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Technical Meeting on the Selection
of Woodworking Machinery

Vienna, 19-23 November 1973

SELECTION OF PLANING AND MOULDING MACHINES
FOR DEVELOPING COUNTRIES^{1/}

by

Lars J. Wissing, Export Manager,
Jonsereds Fabriker AB, Jonsered, Sweden

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SUMMARY

The simplest and usually the first use of planing machines is to bring timber to desired and fairly accurate dimensions. Handicraft production normally requires only one-side planing, but once a certain degree of mechanization is achieved two-side planing is generally accepted as standard practice. High capacity dimensioning and profiling is done with four-side machines using from 5 to 8 cutter heads. Investments in planers and moulders may range from x for the simplest to 10x or more for the more sophisticated models.

Placing of tools is important and varies between softwoods and hardwoods, and power requirements are about 30% more for the latter. The uses of the bottom head, knife box (multi-knife cutter head), side heads, top heads and beading heads are described.

The tools and their concomitant grinding equipment form the basic quality determinants. Tools fall into three categories: square cutter heads with two or more knives; round cutter heads with two or more knives; solid profiled knives, plus special tools. The first type can be dangerous, whilst the second is the most common, having a wedge-type strip touching the knife to secure it. Carbide-tipped teeth are recommended for hardwoods.

A new type of tool has been developed, but until now has only been used for surface planing. The tool body incorporates indexable inserts of carbide-tipped steel which are first turned over, then exchanged, when worn or nicked.

Auxiliary devices are most necessary to take advantage of the inherent capacities of the machines. Lift tables, infeed conveyors, acceleration conveyors and stacking devices must be matched to their capacities to ensure a smooth production flow.

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TRIPLO LINGUA
TECHNICAL SUMMARY
11 noviembre 1973
ESPAÑOL
Original: INGLÉS

Organización de las Naciones Unidas para el Desarrollo Industrial

Reunión técnica sobre selección de maquinaria
para trabajar la madera

Viena, 19-23 noviembre 1973

SELECCION DE CEPILLADORAS Y FREASADORAS PARA LOS PAISES EN DESARROLLO^{1/}

por

Lars J. Wissing, Jefe de la Sección de Exportación de la
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RESUMEN

La aplicación más sencilla que tiene una cepilladora, y generalmente la primera, es reducir la madera a las dimensiones deseadas, relativamente precisas. Normalmente, para la producción artesanal sólo se requiere cepillado por una cara; en cambio, cuando se alcanza cierto nivel de mecanización suele aplicarse el cepillado por dos caras. Para trabajos de dimensionado y perfilado en gran escala se utilizan máquinas que actúan sobre las cuatro caras, con cinco-ocho cabezales portacuchillas. La inversión requerida para una máquina de cepillar o de fresar puede oscilar entre x para el tipo más sencillo y $10x$ para los modelos más complejos.

La colocación de las herramientas es importante y varía según se trate de trabajar especies coníferas o frondosas; asimismo, éstas requieren aproximadamente un 30% más de energía que las primeras. Se describe las aplicaciones que tienen el cabezal inferior, el cabezal múltiple, los cabezales laterales, los cabezales superiores y los cabezales para molduras.

Las herramientas y el correspondiente equipo de afilado constituyen factores determinantes de la calidad básica. Las herramientas se dividen en tres categorías: cabezales portacuchillas cuadrados con 1, 2 o más cuchillas; cabezales portacuchillas redondos, con dos o más cuchillas; cuchillas macizas de forma, más herramientas especiales. El primer tipo puede ser peligroso; el segundo, que es el más corriente, lleva una banda en cuña que va en contacto con la cuchilla y la eficiencia. Para las maderas de frondosas se recomienda usar dientes postizos.

Se ha elaborado un nuevo tipo de herramienta que hasta la fecha, sin embargo, sólo se ha utilizado para cepillar superficies. Al cuerpo de la herramienta se incorporan unas piezas postizas graduables de acero con puntas de carburo que primero se utilizan por un lado, luego por el otro y luego se cambian cuando están usadas o torcidas.

Los aparatos auxiliares son sumamente necesarios para aprovechar totalmente las capacidades inherentes de las máquinas. Las mesas elevadoras, los transportadores de alimentación, los transportadores de aceleración y los aparatos apiladores han de ajustarse a las capacidades de las máquinas para que la corriente de producción resultante sea regular.

^{1/} Las opiniones que el autor expresa en este documento no reflejan necesariamente las de la Secretaría de la ONUDI. La presente versión española es traducción de un texto no revisado.



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13 novembre 1973

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Original : ANGLAIS

Organisation des Nations Unies pour le développement industriel

Réunion technique sur le choix des machines
dans l'industrie du bois

Vienne, 19-23 novembre 1973

RESUME

SELECTION DE MACHINES A RABOTER ET A MOULURER
POUR LES PAYS EN VOIE DE DEVELOPPEMENT^{1/}

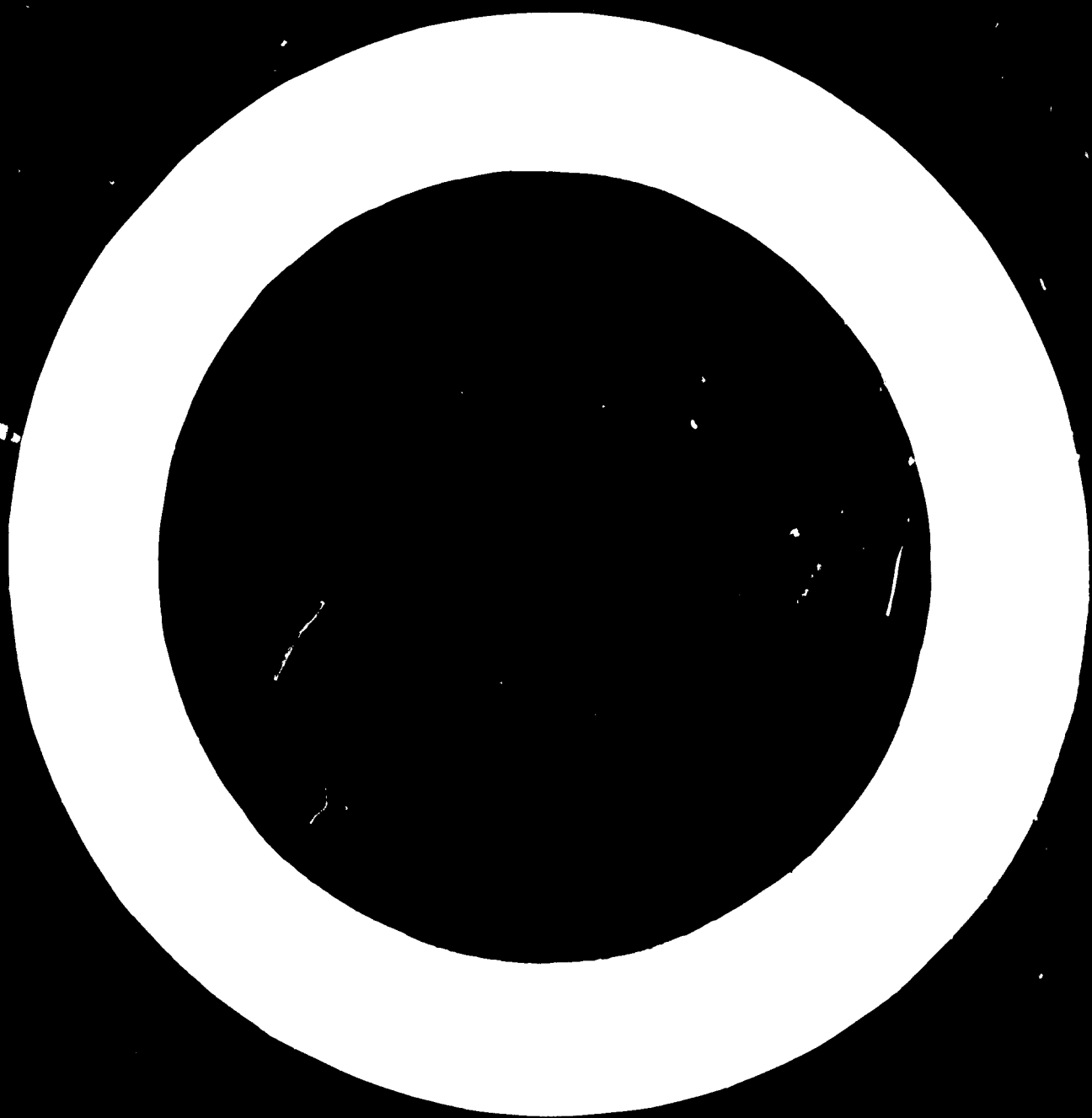
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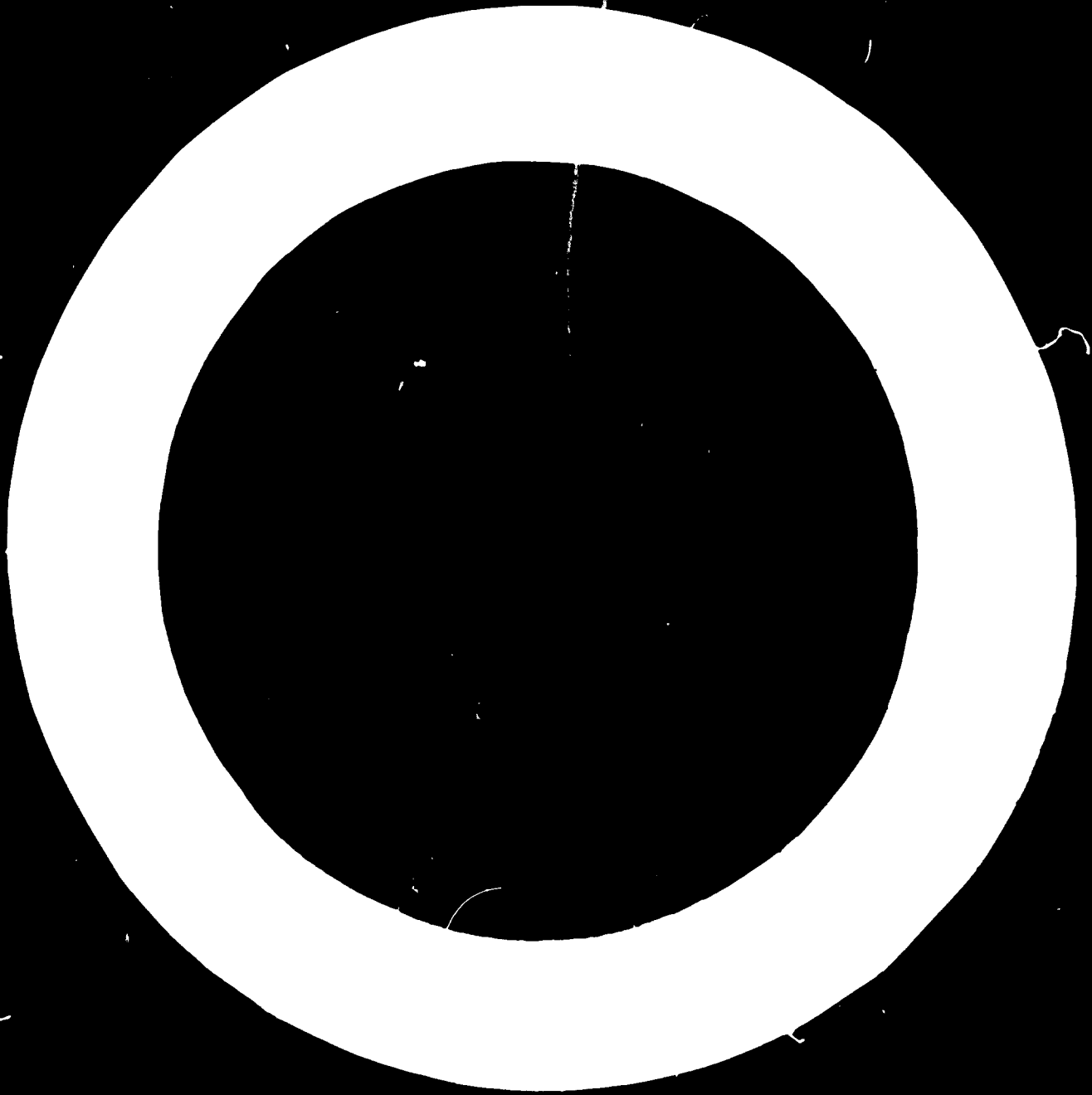
Lars J. Wissing,
Directeur du Service exportation
Jonsereds Fabriker AB, Jonsered (Suède)

La fonction essentielle d'une raboteuse est d'amener une pièce de bois aux dimensions désirées, avec une précision suffisante. La production artisanale n'exige généralement que le rabotage d'une face; mais dès qu'une entreprise atteint un certain niveau de mécanisation, elle préfère normalement des machines deux faces. Il existe également des raboteuses à grande capacité de production travaillant sur quatre faces avec de 5 à 8 porte-outils. Le coût des machines à raboter ou à moulurer peut varier du simple au décuple, et même davantage, suivant le degré de complexité de la machine.

Le positionnement des outils est important et varie suivant la dureté du bois à travailler; de même, la puissance de la machine doit être supérieure d'environ 30 % dans le cas de bois dur. L'auteur décrit les méthodes d'emploi des têtes porte-outils à un ou plusieurs couteaux (supérieures, inférieures, latérales et à moulurer).

^{1/} Les opinions exprimées dans le présent document sont celles de l'auteur et ne reflètent pas nécessairement les vues du Secrétariat de l'ONUDI.





La qualité des outils de coupe et des machines à affûter est essentielle. Il y a trois types principaux de porte-outils : carré à deux ou plusieurs couteaux, arrondi à deux ou plusieurs couteaux, monobloc, sans compter les porte-outils spéciaux. Les premiers peuvent être dangereux; les seconds sont les plus courants, car ils possèdent une bande en forme de coin qui facilite le blocage du couteau. Il est recommandé d'utiliser pour les bois durs des outils à dents en carbure fritté.

Un nouveau type d'outil a fait son apparition, mais il n'a encore été utilisé que pour le rabotage des surfaces. Il comporte des petits couteaux amovibles en carbure fritté, qui peuvent être retournés, puis remplacés lorsqu'ils sont usés ou ébréchés.

Il est indispensable de faire appel à du matériel auxiliaire pour tirer le meilleur parti possible des machines. Des tables de mise à niveau, des dispositifs d'alimentation, des convoyeurs à vitesse variable et des systèmes d'empilage doivent être prévus pour assurer une production régulière.

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I USE OF PLANERS IN WOODWORKING

The first development for a planing industry in a new area is dimension planing, which is planing made directly after sawing and drying of the raw material and may in its simplest execution be only one-sided. It is a method which is seldom used and, when it is, is used primarily in handicraft production where the demand for quality and capacity is not very high. A one-side machine will normally be powered by one 10 H.P. motor, whereas a four-side machine will total 30 H.P. or more.

The most common type of dimension planing is two-side planing, working with one top cutter and one bottom cutter unit. One or both of them can be adjusted to receive one dimension desired. It is a rather simple machine with only a few technically complicated arrangements.

The cutter heads are of the square type and the planer knives are easy to grind. Surfacer of this type can also be made with two side heads for three or four side dimensioning. Feed speeds will range between 10 and 30 m/min.

This type of surfacer is used in joinery and furniture factories and is often used as a simple multi-purpose planer. These machines have maximum widths of from 400 to 800 mm and can be used very well for dimensioning in special connections where a simple machine is required only for this purpose and where the customers do not have high capacity requirements.

The next stage is high capacity dimensioning. The planing programme can be enlarged with such planers through just a simple change of tools, and these machines can make more complicated profiles. These more expensive machines can thus be used for several purposes and the manufacturing programme can be increased. It is also easier to meet with the demand from the market with such machines since they are more flexible.

This type of machine is made for four-side planing and the machines are provided with 5 cutter heads, but it is possible to get them with up to 8 cutter heads. Then the machine is no longer a dimension planer, even if it can be used for this purpose with good results. If one chooses a machine of this type one will get a flexible piece of equipment which can be used for planing of many types of profiled wood products. A multi-purpose four-side five-cutter planer usually has a maximum width of 305 mm and a thickness capacity of 100 to 125 mm. Motors range from 60 to 100 H.P. and maximum feed speeds from 40 to 80 m/min.

With suitable equipment built around this planer one will be able to produce large quantities of planed wood, such as tongued and grooved panels, mouldings, etc. Of course one can concentrate on profiling of mouldings only, but for this type of work a somewhat different machine programme is used. The machines must then be made for thinner dimensions of wood, and one will need double top cutter heads so that one can profile with a good surface in large quantities.

However, it is recommended to start with planing of less complicated profiles, not because of the operation of the machines, but as the handling of tools will be more complicated for difficult profiles one will require more skilled personnel.

Of course the size of the investments to be made has to be decided in advance, as there is always a certain connection between important investments in machinery and important investments in the training of personnel. If one applies a price index of 100 to a simple one-side machine, then a two-side with top and bottom cutter heads would be roughly 250, a three-side with top and 2 side heads about 200 and a four-side machine about 400. A multi-purpose machine as above would be 1000 or more.

II MACHINERY EQUIPMENT

Many machinery manufacturers offer an assortment of machines which is based on one or more basic machines. These machines can be built in various executions to fit the requirements of different markets.

The most important differences are the number of cutter heads and their internal positions, the capacity, feed speeds and planing width.

A typical standard planer for softwood has mostly 5 or 6 cutter heads placed in the following way: bottom head, knife box or multi-knife cutter head, two side heads, one or two top heads, beading head.

On a typical hardwood planer the cutter heads are placed as follows: bottom head, first top head, two side heads, second top head, beading head.

The most important difference between softwood and hardwood planing is that for softwood planing one is working "face down", i.e. the side to be visible after mounting in floors, walls, etc. will be placed downwards in the planer. Of course one can use the same method for hardwood planing, but mostly one is working "face up" and this will facilitate the control of the planing result.

The sawn hardwood often shows big variations as to thickness as the saw equipment in the developing countries, who are supplying the hardwood, is less advanced than the equipment in the softwood producing countries. Furthermore, the tropical hardwood species are generally more difficult to saw.

The Placement of Tools

1. Bottom Head

The bottom head is to plane the bottom side of the wood and the cutting depth can be fixed at 0 - 2.5 or 3 mm.

2. Knife Box or Multi-knife Cutter Head

As mentioned above, this equipment is normally used for softwood planing and it is to give the bottom side a perfect finish. For quality joinery products a finish showing cutter marks with a 2 mm pitch is accepted. This is obtainable at a feed speed of about 10 m/min with one knife rotating at 5000 r.p.m. Consequently, the same finish can be obtained with four knives in the head and a feed speed of 40 m/min or with 6 knives at 60 m/min. As for power requirements, it may be considered that the total horsepower for a five to six-head planer will be increased, for hardwoods, by at least 30% over that required for softwoods.

The knife box is provided with 2 bevelled fixed knives to make a thin chip in the wood. The wood will of course then get an even and perfect surface. This is theoretically an excellent method, but in practice many problems will arise.

To work satisfactorily, the knife box requires wood that is nearly free of knots, spiral and interlocked grain and tension wood, since these cause special problems and obviously reduce the performance of any planer.

The humidity of the wood must also be very low as the fibres will otherwise lift up after some time. Further the adjustment of the knife box is rather complicated.

As a conclusion, it must be said that the knife box will give the best possible finish of the surface, but it requires dry wood which is nearly free from knots and grain irregularities and is in perfect adjustment.

The multi-knife cutter head is a normal round cutter head but has a bigger diameter and more knives. The bigger diameter makes the marking on the surface less visible. The large diameter will somewhat alter the pressure angle and the risk for tear-out around knotty wood will be reduced. In comparison to the knife box the multi-knife cutter head is not as sensitive to humid wood. However, a disadvantage with the multi-knife cutter head is that it is difficult to handle during grinding and tooling. Most machines are now provided with special accessories to facilitate this work. Furthermore, the knives in the multi-knife cutter head will stand up longer as they are always working on an already dressed surface. When using the multi-knife cutter head one can thus use rather wet timber, which need not be completely free from knots. One can also work at a higher feed speed as the multi-knife cutter head with its big diameter can be provided with more knives than the normal cutter head.

3. Side Heads

The side heads are to dimension the timber as to both the desired width and profile, e.g. produce tongued and grooved timber, and mouldings. The right side head works in the same way as the bottom head, i.e. it planes the side touching the fence and serves as a reference for exact dimensioning. The left side head takes away the surplus and will thus give exact dimension to the timber. The side heads can be placed in front of or behind the top head or between two top heads.

4. Top Heads

The main function of the top head is to dimension. The machines are often provided with two top heads. If one is going to plane wood which is not well sawn and has big variations in thickness, the cut-off can be so big that one needs two top heads to be able to plane to the correct dimension. Another reason for using two top heads is that one wants to plane "face up" to get better control of the planed surface. It is also often necessary to have two top heads when profiling is to be done on the top side of the timber in the planer. If one is going to make a deep profile on the top side, the profiling should be shared between the top cutters so that the first one takes the bigger part of the profile and the second one finishes it.

5. Heading Head

The heading head is used for planing, profiling and cutting with saw blades. To be as flexible as possible the planer must have a heading head which can be used as an extra bottom head or cut the timber with one or more saw blades. However, the most common use is for profiling, which is executed with cutters or loose knives mounted in square cutter heads on the heading spindle.

6. Feed Mark

In many cases the machine should have an extra outfeed roller, especially for the production of thin wood at high feed speeds, and slight pressure at the ends of the timber, in order to avoid double feed. Most planers are equipped with four or more feed rollers, but some have a bottom feed-chain and top feed rollers. This is especially preferred when expensive wood is machined to fine mouldings, etc., as the imprints from the fluted rollers are negligible due to the near-perfect feed and the long contact with the bottom feed chain.

III TOOLS

In connection with the choice of machinery there will always arise the problem of how to handle the tools. It is most essential to remember that the planer tools determine the quality of planing, and it is therefore necessary to consider carefully what is necessary to buy and to keep the tools in a perfect condition.

It is also necessary to invest in grinding room equipment at the same time as the machinery. For softwoods, tools of high speed steel are recommended. These tools are easier to grind than the carbide tipped tools and do not require advanced grinding equipment.

Tools for planers are of three main types:

1. Square cutter heads with two or more knives to be fixed by cutter screws. Plane or profile knives can be used. However, the square cutter heads are often avoided as they can cause serious accidents.
2. The most common type is the round cutter head with two or more plane knives. If a knife is not correctly fixed in this type of cutter head it will be further fixed through a wedge-type strip touching the knife and will thus have no possibility of becoming loose.
3. Cutters which are designed for planing or profiling. These tools have special tooth profiles which will be the same also when the cutter has been ground so many times that the teeth are worn out, i.e. solid cutters which are milled to the pattern.
4. As well as these types of tools there are also combination tools for various planing operations.

When hardwood is to be worked, tools with carbide tipped teeth are recommended. The life of such tools is much longer than that of high speed steel tools, but those who handle the tools must be well trained.

A new type of tool has been developed for hardwood planing which will considerably facilitate handling and maintenance. It is a tool body with small loose indexable inserts of carbide tipped steel. These indexable inserts are fixed to the tool body with a screw arrangement. When one side of the insert is worn out one merely has to turn it, and when the other side is also worn out, one just exchanges it. A honing attachment for the carbide tipped inserts increase their life.

However, these tools are only available as a first-aid solution.

IV AUXILIARY DEVICES

To make use of the capacity of the plant to time use, several auxiliary devices for the handling of the timber. These are devices are detailed in the following, and a general inclusion.

A. Planer with Simple In- and Outfeed Units (see Figure 1)

In the case of the above, mechanical action is to reduce manual lifting work as much as possible, which normally handles heavy personnel. The equipment is suitable for planing large dimensions at feed speeds that are not too high. The capacity is up to 60 m/min and costs are roughly US\$ 35,000.

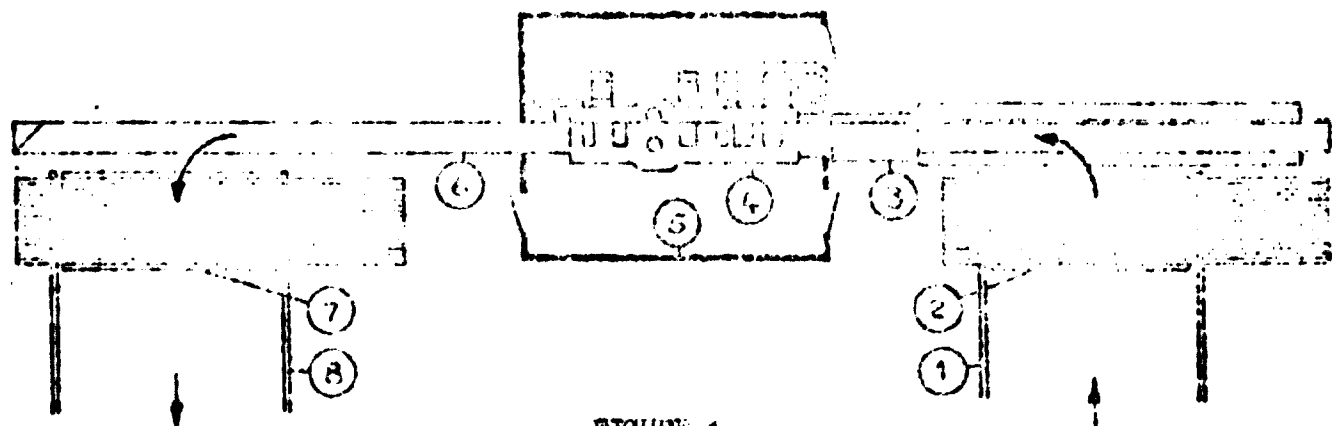


FIGURE 1

- | | |
|-------------------------|----------------------------|
| 1. Roller conveyor | 5. Sound absorbing cabinet |
| 2. Lifting table | 6. Outfeed belt conveyor |
| 3. Infeed belt conveyor | 7. Lifting table |
| 4. Planing machine | 8. Roller conveyor |

B. A Modern Planing Mill for Feed Speeds of up to about 100 m/min (see figure 2)

Figure 2 shows a planing mill which can be served by about three persons. One of them handles the infeed unit and the planer and one or two persons handle the outfeed unit and the piling of the timber. The price will be about US\$ 60,000.

- | | |
|---------------------------|--|
| 1. Infeed roller conveyor | 6. Planing machine |
| 2. Tilt hoist | 7. Pneumatic ejecting equipment |
| 3. Cross feed conveyor | 8. Motorized outfeed unit |
| 4. Infeed table | 9. Tilt table on roller conveyor |
| 5. Acceleration conveyor | 10. Roller conveyor for ready packages |

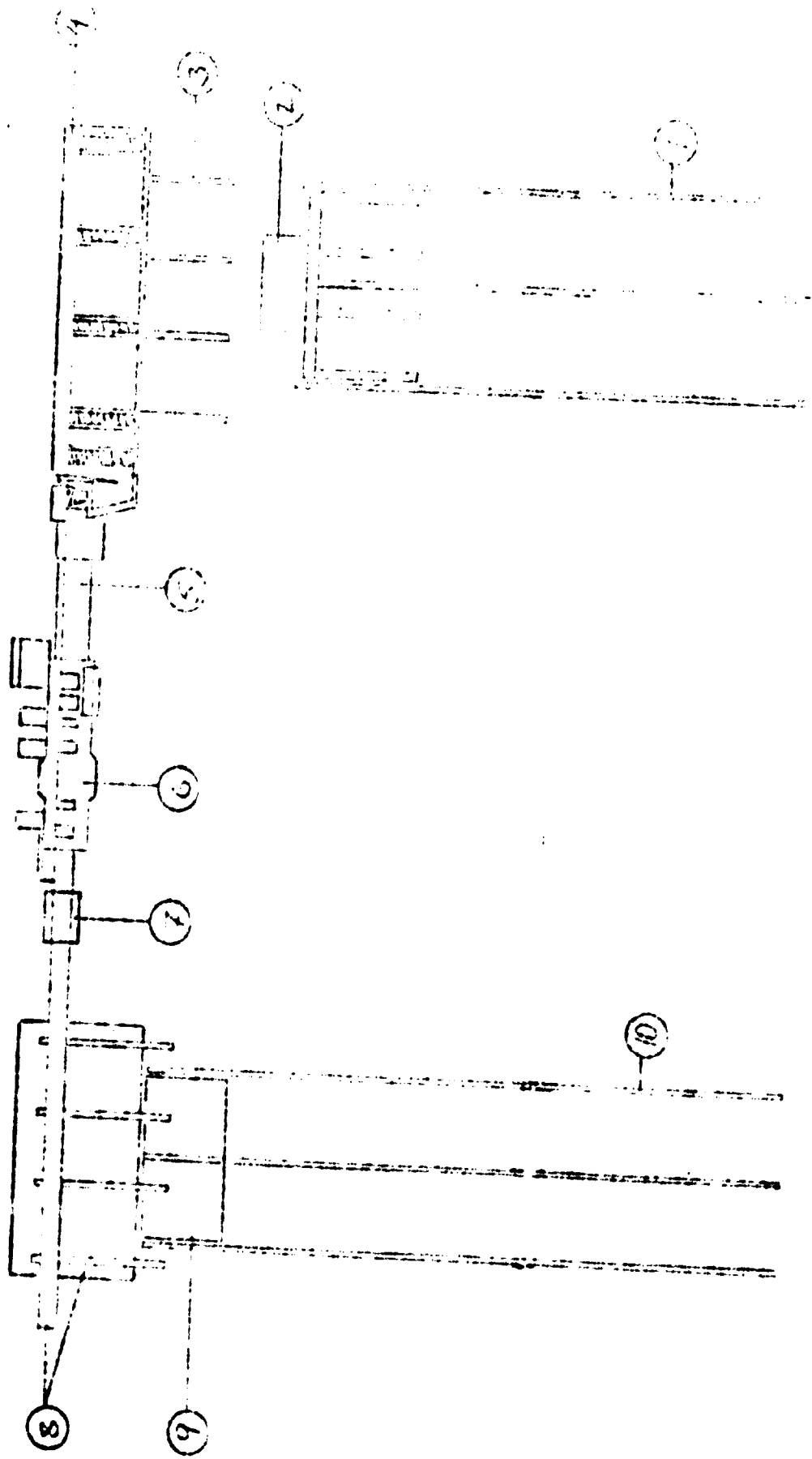


FIGURE 2 : A modern planing mill for feed speeds of up to about 100 r/min.

24,100

8,600

15,300

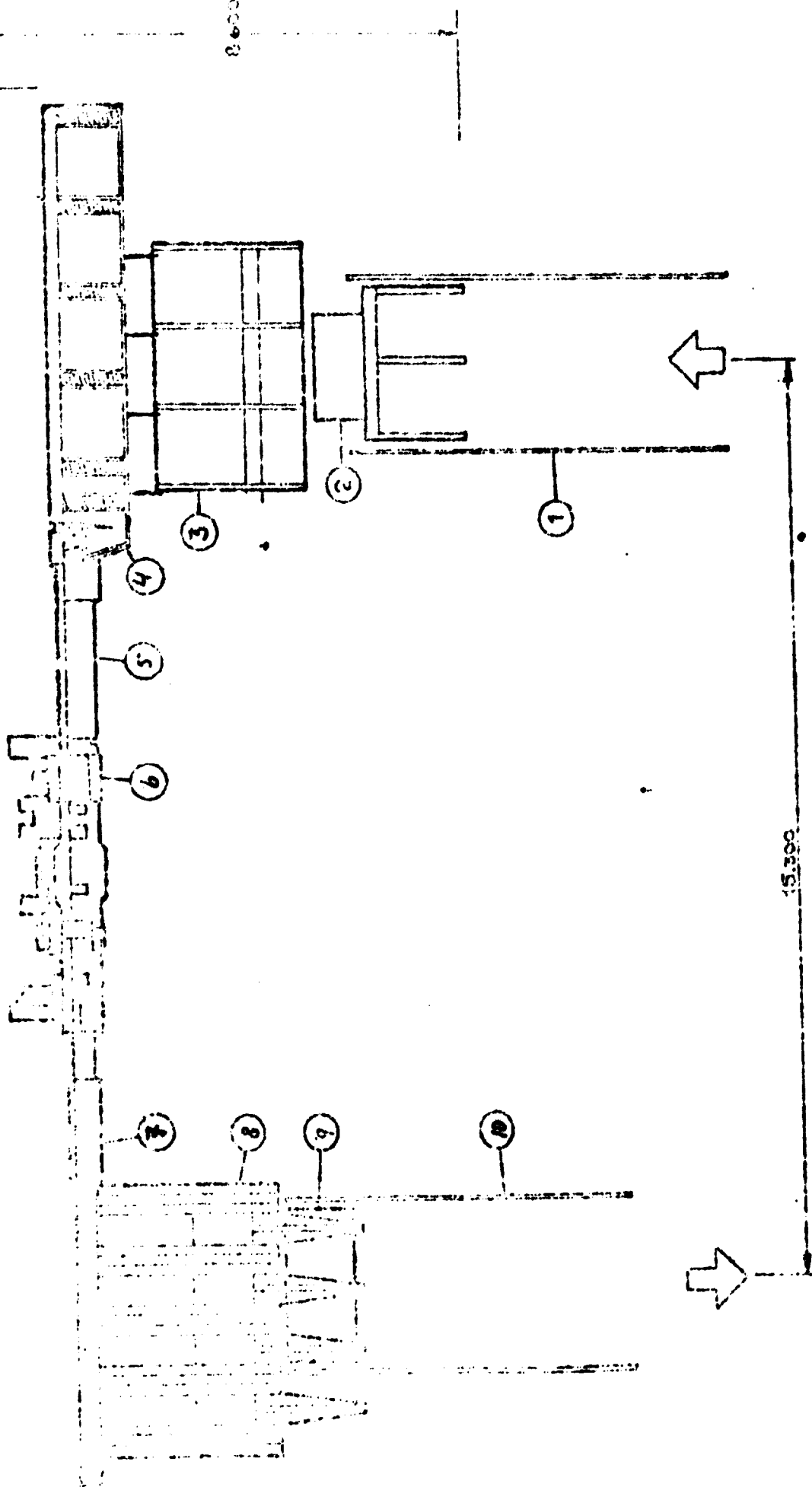


FIGURE 2 : A mechanized planing mill for high feed speeds

C. A Mechanized Planing Line for High (up to 125 m/min) Feed Speeds

(see figure 3)

This planing line can be served by only two persons. One of them has to control the infeed unit and the wood quality and also is responsible for the function of the planing machine. The other one handles the piling arrangement on the outfeed side of the planer. Its cost may be upwards of US\$ 85,000.

- | | |
|--------------------------|---------------------------------|
| 1. Roller conveyor | 6. Planing machine |
| 2. Tilt hoist | 7. Pneumatic ejecting equipment |
| 3. Belt driven table | 8. Stacker |
| 4. Infeed table | 9. Lifting table |
| 5. Acceleration conveyor | 10. Outfeed roller conveyor |

The following descriptions apply to figure 3, and to figures 1 and 2 where the same equipment is included.

Infeed Roller Conveyor

This transport equipment can be both driven and idle and consists of two roller chains. A timber package is fed on these chains and transported to the tilt hoist.

Tilt Hoist

The tilt hoist is served by the person handling the infeed side of the machine and is remote-controlled. Its function is to lift the package from the chains and then tilt it so that it falls down on the infeed table.

Belt Driven Table

The belt driven infeed table has to distribute the timber coming from the tilt hoist and give the operator of the infeed units the possibility of controlling the quality of the wood and of deciding which side of the timber should be the visible one at mounting.

Infeed Table

The infeed table transports the wood to the fence over its screw rollers and gives the machine a continuous feed of timber.

Acceleration Conveyor

The acceleration conveyor adjusts the feed speed of the timber to the working speed of the planer.

Pneumatic Ejecting Equipment

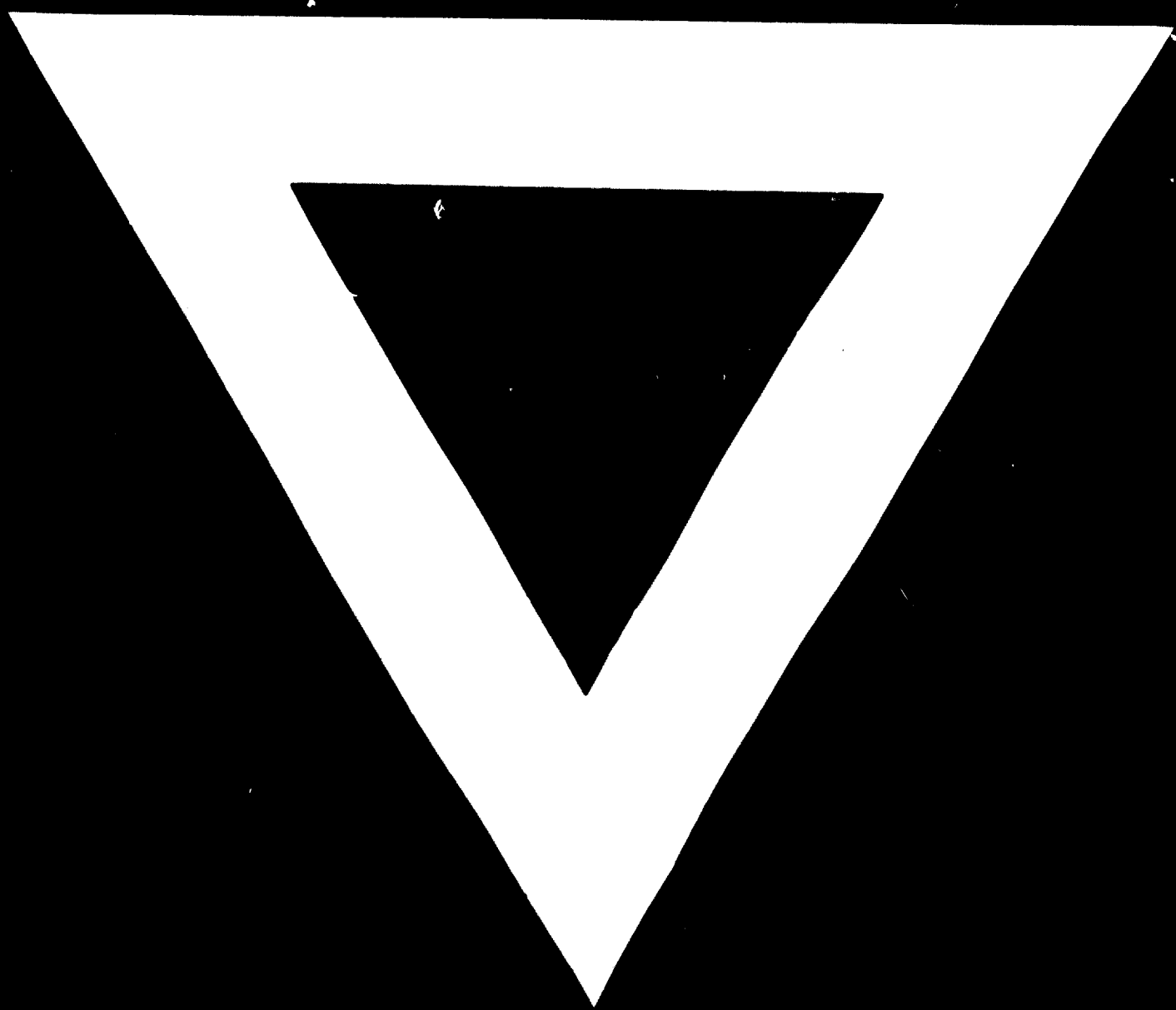
The function of the pneumatic ejecting equipment is to feed the timber automatically to the stacker.

Stacker

The stacker transports the timber sideways to the four movable forks which will enable the automatic packing of each layer in the wood packages. The operator can guide the forks so that the wood pieces fall exactly where desired.

Lifting Table

The lifting table enables the piling of the wood and reduces the falling height when a new package is to be made. Packages can be taken from the lifting table to the outfeed roller conveyor.



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