OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

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

08665

Distr.
LIMITED

ID/WG.277/12
9 November 1978

ENGLISH

United Nations Industrial Development Organization

Technical Course on Criteria for the
Selection of Woodworking Machinery

Milan, Italy, 8 - 19 May 1978

CRITERIA FOR THE SELECTION OF MACHINERY FOR SLICED VENEER*

by

A. Colombo**

* The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

** Consultant in veneer and plywood production.

id.78-7874

CONTENTS

Figures:

1. INTRODUCTION

The word "veneer" is used herein to denote thin sheets of high quality woods, having thicknesses varying from a few tenths to more than one millimeter, normally produced by slicing and sometimes by peeling.

A typical application is decorative facing or panelling for furniture.

2. PRODUCTION METHODS

Logs used for the production of high quality must be carefully selected because the commercial value of the finished product is dependent on the quality of the wood used. The initial production phases consist of debarking and log conversion into flitches usually two or four flitches. This phase which calls for considerable experience, is subject to many features and are very important because of the yield in the slicing operation. Logs thus prepared are normally steamed or subjected to hydro - thermic treatment; in fact dense or semi-dense veneer logs (used for the majority of veneers) must undergo suitable thermal treatment before being sliced.

Various slicing methods are available, the choice being made according to the type of wood involved or market requirements.

Depending on the choice of slicing plane with respect to diametric planes, straight grained or figures veneers can be obtained. The sliced sheets are then dried and put into storage after undergoing a few supplementary operations.

3. LAYOUT CONSIDERATIONS

After this brief outline a detailed examination will be made of the various production phases, evaluating for each of them, the possible alternative from the point of view of rationality and economy in the technological process. The attached Fig.1 shows, in a simple but rational way, the layout of a slicing plant.

To organize production on a rational and economic basis, it is quite important, besides making a correct and careful choice of machine, to take

into account a series of other collateral factors, often erroneously neglected by devoting too much attention to choice of machines. Even highly valid machines can have their production capabilities prejudiced if the following factors are not given due consideration:

- Rational flow of material (from raw material to finished product), ideally represented by a one-way line without bottle-necks. This can be obtained by careful factory layout, co-ordinating the various production phases to achieve smooth working. A relatively simple matter when a new plant is involved; it must not be forgotten when existing plants are being re-built with the inclusion of new machines, in spite of difficulties sometimes being greater due to conditioning determined by existing spaces and installations;

- Rational solution of internal and external handling to avoid the negative influence on production phases caused sometimes and to prevent material waste by incorrect handling systems.
  Care should also be taken in the correct location of lifting gear which should also be adequate as regards capacity and speeds;

- Plant and services should be rational to ensure operational reliability of production machines;

- Rational maintenance, both routine and preventive, to eliminate down time and damage to machines as well as to ensure greater safety for operators.

While these conditions may seem obvious, they are often erroneously disregarded, either because underestimated or because of a false sense of economy.

4. OPERATION SEQUENCE

4.1 Log cutting to length:

The first production phase consists of sectioning the logs to the required width. Due to the varying dimensions of the logs, often quite considerable, a fixed installation is not convenient (as often used in plywood factories). The most suitable solution is to make use of electric portable carriage mounted chain sawing machines.

This simple solution is advisable because of the relatively low incidence of this phase with respect to the rest of the production cycle (in plywood factories the incidence is higher).

4.2 Log debarking:

The phase immediately following the above is debarking. The conventional methods of debarking logs is to use portable electric equipment, or semi-fixed installations, but they are time consuming and tedious.
Milling head machines are much more suitable for debarking operations with high speed cartside rotary cutters.
There are two versions of this debarker, the most common being that in which the log is caused to rotate by a set of discs mounted on parallel shafts. The cutter, under pneumatic pressure, follows the surface of the log and removes the bark (Fig.2).
The most suitable debarker for veneer factories however, bearing in mind that log conformation is often irregular, is the spindle type. The mill operates in the same way as that described above but the rotation system of the log is different: in fact the log is chucked between two hydraulic spindles, as on a peeling lathe.
Chucking of the log is quite safe and no trouble is caused by the irregularities during the debarking. It is therefore evident that any axiel or sectional irregularities in the log are of minor importance (Fig.3).

4.3 Log breakdown:

The logs are sectioned into slicing flitches on a log band-saw with carriage. This is a standard type machine, which has to be rigid in design because of the considerable bulk and weight of the logs. Mechanized loading systems for conveying the logs to the carriage are advantageous to reduce down times.
The log bandsaw should be equipped with remote controlled setworks to facilitate lumber sawing operations. In fact it is sometimes worthwhile using the machine's idle capacity to produce boards from low grade logs not suitable for veneer production. Appropriate complementary equipment in the log sawing department is a circular saw for cutting logs into three parts. The log is placed longitudinally on a mobile carriage and can cut

radially at three stages as required thus obtaining large sections, even from small logs.

4.4 Hydro-thermic treatment:

For easier slicing and to avoid sheets with rough surfaces it is necessary to soften the flitches.

This operation is normally done by steaming in proper vats, or boiling in hot water.

The vats are made of masonry and are provided with efficient covers to avoid heat loss.

The steaming can be direct or indirect; direct heating is usually done by using saturated steam in the vat where it expands.

In the most frequent case of indirect heating the vat is provided on the bottom with coils heated by means of steam or superheated water. These coils exchange heat with the water generating the necessary steam for the treatment of flitches.

On the contrary the boiling is obtained by means of a complete dip into hot water and generally is used only for some assences containing resins or other substances to be eliminated. The temperature of hydro-thermic treatment is normally between 80^{o} and 90^{o}, in order not to damage mechanical properties of the wood.

The time of this treatment is important and it varies according to the quality and diameter of the log to anywhere from 10 to 80 hours.

Suitable tables and statistic controls allow for choosing the exact treatment.

Also of equal importance is the rationalization of loading and unloading systems by using suitable log grips mounted on a gantry crane travelling along the vats.

4.5 Slicing:

Obviously the most important operation of the whole veneer production is the slicing operation. The conversion of flitches into thin sheets is achieved as shown shematioally in Fig.4.

The slicing unit, oonsists of a well sharpened knife and a pressure bar, penetrating the wood, to slice thin sheets by a relative reciprocating motion of the slicing unit and the wood.

While the function of the blade is obvious, the purpose of the pressure bar is to avoid splitting of the sheets which would occur if the blade operates freely. Constructional solutions adopted are numerous and therefore many different models of veneer slicers are on the market, but they all have the same technological layout: slicing unit and log moving relative to each other with feed equal to slicing thickness at each feed and return stroke.

Various technical solutions have been developed around this basic slicing principle, such as log in fixed position and knife moving or vice versa, horizontal or vertical motion, knife placed above or below the log.

The various solutions have not been dictated by the requirements of slicing, but mainly in an attempt to solve collateral problems such as charging of logs and discharging of sheets.

Among the various solutions adopted, two have emerged in practice: horizontal slicing and vertical slicing.

4.51 Horizontal slicing machines:

This is the standard machine and the most diffused and versatile in use.

The flitch is firmly fixed to the bed and rests against the apron of the machine, ensuring safe working and accurate cutting.

The charging of logs is very simple and their inspection and cleaning are easily carried out. The bed is fixed to four threaded spindles for rapid rise and fall adjustment and the intermittent motion for dividing the sheets.

The slicing unit (Fig.6) reciprocates this action being performed by a crank mechanism which is included in the mechanisms possible for actuating horizontal slicers.

This is due to its simplicity, together with the possibility of achieving very high working speeds, impossible by other means.

To ease the veneer sheet transport, an exit belt conveyor is attached following the curvature of the sheet as it leaves the machine.

Important factors for smooth and accurate slicing are:

- slicing unit well inclined with respect to the flitch to ensure smooth outting without cracks;
- slicing unit very rigid, obtained by suitably dimensioning the pressure bar and knife holder carriage which must be very heavy as well, as rigid fixing of the knife.

The latter point is very important because obviously a robust carriage is useless unless the blade is also rigidly fixed.
Generally, the knife is fixed from above to its supporting member. Of course the knife bar with adjusting screws and knife cap bolts but as the knife is practically free among two cap bolts, flexions are created owing to the cutting force; (Fig.7 shows an inverted knife bolting.) The knife support surface is placed on top of the knife, in order to assure a continuous and very rigid support, not at all influenced from cut reaction effects. (Fig.7 shows assembly of the knife blade).
Automatic bolting and relasing of the knife and nosebar on the pressure bar for assembly and cleaning, substitution of all manual operations by motorized movements, have made horizontal slicers much easier to operate besides being highly productive, assuming of course the validity of typical features - rigidity, versatility and precision.
A recent developing of horizontal slicers has been introduced mounting a second set of flitch dogs (front and rear side). Doggingis therefore possible between frontand rear dogs, in addition to the standard dogging against the front part of the slicers. This allows for choosing the best inclined position of the flitches which is sometimes necessary for best slicing operations, besides which it is possible to find the best incidence angle between knife and flitch. Any friction between flitch and front of the slicer has to be avoided to ensure the best aoouracy of the slicing thickness.
Mechanical guards and photo-electric safety devices, nowadays applied to horizontal slicing machines, guarantee safe operations.

4.52 Vertical Slicing machines:

With these machines the flitch reciprocates vertically and the slicing unit is stationary, an intermittent movement for the division of the sheet being applied to it (Fig.8).
Compared with the horizontal machine there are a few advantages and disadvantages.
The advantage mainly consists in the higher slicing speed but this is possible only with flitches which are "easy to work", and not too

dense or of first grade quality.

The disadvantages are:

- Machine less versatile, only suitable for logs smaller than those possible with the horizontal slicer;
- Log fixing system less rigid and secure;
- Log charging and veneer discharging more difficult and more dangerous for the operator;
- Log cleaning and checking slower due to the need to withdraw the knife carriage;
- Three operators instead of two (one for the machine and two for handling the veneer).

4.6 Automatic handling of veneers:

Various systems have been developed, to automate handling from the slicer to the veneer dryer, to eliminate labourers.
These forms of interesting links in production lines do however have certain limitations in use and must therefore be considered carefully. In fact, satisfactory results are possible only with a few first grade species, without starshakes and little tendency to curl, which is unfortunately frequent with veneers; in fact it is normally frequent that different operations must be sliced on the same machine. Furthermore, this linking equipment is complementary between the slicing and the drier. The slicing machine can sometimes be found limited in its capacity by the limited capacity of the drier; vice versa, the drier can run idle during loading and unloading of the slicing machine, for cleaning of the flitch or when turning the flitch, or for other downtime reasons.
Some wood species require intermediate storage in order to bring out the final natural colouring before drying. These production lines therefore cannot be recommended in cases involving the slicing of many different types of wood having considerable variation in quality and when the problem of reducing labour is not of significant importance. An automatic line is therefore advisable only like an auxilliary line where many standard slicers can ensure the basic output with any wood specie whatever and under any circumstance, destining to the line only flitches preliminarily selected and prepared.

4.7 Veneer dryers:

Sliced veneers have a high moisture content which requires to be eliminated by means of a drying process.
For this operation the accepted standard is to use driers with wire mesh conveyors to ensure optimum veneer transport, without damage and good spreading to avoid curling.
As regards the diffusion of hot air, the most advantageous system, for its high efficiency and good ventilation, is the jet system.
Heating is usually by steam or superheated water. A more modern system, which has many advantages, uses diathermic oil as a heating fluid. In fact it is possible to reach much higher temperatures, permitting the use of smaller driers with advantages of economy and space. Furthermore, the circuit, not being pressurized, is less dangerous and does not require qualified operators. The driers have two or three decks but some are equipped with endless "S" shaped conveying systems, resulting in a more compact drier due to reduction in overall dimensions.
The choice of the dryer to be considered must take into account overall dimensions, as well as allowable space for loading and unloading units. Automatic unloading systems are available nowadays which are strongly recommended as they permit automatic stacking with a pre-selected number of sheets. This is obviously more easy and economic when the unloading point is only one. They generally consist of vacuum operated sheet pick up and transport systems with mechanical devices for separation and stacking.

4.8 Veneer pack jointing and trimming machines:

After drying, the veneer packs are jointed and trimmed. The ideal arrangement of these machines is that of two veneer packs with two end trimmers in line. In cases where production is not high, the line can be equipped with two jointers and only one trimmer (Fig.1). The line can continue with the binding machine for automatic strapping of the packs. To follow up these production lines, machines have recently been installed for automatic measurement of the surface of veneers with the idea of labelling, recording and supplying storage data for each pack. It is even possible to achieve automatic stores management.

4.9 Eccentric peeling

Related to slicing is eccentric peeling which is obtained by peeling logs chucked eccentrically between the machine spindles.
Of increasing significance is the stay-log attachment (Fig.9) which is essentially a rod rotating between the spindles and on which the flitch is fixed. The stay-log is equipped with a pneumatic collet or preferably hydraulic (for greater chucking pressure) which grips the log appropriately cut at both ends. The results of these operations are equivalent to slicing but permitting, with a similar log size, the production of larger veneer sheets. A number of advantages are connected with this process, included in which it is possible to reach increased production owing to the facility and rapidity of loading and the working speed, with less labour force.
Owing to the high stresses involved with eccentric peeling, the machine must be very rigid in design and equipped to take into account the considerable unbalance of the system.

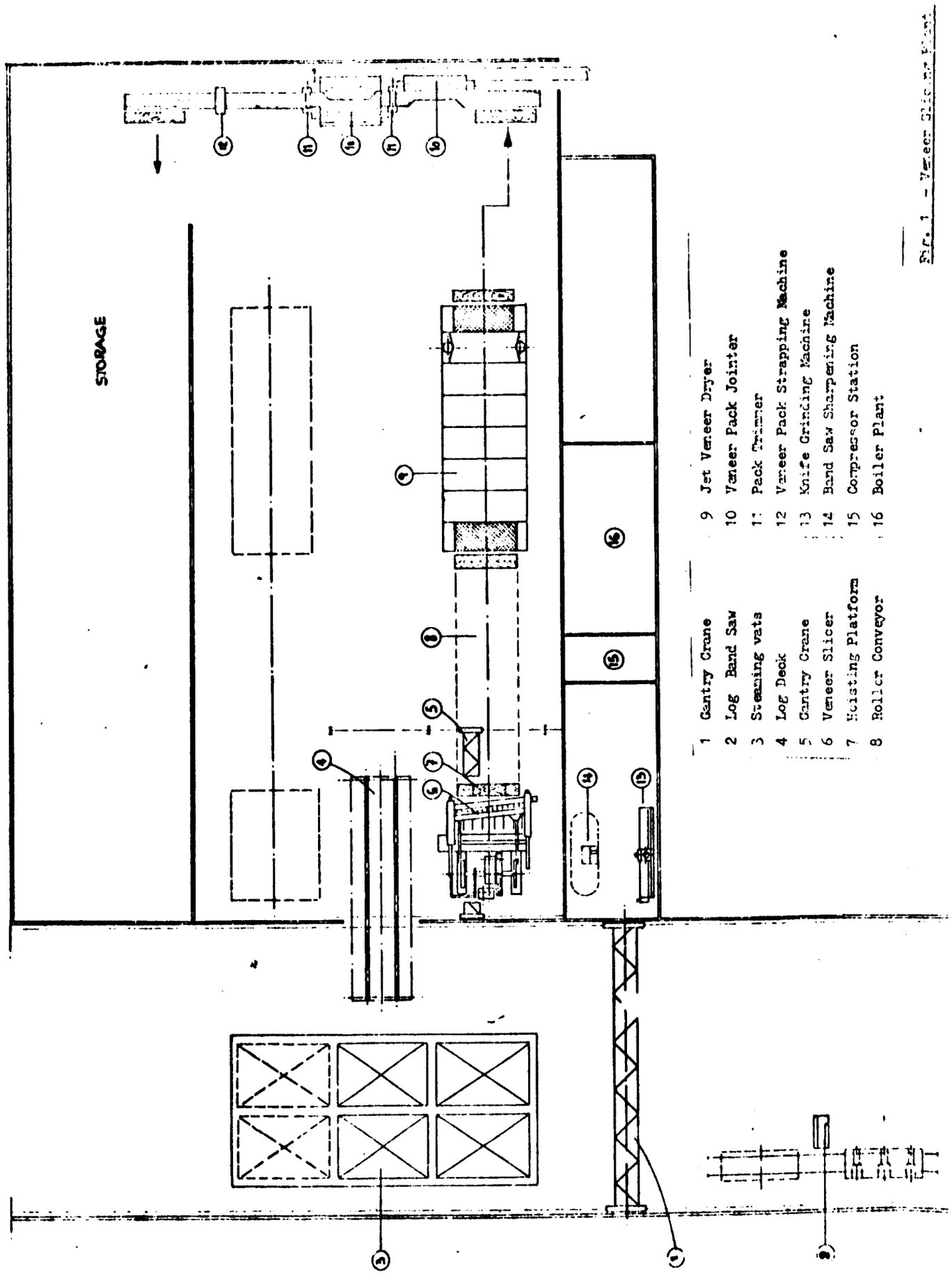
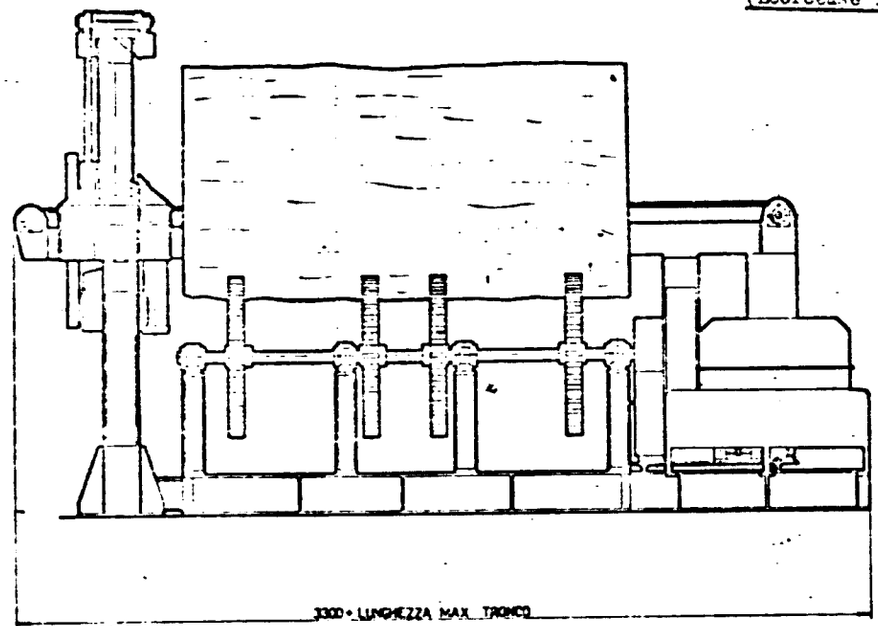
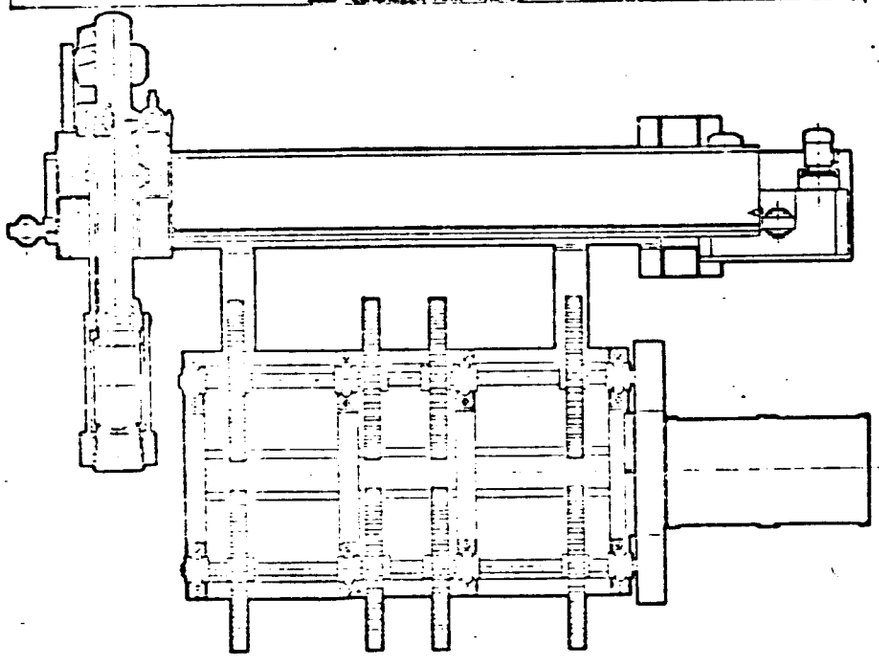


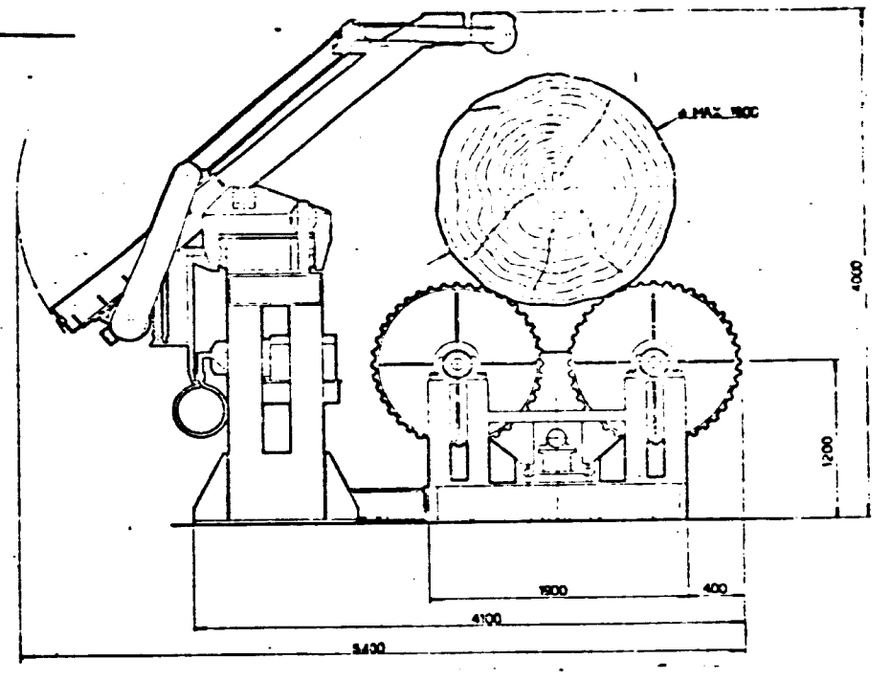
Fig. 1 - Veneer Slicing Plant

Fig.2 Debarking Machine Type STE/RA/1800

(Ecorceuse Type STE/RA/1800)



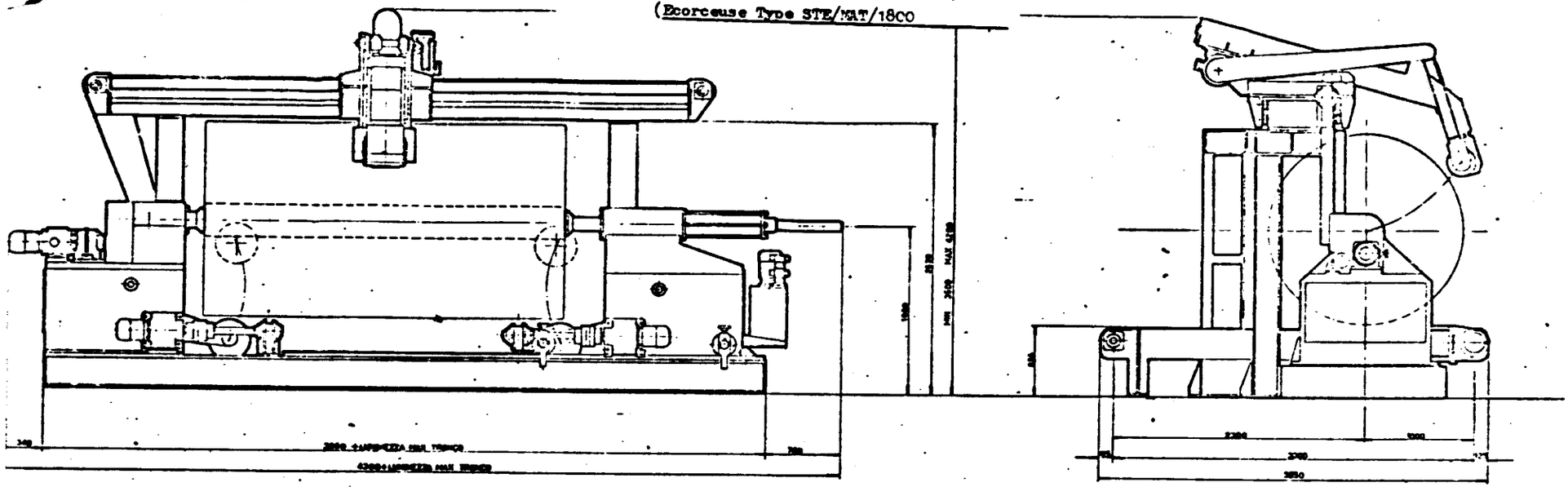


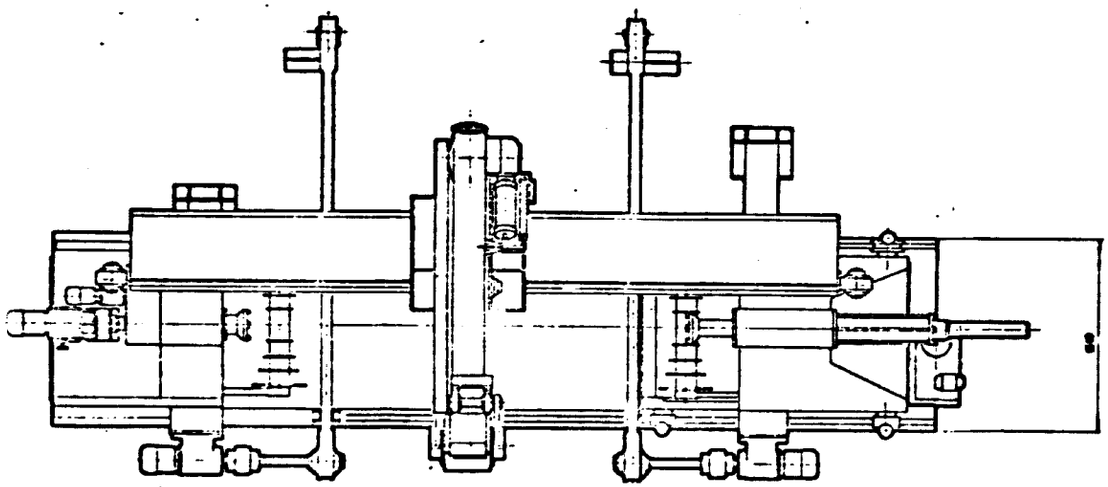


Specification (Données techniques)		STE/RA/ 1800x3300	STE/RA/ 1500x3300	STE/RA/ 1300x4000
Max. log diameter (Diamètre max. de grume)	mm	1800	1500	1300
Min. log diameter (Diamètre min. de grume)	mm	350	350	350
Max. log length (Longueur max. de grume)	mm	3700	3300	4000
Min. log length (Longueur min. de grume)	mm	1000	1000	1000
Log peripheral speed (Vitesse périphérique de grume)	m/1'	0 ÷ 70	0 ÷ 70	0 ÷ 70
Cutter width (Largeur de fraise)	mm	240	240	240
Number of tools (Nombre des outils)	Nr.	24	24	24
Total power (Puissance totale)	HP	34.5	34.5	34.5
Net weight (Poids net)	Kg	9200	10.000	10.000
Gross weight (Poids brut)	Kg	9700	10.500	11.500
Cubage (Cubage)	m3	40	45	53

Fig. 3 – Debarking machine type STE/MAT/1800

(Ecorceuse Type STE/MAT/1800

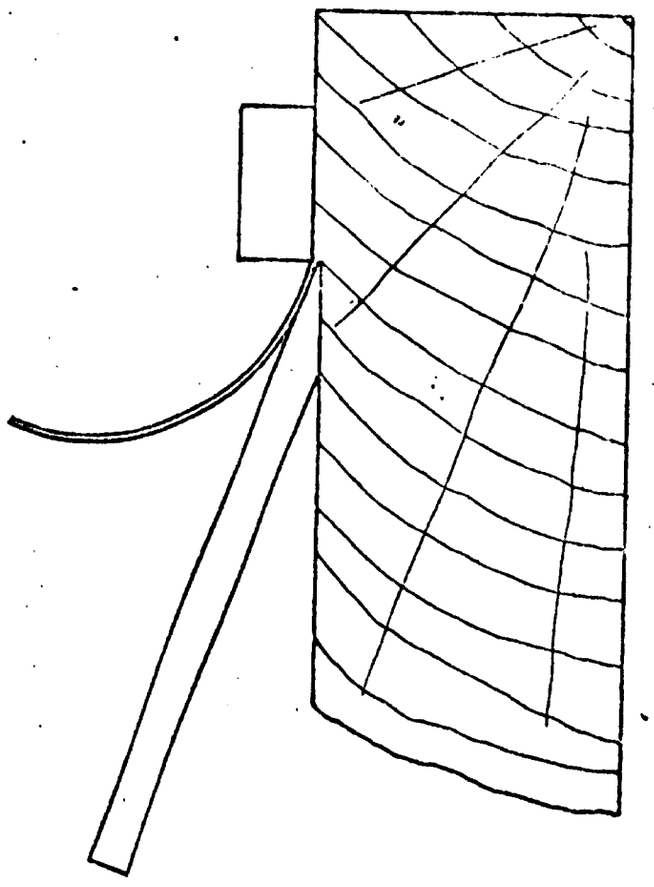




Specification (Données technique)		STE/MAT/ 1800x2700	STE/MAT/ 1800x3300	STE/MAT/ 1800x3600
Max. log diameter (Diamètre max. da grume	mm	1800	1800	1800
Min.log diameter (Diamètre min. de grume	mm	300	300	300
Max. log length (Longueur max. de grume)	mm	2700	3300	3600
Min. log length (Longueur min. de grume)	mm	1000	1000	1000
Log rotation speed (Vitesse de rotation de la grume)	g/1'	0 ÷ 18	0 ÷ 18	0 ÷ 18
Cutter width (Largeur de fraise)	mm	240	240	240
Number of tools (Nombre des outils)	Nr.	24	24	24
Total power (Puissance totale)	HP	36.5	36.5	36.5
Net weight (Poids net)	Kg	11.200	12.000	12.500
Gross weight (Poids brut)	Kg	12.700	13.500	14.200
Cubage (Cubage)	m3	30	35	35

Fig. 4 ....

Horizontal slicing
(Tranchage horizontal)



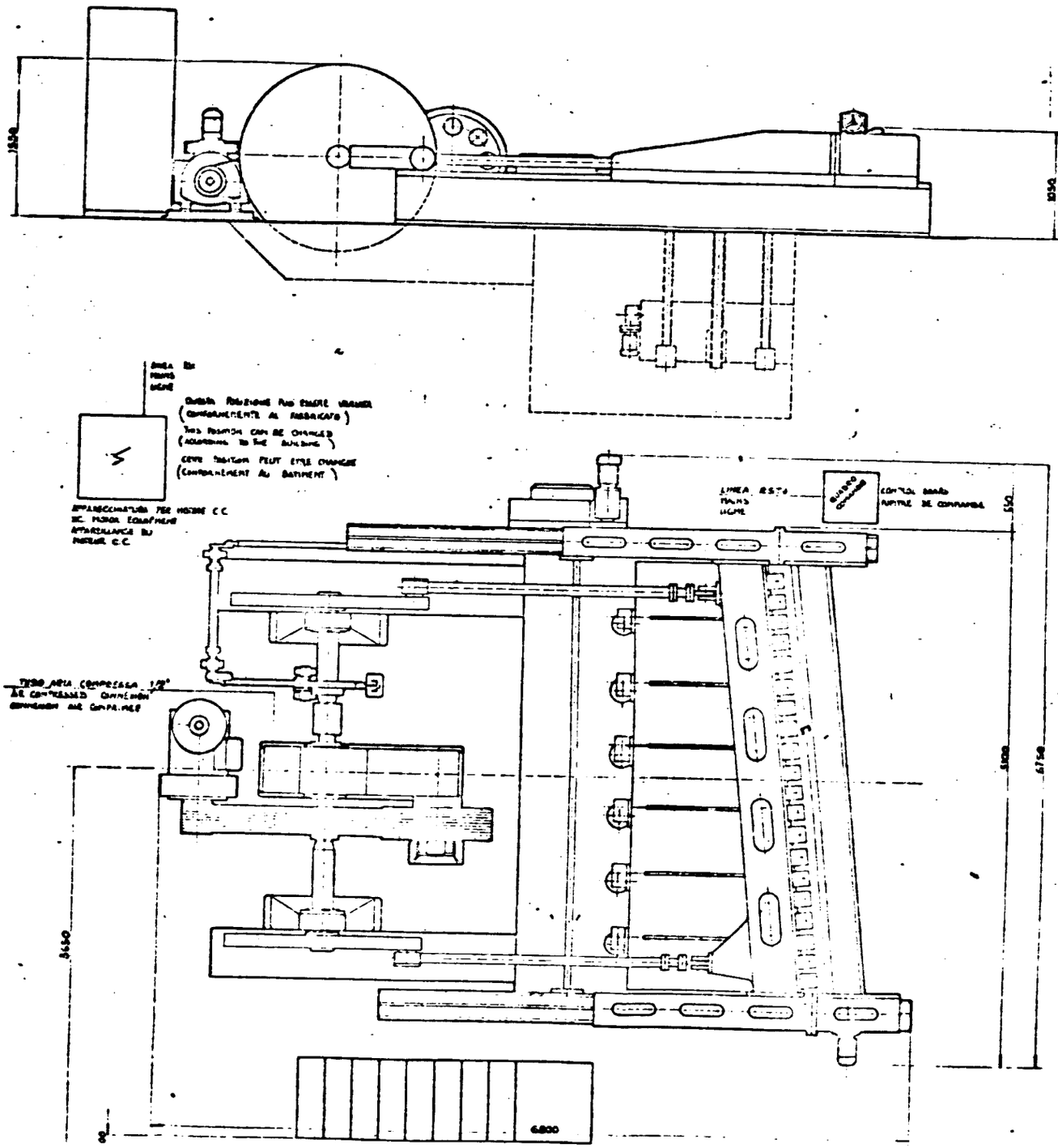


Fig. 5 - Slicer Tor/40 - Specification

Trancheuse Tor/40 - Données Techniques

Cubage (Cubage)	m3	50
Gross weight (Poids brut)	kg	35.000
Net weight (Poids net)	kg	31.000
Total power of auxiliary motors (Puissance moteur auxiliaires)	HP	[illegible]
Power of main motor (Puissance moteur principal	HP	80
Max. Speed (Vitesse max.)	t/'	55
Knife length (Longeur du couteau)	mm	1.050
Range of thickness (Gamme épaisseurs	mm	0.05
Max. log height (Hauteur max. de la grume)	mm	1.000
Max. log width (Largeur max. de la grume)	mm	800 (1100
Max. log length (Longeur max. de la grume)	mm	4000

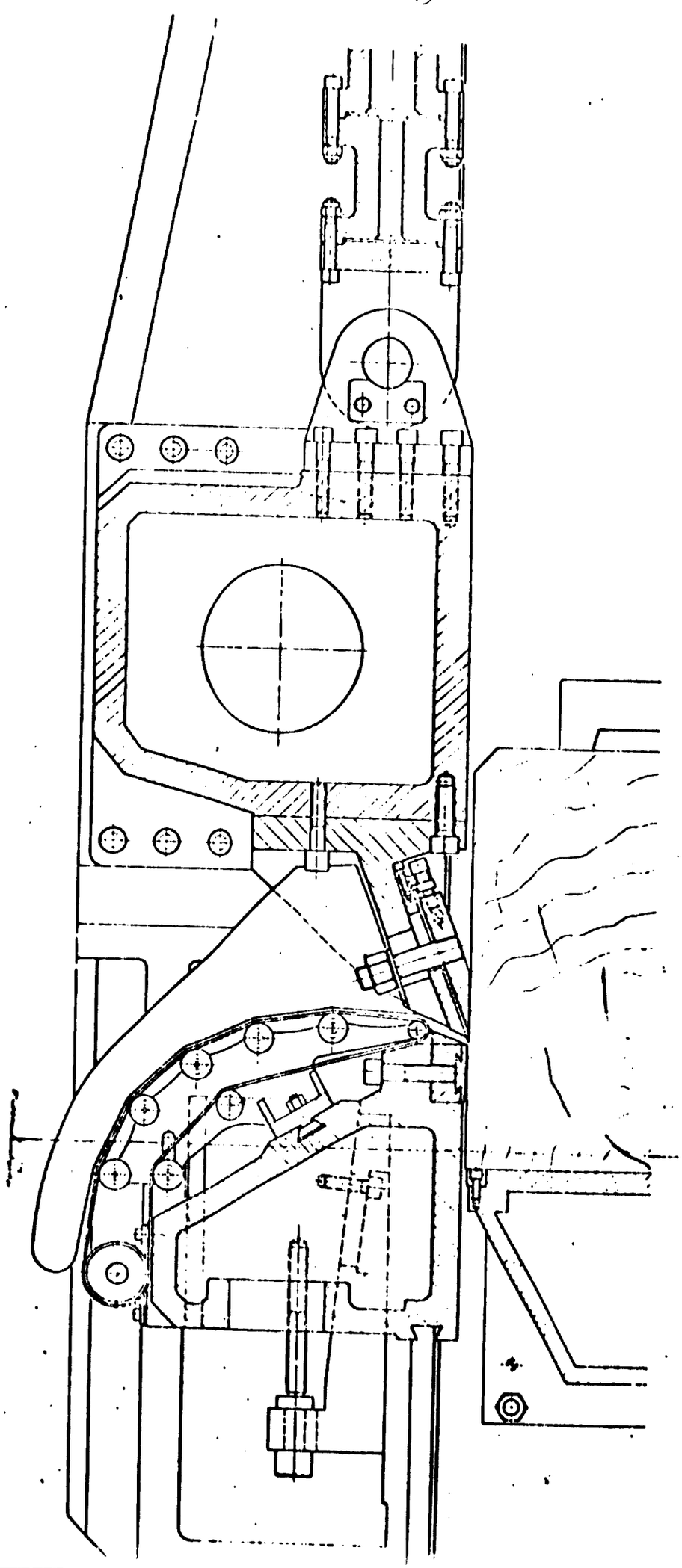
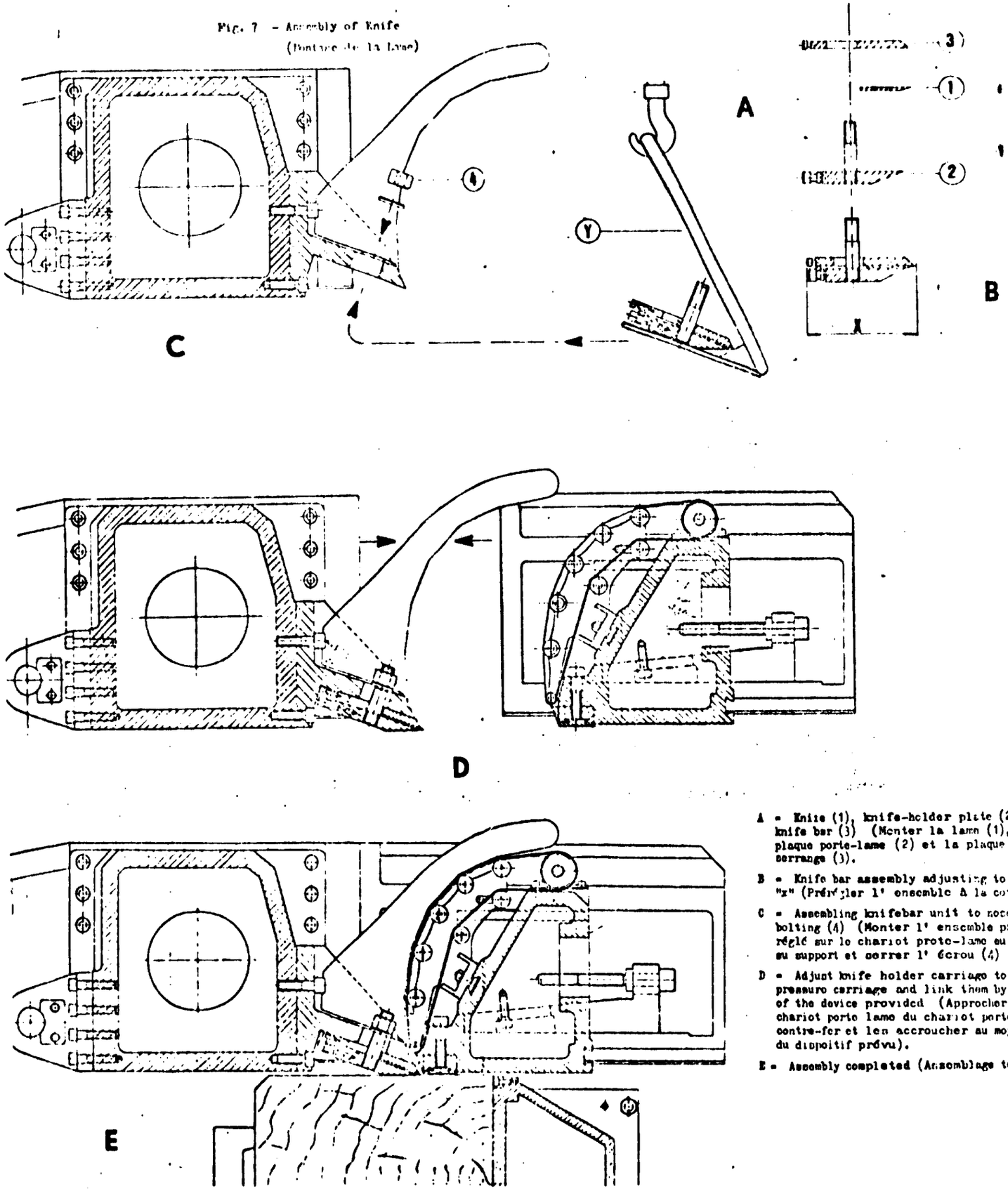


Fig. 6

Fig. 7 - Assembly of Knife
(Montage de la Lame)



A = Knife (1), knife-holder plate (2), knife bar (3) (Monter la lame (1), la plaque porte-lame (2) et la plaque de serrage (3).

B = Knife bar assembly adjusting to width "x" (Prérégler l' ensemble à la cote "x"

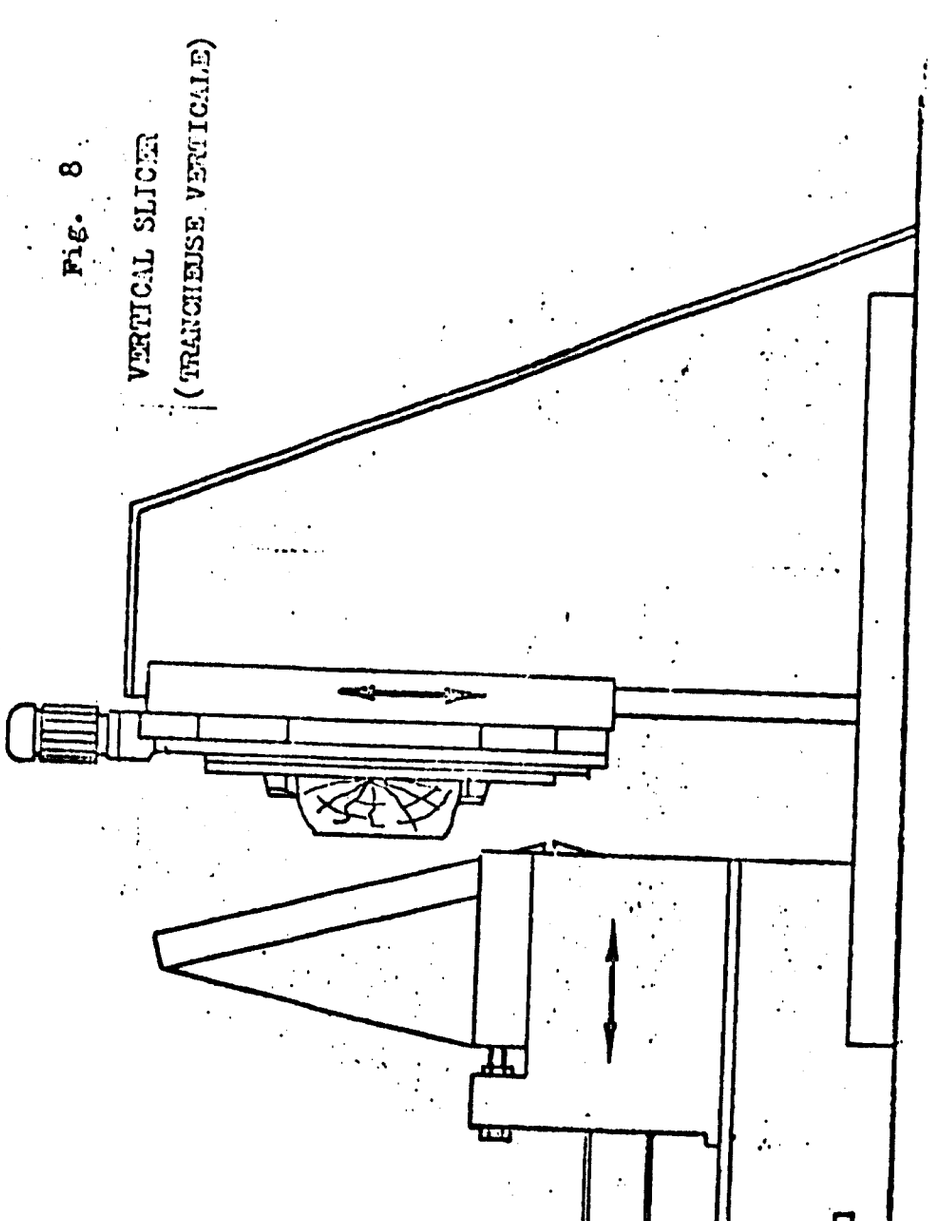
C = Assembling knifebar unit to nose bar bolting (4) (Monter l' ensemble préréglé sur le chariot porte-lame au moyen du support et serrer l' écrou (4)

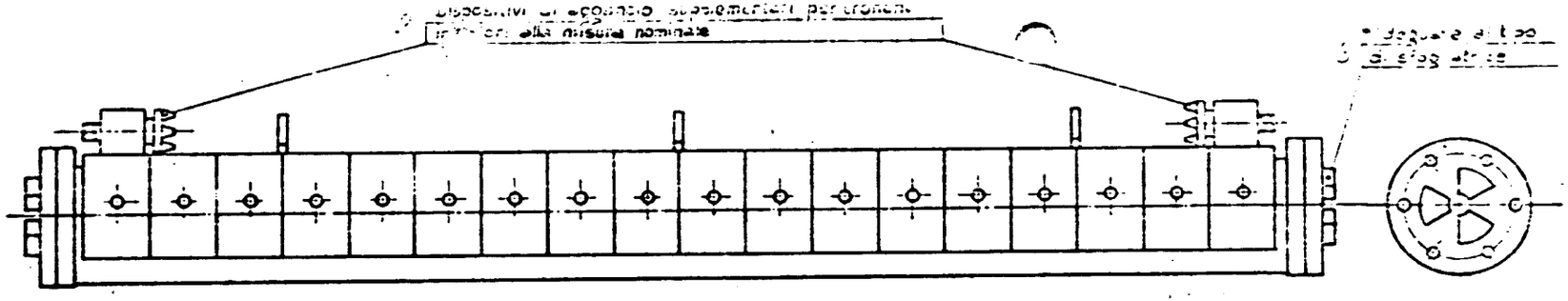
D = Adjust knife holder carriage to pressure carriage and link them by means of the device provided (Approcher le chariot porte lame du chariot porte-contre-fer et les accroucher au moyen du dispositif prévu).

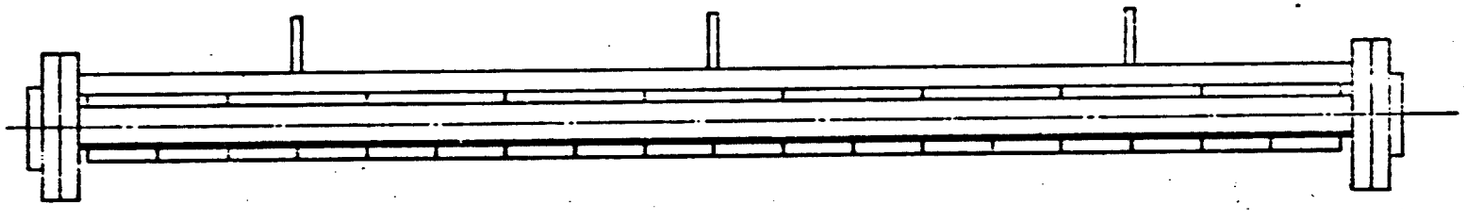
E = Assembly completed (Assemblage terminé

Fig. 8

VERTICAL SLICER
(TRANCHEUSE VERTICALE)







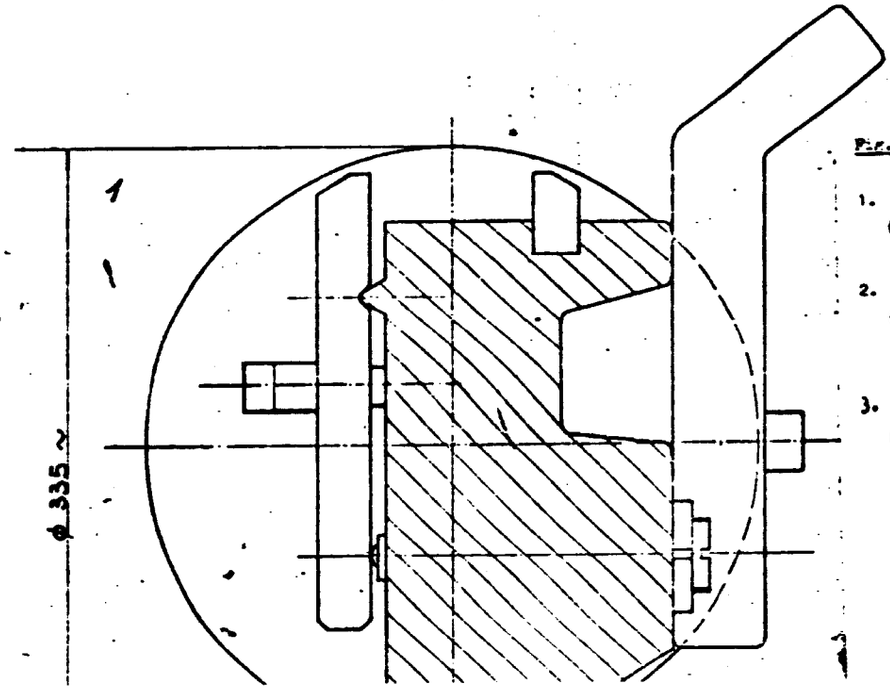


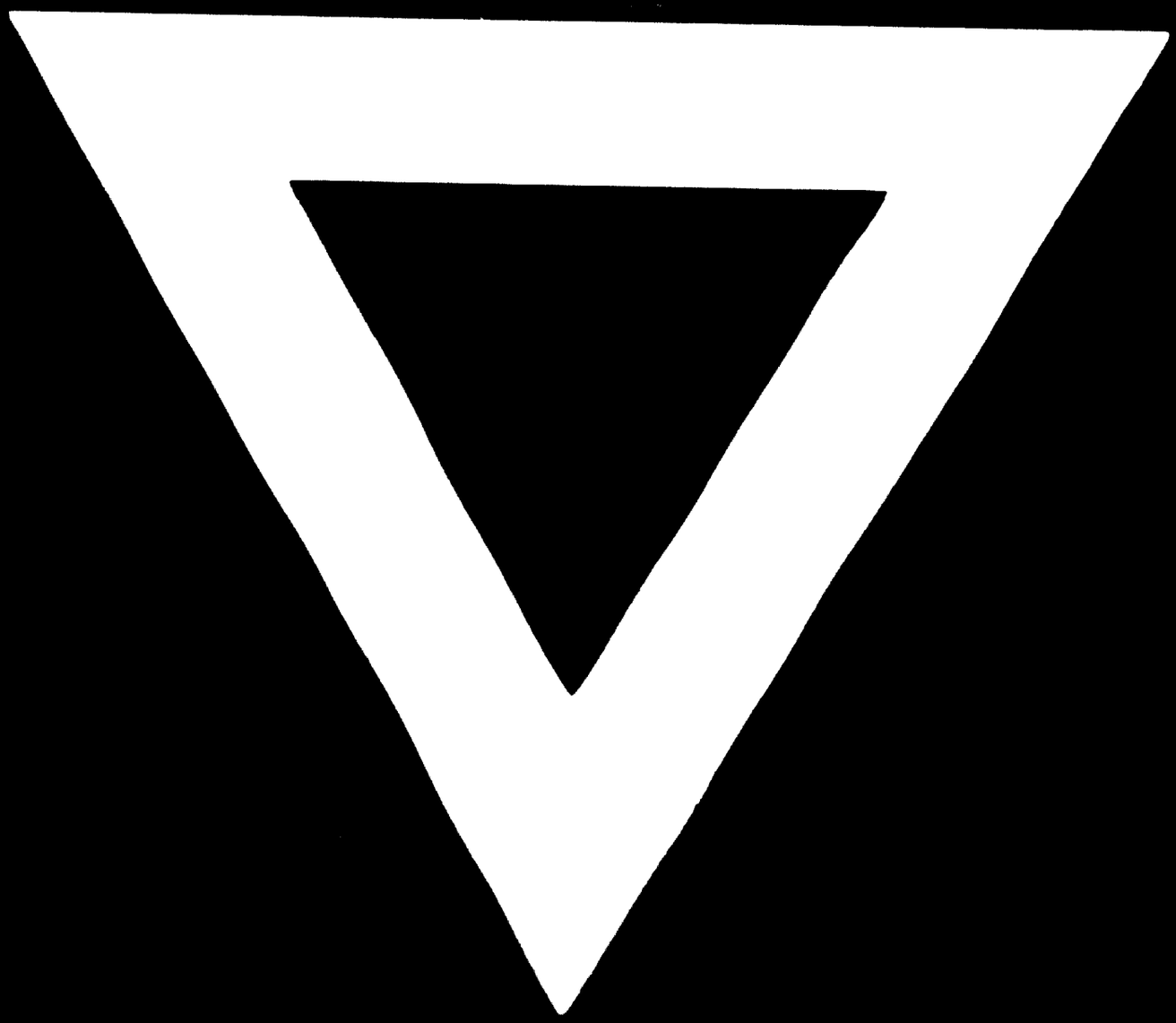
Fig. 9

1. Stay log peeling lathe
   (Stay log pour deroulause)

2. Additional chucks for logs smaller than rated
   (Dispositif de bridage supplémentaires pour grumes de dimensions inférieures à celles nominales

3. Chucking plate of peeling lathe
   (Adapter au type de déroulause

I-79



80.02.01