Bench



WORKSHOP BUILDING

- 4.1 The present workshop building in which some of the machines are installed and used to service the saw blades and cutters for the Forestry Commission's Workshop is adequate in size for a toolroom and some sawdoctoring equipment, but would leave no room for expansion in the future especially if wide bandsaw blades maintenance machinery were to be installed, as this takes up a considerable amount of space.
- 4.2 The workshop is also quite dark and, worst of all, has a flood gate inside in one corner which controls sea water to a boarded over waterway which runs diagonally through the workshop. The rest of the floor being concreted. If this overflowed at anytime, obviously, much damage could be done to the machinery concentrated there.
- 4.3 Another much better building which has a thick hardwood floor and is in altogether much better condition having been renovated for the UNIDO Seminar, would make an excellent Service and Training Centre.
- 4.4 This building, in fact, did at one time house the sawdoctoring equipment which we have found in various storage places and has much better lighting when shuttered windows are open. It also has a ready built partitioned off area which would be excellent for theoretical lectures.
- 4.5 The entire building is 100 feet long by 47 feet wide and could be partitioned off in the centre which would be large enough even for future expansion. This would also leave access thorough double doors to get in the machinery and equipment.
- 4.6 Apparently, this building can be made available and the expert would strongly recommend using this which has so many advantages over the other.
- 4.7 The expert's visit coincided with the visit of Mr. P. Borretti, Woodworking Industry Consultant for UNIDO, who was doing a survey of the Caribbean countries and who suggested that the proposed centre could become, as Guyana is the major supplier of timber in the region, a Regional Centre for this training.
- 4.8 The expert does not know whether this idea is possible or not, but the idea is very attractive and with this superior building together with the proposed equipment, the centre would be worthy of such a part to play in the development of the region.

**EXPERT'S FINDINGS AND RECOMMENDATIONS**

- 5.1        Apparently, Guyana is rich in timber resources which is largely yet unexploited, and, as in many developing countries a minimum value is being realized on the resources, since the timber is being sold in log or squared log form or at best as sawn lumber.
- 5.2        In order to gain more from the resources the logs will have to be converted into quality sawn lumber and if possible further processed into value added goods.
- 5.3        At present, a large percentage of logs are converted into lumber by means of gang framesaws or worst still by circular headrigs, the latter of which can waste easily as much as 30% if converting saw 25mm (1 inch) boards, in the form of useless sawdust.
- 5.4        The trees take hundreds of years to grow and are extremely difficult and costly to extract from the forest. Therefore this waste should not be tolerated for once the trees are cut down and the piles of sawdust made, those trees are gone forever!
- 5.5        As technology stands today, the least wasteful means of sawing logs into lumber is by using wide bandsaw blades and this type of machine should be encouraged not only in the sawmill, but in the secondary wood processing industries. However, investors must realise that they are stepping into another world as far as blade maintenance goes, and that the standard of sawdoctoring has to be extremely high and may well make or break a venture depending on whether the skills are good or bad.
- 5.6        There are no short cuts to training a sawdoctor, and a four year apprenticeship is about right. The best that can be done to cut this down is to train semi-skilled people in one aspect so that, for example, one man learns and works at sharpening, whilst another learns how to tension wide bandsaws and earns his living doing that.
- 5.7        This leads to modular training which is probably the most appropriate system for developing countries where fully skilled sawdoctors who could pass on their skills to apprentices over a four year period, as is often done in developed countries, are very rare.
- 5.9        Training programmes have to be completely flexible to cater for the needs of the individual, who may know nothing or who may have had 20 or more years practical experience.

- 5.9 In addition to this, unlike so many other trades where trainees can all learn the same thing on the same day at the same time, sawdoctoring equipment is so expensive that, apart from demonstrations, the trainees have to do different aspects because the centre may only have one piece of each equipment.
- 5.10 This means that groups of trainees must be small, for even with say six trainees the instructor may well find himself supervising six different aspects at the same time and if a trainee makes a mistake a valuable grinding wheel or even worse a machine may be broken or even a serious accident to the trainee may occur.
- 5.11 What has become clear during the assignment, is that there is a dire need for training both in Tool Maintenance and Sawdoctoring and that there exists a golden opportunity to provide an excellent workshop in which to carry out that training.
- 5.12 The Guyana Government through its Forestry Commission should ensure that every effort is made to prepare the existing facilities, workshop and equipment to as high a standard as is possible during the next 9-12 months, whilst waiting for the new machinery to arrive.
- 5.13 Tasks to be completed are as follows:-
- a. Clean thoroughly (shine like new) all unpainted parts of machinery and equipment and then coat with oil or grease to prevent further rusting.
  - b. Continue to look for missing parts as identified by the expert.
  - c. Move into the new building all items of equipment, both existing and new as it arrives ready for final positioning by the expert on his return.
  - d. Ensure that the electricity supply is adequate and that wiring is available to connect up the machinery.
  - e. Make the Framesaw blade tensioning bench to the drawings left by the expert. (See pages 24 and 25)
  - f. Make the bandsaw blade cleaning and setting bench (see pages 26 and 27).
  - g. Make the welding clamp trolley (see page 28).
  - h. Ensure that the security of the building is good especially doors and windows.

APPENDIX I

DETAILS OF EXISTING EQUIPMENT

<u>Ref. No.</u>	<u>Item</u>	<u>Type or Model</u>	<u>Serial or Test Number</u>	<u>Condition</u>	<u>True or Estimated Value-US\$</u>
E 1	Armstrong Stretcher rolls	3 - 10	12806	New	\$ 3,300
E 2	" Snagging clamp	58 B 60		New	\$ 1,650
E 3	" Circular Saw Anvil	8"-10"		New	\$ 1,000
E 4	" Bandsaw Blade Shears	14"		New	\$ 2,650
E 5	" Pulley Grinder	Barnhart No. 51	1387	New	\$ 2,000
E 6	" Bandsaw levelling Plate	48"x8"x4"		New	\$ 800
E 7	" Bandsaw levelling Plate	72"x8"x4"		New	\$ 1,000
E 8	" Gulletting Machine	54	7666	Needs parts	\$ 2,100
E 9	" Welding Clamp	No.62-12"		Used	\$ 600
E10	" Bandsaw Side Dressing Tools	No. 1 & 2		Used	\$ 720
E11	Wadkin Tool & Cutter Grinder	NH 1041		Used Needs attachments	\$17,000
E12	Vollmer Band/Circular Sharpener	Lilliput-5 175	14-311	Used Needs attachments	\$ 5,000
E13	Vollmer Circular Framesaw Setting	ADM/VI	(1967)	Used Needs cover & parts	\$ 4,000
E14	Vollmer Framesaw Setting	PH 3-DBP	644(1967)	Used Needs parts	\$ 3,500
E15	Robinson Bandsaw Lap Grinder	SQ/E 12"	371 67/48	Used Needs parts	\$ 5,000
E16	White Cutter Balancing Stand		M1933 2D	Used	\$ 2,000
E17	Spears & Jackson Circular Saw Blade Vice			Used	\$ 800
E18	Unknown Make Bandsaw Shears		6" capacity	Used	\$ 80
E19	Spears & Jackson Wide Bandsaw Blade Brazing Clamp	10"		Used	\$ 800
E20	Vollmer Framesaw Blade Sharpening Attachment		Canas/e 51/N34	Used	\$ 2,000
Total					<u>\$ 36,000</u>

APPENDIX II

SPARE PARTS/ACCESSORIES FOR EXISTING EQUIPMENT

<u>Ref. No.</u>	<u>Quantity</u>	<u>Description</u>	<u>Cost \$US</u>
E11		Wadkin U.K. Tool and Cutter Grinding Machine Type NH No. 1041	
	1 <u>1/</u>	Router cutter grinding attachment Type DGA	
	1 <u>1/</u>	Router side relief grinding attachment Type PRFZ	
	1 <u>1/</u>	High speed grinding wheel spindle attachment Type NHG	\$ 3000
E12		Vollmer Dornhan W.G. Lilliput S175 Narrow Bandsaw and Small circular saw blade Grinding Machine No. 14-311	
	1	Narrow bandsaw blade setting device Part No. 246.00.00	\$ 830
E 9		Armstrong Welding Clamp No. 62 - 12"	
	1	Replacement Anvil 2 1/2" x 2 1/2" x 12"	\$ 100
E 8		Armstrong Gulletting Machine 54 No. 7666	
	1	Replacement Grinding Wheel Shaft Pulley Approximately 3" Diameter with 1/2" Bore	\$ 12

1/ Low priority

APPENDIX III

NEW MACHINERY AND EQUIPMENT RECOMMENDATION

<u>Ref. No.</u>	<u>Quantity</u>		<u>Approximate Cost</u> <u>US\$</u>
N. 1	1	Vollmer Biberach Cana/e Automatic Sharpening Machine for Circular Bandsaw and Framesaw Blades. (for specifications see page 12)	14,780
N. 2	1	Vollmer Dornhan Unilep 600 Manual Grinding Machine for T.C.T. Circular Saw Blades 90-600mm diameters. (for specifications see page 13)	4,535
N. 3	1	Vollmer Dornhan MF 600 Manual Side Grinding Machine for T.C.T. Circular Saw blades 100-600mm diameters. (for specifications see page 13)	3,617
N. 4	1	Automatic Straight Knife Grinding Machine for blades up to 920mm minimum. (for specifications see page 14)	
N. 5	1	'Ideal' Flash Butt Welding Machine for narrow bandsaw blades 3-40mm. (for specifications see page 14)	3,985
N. 6	5	Armstrong Tensioning Hammers for Circular, Bandsaw and Framesaw Blades (for specifications see page 15)	355
N. 7	1	Armstrong Swaging Tool for Wide Bandsaw Blades. (for specifications see page 15)	730
N. 8	Set	'Murex' Complete Lightweight Welding Outfit. (for specifications see pages 15 and 16)	489
N. 9	2	'Kef' or Similar Bench Grinding Machines for 150 and 200mm diameter Grinding wheel. (for specifications see page 16)	375
N.10	2	Makita or Similar Lightweight Angle Grinders to take 100 or 110mm diameter grinding discs. (for specifications see page 16)	200
N.11	200 each	Tungsten Carbide Tips Al-11 for the repair of circular woodcutting blades in six different sizes (see drawing on page 30 and specifications on page 16)	240
N.12	2-4 o. tubes	Silver Solder/Flux in form of a paste for brazing on the above T.C.T. tips. (for specifications see page 16)	100

TOTAL

29,406 approx.

APPENDIX IV

SPECIFICATIONS FOR EQUIPMENT RECOMMENDATIONS

<u>Ref. No.</u>	<u>Quantity</u>	<u>Description</u>	<u>Cost \$US</u>
N. I	1	Automatic sharpening machine for circular plate blades, 150-1000mm diameter, Wide bandsaw blades and Gang Framesaw blades 50-250mm wide. Should be capable of bevel grinding 5°-20° and sharpening tooth pitches of 10-100mm. At least 3, preferably 4, tooth shape cams should be built into grind tooth profiles as shown in Appendix VIII, page 21	

Expert's recommendation:

Vollmer Biberach Cans/e	12,808
Protective switch	116
Circular saw blade mounting device N33.1	29
Circular saw blade mounting device N33.5	73
Bandsaw mounting device Cans/e 52/N35d	1,244
Bandsaw mounting device blade guide N35d4	306
Dust filter unit - N81 b	204

Total 14,780

<u>Ref. No.</u>	<u>Quantity</u>	<u>Description</u>	<u>Cost \$US</u>
N. 2	1	<p>Manual T.C.T. circular saw blade grinding machine for blade diameters 90-600mm. For face, and top grinding straight and bevelled up to 45°. The machine can be bench mounted, but should have a coolant pump and coolant tray for wet grinding. Blade mounting cones or bushes should be provided for 25, 30, 35 and 40mm metric bore blades and 1", 1½", 1¾" and 1⅞" imperial bore blades.</p> <p>Expert's recommendation:</p> <p>Vollmer Dornhan Unilepp 600</p> <p>7 additional blade centering bushes to the 30mm supplied with machine or GRIFO (Italy) model UION Formula 'A1'</p>	<p>4,318</p> <p><u>217</u></p> <p><u>\$ 4,535</u></p>
N. 3	1	<p>Manual T.C.T. circular saw blade side grinding machine for blade diameters 100-600mm. The machine may be bench mounted but with coolant tray for wet grinding.</p> <p>Expert's recommendation:</p> <p>Vollmer Dornhan MF 600</p> <p>In addition to magnetic blade holding disc supplied with machine 2 additional discs required, numbers M12.03.00 and M12.06.00</p>	<p>3,332</p> <p><u>285</u></p> <p>Total <u>\$ 3,617</u></p>



<u>Ref. No.</u>	<u>Quantity</u>	<u>Description</u>	<u>Cost \$US</u>
N. 4	1	<p>Automatic straight knife grinding machine for grinding both thin solid high speed steel (H.S.S) and thick mild steel (M.S.) backed knives for the woodworking industry with a minimum capacity to take 920mm (36 ins) long blades.</p> <p>Blade clamping may be magnetic or by mechanical means but should include a simple but accurate means of setting the blades parallel on the block such as sets of setting blocks.</p> <p>The wearing surfaces of the main slides should have replaceable steel strips covering their surfaces. The feed and grinding head electric motors should be powerful enough for heavy duty work and the grinding wheels should be of large diameter preferably of the segmental type. The machine must be equipped for wet grinding preferably having a filter unit to separate the grinding particles from the coolant.</p> <p>Expert's recommendation:</p> <p>Wadkin HQ 36 inch or GRIFO model 1000</p>	6000
N. 5	1	<p>Narrow bandsaw blade Flash butt welding machine for welding woodcutting and metal cutting Carbon Steel and Bi-metal Steel blades.</p> <p>Capacity Woodcutting 3-40mm.</p> <p>Capacity Metal cutting 3-25mm.</p> <p>The machine must be capable of a Flashing cycle preceding the butt welding cycle to enable it to cope with the variety of blades types and to cut down the accuracy needed to prepare the ends to be joined. It must also be equipped with a step-up transformer to operate under conditions prevailing in Georgetown (low voltage and voltage variations)</p> <p>Expert's recommendation:</p> <p>Ideal Flash Butt Welding Machine Type BAS 40</p>	\$ 3,985

<u>Ref. No.</u>	<u>Quantity</u>	<u>Description</u>	<u>Cost \$US</u>
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N. 6		Circular saw blade and Wide Bandsaw blade Levelling and Tensioning Hammers.	
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Expert's recommendation:

1	1½ lb	Doghead Armstrong Part No. 8409	65
1	2½ lb	" " " " "	70
1	3½ lb	" " " " "	80
1	2½ lb	Crossface " " " 8410	65
1	3½ lb	" " " " "	75
		<b>Total</b>	<b>\$ 355</b>

N. 7		Wide bandsaw blade Swaging Tools	
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Expert's recommendation:

Armstrong

1	No. 8½	Swage Part No. 8604	410
2	Spare ½"	swaging dies Part No. 80	80
2	Spare Stationary	clamp screws	36
2	Spare Moving	clamp screws	38
2	Spare Anvils		28
			<b>\$ 592</b>

N. 8		Complete Oxy-acetylene Welding outfit, light-weight.	
------	--	--	--

Expert's recommendation:

Murex

1	Saffire DH outfit	part No. 1250236	127
3	Size 3 spare swaged	nozzles Part No. 122209	10
1	Saffire Series 3 Regulator	Part No. 149690.	117
1	Saffire Series 3 Regulator	Part No. 125606.	117
1	2.5mx5mm Blue Hose fitted	Part No. 1262850	34
1	2.5mx5mm Red Hose Fitted	Part No. 1262800.	34

<u>Ref. No.</u>	<u>Quantity</u>	<u>Description</u>	<u>Cost \$US</u>	
N. 8	Cont'd	1	Nozzle cleaner set Part No. 153391	10
		1	Cup spark lighter Part No. 1380220	6
		24	Spare flints (4x Pack of 6) Part No. 1380221	7
		2	Rayflex Welding Goggles Part No. 153387	10
		10	Spare 3 GMF Lenses Part No. 1380225	<u>17</u>
			Total	<u>\$ 489</u>

N. 9

Bench Grinding Machines with double ended spindles to take 200mm and 150mm Grinding Wheels. Should be wired for 3 phase electricity supply and have easily adjusted tool rests and eye shields.

Expert's recommendation:

K.E.F. SLIBETTE 6 and 8

1	200mm Model	205
1	150mm Model	<u>155</u>
	Total	<u>\$ 360</u>

N. 10

Lightweight Angle Grinders to take 100 or 110mm Diameter grinding discs. Fitted with Rubber backing disc for mounting paper backed sanding discs.

Expert's recommendation:

Makita, Black & Decker or Similar  
@ \$100 each

Total \$ 200

<u>Ref. No.</u>	<u>Quantity</u>	<u>Description</u>	<u>Cost US\$</u>
N.11	200	Tungsten carbide tips, type A1-111 9.0 x 2.8 x 27 mm 9.0 x 3.2 x 27 mm 9.0 x 3.5 x 27 mm 10.7 x 3.7 x 3.5 10.7 x 4.0 x 3.5 10.7 x 5.0 x 3.5  Available from Dansk Haardmetal GmbH. Grundauerweg 4-8 2500 Baden bei Wien	
N.12	2x100 gr tubes	Silver solder/Flux paste from Brazepaste 'Easyflow 3'  Available from: Johnson Mathey Metals Ltd. 100 High Street Southgate London N14 6ET United Kingdom	

**NOTE:**

All machines should be wired for  
3 phase 420/440 volts x 50 cycles  
Electricity supply or  
single phase 220/240 volts x 50 cycles

All large three-phase machines should have  
built-in overload protection switches and  
wiring should be tropically insulated.

APPENDIX V

LIST OF GRINDING WHEELS FOR NEW AND EXISTING MACHINES

<u>Ref. No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit Cost</u>	<u>Total Cost</u> \$U.S.
N. 1	Saw Sharpening Grinding Wheels Specification. AA60-L5-V or Similar Straight Wheels Round or Square Edged.			
	Size. 250x6x20mm Bore	10	\$ 14	140
	250x8x20mm "	10	"	140
	250x10x20mm "	10	"	140
	250x13x20mm "	10	\$ 16	160
	250x16x20mm "	5	\$ 18	90
	Note: Standard 1 1/8" Bore Preferred with Plastic Bushes			
N. 2	Diamond Grinding Wheels for Wet Grinding Specification. D54 x 75 concentration Dish Wheel			
	Size. 125 x 25mm Bore	6	\$ 70	420
N. 3	Diamond Grinding Wheels for Wet Grinding Specification. D91 x 50 concentration Straight Wheel			
	Size. 100 x 20mm Bore 4x4mm Diamond	2	\$ 70	140
N. 4	Grinding Wheels or Segments to suit machine purchased (N.4 on page 14)	4	\$ 70	280
N. 9	Grinding Wheels for off-hand grinding Specification. suitable for H.S.S. and Tool Steels Example AA46-L5-V Straight Square Edged			
	Size. 200x18x1 1/4" Bore	4	\$ 16	64
	200x13x1 1/4" Bore	4	\$ 16	64
	200x8x1 1/4" Bore	4	\$ 16	64

<u>Ref. No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit Cost</u>	<u>Total Cost</u> \$U.S
N10	Grinding discs to suit Angled Grinders purchased is. diameter and bore. Specification: Aluminium Oxide 36 Grit or similar for grinding steel	50	\$ 4	200
	Paper backed Sanding Discs Specification. Aluminium Oxide 60 Grit for Metal	100	\$ 1	100
N11	Grinding Wheels for Tool & Cutter Grinding Specification: AA60-L5-V or Similar for grinding H.S.S and Tool Steels. Size. 6"x1½" Bore (Bushed to ½") Dish Wheel	10	\$14	140
	Size. 4"x3"x1½" Bore (Bushed to ½") Tapered Cup Wheel	5	\$20	100
	Diamond Grinding Wheels for T.C.T Router Cutter grinding Specification. D54 x 50 concentration Size. & Bore to suit High Speed Attachment, but estimated sizes:			
	Taper Cup Wheel 2"x1½"x½" Bore	2	\$55	110
	Dish Wheel 2"x½"x½" Bore	2	\$35	70
	Round Edged Wheel 2"x½"x½" Bore	2	\$18	36
N12	Saw Sharpening Grinding Wheels Specifications: AA60-L8-V or B Bond or Similar Size. 175 x 3 x 51 Bore	10	\$12	120
	175 x 4 x 51 Bore	10	\$12	120
	175 x 5 x 51 Bore	10	\$12	120

Note: In general grinding wheels are more expensive if purchased with the machine from the machine manufacturers, especially diamond wheels. However, often small quantities of special sizes may be cheaper or only available from the machine manufacturer so it is suggested that quotations are obtained from both machine manufacturer and grinding wheel manufacturers. Since specifications vary tremendously, it is always wise to state what the wheels are to grind and give the machine make and type.

Recommended suppliers:

For items 2 and 3:      Diamond Grinding Wheels  
Available from:  
Precision Abrasives Ltd.  
Greenhough Road Industrial Estate  
Lichfield, Staffordshire WS13 7AU  
United Kingdom

For items 1, 4, 9, 10, 2, and 3:  
Abrafract Limited  
Beulah Road  
Sheffield S6 2AR  
United Kingdom

or

TYROLIT  
Schleifmittelwerke  
Swarovski K.G.  
Schwaz  
Austria

APPENDIX VI

LIST OF MANUFACTURERS' NAMES & ADDRESSES

1. **Armstrong Manufacturing Company**  
2135 N.W. 21st Avenue; P.O. Box 3008;  
Portland Oregon 9720<sup>9</sup>; U.S.A.
  
2. **Vollmer Werke, Maschinenfabrik GmbH;**  
Postfach 1760; D-7950 Biberach/Riss 1.  
Federal Republic of Germany
  
3. **Vollmer Schleifmaschinen GmbH and Co. KG,**  
Postfach 11, D-7242 Dornhan,  
Federal Republic of Germany
  
4. **Jos. Loroach, Postfach 1249**  
D-6942, Federal Republic of Germany
  
5. **Wadkin Ltd., Green Lane Works**  
Leicester LE5 4PF, United Kingdom
  
6. **Electro-Apparate-Bau Jungeblodt,**  
Bunsenstrasse 1, D-4780 Lippstadt  
Federal Republic of Germany
  
7. **Murex Welding Products Ltd., Unit 1. Milner Way,**  
Longlands Industrial Estate. Ossett. West Yorkshire,  
WF5 9JE United Kingdom
  
8. **Kef Tools Ltd., Harvey Works, Lingard Street,**  
Burslem. Stoke-on-Trent. United Kingdom.  
or  
KEF Krinders  
T-T Vaerkstedsmaskiner A/S  
Tolderundsvej 3; DK-3000 Odense C, Denmark
  
9. **GRIFO S.R.l. Construzioni Meccaniche**  
Via Montello 135, C.P. 83, I-20038 Seregno MI, Italy



APPENDIX VII

LIST OF SAWMILLS & FACTORIES VISITED

	<u>Name</u>	<u>Product</u>
1.	Demerara Woods Ltd., Mabura Hill, Upper Demerara River	Sawn Timber
2.	Guyana Sawmills Ltd., Water & Bugle Sts., Georgetown	Sawn Timber
3.	N.C.E. Screen Printers/Guyana Wood Products Limited, 6-8 Water & Schumaker Streets, Georgetown	Toys, Fancy goods
4.	Industrial, Domestic & Electrical Appliances Limited, Soedyke, East Bank Demerara	Doors & Furniture
5.	Industrial, Domestic & Electrical Appliances Limited, Water Street, Georgetown.	Sawn Timber
6.	Precision Woodworking Limited, 35 Industrial Estate, Ruimveldt, Georgetown	Furniture
7.	Fries Furniture Factory 38 Industrial Estate, Ruimveldt, Georgetown	Furniture
8.	A.H. & L. Kisson Limited Industrial Estate Ruimveldt, Georgetown.	Furniture

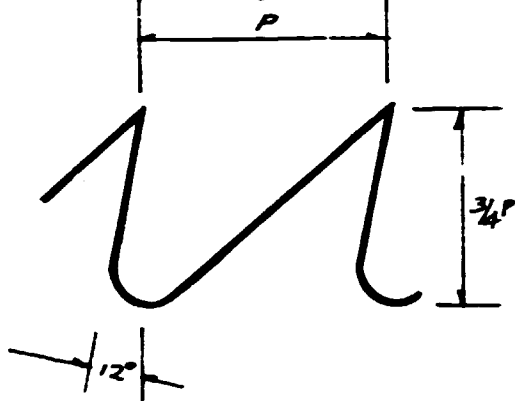
# APPENDIX VIII

## REQUIRED TOOTH SHAPE CAMS FOR

### VOLLMER CANA/E

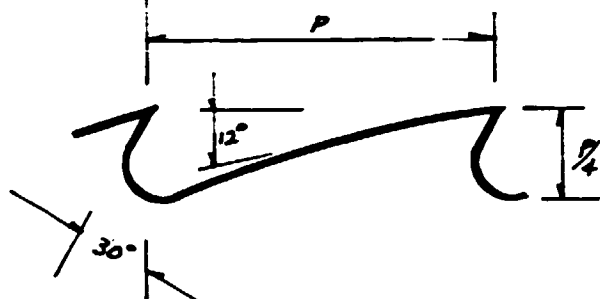
FOR FRAMESAW BLADES

CAM 'A'

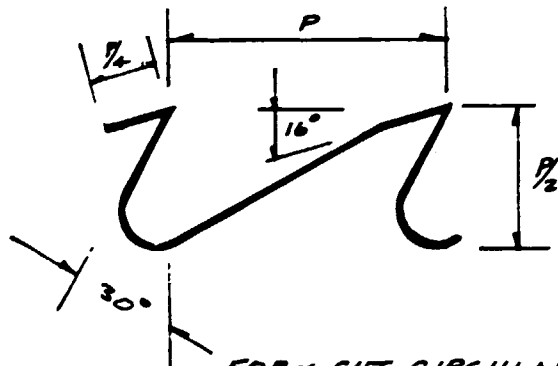


FOR BANDSAW BLADES

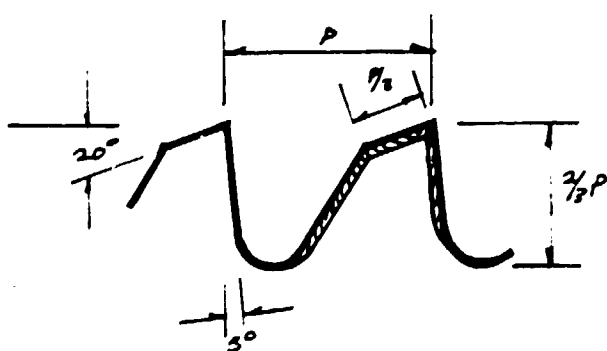
CAM 'B'



FOR RIPPING CIRCULAR SAW BLADES CAM 'C'



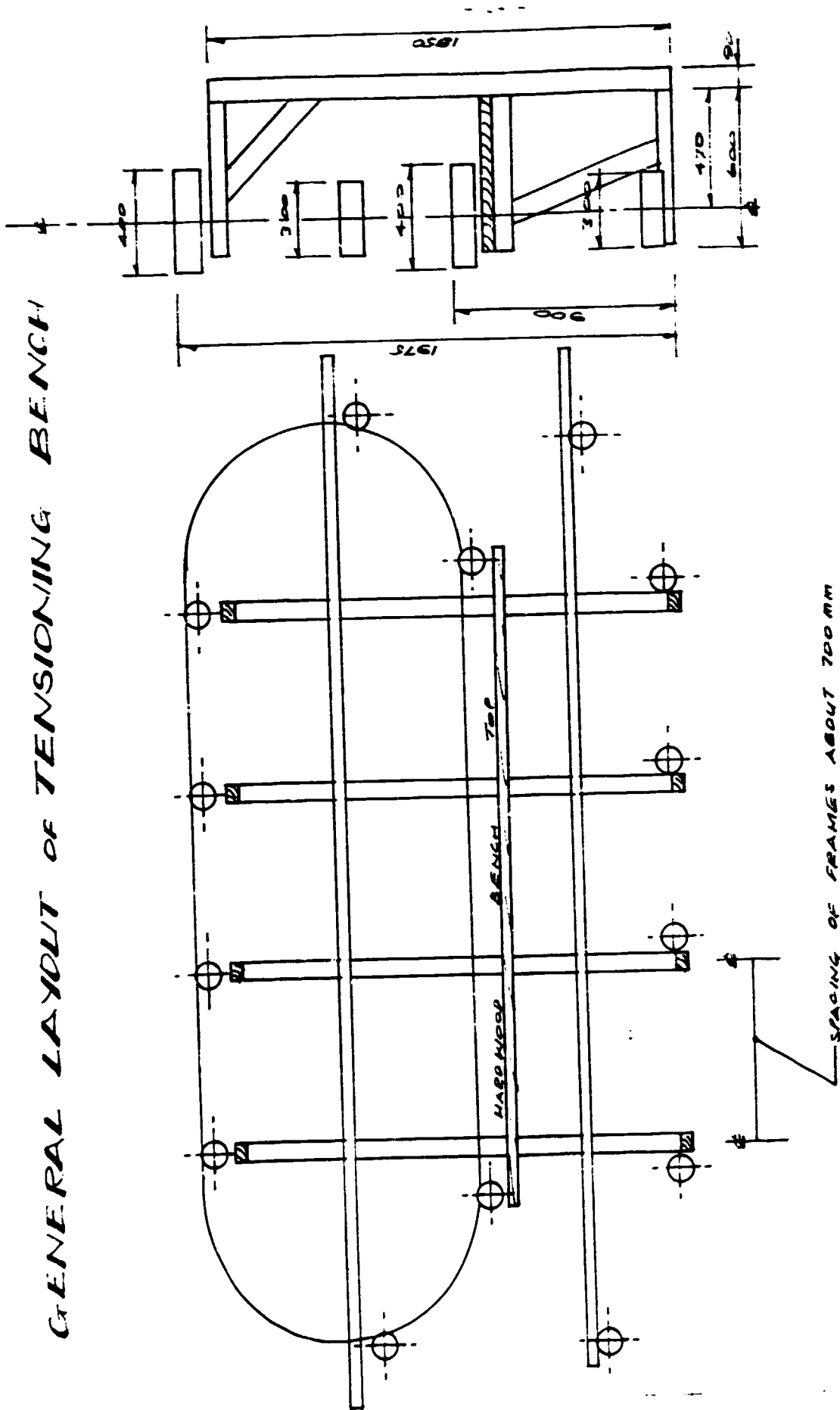
FOR X-CUT CIRCULAR SAW BLADES CAM 'D'



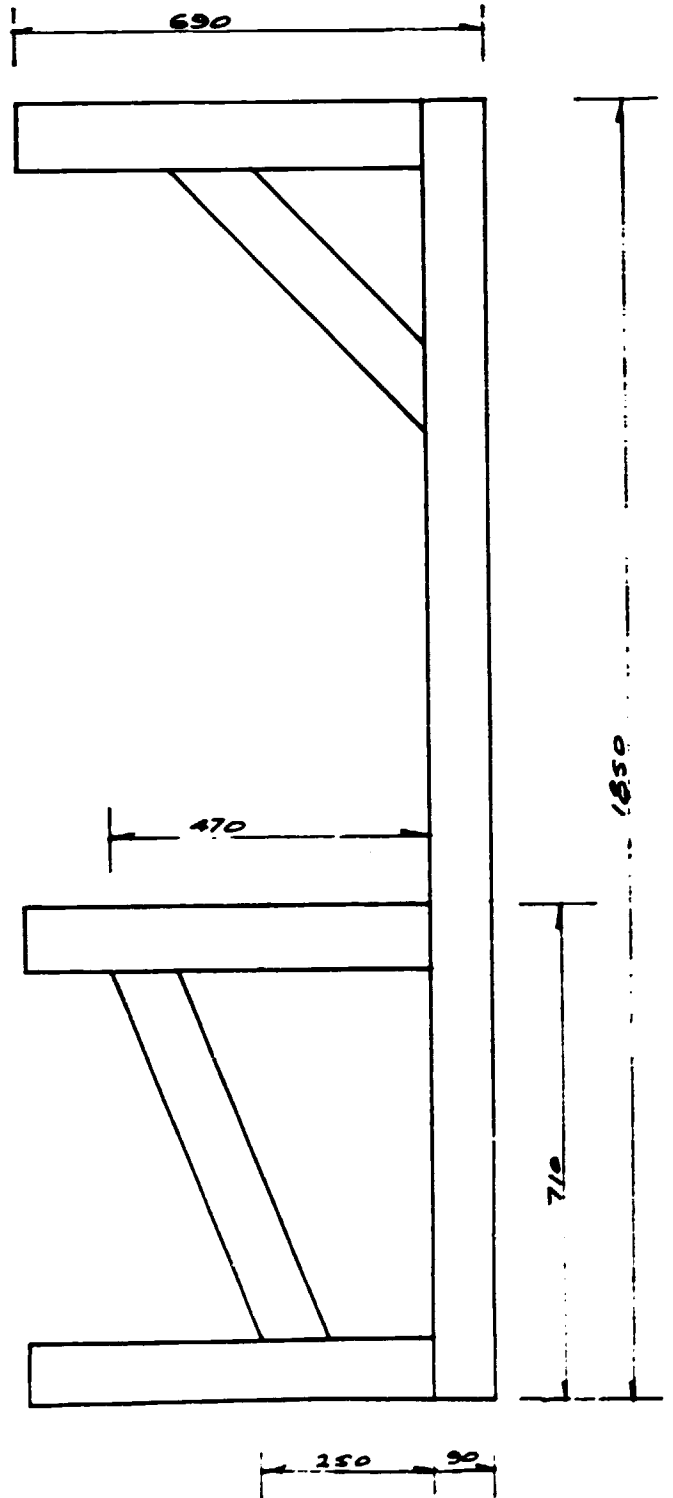
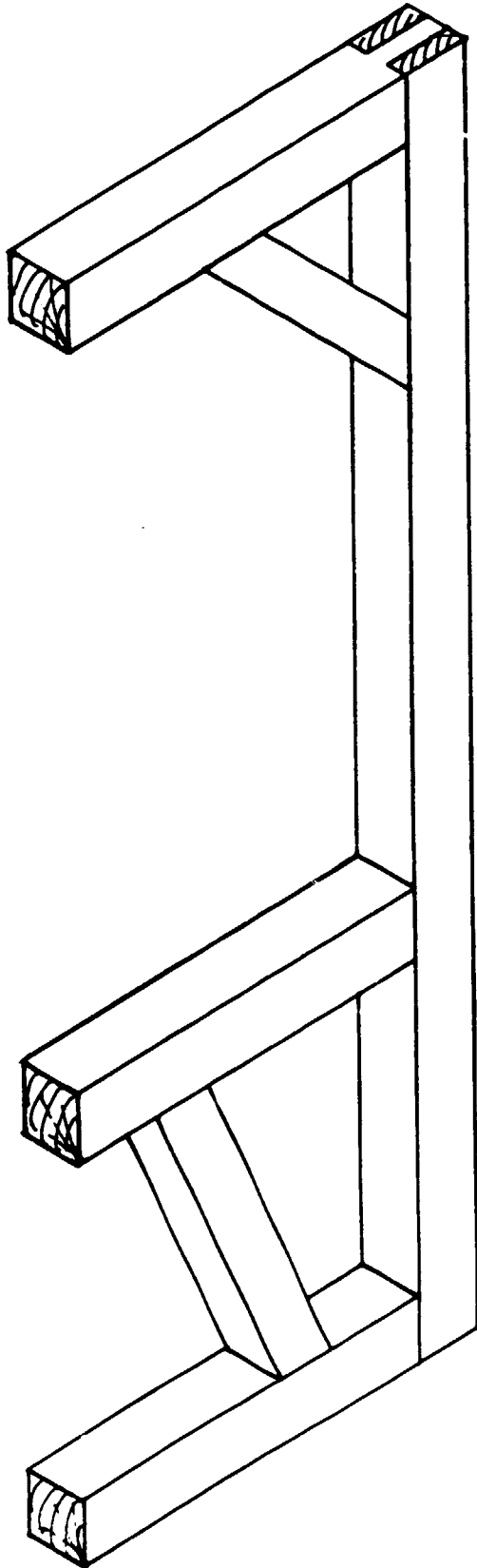
TOOTH PROFILES  
FOR CANA/E

REF.  
N. 1

# GENERAL LAYOUT OF TENSIONING BENCH

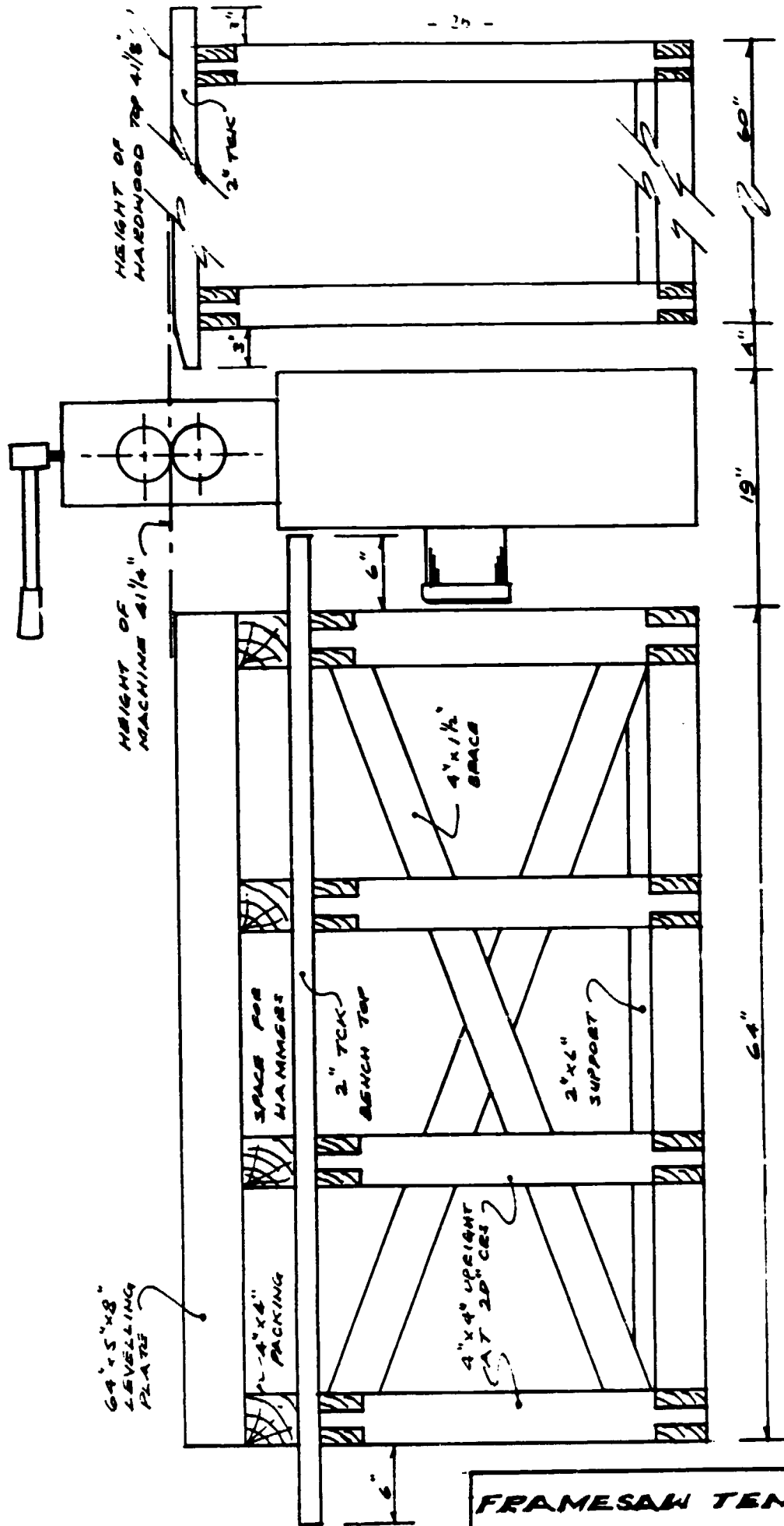


WIDE BANDSAW BLADE REF. NO. A.1  
 TENSIONING BENCH A.1



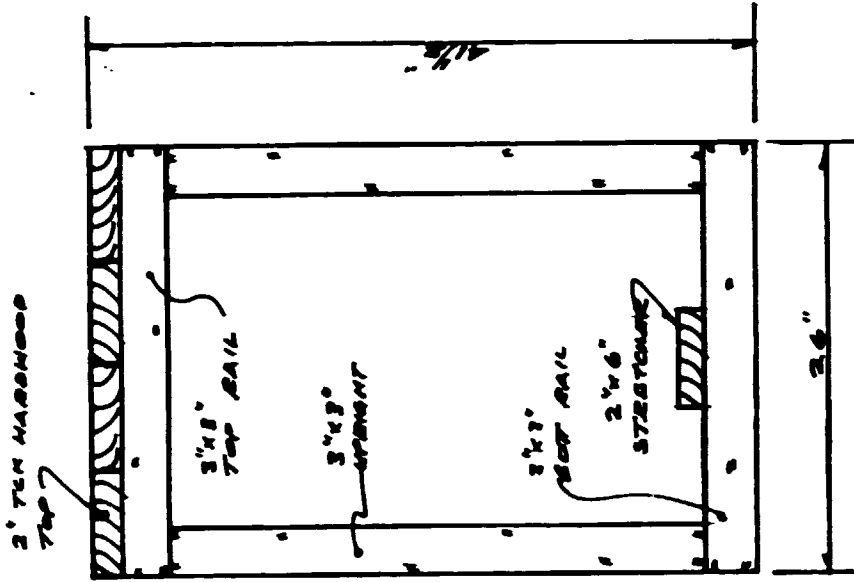
SCALE 1:10

<b>TENSIONING BENCH FRAMES</b>	REF
	NO.
	A:2

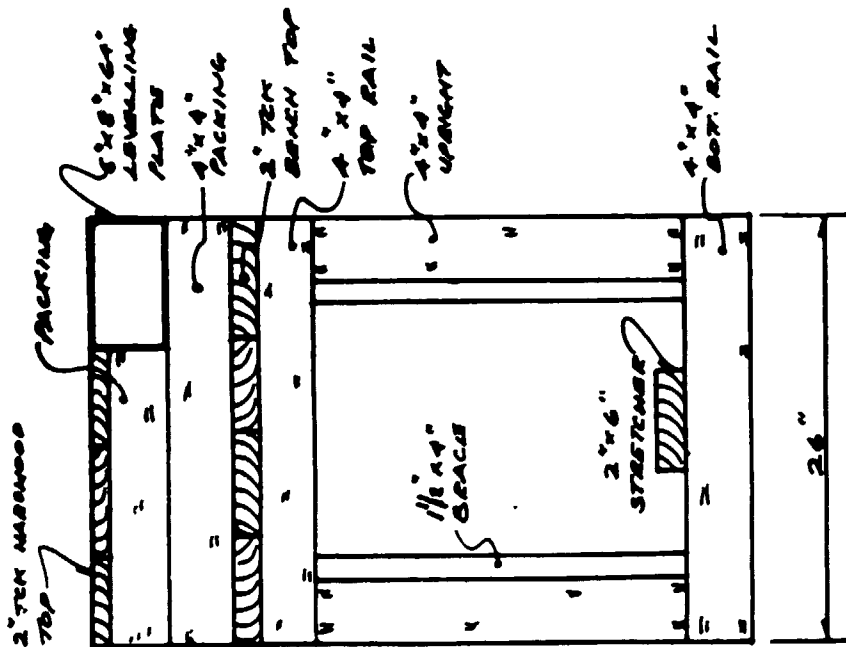


FRONT ELEVATION

FRAMESAW TENSION-REF.  
ING BENCH B 1

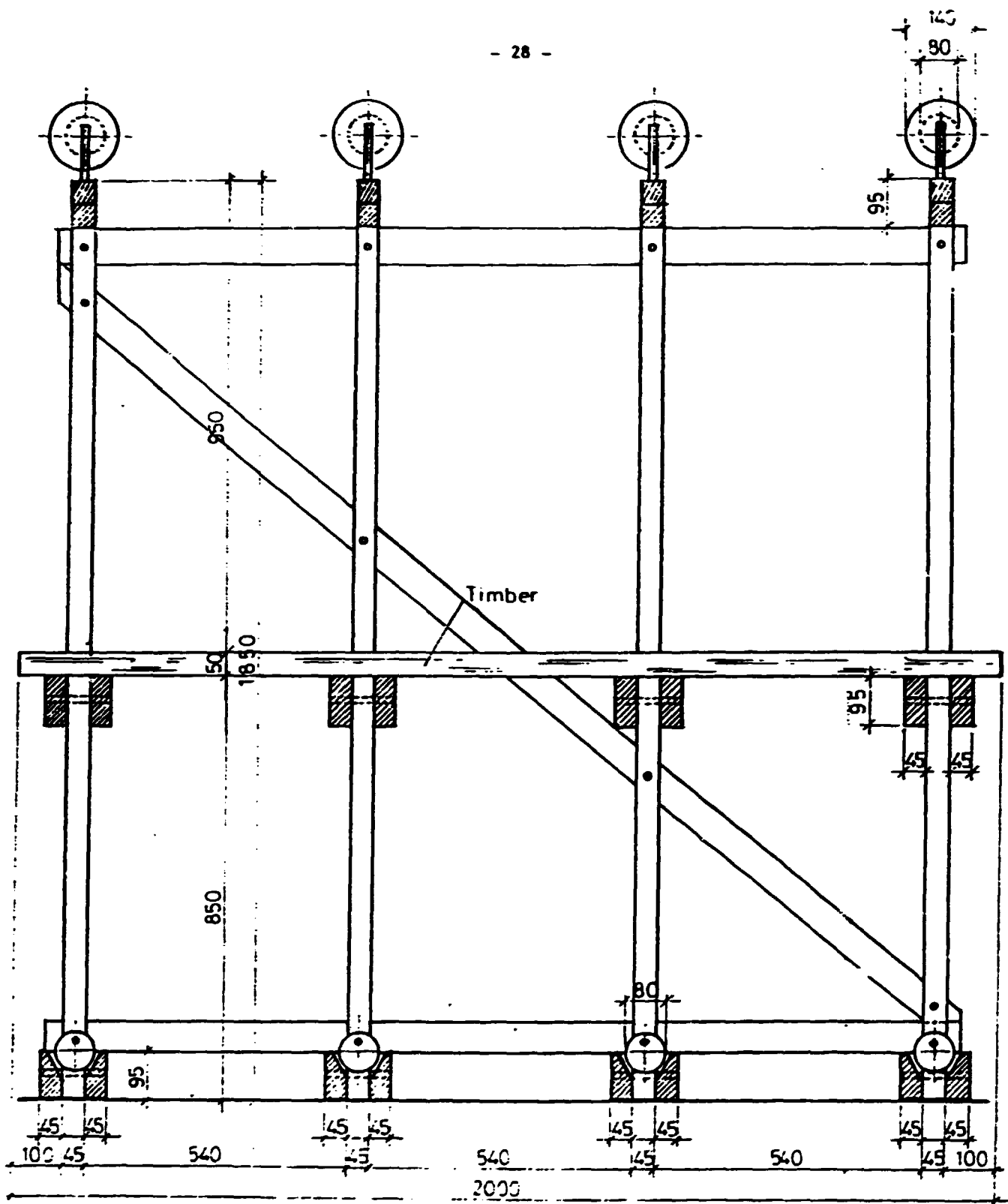


**END ELEVATION  
RIGHT HAND BENCH**



**END ELEVATION  
LEFT HAND BENCH**

<p><b>FRAMESAW TENSION - ING BENCH</b></p>	<p><b>REF. B 2</b></p>
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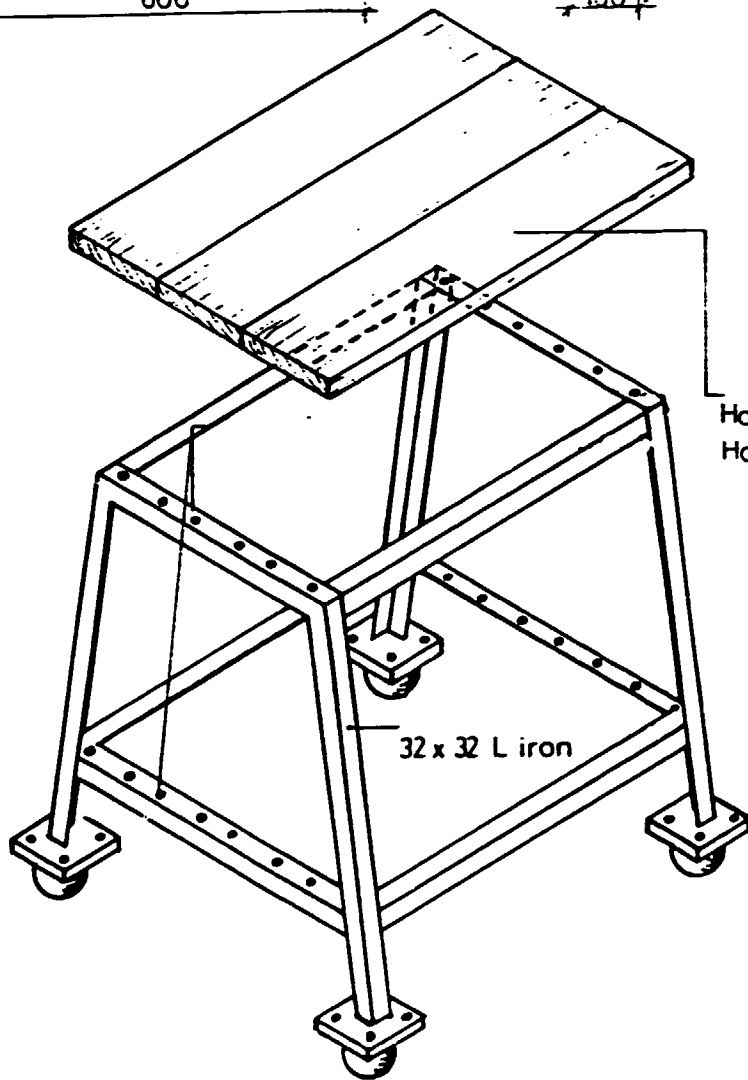
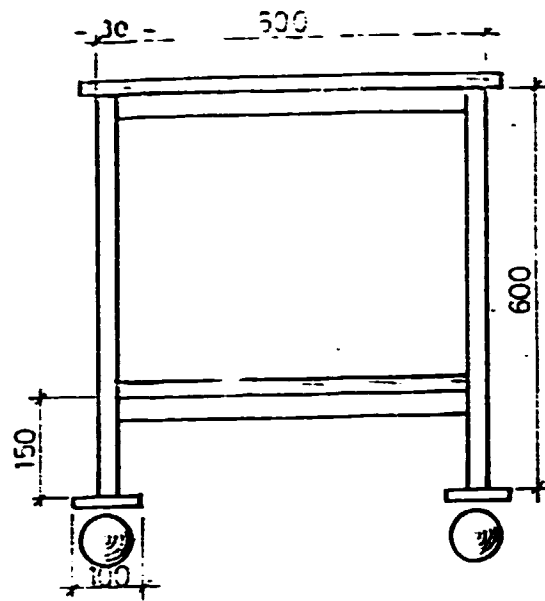
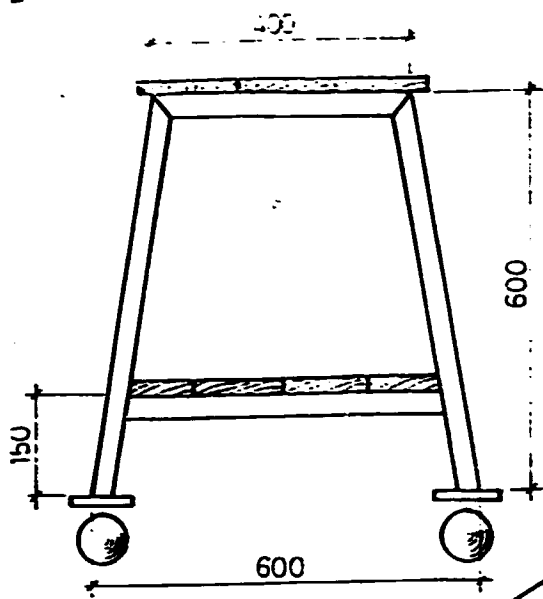


Scale 1 : 10

Wide bandsaw blade cleaning & stellinging bench	REF. C 1
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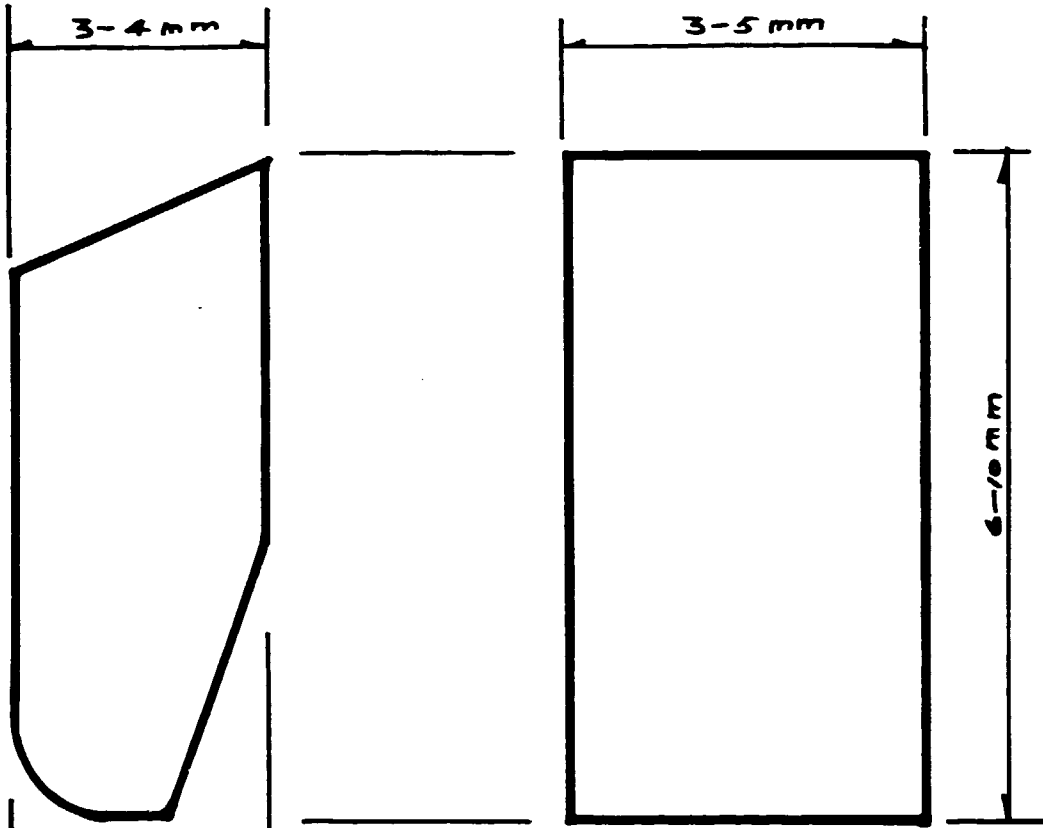


Hardwood top 640 x 440 x 30  
Hardwood shelf 640 x 500 x 30

Scale 1 : 10

Wide bandsaw blade welding clamp	REF. D 1
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GRADE OF TIPS SHOULD  
BE FOR VERY DENSE  
HARDWOODS

TIPS MAY BE  
SIDE RELIEVED  
OR SQUARE EDGED

TUNGSTEN CARBIDE TIPS	REF. N 11
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