

Oct. 26, 1971

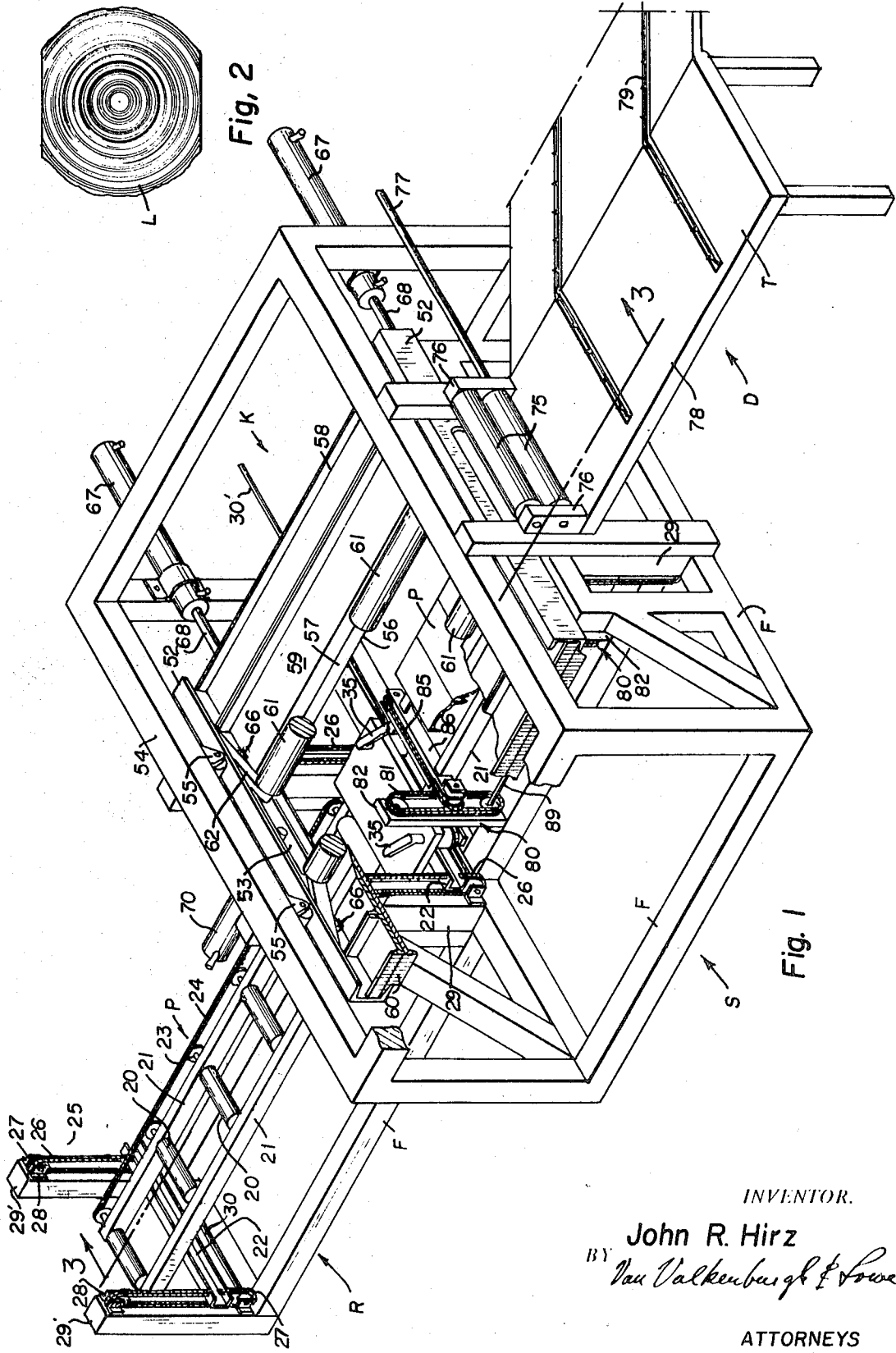
J. R. HIRZ

3,614,968

APPARATUS FOR SLICING LUMBER

Filed Sept. 8, 1969

3 Sheets-Sheet 1



INVENTOR.

John R. Hirz

BY Van Valkenburg & Lowe

ATTORNEYS

Oct. 26, 1971

J. R. HIRZ

3,614,968

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3 Sheets-Sheet 2

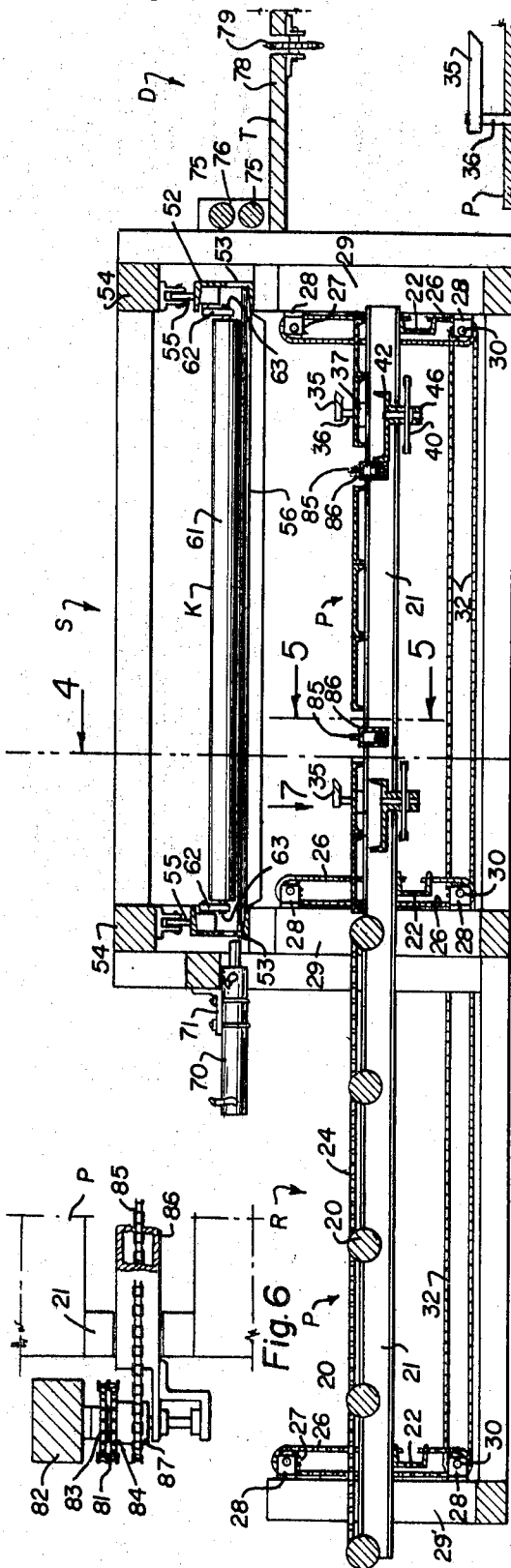


Fig. 3

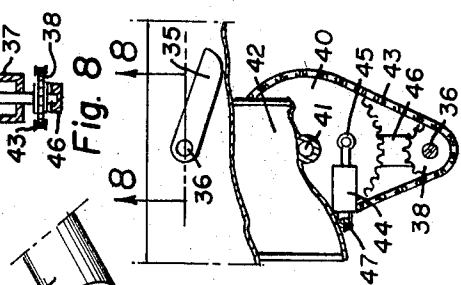


Fig. 8

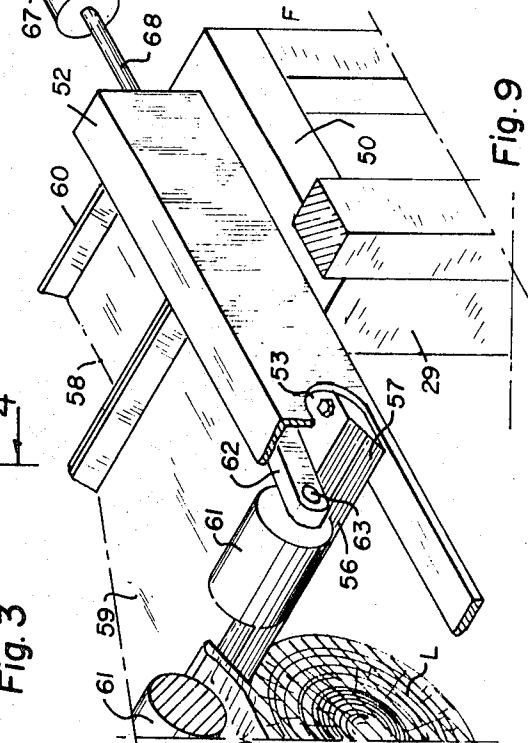


Fig. 9

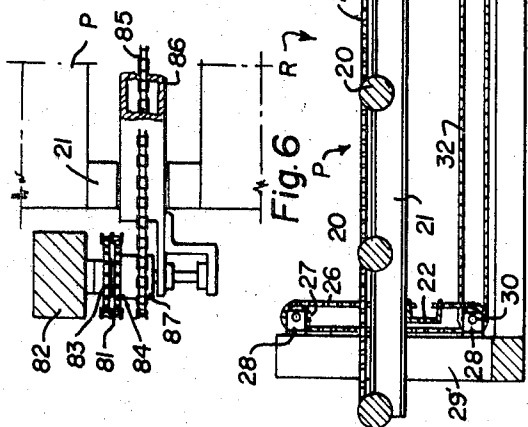


Fig. 6

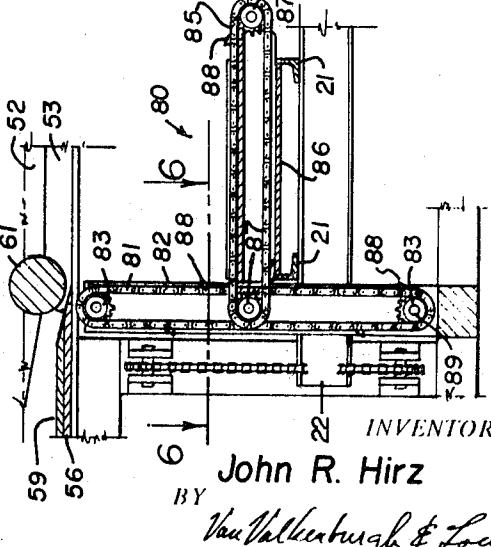


Fig. 5

INVENTOR.  
**John R. Hirz**  
 BY *Van Valkenburg & Lowe*  
 ATTORNEYS

Oct. 26, 1971

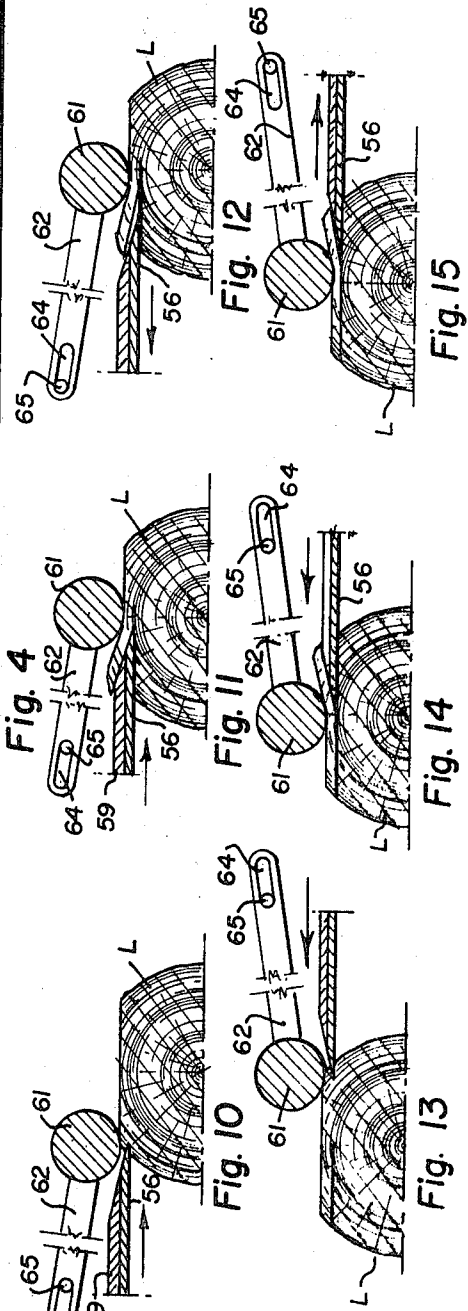
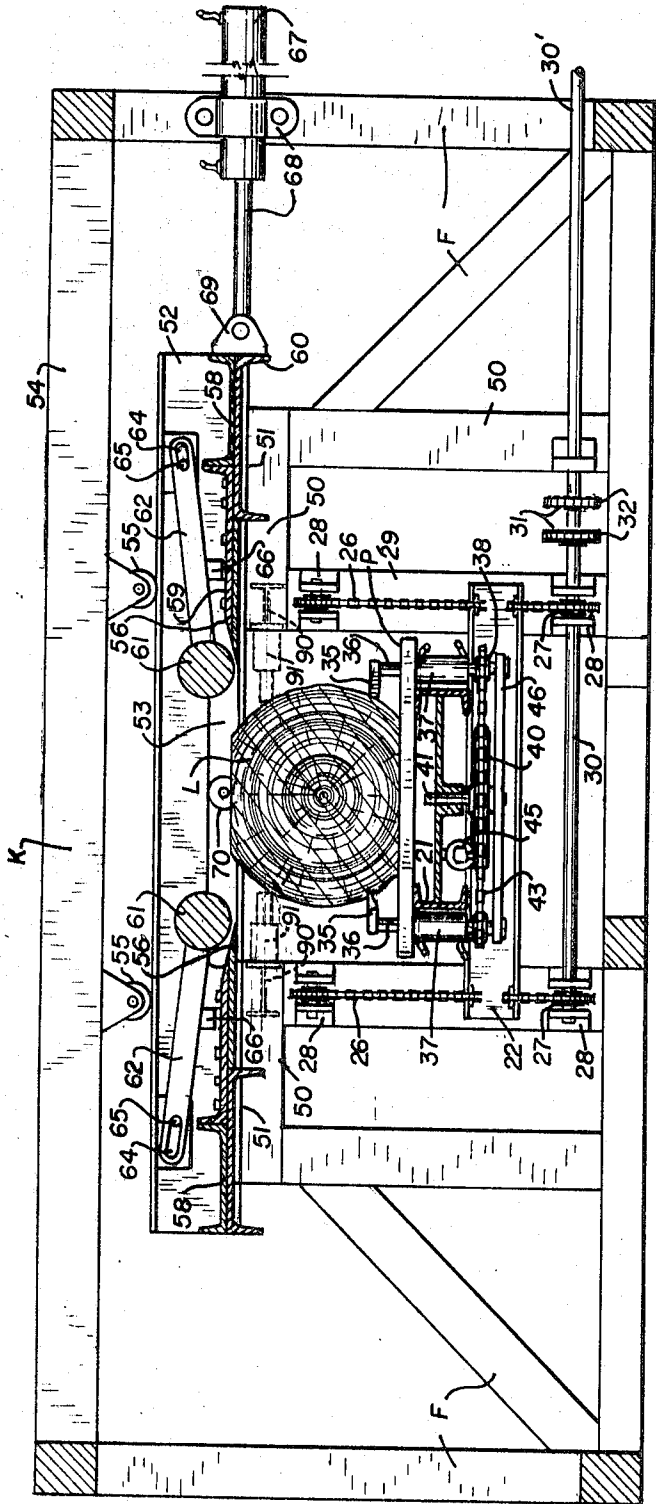
J. R. HIRZ

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APPARATUS FOR SLICING LUMBER

Filed Sept. 8, 1969

3 Sheets-Sheet 3



INVENTOR.

John R. Hirz

BY *Von Valkenburg & Lowe*

AT TORNEYS

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3,614,968  
**APPARATUS FOR SLICING LUMBER**  
John R. Hirz, 1233 S. Bryon, Fort Collins, Colo. 80521  
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Int. Cl. B27I 5/06  
U.S. Cl. 144—178 7 Claims

## ABSTRACT OF THE DISCLOSURE

An apparatus and method for slicing slabs from a cant wherein the slice is effected by two opposing knives with one knife being adapted to move halfway into the cant from one side thereof, and the other knife adapted to be moved halfway into the cant from the other side thereof. With this operation, the knives will not lift the grain of the wood as they slice into the cant.

This invention relates to slicing lumber, to produce slabs from a log with a blade and more particularly, to improvements in machinery for slicing lumber.

Considerable study has been directed towards the reduction of waste incurred in sawing logs into dimension lumber and especially into sheeting. For example, band saws with thin blades have been proposed, but they do not cut accurately nor straight. To completely eliminate waste, it has been proposed that lumber be prepared by slicing slabs from a log with a knife instead of making saw cuts. The article *Slicewood*, in the publication *Forest Products Journal*, May 1962, pages 218-226, provides a review and sets forth the pertinent prior art of cutting lumber in this manner, pointing out as much as twenty percent of the volume of a cant, a log prepared for the sawmill, is lost as sawdust.

The conventional apparatus for slicing, essentially a veneer knife as shown in the publication *Slicewood*, provides for a knife which moves across the face of a log to slice a slab therefrom. The thickness of such a slab may vary from  $\frac{1}{4}$  to  $\frac{3}{4}$  inch. The angle of the knife, disclosed as being ground to a 22° bevel, provides sufficient rigidity to prevent flexing of the edge. Such a blade curls the sliced slab as the knife moves longitudinally through the log. This flexing will rupture a certain amount of the medullary rays of the log and thus produce a "loose grain" or cracks in the wood. A loose grain, if not too severe, is not objectionable for many uses and to minimize the effects of the same, the *Slicewood* article discloses steaming the log flitches and cutting at high temperature, as high as 320° F. to soften the grain.

For productive purposes, the procedures disclosed are inadequate, for example, preheating a log is not practical. It was found, however, that by changing the knife angle to approximately 15 degrees and using freshly cut timber, a satisfactory slab could be sliced. Moreover, it is necessary to work with full log cants instead of prepared flitches or portions of logs. When doing so, a more serious problem arises which was not mentioned in the *Slicewood* article, in that substantial portions of the grain are pulled apart as the knife moves through the cant log. Evidently this grain is pulled apart by a tension action before the knife can effect its cutting action. This produces undesirable rough surfaces and is especially objectionable in certain woods, such as lodgepole pine, where there is a tendency for the grain to wind about the axis of the tree.

The discovery leading to the present invention was the observation that this objectionable pulling apart of the grain did not occur when a cut across a log was being commenced, and when the knife was cutting into the grain and into the inner concentric rings of the grain

nearer the center of the log. However, as the knife moved past the center of the log and commenced to cut out the grain and into the outer concentric rings toward the opposite side of the log, the lifting action separating the grain before being cut by the knife became severe. Pressure bars and plates to hold the slab against the log during cutting were not satisfactory in preventing this. This separation of the grain ahead of the knife in an erratic manner, causing high spots and pits on the slab surfaces, would render any slab slicing operation undesirable and the slabs produced therefrom unsatisfactory for many purposes in spite of the substantial savings of material possible by such an operation.

The present invention was conceived and developed with the above considerations in view and comprises, in essence, a log slicing apparatus which provides a pair of opposed knives, each being adapted to cut into a cant from one side, and to the center of the log.

It follows that an object of the invention is to provide a novel and improved apparatus for slicing slabs from a cant log with the surfaces of the slabs being smoothly cut and without separation of the grain.

Another object of the invention is to provide, in a slab slicing apparatus, an improved knife form combined with means for holding the slab while the knife is cutting into the log to minimize the curling of the slab and breaking of medullary rays, and to permit cutting of slabs without heating the cant.

Another object of the invention is to provide a novel and improved apparatus for slicing lumber slabs which uses logs as they are taken into the mill with an utmost economy of time and labor.

Another object of the invention is to provide a novel and improved apparatus for slicing lumber slabs from a cant which is equally suitable for laminated and sheeting products and for direct use after the slabs are planed or otherwise finished.

Other objects of the invention are to provide a novel and improved apparatus and method for slicing lumber slabs from a cant which is simple, economical, rugged and durable and which will produce improved slabs with many varieties of wood.

With the foregoing and other objects in view, my present invention comprises certain constructions, combinations and arrangements of parts and elements, and sequences, operations and steps, all as hereinafter described in detail, defined in the appended claims, and shown in the accompanying drawing in which:

FIG. 1 is an isometric somewhat diagrammatic view of one embodiment of my apparatus adapted to be used for slicing a cant, but with certain components and controls necessary to operate the apparatus not being shown since the same are essentially conventional.

FIG. 2 is a view of the end of a cant log prepared for use in my apparatus.

FIG. 3 is a longitudinal sectional view at the centerline of the apparatus as taken substantially from the indicated line 3—3 at FIG. 1.

FIG. 4 is a transverse sectional view of the slicing apparatus, as taken from the indicated line 4—4 at FIG. 3, but on an enlarged scale and illustrating a log in place preparatory to the slicing operations.

FIG. 5 is a transverse sectional view of a portion of the slicing apparatus, as taken from the indicated line 5—5 at FIG. 3, but on an enlarged scale.

FIG. 6 is a fragmentary sectional detail as taken from the indicated line 6—6 at FIG. 5.

FIG. 7 is a fragmentary detail as viewed from the indicated arrow 7 at FIG. 3, but on an enlarged scale and with portions of components being broken away to show parts otherwise hidden from view.

FIG. 8 is a fragmentary sectional detail as taken from the indicated line 8—8 at FIG. 7.

FIG. 9 is a fragmentary isometric view of the central portion of one end of the apparatus with portions of elements broken away to illustrate the manner in which a log is sliced by the apparatus.

FIGS. 10 through 15 are each a diagrammatic sectional view of a log, the slicing knife and a restraining roller illustrating specifically the several sequential steps in the complete slicing method for cutting a slab from a log.

Referring to the drawing, the slab cutting apparatus, adapted to cut boards or slabs from a log by a slicing operation, is formed as three sections or stations arranged in a longitudinally extended array and including a cant receiving station R, a slab slicing station S and a slab receiving and dispensing station D. To use the apparatus, a log of a specified length, such as eight feet, is first prepared by sawing slabs from two sides to form a cant log as shown at FIG. 2. This cant is then transported to the receiving station R by any suitable conveyor arrangement, not shown. There it is placed upon a longitudinally extended platform P which extends into the slicing station S. The log is thus moved along this platform and into the slab slicing station where it is held and elevated to proper positions to permit a knife assembly K above the cant to slice slabs or boards from the top of the cant as will be hereinafter described. The slabs are rejected from the slicing station and onto a table T at the holding and dispensing station D. As they are removed from this table, they may be stacked or dried for further use.

The three sections are each built upon and within suitable framework members indicated generally as F, and this framework holds the several operative components of the apparatus as hereinafter described. Suitable driving mechanisms will include both mechanical and hydraulic machines which are mounted upon framework members associated with the framework of the apparatus. However, these driving mechanisms and also the controls for driving them are not shown in the drawing since they may be conventional organizations and may be arranged in any desirable manner alongside the apparatus. Thus, a showing of such is not needed to facilitate an understanding of the operation of the apparatus.

The log support platform P is a narrow, table-like unit extending from the outer end of the receiving section R and to the opposite end of the slicing section S. The platform at the receiving section consists of a group of rollers 20 held between longitudinally disposed beams 21 at its undersurface, and the beams 21 extend into the slicing section S. These beams 21 are, in turn, supported upon short, transverse cross beams 22 located at the ends and at the center of the platform and they are supported by a set lift as will be described.

A log cant will move from the receiving station to the slicing station and a drive means connected to the rollers must be provided for moving the cant into the slicing section S. A sprocket 23 is connected to the shaft of each roller and they are driven by a drive chain 24. One of these rollers is powered to drive the chain as from a shaft 25 which extends to driving controls not shown.

A log cant on the table moves into the slicing station where it is held by dogs as will be described. The log must then be lifted to a sequence of positions as slabs are being sliced from it. For example, if a one-half inch slab is being cut, the platform must be lifted one-half inch each time a cut is completed. Accordingly, the platform is suspended by an adjustable networks. This networks includes a group of suspension chains 26 connected to the ends of the cross beams 22 and directed about upper and lower sprockets 27. The sprockets of each of the group are mounted in bearing clips 28 which are secured to frame posts 29 at each end of the slicing station and to posts 29 at the outer end of the receiving section. These suspension chains are arranged as pairs with each chain of a pair being at one side of the platform to connect one end

of a transverse beam 22 and the other chain of the pair being at the opposite side thereof.

The lower sprockets 27 of each pair of suspension chains 26 are joined together by a transverse shaft 30. Each shaft extends from one side of its pair of lower sprockets 27 to carry sprockets 31. Chains 32 about these sprockets 31 interconnect the three shafts 30 so that the suspension chains 26, connected to the cross beams 22, operate in unison in raising and lowering the platform and maintaining a fixed horizontal plane at all elevations. To complete the networks, an extension 30' of one of the shafts 30 will extend to driving machinery and will be connected into a suitable gear box having controls adapted to rotate to raise or lower the platform to any position needed. The gear box and control to operate the networks is not shown since such may be essentially the same as those commonly used in the networks of a conventional sawmill.

Whenever a cant is moved from the receiving station to the slicing station, it must then be gripped and held in place during the slicing operations. Such gripping is accomplished by an array of opposing pairs of dogs 35 along each side of the platform section within the slicing station. Conventional dogging arrangements may be used for this purpose, but there is disclosed herein an improved arrangement capable of centering a log upon the platform. Two sets of these dogs are illustrated in the drawing, but more may be used, if desired. Each dog 35 is a flat bar having a curved, wedge-shaped point. It is mounted upon a vertically disposed shaft 36 to outstand horizontally therefrom and is adapted to be rotated about this shaft to permit the wedge-shaped point to dig into the log as an incident of such rotation. It is then pulled downwardly to hold the log tightly upon the platform P.

Each dog shaft 36 extends through a hole in the platform, thence into and through a double acting cylinder 37 with the lower end of the shaft, below the cylinder, carrying a sprocket 38. A piston head 39 on the shaft within the cylinder permits it to be forcibly raised and lowered to forcibly hold a cant upon the platform. The rotation of each shaft to turn its dog 35 into a cant log is effected by a central sprocket 40 underneath the platform. This sprocket is mounted upon a shaft 41 carried in a bracket 42 secured to the undersurface of the platform. This sprocket is connected by a chain 43 to the two opposing shaft sprockets 38. Partial rotation of the central sprocket 40, sufficient to rotate the dogs from a release to a gripping position, is effected by a double acting cylinder 44 pivotally mounted upon the bracket 43 with its piston pivotally connecting with a crank pin 45 on the central sprocket 40. It is to be noted that with this arrangement, the dogs at one side of the platform will be normally directed towards one end of the platform while the dogs at the opposite side will be directed oppositely, but both groups will move towards the center of the platform responsive to rotation of the sprocket 40. It is also to be noted that the sprocket 40 is larger in diameter than the sprockets 38 so that a complete swing of the dogs through an arc of approximately 90° is easily attained. Also, as shown in the drawing, the lower end of the shaft 41 of the central sprocket and the lower ends of the shafts 36 are supported upon a cross bar 46. Thus, whenever the dogs are pulled downwardly by action of the cylinders 37, the sprockets 38, sprocket 40, chain 43 and cross bar 46 all move downwardly with movement of the shafts 36 and remain in an approximate alignment sufficient to insure their operation. This requires that the pin connection 45 of the piston of cylinder 44 to the sprocket 40 and the connection 47 of the base of the cylinder to the bracket 42 be of a universal, swivelled type to allow for such vertical movements.

The frame F of the slab cutting station S is generally box-like in form with the platform extending longitudinal-

ly through it from the receiving station end to the opposite end. The framework includes side pillars 50 formed by uprights and posts 29 and a pillar upstands from each end of the frame at each side of the platform. These pillars will carry the networks sprockets 27 and also provide smooth top surfaces 51 whereon the knife assembly K is mounted. The pillars 50 at each end thus form pairs with their top surfaces 51 being in a common alignment. The knife assembly K is formed as a rectangular sash-like member, with each end being formed by a transverse slide 52, a structural channel member which rests upon the tops 51 of a pair of pillars and spans the opening between the pillars above the platform P. A central, elongated slot 53 is formed in the web of each channel adjacent the lower flange, to provide openings for the removal of slabs as they are sliced, as hereinafter described. A transverse beam 54 at each end of the frame F is set above and extends over the channel-shaped slide 52 and restrainer rollers 55 depend from the underside of this beam to facilitate holding the channels in place upon the guides.

The longitudinally disposed knives 56, extending between the slides 52 at each side of the knife assembly K, are flat, barlike members lying in a horizontal plane with the cutting edges opposing each other and paralleling the sides of the platform P. The upper surface of each knife is ground at a slope or bevel 57, preferably approximately 15 degrees, to place the cutting edge at the lower edge of the bar-like member forming the knife 56. Each knife 56 is held by a heavy framework of lapped, longitudinally disposed structural members 58 with a web 59 overlying the body of the knife. This web is also bevelled adjacent to the knife edge 57 to provide for a continuous sloping portion. The outward sides of the sash are formed with flanges 60 of the structural members 58 and the assembly of these members and the knife is secured to and upon the lower flange of each transverse slide channel bar 52.

A pressure means is required to hold a slab in position when it is being sliced by a knife and a heavy roller 61 is provided above each knife for this purpose. Each end of the roller is held by an arm 62 connecting to a pivot stub 63 on the end of the roller. Each arm lies inside the flanges of the channel slide bar 52 and the end opposite to the arm is slotted as at 64, and is connected to the slide bar 52 by a pin 65 outstanding from the channel web and extending into the slot. When moving into a log to cut a slab, the roller will thus assume a first position directly over the knife as illustrated at FIG. 8. However, when moving in the reverse direction to withdraw the knife from the cut, the roller will trail the knife as illustrated at FIG. 10 and hereinafter further described. A boss 66 is provided on the slide bar under each arm 62 to hold the roller off the knife edge when the knife is not cutting a log, as illustrated at FIG. 4.

The sash-like knife assembly K is pushed into a log from each side to cut a slab therefrom, according to the invention, and any suitable powered mechanical or hydraulic drive means may be used to accomplish this pushing and pulling action as will be described. In the illustrated embodiment, a pair of double acting, horizontally mounted hydraulic cylinders 67 are mounted at one side of the frame, one at each end of the frame, with their piston rods 68 being connected to the knife assembly as at brackets 69. The pistons 68 extend and retract in unison by controls not shown since the same are conventional.

The slab cutting operation, in accordance with the invention, is illustrated sequentially at FIGS. 8 to 13. A double action of the sash operation is required to cut inwardly from both sides of a log. FIG. 8 illustrates one knife shown as the left hand knife, about to cut into a log. In this position, the roller moves upon the top of the slab since its weight causes it to be pushed backwards against the direction of motion. It therefore, re-

mains above the edge of the knife to facilitate holding the cut portion of the slab against the log. When the knife reaches the center of the log, as at FIG. 7, the first cycle of operation is terminated. Next, the left hand knife moves out of the log and the weight of the roller causes it to shift its position, through the pin connection in the arm slot 64 to follow the knife and hold the slab against the log as illustrated at FIG. 10. The movement of the sash continues as the right hand knife commences to slice into the log, the third cycle of the cutting operation, as illustrated at FIG. 11. Again, the roller 61 is directly over the knife. This cycle is completed when the knife reaches to the center of the log or slightly therebeyond to assure a complete slicing of the slab as illustrated at FIG. 12. The final cycle of operation commences when the right hand knife is removed from the log. In this action, the roller lags behind the knife holding the slab S in place until the knife is withdrawn and thereby assures the slab remaining in place until the knife is completely withdrawn.

Upon completion of the cutting cycles, the slab is ready for removal. Because this slab is above the level of the bottom of channel slot 53, it may be easily pulled from the slab cutting station S and onto the dispensing section D. This operation is facilitated by a pusher 70, a cylinder mounted on a bracket 71 on the top member 54 of the framework at the side of the slicing station S adjacent the receiving section R. Extension of the piston of cylinder 70 moves it into the slide beam slot 53 to contact and to push a slab cut from a log L through that slot 53 in the slide beam at the opposite side of the slicing section. This piston is operated by controls not shown because they are conventional.

A pair of rollers 75 on the framework at the dispensing station D, and held in a bearing 76 adjacent to the slot 53 of the slide beam, are adapted to receive the end of a slab pushed through the slot 53 by the pusher 70. A drive shaft 77 on at least one roller extends to a power supply to rotate the roller and to quickly move a slab from the slicing section S and to the dispensing station D.

The dispensing section may be a table 78 whereon the slabs are dropped to be disposed of manually. However, a conveyor system such as indicated at 79, may be used to move the slabs from the table as they are placed thereon.

After a number of slabs are sliced from a cant and moved from the slicing station to the dispensing station, and when the cant is sliced to or near the center of the log, it becomes necessary to turn the log to change its position, preferably 180 degrees, to the opposite side so that slicing from the other side of the log may progress. Conceivably, the log may be pulled out of the slicing station and back onto the receiving station where it may be turned by a cant hook or any other suitable means not shown. However, preferably, the log is turned while it is in position at the slicing station by means of a pair of spaced, turning chains 80, one near each end of the receiving section. Each turning chain 80 includes an upright lift chain 81 which is affixed to a post 82 directly underneath the edge of the slicing knife 56 when it is fully opened as illustrated at FIG. 5. This chain 81 is a double chain and one portion of the chain is mounted in sprockets 83 at the top and bottom of the post while the other contiguous reach of the chain is adapted to carry a floating sprocket 84 at the end of a horizontal chain 85 mounted upon the table 20. This chain 85 is formed within the body of a tube 86 which is fitted between the frame channels 21 with the upper portion of the tube above these channels supporting the upper reach of the chain 85 and extending beyond each side of the chain to hold the sprocket 84 at one side of the table and in chain 81, and to hold a sprocket 87 at the opposing side of the table. The lower reach of the chain passes through the tube which is notched to fit between the channels 21 with the chain extending through an

opening in the wall of each channel 21. Suitable hooks 88 may be provided upon each chain 81 and 85 to grip and hold a log whenever a turning operation progresses, and a means may be provided to lift the upper reach of chain 85, if desired. The two turning chains are operated in unison and each bottom sprocket 83 is connected to the other by a shaft 89. This shaft 89 is rotated by a suitable drive means not shown. Rotation of this shaft is such that movement of the reach of the chain 81, adjacent to a log position, is upwardly while movement of the upper surface of the horizontal chain 85 is towards the vertical chain as in the direction of the indicated arrows at FIG. 5. Accordingly, the horizontal chain will grip the log and pull it against the vertical chain which will tend to lift the contacting side of the log and rotate it. When rotated halfway around the log will fall back upon the table with the cut side downwardly. Then the dogs 35 may be rotated to grip the log and center it upon the table to permit the slicing operations to again commence. This slicing can continue without readjusting the height of the setworks and can continue until only a narrow slab is left which may be disposed of by the pusher 70 or in any other suitable manner not shown.

Operation of this apparatus is simple. A log shifted to the receiving station and into the slicing station is held by the dogs 35 until it is sliced halfway through with each slab being pushed through the openings 53 in the channels 52 and thence into the rollers 75 and to the dispensing station. The dogs are then relaxed. The log turner is operated to turn the log upside down. Thereafter, the dogs are again engaged and slicing continues until the log is completely cut up.

A number of alterations and modifications to the construction herein are described as possible. Should the forces on the knife exceed the holding power of the dogs 35, a supplementary beam structure 90 and holding pistons 91 may be provided at the framework adjacent to the knives, as indicated in broken lines at FIG. 4. The simple, slash-like knife assembly K provides for two full strokes to completely cut a slab. It is possible, however, that a pair of knives on independent suspensions may operate simultaneously to cut a slab from both sides of the log at once, although careful adjustment of the knife positions may be required so that they are not damaged when they come together.

I have described a preferred embodiment of my invention in considerable detail and now define the invention by the accompanying claims.

I claim:

1. An apparatus for slicing slabs from a cant log, including:
  - a longitudinal log holding means adapted to hold the cant log with a flat surface of the log adjacent to and in spaced parallelism with the plane where slicing occurs to thus form a slab when slicing occurs;
  - a transverse guideway means parallel to the slicing plane;
  - a longitudinal sashway means mounted upon the guideway means with a side portion at each side of the log holding means;
  - a longitudinally disposed knife mounted upon each side portion of the sash means at the said slicing plane to extend alongside a log mounted on the log holding means; and
  - a shifting means for moving the sash means back and forth along the guideway means and to a first posi-

tion where one of the knives cuts halfway into one side of the cant log at the slicing plane and thence to a second position where the other knife cuts halfway into the other side of the cant log at the slicing plane to complete the slab cutting operation.

2. In the organization defined in claim 1, wherein: said log holding means comprises a log-holding table at one side of the aforesaid slicing plane and means for moving the table towards and away from the slicing plane;

the guideway means are closely adjacent to with at least a portion thereof, at the other side of the said slicing plane; and

means for moving a log longitudinally from one end of the apparatus past the sash means and onto the log-holding table when the table is moved away from the slicing plane.

3. In the organization defined in claim 1, including a pressure means adapted to bear against the cant log surface adjacent to the edge of each knife, and being adapted to hold the slab sliced therefrom tightly against the edge of the knife.

4. In the organization defined in claim 3, wherein said pressure means comprise a pair of rollers carried substantially above the edge of each knife, a holding means on the rollers adapted to hold the rollers adjacent to the edge of its knife when the knife is cutting into the cant log to shift the rollers with respect to the edge of the knife when the knife is being withdrawn, whereby to hold the cut slab in position upon the cant log during the withdrawing operation.

5. In the organization defined in claim 1, including a shifting means adapted to shift the cant log past the slicing plane of the knives after a slab is cut, to position the cant log for the cutting of another slab.

6. In the organization defined in claim 5, wherein said log is held upon the table, said shifting means includes a setworks and dog means adapted to grip the log while it is being cut by the knives.

7. In the organization defined in claim 6, including a log turning means adapted to rotate the cant log on the table whenever it is sliced halfway through; said turning means includes a vertical chain at one side of the platform and a horizontal chain across the platform, and means to move the vertical chain upwardly and the horizontal chain towards the vertical chain.

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DONALD R. SCHRAN, Primary Examiner

U.S. Cl. X.R.

144—312, 162; 83—4, 51, 623