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CENTRE FOR AGRICULTURAL MECHANIZATION AND RURAL TECHNOLOGY (CAMARTEC):  
AGRICULTURAL IMPLEMENTS PRODUCTION PLANT -  
UPGRADING AND STRENGTHENING

TF/RAF/87/902

TANZANIA

Technical report: Development of rural technologies  
at CAMARTEC (Part 2)\*

Prepared for the Government of Tanzania  
by the United Nations Industrial Development Organization

Based on the work of Mr. H. Pearson,  
consultant in workshop technology - CTA

Backstopping officer: P. Prijapratama, Engineering Industries Branch

\* This document has not been edited.

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**SUMMARY**

This report summarizes the work carried out by the consultant for the second mission in Aug/Nov 89 in connection with the counterpart CAMARTEC engaged in the development of rural technologies.

The project will assist in the up-grading of equipment and services within the CAMARTEC workshop complex, to train and up-grade the resident technicians and rural artisans. Through the CFA and the resident junior expert the project will also assist in the modification to present designs of farm implements being produced and introduce new designs for testing and production in CAMARTEC and the rural areas.

The report comprises three parts presented in chronological order of preparation as follows :-

- 1) Project Performance Evaluation Report (PPER) prepared by national and project staff as a requirement at this stage of the projects development and in preparation for a Tri-partite Review Meeting scheduled for late October 1989.
- 2) Various technical development activities have taken place over the mission period. These activities and developments form the second part of the report.
- 3) The visit by the UNIDO Substantive Officer from Vienna for the Tri-partite Review Meeting (TPR), its findings and recommendations are covered in the third section of the report.

## 1) PURPOSE OF PROJECT/BACKGROUND INFORMATION

### PURPOSE OF PROJECT :

To assist the government of Tanzania and specifically the Centre for Agricultural Mechanization and Rural Technology (CAMARTEC) for the production of agricultural tools and implements in strengthening their technological capability through institutional and manpower development with a view to achieve accelerated self-reliance.

### BACKGROUND INFORMATION:

#### CAMARTEC:

The Centre for Agricultural Mechanization and Rural Technology (CAMARTEC) was established by an act of parliament in November 1981. The aim of the centre is to improve the quality of rural life through development, adaptation and implementation of appropriate technologies in the fields of agricultural mechanization, water supply, building construction and sanitation, rural transport and energy.

CAMARTEC officially started its operation in July 1982, is a merger of two separate institutions, one formally known as Tanzania Agricultural Machinery Testing Unit (TAMTU) and Arusha Appropriate Technology Project (AATP). TAMTU used to test agricultural machinery for suitability to Tanzania conditions. TAMTU activities date back to 1955 AATP was started in 1957 as a project under Small Industries Development Organization (SIDO). The function of the project was to do research and development in building materials, rural transportation, energy and water supply. Both institutions apart from their station activities, had extension and production responsibilities to ensure that the developed technology reached the people in the field.

## 2) LOCATION/INTRODUCTION

### LOCATION:

The Centre is located in Arusha region, Northern-Tanzania. The Centre is 16 km from Arusha municipality on the old Moshi Arusha road and railway. The location of the Centre offers a good working environment with cool temperatures and average rainfall. Located on 80 hectares of level land, there is enough room for a residential area, offices, workshops, testing ground and recreation.

The Centre is a parastatal organization under the Ministry of Industry. The running of the Centre is directed by the Board of Directors under a Chairman appointed by the President of the United Republic of Tan-

zania. The day-to-day management of the Centre is directed by the Director General also appointed by the president. There are three directorites under the Director-General:

- 1) Directorate for Agricultural Technology-Energy Housing Water Supply and Sanitation.
- 2) Directorate for Laboratory and Field Testing Production and Marketing.
- 3) Directorate for Extension, Training and Documentation.

#### INTRODUCTION

The author departed Birmingham U.K. on Friday Aug 11th at 16.40 pm. As CTA for for the project in Nov 1988 briefing in Vienna was not required for this mission. The author therefore proceeded to Kilimonjaro International Airport, Tanzania, with plane changes in London and Addis Ababa.

The resident UNIDO project expert Mr Takashi Inoue, met the author and provided transport for the 40km from the airport to the project site. Accomodation for the duration of the mission has kindly been provided by the resident UNIDO expert at his house located in the compound of the project site at CAMARTEC, saving over 60km a day travel from Arusha town to the project site.

#### 3) FIELD TRIPS

##### DAR-ES-SALAAM.

A field trip to Dar-es-Salaam (DSM) was scheduled for Wed Aug 16th. The author was driven by the UNIDO expert in the project Toyota vehicle. The distance of 700km was covered in 11 hours. Much of the road is in very poor condition.

Discussions held with the UNIDO JPO, Mr Rasmussen at the UNDP office highlighted the priorities for the mission as follows:-

Determine more accurately dates for the arrival of the project equipment and raw materials.

Prepare a Project Performance Evaluation Report (PPER).

Work on designs for an improved ox cart and on a tool bar range of animal drawn farm implements. The counterpart had also asked that priority be given to this area of development.

#### VISIT TO THE INSTITUTE OF PRODUCTION INNOVATION AT DSM UNIVERSITY

The UNIDO staff visited DSM University on Aug 16th and talked with Mr Jasper of the marketing section of IPI. Mr Jasper explained the activities of IPI as follows:

The Institute of Production Innovation (IPI) is an applied engineering research and development organization affiliated with the University of Dar-es-Salaam. IPI's basic objectives are twofold:

- A) to contribute to the development of a viable industrial sector in Tanzania through the improvement and utilization of existent know-how and the development of new or adapted technologies, with main emphasis on agriculture, transport and energy, and
- B) to help coordinate the education offered by the University of Dar-es-Salaam Faculty of Engineering with the needs for industry.

In practical terms, IPI endeavours to translate these objectives into reality by developing locally fabricated prototypes which are then passed to local companies for series production. At the same time, IPI offers various other services to industry, ranging from the fabrication of locally made spare parts to consultancy and information services. Cooperation between IPI and CAMARTEC is limited by poor communication, distance, road conditions and available transport. Stronger links would be an advantage to both institutions.

After completing administrative procedures at UNDP the UNIDO staff returned to Arusha on Tue 22 of Aug.

VISIT TO NAIROBI (KENYA) AGRICULTURAL SHOW-FRI SEPT 29 to SUN OCT 1st

The UNIDO staff accompanied by the Director General and the Director for Production and Testing, made a two day visit to Nairobi, Kenya, to observe the annual agricultural show.

The journey by road took 3 hours in the UNIDO experts private car.

The show is very well organized and has many exhibits ranging from heavy agricultural equipment to small scale appropriate technology projects active in Kenya.

It was interesting to see designs for simple farm implements that had originated in TAMTU and CAMARTEC years ago. In particular the present ox cart wheel being manufactured by CAMARTEC was on exhibition as a new development.

4) CAMARTEC

BUDGET & STAFF

BUDGET

Government Allocation for 1989/90

Figures in Tanzania shillings. 150 TS = 1 US\$

Administrative Budget	20 million T/S
Development Budget	5 million T/S
Total Salaries	14 million T/S
Highest Salary	96 thousand T/S-PA
Lowest Salary	18 thousand T/S-PA
Average Salary	57 thousand T/S-PA

Salaries are under review for increase.

STAFF.

Director General's Office	5
Administration	51
Technical Development Dept	32
Production & Technology Dept	53
Training & Extension	15
Nzega out station	15
	----
	175

5) OTHER STAFF MATTERS.

Mr E Protzen, a Swiss engineer, joined CAMARTEC in July under an agreement between the United Republic of Tanzania and the Swiss Federal Council. Mr Protzen is technical advisor to the Director General, will be with CAMARTEC for two years.

Mr Protzen's activities at CAMARTEC and the activities of the UNIDO staff compliment each other, cooperation is very good in all respects. Before joining CAMARTEC Mr Protzen was technical manager for 7 years at the Institute of Production and Innovation (IPI) at Dar-es-Salaam University.

A copy of the agreement between the Swiss Federal Council and the United Republic of Tanzania is attached as APPENDIX No 1.



6) PRODUCTION METHODOLOGY

Technical developments over the mission period has concentrated more on production methodology than on the construction of sample items for later replication.

Early in the mission a weakness was identified in the area of production methodology within CAMARTEC. Equipment such as ox carts and farm implements are being constructed using "one off" methods. Present designs call for excessive material inputs coupled with complex fabrication.

It was agreed that the UNIDO team would better serve CAMARTEC by making sure that new developments such as ox carts and farm implements should include development of the special tools required for production, and that the production methodology should be worked through in detail with the technicians of development and production workshops.

7) COUNTERPART TECHNICAL ABILITY

Workshop technical skills are good with technicians capable of completing machining operations from drawings and verbal instruction. However, methods are very much 'technical college' and not what may be expected from engineers working in a development and production establishment.

All technicians found difficulty in determining operational sequence for machining a component, which dimensions should receive priority and which could be left open. Much time often being wasted on needless accuracy. The major problem, however, was inability to plan machining operations in order that one machined surface was concentric or parallel to another. The assumption often being that the machine tool would take care of the relationship of the machined surfaces to each other.

All technicians appreciated the UNIDO team's approach of first developing the special tools and then using these tools to produce the product. Often using scrap materials, special tools and jigs were produced capable of a quality finished product. The 16inch pressed steel wheel being a good example. The press tools for this component are made from old tractor parts and yet are capable of withstanding the 50 tons of hydraulic pressure required to press the 3mm steel plate into the shape of the wheel.

8) FUTURE TECHNICAL TRAINING

It is recommended consideration be given to future training inputs and that these inputs should take the form of on the job training in production methods with a large practical input from the trainee. Training would have to be realistic - minimum 6 months abroad by attachment to a suitable engineering company.

It has to be appreciated that the training of a good workshop engineer takes 3 to 5 years in a developed country with the technician working in production industry whilst receiving technical college education in engineering theory. One or two years in a developing country technical college can only be considered as a minimum requirement to produce a good workshop engineer.

9) RURAL TRANSPORT - IMPROVED OX CART

The present ox cart manufactured by CANARTEC dates back to 1970 to the time of Tanzania Agricultural Manufacturing and Testing Unit (TAMTU). The cart is largely constructed from wood, other than the axle made from small section railway line, and the wheels - an iron rim and a split rim for use with 16inch X 750 motor tyres. The dated design of the present cart leaves room for improvement. The present inflated tyre wheel rim uses 5 different steel sections in its construction and has 15 separate parts with as many manufacturing steps. Total weight, less tyre is 20kg.

The improved wheel developed by the UNIDO team and counterparts uses 3mm steel plate throughout the construction, has 3 parts and a manufacturing process with 7 steps. Four of these steps are hydraulic press operations and are very rapid. Total weight of the rim is 12kg. The rim is a vertical split design for ease of tyre repair.

AXLE DESIGN.

Present axle design uses two 200mm long round wood bearings set in the wheel hub rotating on 38mm stub axles that are in turn welded to a 1mtr length of light railway line which is fixed to the underbody of the cart.

Recent problems with obtaining hardwood for the bearings has led to rapid wear of the soft wood alternative bearings and for a desire by the counterparts to develop a high speed ball or roller bearing axle assembly.

An interim wood bearing design has fixed wood bearings held by half round clamps. The axle can easily be removed leaving a clean underframe ready to accept a high speed assembly.

Problems with cost and availability of ball or roller bearings on the local market led the team to design a simple ball bearing hub similar to the design employed in a bicycle wheel hub of inner and outer cones. Bearing balls are available locally and 9mm dia are used in the prototype hubs. The machining process is simple and not more complex than required for fitting commercial bearings in a hub.

Components of the cup and cone design are machined and the bearing tracks lapped before being case hardened.

Tests are at present in progress to determine load capacity and operational speed range.

### CART BODY DESIGN

The present design measures 183cm X 158cm X 75cm high. Body construction is from 50mm X 100mm and 100 X 100mm timber sections bolted and nailed together. Even though steel is expensive the use of so much wood in the carts construction can not be justified for the long term. The improved cart body design uses a light angle steel construction with 30mm planks for floor and sides. Overall dimensions are the same as the old model other than the sides which are 300mm high with short pipes provided at each corner for extension poles should more height be required.

The old model weighs 300kg, 100kg more than the new design and is not tipable, a feature of the new model of interest to rural road construction projects.

Some costing has been carried out and the new cart should be cheaper than the old model in view of the lower material inputs and better production format.

Design sketches and technical details are attached covering both models, as APPENDIX No.II to this report.

### 10) FARM IMPLEMENTS DEVELOPMENT

Work on a range of animal drawn farm implements has progressed to the design stage with limited construction. Practical progress has been limited as priority was given, at the counterparts request, to development of the improved ox cart. Also the late arrival of the project equipment and raw materials has influenced implements construction. The design for the tool bar implements system is well proven and does not require much R&D input. The area that does require inputs is development of production tooling and methodology.

The tool bar animal drawn farm implements system covers ploughing, harrowing, planting, cultivation and weed control. Two designs of frame have been constructed, the implements for which will be interchangeable. Also some of the production tools have been fabricated (frame welding jigs).

Technical information and drawings relating to implements development are attached to this report as APPENDIX NO.III.

11) PROJECT WORKSHOP EQUIPMENT

The bulk of the project equipment and raw materials arrived at the project site on Wed Oct 24th after being transported by CAMARTEC vehicles the 700 km from Dar-es-Salaam. Three major items of equipment have received damage that renders them unoperational for the time being. A brief description of the damage is as follows:-

a) HARRISON M450 LATHE SERIAL No 45027/6816

This machine was damaged whilst being unloaded from the ship in Dar-es-Salaam port. The machine was well packed in a wooden box. Gross weight was 2300kg.

Damage was caused to the packing case and the machine inside resulting the crushing of the electronic control box at the rear of the machine. The control box is 450mm square X 140mm deep. Many of the electronic components in the box have been damaged and the whole box will have to be replaced.

Other visible damage to the machine is; coolant pump and tank, rear splash guard, some small fittings and paintwork.

It is not possible at this stage to determine if the accuracy of the machine or functions have been damaged.

b) SURFACE GRINDING MACHINE SERIAL No E222909.

This machine was packed very well in a strong wooden case. The total weight of the package was 3135kg.

Damage to the machine was caused through poor loading on the lorry and the subsequent journey of 700k over poor roads from DSM to Arusha.

The machine broke away from the base security bolts and smashed its way through the side and base of the packing case. The packing case had to be completely dismantled before the machine could be removed from the lorry.

Damage was to the electrical system but does not look very serious.

It is expected to have the machine running in the near future. It is too early to determine if any functions or the accuracy of the machine has been affected.

c) MEDDINGS TAPPING MACHINE SERIAL No 02946/TF4HD.

The machine was packed with the surface grinding machine (above) and received damage from heavy contact with the much larger grinding machine. As with the two previous machines this machine had electrical damage. The complete control box will have to be replaced before the

machine can be operated and tested for other damage.  
All machines came complete with accessories and spare parts.

d) HAND TOOLS AND RAW MATERIALS

The consignment of hand tools and raw materials arrived intact and complete. However, many of the hand tools are of poor quality and of dated design. This and other matters relating to project equipment will be elaborated upon by the CTA when on de-briefing in UNIDO HQ in early November.

e) EQUIPMENT NOT YET RECEIVED AT THE PROJECT

Order No 15-9-0496 N - CANNON PHOTO COPIER MODEL NP 2215.  
Delivery of this equipment was by air freight for April/May 89. The project has not received the equipment and has no other information than the UNIDO purchase order of April 3rd 1989.

Order No 15-9-0524 N - POWER BENDING ROLL MACHINE.

It is understood this equipment has been shipped and should arrive in Dar-es-Salaam in the near future.

Sample Farm Implements for testing and replacement.

A requisition was completed by the CTA in Nov 1988 for purchase of these implements from Lesotho. No purchase order has been received by the project but a telex from UNDP DSM dated June 8th/89 states " Farm Implements purchase from Lesotho Steel Products being effected". This is the only information available at this time.

f) DETAILS OF PARTS REQUIRED FOR DAMAGED MACHINES

Harrison M450 Lathe - Serial No 45027/6816.

Parts required:- Electrical control box complete.

- 400volts 16 amps 7.9 kw.

- No - EWD 401.1

- Serial No 8901309.

Drg No EWD 402/A.

Manufacturer:- T.S.Harrison & Sons Ltd, Union Street, Heckmondwike  
Yorkshire, England, WF16 0HN. Fax: 0924-407285.

Meddings Pitch Contolled Tapping Machine. Serial No 029461- TF4 HD.

Parts Required: Electrical Control Box: 20585/T4/MK7.

Supplied by: Trueperch Ltd The White House, 17 Burley Rd, Oakham,  
Leicestershire, England, LE1 6DH. TLX: 342271 A/B Truper G.

12) CONCLUSIONS

1) Late arrival of project equipment and subsequent damage has caused delays in the execution of the project activities. However progress has been made as follows :-

Equipment Identified.

Purchased-

Delivered-

Workshop Layout Plans.

Completed-

Investigations re Rural Craft Workshops.

Extensive Field Trip with follow up meeting and report-

Staff Training.

Weekly technical meetings organized-

On the job training of technical staff-

Production methods improved through training-

Product costing system initiated-

Quality control methods introduced-

Technical Developments.

Forage chopper developed, constructed and under test-

Two models of ox cart developed and constructed-

One hand cart developed and constructed-

High speed ball bearing axle developed and constructed-

Design and construction of various jigs and press tools-

Designs for range of farm implements complete and construction started-

General assistance to CAMARTEC in maintenance of workshop equipment and vehicles-

Reporting and documentation complete to date.

JUNIOR EXPERT

The junior expert has worked hard. In particular during the mission period the expert devoted much of his free time to assist the mission. The counterpart well satisfied with the junior experts performance and his willingness to assist in any area when requested.

Important future activities (Nov 89 to March 90) for the junior expert will be:-

- a) Commission UNIDO equipment and tools (repairs to damaged equipment)
- b) Initiate training of counterparts in use of project equipment.
- c) Complete development and testing of ox cart frames, wheels, and high speed bearings.
- d) Advance construction of 3-4 prototype farm implements. Project equipment and raw materials now being available.
- e) Documentation and reporting.

#### COUNTERPARTS

Counterpart cooperation continues to be good with willingness at all levels to assist in project progress.

#### 13) RECOMMENDATIONS

- a) Investigation is required to determine the reasons for the very late arrival of project equipment and raw materials to avoid a similar situation in the future, in particular in the case of equipment purchased for Tanzania.
- b) As outlined in the CTA report covering the previous mission (Nov 88) Short term training should be considered for inclusion under future inputs or revisions. Training would consist of a four week study tour by staff from CAMARTEC involved in technical development (heads of department) to similar institutions within the region (Zimbabwe-Lesotho-Botswana and Swaziland). Also consideration should be given for inputs to cover technical training for workshop technical staff as outlined on page 6 item of this report.
- c) The project TOYOTA four wheel drive vehicle has covered 25,000 km and has developed defects related to bodywork and suspension not normally experienced with this make and type of vehicle. The vehicle has a very early serial number (LN106-0000083) and is one of a new 1989 model series. Other projects (FAO) and private owners have also experienced similar structural problems and have expressed concern. The project staff have informed the manufacturer through UNDP and the



the local (DSM) agent. An explanation has not yet been received from the manufacturer.

The mission proposes to submit details through the substantive section to UNIDO/HQ purchase dept recommending that this particular make and model not be purchased for projects in Tanzania or in other countries with similar road conditions. It is also suggested UNIDO purchase branch approach the manufacturer for an explanation.

More in depth information is available in the form of photographs and a video recording from the resident UNIDO expert for the project.

Recommendations are a result of discussions with the counterparts and project staff.

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF FINANCE, ECONOMIC AFFAIRS AND PLANNING

Telegrams: "TREASURY", DAR  
Telephone: 21271.  
(All Official communications should  
be addressed to the Principal  
Secretary to the Treasury and  
NOT to individuals).  
In reply please quote:

à	How	B						2/3
date								
21 JUN. 1989								
réf. <u>Bun 771.22.34 TA</u>								

P.O. Box 9111,  
DAR ES SALAAM.

Ref. No. TYC/E/450/15

3rd June, 1989

H.E. Mr. J. L. Kaufmann,  
Ambassador of Switzerland,  
P.O. Box 2454,  
DAR ES SALAAM.

Your Excellency,

I have the honour to refer to your letter of  
25th May, 1989 ref. 771.22.34.TA/HON/md which reads as  
follows:-

"Re: Exchange of Letters between the Swiss Federal  
Council and the Government of the United  
Republic of Tanzania regarding Technical  
Assistance for the Centre for Agricultural  
Mechanization and Rural Technology (CAMARTEC)

Further to your request dated April 18, 1988  
regarding Technical Assistance for the Centre for  
Agricultural Mechanization and Rural Technology  
(CAMARTEC), I am pleased to inform you that the  
Swiss Development Cooperation (hereinafter referred  
to as SDC) has agreed to finance the above mentioned  
assistance.

The Swiss Technical Assistance shall be for the  
period starting July 1, 1989 and lasting up to  
June 30, 1991. This technical Assistance shall  
consist of the provision of Mr. E. Protzen as  
expatriate technical advisor to CAMARTEC. The Swiss  
Development Cooperation Office in Dar es Salaam  
shall make available to the technical advisor one  
vehicle, some work-related equipment and a limited  
operational budget to cover his running costs.

The field of activities of the technical advisor is defined in the annex to this exchange of letters.

This exchange of letters is governed by the Agreement on technical and scientific cooperation between the two Contracting Parties signed on October 21, 1966, in particular by Article 8, 9 and 11 thereunder

The present Agreement shall come into force on July 1st, 1989 and shall remain in force until December 31st, 1991, unless one of the Contracting Parties terminates it by giving the other Contracting Party a three months written notice.

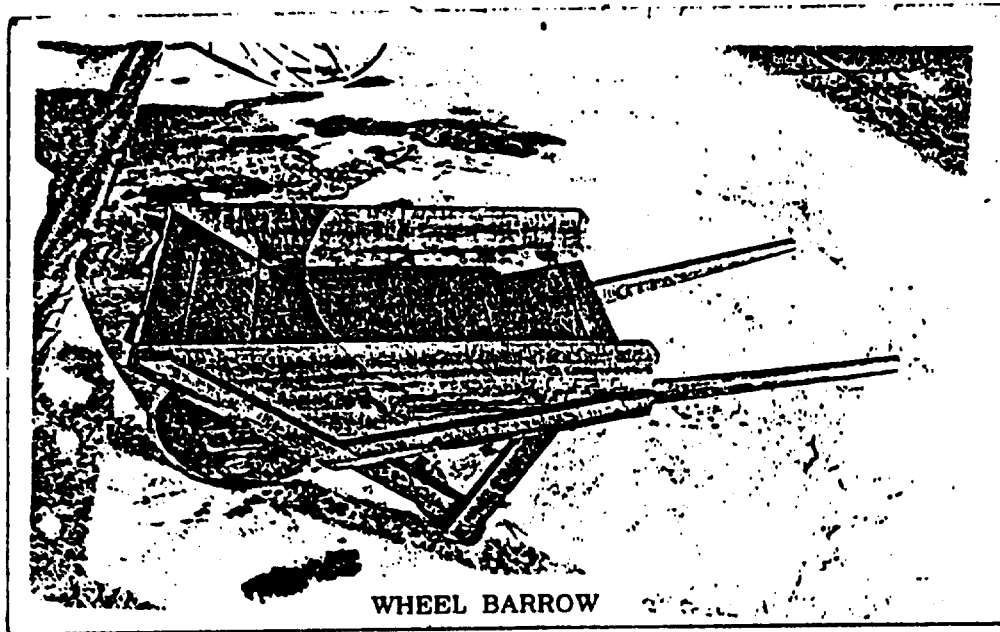
It may be amended by way of an exchange of letters between the two Contracting Parties.

Should the above mentioned proposal be agreeable to you, I would appreciate receiving your written confirmation in this respect. This letter and your response shall then constitute an Agreement between our two Governments."

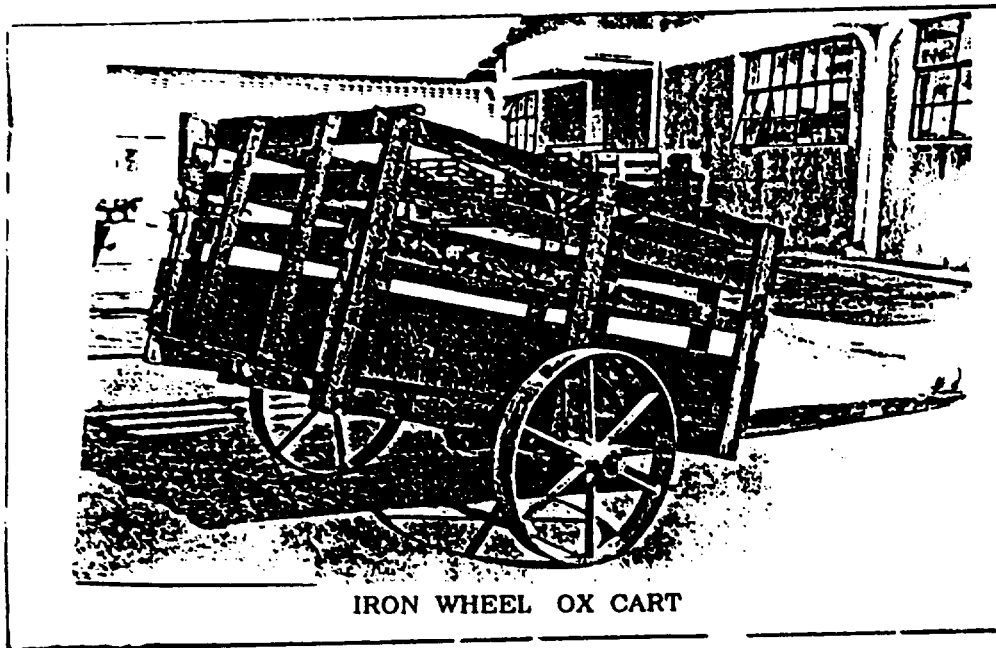
I have the honour to confirm that the above mentioned is acceptable to the Government of the United Republic of Tanzania and to suggest that your letter and my reply to constitute an agreement between our two Governments.

A. T. Makenya  
ACTING PRINCIPAL SECRETARY

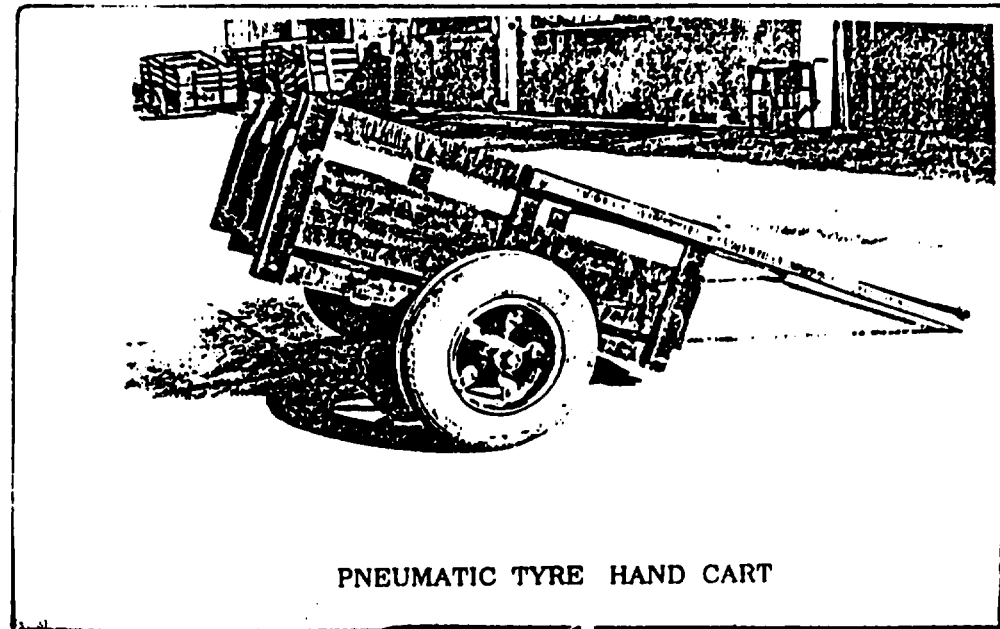
PRESENT  
"CAMARTEC" PRODUCTS



WHEEL BARROW

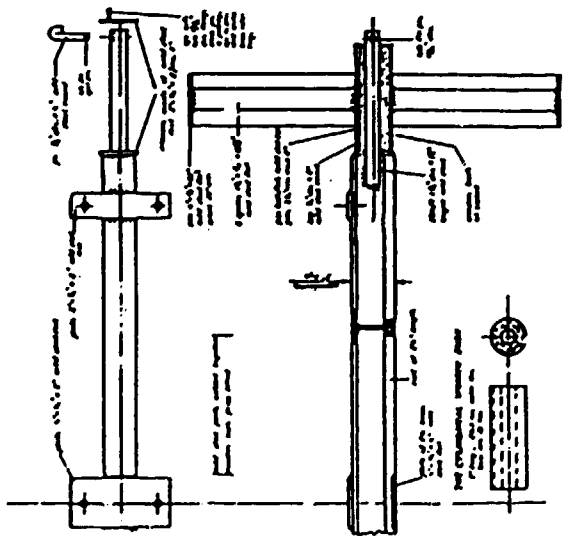


IRON WHEEL OX CART



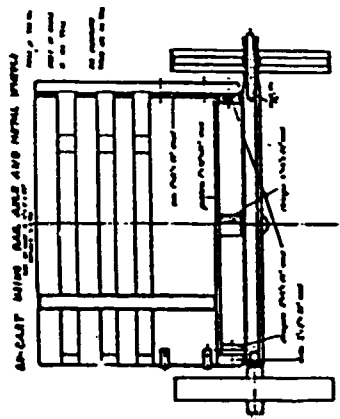
PNEUMATIC TYRE HAND CART

**THE WOODEN BOX RAIL AXLE SYSTEM**  
 designed by most systems

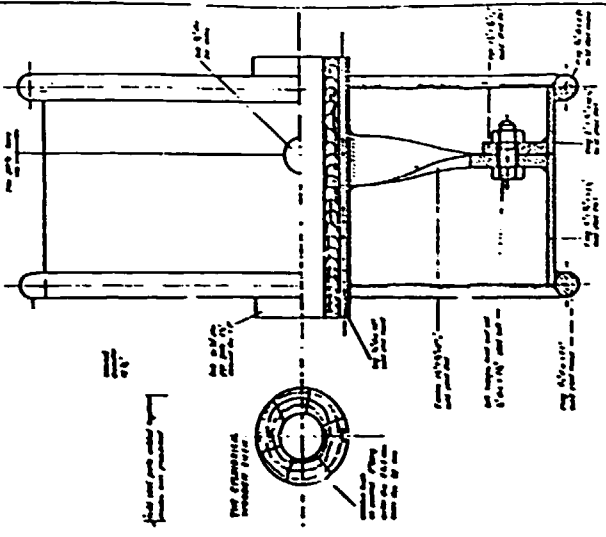


IMPROVED WOODEN BOX RAIL AXLE SYSTEM (SEE FIG. 101)

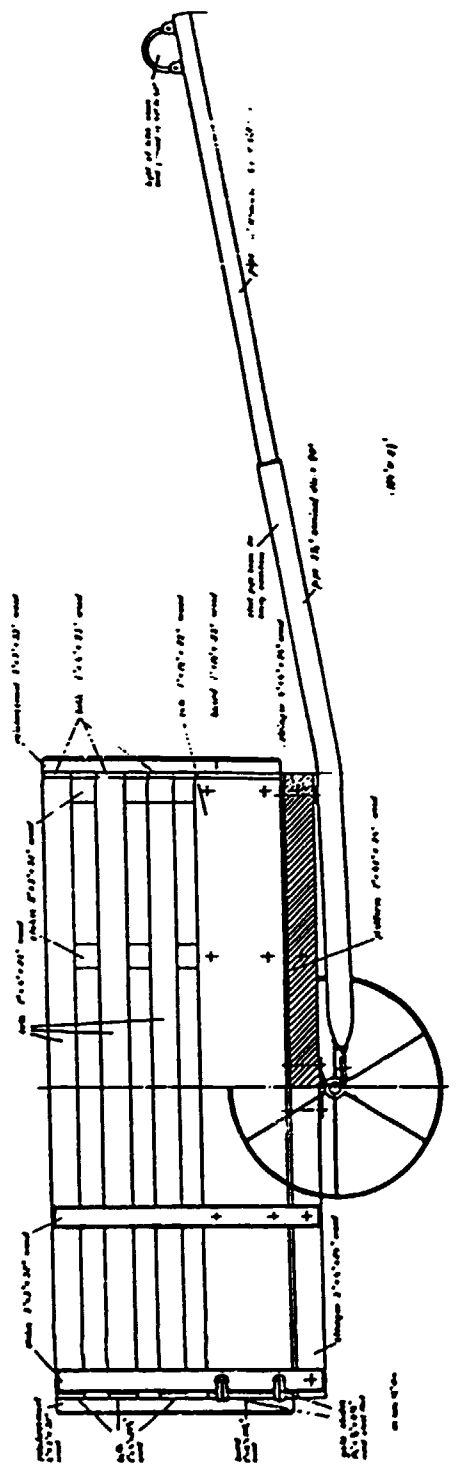
**CONSTRUCTION OF PRESENT OX-CART & WHEEL**



**LOCALLY MADE RIM FOR TYRE 7.50 X 16**  
 Type Low-pressure tyre

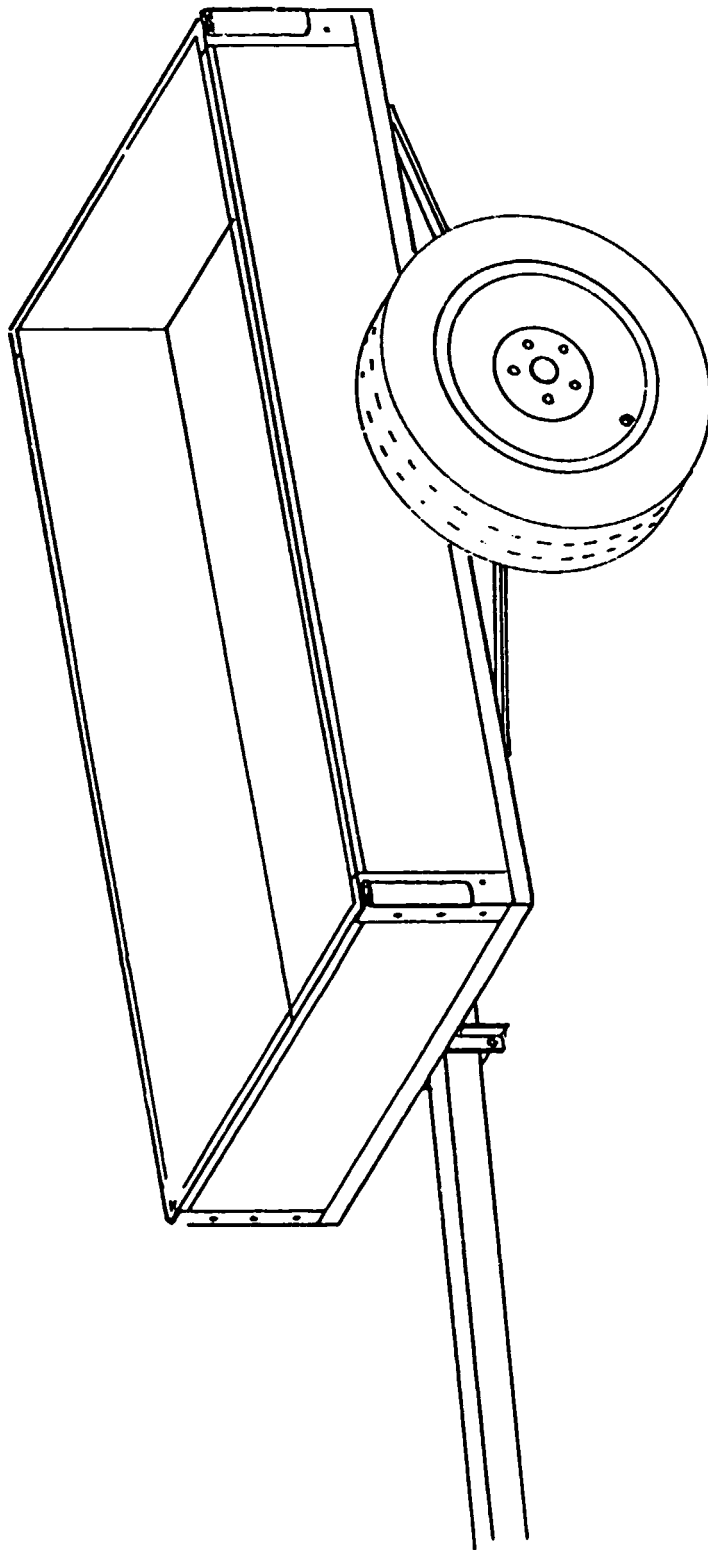


IMPROVED ALUMINUM RIMMING TYRES (SEE FIG. 102)



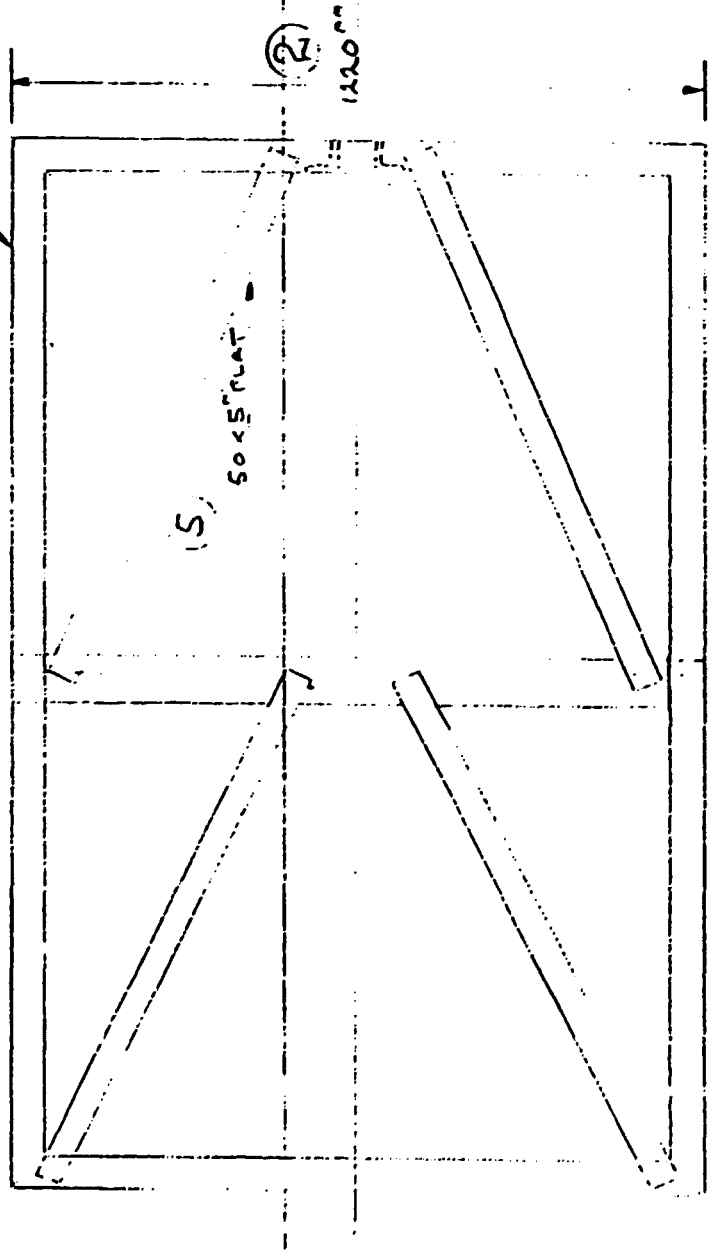
MODIFIED ALUMINUM RIMMING TYRES (SEE FIG. 103)

OX CART



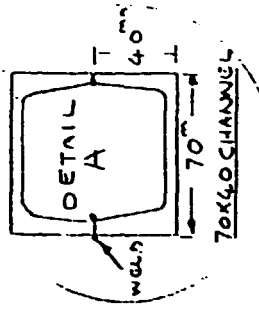
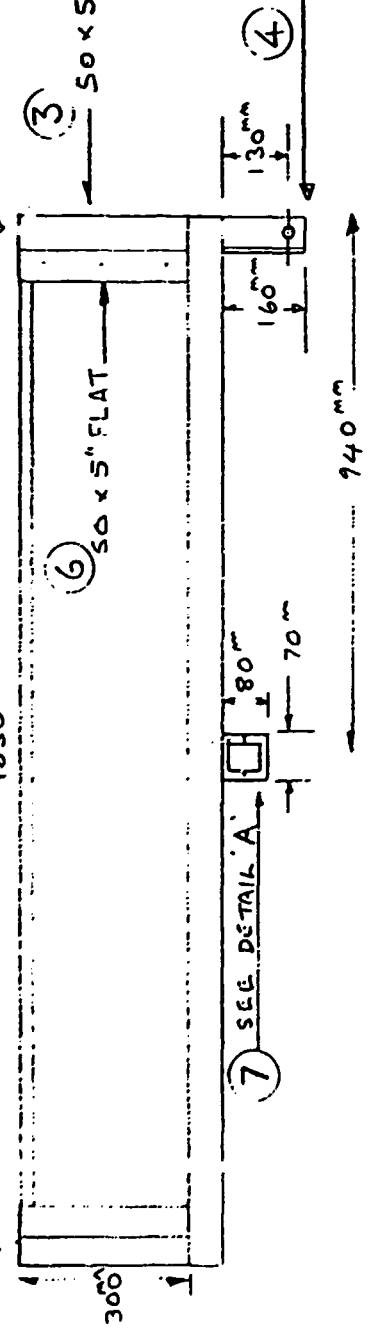
# IMPROVED OX CART (FRAME)

① 50x50x5<sup>mm</sup> LOCAL ANGLE



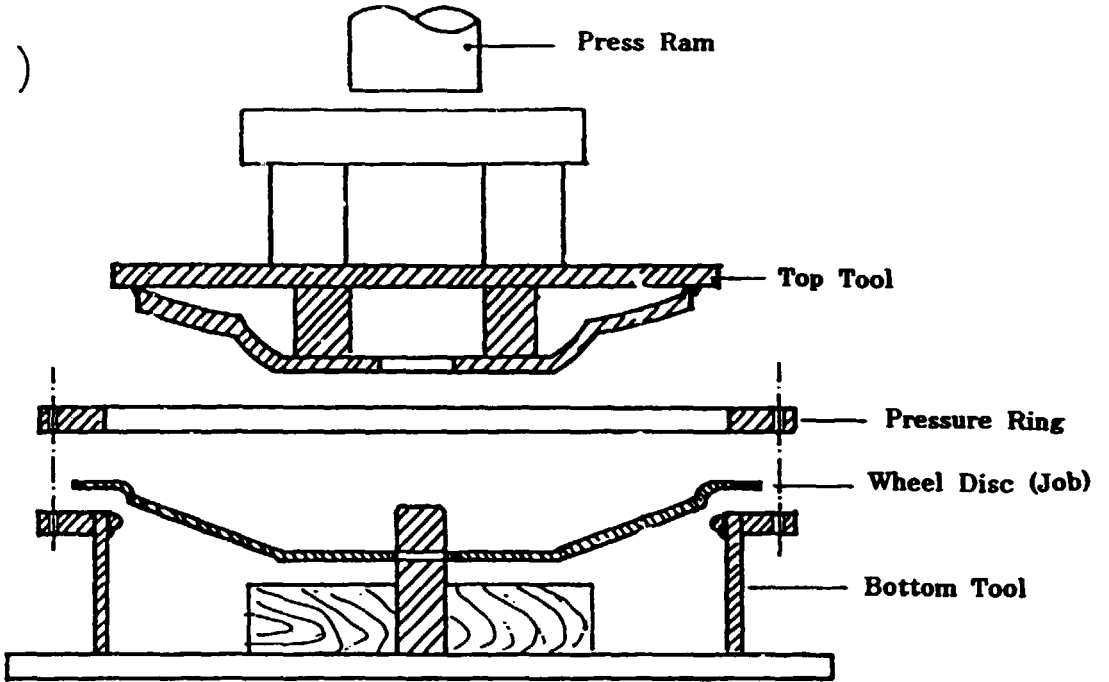
CUTTING LIST		
NO	SECTION	LENGTH
①	50x50x5 <sup>mm</sup> ANGLE	1830 <sup>mm</sup>
②	50x50x5 <sup>mm</sup> ANGLE	1220 <sup>mm</sup>
③	50x50x5 <sup>mm</sup> ANGLE	300 <sup>mm</sup>
④	50x50x5 <sup>mm</sup> ANGLE	160 <sup>mm</sup>
⑤	50x5 <sup>mm</sup> FLAT	1035 <sup>mm</sup>
⑥	50x5 <sup>mm</sup> FLAT	300 <sup>mm</sup>
⑦	70x40 CHANNEL	1220 <sup>mm</sup>

③ 50x50x5<sup>mm</sup> LOCAL ANGLE

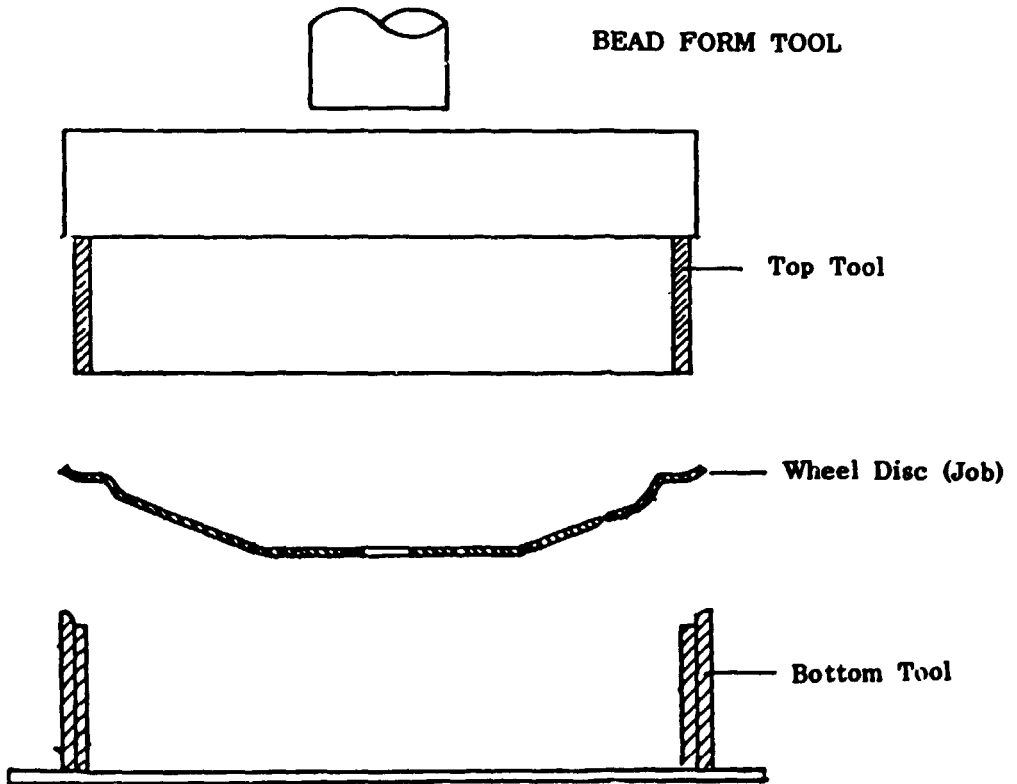


SECTION OF PRESS TOOLS  
FOR OX CART WHEEL RIM

(1)

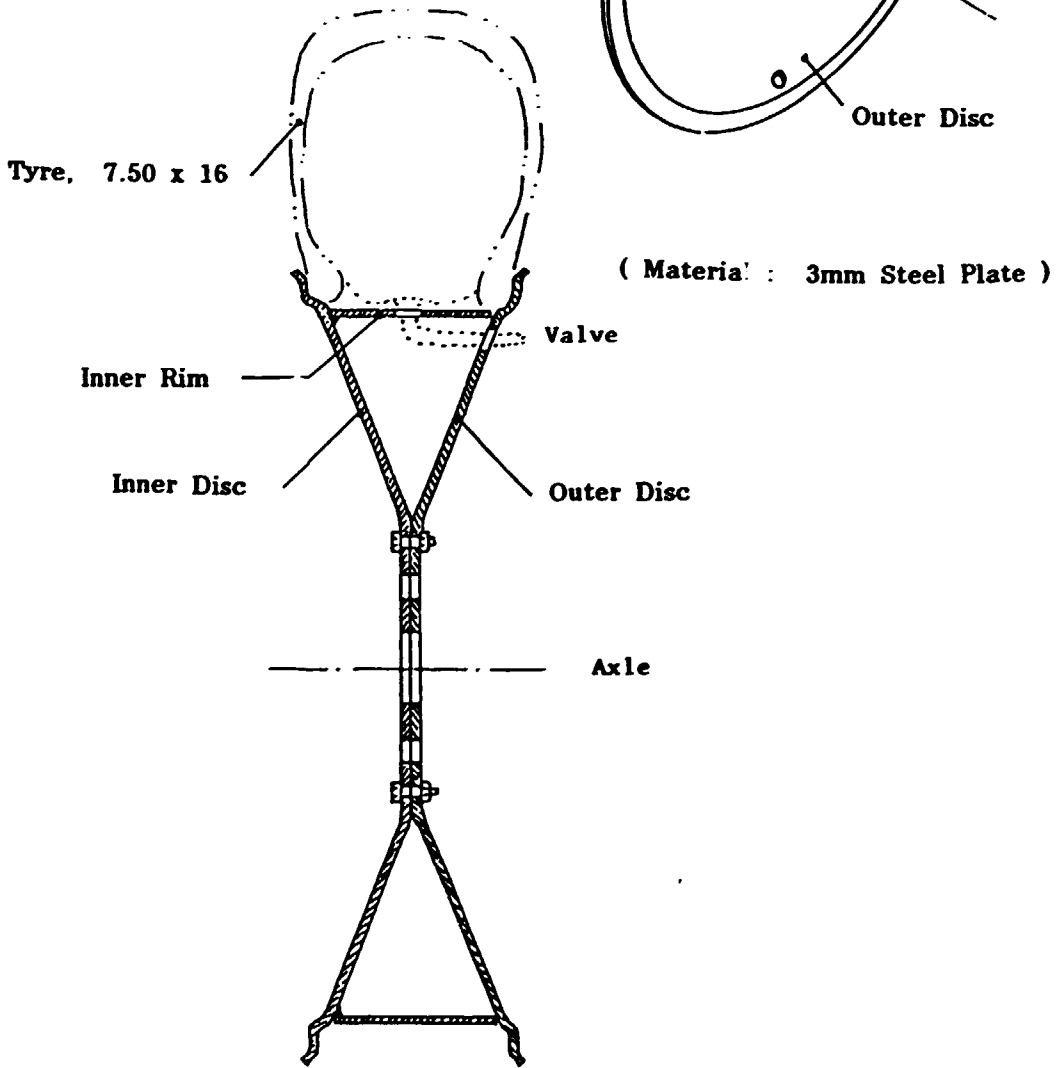
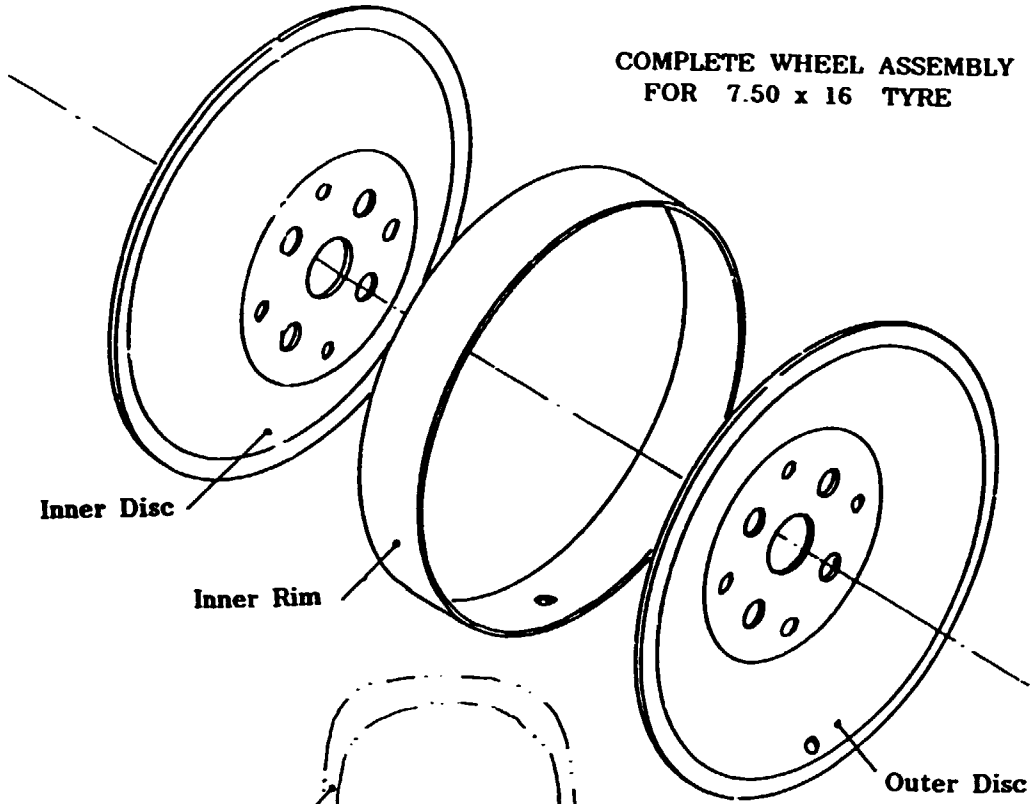


(2)

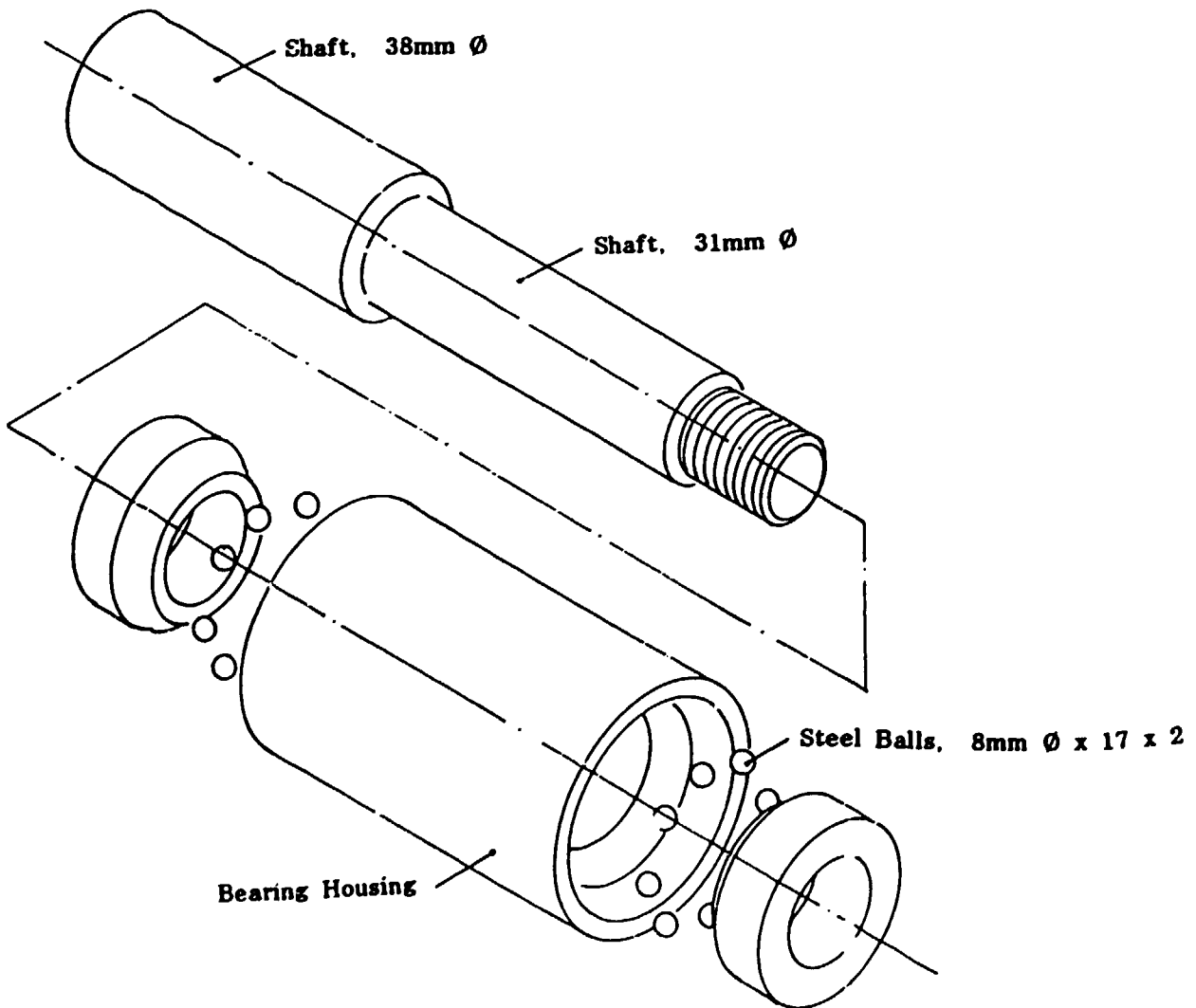
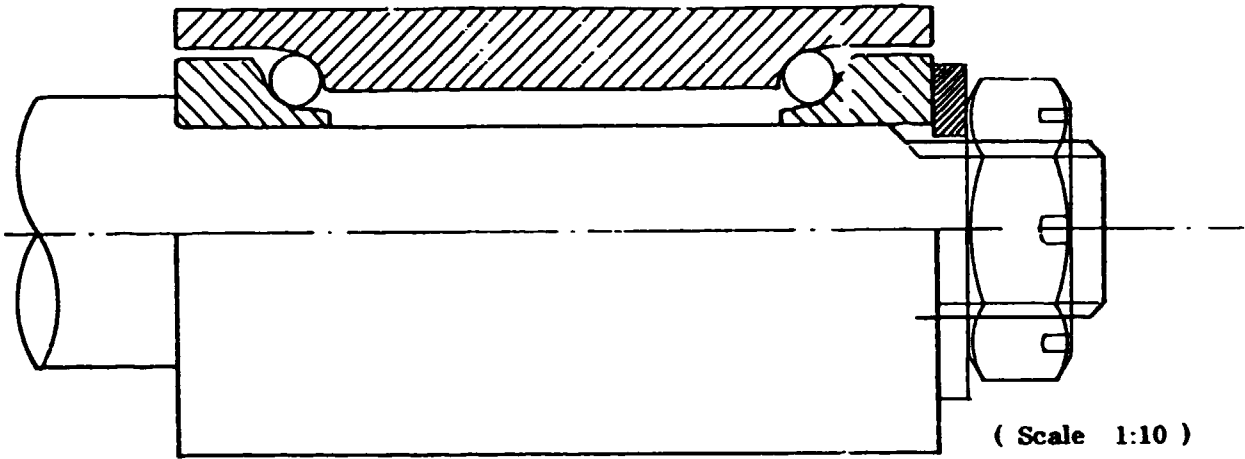


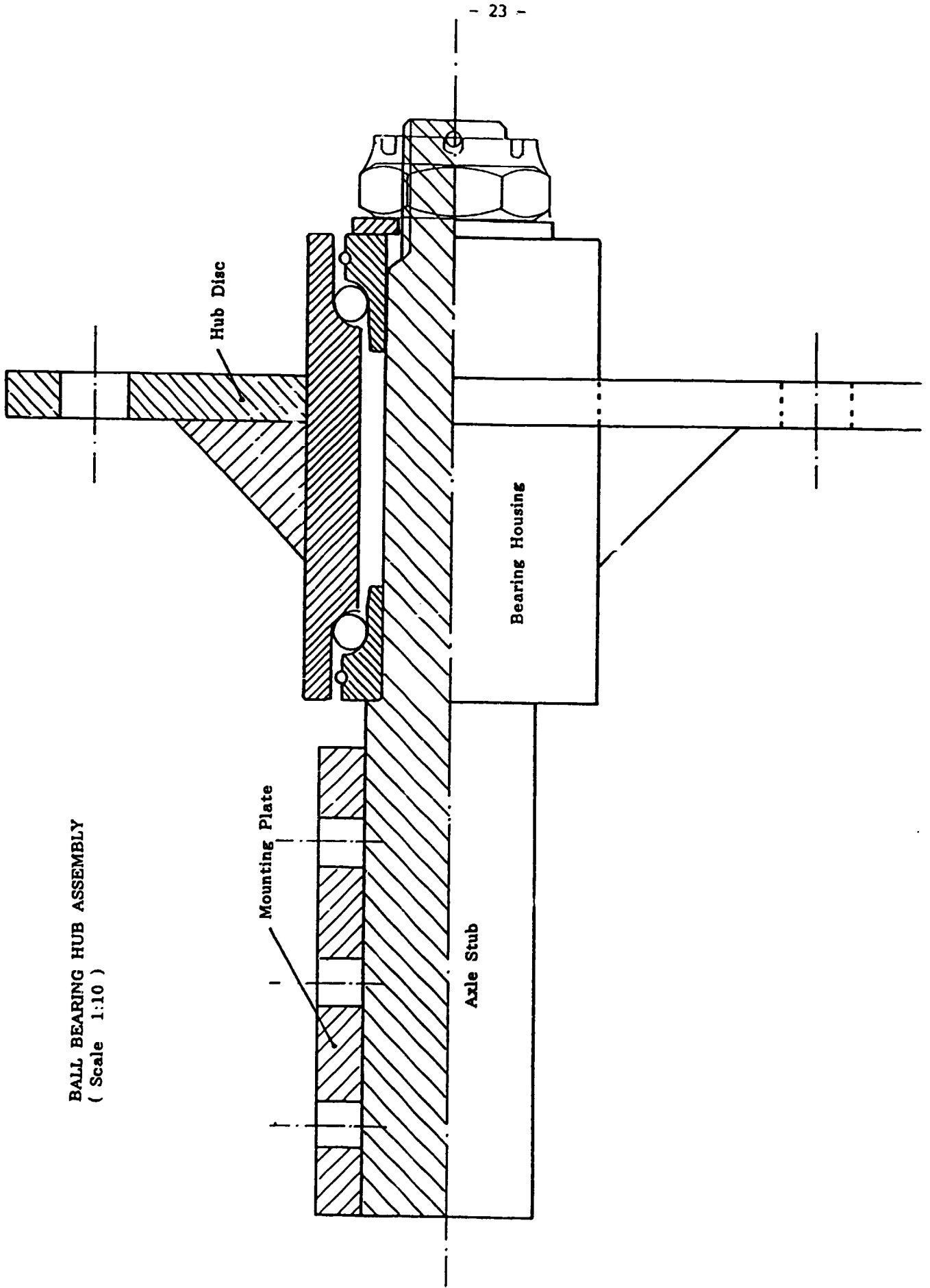


COMPLETE WHEEL ASSEMBLY  
FOR 7.50 x 16 TYRE



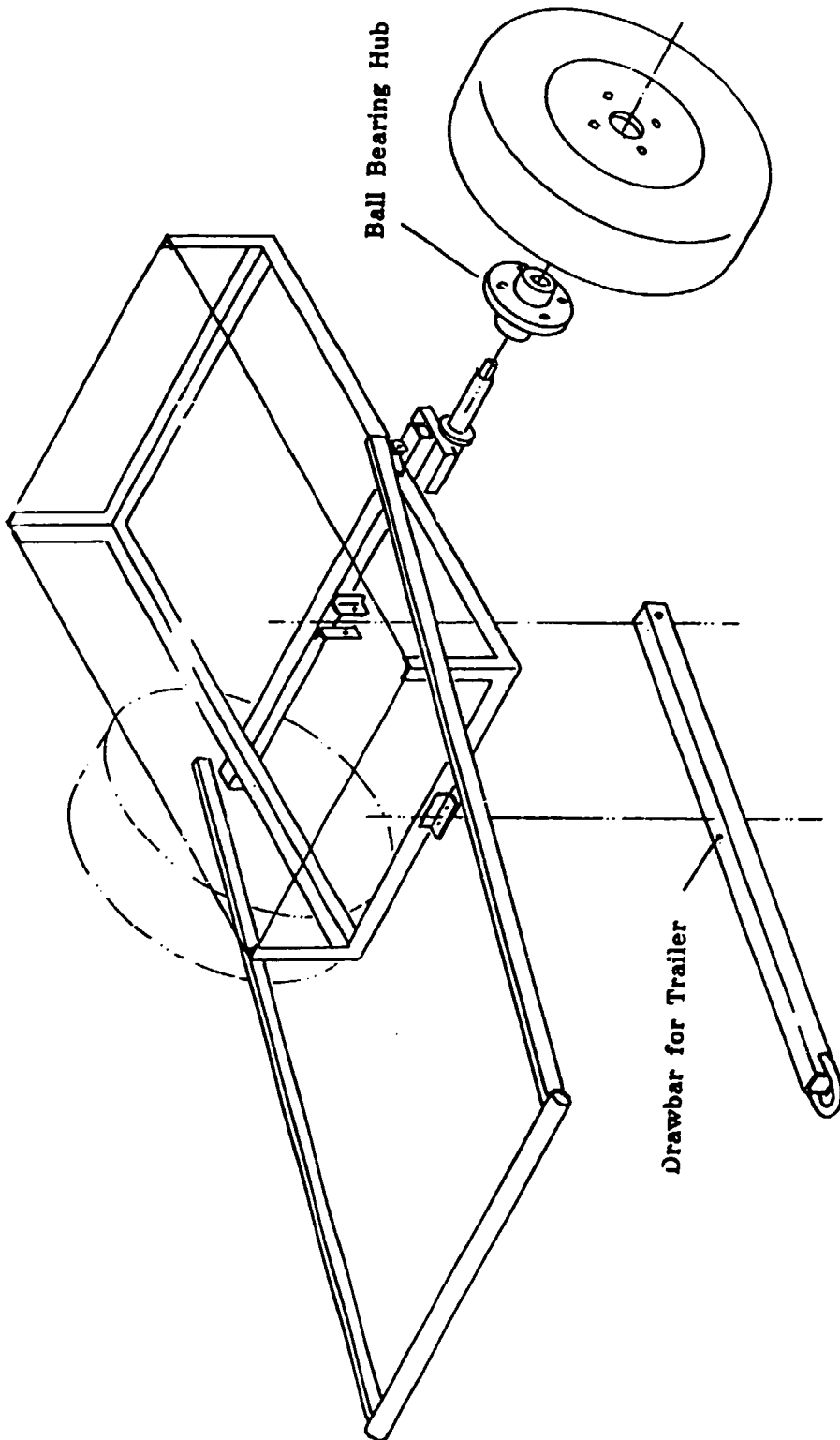
### OX CART BALL BEARING ASSEMBLY



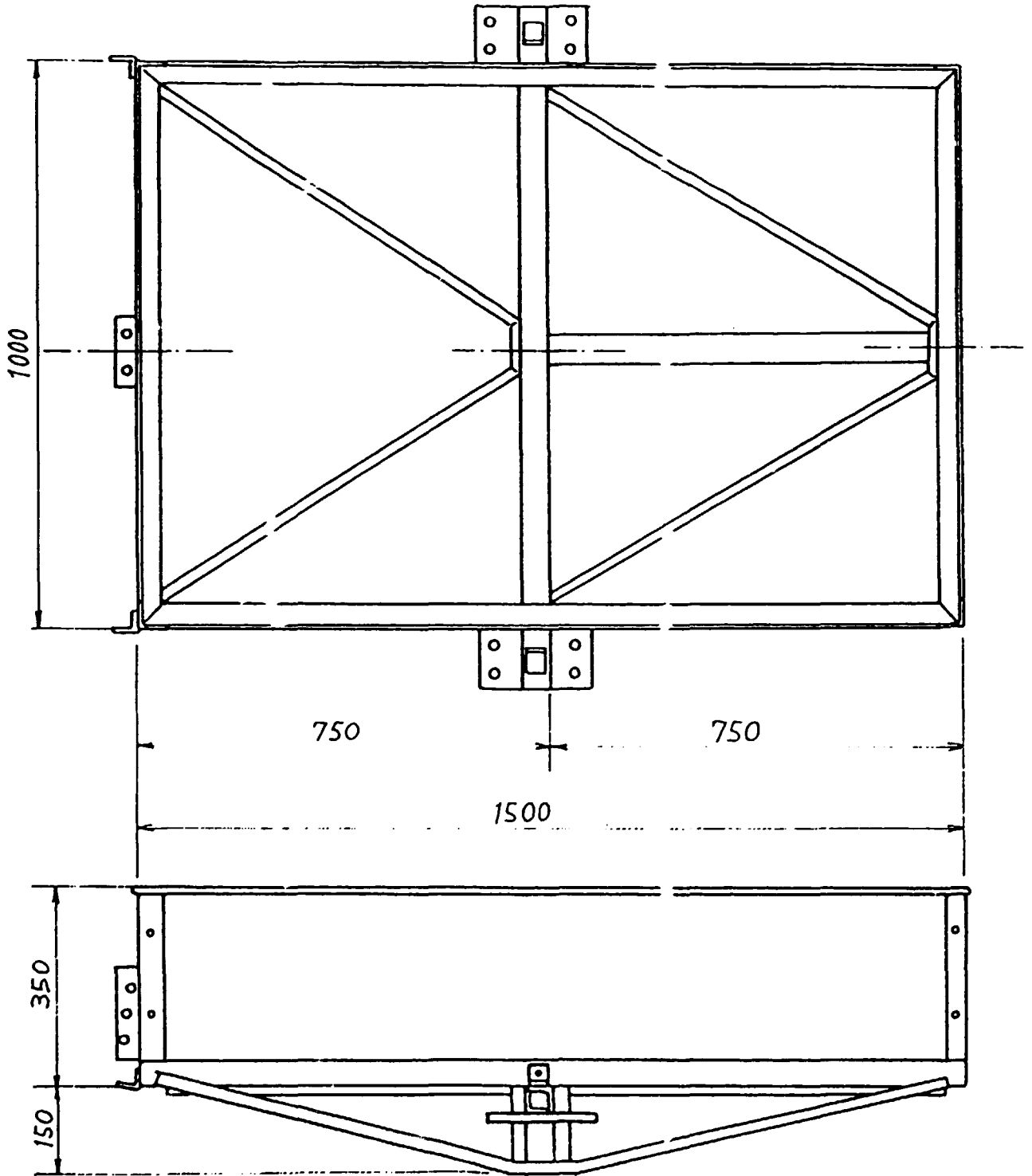


BALL BEARING HUB ASSEMBLY  
( Scale 1:10 )

**HAND CART  
EXPLODED VIEWS**

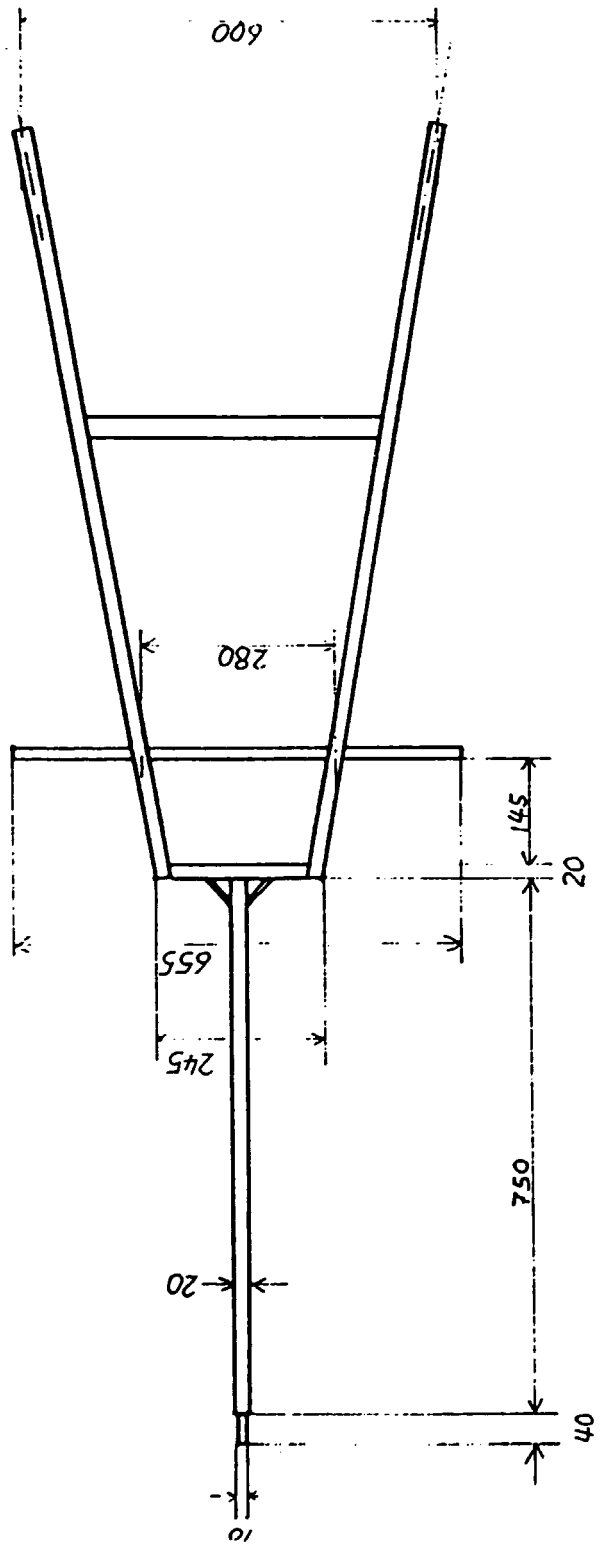
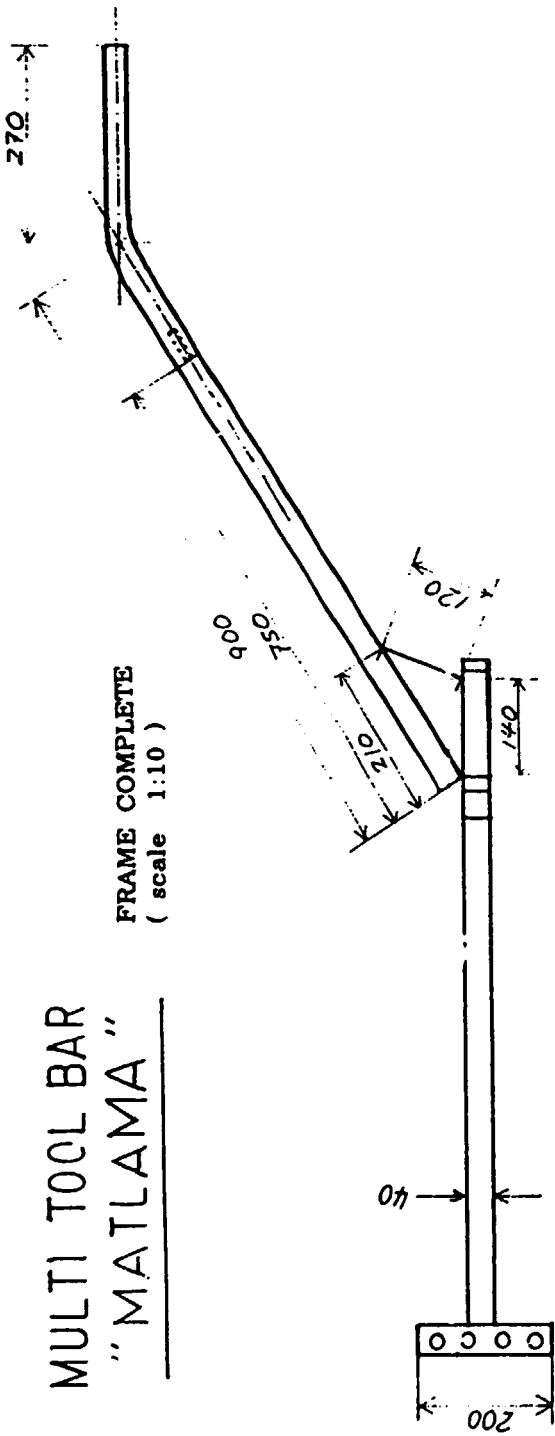


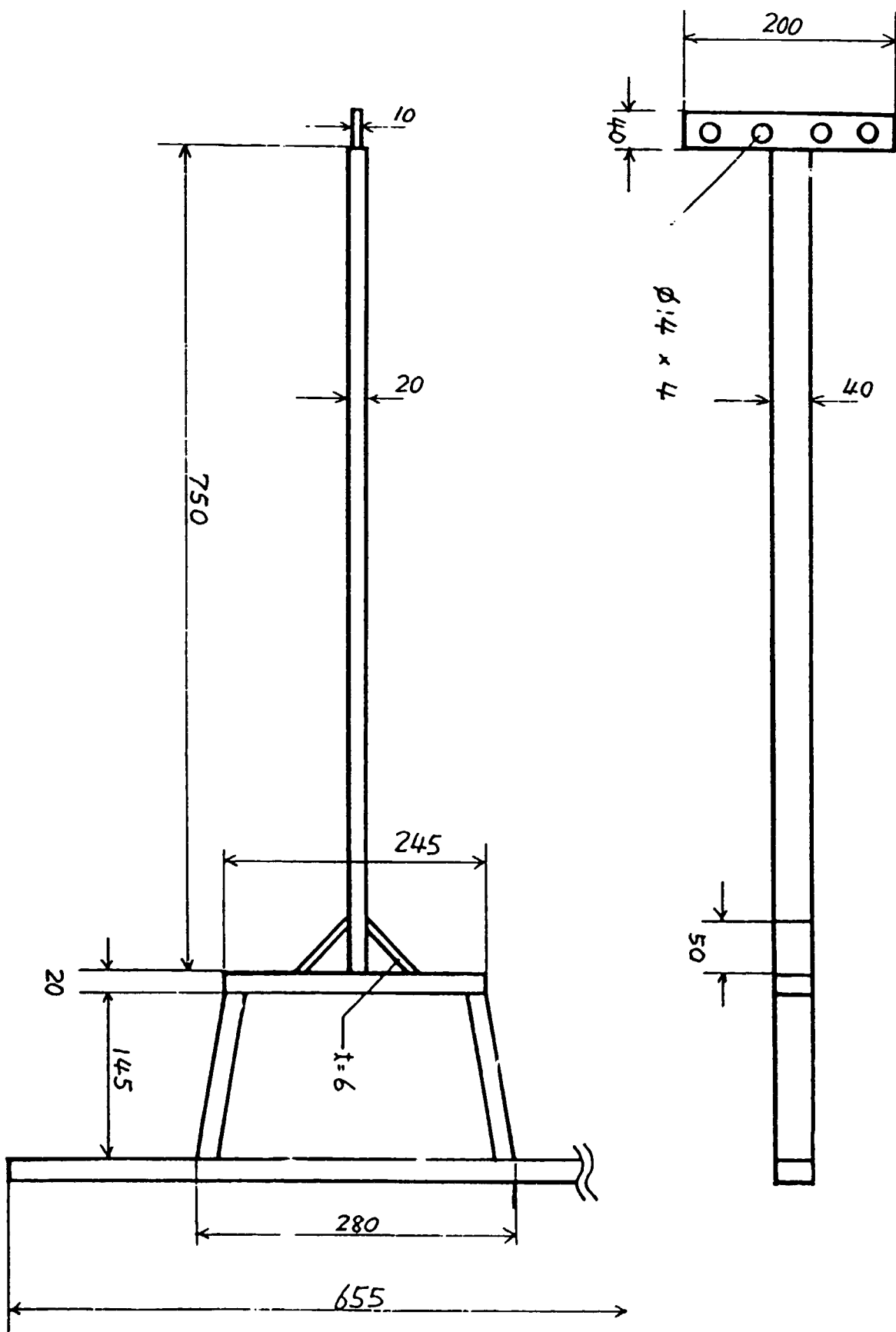
- 25 -  
**HAND CART FRAME**  
( scale 1:10 )



# MULTI TOOL BAR "MATLAMA"

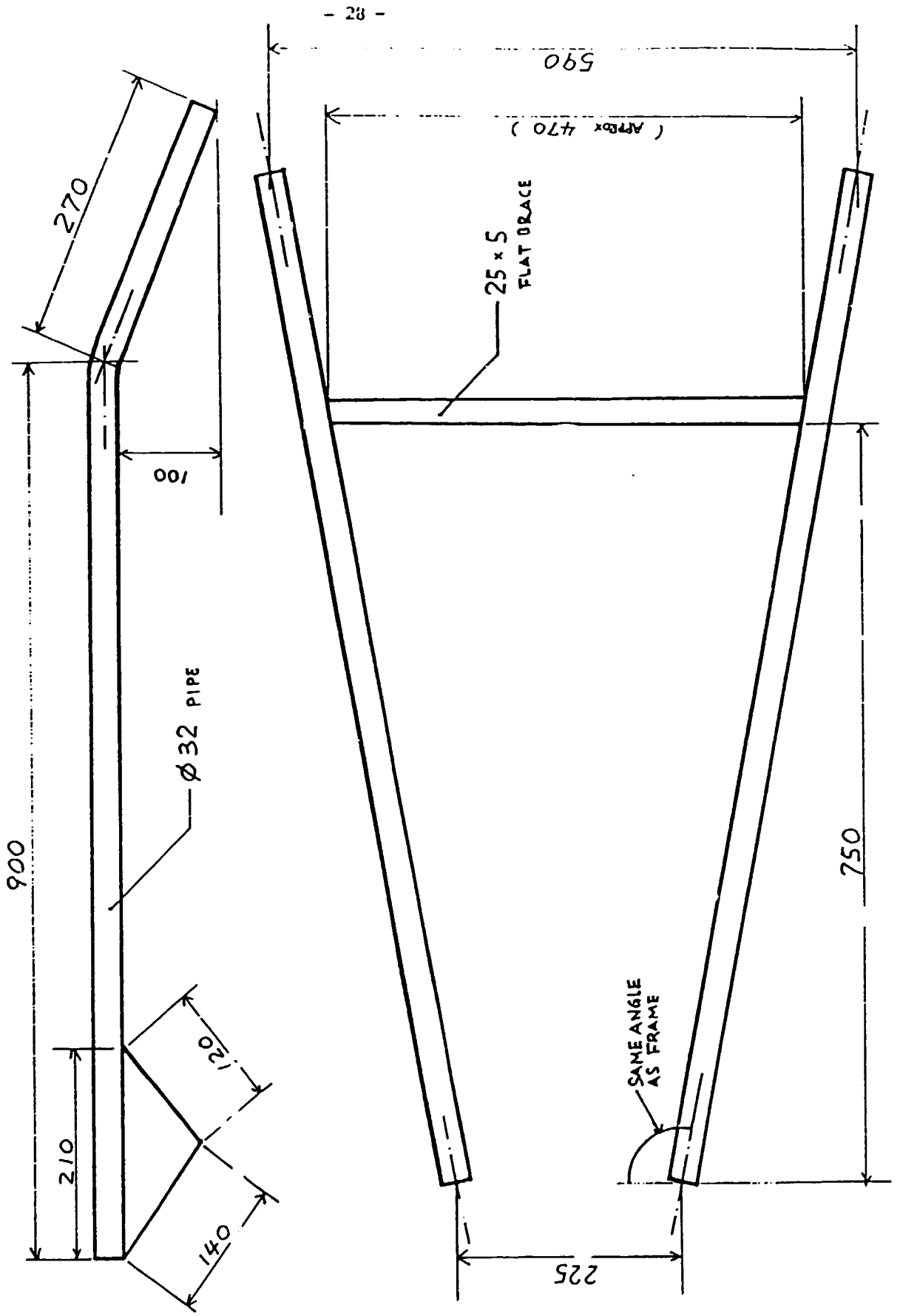
FRAME COMPLETE  
( scale 1:10 )





MULTI TOOL BAR "МАТЛАНКА", FRAME  
( scale 1:5 )

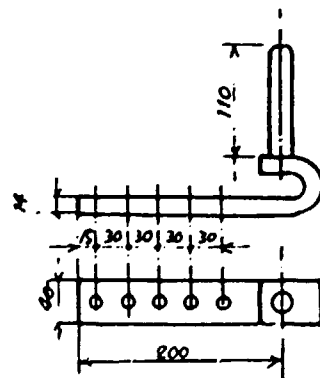
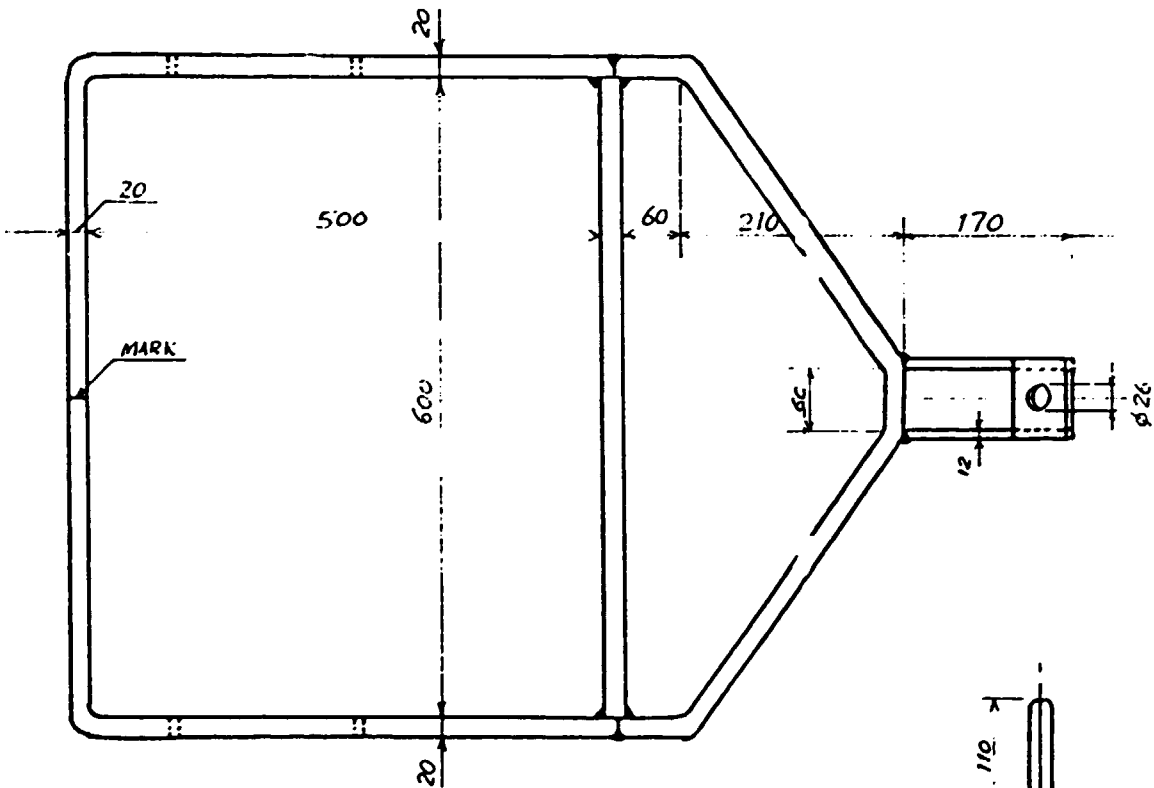
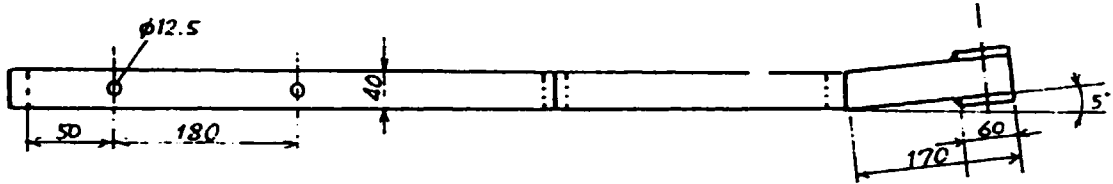
MULTI TOOL BAR 'MATLAMA'. HANDLE  
( scale 1:5 )



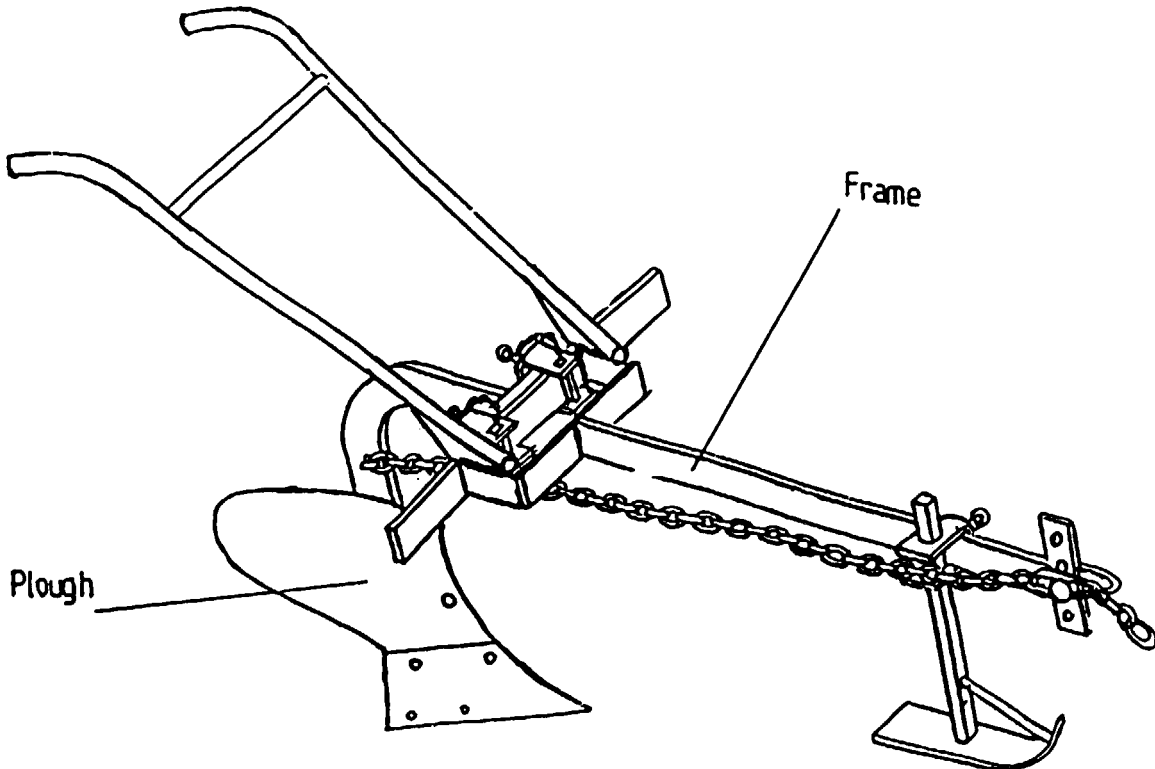
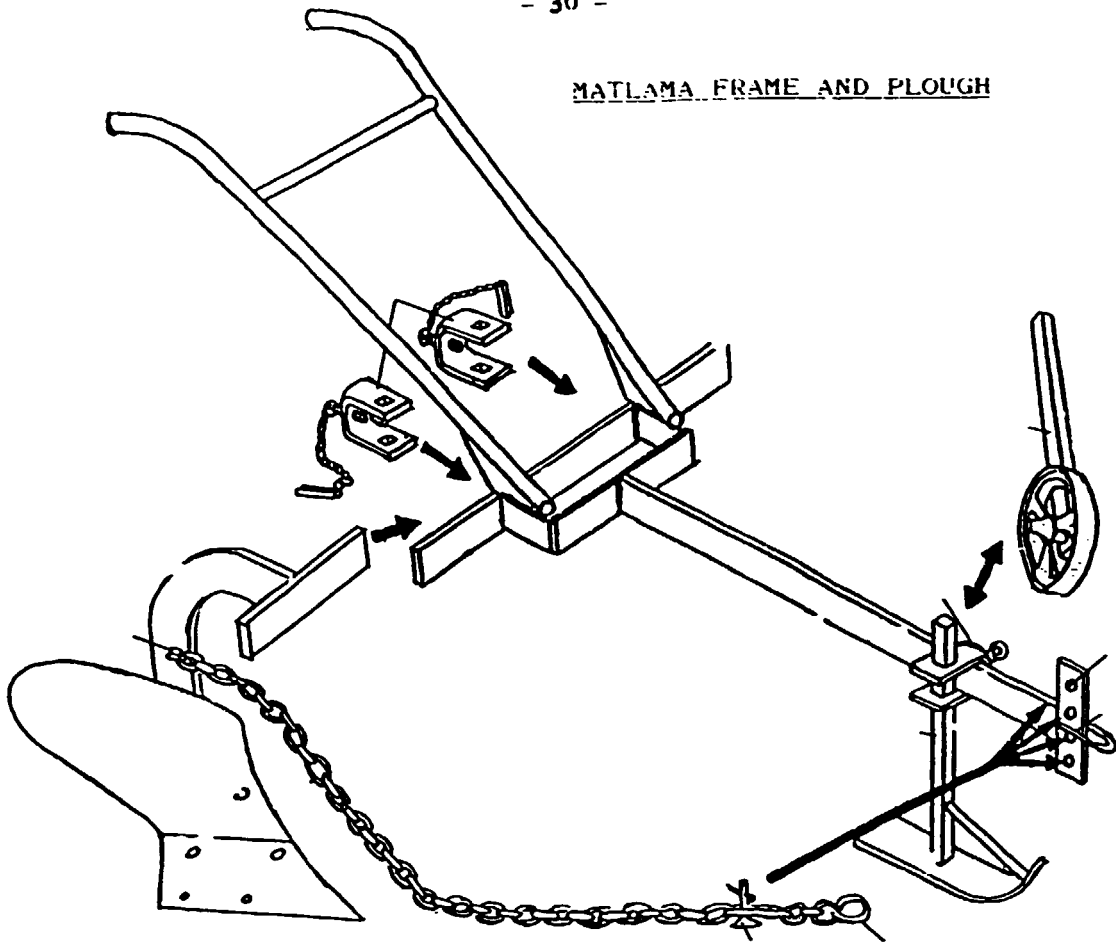


# ARIANA FRAME

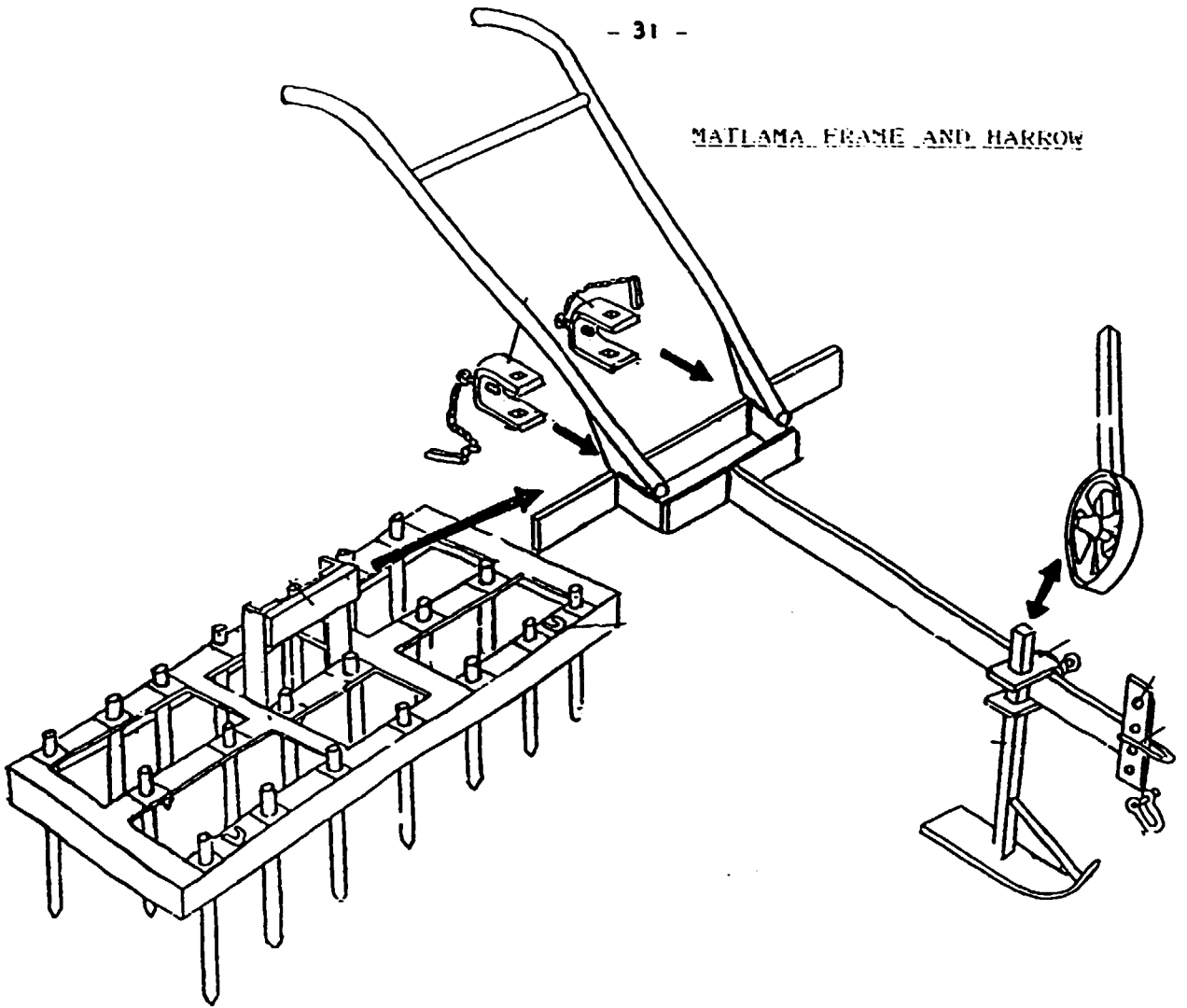
( scale 1:10 )



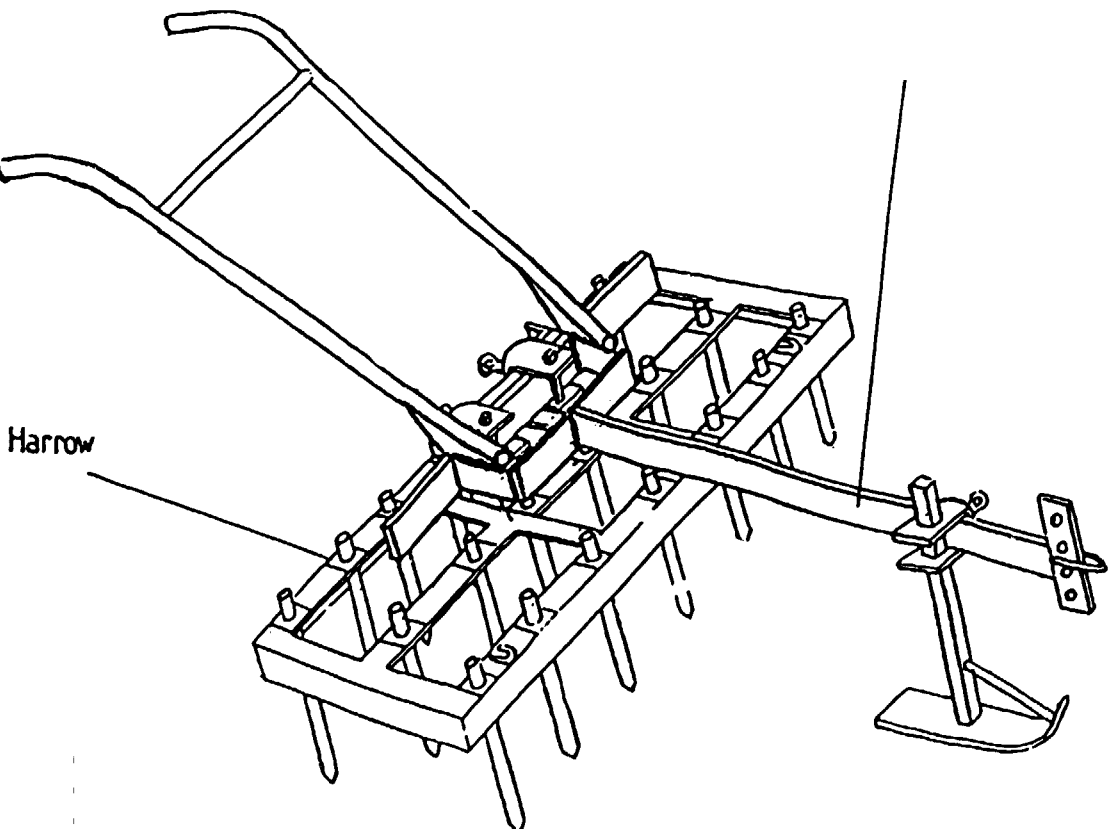
MATLAMA FRAME AND PLOUGH



MATLAMA FRAME AND HARROW

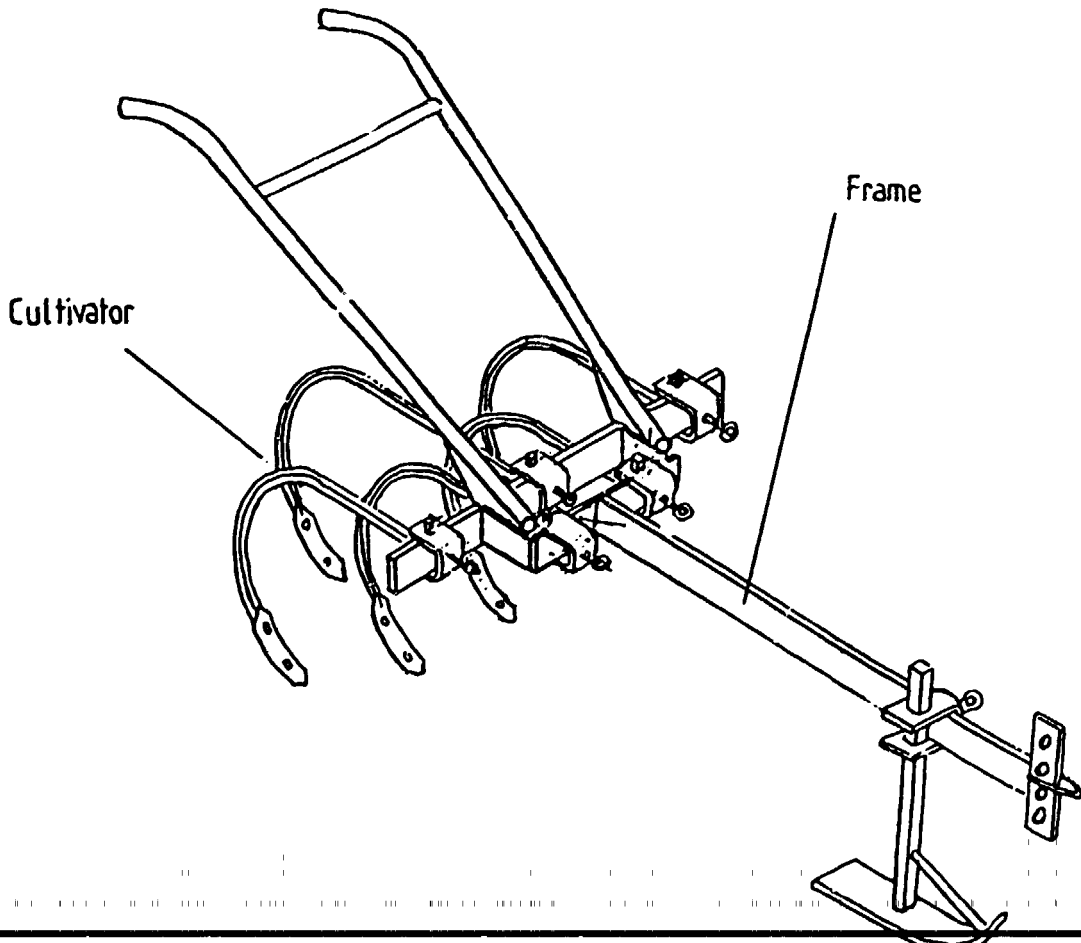
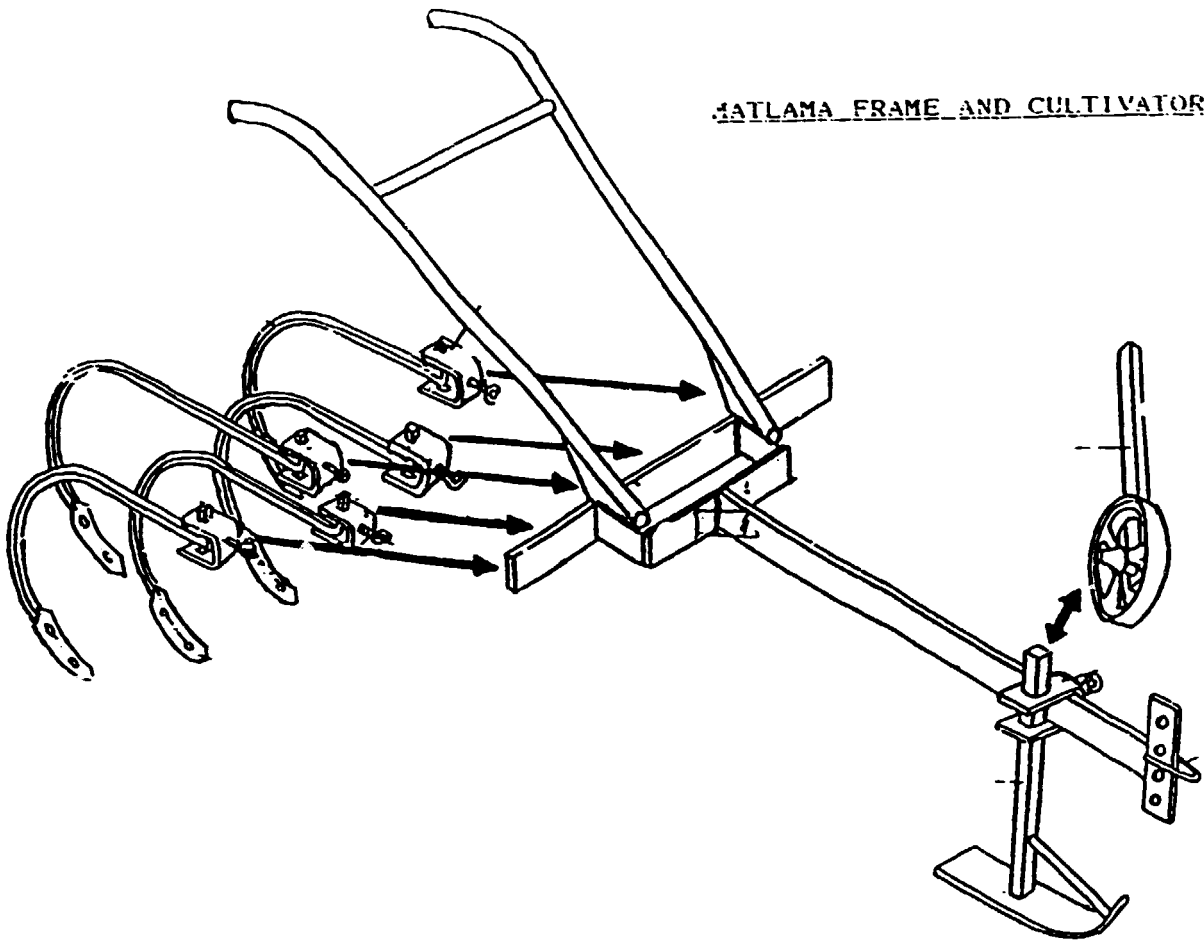


Frame



Harrow

JATLAMA FRAME AND CULTIVATOR



MATLAMA FRAME AND PLANTER

